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Rolling stock configurations and main activated functions for EMU/DMU, locomotives and driving coaches

*Configurations du matériel roulant et fonctions principales en service sur les rames automotrices
électriques/diesel (EMU/DMU), les locomotives et les cabines de réversibilité*

*Fahrzeugkonfiguration und wichtigste aktivierte Funktionen für Elektro- und Dieseltriebwagen (EMU/
DMU), Lokomotiven und Steuerwagen*



UNION INTERNATIONALE DES CHEMINS DE FER
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The provisions in this Leaflet are applicable to rolling stock concerned.

This leaflet does not replace European legislation (TSI, including specific/national cases).

Operational configurations and driver procedures

- Operational configurations and activated functions ("use cases")
- Transition requirements to change the configuration of the rolling stock
- Driver procedures to set up the rolling stock for operational purposes.

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Summary

This leaflet:

- defines rolling stock configurations and main activated functions for EMU/DMU, locomotives and related driving coach driver cabs and also defines transition conditions between configurations;
- fixes the rules associated with the functional requirements for the EMU/DMU, locomotives or driving coach cabs;
- specifies driver procedures to obtain the operational configuration requested.

1 - General

This specification describes rolling stock configurations and main activated functions for EMU/DMU, locomotives and related driving coach driver cabs and also defines transition conditions between configurations. Driver procedures to obtain the operational configuration requested are specified as well.

Objectives of this leaflet	Use	Verification
Define the target condition in order to avoid project specific engineering of common rolling stock functions.	Minimise the scope of interpretation for solutions that meet the requirements, identify deviations/ non-compliance of functional requirements.	Comparison of target/ actual "specification ↔ manufacturer's solution".
Define functional requirements in a precise manner, so that functional changes or restrictions due to technical changes/innovations are avoided or minimised. Functional changes are acceptable if there are proven cost-effective LCC advantages (e.g. reduction of faults and training expenditure) or mandatory regulation (i.e. TSI including specific cases). A set of comprehensive physical interface-specifications for interchangeability, whichever the supplier, is the aim of future standards.	An unambiguous definition of consistent functional interfaces (standardisation) enabling innovative design at module level: old components can be replaced with new ones easily.	- Costs for • spare parts • maintenance • repair - Compliance with regulations and directives.
Retain known operational procedures for the driver, while trying to simplify them further	Reduce training expenditure.	Training costs.
Avoid operating errors through largely self-explanatory and fault-tolerant functions and a high degree of automation and diagnostics.	Increase reliability.	- MTBF - Experience and User Feed-back.



Fig. 1 - UIC Leaflet 612 hierarchy (see Bibliography)

2 - Definitions

See *UIC Leaflet 612-0*, point 2 (see Bibliography - page 40).

All quoted position numbers refer to *UIC Leaflet 612-0*.

3 - Rolling stock configurations

3.1 - Train configurations

3.1.1 - Overview table

Train systems can have different configurations depending on the environment and/or operational service (see Appendix A, table 1 - page 23). Different functions are available in each configuration.

3.1.2 - Self protection Configuration

- Battery protection device has switched off all electrical consumers after allowing time for a controlled shutdown of these consumers (see pr EN 50xxx - see Bibliography - page 40). Only battery protection device itself remains powered.
- Brake pipe status unchanged (depends on previous configuration).
- For resetting this self protection configuration the main battery switch (see *UIC Leaflet 612-0, pos. 508* - see Bibliography - page 40) shall be set from pos. "off" to "on".

3.1.3 - Shut down Configuration (parking or being pulled)

Main battery switch (see *UIC Leaflet 612-0, pos. 508*) is switched off.

Parking:

- Operational scenario: standstill ($V = 0$ and $BP < 2$ bars).
- All electrical consumers are switched off. Only those connected directly to the battery are supplied with power:
 - battery deep discharge protection,
 - interior light available (if on, will be switched off automatically after 15 min, see *UIC Leaflet 612-0*),
 - WSP available in WSP sleep-mode,
 - brake mode selection (see *UIC Leaflet 612-0, pos. 406 - 408*) available,
 - train-bus-node is in sleep mode (and ready for switching on the battery),
 - functionality to switch on the battery by radio remote connection.
- Brake pipe emptied and then isolated and automatic application of the parking brake (see *UIC Leaflet 612-0, pos. 403*). Unintentional feeding of the BP by leakage in MP or reservoir connections shall be prevented.
- This Shutdown-configuration shall be possible for at least 150 h without reaching the self protection configuration. The unit is still safely parked.

