5 Multiple Controls

5.1 Introduction

On larger layouts, it is possible to arrange the wiring to allow for several locomotives to be run by different operators at the same time. There are three basic methods by which this can happen

- Area control
- Cab control
- Loco-borne control

While the wiring for each of these options will be different, the main distinction between them is in the way the layout is operated.

In area control, the operator remains at one location and acts as a signalman, and his or her secondary duty is to act as the driver of the trains in their area. The operator is responsible for a specific area of the layout.

In cab control, the roles are reversed and the operator drives the train from the start to the end of its journey. Operators only act as signalman in each area as their train passes through. In some very large layouts, the duties are split between operators; some acting as drivers and the others as signalmen or dispatchers.

Loco-borne control is a special form of cab control whereby the control mechanism is inside the model itself. Systems include command control (DCC), radio control and infra red control. While with conventional DCC, commands to the loco module are sent through the track with the locomotive power, with radio control or infra red control, locomotive mounted batteries can provide power and layout wiring can be dispensed with altogether.

There is a trade off between wiring complexity, operational flexibility and expense. Loco-borne control methods are the most flexible, as well as being the simplest to wire. However, they are also the most expensive. Area control is relatively simple to wire, but not very flexible from an operating perspective. Properly designed cab control can be almost as flexible as loco-borne control from an operational viewpoint, but is complex to wire and maintain, especially on large layouts.

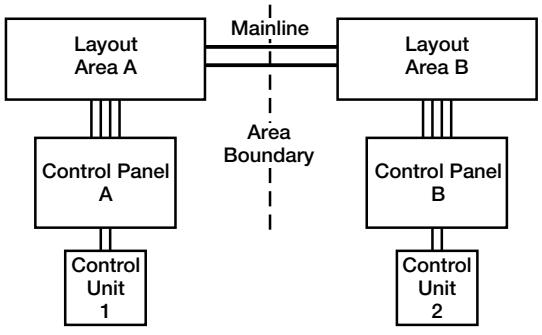

Figure 5-1 Schematic of a layout having two operational areas each controlled by its own control unit.

5.2 Area Control and Control Linking

5.2.1 Point to point - single track main line

Each operator would control the workings in his own operational area but they need to have some means of passing trains to each other along the main line.

Figure 5-1 shows in schematic form, two areas each with its own control unit feeding a number of sections within the area. On the main line, at the boundary between the areas, the feed rail and, depending on the supply system, possibly the return rail would have an insulation break. When a train has to travel from one area to the other it has to pass across the boundary between the two areas. In the system illustrated, the main line is a single track and could be connecting two termini similar to the design described in Section 4. The control panels for these two areas would be similar to those described in Section 4.

As illustrated, the method of transferring trains would be for, say, the A operator to inform the B operator that the train was ready and that he would be setting his speed control to a particular level. The B operator would then isolate any other locomotives in his area and set his control unit to match and inform the A operator that he was ready. The A operator would then drive his train towards B and as it passes over the boundary the B control unit takes over. If the control units are evenly matched the transition should be fairly smooth but this is often difficult to achieve and the transition can be jerky. This sudden change in speed can sometimes cause derailments. To avoid this a system to link the two control areas is needed.

5.2.2 Link switching - single track main line

A general rule for safe operation is for an operator to take control of an adjacent area and drive the train towards the area that he is controlling. In this way, although he may not be able to observe the start clearly, he can observe the train's arrival and stop it safely.

In Figure 5-2 an additional switch unit is interposed between each control unit output and its

