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Field Device Integration (FDI)® – Part 103-1: Profiles – PROFIBUS

IEC 62769-103-1:2023-04 RLV(en)

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Field Device Integration (FDI)® – Part 103-1: Profiles – PROFIBUS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FIELD DEVICE INTEGRATION (FDI®) –

Part 103-1: Profiles – PROFIBUS

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IEC 62769-103-1 has been prepared by subcommittee 65E: Devices and integration in enterprise systems, of IEC technical committee 65: Industrial-process measurement, control and automation. It is an International Standard.

This third edition cancels and replaces the second edition published in 2020. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) added DEVICE_ID to the ProfibusIdentificationType and namespace to Annex A and Annex B;
b) added mapping from PB standard parameters to PA DIM.

The text of this International Standard is based on the following documents:

Draft	Report on voting
65E/862/CDV	65E/919/RVC

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

A list of all parts in the IEC 62769 series, published under the general title *Field device integration (FDI®)*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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FIELD DEVICE INTEGRATION (FDI®) –

Part 103-1: Profiles – PROFIBUS

1 Scope

This part of IEC 62769 specifies an FDI®[1] profile of IEC 62769 for IEC 61784-1_CP 3/1 (PROFIBUS DP)[2] and IEC 61784-1_CP3/2 (PROFIBUS PA)~~[1]~~.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 61784-1, *Industrial communication networks – Profiles – Part 1: Fieldbus profiles*

IEC 61804 (all parts), *Devices and integration in enterprise systems – Function blocks (FB) for process control and electronic device description language (EDDL)*

IEC 62541-100:2015, *OPC Unified Architecture – Part 100: ~~Device Interface~~ OPC UA for Devices*

IEC 62769-2[3], *Field device integration (FDI®) – Part 2: ~~FDI~~ Client*

IEC 62769-4[4], *Field device integration (FDI®) – Part 4: FDI® Packages*

IEC 62769-5[5], *Field device integration (FDI®) – Part 5: ~~FDI~~ Information Model*

IEC 62769-7[6], *Field Device Integration (FDI®) – Part 7: ~~FDI~~ Communication Devices*

PI Order No.: 2.122:2008, *Specification for PROFIBUS – Device Description and Device Integration – Volume 1: GSD, V5.1, July 2008: GSD;* available at <www.PROFIBUS.com>

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1 FDI is a registered trademark of the non-profit organization Fieldbus Foundation, Inc. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the trademark holder or any of its products. Compliance does not require use of the trade name. Use of the trade name requires permission of the trade name holder.

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~~3 Under preparation. Stage at the time of publication: IEC/RFDIS 62769-2:2020.~~

~~4 Under preparation. Stage at the time of publication: IEC/RFDIS 62769-4:2020.~~

~~5 Under preparation. Stage at the time of publication: IEC/RFDIS 62769-5:2020.~~

~~6 Under preparation. Stage at the time of publication: IEC/RFDIS 62769-7:2020.~~

3 Terms, definitions, abbreviated terms and ~~conventions~~ acronyms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61784-1, IEC 61804 (all parts), IEC 62541-100, IEC 62769-4, IEC 62769-5, IEC 62769-7 and PI Order No.: 2.122:2008 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http:www.iso.org/obp

3.2 Abbreviated terms and acronyms

For the purposes of this document, the following abbreviated terms and acronyms apply:

EDD	Electronic Device Description
EDDL	Electronic Device Description Language (see IEC 61804 (all parts))
GSD	General station description (see PI Order No.: 2.122:2008)
I&M	Identification and maintenance function
UUID	Universally unique identifier (see ~~ISO/IEC 11578~~ IEC 62769-8)
XML	Extensible markup language (see REC-xml-20081126)

4 Conventions

4.1 EDDL syntax

This document specifies content for the EDD component that is part of FDI® Communication Packages. The specification content using EDDL syntax uses the font `Courier New`. The EDDL syntax is used for method signature, variable, data structure and component declarations.

4.2 XML syntax

XML syntax examples use font `Courier New`. The XML syntax is used to describe XML document schema.

Example: `<xs:simpleType name="ExampleType">`

4.3 Capitalizations

The IEC 62769 series uses capitalized terms to emphasize that these terms have a FDI® specific meaning.

Some of these terms using an acronym as a prefix for example

- FDI® Client, or
- FDI® Server.

Some of these terms are compound terms such as:

- Communication Servers, or
- Profile Package.

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Parameter names or attributes are concatenated to a single term, where the original terms start in this term with a capital letter such as:

- ProtocolSupportFile or
- ProtocolType.

Parameter names or attributes can also be constructed by using an underscore character to concatenate two or more terms such as:

- PROFILE_ID or
- Profibus_PA_Network

5 Profile for PROFIBUS

5.1 General

This profile document to the FDI® specification in IEC 62769 specifies the protocol specifics needed for FDI® Packages describing Communication Servers, Gateways and Devices.

For Communication Servers this document defines also protocol specifics as these need to be considered in the Communication Servers hosted Information Model.

Annex B defines the XML schema for Direct Access Services. Annex C provides an overview of mapping PROFIBUS standard parameters to PA DIM.

5.2 Catalog profile

5.2.1 Protocol support file

5.2.1.1 FDI® Device Package

Protocol specific attachments are mentioned in the Package Catalog as defined in IEC 62769-5. A communication feature list (GSD) file according to PI Order No.: 2.122:2008 is a mandatory attachment for FDI® Device Packages representing PROFIBUS DP and PROFIBUS PA devices. Table 1 specifies the parameters of the ProtocolSupportFile in the FDI® Device Package.

Table 1 – ProtocolSupportFile for FDI® Device Packages

Parameter	Description
Content Type	text/plain
Root Namespace	empty
Source Relationship	http://fdi-cooperation.com/2010/relationship/attachment-protocol
Filename	According to PI Order No.: 2.122:2008

5.2.1.2 FDI® Communication Packages

A GSD file as specified in PI Order No.: 2.122:2008 is an optional attachment for FDI® Communication Packages representing PROFIBUS DP and PROFIBUS PA devices. Table 2 specifies the parameters of ProtocolSupportFile for FDI® Communication Packages.

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Table 2 – ProtocolSupportFile for FDI® Communication Packages

Parameter	Description
Content Type:	text/plain
Root Namespace:	empty
Source Relationship:	http://fdi-cooperation.com/2010/relationship/attachment-protocol
Filename:	According to PI Order No.: 2.122:2008

5.2.2 CommunicationProfile definition

IEC 62769-4 defines a CommunicationProfileT string for the Catalog XML schema. Table 3 defines the PROFIBUS specific values for this string.

Table 3 – PROFIBUS CommunicationProfile definition schema

Profile Identifier	Protocol
"profibus_dp"	PROFIBUS DP/V0; PROFIBUS DP/V1; PROFIBUS DP/V2
“profibus_pa”	PROFIBUS PA

5.2.3 Profile device

A Profile Package shall provide the catalog values for profile devices, enabling the FDI® Server to leverage a generic device description, if a specific one is not available. The definitions in Table 4 focus on catalog content that is vendor independent.

Table 4 – Catalog values for profile devices

Element	Attribute	Content
PackageType	—	Profile
Manufacturer	—	Empty
DeviceModel	—	The allowed profile identifier values (PROFILE_ID) are provided by PROFIBUS & PROFINET International (PI). PI provides and maintains an XML file (Profile_ID_Table) containing the assignment of PROFILE_ID to profiles. It is available at <http://www.profibus.com/IM/Profile_ID_Table.xml> The file can be downloaded by any engineering or service tool whenever it is connected to the Internet. ~~NOTE~~ More information is provided in PI Order No.: 3.502 (I&M Profile) and related profile definitions are referred therein. The string format shall be hexadecimal starting with 0x, e.g. ‘0x3D00’.

5.2.4 Protocol version information

IEC 62769-4 defines an element type named InterfaceT for the Catalog XML schema. The element type InterfaceT contains an element named Version which is supposed to provide version information about the applied communication protocol profile. The value has to follow the IEC 62769-4 defined version information schema defined in the element type VersionT. Table 5 describes how to apply the currently known protocol versions defined by the non-profit consortium PROFIBUS & PROFINET International. The general rule is to apply the value “0” for parts of the version information according to IEC 62769-4 that are not used in currently known protocol versions.

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Table 5 – Version mapping examples[7]

Protocol / Version	InterfaceT Version value
PROFIBUS DP/V0	0.0.0[a]
PROFIBUS DP/V1	1.0.0[a]
PROFIBUS DP/V2	2.0.0[a]
PROFIBUS PA 3.02	3.2.0[b]
PROFIBUS PA 4.0	4.0.0[b]

[a] The protocols PROFIBUS DP/V0, PROFIBUS DP/V1 and PROFIBUS DP/V2 contain a single number. This number is considered to be the major version. The minor and built numbers are set to "0".

[b] The currently known PROFIBUS PA profile numbers are considered to provide major and minor version information. Leading zeros are not considered in version value evaluation since only the actual decimal values are relevant.

5.3 Associating a Package with a device

5.3.1 Device type identification mapping

The purpose of device type identification mapping is to enable FDI® host systems to compare the scan result against the topology representation in the Information Model. FDI® host systems shall also be enabled to determine the FDI® Device Package that fits for a device entry contained in the scan result. This will enable the user of an FDI® host system to synchronize the Information Model with the actual installation.

The Communication Server implemented scan service (defined in 5.5.1.7) provides the scan result through an XML document (the schema is defined in Clause A.6).

The Gateway implemented scan service (defined in 5.5.2.7) provides the scan result by means of the Information Model that contains data structures created from EDD content as specified in 5.5.2.7.

Common for both ways of presenting the scan result is that scan results contain device type identification and device instance identification.

FDI® host systems comparing the actual network topology configuration against the topology representation in the Information Model shall be enabled to handle the following situations:

a) The physical Device instance identified at a specific device address is not logically present in the Information Model (as Instance): Enable the FDI® Host system to find the appropriate FDI® Device package according to the device catalog information.
b) The physical Device instance identified by the device address is logically present in the Information Model (as Instance): Enable the FDI® Host system to compare device type information presented in scan result (see the identification in Clause A.6) and the device type specific information of the Instance present in the Information Model.

The FDI® Device package contains device type identification information that can be compared to scan result based on the Catalog Schema in IEC 62769-4 defining the XML (simple) element types "DeviceModel" and "Manufacturer". Both types are used in the (complex) element types "Protocol" and "RegDeviceType".

7 The given table can be considered to be an example only since this document cannot foresee how future protocol versions will be defined.

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As a result of the FDI® Package deployment the FDI® Package information is then present in the Information Model as the specified FunctionalGroup Identification containing Ident_Number and Manufacturer_ID (see 5.4.3). The Ident_Number matches with the GSD specified Ident_Number. Manufacturer_ID is specified through the I&M profile defined VendorID and DeviceID (see 5.4.3).

If a device is used as a profile device, the Ident_Number returned in the scan result does not fit to the Ident_Number within the GSD. In this case, DEVICE_ID can be used to identify the FDI® Package.

The mapping between different device identification data sources is described in Table 6. Since scan results provided by the Communication Server or Gateway can convey data that is produced by the device (firmware) the device type identification mapping shall be supported by providing corresponding data in the FDI® Device Package contained Catalog and Information Model.

Table 6 – Device identification information mapping

FDI® Device Package	Information Model	Communication Server provided scan result	Gateway provided scan result
Catalog specified type Manufacturer	FunctionalGroup: Identification Browse Name: Manufacturer_ID	Element (path): ConnectionPoint/Identification Attribute: Manufacturer_ID	COLLECTION ConnectionPoint. Identification. Manufacturer_ID
Catalog specified type DeviceModel	FunctionalGroup: Identification Browse Name: Ident_Number	Element (path): ConnectionPoint/Identification Attribute: Ident_Number	COLLECTION ConnectionPoint. Identification. Ident_Number

5.3.2 Device type revision mapping

IEC 62769-4 envisions a concept that allows to determine the compatibility between an FDI® Device Package and a Device. IEC 62769-4 specifies a life cycle management process bearing on a single version information provided for the entire device.

~~NOTE~~ PROFIBUS related specifications, for example PI Order No.: 2.122:2008 (GSD) and *PI Order No.:* 3.502:2009 (I&M) splits the device type revision into software and hardware related information. The GSD specifies the attributes Hardware_Release and Software_Release. The I&M specifies HARDWARE_REVISION and SOFTWARE_REVISION. Hardware_Release and HARDWARE_REVISION ~~will~~ shall match always. Software_Release and SOFTWARE_REVISION ~~will~~ shall match always.

The goal of 5.3.2 is to describe the translation rules between PROFIBUS related specifications, describing their way of providing the version information, and the IEC 62769-4 specified way of containing the version information that can be compared against the version read from the device. The purpose is to determine the compatibility between an FDI® Device Package and a Device. Figure 1 depicts the problem.

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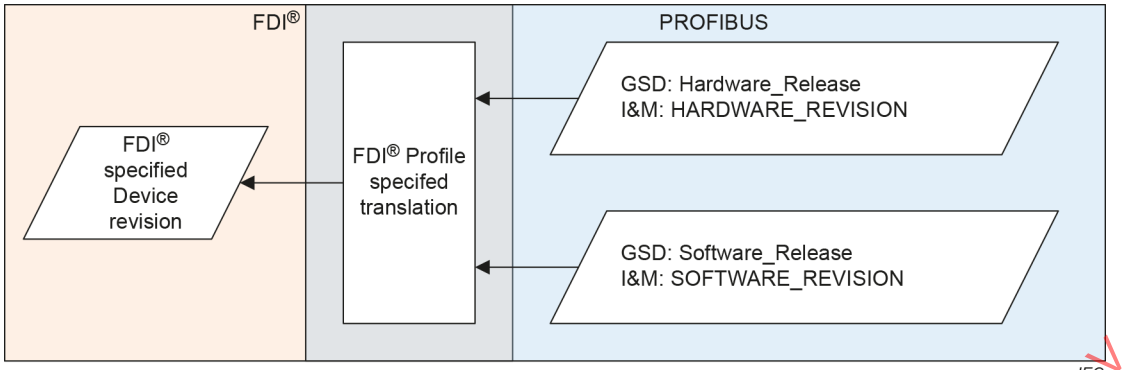

Figure 1 – Version mapping problem

The firmware of a device implements the data exchange interface which shall be described by means of the FDI® Device Package content (EDD). A device firmware that implements the PROFIBUS PA profile enables the reading of the values SOFTWARE_REVISION and HARDWARE_REVISION. The access to these values shall be described in the EDD contained in the FDI® Device Package.

Firmware modifications that affect the firmware implemented data exchange interface shall be reflected in the FDI® Device Package. Such firmware and device description modification shall be visible in the SOFTWARE_REVISION and Software_Release.

Hardware related modifications shall be captured in the HARDWARE_REVISION and Hardware_Release. Hardware related modifications do not necessarily always require a firmware update. Thus HARDWARE_REVISION and Hardware_Release cannot be used to determine compatibility between a device and the FDI® Device Package. But if a hardware modification requires firmware modifications both HARDWARE_REVISION and SOFTWARE_REVISION shall be changed. Hardware_Release and Software_Release shall be changed accordingly.

The IEC 62769-4 specifies the Catalog schema and an element DeviceVersion which is used in the element type declaration ListOfSupportedDeviceVersions. The value of the DeviceVersion shall be compared to the device provided SOFTWARE_REVISION or the GSD provided Software_Release in order to determine the compatibility between an FDI® Device Package and a device.

The data format for the SOFTWARE_REVISION is a string while the DeviceVersion expects three numbers for major, minor, and revision. Therefore the following rules apply: If the string has the format <integer>.<integer>.<integer> this is transferred to major, minor, and revision (in the same order). <integer> references to simple integer number in the string such as ‘1’ or ‘12’, not to other representations such as hexadecimal format (e.g. 0x001A). If <integer>.<integer> is provided, this is transferred to major and minor and ‘0’ is used for revision. If only an <integer> is provided, this is transferred to major and ‘0’ is used for minor and revision. A leading character or a leading character and whitespace shall be ignored. For a string in any other format the revision number shall not be considered to select the correct FDI® package.

5.4 Information Model mapping

5.4.1 ProtocolType definition

The concept to derive PROFIBUS DP and PROFIBUS PA specific Network Types applies to the protocol type definition.

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The protocol type Profibus_DP shall be used to identify the PROFIBUS DP communication. The type Profibus_DP is a subtype of the abstract type ProtocolType in IEC 62541-100. Table 7 specifies the allowed values of the ProtocolType attributes for the protocol type Profibus_DP.

