Locomotive class 186/386 – Traxx MS2

Authors

Model, script, sounds, textures:

Dominik Chaloupka

Some parts of script:

Jáchym Hurtík / https://github.com/JachyHm/RailWorksLUAscriptExamples

Czech signal repeater concept:

Michal

Other people who contributed in any way:

Jiří Švehla, Jakub Smékal, Lukáš Zima, Vojtěch Raim, Ondřej Janiš, Branislav Kysel, Jaroslav Küfner, Tomáš Pospíšil, George VonShark, Michal Mičuda a další...

The biggest thank you belongs to my beloved girlfriend.

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Content

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Description

Traxx is electric four system locomotive made by Bombardier Transportation. In Czech Republic it can be seen mainly leading trains belonging to Metrans and RegioJet.

Max. speed	140/160 km/h (160km/h for 386.2)
Power	4 / 5.6 MW (4MW for 1.5kV)
Weight	84 t
Gauge	1435 mm
Supported voltage systems	1.5kV, 3kV, 15kV 16/3Hz, 25kV 50Hz

Model concept

Model is targeted for advanced users. It is more detailed and more hardware demanding than majority of other models. It is not 100% accurate and there could and would be some inaccuracies, some operations and elements are simplified due to some limitations.

Main model features:

- Authentic 3D models of exterior and interior
- Authentic sounds recorded on multiple real engines
- Czech and German localisation of MFDs and voice messages (can be switched in game)
- Czech safety system Mirel, polish extension SHP and hungarian EVM
- German safety systems PZB / LZB / Sifa
- European safety system ETCS in levels L0, L1 a L2
- Dutch safety system ATB
- Train plan display EbuLa – can show up to 25 different pages, each page have its own properties
- Automatic speed regulation (AFB / vReg)
- Input of train relevant data (radio system / AFB / ETCS / LZB)
- UIC signalisation of opened doors (only with compatible coaches)
- ZWS double loco driving system
- Accurate physical model for simulating traction characteristics accordingly to used traction system (1.5kV / 3kV / 15kV / 25kV) and for simulating traction adhesion
- Accurate physical model for simulating braking effects of different brake types (disc / block brakes), their chararacteristic properties and different brake regimes (R / P / G)
- Time simulation of voltage behaviour in overhead wires and possible undervoltage protection system
- Authentic way of startup and shutdown
- Test of brake units and other tests included in safety systems

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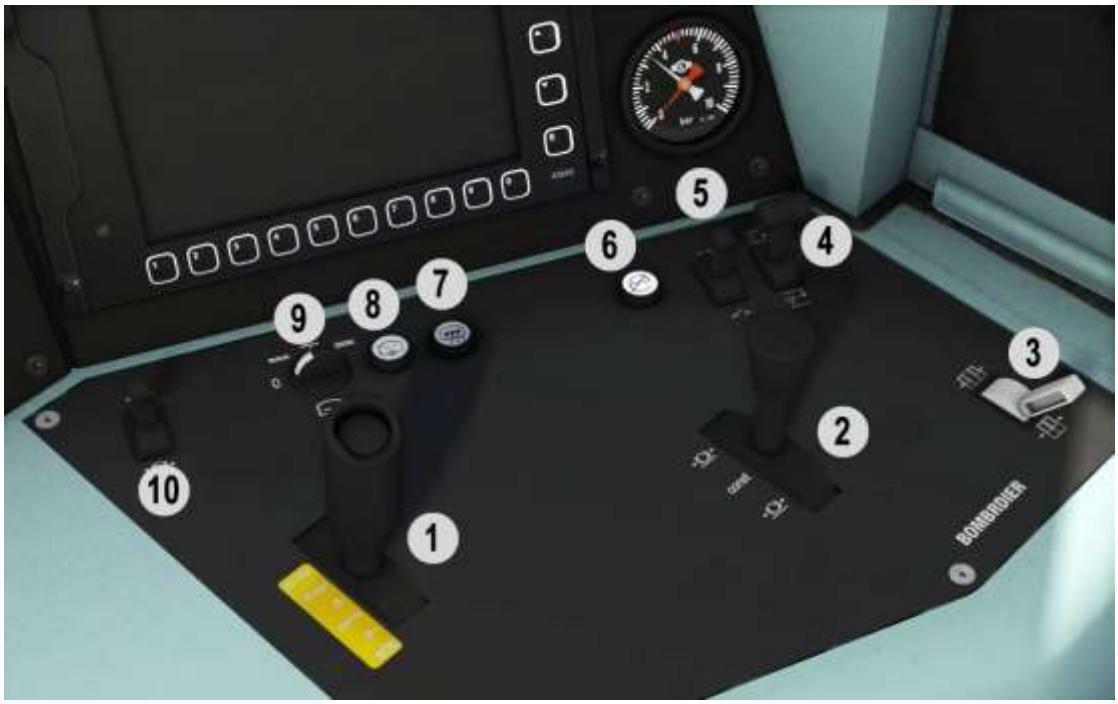
Controls



