KYIV METRO MASTERS 2

81-717 Control

This training material is intended to explain the train control systems of the 81-717 in the game Kyiv Metro Masters 2.

Section 1: TRAIN START

Before starting movement, ensure the train systems are ready. Movement without fulfilling the conditions listed below is prohibited.

1. Door Control (LSD)

Before starting movement, the door control lamp on the LUDS panel must be lit.

- The lamp is named LSD
- The lamp is labeled as “LSD”
- If the lamp is not lit, do not start movement

LSD indicates that all doors are closed and locked.

(In the game, an image of the LSD lamp will be shown)

2. KVD Control (LKVD)

Before starting movement, ensure the KVD lamp (LKVD) is not lit.

- KVD — machinist’s vigilance control system (Movement Control)
- If the lamp is lit, movement is prohibited by the ARS system

To reset KVD:

- press one of the two red buttons labeled:
    - “Vigilance”

3. Pressure in the Brake Line

Before starting movement, the brake line gauge must show:

- 4.2 atm or more

If pressure is lower:

- the train will not move
- restore pressure in the system

Pneumatic braking and pressure management are covered in a separate training section.

Summary

Movement is permitted only if all conditions are met simultaneously:

- LSD lamp is lit
- KVD lamp is not lit
- brake line pressure is at least 4.2 atm

Only then is it allowed to start moving.

After fulfilling all start conditions, begin train control using the driver's controller (KV), moving it to running positions.

Detailed procedure and acceleration features are covered in the separate section "Train Acceleration".

Limitations and Notes

- In the current game version, door emergency situations are absent.
- Inability to open or close doors is due only to unmet control conditions.

WHAT TO DO IF…

- What to do if doors are open and LSD lamp is not lit?
  → Go to section: Door Control
- What to do if brake line pressure is less than 4.1 atm?
  → Go to section: Pneumatic Brake
- What to do if KVD lamp is lit?
  → Your speed must be below permitted, then press one of the buttons labeled "Vigilance"

Section 2: DOOR CONTROL

Door control is performed from the driver's console and is possible only under specified conditions. Violating these conditions prevents door opening.

Conditions for Opening Doors

Before opening doors, ensure:

1. "Door Close" toggle is in the upper position.
    - Upper position means: doors unlocked.
2. Train speed is less than 3 km/h.
    - If speed exceeds 3 km/h, doors will not open.

Only after meeting these conditions may doors be opened.

Opening Doors

To open doors:

- press and hold for 0.5 seconds the button:
  - “Left Doors”, or
  - “Right Doors”

Door type is selected by the driver depending on platform side.
(Blue metro line has stations with left-side doors only)

Left Doors (Main and Backup Buttons)

For left door control, two buttons are provided:

- main left door open button
- backup left door open button

⚠️ **Attention:** At any moment, only one is energized.

Between buttons is the door switch toggle:

- switching toggle up or down selects:
- which left door button is energized
- which button works

At speed less than 3 km/h:

- energized button lights up
- press it to open doors

Right Doors

Button is on another console page, opened by pressing UI button “More”.

For right doors, one open button:

- button always energized
- no additional switches needed (except “Door Close” toggle must be unlocked)

Opening by holding button for 0.5 seconds.

Closing Doors

Two ways to close doors:

1. Main way
    - move “Door Close” toggle to lower position

(toggle unlocked in screenshot)
- lower position means: doors locked
- doors then start closing

2. Backup way
   - press “Backup Door Close” button

After all doors fully closed:

- door control lamp (LSD) lights on LUDS panel
- LSD indicates doors closed and train ready for movement

Both ways perform door closing function.

