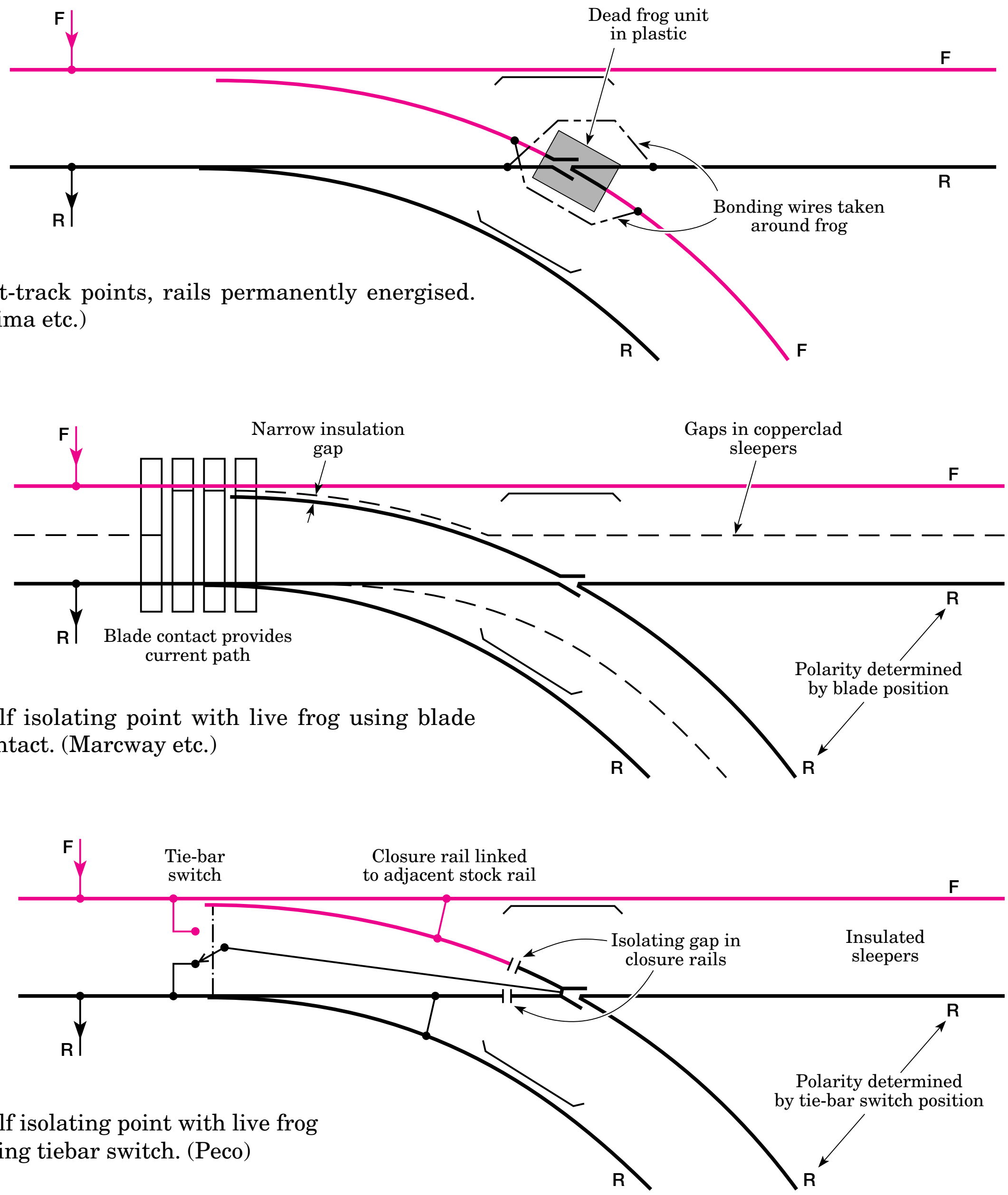
3 Point Wiring

3.1 Two Rail Turnouts

Commercial turnouts are wired in one of two ways, through wired or self isolating. Through wired turnouts, like the Lima version shown in Figure 3-1a, are generally associated with commercial set-track used for small layouts having one locomotive operating at a time. A single power supply connection to the layout ensures that all the track is energised, which is fine if the layout design is simple. However, to ensure good electrical contact between the locomotive and the rail it is preferable to use live crossings but this requires the crossing polarity to change when the point changes. Figures 3-1b and 3-1c show two alternative methods adopted by commercial track builders.

Note: The dotted lines in the following drawings show the location of the gaps required if copperclad sleepers are used.



a) Set-track points, rails permanently energised. (Lima etc.)

b) Self isolating point with live frog using blade contact. (Marcway etc.)

c) Self isolating point with live frog using tiebar switch. (Peco)

FIGURE 3-1
Commercial point construction methods.

There are advantages and disadvantages with each method, for example the blade contact method (Figure 3-1b) does not require any moving parts, apart from the point blades themselves that is, whereas the tiebar switch (Figure 3-1c) gradually suffers from wear and erratic contact. On the other hand, with the blade contact type a small piece of ballast or a film of corrosion on the blade can prevent good electrical contact. This can sometimes cause difficulties as the point movement may appear to be satisfactory, and rolling stock pushed through it moves freely, while a locomotive comes to a dead stop. A further problem that can occur with blade contact type points, especially if the clearances are tight, is arcing between the open blade and the back of the wheel running on the adjacent rail.

When using hand built points, energising the crossing through a change-over switch is to be pre-

Note: The dotted lines in the following drawings show the location of the gaps required if copperclad sleepers are used.

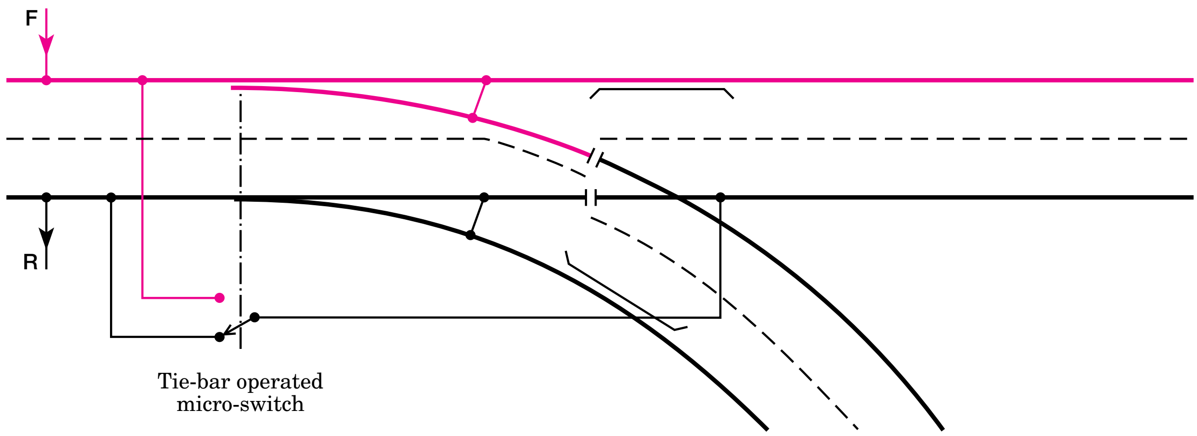


FIGURE 3-2
Basic self-isolating 2-rail point.

