IEC 62769-101-1

Edition 3.0   2023-04
REDLINE VERSION

INTERNATIONAL STANDARD

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Field device Integration (FDI)® –
Part 101-1: Profiles - Foundation Fieldbus H1

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FIELD DEVICE INTEGRATION (FDI®) –

Part 101-1: Profiles – Foundation Fieldbus H1

FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 62769-101-1:2020. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC 62769-101-1 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) updated Transfer service;

b) added OPERATION "GETOD" and "GETDEVICETYPEINFO";

c) added DeviceTag and Block_Index to FoundationIdentificationT and Target;

d) removed arguments "BlockTag" and "ServiceId";

e) changed content type of CFF file to application/vnd.ff.cff.

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

Draft	Report on voting
65E/860/CDV	65E/917/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,

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• replaced by a revised edition, or

• amended.

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FIELD DEVICE INTEGRATION (FDI®) –

Part 101-1: Profiles – Foundation Fieldbus H1

1   Scope

This part of IEC 62769 specifies ~~the IEC 62769~~ an FDI®[1] profile of IEC 62769 for IEC 61784-1_CP 1/1 (FOUNDATION™ Fieldbus H1)[2].

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 61158-5-9:2014*, Industrial communication networks – Fieldbus specifications – Part 5-9: Application layer service definition – Type 9 elements*

IEC 61784-1, *Industrial communication networks – Profiles – Part 1: Fieldbus Profiles*

IEC 61784-2*, Industrial communication networks – Profiles – Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC~~/IEEE~~ 8802-3*

IEC 61784-3:~~2016~~2021*, Industrial communication networks – Profiles – Part 3: Functional safety fieldbuses – General rules and profile definitions*

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

~~IEC 62541-6, OPC unified architecture – Part 6: Mappings~~

IEC 62541-100:–2015, *OPC unified architecture – Part 100: Device Interface*

~~IEC 62769-1, Field device integration (FDI) – Part 1: Overview~~

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

IEC 62769-3*, Field device integration (FDI®) – Part 3: Server*

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

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

IEC 62769-6, *Field device integration (FDI®) – Part 6: ~~FDI~~ Technology Mapping*

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

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

3.1 Terms and definitions

For the purposes of this document, the terms and definitions listed in the normative references given in ~~IEC 61158-5-9, IEC 61784-1, IEC 61784-2, IEC 61784-3, IEC 61804 (all parts), IEC 62541-6, IEC 62541-100, IEC 62769-1, IEC 62769-2, IEC 62769-4, IEC 62769-5, IEC 62769-6, and IEC 62769-7~~ Clause 2 apply.

ISO and IEC maintain terminology 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 abbreviations apply:

CFF	common file format
CP	communication profile (see IEC 61784-1 or IEC 61784-2)
CPF	communication profile family (see IEC 61784-1 or IEC 61784-2)
EDD	Electronic Device Description (see IEC 61804 series)
EDDL	Electronic Device Description Language (see IEC 61804 series)
FB	function block
IM	Information Model
SMIB	system management information base
VFD	virtual field device

4 Conventions

4.1 EDDL syntax

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

4.2 XML syntax

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

Example: `<xsd:simpleType name="Example">`.

4.3 Capitalizations

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

Some of these terms use 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.

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 CP 1/1 (FOUNDATION™ H1)

5.1 General

This profile specifies the protocol specifics needed for FDI® Packages describing communication servers, gateways and devices. ~~Requirements for Direct Access transfer service parameters are given in Annex B.~~

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 (Capability File)

Each CP 1/1 FDI® Device Package shall contain a capability file. The capability file part is described in Table 1.

Table 1 – Capability File part

Parameter	Description
Content Type:	~~txt/plain~~ application/vnd.ff.cff
Root Namespace:	Not applicable
Source Relationship:	http://fdi-cooperation.com/2010/relationships/attachment-protocol
Filename:	Use file extension .CFF

5.2.2 CommunicationProfile definition

IEC 62769-4 defines a CommunicationProfileT string type for the Catalog XML schema. Table 2 defines the CP 1/1 specific values for this string.

