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DIN EN 61158-6-14

ICS 35.100.70; 35.160

Ersatz für
DIN EN 61158-6-14:2008-09
Siehe Anwendungsbeginn

Industrielle Kommunikationsnetze – Feldbusse – Teil 6-14: Protokollspezifikation des Application Layer (Anwendungsschicht) – Typ 14-Elemente (IEC 61158-6-14:2010); Englische Fassung EN 61158-6-14:2012, nur auf CD-ROM

Industrial communication networks –
Fieldbus specifications –
Part 6-14: Application layer protocol specification – Type 14 elements
(IEC 61158-6-14:2010);
English version EN 61158-6-14:2012, only on CD-ROM

Réseaux de communication industriels –
Spécifications des bus de terrain –
Partie 6-14: Spécification des protocoles des couches d'application – Eléments de type 14
(CEI 61158-6-14:2010);
Version anglaise EN 61158-6-14:2012, seulement en CD-ROM

Gesamtumfang 92 Seiten

DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE

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Anwendungsbeginn

Anwendungsbeginn für die von CENELEC am 2012-03-28 angenommene Europäische Norm als DIN-Norm ist 2013-03-01.

Für DIN EN 61158-6-14:2008-09 gilt eine Übergangsfrist bis zum 2015-03-28.

Nationales Vorwort

Vorausgegangener Norm-Entwurf: E DIN IEC 61158-600:2009-06.

Für dieses Dokument ist das nationale Arbeitsgremium K 956 „Feldbus“ der DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE (www.dke.de) zuständig.

Die enthaltene IEC-Publikation wurde vom SC 65C „Industrial networks“ erarbeitet.

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Der Zusammenhang der zitierten Normen mit den entsprechenden Deutschen Normen ergibt sich, soweit ein Zusammenhang besteht, grundsätzlich über die Nummer der entsprechenden IEC-Publikation. Beispiel: IEC 60068 ist als EN 60068 als Europäische Norm durch CENELEC übernommen und als DIN EN 60068 ins Deutsche Normenwerk aufgenommen.

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Da sich die Benutzer der vorliegenden Norm der englischen Sprache als Fachsprache bedienen, wird die englische Fassung der EN 61158-6-14 veröffentlicht. Zu deren Abschnitt 3, der die Begriffe festlegt, wurde eine Übersetzung angefertigt und als informativer Nationaler Anhang NA der vorliegenden Norm hinzugefügt. Für viele der verwendeten Begriffe existieren keine gebräuchlichen deutschen Benennungen, da sich die deutschen Anwender in der Regel ebenfalls der englischen Benennungen bedienen. Diese Norm steht nicht in unmittelbarem Zusammenhang mit Rechtsvorschriften und ist nicht als Sicherheitsnorm anzusehen.

Einführung

Ein Feldbus ist ein digitaler serieller Datenbus für die Kommunikation zwischen Geräten der industriellen Automatisierungstechnik wie beispielsweise Messeinrichtungen, Stellgliedern, Reglern und speicherprogrammierbaren Steuerungen. Die Normen der Reihe DIN EN 61158 legen eine Anzahl von Feldbus-Protokolltypen fest. Die vorliegende Norm legt das Protokoll des Application Layer für Typ 14 fest.

Änderungen

Gegenüber DIN EN 61158-6-14:2008-09 wurden folgende Änderungen vorgenommen:

a) normative Verweisungen und Literaturhinweise auf den neuesten Stand gebracht;

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b) redaktionelle Verbesserungen;

c) Festlegungen für CPF 4 geändert;

d) Anforderungen für alle Konformitätsklassen auf den neuesten Stand gebracht;

e) Anforderungen für alle Konformitätsdienste auf den neuesten Stand gebracht.

Frühere Ausgaben

DIN V 19245-1: 1988-01
DIN EN 61158-6: 2005-05
DIN EN 61158-6-14: 2008-09

Nationaler Anhang NA
(informativ)

3.2 Spezielle Begriffe für die Feldbus-Anwendungsschicht

3.2.1
Zugriffssteuerung
(en: access control)
Steuerung des Lesens und Schreibens eines Objektes

3.2.2
Zugriffspfad
(en: access Path)
Verbindung eines symbolischen Namens mit einer Variablen zum Zweck der offenen Kommunikation

3.2.3
Makrozyklus der Kommunikation
(en: communication macrocycle)
Satz von grundlegenden Zyklen, der für eine konfigurierte Kommunikationsaktivität in einem Makro-Netzwerksegment erforderlich ist

3.2.4
Kommunikationsplanung
(en: communication scheduling)
Algorithmen und Operationen für Datentransfers, die plangesteuert und wiederholt auftreten

3.2.5
Konfiguration (eines Systems oder Gerätes)
(en: configuration (of a system or device))
Schritt während das Systementwurfs: Auswahl funktionaler Einheiten, Zuweisung deren Positionen und Festlegung deren Verbindungen

3.2.6
zyklisch
(en: cyclic)
sich regelmäßig wiederholend

3.2.7
FB-Zielinstanz
(en: destination FB Instance)
FB-Instanz, die die festgelegten Parameter empfängt

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3.2.8
Domäne
(en: domain)
Teil des Speichers, der für die Speicherung von Code oder Daten verwendet wird