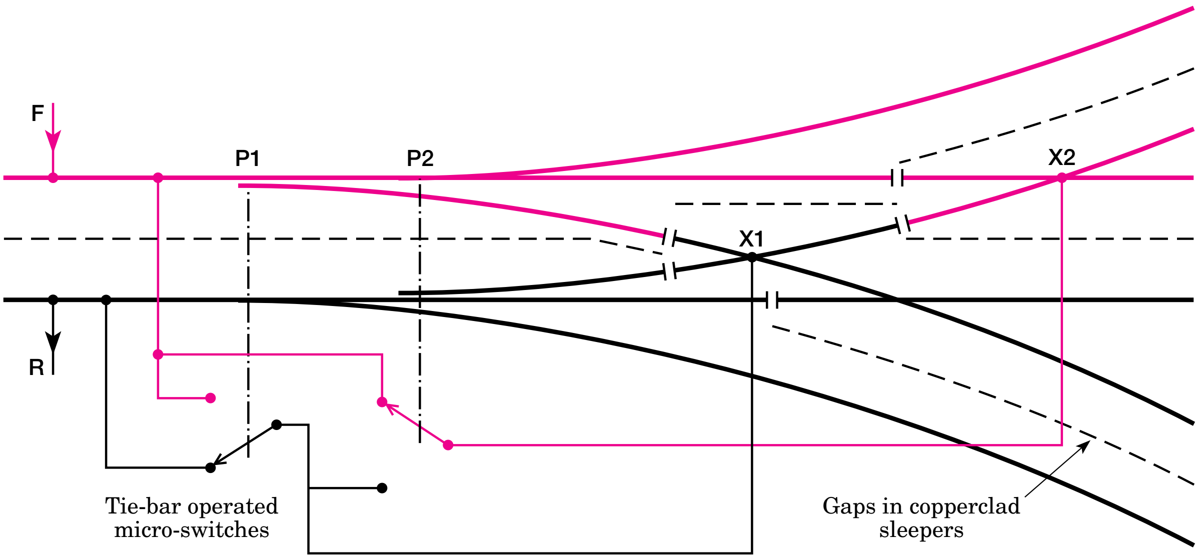


FIGURE 3-3
Standard three way 2-rail point.

ferred to ensure positive electrical contact. Figures 3-2 and 3-3 show the rail breaks and switch wiring for a simple turnout and a three-way turnout. On manually operated points one of the most popular types of change-over switch is the button microswitch operated by the tiebar. An alternative is the slider switch which can double as a simple point lever. Some suggested methods of point operation and switching are shown in Section 3.3.

3.2 Three Rail Turnouts

(These include centre-third, outside-third and stud contact).

The only three rail turnouts produced commercially are those specially prepared for tinplate collectors. In those points the centre-third rail is bonded across the gaps into a single electrical unit. These points do not normally have section switches mounted on them.

Points for three-rail use can either be commercial two rail points adapted or hand built. The usual practice is to bond the running rails throughout the layout to form the common return path and divide the third rail into sections. Examples of an isolating point and a three way point are shown in Figures 3-4 and 3-5.

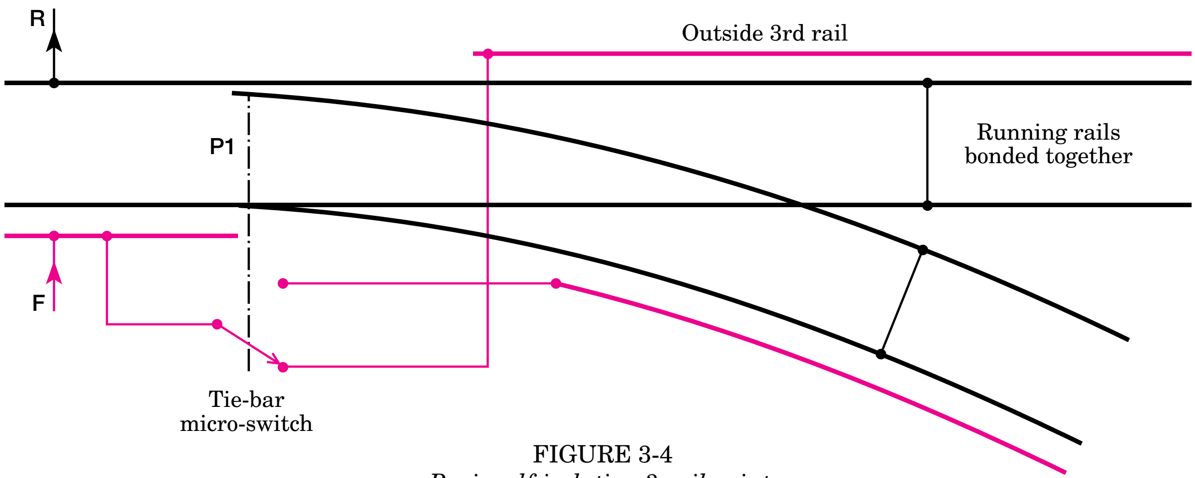


FIGURE 3-4
Basic self-isolating 3-rail point.
Outside third shown but connections are similar for inside third and stud contact collection systems.

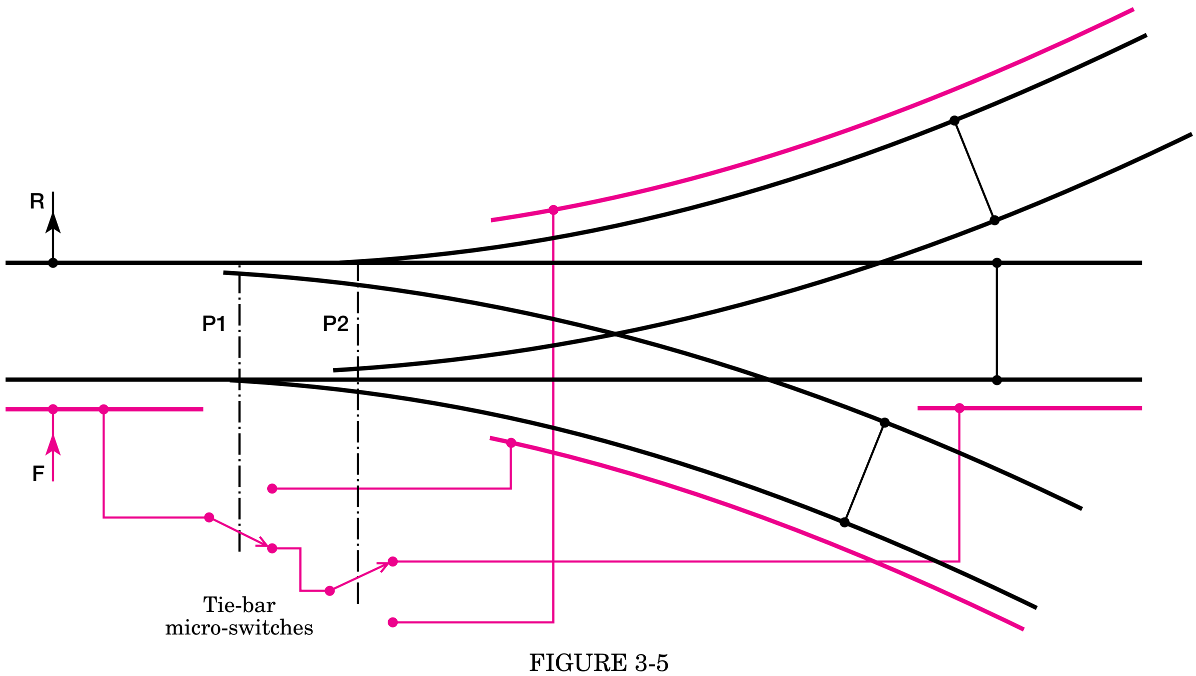


FIGURE 3-5
Standard three way 3-rail point.
Outside third shown but connections are similar for inside third and stud contact collection systems.

