

Class 460 Train Operating Manual



Produced by: Master Key Simulations

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Legend

◆ A red diamond indicates the system/feature being described is only partially simulated, or not simulated in its entirety.

DISCLAIMER: This manual has been developed solely for use in connection with the *Master Key Simulations Class 460* add-on for *Train Simulator*, and is for entertainment ONLY. It is NOT to be used for training or real-world application.

Introduction

The Class 460 (or 8Gat) was the designation of a fleet of 8-car British electric multiple-unit trains built by Alstom in 1999-01. They were part of Alstom's "Juniper" family, which also includes the 334 and 458 classes.

From their introduction until the final units were withdrawn in September 2012, they operated Gatwick Express services between London Victoria and Gatwick Airport, in later years venturing as far south as Brighton. All have since been converted to class 458/5 units (other than four surplus driving vehicles used as spares donors) for operation by South West Trains.

When National Express won the Gatwick Express franchise in 1997, part of the agreement was to replace the ageing Class 73/2 locomotives, British Rail Class 488 coaching stock, and Class 489 motor luggage vans. Therefore, an order was placed with Alstom for the construction of eight Class 460 units.

Deliveries of the new units began in 2000. The units featured sloping cab-ends, which earned them the nickname "Darth Vaders" among rail enthusiasts. A Juniper coupler is located under the removable nose cone although only intended for emergency use. The coupler design was changed many times during their lifetime.

Each 8-car unit was technically two permanently coupled 4-car sub-units, formed of a driving motor luggage van, two intermediate 1st-class/composite trailers, two intermediate 2nd-class motor carriages, an intermediate 2nd-class trailer, another 2nd-class motor carriage, and a 2nd-class driving motor. Formed:
DMLFO(AA)+TFO(AB)+TCO(AC)+MSO(AD)+MSO(AE)+TSO(AF)+MSO(G)+
DMSO(H).

In 2008 the fleet was transferred to Southern when the Gatwick Express franchise was incorporated into the Southern franchise.

From December 2010 the Class 460s were gradually withdrawn from service in favour of refurbished Class 442s, with the final units going off lease in September 2012. The Class 460s were allocated to Stewarts Lane Depot. The 442s themselves have now been replaced entirely by new Class 387 units.

Technical Specifications

TOPS Number	Class 460
Formation	8-car: DMLFO+TFO+TCO+MSO+MSO+TSO+MSO+DMSO
Unit Weight	319.4 tonnes (34-42 tonnes per vehicle)
Vehicle Length	65ft 1in (19.94m)
Vehicle Width	9ft 2in (2.8m)
Body Construction	Aluminium body with fibreglass ends
Power Collection	750 V DC 3rd Rail
Set Power	2,700 kW (10x Alstom T3517 3-phase of 270 kW)
Design Speed	100 mph (161 km/h)
Coupling Type	Scharfenberg
Brake Types	Air (Rheostatic)
Seating	342 (43F/299S)



Rolling Stock (DMFLO)



DMLFO (Driving Motor Luggage First Open) - usually situated at the London end of the formation. The luggage compartment is locked permanently out of use unless required under exceptional circumstances, it can only be accessed through the cab or roller doors when unlocked using a porter's key (note, this is not a BR1 or 'T-key'). The roller doors are not operable in this simulation.

An unpowered bogie is fitted to the number 1 end, equipped with shoe-gear, whilst a motor bogie is located at the number 2 end. Underframe equipment includes brake reservoir, brake module, propulsion inverter, auxiliary converter, and battery box.

Rolling Stock (DMSO)



DMSO (Driving Motor Standard Open) - functionally and mechanically identical to a Driving Motor Luggage First, with the luggage area substituted with 60 seats in a 2 + 2 configuration.

An unpowered bogie is fitted to the number 1 end, equipped with shoe-gear, whilst a motor bogie is located at the number 2 end. Underframe equipment includes brake reservoir, brake module, propulsion inverter, auxiliary converter, and battery box.

Rolling Stock (Cars)



MSO (Motor Standard Open) - has an unpowered bogie, fitted with shoe-gear, at the number 1 end, and a motor bogie at the number 2 end. Equipment includes Brake Reservoir, Brake Module, Propulsion Inverter, Auxiliary Converter and battery box.

TFO (Trailer Open First Lavatory) - with two unpowered bogies, brake supply reservoir, and lavatory tank.

TOCL (Trailer Open Composite Lavatory) - with two unpowered bogies, two lavatory tanks, compressor, main reservoir, and brake supply reservoir.

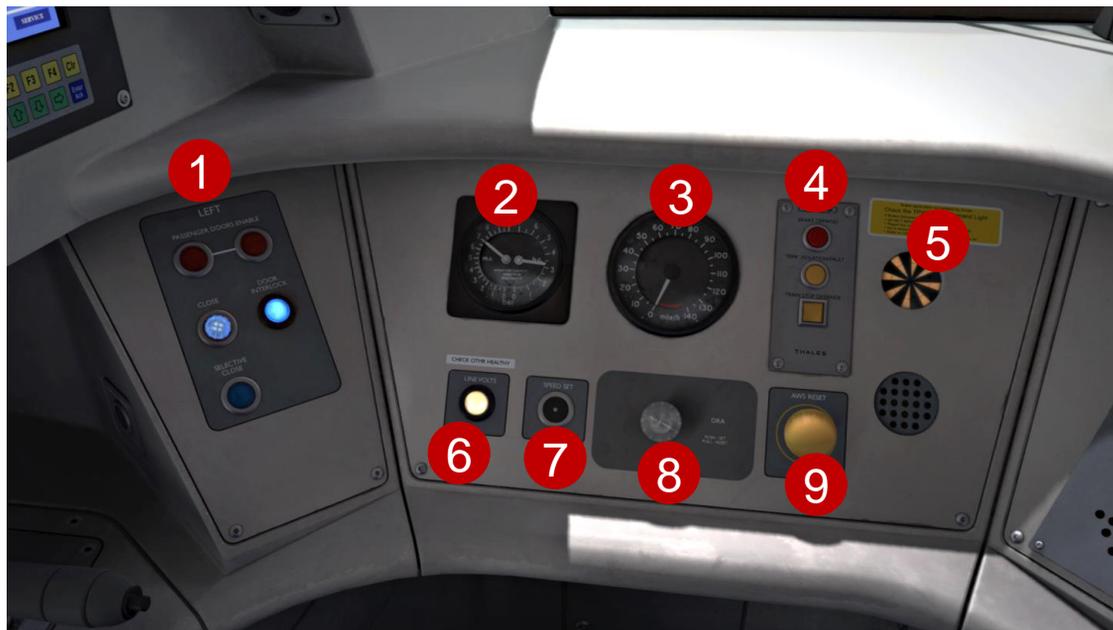
TOSL (Trailer Open Standard Lavatory) - featuring the same equipment as a Trailer Open Composite Lavatory.

Rolling Stock (Coupler)



A Scharfenberg coupler is located under the nose-faring of each driving motor coach. This allows specially converted Class 73 locomotives to haul the units when required. An electrical jumper is provided to allow limited functionality of electrical systems when two Class 460 units are coupled in emergency. These units cannot be coupled to work in multiple but the coupler is compatible with other Scharfenberg-fitted units for emergency purposes only. Press **N** to operate the nose-faring hatch and extend the coupler.