1	Train brake controller	; / ,
	EDB dependency on Train brake toggled by button on top of lever	M
2	Loco brake controller	[/]
3	Door control	Without bind
4	Pantograph control	P / Shift + P
5	Main switch	Z / Ctrl + Z
6	Train heating	Without bind
7	Front glass heating	Non-functioning
8	Washers	Non-functioning
9	Wipers	V / Shift + V
10	Loco brake release	F / Shift + F

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11	Befehl 40	Delete
12	Frei	End
13	Wachsam	Page down
14	Sander	X / Shift + X
15	Horn	B / Shift + B
16	Reflector	H / Shift + H
17	Light switch	L / Shift + L
18	Cab light / desk light	I / Shift + I

19	AFB lever	Z/ C
	AFB lever know	Q
20	Power lever	A / D
	Power lever know	E
21	Backwards direction	W / S
22	Neutral direction	W / S
23	Forward direction	W / S

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24	Control key	Insert by clicking, mouse handling
25	Light regime switch	Without bind
26	Hand brake on	Without bind
27	Hand brake off	Without bind
28	Engine room lights	Non-functioning
29	LZB emergency switch	Non-functioning
30	Heating mode	Non-functioning
31	Multiple loco mode switch	Non-functioning
32	Slave loco hand brake off	Non-functioning

Other shortcuts

SIFA pedal	Space
Consist info	Shift + 5
Mirel switch	Shift + 6
Multiple loco regime (ZWS)	Shift + 7
ETCS switch	Shift + 8
SIFA switch	Shift + 9
LZB switch	Shift + 0
Change of detected voltage system	Ctrl + P
Fast start	Ctrl + Shift + O

33	Mirel	+ / - / Num enter
34	LZB state light	
35	Brake cut	Without bind
36	Stop by all means light	Non-functioning
37	Mirel state light	

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Description of control elements

1. Train brake lever
    i. Lever controls pressure in main brake pipes.
    ii. Positions
        1. >= 5bar
            a. Main pipe are filled faster
        2. 5bar
            a. Main pipe is being filled up to 5bars, this position is need for traction to be unlocked
        3. B-
            a. Raises pressure up to 5bars, blocks traction.
        4. Const
        5. B+
            a. Lowers pressure down to 3.5bar, blocks traction
        6. SOS
            a. Emergency brake
2. Loco brake lever
    i. Lever controls pressure in loco brake cylinders
    ii. Positions
        1. Released
            a. Completely releases loco brakes
        2. Release
            a. Releases loco brakes
        3. Const
        4. Brake
            a. Fills cylinders with air
        5. Full brakes
            a. Completely fills cylinders with air, disables antiskid protection
3. Door control
    i. Door control in UIC regime
    ii. Positions
        1. Closed
        2. Const
        3. Opened
4. Pantograph control
    i. Switch for pantograph control
    ii. Positions
        1. Raise pantographs
        2. Const
        3. Lower pantographs
5. Main switch control
    i. Controls main switch

ii. Positions
    1. On
        a. Turns on main switch, if all pantos are down, raises one of them and sets request for automatic switch turn on
    2. Const
    3. Off
6. Train heating
    i. Controls train heating, if button is illuminated it is not turned on
    ii. It is possible to turn it on only after HS and line switches are turned on
7. Front glass heating
    i. Non-functioning
8. Washers
    i. Non-functioning
9. Wipers
    i. Controls wipers
    ii. Positions
        1. Off
        2. Cycler
        3. Slow
        4. Fast
10. Loko brake release
    i. Releases brake cylinders when they are filled due to lower air pressure in main brake pipes
    ii. If pressure is below 3.5bar it looses its effects
11. Befehl 40
12. Frei
13. Wachsam
14. Sander
    i. Positions
        1. Auto
            a. Permanent sanding
        2. Const
        3. Man
15. Horn
    i. Positions
        1. High tone
        2. Const
        3. Low tone
16. Reflector
    i. Controls reflectors and position lights
    ii. Positions
        1. Suppressed position lights illuminated, non-areted
        2. Position lights illuminated
        3. Reflectors turned on

4. Reflectors turned on with higher range

17. Light switch
    i. Turns on illumination of locomotive
    ii. Positions
        1. On
        2. Off
        3. On
18. Cab light / desk light
    i. Controls illumination of drivers cabin and desk
    ii. Positions
        1. Desk light turned on
        2. Const
        3. Cabin light, non-areted position
19. AFB lever
    i. Controls AFB speed
    ii. For V+ and Vmax positions it is neccessary to press the lever knob (Q)
    iii. Positions
        1. 0
            a. AFB je vypnuto
        2. V-
            a. Snížení rychlosti o 5km/h
        3. Const
        4. V+
            a. Zvýšení rychlosti o 5km/h
        5. Vmax
            a. Rychlé zvyšování rychlosti až na maximální rychlost
20. Power lever
    i. Controls desired power
    ii. For forward positions it is neccessary to press the lever knob (E)
    iii. Positions
        1. EBmax
            a. Max EDB
        2. EB+
            a. Raising EDB power
        3. Const
        4. EB-
            a. Lowering EDB power
        5. 0
        6. T-
            a. Lowering desired power
        7. Const
        8. T+
            a. Raising desired power
        9. Tmax

