DeAGOSTINI MODEL SPACE™

Red Bull Racing
FORMULA ONE TEAM

RB7

RADIO CONTROLLED • BUILD IT YOURSELF • NITRO ENGINE

Pack 21

Stages 81-84

RB7

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BATTERY CHARGERS

TO ENSURE THAT YOUR RB7 MODEL'S RECHARGEABLE BATTERIES WILL HOLD A FULL CHARGE FOR AS LONG AS POSSIBLE, YOU NEED TO USE A CHARGER THAT IS SUITABLE FOR THEM.

The performance of a battery is indicated by its capacity – the amount of electrical charge it will hold – specified in milliampere-hours (mAh). Your RB7 racer needs four size AA batteries to operate, either 1.5-volt disposables or 1.2-volt rechargeables (see Pack 19), and the rechargeables are available in capacities from 700 to 2,700mAh. The larger its capacity, the longer a rechargeable will last – in theory. In practice, whether the specified capacity is ever reached depends largely on how the battery is charged.

SAFE CHARGING

A rechargeable battery's performance will suffer if it isn't charged properly. When overcharged – when the charger continues to supply power after full capacity has been reached – the battery loses some or all of its ability to store energy. Similarly, repeatedly charging the battery when it is only partially discharged, for example, when half-full, will also have a harmful effect on its performance. The battery 'remembers' that only a fraction of its capacity has been used, and then acts as if that fraction were its total capacity. This is known as the 'memory effect', and is why you should wait until your batteries run out of power completely before you recharge them, or use a charger that will discharge them in a controlled manner before recharging them.

Charging batteries correctly is very important, not only to achieve the best performance from them but also for safety. If the cells aren't charged in the right way, they can become so hot that they swell up, leak, or even explode. You must only use a charger that is suitable for your batteries, with overload protection and, if possible, automatic switch-off.

A compact, electronically controlled charger for four NiMH AA cells, with variable charge current, discharge function and automatic charging switch-off for each battery slot.

A low-cost 'dumb' charger. This type of charger is unlikely to provide the maximum life expectancy for the adjacent 4.8V battery pack. The charging current is constant without its level being controlled, there is no automatic switch-off, and the cells are not treated individually.

To avoid accidents or damage, it is important to remember that, in terms of charging, each type of rechargeable battery has its own specific requirements. Also, different types of charger control their power output in different ways, such as the way in which the electrical charge is pumped into the batteries.

When NiMH batteries are being charged by this unit, the charging current can be set for each slot individually by means of the 'Current' button. Accurate to within about 10 milliamps, the charger maintains the values selected throughout the charging process – in the picture below, a nominal 700mA in slot 1 and 500mA in slot 2; battery 3 is being discharged.

CURRENT OR VOLTAGE?

The output from a charger is characterised by its current, measured in milliamperes (mA), and its voltage, expressed in volts (V), and will have either a constant voltage or a constant current. In the first case, the charger supplies power with the same voltage as that of the battery or batteries. This voltage remains constant throughout the charging process, while the current varies according to the amount of charge in the battery. Initially, the current is high, and it then decreases as the batteries become charged. This constant voltage method is suitable for lead-acid batteries and lithium-polymer (LiPo) cells. Nickel-cadmium (NiCd) and nickel-metal hydride (NiMH) batteries must be charged with a constant current: the current remains the same, but the voltage increases as the charging process progresses.

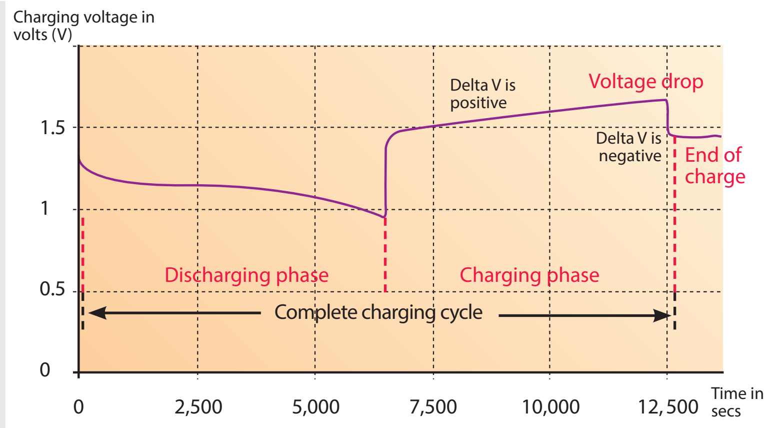
While the preselected charging current remains constant, the applied voltage varies according to the state of the charge. Here, battery 1, with 1.35V is less fully charged than battery 2 (1.38V). Battery 4 has reached its peak voltage and is reported as 'Full' in the charge mode display (see upper photo).

To avoid the consequences of confusing these two fundamentally different methods (and to avoid damaging the batteries), chargers designed to handle many kinds of battery are available. Multi-chargers (or multi-function chargers) that can be used with all types of battery (lead-acid, LiPo, NiCd and NiMH) are relatively expensive, but such a purchase makes sense for drivers of RC electric cars, since battery power is the cars' 'fuel'. With RC cars powered by nitro engines, the batteries have only to supply the onboard electronics and the servos, and a less expensive charger, designed simply for NiCad and NiMH batteries, will be adequate.

WHEN IS CHARGING COMPLETE?

As mentioned earlier, overcharging is one of the main threats to batteries. When the battery is fully charged, the charger must ensure that no more current flows. If it is charging with a constant voltage, this is a simple matter. When the cell has reached the same voltage as the current source, current will no longer flow – the potentials are equalised. But the NiMH or NiCd batteries used in your RB7 racer (and in many other devices) require a constant charging current, and this will continue to flow even when the battery is fully charged. It must be switched off, either

Professional charging stations have outputs for the charging current (red and black) and separate connections for monitoring the charge curve (blue and green). The connections to the battery pack are made via a suitable adapter cable.



DETERMINING FULL CHARGE

As an NiMH or NiCd battery reaches full capacity, there will be a drop in the voltage (V) and so delta V (ΔV), the rate of change in the voltage, becomes negative. A smart charger recognises either this drop in the voltage or the change in delta V, or both, and cuts off the power supply to the battery.

by hand or (better) by the charger itself. Chargers use a number of methods to determine when the batteries are fully charged:

Time: If you divide the battery's capacity by the charging current applied, you can calculate when the charging cycle will be complete. For example, a cell with a capacity of 1,000mAh being charged at 200mA will be fully charged after five hours. However, if the battery was not completely exhausted to begin with, or if the timer is inaccurate, the timing of five hours could be far too long. This is one reason why professional charging units do not use timers.

Negative delta V (–ΔV): Delta V is the rate of change in an NiMH or NiCd battery's voltage (V) during charging, and the voltage actually drops very slightly (delta V becomes negative) after the battery reaches full capacity. The charger monitors the delta V, and switches off the charging current when it turns negative. This method is used by most commercially available 'smart' chargers, and is very safe.