Pulled ("operation as a wagon"):

- Operational scenario: pulled by another mechanically and pneumatically coupled train or loco.
- While running ($V > 0$ or $BP > 2$ bars): Automatic activation of WSP.
- This Shutdown-configuration shall be possible for at least 24 h without reaching the self protection configuration. The unit is still safely pulled.

The EMU/DMU, locomotives and driving coaches shall manage the change between "Parking" and "being pulled" within 10 s.

3.1.4 - Switched on Configuration

→first step of starting after switching on the main battery switch pos. 508

- Main battery switch (see *UIC Leaflet 612-0, pos. 508*) is in "on-position", then all low voltage consumers are supplied without battery charging. If there is no battery charging for 45 min then the main battery switch shall be automatically switched off (this will cause a transition to the shut down configuration).
- Main reservoir is connected to the air consumers (operable, if pressure is present).
- The preconditions for activating the pantograph shall be fulfilled.
- All DDU are available for information only (and for some control functions to be defined - e.g. train radio).

3.1.5 - In service Configuration

→a cab has been activated

- TCMS shall ensure that only one cab is activated as master, TCMS shall not accept another Driver ID card in parallel.
- In active cab DDU are available for control.
- Train preparation and parking can be executed in this configuration from the master cab.
- Other cabs than the master cab can only issue "local" TCMS commands not related to the train. TCMS will ignore all train-wide commands from other cabs and the driver in the master cab will be informed about this situation by the TDD (see *Document 612-03* - see Bibliography - [page 40](#)).
- After coupling or decoupling detected by TCMS: the TCMS shall continuously monitor the train composition in order to be able to detect any modification. After successful inauguration (no master conflict, degraded devices have been identified) the driver is requested to confirm the train composition in the TDD (see *Document 612-03*). In case of a master conflict (= no or more than 1 master), a traction inhibition is commanded train-wide, the train inauguration configuration can not be completed successfully.
- After driver confirmation following the successful train inauguration, the train composition applies. The duration of the train inauguration shall be less than 2 min. The TCMS shall show in every non master cab that a master cab exists on the train.

3.1.6 - Driving Configuration

→ everything is available, normal operation, coupling master, washing and transitions of signalling, radio system and/or radio channel and/or energy sub-systems are specific sub-configurations of the Operation configuration

- The TCMS shall continuously monitor the train composition in order to be able to detect any modification. After successful inauguration (no master conflict, degraded devices have been identified) the driver is requested to confirm the train composition in the TDD (see *Document 612-03*). In case of a master conflict (= no or more than 1 master), a traction inhibition is commanded train-wide, the train inauguration configuration can not be completed successfully.
- After driver confirmation following the successful train inauguration, the train composition applies. The duration of the train inauguration shall be less than 2 min. The TCMS shall show in every non master cab that a master cab exists on the train.

3.1.6.1 - Normal operation

- Operational scenario: the train is available for running. In the case of a second master EMU/DMU, locomotive or driving coach the driver on the second master EMU/DMU, locomotive or driving coach shall apply the push button pos. 303 in order to isolate the driver automatic brake controller and ETCS/STM.
- In case of a master EMU/DMU, locomotive or driving coach, the train inauguration by TCMS triggers the other EMU/DMU, locomotive or driving coach into slave operation.
- TCMS shall ensure that only one cab is activated as master, TCMS shall not accept another card in parallel and while running ignore any further ID card and at Standstill trigger a train-wide traction-inhibition.
- In the active cab DDU are available for complete control.
- Train-wide control can be executed in this configuration from the master cab.
- Cabs other than the master cab can only issue "local" commands unrelated to the train. TCMS will ignore all train-wide commands from these other cabs and the driver in the master cab will be informed about this situation by the TDD (see *Document 612-03*).
- Transition due to change in characteristics of the railway network section (i. e. control-command and/or energy subsystem) will be done automatically by track balise/beacon or radio signal or by the driver activating a soft key in the TDD (network section, STM) triggering the change of power supply and/or STM and/or TCMS network section specific configuration (e. g. language, parameters).
- For multiple traction or push-pull train (front and tail) the activation is carried out as follows:
 - the interoperable control-line (for UIC screw coupler this is *UIC Leaflets 558 and 541-5*, see Bibliography - [page 40](#), for automatic coupler there is not yet any standard available) has to be coupled or radio connection has to be activated;
 - the unit, in which the direction of travel is selected, is defined as master;
 - in all units participating in the train-wide communication the same configuration of train-bus-operation shall be automatically selected (see *UIC Leaflet 612-0, pos. 504*) in normal position).

