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Edition 1.1 2016-05

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VERSION CONSOLIDÉE

colour inside

Field device tool (FDT) interface specification – Part 301: Communication profile integration – IEC 61784 CPF 1

Spécification des interfaces des outils des dispositifs de terrain (FDT) – Partie 301: Intégration des profils de communication – IEC 61784 CPF 1

IEC 62453-301:2009-06+AMD1:2016-05 CSV(en-fr)

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

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

Part 301: Communication profile integration – IEC 61784 CPF 1

FOREWORD

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This Consolidated version of IEC 62453-301 bears the edition number 1.1. It consists of the first edition (2009-06) [documents 65E/125/FDIS and 65E/138/RVD] and its amendment 1 (2016-05) [documents 65E/336/CDV and 65E/395A/RVC]. The technical content is identical to the base edition and its amendment.

In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

International Standard IEC 62453-301 has been prepared by subcommittee 65E: Devices and integration in enterprise systems, of IEC technical committee 65: Industrial-process measurement, control and automation.

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

The French version of this standard has not been voted upon.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 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 the base publication and its amendment will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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- withdrawn,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

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INTRODUCTION

This part of IEC 62453 is an interface specification for developers of FDT (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 kinds of fieldbusses and thus meets the requirements for integrating different kinds of devices into heterogeneous control systems.

Figure 1 shows how IEC 62453-301 is aligned in the structure of the IEC 62453 series.

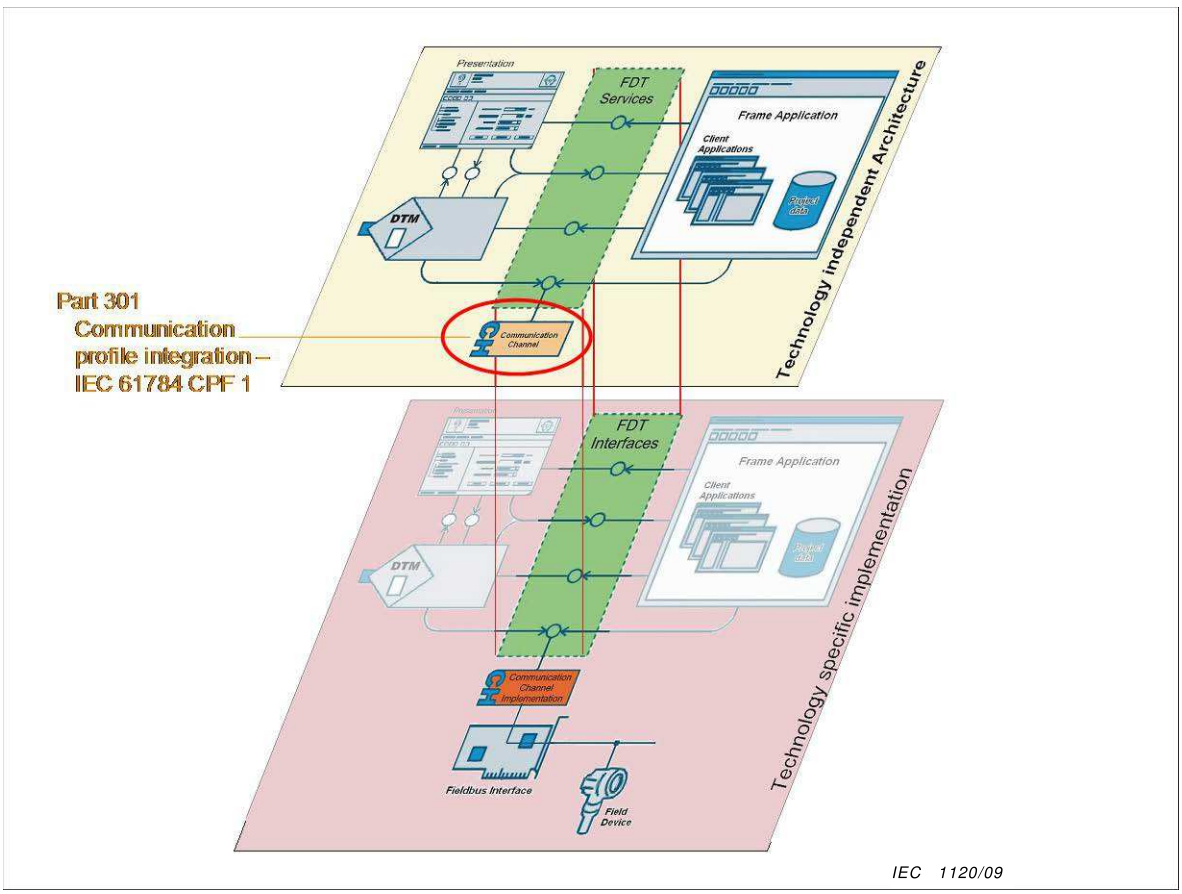

Figure 1 – Part 301 of the IEC 62453 series

FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

Part 301: Communication profile integration – IEC 61784 CPF 1

1 Scope

Communication Profile Family 1 (commonly known as FOUNDATION™ Fieldbus[1]) defines communication profiles based on IEC 61158-2, Type 1, IEC 61158-3-1, IEC 61158-4-1, IEC 61158-5-5, IEC 61158-5-9, IEC 61158-6-5, and IEC 61158-6-9. The basic profiles CP 1/1 (FF H1) and CP 1/2 (FF HSE) are defined in IEC 61784-1.

This part of IEC 62453 provides information for integrating the FOUNDATION™ Fieldbus (FF) protocol into the FDT standard (IEC 62453-2).

The standard describes communication definitions, protocol specific extensions and the means for block (e.g. transducer, resource or function blocks) representation.

The new protocol specific definitions are based on FF-specifications for H1 and HSE protocols. Furthermore, the definitions contain information that is needed by systems to configure FF devices.

The scope is limited to FOUNDATION™ Fieldbus device and system specific definitions.

2 Normative references

The following referenced documents are indispensable for the application of this specification. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies

IEC 61158-2, *Industrial communication networks – Fieldbus specifications – Part 2: Physical layer specification and service definition*

IEC 61158-3-1, *Industrial communication networks – Fieldbus specifications – Part 3-1: Data-link layer service definition – Type 1 elements*

IEC 61158-4-1:2007, *Industrial communication networks – Fieldbus specifications – Part 4-1 Data-link layer protocol specification – Type 1 elements*

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

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

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1 FOUNDATION™ Fieldbus is a trade name of the non-profit organization Fieldbus Foundation. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by IEC of the trade name holder or any of its products. Compliance to this standard does not require use of the trade name Foundation Fieldbus™. Use of the trade name FOUNDATION™ Fieldbus requires permission of Fieldbus Foundation.

IEC 61158-6-5, *Industrial communication networks – Fieldbus specifications – Part 6-5: Application layer protocol specification – Type 5 elements*

IEC 61158-6-9, *Industrial communication networks – Fieldbus specifications – Part 6-9: Application layer protocol specification – Type 9 elements*

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

IEC 62453-1:2009, *Field Device Tool (FDT) interface specification – Part 1: Overview and guidance*

IEC 62453-2:2009, *Field Device Tool (FDT) interface specification – Part 2: Concepts and detailed description*

ISO 646, *Information technology – ISO 7-bit coded character set for information interchange*

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 apply.

3.2 Abbreviated terms

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

SM	System Management
FDA	Federation Drug Association
FF	FOUNDATION™ Fieldbus
FMS	Fieldbus Message Specification
DTM	Device Type Manager
BTM	Block Type Manager
H1	Low speed version of FF
HSE	High Speed Ethernet

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 standard are using UML notation as defined in Annex A of IEC 62453-1.

4 Fundamentals

4.1 System and FDT topology

This standard provides communication definitions, protocol-specific extensions and means for device and block (e.g. resource, transducer or function blocks) configuration.

The communication definitions provide System Management (SM) and Fieldbus Message Specification (FMS) communication.

Separate definitions are designed to support the different management parameters and structures for H1 and HSE devices.

Protocol-specific definitions can be used to identify FOUNDATION™ Fieldbus devices and their internal structure.

A FOUNDATION™ Fieldbus device is represented by a Device Type Manager (DTM) together with a group of Block Type Managers (BTM). Each BTM represents the functionality of a block functionality in an FF device.

4.2 FDT topology for H1 devices

An FF H1 topology may contain Communication DTM, Device DTM and BTMs.

EXAMPLE
The typical FDT topology for H1 devices is illustrated in Figure 2 and Table 1.

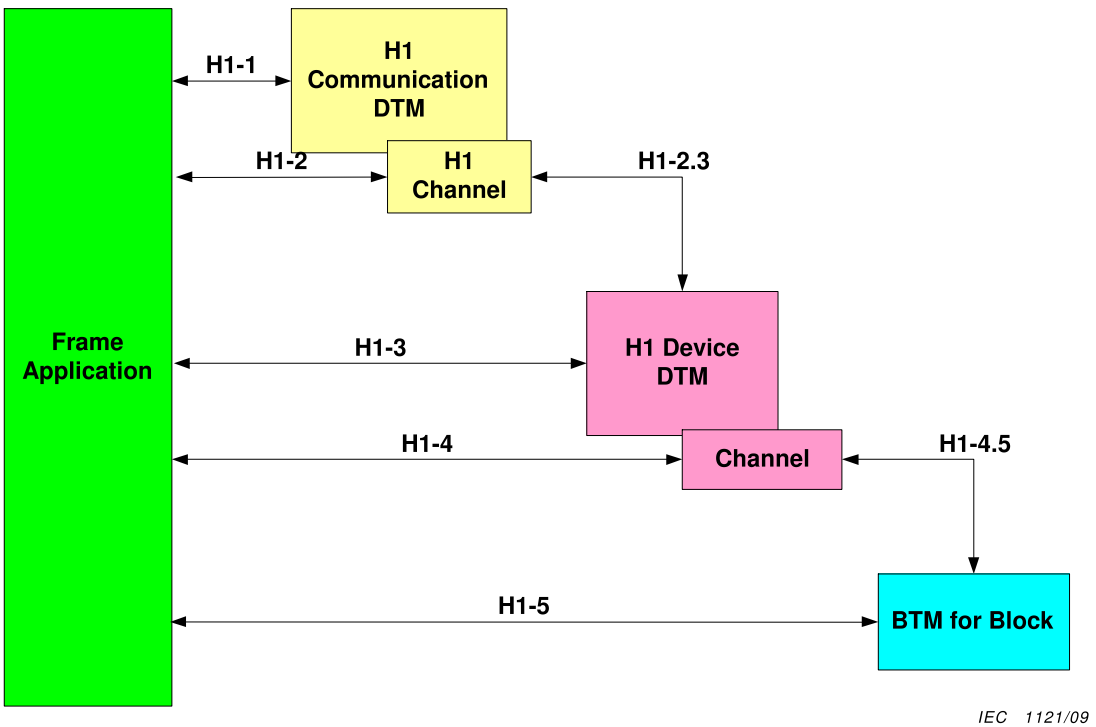

Figure 2 – Object relations for H1 Device DTM

Table 1 – Object relations for H1 Device DTM

Relation	Type of information	Used definitions
H1-1	Management Parameter Access	H1 Management data types (see 10.2) FF common data types (see 11.1)
H1-2	Network Topology	FF common data types (see 11.1) Identification data types (see 13.4) Scan identification data types (see 13.3)
	Channel Parameter Access	Channel parameter data types (see 12)
H1-3	Management Parameter Access	H1 Management data types (see 10.2) FF common data types (see 11.1)
H1-4	List of instantiated blocks	FF common data types (see 11.1) BTM data types (see IEC 62453-2) FF block data types (see 9.2.2) Identification data types (see 13.4) Scan identification data types (see 13.3)
	Channel Parameter Access	Channel parameter data types (see 12)
H1-5	Block Information	BTM Information data types (see IEC 62453-2) BTM data types (see IEC 62453-2) Identification data types (see 13.4) Identification data types (see 13.4))
	Initialization of BTM	BTM Init data types (see IEC 62453-2) BTM data types (see IEC 62453-2)
	Parameter Access	BTM parameter data types (see IEC 62453-2) BTM data types (see IEC 62453-2)
H1-2.3	Communication	FF FMS data types (see 11.2) H1 communication data types (see 11.3) FF common data types (see 11.1)
H1-4.5	Block communication	FF FMS data types (see 11.2) FF Block communication data types (see 11.5) BTM data types (see IEC 62453-2) FF common data types (see 11.1)

4.3 FDT topology for HSE devices

An FF HSE topology may contain Communication DTM, GatewayDTM, Device DTM and BTMs.