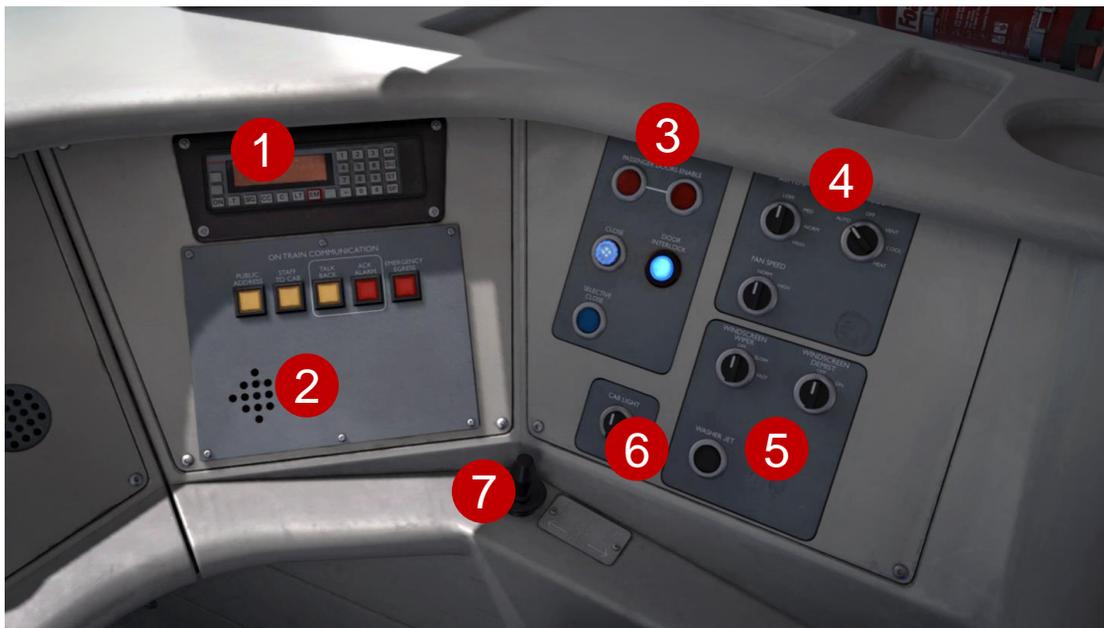
Cab Layout (Desk)



1. Left Door Release Panel
2. Brake Gauge
3. Speedometer
4. Train Protection & Warning System
5. AWS Sunflower
6. Line Volts Indicator
7. Speed Set (Disconnected and inoperable by design)
8. Driver Reminder Appliance
9. AWS/TPWS Reset

There is also a floor mounted DSD pedal (out of shot) directly below the desk panel.

Cab Layout (Desk Continued)



1. Cab Secure Radio (GSM-R in newer cabs)
2. On Train Communications Panel
3. Right Door Release Panel
4. Air Conditioning Panel
5. Windscreen Panel
6. Cab Light
7. Horn

Cab Layout (Left Wall)



1. Lights Panel
2. Train Monitoring System
3. Warning Indicator Panel

Cab Layout (Left Wall Lower)



1. Emergency Brake Plunger (left)
2. Master Key
3. Driver's Direction Selector (DDS)
4. Power Brake Controller
5. Hill-start Button
6. Traction Reset Button

Cab Layout (Right Side)



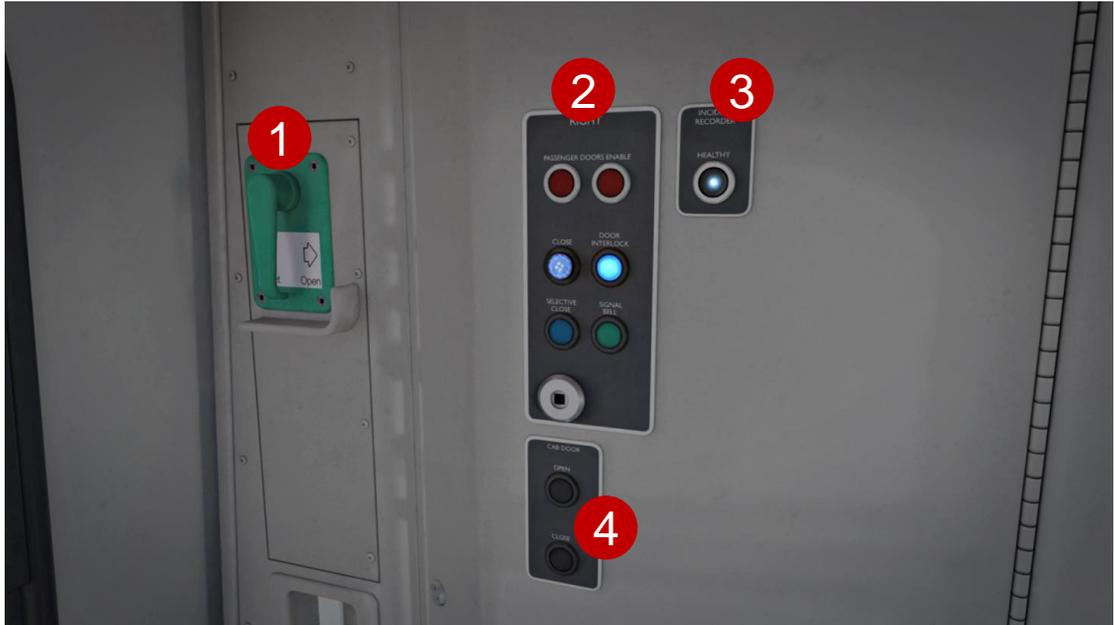
1. Train Protection and Warning System Temporary Isolation Switch

Cab Layout (Isolation Switches)



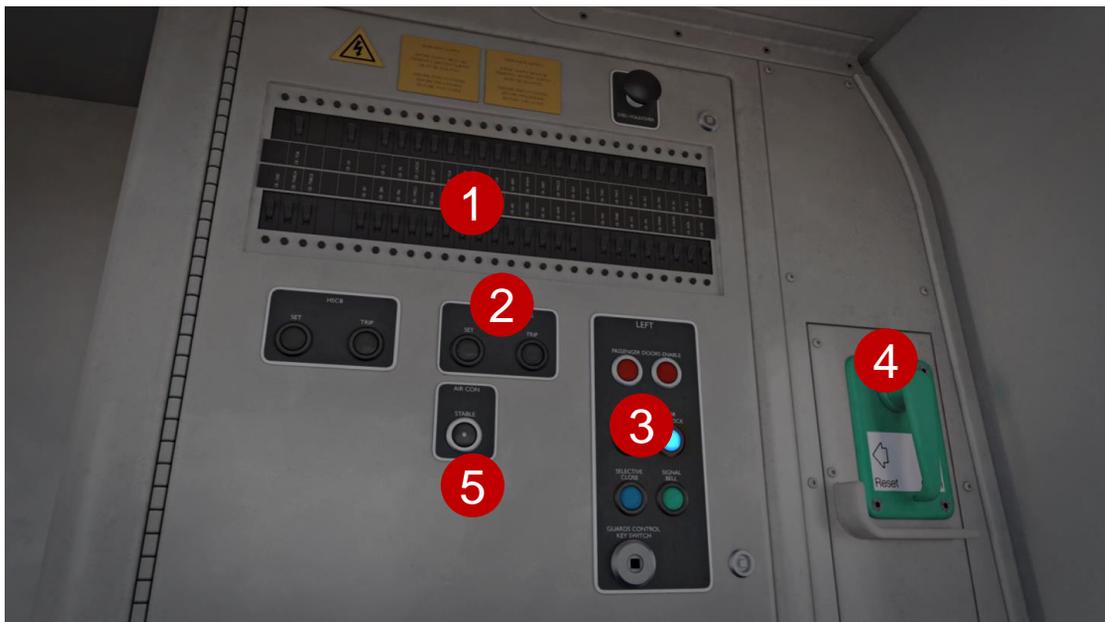
1. Vigilance Isolation
2. Emergency Brake Isolation
3. Driver Safety Device Isolation
4. Train Protection & Automatic Warning System Isolation
5. Driver Reminder Appliance Isolation