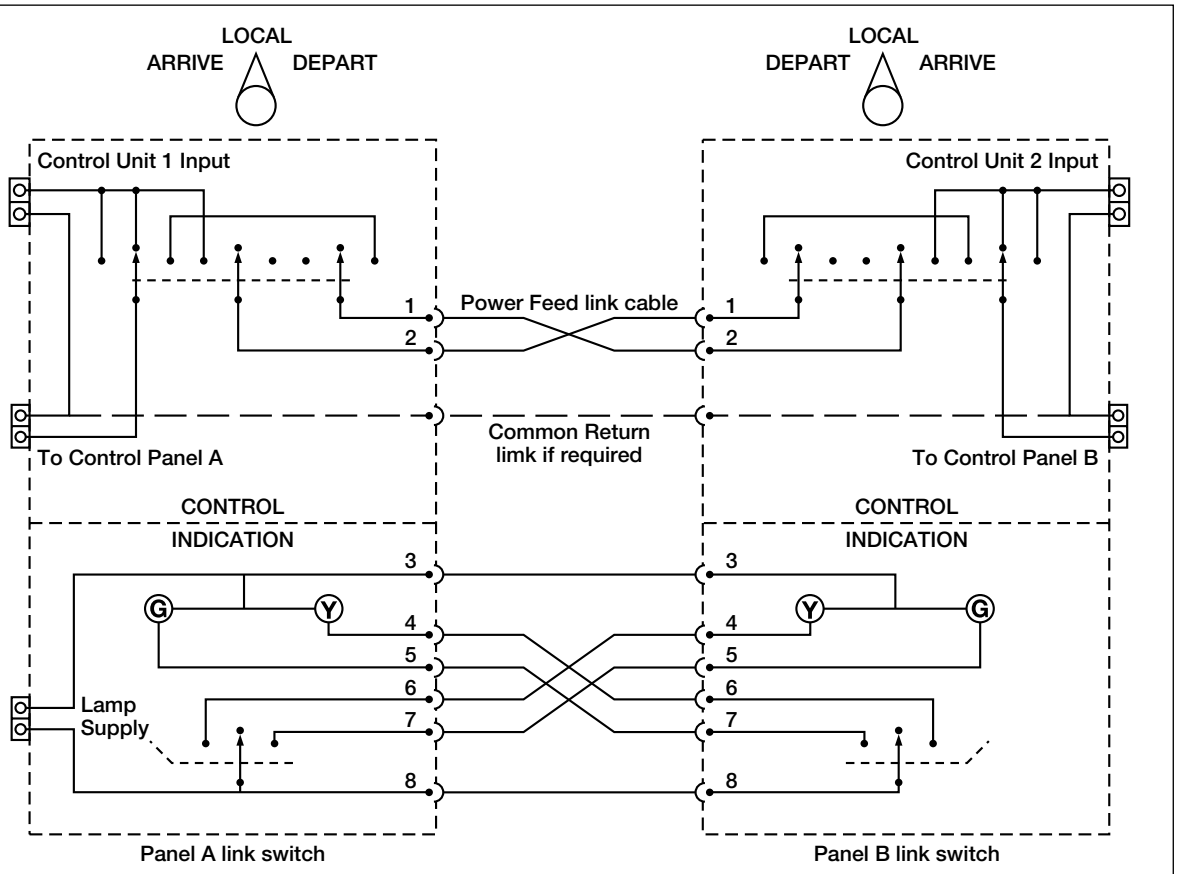

Figure 5-2 Wiring schematic of a linking system interposed between the control unit outputs and their respective control panels. The lower portion of the diagram shows the simple indicating system that can be incorporated into the system if required.

associated control panel. These units, shown dotted, can form part of the control panel or be built as independent units. (See next page) The switches are standard four-pole three-way rotary switches and are wired as shown in the illustration. When the switch is in the central position the control unit is connected to its associated control panel and only operation in its local area can take place. If a train has to be sent from A to B, the A operator turns his switch to Depart. This isolates his control unit from the control panel. When the B operator turns his switch to Arrive, the B control unit power feed is connected to the A control panel by the link cable and the B operator can then drive the train towards the B area and stop it as required. When the movement is completed both switches are returned to the Local position and each operator has control of his own area. Similarly, a movement from B to A is carried out by turning the switches to B Depart and A Arrive.

Note: In the above description it has been assumed that the layout is wired for common return wiring and only the feed wire is switched. If both control units are fed from a common source and feed and returns have to be switched, a six-pole three-way switch is required, (See Part 8, Section 1.8.2). Being non-standard, this would need to be built from a switch kit having two four-pole three-way wafers. The second wafer is wired in the same way as the first and a second pair of link wires are required for the return connection.

5.2.3 Simple indicating system

In the case of a permanent layout, communication between the operators can be by block instrument, telephone or some similar device. (See also Part 6) If a standard four-pole three-way switch is used for the linking switch, a simple indicating system

can be incorporated using the spare way. The lower dotted portions in Figure 5-2 show the wiring of the additional ways and the two signal lamps mounted in each panel.

Assuming that the operating sequence called for a train to travel from A to B, the operating procedure would be as follows.

