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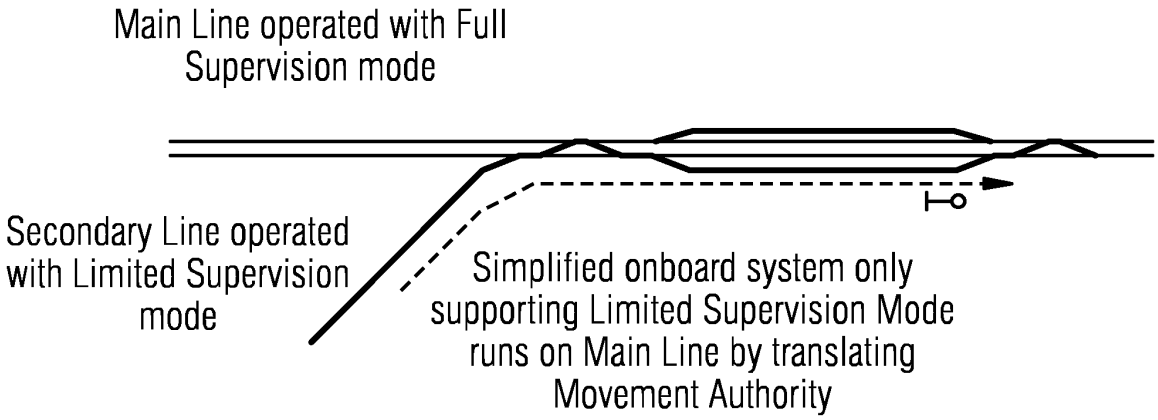
(54) Train control system on the basis of ETCS "Full Supervision" mode

(57) A train control system supporting operation on lines equipped with ETCS «Full Supervision» mode is disclosed wherein a new onboard function is provided. The new onboard function translates «Full Supervision» movement authorities into «Limited Supervision» movement authorities.

FIG 2



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Description

[0001] The present invention relates to a simplified train control system supporting operation on lines equipped with ETCS «Full Supervision» mode according to the preamble of claim 1.

[0002] The European Tranin Control System - hereinafter related to as ETCS - is a standardized train control system, providing a maximum of functionality and safety compared to most other existing proprietary national train control systems. The ETCS requires a relatively complex technology at a resulting price since the railway tracks and the railway vehicules have to upgraded by particular hard and software. Trackside communication units, such as balises and loop cable, have to be installed to transmit train contral data, such as the actual position, signal status, break curves, track inclinations and the like. On the side of the railway vehicle an ETCS control unit has to be installed in order interprete the data telegrams received from the trackside communication units. Details on this system are available under [1] which is herewith incorporated by reference.

[0003] An example of a special embodiment with a RFID-tag of a train control system is disclosed in EP 2 193 972 B1 [2].

[0004] The ETCS onboard system is designed to operate in a number of different operating modes, depending on the requirements of different operational situations. During normal running of a train the ETCS system provides a maximum of supervision functionality, it is then in an operating mode called «Full Supervision». In this mode, the ETCS also provides full cab signaling, thereby eliminating the need for line side signals. Of course, this mode results in the requirement to support the highest safety level SIL 4 according to the relevant CENELEC standards. Other modes have been designed to e.g. perform shunting operations («Shunting» mode), to run onto a track block that is occupied («On Sight» mode) and to operate in degraded situations («Staff Responsible» mode). Some of these modes are commanded by the trackside signaling system, while others are either selected by the driver or are activated automatically as the result of specific operational situations.

[0005] To cater for applications where system installation and implementation cost is critical and/or where not all the ETCS functionality of the Full Supervision mode is required, a special operating mode has been created in the ETCS standard. This mode is called «Limited Supervision». Like the «Full Supervision» mode this mode is commanded by the trackside by sending the corresponding «Movement Authority» in the form of a standardized data telegram to the train. In this mode only a restricted set of information is displayed to the driver in the train-side display of the ETCS control computer, requiring him to drive according to information displayed by traditional line side signals. ETCS is therefore only operating as background supervision, as the driver is acting to information not generated by the ETCS. This allows at the trackside to use incomplete data or data that does not comply with the high safety requirements of cab signaling. «Limited Supervision» mode is especially helpful when applying ETCS onto existing signaling systems, but also used where cab signaling is explicitly not wanted for operational reasons.