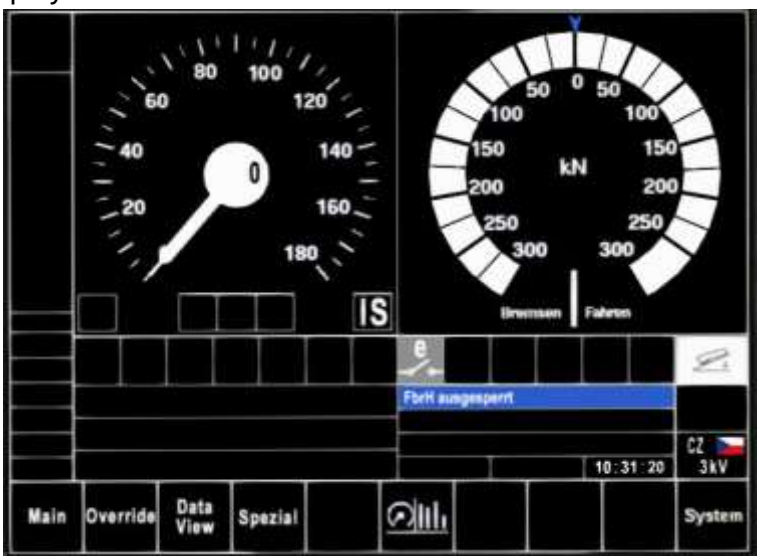
a. Fast raising of desired power up to max value

21. Backwards
22. Neutral
23. Forwards
24. Control key
    i. Key for battery and cabin controls
    ii. For key insertion press the black cylinder
    iii. Key can be inserted only in one cabin at the same time
    iv. Positions
        1. Battery
            a. Functions as battery toggle switch
        2. Neutral
            a. Only position in which it is possible to pull out the key
        3. Cabin is active
            a. This cabin is in this position active
25. Light regime switch
26. Handbrake on
27. Handbrake off
28. Engine room lights
    i. Non-functioning
29. LZB emergency switch
    i. Non-functioning
30. Heating regime
    i. Non-functioning
31. ZWS regime
    i. Non-functioning
32. Handbrake off on slave locomotive
    i. Non-functioning, replaced by buttons 26 and 27
33. Mirel
34. LZB state light
    i. Is illuminated in case of active LZB
35. Brake cut
    i. Is illuminated in case of active brake cut, for its deactivation press the button
36. Stop by all means signal
    i. Non-functioning
37. Mirel state light
    i. Is illuminated in case of Mirels need to press pedal

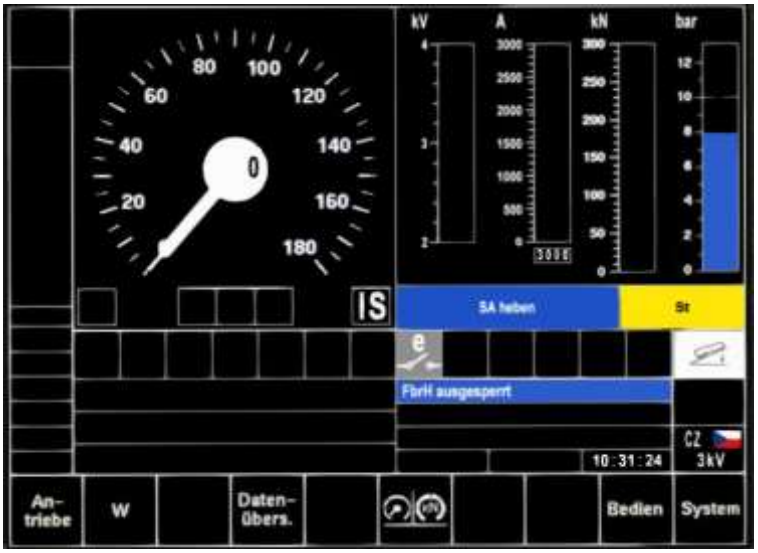
Important displays

38. Front display

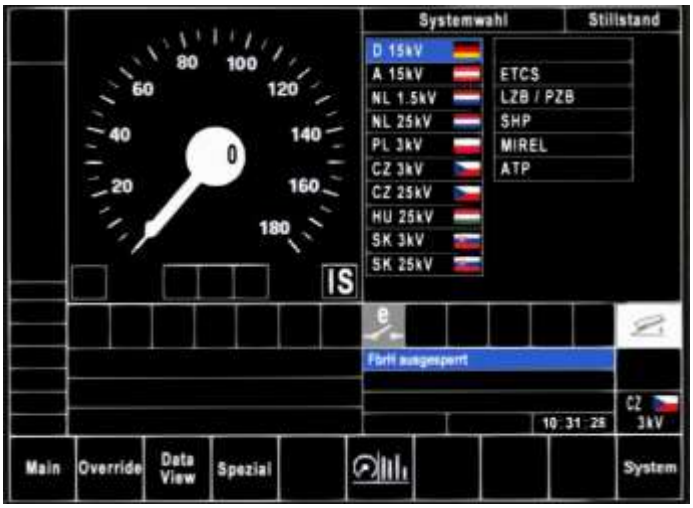
i. Base display

1. 

