SLOVENSKI STANDARD

SIST EN 50170:2001

prva izdaja
april 2001

General purpose field communication system

ICS 35.100.01; 35.200

Referenčna številka
SIST EN 50170:2001(en)

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 50170

Volume 1/3 (P-NET)

December 1996

ICS 35.100.00; 35.200

Descriptors: Fieldbus, FIP, PROFIBUS, P-NET, open systems, physical layer, data link layer, application layer, periodic and aperiodic services, network management

English version

General purpose field communication system

This European Standard was approved by CENELEC on 1996-07-02. 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 Central Secretariat or to any CENELEC member.

This European Standard exists in one official version (English). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

Central Secretariat: rue de Stassart 35, B - 1050 Brussels

Structure of the document and overall table of contents

This standard contains three fieldbus concepts, which are in widespread use and which are already standards or pre-standards on national level of some European countries. The three concept are well known under the name of P-NET, PROFIBUS and WorldFIP. Due to universal use of the overall standard the TC65CX decided to collate the concepts into one standard document and to name it "General Purpose Field Communication System" **(GPFCS)**. Thus manufacturers and users have to refer to only one document while searching for an appropriate solution of their communication needs and they will still have the possibility to make a choice fulfilling their requirements.

In order to give the reader a clear orientation, the standard is divided into three volumes and each volume is divided into well known parts, following the IEC 1158 project subdivision developed by the IEC SC65C WG6 as a guideline.

The part numbering of this document reads as follows: After the EN number the first digit indicates the part of the standard, the second digit indicates the volume which contains the part.

Example: Under EN 50170-6-2 the reader will find Part 6 in volume 2, which is the Application Layer protocol specification of volume 2.

Volume 1 contains:

Foreword

This European Standard was prepared by the Technical Committee CENELEC TC 65CX, Fieldbus.

The text of the draft was submitted to the formal vote and was approved by CENELEC as EN 50170 on 1996-07-02.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 1997-06-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 1997-06-01

In accordance with CEN/CENELEC Memorandum 8 on Standardization and Intellectual Property Rights (IPR), the CENELEC Central Secretariat received a declaration from the three consortia, i.e. PROFIBUS, FIP and P-NET (which are being endorsed as the European Fieldbus solutions with this standard) that

- either there are no IPR rights linked to the specification (FIP and P-NET);
- or that a non-exclusive license is given, free of charge (PROFIBUS).

Some reservation is however to be made to the use of the P-NET® logo, which is limited to members of the International P-Net user Organization ApS. The conditions of using the logo are mentioned in the relevant part of this standard.

Current situation in the European market

The market today is using several well recognised solutions which meet the user needs.

Users and manufacturers in European industry have invested research and development efforts to make fieldbusses becoming a reality in the industrial automation market.

Consequently Europe decided to take advantage of its leadership in technological know-how and product development, in order to ensure return on the investment that have been made in the past.

TC65CX has selected three solutions to define EN 50170 which are standardised in a European country, market proven, open, validated and for each of which conformance tests exist.

The existence of standardised European fieldbus solutions gives therefore stability and certainty to the industry in all European nations and offers the possibility of gaining experience with the new technology today.

A European standard must be available to avoid that too many proprietary de facto solutions occupy the market. Since the completion of future applicable developments in IEC SC65C is still pending, users and manufacturers need today a few cost effective solutions which are applicable to most field devices today.

EN 50170 objective

Given the above mentioned considerations EN 50170 points out the following objectives:

- it is a good solution to fill the gap until IEC 1158 is both complete and proven, and to extend the scope of Fieldbus to many industrial domains,

- it clarifies the situation in Europe with three open standards out of over 50 mainly private solutions . This reduction of the variety of concepts will encourage the manufacturers to develop field devices that are compatible to concepts included in EN 50170. This will increase the competition based on an open neutral communication technology between manufacturers of field equipment to the benefit of the user,

-it eliminates problems of limited availability and monopoly. EN 50170 is, for the time being, the only comprehensive specification fulfilling a variety of user needs for fieldbusses. The specification is complete for all the layers, industrially mature and there are proven applications world-wide. It is the immanent nature of standardisation to avoid monopoly situations by making specifications accessible to the public, ensuring that there are no exclusive intellectual rights owned by a single organisation. As a consequence, EC harmonisation policy has chosen open standards as the basis for products used in public procurement.

From this point of view, EN 50170 is fully in compliance with CENELEC standardisation principles

International standardisation effort

Efforts of numerous fieldbus standards organisations and projects such as the development of the IFC, ISP, WorldFIP, or Fieldbus Foundation have governed this trend in the area of fieldbus communications. Still missing, however, is a world-wide fieldbus standard for field devices and field instruments.