3.2.9
Domänen-Download
(en: domain download)
Operation zum Schreiben von Daten in eine Domäne

3.2.10
Domänen-Upload
(en: domain upload)
Operation zum Lesen von Daten aus einer Domäne

3.2.11
Entität
(en: entity)
bestimmte Sache, wie eine Person, ein Ort, ein Prozess, ein Objekt, ein Konzept, eine Assoziation oder ein Ereignis

3.2.12
Typ-14-Bridge
(en: Type 14 bridge)
DL-Relais-Einheit, die die Synchronisation zwischen Verbindungszweigen (Bussen) durchführt und selektive Store-and-Forward- sowie Routing-Funktionen zum Verbinden zweier Mikro-Netzwerksegmente ausführen kann

3.2.13
Kennung
(en: identifier)
16-Bit-Wort, das einer Systemvariablen zugeordnet ist

3.2.14
Index
(en: index)
Adresse eines Objektes innerhalb eines Anwendungsprozesses

3.2.15
Instanz
(en: instance)
tatsächliches physikalisches Vorkommen eines Objektes innerhalb einer Klasse, das ein oder mehrere Objekte innerhalb derselben Objektklasse identifiziert

3.2.16
Instanziierung
(en: instantiation)
Erzeugung einer Instanz eines bestimmten Typs

3.2.17
Verwaltungsinformationen
(en: management information)
im Netzwerk sichtbare Informationen zum Zweck der Verwaltung des Feldsystems

3.2.18
Verwaltungsinformationsbasis
(en: management information base)
geordnete Liste von Verwaltungsinformationen

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3.2.19
Zuordnung
(en: mapping)
Satz von Werten, der eine festgelegte Verbindung zu den Größen oder Werten eines anderen Satzes aufweist

3.2.20
Member
(en: member)
Teil eines Attributes, das als Element eines Feldes strukturiert ist

3.2.21
Nachrichtenfilterung
(en: message filtering)
Entscheidung über eine Nachricht entsprechend einer bestimmten Regel

3.2.22
Mikrosegment
(en: micro segment)
Teil eines Netzwerks, in dem eine besondere Planung implementiert ist

3.2.23
Abstand
(en: offset)
Anzahl von Oktetten von einer besonders gekennzeichneten Position

3.2.24
Phase
(en: phase)
abgelaufener Teil eines Zyklus, gemessen von einem beliebigen festgelegten Ausgangspunkt

3.2.25
Prozessschnittstelle
(en: process interface)
Datenaustausch und Informationszuordnung zwischen einem physikalischen Prozess und einer Anwendungseinheit

3.2.26
Echtzeit
(en: real-time)
Fähigkeit eines Systems, ein erforderliches Ergebnis in einer begrenzten Zeit bereitzustellen

3.2.27
Echtzeit-Kommunikation
(en: real-time communication)
Transfer von Daten in Echtzeit

3.2.28
Echtzeit-Ethernet (RTE)
(en: Real-Time Ethernet, RTE)
Netzwerk, das auf ISO/IEC 8802-3 basiert und Echtzeit-Kommunikation unterstützt

ANMERKUNG 1 Sofern die Echtzeit-Kommunikation nicht beeinträchtigt wird, können andere Kommunikationsarten unterstützt werden.

ANMERKUNG 2 Diese Definition bezieht sich auf ISO/IEC 8802-3, ist aber nicht darauf beschränkt. Sie könnte auch auf andere IEEE-802-Spezifikationen, z. B. IEEE 802.1Q, anwendbar sein.

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3.2.29
Plan
(en: schedule)
zeitliche Einteilung einer Menge von in Beziehung stehenden Operationen

3.2.30
Makrozyklus der Planung
(en: scheduling macrocycle)
Zeitintervall zur Implementierung eines spezifischen Plans

3.2.31
FB-Quellinstanz
(en: source FB Instance)
FB-Instanz, die einen spezifischen Parameter sendet

3.2.32
Zeitabstand
(en: time offset)
Zeitunterschied zu einer besonders gekennzeichneten Zeit

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NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 61158-6-14

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Industrial communication networks - Fieldbus specifications - Part 6-14: Application layer protocol specification - Type 14 elements

(IEC 61158-6-14:2010)

Réseaux de communication industriels - Spécifications des bus de terrain - Partie 6-14: Spécification des protocoles des couches d'application - Eléments de type 14 (CEI 61158-6-14:2010)

Industrielle Kommunikationsnetze - Feldbusse - Teil 6-14: Protokollspezifikation des Application Layer (Anwendungsschicht) - Typ 14-Elemente (IEC 61158-6-14:2010)

This European Standard was approved by CENELEC on 2012-03-28. 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 CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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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

The text of document 65C/607/FDIS, future edition 2 of IEC 61158-6-14, prepared by SC 65C, "Industrial networks", of IEC/TC 65, "Industrial-process measurement, control and automation" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61158-6-14:2012.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2012-12-28
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2015-03-28

This document supersedes EN 61158-6-14:2008.

EN 61158-6-14:2012 includes the following significant technical changes with respect to EN 61158-6-14:2008:

- update of the Normative references and Bibliography;
- corrections of editorial errors;
- specification changes for CPF3;
- update of the requirements for all conformance classes;
- update of the requirements for all conformance services.

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

Endorsement notice

The text of the International Standard IEC 61158-6-14:2010 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC/TR 61158-1:2010 NOTE Harmonized as CLC/TR 61158-1:2010 (not modified).

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INTRODUCTION

This part of IEC 61158 is one of a series produced to facilitate the interconnection of automation system components. It is related to other standards in the set as defined by the “three-layer” fieldbus reference model described in IEC/TR 61158-1.

