TECHNICAL SPECIFICATION

ISO/TS 20684-7

First edition
2022-10

Intelligent transport systems — Roadside modules SNMP data interface —

Part 7: Support features

Systèmes de transport intelligents — Interface de données SNMP pour les modules en bord de route —

Partie 7: Service de support

Reference number
ISO/TS 20684-7:2022(E)

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

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 documents 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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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 20684 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

The need for standardized communication with ITS field devices is growing around the world. Several countries have adopted Simple Network Management Protocol (SNMP) based field device communication standards.

There is a growing view and empirical evidence that standardizing this activity will result in improved ITS performance, reduced cost, reduced deployment time, and improved maintainability. The ISO 20684 series extends ISO 15784-2 by defining the management information necessary to monitor, configure and control features of field devices. The data elements defined in all parts of ISO 20684 series may be used with any protocol but were designed with an expectation that they would be used with one of the ISO 15784-2 protocols.

By using this approach, agencies can specify open procurements and systems can be expanded geographically in an open and non-proprietary manner, which reduces costs, speeds up deployment, and simplifies integration.

0.2 Overview

SNMP is a collection of well-thought-out and well-proven concepts and principles. SNMP employs the sound principles of abstraction and standardization. This has led to SNMP being widely accepted as the prime choice for communication between management systems and devices on the internet and other communications networks.

The original implementation of SNMP was used to manage network devices such as routers and switches. Since then, the use of SNMP has grown into many areas of application on the internet and has also been used successfully over various serial communications networks.

This document defines management information for ITS field devices following the SNMP conventions.

0.3 Document approach and layout

This document defines:

a) the conformance requirements for this document (Clause 4);

b) a set of user needs for user-defined trigger conditions that can “fire” to initiate actions (Clause 5);

c) a set of detailed requirements for the identified user needs (Clause 6);

d) custom dialogues for the logging feature (Clause 7);

e) security considerations for the information defined in this document (Clause 8);

f) the management information bases that define the data for the defined requirements (Annex A);

g) the requirements traceability matrix (RTM) that traces the requirements to the design elements (Annex B).

Intelligent transport systems — Roadside modules SNMP data interface —

Part 7: Support features

1 Scope

Field devices are a key component in intelligent transport systems (ITS). Field devices include traffic signals, message signs, weather stations, traffic sensors, roadside equipment for connected ITS (C-ITS) environments, etc.

Field devices often need to exchange information with other external entities (managers). Field devices can be quite complex, necessitating the standardization of many data concepts for exchange. As such, the ISO 20684 series is divided several individual parts.

This document specifies user needs, requirements and design elements that are normatively used by other parts of the ISO 20684 series. Specifically, it defines an internal field device clock, a mechanism for grouping object values together to provide for more efficient transfer of data, and it provides formal requirements for the SNMP target and target parameters as defined in IETF RFC 3413.

NOTE 1 There are similarities between certain portions of NTCIP 1103 and NTCIP 1201 and this document.

NOTE 2 ISO 20684-1 provides additional details about how the ISO 20684 series relates to the overall ITS architecture.

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/IEC 8825-1, *Information technology — ASN.1 encoding rules — Part 1: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)*

ISO/IEC 8825-7, *Information technology — ASN.1 encoding rules — Part 7: Specification of Octet Encoding Rules (OER)*

ISO 20684-1:2021, *Intelligent transport systems — Roadside modules SNMP data interface — Part 1: Overview*

IETF RFC 2578, *Structure of Management Information Version 2 (SMIv2), April 1999*.

IETF RFC 2579, *Textual Conventions for SMIv2, April 1999*.

IETF RFC 2580, *Conformance Statements for SMIv2, April 1999*.

IETF RFC 3411, *An Architecture for Describing Simple Network Management Protocol (SNMP) Management Frameworks, December 2002*.

IETF RFC 3413, *Simple Network Management Protocol (SNMP) Applications, December 2002*.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 20684-1 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/

4 Conformance

This clause follows the rules defined in ISO 20684-1. Table 1 traces each user need to a set of software features. Table 2 traces each feature to a set of requirements. Table 3 defines terms that are used as predicates in the conformance codes listed in Tables 1 and 2. For a full understanding of these tables and codes, see ISO 20684-1.

