D&RGW EMD SD9

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Release Version 1.0

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1 Background

1.1 Loco

The EMD SD9 was a 1750hp six-axle (C-C) diesel road-switcher powered by EMDs highly successful two-stroke 567C V-16 diesel power plant.

In total there were 471 SD9's built by Electro-Motive between 1954 and 1959 and it was the immediate successor of the very similar 1500hp SD7, introduced in 1952.

The SD9 was, for all intents and purposes, a lengthened GP9 with six-axles rather than the GP9's four axles. SD stood for Special Duty and was reflective of the units extra lugging ability and/or lighter axle loadings that were achievable from using a C-C rather than a B-B wheel arrangement.

Denver & Rio Grande owned a total of 10 SD9's as well as five of the earlier SD7's with all units originally wearing the distinctive traditional black and orange livery with zebra stripe ends, featuring the small Rio Grande lettering on the sides of the hoods.

The SD9's were primarily based from Provo and used as heavy yard switchers and for local transfer freight services in the Provo/Salt Lake City/ Ogden region.

1.2 Design & Specification

Builder	Electro-Motive
Locomotive Weight	367,000lbs
Vehicle Length	60ft 8.5in (18.5m)
Vehicle Width	10ft (3.04m)
Top Speed	65mph (104km/h)
Brake Types	Dynamic
Tractive Force	90,800lbs (starting) 75,000lbs (continuous)

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2 Rolling Stock

2.1 D&RGW EMD SD9

2.2 Mill Gondola

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3 Driving the EMD SD9

3.1 Cab Controls

1	Train Brake	8	Front Headlights
2	Bell	9	Rear Headlights
3	Independent Brake	10	Number Lights
4	Sander Control	11	Instrument Lights
5	Reverser	12	Cab Lights
6	Throttle	13	Step Lights
7	Dynamic Brake	14	Horn

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3.2 Locomotive Keyboard Controls

Key Equivalent	Action
A D	Increase or Decrease Throttle.
W S	Move reverser control Forward or Backward.
: ; @ '	Increase or Decrease Train Brake.
{ [}]	Increase or Decrease Engine Brake.
< , > .	Increase or Decrease Dynamic Brake.

3.3 General Keyboard Controls

Key Equivalent	Action
T	**Load/Unload.** Press once to load/unload passengers or freight.
H	**Headlights.** Repeatedly pressing will cycle through headlight states where appropriate.
V	**Windscreen Wipers**. Press once to switch on and again to switch off.
Z	**(Expert) Engine Stop/Start**. By default engines will already be running at the start of a scenario. Press this button to stop and then again to restart the engine.
X	**(Expert) Sander**. Causes sand to be laid on the rails next to the wheels to assist with adhesion. Press and hold to activate sander, let go to stop.
Space	**Horn.** Press once to sound the Horn.
B	**Bell.** Press once to sound the Bell.
? /	**Handbrake.** Press to toggle the train Handbrake on and off.
Ctrl 1	**Class Lights.** Press to cycle through the Class Lights.
Ctrl Shift C	**Couple manually.**

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3.4 Advanced Braking Controls

The SD9 locomotive contains new brake scripting, based upon a 26L brake stand, to provide prototypical braking performance.
There are four levels of 'braking difficulty' which may be changed by pressing Ctrl-Shift-1 to decrease the setting and Ctrl-Shift-2 to increase.

Level 1 – Easiest	brake timing simulation is not implemented
Level 2 – Easy	1/3rd full brake timing simulation implemented
Level 3 – Medium	2/3rd full brake timing simulation implemented
Level 4 – Hard	Full brake timing simulation implemented

When braking it is important to monitor the information shown on the two brake gauges.

The left-hand gauge shows the pressures held Main Reservoir (red needle) and Equalising Reservoir (white needle), and the right-hand gauge shows pressures in the locomotive Brake Cylinder (red needle) and the Brake Pipe pressure (white needle).

Moving the Train Brake lever forwards to set the brakes and rearwards to release them directly affects the equalising reservoir pressure, which would normally be at 90psi and reduces as the braking level increases.

In the example above the brakes are released and both the Equalising Reservoir gauge and Brake Pipe gauge show 90psi.

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The Train Brake lever has a series of distinct stages to aid the driver. From the release position the first stage produces an almost instantaneous initial reduction of 6psi.

By moving the Train Brake lever further forwards (after a brief pause) the pressure in the Equalising Reservoir will rapidly reduce and show the 'target' Brake Pipe pressure. Air will be released from the system until the Brake Pipe pressure matches that of the Equalising Reservoir and how rapidly the air is released is dependent upon the train length. In the picture above the Brake Pipe pressure is dropping while the Brake Cylinder pressure is increasing.