EXAMPLE

The typical FDT topology for a HSE based system is illustrated by Figure 3 and Table 2:

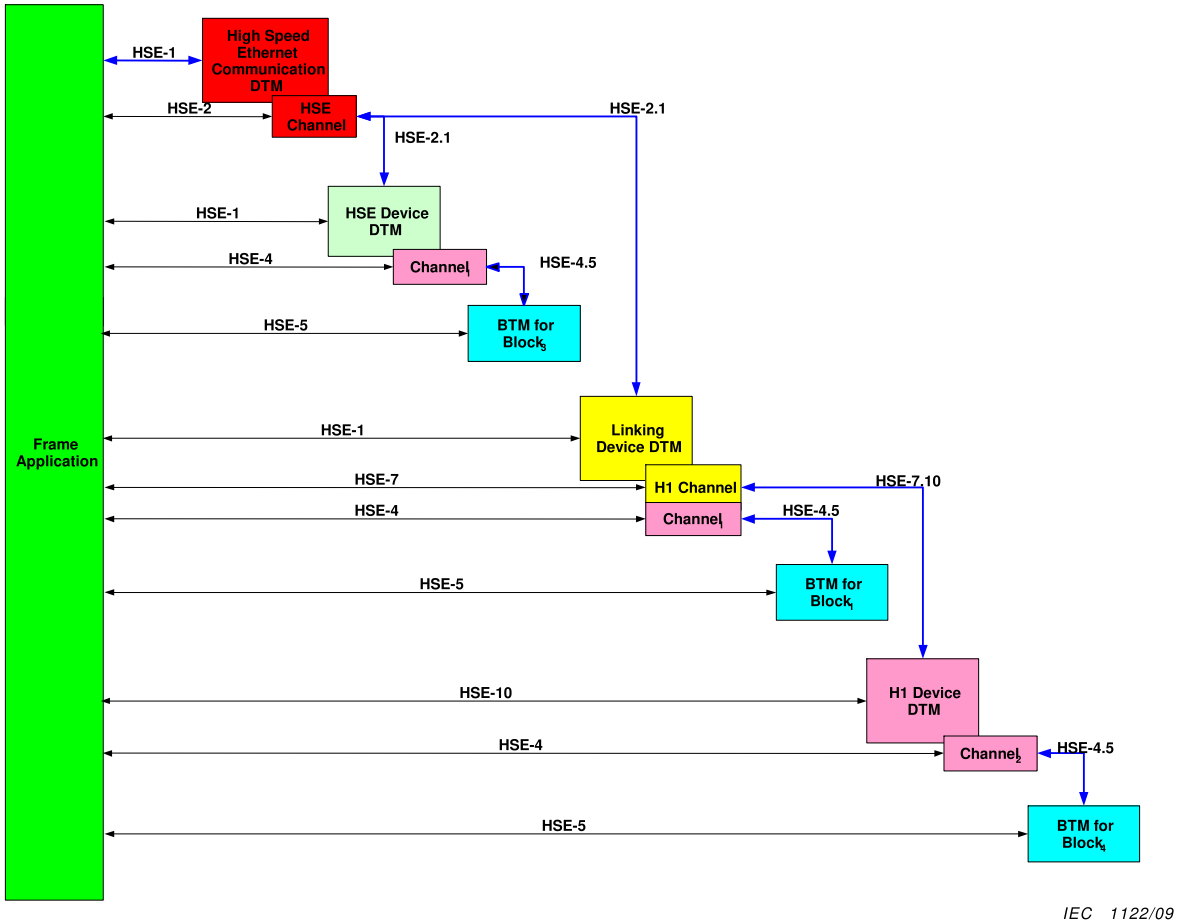

Figure 3 – Object relations for HSE application with DTMs and BTMs

In this illustration, blue lines show the object hierarchy as it is managed in the FDT Frame Application.

Table 2 – Object relations for HSE application wtith DTMs and BTMs

Relation	Type of information	Used definitions
HSE-1	Management Parameter Access	FF HSE management data types (see 10.3)
HSE-2	Network Topology	FF common data types (see 11.1) Identification data types (see 13.4) Scan identification data types (see 13.3)
	Channel Parameter Access	Channel parameter data types (see Clause 12)
HSE-2.1	Communication	FF FMS data types (see 11.2) FF HSE communication data types (see 11.4) FF common data types (see 11.1)
HSE-4.5	Block communication	FF FMS data types (see 11.2) FF Block communication data types (see 11.5) FF common data types (see 11.1) BTM data types (see IEC 62453-2)
HSE-4	List of instantiated blocks	FF common data types (see 11.1) BTM data types (see IEC 62453-2) Identification data types (see 13.4) Scan identification data types (see 13.3)
	Channel Parameter Access	Channel parameter data types (see Clause 12)
HSE-5	Block Information	BTM Information data types (see IEC 62453-2) BTM data types (see IEC 62453-2) Identification data types (see 13.4)
	Initialization of BTM	BTM Init data types (see IEC 62453-2) BTM data types (see IEC 62453-2)
	Parameter Access	BTM parameter data types (see IEC 62453-2) BTM data types (see IEC 62453-2)
HSE-7	Network Topology	FF common data types (see 11.1) FF HSE communication data types (see 11.4) FF Block communication data types (see 11.5)
	Channel Parameter Access	Channel parameter data types (see Clause 12) H1 Management data types (see 10.2)
	Parameter Access	BTM parameter data types (see IEC 62453-2)
HSE-10	Management Parameter Access	H1 Management data types (see 10.2) FF common data types (see 11.1)
HSE-7.10	Communication	FF FMS data types (see 11.2) H1 communication data types (see 11.3) FF common data types (see 11.1)

4.4 Nested communication

Standard FF blocks may be handled by BTMs implementing the standard behavior. These BTMs may be connected to the corresponding DTM that provides the support of an “FDT FF STANDARD BLOCK” communication protocol.

For device-specific BTMs, a device specific (it may be unique) bus category (CATID) shall be defined for the protocol between DTM and BTM.

The Frame Application can use this bus category to identify the device specific blocks and it can prevent a device-specific block from Device A to be assigned to a Device B that does not support the block.

Different communication protocols defined in this document (H1, HSE, Standard blocks) can use the same communication requests (FMS).

5 Bus category

FF protocols are identified in the protocolId element of the structured data type 'fdt:BusCategory' by the following unique identifiers (Table 3):

Table 3 – FF specific protocol identifiers

Protocol Id	ProtocolId name	Description
036D1691-387B-11D4-86E1-00E0987270B9	'FF H1'	Object supports FF H1 protocol
036D1692-387B-11D4-86E1-00E0987270B9	'FF HSE'	Object supports FF HSE protocol
036D1693-387B-11D4-86E1-00E0987270B9	'FF Standard Block'	For FDT FF standard block protocol

FF protocols are using the following unique identifiers in physicalLayer members within PhysicalLayer data type (Table 35 for H1):

Table 35 – Physical layer identifiers for H1

Identifier value	Name	Description
0D8FB517-1D8D-4455-9CE1-1B4A5DD4A0D2	FF H1	FOUNDATION Fieldbus™ H1 physical layer, as described in "FF 816 - 31,25 kbit/s Physical Layer"

Table 36 defines which DataLinkLayer shall be used in combination with the BusCategory values defined in Table 3.

Table 36 – DataLink Layer Identifiers

Identifier value	Name	Description
63D4C62E-91A9-4904-BCFC-3D3479C2EBAD	FDL	FF - 822 H1 Data Link Protocol and FF – 821 H1 Data Link Services

6 Access to instance and device data

6.1 DTM

The minimum set of provided data shall be:

- for FF devices System Management and Network Management parameters may be provided by the DTM as specified in Clause 10;
- the DTM shall provide support for the data described in 9.1.2;
- for each block in the device all standard block parameters shall be provided by the corresponding BTM object as specified in IEC 62453 2.

It is recommended that all non-standard block parameters are also provided as specified in 9.2.

A Device DTM shall provide access to the following groups of parameters if they are presented to the user:

- link parameters;
- action parameters;
- alert parameters;
- trend parameters;
- domain objects;
- program invocation objects.

6.2 BTM

BTMs built according to the function block specification shall expose all parameters for the corresponding block as defined for the DTM. All standard parameters defined for a block in the FF specification shall be exposed. The manufacturer specific parameters may be added to extend this list. User defined parameter shall be exposed if they exist.

7 Protocol specific behavior

7.1 Connection management

The Connect service establishes an FDT connection. The FDT connection acts as a container for FMS connections, as a container for SM connectionless services and as a container for FDA sessions.

It is necessary to maintain the FMS connection separate from the underlying FDT connection.

7.1.1 FMS connection

FDT implements all FMS and SM services as transactions in the respective protocols. This includes the services for the FMS connection management. FmsInitiate transaction and FmsAbort transaction manage the lifetime of a FMS connection.

In order to open multiple FMS connections on the same FDT connection, a Transaction service request is called with an FmsInitiateRequest element as argument.

The communication reference passed with the FmsInitiateRequest element identifies the FDT connection to be used. The FmsInitiateResponse element returned with Transaction service response provides a communication reference used for all further FMS services on that FMS connection.

This mapping allows multiple FMS connections on one FDT connection.

