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Spécification des interfaces des outils des dispositifs de terrain (FDT) – Partie 309: Intégration des profils de communication – CPF 9 de l'IEC 61784

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IEC Secretariat
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

Part 309: Communication profile integration – IEC 61784 CPF 9

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IEC 62453-309 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 2016. This edition constitutes a technical revision.

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

- corrections in regard to accessing information in the respective device and
- corrections in regard to describing support for different protocol versions.

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

Draft	Report on voting
65E/907/FDIS	65E/936/RVD

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.

Each part of the IEC 62453-3xy series is intended to be read in conjunction with IEC 62453-2.

A list of all parts of the IEC 62453 series, under the general title *Field Device Tool (FDT) interface specification*, 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- withdrawn,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
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INTRODUCTION

This part of IEC 62453 is an interface specification for developers of FDT[1] (Field Device Tool) components for function control and data access within a client/server architecture. The specification is a result of an analysis and design process to develop standard interfaces to facilitate the development of servers and clients by multiple vendors that need to interoperate seamlessly.

With the integration of fieldbusses into control systems, there are a few other tasks which need to be performed. In addition to fieldbus- and device-specific tools, there is a need to integrate these tools into higher-level system-wide planning or engineering tools. In particular, for use in extensive and heterogeneous control systems, typically in the area of the process industry, the unambiguous definition of engineering interfaces that are easy to use for all those involved is of great importance.

A device-specific software component, called DTM (Device Type Manager), is supplied by the field device manufacturer with its device. The DTM is integrated into engineering tools via the FDT interfaces defined in this specification. The approach to integration is in general open for all kind of fieldbusses and thus meets the requirements for integrating different kinds of devices into heterogeneous control systems.

Figure 1 shows how IEC 62453-309 is aligned in the structure of the IEC 62453 series.

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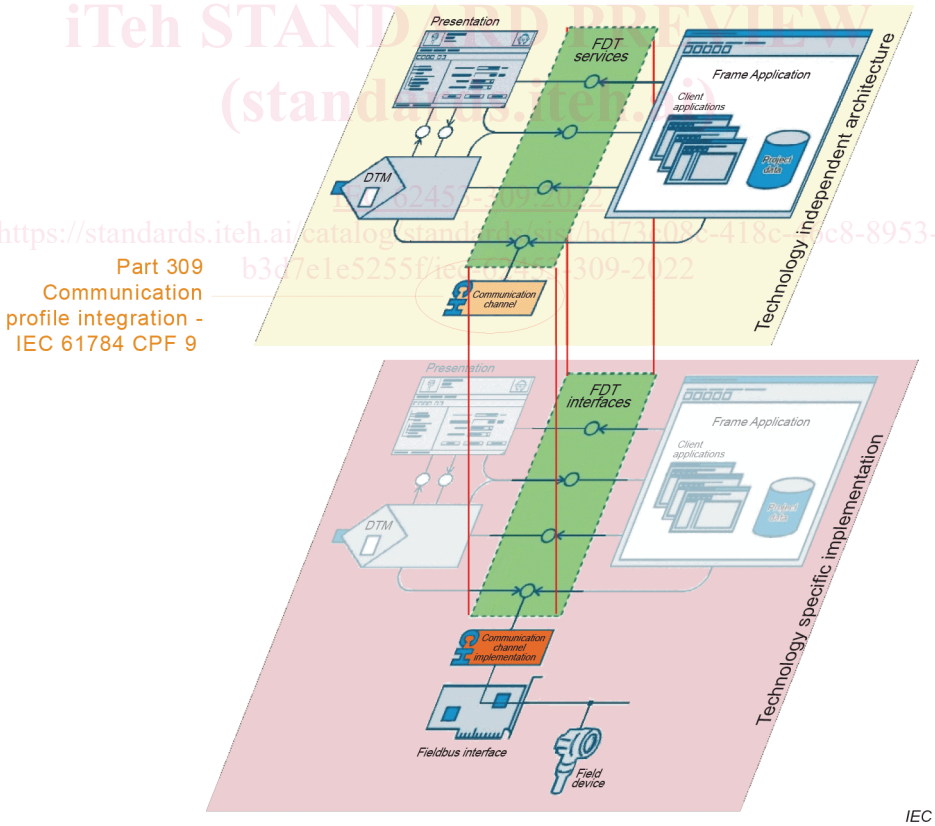

Figure 1 – Part 309 of the IEC 62453 series

[1] FDT® is a trademark of products supplied by FDT Group AISBL. This information is given for convenience of users of this document and does not constitute an endorsement by IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

Part 309: Communication profile integration – IEC 61784 CPF 9

1 Scope

Communication Profile Family 9 (commonly known as HART®[2]) defines communication profiles based on IEC 61158-5-20 and IEC 61158-6-20. The basic profile CP 9/1 is defined in IEC 61784-1.

