

Class 471 electric multiple unit



Authors

Model, scripts, sounds, textures:

Dominik Chaloupka

Signal repeater concept:

Michal

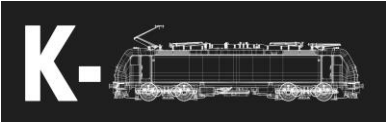
Other people who helped with facts and materials:

Jaroslav Kůfner, Vojtěch Raim, Tomáš Pospíšil, George VonShark, Pavel Hořínek and others...

However biggest Thank you belongs to my loving girlfriend.

Content

- Description 3
- Concept of the model 3
- Control elements 4
- Description of control elements 7
- Important displays..... 10
 - Left display 10
 - Right display 13
 - Radiostation 17
- Important procedures 18
 - 1. Unit startup 18
 - 2. Setting the speedometer data 18
 - 3. LS90 startup..... 18
 - 4. Train registration..... 18
 - 5. Information system..... 18
 - 6. Drive lever 19
 - 7. ATO startup..... 19
 - 8. ATO operations..... 20
 - 9. Setting signals for ATO 20
 - 10. Some ATO notes 20
 - 11. Another notes to the unit..... 21
 - 12. AI units..... 21



Description

Class 471 EMU is single system unit used mainly in commuter passenger transportation under the České dráhy a.s. company.

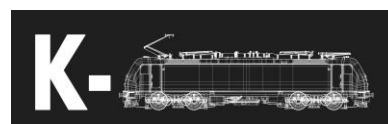
Top speed	140 km/h
Power	2 MW
Weight	155.4 t
Gauge	1435 mm
Supported traction systems	3 kV

Concept of the model

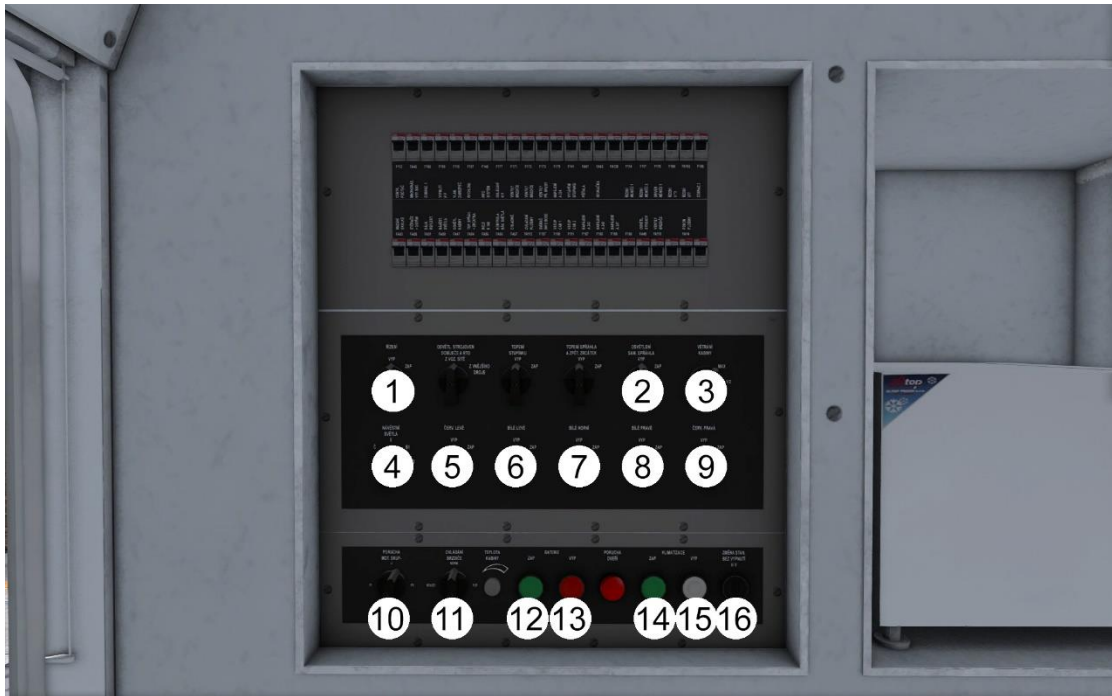
This model is designed for advanced to expert users. It is very detailed and has big hardware demands compared to the rest of available models. It is not expected to be 100% accurate so there may be some things that vary from the reality. Some things and procedures were simplified. Automatic train operations system is an experimental feature, there may be some situations that it will not work properly and You will be required to possibly turn this system off.