The application protocol provides the application service by making use of the services available from the data-link or other immediately lower layer. The primary aim of this standard is to provide a set of rules for communication expressed in terms of the procedures to be carried out by peer application entities (AEs) at the time of communication. These rules for communication are intended to provide a sound basis for development in order to serve a variety of purposes:

- as a guide for implementors and designers;
- for use in the testing and procurement of equipment;
- as part of an agreement for the admittance of systems into the open systems environment;
- as a refinement to the understanding of time-critical communications within OSI.

This standard is concerned, in particular, with the communication and interworking of sensors, effectors and other automation devices. By using this standard together with other standards positioned within the OSI or fieldbus reference models, otherwise incompatible systems may work together in any combination.

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INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

Part 6-14: Application layer protocol specification – Type 14 elements

1 Scope

1.1 General

The Fieldbus Application Layer (FAL) provides user programs with a means to access the fieldbus communication environment. In this respect, the FAL can be viewed as a “window between corresponding application programs.”

This standard provides common elements for basic time-critical and non-time-critical messaging communications between application programs in an automation environment and material specific to Type 14 fieldbus. The term “time-critical” is used to represent the presence of a time-window, within which one or more specified actions are required to be completed with some defined level of certainty. Failure to complete specified actions within the time window risks failure of the applications requesting the actions, with attendant risk to equipment, plant and possibly human life.

This standard specifies interactions between remote applications and defines the externally visible behavior provided by the Type 14 fieldbus application layer in terms of

a) the formal abstract syntax defining the application layer protocol data units conveyed between communicating application entities;
b) the transfer syntax defining encoding rules that are applied to the application layer protocol data units;
c) the application context state machine defining the application service behavior visible between communicating application entities;
d) the application relationship state machines defining the communication behavior visible between communicating application entities.

The purpose of this standard is to define the protocol provided to

a) define the wire-representation of the service primitives defined in IEC 61158-5-14, and
b) define the externally visible behavior associated with their transfer.

This standard specifies the protocol of the Type 14 fieldbus application layer, in conformance with the OSI Basic Reference Model (ISO/IEC 7498) and the OSI application layer structure (ISO/IEC 9545).

1.2 Specifications

The principal objective of this standard is to specify the syntax and behavior of the application layer protocol that conveys the application layer services defined in IEC 61158-5-14.

A secondary objective is to provide migration paths from previously-existing industrial communications protocols. It is this latter objective which gives rise to the diversity of protocols standardized in the IEC 61158-6 series.

1.3 Conformance

This standard does not specify individual implementations or products, nor does it constrain the implementations of application layer entities within industrial automation systems. Conformance is achieved through implementation of this application layer protocol specification.

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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 60559, *Binary floating-point arithmetic for microprocessor systems*

IEC 61158-3-14, *Industrial communication networks – Fieldbus specifications – Part 3-14: Data-link layer service definition – Type 14 elements*

IEC 61158-4-14, *Industrial communication networks – Fieldbus specifications – Part 4-14: Data-link layer protocol specification – Type 14 elements*

IEC 61158-5-14, *Industrial communication networks – Fieldbus specifications – Part 5-14: Application layer service definition – Type 14 elements*

ISO/IEC 7498-1, *Information technology – Open Systems Interconnection – Basic Reference Model – Part 1: The Basic Model*

ISO/IEC 8802-3, *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*

ISO/IEC 8822, *Information technology – Open Systems Interconnection – Presentation service definition*

ISO/IEC 8824-1, *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation*

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

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

3 Terms, definitions, symbols, abbreviations and conventions

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

3.1 Referenced terms and definitions

3.1.1 ISO/IEC 7498-1 terms

For the purposes of this document, the following terms as defined in ISO/IEC 7498-1 apply:

a) application entity
b) application process
c) application protocol data unit
d) application service element
e) application entity invocation
f) application process invocation
g) application transaction
h) real open system
i) transfer syntax

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3.1.2 ISO/IEC 8822 terms

For the purposes of this document, the following terms as defined in ISO/IEC 8822 apply:

a) abstract syntax
b) presentation context

3.1.3 ISO/IEC 9545 terms

For the purposes of this document, the following terms as defined in ISO/IEC 9545 apply:

a) application-association
b) application-context
c) application context name
d) application-entity-invocation
e) application-entity-type
f) application-process-invocation
g) application-process-type
h) application-service-element
i) application control service element

3.1.4 ISO/IEC 8824 terms

For the purposes of this document, the following terms as defined in ISO/IEC 8824 apply:

a) object identifier
b) type

3.1.5 Fieldbus data-link Layer terms

For the purposes of this document, the following terms as defined in IEC 61158-3-14 and IEC 61158-4-14 apply.

a) DL-Time
b) DL-Scheduling-policy
c) DLCEP
d) DLC
e) DL-connection-oriented mode
f) DLPDU
g) DLSDU
h) DLSAP
i) link
j) network address
k) node address
l) node
m) scheduled

3.2 Fieldbus application layer specific terms and definitions

3.2.1
access control
control on the reading and writing of an object

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3.2.2
access Path
association of a symbolic name with a variable for the purpose of open communication

3.2.3
communication macrocycle
set of basic cycles needed for a configured communication activity in a macro network segment

3.2.4
communication scheduling
algorithms and operation for data transfers occurring in a deterministic and repeatable manner

3.2.5
configuration (of a system or device)
step in system design: selecting functional units, assigning their locations and defining their interconnections.