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After a period of time the Brake Pipe pressure matches that of the Equalising Reservoir and the desired brake application has been made.

Bear in mind that the brakes are Self-Lapping, so if the Train Brake lever on the HUD (for ease of reference) is moved to 50% the pressure in the Equalising Reservoir will reduce to half way between a minimal and full service application. To achieve a full service application, the lever must be moved to the full service position. Once the desired Equalising Reservoir pressure has been reached the Train Brake lever may be moved back to the step prior to the Release position so that the Equalising Reservoir pressure is stabilised.

Note also that the Brake Cylinder needle indicates locomotive braking effort and not that applied to the entire train.

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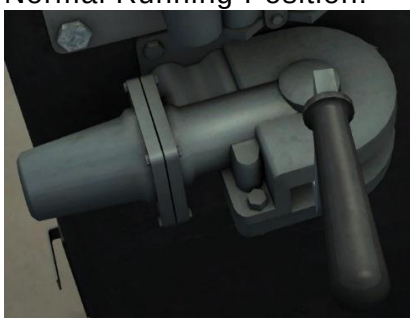
With the Equalisation Reservoir and Brake Pipe pressures balanced the locomotive Independent Brake may be 'Bailed Off' (by moving the Independent Brake lever backwards slightly). This practice removes the danger of the locomotive skidding under braking. In the above picture the locomotive brakes have been Bailed Off with the Train Brake application as before.

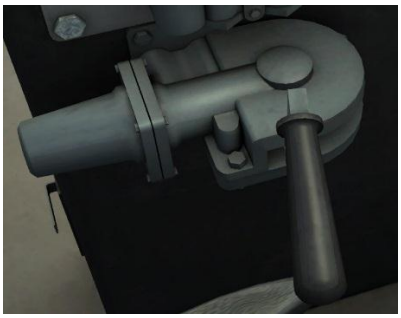
It should also be noted that prior to Bail Off the 'J' Valve in the locomotive brakes will 'remember' the value initially set by the Train Brake application. This allows additional effort to be applied to the locomotive brakes if desired, although it will not reduce below that initially set by the Train Brake until the locomotive brakes are Bailed Off.

The pictures below show the two positions for the Independent Brake lever.

Normal Running Position:



Bail Off Position:



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If an emergency brake application is required a brief pause is required before the Train Brake lever can be moved between its maximum application setting and the Emergency Brake setting to avoid accidental application.*

In the event of an emergency brake application the locomotive Pneumatic Control Switch (PCS) has been simulated and is indicated both by a Popup message and the illumination of the 'PCS Open' light in the cab.

Once the PCS has been tripped all locomotive engines will be returned to Idle regardless of the Throttle setting.

Should the PCS have not been tripped by a manual application (e.g. if a train brake pipe breaks) it requires resetting by moving the Train Brake lever into the Emergency position before moving it back to Release, which will only take effect once the Brake Pipe pressure has reached 0psi. The locomotive Throttle lever will also need to be moved to the idle position.

A Popup will appear to indicate that the PCS has been reset and the 'PCS Open' light will be extinguished.

Partially releasing the train brakes is not an option and so caution should be exercised when they are first applied and the locomotive Dynamic brakes should be used as much as possible!

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The train brakes will release and locomotive gauges will appear normal a long time before each car in the consist has fully recharged its own reservoir from the brake pipe. There is no indication of the actual state of the car's reservoir pressures either prototypically or in the simulation, and repeated application and release of the train brake will result in running out of air and a subsequent run-away!

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4 Scenarios

4.1 [SD9] 1. Assembling the Load

Starting at Provo Yard, you will be assembling a huge consist of 100 Ton Cars to be delivered to Helper later. In this scenario you start with 1000 points and are penalised for any operational errors.

Duration: 45 Minutes
Difficulty: Very Hard

4.2 [SD9] 2. Preparing the Mill

Start this two part sequel by unloading the remaining scrap from two gondolas. You will then be instructed to collect two separate cuts of empty gondolas. Not to worry though, another engine will be along later to collect the empties and deliver them to Provo Yard.

Duration: 20 Minutes
Difficulty: Easy

4.3 [SD9] 3. It's Mill Time

Duty Calls! You have been requested to collect a cut of empties from "Preparing the Mill" and move them to the DRGW Yard at Provo. This run might not be as straight forward as you think.

Duration: 40 Minutes
Difficulty: Medium

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5 Acknowledgements

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Beta Testing Team
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