Cab Layout (Rear Wall Right)



1. Cab Door Egress Handle (right)
2. Door Panel Right (rear wall)
3. OTMR/Incident Recorder Healthy Indicator Lamp
4. Cab Door Right

Cab Layout (Rear Left Wall)



1. Miniature Circuit Breakers
2. Train Auxiliaries Set/Trip
3. Door Panel Left (rear wall)
4. Cab Door Egress Handle (left)
5. Air Conditioning Stable

Keyboard Controls

Master Key In/Out	Shift + W
DVD Pedal Reset	E / Numpad Enter
Hill Start Button	Numpad +
Driver Reminder Appliance	Y
Cab Light Switch	L
Train Auxiliaries Set	X
Train Auxiliaries Trip	Shift + X
Hazard Lights Switch	Shift + H
Windscreen Washer Jet	F
Instrument Light Switch	I
DSD Isolate	Ctrl + D
AWS Isolate	Ctrl + A
Door Operator Switch	Ctrl + R
Passenger Doors Close	R
Passenger Doors Open Left	T + U
Passenger Doors Open Right	T + O
Signal Bell	C
Visual Alarms	Ctrl + Numpad Enter
Random Failures Mode	Ctrl + F
Coupler Hatch Open/Close	N

Controls Description

Driver's Master Key

A mechanical interlock operated by insertion of the driver's master key. Upon insertion of a key, the switch may be turned to the ON position. Access to the emergency braking position is still available in the OFF position.

Driver's Direction Selector

A rotary selector switch, with the following positions:

- OFF, FORWARD, NEUTRAL, REVERSE

Interlocking of the controls ensures that:

- The DDS can only be moved from the OFF position if the driver's key is inserted and turned on.
- The key cannot be removed unless the DDS is in the OFF position.
- The DDS position cannot be changed when the PBC is in powered positions.

If a DDS is moved away from the OFF position when another DDS is ON in another cab, an audible warning is sounded and the OTHER CAB ON indicator illuminates on the Warning Indicator Panel.

Power/Brake Controller (PBC)

Can be moved through an arc incorporating power notches, coasting (off), braking and emergency braking notches. At the end of the PBC handle is a hill start pushbutton that can be used to prevent the train rolling back when starting on an incline. The hill start pushbutton is only operative in off/coast and power notch 1 position at speeds below 5 mph. The control positions are:

- Power notches 1 – 4
- Off/Coast
- Braking: Low – High
- Emergency Brake: Maximum braking (3.0 bar or more)

Driver's Safety Device (DSD)

The electrical safety device is kept energised by depressing the driver's foot pedal whenever the DDS is in the Forward or Reverse position. Release of the foot pedal for more than 6 seconds will cause the brakes to be applied and traction power to be cut off. Following a DSD brake application, the train speed must fall to 4 mph before the brakes can be released. When the train is stationary, the DDS may be placed to Neutral and the foot pedal released. Placing the DDS to Neutral when the train is in motion will cause the brakes to fully apply. The brakes will not release until the DDS has been moved to Forward or Reverse and the train speed has fallen below 4 mph.

Vigilance Equipment

The Class 460 is fitted with vigilance equipment which is used in conjunction with the DSD foot pedal. After the driver has selected either Forward or Reverse, if he makes no other control movements, an audible tone in the cab sounds at approximately 60 seconds interval to indicate that the vigilance equipment needs to be reset. Unless the driver takes action to reset the equipment within approximately 6 seconds, a full brake application will be initiated, which cannot be released until the train speed has fallen below 4 mph. The vigilance equipment can be reset by the driver either lifting the DSD momentarily. If the vigilance equipment fails, a brake application will be initiated and a buzzer will normally sound, irrespective of any attempt by the driver to reset it.

Defective vigilance equipment which has brought a train to a stand can be isolated by means of a vigilance isolating switch, located to the right of the driver's desk. This will enable the brake to release. When the vigilance has been isolated, the DSD is still operative. Isolation of the vigilance isolating switch affects only the cab in which the switch has been operated and will result in an immediate brake application if the DSD is released.

Train Auxiliaries Set & Trip Button

The train auxiliaries control panel comprises of two pushbuttons:

- Train auxiliaries set
- Train auxiliaries trip

The train auxiliaries set pushbutton will close all HSCBs on both sub-units, lights the line volts indicator (if 3rd rail supply is present) and energise the following control circuits, all those circuits not energised directly by the master switch, or those that have been individually switched off, including:

- Auxiliary converters
- Air compressors
- Doors
- Train lights
- Train heating

Pressing the train auxiliaries trip pushbutton will switch off the above auxiliaries.

High Speed Circuit Breakers (HSCBs)

The function of these pushbuttons are not simulated, as they're not part of standard driving procedure, and only used by drivers as a last resort when fault finding.

Incident Recorder Healthy

An indicator light illuminates to indicate that the incident recorder (OTMR) is functioning normally. If the light flashes intermittently, or is not illuminated, one or more inputs may not be functioning.

Air Conditioning Stable

Operation of this pushbutton allows minimum heating levels to be retained in order to prevent freezing. It maintains saloon temperature at 5°C and switches off the main skirting heaters and the air conditioning. The auxiliaries must be set for this function to operate.

Safety System Isolation and Cut-Out Switches

Safety system isolation and cut-out switches are provided in order to isolate equipment that has become faulty. Each switch has two positions: NORMAL and ISOLATED.

The **safety system isolation switches** are:

- Vigilance isolation (VIS)
- Emergency brake isolation (EBS)
- Train door interlock (TIS) (not for driver use)
- DSD isolation
- AWS isolation
- Passenger emergency isolation (not for driver use)

The **cut-out switches** are:

- DRA isolation
- Traction cut-out (not for driver use)
- Forced brake release (not for driver use)
- Traction shore supply interlock (not for driver use)
- Regenerative brake permitted (not for driver use)

Any isolation of a safety system is monitored by the incident recorder (OTMR) and train monitoring system (TMS). When a system has been isolated, an orange indicator light illuminates on the warning indicator panel. Once a safety system isolating switch has been operated, it can usually only be reset by maintenance staff by use of a special key. However, in this simulation it is possible for the driver to reset them using their master key.

Emergency Stop Pushbutton

When an emergency stop pushbutton is operated, it will latch and the emergency brakes will apply. It will not be possible to release the brakes until the train has stopped.

To reset, the button must be turned through 45° against a spring pressure until it unlatches. An additional emergency stop pushbutton is provided on the central pillar between the windscreens.

Warning Indicator Panel

The warning indicator panel consists of a series of orange lights which illuminate to indicate the following:

- Passenger alarm
- Passenger emergency holdover
- Tail light A failed
- Tail light B failed
- Safety system isolated
- HSCB tripped
- Other cab on

Clipboard & Clipboard Light Switches

The clipboard light switch illuminates the adjacent clipboard provided for driver's use.

Hazard Warning Button

A red hazard button illuminates when depressed and causes the headlights to flash simultaneously to indicate an emergency to oncoming trains.

Head/Marker Lights

The head/marker lights switch has four settings:

- Off – External lights off
- Day – Day headlights & marker light
- Night – Night headlight & marker light
- Marker – Marker lights only
- Tail – Tail lights

Instrument Light Switch

A three-position switch for illumination of Instrument panel gauges – OFF, DIM and BRIGHT.

Traction Reset Button ♦

The traction reset button, when operated, resets traction system overloads on the complete train formation. The button is only operative when the PBC is in the off/coast position. If resetting is required when the train is at a stand on a gradient, the hill start button must be used to prevent the train from rolling backwards.