- When A has the train prepared for departure, he turns his selector switch to Depart. This connects the feed link cable to the A control panel to allow B to drive the train.
- Turning the switch also illuminates the green lamp on B's panel to indicate 'you now have control of area A'.
- When operator B is ready to receive the train he turns his selector switch to Arrive. This illuminates the yellow lamp on A's control panel to indicate 'ready' and connects the feed link cable to B's control unit.
- B then drives the train from A into his own area.
- On completion of the movement the switches are returned to Local and the indicator lamps are extinguished.

Example

A harness incorporating the wiring system described above was manufactured for use by the East Midlands Group. At a number of exhibitions, individual member's layouts were linked using baseboard adapter connections to provide a large display layout. The control units were connected to their respective control panels via free standing switch units. The construction of the wiring harness and switch units required the following materials:

- *Two mains surface mounting moulded boxes and blanking plates - 1 gang size. The type used for 13-amp socket mounting provides sufficient depth to house the rotary switches.*
- *Two four-pole three-way rotary switches with pointer knobs to suit. (Break before make preferred).*
- *Four panel lamp holders, LES or similar - 2 yellow and 2 green.*
- *Length of screw terminal strip for the traction power and lighting power connections*
- *Two eight way plug and socket connectors. Alternatively, two additional screw terminal strips.*
- *Sufficient cable to connect the two units together. 8-core cable is preferable in the interests of neatness but is not essential.*

The rotary switches were mounted in the centre of the blanking plates with the locating peg arranged so that the pointer knob pointed to the middle of one side. The panel lamps were mounted above with the green indicating an arrival and yellow indicating a departure. The lamps were handed on each plate so that the pointer movement matched the direction of train movement.

5.2.4 Intermediate station - single track main line

If the layout is large enough to include an intermediate area it is probable that connections between areas make use of the signalling system to provide the connections between areas. However, the link switch system can be adapted for an intermediate area by inserting a secondary switch to connect it to the appropriate area either side. Figure 5-3 shows the connections.

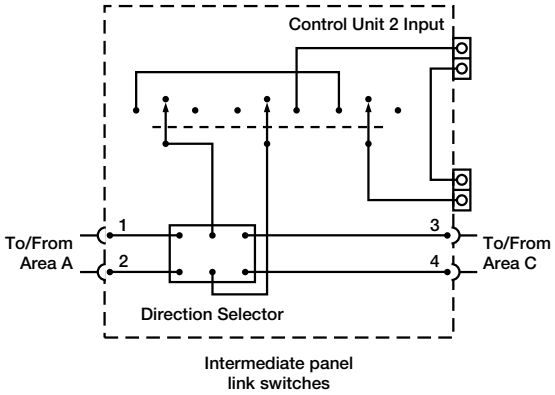

Figure 5-3 A two-pole two-way switch connecting the link switch to the areas on either side.

5.2.5 Point to point - double track main line

In this case the link switches can be simple two-way switches as separate switches are required for the up and down lines. Figure 5-4 shows the general arrangement. Depending on the track configuration and layout design, these switches could form part of a signal mechanism or signal relay instead of a manual switch on the panel. The action of pulling off a signal to accept a train could be used to transfer control to the section in advance, while returning the signal to danger would restore control to the original unit.

If movements along each main line between areas are in one direction only, it is possible to eliminate the switches and provide a hand-over section fed by diodes. This is based on the stan-