Table 7 – Protocol type Profibus_DP

Attribute	Value				
BrowseName	Profibus_DP				
IsAbstract	False				
References	**NodeClass**	**BrowseName**	**DataType**	**TypeDefinition**	**ModellingRule**
Subtype of the ProtocolType defined in IEC 62541-100.					

The network type Profibus_PA_Network shall be used to build PROFIBUS PA network topologies. The type Profibus_DP_Network is a subtype of the abstract type NetworkType in IEC 62541-100. Table 8 specifies the allowed values of the ProtocolType attributes for the protocol type Profibus_PA.

Table 8 – Protocol type Profibus_PA

Attribute	Value				
BrowseName	Profibus_PA				
IsAbstract	False				
References	**NodeClass**	**BrowseName**	**DataType**	**TypeDefinition**	**ModellingRule**
Subtype of the ProtocolType defined in IEC 62541-100.					

5.4.2 DeviceType mapping

The DeviceType property mapping of the DeviceType node is defined in Table 9.

Table 9 – DeviceType property mapping

Property	PROFIBUS Mapping
SerialNumber	SERIAL_NUMBER (see Table 10)
RevisionCounter	REV_COUNTER (see Table 10)
Manufacturer	String taken from FDI® package catalog (ManufacturerName from PackageT)
Model	String taken from FDI® package catalog (Name of DeviceTypeT, which is a localized name)
DeviceRevision	Not supported
DeviceManual	Not supported
SoftwareRevision	SOFTWARE_REVISION (see Table 10)
HardwareRevision	HARDWARE_REVISION (see Table 10)

5.4.3 FunctionalGroup identification definition

As defined in IEC 62541-100:2015, 5.3, each device representation in the FDI® Server hosted Information Model shall contain a protocol specific FunctionalGroup named Identification. The Parameters of this FunctionalGroup are defined for PROFIBUS devices types as follows:

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Table 10 – PROFIBUS Device Types identification attributes

BrowseName	DataType	Mandatory/Optional
Ident_Number	UInt16	Mandatory
MANUFACTURER_ID	UInt16	Mandatory
ORDER_ID	String	Optional
SERIAL_NUMBER	String	Optional
HARDWARE_REVISION	UInt16	Optional
SOFTWARE_REVISION	String	Optional
REV_COUNTER	UInt16	Optional
PROFILE_ID	UInt16	Optional
PROFILE_SPECIFIC_TYPE	UInt16	Optional
IM_VERSION	ByteString	Optional
IM_SUPPORTED	UInt16	Optional
DEVICE_ID	String	Optional

The BaseDataVariable instances, except Ident_Number, shall be created from VARIABLE declarations with identifiers that correspond to the browse names listed in Table 10. The BaseDataVariable instances Ident_Number shall be created from the GSD file attribute Ident_Number.Topology elements.

~~4.5 Topology elements~~

5.4.4 ConnectionPoint definition

In order to support different network topology engineering needs related to different physical layers used by PROFIBUS DP and PROFIBUS PA, two different ConnectionPoint types shall be defined.

The ConnectionPoint type Profibus_DP shall be used to parameterize PROFIBUS DP network access points. The ConnectionPoint type Profibus_DP is a subtype of the abstract type ConnectionPointType defined in IEC 62541-100. Table 11 specifies the allowed values of the ConnectionPoint attributes for the protocol type Profibus_DP.

Table 11 – ConnectionPoint type for Profibus_DP

Attribute	Value				
BrowseName	ConnectionPoint_Profibus_DP				
IsAbstract	False				
References	**NodeClass**	**BrowseName**	**DataType**	**TypeDefinition**	**ModellingRule**
Subtype of the ConnectionPointType defined in IEC 62541-100.					
HasProperty	Variable	Address	Byte	PropertyType	Mandatory

The ConnectionPoint type Profibus_DP shall be described by an EDD element contained in a Communication Device related FDI® Package that can drive a PROFIBUS DP network. Actual ConnectionPoint properties are declared by VARIABLE constructs grouped together in a COLLECTION named ConnectionPoint.

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```
COMPONENT ConnectionPoint_Profibus_DP
{
LABEL "PROFIBUS DP Connection Point";
CLASSIFICATION NETWORK_CONNECTION_POINT;
CAN_DELETE FALSE;
PROTOCOL PROFIBUS_DP;
CONNECTION_POINT ConnectionPoint;
}

VARIABLE Address
{
  LABEL "Station address";
  HELP "Address of the PROFIBUS slave";
  TYPE UNSIGNED_INTEGER(1)
  {
    INITIAL_VALUE 126;
    MIN_VALUE 0;
    MAX_VALUE 126;
  }
  HANDLING READ & WRITE;
  CLASS LOCAL;
}


COLLECTION ConnectionPoint
{
  LABEL "PROFIBUS DP Connection Point data";
  MEMBERS
  {
    CONNECTION_POINT_ADDRESS, Address;
  }
}
```

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The ConnectionPoint type Profibus_PA shall be used to parameterize PROFIBUS PA network access points. The ConnectionPoint type Profibus_PA is a subtype of the abstract type ConnectionPointType defined in IEC 62541-100. Table 12 specifies the allowed values of the ConnectionPoint attributes for the protocol type Profibus_PA.

Table 12 – ConnectionPoint type for Profibus_PA

Attribute	**Value**				
BrowseName	ConnectionPoint_Profibus_PA				
IsAbstract	False				
References	**NodeClass**	**BrowseName**	**DataType**	**TypeDefinition**	**ModellingRule**
Subtype of the ConnectionPointType defined in IEC 62541-100.					
HasProperty	Variable	Address	Byte	PropertyType	Mandatory

The Property Address allowed values are 0 to 126.

The ConnectionPoint type Profibus_PA shall be described by an EDD element contained in a Communication Device related FDI® Package that can drive a PROFIBUS PA network. Actual ConnectionPoint properties are declared by VARIABLE constructs grouped together in a COLLECTION named ConnectionPoint.

```
COMPONENT ConnectionPoint_Profibus_PA
{
LABEL "PROFIBUS PA Connection Point";
CLASSIFICATION NETWORK_CONNECTION_POINT;
CAN_DELETE FALSE;
PROTOCOL PROFIBUS_PA;
}

VARIABLE Address
{
LABEL "Station address";
HELP "Address of the PROFIBUS slave";
CLASS DEVICE;
TYPE UNSIGNED_INTEGER(1)
{
    INITIAL_VALUE 126;
    MIN_VALUE 0;
    MAX_VALUE 126;
  }
  HANDLING READ & WRITE;
  CLASS LOCAL;
}

COLLECTION ConnectionPoint
{
  LABEL "PROFIBUS PA Connection Point data";
  MEMBERS
  {
    CONNECTION_POINT_ADDRESS, Address;
  }
}
```

5.4.5 Communication Device definition

According to IEC 62769-7, each FDI® Communication Package shall contain an EDD element describing the communication device. The following EDDL source code in is an example describing a Communication Server.

```
COMPONENT Profibus_Communication_Server
{
LABEL "PROFIBUS communication server";
PRODUCT_URI "urn:PROFIBUS International:PROFIBUS Communication      Server";
CAN_DELETE TRUE;
CLASSIFICATION NETWORK_COMPONENT;
COMPONENT_RELATIONS
{
  Profibus_Communication_Device_Setup
}
}


COMPONENT_RELATION Profibus_Communication_Device_Setup
{
   LABEL "Relation between Device and communication device";
   RELATION_TYPE CHILD_COMPONENT;
   COMPONENTS
   {
       Profibus_Communication_Device{AUTO_CREATE 1;}
   }
   MINIMUM_NUMBER 1;
   MAXIMUM_NUMBER 4;
}
```

According to IEC 62769-7, each FDI® Communication Package shall contain at least one EDD element describing at least one communication device component. The following EDDL source code in is an example for a PROFIBUS DP communication device:

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```
COMPONENT Profibus_Communication_Device
{
  LABEL "PROFIBUS communication device";
  CAN_DELETE TRUE;
  CLASSIFICATION NETWORK_COMPONENT;
  COMPONENT_RELATIONS { Profibus_Service_Provider_Relation }
  BYTE_ORDER BIG_ENDIAN;
}



COMPONENT_RELATION Profibus_Service_Provider_Relation
{
   LABEL "Relation to communication service provider";
   RELATION_TYPE CHILD_COMPONENT;
   COMPONENTS
   {
       Profibus_Service_Provider{AUTO_CREATE 1;}
   }
   MINIMUM_NUMBER 1;
   MAXIMUM_NUMBER 1;
}
```

In an actual communication device, the value “ConnectionPoint_Profibus_DP” needs to be adapted according to the supported protocol and the related connection point definitions given in 5.5. The attribute BYTE_ORDER value is to be set according to the protocol.

5.4.6 Communication service provider definition

According to IEC 62769-7, each FDI® Communication Package shall contain at least one EDD element describing at least one communication service provider component. The following EDDL source code below is an example for a PROFINET IO communication service provider component.

The component reference (ConnectionPoint_Profibus_DP) corresponds to the related connection point definition in 5.5. The attribute BYTE_ORDER value is to be set according to the protocol.

```
COMPONENT Profibus_Service_Provider
{
  LABEL "PROFIBUS communication service provider";
  CAN_DELETE TRUE;
  CLASSIFICATION NETWORK_COMMUNICATION_SERVICE_PROVIDER;
  COMPONENT_RELATIONS
  {
    Profibus_Service_Provider_Connection_Point_Relation
  }
  BYTE_ORDER BIG_ENDIAN; // EDDL extension
}

COMPONENT_RELATION Profibus_Service_Provider_Connection_Point_Relation
{
   LABEL "Relation between communication service provider and Connection Point";
   RELATION_TYPE CHILD_COMPONENT;
   ADDRESSING {Address}
   COMPONENTS
   {
       ConnectionPoint_Profibus_DP{ AUTO_CREATE 1;}
   }
   MINIMUM_NUMBER 1;
   MAXIMUM_NUMBER 1;
}
```

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5.4.7 Network definition

According to IEC 62769-7, each FDI® Communication Package shall contain at least one EDD element describing network configuration constraints using the component construct.

```
COMPONENT Network_Profibus_DP
{
    LABEL "PROFIBUS DP Network";
    CAN_DELETE TRUE;
    CLASSIFICATION NETWORK;
    COMPONENT_RELATIONS
    {
      Profibus_DP_Network_Connection_Point_Relation
    }
}

COMPONENT_RELATION Profibus_DP_Network_Connection_Point_Relation
{
   LABEL "Relation between network and Connection Point";
   RELATION_TYPE CHILD_COMPONENT;
   ADDRESSING {Address}
   COMPONENTS
   {
       ConnectionPoint_Profibus_DP
   }
   MINIMUM_NUMBER 1;
   MAXIMUM_NUMBER 32;
}
```

5.5 Methods

5.5.1 Methods for FDI® Communication Servers

5.5.1.1 General

The Communication Server contained Information Model shall implement services according to method signatures described in 5.5.1.

5.5.1.2 Connect

Signature:

```
Connect(
   [in]   ByteString        CommunicationRelationId,
   [in]   byte              Address,
   [out]  Int32             ServiceError);
```

Table 13 provides the description of the arguments.

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Table 13 – Method Connect arguments

Argument	Description
CommunicationRelationId	The argument value contains the nodeId of the ConnectionPoint representing the connection between a device and a physical network which is directly connected to the Communication Server hardware. The nodeId allows finding the direct parent-child relation.
Address	The argument name shall match with the corresponding attribute name defined for the ConnectionPoint which is described by a corresponding EDD element specified in 5.5. The argument value holds the device's network address.
ServiceError	0: OK / execution finished, connection established successfully -1: Connect Failed / canceled by caller -3: Connect Failed / device not found -4: Connect Failed / invalid device address -5: Connect Failed / invalid device identification

5.5.1.3 Disconnect

Signature:

```
Disconnect(
   [in]   ByteString        CommunicationRelationId,
   [out]  Int32             ServiceError);
```

Table 14 provides the description of the arguments.

Table 14 – Method Disconnect arguments

Argument	Description
CommunicationRelationId	The argument value contains the nodeId of the ConnectionPoint representing the connection between a device and a physical network which is directly connected to the Communication Server hardware. The nodeId allows finding the direct parent-child relation.
ServiceError	0: OK / disconnect finished successfully -1: Disconnect Failed / no existing communication relation -2: Disconnect Failed / invalid communication relation identifier

5.5.1.4 Transfer

Signature

```
Transfer(
   [in]   ByteString        CommunicationRelationId,
   [in]   String            OPERATION,
   [in]   unsigned char     SLOT,
   [in]   unsigned char     INDEX,
   [in]   ByteString        REQUEST,
   [out]  ByteString        REPLY,
   [out]  ByteString        RESPONSE_CODES,
   [out]  Int32             ServiceError);
```

Table 15 provides the description of the arguments.

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Table 15 – Method Transfer arguments

Argument	Description
CommunicationRelationId	The argument value contains the nodeId of the ConnectionPoint representing the connection between a device and a physical network within the Information Model.
OPERATION	The argument value indicates data transfer direction. Allowed values are “READ” and “WRITE”.
SLOT	The argument name shall match with the corresponding COMMAND – attribute name SLOT. The argument value shall come from the attribute value of COMMAND – attribute SLOT of the corresponding COMMAND that shall be processed.
INDEX	The argument name shall match with the corresponding COMMAND – attribute name INDEX. The argument value shall come from attribute value of COMMAND – attribute INDEX of the corresponding COMMAND that shall be processed.
REQUEST	The argument name shall match with the corresponding COMMAND sub-element name REQUEST. The byte stream submitted trough the argument is created from definitions provided by the REQUEST element of the corresponding COMMAND that shall be processed.
REPLY	The argument name shall match with the corresponding COMMAND sub-element name REPLY. The byte stream returned by this argument applies to definitions provided by the REPLY element of the corresponding COMMAND that shall be processed.
RESPONSE_CODES	The argument name shall match with the COMMAND sub-element name RESPONSE_CODES. The argument value conveys the PROFIBUS specific communication service response bytes.
ServiceError	0: OK / execution finished -1: Transfer Failed / canceled by caller -3: Transfer Failed / no existing communication relation. -4: Transfer Failed / invalid communication relation identifier -5: Transfer Failed / invalid sendData content -6: Transfer Failed / invalid receiveData format

5.5.1.5 GetPublishedData

This method is not supported by PROFIBUS.

5.5.1.6 SetAddress

Signature

```
SetAddress(
  [in]   byte             OldAddress,
  [in]   byte             NewAddress,
  [out]  Int32            ServiceError);
```

Table 16 provides the description of the arguments.

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Table 16 – Method SetAddress arguments

Argument	Description
OldAddress	The argument value holds the current address of a device. Allowed values are 0 to 126.
NewAddress	The argument value holds the new address for a device. Allowed values are 0 to 125.
ServiceError	0: OK / execution finished successfully -1: SetAddress Failed / canceled by caller -3: SetAddress Failed / not initialized -4: SetAddress Failed / not connected to a network -5: SetAddress Failed / no device found responding to oldAddress -6: SetAddress Failed / duplicate address error -7: SetAddress Failed / device did not accept new address -8: SetAddress Failed / invalid oldAddress (in terms of syntax, data type, data format, and so on) -9: SetAddress Failed / invalid newAddress (in terms of syntax, data type, data format, and so on) -10: SetAddress Failed / not possible in status connected

5.5.1.7 Scan

The method signature specified in IEC 62769-7 applies. The corresponding topologyScanResult schema is specified in Annex A.

5.5.1.8 ResetScan

The method signature specified in IEC 62769-7 applies.

5.5.2 Methods for Gateways

5.5.2.1 General

The methods signatures defined in 5.5.2 apply. The methods shall be implemented in the EDD element (IEC 62769-4) contained in a Gateway related FDI® Package containing the communication device definitions.

5.5.2.2 Connect

This subclause describes the PROFIBUS Gateway specific implementation of the service Connect specified in IEC 62769-7.

