DB Class 423
EMU Pack

1 The Class 423

The Class 423 is an Electric Multiple Unit (EMU) made for the S-Bahn commuter networks of Germany (Munich S-Bahn, Cologne S-Bahn, Frankfurt S-Bahn and Stuttgart S-Bahn).

It is similar in size to the Class 420 DMU (which is its predecessor) but benefits from being lighter and from having one large passenger compartment as opposed to that of the Class 420 which is divided into three.

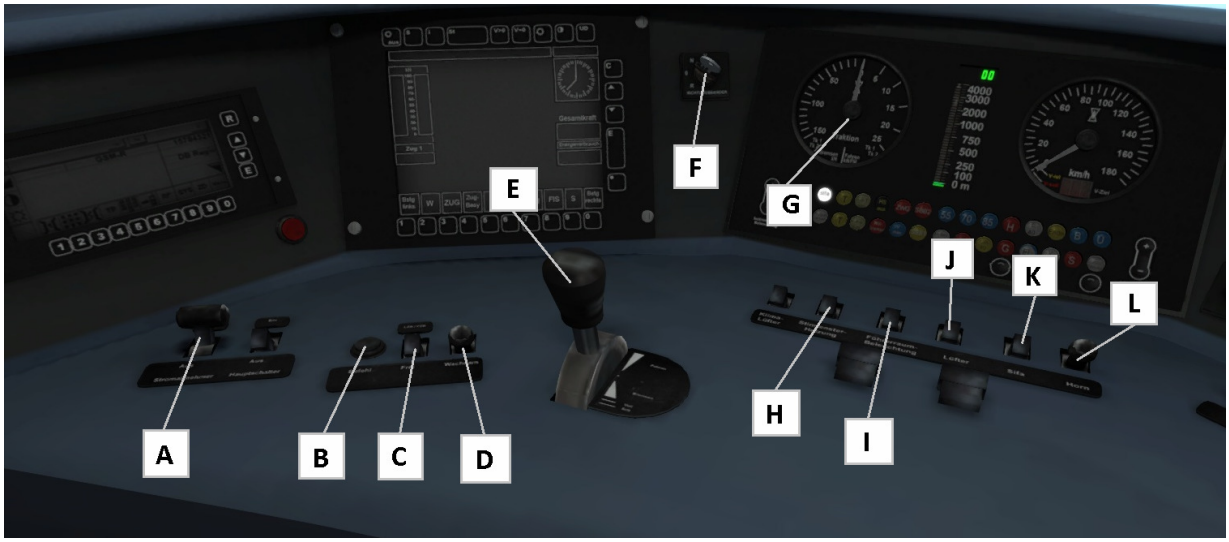
A Class 423 EMU comprises four cars which share three jacobs bogies, and the cars can only be separated at maintenance facilities. The two driving cars are each designated Class 423 and the two inner cars are designated Class 433.

The Class 423 EMU typically runs as either the four-car set, or as two four-car sets coupled together.

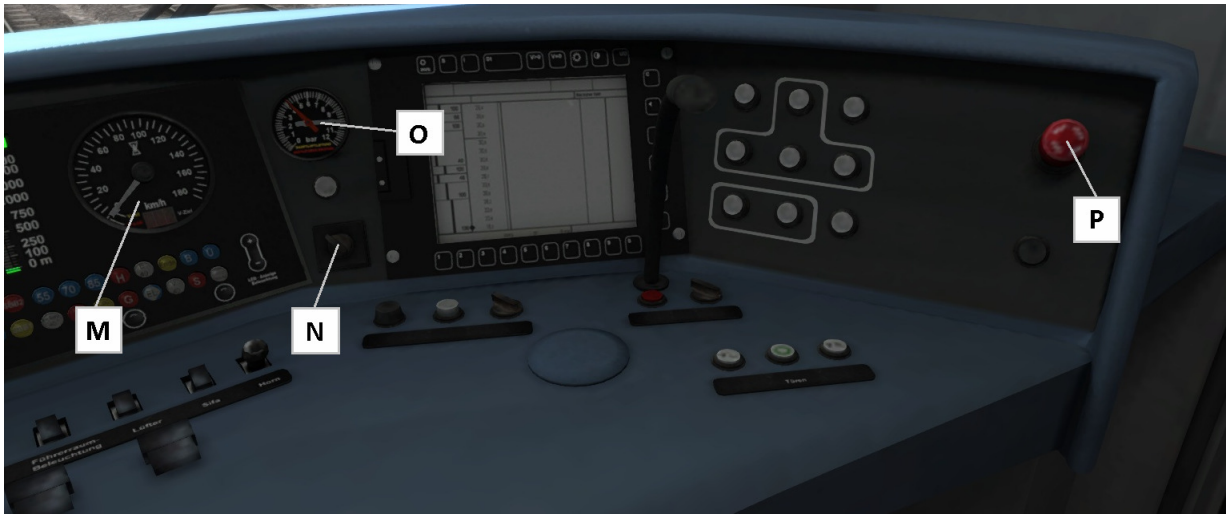
Technical Data

Total Built	462
Weight	105t
Length	221’ (67.4m)
Engine Power	2,350kW
Max Speed	87 mph (140km/h)
Fuel Capacity	N/A