3.3 Self Isolating Points

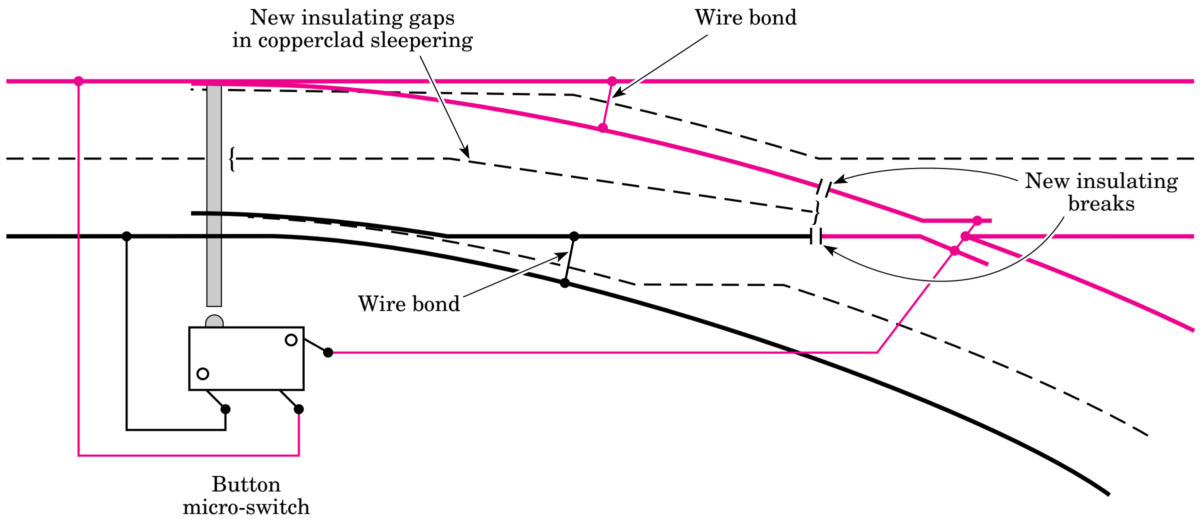


FIGURE 3-6

Self isolating point with tiebar switch.

The rail breaks, new gaps in the copperclad sleepering and wire bonds show how a blade contact point can be converted.

Pointwork having live crossings requires a change-over switch to alter the crossing polarity when the point reverses. One of the simplest and most reliable methods is the button micro-switch operated by the point tiebar as shown in Figure 3-6. The blade contact versions (Figure 3-1b) are difficult to keep electrically clean and it is recommended that they be converted to switch operation when being laid. This entails cutting insulation breaks in the closure rails just before the crossing, bonding the switch and closure rails to their adjacent stock rails and, if the rails are soldered to copperclad sleepering, cutting additional insulation gaps. (Figure 3-6) Note that the three wires involved are local to the point and do not necessarily form part of the power supply to the track. Also note that there are several designs of micro-switch available so check which terminal is which before connecting up.

Where point movement is controlled by a point motor, there is usually at least one auxiliary change-over switch mounted on the point motor body which can be used to change the crossing polarity.

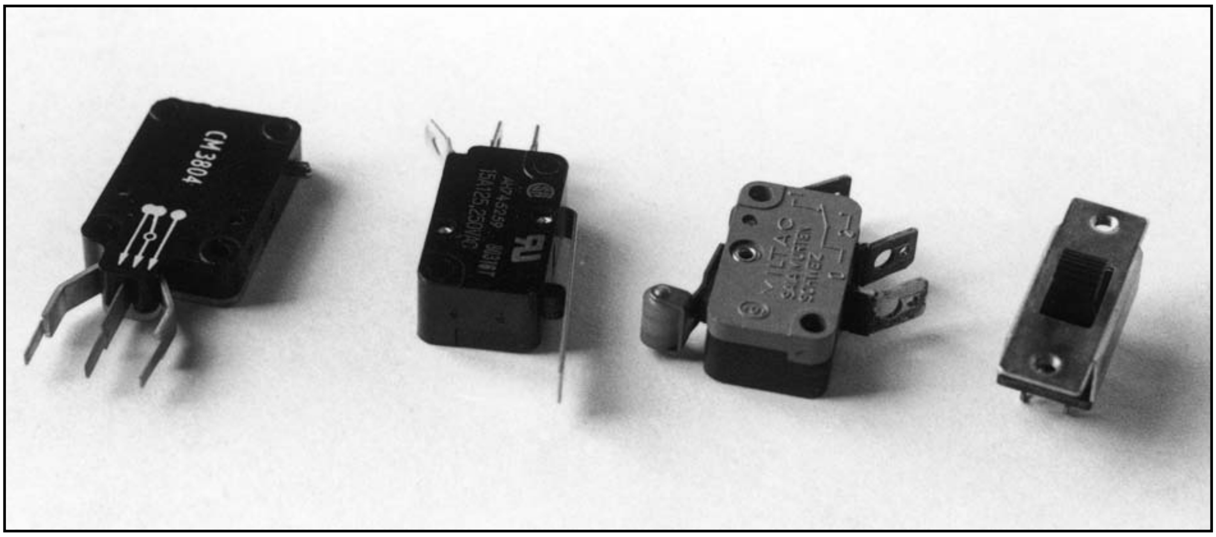


PHOTO 3.1

From the left, button, lever and roller micro switches suitable for changing the polarity of the point crossing. The slider switch, if fitted with a point operating rod, makes a useful local point control.

3.3.1 Multiple sidings

Figure 3-7 shows a fan of four dead end sidings. Each of the three point crossings (X1, X2 and X3) is wired 'locally' and, as a result, only one siding can be made live from the track feed and return connections. **Handy Hint:** The usual convention when sketching track power feed and return connections (F and R on the drawing) is to show them at the toe of the point(s). However, they could equally be made at the positions marked F[1] and R[1] as the outer rails of the fan do not have any breaks. Useful if the control position happens to be at the far end of the sidings.

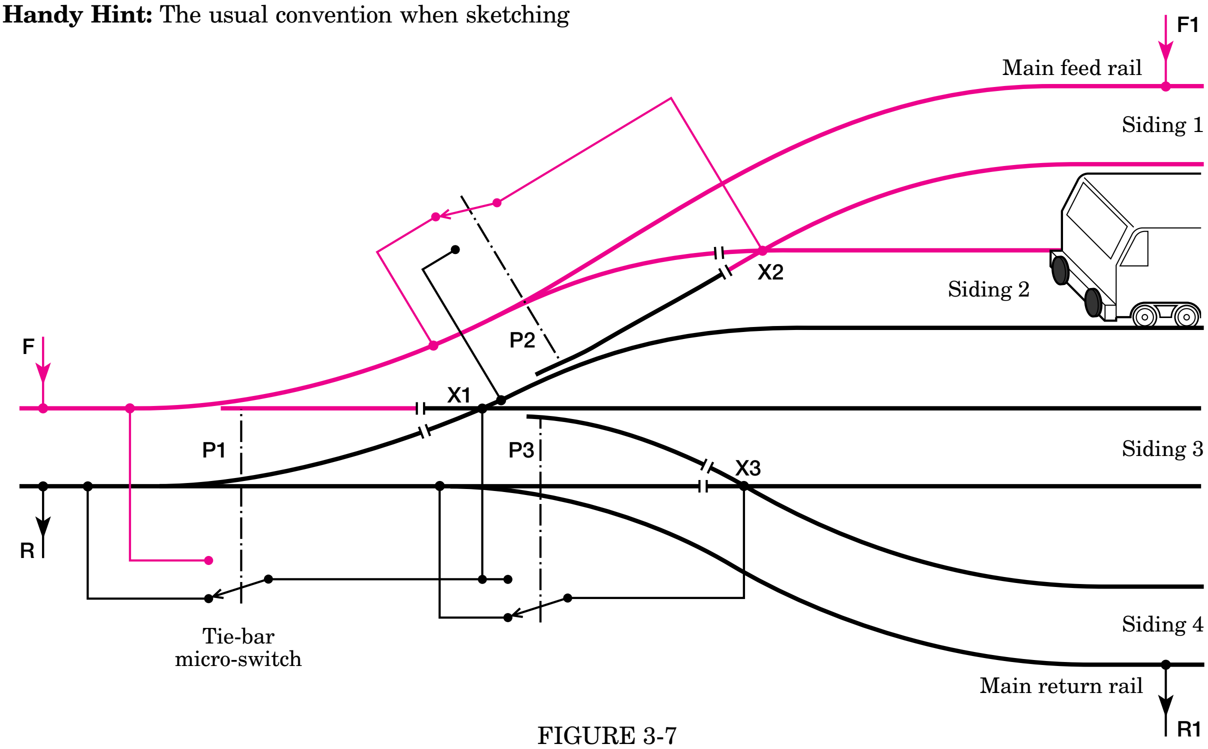


FIGURE 3-7
Siding fan showing only one road energised via the self isolating points.