After the direction of travel is chosen, the train is initialised: the slave units and all further communicating rolling stock are displayed on the main screen of the TDD (see *Document 612-03*) in the activated cab of the master unit. In case of faults, each unit (master and slaves) protects itself and the failure management applies according to *Document 612-03*.

3.1.6.2 - Restricted Operation: coupling master operation (leading vehicle) with automatic couplers

3.1.6.2.1 - Operational scenario

If equipped, the front (coupler) covers are open and the speed is limited to 3 km/h. If there are no front (coupler) covers, then the train inauguration by the TCMS shall inform the driver about the detected train composition. The other train to be coupled can be in any configuration. But coupling will not result in successful train inauguration in "self protection configuration": the driver shall detect the self protection unit during the train inauguration. However, the intended state of the train or unit "waiting to be coupled and ready for coupling" shall be indicated to the driver approaching the waiting train or unit.

- "Ready for coupling" means: train or unit is braked, doors are closed and locked, flaps and coupler are ready for coupling.
- Indication of "Ready for coupling" should be transmitted to the approaching driver via radio (GSM-R) in scheduled cases or/and by lighting of one of the bottom front signal lights of the train/unit ready for coupling.

3.1.6.2.2 - Coupling

- Activation criteria: The driver operates the soft key "coupling" in the TDD (see *Document 612-03*) and enters the image "coupling". In this image all functions requested for preparation of coupling are provided, e. g. for opening the front or rear flaps, and information regarding the status for coupling is given.
- TCMS shall ensure that only one cab is activated as master. TCMS shall not accept another ID card in parallel and while running will ignore any further ID card and at Standstill trigger a train-wide traction-inhibition.
- TCMS shall ensure that coupling is possible in any possible train configuration.
- During connection of the couplers, TCMS shall accept the presence of two ID cards until the coupling is completed.
- All functions are available from the master cab.
- Cabs other than the master cab can only issue "local" commands unrelated to the train. TCMS will ignore all train-wide commands from these other cabs and the driver in the master cab will be informed about this situation by the TDD (see *Document 612-03*).
- Speed is limited by TCMS to 3 km/h and can be varied by the driver using the speed selector pos. 019 linear between 0 and 3 km/h.
- TCMS ensures that the selected speed is maintained and is not exceeded.
- After successful train coupling, the train composition is automatically entered and the holding brakes or a full service brake are applied train-wide. The driver shall confirm the train-composition in the TDD after which the train is automatically in In-service configuration.

3.1.6.2.3 - Uncoupling

- Operational scenario: The units are coupled and are both standing still.
- Activation criteria:
 - in the master cab: select in the TDD, image "coupling" for the couplers to be uncoupled and trigger the decoupling by confirmation by pressing "Enter" (see *Document 612-03*);
 - in all other cabs: push pos. 308 (see *UIC Leaflet 612-0*).
- TCMS shall ensure that uncoupling can be performed.
- TCMS shall uncouple the two units and trigger the "stand-by"-configuration for the decoupled slave.
- TCMS shall inform the staff that the units are not anymore coupled and may be moved apart by indication of the coupling status in the TDD-image "coupling" (see *Document 612-03*).
- Closing of flaps may be commanded manually in the TDD-image "coupling" (see *Document 612-03*) or automatically with $V > 45$ km/h.

In a degraded situation the couplers may be separated by a manual handle located at the couplers. It shall be sufficient to operate one handle to separate the two couplers. No precondition shall apply. TCMS shall trigger a train inauguration after this action.