Keeping batteries in good shape: here, slot 3 is in refresh mode. The cell is being fully discharged at the appropriate current (in this case 254mA), and will then be recharged.

Delta peak: This modification of the negative delta V method determines the point at which the peak value of the battery voltage is reached. It calculates when charging is completed by detecting the first downturn of the voltage curve, and using this technique, switching off occurs slightly earlier than with negative delta V. Some chargers use both negative delta V and delta peak when monitoring battery voltage.

Temperature: The end of the charging process can be detected very precisely by measuring the battery temperature – a rise in the temperature precedes the voltage drop described above. When this method is used, charging stops a tiny bit earlier.

Devices that switch off automatically when charging is complete are available at reasonable prices. Given the high degree of safety that all the above methods provide, they are well worth the money.

CHARGE RATES AND BATTERY LIFE

Other criteria that define the quality of a charger are ease of loading and the ability to keep the battery in peak condition through many charge cycles. The key to doing this is variable charge current.

As a rule of thumb, a charge rate that is one-tenth of the battery's capacity (commonly shortened to C10 or C/10) is ideal for its longevity. So a cell with a capacity of 1,100mAh will be optimally charged by a current of about 110mA, and a 2,700mAh by about 270mA. So it is a great advantage if the charging current can be varied, ideally for each battery slot independently.

Of course, having to wait for 10 hours until your batteries are ready to be used again can be inconvenient. For this reason, many chargers have a quick-charging function. In this case, the battery receives two to three times the usual charging current, which reduces the charging time to a half or a third.

However, fast charging has an impact on the internal structure of the battery, and it will then release its energy more readily. It will provide a higher output current, but it will also run down more quickly. So as not to limit the battery's longevity, and to avoid the memory effect described earlier, on every seventh charging cycle you should discharge it fully and then recharge it, using the optimum regeneration current (C10) for both discharge and recharge. The best chargers have a 'refresh' setting for this purpose, but with simpler devices, you should select a relatively weak current setting.

A professional multi-charger for all popular battery types. The charging current is continuously adjustable and is supplied to the batteries via interchangeable connecting leads.

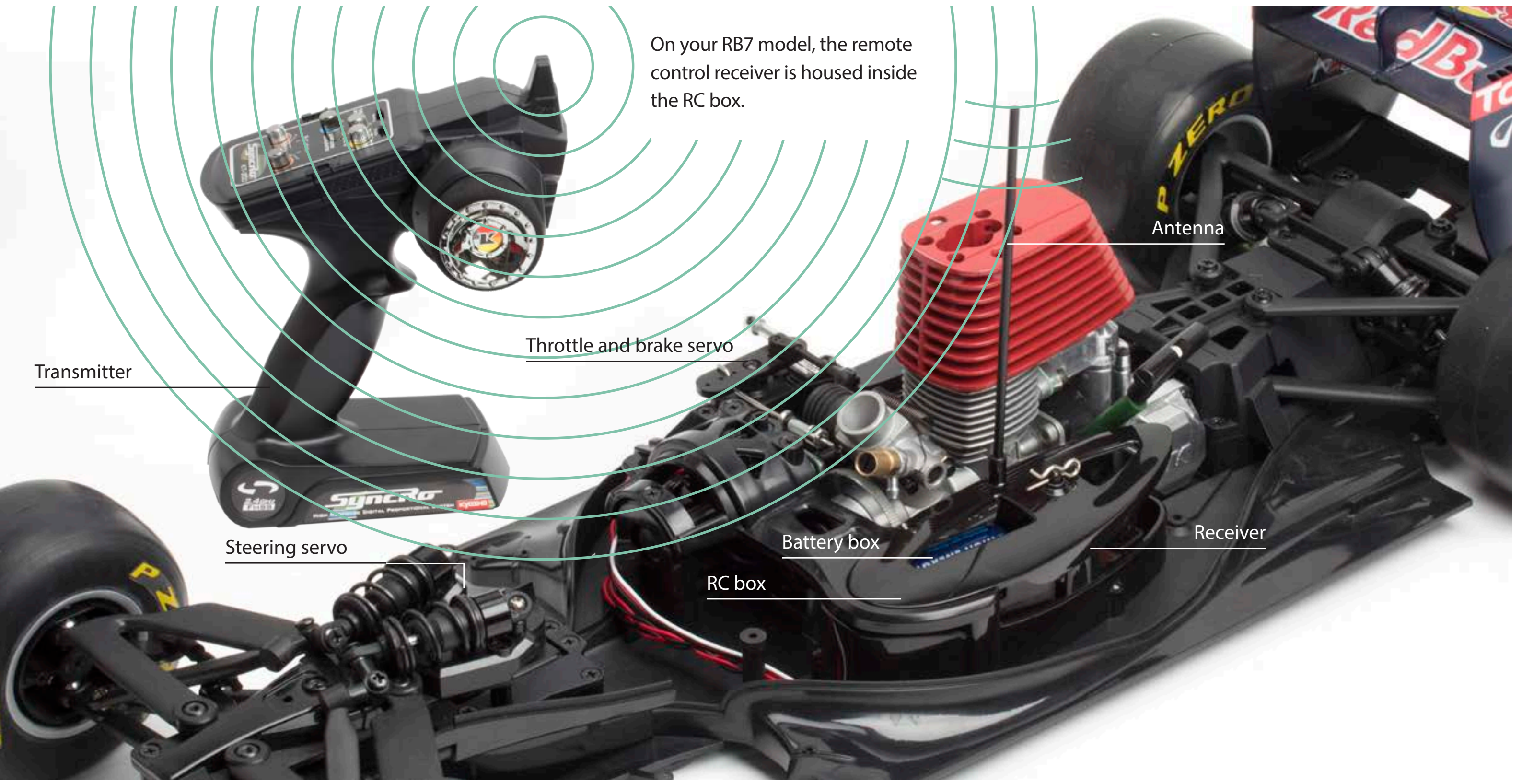
THE REMOTE CONTROL SYSTEM

THE 'STEERING WHEEL' OF THE RB7 RACER ISN'T ON THE MODEL, IT'S CARRIED IN THE HANDS OF THE DRIVER, WHO MAY BE STANDING UP TO 40 METRES FROM THE CAR. HERE IS AN OVERVIEW OF THE RADIO-BASED REMOTE CONTROL SYSTEM THAT MAKES THIS POSSIBLE.

The main components of an RC car's remote control system can be divided into two groups: those that transmit and receive radio signals, and those that implement the instructions that the signals carry. The first group includes the transmitter, which the driver holds, and the receiver, which is about the size of a matchbox and is fitted to the car. Associated with the receiver are the servos and the power supply components (the batteries and the switch).