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```
METHOD BeginConnect(
   DD_STRING                CommunicationRelationId,
   unsigned char            Address,
   unsigned long            ServiceId,
   unsigned long            &DelayForNextCall,
   long                     &ServiceError)
{
  ACCESS ONLINE;
  DEFINITION{<Gateway specific implementation>}
}

METHOD EndConnect(
   DD_STRING                CommunicationRelationId,
   unsigned long            ServiceId,
   unsigned long            &DelayForNextCall,
   long                     &ServiceError)
{
  ACCESS ONLINE;
  DEFINITION{<Gateway specific implementation>}
}

METHOD CancelConnect(
   DD_STRING                CommunicationRelationId,
   unsigned long            ServiceId,
   long                     &ServiceError)
{
  ACCESS ONLINE;
  DEFINITION{<Gateway specific implementation>}
}
```

Table 17 provides the description of the arguments.

Table 17 – Connect service arguments

Argument	Description
CommunicationRelationId	The argument value contains the nodeId of the ConnectionPoint representing the connection between a device and a physical network which is directly connected to the Communication Server hardware. The nodeId allows finding the direct parent-child relation.
Address	The argument name shall match with the corresponding attribute name defined for the ConnectionPoint which is described by a corresponding EDD element specified in 5.5. The argument value holds the device's network address.
ServiceId	The service transaction code establishes the relation between the service request and the corresponding response.
DelayForNextCall	The value specifies a delay time in ms to limit the EndConnect invocation cycle that shall not be faster than specified in the argument value.
ServiceError	1: OK / function started asynchronously, result has to be polled with EndConnect 0: OK / execution finished, connection established successfully -1: Connect Failed / canceled by caller -2: Call Failed / unknown service ID -3: Connect Failed / device not found -4: Connect Failed / invalid device address -5: Connect Failed / invalid device identification

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5.5.2.3 Disconnect

This subclause describes the PROFIBUS specific implementation of the service Disconnect specified in IEC 62769-7.

```
METHOD Disconnect(
    DD_STRING CommunicationRelationId,
    long  &ServiceError)
{
  ACCESS ONLINE;
  DEFINITION{<Gateway specific implementation>}
}
```

All the arguments of the Disconnect method are described in Table 14.

5.5.2.4 Transfer

Subclause 5.5.2.4 describes the PROFIBUS specific implementation of the service Transfer specified in IEC 62769-7.

```
METHOD BeginTransfer(
    DD_STRING               CommunicationRelationId,
    DD_STRING               OPERATION,
    unsigned char           SLOT,
    unsigned char           INDEX,
    DD_STRING               REQUEST,
    DD_STRING               &REPLY,
    DD_STRING               &RESPONSE_CODES,
    unsigned long           ServiceId,
    unsigned long           &DelayForNextCall,
    long                    &ServiceError)
{
  ACCESS ONLINE;
  DEFINITION{<Gateway specific implementation>}
}

METHOD EndTransfer(
    DD_STRING               CommunicationRelationId,
    DD_STRING               &REPLY,
    DD_STRING               &RESPONSE_CODES,
    unsigned long           ServiceId,
    unsigned long           &DelayForNextCall,
    long                    &ServiceError)
{
  ACCESS ONLINE;
  DEFINITION{<Gateway specific implementation>}
}

METHOD CancelTransfer(
    DD_STRING               CommunicationRelationId,
    DD_STRING               &REPLY,
    DD_STRING               &RESPONSE_CODES,
    unsigned long           ServiceId,
    long                    &ServiceError)
{
  ACCESS ONLINE;
  DEFINITION{<Gateway specific implementation>}
}
```

Table 18 provides the description of the arguments.

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Table 18 – Method Transfer arguments

Argument	Description
CommunicationRelationId	The argument value contains the nodeId of the ConnectionPoint representing the connection between a device and a physical network within the Information Model.
OPERATION	The argument value indicates the data transfer direction. Allowed values are “READ” and “WRITE”.
SLOT	The argument name shall match with the corresponding COMMAND – attribute name SLOT. The argument value shall come from the attribute value of COMMAND – attribute SLOT of the corresponding COMMAND that shall be processed.
INDEX	The argument name shall match with the corresponding COMMAND – attribute name INDEX. The argument value shall come from the attribute value of COMMAND – attribute INDEX of the corresponding COMMAND that shall be processed.
REQUEST	The argument name shall match with corresponding COMMAND sub-element name REQUEST. The byte stream submitted trough argument is created from definitions provided by the REQUEST element of the corresponding COMMAND that shall be processed.
REPLY	The argument name shall match with corresponding COMMAND sub-element name REPLY. The byte stream returned by this argument applies to definitions provided by the REPLY element of the corresponding COMMAND that shall be processed.
RESPONSE_CODES	The argument name shall match with the COMMAND sub-element name RESPONSE_CODES. The argument value conveys the PROFIBUS specific communication service response bytes.
ServiceId	The service transaction code establishes the relation between the service request and the corresponding response.
DelayForNextCall	The value specifies a delay time in ms to limit the EndTransfer invocation cycle that shall not be faster than specified in the argument value.
ServiceError	1: OK / function started asynchronously, result has to be polled with EndTransfer 0: OK / execution finished -1: Transfer Failed / canceled by caller -2: Call Failed / unknown service ID -3: Transfer Failed / no existing communication relation -4: Transfer Failed / invalid communication relation identifier -5: Transfer Failed / invalid sendData content -6: Transfer Failed / invalid receiveData format

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5.5.2.5 GetPublishedData

This method is not supported in PROFIBUS.

5.5.2.6 SetAddress

Subclause 5.5.2.6 describes the PROFIBUS specific implementation of the service SetAddress specified in IEC 62769-7.

```
METHOD BeginSetAddress(
   unsigned char           OldAddress,
   unsigned char           NewAddress,
   unsigned long           ServiceId,
   unsigned long           &DelayForNextCall,
   long                    &ServiceError)
{
  ACCESS ONLINE;
  DEFINITION{<Gateway specific implementation>}
}

METHOD EndSetAddress(
   unsigned long           ServiceId,
   unsigned long           &DelayForNextCall,
   long                    &ServiceError)
{
  ACCESS ONLINE;
  DEFINITION{<Gateway specific implementation>}
}

METHOD CancelSetAddress(
   unsigned long           ServiceId,
   long                    &ServiceError)
{
  ACCESS ONLINE;
  DEFINITION{<Gateway specific implementation>}
}
```

Table 19 provides the description of the arguments.

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Table 19 – Method SetAddress arguments

Argument	Description
OldAddress	The argument value holds the current address of a device. Allowed values are 0 to 126.
NewAddress	The argument value holds the new address for a device. Allowed values are 0 to 125.
ServiceId	The service transaction code establishes the relation between the service request and the corresponding response.
DelayForNextCall	The value specifies a delay time in ms to limit the EndTransfer invocation cycle that shall not be faster than specified in the argument value.
ServiceError	1: OK / function started asynchronously, result has to be polled with EndSetAddress 0: OK / execution finished successfully -1: SetAddress Failed / canceled by caller -2: Call Failed / unknown service ID -3: SetAddress Failed / not initialized -4: SetAddress Failed / not connected to a network -5: SetAddress Failed / no device found responding to oldAddress -6: SetAddress Failed / duplicate address error -7: SetAddress Failed / device did not accept new address -8: SetAddress Failed / invalid oldAddress (in terms of syntax, data type, data format, and so on) -9: SetAddress Failed / invalid newAddress (in terms of syntax, data type, data format, and so on) -10: SetAddress Failed / not possible in status connected

5.5.2.7 Scan

The method signature specified in IEC 62769-7 applies. The PROFIBUS gateway business logic shall create the scan result following IEC 62769-7. The following definitions shall be present in the COMPONENT declaration that holds the definitions for a communication device. The data structure corresponds to the data structure defined in the XML schema in 5.2. The SCAN_LIST attribute inside the COMPONENT declaration shall refer to LIST TopologyScanResult.

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```
VARIABLE DP_Address
{
LABEL "Station address";
TYPE UNSIGNED_INTEGER(1);
CLASS LOCAL;
}

VARIABLE DP_DeviceID
{
LABEL "Device ID";
TYPE UNSIGNED_INTEGER(2);
CLASS LOCAL;
}

COLLECTION ScanItemType
{
  MEMBERS
  {
    DP_ADDRESS_ID, DP_Address;
    DP_DEVICE_ID, DP_DeviceID;
  }
}

LIST TopologyScanResult
{
  TYPE ScanItemType;
  CAPACITY 126;
}
```

5.5.2.8 ScanNext

The method signature specified in IEC 62769-7 applies. The PROFIBUS gateway business logic shall create the scan result following IEC 62769-7. The method ScanNext stores the result into data structures described for the method Scan (5.5.2.7).

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Annex A
(normative)

Topology Scan result schema

A.1 General

The topology scan result schema specified in Annex A describes the PROFIBUS specific format Method Scan argument `topologyScanResult`. The XML document content and structure shall correspond to the Information Model designed concept to describe a topology in order to enable generic matching between physical devices connected to the network and the FDI® Server hosted Information Model.

A.2 Target Namespace

The target namespace defined for the scan result is defined by:

```
<xs:schema
   xmlns:PI="http://PI/2012/FDI/PROFILE/PROFIBUS"
   xmlns:xs="http://www.w3.org/2001/XMLSchema"
   targetNamespace="http://PI/2012/FDI/PROFILE/PROFIBUS"
   elementFormDefault="unqualified" version="1.1.0">
```

A.3 Network

The subsequent element is used to return the scan result corresponding to the Information Model described in IEC 62769-5.

The XML schema for a Network element is:

```
<xs:element name="Network" type="PI:ProfibusNetworkT"/>
```

A.4 ProfibusNetworkT

The element type describes the complete scan result for a single network because of the scan method that is provided per instance of a "Communication Device" which exists in 1:1 relation to a network instance.

The XML schema for a ProfibusNetworkT type is:

```
<xs:complexType name="ProfibusNetworkT">
   <xs:sequence>
      <xs:element name="ConnectionPoint"
         type="PI:ProfibusConnectionPointT" maxOccurs="unbounded"/>
   </xs:sequence>
</xs:complexType>
```

The elements of a ProfibusNetworkT type are described in Table A.1.

Table A.1 – Elements of ProfibusNetworkT

Element	Description
ConnectionPoint	The ConnectionPoint element holds the address and identification of the network connected device that has been found during bus scan operations.

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A.5 ProfibusConnectionPointT

The XML schema for a ProfibusConnectionPointT type is:

```
<xs:complexType name="ProfibusConnectionPointT">
   <xs:sequence>
      <xs:element name="Identification"
         type="PI:ProfibusIdentificationT"/>
   </xs:sequence>
   <xs:attribute name="Address" type="PI:ProfibusAddressT"
      use="required"/>
</xs:complexType>
```

The attributes of a ProfibusConnectionPointT type are described in Table A.2.

Table A.2 – Attributes of ProfibusConnectionPointT

Attribute	Description
Address	The Attribute value holds the address of the network connected device.

The elements of a ProfibusConnectionPointT type are described in Table A.3.

Table A.3 – Elements of ProfibusConnectionPointT

Element	Description
Identification	The element data holds the device type identification data. Compared to the Information Model (IEC 62541-100) the ConnectionPoint does not contain or refer to the device type identification data. But in order to support the FDI® host system in finding the package that matches the connected device this schema associates the device type identification with the ConnectionPoint.

A.6 ProfibusIdentificationT

The element content corresponds to the "FunctionalGroup Identification".

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The XML schema for a ProfibusIdentificationT type is:

```
<xs:complexType name="ProfibusIdentificationT">
   <xs:attribute name="Ident_Number" type="xs:unsignedShort "
      use="required"/>
   <xs:attribute name="MANUFACTURER_ID" type="xs:unsignedShort "
      use="optional"/>
   <xs:attribute name="ORDER_ID" type="xs:string" use="optional"/>
   <xs:attribute name="SERIAL_NUMBER" type="xs:string"
      use="optional"/>
   <xs:attribute name="HARDWARE_REVISION" type="xs:unsignedShort "
      use="optional"/>
   <xs:attribute name="SOFTWARE_REVISION" type="xs:string"
      use="optional"/>
   <xs:attribute name="REV_COUNTER" type="xs:unsignedShort "
      use="optional"/>
   <xs:attribute name="PROFILE_ID" type="xs:unsignedShort "
      use="optional"/>
   <xs:attribute name="PROFILE_SPECIFIC_TYPE" type="xs:unsignedShort "
      use="optional"/>
   <xs:attribute name="IM_VERSION" type="xs:string" use="optional"/>
   <xs:attribute name="IM_SUPPORTED" type="xs:unsignedShort "
      use="optional"/>
   <xs:attribute name="DEVICE_ID" type="xs:string" use="optional">
</xs:complexType>
```

The attributes of a ProfibusIdentificationT type are described in Table A.4.

Table A.4 – Attributes of ProfibusIdentificationT

Attribute	Description
Ident_Number	See Table 10
MANUFACTURER_ID	See Table 10
ORDER_ID	See Table 10
SERIAL_NUMBER	See Table 10
HARDWARE_REVISION	See Table 10
SOFTWARE_REVISION	See Table 10
REV_COUNTER	See Table 10
PROFILE_ID	See Table 10
PROFILE_SPECIFIC_TYPE	See Table 10
IM_VERSION	See Table 10
IM_SUPPORTED	See Table 10
DEVICE_ID	See Table 10 DEVICE_ID shall only be used, if FDI® Technology version of the FDI® Server and the FDI® Communications server is greater or equal to 1.3.0.

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A.7 ProfibusAddressT

The XML schema for a ProfibusAddressT type is:

```
<xs:simpleType name="ProfibusAddressT">
   <xs:restriction base="xs:unsignedByte">
      <xs:minInclusive value="0"/>
      <xs:maxInclusive value="126"/>
   </xs:restriction>
</xs:simpleType>
```

Annex B
(normative)

Transfer service parameters

B.1 General

Direct Access Services specified in IEC 62769-2 enable the User Interface Plug-in (UIP) to directly exchange data with the device. Direct data exchange means that data exchanged between a device and a UIP may not be reflected in the Information Model. The IEC 62769-5 defined interface IDirectAccess corresponds to the IEC 62769-2 specified Direct Access Services. Interface IDirectAccess defined functions BeginTransfer and EndTransfer need to convey protocol specific information. The protocol specifics shall be captured in an XML document.

B.2 Target Namespace

The target namespace defined for the transfer service parameters document is defined in Clause A.2.

B.3 sendData

The element described in the following contains data to be submitted through the IDirectAccess function BeginTransfer defined argument sendData.

The XML schema for a sendData element is:

```
<xs:element name="sendData" type="PI:TransferSendDataT"/>
```

B.4 ~~xsreceiveData~~ receiveData

The element described in the following contains data that is returned through the IDirectAccess function EndTransfer defined return value.

The XML schema for a receiveData element is:

```
<xs:element name="receiveData" type="PI:TransferResultDataT"/>
```

B.5 ~~xsTransferSendDataT~~ TransferSendDataT

A complex type that defines the service parameter data format that shall be applied to Transfer defined argument sendData.

The XML schema for a TransferSendDataT type is:

```
<xs:complexType name="TransferSendDataT">
   <xs:attribute name="OPERATION" type="PI:OperationT"
      use="required"/>
xs
   <xs:attribute name="SLOT" type="xs:unsignedShort" use="required"/>
xs <xs:attribute name="INDEX" type="xs:unsignedShort" use="required"/>
xs <xs:attribute name="REQUEST" type="xs:hexBinary" use="required"/>
xs</xs:complexType>
```

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The attributes of a TransferSendDataT type are described in Table B.1.

Table B.1 – Attributes of TransferSendDataT

Attribute	Description
OPERATION	The attribute corresponds to the Transfer method argument OPERATION.
SLOT	The attribute corresponds to the Transfer method argument SLOT.
INDEX	The attribute corresponds to the Transfer method argument INDEX.
REQUEST	The attribute corresponds to the Transfer method argument REQUEST.

B.6 TransferResultDataT

A complex type that defines the service parameter data format that shall be applied to Transfer defined receivedData return value.

```
<xs:complexType name="TransferResultDataT">
   <xs:attribute name="REPLY" type="xs:hexBinary" use="required"/>
xs <xs:attribute name="RESPONSE_CODES" type="xs:hexBinary"
      use="required"/>
xs
</xs:complexType>
```

The attributes of a TransferResultDataT type are described in Table B.2.

Table B.2 – Attributes of TransferResultDataT

Attribute	Description
REPLY	The attribute corresponds to the Transfer method argument REPLY.
RESPONSE_CODES	The attribute corresponds to the Transfer method argument RESPONSE_CODES.

B.7 OperationT

A simple type that defines possible service operations.

The XML schema for a OperationT enumeration type is:

```
<xs:simpleType name="OperationT">
   <xs:restriction base="xs:string">
      <xs:enumeration value="READ"/>
      <xs:enumeration value="WRITE"/>
   </xs:restriction>
</xs:simpleType>
```

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Annex C
(informative)

Mapping to PA DIM

C.1 General

IEC 62769-8 specifies how the internal view of a device model represented by the EDD can be transferred into an external view as an OPC-UA information model by mapping EDD constructs to OPC-UA objects. This Annex C gives an overview on the mapping of standard parameters defined in PROFIBUS PA Profile 3.02 and PROFIBUS/PROFINET Profile 4.01 to PA DIM.

