



Technical Specification

ISO/TS 22741-10

Intelligent transport systems — Roadside modules AP-DATEX data interface —

Part 10: Variable message signs

*Systèmes de transport intelligents — Interface de données AP-
DATEX pour les modules en bord de route —*

Partie 10: Panneaux à messages variables

**First edition
2024-10**



COPYRIGHT PROTECTED DOCUMENT

© ISO 2024

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Symbols and abbreviated terms	2
5 Conformance	2
6 Physical architecture	5
7 User needs	6
7.1 Manage the control mode of the VMS	6
7.2 Manage the sign display	7
7.3 Monitor the sign display doors	7
7.4 Monitor the sign display mains power	7
7.5 Monitor the sign display power supplies	7
8 Requirements	7
8.1 Message sign control mode	7
8.1.1 Message sign control mode definition	7
8.1.2 Message sign control mode data exchange requirements	7
8.1.3 Message sign control mode capabilities	8
8.2 Message library	8
8.2.1 Message library definition	8
8.2.2 Message library data exchange requirements	8
8.2.3 Message library capabilities	10
8.3 Sign display	12
8.3.1 Sign display definition	12
8.3.2 Sign display data exchange requirements	12
8.4 Sign display doors	13
8.4.1 Sign display doors definition	13
8.4.2 Sign display doors data exchange requirements	13
8.4.3 Sign display door capability requirements	14
8.4.4 Sign display door design constraints	14
8.5 Sign display mains power	14
8.5.1 Sign display mains power definition	14
8.5.2 Sign display mains power data exchange requirements	14
8.5.3 Sign display mains power capability requirements	14
8.5.4 Sign display mains power design constraints	14
8.6 Sign display power supplies	14
8.6.1 Sign display power supplies definition	14
8.6.2 Sign display power supplies exchange requirements	15
8.6.3 Sign display power supplies capability requirements	15
8.6.4 Sign display power supplies design constraints	15
8.7 Sign display light sensors	15
8.7.1 Sign display light sensors definition	15
8.7.2 Sign display light sensors exchange requirements	15
8.7.3 Sign display light sensors capability requirements	15
8.7.4 Sign display light sensors design constraints	15
8.8 Sign display pixels	16
8.8.1 Sign display pixels definition	16
8.8.2 Sign display pixels data exchange requirements	16
8.8.3 Sign display pixels capability	16
9 Dialogues	16

9.1 Get elemental data.....16

9.2 Set elemental data 17

Annex A (normative) Data packet structures.....18

Annex B (normative) Requirements traceability matrix.....25

Bibliography.....30

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*.

A list of all parts in the ISO 22741 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

0.1 Background

A variable message sign (VMS) is an electronic traffic sign installed on the roadside to provide real-time traffic information to travellers, thereby improving their efficiency in using road traffic. A VMS is a major physical component of the intelligent transportation system (ITS), to which it supplies information for improvement of the safety on the road.

More VMSs are expected to be installed and operated due to increasing demand for the establishment of ITS and the replacement of existing VMSs which have exceeded their durability terms.

Operators of traffic management centres need real-time data exchange between a VMS and the centre in order to supply information to the VMS in real time and to control and manage the VMS.

However, no standards for the information transmitted and received between the traffic management centre and the VMS have been established, leading to the development of various protocols and their application to each VMS construction project. As a result, a variety of problems have arisen, including redundant investment in development costs and forced dependence on the protocol of the previous operator when replacing the existing VMSs with new ones.

This document therefore defines the data items (messages), formats and communication protocols (application, presentation, session and transport layers) required to ensure the interoperability of the information transmitted and received between the VMS and the traffic management centre, thereby ensuring interoperability between the VMS and the centre.

0.2 Overview

This document defines the message, the data elements making up the message, and the application layer profile for message transmission in order to ensure the interoperability between the VMS and the traffic management centre.

In particular, in order to ensure the interoperability between the VMS and the traffic management centre, the interoperability is developed based on OSI (open system interconnection) 7 layers. A collection of standard protocols for each layer is referred to as a "profile".

ISO/IEC TR 10000-2 defines the basic classification and object presentation of OSI profiles as follows.

- a) Interchange format and representation profiles define the information on and message structure of the data exchanged by applications.
- b) Application profiles define the transmission mechanism for data exchange (concerning OSI layers 5 to 7 – session, presentation and application layers).
- c) Transport profiles define the procedures and methods to exchange data packets between systems (concerning ;OSI layers 1 to 4 – transport, network, data link and physical layers).
- d) Relay profiles define the relaying function which enables the interconnection between systems while using different transmission profiles.