3.2.6
cyclic
repetitive in a regular manner

3.2.7
destination FB Instance
FB instance that receives the specified parameters

3.2.8
domain
part of memory used to store code or data

3.2.9
domain download
operation to write data in a domain

3.2.10
domain upload
operation to read data from a domain

3.2.11
entity
particular thing, such as a person, place, process, object, concept, association, or event

3.2.12
Type 14 bridge
DL-relay entity which performs synchronization between links (buses) and may perform selective store-and-forward and routing functions to connect two micro network segments

3.2.13
identifier
16-bit word associated with a system variable

3.2.14
index
address of an object within an application process

3.2.15
instance
actual physical occurrence of an object within a class that identifies one of many objects within the same object class

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3.2.16
instantiation
creation of an instance of a specified type.

3.2.17
management information
network-visible information for the purpose of managing the field system.

3.2.18
management information base
organized list of management information

3.2.19
mapping
set of values having defined correspondence with the quantities or values of another set.

3.2.20
member
piece of an attribute that is structured as an element of an array

3.2.21
message filtering
decision on a message according to a special rule.

3.2.22
micro segment
part of a network, where special scheduling is implemented.

3.2.23
offset
number of octets from a specially designated position.

3.2.24
phase
elapsed fraction of a cycle, measured from some fixed origin

3.2.25
process interface
data exchange and information mapping between physical process and application unit

3.2.26
real-time
ability of a system to provide a required result in a bounded time

3.2.27
real-time communication
transfer of data in real-time.

3.2.28
Real-Time Ethernet
RTE
ISO/IEC 8802-3-based network that includes real-time communication

NOTE 1 Other communication can be supported, providing the real-time communication is not compromised.

NOTE 2 This definition is dedicated, but not limited, to ISO/IEC 8802-3. It could be applicable to other IEEE 802 specifications, for example IEEE 802.1Q.

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3.2.29
schedule
temporal arrangement of a number of related operations.

3.2.30
scheduling macrocycle
time interval to implement a specific schedule.

3.2.31
source FB Instance
FB instance that sends a specific parameter

3.2.32
time offset
time difference from a specially designated time

3.3 Abbreviations and symbols

AAE	Application Access Entity
AE	Application Entity
AL	Application Layer
ALE	Application Layer Entity
ALP	Application Layer Protocol
APO	Application Object
AP	Application Process
APDU	Application Protocol Data Unit
API	Application Process Identifier
AR	Application Relationship
ARP	Address Resolution Protocol
AREP	Application Relationship End Point
ASE	Application Service Element
Cnf	Confirmation
CR	Communication Relationship
CREP	Communication Relationship End Point
CSMA/CD	Carrier Sense Multiple Access Protocol with Collision Detection
DD	Device Description
DHCP	Dynamic Host Configuration Protocol
DL-	(as a prefix) data-link-
DLCEP	Data-link Connection End Point
DLL	Data-link Layer
DLE	Data-link Entity
DLM	Data-link-management
DLS	Data-link Service
DLSAP	Data-link Service Access Point
DLSDU	DL-service-data-unit
ECSME	Type 14 communication scheduling management entity
Type 14	Ethernet for Plant Automation
EM_	(as a prefix) Type 14 Management
ESME	Type 14 Socket Mapping Entity
FB	Function Block

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FBAP	Function Block Application Process
FME	FAL Management Entity
FRT	Fast Real-time
Ind	Indication
IP	Internet Protocol
LLC	Logical Link Control
LMP	Link Management Protocol
MAC	Medium Access Control
MAU	Medium Attachment Unit
MOB	Management Object Base
PAD	Pad (bits)
PDU	Protocol Data Unit
P/S	Publisher/Subscriber
Req	Request
Rsp	Response
RTE	Real-Time Ethernet
RT-Ethernet	Real-Time Ethernet
SAP	Service Access Point
SDU	Service Data Unit
SME	System Management Entity
SNTP	Simple Network Time Protocol
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
.cnf	Confirm Primitive
.ind	Indication Primitive
.req	Request Primitive
.rsp	Response Primitive

3.4 Conventions

3.4.1 General concept

The FAL is defined as a set of object-oriented ASEs. Each ASE is specified in a srate subclause. Each ASE specification is composed of three parts: its class definitions, its services, and its protocol specification. The first two are contained in IEC 61158-5-14. The protocol specification for each of the ASEs is defined in this standard.

The class definitions define the attributes of the classes supported by each ASE. The attributes are accessible from instances of the class using the Management ASE services specified in IEC 61158-5-14. The service specification defines the services that are provided by the ASE.

This standard uses the descriptive conventions given in ISO/IEC 10731.

3.4.2 Conventions for state machines for Type 14

A state machine describes the state sequence of an entity and can be represented by a state transition diagram and/or a state table.

In a state transition diagram (Figure 1), the transition between two states represented by circles is illustrated by an arrow beside which the transition events or conditions are presented.

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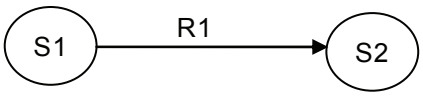

Figure 1 – State transition diagram

Table 1 – State machine description elements

#	Current state	Events or conditions that trigger this state transaction => Action	Next state
Name of this transition	The current state to which this state transition applies	Events or conditions that trigger this state transaction. => The actions that are taken when the above events or conditions are met. The actions are always indented below events or conditions	The next state after the actions in this transition is taken

The conventions used in the state transition table (Table 1) are as follows.

