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Railway applications - Radio remote control system of traction vehicle for freight traffic in multiple traction operation

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English version

Railway applications
Radio remote control system of traction vehicle for freight traffic in multiple traction operation

This CENELEC Report has been prepared by SC 9XA, Communication, signalling and processing systems, of Technical Committee CENELEC TC 9X, Electrical and electronic applications for railways. It was approved by SC 9XA on 1999-10-05 and endorsed by the CENELEC Technical Board on 2000-04-01.

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CENELEC
European Committee for Electrotechnical Standardization
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Foreword

This CENELEC Report was prepared by SC9XA, Communication, signalling and processing systems, of the Technical Committee CENELEC TC9X, Electrical and electronic applications for railways.

It was approved by SC 9XA on 1999-10-05 and endorsed by the CENELEC Technical Board on 2000-04-01.

Introduction

The purpose of this report is to serve as a guideline for the application of radio remote control system of traction vehicles for multitraction operation.

The European Standard EN 50239 is applicable for the radio remote control system of traction vehicles for freight traffic. This standard sets out 14 application examples. It does not include an example of multitraction operation; it only includes an example whereby a traction vehicle is controlled by an appropriate driving trailer in a train consist (example 13 of the EN 50239).

The purpose of this report is to serve as a guideline for the application of radio remote control system of traction vehicles for multitraction operation.

This report is based on EN 50239 and provides an indication of the additional requirements relevant for the multitraction application.

1 General

Multitraction is used whenever:

- the tractive effort of the traction vehicle is not sufficient for the particular operational application,
- different independent trains are linked together to form a longer train consist.

In a train consist with more than one traction vehicle, one of the traction vehicles is always the Leading Traction Vehicle (LTV). The other traction vehicles contained in the overall train consist are controlled and monitored by the LTV. This arrangement means that communication between the different traction vehicles is necessary.

Communication can be achieved by means of a cable link or a radio link. A radio link is for example necessary whenever there are wagons between the traction vehicles and whenever these wagons do not have any communication cables with appropriate infrastructure.

Commands are generally sent by the operating personnel only to the LTV.

If there are wagons between the traction vehicles, the effect of longitudinal dynamic effort and braking behaviour must be taken into consideration during risk analysis. This is applicable particularly when the overall train consist or individual train segments are very long and/or heavy.

It should be possible for every traction vehicle to be used as a LTV or as a Guided Traction Vehicle (GTV) in the train consist.

In all circumstances the operator should have a clear view of the track in the direction of travel.

With a radio link, particular attention should as a minimum be given to the following points:

- **Allocation of traction vehicles in the train consist**
  - location and address of the GTV and LTV in the train consist;
  - definition of direction of travel for each traction vehicle;
  - it should be impossible for any LTV to control any GTV from another train consist at any time.

- **Consideration of special aspects of a radio link**
  - maximum number of all traction vehicles in a radio system:
    - unique address for each traction vehicle,
    - address stock,
    - number of traction vehicles or trains that can be simultaneously operated in the area of coverage,
    - response time;
  - radio response times;
  - radio interference/radio interruption:
    - local infrastructure (e.g. stationary repeaters),
    - train consist equipment (e.g. multiple receivers and repeaters on the train),
  - radio transmission system (see 9.2.4 of EN 50239):
    - EN 50159-1 closed transmission system, or
    - EN 50159-2 open transmission system;
  - area of application;
  - consideration given to regulations in the country of use;
  - availability of the radio channel:
    - exclusive or non-exclusive frequencies in the area of application,
    - guaranteed time for connection establishment or command transmission depending on the assigned frequency channel.

- **Response after radio interruption**
  (by the operator and/or automatically by the train consist)
  - depending on the train length and weight involved;
  - depending on whether the Brake Pipe (BP)is segmented or unsegmented;
  - depending on the train speed;
  - depending on the duration of radio interruption;
  - depending on the local topography (e.g. tunnels).

2 Typical examples in multiple traction applications

The following fundamental distinctions are made for applications:

- segmented or unsegmented BP;
- operation of LTV
  - by means of portable transmitter outside the train consist,
  - on a driving trailer,
  - on the LTV;
- braking via BP only from the LTV or from several points in the train consist;
- two or more traction vehicles in the train consist.

Five typical combination examples are set out annex A.

