

# GEML Class 90



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## Technical information

<b>Manufacturer</b>	BREL (British Rail Engineering Limited) Crewe
<b>Years built</b>	1987 - 1990
<b>Number built</b>	50 (90001 – 90050)
<b>Traction motors</b>	GEC G412CY / continuous rating of 5000hp (3730kw)
<b>Maximum speed</b>	110mph (177km/h)
<b>Coupling type</b>	Buckeye & screw
<b>Length</b>	18.80m
<b>Height</b>	3.96m
<b>Width</b>	2.74m
<b>Weight</b>	84.5 tonnes

# Liveries

## Class 90

Blue/White (Striped) with standard headlights - *Blue/White (S)*



Blue/White with LED headlights- *Blue/White*



Grey/White with standard headlights - *Grey/White*



Grey/White with LED headlights - *Grey/White LED*



## Mk3 DVT

Blue/White (Striped) - *Blue/White (S)*



Blue/White



Grey/White



## **Mk3 coaches (FO, RFB & SO)**

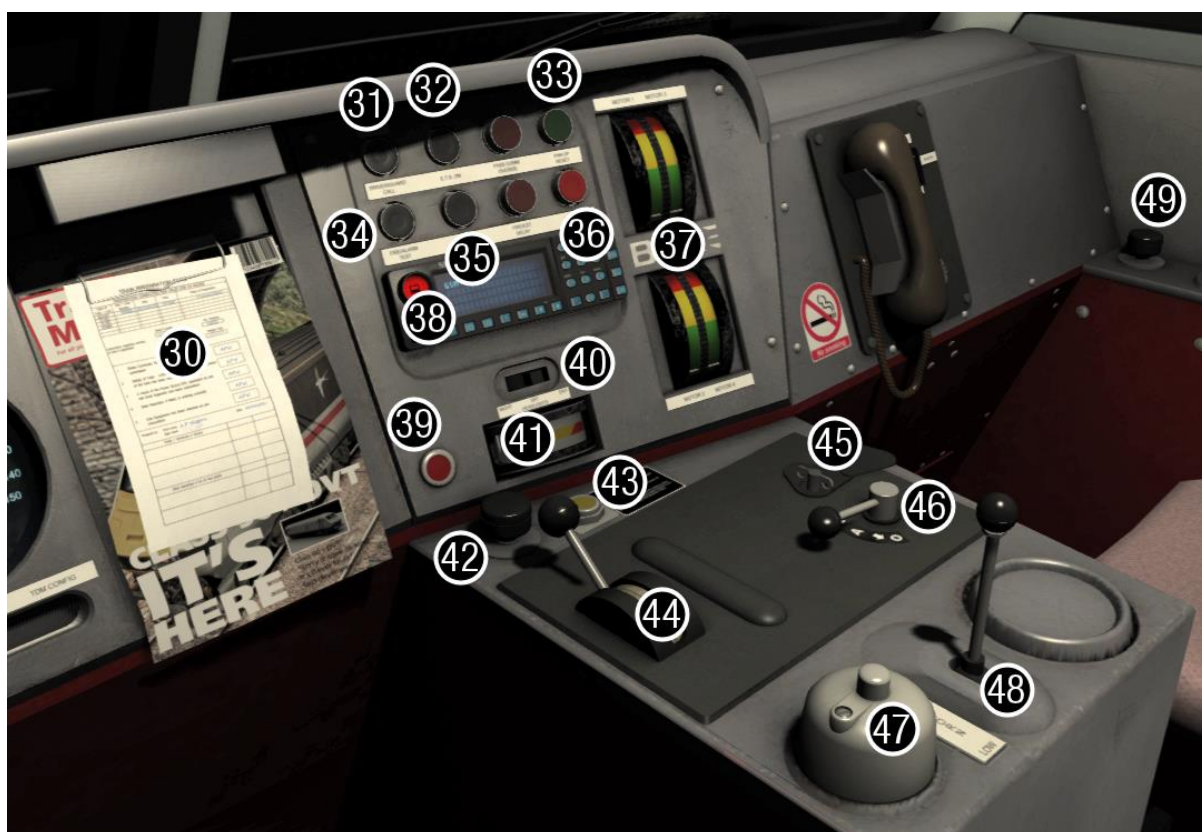
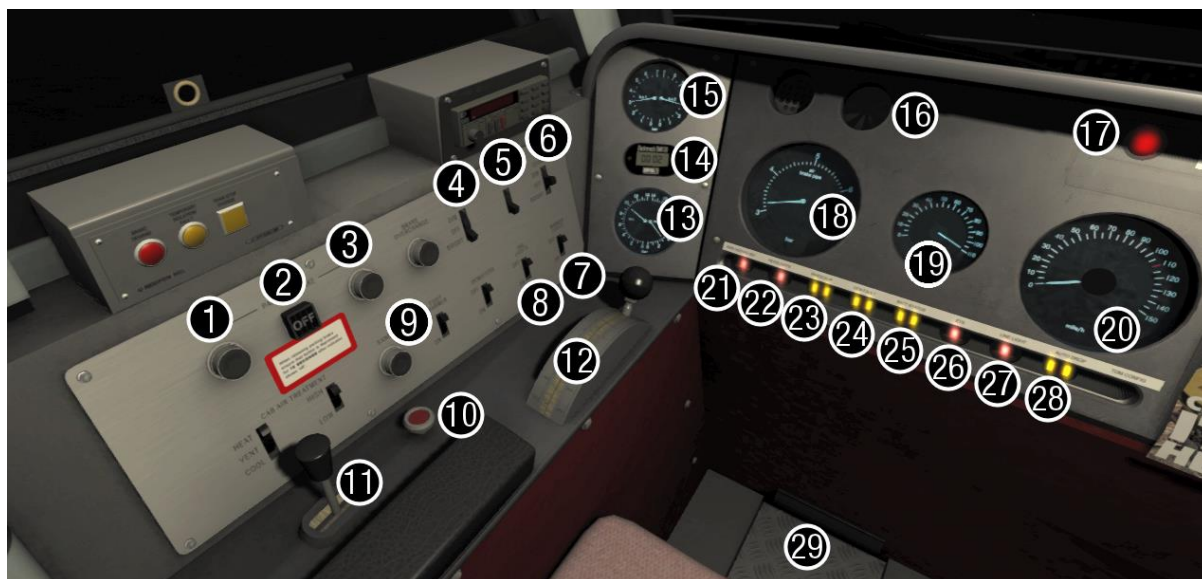
Blue/White