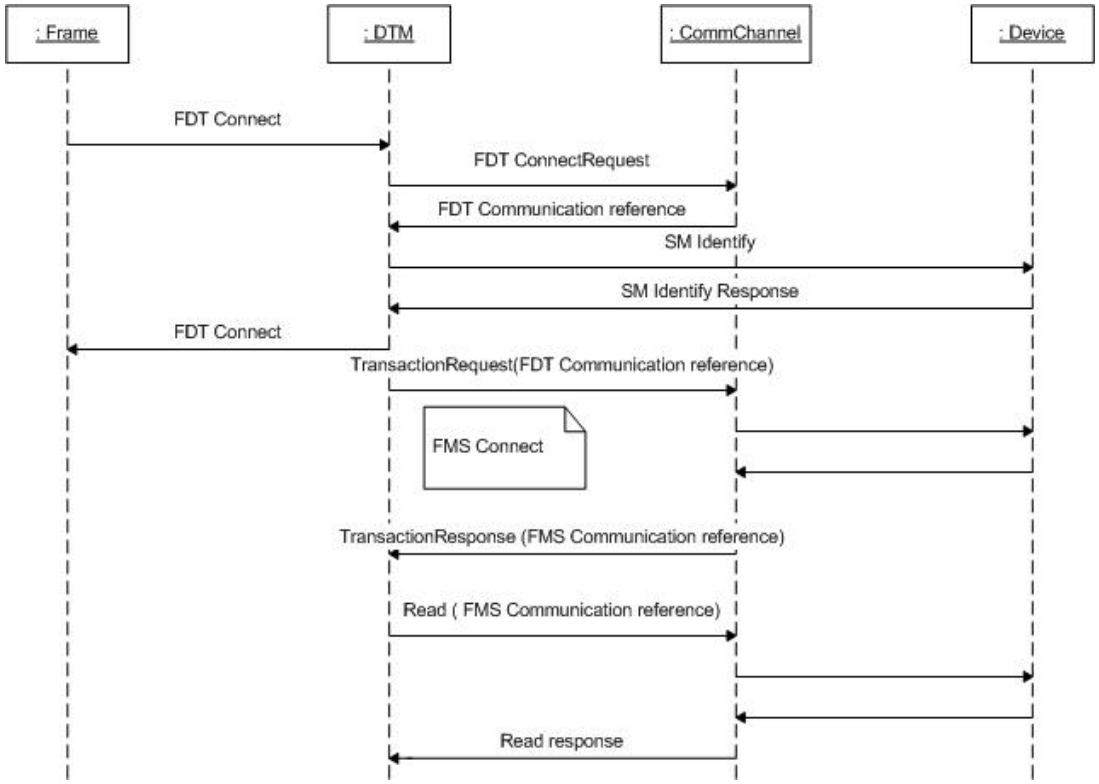

Figure 4 – FMS mapping in the FDT connection

If the FDT connection is closed, the FMS connections for this connection are also closed automatically (by the communication channel) before the FDT Disconnect service is completed.

Any transactions requested after that will fail. No outstanding services will be processed.

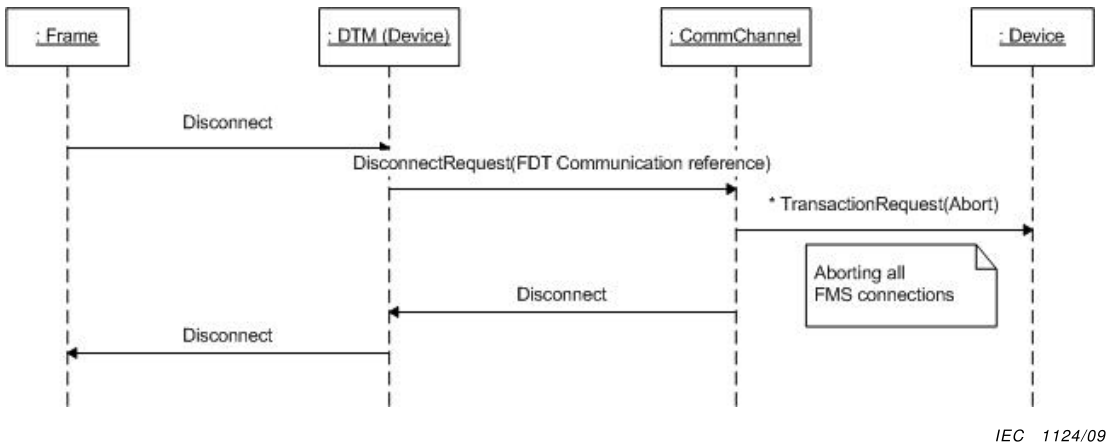

Figure 5 – FDT Disconnect service

FMSAbort service request closes a single FMS connection.

7.1.2 FDT connection

FDT connection is using Connect service request:

- to establish an FDT connection intended for System Management services only. When FDT connections for SM services only are established, the OpenSessionRequest element

is not part of the ConnectRequest. Any request to establish an FMS connection on this type of FDT connection shall be rejected;

- to establish an FDT connection that represents a session as described with the specification FF-588 Field Device Access Agent. FMS connections can be established by using the FDT communication reference returned as a result of FDT connection establishment. Note that multicast SM services are not allowed in this connection.

If an HSE device needs both types of connections it needs to create System management and FDT Session Connections.

When a Frame Application requests the DTM to disconnect, all FMS connections and FDT connections (SM and Session) shall be terminated.

7.2 Abort

7.2.1 OnAbort Indication

At any moment during the lifetime of the (FDT or FMS) Connection an OnAbort event indication can be received by the DTM/BTM from the Communication Channel. There can be two reasons for OnAbort Event:

- FMS Connection Abort;
- FDT Connection Abort.

The Communication reference uniquely identifies the Connection to be aborted. If a FDT Connection Abort is indicated, all FMS connections of the corresponding FDT Connection shall be terminated. No Abort requests are issued to the Communication Channel. All pending requests shall be cancelled.

If an FMS Connection Abort is indicated, only the FMS Connection identified by that Communication Reference is terminated.

7.2.2 Abort request

At any moment during the lifetime of the (FDT or FMS) connections a DTM/BTM can issue an Abort request to the Communication Channel. There can be two types of Communication References in the Abort request:

- FMS Communication Reference;
- FDT Communication Reference.

The Communication reference uniquely identifies the Connection to be aborted.

If an FDT Connection Abort is requested, all related FMS connections in the Communication channel shall be terminated. No separate Abort requests are issued to the Communication Channel for the individual FMS Connections. All pending requests shall be cancelled.

If an FMS Communication Reference is used in the Abort, only the FMS Connection identified by that Communication Reference is terminated.

7.3 Relation of FMS requests and FMS responses

If a DeviceDTM (communication client) issues an FMS request as in Table 4, it shall expect a response as shown in the table.

Table 4 – Relation of FMS requests and FMS responses

Request	Response (s)
FmsInitiateRequest	FmsInitiateResponse FmsInitiateError
FmsAbortRequest	FmsStandardResponse
FmsReadRequest	FmsReadResponse FmsServiceError
FmsWriteRequest	FmsStandardResponse FmsServiceError
FmsStatusRequest	FmsStatusResponse FmsServiceError
FmsIdentifyRequest	FmsIdentifyResponse FmsServiceError
FmsDefineVariableListRequest	FmsDefineVariableListResponse FmsServiceError
FmsDeleteVariableListRequest	FmsStandardResponse FmsServiceError
FmsGetOdRequest	FmsGetOdResponse FmsServiceError
FmsGenericInitiateDownloadSequenceRequest	FmsStandardResponse FmsServiceError
FmsGenericDownloadSegmentRequest	FmsStandardResponse FmsServiceError
FmsGenericTerminateDownloadSequenceRequest	FmsGenericTerminateDownloadSequenceResponse FmsServiceError
fms:FmsInformationReport	fms:FmsInformationReport
fms:CreateProgramInvocation	FmsStandardResponse FmsServiceError
fms:DeleteProgramInvocation	FmsStandardResponse FmsServiceError
fms:Start	FmsStandardResponse FmsServiceError
fms:Stop	FmsStandardResponse FmsServiceError
fms:Resume	FmsStandardResponse FmsServiceError
fms:Reset	FmsStandardResponse FmsServiceError
fms:Kill	FmsStandardResponse FmsServiceError
H1SubscribeRequest	H1SubscribeResponse
H1UnSubscribeRequest	H1UnSubscribeResponse
HSESubscribeRequest	HSESubscribeResponse
HSEUnSubscribeRequest	HSEUnSubscribeResponse
Any Service	fdt:CommunicationError

A DTM or a BTM can receive a standard FDT CommunicationError response instead of FMS Transaction response to indicate a general communication error. Communication clients shall be prepared to handle such a response.

If the FMS connection in the Device DTM is shared between several BTMs, all connections will receive OnAbort event when the Device FMS connection is aborted.

7.4 Subscription mechanism

The FF subscription mechanism is based on the rules of the device initiated data transfer. For a DTM that supports Device Initiated Data Transfer there may be one or multiple subscribers expecting data at the same time.

7.4.1 General

To support the device initiated data transfer for IEC 61784 CPF 1 additional transaction request and transaction responses are defined. Two transaction requests are used to initiate the FMS subscription connection and four transaction responses are associated with the FMS subscriptions. These transactions are detailed below:

- transaction request for subscribing;
- transaction response for subscribing;
- transaction request for unsubscribing;
- transaction response for unsubscribing;
- transaction detailing the FMS Information Report;
- transaction response detailing the FMS EventNotification.

7.4.2 Transactions for subscribing H1

Device DTM/BTM can subscribe to data by calling a H1SubscribeRequest Transaction. It can subscribe for

- data collected in a trend object [H1TrendSubscriptionInfo];
- single device parameter [H1ParameterSubscriptionInfo];
- an alarm or event[H1EventSubscriptionInfo].

Additional information to identify the device is provided in the transaction request. This information may be used by the Communication Provider to speed up the process of subscribing.

The result of the subscription mechanism is provided in the H1SubscribeResponse transaction. The communication reference used is the communication reference of the FDT connection.

The InvokeID of the subscription request will be used to provide the association between the subscription and FmsInformationReport or FmsEventNotification transaction.

The InvokeID received during the subscription will be used for Unsubscribing.

The InvokeID uniquely identifies all transactions related to the created subscription and shall not be used for any other transactions during the lifetime of the subscription.

7.4.3 Transactions for subscribing HSE

The HSE Linking Device DTM can subscribe to data by calling an HSESubscribeRequest Transaction. DTMs can map the subscription from a H1 DTM to a HSE subscription.

The HSE subscription can be used to subscribe for data from

- an H1 device via a HSE Linking device;
- an HSE device.

It can subscribe for

- data in a trend object on an H1 device (HSETrendSubscriptionInfo);
- data in a trend object on an HSE device (LocalTrendSubscriptionInfo);
- single parameter from an H1 device (HSEParameterSubscriptionInfo);
- single parameter from an HSE device (LocalParameterSubscriptionInfo),
- an Event from an H1 device (HSEEventSubscriptionInfo);
- an Event from an HSE device (LocalEventSubscriptionInfo).

Additional information about the device is provided in the transaction request. This information may be used by the Communication Provider to speed up the process of subscribing.

The result of the subscription mechanism is provided in the HSESubscribeResponse transaction.

The communication reference used is the communication reference of the FDT connection.

The InvokeID of the subscription request will be used to provide the association between the subscription and FmsInformationReport or FmsEventNotification transaction. The same InvokeID will identify the subscription during the Unsubscribing.

The InvokeID uniquely identifies all transactions related to the created subscription and shall not be used for any other transactions during the lifetime of the subscription.

7.4.4 Transactions for subscribing BTM

A BTM can subscribe for data by calling a BtmSubscribeRequest Transaction. The parent DTM can map the subscription from a BTM to an H1 or HSE subscription.