Table 1 — User need and feature conformance

Need	Requirement	Conformance
5.1: Efficient exchange of data		O
	6.4: Object group	M

Table 2 — Requirement conformance

Feature	Requirement	Conformance
6.1: Local clock		
	6.1.2.1: Configure local clock	M
	6.1.2.2: Confirm local clock configuration	M
	6.1.2.3: Determine local clock time	M
6.2: UTC clock		
	6.2.2.1: Discover UTC clock capabilities	M
	6.2.2.2: Configure UTC clock	M
	6.2.2.3: Confirm UTC clock configuration	M
	6.2.2.4: Determine UTC clock status	M
	6.2.2.5: Determine UTC time source status	M
	6.2.2.6: Set UTC time	snmp_time:M
	6.2.2.7: Retrieve UTC time	M
	6.2.2.8: Determine time discontinuity information	M
	6.2.3.1.1: Support for SNMP time configuration	O.1 (1..*)
	6.2.3.1.2: Support for network time protocol	O.1 (1..*)
	6.2.3.1.3: Support for radio time broadcast	O.1 (1..*)
	6.2.3.1.4: Support for satellite time signal	O.1 (1..*)
	6.2.3.2.1: Line frequency	O.2 (1..*)
	6.2.3.2.2: Crystal	O.2 (1..*)
6.3: Daylight saving time		
	6.3.2.1: Determine daylight saving time capabilities	M
	6.3.2.2: Configure daylight savings schedule	M
	6.3.2.3: Confirm daylight savings schedule configuration	M
	6.3.2.4: Determine daylight savings time active	M
	6.3.2.5: Determine daylight savings time adjustment	M

Table 2 *(continued)*

Feature	Requirement	Conformance
	6.3.3.1: Number of daylight saving entries	M
6.4: Object group		
	6.4.2.1: Determine object group capabilities	M
	6.4.2.2: Configure object group	M
	6.4.2.3: Confirm object group configuration	M
	6.4.2.4: Retrieve simple object group data	M
	6.4.2.5: Retrieve complex object group data	O
	6.4.2.6: Set new value for the object group	set:M
	6.4.2.7: Retrieve the last object group value set	set:M
	6.4.2.8: Retrieve object group statistics	M
	6.4.2.9: Clear object group	M
	6.4.2.10: Toggle object group	M
	6.4.2.11: Retrieve object group status	M
	6.4.3.1: Number of referenced objects	M
	6.4.3.2: Object group variable bindings size	M
	6.4.3.3: Object group basic encoding	M
	6.4.3.4: Object group octet encoding	O
	6.4.3.5: Support of set operations on object groups	O
	6.4.3.6: Support for complex object groups	O
6.5: SNMP target		
	6.5.2.1: Configure a target	M
	6.5.2.2: Confirm a target configuration	M
	6.5.2.3: Delete a target configuration	M
	6.5.2.4: Toggle a target	M
	6.5.2.5: Retrieve target row status	M
	6.5.2.6: Retrieve target statistics	M
	6.5.3.1.1: Support for SNMPv1 targets	O
	6.5.3.1.2: Support for SNMPv2c targets	O
	6.5.3.1.3: Support for SNMPv3 targets	M
	6.5.3.1.4: Support for STMP targets	O
	6.5.3.2.1: Support for UDP/IP targets	O
	6.5.3.2.2: Support for TCP/IP targets	O
	6.5.3.2.3: Support for DTLS/IP targets	M
	6.5.3.2.4: Support for TLS/IP targets	O
	6.5.3.3: Security profiles	M
6.6: SNMP target parameters		
	6.6.2.1: Configure SNMP target parameters	M
	6.6.2.2: Confirm configuration of SNMP target parameters	M
	6.6.2.3: Delete SNMP target parameters	M

Table 3 — External standard reference

Predicate	Clause
snmp_time	6.2.3.1.1
set	6.4.3.5

5 User needs

5.1 Efficient exchange of data

5.1.1 Object group user need

It is not uncommon for an SNMP manager to perform requests on the same group of managed object values from an SNMP agent multiple times. For example, an SNMP manager can potentially be configured to request a specific group of objects periodically to monitor the status of a device or when a certain set of predefined conditions occur. Normal SNMP operations require the complete object identifier (OID) of every object value to be specified in each request. These OIDs are often 10-20 octets in length, which can significantly increase communications overhead when the values being retrieved are small (e.g. one-octet INTEGERs). This document defines a mechanism to allow a manager to configure object groups, which can then be used to interact with multiple managed objects via a single OID.

6 Requirements

6.1 Local clock

6.1.1 Local clock definition

The local clock feature allows a field device to be aware of the local time as adjusted from the UTC clock by the local time zone and any daylight saving algorithms in effect, if the daylight saving feature is supported.