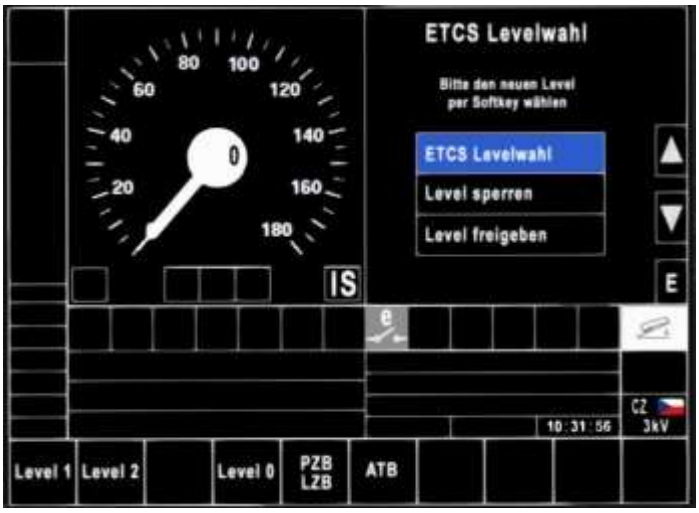
ii. Base display with more info

1. 

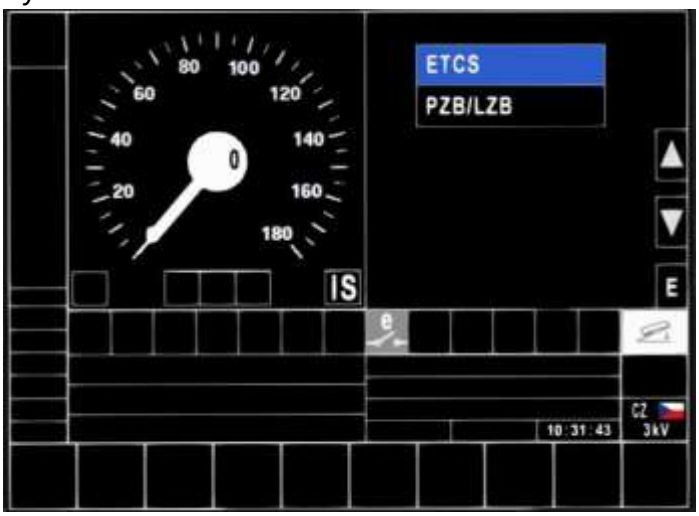
iii. Traction system selection

1. 

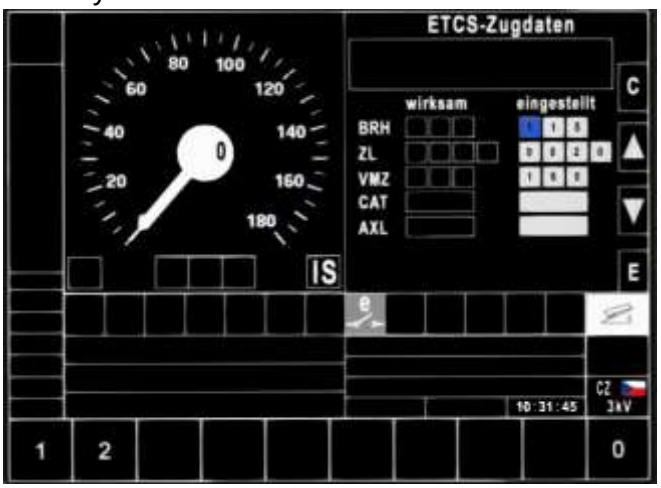
iv. ETCS level selection

1. 

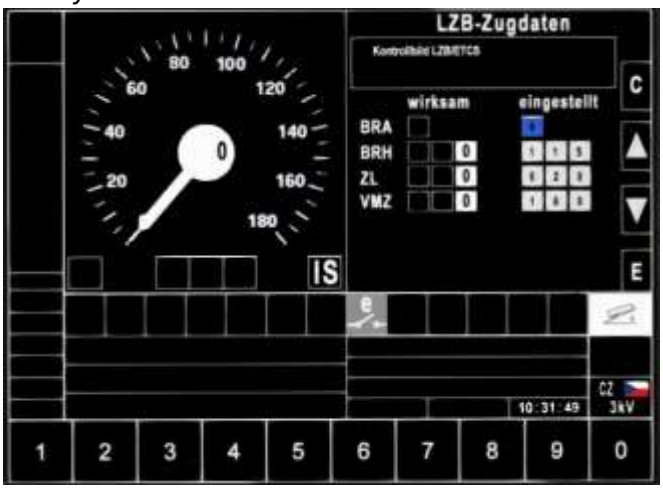
v. Data entry selection

1. 

