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Home and Building Electronic Systems (HBES)

Part 1: Standardization structure

Norwegian electrotechnical standard

Elektronikksystemer for hjem og bygninger (HBES)

Del 1: Struktur for standardisering

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Systèmes électroniques pour les foyers domestiques et les bâtiments (HBES) - Partie 1: Structure de la norme

Elektrische Systemtechnik für Heim und Gebäude (ESHG) - Teil 1: Aufbau der Norm

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CENELEC

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

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Foreword

This European Standard was prepared by the Technical Committee CENELEC TC 205, Home and Building Electronic Systems, joined by the co-operating partner Konnex Association.

The text of the draft was submitted to the Unique Acceptance Procedure and was accepted by CENELEC as EN 50090-1 on 2011-02-21.

This document supersedes EN 50090-2-1:1994.

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

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)	2012-02-21
– latest date by which the national standards conflicting with the EN have to be withdrawn	(dow)	2014-02-21

EN 50090-1 is part of the EN 50090 series “Home and Building Electronic Systems (HBES)”, which will comprise the following parts (see Clause 2 for further details):

Part 1: Standardization structure;

Part 2: Void;

NOTE EN 50090-2-1:1994 is incorporated and superseded by this Part 1.

EN 50090-2-2:1996 and its amendments are incorporated and superseded by EN 50491-3:2009, EN 50491-5-1:2010, EN 50491-5-2:2010 and EN 50491-5-3:2010.

EN 50090-2-3:2005 will be incorporated and superseded by the EN 50491 series.

Part 3: Aspects of application;

Part 4: Transport layer and network layer;

Part 5: Media and media dependent layers;

Part 6: Interfaces;

Part 7: Management;

Part 8: Conformity assessment of products;

Part 9: Installation requirements.

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Introduction

This European Standard outlines the main elements of the HBES Open Communication System and the concept behind it. It should be used as a guideline for the EN 50090 series.

Home and Building Electronic Systems as provided by the HBES Open Communication System are a specialized form of automated, decentralised and distributed process control, dedicated to the needs of home and building applications.

The specification of the HBES Open Communication System provides, besides runtime characteristics, a “toolkit” of services and mechanisms for network management.

On the HBES Open Communication System Device Network, all devices form distributed applications, which are able to interact with one another taking into account Interworking rules (standardized Datapoint Types and “Functional Block” objects, modelling logical device channels). This run-time Interworking allows the creation of a comprehensive and multi-domain home and building communication system

The available communication media range from Twisted Pair to Powerline and 868 MHz band Radio Frequency.

The HBES Open Communication system is independent of any specific microprocessor platform or architecture. Depending on the profile chosen by the manufacturer, any suitable industry-standard chip can be chosen. Some HBES Open Communication System profiles allow a tiny system footprint (say < 5 kbit) and can run on an 8-bit processor. Implementations can however also be realised on 16- or 32-bit processors, or even PC’s.

The features of HBES Open Communication System allow its use in different application domains and installation types, and also in “Service Network” environments (usually based on broadband networks running IP, the Internet Protocol). To address this need, the transmission of HBES Open Communication System frames across an IP network has been standardised in EN 50090-4-3:2007.

1 Scope

This European Standard concentrates on control applications for Home and Building HBES Open Communication System and covers any combination of electronic devices linked via a digital transmission network. Home and Building Electronic System as provided by the HBES Open Communication System is a specialized form of automated, decentralised and distributed process control, dedicated to the needs of home and building applications.

The EN 50090 series concentrates on HBES Open Communication System Class 1 and includes a specification for a communication network for Home and Building for example for the control of lighting, heating, food preparation, washing, energy management, water control, fire alarms, blinds control, different forms of security control, etc.

This European Standard gives an overview of the features of the HBES Open Communication System and provides the reader with references to the different parts of EN 50090 series.

This European Standard is used as a product family standard. It is not intended to be used as a stand-alone standard.

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.