This part of IEC 62453 provides information for integrating the HART® technology into the FDT standard (IEC 62453-2).

This part of the IEC 62453 specifies communication and other services.

This document neither contains the FDT specification nor modifies it.

2 Normative references

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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.

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IEC 61158-5-20, *Industrial communication networks – Fieldbus specifications – Part 5-20: Application layer service definition – Type 20 elements*

IEC 61158-6-20, *Industrial communication networks – Fieldbus specifications – Part 6-20: Application layer protocol specification – Type 20 elements*

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

IEC 62453-1:–[3], *Field device tool (FDT) interface specification – Part 1: Overview and guidance*

IEC 62453-2:–[3], *Field device tool (FDT) interface specification – Part 2: Concepts and detailed description*

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[2] HART® and WirelessHART® are trade names of products supplied by FieldComm Group. This information is given for convenience of users of this document and does not constitute an endorsement by IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

[3] Under preparation. Respective stage at the time of publication: IEC/CCDV 62453-1:2022 and IEC/RFDIS 62453-2:2022.

3 Terms, definitions, symbols, abbreviated terms and conventions

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62453-1 and IEC 62453-2, as well as the following apply.

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

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

3.1.1
burst mode
mode in which the field device generates response telegrams without request telegram from the master

3.2 Abbreviated terms

For the purposes of this document, the abbreviations given in IEC 62453-1, IEC 62453-2, as well as the following apply.

BACK	Burst ACKnowledge
C8PSK	Coherent 8-way Phase Shift Keying, HART communication layer as defined in HCF_SPEC-60, Revision 1.0
DR	delayed response
EDD	Electronic Device Description
FSK	Frequency Shift Keying, HART communication layer as defined in HCF_SPEC-54, Revision 8.1
HART	Highway Addressable Remote Transducer

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3.3 Conventions

3.3.1 Data type names and references to data types

The conventions for naming and referencing of data types are explained in IEC 62453-2:–, Clause A.1.

3.3.2 Vocabulary for requirements

The following expressions are used when specifying requirements:

Usage of “shall” or “mandatory”	No exceptions allowed.
Usage of “should” or “recommended”	Strong recommendation. It may make sense in special exceptional cases to differ from the described behaviour.
Usage of “can’ or “optional’	Function or behaviour may be provided, depending on defined conditions.

3.3.3 Use of UML

Figures in this document are using UML notation as defined in IEC 62453-1:–, Annex A.

4 Bus category

IEC 61784 CPF 9 protocol is identified in the protocolId element of structured data type 'fdt:BusCategory' by the following unique identifiers (see Table 1):

Table 1 – Protocol identifiers

Identifier value	ProtocolId	Display String	Description
036D1498-387B-11D4-86E1-00E0987270B9	HART_Basic	'HART'	Support of IEC 61784 CPF 9 protocol over FSK communication with basic functionality (deprecated)
98503B8F-0FFB-4EB7-BB67-F4D6BD16DB8D	HART_FSK	'HART FSK'	Support of HART protocol over FSK communication with complete functionality
74D29D22-F752-40EF-A747-ACA72C791155	HART_Wireless	'HART Wireless'	Support of WirelessHART protocol
58001A08-C178-4A59-A76B-9EF9111CB83D	HART_RS485	'HART RS485'	Support of HART protocol over RS485 communication
EF708CB7-A2A1-42AF-890C-15CEB680CC12	HART_Infrared	'HART Infrared'	Support of HART protocol over Infrared communication
D122D172-F0C7-4B03-965B-512CD4C0871E	HART_IP	'HART IP'	Support of HART over IP protocol

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The 'HART_Basic' protocol is maintained for backward compatibility only (e.g. for interaction with DTMs according to IEC 62453-309:2009). The other protocol identifiers provide a better support for planning of network topologies and for establishment of connections between DTM and respective device. For DTMs complying with this document, support for one of the other protocols is mandatory.

Within this document, the other protocols (HART_FSK, HART_Wireless, HART_RS485, HART_Infrared, HART_IP) are referenced as 'Extended_HART' protocols. (E.g. for definitions that apply to all protocols except 'HART_Basic'.)

Table 2 defines which PhysicalLayer can be used together with the BusCategory defined in Table 1.