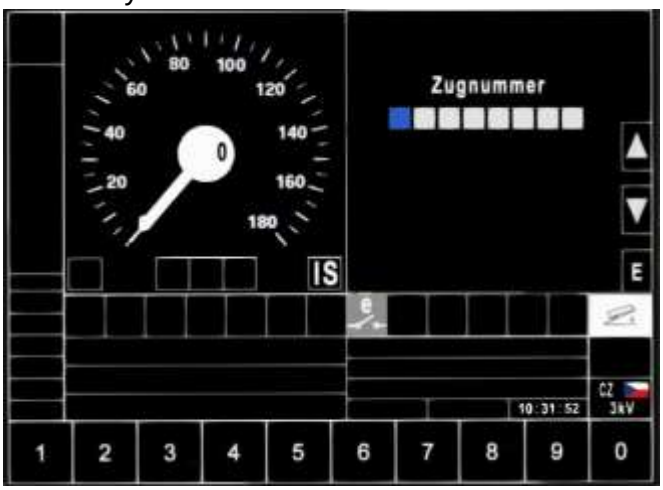
vi. ETCS data entry

1. 

vii. LZB data entry

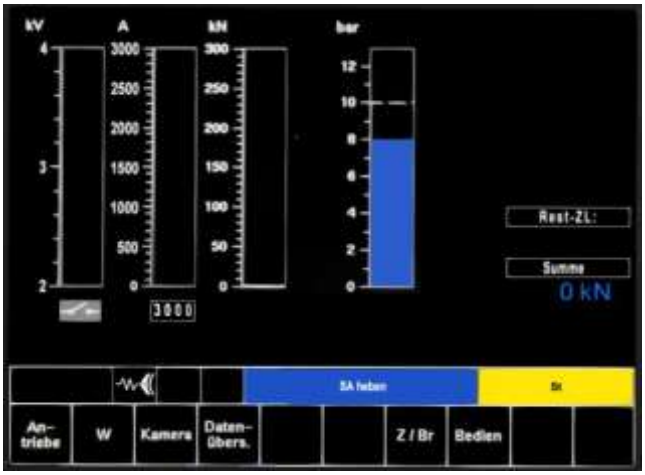
1. 

viii. Train number entry

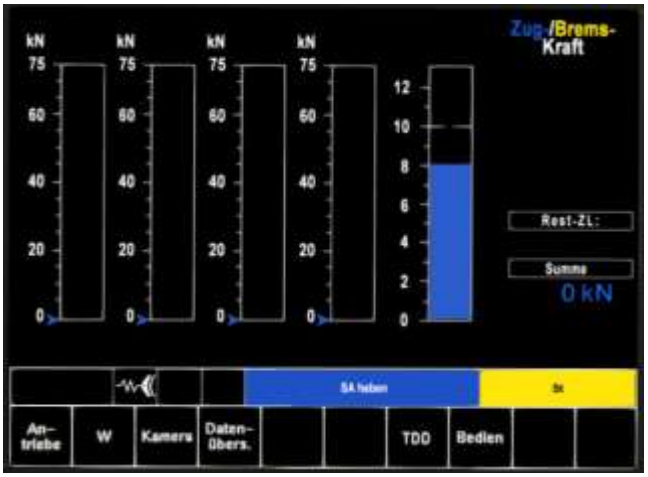
1. 

39. Left display

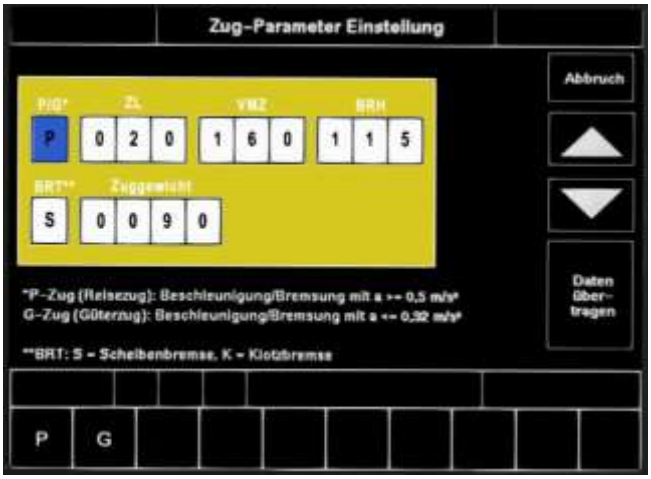
i. Base display

1. 