SENDING THE SIGNALS

The starting point of radio control is the transmitter. This converts the movements of the remote control unit's steering wheel and throttle/brake trigger into pulses of electricity, and transmits them, via its antenna, in the form of radio signals. The counterpart of the transmitter is the model's receiver, which is also fitted with an antenna. The receiver converts the radio signals back into electrical



With a non-proportional remote control system, the front wheels would be either at full lock (green) or straight ahead (grey). Proportional control enables the driver to the set the front wheels to any position, such as the half-turned position (orange).

pulses and passes them on to the servos – small electric motors, whose direction of rotation depends on whether a positive or negative voltage is applied to them. Your RB7 model has two servos, mounted on the chassis, and their movements are transferred to the steering, throttle and brake by a system of linkages and levers.

There are various ways of sending the signal from the transmitter to the receiver, which will be explained in more detail in a later pack, but any system has to ensure that the receiver acts only on signals that originate from its designated transmitter and not from those of other drivers. This can be achieved in either of two basic ways.

Fixed frequency: In this traditional system, frequencies are assigned by using narrowly defined sectors within the frequency bands approved for RC models (such as 29MH or 36MHz). A matched pair of quartz crystals in the transmitter and receiver sets the frequency. If this frequency is already being used by another RC system at the race track, the pair of crystals must be changed for another pair that work on a different, unused frequency.

Automatic allocation: Since about 2007, digital systems operating on the 2.4GHz ISM (Industrial, Scientific and Medical) band have appeared on the market. Their great advantage is that the transmitter and receiver are 'paired' by using a passcode. Once this is done, they automatically look for an unused frequency, even changing it if a fault should occur. The Kyosho Syncro KT-200, which you can buy as part of this collection at a special price, works in this way.

PROPORTIONAL CONTROL

The KT-200 also controls the servos proportionally. This means that the more the steering wheel control is moved, the greater the steering angle of the model (see illustration above). The same proportional principle applies to the throttle and the brake. With this type of control, the car can be manoeuvred accurately through corners, bends and chicanes. If the model had a non-proportional radio control system, then the effect would be the same whether the steering control was moved just a little or all the way – the servo would always move the front wheels to full lock.

FUELS FOR RC CARS

NITRO ENGINES, SUCH AS YOUR GX21, RUN ON CAREFULLY FORMULATED FUELS. THE MIXTURES USED CONTAIN VARYING PROPORTIONS OF NITROMETHANE AND METHANOL, AND THEY REQUIRE CAREFUL HANDLING.

Two-stroke engines of conventional design are self-lubricating. The oil that is needed to minimise the friction of the moving parts, such as the piston and the crankshaft, is added to the fuel. But the two-stroke mixture used in full-size engines must not be used in model two-stroke engines, under any circumstances.

MIXTURE FOR HIGH SPEEDS

The reason you must never use a conventional two-stroke mixture in model engines is that these motors rotate at enormous speeds. An engine speed of more than 30,000rpm is not unusual for racing models, way beyond what is possible even with the engines of racing motorcycles and Formula 1 cars. Such high-speed engines require special fuel mixtures.

The fuel used in an RC engine is not petrol but a type of alcohol called methanol, or methyl alcohol. This is as flammable as ethanol (ethyl alcohol), the alcohol found in drinks, and it releases comparable amounts of energy when it's burned. But unlike ethanol, methanol is hazardous to health if it is swallowed or inhaled, even in relatively small doses. So when handling it, make sure that you always observe the safety precautions (see the box on page 408).

The second component of an RC fuel is the lubricant. Previously, the main ingredient of this was castor oil, a natural lubricant with excellent performance at high temperatures. But during combustion – in two-stroke engines, the lubricant is always burned along with the fuel – it forms residues that contaminate the engine and the track. Because of these drawbacks, commercial fuels now mainly use synthetic oils, with castor oil, if used at all, present in only small amounts (up to six per cent).

Two commercial RC fuels. The one on the left has a nitromethane content of 16 per cent and that on the right has 20 per cent. When you are handling RC fuel, you should always wear suitable protective rubber gloves.

NITROMETHANE

To make the combustion process in the cylinder more efficient, the fuel also contains a small proportion of nitromethane (nitro). This transparent, almost odourless (but harmful) liquid provides additional oxygen for combustion, increasing the force of the explosion when the mixture is ignited by the glow plug. The more nitromethane the fuel contains, the greater the power the engine will develop.

The ready-made fuel sold by model shops contains from 5 to 30 per cent nitromethane. A high proportion of nitromethane (over about 20 per cent) helps the engine to start and increases the maximum speed, but high-performance mixtures so rich in methanol are not really recommended for general use.

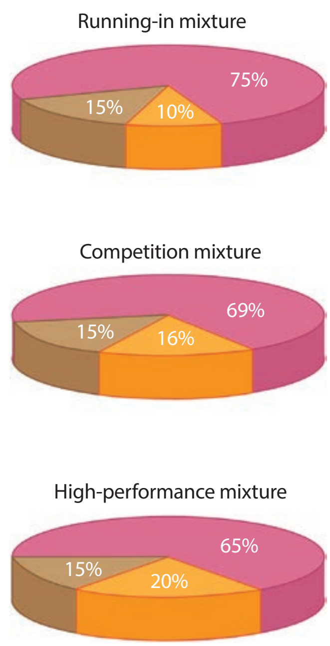
This is because thermal and mechanical stresses are increased by the extra power, and there is a high risk of the engine overheating. When that happens, the lubricating film deposited on the piston and cylinder liner by the fuel can fail, resulting in the piston running dry in the cylinder. The likelihood of piston seizure is then greatly increased.

THE OPTIMAL MIX

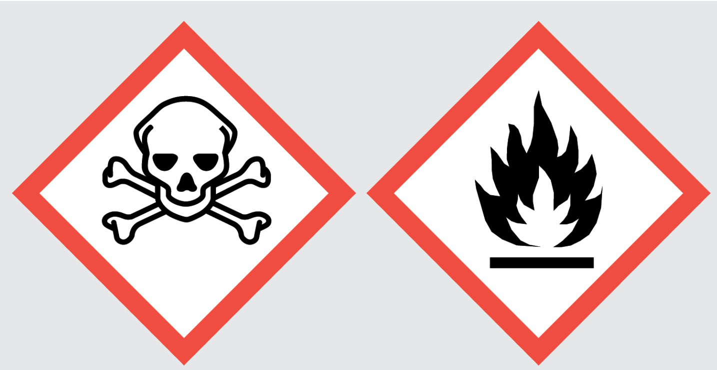
When you've finished building your RB7 model and you start driving it, it's worth buying a small bottle of 10 or 15 per cent running-in fuel and using that for the first five or six tankfuls. After that, fuel with a nitromethane content of between 10 and 20 per cent will be ideal for recreational and most competition use (see chart above right).

Many RC competitions specify a fuel mixture with a 16 per cent nitromethane content, and this blend is also recommended for use by inexperienced drivers and for general recreational driving.