EN 50090-3-1	1994	Home and Building Electronic Systems (HBES) – Part 3-1: Aspects of application – Introduction to the application structure
EN 50090-3-2	2004	Home and Building Electronic Systems (HBES) – Part 3-2: Aspects of application – User process for HBES Class 1
EN 50090-3-3	2009	Home and Building Electronic Systems (HBES) – Part 3-3: Aspects of application – HBES Interworking model and common HBES data types
EN 50090-4-1	2004	Home and Building Electronic Systems (HBES) – Part 4-1: Media independent layers – Application layer for HBES Class 1
EN 50090-4-2	2004	Home and Building Electronic Systems (HBES) – Part 4-2: Media independent layers – Transport layer, network layer and general parts of data link layer for HBES Class 1
EN 50090-4-3	2007	Home and Building Electronic Systems (HBES) – Part 4-3: Media independent layers – Communication over IP (EN 13321-2:2006)
EN 50090-5-1	2005	Home and Building Electronic Systems (HBES) – Part 5-1: Media and media dependent layers – Power line for HBES Class 1
EN 50090-5-2	2004	Home and Building Electronic Systems (HBES) – Part 5-2: Media and media dependent layers – Network based on HBES Class 1, Twisted Pair
EN 50090-5-3	2006	Home and Building Electronic Systems (HBES) – Part 5-3: Media and media dependent layers – Radio frequency
EN 50090-7-1	2004	Home and Building Electronic Systems (HBES) – Part 7-1: System management – Management procedures
EN 50090-8	2000	Home and Building Electronic Systems (HBES) – Part 8: Conformity assessment of products

EN 50090-9-1	2004	Home and Building Electronic Systems (HBES) – Part 9-1: Installation requirements – Generic cabling for HBES Class 1 Twisted Pair
CLC/TR 50090-9-2	2007	Home and Building Electronic Systems (HBES) – Part 9-2: Installation requirements – Inspection and testing of HBES installation
EN 50491-2	2010	General requirements for Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS) – Part 2: Environmental conditions
EN 50491-3	2009	General requirements for Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS) – Part 3: Electrical safety requirements
EN 50491-5-1	2010	General requirements for Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS) – Part 5-1: EMC requirements, conditions and test set-up
EN 50491-5-2	2010	General requirements for Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS) – Part 5-2: EMC requirements for HBES/BACS used in residential, commercial and light industry environment
EN 50491-5-3	2010	General requirements for Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS) – Part 5-3: EMC requirements for HBES/BACS used in industry environment
CLC/TR 50552	2010	Home and Building Electronic Systems (HBES) – Open communication system – Interfaces – Medium interface, twisted pair, class 1

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1
Home and Building Electronic Systems (HBES)
communication system on which elements or entities of several applications are distributed and logically linked together via one or more networks

3.1.2
HBES Open Communication System
HBES according to EN 50090 series

3.1.3
HBES Class 1
HBES with transport capabilities for applications such as:

- control;
- monitoring;
- measurement;
- alarm;
- low speed data transfer

3.2 Abbreviations

For the purposes of this document, the following abbreviations apply:

IP	Internet Protocol
TPCI	Transport Layer Protocol Control Information
APCI	Application Layer Protocol Control Information
LPDU	Link Layer Protocol Data Unit

4 General requirements

A product claiming compliance with EN 50090 shall comply with the full set of EN 50090 series, according to the selected media, and with the relevant parts of EN 50491 series listed under Clause 2.

5 Elements of the HBES Open Communication System Architecture

5.1 General

The HBES Open Communication System specification contains a number of mechanisms to bring the network into operation but leaves the possibility for the implementer to choose the most adapted configuration Figure 1 shows an overview of the HBES Open Communication System model.