3.3.2 Loops

Where self isolating points lead to a loop, additional insulation breaks are needed. Figure 3-8a shows a loop with both points set to the straight route resulting in a short circuit. By the addition of the two rail insulation breaks shown in Figure 3-8b the short circuit is prevented. The location of these insulation breaks can be varied but a useful position is one and a half locomotive lengths from the fouling point. Should a locomotive be accidentally driven beyond the break when the loop exit point is set against it, it will be brought to a halt before it can foul the other line.

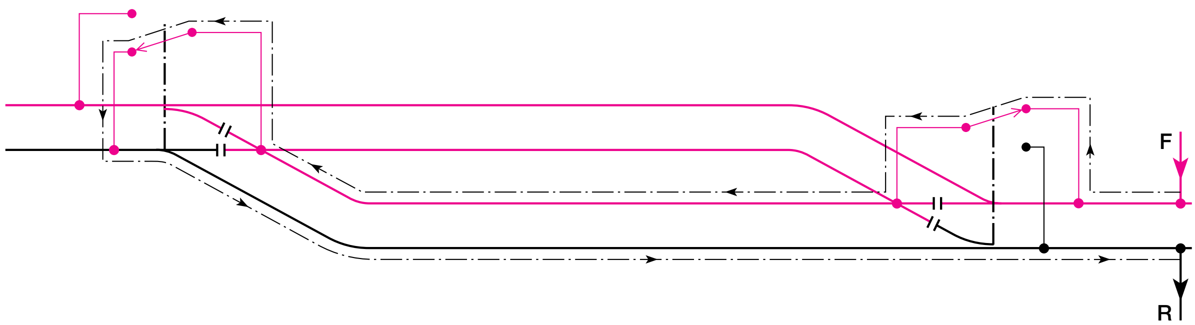


FIGURE 3-8a
Short circuit occurring through a loop, additional insulation gaps needed.

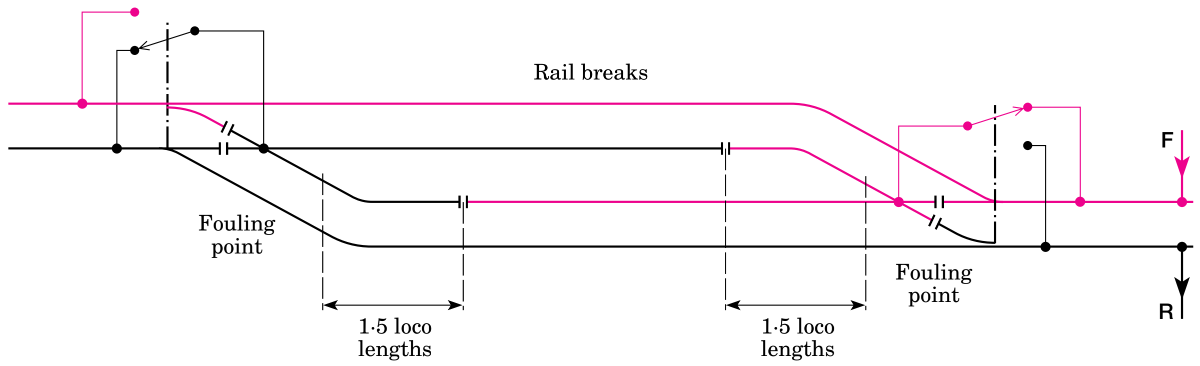


FIGURE 3-8b
Loop with additional insulation gaps set back to clear the fouling point.

3.3.3 Safety dead sections

The simple insulation breaks described in 3.3.2 above provide satisfactory protection in the majority of cases. However, a temporary short circuit can be created when a locomotive overruns the break and bridges the break with its frames. If this brief short circuit is unacceptable then the addition of a further insulation break at the fouling point will create an electrically dead section. This is the section marked **a** in Figure 3-9. Power is supplied via a second tiebar switch which connects it to the crossing when the point is set in its direction. Where the two tracks are used for converging movements it is useful to put a similar dead section in the other track (marked **b** in the drawing). In this case the power feed is supplied from the other contact of the additional tiebar switch. An alternative method would be to feed the dead sections from contacts mounted on the corresponding signal operating mechanisms or their associated relays but that is dealt with in a later section.

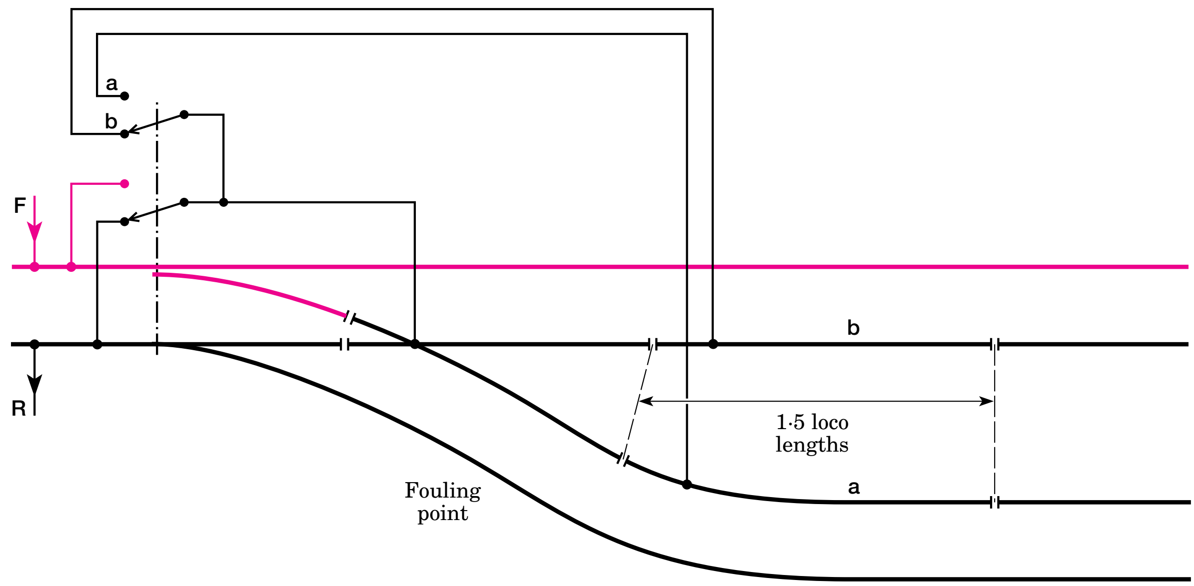


FIGURE 3-9
Additional insulation gaps at the fouling point give an electrically dead safety section to prevent momentary short circuits.

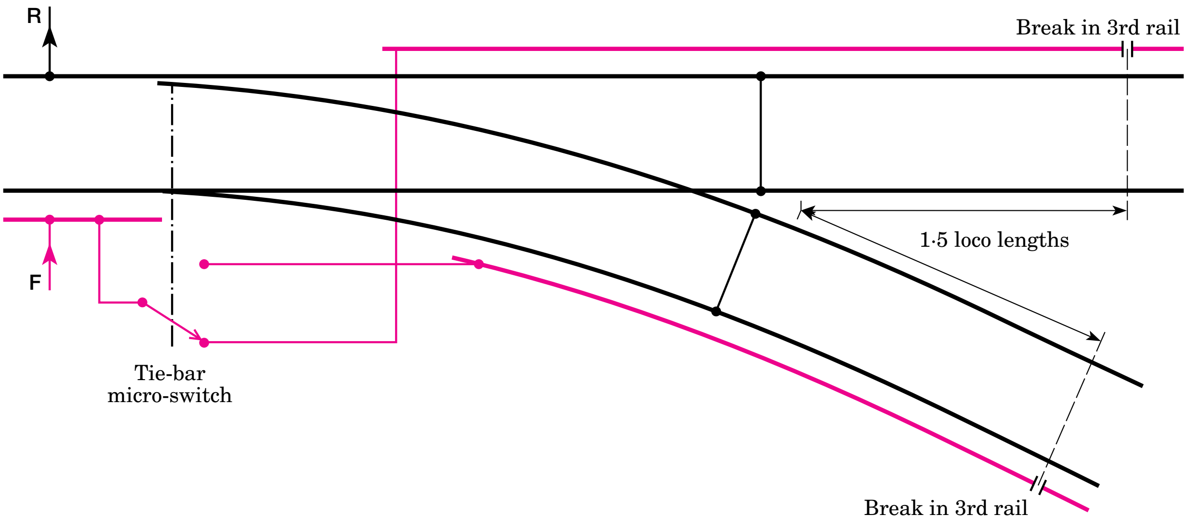


FIGURE 3-10
Safety dead sections in three rail wiring

To provide safety dead sections in three rail wiring does not require additional switching, just breaks in the third rail at the appropriate distance from the fouling point.