Grey/White



# Cab guide



- 1 - Parking brake on button
- 2 - Parking brake indicator
- 3 - Parking brake off button
- 4 - Instrument lights switch (dim/off/bright)
- 5 - Cab light (off/on)
- 6 - Clipboard light switch (dim/off/bright)
- 7 - Marker lights switch (off/on)



- 8 - Tail lights switch (off/on)
- 9 - Sander button
- 10 - Emergency brake plunger



- |   |   |
|---|---|
| 11 - Straight air loco brake ( <i>class 90 only</i> ) | 31 - Driver/guard call button                     |
| 12 - Automatic air train brake                        | 32 - ETS (Electric Train Supply) on button        |
| 13 - Main air reservoir gauge                         | 33 - Pantograph up button                         |
| 14 - Digital clock                                    | 34 - Fire alarm bell test button                  |
| 15 - Brake cylinder pressure gauge                    | 35 - ETS (Electric Train Supply) off button       |
| 16 - AWS sunflower display                            | 36 - Pantograph down button                       |
| 17 - DRA (Driver Reminder Appliance)                  | 37 - Ammeters ( <i>class 90 only</i> )            |
| 18 - Air brake pipe gauge                             | 38 - GSM-R unit                                   |
| 19 - Speed set selector switch                        | 39 - ADD alarm reset button                       |
| 20 - Speedometer (mph)                                | 40 - Headlights switch (night/off/day)            |
| 21 - AWS/DSD (vigilance) isolation status             | 41 - Motor temperature gauge                      |
| 22 - Headlights status                                | 42 - Driver wiper switch                          |
| 23 - Wheelslip light                                  | 43 - Train length button ( <i>class 90 only</i> ) |
| 24 - General fault light                              | 44 - Throttle                                     |
| 25 - Battery status light                             | 45 - Master key                                   |
| 26 - ETS (Electric Train Supply) light                | 46 - Reverser                                     |
| 27 - Line light                                       | 47 - AWS reset button                             |
| 28 - Pantograph auto drop light                       | 48 - Horn (high/low)                              |
| 29 - Deadman's pedal                                  | 49 - Guard wiper switch                           |
| 30 - Clipboard & clipboard light                      | 50 - Traction/brake LED ( <i>Mk3 DVT only</i> )   |

# Keyboard controls

Non-standard keyboard controls are listed below:

Ctrl+B -	BIS (Battery Isolation Switch) ON/OFF
L -	Cab light ON/OFF
U -	Clipboard light switch DOWN
Shift+U -	Clipboard light switch UP
Numpad Enter -	Deadman's pedal (DSD vigilance reset)
M -	Mk3 DVT Doors OPEN/CLOSE
F -	DRA (Driver Reminder Appliance) ON/OFF
N -	Driver to guard call
Ctrl+R -	DSD viligance ON/OFF
H -	Headlight switch RIGHT
Shift+H -	Headlight switch LEFT
Space -	Horn (low tone)
B -	Horn (high tone)
I -	Instrument lights switch DOWN
Shift+I -	Instrument lights switch UP
Ctrl+F -	Locomotive faults ON/OFF
J -	Marker lights ON/OFF
Ctrl+Z -	Master key IN/OUT
P -	Pantograph UP
Shift+P -	Pantograph DOWN
/ -	Parking brake ON
Shift+/- -	Parking brake OFF
R -	Retract buffers (Class 90 only)
C -	Speed set selector switch DOWN
Y -	Speed set selector switch UP
K -	Tail lights ON/OFF
O -	Train length button
Ctrl+Numpad Enter -	Visual aids ON/OFF
V -	Wiper (driver) ON/OFF
Shift+V -	Wiper (guard) ON/OFF

# Features

- [Advanced and HUD versions](#)
- Detailed internal & external audio
- Accurate performance physics
- [Prototypical braking system \(rheostatic/air\)](#)
- [Random locomotive faults](#)
- [Speed set \(cruise control\)](#)
- Traction motor temperature linked to cooling fan operation
- [Semi-prototypical parking brake operation](#)
- BIS (Battery Isolation Switch) functionality with external animation
- Cold start option
- Working master key
- Prototypical reverser function
- AWS self-test
- DSD (Driver Safety Device) (optional)
- DRA (Driver Reminder Appliance)
- [AWS/DSD visual aids](#) (optional)
- [Train length button](#) (class 90 only)
- Guard/driver call button
- Independent driver and guard wipers
- Cab clipboard lighting (off/dim/bright)
- Cab instrument lighting (off/dim/bright)
- Cab light
- [Cab LED status lights](#)
- Prototypical day and night headlights with AI functionality
- Operable sun blinds
- [Mk3 DVT Doors can open/close independently of passenger doors](#)
- TSX headlight and rain effects

## Advanced and HUD versions

### *Advanced*

The 'advanced' version of the class 90/mk3 DVT is represented in the simulator with a suffix of 'ADV' and includes all of the features listed in this manual. Basic controls such as the throttle and brake can be controlled using the F4 HUD display but many other features cannot. The xBox controller cannot be used at all.

### *HUD*

The 'HUD' version of the class 90/mk3 DVT is greatly simplified and doesn't include many of the features listed in this manual. It can be driven like any other electric locomotive and is fully compatible with both the F4 HUD display and xBox controller.