Table 2 – CommunicationProfile definition

CommunicationProfile	Description
foundation_h1	CP 1/1 device type with a function block application

5.2.3 Profile device

Not supported in this document.

5.2.4 Protocol version information

IEC 62769-4 defines an element type named InterfaceT for the Catalog XML Schema. Element type InterfaceT contains an element named Version which is supposed to provide version information about the applied communication protocol profile. The value follows the IEC 62769-4 defined version information schema defined in element type VersionT.

The major version part of VersionT shall be set to the ITK_VER parameter. The minor and builds parts shall be set to 0.

EXAMPLE   For ITK_VER 5, the value for InterfaceT is 5.0.0.

5.3 Associating a Package with a CP 1/1 device

5.3.1 Device type identification mapping

CP 1/1 device types are uniquely identified by the parameters MANUFAC_ID, DEVICE_TYPE and DEV_REV found in the Resource Block. These parameters are used to associate a given device instance to an FDI® Device Package. These parameters are mapped to the FDI® Device Package Catalog according to Table 3.

Table 3 – Device type catalog mapping

Catalog Element	CP Mapping
Manufacturer element of InterfaceT (IEC 62769-4)	MANUFAC_ID String format "0xdddd" where dddd is the MANUFAC_ID number in hexadecimal format.
DeviceModel element of InterfaceT (IEC 62769-4)	DEVICE_TYPE String format "0xdddd" where dddd is the DEVICE_TYPE number in hexadecimal format.
DeviceRevision element ListOfSupportedDeviceRevisionsT (IEC 62769-4)	DEV_REV String format "x.0.0" where x is the DEV_REV in decimal format (no leading zeros).

5.3.2 Device type revision mapping

Each device type is identified according to 5.3.1. A device may also include a parameter COMPATIBILITY_REV from the Resource Block. This parameter specifies the lowest device version (DEV_REV) that a new device can replace while maintaining compatibility with a prior FDI® Device Package.

5.4 Information Model mapping

5.4.1 ProtocolType definition

Table 4 defines the ProtocolType used to identify CP 1/1 network communications.

Table 4 – ProtocolType Foundation_H1 definition

Attribute	Value				
BrowseName	Foundation_H1				
IsAbstract	False				
References	**NodeClass**	**BrowseName**	**DataType**	**TypeDefinition**	**ModellingRule**
Inherits the properties of ProtocolType defined in IEC 62541-100.					

5.4.2 DeviceType mapping

Each device type inherits the properties of the DeviceType. The mapping of the inherited properties from the DeviceType is defined in Table 5.

Table 5 – Inherited DeviceType Property mapping

Property	CP Mapping
SerialNumber	DEV_ID (System Management Information Base)
RevisionCounter	-1 (not defined)
Manufacturer	String obtained from FDI® package catalog (ManufacturerName from PackageT)
Model	String obtained from FDI® package catalog (Name of DeviceTypeT, which is a localized name)
DeviceManual	entry text string (not supported) [a]
DeviceRevision	DEV_REV (Resource Block)
SoftwareRevision	SOFTWARE_REV (if available, otherwise empty string)
HardwareRevision	HARDWARE_REV (if available, otherwise empty string)
[a] Device manuals are exposed as attachments of the FDI® Device Package.	

5.4.3 FunctionalGroup Identification definition

As defined in IEC 62541-100, each device representation in the FDI® Server hosted Information Model shall contain a protocol specific FunctionalGroup called Identification. This FunctionalGroup organizes variables found in the Resource Block of the device type instance. The FunctionalGroup Identification for CP 1/1 is defined in Table 6.

Table 6 – Identification parameters

BrowseName	DataType	Optional/Mandatory
MANUFAC_ID	UInt32	Mandatory
DEV_TYPE	UInt16	Mandatory
DEV_REV	UInt8	Mandatory
HARDWARE_REV	String	Optional
SOFTWARE_REV	String	Optional
COMPATIBILITY_REV	UInt8	Optional
CAPABILITY_LEV	UInt8	Optional
ITK_VER	UInt16	Mandatory
SIF_ITK_VER	UInt16	Optional
FD_VER	UInt16	Optional
DeviceTag	String	Optional
Block_index	UInt16	Optional

5.4.4 BlockType property mapping

CP 1/1 device types are block-oriented according to IEC 62541-100. IEC 62769-5 specifies the mapping of EDDL BLOCK_A elements to block types and instances.

