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Javni prevoz – Sistemi za časovno razporejanje in nadzor cestnih vozil – 1. del: Definicija po WORLDFIP in aplikacijska pravila za prenos podatkov z vgrajeno opremo

Public transport - Road vehicle scheduling and control systems - Part 1: WORLDFIP definition and application rules for onboard data transmission

Öffentlicher Verkehr - Planungs- und Steuerungssysteme für Straßenfahrzeuge - Teil 1: WORLDFIP Definitions- und Anwendungsregel für bordgebundene Datenübertragung

Transport Public - Systèmes de planification et de contrôle des véhicules routiers - Partie 1: Regles de définition et d'application WORLDFIP pour les systemes embarqués de transmission de données

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Public transport - Road vehicle scheduling and control systems - Part 1: WORLDFIP definition and application rules for onboard data transmission

Öffentlicher Verkehr - Planungs- und Steuerungssysteme für Straßenfahrzeuge - Teil 1: WORLDFIP Definitions- und Anwendungsrichtlinien für bordeigene Datenübertragung

This European Standard was approved by CEN on 1 April 2004.

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Contents

Foreword

This document (EN 13149-1:2004) has been prepared by Technical Committee CEN/TC 278 "Road Transport and Traffic Telematics", the secretariat of which is held by NEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2005, and conflicting national standards shall be withdrawn at the latest by February 2005.

This document supersedes ENV 13149-1:1999.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

The present situation is the following:

— A large number of Vehicle Scheduling and Control Systems (VSCS) do not use a data bus, resulting in

  — point to point data links with expensive cabling which cannot be preinstalled during the manufacturing of the vehicle, increasing the cost of the system

  — different proprietary transmission protocols which have to be implemented as and when required

  — difficulty in changing the provider of a given type of equipment as no compatibility exists between different providers of the same type of equipment

— Some systems implement the VDV IBIS bus specification, but:

  — IBIS bus is very slow and no longer covers the need for high speed data transmission between equipment

  — IBIS bus is not an open system and does not cover some of the necessary messages

  — practically every VSCS manufacturer has been obliged to implement a second high speed data bus which is proprietary, resulting in no possibility of interchanging equipment with other manufacturers

The buses, which are proposed by CEN/TC278, aim at avoiding the preceding difficulties with the following characteristics:

— high capacity and high speed data bus

— consistent workplan ensuring interoperability down to the message level

— low cost solution

— already standardised data bus

— large number of already existing and future applications outside the VSCS area, ensuring the existence of equipment on the market, the progressive decrease of the cost of the necessary chips and the timelessness of the solution

— existing chips and basic software up to and including the layer 7 of the ISO 7 layer communication model and existing developments tools, minimising the development costs

The buses proposed by CEN/TC 278 have been chosen among others through a progressive selection process. This work took into account a flexible approach to the range of applications, the potential traffic loading under different operating circumstances and the definition of objective criteria for a transmission bus. The candidate buses were evaluated against the criteria in terms of performance, cost, industrial support and the existence of maintained documents.

1 Scope

The present document specifies the choice and the general application's rules of an onboard data transmission bus between the different equipment for service operations and monitoring of the fleet. This applies to equipment installed onboard buses, trolleybuses and tramways only as part of a bus fleet operation. It excludes tramways when they are operated as part of a train, subway or metro operation. The equipment includes operations aid systems, automatic passenger information systems, fare collection systems, etc....

The equipment directly related to the functioning of the vehicle (driver dashboard, engine management, brake systems, door opening systems, etc...) are excluded from the scope of the present document and are dealt with in other standardisation bodies.

Two alternative transmission buses will be accepted. This document refers to the so called WORLDFIP bus. A second set of documents will be published for the second solution (so called CAN). There is no ranking between the two solutions and the selected bus system, between the two standardised alternatives, shall be subject to an agreement between each transport operating organisation and its equipment providers.

The present document refers to the so-called OSI transmission model and covers OSI layers 1,2,7, the other layers are not used in our applications.

The present document covers the link between equipment inside a single vehicle. Although it could be applied to multiple vehicles, this application is not explicitly covered by this document.

