ECSS-E-ST-50-51C
5 February 2010

Space engineering

SpaceWire protocol identification

ECSS Secretariat
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Foreword

This Standard is one of the series of ECSS Standards intended to be applied together for the management, engineering and product assurance in space projects and applications. ECSS is a cooperative effort of the European Space Agency, national space agencies and European industry associations for the purpose of developing and maintaining common standards. Requirements in this Standard are defined in terms of what shall be accomplished, rather than in terms of how to organize and perform the necessary work. This allows existing organizational structures and methods to be applied where they are effective, and for the structures and methods to evolve as necessary without rewriting the standards.

This Standard has been prepared by the ECSS-E-ST-50-51 Working Group, reviewed by the ECSS Executive Secretariat and approved by the ECSS Technical Authority.

Disclaimer

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Scope

There is a number of communication protocols that can be used in conjunction with the SpaceWire Standard (ECSS-E-ST-50-12), to provide a comprehensive set of services for onboard user applications. These protocols are covered by the ECSS-E-ST-50-5x series.

To distinguish between the various protocols a protocol identifier is used. This Standard specifies this protocol identifier.

This standard may be tailored for the specific characteristic and constrains 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 revision 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 more recent editions of the normative documents indicated below. For undated references, the latest edition of the publication referred to applies.

ECSS-S-ST-00-01	ECSS system - Glossary of terms
ECSS-E-ST-50-12	Space engineering - SpaceWire - Links, nodes, routers and networks
ECSS-E-ST-50-52	Space engineering - SpaceWire - Remote memory access protocol
ECSS-E-ST-50-53	Space engineering - SpaceWire - CCSDS packet transfer protocol
CCSDS 133.0-B-1	Space Packet Protocol, Blue Book
SMCS-ASTD-PS-001 Issue 1.1, 24 July 2009	STUP SpaceWire Protocol - Protocol Specification, EADS Astrium ASE4
417-R-RTP-0050 Version 2.1, 16 January 2008	Geostationary Operational Environmental Satellites (GOES), GOES-R Series, GOES-R Reliable Data Delivery Protocol (GRDDP), NASA Goddard Spaceflight Centre

3
Terms, definitions and abbreviated terms

3.1 Terms defined in other standards

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

3.2 Terms specific to the present standard

3.2.1 byte

8-bits where bit 7 is the most-significant bit

3.2.2 command

instruction to a SpaceWire node (target) to perform some action

NOTE For example, write data to memory.

3.2.3 command packet

packet that contains a command

3.2.4 confirmation

primitive passed from a service provider to a service user to indicate the success or otherwise of a previous service request

3.2.5 data character

SpaceWire symbol containing 8-bits of user information

3.2.6 Error End of Packet marker (EEP)

control character indicating that the Packet was terminated prematurely

3.2.7 End of Packet marker (EOP)

control character indicating the end of a packet

3.2.8 extender protocol identifier

two data characters following a protocol identifier which has value 0x00 that identify a particular protocol being used for communication

3.2.9 indication

primitive passed from a service provider to a service user to provide information or status to the service user

3.2.10 initiator

SpaceWire node that starts a transaction by sending a command to a SpaceWire node

3.2.11 initiator user application

application in an initiator that is using the SpaceWire protocol services

3.2.12 logical address

identifier of a initiator or target which can be used to route a Packet to the target or, if path addressing is being used, to confirm that the final target is the correct one i.e. that the logical address of the target matches the logical address in the packet

3.2.13 memory

addressable storage element including random access memory, registers, FIFO, mailboxes

3.2.14 packet

SpaceWire packet

3.2.15 path address

sequence of one or more SpaceWire data characters that defines the route to a target by specifying, for each router encountered on the way to the target, the output port that a Packet is forwarded through

3.2.16 protocol identifier

data character that identifies a particular protocol being used for communication

3.2.17 reply

response sent by a target to the initiator or some other node expecting the reply to provide the required information or to indicate that some commanded action has been completed by the target

3.2.18 reply packet

packet containing a reply

3.2.19 request

primitive passed from a service user to a service provider to request a service

3.2.20 response

primitive passed from a service user to a service provider in response to an indication from the service provider