BTM can subscribe for

- single parameter (BtmParameterSubscriptionInfo);
- data collected in the Device Trend object (BtmTrendSubscriptionInfo);
- an alarm or event (BtmEventSubscriptionInfo).

The Device DTM shall provide association and configuration of the trend object if a subscription for trend data is requested.

The result of the subscription mechanism is provided in the BtmSubscribeResponse transaction.

The communication reference used is the communication reference of the FDT connection.

The InvokeID of the subscription request will be used to provide the association between the subscription and FmsInformationReport or FmsEventNotification transaction. The same InvokeID will identify the subscription during the Unsubscribing. The InvokeID shall not be used for any other transactions during the lifetime of the subscription.

If more than one BTM is subscribed for the same object, the Device DTM shall propagate the information to all subscribed BTMs.

8 Protocol specific usage of general data types

8.1 Address

For all exposed parameters in DTMs and BTMs the address (defined in Part 2) shall be constructed according to the following model:

VFD:xx.INDEX:yyy[.SUBINDEX:zz],

where

- xx is the VFD tag or a number presenting the index of the VFD (one based);
- yy is a number presenting the parameter index from the beginning of the VFD;
- zz is a number showing the parameter sub-index.

The values of xx, yy and zz shall be integers (some can be 32 bit) and are presented as decimals digits. There should be no leading zeros for the numbers.

The sub-index portion of the address is optional and may be omitted or set to 0.

Providing this information with the device data set is sufficient for accessing the device/block parameters and there is no need for process channel definition for BTMs.

8.2 protocolID

See Clause 5.

8.3 applicationDomain

The applicationDomain attribute is fixed: FDT_FoundationFieldbus.

8.4 semanticId

The semanticId for FF related parameter follows the following rules:

- the semanticId shall be built based on the names defined in the FF specification;
- structured parameters shall be combined with a '.';
- spaces within the profile definition shall be exchanged with an underscore;
- only capital letters should be used.

8.4.1 Block specific definitions

For detailed description, please refer to 9.2.2 for block specific definitions.

EXAMPLES

OUT.STATUS

OUT.VALUE

OUT

8.4.2 Fieldbus management definitions

SemanticID for FF Fieldbus management parameter shall be created according to the following rule:

'FDT.UserDefinedBus' followed by the structure of the data type definitions of the management parameter. Each element shall be divided by a '.'.

EXAMPLE

FDT.UserDefinedBus.ListOfH1NmaVfds.H1NmaVfd.SMIB.SmAgent.T1.t1

defines the semantic ID for the T1 parameter.

8.4.3 Fieldbus specific definitions

For the parameters used for device/block identification (see Clause 12) a set of unique IDs are defined.

- For H1 devices a set of fixed semantic IDs are defined as follows:
  - IdAddress – Node address assigned to the device;
  - IdManufacturer – Device manufacturer ID;
  - IdTypeID – Device Type;
  - IdSoftwareRevision– Device and Device Descriptor's revision;
  - IdTag – Physical Device Tag;
  - IdSerialNumber – Physical device ID. This is unique identifier of the device instance;
- For HSE devices this IDs are defined as follows:
  - IdAddress – Address of the HSE device;
  - IdManufacturer – Device manufacturer ID;
  - IdTypeID – Device Type;
  - IdTag – Physical Device Tag;
  - IdSerialNumber – Physical device ID. This is unique identifier of the device instance;
  - numberOfLinks – link count;
  - linkeId[0.. (numberOfLinks-1)] – link ID for the corresponding H1 link;
- For HSE device with Application VFD, the required IDs are:
  - IdManufacturer – Device manufacturer ID;
  - IdTypeID – Device Type;
  - IdSoftwareRevision– Device and Device Descriptor's revision;
- For FF blocks the following fixed semantic IDs are be defined:
  - IdTag – Block Tag as defined in BLOCK.BLOCK_TAG;
  - IdManufacturer – Block manufacturer ID is same as the device manufacturer ID;
  - IdTypeID – Block device type ia same as the device type;
  - IdSoftwareRevision– Block revision is same as the device revision;
  - Profile – Block Profile information as defined in BLOCK.PROFILE;
  - profileRevision – Block Profile revision information as defined in BLOCK. PROFILE_REVISION;
  - blockIndex – the starting index of the block.

9 Protocol specific data types

9.1 DTM

9.1.1 Topology scan definitions

As a result of the scanning, the DTM detects DTMs and BTM objects that are connected to the channel object. As a result of topology scan a DTM can expose information about the FF linking devices, about FF instruments and about the Blocks in the instruments.

9.1.2 Parameter access

9.1.2.1 General

DTM services to access instance data enable Frame Application access to device parameters. The DTM provides its current in-memory representation of its instance data.

DTM services to access device data enable Frame Application access to specific parameters in the device.

A FF device DTM can provide access to the following groups of parameters:

- link parameters;
- action parameters;
- alert parameters;
- trend parameters;
- domain objects;
- program invocation;
- views objects.

It is up to a DTM and depends on the device- and fieldbus-type to extend the list of device parameters.

9.1.2.2 Action structure

The action structure allows an instance of a block or object to be created or deleted in a resource supporting the action object. Through the FB_Action service, a write request may be issued to the action object. If the requested action is supported for the identified function, then the associated objects or blocks (and associated views object) will be created or deleted in the object dictionary.

This data structure consists of an action identifier and associated information concerning the type, function, and occurrence for their related object or block.

The following Table 5 provides the Action structured parameter Mnemonic (based on FOUNDATION™ Fieldbus specifications FF-890) and Action structured parameters mapping to the FDT data types. The mnemonic for the structure and each parameter should be used as name attribute value for parameter definition:

Table 5 – Action object definitions (refer to FF-890):

Structure [2]	Parameter mnemonic of member	Fieldbus foundation datatype/structure
ACTION_STRUCTURE	ACTION_STRUCTURE	DS-86
	ACTION_INDEX	-
	ACTION	Unsigned8
	FUNCTION	Unsigned32
	OCCURRENCE	Unsigned16

9.1.2.3 Link structure

Link structure objects provide a mapping between resources and the information exchanged via a communication network. Process data and events to be exchanged between function blocks within a resource or between resources may be defined through link objects. In addition, the communication exchange for support of trends and alerts may be defined using link objects.

Parameters with a class of output and input are connected by function block links.

Links between field devices and interface devices may be defined for access to trend objects, and alert reporting. Link objects identify block parameters, trend objects, events, and the communication characteristics that define how they exchange data. Through link object definition, the alerts and trends may be routed to different devices for processing.

The following Table 6 provides the Link structured parameter mnemonic (based on FOUNDATION™ Fieldbus specifications FF-890) and Link structured parameters mapping to the FDT data types. The mnemonic for the structure and each parameter should be used as the name attribute value for parameter definition:

Table 6 – Link object definitions

Structure	Parameter mnemonic of member	Fieldbus foundation data type/structure
LINK_STRUCTURE	LINK_STRUCTURE	DS-81
LINK_STRUCTURE (HSE)	LINK_STRUCTURE	DS-165
	LINK_TYPE	-
	LOCAL_INDEX	Unsigned32
	VCR_LINK_ID	Unsigned16
	VCR_NUMBER	Unsigned16
	REMOTE_INDEX	Unsigned32
	SERVICE_OPERATION	Unsigned8
	STALE_COUNT_LIMIT	Unsigned8
	H1_SUBSCRIBER_INDEX	Unsigned16

[2] The names for members are defined by the scheme: name of the structured variable „.“ Name of the Member (see definition of StructuredVariable within FDTDataTypes definition – members of structures are referenced within the definition.). For example TARGET of DS-69 would expand to MODE_BLK.TARGET.

9.1.2.4 Alert structure

Alert structured objects are used to communicate notification messages when alarms or events are detected. An event is an instantaneous occurrence that is significant to scheduling block execution and to the operational view of an application. An alarm is the detection of a block leaving a particular state and when it returns back to that state. The time at which the alert state was detected is included as a time stamp in the alert message. Also, the priority is included to indicate whether this is an advisory or critical alert.

Resources each have an alert notifier responsible for reporting their alert occurrences. Alerts may also be acknowledged. Alert objects are used to report alarm and event occurrences as event notification messages. Acknowledgment indicates that the alert has been processed by an interface device to satisfy operational interface requirements.

Based on the type of alarm and event information which may be reported by blocks contained in a resource, up to three classes of alerts may be defined in the resource:

- analog alert - alert used to report alarms or events whose associated value is the floating point;
- discrete alert - alert used to report alarms or events whose associated value is discrete;
- update alert - alert used to report a change in the static data of the block.

Table 7 provides the alert structured parameter mnemonic (based on specification FF-890) and alert structured parameters mapping to the FDT data types. The mnemonic for the structure and each parameter should be used as name attribute value for parameter definition:

Table 7 – Alert object definitions

Structure mnemonic	PARAMETER MNEMONIC OF MEMBER	Fieldbus foundation datatype/structure
ALERT_ANALOG	ALERT_ANALOG	DS-75
ALERT_ANALOG (HSE)	ALERT_ANALOG	DS-167
	BLOCK_INDEX	Unsigned16/Unsigned32
	ALERT_KEY	Unsigned8
	STANDARD_TYPE	Unsigned8
	MFR_TYPE	Unsigned8
	MESSAGE_TYPE	Unsigned8
	PRIORITY	Unsigned8
	TIME_STAMP	TimeValue
	SUBCODE	Unsigned16
	VALUE	Float
	RELATIVE_INDEX	Unsigned16/Unsigned32
	UNITINDEX	Unsigned16
ALERT_DISCRETE	ALERT_DISCRETE	DS-76
ALERT_DISCRETE(HSE)	ALERT_DISCRETE	DS-168
	BLOCK_INDEX	Unsigned16/Unsigned32
	ALERT_KEY	Unsigned8
	STANDARD_TYPE	Unsigned8
	MFR_TYPE	Unsigned8
	MESSAGE_TYPE	Unsigned8
	PRIORITY	Unsigned8

Structure mnemonic	PARAMETER MNEMONIC OF MEMBER	Fieldbus foundation datatype/structure
	TIME_STAMP	TimeValue
	SUBCODE	Unsigned16
	VALUE	Unsigned8
	RELATIVE_INDEX	Unsigned16/Unsigned32
	UNITINDEX	Unsigned16
ALERT_UPDATE	ALERT_UPDATE	DS-77
ALERT_UPDATE(HSE)	ALERT_UPDATE	DS-169
	BLOCK_INDEX	Unsigned16/Unsigned32
	ALERT_KEY	Unsigned8
	STANDARD_TYPE	Unsigned8
	MFR_TYPE	Unsigned8
	MESSAGE_TYPE	Unsigned8
	PRIORITY	Unsigned8
	TIME_STAMP	TimeValue
	STATIC_REVISION	Unsigned16
	RELATIVE_INDEX	Unsigned16/Unsigned32

9.1.2.5 Trend structure

Trend structure objects support management and control of function blocks by providing visibility into history information for reviewing their behavior. Based on the type of information collected, three classes of trend objects may be defined:

- trend float - trend object used to collect the values and status of floating point input and output parameters;
- trend discrete - trend object used to collect the values and status of discrete input and output parameters;
- trend bit string - trend object used to collect the values and status of bit string input and output parameters.