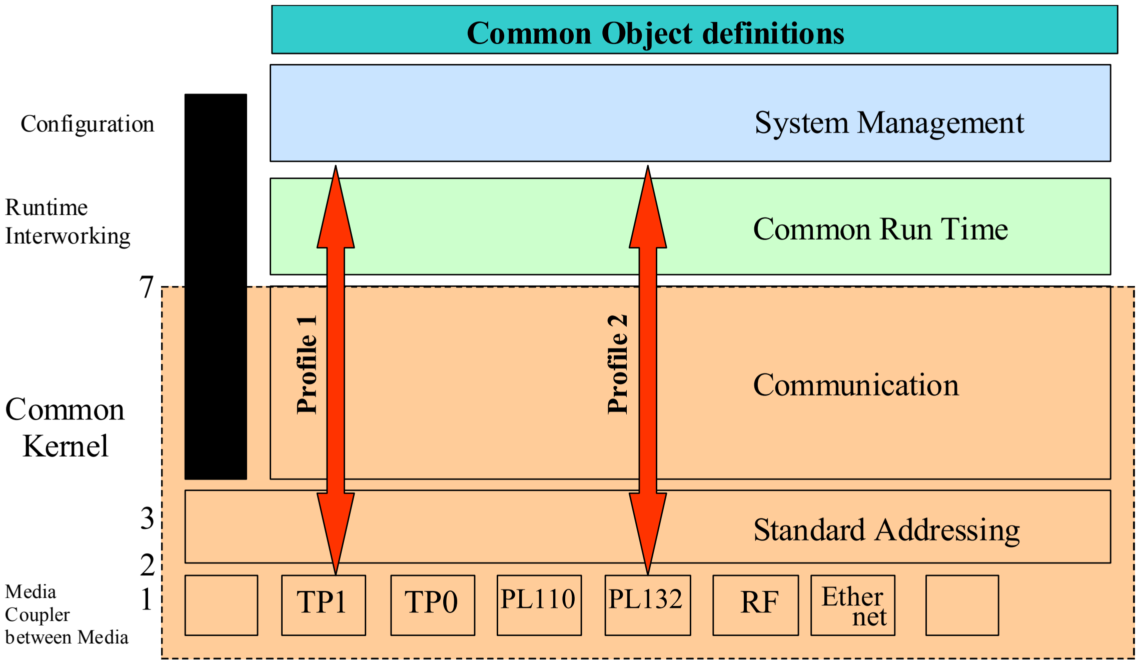

Figure 1 – The HBES Open Communication System Model

The following constitute the essential ingredients of the HBES Open Communication System:

- Interworking and (Distributed) Application Models for the various tasks of Home and Building Automation. These are described in EN 50090-3-2 and EN 50090-3-3 (Aspects of application – HBES Interworking model and common HBES data types).

- Schemes for Configuration and Management, to properly manage all resources on the network, and to permit the logical linking or binding of parts of a distributed application, which run in different devices. These are structured in a set of Management Procedures as described in EN 50090-7-1.

- Communication System, with a set of physical communication media, a message protocol and corresponding models for the communication stack in each node; this Communication System has to support all network communication requirements for the Configuration and Management of an installation, as well as to host Distributed Applications on it. This is typified by the HBES Open Communication System Common Kernel. These are described in EN 50090-5 series (for the different supported media) and in EN 50090-4 series (for the media independent layers).

- Concrete Device Models, summarized in Profiles for the effective realization and combination of the elements above when developing actual products or devices, which will be mounted and linked in an installation. These are described in EN 50090-9-1, CLC/TR 50090-9-2 and CLC/TR 50552.

A more detailed description of the above-mentioned elements is given below.

5.2 Applications, Interworking and Binding

Central to HBES Open Communication System application concepts is the idea of Datapoints: they represent the process and control variables in the system, as explained in EN 50090-3 series. These Datapoints may be inputs, outputs, parameters, diagnostic data etc. The standardized containers for these Datapoints are Group Objects and Interface Object Properties.

The Communication System and Protocol are expected to offer a reduced instruction set to read and write (set and get) Datapoint values: any further application semantics is mapped to the data format and the bindings, making the HBES Open Communication System primarily “data driven”.

In order to achieve Interworking, the Datapoints have to implement Standardized Datapoint Types, themselves grouped into Functional Blocks. These Functional Blocks and Datapoint Types are related to applications fields, but some of them are of general use and named functions of common interest (such as date and time).

Datapoints may be accessed through unicast or multicast mechanisms.

Clause 8 zooms in on these aspects.

5.3 Configuration

There are two levels at which an installation has to be configured. First of all, there is the level of the network topology and the individual nodes or devices.

In a way, this first level is a precondition, prior to the configuration of the Distributed Applications, i.e. binding and parameter setting.

Configuration may be achieved through a combination of local manipulations on the devices (e.g. pushing a button, setting a code wheel, or using a locally connected configuration tool), and active Network Management communication over the bus (peer-to-peer as well as more centralized master-slave schemes).

5.4 Network Management and Resources

To accommodate all active configuration needs of the system, HBES Open Communication System is equipped with a toolkit for network management. These instruments can be used throughout the lifecycle of an installation: for initial set-up, for integration of multi-mode installations, for subsequent diagnostics and maintenance, as well as for later extension and reconfiguration.

Network Management in the HBES Open Communication System specifies a set of mechanisms to discover, set or retrieve configuration data actively via the network. It proposes Procedures (i.e. message sequences) to access values of the different network resources within the devices, as well as identifiers and formats for these resources – all of this in order to enable a proper Interworking of all

HBES Open Communication System network devices. These resources may be addresses, communication parameters, application parameters, or complex sets of data like binding tables or even the entire executable application program.

