The Bachmann Class 04 shunter is based on a chassis which was originally designed by Mainline Railways for its ground-breaking model of the BR Class 03 shunter. It has a split frame chassis with current collection through split axles and the chassis frame to the motor which is directly connected to each half of the split chassis. It makes it an interesting, if challenging, model to convert to DCC.

Simple decoder installation was not, in all likelihood a priority for the designers of the split frame chassis concept. The benefits which were considered to be more of a priority included simplified electrical paths from track to motor, easier manufacturing methods together with the elimination of what were considered to be troublesome wiper pick-ups. It is easy to understand why the split frame chassis design became popular when taking one to pieces. They consist of two diecast sections which are a mirror image of each other where each makes up one half of the chassis. Insulation sleeves and bushes together with the use of split axles for the driven wheel sets ensures that each side of the chassis is electrically isolated from the other.

In effect, the design ensures there is an electrical path to the motor without the need for circuit boards and wires. Split chassis design simplified things for the manufacturer with no need for complicated electrical pick-up devices, complex circuitry and motor connections. However, the advent of DCC soon put an end to this design in OO gauge.

Electrical current from the track is collected via the wheels and direct contact between the axle and the bearing surface (steam locomotives and fixed frame diesel shunters) which is usually part of the split chassis frame shell. The motor and gears are fitted between the diecast chassis sections with a direct electrical contact between the chassis and motor contacts. Both sides of the split frame chassis are live, with the insulation sleeves and bushes fitted between the halves of the chassis preventing a short circuit.

There were a large number of 4mm scale ready-to-run models of various types produced with split frame chassis of one sort or another; from small shunters to larger tender engines, many of which are very robust and reliable designs and likely to be still in service on layouts today. Primarily, they are found in Bachmann models originating from the Mainline Railways range and includes our subject models: the Class 04 shunter and J72 tank engine.

The first significant issue for modellers to consider is the lack of space for a decoder in split frame engines. The opportunity to pack as much ballast into the model as possible was taken by the manufacturer to meet the demand for good haulage capability.

The second point that DCC-users encounter is fundamental to the function of a decoder. They receive and interpret packets of data sent from the command station and ultimately the controller the modeller is using to operate the layout. Those packets of data are transmitted as part of the track supply current. Decoders, with their unique addresses, await their 'call sign' and when that is received, they will respond to any instruction that is transmitted to it. Decoders also utilise the constant supply of power from DCC systems and rectify this so an electric motor can perform normally. Consequently, the decoder has to sit between the track current supply and the motor with no direct connection between the track and the motor at all. Isolating the motor from the diecast chassis is critical to a successful installation. There must be no electrical contact between the motor and the chassis frame, bypassing the decoder or it will be destroyed!

The following projects demonstrate how to fit decoders to split frame chassis. The technique is basically the same no matter the model involved. When the conversion is complete, the model should be tested on a service track before being exposed to full track power. All NMRA compliant decoders are programmed with default address 0003 when produced at the factory. After the model has been tested for a satisfactory decoder installation, a new address can be allocated.
For each of these projects, the following tools and materials were used:

- Electrical insulation tape
- Bachmann 6-pin adapter (36-562)
- 'Kapton' tape
- Jeweller's screwdrivers
- A selection of 0.6mm electrical cable
- Soldering iron and electrical solder
- Needle files
- Tweezers
- Scissors and wire strippers
- Hacksaw
- Bench vice
- Bachmann 6-pin decoder
- Power drill and 4mm diameter drill suitable for metal
- Wet and dry abrasive paper.

With so much metal making up the internals of these models, insulation tape is essential to protect the decoder from direct contact with the chassis. Insulation tape, be it old fashioned electrical tape, or where space is tight, specialist tape such as 'Kapton' tape, should be applied to metal surfaces where a decoder will be fitted or could come into contact with it.

Before commencing the actual conversion, the model has to be dismantled into its component parts, something which can be quite daunting. However, there’s no cutting up chassis blocks until everything is removed and safely put aside. Do not be put off by having to take things apart. The construction of split frame chassis models is relatively straightforward; only those locomotives with complex valve gear may present a challenge.

When deciding where to locate a decoder, choose a spot where the least amount of metal has to be removed. This is important in several respects: to make the job easier, and to retain as much ballast weight as possible so impact on locomotive performance is not affected. Remember, there has to be some space around the decoder to allow air flow over it. However, the large metal chassis block will ensure that any heat from the decoder is dissipated.

An easy way of checking that a motor is completely isolated from the chassis frames in a converted model is to apply test leads to either side of the reassembled chassis and see if the motor rotates. A connection to each of the new motor leads alternately with the chassis block on the opposite side will soon reveal if the connection between motor and chassis is broken, as required for this type of conversion.