C.2 Mapping table

Table C.1 specifies the parameters, for which a direct mapping exists. Other parameters, as for example the manufacturer, cannot be mapped directly. In those cases, mapping tables can be used.

Table C.1 – Mapping from PB standard parameters to PA DIM

Usage	PA-DIM BrowsePath	IEC 61987 CDD	Mapping PROFIBUS PA Profile 3.0/3.01/3.02	Mapping PROFIBUS PA Profile 4.0
Identification	SerialNumber	0112/2///61987#ABA951#007	PB.DEVICE_SER_NUM	PB.IM_Serial_Number
Identification	HardwareRevision	0112/2///61987#ABA926#006	PB.HARDWARE_REVISION	PB.HARDWARE_REVISION
Identification	SoftwareRevision	0112/2///61987#ABA601#006	PB.SOFTWARE_REVISION	PB.SOFTWARE_REVISION
Identification	RevisionCounter	0112/2///61987#ABN603#001	--	PB.IM_Revision_Counter
Identification	ProductCode	0112/2///61987#ABA300#006	--	PB.OrderID
AssetId (User Tag of Device)	AssetId	0112/2///61987#ABA038#003	--	IM_Tag_Location
DeviceHealth	DeviceHealth	0112/2///61987#ABN972#001	--	NE107_STATUS
Administration	DisplayLanguage	0112/2///61987#ABN597#001	--	PB.LANGUAGE
Administration	DateOfLastChange	0112/2///61987#ABN604#001	--	LATEST_CHANGE
Identification	RevisionCounter	0112/2///61987#ABN603#001	--	PB.IM_Revision_Counter
AssetId (User Tag of Device)	AssetId	0112/2///61987#ABA038#003	--	IM_Tag_Location

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PI Order No.: 3.042:2009, *PROFIBUS – Profile for Process Control Devices;* available at <www.PROFIBUS.com>

PI Order No.: 3.502:2009, *Profile Guidelines – Part 1: Identification & Maintenance Functions;* available at <www.PROFIBUS.com>

REC-xml-20081126, Extensible Markup Language (XML) 1.0 (Fifth Edition) – W3C Recommendation 26 November 2008, available at http://www.w3.org/TR/xml/

http://www.profibus.com/IM/Profile_ID_Table.xml

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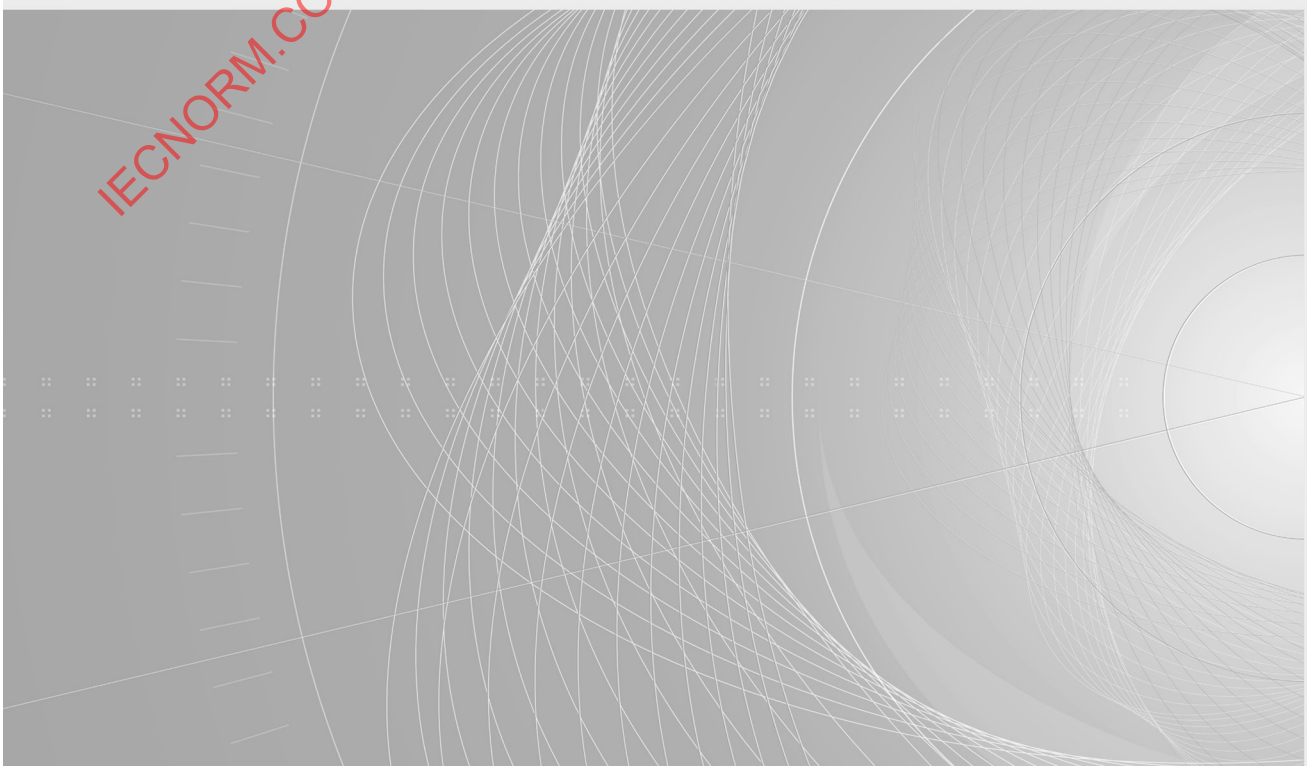
Intégration des appareils de terrain (FDI)® – Partie 103-1: Profils – PROFIBUS



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FIELD DEVICE INTEGRATION (FDI®) –

Part 103-1: Profiles – PROFIBUS

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IEC 62769-103-1 has been prepared by subcommittee 65E: Devices and integration in enterprise systems, of IEC technical committee 65: Industrial-process measurement, control and automation. It is an International Standard.

This third edition cancels and replaces the second edition published in 2020. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) added DEVICE_ID to the ProfibusIdentificationType and namespace to Annex A and Annex B;
b) added mapping from PB standard parameters to PA DIM.

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The text of this International Standard is based on the following documents:

Draft	Report on voting
65E/862/CDV	65E/919/RVC

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

A list of all parts in the IEC 62769 series, published under the general title *Field device integration (FDI®)*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

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FIELD DEVICE INTEGRATION (FDI®) –

Part 103-1: Profiles – PROFIBUS

1 Scope

This part of IEC 62769 specifies an FDI®[1] profile of IEC 62769 for IEC 61784-1_CP 3/1 (PROFIBUS DP)[2] and IEC 61784-1_CP3/2 (PROFIBUS PA).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 61784-1, *Industrial communication networks – Profiles – Part 1: Fieldbus profiles*

IEC 61804 (all parts), *Devices and integration in enterprise systems – Function blocks (FB) for process control and electronic device description language (EDDL)*

IEC 62541-100:2015, *OPC Unified Architecture – Part 100: OPC UA for Devices*

IEC 62769-2, *Field device integration (FDI®) – Part 2: Client*

IEC 62769-4, *Field device integration (FDI®) – Part 4: FDI® Packages*

IEC 62769-5, *Field device integration (FDI®) – Part 5: Information Model*

IEC 62769-7, *Field device integration (FDI®) – Part 7: Communication devices*

PI Order No.: 2.122:2008, *Specification for PROFIBUS – Device Description and Device Integration – Volume 1: GSD, V5.1, July 2008: GSD;* available at <www.PROFIBUS.com>

3 Terms, definitions, abbreviated terms and acronyms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61784-1, IEC 61804 (all parts), IEC 62541-100, IEC 62769-4, IEC 62769-5, IEC 62769-7 and PI Order No.: 2.122:2008 apply.

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ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http:www.iso.org/obp

3.2 Abbreviated terms and acronyms

For the purposes of this document, the following abbreviated terms and acronyms apply:

EDD	Electronic Device Description
EDDL	Electronic Device Description Language (see IEC 61804 (all parts))
GSD	General station description (see PI Order No.: 2.122:2008)
I&M	Identification and maintenance function
UUID	Universally unique identifier (see IEC 62769-8)
XML	Extensible markup language (see REC-xml-20081126)

4 Conventions

4.1 EDDL syntax

This document specifies content for the EDD component that is part of FDI® Communication Packages. The specification content using EDDL syntax uses the font `Courier New`. The EDDL syntax is used for method signature, variable, data structure and component declarations.

4.2 XML syntax

XML syntax examples use font `Courier New`. The XML syntax is used to describe XML document schema.

Example: `<xs:simpleType name="ExampleType">`

4.3 Capitalizations

The IEC 62769 series uses capitalized terms to emphasize that these terms have a FDI® specific meaning.

Some of these terms using an acronym as a prefix for example

- FDI® Client, or
- FDI® Server.

Some of these terms are compound terms such as:

- Communication Servers, or
- Profile Package.

Parameter names or attributes are concatenated to a single term, where the original terms start in this term with a capital letter such as:

- ProtocolSupportFile or
- ProtocolType.

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Parameter names or attributes can also be constructed by using an underscore character to concatenate two or more terms such as:

- PROFILE_ID or
- Profibus_PA_Network

5 Profile for PROFIBUS

5.1 General

This profile document to the FDI® specification in IEC 62769 specifies the protocol specifics needed for FDI® Packages describing Communication Servers, Gateways and Devices.

For Communication Servers this document defines also protocol specifics as these need to be considered in the Communication Servers hosted Information Model.

Annex B defines the XML schema for Direct Access Services. Annex C provides an overview of mapping PROFIBUS standard parameters to PA DIM.

5.2 Catalog profile

5.2.1 Protocol support file

5.2.1.1 FDI® Device Package

Protocol specific attachments are mentioned in the Package Catalog as defined in IEC 62769-5. A communication feature list (GSD) file according to PI Order No.: 2.122:2008 is a mandatory attachment for FDI® Device Packages representing PROFIBUS DP and PROFIBUS PA devices. Table 1 specifies the parameters of the ProtocolSupportFile in the FDI® Device Package.

Table 1 – ProtocolSupportFile for FDI® Device Packages

Parameter	Description
Content Type	text/plain
Root Namespace	empty
Source Relationship	http://fdi-cooperation.com/2010/relationship/attachment-protocol
Filename	According to PI Order No.: 2.122:2008

5.2.1.2 FDI® Communication Packages

A GSD file as specified in PI Order No.: 2.122:2008 is an optional attachment for FDI® Communication Packages representing PROFIBUS DP and PROFIBUS PA devices. Table 2 specifies the parameters of ProtocolSupportFile for FDI® Communication Packages.

Table 2 – ProtocolSupportFile for FDI® Communication Packages

Parameter	Description
Content Type:	text/plain
Root Namespace:	empty
Source Relationship:	http://fdi-cooperation.com/2010/relationship/attachment-protocol
Filename:	According to PI Order No.: 2.122:2008

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5.2.2 CommunicationProfile definition

IEC 62769-4 defines a CommunicationProfileT string for the Catalog XML schema. Table 3 defines the PROFIBUS specific values for this string.

Table 3 – PROFIBUS CommunicationProfile definition schema

Profile Identifier	Protocol
"profibus_dp"	PROFIBUS DP/V0; PROFIBUS DP/V1; PROFIBUS DP/V2
“profibus_pa”	PROFIBUS PA

5.2.3 Profile device

A Profile Package shall provide the catalog values for profile devices, enabling the FDI® Server to leverage a generic device description, if a specific one is not available. The definitions in Table 4 focus on catalog content that is vendor independent.

Table 4 – Catalog values for profile devices

Element	Attribute	Content
PackageType	—	Profile
Manufacturer	—	Empty
DeviceModel	—	The allowed profile identifier values (PROFILE_ID) are provided by PROFIBUS & PROFINET International (PI). PI provides and maintains an XML file (Profile_ID_Table) containing the assignment of PROFILE_ID to profiles. It is available at <http://www.profibus.com/IM/Profile_ID_Table.xml> The file can be downloaded by any engineering or service tool whenever it is connected to the Internet. More information is provided in PI Order No.: 3.502 (I&M Profile) and related profile definitions are referred therein. The string format shall be hexadecimal starting with 0x, e.g. ‘0x3D00’.

5.2.4 Protocol version information

IEC 62769-4 defines an element type named InterfaceT for the Catalog XML schema. The element type InterfaceT contains an element named Version which is supposed to provide version information about the applied communication protocol profile. The value has to follow the IEC 62769-4 defined version information schema defined in the element type VersionT. Table 5 describes how to apply the currently known protocol versions defined by the non-profit consortium PROFIBUS & PROFINET International. The general rule is to apply the value “0” for parts of the version information according to IEC 62769-4 that are not used in currently known protocol versions.

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Table 5 – Version mapping examples[3]

Protocol / Version	InterfaceT Version value
PROFIBUS DP/V0	0.0.0[a]
PROFIBUS DP/V1	1.0.0[a]
PROFIBUS DP/V2	2.0.0[a]
PROFIBUS PA 3.02	3.2.0[b]
PROFIBUS PA 4.0	4.0.0[b]

[a] The protocols PROFIBUS DP/V0, PROFIBUS DP/V1 and PROFIBUS DP/V2 contain a single number. This number is considered to be the major version. The minor and built numbers are set to "0".

[b] The currently known PROFIBUS PA profile numbers are considered to provide major and minor version information. Leading zeros are not considered in version value evaluation since only the actual decimal values are relevant.

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5.3 Associating a Package with a device

5.3.1 Device type identification mapping

The purpose of device type identification mapping is to enable FDI® host systems to compare the scan result against the topology representation in the Information Model. FDI® host systems shall also be enabled to determine the FDI® Device Package that fits for a device entry contained in the scan result. This will enable the user of an FDI® host system to synchronize the Information Model with the actual installation.

The Communication Server implemented scan service (defined in 5.5.1.7) provides the scan result through an XML document (the schema is defined in Clause A.6).

The Gateway implemented scan service (defined in 5.5.2.7) provides the scan result by means of the Information Model that contains data structures created from EDD content as specified in 5.5.2.7.

Common for both ways of presenting the scan result is that scan results contain device type identification and device instance identification.

FDI® host systems comparing the actual network topology configuration against the topology representation in the Information Model shall be enabled to handle the following situations:

a) The physical Device instance identified at a specific device address is not logically present in the Information Model (as Instance): Enable the FDI® Host system to find the appropriate FDI® Device package according to the device catalog information.
b) The physical Device instance identified by the device address is logically present in the Information Model (as Instance): Enable the FDI® Host system to compare device type information presented in scan result (see the identification in Clause A.6) and the device type specific information of the Instance present in the Information Model.

The FDI® Device package contains device type identification information that can be compared to scan result based on the Catalog Schema in IEC 62769-4 defining the XML (simple) element types "DeviceModel" and "Manufacturer". Both types are used in the (complex) element types "Protocol" and "RegDeviceType".

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3 The given table can be considered to be an example only since this document cannot foresee how future protocol versions will be defined.

As a result of the FDI® Package deployment the FDI® Package information is then present in the Information Model as the specified FunctionalGroup Identification containing Ident_Number and Manufacturer_ID (see 5.4.3). The Ident_Number matches with the GSD specified Ident_Number. Manufacturer_ID is specified through the I&M profile defined VendorID and DeviceID (see 5.4.3).

If a device is used as a profile device, the Ident_Number returned in the scan result does not fit to the Ident_Number within the GSD. In this case, DEVICE_ID can be used to identify the FDI® Package.

The mapping between different device identification data sources is described in Table 6. Since scan results provided by the Communication Server or Gateway can convey data that is produced by the device (firmware) the device type identification mapping shall be supported by providing corresponding data in the FDI® Device Package contained Catalog and Information Model.

Table 6 – Device identification information mapping

FDI® Device Package	Information Model	Communication Server provided scan result	Gateway provided scan result
Catalog specified type Manufacturer	FunctionalGroup: Identification Browse Name: Manufacturer_ID	Element (path): ConnectionPoint/Identification Attribute: Manufacturer_ID	COLLECTION ConnectionPoint. Identification. Manufacturer_ID
Catalog specified type DeviceModel	FunctionalGroup: Identification Browse Name: Ident_Number	Element (path): ConnectionPoint/Identification Attribute: Ident_Number	COLLECTION ConnectionPoint. Identification. Ident_Number

5.3.2 Device type revision mapping

IEC 62769-4 envisions a concept that allows to determine the compatibility between an FDI® Device Package and a Device. IEC 62769-4 specifies a life cycle management process bearing on a single version information provided for the entire device.