While, outside Europe, discussions are still going on about the fieldbus concepts, European fieldbus solutions are becoming commodity items in many application domains.

Taking into account the development process of the specification of the international fieldbus in the IEC SC65C WG6, which up to now resulted in the publication of the common IEC/CENELEC publication on the physical layer IEC IS 1158-2/EN 61158-2, the following statements are obvious and they should be taken into account while considering the results of CENELEC TC 65CX.

Standardised profiles are needed to allow inter-working between devices in given industrial domains. The NWIP (New Work Item Proposal) « profiles for process control and manufacturing » is approved inside IEC SC65C WG1, but no work has started yet.

Even if IEC fieldbus standard compliant products may be made available after completion of the specification and its industrial implementation, the definition of conformance test requirements has not yet started.

However, the NWIP « conformance testing » is approved within IEC SC65C WG6, but there are still no plans to start the work effort.

The international standard status

The publication of a complete and proven international fieldbus standard can be expected in three to five years at the earliest.

The only approved standard IEC IS 1158-2/EN 61158-2 is receiving several series of amendments either to amend the existing specification or to add new media, which will not directly inter-communicate, unless there are additional adaptions.

Ultimate aim of international fieldbus standardisation

IEC SC 65C and CENELEC TC65CX will continue to strive for an international fieldbus base standard, several international standardised profiles and internationally standardised conformance test methods within the IEC SC65C. TC65CX has already agreed to adopt the results of SC65C on fieldbus once the work is complete and proven. To assess this, they will propose to European nations an explicit vote to publish IEC 1158 project specifications as an EN.

This page is intentionally left blank.

Usage of EN 50170

According to the history and the decision of TC65CX neither to develop any new compromise nor re-write the actual concepts on the market, the reader should pay his dedicated

ATTENTION

to the following notes:

- ***"The EN 50170 contains the following three different specifications without attempting to develop any compromise or to mix them as per the PAS principles:***
  - ***EN 50170 volume 1 (based on and technically identical to DK 502058 and DK 502066)***
  - ***EN 50170 volume 2 (based on and technically identical to DIN 19245 series)***
  - ***EN 50170 volume 3 (based on and technically identical to NFC46602, NFC 46603, NFC46605, NFC46606, NFC46606_A1, NFC46607, NFC46607_A1, IEC IS1158-2).***

  The concepts of these specification are different from each other and therefore they cannot communicate together unless there are additional adaptions. For each implementation, you have to select the one which suits the users' application needs"

- Each one of the three concepts has been described according to ISO/OSI layering even if for performance considerations the layers structure adopted in each concept is simplified and does not comply in detail with the classical one, This limits the combination, reduces the variety of solutions easening the inter-operability inside each concept. The interoperability between the three concepts contained in this standard is not forseen and may be achieved by other means in the users application only.

- Provisions exist in each concept to detect any attempt to mix products pertaining to other concepts and to avoid that such a mistake will not lead to corrupt the working fieldbus; Several levels of protection exist, that cover connectors, physical layer coding, different speeds and effective network management.

- IEC based solutions will not solve more easily those safety problems of connecting a device which is not allowed on that bus. Several hazards will still exist due to variations of the versions of the physical layer (connector is not mandatory, neither is the insulation via a transformer), also different options in the Data Link which may corrupt the Link Active Scheduler timing schedule.

Conformance testing

It is stated by CLC/TC65CX that one (or more) Competence Body has to be accredited by the appropriate authority as soon as possible, in order to certify the products as compliant to the possible concepts of EN 50170, so that users may be provided with the correct elements to select products for their fieldbus applications. Meanwhile each product supplier has to declare, under his own responsibility, which EN 50170 concept he uses, and to what extend within that given concept, his product is compliant to. To facilitate this TC 65CX will publish after EN 50170 has been approved the appropriate set of PICS (Protocol Implementation Conformance Statements) pro-forma.

This page is intentionally left blank.

General Purpose Field Communication System

Part 0-1

Introduction

Contents

1 Scope

General communication standards for automation systems have come a long way in the last years, bringing the concept of open system interconnection closer to general acceptance and wide spread use.

EN 50170 is a standard specifying a set of solutions named General Purpose Field Communication System. The scope covers complex devices, intelligent field devices as well as simple I/Os. It is not limited to the process industry but it intends to meet the needs of most industrial domains. To date, there is no single concept able to cover the complete range of communication qualities in a simple way.

2 Introduction to General Purpose Field Communication System

2.1 What is a "General Purpose Field Communication System"?

The „general purpose field communication system" is principally a communication means between equipment close to the manufacturing process like sensors and actuators on machines, etc. and the control level equipment. Further precise definition is difficult as it limits the use of this communication technology.