Some features:

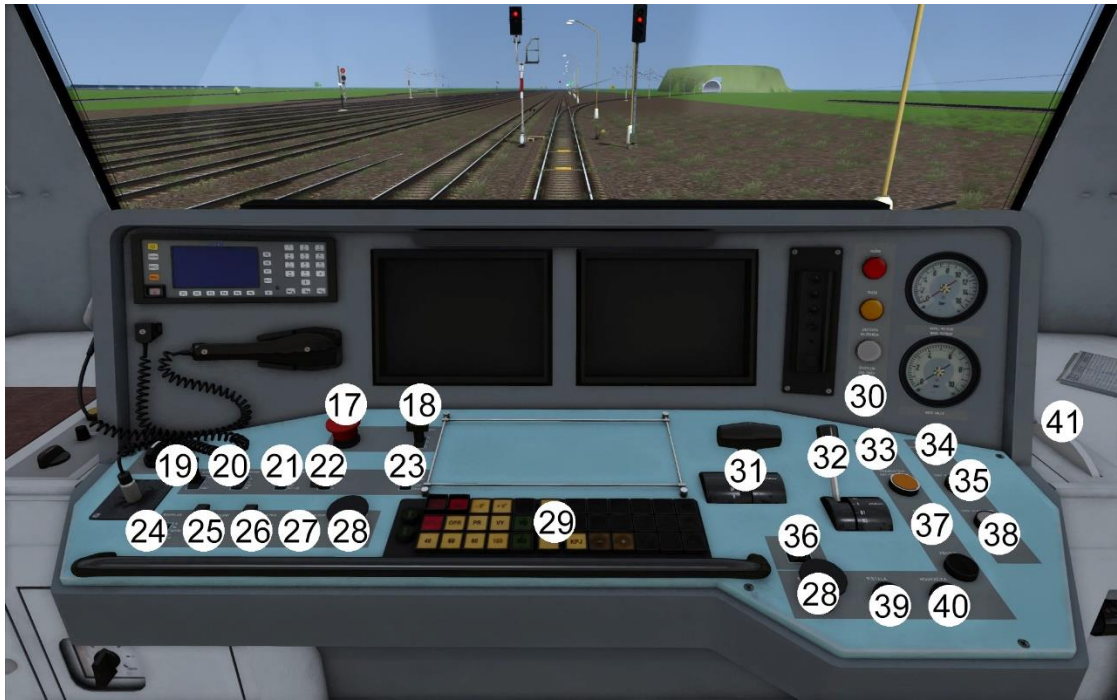
- Realistic 3D model of exterior and interior
- Authentic sounds recorded on multiple sets of class 471
- Train stops announcements recorded for Prague S9 line (Praha – Benešov)
- Czech LS90 safety system
- Experimental implementation of ATO (Automatic train operations) system
- Working information system featuring custom timetables on the display and exterior tables
- Automatic speed regulation
- Working interior passenger lights
- Random request for usage of wheelchair lift
- Log of failures
- Addressable commands for multiple engine units
- Working multiple unit control
- Animated coupler
- Physical model of disc brakes and their characteristic behaviour
- Working magnetic brake
- Authentic start up and shut down procedures
- Working wheelslip (while power is applied) and wheelskid (during braking) with sound effects



Control elements



1	Driving switch	
2	Coupling lights	
3	Cab air conditioning	
4	Signal lights (rear vehicle control)	
5	Front red left light	
6	Front white left light	
7	Front white upper light	
8	Front white right light	
9	Front red right light	
10	Engine groups toggle switch	
11	Backup brake control switch	
12	Battery turn on button	
13	Battery turn off button	
14	Air conditioning turn on button	
15	Air conditioning turn off button	
16	Cab change without turning off the circuit breaker	