The present document is the first part of a set of standards related to the onboard transmission bus, which will comprise, for each allowed transmission bus, the following set of documents:

a) choice of the bus and general application's rules (EN 13149-1)

b) cabling specifications (EN 13149-2)

c) message's content specifications (prCEN TS 13149-3)

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 13149-2	*Public transport - Road vehicle scheduling and control systems - Part 2: WORLDFIP cabling specifications*
EN 50170	*General purpose field communication system*
EN 61158-2:1994	*Fieldbus standard for use in industrial control systems; part 2: physical layer specification and service definition (IEC 61158-2:1993)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply:

3.1
network
system formed by a particular implementation of the data transmission bus

3.2
presence variable
variable transmitted by a device to indicate that it is present on the bus

4 Typical structure of the network

4.1 Outline functions of the network

The network is provided as a means of communication between equipment, not as a means of power distribution. It will provide for the Physical, Data Link and Application layers. Power distribution may be provided within the same cable (on different wires) provided it does not contravene other requirements of this document. The following gives a brief summary of some of the main features of the network:

— Essentially fieldbus linear topology

— Periodic (Cyclic) data

— A periodic (Events) data

— Message and file transfer

— Provides for control and information transfer

— Deterministic performance-parametering of priority order and periods

— Bus arbitration to ensure time critical data is undisturbed by less critical events and messages

— Producer consumer model with provision to broadcast data

— Open network

— Self clocking

— Half duplex

— Medium redundancy possibility

— Remote monitoring

— Intelligent and non-intelligent devices

— Distributed database

— Error detection

4.2 Diagram of preferred implementation

Figure 1 shows a diagram of the preferred implementation.

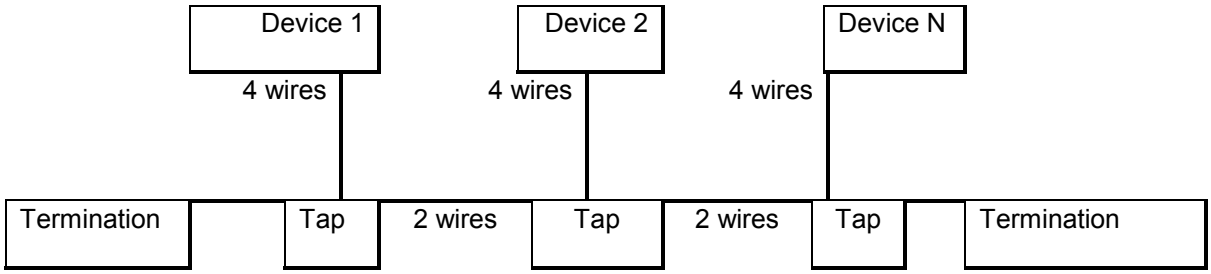

Figure 1 — Preferred implementation

5 Specifications for the on-board data transmission system

5.1 Data transmission bus

The data transmission bus shall be as defined in EN 50170, which is generally known as WorldFIP.

5.2 General rules

5.2.1 Introduction

These general rules are derived from EN 61158-2, and particularly those referring to the Medium Attachment Unit (MAU): 1Mbits/s, voltage mode, wire medium. The following are particularly relevant and shall apply.

5.2.2 Network medium

This consists of shielded twisted pair wires mainly used in a linear topology

5.2.3 Transmission speed

The devices connected to the bus shall operate at the nominal rate of 1Mbit/second.

5.2.4 Coupling mode

The coupling of a device to the medium shall be by the voltage mode (parallel coupling) using transformers.

5.2.5 Redundant media

Four wire configurations providing a medium redundancy network are permitted but not mandatory

5.2.6 Network configuration rules

The network configuration rules of EN 61158-2:1994, section 12 shall apply with the exception that the limit to 32 devices on a bus applies only to a bus segment. The bus can consist of more than one segment resulting in more than 32 devices attached to the same bus.

5.2.7 Encoding

The Preamble and Delimiters coding shall be as defined by EN 61158-2:1994 section 9. CRC coding shall be as defined by EN 50170.

5.2.8 Turnaround time

The turnaround time TR of the different devices shall be set to 10 µs. plus or minus 0,025µs.

5.2.9 Waiting time at the bus arbiter level for an answer

The waiting time (or silence time) for an answer after requesting a given variable or message (when the corresponding equipment fails to answer) shall be set to 150µs. plus or minus 0,025µs.

5.2.10 Jabber inhibit

The jabber inhibits requirements of EN 61158-2:1994 section 12 shall apply.

5.2.11 Connectors

The connectors referred to in EN 61158-2:1994 section 12 are not mandatory. They are defined in EN 13149-2.

