



Class 680 electric multiple unit

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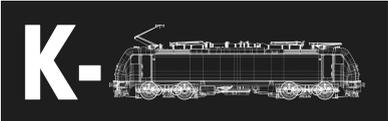
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Content

- Description..... 3**
- Concept of the model..... 3**
- Control elements.....4**
 - Another key shortcuts..... 8**
 - Diagnostic panel description..... 8**
- Description of control elements..... 9**
- Important procedures.....12**
 - 1. Unit startup..... 12**
 - 2. LS90 startup..... 13**
 - 3. Automatic speed control.....13**
 - 4. Active tilting..... 13**
 - 5. ERTMS and infosystem..... 14**
 - 6. No voltage test..... 14**
- Possible failures..... 15**
- Timetable creation.....17**



Description

Class 680 is high speed tilting electric unit used by České dráhy a.s. company. Their nickname Pendolino is derived from the tilting system. They were manufactured by Alstom Ferroviara in Italian Savigliano.

It is the only class with active tilting system used by České dráhy.

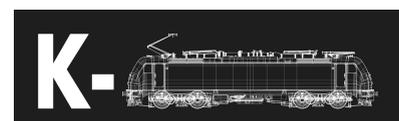
Max. allowed speed	200 km/h
Construction speed	230 km/h
Weight	385 t
Gauge	1435 mm
Power	3.92 MW
Max tractive effort	200 kN

Concept of the model

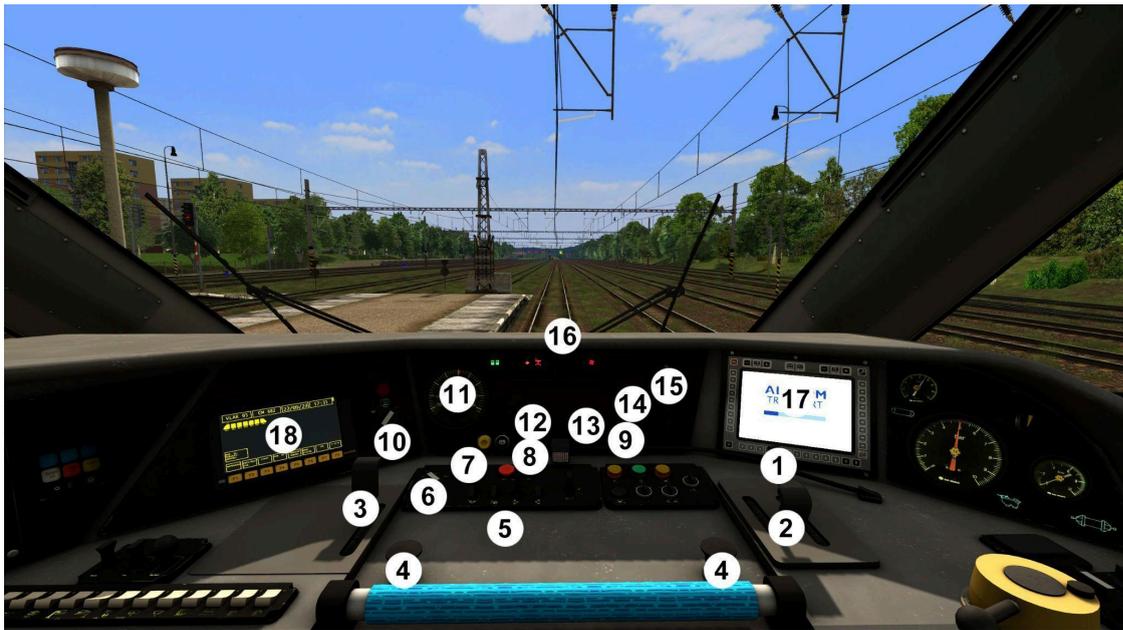
This model is designed for advanced to expert users. It is very detailed and has big hardware demands compared to the rest of available models. It is not expected to be 100 % accurate so there may be some things that vary from the reality. Some things and procedures were intentionally simplified.