3.2.21 target

SpaceWire node that responds to a command sent by an initiator

3.2.22 target user application

application in a target that is using the SpaceWire protocol services

3.2.23 transaction

interaction between an initiator and a target

3.2.24 word

multiple bytes held in a single memory location

3.3 Abbreviated terms

The following abbreviations are defined and used within this standard:

Abbreviation	Meaning
CCSDS	Consultative Committee for Space Data Systems
EEP	error end of packet
EOP	end of packet
FIFO	first in first out
ID	identifier
RMAP	remote memory access protocol
VHSIC	very high speed integrated circuit

3.4 Conventions

In this document hexadecimal numbers are written with the prefix 0x, for example 0x34 and 0xDF15.

Binary numbers are written with the prefix 0b, for example 0b01001100 and 0b01.

Decimal numbers have no prefix.

4 Principles

To distinguish between the various protocols that can be used in conjunction with the SpaceWire protocol defined in ECSS-E-ST-50-12, a protocol identifier is used. This standard specifies such a protocol identifier. The protocols that operate over SpaceWire are then specified in the ECSS-E-ST-50-5x series of standards.

Examples of these protocols are:

- Remote Memory Access Protocol (RMAP)

  The aim of RMAP is to support reading from and writing to memory in a remote SpaceWire node. RMAP can be used to configure a SpaceWire network, control SpaceWire nodes, and to transfer data to and from SpaceWire nodes. RMAP is specified in ECSS-E-ST-50-52.

- CCSDS Packet Transfer Protocol

  The aim of the CCSDS Packet Transfer Protocol is to transfer CCSDS Packets across a SpaceWire network. It does this by encapsulating the CCSDS Packet in a SpaceWire packet, transferring it across the SpaceWire network and then extracting the CCSDS Packet at the target. The CCSDS Packet Transfer Protocol is specified in ECSS-E-ST-50-53.

5 Requirements

5.1 Overview

The protocol identification scheme enables many different protocols to operate concurrently over a SpaceWire network without them interfering with each other. To achieve this, an identifier is given to each protocol. Nodes receiving packets process and respond to them according to the protocol specified by the Protocol Identifier in the packet. If a packet arrives with a particular Protocol Identifier that is not supported by a node then it is ignored.

5.2 Protocol identification

5.2.1 Addressing

a. A packet containing a Protocol Identifier shall start with a single byte logical address when it arrives at the target.

NOTE 1 See Figure 5-1.

NOTE 2 When sent by the initiator the packet can have one or more leading path or logical address bytes which are stripped off (SpaceWire Address) on the way through the SpaceWire network leaving the single logical address byte when it arrives at the target.

b. The logical address 254 (0xFE) shall be used as a default value when the target does not have another value specified for its logical address.

NOTE When the initiator does not know the logical address of the target the default logical address 254 (0xFE) can be used.

c. A target may choose to ignore packets with logical address 254 (0xFE).

NOTE If a packet with a logical address is ignored then the target can record and make available a count of the number of packets it received and ignored with logical address 254 (0xFE).

d. A target may accept packets with one or more different logical address values.

NOTE For example, a node accepting packets with logical addresses 60, 61 or 254.

5.2.2 Protocol Identifier

a. A Protocol Identifier shall comprise a single byte immediately following the logical address.

NOTE See Figure 5-1.

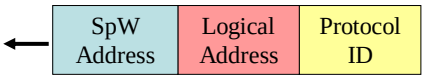
b. A value of zero shall be used to identify an Extended Protocol Identifier.

NOTE The value of zero in the Protocol Identifier byte is reserved for extension of the Protocol Identifier, as specified in clause 5.2.3.

c. A Protocol Identifier with a value of 255 (0xFF) shall not be used.

NOTE It is reserved for future use.

Logical Address with Protocol ID



SpaceWire Address and Logical Address with Protocol ID

Figure 5-1: Protocol Identifier position

5.2.3 Extended Protocol Identifier

a. If an Extended Protocol Identifier is supported, the following shall apply:

1. Protocol Identifier has the value zero (0x00).
2. The two bytes following the reserved Protocol Identifier (zero) form a 16-bit Extended Protocol Identifier.