3.3.4 Heel fed points.

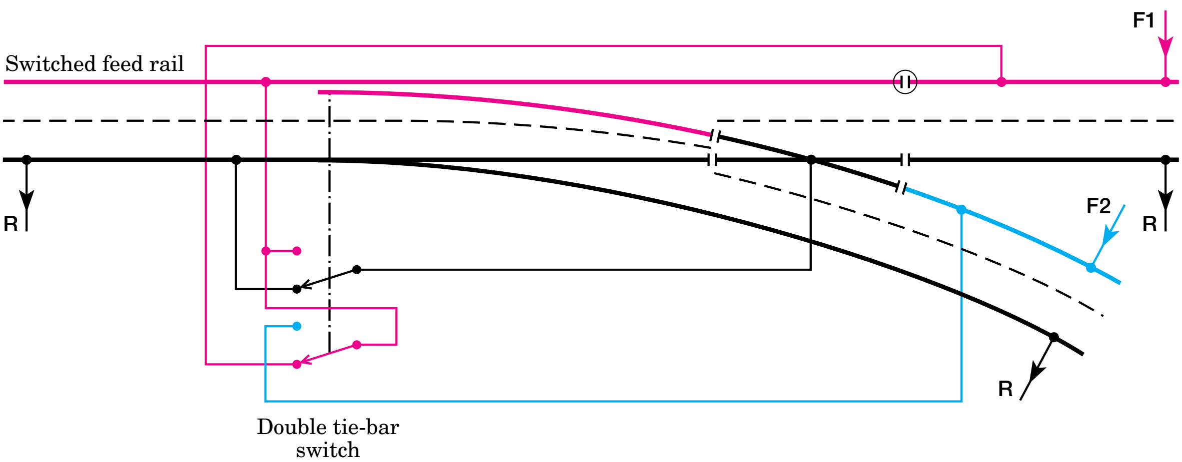


FIGURE 3-11
Self isolating point fed from the heel.

Note the similarity to Figure 3-9. An additional break, shown ringed, is needed in the feed rail. This configuration has a number of uses, for example, the release crossover at the end of a terminal road. Feed F1 could be the platform road feed and F2 the engine escape road feed. The switched feed rail in the dead end is normally fed from F1 via the extra tie-bar switch. After arrival, the locomotive is uncoupled and runs forward into the dead end. Reversing the point transfers the switched feed rail connection to F2 and the locomotive can be driven out along the engine release road. (See Figure 3-18.)

The insulation gaps required to provide the safety dead sections shown in Figure 3-9 can be retained if needed but would require a third tie-bar switch to operate them.

3.3.5 Slips, diamonds, multiple crossings.

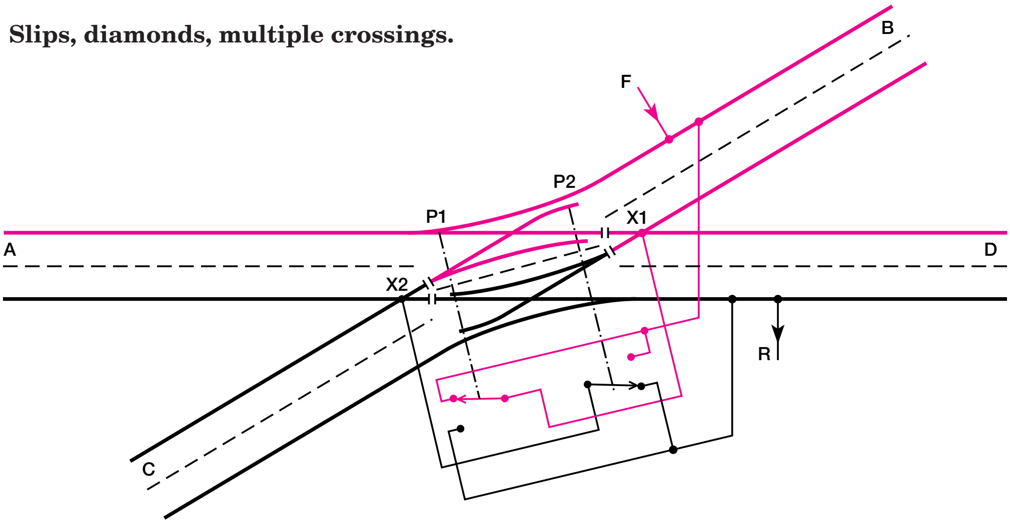


FIGURE 3-12
Double Slip

A double slip is the equivalent of two simple points set back to back. As shown the route is set from A to D with the crossing X1 connected to the feed side and crossing X2 connected to the return. Reversing P1 sets the route from A to B and connects the crossing X1 to the return side. Reversing P2 sets the route from C to D and connects the crossing X2 to the feed side. Reversing both P1 and P2 sets the route from C to B and connects crossing X1 to the return side and crossing X2 to the feed side.

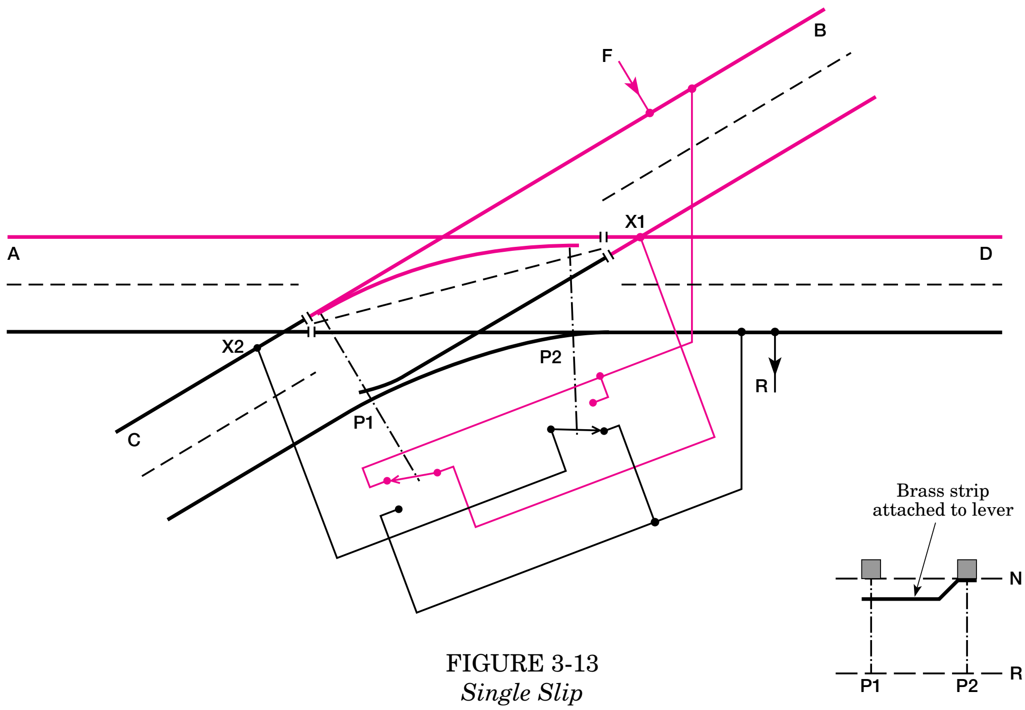


FIGURE 3-13
Single Slip

Construction of a single slip is similar to a double slip but, unlike the double slip, the points must be operated in a set sequence to avoid cross feeds. As shown, the route set is from A to D with crossing X1 supplied from the feed side via point P1 switch and crossing X2 supplied from the return side via point P2 switch. This would be considered the normal setting. Reversing P2 sets the route from C to D and connects crossing X2 to the feed side via P2 switch. Reversing P1 sets the route from C to B and connects crossing X1 to the return side via point P1 switch, but it is also necessary to reverse P2 to ensure that crossing X2 is connected to the feed side via P2 switch to give the correct polarity through the point. A simple way to ensure this is to interlock the point levers so that P2 must be reversed before P1 can be moved. The inset sketch of the point levers shows one way that this can be done.