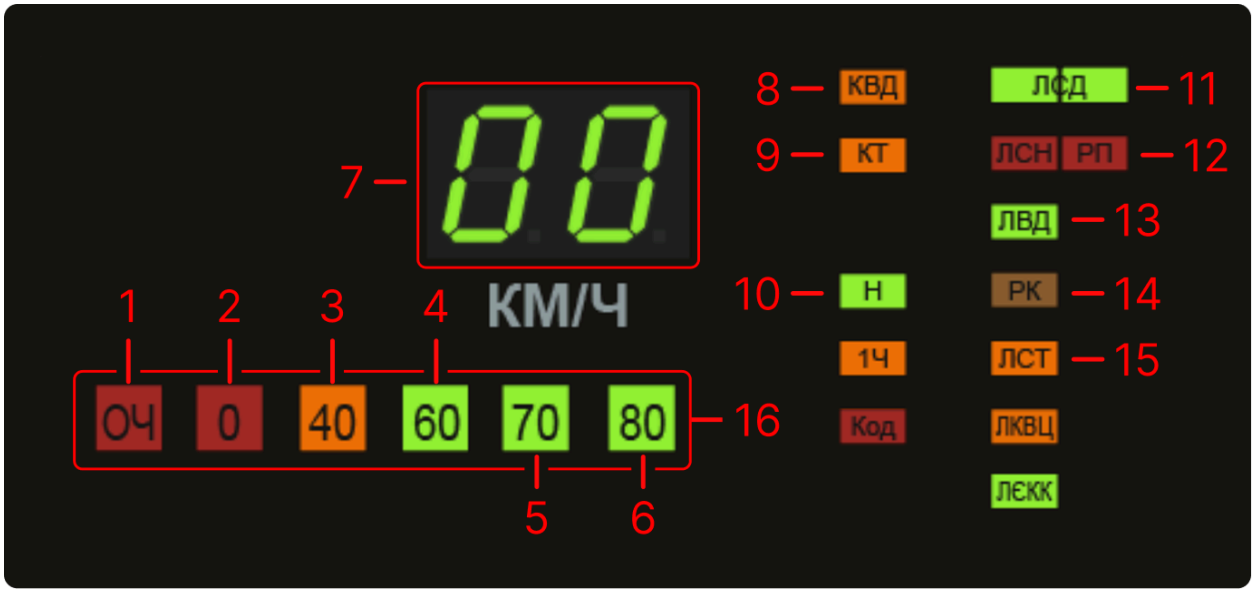
WHAT TO DO IF…

- Doors won’t open?
  → Check train speed (less than 3 km/h) and “Door Close” toggle position

- Left door button not responding?
  → Check door switch toggle and select energized button

- Doors won’t close?
  → Use “Backup Door Close” button

Section 3: LUDS PANEL



LUDS panel (Locomotive Permitted Speed Indicator) displays train system status, safety signals, and permitted speeds. Below is description of panel elements by scheme numbering.

Note: lamp names and abbreviations are not translated as they are technical designations.

LUDS Panel Elements Description

1. OCH
   OCH lamp — ARS frequency absence.
   - If lit, ARS signal absent (max permitted speed — 0 km/h)
2. 0
   Max permitted ARS speed — 0 km/h.
   ● If lit, movement prohibited in most cases.
3. 40
   Max permitted ARS speed — 40 km/h.
4. 60
   Max permitted ARS speed — 60 km/h.
5. 70
   Max permitted ARS speed — 70 km/h.

6. 80
   Max permitted ARS speed — 80 km/h.

7. Speedometer
   Shows current train speed in km/h.

8. KVD
   KVD lamp signals permitted speed exceedance.
   ● If lit:
   o reduce speed below permitted
   o after speed reduction, press “Vigilance” button on console

9. KT-
   KT- lamp has several operating modes:
   ● if lit — pneumatic braking activated
   ● during electrodynamic braking:
   o lit — sufficient braking force from controller
   o flashing — braking force starting to insufficient
   o off — no braking force

10. N
    N lamp — direction lamp.
    ● Lit if train reverse set to correct movement direction.

11. LSD
    LSD lamp — door signaling.
    ● Lit if all doors closed.

12. LSN / RP
    LSN and RP lamps lit if scheme assembly in progress:
    ● for traction or
    ● for braking

    Even if scheme assembles on one car, lamps light.

    In normal conditions, lamps extinguish automatically.

    Possible causes if lamps stay lit:
    ● RP blown on one car
    ● insufficient train voltage

    If RP blown:
    ● green LVRP lamp lit on driver’s console
    ● hold “RP Return, BV On” button 0.2–1 sec (no more)
    ● after short time, lamps should extinguish, RP on cars reassembles

13. LVD
    LVD lamp — engine activation lamp.
    ● Lit if driver's controller (KV) in traction position (acceleration).