6.1.2 Local clock data exchange requirements

6.1.2.1 Configure local clock

The field device shall allow a manager to configure the local time zone for the clock.

6.1.2.2 Confirm local clock configuration

The field device shall allow a manager to confirm the configuration of the local clock.

6.1.2.3 Determine local clock time

The field device shall allow a manager to determine the local date and time.

6.2 UTC clock

6.2.1 UTC clock definition

The UTC clock feature allows a field device to maintain awareness of passing time; it represents the UTC time within the field device. However, there is no formal requirement as to the exact time source or accuracy. Ideally, it should be synchronized with a reliable and accurate time source in a secure manner.

6.2.2 UTC clock data exchange requirements

6.2.2.1 Discover UTC clock capabilities

The field device shall allow a manager to determine the capabilities of the UTC clock, including which time source and time-keeping options are available.

6.2.2.2 Configure UTC clock

The field device shall allow a manager to configure which available time source and time-keeping option to use as well as the frequency for synchronizing the clock and when to report discontinuities in time synchronization.

6.2.2.3 Confirm UTC clock configuration

The field device shall allow a manager to determine the configuration of the UTC clock.

6.2.2.4 Determine UTC clock status

The field device shall allow a manager to determine the time source and time-keeping option actually being used and the last time the clock was synchronized with the configured time source.

6.2.2.5 Determine UTC time source status

The field device shall allow a manager to determine the status of each supported time source.

6.2.2.6 Set UTC time

If a field device supports the configured time capability of the UTC clock feature, the field device shall allow a manager to set the current UTC time using SNMP.

NOTE This is perhaps the easiest time synchronization to implement, but also the least accurate. Variable multi-second communication network delays can occur between the time the manager initiates the set operation and the time the field device receives the command, especially when the command has to traverse a complex communications network.

6.2.2.7 Retrieve UTC time

The field device shall allow a manager to retrieve the current time in UTC.

NOTE Variable multi-second communication network delays can occur between the field device transmitting the time and the manager receiving it, especially when the command has to traverse a complex communications network.

6.2.2.8 Determine time discontinuity information

The field device shall allow a manager to determine information about discontinuities in its UTC time to enable to the detection of unusual behaviour in the clock.

NOTE The UTC time is expected to consistently increment its value. However, resynchronizing with an outside time source can result in an adjustment, known as a discontinuity.

6.2.3 UTC clock capabilities

6.2.3.1 Time source

6.2.3.1.1 Support for SNMP time configuration

The field device shall allow a manager to configure the time by SNMP.

6.2.3.1.2 Support for network time protocol

The field device allows the time to be set using the Network Time Protocol version 4 (NTPv4).

NOTE NTPv4 does not have any security. Devices that support NTPv4 are encouraged to provide mechanisms to physically disable access to this protocol and thereby close a potential security threat for systems that choose not to use this feature.

6.2.3.1.3 Support for radio time broadcast

The field device is able to set its time using a time signal broadcast over land-based radio waves.

6.2.3.1.4 Support for satellite time signal

The field device shall allow setting the time in the device based on satellite time signals.

6.2.3.2 Time-keeping

6.2.3.2.1 Line frequency

The field device shall allow time-keeping by monitoring the local electrical line frequency.

6.2.3.2.2 Crystal

The field device shall allow time-keeping with the use of an on-board time crystal.

6.3 Daylight saving time

6.3.1 Daylight saving time definition

The daylight saving time (DST) feature allows a manager to define when the local clock should spring forward and fall backwards to conform to local time customs. In addition to defining when the events occur, the design also allows the manager to specify how large of a shift is required. Finally, the design allows for multi-stage daylight savings adjustments (e.g. spring a half hour forward and then spring another half hour forward before falling back half an hour twice), but only requires support for a single stage. A procurement specification can require support for multi-stage changes, if deemed necessary.

6.3.2 Daylight saving time data exchange requirements

6.3.2.1 Determine daylight saving time capabilities

The field device shall allow a manager to determine the number of daylight saving time event pairs that the device supports.

NOTE A daylight saving time event pair consists of the spring forward and fall back events.

6.3.2.2 Configure daylight savings schedule

The field device shall allow a manager to configure the start and end times for daylight saving time as well as the amount of time that the local time should shift.

6.3.2.3 Confirm daylight savings schedule configuration

The field device shall allow a manager to confirm the configuration of the daylight savings schedule.