Door Control Panels

The driver's door control panels for left and right side door operation are energised when an associated master switch is away from OFF.

The panel consists of:

- Two door enable pushbuttons
- Door close pushbutton
- Selective door close pushbutton (not operational)
- Door interlock indicator light

Although the door enable pushbuttons are clickable, due to the way Train Simulator's core functions are programmed, you must press 'T' for the game to acknowledge the doors being opened at a station stop.

Line Volts Indicator

The line volts indicator illuminates when the train auxiliaries set button has been operated to prove that the high speed circuit breaker has closed and that a line volt supply is available.

Cab Temperature Controls

Three rotary switches are provided for maintaining cab temperatures:

- Air temperature switch: LOW, MED, NORM, HIGH
- Mode switch: AUTO, OFF, VENT, COOL, HEAT
- Fan speed switch: NORM, HIGH

Cab Light Switch

The cab light switch controls the operation of the main ceiling-mounted cab lights.

Windscreen Controls

Two switches and one pushbutton is provided for windscreen control:

- Windscreen demist: OFF, ON
- Windscreen wiper: OFF, SLOW, FAST
- Washer jet pushbutton

On Train Communications Panel

The OTC panel would usually be used for vocal communication between the driver, guard, and passengers. Although this panel serves no operational purpose in this simulation, the buttons are clickable and light/beep as per reality.

Train Protection Warning System

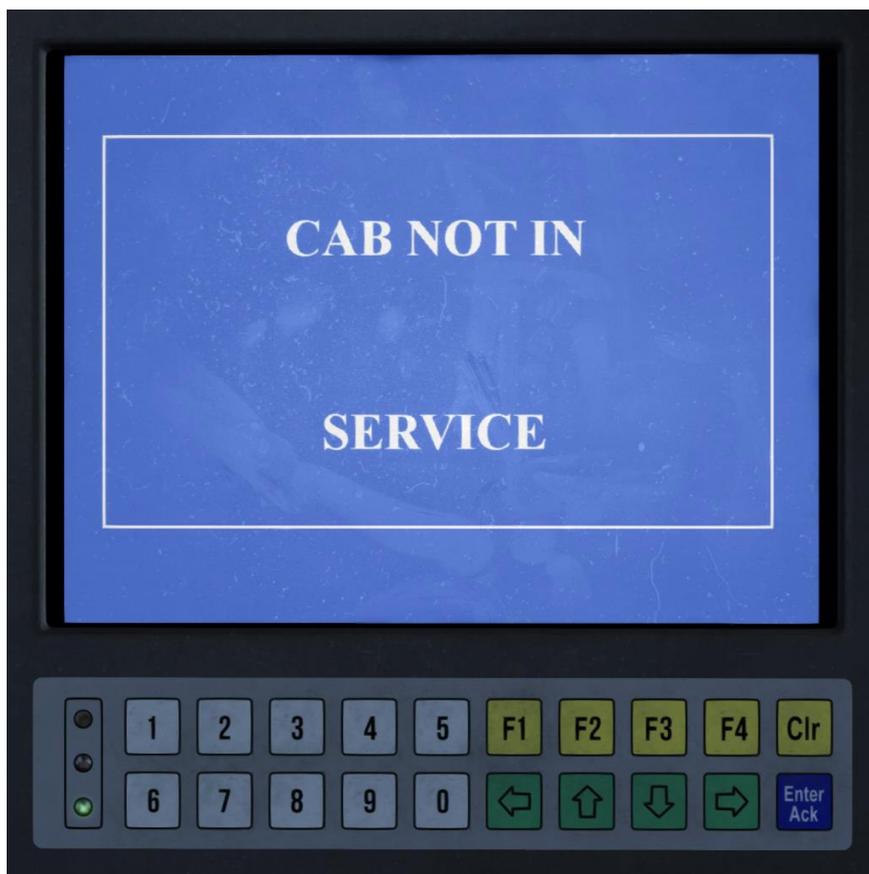
The TPWS panel is comprised of two indicator lights and a pushbutton, along with a separate TPWS isolation switch located on the second-man's side of the cab. The AWS/TPWS acknowledge button is also linked to this system and is used to acknowledge a brake application initiated by the TPWS. TPWS protects the train by automatically initiating a brake demand under certain circumstances, such as passing a signal at danger, or approaching a signal at danger too fast.

Cab Doors

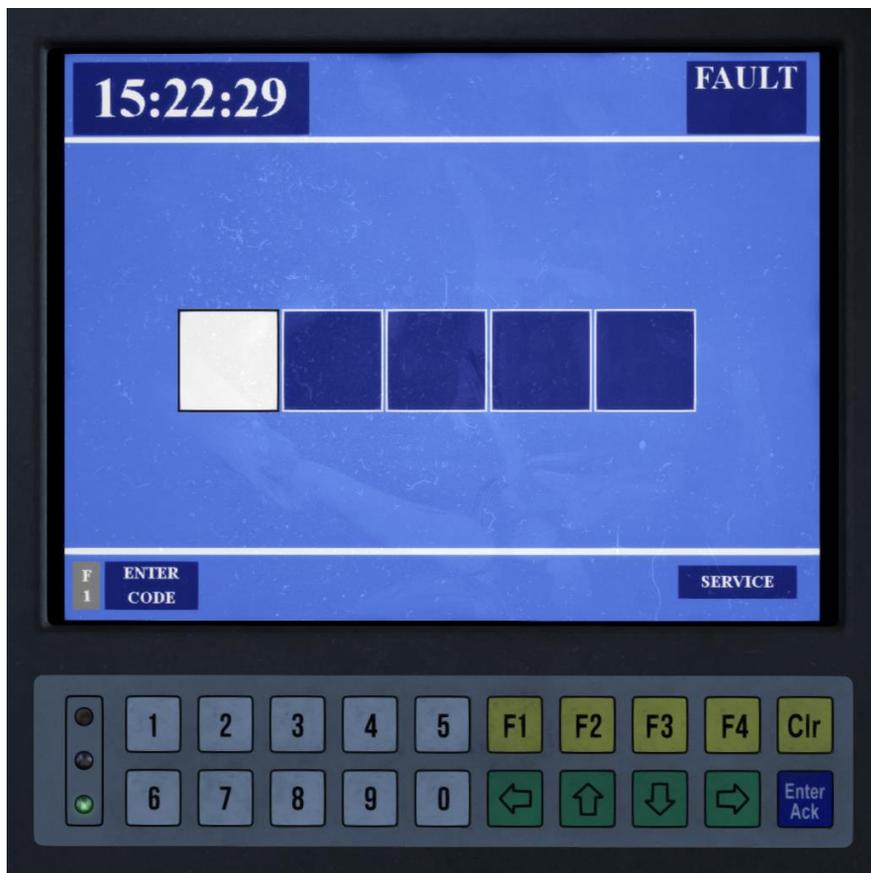
The cab doors are operated via pushbuttons on the rear wall, and egress handles internally and externally. To lock a cab door, the door must be pulled closed, the egress handle must be in the reset position and the cab door close pushbutton depressed for 5 seconds, which will lock the door in the closed position. If a cab door is operated at any speed above 4 mph the emergency brakes will apply automatically.

Train Monitoring System

The train monitoring system not only monitors many train functions and systems, but also alerts the driver of any faults or issues as they're detected. The passenger information system is built into the TMS and allows the driver to input service routes and destinations, playing pre-recorded public address messages automatically, or by selection of the driver.



The train monitoring system comprises of a digital display screen, and a keypad for interacting the display. When the DDS is in the OFF position, this screen will be displayed. To activate the TMS the DDS must be moved away from OFF.