## Braking system (rheostatic/air)

The class 90 is fitted with both rheostatic brakes, which uses the traction motors to brake, and traditional air brakes. Please see below for when each system is active:

### *Train Brake*

**110-30mph** - Rheostatic & air brakes

*Class 90* - The locomotive uses solely the rheostatic brake resulting in its brake force being viewable on the ammeters. The rest of the train will brake using traditional air brakes which is evident on the air brake pipe gauge. At mid to high applications, you will hear the traction motors whining.

*Mk3 DVT* - Air brake force visible on the air brake pipe & brake cylinder pressure gauges. The only indication of rheostatic braking on the rear class 90 is the traction LED which illuminates when it is either powering or braking.

**30-0mph** - Rheostatic brakes reduce in force on the class 90 as speed decreases and its loco brake simultaneously applies in equal measure.

*Class 90* - The needles on the ammeters will fall whilst the loco brake cylinder pressure gauge will activate to represent the application of the loco brake.

*Mk3 DVT* - There is no obvious change of behaviour from the cab.

### *Loco Brake*

The loco brake is solely air operated and does not take advantage of rheostatic braking at any speed.

## Random locomotive faults

With the class 90, there is a very low possibility that you will experience a locomotive fault as per reality. Please see below for the three possible problems that might occur and what to do if they happen:

### *Traction motor failure*

- 1) The fault will appear written on the train preparation sheet (located on the clipboard) beneath the 'Faults/restrictions in service' column and the 'Gen Fault' LED light will turn to red
- 2) As a result of this, acceleration and rheostatic braking performance will decrease and one of the ammeters will show a zero reading so you must adjust your driving technique accordingly

### *Speed set control failure*

- 1) The fault will appear written on the train preparation sheet (located on the clipboard) beneath the 'Faults/restrictions in service' column
- 2) As a result of this, you will no longer be able to use this function to control your speed

### *ADD (Auto Dropping Device) fault*

- 1) The pantograph will drop, the ADD alarm will sound and both the 'Auto Drop' & 'Line Light' LED lights will turn to red
- 2) To rectify this, come to a stop as soon as possible, cancel the alarm by pressing the red 'ADD Alarm Reset' button to the bottom right of the clipboard and hold the 'Pan Up' button until the 'Line Light' LED turns to yellow

If you wish to disable the chance of these faults occurring, you can do so by pressing 'Ctrl+F'. To re-enable, simply press 'Ctrl+F' again.

## Speed set

The 'speed set' feature allows you to choose a desired speed on the dial and the on-board electronics will automatically regulate the throttle and rheostatic braking to maintain this speed. To make use of this feature, simply turn the switch on the speed set dial (to the left of the speedometer) to your desired speed and use the throttle to choose how much power you would like to make available to the locomotive. This feature can also be used to brake but this is only recommended for small decreases in speed such as 5-15mph. Any more than this, the throttle should be closed and braking applied in the usual manner. Please note that as with powering, you must have the throttle engaged for the speed set to take advantage of rheostatic braking.



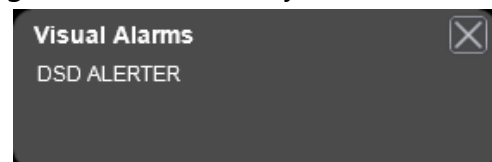
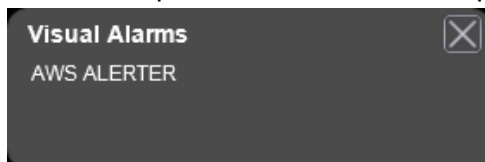
## Parking brake

To apply the parking brake, simply hold the 'ON' button until the indicator displays 'ON'. To release it, hold the 'OFF' button until the indicator displays 'OFF' and for a further 15 seconds after as per the sticker below the indicator. As with the prototype, any other class 90/Mk3 DVT in a consist will also have their parking brake engaged/disengaged.