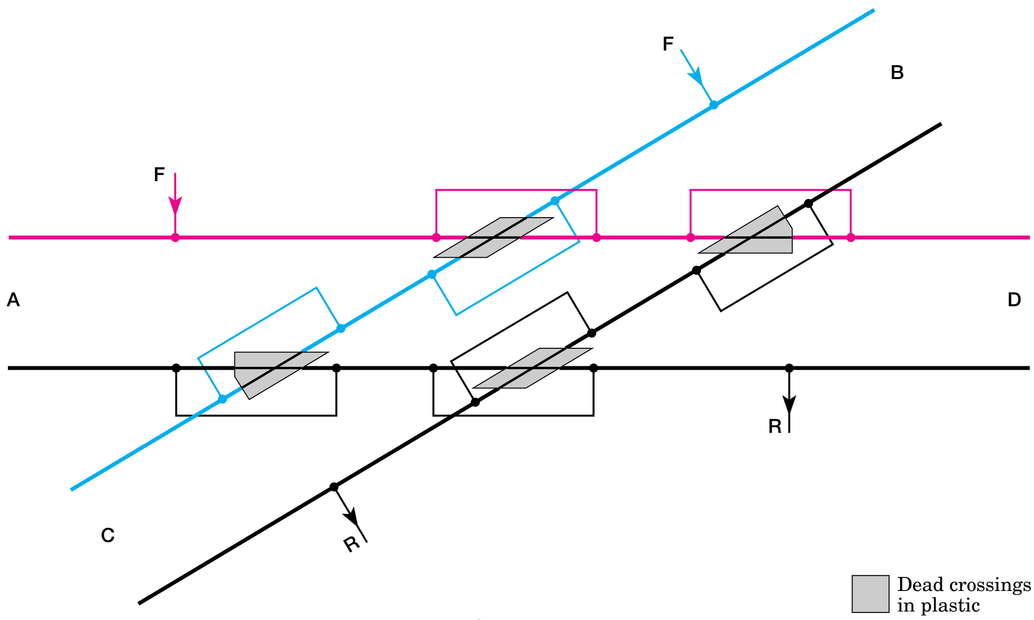


FIGURE 3-14
Crossing Diamond. (Dead frog)

Normally only found in set-track diamonds, e.g. Lima, where the two circuits are kept separate and no switching is required.

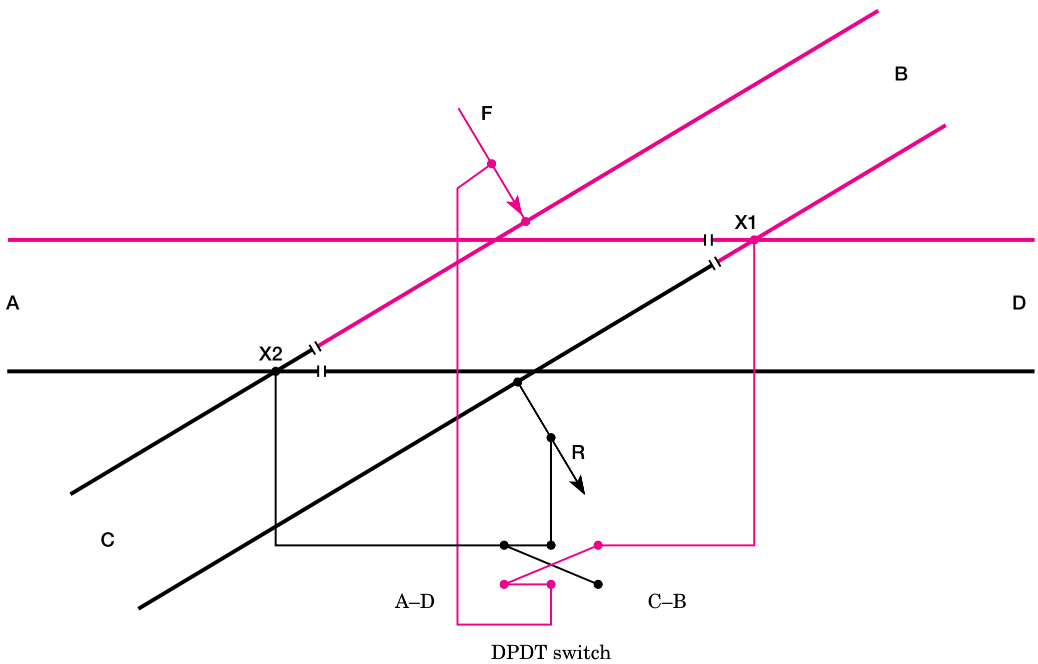


FIGURE 3-15
Crossing Diamond. (Live frog)

In the absence of moving parts (except where the diamond angle is so shallow that the K-crossing rails are made movable) it is necessary to provide a separate switch to change the polarity of the two crossings. If the diamond forms part of a more complex junction it is possible that the switching can be carried out by adjacent pointwork. An example would be a double junction, (illustrated in Figure 3-16).