Table 2 – Definition of PhysicalLayer

PhysicalLayer Id value	PhysicalLayer name value	Description
BAB2091A-C0A7-4614-B9DE-FCC2709DCF5D	HART FSK Physical Layer	Support of HART FSK physical layer
B9F1A250-AC94-4487-8F25-A8F3F8F89DC5	WirelessHART Physical Layer	Support of WirelessHART physical layer
036D1591-387B-11D4-86E1-00E0987270B9	HART RS-485 Physical Layer	Support of HART devices using RS-485 communication
AE4119EF-B9FD-429c-B244-134DB182296A	HART Infrared Physical Layer	Support of HART devices using infrared communication
307dd808-c010-11db-90e7-0002b3ecdcbe	10BASET	HART Ethernet based Physical Layers
307dd809-c010-11db-90e7-0002b3ecdcbe	10BASETXHD	
307dd80a-c010-11db-90e7-0002b3ecdcbe	10BASETXFD	
307dd80b-c010-11db-90e7-0002b3ecdcbe	10BASEFLHD	
307dd80c-c010-11db-90e7-0002b3ecdcbe	10BASEFLFD	
307dd80d-c010-11db-90e7-0002b3ecdcbe	10BASEFXHD	
307dd80e-c010-11db-90e7-0002b3ecdcbe	10BASEFXFD	

PhysicalLayer Id value	PhysicalLayer name value	Description
307dd80f-c010-11db-90e7-0002b3ecdcbe	100BASETXHD	
307dd810-c010-11db-90e7-0002b3ecdcbe	100BASETXFD	
307dd811-c010-11db-90e7-0002b3ecdcbe	100BASEFXHD	
307dd812-c010-11db-90e7-0002b3ecdcbe	100BASEFXFD	
307dd813-c010-11db-90e7-0002b3ecdcbe	100BASELX10	
307dd814-c010-11db-90e7-0002b3ecdcbe	100BASEPX10	
307dd815-c010-11db-90e7-0002b3ecdcbe	1000BASEXHD	
307dd816-c010-11db-90e7-0002b3ecdcbe	1000BASEXFD	
307dd817-c010-11db-90e7-0002b3ecdcbe	1000BASELXHD	
307dd818-c010-11db-90e7-0002b3ecdcbe	1000BASELXFD	
307dd819-c010-11db-90e7-0002b3ecdcbe	1000BASESXHD	
307dd81a-c010-11db-90e7-0002b3ecdcbe	1000BASESXFD	
307dd81b-c010-11db-90e7-0002b3ecdcbe	1000BASETHD	
307dd81c-c010-11db-90e7-0002b3ecdcbe	1000BASETFD	
307dd81d-c010-11db-90e7-0002b3ecdcbe	10GigBASEFX	

The significant information for topology planning is the BusCategory. The PhysicalLayer (which is provided in the BusInformation data type) shall be used only for additional information.

The DataLinkLayer property is not applicable for HART and shall be set to null.

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5 Access to instance and device data

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5.1 General

The HART protocol has semantics defined that allow in a wide range the identification of device variables and device parameters. Most of this semantic information is defined in the standard EDD import libraries.

Clause 5 describes how the semantic information defined with the HART protocol shall be used to export device data, instance data and process data.

5.2 Process Channel objects provided by DTM

The minimum set of provided data shall be the first four provided process related values (PV, SV, …) – if available – modeled as channel references. The referenced channel shall include ranges and scaling.

A HART device communicates the process data either via its analogue channels or via digital information (e.g. by request or by burst mode). Analogue channels are always related to a dynamic variable, as specified in [1][4] chapter 8 and therefore the description of an analogue channel shall be accessed using the respective dynamic variable (e.g. the attributes of dynamic variable PV always describe the first analogue channel).

4 Figures in square brackets refer to the bibliography.

HART distinguishes between three methods to access digital signals:

1) Access to analogue value and assigned dynamic variables (Command #3)

   IO signals can be assigned to one of the four dynamic variables PV, SV, TV, and QV. Using the command #3 the analogue value and the dynamic variables can be read without specific device knowledge.

2) Indexed access to device variables (Command #33)

   All device variable values and their units can be read using the related device variable code information in command #33.

3) Indexed access to device variable classification and device variable status (Command #9)

   Command #9 provides more information than command #33. Beside of the value and unit also a classification and the variable status can be determined.

The command initiator determines by means of the HART specification which commands will be used.

5.3 DTM services to access instance and device data

The services InstanceDataInformation and DeviceDataInformation shall provide access to at least all parameters of the Universal and Common Practice commands (as far as the device supports the function).

Furthermore, the Response Byte 0 and the Response Byte 1 for each command shall be exposed.

The services InstanceDataInformation and DeviceDataInformation may also provide access to device specific parameters (e.g. diagnostic information).

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https://standards.iteh.ai/catalog/standards/sist/bd73c08c-418c-46c8-8953-b3d7e1e5255f/iec-62453-309-2022

6 Protocol-specific behavior

6.1 Overview

There is only one protocol-specific sequence defined for IEC 61784 CPF 9: burst mode subscription.