Trend objects provide for short term history data to be collected and stored within a resource. Such collection may be efficiently accessed by interface or temporary devices which gather this information to provide long term history data. Through link object configuration, some or all trend objects in a resource may be automatically reported to an interface device each time a new set of data is collected. Also, trend objects may be read at any time by an interface device using FMS read services.

Table 8 provides the Trend structured parameter mnemonic (based on specification FF-890) and Trend structured parameters mapping to the FDT data types. The mnemonic for the structure and each parameter should be used as name attribute value for parameter definition:

Table 8 – Trend object definitions

Structure mnemonic	Parameter mnemonic of member	Fieldbus foundation datatype/structure
TREND_FLOAT		DS-78
TREND_FLOAT (HSE)		DS-170
	BLOCK_INDEX	Unsigned16/Unsigned32

Structure mnemonic	Parameter mnemonic of member	Fieldbus foundation datatype/structure
	PARAMETER_RELATIVE_INDEX	Unsigned16
	SAMPLE_TYPE	Unsigned8
	SAMPLE_INTERVAL	Unsigned32
	LAST_UPDATE_TIME	TimeValue
	STATUS[0]	Unsigned8
	SAMPLES[0]	Float
	. . . . .	. . . .
	STATUS[15]	Unsigned8
	SAMPLES[15]	Float
TREND_DISCRETE		DS-79
TREND_DISCRETE (HSE)		DS-171
	BLOCK_INDEX	Unsigned16/Unsigned32
	PARAMETER_RELATIVE_INDEX	Unsigned16
	SAMPLE_TYPE	Unsigned8
	SAMPLE_INTERVAL	Unsigned32
	LAST_UPDATE_TIME	TimeValue
	STATUS[0]	Unsigned8
	SAMPLES[0]	Unsigned8
	. . . . .	. . . .
	STATUS[15]	Unsigned8
	SAMPLES[15]	Unsigned8
TREND_BIT_STRING		DS-80
TREND_BIT_STRING (HSE)		DS-172
	BLOCK_INDEX	Unsigned16/Unsigned32
	PARAMETER_RELATIVE_INDEX	Unsigned16
	SAMPLE_TYPE	Unsigned8
	SAMPLE_INTERVAL	Unsigned32
	LAST_UPDATE_TIME	TimeValue
	STATUS[0]	Unsigned8
	SAMPLES[0]	BitString
	. . . . .	. . . .
	STATUS[15]	Unsigned8
	SAMPLES[15]	BitString

9.1.2.6 View structure

View objects support management and control of function blocks by providing visibility into their configuration and operation. The first parameter of each view object is the static revision code. Accordingly, the remaining parameters included in the view block definition will follow the static revision code sequentially by order of their associated index within the function block. View objects provided for the grouping of dynamic and static data associated with

operation, diagnostic, and configuration. This grouping provides for efficient data transfer and processing.

Table 9 provides the view structured parameter mnemonic (based on specification FF-890) and the view structured parameters mapping to the FDT data types. The mnemonic for the structure and each parameter should be used as name attribute value for parameter definition:

Table 9 – View definition

Structure mnemonic	Parameter mnemonic of member	Fieldbus foundation datatype/structure
VIEW		
	VIEW_INDEX	Unsigned16/Unsigned32
	ELEMENT_1 (1. . . NUMBER OF ELEMENTS)	Unsigned16/Unsigned32

9.1.2.7 Domain object

A domain is a part of memory. It may contain programs or data. The FF specification defines that the domain data shall be of data type “octet string”. The encoding of information in the domain is not defined by FF specification. The maximum number of octets of a domain shall be defined in the domain object. Note that the domain state represents the DTM estimation of the real domain state in the device. Full definition of the domain object memer can be found in FF-870 Fieldbus Message Specification.

Table 10 provides the domain structured parameter mnemonic (based on specification FF-870) and domain structured parameters mapping to the FDT data types. The mnemonic for the structure and each parameter should be used as name attribute value for parameter definition:

Table 10 – Domain object definitions

Structure mnemonic	Parameter mnemonic of member	Fieldbus foundation datatype/structure
DOMAIN_DESCRIPTION		-
	INDEX	Unsigned32
	MAX_OCTETS	Unsigned32
	DOMAIN_STATE	Unsigned8
	UPLOAD_STATE	Unsigned8
	COUNTER	Integer8
	DOMAIN_DATA	OctetString

9.1.2.8 Program invocation object

The program invocation model provides services to link domains to a program, to start this program, to stop and to delete it. More than one program invocation may be created in a device.

Domain list associated with the PI object is provided by providing the OD index for each domain in the list. The number of domains can be caculated by counting the elements with name attribute value equal to “domain” in the PI object.

Table 11 provides the PI structured parameter mnemonic (based on specification FF-890) and PI structured parameters mapping to the FDT data types. The mnemonic for the structure and each parameter should be used as name attribute value for parameter definition:

Table 11 – Program invocation object definitions

Structure mnemonic	Parameter mnemonic of member	Fieldbus foundation datatype/structure
PROGRAM_INVOCATION		-
	PI_INDEX	Unsigned32
	REUSABLE	Integer8
	DELETABLE	Integer8
	PI_STATE	Integer8
	DOMAIN	Unsigned32

9.1.3 FF device data types

The following Table 12 specifies FF device data types and it provides description information about the FF devices.

Namespace: fdtffdevice

Table 12 – Structured FF device data types

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
BlockList	STRUCT			Provides the list of blocks in the device
	ffblock:BlockInformation	O	[0..*]	
HSEDeviceInformation	STRUCT			HSEDeviceInformation describes High Speed Eternet compatible devices including device version, redundancy, etc.
	ffhse:stateSMK	M	[1..1]	
	ffhse:repeatTimeHSE	O	[0..1]	
	ffhse:duplicateDetectionState	O	[0..1]	
	fftypes:ip	O	[0..1]	
	fftypes:IP	M	[1..1]	
	ffhse:DeviceInformation	M	[1..1]	
	ffhse:RedundancyInformation	O	[0..1]	
	ffhse:VersionInformation	O	[0..1]	
FoundationFieldbusH1 Device	STRUCT			FoundationFieldbusH1Device includes information describing H1 compatible devices
	fftypes:deviceType	M	[1..1]	
	fdt:tag	M	[1..1]	
	fftypes:devID	M	[1..1]	
	fftypes:VfdIdentification	M	[1..*]	
	fftypes:DataLinkAddress	M	[1..1]	
FoundationFieldbus-HSEDevice	STRUCT			Describes HSE compatible devices including the device address, VFD information, etc.
	fftypes:deviceType	M	[1..1]	
	fdt:tag	M	[1..1]	
	fftypes:devID	M	[1..1]	
	fftypes:VfdIdentification	M	[1..*]	
	HSEDeviceInformation	M	[1..1]	
	fftypes:DataLinkAddress	M	[1..1]	

9.2 BTM

9.2.1 General

In the case of a BTM, the following definitions are used instead of the DTM-specific definitions defined within the FDT specification.

9.2.2 Parameter access - FF specific definitions

Block parameters can be accessed through the following services:

- services to access instance data;

- services to access device data.

BTMs should use standard name attributes for standard block parameters. The following table provides the list of the standard block parameter mnemonic (based on specification FF-890, FF-891, FF-892, FF-893, and FF-894) and their mapping to the FDT data types.

The application domain for FF block parameters shall be “FDT_FFBlock”

The parameter mnemonic should be used as the name attribute value and as a semantic ID for the parameter definition as defined in Table 13:

Table 13 – Parameter mnemonic

Parameter mnemonic	Fieldbus foundation datatype/structure
ACCEPT_ALM	DS-72
ACCEPT_D	Unsigned8
ACCEPT_PRI	Unsigned8
ACK_OPTION	Bit String
ALARM_HYS	Float
ALARM_SUM	DS-74
ALERT_KEY	Unsigned8
ALGORITHM_SEL	Unsigned32
ALM_RATE_DN	Float
ALM_RATE_UP	Float
ARITH_TYPE	Unsigned8
AUTO_CYCLE	Unsigned8
BAL_TIME	Float
BIAS	Float
BIAS_IN_1	Float
BIAS_IN_2	Float
BIAS_IN_3	Float
BKCAL_HYS	Float
BKCAL_IN	DS-65
BKCAL_IN_1	DS-65
BKCAL_IN_2	DS-65
BKCAL_IN_D	DS-66
BKCAL_OUT	DS-65
BKCAL_OUT_D	DS-66
BKCAL_SEL_1	DS-65
BKCAL_SEL_2	DS-65
BKCAL_SEL_3	DS-65
BLOCK	DS-64
BLOCK_ALM	DS-72
BLOCK_ERR	Bit String
BYPASS	Unsigned8
CAS_IN	DS-65
CAS_IN_D	DS-66

Parameter mnemonic	Fieldbus foundation datatype/structure
CFM_ACT1_TIME	Float
CFM_ACT2_TIME	Float
CFM_PASS_TIME	Float
CHANNEL	Unsigned16
CHARACTERISTICS [3]	DS-64
CLOCK_PER	Float
CLR_FSTATE	Unsigned8
COMB_TYPE	Unsigned8
COMP_HI_LIM	Float
COMP_LO_LIM	Float
CONFIRM_TIME	Unsigned32
CONTENTS_REV	Unsigned32
CONTROL_OPTS	Bit String
CRACK_TIME	Float
CRACK_TIMER	Float
CURVE_X	Float
CURVE_Y	Float
CYCLE_SEL	Bit String
CYCLE_TYPE	Bit String
DC_STATE	Unsigned8
DD_RESOURCE	Visible String
DD_REV	Unsigned8
DEAD_TIME	DS-65
DELAY_TIME	Float
DELAY_TIMER	Float
DEV_REV	Unsigned8
DEV_TYPE	Unsigned16
DEVICE_OPTS	Bit string
DISABLE_1	DS-66
DISABLE_2	DS-66
DISABLE_3	DS-66
DISABLE_4	DS-66
DISC_ALM	DS-72
DISC_LIM	Unsigned8
DISC_PRI	Unsigned8
DURATION	DURATION_TYPE (10 Floats) [4]
DV_HI_ALM	DS-71
DV_HI_LIM	Float

[3] Represents the block structure of the block as defined in 5.14.1 of the specification FF-890.

[4] Defined as an array of 10 floats in the Fieldbus Foundation specification FF-892 and will be mapped to a StructuredVariable containing the elements of the array.

Parameter mnemonic	Fieldbus foundation datatype/structure
DV_HI_PRI	Unsigned8
DV_LO_ALM	DS-71
DV_LO_LIM	Float
DV_LO_PRI	Unsigned8
EXPAND_DN	Float
EXPAND_UP	Float
FAIL	Unsigned16
FAIL_ALM	DS-72
FAIL_PRI	Unsigned8
FAULT_STATE	Unsigned8
FCF_LOCATOR	LOCATOR (Unsigned32 Array) 5
FDD_LOCATOR	LOCATOR (Unsigned32 Array)
FEATURE_SEL	Bit String
FEATURES	Bit String
FF_GAIN	Float
FF_SCALE	DS-68
FF_VAL	DS-65
FIELD_VAL	DS-65
FIELD_VAL_D	DS-66
FILE_LOCATOR	LOCATOR (Unsigned32 Array)
FILE_REV	Unsigned32
FOLLOW	DS-66
FREE_SPACE	Float
FREE_TIME	Float
FSTATE_STATUS	Unsigned8
FSTATE_TIME	Float
FSTATE_VAL	Float
FSTATE_VAL_D	Unsigned8
FSTATE_VAL_D1	Unsigned8
FSTATE_VAL_D2	Unsigned8
FSTATE_VAL_D3	Unsigned8
FSTATE_VAL_D4	Unsigned8
FSTATE_VAL_D5	Unsigned8
FSTATE_VAL_D6	Unsigned8
FSTATE_VAL_D7	Unsigned8
FSTATE_VAL_D8	Unsigned8
FSTATE_VAL1	Float
FSTATE_VAL2	Float
FSTATE_VAL3	Float

5 Defined as an array of 3 Unsigned32 values in the Fieldbus Foundation specification FF-894 and will be mapped to a StructuredVariable containing the elements of the array.