Because of the health risks associated with nitro fuels, always follow the instructions for storage and use given on the container.



The percentage composition of the three most common fuel mixtures for RC cars. The higher the nitromethane content, the more power the engine will deliver. With fuels from different manufacturers, the proportion of lubricant contained may vary from the value shown here (15 per cent).



TOXIC AND FLAMMABLE

The main constituents of RC fuel – methanol and nitromethane – are poisonous when swallowed or inhaled, and through contact with the skin or the mucous membranes, so please observe these precautions:

- Keep fuel under lock and key, out of the reach of children.
- Keep the fuel container tightly closed and only use it in well-ventilated areas.
- Store and use fuel away from ignition sources. Do not smoke
- Wear appropriate protective clothing, such as rubber gloves and safety glasses.
- If fuelling in an enclosed space, provide adequate ventilation.
- In case of accidental swallowing, inhalation or contact with the fuel, or if you feel unwell after using it, see a doctor.

RADIO CONTROL FREQUENCIES

THE COMMANDS THAT CONTROL AN RC MODEL ARE TRANSMITTED BY RADIO, IN A SIMILAR WAY TO THE BROADCASTING OF RADIO AND TELEVISION PROGRAMMES. TO AVOID INTERFERENCE, RC DRIVERS MUST SET UP THEIR RADIO CONTROL SYSTEMS CORRECTLY BEFORE USING THEM.

Many systems, including radio and television networks and remote control systems for models, use radio signals to transmit information. These electromagnetic waves are generated by a transmitter and broadcast by an antenna. A receiver picks up the signals and converts them into electrical impulses that create images and sounds, or, in the case of RC models, control one or more servos. To avoid interference with other radio networks, the signals for RC models are transmitted on fixed frequency bands. In the UK, the 27MHz band is used for remote control toys, the

The frequency of an RC system can be altered by using different pairs of quartz crystals (inset). The TX quartz is for the transmitter and the RX quartz for the receiver. When many remote controls are in use, interference may occur if two are transmitting on the same frequency, so drivers must agree which frequency each is going to use.

The Kyosho Perfex KT-3HS, a pistol-style remote control transmitter, and its associated Perfex KR-3 receiver (inset picture), operate on the 27MHz band.

40MHz band is used mainly by model cars and boats, and the 35MHz band is reserved for model aircraft.

CRYSTAL CONTROL

Since many RC transmitters and receivers will be communicating with each other within the assigned frequency bands, each transmitter/receiver pair must be assigned a unique frequency at any particular venue. This frequency is determined by a pair of quartz crystals. These are artificially produced crystals that oscillate only at a very specific frequency. When fitted in the transmitter and receiver, these crystals ensure that the two units operate accurately on the required frequency.

CHOOSING YOUR CHANNEL

Because of the limited number of frequencies available, it can happen at a model sports ground that two remote controls are transmitting on the same frequency. This leads to interference, which could cause the models receiving signals on the same frequency to respond to the commands sent to them only partially or not at all, or to respond to commands meant for the other model.

To prevent confusion and possibly accidents, it is essential to consult with the other RC drivers about the radio frequencies they are using before operating your remote control. On days when only a few RC drivers are on the track, check with the other drivers to let them know the channel number you intend to use. If one of them is already using that channel, you will need to switch to another one by using a different pair of crystals. If a lot of other models are in use, you will need to consult the person in charge of the circuit. This person will have a list on which all the drivers enter the frequencies of their remote controls. Again, if your intended frequency is already in use, you will have to use another pair of crystals.

THE 2.4GHz BAND

The most advanced remote controls transmit on the 2.4GHz band, which is divided into 80 channels. The transmitters and receivers are designed so that they constantly switch frequencies as they operate. There is no interference, which can occur with other bands, and no need for drivers to agree among themselves about which frequencies to use. All that is needed is for the transmitter and receiver to synchronise with each other when they are first turned on.

KYOSHO SYNCRO RC TRANSMITTER: AN OVERVIEW

ONLY SOMEONE WHO KNOWS HOW TO OPERATE THE RADIO REMOTE CONTROL PROPERLY WILL BE ABLE TO KEEP THE CAR SAFELY UNDER CONTROL ON THE TRACK. THE FIRST THING TO DO IS TO BECOME THOROUGHLY FAMILIAR WITH ALL THE FUNCTIONS OF YOUR KYOSHO SYNCRO RADIO TRANSMITTER.

The Kyosho Syncro transmitter is the control centre for your RB7 model. Its various functions allow you to control the model precisely, and also provide a variety of options for tailoring it to suit different circuits.

TYPES OF REMOTE CONTROL

The Syncro is a pistol-style remote control. Unlike console-type remote controls, which are used mainly for operating model aircraft and have a pair of joysticks with which to manoeuvre the model, the Kyosho Syncro has a pistol grip with a trigger switch, a steering wheel and a top panel housing switches, dials and LED indicators.

Pistol remote controls are particularly suitable for operating car or ship models, because no more than two servos need be activated at the same time. On your Red Bull RB7 racer, one of these servos controls the steering mechanism while the other servo controls the throttle and brake.

A console remote control is recommended for flying helicopter models, because it can control up to four servos at the same time. This is because to keep a model helicopter in the air, servos controlling yaw, pitch and roll are needed as well as the throttle.

Because of their shape and the way in which they are held, remote controls such as the Kyosho Syncro KT-200 are known as pistol remote controls.

Two of the controls on the top of the KT-200 are slide switches, the servo reverse switches. By using them, you can change the direction in which each servo moves.

The steering wheel, which controls the steering servo, can be moved a maximum of an eighth of a turn forward or back. A spring automatically returns it to its initial position when it is released.

THE STEERING WHEEL

With a console remote control, the servos are controlled by two joysticks, but the pistol remote control uses its trigger and steering wheel to control the model's servos. The steering wheel is mounted on the 'muzzle' of the pistol and resembles a wheel with a tyre. From its initial position, it can be moved about an eighth of a turn forward or back. This produces the maximum steering angle of the wheels in one direction or the other. A return spring ensures that the wheel returns to its initial position after any steering operation.

THE TRIGGER AND TOP PANEL

The trigger lever of the remote control is mounted below the muzzle, alongside the steering wheel. It can be moved forward and backwards to control the throttle and the brake – with model cars, both functions are operated by a single servo. Pulling the lever towards the handle accelerates the car, and pushing it forward slows it down. A projection at the rear of the lever serves as a stop and prevents it being pulled back too far.

The slanted panel on top of the transmitter is equipped with a number of controls and indicators. Two of the controls are slide switches, the servo reverse switches, which reverse the direction of movement of the two servos if necessary. This is a useful feature if the transmitter is used with a model on which one or both of the servos are set up to operate in the reverse direction.

Moving the trigger activates the throttle/brake servo. Pulling the trigger backwards makes the car accelerate, while pushing it forward applies the brake.

