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Odprta izmenjava podatkov v avtomatizaciji stavb in izvršnih elementov ter pri upravljanju stavb - Preslikava med Lonworks in BACnet

Open data communication in building automation, controls and building management - Mapping between Lonworks and BACnet

Offene Datenkommunikation für die Gebäudeautomation und Gebäudemanagement - Gegenseitige Abbildung von LONWORKS- und BACnet-Objekten

Réseau ouvert de communication de données pour l'automatisation, la régulation et la gestion technique du bâtiment - Intégration des fonctionnalités (mapping) entre LONWorks et BACnet

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Open data communication in building automation, controls and building management - Mapping between Lonworks and BACnet

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This Technical Specification (CEN/TS) was approved by CEN on 22 August 2005 for provisional application.

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Contents

Foreword

This Technical Specification (CEN/TS 15231:2006) has been prepared by Technical Committee CEN/TC 247 “Building automation, controls and building management”, the secretariat of which is held by SNV.

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This technical specification covers the methods of mapping LONWORKS objects and services to BACnet objects and services and vice versa. The LONWORKS objects and services are defined in the standard EN 14908-1 "Control Network Protocol" and the BACnet objects and services are defined in the standard EN ISO 16484-5 "Data Communication Protocol".

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this CEN Technical Specification: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

This Technical Specification specifies methods for the mapping of objects and services of the Control Network Protocol (CNP) , called LONWORKS (see EN 14908-1), and the Data communication protocol, called BACnet (see EN ISO 16484-5), for exchanging information between both systems.

This Technical Specification has been prepared to provide mechanisms through which various vendors of building automation, control, and building-management systems, may exchange information in a standardised way between both LONWORKS and BACnet communication systems. It specifies communication and internal-documentation requirements.

This Technical Specification is for use by all involved in design, manufacture, engineering, installation, and commissioning activities; and has been made in response to the essential requirements of the Construction Products Directive.

1 Scope

The LONWORKS communication system is widely used in building automation systems for field-level and application-level functions for residential and non-residential controls in lighting, sun protection, HVAC, energy management and security applications. The BACnet communication system is also used in building automation systems for management-level and application-level functions. This Technical Specification defines the methods for combining BACnet networks with LONWORKS networks, and standardizes the interface between BACnet and LONWORKS systems.

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 ISO 16484-5:2003, *Building automation and control systems — Part 5: Data communication protocolcity (ISO 16484-5:2003).*

prEN 14908-5, *Open Data Communication in Building Automation - Controls and Building Management - Control Network Protocol - Part 5: Implementation Guideline.*

3 Terms and definitions

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

3.1
Functional Profile
FP
A template that describes common units of functional behaviour. Functional profiles are also known as profiles, or FPs; which can be represented with a machine-readable functional-profile template (FPT). Standard functional profiles are also known as LONMARK profiles. Each functional profile consists of a profile description and a specified set of network variables and configuration properties designed to perform a single function on a device. The network variables and configuration properties specified by the functional profile are called the functional-profile members. A functional profile specifies whether the implementation of each functional-profile member is mandatory or optional. A profile is uniquely identified by a program-ID template, scope, and functional-profile number.

3.2
LONWORKS
LONWORKS is the name of the whole technology used in LONWORKS. It describes the language, the transceivers and the Neuron Chips. The communication is typically based on network variables organized in functional profiles, which are standardized by LONMARK International.

3.3
LONMARK International
LONMARK International's mission is to enable the easy integration of multi-vendor systems based on CNP networks. LONMARK INTERNATIONAL provides an open forum for member companies to work together on marketing and technical programs to promote the availability of open, interoperable control devices.

3.4
Network Variable
NV
A data item that a particular device application program expects to get from other devices on a network (an input network variable) or expects to make available to other devices on a network (an output network

variable). Examples are a temperature, switch value, and actuator position setting. Network variable data is typically stored in a device's volatile memory.