Parameter mnemonic	Fieldbus foundation datatype/structure
FSTATE_VAL4	Float
FSTATE_VAL5	Float
FSTATE_VAL6	Float
FSTATE_VAL7	Float
FSTATE_VAL8	Float
GAIN	Float
GAIN_IN_1	Float
GAIN_IN_2	Float
GAIN_IN_3	Float
GOOD_LIM	Float
GRANT_DENY	DS-70
HARD_TYPES	Bit String
HI_ALM	DS-71
HI_BIAS	Float
HI_GAIN	Float
HI_HI_ALM	DS-71
HI_HI_BIAS	Float
HI_HI_LIM	Float
HI_HI_LIMX	Float
HI_HI_PRI	Unsigned8
HI_LIM	Float
HI_LIMX	Float
HI_PRI	Unsigned8
HYSTVAL	Float
IGNORE	Bit String
IGNORE_ALM	DS-72
IGNORE_PRI	Unsigned8
IGNORE_TIME	Float
IN	DS-65
IN_1	DS-65
IN_2	DS-65
IN_3	DS-65
IN_4	DS-65
IN_5	DS-65
IN_6	DS-65
IN_7	DS-65
IN_8	DS-65
IN_ARRAY	Float
IN_D	DS-66
IN_D1	DS-66
IN_D2	DS-66
IN_D3	DS-66
IN_D4	DS-66

Parameter mnemonic	Fieldbus foundation datatype/structure
IN_LO	DS-65
INPUT_OPTS	Bit string
INTEG_OPTS	Bit string
INTEG_TYPE	Unsigned8
INTERLOCK_D	DS-66
INVERT_OPTS	Bit string
IO_OPTS	Bit string
ITK_VER	Unsigned16
L_TYPE	Unsigned8
LAG_TIME	Float
LEAD_TIME	Float
LIM_NOTIFY	Unsigned8
LO_ALM	DS-71
LO_BIAS	Float
LO_GAIN	Float
LO_LIM	Float
LO_LIMX	Float
LO_LO_ALM	DS-71
LO_LO_BIAS	Float
LO_LO_LIM	Float
LO_LO_LIMX	Float
LO_LO_PRI	Unsigned8
LO_PRI	Unsigned8
LOCKVAL	Unsigned8
LOW_CUT	Float
MANUFAC_ID	Unsigned32
MAX_NOTIFY	Unsigned8
MEMORY_SIZE	Unsigned16
MIN_CYCLE_T	Unsigned32
MIN_GOOD	Unsigned8
MO_OPTS	Bit string
MODE_BLK	DS-69
N_RESET	Float
N_START	Unsigned16
NV_CYCLE_T	Unsigned32
OP_CMD_INT	Unsigned8
OP_CMD_SPG	Unsigned8
OP_SELECT	DS-66
OUT	DS-65
OUT_1	DS-65
OUT_1_RANGE	DS-68
OUT_2	DS-65
OUT_2_RANGE	DS-68

Parameter mnemonic	Fieldbus foundation datatype/structure
OUT_3	DS-65
OUT_4	DS-65
OUT_5	DS-65
OUT_6	DS-65
OUT_7	DS-65
OUT_8	DS-65
OUT_ALM	DS-66
OUT_ALM_SUM	Unsigned8
OUT_ARRAY	Float
OUT_D	DS-66
OUT_D5	DS-66
OUT_D6	DS-66
OUT_D7	DS-66
OUT_D8	DS-66
OUT_EXP	DS-65
OUT_HI_LIM	Float
OUT_LO_LIM	Float
OUT_PTRIP	DS-66
OUT_RANGE	DS-68
OUT_REM	DS-65
OUT_SCALE	DS-68
OUT_STATE	Unsigned16
OUT_TRIP	DS-66
OUTAGE_LIM	Float
PAUSE	DS-66
PAUSE_CAUSE	Unsigned8
PCT_INCL	Float
PERMISSIVE_D	DS-66
PI_POINTER	Unsigned32
PRE_OUT	DS-65
PRE_OUT_ALM	DS-66
PRE_OUT_D	DS-66
PRE_TRIP	Float
PSP	DS-65
PULSE_VAL1	Float
PULSE_VAL2	Float
PV	DS-65
PV_D	DS-66
PV_FTIME	Float
PV_SCALE	DS-68
PV_STATE	Unsigned16
QUIES_OPT	Unsigned8
RA_FTIME	Float

Parameter mnemonic	Fieldbus foundation datatype/structure
RANGE_HI	Float
RANGE_LO	Float
RATE	Float
RCAS_IN	DS-65
RCAS_IN_D	DS-66
RCAS_OUT	DS-65
RCAS_OUT_D	DS-66
READBACK	DS-65
READBACK_D	DS-66
RESET	Float
RESET_CONFIRM	DS-66
RESET_D	Unsigned8
RESET_IN	DS-66
RESTART	Unsigned8
RESTART_TIME	Float
REV_FLOW1	DS-66
REV_FLOW2	DS-66
ROUT_IN	DS-65
ROUT_OUT	DS-65
RS_STATE	Unsigned8
RTOTAL	Float
SEL_1	DS-65
SEL_2	DS-65
SEL_3	DS-65
SEL_TYPE	Unsigned8
SELECT_TYPE	Unsigned8
SELECTED	DS-66
SET_FSTATE	Unsigned8
SHED_OPT	Unsigned8
SHED_RCAS	Unsigned32
SHED_ROUT	Unsigned32
SHUTDOWN_D	DS-66
SIMULATE	DS-82
SIMULATE_D	DS-83
SP	DS-65
SP_D	DS-66
SP_HI_LIM	Float
SP_LO_LIM	Float
SP_RATE_DN	Float
SP_RATE_UP	Float
SPG_STATE	Unsigned8
SRTOTAL	Float
SSP	Float

Parameter mnemonic	Fieldbus foundation datatype/structure
ST_REV	Unsigned16
START	DS-66
START_TYPE	Unsigned8
START_VAL	START_VAL _TYPE (11 Floats) 6
STATUS_OPTS	Bit string
STEP_POSN	DS-66
STOTAL	Float
STRATEGY	Unsigned16
SWAP_2	Unsigned8
TAG_DESC	Octet string
TEST_RW	DS-85
TIME_POSN	DS-65
TIME_POSN_T	DS-65
TIME_UNIT1	Unsigned8
TIME_UNIT2	Unsigned8
TIME_UNITS	Unsigned8
TIMER_SP	Float
TIMER_TYPE	Unsigned8
TOTAL_SP	Float
TRAVEL_TIMER	Float
TRIP_TIME	Float
TRK_IN_D	DS-66
TRK_SCALE	DS-68
TRK_VAL	DS-65
UNCERT_LIM	Float
UNIT_CONV	Float
UPDATE_EVT	DS-73
WRITE_ALM	DS-72
WRITE_LOCK	Unsigned8
WRITE_PRI	Unsigned8
X_RANGE	DS-68
XD_SCALE	DS-68
XD_STATE	Unsigned16
Y_RANGE	DS-68

Table 14 describes the structure definitions (according to the FF specification) and their mapping to FDT data type definitions:

6 Defined as an array of 11 floats within Fieldbus Foundation specification FF-892 and will be mapped to a StructuredVariable containing the elements of the array.

Table 14 – Mnemonic of structured data types

Structure	Parameter mnemonic of member	Fieldbus foundation datatype/structure
DS-64		DS-64
DS-64		DS-166
	BLOCK_TAG	Visible String
	DD_MEMBER	Unsigned32
	DD_ITEM	Unsigned32
	DD_REVIS	Unsigned16
	PROFILE	Unsigned16
	PROFILE_REVISION	Unsigned16
	EXECUTION_TIME	Unsigned32
	EXECUTION_PERIOD	Unsigned32
	NUM_OF_PARAMS	Unsigned16
	NEXT_FB_TO_EXECUTE	Unsigned16/ Unsigned32
	VIEWS_INDEX	Unsigned16/ Unsigned32
	NUMBER_VIEW_3	Unsigned8
	NUMBER_VIEW_4	Unsigned8
DS-65		DS-65
	STATUS	Unsigned8
	VALUE	Float
DS-66		DS-66
	STATUS	Unsigned8
	VALUE	Unsigned8
DS-67		DS-67
	STATUS	Unsigned8
	VALUE	Bit String
DS-68		DS-68
	EU_100	Float
	EU_0	Float
	UNITS_INDEX	Unsigned16
	DECIMAL	Integer8
DS-69		DS-69
	TARGET	Bit String
	ACTUAL	Bit String
	PERMITTED	Bit String
	NORMAL	Bit String
DS-70		DS-70
	GRANT	Bit String
	DENY	Bit String
DS-71		DS-71
	UNACKNOWLEDGED	Unsigned8
	ALARM_STATE	Unsigned8

Structure	Parameter mnemonic of member	Fieldbus foundation datatype/structure
	TIME_STAMP	Time value
	SUB_CODE	Unsigned16
	VALUE	Float
DS-72		DS-72
	UNACKNOWLEDGED	Unsigned8
	ALARM_STATE	Unsigned8
	TIME_STAMP	Time value
	SUB_CODE	Unsigned16
	VALUE	Unsigned8
DS-73		DS-73
	UNACKNOWLEDGED	Unsigned8
	UPDATE_STATE	Unsigned8
	TIME_STAMP	Time value
	STATIC_REVISION	Unsigned16
	RELATIVE_INDEX	Unsigned16
DS-74		DS-74
	CURRENT	Bit String
	UNACKNOWLEDGED	Bit String
	UNREPORTED	Bit String
	DISABLED	Bit String
DS-82		DS-82
	SIMULATE_STATUS	Unsigned8
	SIMULATE_VALUE	Float
	TRANSDUCER_STATUS	Unsigned8
	TRANSDUCER_VALUE	Float
	ENABLE_DISABLE	Unsigned8
DS-83		
	SIMULATE_STATUS	Unsigned8
	SIMULATE_VALUE	Float
	TRANSDUCER_STATUS	Unsigned8
	TRANSDUCER_VALUE	Float
	ENABLE_DISABLE	Unsigned8
DS-84		
	SIMULATE_STATUS	Unsigned8
	SIMULATE_VALUE	BitString
	TRANSDUCER_STATUS	Unsigned8
	TRANSDUCER_VALUE	BitString
	ENABLE_DISABLE	Unsigned8
DS-85		DS-85
	VALUE_1	Boolean
	VALUE_2	Integer8
	VALUE_3	Integer16
	VALUE_4	Integer32