The scope of information transfer goes far beyond of replacing analogue 4 to 20 mA signals. Decentralised intelligent systems need communication from and to devices in a comfortable user or application oriented way. They have to fulfil all requirements of modern Industrial Process Measurement and Control Systems (IPMCS), which means high flexibility and adaptability. There is a clear trend in all economical sectors towards the use of intelligent decentralised systems using field communication as a basic functionality.

Nevertheless the "general purpose field communication systems", which will further on be called "fieldbus", can be described by some outstanding characteristics:

Closeness to the physical process

For a long time fieldbus has been considered as the lowest level in the communication hierarchy. The fieldbus connects the sensors, actuators and even complex devices to the control system, independently whether they handle binary or analogue signals. These sensors and actuators are directly installed in the physical process. Consequently the fieldbus builds the borderline between the physical process based on analogue signals and the control domain based on digital information. In the meantime the technical progress leads to more specialised solutions, e. g. ASI, CAN and others, which are summarised by the term "sensor/actuator busses". Systems which are optimised in this direction are not in the scope of this standard.

The equipment located close to the process has integrated more and more intelligence and need to be served by a more general purpose communication system without sacrifying the requirement of transferring in a timely way the primary control information.

Larger areas

The word "field" also associates a larger expansion. While distances up to 10 m are still the domain of parallel or specialised serial busses, fieldbusses cover distances between several 100 m up to 5000 m.

Number of devices, costs

As the fieldbus concept is far away from the initial 4 to 20 mA control loop, the number of devices connected has increased and is considered in the range of ten to several hundred for one bus. In a plant (i.e. chemical plants or off shore platforms) up to ten or more fieldbus segments may be implemented having several thousand devices connected to the busses. The fieldbus is then a technology to interconnect very simple devices to sophisticated ones and there is a need for a range of connecting interfaces where low cost is a dominating requirement.

Time-critical operations

Fieldbus communication systems are oftenly integral part of control functions of automated processes. As such they have to comply with time constraints imposed by the control system. Basic features are predictable time access as well as predictable delivery time. It should also offer resistance to traffic overload in case of burst of events.

Transmission integrity, availability

As this communication system is the only link to the production process, the transmission shall be very reliable. Fieldbusses should therefore offer the following features at minimum:

- transmission integrity with undetected error rate below one error in 20 years
- redundancy capabilities such as dual media or dual buses, ...
- transmission verification (timelines, acknowledgement, ...)

User selection of services

Application have various needs in terms of priority, services integrity, time behaviour and recovery in case of network congestion.

This means that services and quality of services shall be user (or application) selectable.

For a given field equipment, it may have to accomplish this different qualities when used in one or another type of application. Then the fieldbus shall support remote configuration in order to select the proper communication quality as well as the proper local application options.

Integration, open architecture

In addition to the classical client server approach, the fieldbus should support distributed time critical architecture in which the exchanges are done through „variables" which constitute a shared database updated in real time.

Heavy environmental condition

As the fieldbus is close to the process, it is subject to harsh environment and more specifically shall withstand without error high electromagnetic interference. This level of interference is modelled by the „severity 3" of the IEC 801.x standards and enforced by the EEC directive 89/336 (CE mark).

Solutions

All of the above features are engineered in distinct fieldbus solutions. Each of them have privileged certain aspects according to the overall system philosophy.

These solutions are now well established on the market and cannot be reconciled easily in a single solution, without requesting a complete re-engineering of them and finally leading to a distinct profile of the common solution.

The EN 50170 has selected solutions whose functionalities will be integrated by IEC 1158, when available, according to the following set of criteria:

1. Candidates shall be national standard or pre-standard.

2. Candidates shall fit into the scope and policy statement of TC65CX (see documents CLC/TC65CX(SEC)4 and CLC/TC65CX(Bxl/SEC)1).

3. Candidates shall be suitable for comparable usage in applications by providing features such as:

   - bus type topology
   - client/server functionality or producer/consumer functionality with distributed database
   - a complete range of services in Data Link Layer, Application Layer and for System Management
   - bandwidth of candidates shall be appropriate to the number of connected elements

4. Candidates should be documented in English language according to classical OSI/IEC decomposition in layers.

5. The description shall cover all aspects of communication in order to be able to build an open working system.

6. Candidates shall be already in use in commercial products and running in industrial plants (demo is not considered as industrial use).

7. Products should be available in quantities and at low price. Users shall be in the position to make experiences with fieldbus products and be given advice on how to use existing concepts.