14. RK
    RK lamp — rheostatic controller.
    ● Lit if rheostatic controller control via KV active.

15. LST
    LST lamp — braking signaling lamp.
    ● Lit if driver's controller (KV) in braking position.

16. BARS Permitted Speeds Panel
    Panel shows BARS (ARS Block) permitted speeds.
    ● if one lamp lit — next section permitted speed same or higher
    ● if two lamps lit — next section permitted speed lower

    In this case:
    ● orient on lower permitted speed
    ● if train speed exceeds — reduce speed
    ● otherwise ARS will trigger soon

WHAT TO DO IF…

● KVD lit?
→ Reduce speed to permitted and press "Vigilance" button
● LSN / RP not extinguishing?
→ Check LVRP lamp and perform RP return
● Unclear next permitted speed?
→ Orient on lower speed from BARS panel

Section 4: IF TRAIN WON'T START FROM STOP

This section for quick system status check if train fails to start despite correct driver actions.

Recommended check order below.

Check Sequence

1. Doors and LSD
   ● ensure all doors closed
   ● check LSD lamp lit
   ● if LSD off — movement prohibited

2. KVD
   ● check KVD lamp not lit
   ● if KVD lit:

o reduce speed to permitted
o press “Vigilance” button

3. Brake Line Pressure
   ● ensure brake line pressure ≥4.2 atm
   ● if lower — movement impossible

   Note: pneumatic brake operation detailed in separate section.

4. RP and LSN
   ● if RP and LSN lamps lit and stay lit, train may not start

   In this case:

   - check green LVRP lamp on driver’s console
   - if LVRP lit — RP possibly blown on all or some cars
   - hold “RP Return, BV On” button 0.2–1 sec (no more)
   - after short time LVRP should extinguish

Summary

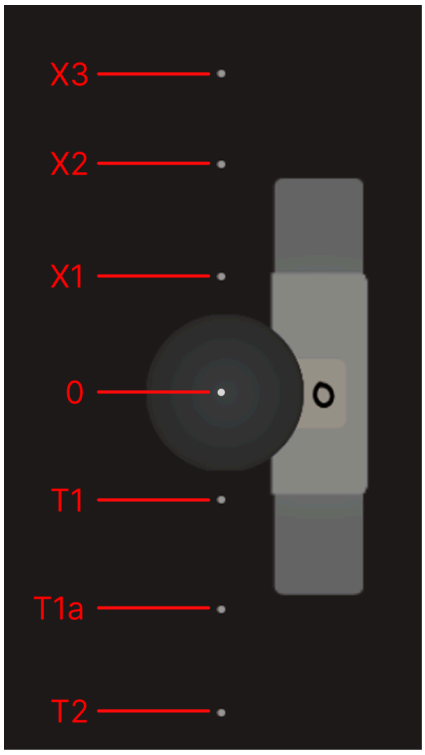
If all conditions met:

- LSD lit
- KVD off
- pressure normal
- LVRP off

— train ready to start.

If still won’t start, check prior sections or current ARS / BARS limits.

Section 5: DRIVER'S CONTROLLER (KV)



Driver's controller (KV) is main train movement control organ. Driver uses it for acceleration, coasting, and braking.

7 fixed KV positions implemented, sequential top to bottom.

This section describes KV position purposes. Practical acceleration use in separate "Train Acceleration" section.

Driver's Controller Positions

1. Run 3 (X3)
   Top KV position.
   - Max train acceleration
   - Provides highest acceleration
   - Recommended for start and quick speed gain

2. Run 2 (X2)
   - Near-max acceleration
   - For confident but smoother acceleration

3. Run 1 (X1)
   - Maintains gained acceleration force
   - If no prior acceleration — minimal acceleration

   ⚠ Note: not recommended as main acceleration mode, acceleration very low.

4. Position 0 (coasting)
   - Train engines off
   - Coasting transition ~0.8 sec
   - Train coasts by inertia

5. T1
   - Minimal electrodynamic braking
   - Braking possible only if sufficient RK positions

6. T1a
   - Maintains current braking force if already gained
   - If no braking — sets T1 level braking force

7. T2
   - Max electrodynamic braking
   - Provides max possible braking force
   - RK positions auto-collected here

Summary

- X3 / X2 / X1 — traction positions (acceleration)
- 0 — coasting
- T1 / T1a / T2 — braking positions

Driver's controller used constantly during movement, key control element.