## AWS/DSD visual aids

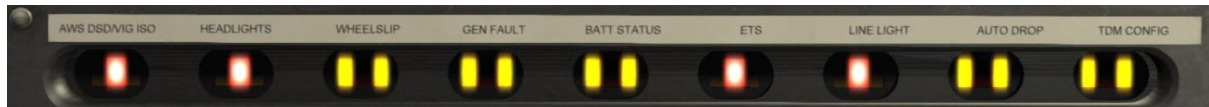
For those who would like to make sure they don't miss an AWS alert or DSD vigilance alarm when in an external view or perhaps have trouble hearing high pitched sounds, visual aids can be activated and deactivated by pressing 'Ctrl+Numpad Enter'. These will appear in the top right-hand corner of your screen.



## Train length button (class 90 only)

The train length button allows you to accurately judge the length of your train. To use it, simply press 'O' at the point you would like the system to tell you when the rear of the train has passed it, usually at a speed limit post or junction. You will hear a single beep as an acknowledgement and when the rear of the train has passed your chosen point, a further two beeps.

## Cab LED status lights



For all lights, YELLOW is displayed for a 'normal' condition and RED for a 'fault' or 'abnormal' condition. Please see below for an explanation of each light:

*AWS DSD/VIG ISO* - Red if AWS or DSD are not in use such as when reverser is at OFF

*HEADLIGHTS* - Red if headlight switch is at OFF

*WHEELSLIP* - Red if persistent wheelslip or wheelslide is taking place

*GEN FAULT* - Red in the event of a traction motor fault on the loco or one in multiple

*BATT STATUS* - Yellow if the battery is operational. Will never turn red in the simulator.

*ETS* - Red if the electric train supply has been lost or has not been established

*LINE LIGHT* - Red if there is no overhead line supply such as when the pantograph is down

*AUTO DROP* - Red if the Auto Dropping Device has activated on the loco or one in multiple

*TDM CONFIG (DVT ONLY)* - Yellow to confirm the Time-division multiplexing system is operational between the DVT and class 90. Will never turn red in the simulator.

## Mk3 DVT doors

When the passenger doors are open and the DVT is beside the platform, the DVT doors can be opened by pressing the 'M' key when you are driving either the DVT or class 90. Please note that due to errors on some platforms, the doors may not open due to the relevant marker not extending far enough.



## Setting up the driver's cab

Please follow the steps below to find out how to prepare the 'advanced' version of the class 90/Mk3 DVT from a 'cold' start. If you enter the cab, and the cab LED status lights are already illuminated, please follow step 3 and then skip to step 5:

- 1) Switch the BIS (Battery Isolation Switch) off by pressing 'Ctrl+B' on the keyboard. You should hear an audible clunk and the cab LED status lights will illuminate.
- 2) Release the parking brake by holding down 'Shift+/' on the keyboard until the indicator displays 'OFF'.
- 3) Insert the master key by pressing 'Ctrl+Z' on the keyboard.
- 4) Raise the pantograph by holding 'P' on the keyboard until the Line Light LED turns to yellow.
- 5) Move the reverser to the neutral position by pressing 'W' on the keyboard twice.
- 6) Cancel the AWS warning sound by pressing 'Q' on the keyboard.
- 7) Turn on the marker lights by pressing 'J' on the keyboard
- 8) Turn on the main headlights by pressing 'H' on the keyboard for the 'Day' setting or 'Shift+H' for the 'Night' setting. Remember to also set the tail lights in the rear class 90/Mk3 DVT if you are driving one of these sets.
- 9) Turn off the Driver Reminder Appliance (DRA) by pressing 'F' on the keyboard.

You should now be ready to move off. For information on how to do so, please see the ['Driving guide'](#) section below.