The network management basically makes use of the services offered by the application layer as specified in EN 50090-4-1. For configuration purposes, each device shall implement the services and resources specified in the relevant “profile”.

For managing the devices, these services are used within procedures. Configuration can be ensured via an identified set of procedures, which are described in EN 50090-7-1. Different solutions are possible, ranging from the commissioning of devices by:

- a connected PC with installed software program, sometimes referred to as "System Mode". The product data is either part of the tool or imported into a database of the tool. By means of these product descriptions, the binding and parameterisation of products is realised;
- a connected Controller acting as a master device, scanning for devices on the network and obtaining information on their features via a device descriptor sent by the connected devices. On the basis of a database inside the controller and appropriate settings via a display on the controller, the products are linked and parameterised. This type of configuration is sometimes referred to as "Easy controller mode";
- activating actuators to acquire sensors as partner devices: only when devices send device descriptors that can be linked, will the devices be linkable. Parameters in this case are often set locally on the device. This type of configuration is referred to as "Push button mode";
- assigning semantically or geographical zoning tags to partner devices: only when the tag matches, will devices be able to communicate to one another. This type of configuration is referred to as "Logical Tag Reflex mode".

Underneath the Communication System’s messaging solutions for applications as well as management are described, beginning with the physical transmission media.

5.5 Communication: Physical Layers

The HBES Open Communication System offers the choice for the manufacturers, depending on his market requirements and habits, to choose between several physical layers, or to combine them. With the availability of routers, and combined with the Interworking, multi-media, and also multi-vendor configurations can be built.

The different media are:

a) TP 0 and TP 1, provide both improved solutions for twisted pair cabling, both using a SELV or PELV network and supply system. Main characteristics are: data and power transmission with one pair (devices with limited power consumption may be fed by the bus), and asynchronous character oriented data transfer and half duplex bi-directional communication. TP 0 transmission rate is 2 400 bit/s while TP 1 is 9 600 bit/s. Both media implement CSMA/CA collision avoidance. All topologies may be used and mixed (line, star, tree). These media are described in EN 50090-5-2.

b) PL 110 and PL 132 enable communication over the mains supply network. Main characteristics are: spread frequency shift keying signalling, asynchronous transmission of data packets and half duplex bi-directional communication. Both differ mainly by their central frequency (110 kHz and 132 kHz), their decoding process, and data rate (PL 110 = 1 200 bit/s; PL 132 = 2 400 bit/s). Both media implement CSMA and are compliant to EN 50065-1 (respectively in frequency band without and with standard access medium protocol). These media are described in EN 50090-5-1.

c) RF enables wireless communication in the 868 MHz radio frequency band. The main characteristics are frequency shift keying signalling, asynchronous transmission and half duplex bi-directional or unidirectional communication. The central frequency is 868,30 MHz for short-range devices with duty cycle limited to < 1 %, and a data rate of 32 kHz. The medium access is based on CSMA mechanisms. The medium and the lower part of the Data Link Layer have been specified in common with CEN/TC 294 for metering, to be able to share hardware platforms. HBES Open Communication System RF is compliant to ERC recommendation ERC/REC 70-03 and the ETSI EN 300 220 series. This medium is described in EN 50090-5-3.

d) Beyond these Device Network media, the HBES Open Communication System has unified service and integration solutions for IP-enabled media like:

   1) Ethernet (IEEE 802.2);

   2) Bluetooth, Wi-Fi/Wireless LAN (IEEE 802.11);

   3) “FireWire” (IEEE 1394), etc.,

   as documented in EN 50090-4-3.

5.6 Communication: Common Kernel and Message Protocol

The Communication System must tend to the needs of the Application Models, Configuration and Network Management. On top of the Physical Layers and their particular Data Link Layer, a Common Kernel model is shared by all the devices of the HBES Open Communication System Network; in order to answer all requirements, it includes a 7 Layers OSI model compliant communication system.

- Data Link Layer General, above Data Link Layer per medium, provides the medium access control and the logical link control. This layer is described in EN 50090-4-2.

- Network Layer provides a segment wise acknowledged telegram; it also controls the hop count of a frame. Network Layer is of interest mainly for nodes with routing functionality. This layer is described in EN 50090-4-2.