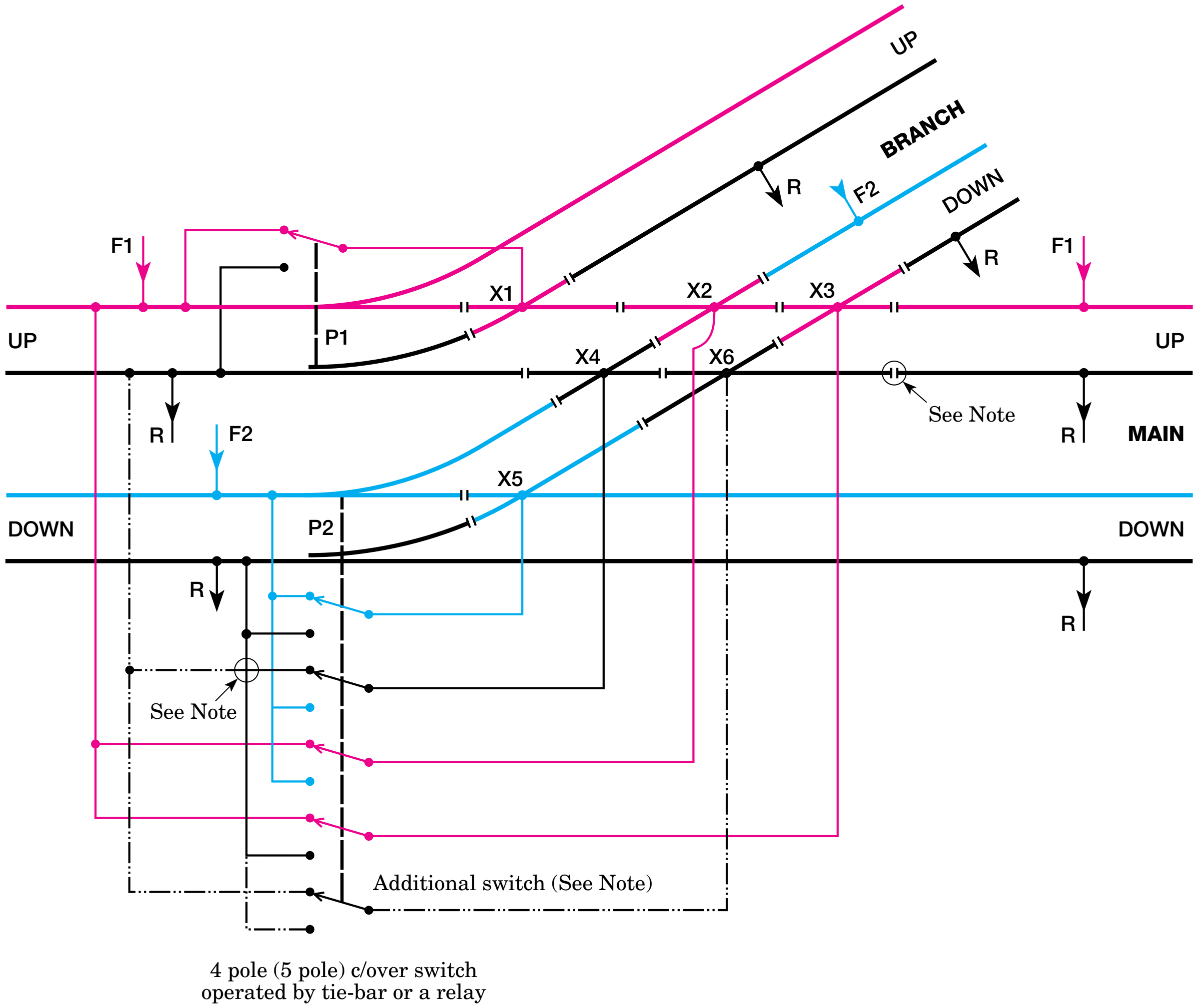


FIGURE 3-16
Double Junction.

The basic arrangement shown here assumes that one controller (F1) is supplying the Up Line and a second controller (F2) is supplying the Down Line. The return rails (R) are all connected together to form the Common Return to the controllers. (See note below re. crossing X6 and Down Branch common return). Prototype practice is followed, that is, to set the junction for a movement from Down Branch to Down Main, Up Line point P1 must be reversed before Down Line point P2 and, similarly, point P2 must be restored to normal before P1. As the diamond polarity changes are only required when there is a movement from Down Branch to Down Main, the additional switches to change the polarity of crossings X2, X3 and X4 are operated by point P2. Point P1 is a basic unit requiring only one crossing switch.

Note: If the two controllers are fed from a single power supply unit (see Section 1, Figure 1-3) each control unit will require its own return circuit. This means that an additional insulation gap in the up line return rail (shown circled) is needed to create section X6 which is required to prevent the separate returns from being cross connected and creating the possibility of a short circuit. The additional switch with its connections to the up line return are shown. Also the switch supplying crossing X4 needs to be fed from the up line return instead of from the adjacent down line return (circled). This shows the advantage of using common return wiring.

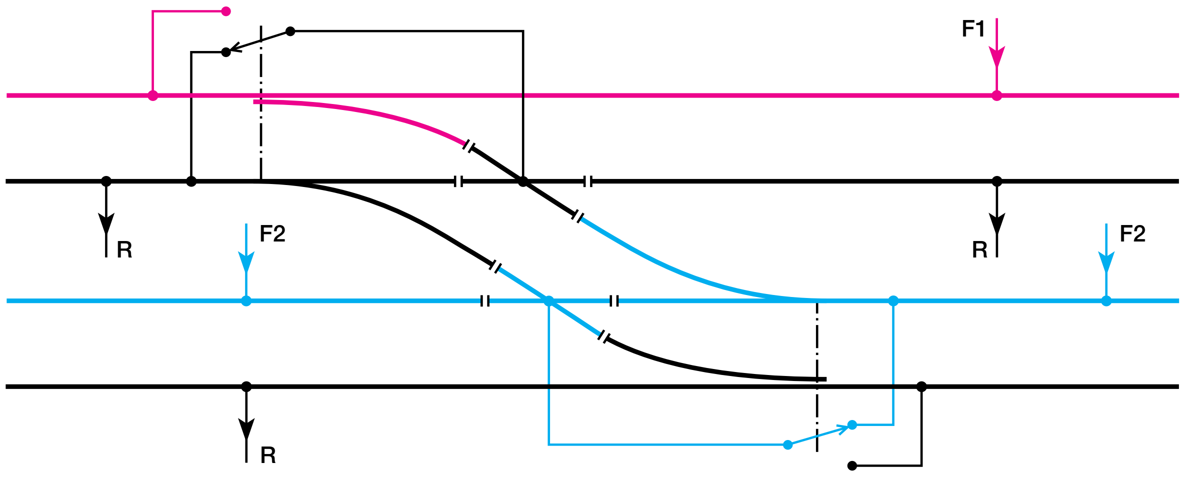


FIGURE 3-17
Crossover

In this configuration it is assumed that both points work as a pair from a single lever. The power supply to the crossings follows standard practice but additional insulation gaps are provided to prevent cross connections. The crossover illustrated is a facing crossover but the wiring for a trailing crossover is similar.

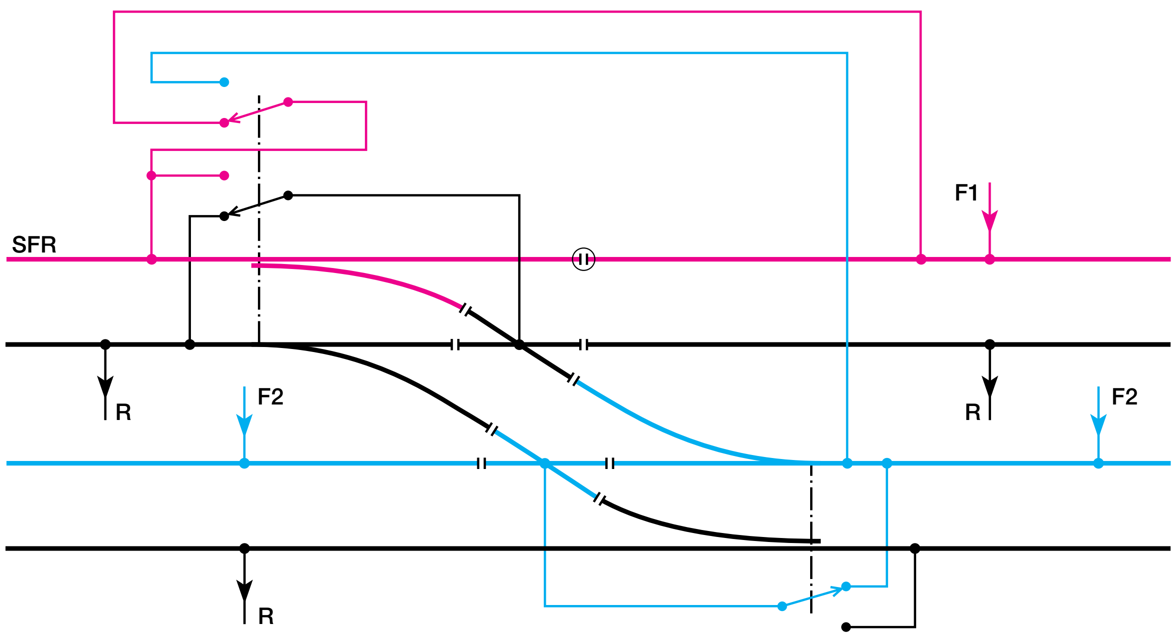


FIGURE 3-18
Crossover with switched feed rail (SFR) heel fed

This combines the switching illustrated in Figure 3-11 and 3-17 and can be used for an engine escape road or similar situation. Using a point operated micro-switch eliminates the need for a change-over switch mounted on the control panel.