Section 6: TRAIN ACCELERATION

Train acceleration via driver's controller (KV) in traction positions. Proper mode selection ensures schedule adherence, speed limits, smooth operation.

This section covers practical acceleration procedure.
KV positions described in prior "Driver's Controller (KV)" section.

General Acceleration Principles

- acceleration allowed only after start conditions met
- train speed must not exceed ARS / BARS permitted
- during acceleration constantly monitor speedometer and LUDS indication

Acceleration Start

After starting:

1. Move KV to X2 or X3.

2. Wait for confident speed gain.

3. After reaching required speed, move KV to 0 (coasting).

⚠ Attention: not recommended to accelerate only via X1, acceleration very low.

Acceleration Mode Selection

Run 3 (X3)

- for intensive acceleration
- recommended leaving station
- quick required speed gain

Run 2 (X2)

- Same smoothness as X3
- End of acceleration softer: doesn’t reach absolute max acceleration like X3

Run 1 (X1)

- Not for zero-start active acceleration
- Used for:
  - maintaining gained acceleration force
  - smooth coasting transition
- If no prior — minimal acceleration

Coasting Transition

After required speed:

- move KV to 0 (coasting)
- engines off ~0.8 sec
- train continues by inertia

Coasting allows:

- reduce energy use
- smooth approach to braking zone or speed limit

Train Operation Mode Compliance

During movement, adhere to set speed regimes.
Game has train operation mode document:

Режим ведення поїздів у ранкові та вечірні години на ОТЛ по 2 колії з 14.11.22				
Час / Станції	ПІК		НЕ ПІК	
	пол. КВ	шв. руху	пол. КВ	шв. руху
Героїв Дніпра	2	50	2	50
Мінська	2	55	2	55
Оболонь	3	65	2	65
Почайна	2	55	2	55
Тараса Шевченка	2	46 45	2	46 45
Контрактова Площа	2	55	2	50
Поштова Площа	2	25	2	25
Майдан Незалежності	3	68	3	68
Льва Толстого	3	60	2	55
Олімпійська	2	55	2	50
Палац Україна	2	55	2	50
Либідська	2	70*	2	70*
Деміївська	3	70	3	70
Голосіївська	2	53*	2	53*
Васильківська	2	20 40	2	20 40
Виставковий центр	2	40	2	40
Іподром	2	55	2	55
Теремки (маневри)	2	25	2	25

*- до стріли відключення ТД

Open by pressing “More” UI button near control console.

Document specifies:

- recommended movement speeds
- train handling features on sections

Acceleration Monitoring

During acceleration, watch:

- speedometer — current train speed
- ARS / BARS permitted speed lamps

- KVD lamp — speed exceedance

On exceedance:

● move KV to coasting
● ensure speed drops to permitted, press “Vigilance” button

WHAT TO DO IF…

● Train accelerates very slowly?
→ Check not using only X1. Switch to X2 or X3.
● Speed gains fast but limit ahead?
→ Early KV to coasting or braking.
● KVD lamp lit?
→ Reduce to permitted speed, confirm vigilance.

Section 7: TRAIN BRAKING

Game implements electrodynamic braking system close to real metro trains. At low speeds, braking doesn’t start instantly — normal system behavior.

Braking via rheostatic controller (RK), controlled by driver’s controller (KV).

Current RK positions visible upper left screen corner.

Max RK positions — 18.

Rheostatic Controller (RK)

RK doesn’t set braking force directly, determines if electrodynamic braking possible at all.

● train brakes only if sufficient RK positions for current speed
● insufficient RK positions — no electrodynamic braking

❗ Important: RK positions don’t “strengthen” braking — create condition for braking to work.

Braking vs Speed Dependency

Electrodynamic braking efficiency directly speed-dependent.

On speed drop, increase RK positions.

Approximate guides:

● ~35 km/h — effective braking start with 6 RK positions
● ~20 km/h — more positions to maintain braking force
● ≤10 km/h — up to 18 RK positions needed

Low speed pre-braking delay normal.