Some features:

- Authentic exterior and interior 3D models
- Authentic sounds
- Czech safety system LS90
- German safety systems Indusi, SIFA
- Working information system showing destinations on exterior panels
- Automatic speed regulation
- Working interior lights
- Authentic startup and shutdown procedures
- Active tilting system
- Random failures



Control elements



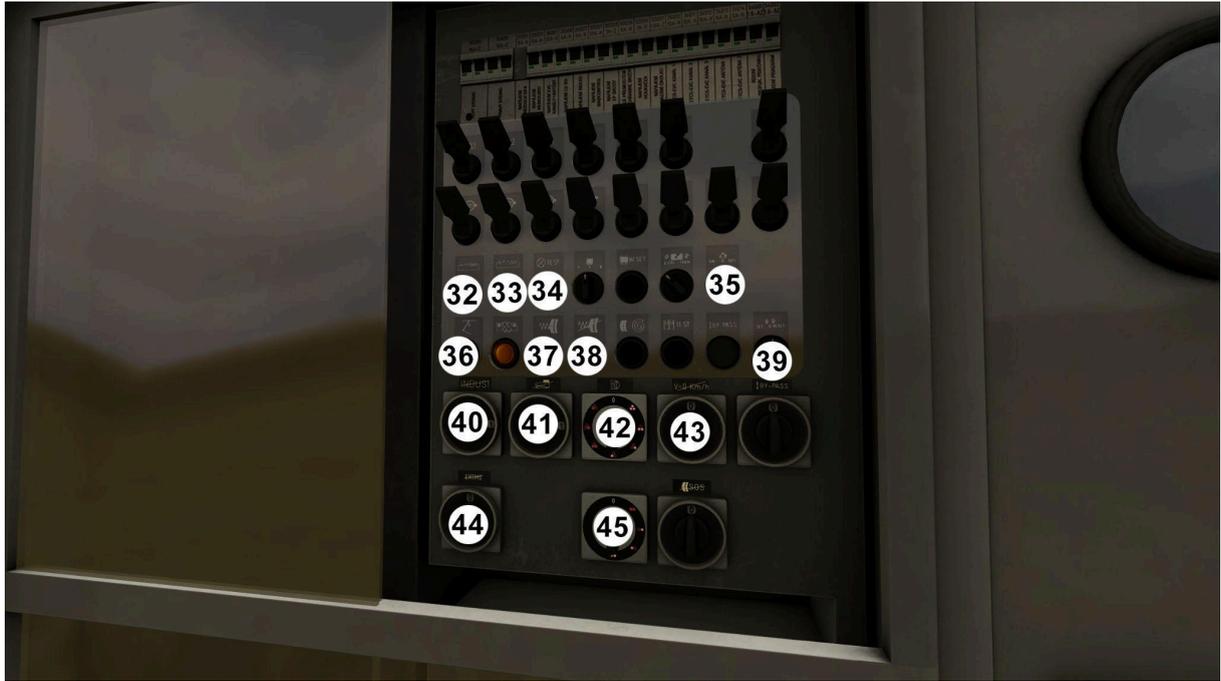
1	Reverser	W / S
2	Drive lever	A / D
3	ARR lever	Y / C
4	Vigilance button	Q
5	High voltage control panel	
6	Voltage system switch	
7	Driving key	
8	MCB buttons	Z / Ctrl + Z
9	Doors control buttons	
10	Active tilting switch	
11	Tractive effort	
12	Voltmeter	
13	Ampermeter	
14	Battery voltmeter	
15	LS90	
16	Diagnostic panel	
17	ERTMS display	
18	Diagnostic display	



19	Train brake lever	ú / §
20	Sander button	X
21		
22	Cab ventilation switch	
23	Train ventilation switch	
24	Radiostation	
25	Main reservoir manometer	
26	Brake pipe manometer	
27	Brake cylinder manometer	