- Transport Layer (TL) enables four types communication relationship between communication points: one-to-many connectionless (multicast), one-to-all connectionless (broadcast), one-to-one connectionless, one-to-one connection-oriented. For freely bound models (see below), TL also separates (“indirect”) the network multicast address from the internal representation. This layer is described in EN 50090-4-2.

- Session and presentation Layers are empty.

- Application Layer offers a “toolkit” variety of application services to the application process. These services are different depending on the type of communication used at transport layer. Services related to point-to-point communication and broadcast mainly serve to the network management, whereas services related to multicast are intended for runtime operation. This layer is described in EN 50090-4-1.

The HBES Open Communication System does not fix the choice of microprocessor. Since in addition, the HBES Open Communication System allows a range of configuration and device models, the precise requirements governing a particular implementation are established in detailed profiles. Within these boundaries, the HBES Open Communication System developer is encouraged to find the optimal solution to accommodate his implementation requirements.

As will be shown in the underneath paragraphs, the HBES Open Communication System message frame or telegram format also reflects this communication structure.

5.7 Resources

Network Management consists of Procedures for manipulating Resources and the Common Kernel provides a toolkit of services for this purpose.

Resources can be:

- "System" (configuration) resources, with address, lookup and parameter information to help the layers of the communication system carry out their task.

  An example of such a system resource would be the address and indirection tables for free Group Communication or the Individual Address of the node as such. System resources also include '"discovery" information, allowing a partner on the network to find out about the capabilities of some other node or application. As a consequence of this, interaction becomes possible between Configuration Controllers or PC-based tools and the network.

- Parameters controlling the application.

  It is worth noting that HBES' Open Communication System Interface Objects provide an implementation-independent framework for realizing resources, the individual elements of which can be modelled as Datapoints. Interface Objects and their relationship to Datapoint are explained below.

5.8 Device Models

HBES Open Communication System installation consists of a set of devices connected to the bus or network. Every facet outlined above is ultimately realized in and through the devices. Models vary according to node capabilities, management features, type of configuration and to the role of the device in the network, e.g. typical "application (end) device", configuration master, router, gateway, etc.

5.9 Device identification

In complement to the basic operational system, a set of identification mechanisms is provided:

a) Devices may be identified and subsequently accessed throughout the network either by their individual address, or by their unique serial number, depending on the configuration mode.

b) Installation's extendibility and maintenance is considerably eased through product identification (i.e. a manufacturer specific reference) and functional identification (manufacturer independent) information retrievable from devices.

c) Mechanisms are defined around the unique serial number feature to:

   1) get individual address of a device with a given serial number (so providing further access);

   2) set individual address of a device with a given serial number;

   3) retrieve serial number of a device at a given individual address.

The manufacturer shall ensure the uniqueness of the serial numbers.

6 System Capabilities, Communication and Addressing Models

6.1 General

The encoding space for addressing fixes some fundamental capabilities of the system in terms of size (maximum number of addressable devices and Datapoints). The addressing is reflected in the encoding format of the message frame or telegram, as is the "shadow" of the communication stack and kernel. According to which principles addresses are used to identify Datapoints (binding) will be described in Clause 7.

6.2 Logical Topology and Individual Address Space

HBES Open Communication System is a distributed network, which accommodates up to 65 536 devices in a 16 bit Individual Address space. The logical topology or *subnetwork* structure allows 256 devices on one *line*. As shown in Figure 2 lines may be grouped together with a *main line* into an *area*. An entire domain is formed by 15 areas together with a *backbone line*.

NOTE The backbone line may be supported by IP communication according to EN 50090-4-3.

As shown in Figure 2, this topology is reflected in the numerical structure of the individual addresses, which (with few exceptions) uniquely identify each node on the network.

On Powerline, nearby domains are logically separated with a 16-bit Domain Address. Without the addresses reserved for couplers, (255 × 16) × 15 + 255 = 61 455 end devices may be joined by an HBES Open Communication System network. Installation restrictions may depend on implementation (medium, transceiver types, power supply capacity) and environmental (electromagnetic noise, etc.) factors. Installation and product guidelines shall be taken into account.

On RF, interference between two adjacent installations is avoided by using the extended address scheme that associates the Individual Address and Group Addresses to the unique device identifier. This also enables taking into account unidirectional devices only, which can be designed at lower cost for sensor functions.