17	Circuit breaker turn off	
18	Reverser	W/S
19	Information system (unused)	
20	Compressors	
21	Wipers	V / Shift + V
22	Drive regime (R/A/CB)	
23	Circuit breaker + pantograph	P / Shift + P
24	Announcement systém (+ information systém)	
25	Cab lights	L / Shift + L
26	Mirrors	
27	Headlights	H / Shift + H
28	Vigilance button	Q
29	Speed keyboard	Viz. další klávesové zkr.
30	Desk lights	
31	Drive lever	A / D, E, Backspace
32	Direct brake	Ú /)
33	Sander	X
34	Automatic coupler control	
35	Interior lights turn on	
36	Doors switch	
37	Brake cutout	
38	Interior lights turn off	
39	Bell	B
40	Horn	Mezerník
41	Emergency brake lever	



42	LS90 switch	
----	-------------	--



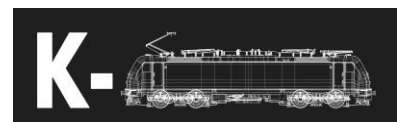
43	Wheelchair lift switch (left, 0, right)	
----	---	--

Another key shortcuts

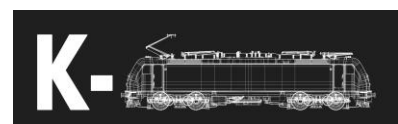
ARR speed 0 - 90 km/h	Ctrl + 0-9
ARR speed 100 - 160 km/h	Ctrl + Shift + 0-6
ARR speed +5 km/h	Y
ARR speed -5 km/h	C
End of train	Enter
ATO generating mode (toggle)	Ctrl + Shift + A
Fast start	Ctrl + Shift + O

Description of control elements

1. Driving switch
 - a. Off / on
2. Coupling lights
 - a. Off / on, turns on position lights
3. Cab air conditioning
 - a. Controls speed of the air conditioning inside the drivers cabin
4. Signal lights
 - a. Controls lights at the end of the train (rear vehicle)
 - b. Č - red lights, end of train signal
 - c. B1 - inactive vehicle
 - d. B2 - shunting
5. Front red left light
 - a. Off / on
6. Front white left light
 - a. Off / on
7. Front white upper light
 - a. Off / on
8. Front white right light
 - a. Off / on
9. Front red right light
 - a. Off / on
10. Engine groups toggle switch
 - a. Unused
11. Backup brake control switch
 - a. Unused
12. Battery turn on button
13. Battery turn off button
14. Air conditioning turn on button
 - a. Turns on air conditioning for the whole train
15. Air conditioning turn off button
 - a. Turns off air conditioning for the whole train
16. Cab change without turning off the circuit breaker



- a. If pushed before turning off the driving switch, circuit breaker will stay turned on, lasts up to 10 minutes
- 17. Circuit breaker turn off
 - a. Turns off the circuit breaker and shortens the filters
- 18. Reverser
 - a. Forward / 0 / reverse
- 19. Information system
 - a. Unused
- 20. Compressors
 - a. PK – auxiliary compressor
 - b. Vyp – turned off
 - c. Aut – automatic run of the compressors
 - d. R – manual run of the compressors
- 21. Wipers
 - a. Controls speed of the wiper
- 22. Drive regime
 - a. R – manual drive, in case that ATO was turned on before, it is now completely turned off
 - b. A – ARR (Automatic speed regulation) active, if ATO was turned on before, it is now turned to pasife mode
 - c. CB – ATO (Automatic train operations), if train is standing still, it is now possible to put the data in
- 23. Circuit breaker + pantograph
 - a. Dolů – lower the pantograph
 - b. I Vyp – turn off the K35 (line breakers)
 - c. Start – turns on circuit breaker, raises pantograph and turns on K35
- 24. Announcement system
 - a. Vyp – does not control the information system
 - b. Nastav – controls exterior tables
 - c. A – automatic mode, controls announcement sounds and exterior tables
- 25. Cab lights
 - a. ZÁŘ – main light
 - b. ŽÁR – bulb light
 - c. Vyp – light turned off
 - d. TL – low manometers light
 - e. PL – full manometers light
- 26. Mirrors
 - a. Vyk – extends the mirrors, turns on the automatic mirrors mode whose will extend when the doors are opened
 - b. Zak – pulls the mirrors, turns off the automatic mirrors mode
- 27. Headlights
 - a. TL – half power
 - b. PL – full power
- 28. Vigilance buttons



29. Speed keyboard

- a. The keyboard works in three modes depending to the current drive move
- b. In the „Man“ mode there is only [KPJ] button working. This button turn on train length counter
- c. In the „Aut“ mode, there is also the right part of the keyboard. Speed buttons here work for setting the desired speed to speed regulation. To control maximum power or force used, there are [+], [-] and [TAH] buttons. When [TAH] buttons is lightened up, [+] and [-] set maximum force used. Otherwise they set maximum power used.
- d. In the „CB“ mode, all buttons are working.