The knob with a blue scale below the two EPA regulators is used to adjust the steering dual rate function. This is used to set the maximum steering angle of the wheels according to the requirements of each track.

Below the knob controlling the steering dual rate function are the two trim controls, with which you can adjust the starting positions of the two servos. The left knob controls the throttle/brake servo and the one on the right the steering servo.

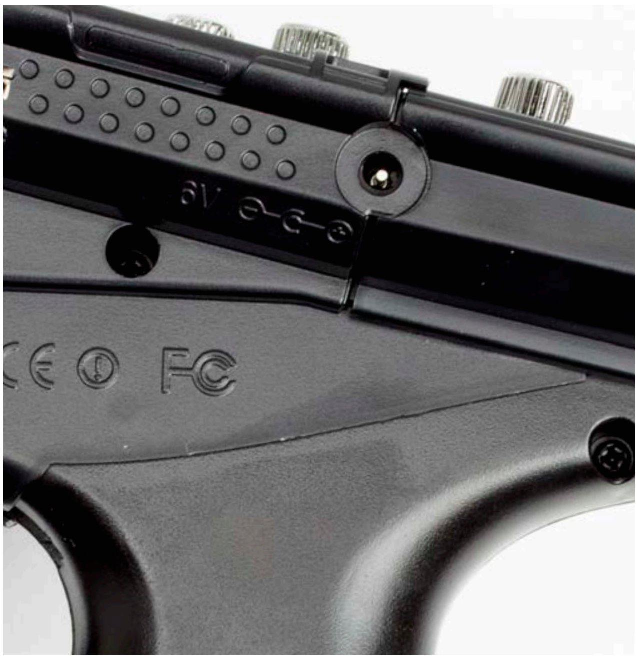
Below these switches are two knobs with the designation 'A-EPA-B' (the 'EPA' is an abbreviation for 'end point adjustment'). These make it possible to adjust the maximum deflection of the brake and throttle servos in each direction. The brake and throttle can be adjusted individually, even though both are operated by a single servo.

DUAL RATE AND TRIM CONTROL

Below the throttle and brake servo deflection controls, there is another knob labelled 'STEERING DUAL RATE'. This is used to set the maximum steering deflection of the front wheels. 'Dual Rate' is the technical term for this feature. When the knob is rotated anticlockwise until it stops, the maximum steering deflection is reduced to one tenth of the normal rate. This setting might be used for tracks without sharp corners. If it is turned fully clockwise, the steering angle of the wheels is maximised, so that tight corners can be tackled. With this setting the model is very sensitive, responding to the slightest steering movements, so it is unsuitable for race tracks with long straights because you may find it difficult to keep the car travelling in a straight line.

The two LEDs indicate the state of charge of the KT-200's batteries. If only the red LED is on, the voltage delivered by the batteries is no longer enough for safe operation.

Below the DUAL RATE control are two more knobs, which are used to trim the two servos, that is, to set their rest positions. This is useful when, for example, it comes to setting the front wheels so that they are in their normal straight-ahead positions, or if the idling speed must be adjusted so that the wheels turn very slowly without accelerating. The left-hand knob is used to control the throttle trim, with which you can vary the initial position of the throttle/brake servo.



There is a charging jack on the left side of the remote control, just below the edge of the top panel. If your unit is running on rechargeable batteries, you can recharge them by simply plugging in a suitable adapter and charger, without having to remove them.

The knob on the right is the steering trim, for adjusting the steering servo. Both knobs are surrounded by a scale so that you can identify the setting of the adjustment. We will explain how to set the proper trim in future packs.

THE MAIN SWITCH

The main power switch is at the back of the remote control unit. It is flush with the exterior, to avoid it being pressed accidentally when you are driving your model. To activate your KT-200 remote control, simply move the switch to the 'ON' position and you can start running your model immediately.

POWER SUPPLY

When you switch your KT-200 on, the two LEDs on the top panel light up. These have two functions: they indicate whether the remote control is switched on or off, and they serve as charging indicators. If both LEDs light up, and you are using disposable batteries, this indicates that they have enough voltage. If you are using rechargeable batteries, both LEDs light when they are fully charged. When both LEDs flash, you should stop driving and replace the batteries, and if only the red LED is on, stop driving at once – the cells are almost completely discharged and must be replaced or recharged immediately.

To do this, open the battery compartment at the bottom of the remote control, which takes four AA batteries. If you are running the unit with disposables, replace them with new ones. If you've opted for rechargeable batteries, you can either remove them and put them into your charger, or you can use the charging socket on the left side of the remote control to recharge them without removing them. All you need to do this is an adapter to connect a suitable charger to the socket. Suitable devices and adapters are available in model shops.

Please be aware that general-purpose battery chargers are not suitable for this, because batteries can quickly be damaged if the charging current is too high. The same applies to the circuit boards in the KT-200. To avoid damage, the charging current should not exceed 200 to 300mA.

SERVO HORN ADJUSTMENT

There is a slide switch labelled 'NP-ADJ' on the left side of the remote control, flush with the exterior of the unit to prevent it being operated unintentionally. This switch selects the ratio between the left and right deflections of the throttle/brake servo horn, which can be 1:1 or 7:3. The 1:1 position is the one marked 'NP' (for 'neutral position').

Stage 81

THROTTLE AND BRAKE SERVO

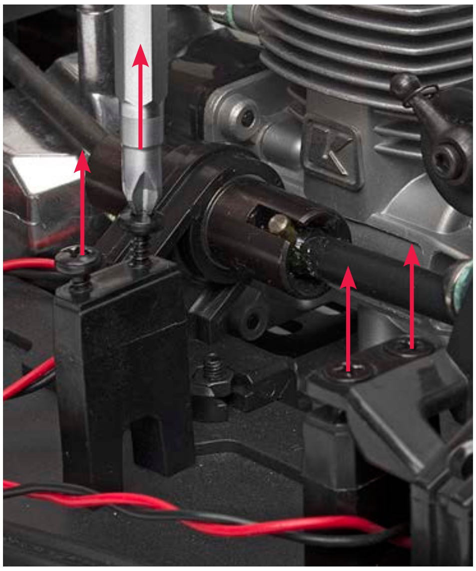
THE SERVO SUPPLIED WITH THIS STAGE WILL OPERATE BOTH YOUR RB7'S THROTTLE AND ITS BRAKE, AND WILL BE FITTED TO THE SERVO MOUNTS THAT YOU ADDED TO THE CHASSIS IN STAGE 58.