[0006] While the ETCS standard contains the «Limited Supervision» mode to allow implementation of simplified ETCS trackside equipment it does not permit the implementation of a simplified onboard system that only supports «Limited Supervision» mode, but not «Full Supervision» mode. This would however be technically possible, therefore also allowing the onboard system to be designed to lower safety requirements and/or with a simplified driver machine interface, resulting in a number of benefits such as reduced cost, space requirements for driver machine interfaces etc. While such an onboard system would not comply with European Legislation for ETCS it could be used in some applications and markets.

[0007] The drawback of such a simplified «Limited Supervision» onboard system would be that it can not operate on lines commanding «Full Supervision» operation. This could be problematic e.g. in applications where trains are operating on secondary lines under «Limited Supervision» mode, but also have to operate over main lines where «Full Supervision» mode is used, as shown in Figure 1.

[0008] The goal of the present invention is to provide a simplified onboard system which is also operates on lines commanding «Full Supervision».

[0009] This goal is achieved according to the present invention by a train control system supporting operation on lines equipped with ETCS «Full Supervision» mode, wherein an onboard function is provided in the train control system which translates onboard a «Full Supervision» movement authority received from a line side communication unit, such as an ETCS balise, into a «Limited Supervision» movement authority.

[0010] Therefore, the present invention provides a system that allows train control computer to cope with the incomplete data telegrams that might be transmitted in the Limited Supervision mode. Otherwise, it might happen that the onboard train control unit misinterprets a Full Supervision movement authority as being incomplete which results in an emergency brake of the train.

[0011] A movement authority can be explained as follows: ETCS, in particular ETCS Level 1, uses principally ETCS-balises, so-called Euro Balises - as communication units. As mentioned earlier, the most important information transmitted by the ETCS communication units, such as an Euro balise or an RBC, are track gradient, speed limits, break curves or stop positions. These information form together with the ETCS mode the so-called Movement Authority (MA).

[0012] The working principle of the invention will now be described more in detail with reference to the accompanying drawings wherein:

[0013] Figure 1

problem of onboard only supporting «Limited Supervision mode;

[0014] Figure 2
onboard system only supporting «Limited Supervision» mode running on line requiring «Full Supervision» mode.

[0015] To solve this problem a new onboard function is proposed that translates "Full Supervision" movement authorities into "Limited Supervision" movement authorities.

[0016] If required, this function could be enabled, respectively disabled by additional information added to each Movement Authority. This can be helpful on railway networks where ETCS Full Supervision mode is implemented also on lines where trains supporting only Limited Supervision mode shall not run, e.g. where only limited line side signaling is provided. To prevent this additional information impacting trains and/or railway vehicles supporting ETCS Full Supervision mode, this information can be transmitted as a special data packet, usually «Packet 44», that is part of the ETCS standard. This data packet can be ignored by onboard ETCS bord computer/systems that are not specifically designed to interpret it. The definition of a movement authority can e.g. be also found in document [3] on page 43. Document [3] is herewith incorporated by reference..

[0017] This new function could be used in both ETCS Level 1 and Level 2 applications.

List of reference signs, glossary

[0018]

ERTMS	European Rail Traffic Management System in brief: ERTMS = ETCS + GSMR
ETCS	European Train Control System
GSMR	Global System for Mobile Communications - Railways
LEU	Line side Electronic Unit

List of cited literature and sources

[0019]

[1] http://www.ertms.net/
European Railway Traffic Management System
[2] EP 2 193 972 B1
«Train safety system»
Siemens Schweiz AG, 8047 Zürich
[3] ETCS
Implementation handbook
UIC ISBN 2.7461-1499-2

Claims

1. Train control system supporting operation on lines equipped with ETCS «Full Supervision» mode,
characterized by
an onboard function translating «Full Supervision» movement authorities into «Limited Supervision» movement authorities.

