SLOVENSKI STANDARD
SIST EN 16603-50-03:2015

01-januar-2015

Vesoljska tehnika - Vesoljske podatkovne povezave - Okvirni protokol za prenos telemetrijskih podatkov

Space engineering - Space data links - Telemetry transfer frame protocol

Raumfahrttechnik - Telemetrieübertragungs-Rahmen-Protokoll

Ingénierie spatiale - Liaisons des données spatiales - Protocole trame de transfert de télémesure

Ta slovenski standard je istoveten z: EN 16603-50-03:2014

ICS:

33.200	Daljinsko krmiljenje, daljinske meritve (telemetrija)	Telecontrol. Telemetering
49.140	Vesoljski sistemi in operacije	Space systems and operations

SIST EN 16603-50-03:2015 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 16603-50-03

September 2014

ICS 49.140

English version

Space engineering - Space data links - Telemetry transfer frame protocol

Ingénierie spatiale - Liaisons des données spatiales - Protocole trame de transfert de télémesure

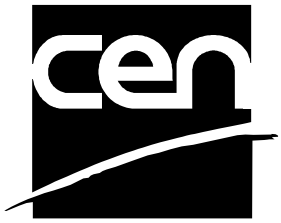
Raumfahrtproduktsicherung - Telemetrieübertragungs-Rahmen-Protokoll

This European Standard was approved by CEN on 11 April 2014.

CEN and CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN and CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN and CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN and CENELEC members are the national standards bodies and national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



CEN-CENELEC Management Centre:
Avenue Marnix 17, B-1000 Brussels

Table of contents

Figures

Tables

Foreword

This document (EN 16603-50-03:2014) has been prepared by Technical Committee CEN/CLC/TC 5 “Space”, the secretariat of which is held by DIN.

This standard (EN 16603-50-03:2014) originates from ECSS-E-ST-50-03C.

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 March 2015, and conflicting national standards shall be withdrawn at the latest by March 2015.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

This document has been developed to cover specifically space systems and has therefore precedence over any EN covering the same scope but with a wider domain of applicability (e.g. aerospace).

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

1
Scope

This Standard contains the definition for Telemetry Transfer Frames which are fixed-length data structures, suitable for transmission at a constant frame rate on a space data channel.

The Telemetry Transfer Frame provides a standardized data structure for the transmission of space-acquired data over a telemetry space data link.

Usually, the source of the data is located in space and the receiver is located on the ground. However, this Standard may also be applied to space-to-space telemetry data links.

Further provisions and guidance on the application of this standard can be found, respectively, in the following publications:

- The higher level standard ECSS-E-ST-50, Communications, which defines the principle characteristics of communication protocols and related services for all communication layers relevant for space communication (physical- to application-layer), and their basic relationship to each other.

- The handbook ECSS-E-HB-50, Communications guidelines, which provides information about specific implementation characteristics of these protocols in order to support the choice of a certain communications profile for the specific requirements of a space mission..

Users of this present standard are invited to consult these documents before taking decisions on the implementation of the present one.

This standard may be tailored for the specific characteristics and constraints of a space project in conformance with ECSS-S-ST-00.

2
Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this ECSS Standard. For dated references, subsequent amendments to, or revisions of any of these publications, do not apply. However, parties to agreements based on this ECSS Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references the latest edition of the publication referred to applies.

EN reference	Reference in text	Title
EN 16601-00-01	ECSS-S-ST-00-01	ECSS system – Glossary of terms
EN 16603-50-01	ECSS-E-ST-50-01	Space engineering – Space data links – Telemetry synchronization and channel coding
EN 16603-50-04	ECSS-E-ST-50-04	Space engineering – Space data links – Telecommand protocols, synchronization and channel coding
	CCSDS 133.0-B-1	Space Packet Protocol – Blue Book, Issue 1, September 2003
	CCSDS 135.0-B-3	Space Link Identifiers – Blue Book, Issue 3, October 2006

3
Terms, definitions and abbreviated terms

3.1 Terms from other standards

For the purpose of this Standard, the terms and definitions from ECSS-ST-00-01 apply.

3.2 Terms specific to the present standard

3.2.1 idle data

data which carries no information, but is sent to conform to timing or synchronization requirements

NOTE The bit pattern of idle data is not specified.

3.2.2 mission phase

period of a mission during which specified telemetry characteristics are fixed

NOTE The transition between two consecutive mission phases can cause an interruption of the telemetry services.

3.2.3 octet

group of eight bits

NOTE 1 The numbering for octets within a data structure starts with 0.

NOTE 2 Refer to clause 3.4 for the convention for the numbering of bits.

3.2.4 packet

variable-length data structure consisting of higher layer user data encapsulated within standard header information

3.2.5 static

unchanged within a specific virtual channel or within a specific master channel

NOTE This Standard contains requirements on the invariability, throughout one or all mission phases, of certain characteristics of the data structures specified in it.

3.3 Abbreviated terms

For the purpose of this Standard, the abbreviated terms from ECSS-ST-00-01 and the following apply:

Abbreviation	Meaning
ASM	attached sync marker
CCSDS	Consultative Committee for Space Data Systems
FECF	Frame Error Control Field
MSB	most significant bit
TM	Telemetry

3.4 Conventions

3.4.1 bit 0, bit 1, bit N−1

To identify each bit in an N-bit field, the first bit in the field to be transferred (i.e. the most left justified in a graphical representation) is defined as bit 0; the following bit is defined as bit 1 and so on up to bit N-1.