Tools & Materials

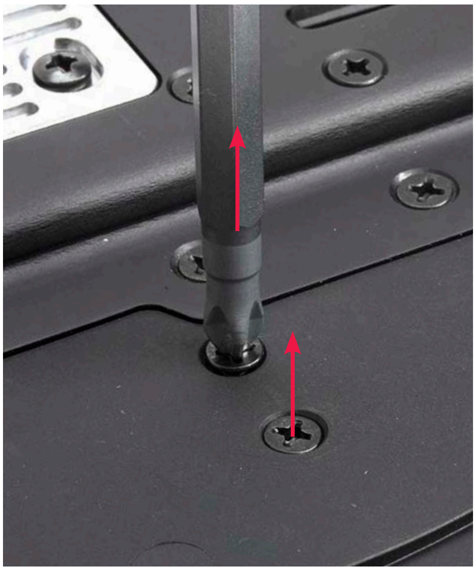
Phillips screwdriver (size 1)
Phillips screwdriver (size 2)

1 Servo horn
2 Screw
3 Throttle and brake servo

01 First, unplug the two connectors that join the power switch and battery box cables.



02 On the opposite side of the chassis, use a size 2 Phillips screwdriver to unscrew the two countersunk screws from the top of the front throttle servo mount, and the two dome-headed screws from the rear throttle servo mount. Keep the screws to hand as you will be using them again.



03 Turn the assembly over so that the underside of the chassis is facing upwards. Undo the two screws securing the rear throttle servo mount, and remove it.

04 Turn the assembly over and, holding the throttle and brake servo in your hand, feed its red, white and black cable and connector through the cutaway at the bottom of the front servo mount (see arrow).

05 Pull the cable through until the connector is beyond the front end of the gearbox.

06 Slide the servo into place, with its front mounting tab fitting into the gap between the gearbox cover and the top of the servo mount (see arrows).

07 Push the servo fully into place, making sure that its screw holes align with those of the gearbox cover and the servo mount, as shown.

08 Hold the servo mount removed in Step 03 as shown in the photo, and put it back in its original position, with its flat side facing towards the front of the car and the screw holes in its base aligned with those on the chassis.

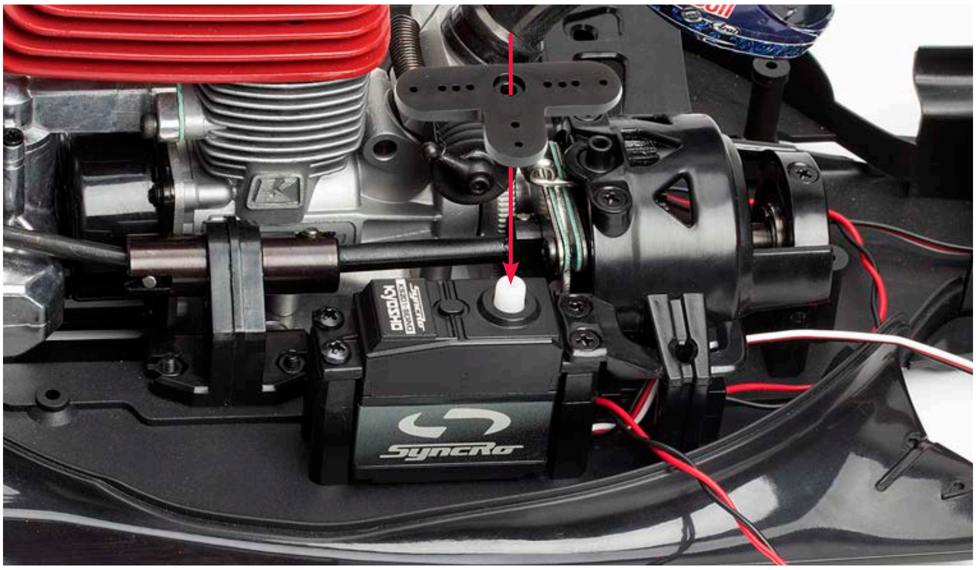
09 Your assembly should look like this, with the screw holes at the top of the mount aligned with those of the mounting tab at the rear of the servo.

10 Holding the mount and servo in place, turn the chassis over and insert the two screws removed in Step 03. Tighten them into place with the size 2 screwdriver.

11 Turn the assembly around and make sure that the screw holes in the top of the mount and those of the servo are still aligned.

12 Put the two countersunk screws removed in Step 02 into the holes at the front of the servo, and tighten them using the size 2 screwdriver.

13 Insert and tighten the two dome-headed screws removed in Step 02, to secure the rear of the throttle servo to the mount.



14 Lower the servo horn, positioned as shown – with its shortest arm facing outwards and the circular socket at its centre facing downwards – onto the white gear on the top of the servo (see red arrow).

15 Place the screw supplied with this stage into the hole in the top of the servo horn, and tighten it using a size 1 Phillips screwdriver.

16 This stage is complete, and your assembly should now look like this. Store it away safely until next time.

Stage 82

INSTALLING THE FUEL TANK

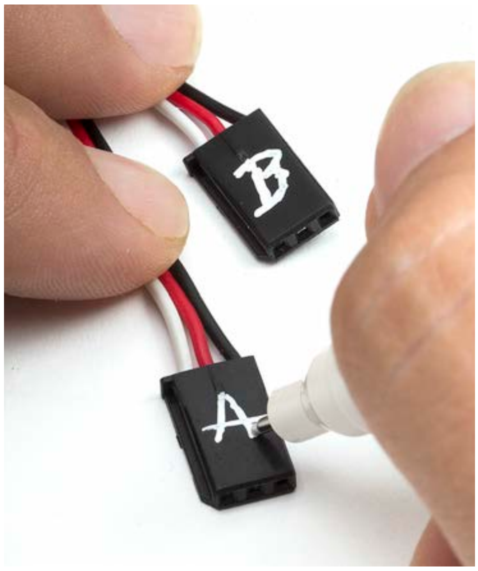
IN THIS SESSION YOU WILL MOUNT THE FUEL TANK ONTO THE CHASSIS OF YOUR RB7, THEN CONNECT IT TO THE CARBURETTOR, READY FOR USE.

Tools & Materials

Phillips screwdriver (size 2)
Needle-nose pliers
Craft knife
Cutting mat
Ruler

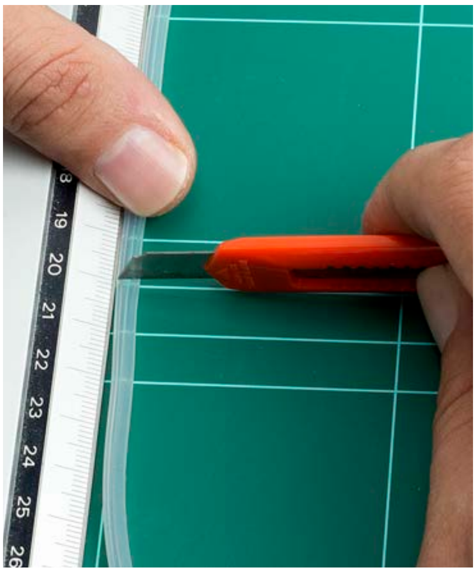
1. Fuel tank
2. 2 O-rings
3. 2 dome-headed screws 3 x 12mm
4. Fuel tube (32cm)