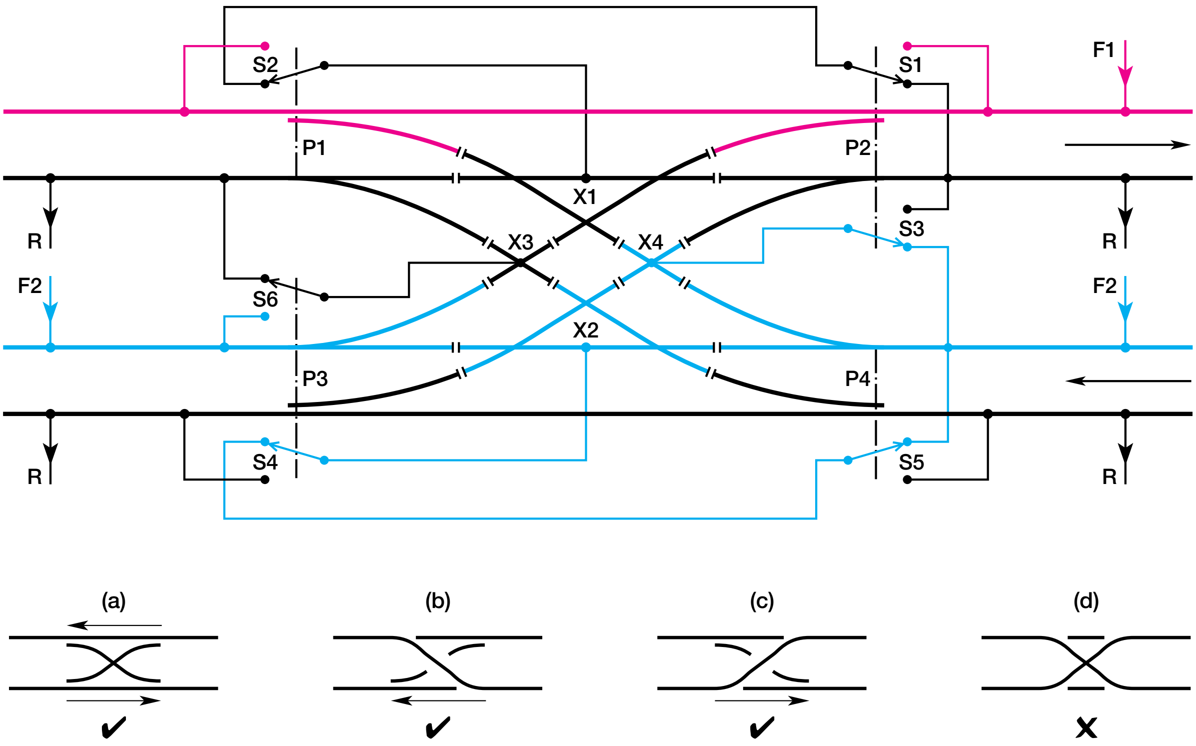


FIGURE 3-19a
Scissors Crossover (Basic switching)

A scissors crossover combines both a facing and a trailing crossover and has four crossings, X1 to X4, that need to have their polarity changed. A total of six switches (S1 to S6 on the diagram) are needed to provide the required polarity change-over. This can be achieved by either micro-switches operated by the point tie bars or as part of an associated relay system. The points would be worked as pairs, in this case P1 - P4 and P2 - P3. Passage through the crossover can be either with both points normal or with one of the two pairs reversed. The point operating system must be arranged to prevent both pairs being reversed at the same time to ensure that each crossing has the correct polarity (see the inset sketches). When moving a train across the crossover the controller outputs to F1 and F2 must be matched to avoid jerky running. Alternatively, F1 and F2 must be switched to the same controller. Taking the three situations in turn, the connections would be as follows:-

Both Points Normal (inset a)
Crossing X1 is fed from the common return via S1 and S2.
Crossing X2 is fed from F2 via S4 and S5.
Crossings X3 and X4 are not in service and can be ignored.

Points P1 - P4 Reversed (inset b)
Crossing X1 is fed from F1 via S2.
Crossing X2 is fed from the common return via S4 and S5.
Crossing X3 is fed from the common return via S6.
Crossing X4 is fed from F2 via S3.

Points P2 - P3 Reversed (inset c)
Crossing X1 is fed from F1 via S1 and S2.
Crossing X2 is fed from the common return via S4.
Crossing X3 is fed from F2 via S6.
Crossing X4 is fed from the common return via S3.

A scissors crossover is usually only found in the approach roads of a terminus station. By the use of four additional switches it is possible for the point operation to also provide a simple route control for trains passing into or out of the terminus. Power supplies to the track would normally be taken to the 'main line' end of the crossover and be routed to the station terminal roads by the tie bar switches or an associated relay system. This configuration requires an additional isolation gap in the upper feed rail (circled). The points would be worked as pairs as described above. As shown, the main lines are to the right and the station to the left. The departure line

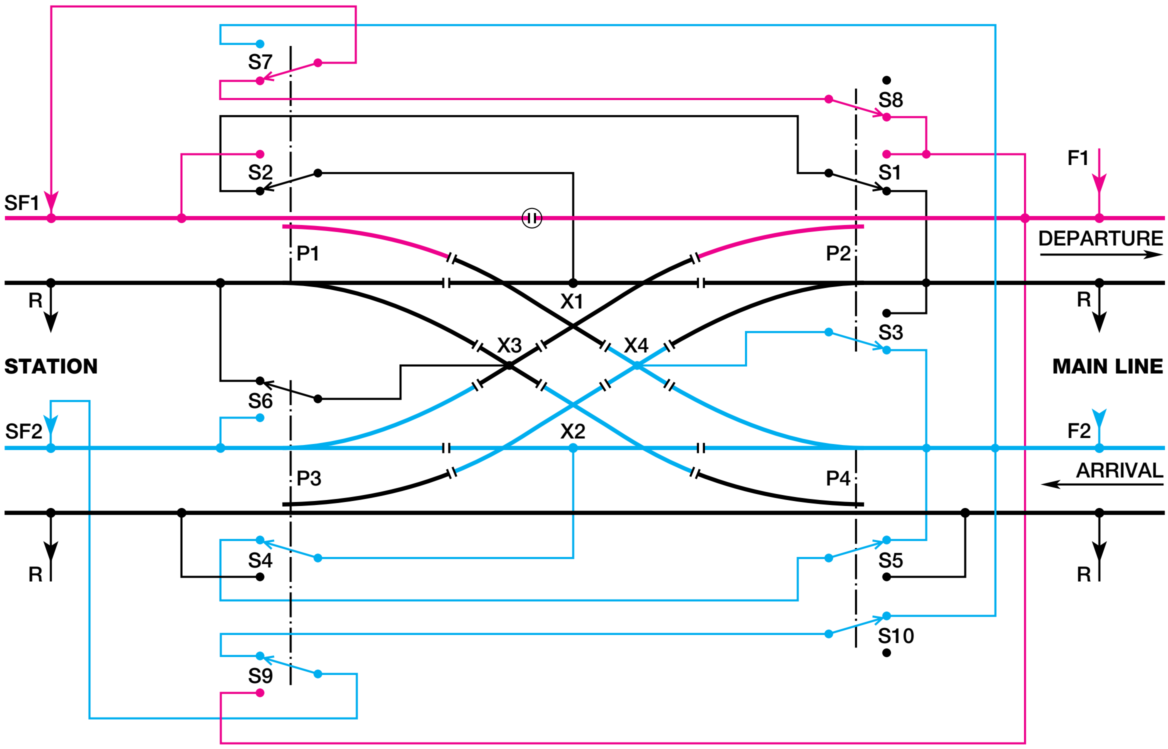


FIGURE 3-19b
Scissors Crossover (Route switching)

is fed by (controller) F1 and the arrival line by (controller) F2. Taking the three situations in turn, the connections would be as follows:-

Both Points Normal (inset a)
Station Track Feed SF1 is fed from F1 via S7 and S8.
Station Track Feed SF2 is fed from F2 via S9 and S10.
Crossing X1 is fed from the common return via S1 and S2.
Crossing X2 is fed from F2 via S4 and S5.
Crossings X3 and X4 are not in service and can be ignored.

Points P1 - P4 Reversed (inset b) - arrival movement
Station Track Feed SF1 is fed from F2 via S7.
Station Track Feed SF2 is made dead by S10 opening.
Crossing X1 is fed from SF1 via S2.
Crossing X2 is fed from the common return via S4 and S5.
Crossing X3 is fed from the common return via S6.
Crossing X4 is fed from F2 via S3.

Points P2 - P3 Reversed (inset c) - departure movement
Station Track Feed SF1 is made dead by S8 opening.
Station Track Feed SF2 is fed from F1 via S9.
Crossing X1 is fed from F1 via S1 and S2.
Crossing X2 is fed from the common return via S4.
Crossing X3 is fed from SF2 via S6.
Crossing X4 is fed from the common return via S3.