PROFIBUS related specifications, for example PI Order No.: 2.122:2008 (GSD) and *PI Order No.:* 3.502:2009 (I&M) splits the device type revision into software and hardware related information. The GSD specifies the attributes Hardware_Release and Software_Release. The I&M specifies HARDWARE_REVISION and SOFTWARE_REVISION. Hardware_Release and HARDWARE_REVISION shall match always. Software_Release and SOFTWARE_REVISION shall match always.

The goal of 5.3.2 is to describe the translation rules between PROFIBUS related specifications, describing their way of providing the version information, and the IEC 62769-4 specified way of containing the version information that can be compared against the version read from the device. The purpose is to determine the compatibility between an FDI® Device Package and a Device. Figure 1 depicts the problem.

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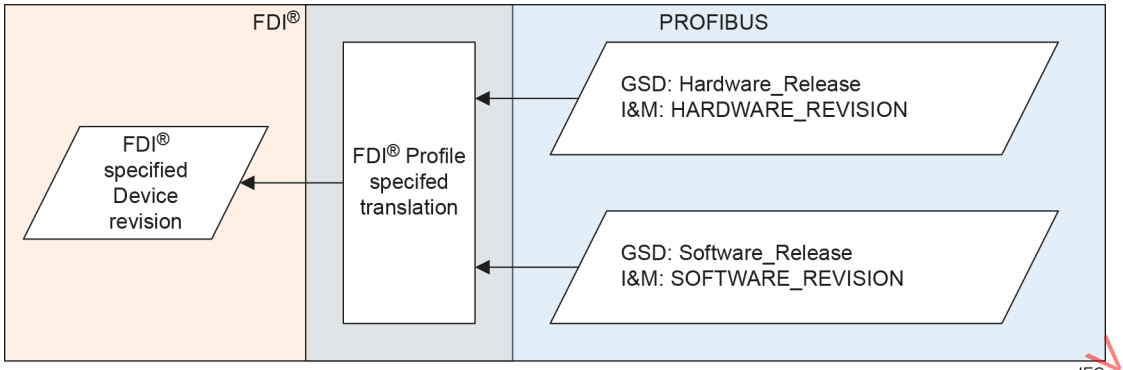

Figure 1 – Version mapping problem

The firmware of a device implements the data exchange interface which shall be described by means of the FDI® Device Package content (EDD). A device firmware that implements the PROFIBUS PA profile enables the reading of the values SOFTWARE_REVISION and HARDWARE_REVISION. The access to these values shall be described in the EDD contained in the FDI® Device Package.

Firmware modifications that affect the firmware implemented data exchange interface shall be reflected in the FDI® Device Package. Such firmware and device description modification shall be visible in the SOFTWARE_REVISION and Software_Release.

Hardware related modifications shall be captured in the HARDWARE_REVISION and Hardware_Release. Hardware related modifications do not necessarily always require a firmware update. Thus HARDWARE_REVISION and Hardware_Release cannot be used to determine compatibility between a device and the FDI® Device Package. But if a hardware modification requires firmware modifications both HARDWARE_REVISION and SOFTWARE_REVISION shall be changed. Hardware_Release and Software_Release shall be changed accordingly.

The IEC 62769-4 specifies the Catalog schema and an element DeviceVersion which is used in the element type declaration ListOfSupportedDeviceVersions. The value of the DeviceVersion shall be compared to the device provided SOFTWARE_REVISION or the GSD provided Software_Release in order to determine the compatibility between an FDI® Device Package and a device.

The data format for the SOFTWARE_REVISION is a string while the DeviceVersion expects three numbers for major, minor, and revision. Therefore the following rules apply: If the string has the format <integer>.<integer>.<integer> this is transferred to major, minor, and revision (in the same order). <integer> references to simple integer number in the string such as ‘1’ or ‘12’, not to other representations such as hexadecimal format (e.g. 0x001A). If <integer>.<integer> is provided, this is transferred to major and minor and ‘0’ is used for revision. If only an <integer> is provided, this is transferred to major and ‘0’ is used for minor and revision. A leading character or a leading character and whitespace shall be ignored. For a string in any other format the revision number shall not be considered to select the correct FDI® package.

5.4 Information Model mapping

5.4.1 ProtocolType definition

The concept to derive PROFIBUS DP and PROFIBUS PA specific Network Types applies to the protocol type definition.

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The protocol type Profibus_DP shall be used to identify the PROFIBUS DP communication. The type Profibus_DP is a subtype of the abstract type ProtocolType in IEC 62541-100. Table 7 specifies the allowed values of the ProtocolType attributes for the protocol type Profibus_DP.

Table 7 – Protocol type Profibus_DP

Attribute	Value				
BrowseName	Profibus_DP				
IsAbstract	False				
References	**NodeClass**	**BrowseName**	**DataType**	**TypeDefinition**	**ModellingRule**
Subtype of the ProtocolType defined in IEC 62541-100.					

The network type Profibus_PA_Network shall be used to build PROFIBUS PA network topologies. The type Profibus_DP_Network is a subtype of the abstract type NetworkType in IEC 62541-100. Table 8 specifies the allowed values of the ProtocolType attributes for the protocol type Profibus_PA.

Table 8 – Protocol type Profibus_PA

Attribute	Value				
BrowseName	Profibus_PA				
IsAbstract	False				
References	**NodeClass**	**BrowseName**	**DataType**	**TypeDefinition**	**ModellingRule**
Subtype of the ProtocolType defined in IEC 62541-100.					

5.4.2 DeviceType mapping

The DeviceType property mapping of the DeviceType node is defined in Table 9.

Table 9 – DeviceType property mapping

Property	PROFIBUS Mapping
SerialNumber	SERIAL_NUMBER (see Table 10)
RevisionCounter	REV_COUNTER (see Table 10)
Manufacturer	String taken from FDI® package catalog (ManufacturerName from PackageT)
Model	String taken from FDI® package catalog (Name of DeviceTypeT, which is a localized name)
DeviceRevision	Not supported
DeviceManual	Not supported
SoftwareRevision	SOFTWARE_REVISION (see Table 10)
HardwareRevision	HARDWARE_REVISION (see Table 10)

5.4.3 FunctionalGroup identification definition

As defined in IEC 62541-100:2015, 5.3, each device representation in the FDI® Server hosted Information Model shall contain a protocol specific FunctionalGroup named Identification. The Parameters of this FunctionalGroup are defined for PROFIBUS devices types as follows:

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Table 10 – PROFIBUS Device Types identification attributes

BrowseName	DataType	Mandatory/Optional
Ident_Number	UInt16	Mandatory
MANUFACTURER_ID	UInt16	Mandatory
ORDER_ID	String	Optional
SERIAL_NUMBER	String	Optional
HARDWARE_REVISION	UInt16	Optional
SOFTWARE_REVISION	String	Optional
REV_COUNTER	UInt16	Optional
PROFILE_ID	UInt16	Optional
PROFILE_SPECIFIC_TYPE	UInt16	Optional
IM_VERSION	ByteString	Optional
IM_SUPPORTED	UInt16	Optional
DEVICE_ID	String	Optional

The BaseDataVariable instances, except Ident_Number, shall be created from VARIABLE declarations with identifiers that correspond to the browse names listed in Table 10. The BaseDataVariable instances Ident_Number shall be created from the GSD file attribute Ident_Number.Topology elements.

5.4.4 ConnectionPoint definition

In order to support different network topology engineering needs related to different physical layers used by PROFIBUS DP and PROFIBUS PA, two different ConnectionPoint types shall be defined.

The ConnectionPoint type Profibus_DP shall be used to parameterize PROFIBUS DP network access points. The ConnectionPoint type Profibus_DP is a subtype of the abstract type ConnectionPointType defined in IEC 62541-100. Table 11 specifies the allowed values of the ConnectionPoint attributes for the protocol type Profibus_DP.

Table 11 – ConnectionPoint type for Profibus_DP

Attribute	Value				
BrowseName	ConnectionPoint_Profibus_DP				
IsAbstract	False				
References	**NodeClass**	**BrowseName**	**DataType**	**TypeDefinition**	**ModellingRule**
Subtype of the ConnectionPointType defined in IEC 62541-100.					
HasProperty	Variable	Address	Byte	PropertyType	Mandatory

The ConnectionPoint type Profibus_DP shall be described by an EDD element contained in a Communication Device related FDI® Package that can drive a PROFIBUS DP network. Actual ConnectionPoint properties are declared by VARIABLE constructs grouped together in a COLLECTION named ConnectionPoint.

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```
COMPONENT ConnectionPoint_Profibus_DP
{
LABEL "PROFIBUS DP Connection Point";
CLASSIFICATION NETWORK_CONNECTION_POINT;
CAN_DELETE FALSE;
PROTOCOL PROFIBUS_DP;
CONNECTION_POINT ConnectionPoint;
}

VARIABLE Address
{
  LABEL "Station address";
  HELP "Address of the PROFIBUS slave";
  TYPE UNSIGNED_INTEGER(1)
  {
    INITIAL_VALUE 126;
    MIN_VALUE 0;
    MAX_VALUE 126;
  }
  HANDLING READ & WRITE;
  CLASS LOCAL;
}


COLLECTION ConnectionPoint
{
  LABEL "PROFIBUS DP Connection Point data";
  MEMBERS
  {
    CONNECTION_POINT_ADDRESS, Address;
  }
}
```

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The ConnectionPoint type Profibus_PA shall be used to parameterize PROFIBUS PA network access points. The ConnectionPoint type Profibus_PA is a subtype of the abstract type ConnectionPointType defined in IEC 62541-100. Table 12 specifies the allowed values of the ConnectionPoint attributes for the protocol type Profibus_PA.

Table 12 – ConnectionPoint type for Profibus_PA

Attribute	**Value**				
BrowseName	ConnectionPoint_Profibus_PA				
IsAbstract	False				
References	**NodeClass**	**BrowseName**	**DataType**	**TypeDefinition**	**ModellingRule**
Subtype of the ConnectionPointType defined in IEC 62541-100.					
HasProperty	Variable	Address	Byte	PropertyType	Mandatory

The Property Address allowed values are 0 to 126.

The ConnectionPoint type Profibus_PA shall be described by an EDD element contained in a Communication Device related FDI® Package that can drive a PROFIBUS PA network. Actual ConnectionPoint properties are declared by VARIABLE constructs grouped together in a COLLECTION named ConnectionPoint.

```
COMPONENT ConnectionPoint_Profibus_PA
{
LABEL "PROFIBUS PA Connection Point";
CLASSIFICATION NETWORK_CONNECTION_POINT;
CAN_DELETE FALSE;
PROTOCOL PROFIBUS_PA;
}

VARIABLE Address
{
LABEL "Station address";
HELP "Address of the PROFIBUS slave";
CLASS DEVICE;
TYPE UNSIGNED_INTEGER(1)
{
    INITIAL_VALUE 126;
    MIN_VALUE 0;
    MAX_VALUE 126;
  }
  HANDLING READ & WRITE;
  CLASS LOCAL;
}

COLLECTION ConnectionPoint
{
  LABEL "PROFIBUS PA Connection Point data";
  MEMBERS
  {
    CONNECTION_POINT_ADDRESS, Address;
  }
}
```

5.4.5 Communication Device definition

According to IEC 62769-7, each FDI® Communication Package shall contain an EDD element describing the communication device. The following EDDL source code in is an example describing a Communication Server.

```
COMPONENT Profibus_Communication_Server
{
LABEL "PROFIBUS communication server";
PRODUCT_URI "urn:PROFIBUS International:PROFIBUS Communication      Server";
CAN_DELETE TRUE;
CLASSIFICATION NETWORK_COMPONENT;
COMPONENT_RELATIONS
{
  Profibus_Communication_Device_Setup
}
}


COMPONENT_RELATION Profibus_Communication_Device_Setup
{
   LABEL "Relation between Device and communication device";
   RELATION_TYPE CHILD_COMPONENT;
   COMPONENTS
   {
       Profibus_Communication_Device{AUTO_CREATE 1;}
   }
   MINIMUM_NUMBER 1;
   MAXIMUM_NUMBER 4;
}
```

According to IEC 62769-7, each FDI® Communication Package shall contain at least one EDD element describing at least one communication device component. The following EDDL source code in is an example for a PROFIBUS DP communication device:

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```
COMPONENT Profibus_Communication_Device
{
  LABEL "PROFIBUS communication device";
  CAN_DELETE TRUE;
  CLASSIFICATION NETWORK_COMPONENT;
  COMPONENT_RELATIONS { Profibus_Service_Provider_Relation }
  BYTE_ORDER BIG_ENDIAN;
}



COMPONENT_RELATION Profibus_Service_Provider_Relation
{
   LABEL "Relation to communication service provider";
   RELATION_TYPE CHILD_COMPONENT;
   COMPONENTS
   {
       Profibus_Service_Provider{AUTO_CREATE 1;}
   }
   MINIMUM_NUMBER 1;
   MAXIMUM_NUMBER 1;
}
```

In an actual communication device, the value “ConnectionPoint_Profibus_DP” needs to be adapted according to the supported protocol and the related connection point definitions given in 5.5. The attribute BYTE_ORDER value is to be set according to the protocol.

5.4.6 Communication service provider definition

According to IEC 62769-7, each FDI® Communication Package shall contain at least one EDD element describing at least one communication service provider component. The following EDDL source code below is an example for a PROFINET IO communication service provider component.

The component reference (ConnectionPoint_Profibus_DP) corresponds to the related connection point definition in 5.5. The attribute BYTE_ORDER value is to be set according to the protocol.

```
COMPONENT Profibus_Service_Provider
{
  LABEL "PROFIBUS communication service provider";
  CAN_DELETE TRUE;
  CLASSIFICATION NETWORK_COMMUNICATION_SERVICE_PROVIDER;
  COMPONENT_RELATIONS
  {
    Profibus_Service_Provider_Connection_Point_Relation
  }
  BYTE_ORDER BIG_ENDIAN; // EDDL extension
}

COMPONENT_RELATION Profibus_Service_Provider_Connection_Point_Relation
{
   LABEL "Relation between communication service provider and Connection Point";
   RELATION_TYPE CHILD_COMPONENT;
   ADDRESSING {Address}
   COMPONENTS
   {
       ConnectionPoint_Profibus_DP{ AUTO_CREATE 1;}
   }
   MINIMUM_NUMBER 1;
   MAXIMUM_NUMBER 1;
}
```

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5.4.7 Network definition

According to IEC 62769-7, each FDI® Communication Package shall contain at least one EDD element describing network configuration constraints using the component construct.

```
COMPONENT Network_Profibus_DP
{
    LABEL "PROFIBUS DP Network";
    CAN_DELETE TRUE;
    CLASSIFICATION NETWORK;
    COMPONENT_RELATIONS
    {
      Profibus_DP_Network_Connection_Point_Relation
    }
}

COMPONENT_RELATION Profibus_DP_Network_Connection_Point_Relation
{
   LABEL "Relation between network and Connection Point";
   RELATION_TYPE CHILD_COMPONENT;
   ADDRESSING {Address}
   COMPONENTS
   {
       ConnectionPoint_Profibus_DP
   }
   MINIMUM_NUMBER 1;
   MAXIMUM_NUMBER 32;
}
```

5.5 Methods

5.5.1 Methods for FDI® Communication Servers

5.5.1.1 General

The Communication Server contained Information Model shall implement services according to method signatures described in 5.5.1.

5.5.1.2 Connect

Signature:

```
Connect(
    [in]   ByteString       CommunicationRelationId,
    [in]   byte             Address,
    [out]  Int32            ServiceError);
```

Table 13 provides the description of the arguments.

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Table 13 – Method Connect arguments

Argument	Description
CommunicationRelationId	The argument value contains the nodeId of the ConnectionPoint representing the connection between a device and a physical network which is directly connected to the Communication Server hardware. The nodeId allows finding the direct parent-child relation.
Address	The argument name shall match with the corresponding attribute name defined for the ConnectionPoint which is described by a corresponding EDD element specified in 5.5. The argument value holds the device's network address.
ServiceError	0: OK / execution finished, connection established successfully -1: Connect Failed / canceled by caller -3: Connect Failed / device not found -4: Connect Failed / invalid device address -5: Connect Failed / invalid device identification

5.5.1.3 Disconnect

Signature:

```
Disconnect(
   [in]   ByteString        CommunicationRelationId,
   [out]  Int32             ServiceError);
```

Table 14 provides the description of the arguments.