NOTE 1 This allows up to 65535 protocols to be carried over a SpaceWire network.

NOTE 2 An Extended Protocol Identifier need not be implemented.

NOTE 3 See Figure 5-2.

b. If an Extended Protocol Identifier is not supported, then a packet with a Protocol Identifier with the value zero (reserved Protocol Identifier) shall be discarded when received.

NOTE If a target ignores the Extended Protocol Identifier then it can record and make available a count of the number of packets it received with an Extended Protocol Identifier.

c. Extended Protocol Identifiers with values in the range 0x0000 to 0x00FF are reserved and shall not be used.

d. A packet with an Extended Protocol Identifier with a value in the range 0x0000 to 0x00FF shall be discarded when received.

NOTE These values are reserved for future use.

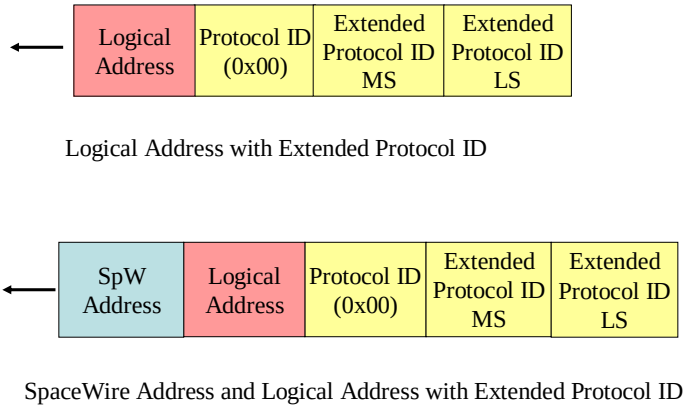


Figure 5-2: Extended Protocol Identifier

5.2.4 Ignoring unknown protocols

a. If a packet arrives with a Protocol Identifier or Extended Protocol Identifier that is not supported (unknown) by that target then the packet shall be discarded.

NOTE The target can count the number of packets that arrive at a target with unknown Protocol Identifier or Extended Protocol Identifier can be kept and made available by the target.

5.2.5 Protocol Identifier and Extended Protocol Identifier Allocation

a. Protocol Identifiers in the range 1 to 239 (0x01 to 0xEF) that shall be used are those listed in Table 5-1.

NOTE 1 The identifiers in Table 5-1 have been assigned by the SpaceWire working group. The protocols starting at number 1 and working upwards as defined in this standard document define the current set of approved SpaceWire protocols and their Protocol Identifiers. The protocols starting at 239 and working downwards are legacy protocols and are not covered by this standard document.

NOTE 2 The reader is advised to consult the SpaceWire website (http://www.spacewire.esa.int) for the latest Table defining the Protocol Identifiers and Extended Protocol Identifier allocation.

b. Protocol Identifiers in the range 240 to 254 (0xF0 to 0xFE) shall be assigned by the project.

NOTE 1 Developers can use these Protocol Identifiers but it is important to note that they can clash with protocols being developed by other users. Concurrent operation of different protocols is

only assured for Protocol Identifiers in the range 1 to 239 (0x01 to 0xEF).

NOTE 2 Proven protocols can be recommended for adoption by the SpaceWire working group and then be included in future revisions or extensions to this SpaceWire Protocols standard. Once adopted they are given a unique Protocol Identifier in the range 1 to 239.

NOTE 3 No Extended Protocol Identifiers have been allocated.

Table 5-1: Protocol identifier allocation

Protocol Identifier	Protocol	Specified in
0	Extended Protocol Identifier	Clause 5
1	Remote Memory Access Protocol	ECSS-E-ST-50-52
2	CCSDS Packet Transfer Protocol	ECSS-E-ST-50-53
238	GOES-R Reliable Data Delivery Protocol	417-R-RTP-0050 Version 2.1, 16 January 2008
239	Serial Transfer Universal Protocol	SMCS-ASTD-PS-001 Issue 1.1, 24 July 2009

Bibliography

ECSS-ST-S-00	ECSS system - Description, implementation and general requirements
http://www.spacewire.esa.int	SpaceWire website