With the DDS away from OFF, the login page will be displayed on the TMS. Use the keypad to enter a 5 digit operator code, then press **F1** on the keypad to activate. Press the **Clr** button if you make a mistake and wish to re-enter the code.

Whilst the TMS will accept any 5 digit operator code by design, the same code should always be used as this information is used by the incident recorder to track which driver is operating the unit at the time.



Once logged in, the TRAIN STATUS page will appear. This allows the driver to check the status of many critical and important systems, including door interlock, traction motors, and brake continuity wires.

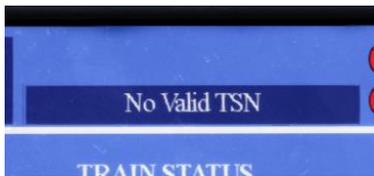


To the top right of the display is the tail light indicators front and rear. This is not failsafe, and the driver should still perform a visual inspection of the tail lights to ensure they're set correctly.

The left two concern the driving vehicle's tail lights, whilst the two on the right concern the rear vehicle's lights.



If a fault is detected by the TMS, the fault number will be displayed on the top right of the screen. If no number is displayed, there is no fault.



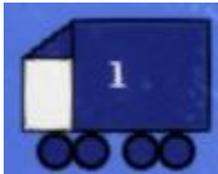
In the middle of the screen the active destination will be displayed, provided a train service number has been entered.



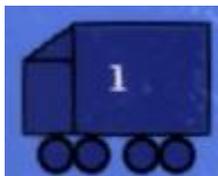
Blue wheels indicate a motorised coach.



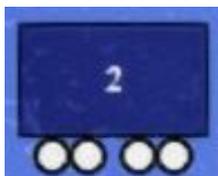
White wheels indicate a trailer coach (no motors).



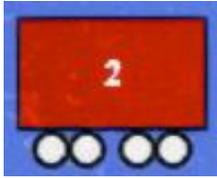
Driving vehicle with active cab (car number 1).



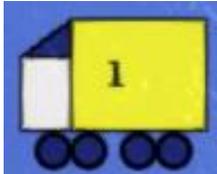
Driving vehicle with non-active cab (car number 1).



Intermediate coach (car number 2)



A red vehicle indicates a fault that requires driver action.



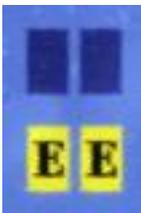
A yellow vehicle indicates a driver information fault.



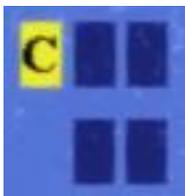
An OK indication shows the system is healthy and communicating with the TMS.



A NOT OK indication shows there is a fault with the relevant system.



A yellow box indicates the door is unlocked, and an “E” indicates the door is enabled. In this example both left-hand side doors are enabled, whilst the right-hand doors are closed.



In this example, a cab door is unlocked, indicated by the yellow box. The “C” indicates it is a cab door.



The white arrow indicates the direction of travel, based on the position of the driver's direction selector.



DOOR I/LOCK (interlock) text will change to red when the doors are enabled, or there is a fault in the system.



The MAIN MENU page can be accessed by pressing **F1** on the keypad whilst on the TRAIN STATUS page. From here other pages can be accessed.

This page can also be used to sign off without moving the DDS to OFF, by pressing **F3** on the keypad, and confirming by pressing **F2**.

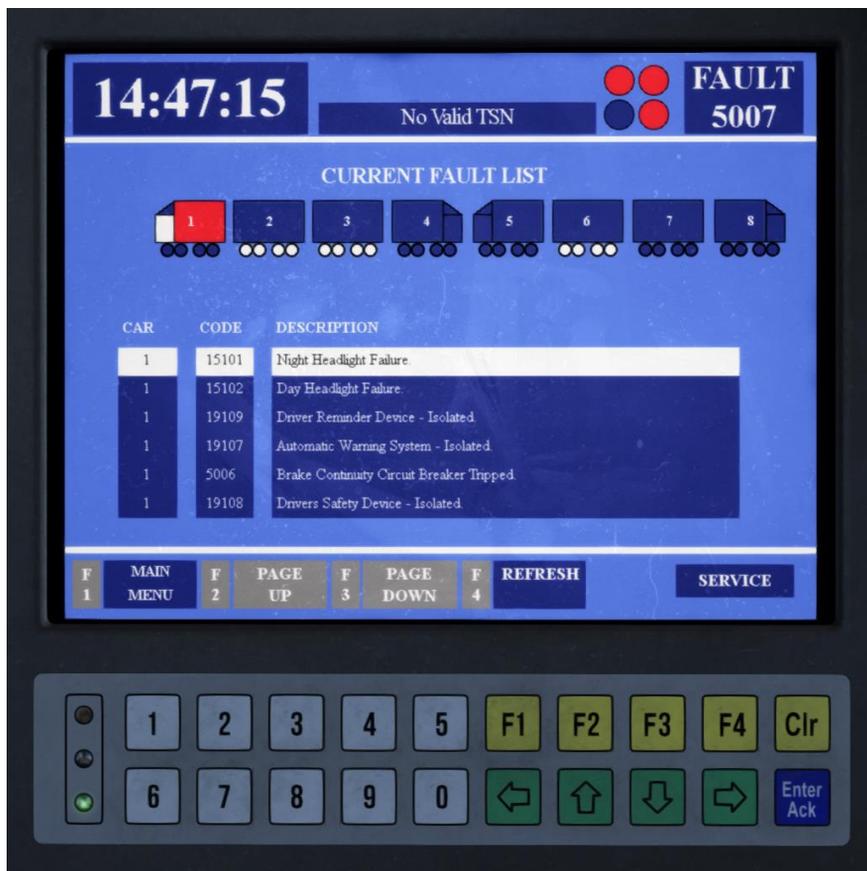
Maintenance mode is not available to drivers.

Test mode is not simulated in the current version of this train.



If a fault develops, an audible warning will sound and the TMS screen will display information about the fault until the driver acknowledges it by pressing the **F1** button on the keypad.

The fault number will be displayed at the top right of the screen, whilst the car(s) affected by the fault will show in red or yellow. A description of the fault along with the action the driver should take to resolve is also displayed.



Once the fault(s) have been acknowledged, the driver may access the current list of faults by returning to the TRAIN STATUS page and pressing the **F4** button on the keypad to visit the CURRENT FAULT LIST page.

Pressing **F4** again on the keypad will update the page. Pressing **F2** or **F3** allows the driver to scroll through the list of active faults, in the event there are more than can be displayed on a single page. The affected car(s) of the highlighted fault will show in red or yellow, depending on the type of fault.



By pressing **F2** on the TRAIN STATUS page, the driver can access the train service number page, which is used to set the active destination. Available service numbers (TSNs):

- 0090 – Brighton
- 0091 – Gatwick Airport (starting from Victoria)
- 0092 – London Victoria (starting from Gatwick)
- 0997 – Not In Service
- 0998 – Empty To Depot

Once a TSN has been inputted using the keypad, pressing the **F2** key will set it as the active destination. If there are automatic PA announcement recordings associated with this TSN, they will be activated immediately.

The automatic announcements are played based on the distance travelled as per reality, so entering a London Victoria TSN from a station other than Gatwick Airport will cause the announcements to play at incorrect times. To prevent this, the driver must select "DISABLE AUTO" on the audio announcement page, and make any announcements manually. Modified starts are not part of this simulation.

