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INTERNATIONAL STANDARD

NORME INTERNATIONALE

Field device integration (FDI)® – Part 109-1: Profiles – HART® and WirelessHART®

Intégration des appareils de terrain (FDI)® – Partie 109-1: Profiles – HART® et WirelessHART®

IEC 62769-109-1:2023-04(en-fr)

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Intégration des appareils de terrain (FDI)® – Partie 109-1: Profils – HART® et WirelessHART®

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FIELD DEVICE INTEGRATION (FDI®) –

Part 109-1: Profiles – HART® and WirelessHART®

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IEC 62769-109-1 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 content type for DeviceInfo files;
b) added mapping from HART standard parameters to PA DIM;

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

Draft	Report on voting
65E/864/CDV	65E/921/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/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 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- withdrawn,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.

FIELD DEVICE INTEGRATION (FDI®) –

Part 109-1: Profiles – HART® and WirelessHART®

1 Scope

This part of IEC 62769 specifies an FDI®[1] profile of IEC 62769 for IEC 61784-1_CP 9/1 (HART®)[2] and IEC 61784-1_CP 9/2 (WirelessHART®)[3].

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 62541-100, *OPC Unified Architecture Specification – Part 100: OPC Device Interface*

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*

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 62541-100, IEC 62769-4, IEC 62769-5 and IEC 62769-7 apply.

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

- IEC Electropedia: available at http://www.electropedia.org/
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3.2 Abbreviated terms and acronyms

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

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 the IEC 61804 series)
EDDL Electronic device description language (see the IEC 61804 series)
FDI® Field device integration
FSK Frequency-Shift-Keying
HCF HART Communication Foundation
ID Identification
IM Information Model
IP Internet protocol
PDU Protocol data unit
PSK Phase-Shift-Keying
TCP Transmission Control Protocol (see IETF RFC 793)
UDP User Datagram Protocol (see IETF RFC 768)
XML Extended markup language

4 Conventions

4.1 EDDL syntax

This document specifies content for the EDD component that is part of FDI® Communication Packages. 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 font Courier New. The XML syntax is used to describe XML document schema.

Example: <xs:simpleType name="ExampleT">

4.3 Capitalizations

The IEC 62769 series uses capitalized terms to emphasize that these terms have an 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:

- FDI® 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 like:

- PROFILE_ID or
- HART_Network

5 Profile for CP 9/1 (HART®) or CP 9/2 (WirelessHART®)

5.1 General

This profile document to the FDI® specification in IEC 62769 selects the protocol specifics needed for FDI® Packages describing FDI® Communication Servers, gateways and devices.

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

Device information files provide metadata for the dynamic runtime data that is supplied by the device. This metadata is a subset of information that is contained in the EDD. The device information files may be extracted from the package by light-weight gateway or server implementations to exchange runtime device information with minimal implementation overhead. Device information files do not replace the need for the EDD part because device information files only contain a subset of the information from the EDD, and do not provide any user-interface elements.

The formats of the Device Information Files are described in Table 1.

Table 1 – Device Information Files

Part	Content
Content Type	application/vnd.hart.json
Root Namespace	Not specified here
Source Relationship	http:// fdi-cooperation.com/2010/relationships/attachment-protocol
Filename	Not specified here

The Device Information Files are specified in FCG AG21073.

5.2.2 CommunicationProfile definition

IEC 62769-4 defines a CommunicationProfileT string type for the Catalog XML schema. Table 2 defines the CP 9/1 specific values for this enumeration.

Table 2 – CommunicationProfile definition

CommunicationProfile	Description
hart_fsk	CP 9/1 device type that supports an FSK physical layer (Frequency-Shift-Keying on a pair of wires)
hart_psk	CP 9/1 device type that supports a PSK physical layer (Phase-Shift-Keying on a pair of wires). Devices supporting PSK are required to also inherently support FSK, and therefore PSK will always be used only in combination with at least FSK.
hart_wirelesshart	CP 9/2 device type that supports a wireless physical layer (communication between device and gateway).
hart_ip	CP 9/1 device type that supports Internet Protocol (these devices support both TCP and UDP).
hart_rs485	CP 9/1 device type that supports EIA-485 digital communication.
hart_ir	CP 9/1 device type that supports an Infrared physical layer (designed to be transparent to FSK masters – included only as information to indicate that the device supports IR connection).
NOTE It is possible for a single CP 9/1 device to support more than one CP.	

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 3 focus on catalog content that is vendor independent.