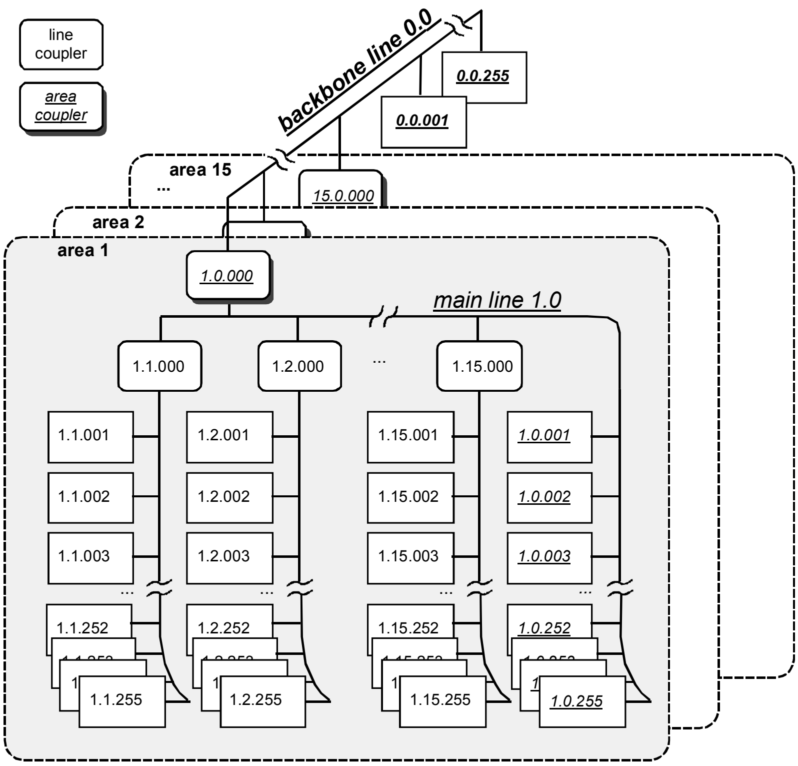

Figure 2 – The logical topology of HBES Open Communication System

Couplers connect lines or segments, e.g. within the Twisted Pair (TP) medium, or different media; their functionality may be (some combination of) repeater, bridge, router, package filter (for traffic optimisation), firewall protection, etc. The HBES Open Communication System defines various standard coupler profiles.

6.3 Network & Resource Management with Broadcast and Unicast “Point-To-Point” Services

To manage network and device resources (e.g. when configuring an installation), the HBES Open Communication System uses a combination of broadcast and point-to-point communication.

Most often, each device in the installation is assigned a unique Individual Address via broadcast (optionally using a device’s unique serial number), which is used from then on for further point-to-point communication.

- A connection (optionally with access authorisation) may be built up, for example to download the complete "applet" binary image of an application program.
- Some resources may also be accessed in connectionless point-to-point communication.

6.4 Multicast “Group Addressing” for Run-time Efficiency

The HBES Open Communication System supports full multicast (“group”) addressing, which is mainly used for run-time communication in the HBES Open Communication System. *Full* means that:

a) HBES is not limited to grouping devices: each device may publish several Datapoints (known as “(Group) Communication Objects”) individually, which can be grouped independently from one another into network-wide shared variables. Properties of Interface Objects (see 7.4) may also be published as shared variables;

b) as explained above in the description of the group-oriented HBES Open Communication System communication stack, a shared variable can be read/write bi-directional. In this way, all devices can also send unsolicited multicast frames;

c) the HBES Open Communication System makes a 16-bit address space available for these shared variables. This signifies that one installation may have up to 64 k shared variables (or “group addresses”), each with any number of local instances.

6.5 Frame Overview

This subclause describes the actual HBES Open Communication System message format, as serially encoded in the frames or telegrams sent on the bus.

Depending on the modulation technique or access and collision control of any specific medium, some preamble or envelope sequence may be defined, which is not described in this clause. The following example format actually corresponds to the interface above Layer 2. Special acknowledge frames, etc. are all described at length in the respective parts of EN 50090-5 series.

<table>
<tr><td>Octet 0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td colspan="3">6</td><td colspan="3">7</td><td>8</td><td>…</td><td>N – 1</td><td>N ≤ 22</td></tr>
<tr><td>Control Field</td><td colspan="2">Source Address</td><td colspan="2">Destination Address</td><td>Address Type; NPCI; length</td><td colspan="2">TPCI</td><td colspan="2">APCI</td><td colspan="2">data/ APCI</td><td colspan="3">data</td><td>Frame Check</td></tr>
</table>

Figure 3 – HBES Open Communication System LPDU standard frame structure (long frames allow N < 255)

First of all, the Control Field determines the frame Priority and distinguishes between the Standard and Extended Frame. In each case, there is an individual Source Address and individual (unicast) or group (multicast) Destination Address; a special field determines the Destination Address type.