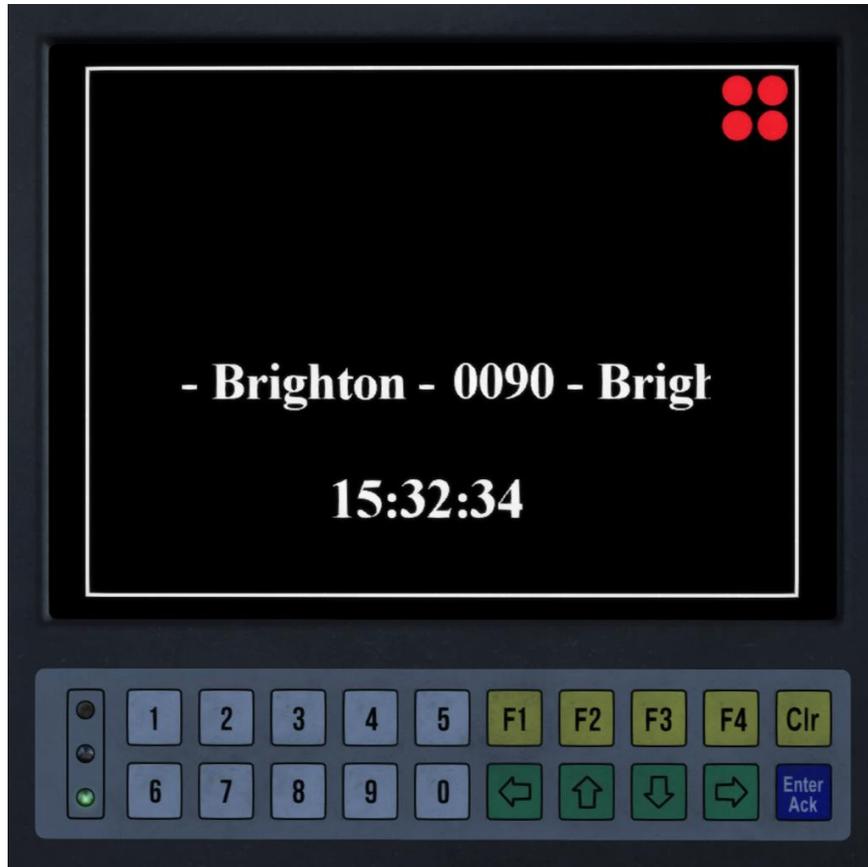


The AUDIO ANNOUNCEMENT page can be accessed via the MAIN MENU page, or by pressing **F3** on the TRAIN STATUS page.

Pressing **F2** on the keypad will disable all automatic TSN related announcements. This should be done before entering a TSN from a non-standard starting location, to avoid passenger confusion.

Other announcements are available on this page, which can be select using the **Up** and **Down** arrows on the keypad, and played using the **Enter/Ack** button on the keypad.

If an announcement is already playing, a warning will appear stating “COMMAND FAILED – AUDIO BUSY RETRY LATER”. Wait until the current message has finished before attempting to play another audio announcement.



After 30 seconds of inactivity, the screensaver will appear, showing the TSN, destination, current time, and tail light status. Pressing any button on the keypad will return to the previous page.

Cab Secure Radio

The cab secure radio will only function if the desk is opened. To activate the CSR, insert a master key and move the driver's direction selector away from the OFF position.



Radio buttons:

ON

ON: This powers up the CSR console.

T

Test: This performs a test function by transmitting data to and from the signal box control system.

SG

Standing at signal: This sends a text message to remind the signaller of your train's presence.

CC

Call clear: Clears the call request to the signal box. This will not clear an emergency call message.

C

Call: Sends a call request to the controlling signal box. The message will include the six-digit traction unit number.

LT

Lamp test: Illuminates all the lamps to confirm the display is working



Emergency: Sends an emergency call message to the signaller. It will time out after 30 seconds if delivery fails and must then be pressed again.



Blank (lower): Unmarked button when pressed will display the six-digit traction unit number stored in the radio.



Enter area code: Allows you to enter the two-digit area code into the radio that corresponds to the area of the controlling signaller.



Set up: Allows you to enter the four-digit code which identifies the signal the train is standing at during the set up procedure.



Stop acknowledge: You must press this as soon as your train has been brought to a stand after receiving a 'STOP' instruction.



Speak: You must press this to answer an incoming speech call. This does not apply to a general call or an emergency call.



Star: Used to register characters into the radio.



Hash: Used to cancel entries made into the radio.



Blank (left): Both blank buttons on the left of this console are not used.

Setting up the Cab Secure Radio:

1. With the desk opened, press the **ON** button on the CSR console.
2. Press the **AR** button.
3. Using the numerical keys, enter the CSR area code pressing the * button once entered. To erase the last entered digit, press the # button.
4. Once the area code has registered, it will appear on the display.
5. Press the **SU** button.
6. Using the numerical keys, enter the signal number of the signal in front of you. This must be a 4 digit number, so enter the required amount of 0s to the beginning of the signal number to make it 4 digits long.
7. Once registered and validated, the train's headcode will be displayed on the screen.

In case of an emergency:

1. Press the **EM** button.
2. "EM SENT" will display on the screen when the message has been sent.
3. Press the # button to return to the previous screen.

Please refer to the RSSB cab secure radio handbook for further information on the cab secure radio system.

GSM-R Radio

The GSM-R radio will only function if the desk is opened, or by pressing and holding down either the **Register** or **Accept** button for 5 seconds.



Console Buttons:



0-9: These buttons are used to enter numbers and letters. Pressing the button multiple times in quick succession selects the subsequent letter assigned to that button.



ST: Used to send a broadcast acknowledgement message to the signaller and to acknowledge a railway emergency group call. ♦



Reduce Brightness: Reduces the brightness of the display and button backlighting, or scroll along text messages that are longer than 20 characters.



Increase Brightness: Increases the brightness of the display and button backlighting, or scroll along text messages that are longer than 20 characters.



Test: Tests the cab radio.



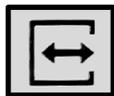
MU: Provides access to the menu. ♦



Down: Used to scroll downwards through the screen or menu options or to reduce the volume.



Up: Used to scroll upwards through the screen or menu options or to increase the volume.



Register: Enables registration and deregistration of the cab radio.



Standing at signal: Sends the 'Standing at signal' operational text message.



Phonebook: Provides access to the train operator phonebook. ♦



Call Signaller: To make a call to the signaller. ♦



Accept: Used to answer calls and accept user entry.



Cancel: Used to reject or end a call and cancel user entry. Press it once to delete the last character entered or hold it down to clear all the characters entered.



Emergency Call: To make a railway emergency group call. ♦



Urgent Call: To make an urgent point-to-point call to the signaller. ♦

GSM-R Radio Registrations:

1. With the desk opened, the GSM-R console should come on automatically.
2. Wait for any self-test to complete, then press the **Register** button.
3. Using the numerical keys, enter the train reporting number, followed by the signal the train is standing at. To erase the last entered digit, press the **X** button.
4. Once the TRN and signal number has been entered, press the **Accept** button.
5. If successful, the TRN should appear on the top right of the GSM-R display.



A successfully registered GSM-R, with the train reporting number 2A58.

Train Protection & Warning System



Brake Demand Indicator

The indicator has three states:

OFF: The TPWS is not causing a brake application.

FLASHING: The TPWS is causing a brake application

ON: The TPWS is causing a brake application acknowledged by the driver.

Temporary Isolation/Fault Indicator

The indicator has three states:

OFF: The driver has not isolated the system and no faults are detected.

FLASHING: A fault has been detected in the system. ♦

ON: The driver has selected temporary isolation.

Train Stop Override Pushbutton

When pushed, the train may pass over a TPWS-fitted signal at danger without a TPWS initiated brake application. Once pressed, the button will light up for 20 seconds, the system will resume normal operation after this time, or when the train has passed the signal at danger. If the train passes the signal at danger after the 20 seconds has elapsed, a TPWS initiated brake application will occur.