1.1 Cab Controls



A – Pantograph Up/Down
B – PZB Befehl40 (Override)
C – PZB Frei (Release)
D – PZB Wachsam (Acknowledge)
E – Throttle and Brake Lever
F – Reverser
G – Traction Effort Meter
H – Cab Light
I – Sander
J – Headlights
K – Sifa Reset
L – Horn



M – Speedometer
N – Wipers
O – Brake Pressure Dials
P – Emergency Brake

1.2 Keyboard Guide

Increase / Decrease Throttle / Brake	A / D
Increase / Decrease Reverser	W / S
Horn	Space
Open Passenger Doors	T
Request Permission to Pass Signal Ahead	Tab
Request Permission to Pass Signal Behind	Ctrl-Tab
Headlights On / Headlights Off	H / Shift + H
Raise / Lower Pantograph	P
Emergency Brake	Backspace
Wipers Toggle	V
Change state of Junction Ahead / Behind	G / Shift + G
Couple Manually	Ctrl + Shift + C
SIFA Toggle	Shift + Numpad Enter
SIFA Acknowledge	Numpad Enter
LZB Toggle (only needed for Non-LZB routes)	Shift Ctrl Numpad+
LZB Automatic Brake Intervention Toggle	Ctrl Numpad+
PZB Toggle	Ctrl + Numpad Enter
PZB Wachsam / Acknowledge	Page Down
PZB Frei / Release	End
PZB Befehl40 / Override	Del
Toggle Cab Light	L

2 Cab Functions

2.1 SIFA Driver Vigilance

SIFA is short for Sicherheitsfahrschaltung or “Safety Driving Switch”.

The SIFA vigilance alerter is disabled at startup, but can be activated or deactivated by pressing ‘Shift+Enter(Numpad)’. While activated the SIFA light on the cab dashboard is normally switched off. While the train is moving the driver is required to confirm an alarm every 30 seconds.

When the 30 second alarm is triggered the SIFA light on the cab dashboard will illuminate, after an additional 4 seconds an audible alert will sound. After a further 2.5 seconds the emergency brake will be applied. This can be avoided by acknowledging the alarm at any stage by pressing the ‘Enter(Numpad)’ key.

2.2 LZB

LZB is a cab signaling and train protection system. LZB brake intervention is off by default. It can be enabled with Ctrl-numpad+. B indicator will show when brake intervention is enabled. LZB displays will activate when needed, regardless of brake intervention state, LZB active is shown by Ü.
LZB is activated by an LZB start sign. It is ended by LZB end balises. Displays can also be enabled/disabled by the user pressing Ctrl/shift-numpad+ (usefull for existing routes with no balises).
LZB will override any enabled PZB (enabled by Crl-Enter(Numberpad)). PZB will run in the background and will takeover when LZB deactivates. This may be in a restricted state resulting from 1000hz balises. Active 2000hz balises will also cause a brake application with LZB.

When active LZB shows the distance to the next speed change, on a 4000m range graphic bar, or digits upto 9900m. The next speed target is shown in digits at the base of the speedo, if the next speed target is less than the current speed limit, in which case the current speed limit is shown. The current speed limit is always displayed with a bug on the speedo.

Exceeding the limit will cause the G light to be shown. When LZB brake intervention is enabled if the limit is exceeded for 5 seconds the brakes will be applied.

When approaching reduced speed targets (including 000 for red signals) the limit bug will command a decelleration rate by gradually moving the bug counter clockwise. While commanding decelleration the G light will be shown.

At the end of an LZB section the ENDE light will flash. If LZB brake intervention is enabled this must be acknowledged within 10 seconds or the brakes will be applied.

2.3 PZB90 Cab Signaling

The PZB90 function is similar to the UK AWS function. By default it is disabled.

The following keyboard controls are used for operation:

Function	Keyboard
Activate/Deactivate	Ctrl+Enter(Numpad)
Acknowledge	Page Down
Release	End
Override	Del

There are six cab dashboard lights associated with the function – 85, 70, 1000, 500, befehl40 and S.