3.1.6.3 - Restricted Operation: washing operation

- Operational scenario: the blowers are switched off and the speed is limited to 3 km/h.
- Activation criteria: soft key "washing" in the TDD (see *Document 612-03*).
However, the soft key for activating the washing program is only possible if:
 - the EMU/DMU, locomotive or driving coach is stationary;
 - direction of travel "F" or "R" has been selected;
 - the traction/dynamic brake controller (see *UIC Leaflet 612-0, pos. 020*) has been set to "0";
 - the main circuit breaker (see *UIC Leaflet 612-0, pos. 017*) has been switched on;
 - the driver's automatic brake controller (see *UIC 612-0, pos. 032*) is set to running position.
- After pushing the soft key "washing" in the TDD (see *Document 612-03*) the following applies:
 - TCMS sets the speed-limit according to the selected network
(SNCF/Trenitalia: $V_{\text{target}} = 3$ km/h, DB: $V_{\text{target}} = (1,5 \pm 0,5)$ km/h).
The ASC-system is switched on automatically in order to maintain the selected speed-limit;
 - TCMS automatically applies the holding brake to secure the train at standstill. The driver shall use the direct brake (pos. 037) or the traction/dynamic brake controller (see *UIC Leaflet 612-0, pos. 020*) in any traction force position in order to release the holding brake and start the train for washing;
 - when the traction/dynamic brake controller (see *UIC Leaflet 612-0, pos. 020*) is shifted from "F" to "0", the EMU/DMU or locomotive will continue to roll without power (coasting).
- TCMS shall ensure that only one cab is activated as master. TCMS shall not accept another ID card in parallel and while running will ignore any further ID card and at Standstill trigger a train-wide traction-inhibition.

- Train-wide control can be executed in this configuration from the master cab.
- All functions are available from the master cab.
- Cabs other than the master cab can only issue "local" commands unrelated to the train. TCMS will ignore all train-wide commands from these other cabs and the driver in the master cab will be informed about this situation by the TDD (see Document 612-03).
- Speed can be varied by the driver using the speed-selector (see *UIC Leaflet 612-0, pos. 019*) linear between 0 and 3 km/h.
- By driver-activation of the soft key "washing finished" on the TDD (see *Document 612-03*) the normal operation is activated again.

3.1.6.4 - Restricted Operation: signalling, radio system and/or radio channel and/or energy sub-system transitions (change in characteristics of the railway network section)

If a traction and/or leading vehicle passes from one specific network section to another, its system-relevant functions shall be adapted to the network section-specific conditions by means of transition and all following EMU/DMU or locomotives in the train shall be configured to achieve compliancy.

The transition process is subject to the following propositions:

- the driver is responsible for carrying out the transition, if it is not automated;
- in the case of a stationary transition, the change-over is carried out at standstill at a convenient halt near the border prior to or after crossing the border;
- in the case of a transition while the train is in motion, the commutation is carried out during the journey within a route section intended for this purpose;
- depending on the situation, the transition may be triggered or monitored by means of signals from the infrastructure.

The control operation shall meet the following requirements:

- the transition process control shall be designed to prevent the accidental triggering of a transition;
- the driver shall be able to see clearly if the triggered transition process has been fully completed;
- the activated network section selection shall be visible and verifiable by the driver in the activated driver cab.

Train safety equipment:

- by activating the applicable train safety information in the activated driver cab, the status of each operation in the automatic train protection system shall be clearly visible;
- train safety devices, specific to one network section and not used elsewhere, shall be switched and positioned during transition in order to ensure that the vehicle antennae etc. of these systems do not interfere with the infrastructure;

- depending on the network transition, if a fault occurs during the transition process of the train safety equipment, an automatic emergency brake can be applied.

Network section selection process:

- if requested by the Infrastructure Register: MCB off and, depending on network section, pantograph down;
- automatic or manual selection of the new network section;
- confirmation of the selected network section by the driver in the TDD (see *Document 612-03*);
- configuration is performed automatically;
- if the position of the EMU/DMU or locomotive in the train is known by TCMS in absolute distances, the lifting of pantographs / closing MCB's can be "way-delayed", i.e. after each unit concerned enters the new line section;
- all EMU/DMU and locomotives are configured again (pantograph filling position) and all of the prepared EMU/DMU and locomotives are entirely within the new network section → pantograph up → pantograph lifted for the new network section;
- pantograph detects the new contact wire voltage in the new network section (validity check: catenary voltage with network section selection, optionally by GPS or Euro-balise) and continues with the new configuration for the selected network section;
- after new configuration is complete, TCMS validates the set network sections of all slave EMU/DMU and locomotives to the master EMU/DMU, locomotive or driving coach. If a traction vehicle cannot select the new network section, the EMU/DMU or locomotive shuts down (pantograph down) and reports a fault;
- in case of an error in selection detected by TCMS, TCMS shall cancel the transition and lower the pantographs.

Language:

- There are two kinds of language message:
 - coded messages (e. g. ETCS, GSM-R, TCMS information): this shall be displayed in the language requested by the Driver ID card (see *UIC Leaflet 612-0, pos. 036*). This pre-selected language can be changed by the driver who may select another language on any DDU by operating hard key K1.2 (language selection, see *Document 612-01*);
 - plain messages: data which can only be transferred and not processed by TCMS therefore no change of language is possible.