TPWS & AWS Self-test

When the driver's direction selector is moved away from OFF, it will initiate a TPWS & AWS self-test, which progresses through three stages:

1. The Sunflower turns black/yellow (if not already), and then back to black.
2. Both pushbutton and indicators will illuminate on the TPWS panel.
3. The brakes will fully apply to emergency pressure.

Once the self-test is complete, the horn will sound. The driver should press the AWS/TPWS Cancel button on the desk, which should reset the AWS Sunflower, release the brakes (to the PBC position), and extinguish all other warning/indicator lights.

The driver may notice a 'chirp' associated with a clear aspect as the horn is silenced.

Train Stop

If the train passes a signal at danger, TPWS will initiate an emergency brake application, a horn will sound, and the brake demand indicator will flash. The driver must acknowledge this using the TPWS/AWS cancel button, after which the horn will silence and the brake demand indicator will show a steady indication. Once the train has come to a stop, and at least 60 second has elapsed, the brakes will be released and the brake demand indicator will extinguish.

The brakes will not release until the 60 seconds has elapsed and the driver has pressed and released the TPWS/AWS cancel button.

Temporary isolation of the TPWS

Under certain circumstances it may be necessary to temporary isolate the TPWS where specifically authorised to do so. The driver may temporarily isolate the TPWS under the following circumstances:

- When it is necessary to pass multiple signals at danger, and operating of the train stop override button is inconvenient.
- Temporary block working is in effect.

When leaving the section of line concerned, TPWS must be reinstated.

Full TPWS/AWS Isolation

Fully isolating the TPWS/AWS system via the TPWS isolation switch isolates all three TPWS functions (AWS, train stop, and overspeed sensor). If selected, the safety system isolated indicator will illuminate on the driver's warning indicator panel.

Speed must not exceed 40 mph if TPWS/AWS is fully isolated. If the driver finds the TPWS /AWS Isolation Switch in the isolated position, the unit must not enter service.



TPWS Temporary Isolation Switch

Consisting of a rotary action switch, sprung-loaded to the central position. The switch is protected by a polycarbonate clip, once broken cannot be re-sealed. A unit must NOT be brought into service without a protection clip fitted to the TPWS temporary isolation switch.

To isolate the system, move the switch to the ISOLATE position (this will break the protection clip). Once released, the switch will spring back to a central position.

To return the system to normal function, moving the switch to the NORMAL position, once released it will again spring back to a central position.

When temporary isolation is selected, the temporary isolation/fault indicator on the TPWS panel illuminates. Temporary isolation is used in response to a fault, or under special operating circumstances such as:

- Propelling or driving from the non-leading cab
- Passing a signal at danger (when train stop override cannot be used)
- Multiple units operating in tandem

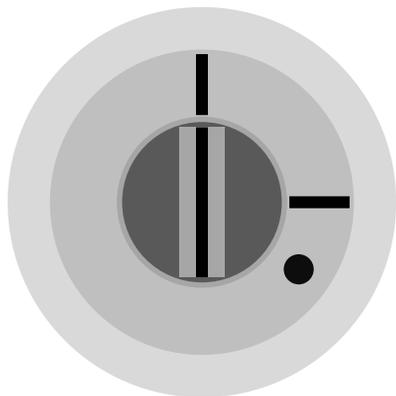
Although TPWS temporary isolation can be selected during a TPWS brake application, it will not release that application.

Temporary isolation will cease once the desk has been closed. If isolation is required after the desk has been closed, it must be reselected after opening the desk again.

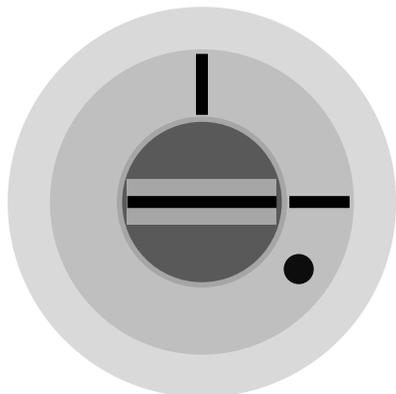
MCB	Circuit	Result if tripped
CB-TLIB	Tail Lights	Tail light B will not illuminate.
CB-DSD	Driver Safety Device	Driver safety device will not operate – Emergency brakes will apply (can be isolated).
CB-BC	Brake Control	Brake continuity circuit will not energise. Emergency brakes will apply (can be isolated).
CB-EBK	Emergency Brake	Emergency brakes will not release.
CB-TMCC1	Train Monitoring & PA	TMS loses automatic announcements and public address system will not operate.
CB-HLA	Headlights	Headlight A will not illuminate.
CB-HLB	Headlights	Headlight B will not illuminate.
CB-DCL	Door Control	Doors cannot be released from the affected cab. Doors will close (if open) on removal of the master key.
CB-DRD	Driver's Reminder Appliance	Driver's reminder appliance will not operate (can be isolated).
CB-AWS	AWS & TPWS	TPWS & AWS will not operate – Emergency brakes will apply (can be isolated).
CB-INC	Warning Indicator Panel	Warning indicator panel will not function.
CB-TMDD	Train Monitoring	TMS display will not operate.
CB-CACAC	Cab Air Conditioning	Cab air conditioning will not operate.

Realistic faults & failures mode may be enabled by pressing **Ctrl + F**, which may occasionally result in a system failure causing an MCB to trip.

Safety Isolation & Cut-Out Switches



When the central part of the switch aligns vertically, the switch is in the NORMAL position and is not isolated.



When the central part of the switch aligns horizontally, the switch is in the ISOLATE position. It can usually only be reset by a fitter, however in this simulation we've chosen to enable resetting of safety isolation switches by the driver's master key.

When a safety isolation switch is in the ISOLATE position, the "SAFETY SYSTEM ISOLATED" warning indicator will illuminate on the warning indicator panel. The indicator will remain lit for the duration of a switch being in the ISOLATE position.

Safety Isolation & Cut-Out Switches

- Vigilance isolation
- Emergency brake isolation
- Driver safety device isolation
- Train protection & automatic warning system isolation
- Driver reminder appliance isolation

Warning indicator Panel

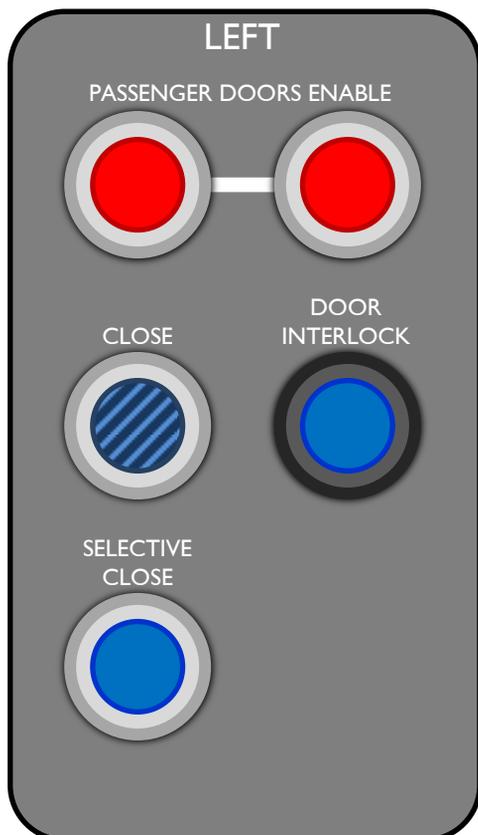


The warning indicator panel alerts the driver when the following occurs:

- A passenger alarm is activated.
- The passenger emergency holdover foot operated button is used.
- Tail light A fails.
- Tail light B fails.
- A safety system is isolated.
- A cut-out switch is used.
- A HSCB on the unit trips.
- Another cab has a DDS away from the OFF position (other cab on).