# Driving guide

The following steps will allow you to drive the 'advanced' version of the class 90/Mk3 DVT in a realistic and safe manner:

- 1)** If you are driving a passenger service and loading/unloading passengers, wait for the doors to close and listen out for the guard buzzing you twice which means the train is ready to depart. Buzz back twice by pressing the 'N' key on the keyboard to confirm this. Please note that this feature will not function if the locomotive is located off the end of the platform.
- 2)** Move the reverser to your desired direction of travel by pressing either 'W' on the keyboard for forward or 'S' for reverse.
- 3)** Cancel the DSD (Driver Safety Device) by pressing 'Numpad Enter' on the keyboard. Remember that this can be disabled by pressing 'Ctrl+R'.
- 4)** Move the train brake handle to notch 3 or less by pressing the ';' key.
- 5)** Move the speed control switch to the relevant line speed.
- 6)** Apply power by pressing the 'A' key on the keyboard until you reach the required tractive effort to get your train on the move. At the same time, move the train brake handle to the 'running' position until the brakes fully release. Please note the class 90 also has a 'release' position which will release the brakes slightly quicker.
- 7)** As soon as you are satisfied that the locomotive has sufficient grip, you may further increase power.
- 8)** To brake the train using the train brake, you may make graduated applications and releases by moving the handle between notch 'running' and 'full service'.
- 9)** When running light engine, you may also brake the train using the loco brake. To apply the brake, simply hold the handle in the spring-loaded apply position until you reach your desired brake force. Then simply let go of it and it will return to the 'running' position. Releasing the brakes operates in a similar manner except the release position is notched rather than spring-loaded.
- 10)** In the event of an emergency brake application, the locomotive will come to a stop and only then will you be able to release the brake.

# How to use in the scenario editor

## How to place

To place the class 90 or Mk3 DVT in the scenario editor, please follow the instructions below:

- 1) In the left-hand rolling stock fly-out, click the object set filter which looks like a blue box with an orange arrow to the right of it.
- 2) Go to the right-hand fly-out which should have appeared. Select 'AP\_Waggonz' from the drop-down menu.
- 3) Tick the first box beside 'Class90Pack01'.
- 4) The class 90 & Mk3 DVT liveries should now be visible in the left hand rolling stock fly-out.



## Numbering

When placing the 'advanced' version of the class 90/Mk3 DVT in the scenario editor, you are able to control via its number whether it is has already been prepared or is 'cold'. Please see below for an explanation:

Example number:

**190001**

Key:

**0 or 1** - Cold = **0**. Prepared/warm = **1**.

**90001** - Locomotive number

# Scenarios

## **[90] 1P21 08:30 Norwich - London Liverpool Street**

Route = GEML London Ipswich  
Track covered = Ipswich - London Liverpool Street  
Traction = Blue/White (Striped) 90011  
Year = 2012  
Duration = 1 hour 10 minutes



## **[90] 1P32 13:30 London Liverpool Street - Norwich**

Route = GEML London Ipswich  
Track covered = London Liverpool Street - Ipswich  
Traction = Blue/White Mk3 DVT  
Year = 2013  
Duration = 1 hour 15 minutes



## **[90] 1P50 17:30 London Liverpool Street - Norwich**

Route = GEML London Ipswich  
Track covered = London Liverpool Street - Ipswich  
Traction = Grey/White Mk3 DVT  
Year = 2013  
Duration = 1 hour 10 minutes



## **[90] 1Z99 20:55 Colchester - Witham**

Route = GEML London Ipswich  
Track covered = Colchester - Witham - Ipswich  
Traction = Grey/White 90003  
Year = 2013  
Duration = 1 hours 5 minutes



## **Important note**

There are two versions of each scenario:

Prefix [90ADV]: Uses the 'advanced' version of the class 90/mk3 DVT

Prefix [90HUD]: Uses the 'HUD' version of the class 90/mk3 DVT

# Credits

We would like thank the following individuals for their contribution to this add-on:

## **RSC Beta Testers**

**Special Thanks:** Ian Bishop (legomanbiffo) & Norwich Crown Point - Greater Anglia