energized. This opens the interlock in the line breaker circuit and prevents the line breaker from being energized.

The movement of the contact tips on both power circuit contactors is monitored by position sensors. These position sensors are not part of the contactors but are mounted next to the movable portion of the contactor. There is no direct mechanical or electrical connection between the contactors and the position sensors. PSLB is the line breaker position sensor and PSLCC is the line charging contactor position sensor. The sensors are supplied with 12 Vdc and output a status feedback signal to the logic when the contactor power contacts are closed.

2.5.4. MASTER CONTROLLER

The master controller is the primary interface between the operator and the propulsion system. The master controller has a three position key operated switch that controls the functions of the controller and the car. The master controller is seen in Figure 3-34. In the LAY-UP position, the low voltage systems are shut down and the controller is locked off with the main handle and reverser disabled. In the STANDBY position, control power is sent to the low voltage circuits (presuming the battery circuit breaker is on) and the car auxiliary power system can be activated using the shop power receptacle. The APS is also activated if the pantograph was left up when the car was put into LAYUP. In the OPERATE position, the low voltage circuits are operational and the pantograph can be brought up with the car operated from the overhead supply line.

The controller main handle and reverser switch are interlocked so that the reverser can not be moved unless the main handle is in the full service brake position. The main handle has a spring loaded dead man function. To come out of the deadman position, the controller handle must be rotated 90 degrees clockwise.

The movement of the main handle forward from MIN to MAX controls a gradual increase in the amount of tractive effort demand. The movement of the main handle in the opposite direction controls the braking effort demand from MIN to full service brake (FSB). A stable 7.5 Vdc is used as the voltage source to the potentiometer that is connected to the operators handle. This ensures that the output voltage from the master controller to the P-signal generator is uniform for any given master controller handle position. Beyond the full service brake position is the full service track brake (FSTB) position. This position gives a full service brake application with the track brakes activated. The bottom position is emergency (EMER). In emergency, an emergency brake rate as well as track brake is activated.

The DC voltage signal from the master controller potentiometer is sent to the P-signal generator. The P-signal generator converts the DC voltage from the master controller to a 109 Hz variable amplitude alternating current. The variable amplitude P-signal is controlled by the position of the operators handle (0 - 100 milliamps RMS). The P-signal is then sent to the P-signal trainline and input to the logic racks using logic interface boards. A fixed amplitude (100 milliamps RMS) 109 Hz brake signal is sent to the BRK trainline and input to the logic racks using logic interface boards. The BRK signal is produced from the P-signal generator and is sent to the BRK signal trainline when a power demand is made. The BRK signal is disabled when a brake demand is made.

As seen on sheet 32 of the system schematic diagram, there are many car builder relays that control both the master controller and the P-signal and BRK-signal trainlines. The output signals from the master controller are enabled only when a cab is activated. Once one cab is activated, all the other cabs in that consist are locked out by a solenoid located in the master controller.

The P-signal and BRK-signal trainlines are ac current control loops. The logic interface boards associated with each logic rack receive the P-signal and BRK-signal and convert the signals to a dc voltage level that is input to the logic rack. This ensures that every logic in each car of the consist receives the same demand signal. There are a number of car builder relays that are incorporated into the trainline loop signals. The following conditions must be true to allow the P-signal and BRK-signal trainlines to function:

- The car can not be in Emergency.
- There are no friction brake system faults detected.
- The passenger doors must be closed (or the door by-pass switch activated).
- A cab must be made up (activated).
- The current loop is completed at the end of the consist with the use of a drum switch.
- Required friction brake cylinder pressure must be present.

The P-signal generator monitors the master controller potentiometer (MC POT) that controls the amplitude of the P-signal. If the potentiometer should go open circuit, a full service brake application is initiated regardless of the position of the master controller handle.

2.5.5. PROPULSION EQUIPMENT RESET

Most of the fault conditions detected by the propulsion system are automatically reset at zero speed (presuming the propulsion system has not been locked out). If the propulsion fault indicator in the controlling cab does not go out once zero speed has been achieved, the propulsion reset pushbutton on the operators control panel must be depressed. The propulsion reset pushbutton controls the reset trainline. The logic does not react to the reset pushbutton signal unless the car is at zero speed with the controller in full service brake.

If the propulsion fault indicator does not go out after the propulsion reset pushbutton is depressed, the vehicle health monitor can be examined to give an indication as to what the fault condition is. The portable test unit can then be connected to the affected logic to determine the fault condition.

The following conditions require a manual reset via the propulsion reset pushbutton.

- No Motion Fault
- Power up of the logic
- Loss of line voltage (after 15 seconds when the LB has opened and the brake choppers fired)
- Neutral to Reverse or Neutral to Forward Transitions

✍ **Note:**

Neutral to Reverse or Neutral to Forward Transitions must be used to reset the friction brake faults.