The warning indications cannot be cancelled or acknowledged, and will remain lit for the entire time a warning event is active.

Door Release Panel



There are four door release panels in each driving cab, a desk and rear-wall panel for each side respectively. Door release panels automatically become active as soon as the desk is opened (master key inserted), and become inactive when the master key is removed.

To release the doors, push both red passenger doors enable buttons simultaneously. Due to hardcoded game functions, you must always press **T** on your keyboard for the game to register the doors being opened. For this reason, we advise using a combination of **T + U** for the left side doors, and **T + O** for the right side. These keyboard commands release the doors on the external model, whilst allowing the game to register it as a passenger stop. This also closely mimics the real-life procedure of pressing both door enable buttons simultaneously.

To close the doors, press any close button on any door release panel in an active driving cab, or by pressing **R**. All open doors (except cab doors) will be closed and locked. You can see which doors are open by viewing the TRAIN STATUS PAGE on the train monitoring system.

The passenger doors enable pushbuttons will illuminate whenever the doors associated with that panel are released.

A blue door interlock indicator will illuminate when door interlock is achieved. It is not possible to take traction or release the brakes without door interlock.

Selective close is not enabled on this train.

Class 460 Driving Instructions



The following section provides basic driving instructions, in order to safely and correctly operate the Class 460 units.

Preparing For Service

1. Enter the driving cab, checking for any tripped MCBs or isolation/cut-out switches in the ISOLATE position. A unit must NOT be brought into service with any tripped MCBs or isolated systems.
2. Check emergency plungers are set (black line must be vertical).
3. Check the PBC is in the HIGH position.
4. If not already set, set the auxiliaries by holding down the train auxiliaries set button for five seconds, or until the line volts indicator is lit.
5. At this point, the compressor will begin charging the main reservoir (the main reservoir must charge to at least 5.6 bar for the brakes to release).
6. Set the HEADLIGHTS as required.
7. Set TAILLIGHTS as required.
8. Insert and turn the Master Key through 90 degrees clockwise.
9. Operate the passenger doors if at station of service origin.
10. Move the driver's direction selector (DDS) to the NEUTRAL position.
11. Observe all TPWS light on.
12. Observe AWS activation via horn and sunflower movement.
13. Reset AWS.
14. Check DRA is in the 'On/Set' position.
15. Observe incident recorder 'Healthy' light on back wall.
16. Check no cab warning indications.
17. Login to the TMS by entering 00000, and set the TSN if at station of service origin.
18. Register the CSR or GSM-R radio.
19. Once the main reservoir is fully charged, check for any faults showing on the TMS fault page.
20. Ensure cab doors are shut and locked.
21. Close passenger doors if opened, ensuring door interlock is gained.

Driving In Service

1. Ensure any relevant signal is not showing a “Do not proceed” aspect.
2. Reset the driver reminder appliance.
3. With the hillstart button depressed, move the PBC from a braking position, into notch 1, releasing the hillstart button as the unit begins to move.
4. Move the PBC into the highest power position with regards to:
 - Signal aspect
 - Speed restrictions
 - Rail conditions

The aim should be to quickly accelerate to running speed as smoothly as possible.

Braking

The train is fitted with an infinitely variable control electro-pneumatic brake, this means between 1 bar (minimum braking pressure) and 3.3 bar (maximum service braking pressure), the driver may select any amount of braking desired.

There are two forms of braking, electronically blended:

- Dynamic braking: whereby the traction motors act as generators, with the current produced being converted to heat via resistors.
- Air (friction) braking: whereby pads are applied to brake discs on every axle.

Moving the PBC from a power position to a braking position causes the brake control unit to apply an in-shot of air for the purpose of reducing dead time. This produces the distinctive high pitched ‘squeal’, heard when making larger increases in braking pressure.

Braking under normal conditions

The braking point will depend on a number of factors:

- Weather conditions
- Gradients
- Speed

At the appropriate point, select a braking rate to bring the train smoothly to a stand in the required distance. Because the air brake supplements dynamic braking, brake cylinder pressure may not register until the train speed reduces considerably. As the train is just about to come to a stand, but not too soon, the brake should be released to approximately 1.0 bar ensuring a smooth stop. Experience will show the correct speed to ease the brake. Upon coming to a stand, maximum service brake should be selected to secure the train from further movement. Frequent movement of the power / brake controller during braking (fanning), is poor technique and should be avoided.

Braking under adverse conditions

Braking distances will always increase when rail conditions are ice, greasy, or wet. Because of this, under these conditions the driver must be proactive in ensuring it does not negatively affect the running of their service, or result in overshooting speed restrictions, signals and stations. In these adverse conditions, the driver must brake earlier and lighter.

In the event of wheel slide protection activity, do not release the brakes, and allow the system to operate as designed. You will notice audible WSP activity and erratic movements of the speedometer when the system is operating.

If at any point you doubt you will slow, or stop at your desired point, select "EMERGENCY" on the PBC immediately. This will disable dynamic braking, and provide the maximum stopping capability in all conditions. The emergency brake will not release until below 5 mph.

Included Scenarios



1A47 Brighton - London Victoria

60 minutes, medium difficulty.

Take a gentle stroll up from the coast on a weekend morning.



1U21 Gatwick CS - London Victoria

40 minutes, hard difficulty.

Prepare the unit in the Carriage sidings before making your way to Victoria.



1U43 Stewarts Lane - Three Bridges

65 minutes, very hard difficulty.

Fog, ice, adverse signals - a challenge for even the most experienced driver.

The included scenarios are based on real world timetables, with some services excluded to ensure reasonable performance on all computers. For more scenarios please visit the Steam Workshop.

Advanced Scenario Features

Rail Vehicle Number Options

To assist with scenario creation, it is possible to set a number of options via the DMFLO (AA) rail vehicle number, which affects the entire train.

Cold Start on Scenario Load

Adding the suffix ;Cold=1 to the rail vehicle number will set the unit's state to cold (aux off, no air etc.) on scenario load. The ";" separates the actual rail vehicle number from the proceeding option. A ";" should be added between each option in the rail vehicle number.

AI Train Destination Display

To set the destination on an AI Class 460 unit, add one of the following letter suffixes to the unit number, such as 460001A, where A can also be any letter between A and H corresponding to the following TMS destination:

- A = "0090", Brighton
- B = "0091", Gatwick Airport
- C = "0092", London Victoria
- D = "0993", Special
- E = "0997", Not in Service
- F = "0998", Empty to Depot

Cab Secure Radio

- Support for CSR Area track markers (same signals as the AP Class 205 pack)
- CSR parameters via suffix in the rail vehicle number: ;CSR=S;AA;NNNN;TTTT where:
 - S is the default state of the CSR on scenario load (1 for on, 0 for off).
 - AA is the required two digit area number.
 - NNNN is the required four digit signal number.
 - TTTT is the train reporting number displayed by the CSR console when set-up.

GSM-R Radio

- GSM-R parameters via suffix in the rail vehicle number: ;GSMR=TTTT;NNN where:
 - TTTT is the required train reporting number.
 - NNN is the required signal plate number.

Summary & Credits

The Master Key Simulations Class 460 has been built to the highest standard possible considering the small amount of reference material available. We've made every effort to ensure a faithful recreation in Train Simulator through the use of manuals, technical documentation, and real-world Class 460 driver testing.

With thanks to:

Dovetail Games & Beta Testers

David Guilnard

We'd also like to extend a special thank you to our exceptionally kind and knowledgeable technical advisors, most of whom worked closely with the Class 460, for giving up their time on weekends and evenings to help us with this project. The insight they provided into various systems and operational procedures proved invaluable in developing this add-on.

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