01 For this assembly session, you will need your model plus the fuel tank and associated parts supplied with this stage.

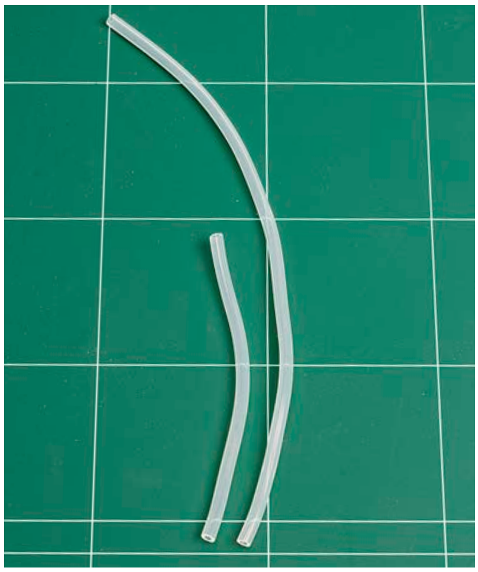


02 Before you begin, mark the connector on the cable from the steering servo with an 'A', and the one on the cable from the throttle servo with a 'B'. This is important, because it will be difficult to tell which connector is which once the fuel tank is in place.

03 Arrange the cables on the chassis as shown in the photo, to prevent them being damaged by the fuel tank when you install it.



04 Lay the fuel tube on a cutting mat next to a ruler, and use a craft knife to cut it to a length of 20cm.



05 When you cut the 20cm length from the tube, there will be a shorter length left over. Trim this shorter piece to a length of 10cm, and keep it to hand because you will need it in Step 07.

06 Push the tip of the 20cm length of fuel pipe over the nozzle on the top of the fuel tank (red arrow). Push the end of the tube on as far as it will go.

07 Push the 10cm length of fuel pipe over the nozzle at the bottom of the tank.

08 Position the fuel tank on your work surface, then place one of the dome-headed screws into the hole near the 20cm length of pipe (arrowed).

09 Turn the fuel tank over and slide one of the O-rings over the threaded section of the screw. You may find it easier to use needle-nose pliers to do this. When the O-ring is in place, repeat Steps 08 and 09 for the screw hole on the opposite side of the fuel tank.

10 Carefully lower the fuel tank into place at the front of your model, behind the front lower chassis and beneath the helmet air filter cover, so that the two screws fitted in Steps 08 and 09 line up with the fuel tank posts that you fitted in Stage 31.

11 Your assembly should look like this, with the lip at the front of the tank underneath the rear end of the front lower chassis plate (arrowed).

12 Tighten the two screws into the fuel tank posts, using a screwdriver.

13 Next, push the end of the 20cm length of fuel tube over the arrowed spigot just in front of the muffler. You may find it easier to do this using needle-nose pliers.

14 Now push the end of the 10cm length of tube over the spigot on the carburettor (arrowed).

15 This session is now complete, with your RB7's fuel tank installed and its fuel tubes in place, ready for use. Store your assembly safely until next time.

Stage 83

RC BOX AND STARTER BAR

IN THIS SESSION, YOU WILL FIT AN IMPROVED HANDLE TO THE RECOIL STARTER AND THEN INSTALL THE RC BOX, WHICH IS MOUNTED ON THE CHASSIS AND HOUSES THE BATTERY BOX AND THE RC RECEIVER.

Tools & Materials

Phillips screwdriver (size 2)
Large screwdriver
Needle-nose pliers
Scissors
Superglue

1. RC box lower
2. RC box top
3. Body pin
4. 2 self-tapping countersunk screws 3 x 10mm
5. 3 self-tapping countersunk screws 3 x 8mm
6. Recoil starter ring
7. Recoil starter bar
8. Double-sided foam tape

01 Gently pull out the recoil starter cord until it is fully extended. Then wrap the cord around a large screwdriver, close to the engine, to stop it being pulled back in again by the recoil starter spring.

02 At the other end, use needle-nose pliers to pull the knotted end of the cord out from within the starter handle. Use scissors to cut the knot off, cutting as close to the knot as possible.

03 Remove the existing handle from the cord and put in a safe place.

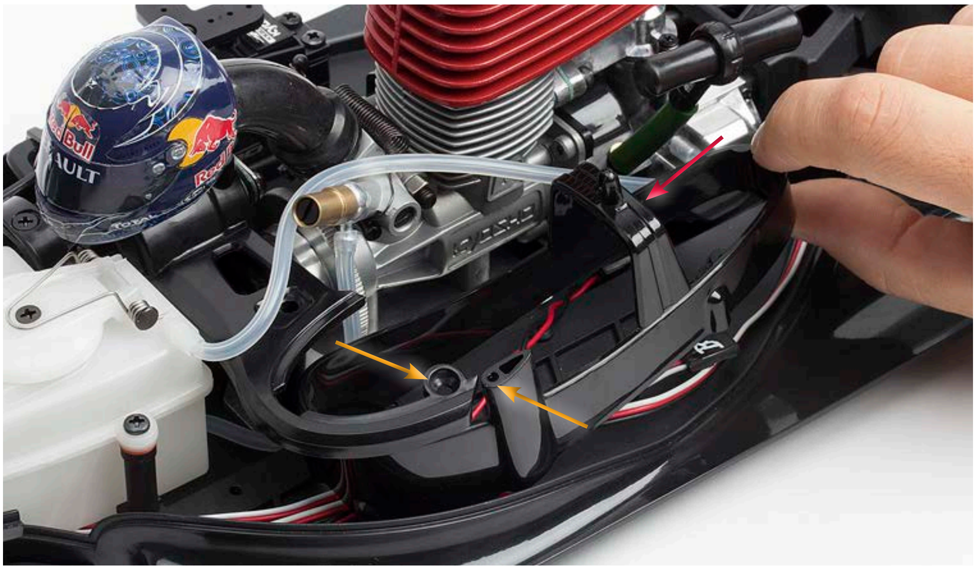
04 Place the recoil starter ring, supplied with this stage, flat on your work surface and feed the end of the cord into it, as shown.

05 Use needle-nose pliers to pull the tip of the cord out from the rectangular opening in the ring, then tie a knot in the free end.

06 Pull the knot tight, using the needle-nose pliers if it helps, then trim off any excess with the scissors. Apply a small blob of superglue to the knot to make it more secure.

07 Pull the cord back through the ring so that the knot sits within the rectangular cut-out in the starter ring, as shown above.

08 Hold the ring with its wider side facing upwards, and push the thinner end of the recoil starter bar into it as far as it will go. Then gently twist the bar until it snaps into place.



09 Next, begin the installation of the RC box on the left side of your RB7's chassis by hooking the fuel tube over the top of the carburettor so that it doesn't get in the way or become kinked. Then hold the RC box lower so that its wider end is facing the front and the crossbar (red arrow) is facing upwards. Slide the part down and forward onto the chassis, so that it fits neatly beneath the curved arm of the gearbox cover. Make sure that the screw hole in the RC box lower ends up directly below the one on the tip of the gearbox cover (orange arrows).

