TRAM CONTROLLERS

The two main controls in a W class tram are the Controller and the air brake. Whilst the air brake performs one simple function the Controller is a more complex piece of equipment that deals with several different tasks in the operation of the tram.

The W class Controller has three functions:

1. To regulate the flow of electricity from the overhead to the motors thereby controlling the acceleration of the tram.
2. To stop the tram in an emergency situation by utilising the electric brake.
3. To isolate defective motors enabling the tram to return to the depot after a breakdown.

There are two handles on the Controller—the Controller handle, which is permanently attached, and a removable Controller key. The Controller handle cannot be operated unless the Controller key is inserted and locked into position and once the Controller handle is moved from the "off" position the Controller key is locked into position.

The Controller has several notches marked on the cover with the number varying depending on the type of Controller however, for this particular Controller (EE Q2RC1) there are fourteen notches. As the Controller handle is moved from the "off" position, the pointer at the base of the handle passes each notch in turn thereby increasing the voltage to the motors.

SERIES AND PARALLEL

The notches are divided into two groups—Series and Parallel—and there are seven notches in each group. When the Controller handle operates in the Series notches the voltage from the overhead (600 volts) is divided between the motors and the tram reaches half speed. When the Controller handle operates in the Parallel notches each motor receives the full line voltage and the tram attains full speed.

RESISTANCE AND RUNNING NOTCHES

Both groups have two different types of notches—resistance notches and running notches—and both have a different function. The first six notches are Resistance notches and they direct the voltage through step-down resistances to prevent the full line voltage from reaching the motors in one go. As the Controller handle is moved through the rest of the notches more voltage is allowed to pass through to the motors letting the tram accelerate smoothly. If

the Controller handle is left too long on a Resistance notch the Resistance will overheat and could start a fire.

The seventh notch is a running notch which lets the power flow straight to the motors bypassing the resistances. This "Full Series" notch allows the driver to keep the tram running at half speed for as long as he wants. If the driver wishes to further increase the speed of his vehicle he will move the Controller handle through the Parallel Resistance notches letting the full line voltage gradually through to each motor. The last notch, the "Full Parallel" notch, bypasses all resistances so that each motor now gets the full 600 volts and the tram is running at full speed.

ELECTRIC BRAKE

The Controller operates the electric brake which is only used in an emergency situation such as trying to avoid an accident or if the air brake fails. The electric brake is applied by the driver pulling the Controller key straight back to the reverse position turning the motors into generators. This forces the motors to try and drive in the opposite direction and, with the air brakes also fully applied, the maximum retarding force is put into operation.

MOTOR CUT-OUT SWITCHES

The Controller has two switches inside the cover which are used to isolate defective motors from the main circuits. The switches can be located in various places depending on the type of Controller but for this Controller one switch is positioned underneath the cover and the other is near the bottom. The switches are coloured, one yellow and one red, with the yellow one used to isolate motors one and three whilst the red switch isolates motors two and four.