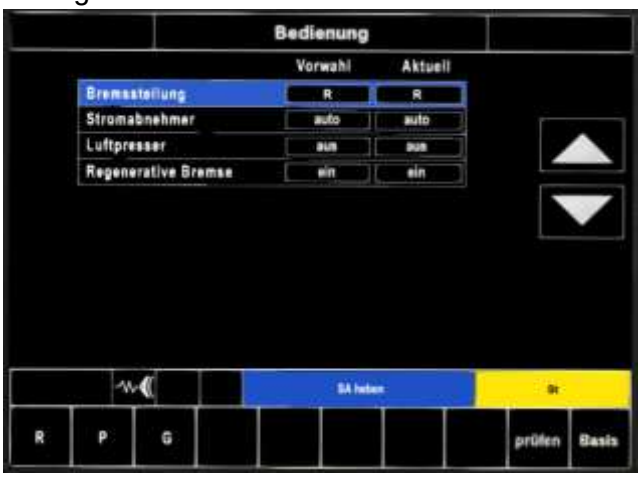
ii. Each traction engine display

1. 

iii. AFB data entry

1. 

iv. Serve – settings of some locomotives functions

1. 

v. Try – function tests of brake units

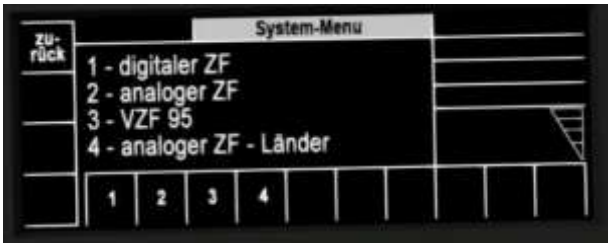
1. 

40. Radio

i. Base display

1. 

ii. System selection display

1. 

Basic function procedures

41. Startup procedures

i. After entry to cabin, put key into its place on back wall. Then turn it to the left to switch battery on and wait for complete boot of displays. Afterwards obtain control on that cabin by putting the key to the right position.

ii. With active cabin it is neccessary to choose the correct traction system. Selection is possible on the front display by pressing „System" buton. Before raising pantograph it is neccesary to make sure that detected system is the same as chosen system. This is possible via more ways:

1. Locomotive ID
2. By driving through marker in tracks (not possible in startup)
3. Switching by shortcut Ctrl + p

iii. After system selection and unblocking of SA, it is possible to raise them (SA heben will appear on display). After unblocking of HS it is possible to switch it on. The locomotive is still not ready to drive.

iv. It is neccessary to do all function tests. First do all tests for safety systems (Mirel / ETCS). Then do brake units test. For this You need to have 5bar in main brake pipe and at least 8bar in main reservoir. Triggering the test is possible by two ways:

1. Front display -> Spezial -> Test -> ETCS Bremstest
2. Left display -> Bedien -> Prufen -> ETCS Bremstest

v. After doing all tests it is possible to release all brakes including springbrake and drive.

42. Fast startup

i. It is possible to do fast startup via Ctrl + Shift + O. It consist of three phases:

1. Display boot
2. Filling with air
3. Completing function tests

ii. After fast startup it is still neccessary to do Mirel D1 test.

43. Startup in double traction mode

i. After starting up batteries on both locomotives, move to the back locomotive and by pressing Shift + 7 turn on ZWS. Pull out the key from back wall.

ii. After ZWS activation move to front locomotive, turn on ZWS the same way, put in the key and activate the cabin. Back locomotive is now in slave mode and listens to orders from front locomotive

44. Fast startup in double traction mode

i. Activate ZWS on both locomotives

ii. Trigger fast startup on front locomotive

45. AFB data entry
    i. Press „Daten-ubers“ on left display, now You can set all data relevant for AFB.
    ii. Data description
        1. P/G – passenger / freight train
        2. ZL – train length in metres
        3. VMZ – max speed in km/h
        4. BRH – brake percents
        5. BRT – brake type S – disc brakes / K – block brakes
            a. This determines brake simulation for the whole train.
        6. Zuggewicht – train weight in tons
    iii. Confirm by pressing enter
46. ETCS / LZB data entry
    i. On front display -> Main -> Zugdaten it is possible to set data for ETCS and LZB.
    ii. ETCS data
        1. BRH – brake percents
        2. ZL – train length
        3. VMZ – max speed
    iii. LZB data
        1. BRA – LZB train type
        2. BRH – brake percents
        3. ZL – train length
        4. VMZ – max speed
    iv. It is neccessary to confirm LZB data by pressing Wachsam.
47. Train number entry
    i. On front display -> Main -> Zugnummer it is possible to set train number.
48. Loco settings
    i. It is possible to set some functions of the locomotive on left display -> Bedien
        1. Brake regime – R/P/G
        2. Pantograph regime – auto/SA1/SA2/both
        3. Compressor regime – auto/on/off
        4. EDB recuperation – on/off

49. Radio system selection

i. After clicking on SYS it is possible to choose radio system.