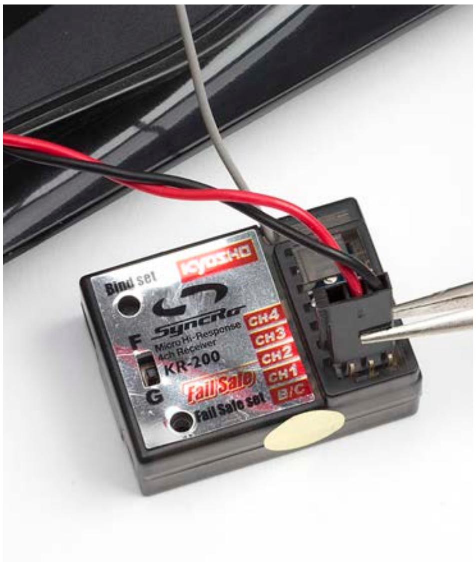
10 There is a rectangular cut-away section in the bottom of the front end of the RC box lower, through which the cables should run. Make sure that all the cables are fitting comfortably within this space, with none trapped between the box and the chassis.

11 Take the 3 x 8mm countersunk screw left over from Stage 61, and insert it through the hole at the tip of the gearbox cover and into the corresponding hole of the RC box lower. Tighten it fully with a Phillips screwdriver.

12 Holding the parts in place, turn the assembly over and place the three 3 x 8mm countersunk screws supplied with this stage into the three countersunk holes marked with the red arrows. Tighten each with the Phillips screwdriver.

13 Next, place the two 3 x 10mm countersunk screws supplied with this stage into the two holes marked with the red arrows. Tighten them fully.

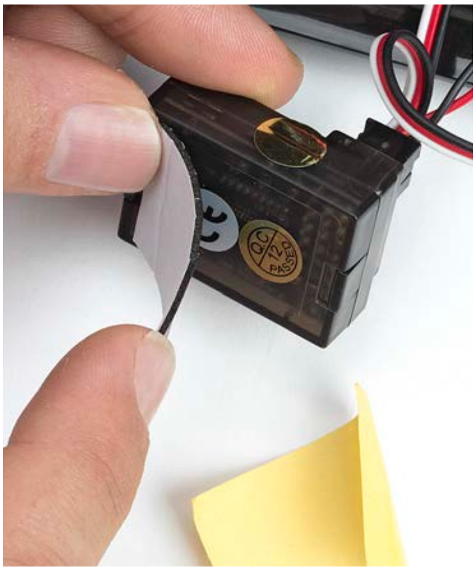
14 Turn the assembly back over and connect the cable from the battery box to the red connector. NB: Don't put the battery box into the RC box at this point.



15 Place your RC receiver (included in your subscription) face-up on your work surface, as shown. Plug the black double-wired connector into the socket labelled B/C, with the black wire on the right, as shown here.

16 Next, plug the connector that you marked with an 'A' in the previous stage's assembly session into the socket labelled CH1. Then fit the connector marked 'B' into the adjacent socket, labelled CH2.

17 Lay the RC receiver on its side, then hold the double-sided foam tape next to it and cut away a section the same size as the receiver's base.

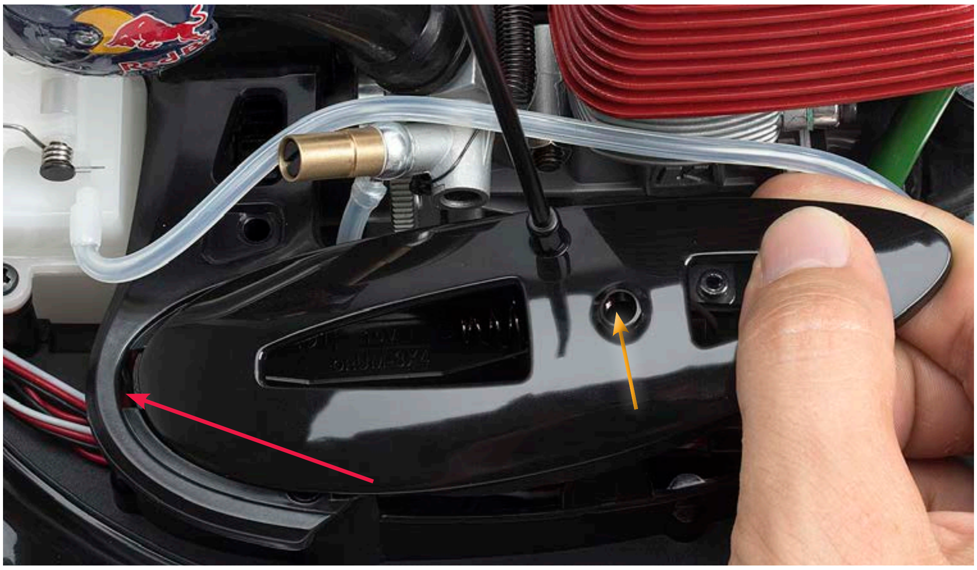


18 Remove the yellow backing from the foam tape, and stick the tape onto the base of the RC receiver.

19 Carefully lower the RC receiver into the RC box, making sure that the base doesn't touch the chassis until the part is in place, and position it as far towards the rear of the box as it will go. Then lower it onto the chassis and press it down to stick it in place.

20 When the RC receiver is in place, slot the battery box into place at the front of the RC box.

21 Take the antenna tube, supplied with Stage 80, and push it into the hole in the top of the RC box. Then feed the RC receiver's antenna cable (the grey cable) through the hole in the RC box top as shown, inserting it from the underside of the box top, and push it through as far as it will go.



22 Slide the RC box top into place so that the tab at the front slots into the corresponding recess on the RC box lower (red arrow), and the hole marked by the orange arrow fits fully over the raised boss on the crossbar of the lower section. Carefully press the box top down until the boss is protruding through the hole.

23 Using needle-nose pliers, push the straight leg of the body pin through the horizontal hole in the boss until the pin snaps into place.

24 This session is now complete, and all the electronic components of your RB7 racer are securely in place, ready for use. Store your assembly away safely until next time.

Stage 84

FRONT BODY AND NOSE

IN THIS SESSION, YOU TEST-FIT THE FIRST PARTS THAT WILL MAKE UP YOUR RED BULL RACING RB7'S DISPLAY BODY.

1 Front body
2 Nose

01 Join the upper nose to the front body. The parts should clip neatly into place (see red arrow).

02 Hold the assembly above the front end of your model, as shown, and carefully lower it into place so that the cut-away sections on either side of the front body fit over the upper wishbones.

03 Make sure that the edge of the front body sits flush to the curved side of the chassis.

04 This stage is complete, and you should now have an idea of what the finished display model will look like. For now, remove the parts and store them in a safe place until they are needed.