Table 14 – Method Disconnect arguments

Argument	Description
CommunicationRelationId	The argument value contains the nodeId of the ConnectionPoint representing the connection between a device and a physical network which is directly connected to the Communication Server hardware. The nodeId allows finding the direct parent-child relation.
ServiceError	0: OK / disconnect finished successfully -1: Disconnect Failed / no existing communication relation -2: Disconnect Failed / invalid communication relation identifier

5.5.1.4 Transfer

Signature

```
Transfer(
   [in]   ByteString        CommunicationRelationId,
   [in]   String            OPERATION,
   [in]   unsigned char     SLOT,
   [in]   unsigned char     INDEX,
   [in]   ByteString        REQUEST,
   [out]  ByteString        REPLY,
   [out]  ByteString        RESPONSE_CODES,
   [out]  Int32             ServiceError);
```

Table 15 provides the description of the arguments.

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Table 15 – Method Transfer arguments

Argument	Description
CommunicationRelationId	The argument value contains the nodeId of the ConnectionPoint representing the connection between a device and a physical network within the Information Model.
OPERATION	The argument value indicates data transfer direction. Allowed values are “READ” and “WRITE”.
SLOT	The argument name shall match with the corresponding COMMAND – attribute name SLOT. The argument value shall come from the attribute value of COMMAND – attribute SLOT of the corresponding COMMAND that shall be processed.
INDEX	The argument name shall match with the corresponding COMMAND – attribute name INDEX. The argument value shall come from attribute value of COMMAND – attribute INDEX of the corresponding COMMAND that shall be processed.
REQUEST	The argument name shall match with the corresponding COMMAND sub-element name REQUEST. The byte stream submitted trough the argument is created from definitions provided by the REQUEST element of the corresponding COMMAND that shall be processed.
REPLY	The argument name shall match with the corresponding COMMAND sub-element name REPLY. The byte stream returned by this argument applies to definitions provided by the REPLY element of the corresponding COMMAND that shall be processed.
RESPONSE_CODES	The argument name shall match with the COMMAND sub-element name RESPONSE_CODES. The argument value conveys the PROFIBUS specific communication service response bytes.
ServiceError	0: OK / execution finished -1: Transfer Failed / canceled by caller -3: Transfer Failed / no existing communication relation. -4: Transfer Failed / invalid communication relation identifier -5: Transfer Failed / invalid sendData content -6: Transfer Failed / invalid receiveData format

5.5.1.5 GetPublishedData

This method is not supported by PROFIBUS.

5.5.1.6 SetAddress

Signature

```
SetAddress(
  [in]   byte             OldAddress,
  [in]   byte             NewAddress,
  [out]  Int32            ServiceError);
```

Table 16 provides the description of the arguments.

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Table 16 – Method SetAddress arguments

Argument	Description
OldAddress	The argument value holds the current address of a device. Allowed values are 0 to 126.
NewAddress	The argument value holds the new address for a device. Allowed values are 0 to 125.
ServiceError	0: OK / execution finished successfully -1: SetAddress Failed / canceled by caller -3: SetAddress Failed / not initialized -4: SetAddress Failed / not connected to a network -5: SetAddress Failed / no device found responding to oldAddress -6: SetAddress Failed / duplicate address error -7: SetAddress Failed / device did not accept new address -8: SetAddress Failed / invalid oldAddress (in terms of syntax, data type, data format, and so on) -9: SetAddress Failed / invalid newAddress (in terms of syntax, data type, data format, and so on) -10: SetAddress Failed / not possible in status connected

5.5.1.7 Scan

The method signature specified in IEC 62769-7 applies. The corresponding topologyScanResult schema is specified in Annex A.

5.5.1.8 ResetScan

The method signature specified in IEC 62769-7 applies.

5.5.2 Methods for Gateways

5.5.2.1 General

The methods signatures defined in 5.5.2 apply. The methods shall be implemented in the EDD element (IEC 62769-4) contained in a Gateway related FDI® Package containing the communication device definitions.

5.5.2.2 Connect

This subclause describes the PROFIBUS Gateway specific implementation of the service Connect specified in IEC 62769-7.

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```
METHOD BeginConnect(
   DD_STRING                CommunicationRelationId,
   unsigned char            Address,
   unsigned long            ServiceId,
   unsigned long            &DelayForNextCall,
   long                     &ServiceError)
{
  ACCESS ONLINE;
  DEFINITION{<Gateway specific implementation>}
}

METHOD EndConnect(
   DD_STRING                CommunicationRelationId,
   unsigned long            ServiceId,
   unsigned long            &DelayForNextCall,
   long                     &ServiceError)
{
  ACCESS ONLINE;
  DEFINITION{<Gateway specific implementation>}
}

METHOD CancelConnect(
   DD_STRING                CommunicationRelationId,
   unsigned long            ServiceId,
   long                     &ServiceError)
{
  ACCESS ONLINE;
  DEFINITION{<Gateway specific implementation>}
}
```

Table 17 provides the description of the arguments.

Table 17 – Connect service arguments

Argument	Description
CommunicationRelationId	The argument value contains the nodeId of the ConnectionPoint representing the connection between a device and a physical network which is directly connected to the Communication Server hardware. The nodeId allows finding the direct parent-child relation.
Address	The argument name shall match with the corresponding attribute name defined for the ConnectionPoint which is described by a corresponding EDD element specified in 5.5. The argument value holds the device's network address.
ServiceId	The service transaction code establishes the relation between the service request and the corresponding response.
DelayForNextCall	The value specifies a delay time in ms to limit the EndConnect invocation cycle that shall not be faster than specified in the argument value.
ServiceError	1: OK / function started asynchronously, result has to be polled with EndConnect 0: OK / execution finished, connection established successfully -1: Connect Failed / canceled by caller -2: Call Failed / unknown service ID -3: Connect Failed / device not found -4: Connect Failed / invalid device address -5: Connect Failed / invalid device identification

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5.5.2.3 Disconnect

This subclause describes the PROFIBUS specific implementation of the service Disconnect specified in IEC 62769-7.

```
METHOD Disconnect(
    DD_STRING CommunicationRelationId,
    long  &ServiceError)
{
  ACCESS ONLINE;
  DEFINITION{<Gateway specific implementation>}
}
```

All the arguments of the Disconnect method are described in Table 14.

5.5.2.4 Transfer

Subclause 5.5.2.4 describes the PROFIBUS specific implementation of the service Transfer specified in IEC 62769-7.

```
METHOD BeginTransfer(
    DD_STRING               CommunicationRelationId,
    DD_STRING               OPERATION,
    unsigned char           SLOT,
    unsigned char           INDEX,
    DD_STRING               REQUEST,
    DD_STRING               &REPLY,
    DD_STRING               &RESPONSE_CODES,
    unsigned long           ServiceId,
    unsigned long           &DelayForNextCall,
    long                    &ServiceError)
{
  ACCESS ONLINE;
  DEFINITION{<Gateway specific implementation>}
}

METHOD EndTransfer(
    DD_STRING               CommunicationRelationId,
    DD_STRING               &REPLY,
    DD_STRING               &RESPONSE_CODES,
    unsigned long           ServiceId,
    unsigned long           &DelayForNextCall,
    long                    &ServiceError)
{
  ACCESS ONLINE;
  DEFINITION{<Gateway specific implementation>}
}

METHOD CancelTransfer(
    DD_STRING               CommunicationRelationId,
    DD_STRING               &REPLY,
    DD_STRING               &RESPONSE_CODES,
    unsigned long           ServiceId,
    long                    &ServiceError)
{
  ACCESS ONLINE;
  DEFINITION{<Gateway specific implementation>}
}
```

Table 18 provides the description of the arguments.

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Table 18 – Method Transfer arguments

Argument	Description
CommunicationRelationId	The argument value contains the nodeId of the ConnectionPoint representing the connection between a device and a physical network within the Information Model.
OPERATION	The argument value indicates the data transfer direction. Allowed values are “READ” and “WRITE”.
SLOT	The argument name shall match with the corresponding COMMAND – attribute name SLOT. The argument value shall come from the attribute value of COMMAND – attribute SLOT of the corresponding COMMAND that shall be processed.
INDEX	The argument name shall match with the corresponding COMMAND – attribute name INDEX. The argument value shall come from the attribute value of COMMAND – attribute INDEX of the corresponding COMMAND that shall be processed.
REQUEST	The argument name shall match with corresponding COMMAND sub-element name REQUEST. The byte stream submitted trough argument is created from definitions provided by the REQUEST element of the corresponding COMMAND that shall be processed.
REPLY	The argument name shall match with corresponding COMMAND sub-element name REPLY. The byte stream returned by this argument applies to definitions provided by the REPLY element of the corresponding COMMAND that shall be processed.
RESPONSE_CODES	The argument name shall match with the COMMAND sub-element name RESPONSE_CODES. The argument value conveys the PROFIBUS specific communication service response bytes.
ServiceId	The service transaction code establishes the relation between the service request and the corresponding response.
DelayForNextCall	The value specifies a delay time in ms to limit the EndTransfer invocation cycle that shall not be faster than specified in the argument value.
ServiceError	1: OK / function started asynchronously, result has to be polled with EndTransfer 0: OK / execution finished -1: Transfer Failed / canceled by caller -2: Call Failed / unknown service ID -3: Transfer Failed / no existing communication relation -4: Transfer Failed / invalid communication relation identifier -5: Transfer Failed / invalid sendData content -6: Transfer Failed / invalid receiveData format

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5.5.2.5 GetPublishedData

This method is not supported in PROFIBUS.

5.5.2.6 SetAddress

Subclause 5.5.2.6 describes the PROFIBUS specific implementation of the service SetAddress specified in IEC 62769-7.

```
METHOD BeginSetAddress(
   unsigned char           OldAddress,
   unsigned char           NewAddress,
   unsigned long           ServiceId,
   unsigned long           &DelayForNextCall,
   long                    &ServiceError)
{
  ACCESS ONLINE;
  DEFINITION{<Gateway specific implementation>}
}

METHOD EndSetAddress(
   unsigned long           ServiceId,
   unsigned long           &DelayForNextCall,
   long                    &ServiceError)
{
  ACCESS ONLINE;
  DEFINITION{<Gateway specific implementation>}
}

METHOD CancelSetAddress(
   unsigned long           ServiceId,
   long                    &ServiceError)
{
  ACCESS ONLINE;
  DEFINITION{<Gateway specific implementation>}
}
```

Table 19 provides the description of the arguments.

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Table 19 – Method SetAddress arguments

Argument	Description
OldAddress	The argument value holds the current address of a device. Allowed values are 0 to 126.
NewAddress	The argument value holds the new address for a device. Allowed values are 0 to 125.
ServiceId	The service transaction code establishes the relation between the service request and the corresponding response.
DelayForNextCall	The value specifies a delay time in ms to limit the EndTransfer invocation cycle that shall not be faster than specified in the argument value.
ServiceError	1: OK / function started asynchronously, result has to be polled with EndSetAddress 0: OK / execution finished successfully -1: SetAddress Failed / canceled by caller -2: Call Failed / unknown service ID -3: SetAddress Failed / not initialized -4: SetAddress Failed / not connected to a network -5: SetAddress Failed / no device found responding to oldAddress -6: SetAddress Failed / duplicate address error -7: SetAddress Failed / device did not accept new address -8: SetAddress Failed / invalid oldAddress (in terms of syntax, data type, data format, and so on) -9: SetAddress Failed / invalid newAddress (in terms of syntax, data type, data format, and so on) -10: SetAddress Failed / not possible in status connected

5.5.2.7 Scan

The method signature specified in IEC 62769-7 applies. The PROFIBUS gateway business logic shall create the scan result following IEC 62769-7. The following definitions shall be present in the COMPONENT declaration that holds the definitions for a communication device. The data structure corresponds to the data structure defined in the XML schema in 5.2. The SCAN_LIST attribute inside the COMPONENT declaration shall refer to LIST TopologyScanResult.

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```
VARIABLE DP_Address
{
LABEL "Station address";
TYPE UNSIGNED_INTEGER(1);
CLASS LOCAL;
}

VARIABLE DP_DeviceID
{
LABEL "Device ID";
TYPE UNSIGNED_INTEGER(2);
CLASS LOCAL;
}

COLLECTION ScanItemType
{
  MEMBERS
  {
    DP_ADDRESS_ID, DP_Address;
    DP_DEVICE_ID, DP_DeviceID;
  }
}

LIST TopologyScanResult
{
  TYPE ScanItemType;
  CAPACITY 126;
}
```

5.5.2.8 ScanNext

The method signature specified in IEC 62769-7 applies. The PROFIBUS gateway business logic shall create the scan result following IEC 62769-7. The method ScanNext stores the result into data structures described for the method Scan (5.5.2.7).

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Annex A
(normative)

Topology Scan result schema

A.1 General

The topology scan result schema specified in Annex A describes the PROFIBUS specific format Method Scan argument `topologyScanResult`. The XML document content and structure shall correspond to the Information Model designed concept to describe a topology in order to enable generic matching between physical devices connected to the network and the FDI® Server hosted Information Model.

A.2 Target Namespace

The target namespace defined for the scan result is defined by:

```
<xs:schema
   xmlns:PI="http://PI/2012/FDI/PROFILE/PROFIBUS"
   xmlns:xs="http://www.w3.org/2001/XMLSchema"
   targetNamespace="http://PI/2012/FDI/PROFILE/PROFIBUS"
   elementFormDefault="unqualified" version="1.1.0">
```

A.3 Network

The subsequent element is used to return the scan result corresponding to the Information Model described in IEC 62769-5.

The XML schema for a Network element is:

```
<xs:element name="Network" type="PI:ProfibusNetworkT"/>
```

A.4 ProfibusNetworkT

The element type describes the complete scan result for a single network because of the scan method that is provided per instance of a "Communication Device" which exists in 1:1 relation to a network instance.

The XML schema for a ProfibusNetworkT type is:

```
<xs:complexType name="ProfibusNetworkT">
   <xs:sequence>
      <xs:element name="ConnectionPoint"
         type="PI:ProfibusConnectionPointT" maxOccurs="unbounded"/>
   </xs:sequence>
</xs:complexType>
```

The elements of a ProfibusNetworkT type are described in Table A.1.

Table A.1 – Elements of ProfibusNetworkT

Element	Description
ConnectionPoint	The ConnectionPoint element holds the address and identification of the network connected device that has been found during bus scan operations.

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A.5 ProfibusConnectionPointT

The XML schema for a ProfibusConnectionPointT type is:

```
<xs:complexType name="ProfibusConnectionPointT">
   <xs:sequence>
      <xs:element name="Identification"
         type="PI:ProfibusIdentificationT"/>
   </xs:sequence>
   <xs:attribute name="Address" type="PI:ProfibusAddressT"
      use="required"/>
</xs:complexType>
```

The attributes of a ProfibusConnectionPointT type are described in Table A.2.

Table A.2 – Attributes of ProfibusConnectionPointT

Attribute	Description
Address	The Attribute value holds the address of the network connected device.

The elements of a ProfibusConnectionPointT type are described in Table A.3.

Table A.3 – Elements of ProfibusConnectionPointT

Element	Description
Identification	The element data holds the device type identification data. Compared to the Information Model (IEC 62541-100) the ConnectionPoint does not contain or refer to the device type identification data. But in order to support the FDI® host system in finding the package that matches the connected device this schema associates the device type identification with the ConnectionPoint.

A.6 ProfibusIdentificationT

The element content corresponds to the "FunctionalGroup Identification".

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The XML schema for a ProfibusIdentificationT type is:

```
<xs:complexType name="ProfibusIdentificationT">
   <xs:attribute name="Ident_Number" type="xs:unsignedShort "
      use="required"/>
   <xs:attribute name="MANUFACTURER_ID" type="xs:unsignedShort "
      use="optional"/>
   <xs:attribute name="ORDER_ID" type="xs:string" use="optional"/>
   <xs:attribute name="SERIAL_NUMBER" type="xs:string"
      use="optional"/>
   <xs:attribute name="HARDWARE_REVISION" type="xs:unsignedShort "
      use="optional"/>
   <xs:attribute name="SOFTWARE_REVISION" type="xs:string"
      use="optional"/>
   <xs:attribute name="REV_COUNTER" type="xs:unsignedShort "
      use="optional"/>
   <xs:attribute name="PROFILE_ID" type="xs:unsignedShort "
      use="optional"/>
   <xs:attribute name="PROFILE_SPECIFIC_TYPE" type="xs:unsignedShort "
      use="optional"/>
   <xs:attribute name="IM_VERSION" type="xs:string" use="optional"/>
   <xs:attribute name="IM_SUPPORTED" type="xs:unsignedShort "
      use="optional"/>
   <xs:attribute name="DEVICE_ID" type="xs:string" use="optional">
</xs:complexType>
```

The attributes of a ProfibusIdentificationT type are described in Table A.4.