Function	Control Panel Light(s)
85km/h maximum / Normal operation	85
45km/h maximum	Alternating 70 85
25km/h maximum	500 + alternating 70 85
Distant at warning passed. 85km/h maximum	85 + 1000
Stop signal approaching. 45km/h maximum	85 + 500
Emergency brake applied	S + flashing 1000

2.3.1 Pulling away

When first pulling away the PZB will enter the starting program mode until speed exceeds 5km/h. This is shown by the 70 and 85 lights flashing alternately. Speeds below 45km/h will be allowed for the next 700m. If there is no adverse stop signal ahead the speed monitoring can be cancelled with the 'End' key. However, if the monitoring is cancelled and the next signal is red when passing the 500hz balise (similar to an AWS ramp), the emergency brakes will be applied, whatever the train speed.

2.3.2 Passing a Distant Signal at Warning

When passing a distant signal set at warning, the signal should be acknowledged with the Acknowledge key ('Page Down') within 2.5 seconds of passing or the emergency brakes will be applied. After acknowledging the signal, the 1000 light will show, and 85 will start flashing. You now have 23 seconds to reduce speed to 85km/h or less, or the emergency brakes will be applied.

Once train speed drops below 85km/h the speed will be monitored to this maximum. This cannot be cancelled while 1000 is lit. 700m after passing the distant signal, the 1000 light will go out. The speed monitoring can now be released

If the train speed drops below 10km/h while 1000hz 85km/h monitoring is active, hen the maximum speed will be reduced to 45km/h. This is indicated by 70 and 85 flashing alternately as per the start program mode.

If speed monitoring is not cancelled with the Release key ('End') it will expire 1250m after the distant signal (providing another active distant has not been passed).

2.3.3 Approaching a Stop Signal at Danger

If the stop signal ahead is red then passing a 500hz balise will cause the 85 and 500 lights to be displayed steady. If the train speed exceeds 65km/h at this point the emergency brakes will be immediately applied. If not, you have 153m to reduce speed to below 45km/h, or again the emergency brakes will be applied.

If train speed drops below 10km/h while 500hz 45km/h monitoring is active then the maximum monitored speed will be reduced to 25km/h. This is indicated by 70 and 85 flashing alternately together with the 500hz lit.

Speed monitoring cannot be released while the 500hz light is on. It is extinguished, and the 500hz monitoring expired, 250m after passing the 500hz balise, which should be approximately the position of the associated stop signal.

If an adverse stop signal is passed (2000hz balise) the emergency brakes will immediately be applied.

2.3.4 Passing a Stop Signal at Danger

If it is necessary to pass a red signal, press and hold the Override key ('Del') while passing the signal. Ensure train speed is below 40km/h. As the signal is passed, the befehl40 light will show. The Override key can now be released. If the 1000 and 500 lights are out then any speed monitoring can be cancelled using the Release key.

3 Scenarios

3.1 [DB 423] Driver Training

Time of Day: 16:00
Weather: Cloudy, Autumn
Duration: 10 minutes
Description: Learn how to operate a DB Class 423. Pick up passengers from stations and recognise signals.

3.2 [DB 423] S3 to Mammendorf

Time of Day: 15:00
Weather: Cloudy, Spring
Duration: 40 minutes
Description: The lunchtime rush has just finished as your shift begins in Munich Hauptbahnhof (Tunnel). You will be running the S3 service, stopping at all stations, finishing at Mammendorf. You have a strict timetable so ensure you keep a reliable service.

3.3 [DB 423] Unwelcome Interruption

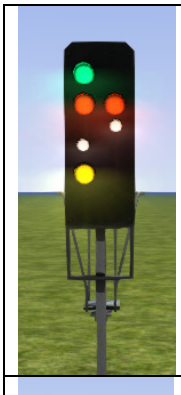
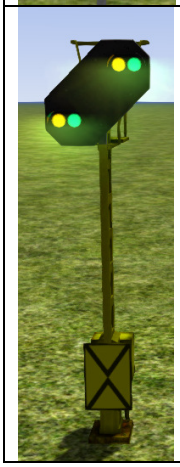
Time of Day: 07:00
Weather: Stormy Showers, Autumn
Duration: 40 minutes
Description: You are driving the S3 from Mammendorf to Hauptbahnhof (Tunnel) on this gloomy morning. Stop at all stations on the way. You have a very tight timetable so ensure there are no errors.