5.2.12 Cables

Cables are referred to in EN 61158-2:1994 section 12 and the corresponding specifications are laid down in EN 13149-2.

5.3 Conformance Class

The network shall operate to electrical conformance class CH as defined in EN 50170.

5.4 Bus Arbiter

The following rules apply:

a) There shall be at least one bus arbiter but any device can be nominated as the main bus arbiter.

b) Secondary bus arbiters are permitted to suit the application.

c) It shall be possible to modify the arbitration table easily by updating the memory.

d) It shall be possible for the arbiter to store and manage at least four arbitration tables, which can be received and switched via the bus

e) The arbiter shall provide for a minimum of 64 Kbytes of dedicated memory for the arbitration function.

5.5 Presence Variable

Each device connected to the bus shall have one variable, which acts as a presence variable.

Annex A
(informative)

CEN/TC 278 Internal report on requirements for on board transmission between equipment

TABLE OF CONTENTS

1-Introduction:

1-1-Scope:

This informative annex is aimed at explaining the path followed to choose the transmission buses.

The purpose of this document is to specify the main requirements of a transmission bus to be used between the on board equipment of a Vehicle Scheduling and Control System for road public transport vehicles. It corresponds to the Work Item 3.1.1 of the program of work of the CEN TC278/WG3 "Public Transport". It applies to equipment installed onboard buses, trolleybuses and tramways only as part of a bus fleet operation. It excludes tramways when they are operated as part of a train, subway or metro operation. This document has been the basis for the rest of the standardisation work on the on board data transmission bus, it has first been published as part of an Internal Technical report.

The use of this transmission bus is limited to the systems and equipment on board the vehicles of urban and interurban public transportation (buses and tramways when they are operated as buses, excluding transportation in complete individual sites such as trains or tramways operated as trains) that are designed for the operation of public transportation (operation aid systems, automatic passenger information systems, fare collection systems, maintenance aid systems).

The functions corresponding to the management of the vehicle itself (such as for example engine control, brake control, etc.) are totally excluded from the scope of work of the present document.

Normally the scope of the document is limited to the transmissions taking place onboard a single vehicle, the transmission between more than one vehicle may require a separate intervehicle bus. However, it would be preferred (but it is not taken as mandatory for the definition of the required bus), to be able to extend the bus through multiple vehicles (3 at the maximum) to avoid the complication of an intervehicle bus. To evaluate this possibility, the additional transmission load corresponding to the addition of a supplementary vehicle will be defined.

The Tables given in chapter 4 to evaluate the transmission busload are only rough estimates and shall not been taken as mandatory.

1-2-Environment of production:

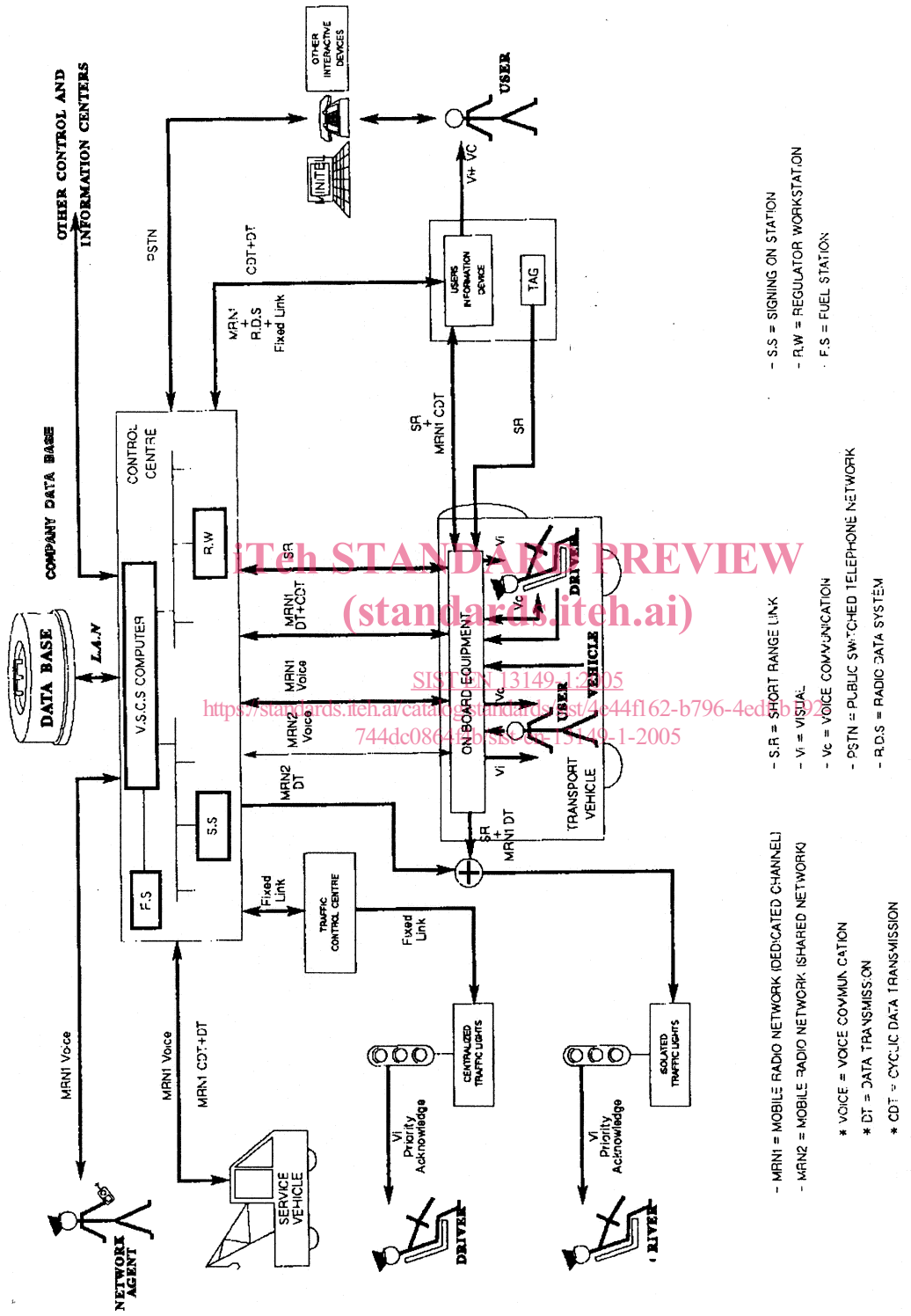

Figure A.1 – VSCS General Description

The present document has been produced by a subgroup of the working group N°3 "Public Transport" of the Technical Committee N°278 of CEN.

1-3-Definitions:

-Vehicle Scheduling and Control Systems (VSCS)/Automatic Vehicle Monitoring Systems (AVMS):

System equipment on board the vehicle of urban and interurban public transportation (buses and tramways, excluding transportation in complete individual sites such as trains) and the corresponding equipment installed on ground, that are designed for the operation of public transportation (operation aid systems, automatic passenger information systems, maintenance aid systems)

-Transmission bus:

A set of wires connecting together the different on board VSCS/AVMS equipment for powering and data transmission, and the associated transmission protocols

2-General description of the overall VSCS:

Generally speaking a comprehensive VSCS is a system based on the automatic localisation of the Public Transport vehicles in a central control room cyclically or on demand with a two-way radio data transmission between each vehicle and a central computer. The vehicles are equipped with microcomputers linked to various on board sensors, actuators and peripherals and specially a driver console allowing the system to communicate with the driver.

The localisation information is used for various purposes, for example:

-calculation of advances or delays of the vehicles as compared to theoretical schedules and/or headway monitoring, and transmission of this information to the driver and to the central control room operator

-transmission to the driver of the orders of departure in terminals or in selected stations

-management of the large deviations from the theoretical schedule by specific algorithms acting for example on departure orders

-management of the connections between different Public Transport lines

-information of the passengers at home, at stops and onboard the vehicle

-management of the fare collection function

-vehicle priority at intersections

-Etc.

On the other hand, the data transmission system coupled with the on board system is used to acquire information (statistics on the travel times, on the functioning of the vehicle, on the passengers and the corresponding revenues, etc.) and to load the vehicle with different data (fare tariffs, black lists of tickets, description of the lines, schedules, etc.).

Not all of the systems are comprehensive and there exist systems that have only a very limited subset of these functions. For example there exist fare collection systems which are not linked to a localisation system and which have no data communication with a central control room except perhaps by exchanging memory modules. Nevertheless as soon as these limited systems have on board equipment they will make use of the transmission bus.

2-1-Functions of the system:

The VSCS may implement a subset or all of the main following functions:

-Voice communications management between the mobiles and the Central Control Room