:= Value of an item on the left is replaced by value of an item on the right. If an item on the right is a parameter, it comes from the primitive shown as an input event.

xxx A parameter name.

Example:

Identifier := reason
means value of a 'reason' parameter is assigned to a parameter called 'Identifier.'
"xxx" Indicates fixed value.

Example:

Identifier := "abc"
means value "abc" is assigned to a parameter named 'Identifier.'

= A logical condition to indicate an item on the left is equal to an item on the right.
< A logical condition to indicate an item on the left is less than the item on the right.
> A logical condition to indicate an item on the left is greater than the item on the right.
<> A logical condition to indicate an item on the left is not equal to an item on the right.
&& Logical "AND"
|| Logical "OR"

Service.req represents a Request Primitive; Service.req{} indicates that a request primitive is sent;

Service.ind represents an Indication Primitive; Service.ind{} indicates that an Indication Primitive is received;

Service.rsp represents a Response Primitive; Service.rsp{} indicates that a Response Primitive is sent;

Service.cnf represents a Confirm Primitive; Service.cnf{} indicates that a Confirm Primitive is received.

4 Abstract syntax

4.1 Fixed format PDU description

Type 14 PDU consists of fixed-length PDU header and variable-length PDU body. The former contains service type, message type and message length, etc.

```
Type 14 PDU : : = CHOICE {
        confirmed-RequestPDU            [0]     IMPLICIT  Confirmed-RequestPDU,
```


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```
        confirmed-ResponsePDU           [1]     IMPLICIT  Confirmed-ResponsePDU,
        confirmed-ErrorPDU              [2]     IMPLICIT  Confirmed-ErrorPDU,
        unconfirmed-RequestPDU          [3]     IMPLICIT  Unconfirmed-RequestPDU
}
Confirmed-RequestPDU : : = SEQUENCE {
        pduHeader                       PDUHeader,
        confirmed-request               Confirmed-Request
}
Confirmed-ResponsePDU : : = SEQUENCE {
        pduHeader                       PDUHeader,
        confirmed-response              Confirmed-Response
}
Confirmed-ErrorPDU : : = SEQUENCE {
        pduHeader                       PDUHeader,
        confirmed-error                 Confirmed-Error
}
Unconfirmed-RequestPDU : : = SEQUENCE {
        pduHeader                       PDUHeader,
        unconfirmed-request             Unconfirmed-Request
}
```

4.1.1 Confirmed request service

```
Confirmed- Request : : = CHOICE {
        EM_GetDeviceAttribute           [0]     IMPLICIT  EM_GetDeviceAttribute-RequestPDU,
        EM_ConfiguringDevice            [1]     IMPLICIT  EM_ConfiguringDevice-RequestPDU,
        EM_SetDefaultValue              [2]     IMPLICIT  EM_SetDefaultValue-RequestPDU,
        DomainDownload                  [3]     IMPLICIT  DomainDownload-RequestPDU,
        DomainUpload                    [4]     IMPLICIT  DomainUpload-RequestPDU,
        AcknowledgeEventRoport          [5]     IMPLICIT  AcknowledgeEventNotifi-RequestPDU,
        ReportConditionChanging         [6]     IMPLICIT  AlterEventConditionMon-RequestPDU,
        Read                            [7]     IMPLICIT  Read-RequestPDU,
        Write                           [8]     IMPLICIT  Write-RequesPDU,
        FRTRead                         [9]     IMPLICIT  FRTRead-RequestPDU,
        FRTWrite                        [10]    IMPLICIT  FRTWrite-RequesPDU
}
```

4.1.2 Confirmed response service

```
Confirmed- Response : : = CHOICE {
        EM_GetDeviceAttribute           [0]  IMPLICIT  EM_GetDeviceAttribute-ResponsePDU,
        EM_ConfiguringDevice            [1]  IMPLICIT  EM_ConfiguringDevice-ResponsePDU,
        EM_SetDefaultValue              [2]  IMPLICIT  EM_SetDefaultValue-ResponsePDU,
        DomainDownload                  [3]  IMPLICIT  DomainDownload-ResponsePDU,
        DomainUpload                    [4]  IMPLICIT  DomainUpload-ResponsePDU,
        AcknowledgeEventRoport          [5]  IMPLICIT  AcknowledgeEventNotifi-ResponsePDU,
        ReportConditionChanging         [6]  IMPLICIT  AlterEventConditionMon-ResponsePDU,
        Read                            [7]  IMPLICIT  Read-ResponsePDU,
        Write                           [8]  IMPLICIT  Write-ResponsePDU,
        FRTRead                         [9]  IMPLICIT  FRTRead-RequestPDU,
        FRTWrite                        [10] IMPLICIT  FRTWrite-RequesPDU
}
```

4.1.3 Confirmed error

```
Confirmed- Error : : = CHOICE {
        EM_GetDeviceAttribute           [0]     IMPLICIT  Error-Type,
        EM_ConfiguringDevice            [1]     IMPLICIT  Error-Type,
        EM_SetDefaultValue              [2]     IMPLICIT  Error-Type,
        DomainDownload                  [3]     IMPLICIT  Error-Type,
        DomainUpload                    [4]     IMPLICIT  Error-Type,
        AcknowledgeEventRoport          [5]     IMPLICIT  Error-Type,
        ReportConditionChanging         [6]     IMPLICIT  Error-Type,
        Read                            [7]     IMPLICIT  Error-Type,
        Write                           [8]     IMPLICIT  Error-Type,
```


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```
        FRTRead                     [9]     IMPLICIT  Error-Type,
        FRTWrite                    [10]    IMPLICIT  Error-Type
}
```