50. Traction system selection

i. For changing of the traction system You first need to turn off train heating, switch off main switch and lower pantographs. Then on fron display press System and select desired traction system. Locomotive then prepares all high voltage devices and informs You when it is possible to raise again pantograph.

ii. If selected system doesn´t match with detected system locomotive automatically lowers pantograph.

Driving of the locomotive

51. Power and EDB controls

i. In positive positions it is possible to control desired power. For transition into those positions it is neccessary to press the lever knob. Max desired power is also maximal power used by AFB.

ii. In negative positions it is possible to control desired EDB power.

52. AFB

i. You can turn on AFB by moving the AFB lever from zero position. When it is possible for AFB to be turned on, on the left display there appears two options – AFB and V-reg. V-reg controls only power and dynamic brake, not train brake or parking brakes.

ii. Speed can be set by positions V-, V+ and Vmax.

1. V- lowers speed by 5km/h
2. V+ raises speed by 5km/h, it is neccessary to press the lever knob before.
3. Vmax raises speed by 5km/h faster

iii. AFB will be turned off by moving the lever to zero position.

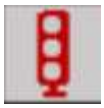
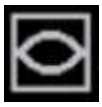
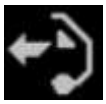
53. Traction characteristics, adhesion, wheelslips

i. Model contains simulation of traction characteristics due to selected traction systems. It also contains a complex simulation of adhesion forces by which it computes all effects of wheelslip and wheelslip protection.

Safety systems

54. Mirel
    i. Manual for Mirel, SHP and EVM is available at *http://www.hmh.sk/files/articles/file/153VZ1%20E%20Operating%20manual%20v04.pdf*
55. SHP
56. EVM
57. ETCS
    i. ETCS (European train control system) is designed to be funcional in three levels (L0, L1, L2) on all routes in game. It is neccessary for the route to not have any bugs in rail network, otherwise it could not be working properly. Some functionalities are simplified due to nature of the model and some functionalities of game.
    ii. Basic concept
        1. **Úrovně ETCS**
            a. L0 – level without track part of ETCS, max speed is 100 km/h
            b. L1 – point transfer of informations on mobile part, informations about signals are transmitted only around specific points. This is emulated by transmitting informations in fixed intervals and around signals.
            c. L2 – informations are transmitted continuosly via GSM-R. It is neccessary to be connected to radiocentrale (RBC), otherwise the train can´t move.
        2. Stavy ETCS
            a. Isolation 

                i. ETCS is isolated from the train.
            b. Initialization 
                i. ETCS is ready to work, but input of necessary informations is needed. Train can not move.
            c. Specific transmission module (STM) 
                i. Specific national module (PZB/LZB/ATB)
            d. On sight (OS) 
                i. Train runs on sight -> Vmax 40 km/h, in Czech Republic 100 km/h.

e. Trip (TR) 
    i. Trip occurs after SPAD or other dangerous situations. It triggers emergency brakes until train halts.
f. Post trip (PT) 
    i. Mode after trip, emergency brake can be released now.
g. Override (OR) 
    i. Mode for passing red signal.
h. Shunt (SH) 
    i. Shunting mode, Vmax 40 km/h, it is not necessary to set train data. Can be triggered from Initialization mode.
i. Full supervision (FS) 
    i. All informations about route are transmitted to DMI (Driver machine interface), ETCS oversees train speed.
j. Staff responsible (SR) 
    i. Vmax 40 km/h
k. Unfitted (UN) 
    i. Train is not fitted with ETCS, active in L0, Vmax 100 km/h.
l. Reverse (RV) 
    i. Mod used for pushing from tunnel. Obtained by activating reverse direction in tunnel, after circa 10 seconds it is confirmed by RBC and train can be now pushed.
    ii. In any other cases train can be pushed only in shunting mode.

3. Some concepts
    a. SoM – Start of mission, performed by START button after all data are set
    b. EoM – End of mission, performed by transition to Shunting mode or by turning off ETCS
    c. EoA – End of Authority, red signal, rail end
    d. Release speed
        i. Speed is numerically displayed in the lower left part below speedometer
        ii. This speed is mainly visible in L1, it allows train to approach signal faster and smoother
4. Level transitions
    a. Level 0
        i. Transitions are not needed to confirm
        ii. Transition to L0 is needed to confirm if it is not announced before
    b. Level 1
        i. Transition to L0/L2 is needed to confirm
    c. Level 2
        i. Transition to L0 is needed to confirm
    d. Level STM
        i. Transitions to other levels is not needed to confirm
        ii. Transition to STM is needed to confirm after the transition. There appears a sign below speedometer announcing a pending confirmation request. If it is not requested, ETCS applies brake until it is confirmed

5. Full supervision display

a. 