This sequence explains how the sequence “Device initiated data transfer”, defined in IEC 62453-2, is applied in context of burst telegrams as defined by IEC 61784 CPF 9.

Additionally, Clause 6 provides information regarding:

- usage of device addressing information,
- support of extended command codes,
- handling of communication failures,
- handling of delayed responses, and
- management of physical topologies.

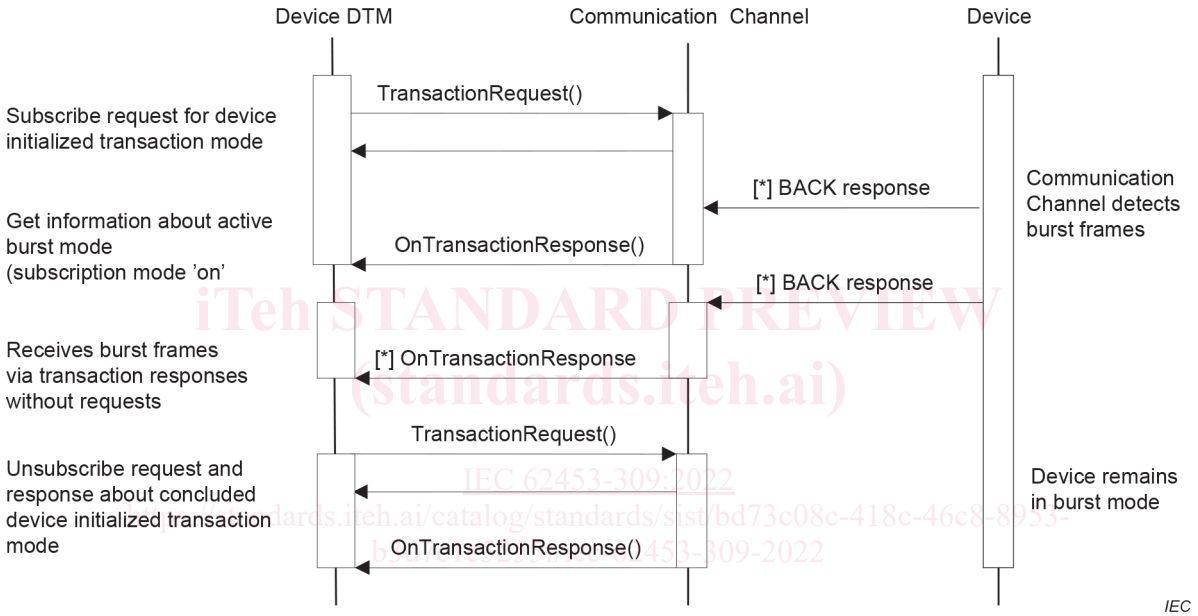
6.2 Burst mode subscription

A subscription to device-initiated data transfer can be requested by sending a transaction request with SubscribeRequest content (see Figure 2). The Communication Channel may detect if the device is already in burst mode.

NOTE In HART 5 this can be detected only when burst frames are received from the device. In HART 6 the burst mode can be detected using command #105.

The Communication Channel answers to a SubscribeRequest with a SubscribeResponse content. If burst frames are received, the device is in burst mode and burstModeDetected value is set to TRUE. This means that Device DTM will start to receive burst messages via the transaction response mechanism. In the case that no burst messages were received, burstModeDetected value is set to FALSE. It is up to Device DTM to set device into burst mode. Then Device DTM may call a transaction request with SubscribeRequest content again in order to receive burst messages.

In order to unsubscribe, the Device DTM sends a transaction request with a UnsubcribeRequest. The Communication Channel answers with a UnsubscribeResponse where burstModeDetected value is set to FALSE. The Device DTM will not receive any more burst information via the transaction response mechanism. The Communication Channel does not switch off the burst mode in the device. The Device DTM may switch burst mode on or off by using normal transaction requests (command #109). This is independent of the subscription.



NOTE BACK means Burst ACKnowledge.

Figure 2 – Burst mode subscription

6.3 Usage of device addressing information

HART is a connectionless master/slave protocol. Transaction requests are always addressed using unique device address information (a 5 byte integer), the so called long address.

Device addressing in HART therefore is mainly focused to determine this long address.

There are currently three ways possible to determine the long address.

1) short address

   The short address is a number between 0 and 63 (for HART version 5 only 0 to 15). In the context of a direct connection to the device the short address is unique and allows to read the long address using command #0.

2) short tag

   With command #11 the long address information can be requested for a device with a specific short tag. Such requests are especially used for installations with a huge amount of connected HART devices. All HART multiplexer devices and other HART communication structures shall support this command.