4.1.4 Error type

```
ErrorType : : = SEQUENCE {
        ErrorClass                  [0]             IMPLICIT  Integer8,
        ErrorCode                   [1]             IMPLICIT  Integer8,
        AdditionalCode              [2]             IMPLICIT  Integer8,
        Reserved                    [3]             IMPLICIT  OctetString,
        AdditionalDescription  [4]          IMPLICIT  VisibleString
}
```

4.1.5 Error class

```
ErrorClass ::=  CHOICE {                                                ErrorCode
    Resource                    [0]   IMPLICIT  Integer8 {
                                          memory-unavailable            (0),
                                          Other                         (1)
    },
    Service                     [1]   IMPLICIT  Integer8 {
                                          object-state-conflict         (0),
                                          object-constraint-conflict    (1),
                                          parameter-inconsistent        (2),
                                          illegal-parameter             (3),
                                          Size Error                    (4),
                                          Other                         (5)
    }
    Access                      [2]   IMPLICIT  Integer8 {
                                          object-access-unsupported     (0),
                                          object-non-existent           (1),
                                          object-access-denied          (2),
                                          hardware-fault                (3),
                                          type-conflict                 (4),
                                          object-attribute-inconsistent (5),
                                          Access-to-element-unsupported (6),
                                          Other                         (7)
    }
    Timer                       [3]   IMPLICIT  Integer8 {
                                          Timer-Expire                  (0),
                                          Timer-Error                   (1),
                                          Other                         (2)
    },
    Other                       [4]   IMPLICIT  Integer8 {
                                          Other                         (0)
    }
}
```

4.1.6 Unconfirmed request

```
Unconfirmed-Request: : = CHOICE {
        EM_DetectingDevice          [0]     IMPLICIT  EM_DetectingDevice-RequestPDU,
        EM_OnlineReply              [1]     IMPLICIT  EM_OnlineReply-RequestPDU,
        EM_ActiveNotification  [2]      IMPLICIT  EM_ActiveNotification-RequestPDU,
        EventRoport                 [3]     IMPLICIT  EventRoport-RequestPDU,
        VariableDistribute          [4]     IMPLICIT  VariableDistribute-RequestPDU,
        FRTVariableDistribute [4]       IMPLICIT  FRTVariableDistribute-RequestPDU
}
```

4.1.7 Type 14 application layer PDU

```
ApplicationLayerPDU ::=  SEQUENCE {
        PDUHeader,
        PDUBody                 CHOICE {
                        Confirmed-Request,
                        Confirmed-Response,
                        Confirmed-Error,
                        Uniconfirmed-Request
        }
```


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```
}
```

4.1.8 APDU header format

```
PDUHeader : : = SEQUENCE {
        ServiceID                       [0]     IMPLICIT  Unsigned8,
        Reserved                        [1]     IMPLICIT  OctetString,
        Length                          [2]     IMPLICIT  Unsigned16,
        MessageID                       [3]     IMPLICIT  Unsigned16
}
```

4.1.9 FAL Management Entity services

4.1.9.1 EM_DetectingDevice service

```
EM_DetectingDevice-RequestPDU : : = SEQUENCE {
        QueryType                       [0]     IMPLICIT  Unsigned8,
        Reserved                        [1]     IMPLICIT  OctetString,
        PDTag                           [2]     IMPLICIT  VisibleString,
        FBTag                           [3]     IMPLICIT  VisibleString,
        ElementID                       [4]     IMPLICIT  Unsigned16
}
```

4.1.9.2 EM_OnlineReply service

```
EM_OnlineReply -RequestPDU : : = SEQUENCE {
        QueryType                       [0]     IMPLICIT  Unsigned8,
        DuplicateTagDetacted    [1]     IMPLICIT  Boolean,
        Reserved                        [2]     IMPLICIT  OctetString,
        QueriedObjectIpAddress          [3]     IMPLICIT  Unsigned32,
        QueriedObjectDeviceID           [4]     IMPLICIT  VisibleString,
        QueriedObjectPDTag              [5]     IMPLICIT  VisibleString
}
```

4.1.9.3 EM_GetDeviceAttribute service

```
EM_GetDeviceAttribute-RequestPDU : : = SEQUENCE {
        DestinationIPAddress    [0]     IMPLICIT  Unsigned32,
}
EM_GetDeviceAttribute-ResponsePDU : : = CHOICE {
        EM_GetDeviceAttribute-PositiveResponsePDU,
        EM_GetDeviceAttribute-NegativeResponsePDU
}
EM_GetDeviceAttribute-PositiveResponsePDU : : = SEQUENCE {
        DeviceID                        [0]     IMPLICIT  VisibleString,
        PdTag                           [1]     IMPLICIT  VisibleString,
        Status                  [2]     IMPLICIT  Unsigned8,
        DeviceType              [3]     IMPLICIT  Unsigned8,
        Annunciation Interval           [4]     IMPLICIT  Unsigned16,
        Annunciation Version Number [5]      IMPLICIT  Unsigned16,
        DuplicateTagDetected    [6]     IMPLICIT  Boolean,
        DeviceRedundancyNumber          [7]     IMPLICIT  Unsigned8,
        LANRedundancyPort               [8]     IMPLICIT  Unsigned16
        DeviceRedundancy State          [9]     IMPLICIT  Unsigned8,
        MaxRedundancyNumber             [10]    IMPLICIT  Unsigned8,
        ActiveIPAddress                 [11]    IMPLICIT  Unsigned32
}
EM_GetDeviceAttribute-NegativeResponsePDU : : = SEQUENCE {
        DestinationIPAddress    [0]     IMPLICIT        Unsigned32,
        Error-Type                      [1]     IMPLICIT        Error-Type
}
```

4.1.9.4 EM_ActiveNotification service