This document specifies "interchange format and representation" as defined in ISO/IEC TR 10000-2, covering the following points:

- 1) components and data elements of basic messages define the messages and detailed data elements which the operator of the traffic information system needs for operation of the VMS;
- 2) the data exchange communication profile defines the procedures and encoding methods for information exchange between the traffic management centre and the VMS.

0.3 Document approach and layout

This document specifies the following:

- a) physical architecture for variable message signs ([Clause 6](#));
- b) user needs that are deemed to be common to many types of field devices ([Clause 7](#));
- c) requirements for implementing the identified user needs, organized by major feature ([Clause 8](#));
- d) dialogues for exchange data between variable message signs and the central/local computer ([Clause 9](#));
- e) the data packet structures for the features defined by this document ([Annex A](#));
- f) a requirements traceability table that traces requirements to the design elements ([Annex B](#)).

In addition, a simplified version of the conformance table and the data packet structures are available electronically at <https://standards.iso.org/iso/ts/22741/-10/ed-1/en/>.

ISO 22741-1 provides additional details about how the ISO 22741 series relates to the overall ITS architecture.

Intelligent transport systems — Roadside modules AP-DATEX data interface —

Part 10: Variable message signs

1 Scope

Variable message signs (VMSs) are installed in areas where traffic managers identify a frequent need to convey information to the travelling public, such as upstream from interchanges to alert the public to downstream congestion in time for them to alter their routes. This allows traffic managers to improve the efficiency, safety and quality of traveller journeys.

In order to manage the operation of a VMS and the messages displayed, information exchange between the management systems and the VMS is needed.

This document identifies basic user needs for the management of light-emitting diode (LED) matrix VMSs and traces these needs to interoperable designs. This includes the ability to identify the device, its capabilities, and its status.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO 22741-1, *Intelligent transport systems — Roadside modules AP-DATEX data interface — Part 1: Overview*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 22741-1 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1 architecture

fundamental concepts or properties of a system in its environment embodied in its elements, relationships, and in the principles of its design and evolution

3.2 centre system

intelligent transport systems (ITS) component that provides application, management and/or administrative functions from a centralized location (i.e. not at the roadside)

3.3 message

data concept consisting of a grouping of data elements, data frames, or data elements and data frames, that is used to convey a complete set of information

3.4

traffic management system

centre system that monitors and controls traffic and the road network

3.5

variable message sign

VMS

field device that can display real-time traveller information to the public

Note 1 to entry: A VMS can display the message predefined in a stored library by the operator. A VMS can also immediately display the message desired by the operator.

Note 2 to entry: A VMS typically consists of one sign display, one sign controller, a cabinet that houses the sign controller, and potentially other components.

4 Symbols and abbreviated terms

ASCII	american standard code for information interchange
AP-DATEx	application profile-data exchange
CRC	cyclical redundancy check
I/O	input and output
ITS	intelligent transportation systems
MULTI	markup language for transportation information
NTCIP	national transportation communications for its protocol
RTM	requirements traceability matrix
UTF-8	universal coded character set transformation format – 8-bit
VMS	variable message signs

5 Conformance

This clause follows the rules defined in ISO 22741-1. [Table 1](#) traces each user need to a set of software features. [Table 2](#) traces each feature to a set of requirements. For a full understanding of these tables and codes, see ISO 22741-1.

NOTE 1 The development of the content of this document followed a formal systems engineering process, which entails:

- defining needs;
- developing a set of interface requirements;
- developing features as a part of a high-level design to meet the requirements;
- refining the interface requirements from Step 2 to reflect the high-level design; and
- developing a low-level design defining the dialogues and data elements necessary to implement the requirements.

The documentation omits the original requirements as they are refined in Step 4 and listing the original requirements would make the document highly redundant.