Table A.4 – Attributes of ProfibusIdentificationT

Attribute	Description
Ident_Number	See Table 10
MANUFACTURER_ID	See Table 10
ORDER_ID	See Table 10
SERIAL_NUMBER	See Table 10
HARDWARE_REVISION	See Table 10
SOFTWARE_REVISION	See Table 10
REV_COUNTER	See Table 10
PROFILE_ID	See Table 10
PROFILE_SPECIFIC_TYPE	See Table 10
IM_VERSION	See Table 10
IM_SUPPORTED	See Table 10
DEVICE_ID	See Table 10 DEVICE_ID shall only be used, if FDI® Technology version of the FDI® Server and the FDI® Communications server is greater or equal to 1.3.0.

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A.7 ProfibusAddressT

The XML schema for a ProfibusAddressT type is:

```
<xs:simpleType name="ProfibusAddressT">
   <xs:restriction base="xs:unsignedByte">
      <xs:minInclusive value="0"/>
      <xs:maxInclusive value="126"/>
   </xs:restriction>
</xs:simpleType>
```

Annex B
(normative)

Transfer service parameters

B.1 General

Direct Access Services specified in IEC 62769-2 enable the User Interface Plug-in (UIP) to directly exchange data with the device. Direct data exchange means that data exchanged between a device and a UIP may not be reflected in the Information Model. The IEC 62769-5 defined interface IDirectAccess corresponds to the IEC 62769-2 specified Direct Access Services. Interface IDirectAccess defined functions BeginTransfer and EndTransfer need to convey protocol specific information. The protocol specifics shall be captured in an XML document.

B.2 Target Namespace

The target namespace defined for the transfer service parameters document is defined in Clause A.2.

B.3 sendData

The element described in the following contains data to be submitted through the IDirectAccess function BeginTransfer defined argument sendData.

The XML schema for a sendData element is:

```
<xs:element name="sendData" type="PI:TransferSendDataT"/>
```

B.4 receiveData

The element described in the following contains data that is returned through the IDirectAccess function EndTransfer defined return value.

The XML schema for a receiveData element is:

```
<xs:element name="receiveData" type="PI:TransferResultDataT"/>
```

B.5 TransferSendDataT

A complex type that defines the service parameter data format that shall be applied to Transfer defined argument sendData.

The XML schema for a TransferSendDataT type is:

```
<xs:complexType name="TransferSendDataT">
   <xs:attribute name="OPERATION" type="PI:OperationT"
      use="required"/>
xs
   <xs:attribute name="SLOT" type="xs:unsignedShort" use="required"/>
xs <xs:attribute name="INDEX" type="xs:unsignedShort" use="required"/>
xs <xs:attribute name="REQUEST" type="xs:hexBinary" use="required"/>
xs</xs:complexType>
```

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The attributes of a TransferSendDataT type are described in Table B.1.

Table B.1 – Attributes of TransferSendDataT

Attribute	Description
OPERATION	The attribute corresponds to the Transfer method argument OPERATION.
SLOT	The attribute corresponds to the Transfer method argument SLOT.
INDEX	The attribute corresponds to the Transfer method argument INDEX.
REQUEST	The attribute corresponds to the Transfer method argument REQUEST.

B.6 TransferResultDataT

A complex type that defines the service parameter data format that shall be applied to Transfer defined receivedData return value.

```
<xs:complexType name="TransferResultDataT">
   <xs:attribute name="REPLY" type="xs:hexBinary" use="required"/>
xs <xs:attribute name="RESPONSE_CODES" type="xs:hexBinary"
      use="required"/>
xs
</xs:complexType>
```

The attributes of a TransferResultDataT type are described in Table B.2.

Table B.2 – Attributes of TransferResultDataT

Attribute	Description
REPLY	The attribute corresponds to the Transfer method argument REPLY.
RESPONSE_CODES	The attribute corresponds to the Transfer method argument RESPONSE_CODES.

B.7 OperationT

A simple type that defines possible service operations.

The XML schema for a OperationT enumeration type is:

```
<xs:simpleType name="OperationT">
   <xs:restriction base="xs:string">
      <xs:enumeration value="READ"/>
      <xs:enumeration value="WRITE"/>
   </xs:restriction>
</xs:simpleType>
```

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Annex C
(informative)

Mapping to PA DIM

C.1 General

IEC 62769-8 specifies how the internal view of a device model represented by the EDD can be transferred into an external view as an OPC-UA information model by mapping EDD constructs to OPC-UA objects. This Annex C gives an overview on the mapping of standard parameters defined in PROFIBUS PA Profile 3.02 and PROFIBUS/PROFINET Profile 4.01 to PA DIM.

C.2 Mapping table

Table C.1 specifies the parameters, for which a direct mapping exists. Other parameters, as for example the manufacturer, cannot be mapped directly. In those cases, mapping tables can be used.

Table C.1 – Mapping from PB standard parameters to PA DIM

Usage	PA-DIM BrowsePath	IEC 61987 CDD	Mapping PROFIBUS PA Profile 3.0/3.01/3.02	Mapping PROFIBUS PA Profile 4.0
Identification	SerialNumber	0112/2///61987#ABA951#007	PB.DEVICE_SER_NUM	PB.IM_Serial_Number
Identification	HardwareRevision	0112/2///61987#ABA926#006	PB.HARDWARE_REVISION	PB.HARDWARE_REVISION
Identification	SoftwareRevision	0112/2///61987#ABA601#006	PB.SOFTWARE_REVISION	PB.SOFTWARE_REVISION
Identification	RevisionCounter	0112/2///61987#ABN603#001	--	PB.IM_Revision_Counter
Identification	ProductCode	0112/2///61987#ABA300#006	--	PB.OrderID
AssetId (User Tag of Device)	AssetId	0112/2///61987#ABA038#003	--	IM_Tag_Location
DeviceHealth	DeviceHealth	0112/2///61987#ABN972#001	--	NE107_STATUS
Administration	DisplayLanguage	0112/2///61987#ABN597#001	--	PB.LANGUAGE
Administration	DateOfLastChange	0112/2///61987#ABN604#001	--	LATEST_CHANGE
Identification	RevisionCounter	0112/2///61987#ABN603#001	--	PB.IM_Revision_Counter
AssetId (User Tag of Device)	AssetId	0112/2///61987#ABA038#003	--	IM_Tag_Location

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COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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INTÉGRATION DES APPAREILS DE TERRAIN (FDI®) –

Partie 103-1: Profils – PROFIBUS

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L'IEC 62769-103-1 a été établie par le sous-comité 65E: Les dispositifs et leur intégration dans les systèmes de l'entreprise, du comité d'études 65 de l'IEC: Mesure, commande et automation dans les processus industriels. Il s'agit d'une Norme internationale.

Cette troisième édition annule et remplace la deuxième édition parue en 2020. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

a) ajout de DEVICE_ID à ProfibusIdentificationType et d'un espace de noms à l'Annexe A et à l'Annexe B;
b) ajout du mapping des paramètres normalisés PB avec le PA DIM (*Process Automation Device Information Model*).

Le texte de cette Norme internationale est issu des documents suivants:

Projet	Rapport de vote
65E/862/CDV	65E/919/RVC

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à son approbation.

La langue employée pour l'élaboration de cette Norme internationale est l'anglais.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2, il a été développé selon les Directives ISO/IEC, Partie 1 et les Directives ISO/IEC, Supplément IEC, disponibles sous www.iec.ch/members_experts/refdocs. Les principaux types de documents développés par l'IEC sont décrits plus en détail sous www.iec.ch/publications/.

Une liste de toutes les parties de la série IEC 62769, publiées sous le titre général *Intégration des appareils de terrain (FDI®)*, se trouve sur le site web de l'IEC.

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INTÉGRATION DES APPAREILS DE TERRAIN (FDI®) –

Partie 103-1: Profils – PROFIBUS

1 Domaine d'application

La présente partie de l'IEC 62769 spécifie un profil FDI®[1] de l'IEC 62769 pour le profil de communication CP 3/1 défini dans l'IEC 61784-1 (PROFIBUS DP)[2] et pour le profil de communication CP 3/2 (PROFIBUS PA) défini dans l'IEC 61784-1.

2 Références normatives

Les documents suivants sont cités dans le texte de sorte qu'ils constituent, pour tout ou partie de leur contenu, des exigences du présent document. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 61784-1, *Réseaux de communication industriels – Profils – Partie 1: Profils de bus de terrain*

IEC 61804 (toutes les parties), *Les dispositifs et leur intégration dans les systèmes de l'entreprise – Blocs fonctionnels (FB) pour les procédés industriels et le langage de description électronique de produit (EDDL)*

IEC 62541-100:2015, *Architecture unifiée OPC – Partie 100: Interface d'appareils*

IEC 62769-2, *Intégration des appareils de terrain (FDI®) – Partie 2: Client*

IEC 62769-4, *Intégration des appareils de terrain (FDI®) – Partie 4: Paquetages FDI®*

IEC 62769-5, *Intégration des appareils de terrain (FDI®) – Partie 5: Modèle d'information*

IEC 62769-7, *Intégration des appareils de terrain (FDI®) – Partie 7: Appareils de communication*

Spécification PI n° 2.122:2008, *Specification for PROFIBUS – Device Description and Device Integration – Volume 1: GSD, V5.1, juillet 2008: GSD,* disponible en anglais à l'adresse <www.PROFIBUS.com>

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1 FDI est une marque déposée de l'organisation à but non lucratif Fieldbus Foundation, Inc. Cette information est donnée à l'intention des utilisateurs du présent document et ne signifie nullement que l'IEC approuve le détenteur de la marque ou l'emploi de ses produits. La conformité n'exige pas l'utilisation de la marque. L'utilisation de la marque exige l'autorisation du détenteur de la marque.

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3 Termes, définitions, abréviations et acronymes

3.1 Termes et définitions

Pour les besoins du présent document, les termes et les définitions de l'IEC 61784-1, l'IEC 61804 (toutes les parties), l'IEC 62541-100, l'IEC 62769-4, l'IEC 62769-5, l'IEC 62769-7 et la spécification PI n° 2.122:2008 s'appliquent.

L'ISO et l'IEC tiennent à jour des bases de données terminologiques destinées à être utilisées en normalisation, consultables aux adresses suivantes:

- IEC Electropedia: disponible à l'adresse http://www.electropedia.org/
- ISO Online browsing platform: disponible à l'adresse http:www.iso.org/obp

3.2 Abréviations et acronymes

Pour les besoins du présent document, les abréviations et acronymes suivants s'appliquent:

EDD (Electronic Device Description)	Description électronique de produit
EDDL (Electronic Device Description Language)	Langage de description électronique de produit (voir l'IEC 61804 (toutes les parties))
GSD (General Station Description)	Description générale de station (voir la Spécification PI n° 2.122:2008)
I&M (Identification and Maintenance)	Fonction d'identification et de maintenance
UUID (Universally Unique Identifier)	Identificateur unique universel (voir l'ISO/IEC 11578)
XML (Extensible Markup Language)	Langage de balisage extensible (voir REC-xml-20081126)

4 Conventions

4.1 Syntaxe EDDL

Le présent document spécifie le contenu du composant EDD qui fait partie des Paquetages de communication FDI®. Le contenu de la spécification qui utilise la syntaxe EDDL est rédigé avec la police `Courier New`. La syntaxe EDDL est utilisée pour les déclarations de signature de méthode, de variable, de structure de données et de composant.

4.2 Syntaxe XML

Les exemples de syntaxe XML utilisent la police `Courier New`. La syntaxe XML est utilisée pour décrire le schéma des documents XML.

Exemple: `<xs:simpleType name="ExampleType">`

4.3 Utilisation de majuscules

La série IEC 62769 utilise des termes en majuscules pour souligner que ces termes ont une signification spécifique de la FDI®.

Certains de ces termes utilisent un acronyme comme préfixe, par exemple:

- Client FDI®; ou
- Serveur FDI®.

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Certains de ces termes sont des termes composés, par exemple:

- Serveurs de communication; ou
- Paquetage de profil.

Les noms de paramètres ou attributs sont concaténés en un seul et même terme, où les termes d'origine composant ce terme commencent par une lettre majuscule. Par exemple:

- ProtocolSupportFile; ou
- ProtocolType.

Les noms de paramètres ou attributs peuvent également être combinés au moyen d'un trait de soulignement afin de concaténer deux ou plusieurs termes. Par exemple:

- PROFILE_ID; ou
- Profibus_PA_Network.

5 Profil pour PROFIBUS

5.1 Généralités

Le présent document de profil, lié à la spécification FDI® de l'IEC 62769, spécifie les éléments spécifiques du protocole nécessaires aux Paquetages FDI® qui décrivent les Serveurs de communication, les Passerelles et les Appareils.

Pour les Serveurs de communication, le présent document définit également les éléments spécifiques du protocole qu'il est nécessaire de prendre en compte dans le Modèle d'information hébergé sur les Serveurs de communication.

L'Annexe B définit le schéma XML des Services d'accès direct. L'Annexe C fournit une vue d'ensemble du mapping des paramètres normalisés PROFIBUS avec le PA DIM.

5.2 Profil de catalogue

5.2.1 Fichier de prise en charge de protocole

5.2.1.1 Paquetage d'Appareil FDI®

Les pièces jointes spécifiques à un protocole sont mentionnées dans le Catalogue de Paquetage, comme cela est défini dans l'IEC 62769-5. Un fichier GSD qui contient la liste des fonctionnalités de communication, établi conformément à la Spécification PI n° 2.122:2008, est une pièce jointe obligatoire pour les Paquetages d'Appareil FDI® qui représentent des appareils PROFIBUS DP et PROFIBUS PA. Le Tableau 1 spécifie les paramètres du ProtocolSupportFile dans le Paquetage d'Appareil FDI®.

Tableau 1 – ProtocolSupportFile pour les Paquetages d'appareils FDI®

Paramètre	Description
Type de contenu	Texte brut
Root Namespace (Espace de noms racine)	vide
Relation source	http://fdi-cooperation.com/2010/relationship/attachment-protocol
Nom de fichier	Conformément à la Spécification PI n° 2.122:2008

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5.2.1.2 Paquetages de communication FDI®

Un fichier GSD, comme cela est spécifié dans la Spécification PI n° 2.122:2008, est une pièce jointe facultative pour les Paquetages de Communication FDI® qui représentent des appareils PROFIBUS DP et PROFIBUS PA. Le Tableau 2 spécifie les paramètres de ProtocolSupportFile pour les Paquetages de communication FDI®.

Tableau 2 – ProtocolSupportFile pour les Paquetages de communication FDI®

Paramètre	Description
Type de contenu:	Texte brut
Espace de noms racine:	vide
Relation source:	http://fdi-cooperation.com/2010/relationship/attachment-protocol
Nom de fichier:	Conformément à la Spécification PI n° 2.122:2008

5.2.2 Définition du CommunicationProfile

L'IEC 62769-4 définit une chaîne CommunicationProfileT pour le schéma XML Catalog. Le Tableau 3 définit les valeurs spécifiques de PROFIBUS pour cette chaîne.

Tableau 3 – Schéma de définition pour PROFIBUS CommunicationProfile

Identificateur de profil	Protocole
"profibus_dp"	PROFIBUS DP/V0; PROFIBUS DP/V1; PROFIBUS DP/V2
"profibus_pa"	PROFIBUS PA

5.2.3 Appareil de profil

Un Paquetage de Profil doit fournir les valeurs de catalogue des appareils de profil en permettant au Serveur FDI® d'optimiser la description d'appareil générique, si une description spécifique n'est pas disponible. Les définitions du Tableau 4 portent sur le contenu du catalogue qui est indépendant du fournisseur.

Tableau 4 – Valeurs de catalogue pour les appareils de profil

Elément	Attribut	Contenu
PackageType	—	Profil
Manufacturer	—	Vide
DeviceModel	—	Les valeurs d'identificateur de profil admises (PROFILE_ID) sont fournies par PROFIBUS & PROFINET International (PI). PI fournit et gère un fichier XML (Profile_ID_Table) qui contient l'attribution des PROFILE_ID aux profils. Il est disponible à l'adresse <http://www.profibus.com/IM/Profile_ID_Table.xml>. Le fichier peut être téléchargé par n'importe quel outil technique ou outil de service, dès lors qu'il est connecté à Internet. Des informations supplémentaires sont fournies dans la spécification PI n° 3.502 (Profil I&M) et les définitions de profils connexes y sont référencées. La chaîne doit être au format hexadécimal en commençant par 0x, par exemple "0x3D00".