```
EM_ActiveNotification-RequestPDU : : = SEQUENCE {
        DeviceID                        [0]     IMPLICIT  VisibleString,
        PdTag                           [1]     IMPLICIT  VisibleString,
```


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```
        Status                          [2]     IMPLICIT  Unsigned8,
        DeviceType                      [3]     IMPLICIT  Unsigned8,
        AnnunciationVersionNumber               [4]     IMPLICIT  Unsigned16,
        Device Redundancy Number                [5]     IMPLICIT  Unsigned8,
        DeviceRedundancyState                   [6]     IMPLICIT  Unsigned8,
        LANRedundancyPort                       [7]     IMPLICIT  Unsigned16
        DuplicateTagDetected            [8]     IMPLICIT  Boolean,
        MaxRedundancyNumber                     [9]     IMPLICIT  Unsigned8,
        Reserved                                [10]    IMPLICIT  OctetString,
        ActiveIPAddress                         [11]    IMPLICIT  Unsigned32
}
```

4.1.9.5 EM_ConfiguringDevice service

```
EM_ConfiguringDevice-RequestPDU : : = SEQUENCE {
        DestinationIPAddress            [0]     IMPLICIT  Unsigned32,
        DeviceID                                [1]     IMPLICIT  VisibleString,
        PdTag                                   [2]     IMPLICIT  VisibleString,
        AnnunciationInterval                    [3]     IMPLICIT  Unsigned16,
        DuplicateTagDetected            [4]     IMPLICIT  Boolean,
        DeviceRedundancyNumber                  [5]     IMPLICIT  Unsigned8,
        LANRedunancyPort                        [6]     IMPLICIT  Unsigned16,
        DeviceRedundancyState                   [7]     IMPLICIT  Unsigned8,
        MaxRedundancyNumber                     [8]     IMPLICIT  Unsigned8,
        ActiveIPAddress                         [9]     IMPLICIT  Unsigned32
}
EM_ConfiguringDevice-ResponsePDU : : = CHOICE {
        EM_ConfiguringDevice-PositiveResponsePDU,
        EM_ConfiguringDevice-NegativeResponsePDU
}
EM_ConfiguringDevice-PositiveResponsePDU : : = SEQUENCE {
        DestinationIPAddres             [0]     IMPLICIT  Unsigned32,
        MaxRedundancyNumber             [1]     IMPLICIT  Unsigned8
}
EM_ConfiguringDevice-NegativeResponsePDU : : = SEQUENCE {
        DestinationIPAddress  [0]       IMPLICIT  Unsigned32,
        ErrorType                       [1]     IMPLICIT  ErrorType
}
```

4.1.9.6 EM_SetDefaultValue service

```
EM_SetDefaultValue-RequestPDU : : = SEQUENCE {
        DestinationIPAddress  [0]       IMPLICIT  Unsigned32,
        DeviceID                        [1]     IMPLICIT  VisibleString,
        PdTag                           [2]     IMPLICIT  VisibleString
}
EM_SetDefaultValue-ResponsePDU : : = CHOICE {
        EM_SetDefaultValue-PositiveResponsePDU ,
        EM_SetDefaultValue-NegativeResponsePDU
}
EM_SetDefaultValue-PositiveResponsePDU : : = SEQUENCE {
        DestinationIPAddress  [0]       IMPLICIT  Unsigned32
}
EM_SetDefaultValue-NegativeResponsePDU : : = SEQUENCE {
        DestinationIPAddress  [0]       IMPLICIT  Unsigned32,
        ErrorType                       [1]     IMPLICIT  ErrorType
}
```

4.1.10 Application Access Entity (AAE) services

4.1.10.1 DomainDownload service

```
DomainDownload-RequestPDU : : = SEQUENCE {
        SourceAppID                     [0]   IMPLICIT  Unsigned16,
        DestinationAppID                [1]   IMPLICIT  Unsigned16,
```


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```
        DestinationObjectID         [2]  IMPLICIT  Unsigned16,
        DataNumber                  [3]  IMPLICIT  Unsigned16,
        MoreFollows                 [4]  IMPLICIT  Boolean,
        Reserved                    [5]  IMPLICIT  OctetString,
        DataLength                  [6]  IMPLICIT  Unsigned16,
        LoadData                    [7]  IMPLICIT  OctetString
}
DomainDownload-ResponsePDU : : = CHOICE {
        DomainDownload-PositiveResponsePDU,
        DomainDownload-NegativeResponsePDU
}
DomainDownload-PositiveResponsePDU : : = SEQUENCE {
        DestinationAppID            [0]  IMPLICIT  Unsigned16
}
DomainDownload-NegativeResponsePDU : : = SEQUENCE {
        DestinationAppID            [0]      IMPLICIT  Unsigned16,
        Reserved                    [1]      IMPLICIT  OctetString,
        ErrorType                   [2]      IMPLICIT  ErrorType
}
```

4.1.10.2 DomainUpload service