Structure	Parameter mnemonic of member	Fieldbus foundation datatype/structure
	VALUE_5	Unsigned8
	VALUE_6	Unsigned16
	VALUE_7	Unsigned32
	VALUE_8	Float
	VALUE_9	Visible String
	VALUE_10	Octet String
	VALUE_11	Date
	VALUE_12	Time of Day
	VALUE_13	Time Difference
	VALUE_14	Bit String
	VALUE_15	Time Value
DS-141		
	Reserved	OctetString
	Status	Unsigned8
	Value	Boolean
DS-142		
	Reserved	OctetString
	Status	Unsigned8
	Value	Integer8
DS-143		
	Reserved	OctetString
	Status	Unsigned8
	Value	Integer16
DS-144		
	Reserved	OctetString
	Status	Unsigned8
	Value	Integer32
DS-145		
	Reserved	OctetString
	Status	Unsigned8
	Value	Unsigned16
DS-146		
	Reserved	OctetString
	Status	Unsigned8
	Value	Unsigned 32
DS-147		
DS-148		
DS-149		
DS-150		
DS-151		
DS-152		
	Reserved	OctetString
	Status	Unsigned8

Structure	Parameter mnemonic of member	Fieldbus foundation datatype/structure
	Value	VisibleString
DS-153		
	Status	Unsigned8
	Value	Date
DS-154		
	Reserved	OctetString
	Status	Unsigned8
	Value	TimeOfDay
DS-155		
	Reserved	OctetString
	Status	Unsigned8
	Value	TimeDifference
DS-156		
	Reserved	OctetString
	Status	Unsigned8
	Value	Time
DS – 157		
DS – 158		
	Reserved	OctetString
	Status	Unsigned8
	Value	BitString(32)/ BitString(64)
DS – 159		
	Reserved	OctetString
	Status	Unsigned8
	Value_1	Unsigned8
	. . . .	
	Value_8	Unsigned8
DS – 160		
	Reserved	OctetString
	Status	Unsigned8
	Value_1	Unsigned8
	. . . .	
	Value_16	Unsigned8
DS – 161		
	Reserved	OctetString
	Status	Unsigned8
	Value_1	Unsigned8
	. . . .	
	Value_32	Unsigned8
DS – 162		
	Reserved	OctetString
	Status	Unsigned8

Structure	Parameter mnemonic of member	Fieldbus foundation datatype/structure
	Value_1	Float
	. . . .	
	Value_8	Float
DS – 163		
	Reserved	OctetString
	Status	Unsigned8
	Value_1	Float
	. . . .	
	Value_16	Float
DS – 164		
	Reserved	OctetString
	Status	Unsigned8
	Value_1	Float
	. . . .	
	Value_24	Float
DURATION_TYPE	DURATION_1 -	Float
	DURATION_10	Float
START_VAL _TYPE	START_VAL _1	Float
	START_VAL _11	Float
LOCATOR	KEY	Unsigned32
	LENGTH	Unsigned32
	LOCATION_INDEX	Unsigned32

Table 15 describes the simple common data types (according to the FF specification) and their mapping to FDT data type definitions:

Table 15 – Simple common data types

FF data type definition	FDT datatype	Note
Boolean	Int	Definition: == 0 is False != 0 is True
Integer 8	Int	Note that only the first 8 bits (LSBs) will be used
Integer 16	Int	Note that only the first 16 bits (LSBs) will be used
Integer 32	Int	
Unsigned 8	Unsigned	Note that only the first 8 bits (LSBs) will be used
Unsigned 16	Unsigned	Note that only the first 16 bits (LSBs) will be used
Unsigned 32	Unsigned	
Floating Point	Float	
Visible String	ascii	Please see FF-870, 9.3.1.5 for a detailed definition and byte sequence
Octet String	hexString	Please see FF-870, 9.3.1.6 for a detailed definition and byte sequence of Octet string
Date	dateAndTime	The standard dateTime data type will be used to present the value

FF data type definition	FDT datatype	Note
Time of Day	dateAndTime	The standard dateTime data type will be used to present the value
Time Difference	hexString	Please see FF-870, 9.3.1.9 for a detailed definition and byte sequence of Time Difference
Bit String	bitString	NOTE Bit enumerations will be used if possible
Time Value	hexString	Please see FF-870, 9.3.1.11 for a detailed definition and byte sequence of Time Value

10 Network management data types

10.1 General

The management definitions will be used as an inline definition within an instance of the DTMParameterDefinition at the element 'BusInformation\UserDefinedBus' as an inline definition.

10.2 H1 network management definitions

The H1 Fieldbus Management data types are defined in Table 16 and used with namespace: ffH1Mngmnt:)

Table 16 – H1 Fieldbus Management data types

Name	Description
ListOfH1NmaVfds	List of Network Management VFDs
H1NmaVfd	The Network Management Agent is an application process modeled by the Management VFD. The Management VFD is shared between the NMA and the System Management Kernel, and contains the NMIB and the SMIB
NMIB	Network Management Information Base
SMIB	System Management Information Base

10.3 HSE network management data types

The simple HSE Fieldbus Management definitions are listed in Table 17 and used with namespace: ffhsemngmnt

Table 17 – Simple HSE Fieldbus Management Definitions

Data type	Definition	Description
actualNumberOfVFDs	UDINT	Actual Number of VFDs. FF-803 FS 1.19 SM Section 6.2.1
bufferSize	UDINT	This attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the Buffer Size. DEFAULT_BUFFER_SIZE = 1460 FF-803 FS 1.19 NM Section 5.1.2.
capableTimeSyncClass	UDINT	This variable specifies the time sync class that the SNTP time client in the HSE Presence is capable of supporting. The enumeration of time sync classes is as shown below, defined in IEC 61158-4-1, 7.6, subfield TTT. FF-803 FS 1.19 SM Section 6.2.2.1.

Data type	Definition	Description
daylightTimeDifference	DINT	This variable contains the number of signed ticks to add to Current Time to obtain Daylight time-stamp time. It is used instead of Standard Time Difference when Current Time is inside of the interval defined by Start Daylight Time and End Daylight Time. FF-803 FS 1.19 SM Section 6.2.2.1
discardedForForwardingDelayExceeded	UDINT	
discardedForLackOfBuffers	UDINT	This element counts the number of valid frames that should have been submitted for transmission on one or more outbound interfaces, but were discarded because of a lack of available forwarding buffers. FF-803 FS 1.19 NM Section 5.9.6
dstLinkAddress	UDINT	This attribute contains the 16-bit destination address (HL) of the message that should be forwarded by the H1 Bridge. If the value is 0, then this entry is not configured. FF-803 FS 1.19 NM Section 5.9.5
endpointType	USINT	This attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the Endpoint Type, and indicates the type of the endpoint. FF-803 FS 1.19 NM Section 5.1.2
fasDllMaxConfirmDelayOnConnect	UINT	This element is defined in the Network Management Specification [FF-801] as FasDllMaxConfirmDelayOnConnect. FF-803 FS 1.19 NM Section 5.9.4
fasDllMaxDlsduSize	UINT	This element is defined in the Network Management Specification [FF-801] as FasDllMaxDlsduSize. FF-803 FS 1.19 NM Section 5.9.4
fasDllSDAP	USINT	This element is defined in the Network Management Specification [FF-801] as FasDllSDAP. . FF-803 FS 1.19 NM Section 5.9.4
fBScheduleDescriptor		This attribute is the OD index of the FB Schedule Descriptor Record. The value of this attribute is FB Schedule OD Index + 2 + offset, where offset represents the zero-based position in the list. That is, the offset of the first record in the list is zero. The offset is no greater than the number of schedules specified in the FB Schedule List Characteristics record minus 1. FF-803 FS 1.19 SM Section 6.2.5.2
fdaAddress	ARRAY OF USINT	This attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the FDA Address. FF-803 FS 1.19 NM Section 5.1.3
fdaGuardBand	UDINT	This attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the Guard Band. FF-803 FS 1.19 NM Section 5.2.1
filteringDatabaseListHeaderOdIndex	UDINT	This is an instance of the ListHeader class representing the Filtering Database header. FF-803 FS 1.19 NM Section 5.9.1
forwardedInbound	UDINT	This element counts the number of valid frames received by the interface that were submitted for transmission on one or more outbound interfaces. FF-803 FS 1.19 NM Section 5.9.6
h1ConfiguratorAddress	UDINT	This element contains the H1 address of the H1 configurator device. FF-803 FS 1.19 NM Section 5.9.3
h1DlOperatFunctionalClassSupported	USINT	This attribute corresponds to the class supported by all H1 interfaces of a linking device. It has the same definition of DlOperatFunctionalClass attribute specified in the Network Management Specification [FF-801]. Its value is zero when the HSE device is not a linking device. FF-803 FS 1.19 NM Section 5.2.1
h1Timeout	UDINT	This attribute defines the amount of time, in milliseconds, that the Linking Device waits before releasing invoke ids that were allocated for FMS and/or SM requests sent on any H1 interface. FF-803 FS 1.19 NM Section 5.2.1
hseSubnetMask	ARRAY OF USINT	This attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the HSE Subnet Mask. FF-803 FS 1.19 NM Section 5.1.3

Data type	Definition	Description
hseSubnetMaskBits	ARRAY OF USINT	This attribute when ANDED with an IP address or HSE Subnet Mask yields the HSE subnet address defined in the Field Device Access (FDA) Agent Specification [FF-588]. It is used for HSE VCRs with the HSE Subnet Mask attribute. FF-803 FS 1.19 NM Section 5.2.1
hseVcrType	UDINT	This attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the HSE VCR Type, and indicates the type of the HSE VCR. FF-803 FS 1.19 NM Section 5.1.3
ignoredInbound	UDINT	This element counts the number of valid frames received by the interface that the Forwarding Process determined did not need forwarding. FF-803 FS 1.19 NM Section 5.9.6
inactivityCloseTime	UDINT	This attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the Inactivity Close Time. DEFAULT_INACTIVITY_CLOSE_TIME = 30 s FF-803 FS 1.19 NM Section 5.1.2
installedInterfaces	ARRAY OF USINT	Installed Interfaces. The entry "Installed" means the hardware is in place and functioning. Each bit in the entry corresponds to an H1 interface with bit k corresponding to interface k. Bit 1 is the MSB. FF-803 FS 1.19 SM Section 6.2.1
interfaceLinkId	UINT	
interfaceNodeId	USINT	
interfaceNumber	USINT	This attribute specifies the index into the InterfaceAddressArray for forwarding. FF-803 FS 1.19 NM Section 5.9.5
interfaceStateArray	ARRAY OF USINT	
interfaceStatisticsSupported	ARRAY OF USINT	The value of this element indicates the interface statistics supported. FF-803 FS 1.19 NM Section 5.9.2
lastSNTPMessage	ARRAY OF USINT	This object holds the first 48 octets of the last SNTP message received. This object contains only dynamic data, which does not affect the calculation of version numbers. FF-803 FS 1.19 SM Section 6.2.2
maxForwardingDelayNormal	UINT	This attribute is defined in the Data Link Protocol Specification: Bridge Operation Addendum [FF-806]. 1/32 ms FF-803 FS 1.19 NM Section 5.9.2
maxForwardingDelayTimeAvailable	UINT	This attribute is defined in the Data Link Protocol Specification: Bridge Operation Addendum [FF-806]. Unit = 1/32 ms. FF-803 FS 1.19 NM Section 5.9.2
maxForwardingDelayUrgent	UINT	This attribute is defined in the Data Link Protocol Specification: Bridge Operation Addendum [FF-806]. Unit = 1/32 ms. FF-803 FS 1.19 NM Section 5.9.2
maxMessageLength	UDINT	This attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the Max Message Length. FF-803 FS 1.19 NM Section 5.1.2
maxNumberOfInterfaces	UDINT	The entry "Max number of interfaces (M)" indicates the maximum number of H1 interfaces that can be installed into the device. The maximum value for this entry is 30. See the Network Management specification [FF-803] on Bridge Characteristics. FF-803 FS 1.19 SM Section 6.2.1
maxNumberOfVFDs	UDINT	Maximal Number of VFDs. FF-803 FS 1.19 SM Section 6.2.1
maxNumEntries	UDINT	This element indicates the maximum number of entries that may be defined in the list (NumConfigured + NumUnconfigured). FF-803 FS 1.19 NM Section 5.1.1
maxNumOfVcrs	UDINT	This element contains the counter for the maximum number of HSE VCRs that have been concurrently related to the Session Endpoint Entry object. This element represents the “high water mark” for the number of VCRs related to this session. This attribute may not be written. FF-803 FS 1.19 NM Section 5.5.2