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5.2.4 Informations relatives à la version du protocole

L'IEC 62769-4 définit un type d'élément nommé InterfaceT pour le schéma XML Catalog. Le type d'élément InterfaceT contient un élément nommé Version qui a pour objet de fournir des informations de version relatives au profil de protocole de communication appliqué. La valeur doit respecter le schéma d'informations de version de l'IEC 62769-4 défini dans le type d'élément VersionT. Le Tableau 5 décrit comment appliquer les versions de protocole actuellement connues qui sont définies par le consortium à but non lucratif PROFIBUS & PROFINET International. La règle générale consiste à utiliser la valeur "0" pour les parties des informations de version, établies conformément à l'IEC 62769-4, qui ne sont pas utilisées par des versions de protocole actuellement connues.

Tableau 5 – Exemples de mapping de versions[3]

Protocole/version	Valeur de version InterfaceT
PROFIBUS DP/V0	0.0.0[a]
PROFIBUS DP/V1	1.0.0[a]
PROFIBUS DP/V2	2.0.0[a]
PROFIBUS PA 3.02	3.2.0[b]
PROFIBUS PA 4.0	4.0.0[b]
[a] La version des protocoles PROFIBUS DP/V0, PROFIBUS DP/V1 et PROFIBUS DP/V2 n'est composée que d'un seul chiffre. Ce chiffre est considéré comme étant la version majeure. Les numéros de version mineure et de compilation (build) sont mis à "0". [b] Les numéros de profil PROFIBUS PA actuellement connus sont présumés fournir les informations relatives aux versions majeure et mineure. Les zéros de tête ne sont pas pris en compte dans l'évaluation de la valeur des versions, car seules les valeurs décimales réelles sont pertinentes.	

5.3 Association d'un Paquetage à un appareil

5.3.1 Mapping d'identification du type d'appareil

L'objet du mapping d'identification du type d'appareil est de configurer les systèmes Hôtes FDI® afin qu'ils comparent le résultat du balayage à la représentation topologique dans le Modèle d'information. Les systèmes Hôtes FDI® doivent également être configurés afin de déterminer le Paquetage d'Appareil FDI® qui convient pour une entrée d'appareil contenue dans le résultat du balayage. Cela permet à l'utilisateur d'un système Hôte FDI® de synchroniser le Modèle d'information avec l'installation réelle.

Le service de balayage mis en œuvre dans le Serveur de Communication (défini au 5.5.1.7) fournit le résultat du balayage par l'intermédiaire d'un document XML (le schéma est défini à l'Article A.6).

Le service de balayage mis en œuvre par la Passerelle (défini en 5.5.2.7) fournit le résultat du balayage au moyen du Modèle d'information qui contient des structures de données créées à partir du contenu EDD, comme cela est spécifié en 5.5.2.7.

Les deux manières de présenter le résultat du balayage ont en commun le fait que les résultats du balayage contiennent une identification du type d'appareil et une identification de l'instance d'appareil.

[3] Le tableau fourni peut être pris comme exemple uniquement, car le présent document ne peut pas prévoir comment les futures versions de protocole seront définies.

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Les systèmes Hôtes FDI®, qui comparent la configuration de la topologie réseau réelle à la représentation topologique du Modèle d'information, doivent être en mesure de gérer les situations suivantes:

a) l'instance d'Appareil physique identifiée à une adresse d'appareil spécifique n'est pas logiquement présente dans le Modèle d'information (en tant qu'Instance): configurer le système Hôte FDI® afin qu'il trouve le Paquetage d'Appareil FDI® approprié en fonction des informations du catalogue d'appareils;

b) l'instance d'Appareil physique identifiée par l'adresse de l'appareil est logiquement présente dans le Modèle d'information (en tant qu'Instance): configurer le système Hôte FDI® afin qu'il compare les informations de type d'appareil fournies dans le résultat du balayage (voir l'identification à l'Article A.6) aux informations spécifiques du type d'appareil de l'Instance fournies dans le Modèle d'information.

Le Paquetage d'Appareil FDI® contient des informations d'identification de type d'appareil qui peuvent être comparées au résultat du balayage issu du schéma Catalog de l'IEC 62769-4, qui définit les types d'éléments XML (simples) "DeviceModel" et "Manufacturer". Ces deux types sont utilisés dans les types d'éléments (complexes) "Protocol" et "RegDeviceType".

Après le déploiement du Paquetage FDI®, les informations relatives au Paquetage FDI® sont alors présentes dans le Modèle d'information sous la forme du FunctionalGroup "Identification" spécifié, qui contient les éléments Ident_Number et Manufacturer_ID (voir 5.4.3). L'Ident_Number concorde avec l'Ident_Number spécifié par la GSD. Le Manufacturer_ID est spécifié par le biais de VendorID et de DeviceID, définis par le profil I&M (voir 5.4.3).

Si un appareil est utilisé comme un appareil de profil, l'Ident_Number renvoyé dans le résultat du balayage ne correspond pas à l'Ident_Number dans la GSD. Dans ce cas, le DEVICE_ID peut être utilisé pour identifier le Paquetage FDI®.

Le mapping entre les différentes sources de données d'identification d'appareil est décrit dans le Tableau 6. Etant donné que les résultats du balayage fournis par le Serveur de communication ou la Passerelle peuvent comporter des données produites par l'appareil (micrologiciel), le mapping d'identification de type d'appareil doit être assuré en fournissant les données correspondantes qui figurent dans le Catalogue et le Modèle d'information du Paquetage d'Appareil FDI®.

Tableau 6 – Mapping des informations d'identification d'appareil

Paquetage d'Appareil FDI®	Modèle d'information	Résultat du balayage fourni par le Serveur de Communication	Résultat du balayage fourni par la Passerelle
Type spécifié dans le catalogue Manufacturer	FunctionalGroup: Identification Nom d'exploration: Manufacturer_ID	Elément (chemin): ConnectionPoint/Identification Attribut: Manufacturer_ID	COLLECTION ConnectionPoint. Identification. Manufacturer_ID
Type spécifié dans le catalogue DeviceModel	FunctionalGroup: Identification Nom d'exploration: Ident_Number	Elément (chemin): ConnectionPoint/Identification Attribut: Ident_Number	COLLECTION ConnectionPoint. Identification. Ident_Number

5.3.2 Mapping de révision de type d'appareil

L'IEC 62769-4 prévoit un concept qui permet de déterminer la compatibilité entre un Paquetage d'Appareil FDI® et un Appareil. L'IEC 62769-4 spécifie un processus de gestion du cycle de vie qui s'appuie sur une information de version unique fournie pour l'ensemble de l'appareil.

Les spécifications PROFIBUS, par exemple la Spécification PI n° 2.122:2008 (GSD) et la *Spécification PI n°* 3.502:2009 (profil I&M), divisent la révision de type d'appareil en informations relatives au logiciel et en informations relatives au matériel. La GSD spécifie les

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attributs Hardware_Release et Software_Release. Le profil I&M spécifie HARDWARE_REVISION et SOFTWARE_REVISION. Hardware_Release et HARDWARE_REVISION doivent toujours concorder. Software_Release et SOFTWARE_REVISION doivent toujours concorder.

L'objectif de 5.3.2 est de décrire les règles de traduction entre les spécifications PROFIBUS, en décrivant leur manière de fournir les informations de version, et la manière spécifiée par l'IEC 62769-4 en ce qui concerne les informations de version qui peuvent être comparées à la version lue dans l'appareil. L'objectif est de déterminer la compatibilité entre un Paquetage d'Appareil FDI® et un Appareil. La Figure 1 décrit le problème.

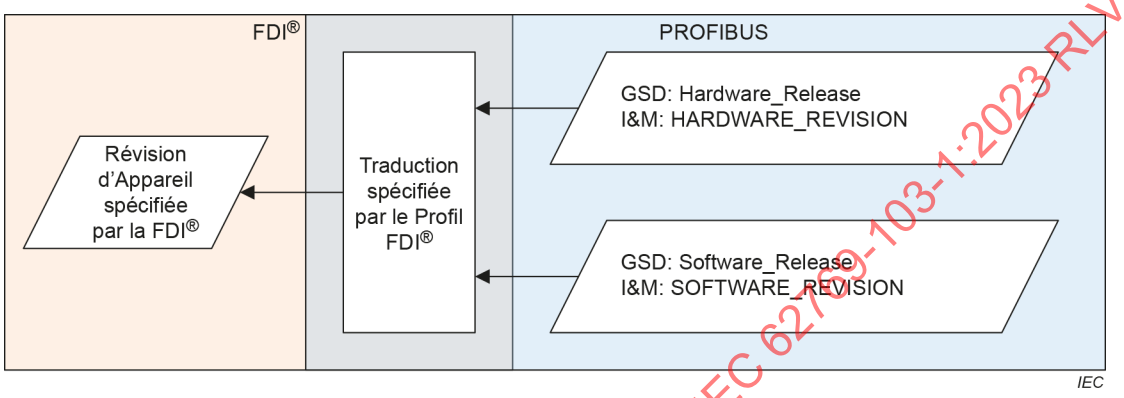

Figure 1 – Problème de mapping des versions

Le micrologiciel d'un appareil met en œuvre l'interface d'échange de données qui doit être décrite au moyen du contenu du Paquetage d'Appareil FDI® (EDD). Un micrologiciel d'appareil qui met en œuvre le profil PROFIBUS PA permet de lire les valeurs SOFTWARE_REVISION et HARDWARE_REVISION. L'accès à ces valeurs doit être décrit dans l'EDD contenue dans le Paquetage d'Appareil FDI®.

Les modifications du micrologiciel qui ont une incidence sur l'interface d'échange de données mise en œuvre par le micrologiciel doivent être reflétées dans le Paquetage d'Appareil FDI®. De telles modifications de micrologiciel et de description d'appareil doivent être visibles dans les attributs SOFTWARE_REVISION et Software_Release.

Les modifications relatives au matériel doivent être collectées dans les attributs HARDWARE_REVISION et Hardware_Release. Les modifications du matériel n'exigent pas nécessairement une mise à jour du micrologiciel. Par conséquent, HARDWARE_REVISION et Hardware_Release ne peuvent pas être utilisés pour déterminer la compatibilité entre un appareil et le Paquetage d'Appareil FDI®. Par contre, si une modification du matériel exige des modifications du micrologiciel, HARDWARE_REVISION et SOFTWARE_REVISION doivent être modifiés tous les deux. Hardware_Release et Software_Release doivent être modifiés en conséquence.

L'IEC 62769-4 spécifie le schéma Catalog et un élément DeviceVersion qui est utilisé dans la déclaration de type d'élément ListOfSupportedDeviceVersions. La valeur de DeviceVersion doit être comparée à l'attribut SOFTWARE_REVISION fourni par l'appareil, ou à l'attribut Software_Release fourni par la GSD, afin de déterminer la compatibilité entre un Paquetage d'Appareil FDI® et un Appareil.

Le format de données pour l'attribut SOFTWARE_REVISION est une chaîne alors que l'élément DeviceVersion attend trois chiffres (version majeure, version mineure et révision). Par conséquent, les règles suivantes s'appliquent: si la chaîne est au format <entier>.<entier>.<entier>, elle est transférée ainsi: majeure, mineure et révision (dans le même ordre). <entier> désigne un nombre entier simple dans la chaîne, par exemple "1" ou "12", mais aucune autre représentation telle que le format hexadécimal (par exemple "0x001A").

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Si la chaîne est au format <entier>.<entier>, elle est transférée ainsi: majeure, mineure et "0" est utilisé pour la révision. Si la chaîne comporte un seul <entier>, elle est transférée ainsi: majeure et "0" est utilisé pour mineure et la révision. Un caractère de poids fort ou un caractère de poids fort associé à un espace doivent être ignorés. Si une chaîne figure dans un autre format, le numéro de révision ne doit pas être pris en compte pour choisir le Paquetage FDI® adéquat.

5.4 Mapping du Modèle d'information

5.4.1 Définition du ProtocolType

Le concept utilisé pour déterminer les Types de Réseaux spécifiques de PROFIBUS DP et PROFIBUS PA s'applique à la définition du type de protocole.

Le type de protocole Profibus_DP doit être utilisé pour identifier la communication PROFIBUS DP. Le type Profibus_DP est un sous-type du type abstrait ProtocolType défini dans l'IEC 62541-100. Le Tableau 7 spécifie les valeurs admises des attributs ProtocolType pour le type de protocole Profibus_DP.

Tableau 7 – Type de protocole Profibus_DP

Attribut	Valeur				
BrowseName	Profibus_DP				
IsAbstract	False				
Références	**NodeClass**	**BrowseName**	**DataType**	**TypeDefinition**	**ModellingRule**
Sous-type du ProtocolType défini dans l'IEC 62541-100.					

Le type de réseau Profibus_PA_Network doit être utilisé pour construire des topologies de réseau PROFIBUS PA. Le type Profibus_DP_Network est un sous-type du type abstrait NetworkType défini dans l'IEC 62541-100. Le Tableau 8 spécifie les valeurs admises des attributs ProtocolType pour le type de protocole Profibus_PA.

Tableau 8 – Type de protocole Profibus_PA

Attribut	Valeur				
BrowseName	Profibus_PA				
IsAbstract	False				
Références	**NodeClass**	**BrowseName**	**DataType**	**TypeDefinition**	**ModellingRule**
Sous-type du ProtocolType défini dans l'IEC 62541-100.					

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5.4.2 Mapping de DeviceType

Le mapping des propriétés DeviceType du nœud DeviceType est défini dans le Tableau 9.

Tableau 9 – Mapping des propriétés DeviceType

Propriété	Mapping PROFIBUS
SerialNumber	SERIAL_NUMBER (voir Tableau 10)
RevisionCounter	REV_COUNTER (voir Tableau 10)
Manufacturer	Chaîne issue du Catalogue de Paquetage FDI® (ManufacturerName issu de PackageT)
Model	Chaîne issue du Catalogue de Paquetage FDI® (Name de DeviceTypeT, qui est un nom localisé)
DeviceRevision	Non prise en charge
DeviceManual	Non prise en charge
SoftwareRevision	SOFTWARE_REVISION (voir Tableau 10)
HardwareRevision	HARDWARE_REVISION (voir Tableau 10)

5.4.3 Définition du FunctionalGroup "Identification"

Comme cela est défini en 5.3 de l'IEC 62541-100:2015, chaque représentation d'appareil dans le Modèle d'information hébergé sur le Serveur FDI® doit contenir un FunctionalGroup spécifique d'un protocole, appelé Identification. Les paramètres de ce FunctionalGroup sont définis pour les types d'appareils PROFIBUS, comme suit:

Tableau 10 – Attributs d'identification des types d'appareils PROFIBUS

BrowseName	DataType	Obligatoire/Facultatif
Ident_Number	UInt16	Obligatoire
MANUFACTURER_ID	UInt16	Obligatoire
ORDER_ID	String	Facultatif
SERIAL_NUMBER	String	Facultatif
HARDWARE_REVISION	UInt16	Facultatif
SOFTWARE_REVISION	String	Facultatif
REV_COUNTER	UInt16	Facultatif
PROFILE_ID	UInt16	Facultatif
PROFILE_SPECIFIC_TYPE	UInt16	Facultatif
IM_VERSION	ByteString	Facultatif
IM_SUPPORTED	UInt16	Facultatif
DEVICE_ID	String	Facultatif

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Les instances de BaseDataVariable, à l'exception d'Ident_Number, doivent être créées à partir des déclarations de VARIABLE avec des identificateurs qui correspondent aux noms d'exploration énumérés dans le Tableau 10. Les instances Ident_Number de BaseDataVariable doivent être créées à partir des éléments Ident_Number.Topology de l'attribut de fichier GSD.

5.4.4 Définition du ConnectionPoint

Afin de prendre en charge les différents besoins d'ingénierie de topologie réseau relatifs aux différentes couches physiques utilisées par PROFIBUS DP et PROFIBUS PA, deux types différents de ConnectionPoint doivent être définis.

Le ConnectionPoint de type Profibus_DP doit être utilisé pour paramétrer les points d'accès réseau PROFIBUS DP. Le ConnectionPoint de type Profibus_DP est un sous-type du type