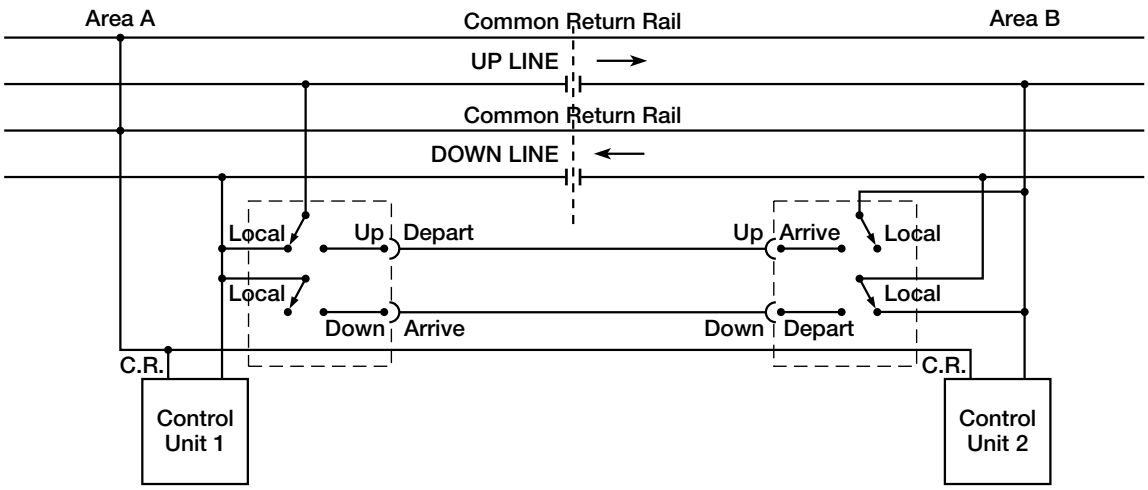

Figure 5-4 Linking system variation for double track. If double pole switches are used for the four link switches, the second pole could be used to illuminate panel indicator lamps as in Figure 5-2

dard for track electrification where the right hand rail is positive for forward motion. The system is similar to that described in 5.2.7 and illustrated in Figure 5-6 for stud contact / third rail systems

5.2.6 Intermediate area - double track main line

An intermediate area with double track main line requires the link switches to be duplicated. The system can also be used to 'switch out' the intermediate area and provide through running between termini. The wiring is shown in Figure 5-5.

5.2.7 Linking three-rail areas

The methods described for two-rail operation can apply equally to three-rail. However, as explained in Section1.9, the direction of motion of a three-rail locomotive depends on the way that it is facing as the standard is for the locomotive to go forward when the conductor rail or studs are positive. This

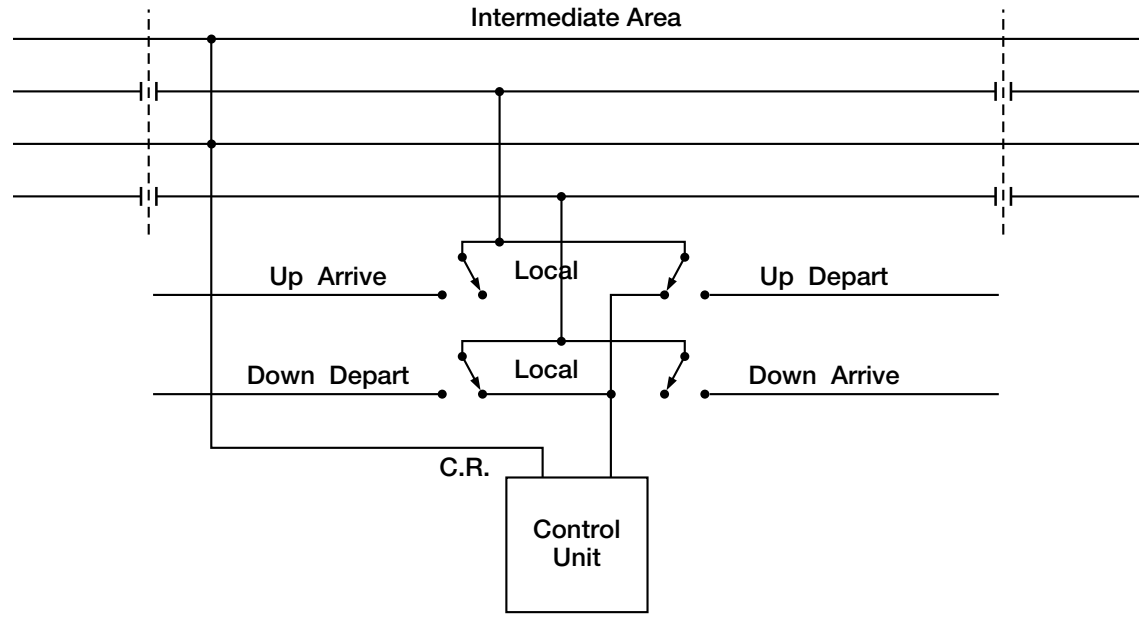

Figure 5-5 Duplicate switches for connecting an intermediate area to the areas either side.

requires the receiving operator to know which direction the locomotive is facing when taking control. If the locomotive is fitted with a reversing switch (as suggested in Section 2.3.1) the track polarity can be standardised for movements between areas. This not only simplifies the task of the operator receiving the train but also lends itself to a simple solid state solution to the problem of handing over control. Figure 5-6 shows a section of single track where movement from one area to another requires the conductor rail or studs to be positively energised. An intermediate section of conductor rail is supplied from both the adjacent areas by diodes. The diodes prevent interference between the two control units and, provided that the control units settings are reasonably well matched, the locomotive can pass from one area to the other without switches being involved.

