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Real-time Ethernet – EtherNet/IP™ with time synchronization

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International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch

Commission Electrotechnique Internationale
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

Real-time Ethernet – EtherNet/IP™[1] with time synchronization

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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A PAS is a technical specification not fulfilling the requirements for a standard but made available to the public.

IEC-PAS 62413 has been processed by subcommittee 65C: Digital communications, of IEC technical committee 65: Industrial-process measurement and control.

The text of this PAS is based on the following document:	This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document
Draft PAS	**Report on voting**
65C/361/NP	65C/377/RVN

Following publication of this PAS, the technical committee or subcommittee concerned will transform it into an International Standard.

[1] EtherNet/IP™ is a trade name of ControlNet International, Ltd. and Open DeviceNet Vendor Association, Inc. This information is given for the convenience of users of this PAS and does not constitute an endorsement by IEC of the trademark holder or any of its products. Compliance to this PAS does not require use of the trade name EtherNet/IP™. Use of the trade name EtherNet/IP™ requires permission of either ControlNet International, Ltd. or Open DeviceNet Vendor Association, Inc.

It is intended that the content of this PAS will be incorporated in the futures new editions of the various parts of IEC 61158 series and/or IEC 61784 series according to the structure of these series.

This PAS shall remain valid for an initial maximum period of three years starting from 2005-07. The validity may be extended for a single three-year period, following which it shall be revised to become another type of normative document or shall be withdrawn.

INTRODUCTION

The EtherNet/IP™ communication technology, standardized in IEC 61784-1 as Communication Profile 2/2 (using Type 2 specifications in IEC 61158), already provides ISO/IEC 8802-3 based real time communication, through the use of frame prioritization. The addition of time synchronization services and protocols allows using it also for the most demanding applications.

Real-time Ethernet – EtherNet/IP™ with time synchronization

1 Scope

This PAS defines additional mechanisms to provide accurate time synchronization between nodes using the ISO/IEC 8802-3 based real time communication technology EtherNet/IP.

It contains specifications for Application layer service definition and application layer protocol specification.

2 Normative references

The following referenced documents are indispensable for the application 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.

IEC 61158 (all parts), *Digital data communications for measurement and control — Fieldbus for use in industrial control systems*

IEC 61158-5:2003, *Digital data communications for measurement and control – Fieldbus for use in industrial control systems - Part 5: Application layer service definition*

IEC 61158-6:2003, *Digital data communications for measurement and control – Fieldbus for use in industrial control systems - Part 6: Application layer protocol specification*

IEC 61588:2004, *Precision clock synchronization protocol for networked measurement and control systems*

IEC 61784-1:2003, *Digital data communications for measurement and control — Part 1: Profile sets for continuous and discrete manufacturing relative to fieldbus use in industrial control systems*

ISO/IEC 8802-3:2000, *Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications*

3 Terms, definitions, symbols, abbreviated terms and conventions

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61158 (general and Type 2 specific ones) and the following apply.

3.1.1
current data set
data set which defines members whose values characterize the current properties of the local clock that describe the source and quality of the local time
[IEC 61588]

3.1.2
default data set
data set which defines inherent or assumed properties of the local clock
[IEC 61588]

3.1.3
epoch
reference time defining the origin of a time scale
[IEC 61588]

3.2 Symbols and abbreviated terms

For the purposes of this document, the symbols and abbreviated terms given in IEC 61158 and IEC 61784-1 (general and Type 2 specific ones) and the following apply.

PTP Precision Time Protocol [IEC 61588]

3.3 Terms and definitions of conventions

For the purposes of this document, the conventions given in IEC 61158 apply (general and Type 2 specific ones).

4 Application layer service definition – Data type ASE

4.1 General

This PAS uses the following data types as defined in IEC 61158-5:
BOOL, BYTE, USINT, UINT, UDINT, SINT, INT, DINT, LINT,
and the additional STIME data type specified in 4.2.1.1.1 and 6.1.2.1, according to the format defined in IEC 61158-5.

4.2 FAL defined data types

4.2.1 Fixed length types

4.2.1.1 Date types

4.2.1.1.1 STIME

1	Data Type Numeric Identifier	=	not used
2	Data Type Name	=	STIME
3	Format	=	FIXED LENGTH
4.1	Octet Length	=	8

This data type expresses the Synchronized Time in nanoseconds.

The range of values for variables of type STIME is the same as for variables of type LINT, representing the absolute time in nanoseconds since the epoch. The epoch is not defined by STIME.

5 Application layer service definition – Type 2 communication model specification

5.1 Concepts

Time synchronization for CP 2/2 of IEC 61784-1 is specified as an extension of the Type 2 Object management ASE defined in IEC 61158-5.