Table 3 – Catalog values for profile devices

Element	Attribute	Content
PackageType	—	Profile
DeviceModel	—	Empty
Manufacturer	—	Empty

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 has to follow the IEC 62769-4 defined version information schema defined in element type VersionT. Subclause 5.2.4 describes how to apply the currently known protocol versions for CP 9/1 or CP 9/2 entries in the device catalog. The general rule is to use the Universal Revision of the protocol for the major version part of VersionT, and the value “0” for the minor version and build parts. Table 4 shows the Protocol Version Information.

Table 4 – Protocol Version Information

Protocol Version	InterfaceT Version value
HART Universal Revision 5	5.0.0
HART Universal Revision 6	6.0.0
HART Universal Revision 7	7.0.0
The Protocol Version defined in a package is provided for informational purposes only, and shall not be used to determine the compatibility or applicability of a package to a device.	

5.3 Associating a Package with a CP 9/1 device

5.3.1 Device type identification mapping

CP 9/1 device types are uniquely identified by parameters Manufacturer, Model and DeviceRevision. 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 5.

Table 5 – Device type catalog mapping

Catalog element	CP mapping (SeeTable A.1)
Manufacturer element of InterfaceT (IEC 62769-4:2023, Clause E.11)	Manufacturer String format “0xdddd” where dddd is the MANUFACTURER_ID in hexadecimal format.
DeviceModel element of InterfaceT (IEC 62769-4:2023, Clause E.11)	Model String format “0xdddd” where dddd is the DEVICE_TYPE in hexadecimal format.
DeviceRevision element ListOfSupportedDeviceRevisionsT (IEC 62769-4:2023, Clause E.20)	DeviceRevision String format “x.0.0” where x is the DEVICE_REVISION in decimal format (no leading zeros).

5.3.2 Device type revision mapping

Each device type is identified as per 5.3.1. If a package with matching DeviceRevision is not available, any CP 9/1 FDI® package for a corresponding manufacturer and model shall always be compatible with a field device as long as the device revision of the field device is equal to or greater than the device revision specified in the FDI® package.

5.4 Information Model mapping

5.4.1 ProtocolType definition

Table 6 defines the ProtocolType used to identify CP 9/1 network communications.

Table 6 – ProtocolType HART definition

Attribute	Value				
BrowseName	HART				
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 DeviceType. The mapping of the inherited properties from DeviceType is defined in Table 7.

Table 7 – Inherited DeviceType Property mapping

Property	Foundation mapping
SerialNumber	Unique ID of a device, mapped to SERIAL_NUMBER of IdentificationT.
RevisionCounter	Configuration change counter, mapped to REV_COUNTER of IdentificationT
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)
DeviceManual	Entry text string (not supported) [a]
DeviceRevision	Device revision level of a device, mapped to DEVICE_REVISION of IdentificationT
SoftwareRevision	Software revision level of a device, mapped to SOFTWARE_REVISION of IdentificationT
HardwareRevision	Hardware revision level of a device, mapped to HARDWARE_REVISION of IdentificationT
[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 device type instance. The FunctionalGroup Identification for CP 9/1 is defined in Table 8.

Table 8 – Identification parameters

BrowseName	DataType	Optional/Mandatory
MANUFACTURER_ID	UInt16	Mandatory
DEVICE_TYPE	UInt16	Mandatory
DEVICE_REVISION	UInt8	Mandatory
UNIVERSAL_REVISION	UInt8	Optional
SERIAL_NUMBER	UInt24	Optional
HARDWARE_REVISION	UInt8	Optional
SOFTWARE_REVISION	UInt8	Optional
REVISION_COUNTER	UInt16	Optional

5.5 Topology elements

5.5.1 ConnectionPoint definition

5.5.1.1 General

CP 9/1 devices can support up to five different ConnectionPoint types that are used for network communications.

5.5.1.2 HART_TP5, HART_TP6, HART_TP7

The ConnectionPoint types HART_TP5, HART_TP6, and HART_TP7 shall be used to identify CP 9/1 token passing network communication and are defined in Table 9. HART_TP5, HART_TP6, and HART_TP7 all contain the same properties, but each provides different

qualification information for some of the properties (described below). The Protocol Version (UNIVERSAL_REVISION) described in 5.2.3 can be used as an aid to determine which of the three token passing Connection Point types is the most appropriate. CP 9/1 token passing communications can be used on a variety of physical layers. FSK, PSK, RS485, and Infrared physical layer connections shall all use the HART_TP connection type. The ConnectionPoint types HART_TP5, HART_TP6, and HART_TP7 are subtypes of abstract type ConnectionPointType defined in IEC 62769-5.