Table 1 — User need to feature conformance

User Need	Feature	Conformance
Inherited user needs		
ISO/TS 22741-2:2024, 7.1: Monitor the field device		M
ISO/TS 22741-2:2024, 7.3.1: Monitor cabinet doors		O
ISO/TS 22741-2:2024, 7.3.2: Monitor and control cabinet fans		O
ISO/TS 22741-2:2024, 7.3.3: Monitor and control cabinet heaters		O
ISO/TS 22741-2:2024, 7.3.4: Monitor cabinet humidity		O
ISO/TS 22741-2:2024, 7.3.5: Monitor cabinet temperature		O
ISO/TS 22741-2:2024, 7.3.6: Monitor cabinet AC power		O
ISO/TS 22741-2:2024, 7.3.7: Monitor cabinet battery power		O
ISO/TS 22741-2:2024, 7.3.8: Monitor cabinet generator power		O
ISO/TS 22741-2:2024, 7.3.9: Monitor cabinet solar power		O
ISO/TS 22741-2:2024, 7.3.10: Monitor cabinet wind power		O
User needs defined in this document		
7.1: Manage the control mode of the VMS		M
8.1 : Message sign control mode		M
7.2: Manage the sign display		M
8.2 : Message library		M
8.3 : Sign display		M
8.7 : Sign display light sensors		O
8.8 : Sign display pixels		O
7.3: Monitor the sign display doors		O
8.4 : Sign display doors		M
ISO/TS 22741-2:2024, 8.2: General-purpose I/O		M
7.4: Monitor the sign display mains power		O
8.5 : Sign display mains power		M
ISO/TS 22741-2:2024, 8.2: General-purpose I/O		M
7.5: Monitor the sign display power supplies		O
8.6 : Sign display power supplies		M
ISO/TS 22741-2:2024, 8.2: General-purpose I/O		M

Table 2 — Feature to requirement conformance

Feature	Requirement	Conformance ^a
8.1: Message sign control mode		
8.1.2.1 : Configure control mode		8.1.3.2 :M
8.1.2.2 : Verify control mode		M
8.1.3.1 : Support central control mode		M
8.1.3.2 : Support local control mode		O
8.1.3.3 : Support central override control mode		8.1.3.2 :M
8.2: Message library		
8.2.2.1 : Discover capabilities of the message library		M
8.2.2.2 : Configure default flash times		O
8.2.2.3 : Verify default flash times		8.2.2.2 :M
8.2.2.4 : Configure default page times		O

^a. Conformance column follows the rules defined in ISO 22741-1:2022, Clause 5

Table 2 (continued)

Feature	Requirement	Conformance ^a
	8.2.2.5 : Verify default page times	8.2.2.4 :M
	8.2.2.6 : Configure default line justification	O
	8.2.2.7 : Verify default line justification	8.2.2.6 :M
	8.2.2.8 : Configure default page justification	O
	8.2.2.9 : Verify default page justification	8.2.2.8 :M
	8.2.2.10 : Configure default colours	M
	8.2.2.11 : Verify default colours	M
	8.2.2.12 : Configure message encoding	M
	8.2.2.13 : Verify message encoding	M
	8.2.2.14 : Configure a message	M
	8.2.2.15 : Verify message configuration	M
	8.2.2.16 : Verify message code	M
	8.2.2.17 : Retrieve message enabled status	M
	8.2.2.18 : Toggle message enabled status	M
	8.2.2.19 : Delete message	M
	8.2.2.20 : Delete all messages	M
	8.2.3.1.1 : Supported minimum flash time	8.2.2.2 :M
	8.2.3.1.2 : Supported maximum flash time	8.2.2.2 :M
	8.2.3.1.3 : Supported flash time step size	8.2.2.2 :M
	8.2.3.2.1 : Supported minimum page time	8.2.2.4 :M
	8.2.3.2.2 : Supported maximum page time	8.2.2.4 :M
	8.2.3.2.3 : Supported page time step size	8.2.2.4 :M
	8.2.3.3.1 : Line justification – Left	8.2.2.6 :M
	8.2.3.3.2 : Line justification – Centre	8.2.2.6 :M
	8.2.3.3.3 : Line justification – Right	8.2.2.6 :M
	8.2.3.3.4 : Line justification – Full	8.2.2.6 :M
	8.2.3.4.1 : Page justification – Top	8.2.2.8 :M
	8.2.3.4.2 : Page justification – Middle	8.2.2.8 :M
	8.2.3.4.3 : Page justification – Bottom	8.2.2.8 :M
	8.2.3.5.1 : Message encoding – ASCII	O.1 (1..*)
	8.2.3.5.2 : Message encoding – UTF-8	O.1 (1..*)
	8.2.3.6.1 : Circular moving text	O
	8.2.3.6.2 : Linear moving text	O
8.3: Sign display		
	8.3.2.1 : Discover characteristics of the sign display	M
	8.3.2.2 : Configure location of sign display	M
	8.3.2.3 : Verify location of sign display	M
	8.3.2.4 : Configure end duration message	M
	8.3.2.5 : Verify end duration message	M
	8.3.2.6 : Display a message on the sign display	M
	8.3.2.7 : Monitor current message	M
	8.3.2.8 : Monitor dynamic fields of current message	O
8.4: Sign display doors		
a. Conformance column follows the rules defined in ISO 22741-1:2022, Clause 5		