5.3 Cab Control

In Section 4, which deals with small layout wiring, Sub-section 4.5, Two trains at once, describes how each track section can be fed from one of two control units. The wiring for this arrangement is illustrated in Figure 4-6. This is the most basic form of 'cab' control. In larger layouts with three or more control units or 'cabs', the section switches would have to be replaced by multi-position selector switches. A standard single pole twelve way rotary switch would allow up to twelve different control units to be selected for a particular section. Each rotary selector switch can have one position selected as an OFF position or a separate switch in the connection to the track. The latter is to be preferred as in the former arrangement it is possible to briefly connect two trains to a single control unit when moving the selector switch. This system can be used for both 2-rail and 3-rail layouts.

Cab control provides the most flexible way of operating a layout. With the route for a particular train set up, the rotary section switches on that route can be selected to one control unit and the train driven throughout by the same operator. Also, the way the layout is divided into sections depends on the operational requirements. As an example, Figure 5-7 shows a pair of parallel storage roads, each of which can be fed from any one of four control units. For simplicity only two roads are shown but the wiring of additional roads would be similar. In the illustration, the rotary selector switches for siding 1 and main line 2 are both set to control unit 3 so, once the route is set, the train can be driven on to the main line. At the same time a second train can be entering siding 2 from main line 1 driven by control unit 1. If the storage sidings were long enough, splitting siding 1 into two switched sub-sections as shown would allow the operator to park a small train or light engine at the end of the siding, switch it off and bring a second train into the siding behind it.

5.3.1 Zone control

A half-way house between full cab control and area control is illustrated in Figure 5-8. Although not as flexible as full cab control it eliminates the need for control linking between areas. Instead of the three layout areas being connected to individual control units they can be fed from any one of the four control units via rotary selector switches. This greatly simplifies both passing trains from one area to another and for through running, as all three areas can be connected to the same control unit when these movements take place. The illustration shows each area with its own control unit with No. 2 unit spare. If a train had to be driven from A to C then, once the route had been set up, selecting areas A and B to control unit 4 would allow the C operator to drive the train towards the destination. The name sometimes given to this variation is zone control to distinguish it from area control described earlier.

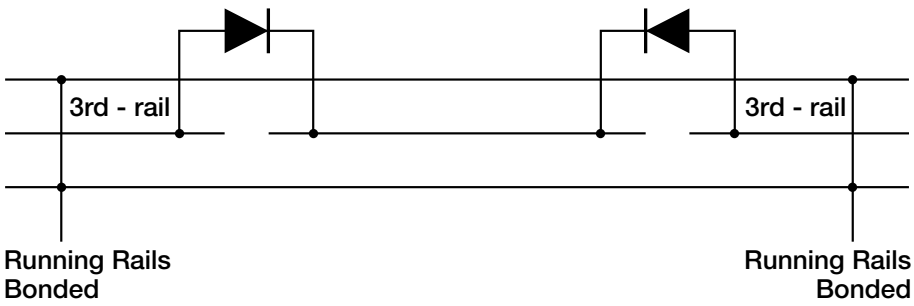

Figure 5-6 Intermediate section of a conductor rail or studs fed from either end. Control unit settings need to be matched for smooth transfer.