KV Braking Control

Electrodynamic braking force primarily from KV position.

RK determines if conditions sufficient for that braking.

T2 Position

- T2 — max braking
- max possible braking force
- if sufficient RK — max train braking

RK in T2:

- auto-collected
- ~0.5 sec interval

Recommended:

- low speed
- quick braking condition setup

T1a Position

- T1a maintains current braking if present
- e.g.: T2 braking → T1a preserves it

If no braking and minimal RK sufficient:

- T1a sets minimal possible electrodynamic braking
- equivalent to T1 force

T1 Position

- T1 minimal electrodynamic braking
- only if sufficient RK positions

Insufficient RK:

- no braking regardless KV position

T1 / T1a Positions

Higher speeds: manual braking

- KV switching T1 ↔ T1a
- each switch adds 1 RK position

Braking Condition

Key principle reminder:

Train brakes only with sufficient RK positions.

If braking absent or fades:

- add RK positions
- braking possible again

Recommended cycle:

- T1 → T2 → T1

Cycle allows:

- collect RK positions
- restore/maintain electrodynamic braking

Braking Indication

During braking, monitor LUDS lamps:

- KT-
  - lit — sufficient braking force
  - flashing — braking weakening (add ~5 RK positions)
  - off — no braking force

- LST
  - lit if KV in braking position

WHAT TO DO IF…

- Train not braking at low speed
→ Increase RK positions

- Braking started but speed not dropping
→ Add RK or change KV mode

- KT- flashing
→ Insufficient force, add RK positions

Pneumatic braking and brake line pressure interaction in separate training section.

Section 8: BARS (ARS BLOCK)

BARS system (ARS Block) for automatic speed control and enforced movement limit compliance. In game, works close to real metro logic.

BARS constantly compares train speed to max permitted on LUDS panel.

Permitted Speed Exceedance

If train speed ≥ max permitted, ARS auto-intervenes.

Sequence:

1. Traction engines auto-off.
2. ARS braking scheme assembly starts.
3. Simultaneously, substitution valve 1 (VZ1) triggers.

VZ1 provides light pneumatic braking:

● speed reduction starts immediately
● active while train speed > permitted

VZ1 is pneumatic system element. Detailed in pneumatics section.

When speed ≤ permitted, VZ1 auto-releases.

ARS Braking (T2 from ARS)

After braking scheme complete:

- T2 braking from ARS activates
- independent of KV position

T2 from ARS off only by:

- “Vigilance” button press

Button press:

- confirms driver vigilance
- cancels T2 from ARS
- stops ARS braking scheme assembly

⚠ Important: if braking scheme already assembled, not disassembled, but T2 from ARS starts if vigilance unconfirmed.

Long “Vigilance” Hold

Long hold:

- BARS sets auto 20 km/h limit
- cannot exceed
- train auto-brakes via VZ1

Mode allows:

● start/continue if:
o permitted speed 0 km/h, or
o OCH lit on LUDS

Useful:

● dead-end
● depot maneuvers

If Permitted Speed Drops During Braking

If already braking and permitted drops:

1. Reduce to new permitted ASAP.
2. VZ1 auto-helps.
3. Speed ≤ permitted — press vigilance.

If:

● T2 from ARS active —
o use “Vigilance” button

BARS Operation Summary

● BARS auto speed control
● on exceed:

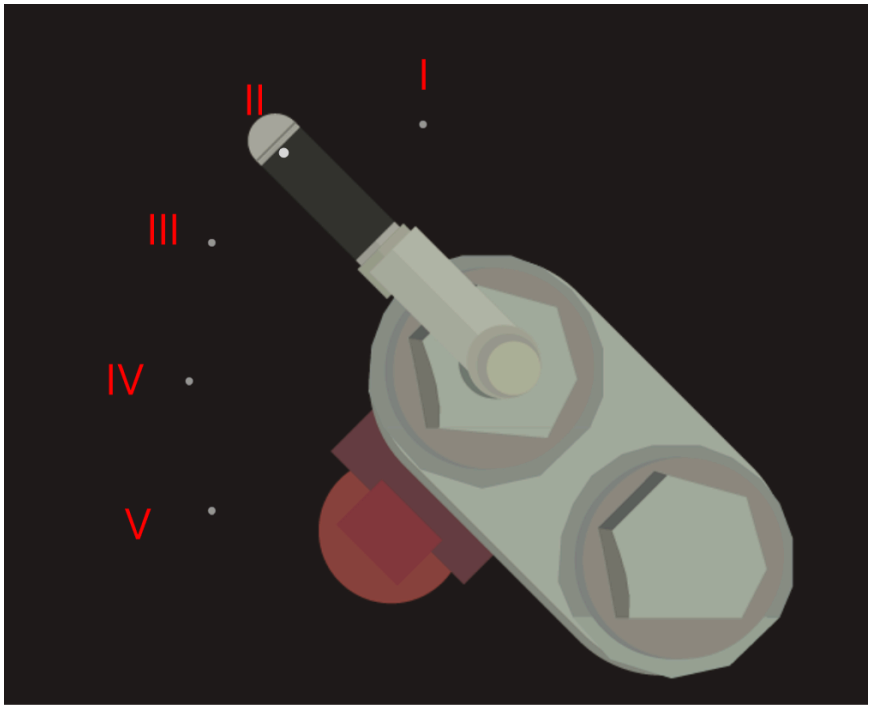
o traction off
o braking scheme assembly
o VZ1 apply

● post-assembly:
o T2 from ARS on

● situation control via vigilance button

BARS signal compliance mandatory for safe line movement.

Section 9: DRIVER'S CRANE



Game implements 334 series driver's crane for pneumatic train braking control.
Positions read top to bottom (handle from top extreme to bottom).

Driver's Crane Positions (Top to Bottom)

I — Release and Charge
Full brake release and brake line charge position.
Used post-braking/stop for quick pressure restore.

II — Train Position
Main running position. Brake line pressure stable, no braking.

III — Overlap
Neutral. Brake line, main reservoir, equalizer reservoir overlapped. Transitional between modes. (Brake line pressure not forcibly reduced.)

IV — Service Braking
Smooth service braking by brake line pressure reduction.
Braking force depends on handle dwell time.

V — Emergency Braking
Max braking. Brake line rapid atmosphere discharge. Emergency only.

Section 10: TRAIN PNEUMATIC SYSTEM

Pneumatic system core of 81-717 operation. In Kyiv Metro Masters 2, implemented per real principles, directly affects braking, door opening, start capability.

Without sufficient compressed air pressure:

- train cannot start;
- brakes won't release;
- doors malfunction.

Pressure Main Line (NM)

Pressure main — high-pressure line feeding entire train pneumatics.

- Normal pressure: 6.3–8.0 atm
- Source: motor-compressors

Feeds from NM:

- brake line;
- door pneumatic drives;
- auxiliary pneumatics.

NM pressure drop means consuming pneumatic devices active.

Brake Line (TM)

Brake line — control line for pneumatic brakes. Controlled by driver's crane.

- Normal charge pressure: 5.0–5.2 atm
- At this pressure, brakes released

Any braking by TM pressure reduction.

Pneumatic Braking Principle

1. Driver moves crane to braking position.
2. Brake line pressure drops.
3. Car distributors detect drop.

4. Air to brake cylinders (TC).

5. Pads press wheels — train brakes.

Greater TM drop → higher TC pressure.