**Project 1: Bachmann OO Gauge Class 04 Shunter:**

In common with all split frame chassis models, the body of the Class 04 conceals a lump of metal designed to give the model maximum haulage capacity. The chassis completely fills the interior of the model except the cab space, with no room for a typical decoder - this being of no importance when this chassis type was first designed. It’s not desirable to put the decoder in the cab because both it and the harness wires will be visible under normal viewing conditions.

To fit a decoder to this model, some cutting of metal from the top of the chassis frame is necessary. However, once 3mm or so of metal has been removed, a Bachmann HO/OO gauge decoder such as the 1 Amp, two function type (36-552) can be easily accommodated. The motor must be isolated from the chassis frames with 'Kapton' tape and the orange and grey harness leads soldered directly to the motor terminals.

A small tank engine, the J72, also presents the same space constraints as the Class 04 shunter. In fact, the primary concern in virtually all split frame chassis engines is the lack of space, even in larger locomotives.

**Points to Consider:**

When undertaking this type of conversion, the choice of decoder can be determined by the available space as well as one of decoder performance. Most modern decoders work well with the majority of ready to run models, so performance is rarely a serious consideration. The Bachmann 6-pin decoder (36-558) fitted to the J72 model with the help of a 6-pin adapter (36-562) has a sufficiently high current rating to cope with the motors fitted to smaller split frame models. A 6-pin dummy plug was fitted first for testing of the converted model on analogue power before the decoder was plugged in.

Isolating the motor from the chassis frames by cutting away the metal that makes contact with the motor terminals is considered to be best practice. However, the design of some locomotives makes it difficult to do this without weakening the chassis or removing a screw mounting hole. In those cases, it is necessary to rely on insulation tape for isolation. Use high quality tape specially designed for high performance situations such as this and 'Kapton' tape will do the job admirably.
Finding the right decoder for a model is as much to do with the available space as it is to do with decoder performance. Choose the largest decoder possible if space can be made inside the model to accommodate it.

It is time to completely dismantle the model to modify the chassis block and break the electrical connections between the chassis and the motor. This is an important part of this type of DCC conversion because the motor terminals are in direct with each half of the chassis block. The way a split frame chassis works is now more apparent with the insulation gap between the frames (A); insulation bushes (B), insulated securing screws (C); electrical contact between split axles and the chassis frame (D) and insulating bushes on each wheel set (E).

Release the three screws holding the chassis together to reach the motor and gears. Note the connections between motor and chassis block (A); insulating bushes (B) and insulation sleeve fitted to the motor (C). Do not lose the insulating bushes!

The installation is basically complete. The red and black harness wires (A) were fed through to the base of the chassis to be held in place by the bottom plate thus forming a positive connection with the split frame chassis block, one cable making contact with either side. Exposed metal of the chassis block has been covered in insulation tape to protect the decoder from accidental contact (B). The decoder has been connected to the two cables leading to the motor terminals (C) thus completing the project. The model was reassembled and the body replaced.

The motor terminals were not isolated from the frames using 'Kapton' tape in this instance, but by completely drilling metal away. Furthermore, part of one chassis frame half was removed to make room for the decoder without the decoder or harness wires showing in the gap between the locomotive frames and the boiler. A lot of drill filings result from this conversion, so care is taken to clean them all away before reassembly of the chassis.

There's no more room for a decoder in the Bachmann J72 of this vintage than in the Class 04 or many other models with split frame chassis. However, the conversion takes around three hours to complete, which is not bad considering the amount of chassis modification required.

This picture offers some idea of how little space actually exists in one of these models. However, the fit was not so close as to leave about 1.5mm all round the inside of the water tanks. This was a real bonus for running harness wires from the decoder to the motor terminals without pinching them between the chassis and body.
Converting Other Models:

The conversion principles described in this article apply to almost any split frame chassis model which works on 12v DC power and almost anything from the Palitoy and Bachmann family. Once the thought of cutting up diecast chassis frame shells has been reconciled, there is no reason why any ready could not tackle such a conversion. The chassis frames are tough, so it is unlikely that they will become damaged in a bench vice unless it is over tightened. Remember to clean filings away, isolate the motor, fit a sharp new blade to the hack saw and split frame chassis conversions are no longer a serious challenge!

Apply the techniques described in this article to any of the Bachmann split frame chassis models including large valve gear fitted locomotives such as the Thompson B1*. In fact, the tender might offer an option for accommodating a decoder without having to modify the chassis too much (other than isolating the motor from the chassis frames) as long as connecting wires between the engine and tender are not going to present a problem.