28	Indusi controls	
29	Indusi display	
30	LS90 panel	
31	Switches panel	

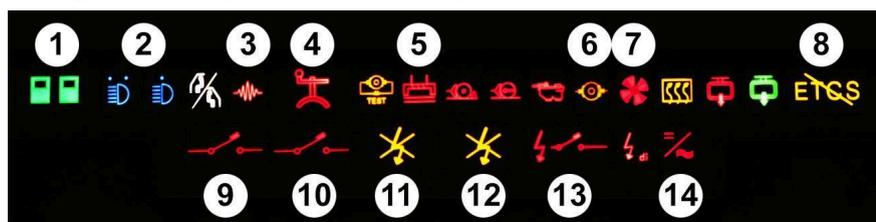


32	Batteries on button	U
33	Batteries off button	U
34	Wheel antiskid test	
35	Interior lights switch	
36	Auxiliary compressor button	
37	Spring brake on button	
38	Spring brake off button	
39	Signal lights activation switch	
40	Indusi isolation	
41	SIFA isolation	
42	Front signal lights template	
43	V=0km/h	
44	ERTMS isolation	
45	Back signal lights template	

Another key shortcuts

Fast start	Ctrl + Shift + O / Ctrl + O
Infosystem correction	Shift + 4
Sifa	Space
PZB Wachsam	Delete
PZB Frei	End
PZB Befehl40	PageDown
Wipers	V / Shift + V
Headlights	H / Shift + H
Horn	B / N
Pantograph 1	P
Pantograph 2	Shift + P
Change of detected voltage system	Ctrl + P

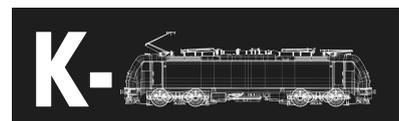
Diagnostic panel description



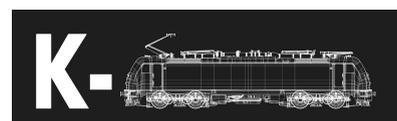
1	Doors closed
2	Headlights
3	Compensator failure
4	Active spring brake
5	Active magnetic brakes
6	Pressure in brake cylinders
7	Train ventilation failure (off)
8	ERTMS isolation
9	MCB of unit 1 off
10	MCB of unit 2 off
11	Unit 1 without high voltage
12	Unit 2 without high voltage
13	High voltage isolation
14	Auxiliary inverters failure

Description of control elements

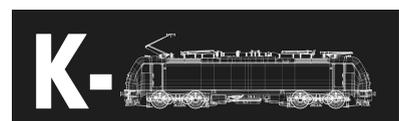
- Reverser
 - a. Lever needs to be inserted at the start
 - b. You can't move the lever without having drive lever in zero position
 - c. Positions
 - i. Forwards
 - ii. 0
 - iii. Reverse
- Drive lever
 - a. Lever controls maximum set tractive effort
 - b. While driving in ARR mode it controls both **tractive and brake effort**
 - c. To move from and to zero position You need to press A/D twice
- ARR lever
 - a. Lever toggles ARR and controls set speed
 - b. Positions
 - i. Off
 - ii. -5 km/h
 - iii. X
 - iv. +5 km/h
- High voltage control panel
 - a. Set of switches for controlling pantographs and high voltage elements
 - b. From the right:
 - i. Pantograph 1
 - 1. Down
 - 2. Up
 - ii. Pantograph 2
 - 1. Down
 - 2. Up
 - iii. Auxiliary inverters
 - 1. Off
 - 2. On



- iv. Compressors
 - 1. Automatic
 - 2. Manual
- Voltage system switch
 - a. Sets used voltage systems, can be controlled only with both pantographs lowered
 - i. 3 kV =
 - ii. 15 kV ~
 - iii. 25 kV ~
- MCB buttons
 - a. Buttons need to be pressed until MCB closes/opens
- Train brake lever
 - a. Positions
 - i. Brake cutout
 - ii. Overcharge
 - 1. Fills brake pipe up to 5.4 bar
 - iii. Drive
 - 1. Maintains pressure of 5 bar in brake pipes
 - iv. Electrodynamic braking
 - 1. Linear control of required EDB
 - 2. Lowers brake pipe pressure in case of insufficient EDB effect
 - v. Electropneumatic braking
 - 1. Linear control of brake pipe pressure decrease
 - vi. Emergency brake
 - b. Press key twice to move between linear positions
- Switches panel
 - a. From the right:
 - i. Headlights
 - ii. Headlights
 - iii. Cab lights
 - iv. Front glass heating
 - v. Wipers
 - vi. X