```
DomainUpload-RequestPDU : : = SEQUENCE {
        SourceAppID                 [0]  IMPLICIT  Unsigned16,
        DestinationAppID            [1]  IMPLICIT  Unsigned16,
        DestinationObjectID         [2]  IMPLICIT  Unsigned16,
        DataNumber                  [3]  IMPLICIT  Unsigned16
}
DomainUpload-ResponsePDU : : = CHOICE {
        DomainUpload-PositiveResponsePDU,
        DomainUpload-NegativeResponsePDU
}
DomainUpload-PositiveResponsePDU : : = SEQUENCE {
        DestinationAppID            [0]  IMPLICIT  Unsigned16,
        DataLength                  [1]  IMPLICIT  Unsigned16,
        MoreFollows                 [2]  IMPLICIT  Boolean,
        Reserved                    [3]  IMPLICIT  OctetString,
        LoadData                    [4]  IMPLICIT  OctetString
}
DomainUpload-NegativeResponsePDU : : = SEQUENCE {
        DestinationAppID            [0]      IMPLICIT  Unsigned16,
        Reserved                    [1]      IMPLICIT  OctetString,
        ErrorType                   [2]      IMPLICIT  ErrorType
}
```

4.1.10.3 EventRoport service

```
EventRoport-RequestPDU : : = SEQUENCE {
        DestinationAppID            [0]  IMPLICIT  Unsigned16,
        SourceAppID                 [1]  IMPLICIT  Unsigned16,
        SourceObjectID              [2]  IMPLICIT  Unsigned16,
        EventNumber                 [3]  IMPLICIT  Unsigned16,
        EventData                   [4]  IMPLICIT  OctetString
}
```

4.1.10.4 AcknowledgeEventRoport service

```
AcknowledgeEventRoport-RequestPDU : : = SEQUENCE {
        DestinationAppID            [0]  IMPLICIT  Unsigned16,
        DestinationObjectID         [1]  IMPLICIT  Unsigned16,
        EventNumber                 [2]  IMPLICIT  Unsigned16
}
AcknowledgeEventRoport -ResponsePDU : : = CHOICE {
        AcknowledgeEventRoport -PositiveResponsePDU,
        AcknowledgeEventRoport -NegativeResponsePDU
```


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```
}
AcknowledgeEventRoport -PositiveResponsePDU: : = SEQUENCE{
        DestinationAppID            [0]   IMPLICIT  Unsigned16
}
AcknowledgeEventRoport -NegativeResponsePDU: : = SEQUENCE{
        DestinationAppID            [0]   IMPLICIT  Unsigned16
        Reserved                    [1]   IMPLICIT  OctetString,
        ErrorType                   [2]   IMPLICIT  ErrorType
}
```

4.1.10.5 ReportConditionChanging service

```
ReportConditionChanging-RequestPDU : : = SEQUENCE {
        DestinationAppID            [0]   IMPLICIT  Unsigned16,
        DestinationObjectID         [1]   IMPLICIT  Unsigned16,
        Enabled                     [2]   IMPLICIT  Boolean
}
ReportConditionChanging -ResponsePDU : : = CHOICE {
        ReportConditionChanging -PositiveResponsePDU,
        ReportConditionChanging -NegativeResponsePDU
}
ReportConditionChanging -PositiveResponsePDU: : = SEQUENCE{
        DestinationAppID            [0]   IMPLICIT  Unsigned16
}
ReportConditionChanging -NegativeResponsePDU: : = SEQUENCE{
        DestinationAppID            [0]   IMPLICIT  Unsigned16
        Reserved                    [1]   IMPLICIT  OctetString,
        ErrorType                   [2]   IMPLICIT  ErrorType
}
```

4.1.10.6 Read service

```
Read-RequestPDU : : = SEQUENCE {
        DestinationAppID            [0]   IMPLICIT  Unsigned16,
        DestinationObjectID         [1]   IMPLICIT  Unsigned16,
        SubIndex                    [2]   IMPLICIT  Unsigned16
}
Read -ResponsePDU : : = CHOICE {
        Read -PositiveResponsePDU,
        Read -NegativeResponsePDU
}
Read-PositiveResponsePDU : : = SEQUENCE {
        DestinationAppID            [0]   IMPLICIT  Unsigned16,
        Reserved                    [1]   IMPLICIT  OctetString,
        Data                        [2]   IMPLICIT  OctetString
}
Read-NegativeResponsePDU : : = SEQUENCE {
        DestinationAppID            [0]   IMPLICIT  Unsigned16,
        Reserved                    [1]   IMPLICIT  OctetString,
        ErrorType                   [2]   IMPLICIT  ErrorType
}
```

4.1.10.7 Write service

```
Write-RequestPDU : : = SEQUENCE {
        DestinationAppID            [0]   IMPLICIT  Unsigned16,
        DestinationObjectID         [1]   IMPLICIT  Unsigned16,
        SubIndex                    [2]   IMPLICIT  Unsigned16,
        Reserved                    [3]   IMPLICIT  OctetString,
        Data                        [4]   IMPLICIT  OctetString
}
Write -ResponsePDU : : = CHOICE {
        Write -PositiveResponsePDU,
        Write -NegativeResponsePDU
}
```


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