The BLOCK_A maps as a subtype of the topology element BlockType and inherits the properties per IEC 62541-100. The mapping of the inherited properties of the BlockType is specified in Table 7.

Table 7 – Inherited BlockType property mapping

Property	CP Mapping (Block ParameterSet)
RevisionCounter	ST_REV
ActualMode	MODE_BLK.ACTUAL
PermittedMode	MODE_BLK.PERMITTED
NormalMode	MODE_BLK.NORMAL
TargetMode	MODE_BLK.TARGET

5.4.5 Mapping to Block ParameterSet

The ParameterSet is relative to each Block. The ParameterSet includes the CHARACTERISTICS records of the block and all the parameters found in the PARAMETERS, LOCAL_PARAMETERS and LIST_ITEMS.

The browse name of the parameters found in the PARAMETERS and LOCAL_PARAMETERS is the member name in the respective lists. For example, ST_REV is the browse name of the Static Revision parameter. LIST_ITEMS do not have member names; therefore the browse name of each LIST in the LIST_ITEMS is the item name of the list.

5.5 Topology elements

5.5.1 ConnectionPoint definition

The ConnectionPoint type ConnectionPoint_Foundation_H1 shall be used to identify CP 1/1 network communication and is defined in Table 8. The ConnectionPoint_Foundation_H1 type is a sub type of the abstract type ConnectionPointType defined in IEC 62541-100.

The Address property shall be the H1 node address.

The OrdinalNumber property reflects the position of the VFD within the SMIB VFD list. For devices exposing multiple FB VFDs, the OrdinalNumber property is mandatory to address the FB VFD. For devices with a single FB VFD, the OrdinalNumber property can be omitted. Devices exposed as instances of type DeviceType define their connection points as components. Hence Devices with multiple FB VFDs shall contain multiple Connection Points, one per FB VFD.

The SIFConnection property denotes whether a safety instrumented function (SIF) connection is necessary or not according to the functional safety profile (IEC 61784-3:~~2016~~2021, Clause 6). CP 1/1 devices that implement the functional safety profile shall have a connection point as a component that has set this property to true. Devices supporting standard connections and SIF connections shall expose two Connections Points as components.

Table 8 – ConnectionPointType ConnectionPoint_Foundation_H1 definition

Attribute	Value				
BrowseName	ConnnectionPoint_Foundation_H1				
IsAbstract	False				
References	**NodeClass**	**BrowseName**	**DataType**	**TypeDefinition**	**ModellingRule**
Inherits the properties of ConnectionPointType defined in IEC 62541-100.					
HasProperty	Variable	Address	Byte	PropertyType	Mandatory
HasProperty	Variable	OrdinalNumber	Int32	PropertyType	Optional
HasProperty	Variable	SIFConnection	Boolean	PropertyType	Optional

The ConnectionPoint type ConnectionPoint_Foundation_H1 shall be described by an EDD element contained in a Communication Device related FDI[®] Package that can drive a CP 1/1 network. Actual ConnectionPoint_Foundation_H1 properties are declared by VARIABLE constructs grouped together in a COLLECTION named Foundation_H1_ConnectionPoint_Properties.

```
COMPONENT ConnectionPoint_Foundation_H1
{
  LABEL "Foundation H1 Connection point";
  CLASSIFICATION NETWORK_CONNECTION_POINT;
  CAN_DELETE FALSE;
  PROTOCOL Foundation_H1;
  CONNECTION_POINT Foundation_H1_ConnectionPoint_Properties;
}

VARIABLE Address
{
  LABEL "H1 Node address";
  HELP "Address of the H1 Node";
  CLASS DEVICE;
  TYPE UNSIGNED_INTEGER (1)
  {
    MIN_VALUE 16;
    MAX_VALUE 255;
  }
  HANDLING READ & WRITE;
}


VARIABLE OrdinalNumber
{
  LABEL "OrdinalNumber address property";
```