3.5
Node
A node is a physical device in LONWORKS. Each LONWORKS device can be a member of maximum two domains. In each domain a maximum number of 255 subnets with 127 devices each can be addressed.

3.6
Standard Configuration Property Type
SCPT
A configuration property type that has been standardized by LONMARK International. A SCPT is a standardized definition of the units, scaling, encoding, valid range, and meaning of the contents of configuration properties.

3.7
Standard Network Variable Type
SNVT
A network variable type that has been standardized by LONMARK International.

4 Object Structures

4.1 LONWORKS Objects (Functional Profile)

4.1.1 General

The primary function of a LONMARK certified device must be implemented using one or more LONMARK profiles which represent the application layer interface of the node. Functional Profiles are divided into mandatory and optional network variables, configuration properties, and a manufacturer defined section that is non-interoperable. They are based on six standard objects listed below.

Table 1 — Standard LONWORKS Objects

Standard Objects	Function
Node Object	Monitoring on functions inside a single node; scanning from status- and alert functions
Open Loop Sensor Object	Detecting devices, measuring absolute values without feedback (temperature sensor, digital contact)
Closed Loop Sensor Object	Detecting devices with feedback, making a check on an actor object using several sensor objects or vice versa
Open Loop Actuator Object	Operating devices without feedback
Closed Loop Actuator Object	Operating devices with feedback
Controller Object	Control algorithms

4.1.2 Node Object

The Node Object in a LONWORKS node implements the application-level network management of the node as a whole. It contains two mandatory network variables (nvi_request and nvo_status).

4.1.3 Sensor Object

Sensor objects are generic objects that can be used with any form of sensor for analog values such as temperature, pressure, humidity or for digital values of switches or buttons. Via an output network variable nvoValue the data can be supplied directly to an actuator object or to a control loop located within a controller object.

4.1.4 Actuator Object

The actuator objects are generic objects that may be used with any type of actuator, such as a valve, a light dimmer or a motor. They may be controlled by a remote controller object or directly by a sensor object.

4.1.5 Closed Loop Object

A closed loop object gives a feedback to the sensor objects. It is used to synchronize sensor(s) and actuator(s).

4.1.6 Controller Object

A controller object is used for complex algorithms to control actuator(s). The controller object is not part of the prEN14908-5 standard.

4.1.7 Analog Output Object

The analog output object is used to integrate devices that do not have the ability to interface directly to LONWORKS, but rather utilize an analog output conversion device that is LONMARK compliant.

4.1.8 Analog Input Object

The analog input object is used to integrate devices that do not have the ability to interface directly to LONWORKS, but rather utilize an analog input conversion device that is LONMARK compliant.

4.2 BACnet Objects

BACnet's object types define functions in terms of semantics and the services used to access these functions. To accomplish this task, BACnet object types contain properties. An object type consists of a non-empty collection of properties of which some are mandatory while others may be optional.

BACnet also defines a device object. A "BACnet Device" contains a collection of instances of object types. Each BACnet Device contains one, and only one, Device Object. Typically, each physical device corresponds to a single BACnet Device and contains a single Device Object.

4.3 Relationship of LONWORKS to BACnet

LONWORKS SNVTs are comparable to BACnet object types. All physical and mathematical LONWORKS SNVTs can be directly mapped to the BACnet Analog Object types. Enumeration SNVTs can be mapped to the BACnet Multi-State-Object type. The LONWORKS Node Object is comparable to the BACnet Device Object. For structured LONWORKS SNVTs it is necessary to define a new BACnet Object type.

5 Properties Needed for Mapping

5.1 Object_Identifier

The Object_Identifier must be unique internetwork-wide. The Object Type field (the upper 10 bits) contains the enumerated value of the BACnet ObjectType.