A frame's Hop Count is decremented by routers to avoid looping messages; when it becomes zero, the frame is discarded from the network.

The TPCI controls the Transport Layer communication relationships, e.g. to build up and maintain a point-to-point connection. Several Application Layer services (Read, Write, Response, etc.) can be encoded in the APCI, which are available for the relevant addressing scheme and communication relationship.

Depending on the addressing scheme and APCI, the standard frame can carry up to 14 octets of data. Segmentation for bulk transfer, like the download of an entire application program, is the responsibility of the management client. The extended frame can harbour up to 248 octets of data.

Finally, the Frame Check helps ensure data consistency and reliable transmission.

7 Application Models, Datapoints and Binding

7.1 General

Ultimately, all elements of the HBES Open Communication System architecture just serve as infrastructure and means for getting application for lighting, HVAC, security, etc. to run on the system. In this section, the central role in HBES Open Communication System application modelling of Datapoints is described and how they are linked ("bound"). Their role and appearance is important to understand Clause 8.

7.2 Datapoints and Distributed Applications

HBES Open Communication System models an application on the Device Network as a collection of sending and receiving Datapoints, distributed over a number of devices.

The system comes to life when Datapoints in different devices are linked via a common identifier, in other words bound, by the multicast Group Address. Accordingly, data can be transferred between different devices, each with its local application.

When a local application in a device, a sensor writes a value to a sending Datapoint, this device sends a ("write") message with the corresponding address and the new value. A receiving Datapoint with this same address will receive this value, and inform its local application. In turn, this receiving application can now act upon this value update if it wishes to do so. This action can be an internal state change or updating one of its own sending Datapoints (like in a controller), or modifying some physical output status (for example in an actuator device); or indeed any combination of these.

In this way, local applications in a number of devices, with linked Datapoints, combine to form a Distributed Application. Datapoints will figure prominently in the Interworking Models.

7.3 Group objects

HBES Open Communication System's principal realization form for Datapoints, is given by the Group objects; as their name suggests, they are accessed via standard, multicast "group" addressing. The links are precisely the Group Addresses. Combined with the standard group message format, they make up the foundation of the system's cross-discipline Interworking and multi-mode integration facilities.

Here, the (local) application sees the bus as a limited set of Group objects; these correspond to those Datapoints, which are of direct relevance to it. Put simply, each Communication Object appears to its application as a local variable with supporting attributes. The variable holds the value received from, or to be sent to the bus. Via the attributes, a default handler on top of the node's communication stack can inform the application that the corresponding value has been updated; vice versa, the application can request the stack to send a value. This assumes a cyclic polling on both sides of the interface; more sophisticated implementations may map this interface to a custom call-back handler.

Transport layer converts a received Group Address to a purely local "internal reference" (using the Group Address Table resource). Now it is up to Application Layer to map this reduced internal message, with possible multiplexing, to one or more Communication Object Number identifiers (by means of the Association Table resource). The converse happens for sending (without local multiplexing).

7.4 Properties of Interface Objects as Datapoints

To accommodate additional requirements, the HBES Open Communication System also provides a more intrinsic notion of Datapoint, in the form of a Property belonging to an Interface Object. The Interface Object simply groups a set of *property* Datapoints into a common interface structure or object.

Whereas a node's Group objects constitute a flat set of Datapoints, which are each directly addressed, each property of an Interface Object is *referenced relative to this Object*, according to the <ObjectReference>.<Property> pattern. In this respect, an Interface Object is well suited to model a Functional Block (see 8.2) from the Application Models.

Interface Objects are not limited to application Datapoints; they also allow a Datapoint-style modelling of management resources in the devices.

The Interface Object itself is referenced relative to the node, with an Index and on point-to-point communication. In this way, they can be used for configuration and parameter setting.

8 Interworking Model

8.1 General

For installers, integrators and especially the consumer, the Interworking Models are definitely the most valuable and valued among the assets the HBES Open Communication System has to offer. Interworking guarantees them the possibility to achieve the richest possible integration between devices within any application, as well as between various application domains.

The interworking model is given in EN 50090-3-3.

8.2 The Application: Datapoint Types and Functional Blocks

HBES Open Communication System Interworking principles rest upon the Application Model from the previous section.