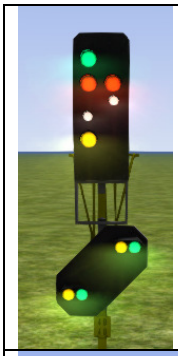
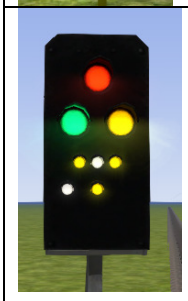
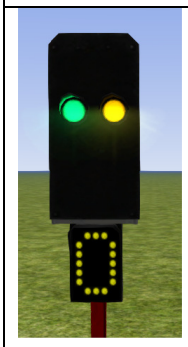
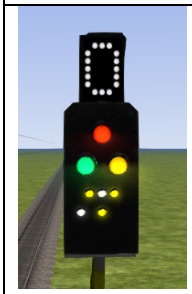
4 Signalling

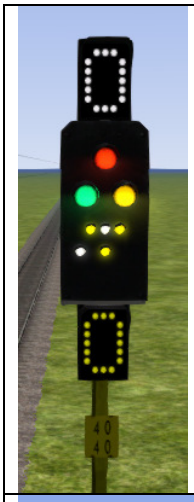
The signalling system employed on German Railways is extremely complex to understand at first; however in reality each signal you encounter will be composed of one or more straight forward signal types to give the final post.

This manual doesn't attempt to cover all the possible signal types and variations, but it should provide sufficient background as to let you work out what each signal post you come across is telling you by explaining the component parts. Note that any signal of a given type that you see should be interpreted the same whether it is on a post, on the ground, on a gantry or in any other position.

Note that in the examples below, the image shows the signal with all lights on so that you can clearly see where they are. The description of the signal describes the various combinations of lights and what they mean when lit. The small code before the description is the technical name by which that combination of lights is known.

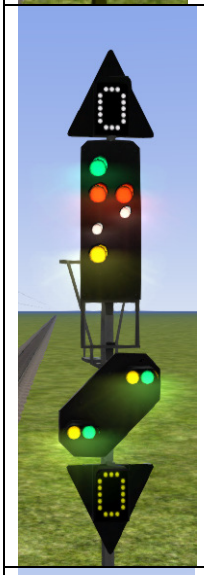
	**Signal Type: Hp** This is signal protects entry to a block. Hp0 – Red, Stop – do not proceed Hp1 – Green: Clear to proceed Hp2 – Yellow and Green: Caution, Proceed at 40km/h Sh 1 – Red and Double White: Shunting permitted
	**Signal Type: Vr** Vr signals are distant signal types and indicate to you what you should expect the *next* active signal to be showing. Vr0 – Two Yellow – Caution, expect stop Vr1 – Two Green – Expect Clear Vr2 – Green/Yellow – Expect Caution with 40km/h restriction Note the "X" post board at the bottom, any signal which has this board is indicating that the signal is to be interpreted as a Distant signal.

	**Combined Signal Type: Hp Vr** This is an example of a combined signal, in this case the example shown is an "Hp Vr" combination. The functions of the individual signal heads are identical to those expained above but they are placed on the same post.
	**Signal Type: Ks** A newer signal type than the Hp signal but the function of it is the same. Hp0 – Single Red – Stop, do not proceed. Ks2 – Single Yellow – Caution, expect next signal at Danger Ks1 – Single Green – Proceed at line speed Ks1 Flashing – Proceed and expect speed reduction at next signal Hp0 + Sh1 – Single Red + Two small white – Shunting permitted
	**Combined Signal Type: Ks Zs3v** The Ks distant signal in this combination functions as normal. Zs3v signals are distant speed indicators. That is, you can expect the speed to change as indicated at the *next* signal. The indicator should be multiplied by 10 to get the speed restriction in km/h, for example, if the Zs3v indicator shows a "3" this means that the speed restriction will be 30km/h at the next signal. The Zs3v signals are clearly identified by being *yellow* and placed *under* the signal. Note that fixed speed limits are often indicated with a yellow-backed triangle board rather than an LED signal as shown here. See the example Zs3v speed board below.
	**Combined Signal Type: Ks Zs3** Similar to the Zs3v signals, a Zs3 signal differs in that it is indicating the speed limit imposed by *this* signal. While travelling down the line you could reasonably expect to see a Ks Zs3v indicating 30km/h at the next signal, and then the next signal would be a Ks Zs3 indicating 30km/h starts at this signal. The Zs3 signals are clearly identified by being *white* and placed *above* the signal. Note that fixed speed limits are often indicated with a white-backed triangle board rather than an LED signal as shown here. See the example Zs3 speed board below.