In this mapping, the content of the 22-bit instance number field depends on whether the Object_Identifier is identifying a Device Object or some other type of object. Subject to the uniqueness constraint, a one-to-one mapping of LONWORKS physical devices to BACnet devices can be achieved by setting the upper 7 bits of the instance number (bit21 to bit15) to a unique LONWORKS Node-ID and 8 bits for the Subnet-ID (bit14 to bit 7). The rest of the 4th octet (bit6 to bit0) is used to identify the mapped network variable. Bit6 identifies the direction of the mapped network variable. A zero value of bit6 represents an output and the value one represents an input. So 64 input and 64 output network variables per physical LONWORKS device can be mapped without address conflict, but this mapping is reduced only to one LONWORKS-Domain. To address more than one LONWORKS-Domain the network variable identifier has to be split into address fields. Commissioning a network a divisor and the used address field or fields have to be chosen. The divisor can’t be changed after commissioning a network. But if the address field is too small for a single device, it has to be checked for an additional available address field. The divisor and the used address field or fields are encoded in the object name. In the Case that the Object instance is already used by another device object from an other physical BACnet device in the network, it is necessary to use another mapping algorithm with unique BACnet Object Identifier internetwork-wide.

Table 2 — Mapping of the Object_Identifier

<table>
<tr><td>Octet</td><td colspan="8">1st octet</td><td colspan="8">2nd octet</td><td colspan="8">3rd octet</td><td colspan="8">4th octet</td></tr>
<tr><td>Bit</td><td>31</td><td>30</td><td>29</td><td>28</td><td>27</td><td>26</td><td>25</td><td>24</td><td>23</td><td>22</td><td>21</td><td>20</td><td>19</td><td>18</td><td>17</td><td>16</td><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td></td><td colspan="10" rowspan="2">10 bit Object Type</td><td colspan="7">Node ID</td><td colspan="8">Subnet ID</td><td>I/O</td><td colspan="6">Network Variable Identifier</td></tr>
<tr><td></td><td colspan="22">22bit Object Instance</td></tr>
</table>

Table 3 — Network Variable Identifier (divisor=12)

	Address Field	Network Variable Identifier Range	max.# SNVTs per Node
domain1	1	0 - 4	5
domain2	2	5 - 9	5
domain3	3	10 - 14	5
domain4	4	15 - 19	5
domain5	5, 6	20 - 29	10
domain6	7	30 - 34	5
domain7	8	35 - 39	5
domain8	9	40 - 44	5
domain9	10	45 - 49	5
domain10	11	50 - 54	5
domain11	12	55 - 59	5
rest	13	60 - 63	4

5.2 Object_Name

The object name is a CharacterString generated from the device class category and device name encoded from the LONMARK Standard Program ID followed by the NodeID, SubnetID, the divisor and the used address field/s.

EXAMPLE Standard Program ID: 80:00:13:52:00:06:04:99

52:00 ⇒ Device Class Number = 80.10

⇒ <Device Class Category="**HVAC**" Name="**VAV Controller**" Number="**80.10**" … />

Address: NodeID=118, SubnetID=73, Divisor=16, used address fields= 2 and 3

The Object_Name string would be “HVAC,VAV Controller,118,73,16 (2,3)”

or the same with the address field 4 would be “HVAC,VAV Controller,118,73,16 (4)”.

5.3 Object_Type

The comparable standard BACnet object type should be used. If there is no comparable BACnet object type a new one has to be defined. In that case the object type number should be the SNVT number plus 500.

EXAMPLE SNVT_sound_db (33) should be mapped into BACnet object type 533

Table 4 — Comparable BACnet Object Types

BACnet Object Type	BACnet Object Number
analog-input	0
analog-output	1
analog-value	2
binary-input	3
binary-output	4
binary-value	5
device	8
multi-state-input	13
multi-state-output	14
multi-state-value	19

5.4 Present_Value

This property contains the present value of the object type. If available use the “Invalid Value” of the used SNVT for commissioning.

EXAMPLE SNVT_press_p (113): Invalid Value= 32,767 (0x7FFF)
Present_Value= “32,767”