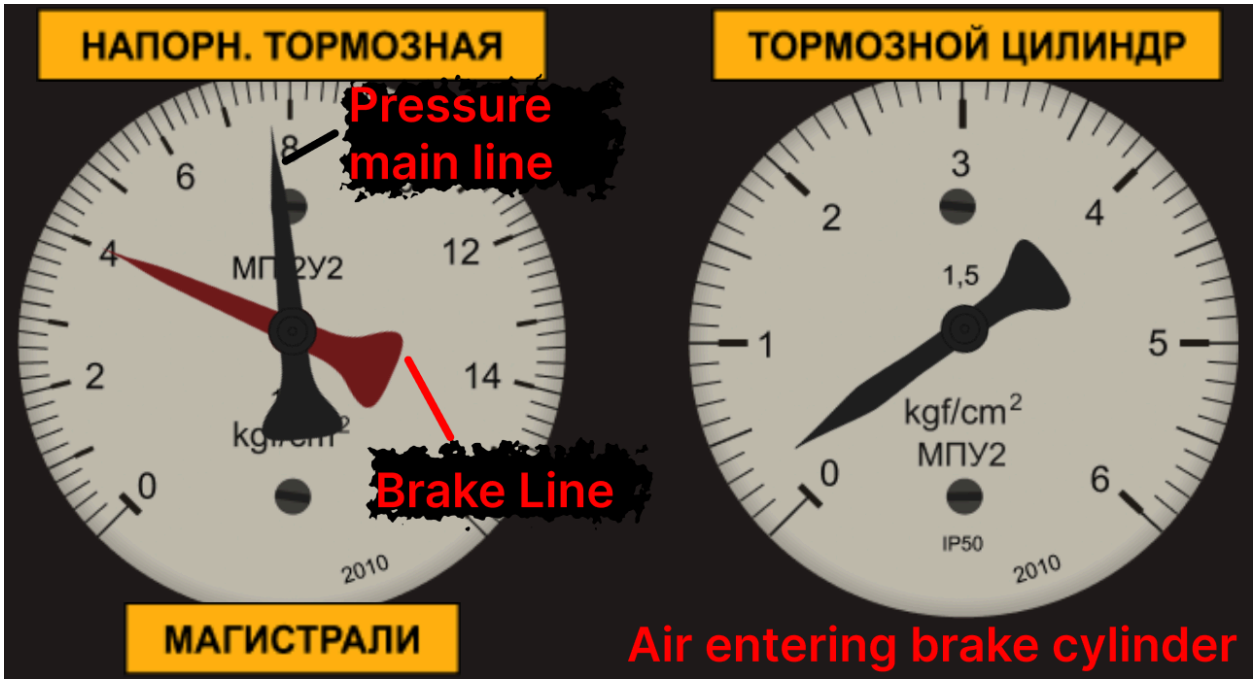
Brake Release

For release:

- crane to release/charge;
- TM pressure rises;
- TC air to atmosphere;
- pads off wheels.

Residual TC pressure after KV to traction — no start.

Gauges



(On screenshot: NM=7.8 atm; TM=4 atm; Air entering brake cylinder. Now — 0.3 atm.)

Driver's console shows:

- Pressure Main (NM) — system air reserve;
- Brake Line (TM) — pneumatic brake status;
- Brake Cylinders (TC) — actual braking force.

Zero TC pressure = fully released brakes.

Minimal Braking

Minimal effective braking degree at:

- TM drop to ~4.3–4.0 atm;
- TC ~1.0–1.2 atm.

Slight TM drop no braking.

Pneumatics Main Principle

TM (brake line) pressure drop auto-triggers train braking.

Safety design:

● line rupture;
● emergencies;
● auto-stop.

Pneumatics tightly linked to BARS, substitution valves, driver's crane. Understanding mandatory for confident safe game train control.

Substitution Valves: VZ #1 and VZ #2

Besides crane braking (TM discharge), 81-717 uses substitution valves. Feed TC air without TM pressure drop.

Auto-operation on train electric scheme signal.

What are Substitution Valves

Electromagnetic valves. Energized — open NM air path direct to TC, bypassing distributor.

Thus pneumatic braking:

● without TM discharge;
● without crane;
● instant, by automation command.

VZ #1 — Substitution Valve #1

Triggers:

During KV braking (T1/T1a/T2), initial electrodynamic. ~10–12 km/h electric ineffective.
You can also trigger by pressing button:

Electric scheme auto-commands VZ #1.

Action:

- valve opens;
- TC small pressure: 0.8–1.0 atm;
- TM unchanged.

Purpose:

- smooth “finish braking”;
- soft low-speed stop;
- electro-brake efficiency compensation.

VZ #2 — Substitution Valve #2

Power valve, critical modes.

Triggers two cases:

1. Emergency braking
    - safety loop (deadman);
2. Electrodynamic failure

- KV to braking (e.g. T2);
- scheme not assembled;
- no LBKU lamp;
- seconds later automation activates VZ #2.

Action:

● full TC pressure:
o 2.4–2.8 atm;
● direct from NM;
● max fast braking.