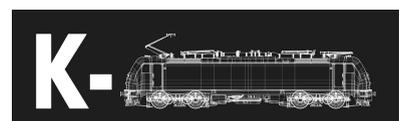
- vii. Indicators test
- viii. Desk lamp
- ix. X
- x. X
- xi. Indusi test
- xii. SIFA test



Important procedures

1. Unit startup

- a. Hold button *32-Batteries on button* in the electric board to start batteries and then activate the cab with *7-Driving key*.
- b. Set used voltage system with switch *6-Voltage system switch* (if other system than 3 kV is used set detected system also by Ctrl+P shortcut). Icon *13-High voltage isolation* will start blinking on the diagnostic panel.
- c. Raise the pantograph with switch on *5-High voltage control panel* after the icon stops blinking. During the first start compensators will need to calibrate. At first, raise the pantograph You will not be using during the drive. Icon *3-Compensator failure* will light up for 100 seconds after closing the MCB by holding button *8-MCB buttons*. After the calibration is done, open the MCB, lower the pantograph and repeat the process with the other pantograph, which would not be needed to lower again.
- d. Turn on auxiliary inverters with switch *5-High voltage control panel* and wait for compressors to start. Turn on train ventilation *23-Train ventilation switch* after.
- e. Fill brake pipe after filling main reservoir at least to 8 bar. Apply brakes after that. Start wheel skid test with button *34-Wheel antiskid test*. To start the test, You need to have at least 0.5 bar pressure in brake cylinders.
- f. Activate the tilting system with switch *10-Active tilting switch*. It's activation is announced with a long beep.
- g. Set front and back light templates with switches *42-Front signal lights template* and *45-Back signal lights template*. Hold switch *39-Signal lights activation switch* in SET position until it lights up.
- h. Deactivate spring brake with button *38-Spring brake off button*.



- i. Activate interior lights with switch *35-Interior lights switch*.

2. LS90 startup

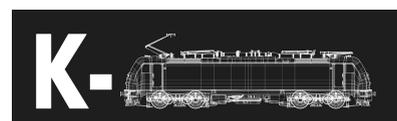
- a. Requirements for LS90 to start
 - i. Brake cylinders pressure at least 1.8 bar
 - ii. Zero speed
- b. If the conditions are met, move the switch *30-LS90 panel* to the START position. Green light will light up, after that it is possible to move to PROVOZ position to start the safety system.

3. Automatic speed control

- a. You can turn on ARR at any time during drive or standing still. Drive lever needs to be in the zero position. Hold ARR lever in +5 km/h position and set desired speed. Holding in -5 km/h position will lower the speed and double pressing C key will turn off ARR. Set speed can be seen at the left diagnostic display in section *PRISTROJ VYB*.
- b. Drive lever then sets maximal used tractive and brake effort.
- c. **ARR will deactivate once the speed drops below 19 km/h!!!**

4. Active tilting

- a. Active tilting system will start to initialize after switching the control switch to ON position. The initialization takes around 45 seconds.
- b. Tilting is active from speed around 70 km/h.
- c. Each tilt consumes a bit of compressed air. Monitor main reservoir pressure on routes with many curves. Two compressor will be enough to feed air to the tilting system, however they can overheat. In that case it is better to slow down to usual track speed and turn off the tilting system.

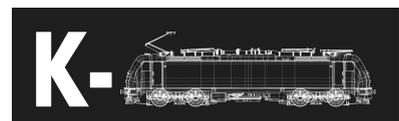


5. ERTMS and infosystem

- a. ERTMS here is really simple. It can only display current speed, insert train driver number and train number. Train number is then used to initialise the infosystem.