Figure 3-1: Bit numbering convention

3.4.2 most significant bit

When an N-bit field is used to express a binary value (such as a counter), the most significant bit is the first bit of the field, i.e. bit 0 (see Figure 3-1).

3.4.3 use of capitals for the names of data structures and fields

In this Standard initial capitals are used for the names of data structures and fields.

This enables field names to be easily identified in the surrounding text. For example, the field Transfer Frame Data Field is easier to see than transfer frame data field in text containing words such as frame and data and field.

It also prevents ambiguity over where the name begins and ends. For example, there are fields Transfer Frame Secondary Header and Transfer Frame Secondary Header Length. The capitals help the reader to distinguish between the Transfer Frame Secondary Header length (meaning 'the length of the Transfer Frame Secondary Header') and the Transfer Frame Secondary Header Length (meaning the field of that name).

4 Overview

4.1 General

The Telemetry Transfer Frame is a fixed-length data structure that provides an envelope for transmitting data units of several types over a telemetry space link. The frame is compatible with the ECSS standard for telemetry synchronization and channel coding defined in ECSS-E-ST-50-01.

The telemetry transfer frame protocol can operate in various configurations of the telemetry space link, depending on the telemetry channel coding scheme and security options selected. The correct operation of the protocol can only occur if a high-quality data channel is provided between the peer entities of the protocol.

NOTE 1 The Standard for telemetry channel coding, ECSS-E-ST-50-01, defines the coding mechanisms for a high-quality data channel, including frame synchronization and randomization. CCSDS 350.0-G-2 describes the security options.

NOTE 2 In this Standard the terms TM Transfer Frame and Telemetry Transfer Frame are used interchangeably, i.e. they are synonyms and have the same meaning as.

NOTE 3 Annex D describes the mission configuration parameters within the scope of this Standard.

4.2 Physical channel

A data channel carrying a stream of bits in a single direction is referred to as a physical channel.

For the TM Transfer Frame specified in this Standard, the value of the Transfer Frame Version Number is constant for all frames of a physical channel.

The length of the frames for a given physical channel is fixed for a mission phase.

4.3 Master channels and virtual channels

The TM Transfer Frame supports the division of the physical channel into master channels and virtual channels by means of identifier fields in the frame header.

A master channel is identified by the values of the Transfer Frame Version Number and the Spacecraft Identifier. Within a given physical channel, a master channel consists of all the frames that have the same Transfer Frame Version Number and the same Spacecraft Identifier.

For a typical space mission, all the frames on a physical channel have the same value for the Spacecraft Identifier, so in this case there is one master channel on the physical channel. However, multiple master channels can share a physical channel, which, for example, can be the case when one spacecraft is transporting another spacecraft such as a probe.

A master channel is divided into virtual channels using the Virtual Channel Identifier field. This is a 3-bit field and therefore supports up to eight virtual channels on a master channel.

4.4 Sharing transmission resources

Virtual channels enable one physical channel to be shared among multiple higher-layer data streams, each of which can have different characteristics.

The mechanisms and parameters for sharing access by the virtual channels to the physical channel are implementation dependent and not within the scope of this Standard.

4.5 Data fields in the frame

Every TM Transfer Frame contains the Transfer Frame Data Field, which is the main data-carrying field in the frame. Within a virtual channel, the length of the Transfer Frame Data Field is static during a mission phase.

There are status fields in the frame header that are related to the use of the Transfer Frame Data Field. The Transfer Frame Data Field carries packets or other data units.

Additionally to the Transfer Frame Data Field, the TM Transfer Frame has two optional fields for carrying data:

- The Transfer Frame Secondary Header, used to carry fixed-length mission-specific data.
- The Operational Control Field, used to carry status information to control the operation of the telecommand space link or other spacecraft activities.

5
TM Transfer Frame

5.1 General

a. The TM Transfer Frame shall encompass the major fields, positioned contiguously if present, in the sequence shown in Figure 5-1.

NOTE 1 Figure 5-1 shows the format of the TM Transfer Frame.

NOTE 2 In the case that TM Transfer Frames are directly submitted to telemetry channel coding, the start of the TM Transfer Frame is always signalled by the attached sync marker (ASM) which immediately precedes the TM Transfer Frame. The ASM is specified in ECSS-E-ST-50-01.

When the TM Transfer Frame is embedded in a Reed-Solomon codeblock or turbo codeblock, the ASM signals the start of both.

Table 5-1: Major fields in a TM Transfer Frame

Field	Presence in TM Transfer Frame	Length in bits
Transfer Frame Primary Header	always present	48
Transfer Frame Secondary Header	optional	16, 24, ... or 512
Transfer Frame Data Field	always present	variable
Transfer Frame Trailer	optional	16, 32 or 48

b. The maximum length for a TM Transfer Frame shall be 2048 octets.

c. The TM Transfer Frame shall be of constant length throughout a specific mission phase.

NOTE Because a change of frame length also changes the time interval between the start of successive frames, it can result in a loss of synchronization at the data capture element.