The DevAddr property shall be the long address (5 bytes) for the device, and is the only parameter necessary to communicate with the field device.

The DevMfg property shall be the 2-byte Manufacturer ID, and can be used to help automate the process of assigning live devices in the scan list to offline placeholders.

The DevType property shall be the 2-byte extended device type, and can be used to help automate the process of assigning live devices in the scan list to offline placeholders.

The DevRev property shall be the device revision, and can be used to help automate the process of assigning live devices in the scan list to offline placeholders.

The DevTag property shall be the long tag for HART® protocol version 6 or 7 devices. The DevTag property shall be the tag for protocol version 5 devices. The DevTag property can be used to help automate the process of assigning live devices in the scan list to offline placeholders. HART_TP5 Connection Points shall limit the DevTag to 8 characters in length. HART_TP6 and HART_TP7 Connection Points shall limit the DevTag to 32 characters in length.

The DevPollAddr property shall be the poll address, and can be used to identify which device is located at a specific poll address. HART_TP5 Connection Points shall be limited to values between 0 and 15 for the DevPollAddr property. HART_TP6 Connection Points shall be limited to values between 0 and 31 for the DevPollAddr property. HART_TP7 Connection Points shall be limited to values between 0 and 63 for the DevPollAddr property.

For forward compatibility, a lower revision HART_TP Connection Point is compatible and can be used for a higher universal revision device connection. For example, if a future HART universal revision 8 device is encountered, and no HART_TP8 is available in the FDI® server, HART_TP7 will be compatible and shall be used to connect to the device. If the Protocol Version (i.e. the Universal Revision) is unknown for any reason, the HART_TP5 Connection Point can be used, and will be forward compatible to later universal revisions.

Table 9 – ConnectionPointType HART_TP definition

Attribute	Value				
BrowseName	ConnnectionPoint_HART_TP5 or ConnnectionPoint_HART_TP6 or ConnnectionPoint_HART_TP7				
IsAbstract	False				
References	**NodeClass**	**BrowseName**	**DataType**	**TypeDefinition**	**ModellingRule**
Inherits the properties of ConnectionPointType defined in IEC 62769-5					
HasProperty	Variable	DevAddr	UInt40	PropertyType	Mandatory
HasProperty	Variable	DevMfg	UInt16	PropertyType	Optional
HasProperty	Variable	DevType	UInt16	PropertyType	Optional
HasProperty	Variable	DevRev	UInt16	PropertyType	Optional
HasProperty	Variable	DevTag	String	PropertyType	Optional
HasProperty	Variable	DevPollAddr	UInt8	PropertyType	Optional

The ConnectionPoint type HART_TP5, HART_TP6, and HART_TP7 shall be described by an EDD element contained in a Communication Device related FDI® Package that can drive a CP 9/1 network. Actual ConnectionPoint properties are declared by VARIABLE constructs grouped together in a COLLECTION named ConnectionPoint_HART_TP5, ConnectionPoint_HART_TP6, or ConnectionPoint_HART_TP7. The following EDDL source code is an example describing a TP5 Connection Point.

```
COMPONENT ConnectionPoint_HART_TP5
{
  LABEL "HART TP Connection Point";
  CLASSIFICATION NETWORK_CONNECTION_POINT;
  CAN_DELETE FALSE;
  PROTOCOL HART;
  CONNECTION_POINT ConnectionPoint_TP5;
}

VARIABLE DevAddr
{
  LABEL "Address";
  CLASS DEVICE;
  TYPE UNSIGNED_INTEGER(5);
  HANDLING READ & WRITE;
}

VARIABLE DevMfg
{
  LABEL "Manufacturer";
  CLASS DEVICE;
  TYPE UNSIGNED_INTEGER(2);
  HANDLING READ & WRITE;
}

VARIABLE DevType
{
  LABEL "Device Type";
  CLASS DEVICE;
  TYPE UNSIGNED_INTEGER(2);
  HANDLING READ & WRITE;
}

VARIABLE DevRev
{
  LABEL "Device Revision";
  CLASS DEVICE;
  TYPE UNSIGNED_INTEGER;
  HANDLING READ & WRITE;
}

VARIABLE DevTag
{
  LABEL "Tag";
  CLASS DEVICE;
  TYPE ASCII(32);
  HANDLING READ & WRITE;
}
```