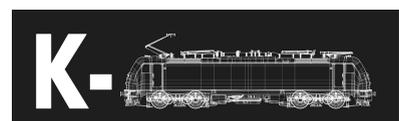
6. No voltage test

- a. No voltage test is the most common way to remove failures on the train. If turning off and back on the faulty component does not help, no voltage test will help in most cases.
- b. Hold the red button *8-MCB buttons* for at least 10 seconds. Icon *13-High voltage isolation* will start to blink for 30 seconds which indicates running no voltage test. Test is completed once the icon stops blinking and then You can proceed to start the unit again.

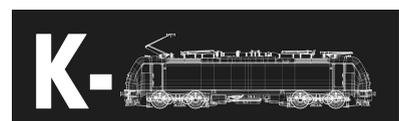


Possible failures

- Compensator failure
 - Compensator can trigger failure randomly during drive or more often during closing the MCB
 - In case of failure:
 - Open and then close MCB
 - Do no voltage test
 - Restart the train
 - If nothing helps use the second pantograph.
- Auxiliary inverters failures
 - Auxiliary inverters will trigger failure mostly by incorrectly starting them. Wait a few seconds after closing the MCB before activating auxiliary inverters, otherwise failures can happen. Wagon with faulty auxiliary inverters is disconnected from traction.
 - Failure is indicated by control *14-Auxiliary inverters failure* on the diagnostic panel.
 - In case of failure:
 - Turn off and back on auxiliary inverters
 - Do no voltage test
 - Restart the train
 - Issue with faulty auxiliary inverters is not working compressors. Compressor have power from:
 - 081 from 681
 - 082 from 682
 - 084 from 683 and 684

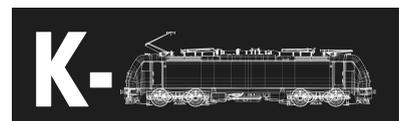


- Compressor failure
 - Compressor are controlled automatically, however it is possible that not all will start once the start request is sent.
 - If there is no auxiliary inverters failure and there is no other reason why compressors will not start, switch the compressor switch *5-High voltage control panel* to Manual position and then back to Automatic position. New request will be send by doing this.
- Overheated compressor
 - Compressors can overheat after a long time of non-stop run. They cool themselves down automatically with time.
- Spring brake can not be deactivated
 - Spring brake needs at least **6.5 bar** pressure in main reservoir.
 - If the pressure drops below **6.5 bar** spring brake will activate even while driving accompanied with an emergency braking.
- Pantograph can not be raised on 15 kV system
 - Both safety systems Indusi and SIFA **need to be active** to raise pantograph on 15 kV system.



Timetable creation

- Timetables are located in a folder corresponding to the models (in case of 680 unit it is folder Assets\Ka1000px\681pack01\Timetables). Naming convention is trainNumber.csv, e.g. 251.csv.
- The first line contains reference to file containing references for audio announcement files. Other lines contain station names and corresponding times.
 - If one time is written, both time of arrival and departure are the same.
 - If arrival and departure are not same, they are written in this order and separated by ",".
 - If any time contains half minute use *.
 - Stations names have to not use diacritics.
 - Example:
 - *221b,S9*
 - *Benesov,11:52*
 - *Mrac,11:57*
 - *Cercany,12:00*
 - *Pysely,12:02*
 - *Ctyrkoly,12:05**
 - *Senohraby,12:08,12:09*
- Timetable contains also link for defining file of audio announcements. This is the first three numbers of route number (e.g. for 221b it is 221).
 - In case of the 680unit those files are located in Assets\Ka1000px\681pack01\Announcements
 - The defining file is named with the first three numbers of the route number, so in the previous example that is Assets\Ka1000px\4681pack01\Announcements\221.csv.
 - Single announcements are defined by three parts. First one is the station name (same as for ATO and timetable names), second part is announcement used when arriving to the platform, the third one is announcement used for the next station announcement. Parts are without any spaces separated by ",".
 - Example:
 - *Benesov,Benesov.wav,ExpectBenesov.wav*



- Station name is Benesov, file Benesov.wav contains arriving announcement, file ExpectBenesov.wav contains announcement played during departure from the previous station.