30. Desk lights

- a. Half and full lighting of the drivers desk

31. Drive lever

- a. This lever controls the whole train. Its behaviour is described later.

32. Direct brake

- a. Direct brake lever
- b. O2 – full release, releases magnetic brake applied by B2 notch
- c. O1 – partial release
- d. X – maintains still pressure
- e. B1 –partial brake application
- f. B2 – full brake application, applies magnetic brakes

33. Sander

34. Automatic coupler control

- a. Ve hře není možné ovládat automatické spřáhlo podobně jako reálně, jeho funkce zde je čistě kosmetická. V polohách Spoj/Rozpoj dojde k otevření krytů spřáhla ještě před najeťím na další jednotku.
- b. It is not possible to fully operate the coupler in the game. Its function is now pure cosmetic function. Spoj/Rozpoj positions open the automatic coupler.

35. Interior lights turn on

- a. Turns on interior lights on the whole unit

36. Door switch

- a. End positions unblock doors depending on the side. Middle positions locks all doors

37. Brake cutout

38. Interior lights turn off

- a. Turns off interior lights on the whole unit

39. Whistle

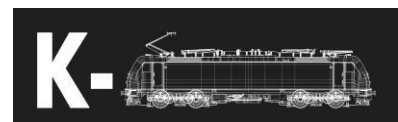
40. Horn

41. Emergency brake lever

- a. Usable emergency brake lever

42. LS90 switch

- a. It is possible to start LS90 in the START position. When all start conditions are met, acoustic warning will be heard and green light will lit up. Then it is possible to turn the switch to PROVOZ.



43. Wheelchair lift switch

- a. End positions unblocks and activates the lift depending on the used side. Middle position deactivates the lift.

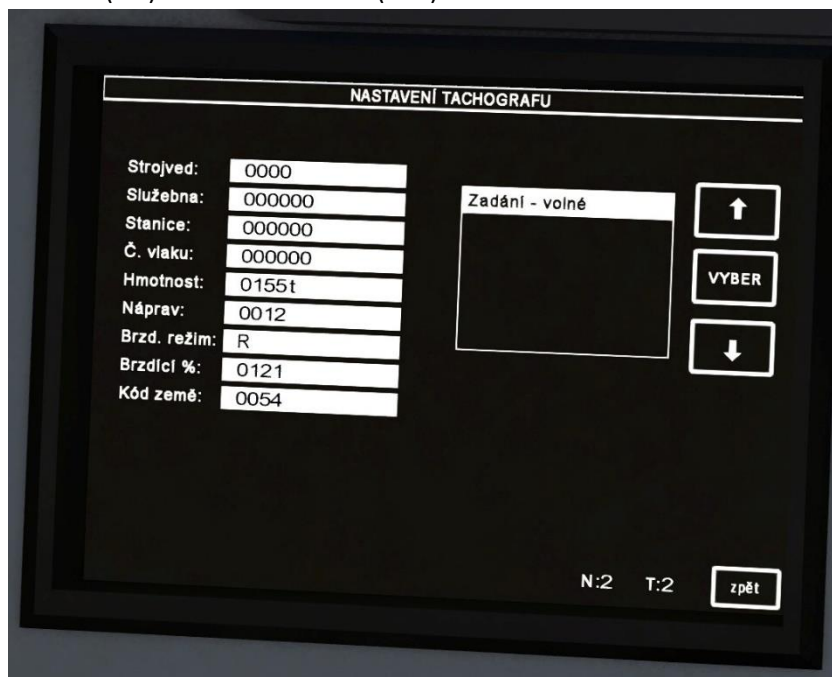
Important displays

Left display



1.