6.3.2.4 Determine daylight savings time active

The field device shall allow a manager to determine the status of each daylight savings time rule.

6.3.2.5 Determine daylight savings time adjustment

The field device shall allow a manager to determine the total of the current daylight savings time adjustments.

6.3.3 Daylight saving time capability requirements

6.3.3.1 Number of daylight saving entries

If a field device supports the local clock feature, the field device shall support at least one annual daylight saving adjustment.

6.4 Object group

6.4.1 Object group definition

An object group can minimize the amount of communications overhead for requests that will be regularly repeated. Each object group value is a user-configured sequence of data elements from the device. The data can be stored or retrieved without including the OID for each individual field within the object group while also using the more efficient octet encoding rules (OER) rather than the normal basic encoding rules.

6.4.2 Object group data exchange

6.4.2.1 Determine object group capabilities

6.4.2.2 Configure object group

A field device shall allow a manager to configure the objects to be contained within an object group.

6.4.2.3 Confirm object group configuration

A field device shall allow a manager to determine the configuration of an object group.

6.4.2.4 Retrieve simple object group data

A field device shall allow a manager to retrieve the values of each object within an object group through a simple request.

6.4.2.5 Retrieve complex object group data

A field device shall allow a manager to retrieve the values of each object within an object group using a two-step process, designed to prevent timeouts for requests that require significant processing time.

6.4.2.6 Set new value for the object group

A field device shall allow a manager to perform a set operation on the object group.

6.4.2.7 Retrieve the last object group value set

A field device shall allow a manager to retrieve the last value submitted in a set request for the object group.

6.4.2.8 Retrieve object group statistics

A field device shall allow a manager to retrieve statistics about when the last retrieval operation was made and the estimated duration for requests.

6.4.2.9 Clear object group

The field device shall allow a manager to clear the definition of an object group.

6.4.2.10 Toggle object group

The field device shall allow a manager to enable/disable an object group.

6.4.2.11 Retrieve object group status

The field device shall allow a manager to retrieve the status of an object group.

6.4.3 Object group capabilities

6.4.3.1 Number of referenced objects

The field device shall support at least two referenced objects for each object group.

NOTE An object group only offers a significant benefit if it compresses at least two objects. A device can perhaps want to establish limits on the number of objects within a group to prevent unreasonably complex requests.

6.4.3.2 Object group variable bindings size

The field device shall support values of the object group data up to a maximum size, which is required to be at least 400 octets.

NOTE The 400-octet limit is based on the standard conformant SNMP data packet size minus adequate room for an SNMP header.

6.4.3.3 Object group basic encoding

The field device shall support encoding object groups as per the basic encoding rules (ISO 8825-1).

6.4.3.4 Object group octet encoding

A field device shall support encoding object groups as per the octet encoding rules (ISO 8825-7).

6.4.3.5 Support of set operations on object groups

The field device shall support set operations on all object groups that only contain writable objects.

6.4.3.6 Support for complex object groups

The field device shall support a two-step request process.

NOTE Otherwise, any object group defined can potentially use the one-step process and complex definitions. If allowed, this can potentially require a significant amount of processing time before a response is generated.

6.5 SNMP target

6.5.1 Target definition

A target represents a remote SNMP entity that can receive messages from the field device. The remote SNMP entity can be a manager that can receive SNMP notifications or can be a remote field device that can receive SNMP requests.

6.5.2 Target data exchange requirements

6.5.2.1 Configure a target

The field device shall allow a manager to configure a target, including its address, security and communication parameters.

6.5.2.2 Confirm a target configuration

The field device shall allow a manager to determine the configuration of a target.

6.5.2.3 Delete a target configuration

The field device shall allow a manager to clear the configuration of a target.

6.5.2.4 Toggle a target

The field device shall allow a manager to enable/disable a target.

6.5.2.5 Retrieve target row status

The field device shall allow a manager to retrieve the status of a target entry row.

6.5.2.6 Retrieve target statistics

The field device shall allow a manager to retrieve statistics about the targets.

6.5.3 Target capabilities

6.5.3.1 Application profiles

6.5.3.1.1 Support for SNMPv1 targets

The field device shall support the SNMPv1 application profile when sending information to targets.

6.5.3.1.2 Support for SNMPv2c targets

The field device shall support the SNMPv2c application profile when sending information to targets.

6.5.3.1.3 Support for SNMPv3 targets

The field device shall support the SNMPv3 application profile when sending information to targets.

6.5.3.1.4 Support for STMP targets

The field device shall support the STMP application profile when sending information to targets.