   i. Grey bar left of speedometer is distance bar, it shows distance to next speed restriction
   ii. Square in the upper left corner is colored accordingly to color of speedometer, it shows distance from brake curve
   iii. Circle around speedometer shows current permited speed
      1. Grey part shows speed after restriction
      2. White part is difference between grey part and current maximal speed permitted by braking curve
   iv. Planning are shows track up to 4km ahead of train. Blue bars mean track speeds and potential EoA.
   v. Yellow bar shows distance to indication curve – then the speedometer turns yellow.
   vi. Icon 2 below distance bar shows current ETCS level.
   vii. Icon below L2 icon shows that ETCS is connected to RBC.
   viii. State row shows messages from ETCS

6. Other informations about ETCS are available at https://www.era.europa.eu/content/etcs-drivers-handbook-now-available_en

58. PZB/LZB

   i. PZB description is available at - http://www.sh1.org/eisenbahn/rindusi.htm
   ii. For turning on PZB/LZB, You first need to start ETCS, set all data and select level PZB/LZB.
   iii. LZB is line track safety system. After entering LZB section there appears a yellow distance bar next to speedometer. This shows distance to next restriction. On the speedometer there appears a red triangle showing

current maximal speed permitted by braking curve. When train is led by AFB this acts as maximal speed for AFB and AFB shall not exceed this limit.

iv. After leaving LZB two scenarios can happen:
    1. AFB is turned on
        a. LZB End shall be confirmed by turning of AFB
    2. AFB is turned off
        a. LZB End shall be confirmed by Wachsam or Frei

59. ATB

i. Dutch train safety system guards those speeds:
    1. 40 km/h
    2. 60 km/h
    3. 80 km/h
    4. 130 km/h
    5. 140 km/h

ii. Maximal permitted speed is determined by next restriction. It is the nearest higher guarded speed:
    1. eg. speed restriction is 75 km/h, guarded speed is 80 km/h

iii. When guarded speed is lowered, it is needed to apply brakes, otherwise ATB applies emergency brake.

Další funkcionality

60. Road runner
    i. When moving road runner can be turned on by double clicking on power lever knob. It then measures length set to AFB and announces its end by double beeping.
61. Axle wheelslip
    i. In low speeds it is possible to see wheelslip on each axle separately.
62. Sparks in winter
    i. During winter or cold autumn teperatures it is possible to see sparks from pantograph during high current consumption.
63. Brake temperature characteristics
    i. It is possible that disc brakes will freeze during cold temperatures and brake effect will be significantly lower.
    ii. Also it is possible that brakes will heat up during long brakings and lose its braking effects.
64. Sunshields
65. Animated doors and windows
66. Overhead wires voltage
    i. Voltage changes over time and also due to current drain. It is advisable to watch curent voltage and accordingly change desired power when voltage is low. It is possible that undervoltage protection will shut down main switch.
67. Last state saving
    i. Model saves its last state and loads it on scenario start. It saves last chosen country mode, last detected traction system and chosen traction system.
68. Multilanguage displays
    i. It is possible to change language of displays by clicking the empty button in the top bar of front display.
69. Locomotive ID
    i. It is possible to set some parameters for AI
    ii. ID needs to contain those strings but it doesn´t matter in which order. Script only looks if they are present in ID.

01kV_	Sets 1.5kV
03kV_	Sets 3kV
15kV_	Sets 15kV
25kV_	Sets 25kV
_front	AI will drive on front pantograph
_rear	AI will drive on rear pantograph
_both	AI will use both pantographs when it is not moving

EBula

70. Model contains emulation of EBula. Now there are only displays for Kolin – Havlickuv Brod route present, but others can be made as well.
71. Settings
    i. In folder Kal000px\386pack01\RailVehicles\Common\EBuLa\Config is present file Config.txt, it is possible to set distances used for switching displays in this file. First line can be true/false. By writting true, You can enable vR EBula helper format, otherwise it uses my format of EBula. Second line means number of displays used and each next line is distance in metres for each display. EBula uses 25 displays (A – Z). If no distance is present, script will automatically use 10 000m.
    ii. Display textures are located in Kal000px\386pack01\RailVehicles\Common\EBuLa\Textures and are represented by textures named by each alphabet characted.
    iii. For using EBula in reverse direction press „i" button, „R" characted will appear in the upper left corner and displays will be switched in reverse direction.
    iv. It is possible to switch displays by arrows.

Common problems

72. Traction is blocked (Traktionssperre)
    i. Options
        1. ETCS brake test hasn´t been completed
        2. Train brake lever is not in 5bar position
        3. Spring brake is on
        4. Line switches are not ready yet (wait a few seconds)
        5. Power lever is not in zero position (needed for blockation confirmation)
73. Pantograph falls down immediately after raising
    i. Selected and detected traction systems are different
74. Main switch turns itself off while driving
    i. Overhead voltage is low, turn on HS again and continue with lower power