Purpose:

● guaranteed stop;
● electric failure reserve;
● emergency safety.

Game Notes

In Kyiv Metro Masters 2, VZ #1/#2 fixed operation.

Real: VZ #2 pressure may load-dependent (autorelease). Game:

● always per norm;
● passenger load no effect.

Distinguishing Valve vs Crane Braking

Crane braking:

● TM (left gauge) drops;
● TC (right gauge) rises.

Valve braking:

● TM stable (~5.0 atm);
● TC gauge jumps up.

Means automation braking, not driver.

Section 11: ANNOUNCER

Announcer for in-train audio announcements. Before start and announcements, turn on and await diagnostics complete.

Announcer Turn-On

1. Move **announcer toggle** to upper position.
2. Announcer activates, auto-starts **self-diagnostics**.

Diagnostics plays service voice message.

Diagnostics Complete

Post successful check:

“Diagnostics completed without errors”

Announcer fully operational.

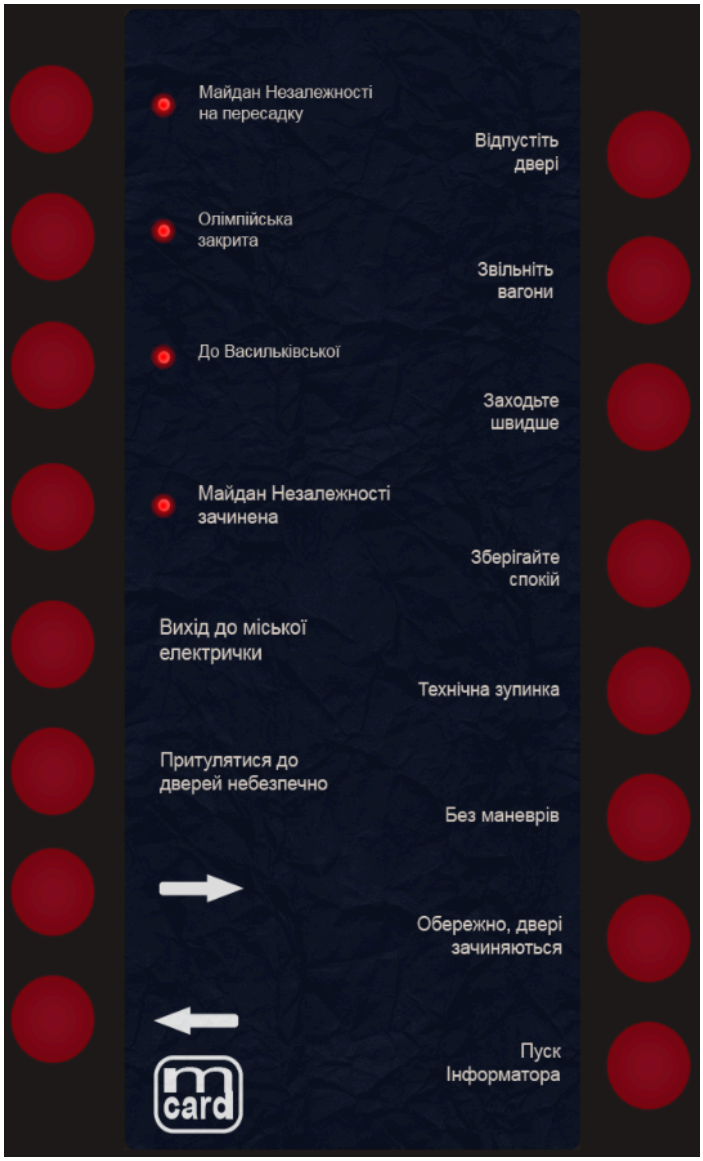
Playback

Post-diagnostics, audio announcements permitted.

- use “|/|| Programs” button on console for playback;
- button controls announcer announcements.

Announcements **only after successful diagnostics**.

Separate Announcer Panel



Besides switch/main playback button, game has **separate announcer panel**.

Open:

- press “More” UI near control console.

Panel has:

- **technical (service) messages** playback buttons
- recording rewind

Service messages no train control effect, add realism matching real metro driver work.

Note

Announcer no movement effect, but key atmosphere/realism element in game.