PUBLICLY
AVAILABLE
SPECIFICATION

IEC PAS 62405

First edition
2005-06

Real-time Ethernet Vnet/IP™ specification

Reference number
IEC/PAS 62405:2005(E)

Publication numbering

As from 1 January 1997 all IEC publications are issued with a designation in the 60000 series. For example, IEC 34-1 is now referred to as IEC 60034-1.

Consolidated editions

The IEC is now publishing consolidated versions of its publications. For example, edition numbers 1.0, 1.1 and 1.2 refer, respectively, to the base publication, the base publication incorporating amendment 1 and the base publication incorporating amendments 1 and 2.

Further information on IEC publications

The technical content of IEC publications is kept under constant review by the IEC, thus ensuring that the content reflects current technology. Information relating to this publication, including its validity, is available in the IEC Catalogue of publications (see below) in addition to new editions, amendments and corrigenda. Information on the subjects under consideration and work in progress undertaken by the technical committee which has prepared this publication, as well as the list of publications issued, is also available from the following:

- **IEC Web Site (www.iec.ch)**

- **Catalogue of IEC publications**

  The on-line catalogue on the IEC web site (www.iec.ch/searchpub) enables you to search by a variety of criteria including text searches, technical committees and date of publication. On-line information is also available on recently issued publications, withdrawn and replaced publications, as well as corrigenda.

- **IEC Just Published**

  This summary of recently issued publications (www.iec.ch/online_news/ justpub) is also available by email. Please contact the Customer Service Centre (see below) for further information.

- **Customer Service Centre**

  If you have any questions regarding this publication or need further assistance, please contact the Customer Service Centre:

  Email: custserv@iec.ch
  Tel: +41 22 919 02 11
  Fax: +41 22 919 03 00

PUBLICLY
AVAILABLE
SPECIFICATION

IEC PAS 62405

First edition
2005-06

Real-time Ethernet Vnet/IP™ specification

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
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE XG

For price, see current catalogue

CONTENTS

Section 3: Application Layer protocol specification

Part 4: Data Link Service definition

INTERNATIONAL ELECTROTECHNICAL COMMISSION

Real-time Ethernet Vnet/IP™ specification

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.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

The International Electrotechnical Commission (IEC) draws attention to the fact that it is claimed that compliance with this document may involve the use of a patent concerning Vnet/IP[1].

The Vnet/IP has the patent applications listed below:

PCT Application No. PCT/JP2004/011537

PCT Application No. PCT/JP2004/011538.

IEC takes no position concerning the evidence, validity and scope of this patent right.

The holder of this patent right has assured the IEC that he is willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holder of this patent right is registered with IEC. Information may be obtained from:

Yokogawa Electric Corporation
Intellectual Property & Standardization Center
2-9-32 Nakacho, Musashino-shi, 180-8750
Tokyo, Japan.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights other than those identified above. IEC shall not be held responsible for identifying any or all such patent rights.

---

[1] Vnet/IP is the trade name of Yokogawa Electric Corporation. 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 profile does not require use of the trade name Vnet/IP. Use of the trade name Vnet/IP requires permission of the Yokogawa Electric Corporation.

A PAS is a technical specification not fulfilling the requirements for a standard but made available to the public .

IEC-PAS 62405 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/352/NP	65C/369/RVN

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

It is intended that the content of this PAS will be incorporated in the future new edition of the various parts of IEC 61158 series according to the structure of this series.

This PAS shall remain valid for an initial maximum period of three years starting from 2005-06. 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.

Real-time Ethernet Vnet/IP™ specification

Section 1: Overview

This PAS has been divided into five sections.

Section 1: Overview

Section 2: Application Layer Service definition

Section 3: Application Layer protocol specification

Section 4: Data Link Layer Service definition

Section 5: Data Link Layer protocol specification

1 Introduction

The Vnet/IP is designed for highly reliable real-time communication, and applies to the operation of process control systems. The process control system consists of many controllers, human-machine interfaces, process monitors, and gateways to external networks which are connected to Ethernet-based IP networks. The data transfer between these devices is performed by peer-to-peer or multicast communication.

It is required that the process control system responds within a deterministic time. At the same time, it is also required that multi-vendor's multi-devices can be connected to the same IP network. For example, the process control system shall handle operational signals for the actuator within a determined time and needs to communicate with other devices connected to Ethernet-based IP networks to exchange non-realtime information such as files and images.

The Vnet/IP realizes these two conflicting requirements on the same network using a unique technology as described in this PAS.

2 Scope and objective

This PAS describes the communication profile of the whole Vnet/IP, services of each layer and the specifications of the protocols for each layer.

3 Structure of this document

Section 1 of this PAS presents an overview of and guidance for the Vnet/IP Specification. It also explains the structure and content of the Vnet/IP Specification and shows how to use each section of the document. In addition, it specifies the communication profile of the Vnet/IP.

Sections 2 and 3 present the Vnet/IP Specification for the Application Layer, and Sections 4 and 5 for the Data Link Layer. This PAS refers the appropriate international standards for the specifications of other layers.

The Data Link and Application Layers are described in complementary ways, in terms of the services offered and the protocol which provides those services.

Table 1 shows the differences between service and protocol viewpoints of the Data Link and Application Layers. The protocol parts show the layer implementer's view and the service parts show the layer user's view.

Table 1 – Concept of DL/AL to separate service and protocol parts

Layer user Oriented view	**Layer implementer** Oriented view
AL Services (Section 2 of this PAS) - Model and concepts - Data type definitions - Application objects - Service description - Communication endpoint management.	**AL Protocol (Section 3 of this PAS)** - Syntax definition and coding - Application relationships procedures - Protocol machines (state machines)
DL Services (Section 4 of this PAS) - Model and concepts - Service description - Management services	**DL Protocol (Section 5 of this PAS)** - Coding - Protocol machines (state machines)

The Application Layer structure is as follows:

- "What" is described by Application Service Elements (ASE); and
- "How" is described by Application Relationships (AR).

The Data Link Layer structure is as follows:

- "What" is described by Data Link services and models; and
- "How" is described by Data Link protocol machines and medium access principles.

4 Normative reference

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For all other undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61158-1:2003, *Digital data communications for measurement and control – Fieldbus for use in industrial control systems – Part 1: Overview and guidance for the IEC 61158 series*

IEC 61158-3:2003, *Digital data communications for measurement and control – Fieldbus for use in industrial control systems – Part 3: Data link service definition*

IEC 61158-4:2003, *Digital data communications for measurement and control – Fieldbus for use in industrial control systems – Part 4: Data link protocol specification*

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*

ISO/IEC 7498 (all parts), *Information technology – Open Systems Interconnection – Basic Reference Model*

ISO/IEC 10731, *Information technology – Open Systems Interconnection – Basic reference model – Conventions for the definition of OSI services*

ISO/IEC 9545:1994, *Information technology – Open Systems Interconnection – Application Layer structure*

ISO/IEC 8824-2:2002, *Information technology – Abstract Syntax Notation One (ASN.1): Information object specification*

ISO/IEC 8825-1:2002, *Information technology – ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding RUles (CER) and Distinguished Encoding RUles (DER)*