- a. Main display, right column indicates set power. Trolley and filter voltages are located above the speedometer. Also there is an indication of circuit breaker (HV) and line breakers (K35).



2.

- a. It is possible to set data after pressing the menu button.



- 3.
- a. Up and down arrows work as navigation. After data are complete, confirm by enter and leave by „Zpět“ (back) button.
- i. Strojvedoucí – train driver number
 - ii. Služebna – train drivers base of operations
 - iii. Stanice – station
 - iv. Č. vlaku – train number
 - v. Hmotnost – weight
 - vi. Náprav – train length in axles, 1 axle equals to 6m
 - vii. Brzdící režim – brake regime
 - viii. Brzdící % - brake %
 - ix. Kód země – code of the country



- 4.
- a. ATO data input while the train is standing still. Upper line of speedometer shows speed used for automatic speed regulation.

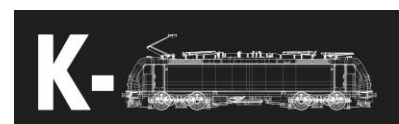
- i. Číslo vlaku – train number (same number and file as for information system)
- ii. Brzdící procenta – brake percents
- iii. Délka vlaku – train length in axles (1 axle = 6m).
- iv. Čas - time



- 5.
 - a. ATO state after confirming the data. It is required here to set desired speed by speed keyboard.



- 6.
 - a. After setting the speed the ATO system starts up. It remains unoriented until the first synchronization marker is passed.

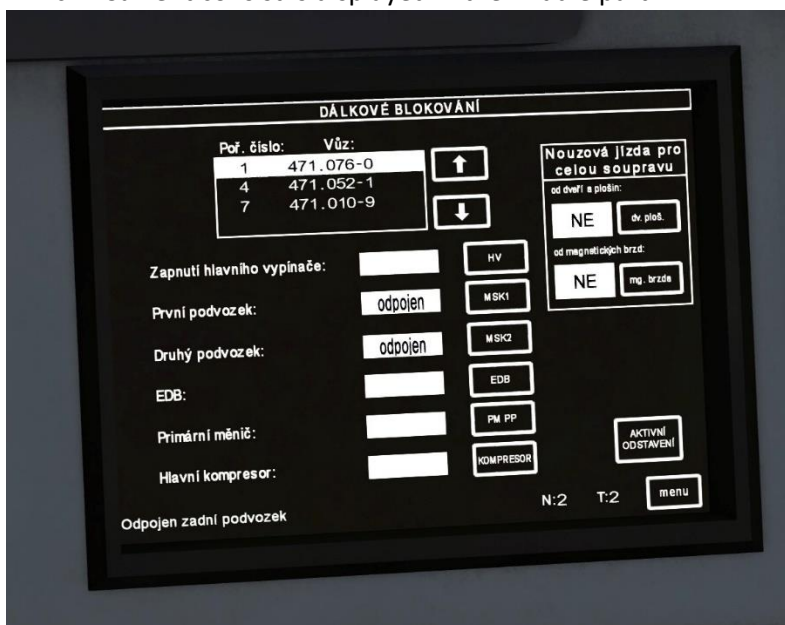


Right display



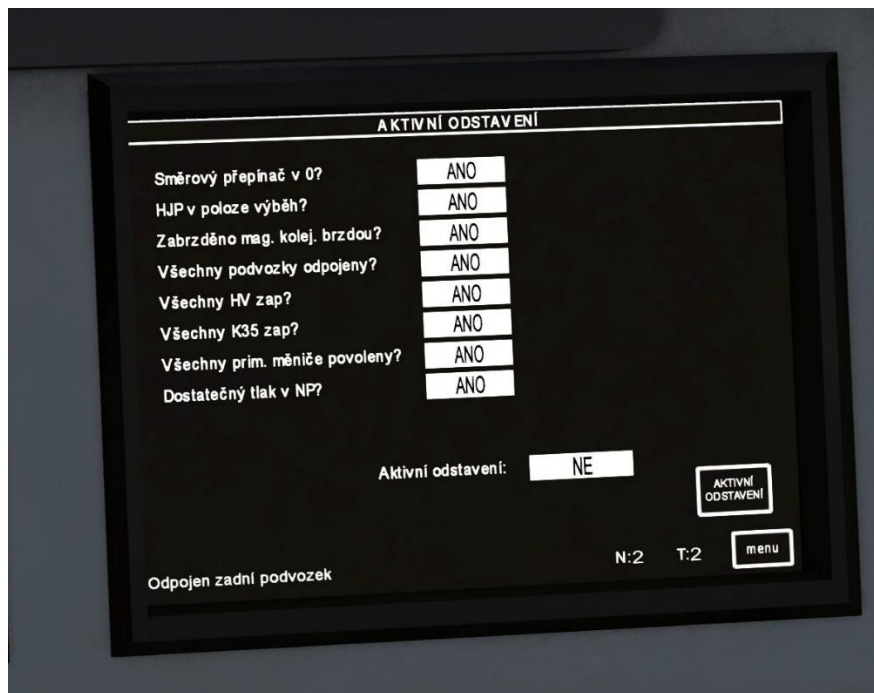
1.