2. Train control system according to claim 1,
characterized by
enabling the onboard function by additional information added to each movement authority.

3. Train control system according to claim 2,
characterized by
the additional information being transmitted as a special data packet that is part of the ETCS standard.

4. Train control system according to claim 3,
wherein
the special data packet is the «Packet 44» of the ETCS standard.

FIG 1

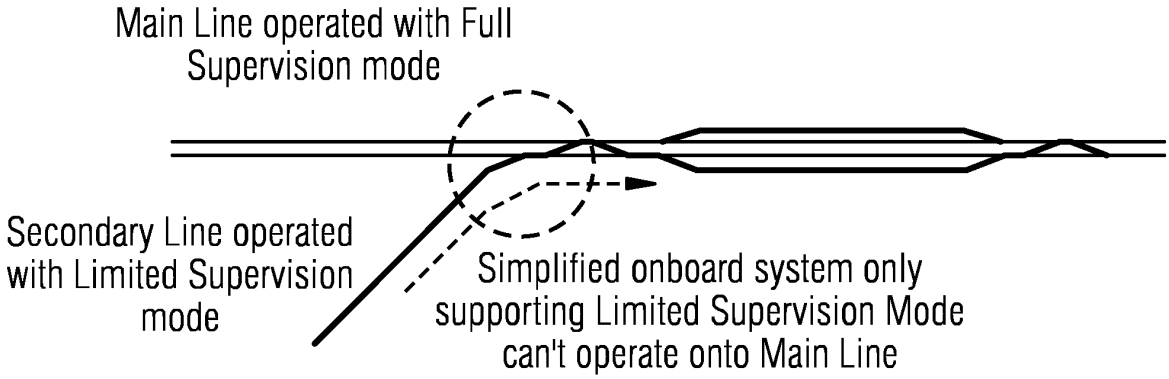
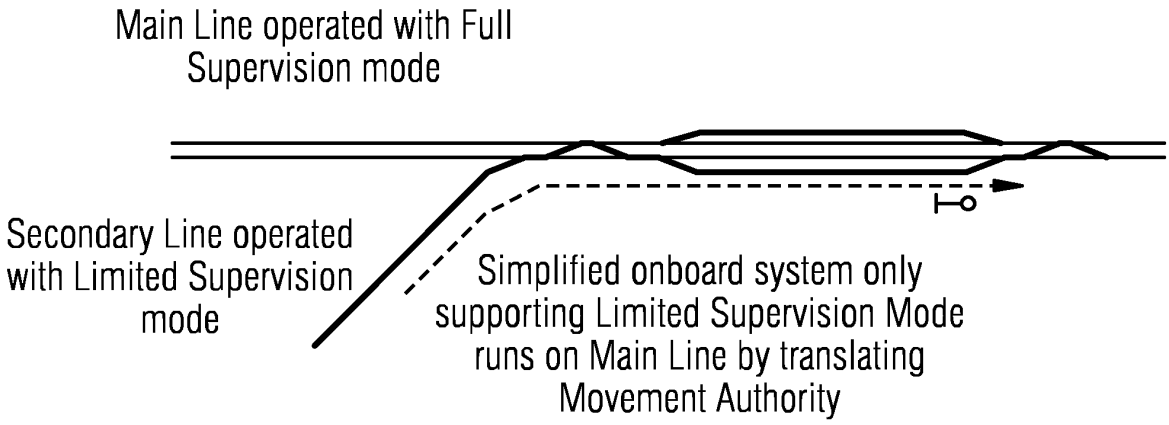

Main Line operated with Full Supervision mode
Secondary Line operated with Limited Supervision mode
Simplified onboard system only supporting Limited Supervision Mode can't operate onto Main Line

FIG 2


Main Line operated with Full Supervision mode
Secondary Line operated with Limited Supervision mode
Simplified onboard system only supporting Limited Supervision Mode runs on Main Line by translating Movement Authority

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 2193972 B1 **[0003] [0019]**