Combined Signal Type: Ks Zs3 Zs3v

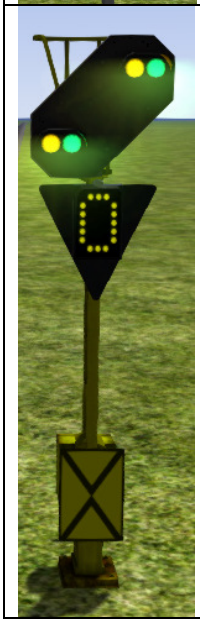
Combining the signals shown previously, this will show you the speed limit imposed as of the section you are about to enter as well as the speed limit of the next section, allowing you adjust your speed through the section accordingly.



Combined Signal Type: Hp Vr Zs3 Zs3v

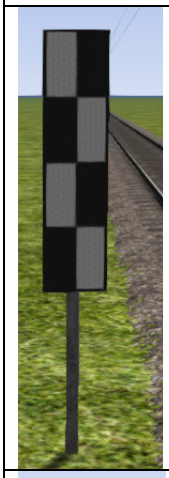
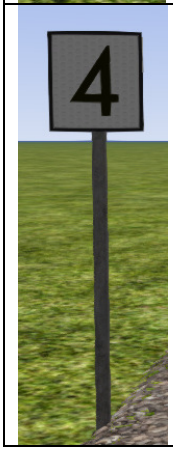
An example of how the signalling can begin to look very complex, however this is simply four signal types combined on to one post. Here you can see:

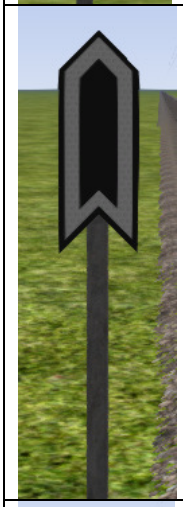
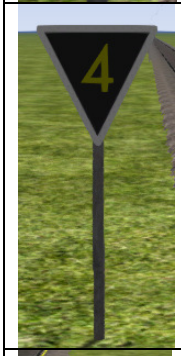
- permission to enter the next block on the Hp signal,
- indication of the signal state for the next signal on the Vr signal
- speed restriction starting from this signal via the Zs3 at the top
- speed restriction in place from the next signal via the Zs3v at the bottom

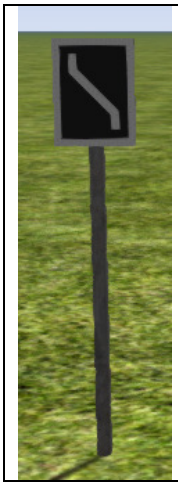


Combined Signal Type: Vr Zs3v

This signal combination naturally combines the distant Vr signal with the distant speed indication in the Zs3v signal.

	**Signal Type: Hp Shunt** This very simple signal will often be found as a ground frame or on a small post and is frequently used in yards and sidings. It has two indications: Two Red lights – Stop, do not proceed Two White Lights – Proceed
	**Post Type: Ne4 Chessboard** The Ne4 Chessboard is used to tell you that a signal that would normally be at this position has been placed in an alternative location, this could be further away from the track or on the other side of the track. The Ne4 board is always located where the signal would normally expected to be positioned.
	**Post Type: Lf6 Advance Warning Speed Post** This speed post provides advance warning that a speed limit change is going to take place. In the example shown, the speed will soon be changing to 40km/h. Following an Lf6 you can expect an Lf7 to mark the start of the new speed limit.
	**Post Type: Lf7 Speed Post** This speed post marks the beginning of a change in speed limit. The example indicated marks the beginning of a 40km/h speed limit and you should not be exceeding this speed as you pass the post.

	**Post Type: Arrow Indicator** Where there might be confusion about which track a sign is assocated with, a small arrow is placed to indicate which line the information applies to. In this example the Lf7 speed restriction applies to the track on the left of the post.
	**Post Type: Zs10 End of Speed Restriction** This post indicates the end of a speed restriction started by a Zs3.
	**Post Type: Zs3 Speed Post** New speed limit takes effect immediately from this point. Shows one white number indicating the tenth the speed allowed from this point. This is normally used in conjunction with main signals. Permanent speed restrictions are instead indicated using Lf type signs.
	**Post Type: Zs3v Distant Speed Post** Shows one yellow number indicating the tenth of the speed allowed from the point where the following Zs3 signal is found. This plate is normally used in conjunction with distant (e.g. Vr) signals.



Post Type: Zs6 Wrong Line Post

This track change display plate is used to indicate that wrong line running (left hand) is to be used from this signal. It is only used in combination with main signals and only on lines where wrong line working is frequent.