Essentially, they describe how each local application looks, when seen from the network; in other words: what its Datapoint interface is. Completed, to the relevant extent, with its intended behaviour in terms of internal state machines, message and physical I/O, this constitutes the so-called Functional Block description of each local part of the distributed application.

Inside the Functional Block specification, each Datapoint is assigned an explanatory name, together with its required Datapoint Type; the type fixes the format of the data, which the Datapoint sends to or receives from the bus. The core set of the HBES Open Communication System data type family comprises types for e.g.:

- Binary Value (Boolean);
- Relative Control (“%”);
- Analogue Value (long and short float);
- Counter Value (signed and unsigned integer);
- Date & Time;
- Status (bit field).

8.3 Parameter Datapoints

“Application variable” Datapoints exhibiting such general-purpose types cover most of the elementary communication needs for run-time operation. For a particular application, its variables in this sense enable it to perform its essential functionality. Complementary to these we find Parameters: specialized Datapoints, sometimes requiring more specific types, to give more detailed control over the basic conduct of the application.

Annex A
(informative)

Overview of Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS) (EN 50491 series) and HBES Open Communication System (EN 50090 series)

Table A.1 – Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS) (EN 50491 series)

EN 50491 series is published under the generic title “General requirements for Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS)”.		
Environmental conditions	EN 50491-2:2010	General safety requirements and environ-mental conditions
Electrical safety requirements	EN 50491-3:2009	Electrical safety requirements
Functional safety	EN 50491-4-1	General requirements (At draft stage)
	EN 50491-4-2	Particular requirements for safety related equipment (Future development)
EMC	EN 50491-5-1:2010	EMC requirements, conditions and test set-up
	EN 50491-5-2:2010	EMC requirements for residential, commercial and light industry environment
	EN 50491-5-3:2010	EMC requirements for industrial environment
Installation	EN 50491-6	Inspection and testing of HBES Installation
Interoperability (between HBES systems)	EN 50491-10	Interoperability (Future development)
HBES gateways	EN 50491-11	Gateways (Future development)
System security	EN 50491-12	System security (Future development)

Table A.2 – HBES Open Communication System (EN 50090 series)

EN 50090 series is published under the generic title “Home and Building Electronic Systems (HBES)”.		
Overview	EN 50090-1	Overview and general requirements
System architecture	EN 50090-2	Void NOTE EN 50090-2-1:1994 is incorporated and superseded by this Part 1. EN 50090-2-2:1996 and its amendments are incorporated and superseded by EN 50491-3:2009, EN 50491-5-1:2010, EN 50491-5-2:2010 and EN 50491-5-3:2010. EN 50090-2-3:2005 will be incorporated and superseded by the EN 50491 series.
Application	EN 50090-3-1	Introduction
	EN 50090-3-2	User process
	EN 50090-3-3	Interworking: Aspects of application – HBES Interworking model and common HBES data types
Media independent layer	EN 50090-4-1	Application layer
	EN 50090-4-2	Transport layer, network, etc.
	EN 50090-4-3	IP routing media independent layers – Communication over IP
Physical layers	EN 50090-5-1	Powerline
	EN 50090-5-2	Twisted pair Class 1
	EN 50090-5-3	Radio frequency
	CLC/TR 50552	Medium Interface, TP
System management	EN 50090-7-1	Management procedures
Conformity	EN 50090-8	Conformity assessment
Installation requirements (current)	EN 50090-9-1	Class 1, TP
	CLC/TR 50090-9-2	Inspection and testing

Bibliography

EN 50065-1		Signalling on low-voltage electrical installations in the frequency range 3 kHz to 148,5 kHz – Part 1: General requirements, frequency bands and electromagnetic disturbances
ERC/REC 70-03		ERC Recommendation 70-03 relating to the use of short range devices (SRD)
ETS 300 220	Series	ElectroMagnetic Compatibility and Radio Spectrum Matters (ERM); Short Range Devices (SRD);Radio equipment to be used in the 25 MHz to 1 000 MHz frequency range with power levels ranging up to 500 mW
IEEE 802.2		Logical Link Control
IEEE 802.11		IEEE Standard for Information Technology-Telecommunications and Information Exchange Between Systems-Local and Metropolitan Area Networks-Specific Requirements – Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications
IEEE 1394		IEEE Standard for a High-Performance Serial Bus

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The European Committee for Electrotechnical
Standardization, CENELEC

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