- On this display, it is possible here to switch to pages BLOKOVÁNÍ (blocking), HLÁŠENÍ (announcements) and PORUCHY (failures).
- Data set to the speedometer are shown in the upper part.
- Current consist is displayed in the middle part.



2.

- Blockation page allows player to enable/disable elements on any engine unit in consist.
 - Zapnutí hlavního vypínač – circuit breaker
 - První/druhý podvozek – first/second bogey
 - EDB – electrodynamic brake
 - Primární měnič – line breakers (K35)
 - Hlavní kompresor – air compressor
- AKTIVNÍ ODSTATENÍ (active shutdown) allows player to display all requirements and enable/disable it.



3.

- a. If all conditions say „ANO“, it is possible to turn active shutdown on. If any condition is not met, it will turn off automatically.
- i. Směrový přepínač v 0? – Reverser switch in zero position
 - ii. HJP v poloze výběh? – drive lever in V position
 - iii. Zabrzděno mag. kolej. Brzdou? – magnetic brakes applied?
 - iv. Všechny HV zap? – all circuit breakers are turned on?
 - v. Všechny K35 zap? – all line breakers are turned on?
 - vi. Všechny prim. Měníče povoleny? – are all line breaker enabled?
 - vii. Dostatečný vlak v NP? – is the air pressure in reservoirs sufficient?

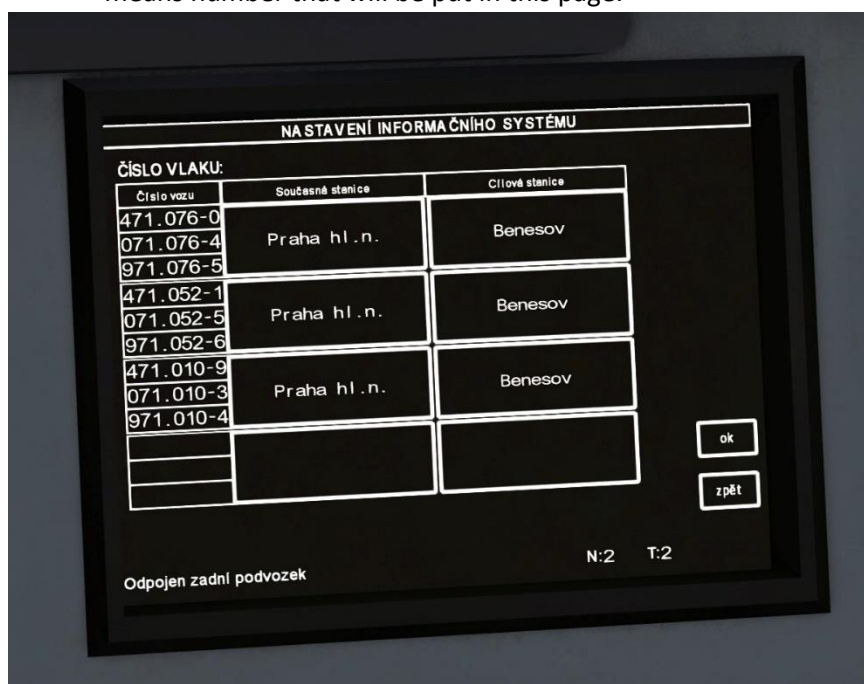


4.