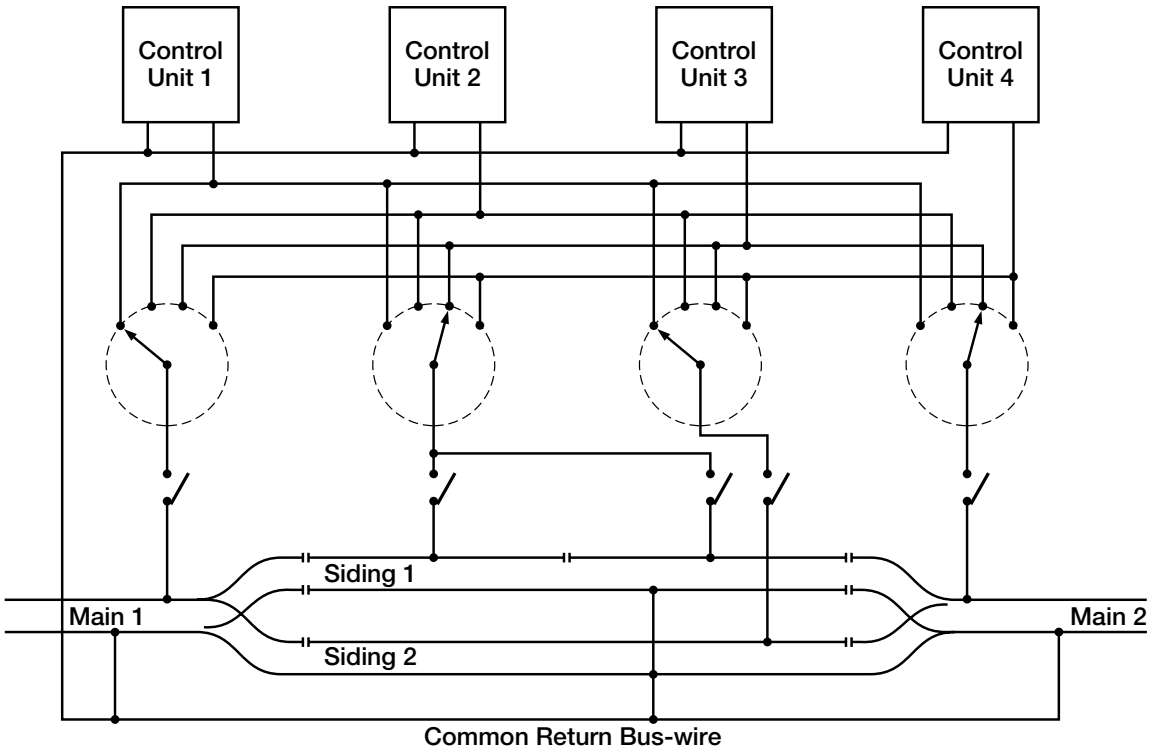

Figure 5-7 Cab control selector switching for a pair of storage sidings. Cabs 1 and 3 in service, cabs 2 and 4 on stand-by.

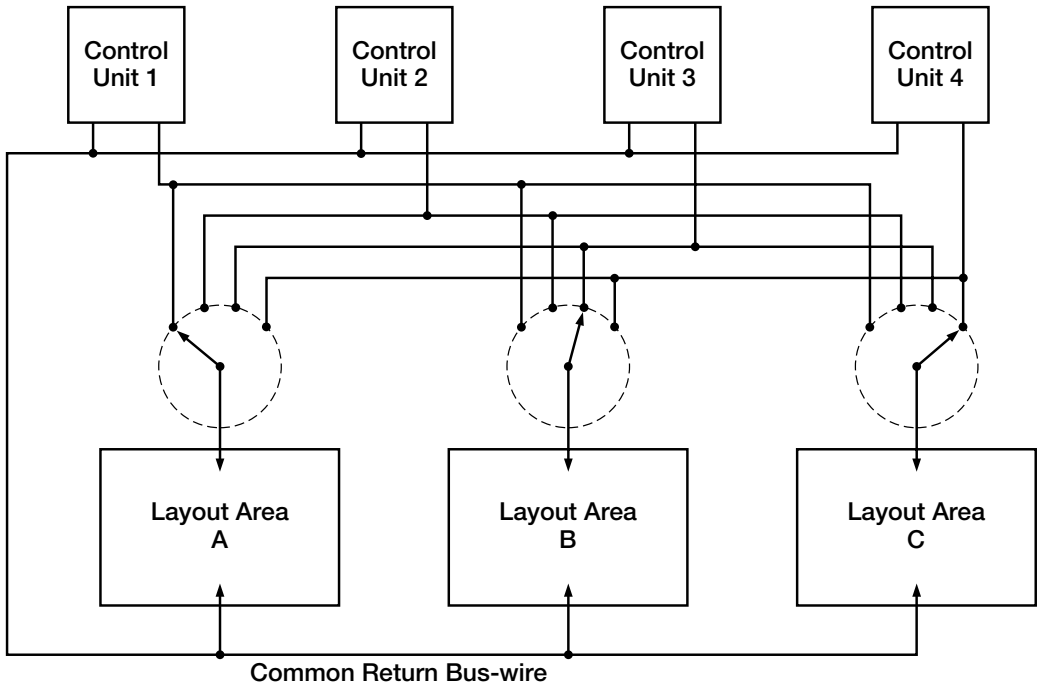

Figure 5-8 A mix of cab and area control sometimes referred to as zone control.