3 Information for risk analysis

Example 13 of EN 50239 describes a situation in which <u>one</u> traction vehicle is controlled by means of radio remote control from an appropriate cabin.

The conditions specified for the equipment of the drivers cab are also applicable as minimum requirements for multitraction operation.

The safety level as defined in EN 50239 is based on unsegmented BP over the complete train consist. If a segmented BP is used additional measures shall be taken to maintain the same safety level as a minimum.

For the special situation in which a multitraction train consist is controlled by means of a portable remote control transmitter outside the driver’s cab, the risk considerations of examples 1-12 detailed in EN 50239 can also be taken into consideration.

However, the safety-relevant functions detailed in Tables A.1 – A.4 of EN 50239 should be extended to include the following safety-relevant functions for multitraction operation:

1) Coordination of power/throttle and brake control

   If an error occurs in the coordination of the power/throttle and brake control between the traction vehicles this may result in a dangerous situation.

   If coordination is no longer possible (e.g. as a result of the radio link being interrupted), risk reduction measures are carried out, particularly with respect to ensuring compliance with the braking distances and ensuring protection against derailing. These measures can be carried out by the operator and/or by means of an automatic system response.

2) Unintended train separation

   If a segmented BP is used the integrity of the train consist (i.e.no loss of vehicles or wagons) shall be monitored with additional measures.

4 Track infrastructure

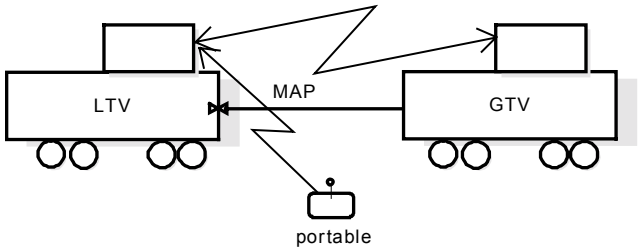
In general, due consideration should be given to the local circumstances and the regulations of the countries of use with respect to existing track infrastructure, e.g.:

- signal or block section lengths;
- length of siding(overtaking) tracks.

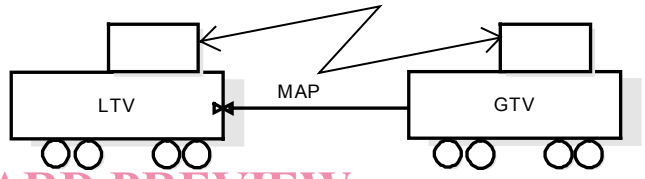
Annex A

Typical multitraction application examples

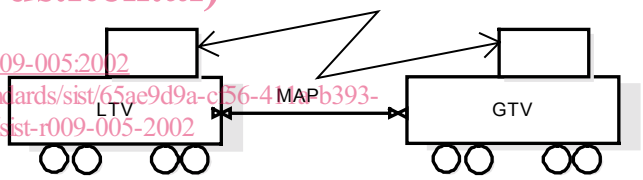
1.) Contrtrolled by portable transmitter
Unsegmented MAP, controlled on one side



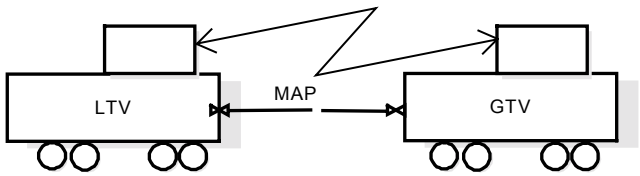
2.) Controlled by traction vehicle
Unsegmented MAP, controlled on one side



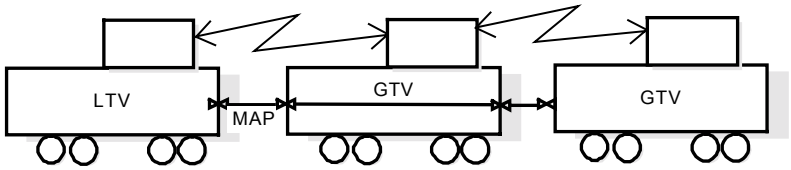
3.) Controlled by traction vehicle
Unsegmented MAP, controlled on both sides



4.) Controlled by traction vehicle
Segmented MAP, each MAP controls its MAP segment



5.) Controlled by traction vehicle
Unsegmented MAP, controlled by all traction vehicles



MAP = Main Air Pipe
LTV = Leading Traction Vehicle
GTV = Guided Traction Vehicle