- a. HLÁŠENÍ button displays main page of train information system.



- 5.
- a. By pressing NASTAVENÍ button it is possible to load existing timetable. For timetable to load, there needs to be a file in Assets\Ka1000px\471pack01\Timetables folder named as xyz.csv, where xyz means number that will be put in this page.



- 6.
- a. After loading the timetable, display will show its summarization. By pressing ok button, data will be confirmed, by pressing zpět, You can load another timetable.



7.
 - a. This is a page with loaded timetable.
 - b. By clicking arrows it is possible to move and do any corrections by „KOREKCE“ button.
 - i. If it is pressed during drive, next station will be set
 - ii. If it is pressed during standing still, current station will be set
 - c. To enable audio announcements, HLÁŠENÍ lever needs to be in AUT position.



8.
 - a. By clicking PORUCHY button You can display all failures that showed in the current drive.

Radiostation



1.

- a. Main display, by pressing F button it is possible to set the train number. After it is set, by F3 button You can register the train. By clicking the F4 buton train will be deregistered.



2.

- a. By F9 button You can proceed to set the train number. To confirm it press enter, to clear it press star button.

Important procedures

1. Unit startup

- a. Turn on batteries by green button at the back wall. Wait until displays load.
- b. Activate cab with switch at the back wall.
- c. Set train lights at the back wall.
- d. Put the compressors switch to PK position and wait until it turns off (approximately 30s). Its run is indicated at the display.
- e. After the auxiliary compressor turned off, put pantograph switch to START position.
- f. After line breakers (K35) finally turned on, put the compressors switch to A position.
- g. After air reservoirs were filled with air, it is possible to release the brakes.
- h. The train is now ready to drive.

2. Setting the speedometer data

- a. Press menu button on the left display, select „Zadání-volné“ and confirm.
- b. Put relevant data here, each line needs to be confirmed by enter.
- c. To save data press the „zpět“ button.

3. LS90 startup

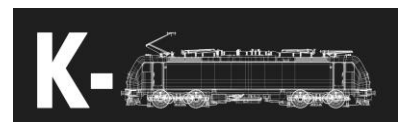
- a. Requirements for LS90 to start
 - i. Brake cylinders pressure at least 1.8bar
 - ii. Zero speed
- b. If the conditions are met, switch the switch to START position. Green light will light up, after that is is possible to switch to PROVOZ position to start the safety system.

4. Train registration

- a. Press F button and then F9 button. Set the train number and confirm by enter.
- b. After the number is set, press F3 button to register to GSM-R.

5. Information system

- a. Press HLÁŠENÍ button on the right display.
- b. By NASTAVENÍ button enter the configuration. There will be one of those two cases:
 - i. Train number is set to speedometer, just confirm the number.
 - ii. Train number was not set, set it here and confirm it.
- c. If the timetable exists it will be loaded.
- d. After its loading confirm it by pressing the ok button.
- e. Working modes of the HLÁŠENÍ switch:
 - i. A – timetable automatically shifts, audio announcements are being played (if they are present), end station is displayed
 - ii. NASTAV – timetable automatically shifts, end station is displayed
 - iii. VYP – information system does not do anything



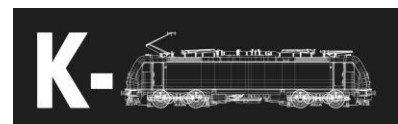
- f. During the train drive, information system can shift train stops automatically. To shift the train stop, it needs to recognize when the train stopped at the station. That is recognized by zero speed and unblocking any side of doors.

