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Vägtrafikinformatik – Kollektivtransporter – Planerings- och styrsystem för vägfordon –
Del 8: Fysiskt lager för IP-kommunikation

Public transport – Road vehicle scheduling and control systems –
Part 8: Physical layer for IP communication

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Dokumentet är framtaget av kommittén för Vägtrafikinformatik, SIS/TK 255.

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Transport public - Systèmes de planification et de contrôle des véhicules routiers - Partie 8: Couche physique pour communication IP

Öffentlicher Verkehr - Planungs- und Steuerungssysteme für Straßenfahrzeuge - Teil 8: Physikalische Schicht für IP-Kommunikation

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Foreword

This document (CEN/TS 13149-8:2013) has been prepared by Technical Committee CEN/TC 278 “Intelligent transport systems”, the secretariat of which is held by NEN.

EN 13149, *Public transport — Road vehicle scheduling and control systems*, is composed of the following parts:

- Part 1: WORLDFIP definition and application rules for onboard data transmission;
- Part 2: WORLDFIP cabling specifications;
- Part 3: WorldFIP message content (CEN/TS 13149-3);
- Part 4: General application rules for CANopen transmission buses;
- Part 5: CANopen cabling specifications;
- Part 6: CAN message content (CEN/TS 13149-6);
- Part 8: Physical layer for IP communication (CEN/TS 13149-8; the present document).

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Introduction

The Technical Specifications in the EN 13149 series provide rules for data communication systems on-board public transport vehicles. Part 8 together with part 7 and part 9 describes a complete solution parallel to, but independent of, parts 1-3 and part 4-6.

Public Transport (PT) vehicles have an increasing array of information and communications systems, including ticket machines, Automated Vehicle Location (AVL) systems, destination displays, passenger announcement systems, vehicle monitoring systems etc. Other systems are beginning to be included such as advertising screens, tourist guides, WiFi “hotspots” and infotainment.

These systems may be provided by a number of different suppliers, and may need to be integrated. For instance a ticket machine may need location information to update fare stages; next-stop and destination information may be drawn from schedule information held in the ticket machine; and location systems may be used to drive signal priority requests.

In addition, equipped PT vehicles will often have communications facilities to enable voice and/or data to be exchanged with the intermodal transport control system centre, other PT vehicles, PT infrastructure, and roadside devices (for instance in requesting priority at traffic signals). Many types of communication channel are utilised, including public and private wireless communication networks.

Without a clear technology framework, integrating these systems would require complex technical discussions every time a device is procured.

A large number of current and future communication networks will use the Internet Protocol (IP) as a core network technology. Existing parts of EN 13149 are not consistent with an IP network and do not support the use of associated protocols. This makes it difficult for integrated on-board systems to use modern networks efficiently.

If an IP approach is adopted, the PT vehicle begins to look like a local area network (LAN) of connected systems. In this context it is relevant to define a hardware network which makes use of IEEE 802 technologies – these are much the most widespread basis for IP LANs worldwide.

The parts 7 to 9 will describe this adaptation. This will facilitate:

— high quality intermodal passenger services based on intermodal PT information,

— integration of new PT services,

— lower cost, lower risks and a smoother onboard integration of PT equipment,

— more efficient operation and maintenance of onboard PT equipment, and

— more efficient development of PT components.

1 Scope

This Technical Specification specifies the physical layer of an onboard data transmission bus between the different equipment for service operations and monitoring of the fleet. This applies to equipment installed on board vehicles that are operating as part of a public transport network, i.e. in operation under public service contracts. This equipment includes operation aid systems, automatic passenger information systems, fare collection systems, etc.

Equipment directly related to the safety-related functioning of the vehicle (propulsion management, brake systems, door opening systems, etc...) are excluded from the scope of this Technical Specification and are dealt with in other standardization bodies. Interfaces to such equipment or safety-critical networks can be provided through dedicated gateways.

Part 8 covers the link between equipment inside vehicles consisting of one carriage only, e.g. buses and trolleybuses, as well as a set of carriages, e.g. trams and trains.

For the described application, three communication systems are standardised under EN 13149. There is no ranking between the three communication systems.

— Parts 1, 2 and 3 describe the WORLDFIP communication system;

— Parts 4, 5 and 6 describe the CANopen communication system;

— Parts 7, 8 and 9 describe the IP-based communication system.

Part 7[1] of the 13149 series specifies the **Network and System Architecture** for onboard equipment. It describes basic principles of communications including a general description of the network topology, addresses schematics, basic network services, a system overview and basic device architecture.

Part 8 of the 13149 series specifies the **Physical Layer for IP-communication** networks onboard PT vehicles. This part specifies the cables, connectors and other equipment including pin assignment and environmental requirements.

Part 9[2] of the 13149 series specifies in detail the **Profiles** of basic and generic **Services and Devices** as well as profiles of specific services and devices.

This part 8-1 specifies wired communication networks onboard PT vehicles which are based on the Ethernet specification IEEE 802.3 — 10 Base T and 100 Base Tx.

2 Normative references

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

EN 50328, *Railway applications — Fixed installations — Electronic power converters for substations*

IEEE 802.3xx:2000, *Standard for Information Technology – Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) access method and physical layer specifications*

ECE R118, *Fire protection*

[1] Part 7 is under development

[2] Part 9 is under development

EN 50155, *Railway applications — Electronic equipment used on rolling stock*

EN 60603-7, *Connectors for electronic equipment (IEC 60603-7, all parts)*

IEC 61156-6, *Multicore and symmetrical pair/quad cables for digital communications — Part 6: Symmetrical pair/quad cables with transmission characteristics up to 1 000 MHz — Work area wiring — Sectional specification*

3 Terms and definitions

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

3.1
consist
set of cars able to run in service, smallest entity in service

3.2
PT vehicle
smallest entity of a rolling stock

EXAMPLE bus, trolley bus, tramway, etc

4 Symbols and abbreviations

DC -	DC- in PoE
DC +	DC+ in PoE
ED	End Device
EMC	Electro Magnetic Capability
CFC	Chlorofluorocarbon
PoE	Power over Ethernet
RX-	Receive -
RX+	Receive +
TBD	To Be Defined
TX-	Transmission +
TX+	Transmission -

5 Requirements

5.1 General Remarks

The general requirements for Ethernet are specified in IEEE 802.3xx – the international standard for information technology. The following chapters provide specific requirements for the applications within the scope of this Technical Specification.

It is important to understand that electrical connections onto the communication network have important impact upon the network performance, and that the application is dependent upon the principles relevant to transmission lines rather than simple electrical power circuits.

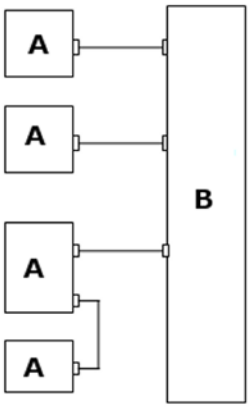
For the purposes of Part 8, all Ethernet ports of devices which are connected to the network shall work in accordance to:

— IEEE 802.3 10 Base-T, or

— IEEE 802.3 100 Base-Tx.

5.2 Network Structure

The general network structure (see figure below) is build up by end devices that are connected via switches.



Key

Box A End Device

Box B Switch

Figure 1 — Ethernet Structure

The following rules should be followed when installing an Ethernet network:

a) the maximum cable length between a switch and a device or between two switches shall not exceed 100m in the half-duplex mode, and

b) the number of connectors (Type 2, see Figure 4) in a cable between a switch and a device or between two switches shall not exceed six (6).

5.3 Cabling

The Ethernet cable used shall fulfil IEC 61156-6 category 5e requirements:

— It should be free from CFCs, halogen, silicone, and lead.

— The cable shall be arranged as a symmetric quad star and shall have suitable shielding for the installation environment (for example, with a primary shield of aluminium laminated foil, either with a copper drain wire or with a secondary braid of tinned copper wires).

— The cable impedance shall be 100 Ohms ± 15Ohms.

— The cross core section area shall be AWG22.

— The service temperature range shall be according to EN 50155 class TX.

— The cable shall conform to flame test requirements according to EN 50328.

— The cable shall be oil resistant.