6. Drive lever

- a. Keyboard controls
 - i. A/D keys moves the lever forwards and backwards. To get back past V position, another key combinations are used:
 1. E – BE position (electrodynamic brake)
 2. Holding D – train brake
 3. Backspace – emergency brake
- b. Manual mode
 - i. In the manual mode, this lever sets power and brake values.
 - ii. S positions increases power up to 100%.
 - iii. J position maintains positive power and lowers negative power to 0%.
 - iv. V position lowers positive power to 0% and maintains negative power.
 - v. BE position lowers power to -100% and uses only electrodynamic brake. If any positive power was set before, it is immediately set to negative power by this formula:
$$PT = -PT_{last}$$
 - vi. BP position lowers brake pipe pressure to 0bar.
 - vii. R position radically lowers pressure to 0bar and sets -100% power.
 - viii. It is possible to disable parking brake in this mode by putting lever to E position and pressing [-] key on the speed keyboard. To turn it on do the same with [+] button or turn on and off back again the automatic speed regulation.
- c. Automatic mode
 - i. S position enables the train to apply power and releases the parking brake. If player used brakes before manually and „PREFERENCE“ is displayed on the display, this position allows the train to apply power again.
 - ii. J position is basic position here. If power usage was confirmed by S, train will use power up to set maximum to maintain the set speed.
 - iii. Train will use only negative power in the V position.
 - iv. In the BE, BP and R positions brake preference is activated. To deactivate it push the lever to S position. Braking works the same as in manual mode.
- d. ATO mode
 - i. Same as automatic mode

7. ATO startup

- a. ATO system can be started by pushing the driving mode switch to CB position. If the train is moving it will start to brake intensively.
- b. Set all the required data.



- c. After request set initial speed.
- d. ATO will stay in unoriented mode up to the passing of first synchronization marker in the route.

8. ATO operations

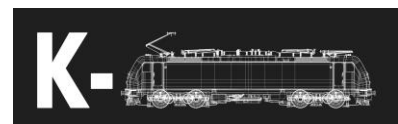
- a. After passing any synchronization marker ATO will continue to fully active mode. By moving the lever to A position, ATO will move to pasive mode and would not interfere in any way to the ride. By moving back to CB position, ATO will move back to active mode. If lever is moved to M position, ATO will be fully turned off.
- b. ATO system automatically brakes to lower track speeds. It is necessary to confirm any increase of track speed by pressing speed buttons in the right part of the speed keyboard.
- c. ATO will recognize signals if ATO is turned on. It is possible that some signals will need to be corrected. That correction can be made by buttons on the left side of the speed keyboard.
- d. It is necessary to set every signal manually if the LS90 is turned off.

9. Setting signals for ATO

- a. In case of any manual input respect this saying:
„Press what You see.
- b. Signals are entered from the bottom light to the upper one.
 - i. [PR] button is presignal
 - ii. [OPR] button is repeated presignal
 - iii. [VO] button is for green light (free)
 - iv. [VY] button is for yellow light (caution)
 - v. [STŮJ] button is for red light (stop)
 - vi. [BO] button is for clearing signalled speed (without restriction)
 - vii. For example in case of signal „60 km/h and expect 40 km/h“ do the following sequence:
 - 1. [60],[PR],[40]
 - viii. To set the 50km/h speed push the [40] button for at least 2s.
 - ix. Press [BO] button to clear speed restriction.
 - x. [VO], [VY] and [STŮJ] buttons set the upper light of the signal.
 - xi. To change the speed restriction to another speed, press the button twice. This works as a safety measure.

10. Some ATO notes

- a. After stopping at the platform, another drive is restricted until following conditions are met:
 - i. Drive lever in V position for at least 8s
 - ii. Distance to platform <10m (shown on the display)
 - iii. Parking brake is active
- b. In case that some of those conditions could not be met, press the [RZ] button.
- c. If any case that You need to drive through red signal, use the [PŘIV] button.



- d. If red signal is located at the end of platform and the train will stop too soon, also use the [PŘIV] button. Train should stop 50m in front of the red signal, now it should continue to minimum distance of 10m.
- e. Because this is highly experimental implementation of ATO system, it is almost unavoidable that some non-standard situations will appear. Simply setting ATO to passive mode should be enough to drive through sections that causes this behaviour in most cases.

11. Another notes to the unit

- a. Unit is equipped with side selective door locks. To unlock doors after stopping move the doors switch to the corresponding side. The doors will be opened just after their unlocking and pressing T at the platform. To close them, lock them after the game allows You to.
- b. It is possible for random lift request to appear during train is stopped at any platform with doors opened. The request is signalled with loud acoustic warning and display warning. To activate it use the switch on the left part of the drivers desk.

12. AI units

- a. This unit allows AI consists to load any timetable and show the end station on exterior tables. To load it, set ID of any end vehicles of the unit to corresponding timetable number.