Data type	Definition	Description
minForwardingDelayNormal	UINT	This attribute is defined in the Data Link Protocol Specification: Bridge Operation Addendum [FF-806]. 1/32 ms. FF-803 FS 1.19 NM Section 5.9.2
minForwardingDelayTimeAvailable	UINT	This attribute specifies the lowest value the device supports for MinForwardingDelayTimeAvailable. Unit = 1/32 ms. FF-803 FS 1.19 NM Section 5.9.2
minForwardingDelayUrgent	UINT	This attribute specifies the lowest value the device supports for MaxForwardingDelayUrgent. Unit = 1/32 ms. FF-803 FS 1.19 NM Section 5.9.2
minRepublishingDelay	UINT	This attribute is defined in the Data Link Protocol Specification: Bridge Operation Addendum [FF-806]. Unit = 1/32 ms. FF-803 FS 1.19 NM Section 5.9.2
msgHdrOptions	ARRAY OF USINT	This attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the Message Header Options. DEFAULT_HDR_OPTIONS = 0 FF-803 FS 1.19 NM Section 5.1.2
msgHdrOptionsSupported	ARRAY OF USINT	This attribute defines the message header options that are supported by the HSE device. FF-803 FS 1.19 NM Section 5.2.1
nmaConfigurationUse	USINT	This attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the NMA Configuration Use. Set this attribute to zero when writing to any attribute of the SessionEndpointEntry class. FF-803 FS 1.19 NM Section 5.1.2.
numberOfInterfaces	USINT	This attribute defines the number of H1 interfaces of the H1 Bridge. Its maximum value is 30, because of the FasDllMaxDlsduSize attribute of Standardized Management Relationship in the Network Management Specification [FF-801]. FF-803 FS 1.19 NM Section 5.9.2.
numberOfSchedule	UINT	This attribute contains the number of schedule domains that contain schedules. It is incremented each time that a new schedule domain is downloaded. It is decremented each time that a schedule domain is initialized. FF-803 FS 1.19 SM Section 6.2.5.1
numConfigured	UDINT	This element indicates the number of entries in the list that are currently configured (independently of whether or not they are being used). It may be written, but only the value zero should be written. Writing zero causes the list to be cleared, with three exceptions.FF-803 FS 1.19 NM Section 5.1.1
numOfAborts	UDINT	This element contains the counter for the number of times the HSE VCR has been aborted, either by the user or by the communication stack. This attribute may not be written. FF-803 FS 1.19 NM Section 5.8.2
NumOfConfirmedRequestMessagesReceived	UDINT	NumOfRequestMessagesReceived This element contains the counter for the number of confirmed request messages received from the VCR. This attribute may not be written. FF-803 FS 1.19 NM Section 5.8.2
NumOfConfirmedRequestMessagesSent	UDINT	This element contains the counter for the number of confirmed request messages sent from the VCR. This attribute may not be written. . FF-803 FS 1.19 NM Section 5.8.2
numOfConnects	UDINT	This element contains the counter for the number of times the HSE VCR has been connected, either by the user or by the communication stack. This attribute may not be written FF-803 FS 1.19 NM Section 5.8.2
numOfDuplicatedMessages	UDINT	This element contains the counter for the number of duplicated messages the HSE VCR has received. See Field Device Access (FDA) Agent Specification [FF-588]. FF-803 FS 1.19 NM Section 5.8.2
numOfErrorMessagesReceived	UDINT	This element contains the counter for the number of negative response messages received through the HSE VCR. This attribute may not be written. FF-803 FS 1.19 NM Section 5.8.2

Data type	Definition	Description
numOfErrorMessagesSent	UDINT	This element contains the counter for the number of negative response messages sent through the HSE VCR. This attribute may not be written. FF-803 FS 1.19 NM Section 5.8.2
numOfInvalidMsgsReceived	UDINT	This element contains the counter for the number of invalid FDA messages received. This attribute may not be written. FF-803 FS 1.19 NM Section 5.5.2
numOfLateMessages	UDINT	This element contains the counter for the number of late messages the HSE VCR has received. See Field Device Access (FDA) Agent Specification [FF-588]. FF-803 FS 1.19 NM Section 5.8.2
numOfLossOfSyncMessages	UDINT	This element contains the counter for the number of losses of sync the HSE VCR has detected. See Field Device Access (FDA) Agent Specification [FF-588]. FF-803 FS 1.19 NM Section 5.8.2
numOfMissedMessages	UDINT	This element contains the counter for the number of messages the HSE VCR has missed. See Field Device Access (FDA) Agent Specification [FF-588]. FF-803 FS 1.19 NM Section 5.8.2
numOfMsgsReceived	UDINT	This element contains the counter for the number of FDA messages received. This attribute may not be written. FF-803 FS 1.19 NM Section 5.5.2
numOfMsgsSent	UDINT	This element contains the counter for the number of FDA messages sent. This attribute may not be written. FF-803 FS 1.19 NM Section 5.5.2
numOfNonMisorderedMessages	UDINT	
numOfOpenStateCtr	UDINT	This element contains the counter for the number of times the Session Endpoint was opened. This attribute may not be written. FF-803 FS 1.19 NM Section 5.5.2
numOfResponseMessagesReceived	UDINT	This element contains the counter for the number of positive response messages received through the HSE VCR. This attribute may not be written. FF-803 FS 1.19 NM Section 5.8.2
numOfResponseMessagesSent	UDINT	NumOfPositiveResponseMessagesSent. This element contains the counter for the number of positive response messages sent through the HSE VCR. This attribute may not be written. FF-803 FS 1.19 NM Section 5.8.2
numOfUnconfirmedMessagesReceived	UDINT	This element contains the counter for the number of unconfirmed request messages received from the VCR. This attribute may not be written. FF-803 FS 1.19 NM Section 5.8.2
numOfUnconfirmedMessagesSent	UDINT	
onChangeRefreshRate	USINT	This attribute is used for an HSE Local Publisher VCR that is not transferring due OnChangeThreshold (see Field Device Access (FDA) Agent Specification [FF-588]). It determines how many publisher execution cycles the HSE Local Publisher VCR must wait before transferring the latest published variable value. FF-803 FS 1.19 NM Section 5.2.1
onChangeThreshold	UDINT	This attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the On Change Threshold. FF-803 FS 1.19 NM Section 5.1.3
repubAddress	UDINT	This is the 32-bit republishing address: FF-803 FS 1.19 NM Section 5.9.4
republishingDatabaseListHeaderOdIndex	UDINT	

Data type	Definition	Description
restartStatisticsCollectionControl	USINT	This element is used to restart statistics collection of all entries in the specified statistics entry list. Restarting statistics collection causes the StatisticsCollectionStartTime to be updated and all statistics counters to be cleared and restarted. FF-803 FS 1.19 NM Section 5.2.1. 0 Do nothing 1 Restart statistics collection for all entries of the Session Statistics List. 2 Restart statistics collection for all entries of the HSE VCR Statistics List. 3 Restart statistics collection for all entries of the Session Statistics List and of the HSE VCR Statistics List
rootInterface	USINT	The interface number of the H1 Bridge which is the root interface, if any. FF-803 FS 1.19 NM Section 5.9.2
scheduleSyncPeriod	UDINT	This variable contains an argument of the modulus function described in section 4.6 that is used to determine the next start time for a macrocycle, in ticks. FF-803 FS 1.19 SM Section 6.2.2.1
sessionMaxOutstanding	UDINT	This element represents the maximum number of requests that a client or server endpoint may have outstanding at any point in time (see Field Device Access (FDA) Agent Specification [FF-588]). FF-803 FS 1.19 NM Section 5.2.1
sessionStatisticsControlDefaultValue	USINT	This element contains the default value used for the StatisticsControl attribute of the SessionStatistics entry. Its initial value is “OnOpening”. When a SessionStatistics entry is initialized, the value of its StatisticsControl attribute is set to this value. FF-803 FS 1.19 NM Section 5.2.1
sNTPTimestamp	UDINT	This array object holds the four times used to calculate delay and offset, described in RFC-2030 as T1, T2, T3 and T4. The first element in the array holds the integer seconds part of T1. The second element holds the fractional seconds of T1. The remaining records repeat this sequence for the remaining SNTP times. This object contains only dynamic data, which does not affect the calculation of version numbers. FF-803 FS 1.19 SM Section 6.2.2
standardTimeDifference	DINT	This variable contains the number of signed ticks to add to Current Time to obtain Standard time-stamp time. It is used instead of Daylight Time Difference when Current Time is outside of the interval defined by Start Daylight Time and End Daylight Time, or if Start Daylight Time is zero.FF-803 FS 1.19 SM Section 6.2.2.1
state	USINT	This read-only attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the State, and specifies the session endpoint state. Set this attribute to zero when writing to any attribute of the SessionEndpointEntry class. FF-803 FS 1.19 NM Section 5.2.1
statisticsControl	USINT	This attribute specifies when the statistics collection is to be started and restarted. Restarting statistics collection causes the StatisticsCollectionStartTime to be updated and all statistics counters to be cleared and restarted. FF-803 FS 1.19 NM Section 5.8.2
subAddress	UDINT	This is the 32-bit subscribe to address. If the value is 0, then this entry is not configured. FF-803 FS 1.19 NM Section 5.9.4
targetTimeSyncClass	UDINT	This variable represents the configured time synchronization class for the SNTP time client in the HSE Presence. The enumeration is the same as the Capable Time Sync Class. FF-803 FS 1.19 SM Section 6.2.2.1
tcpProtocolSupported	BOOL	This attribute defines if the HSE device supports the TCP protocol or not. It is set to TRUE when the HSE device supports the TCP protocol. Otherwise, it is set to FALSE. FF-803 FS 1.19 NM Section 5.2.1

Data type	Definition	Description
timeRequestInterval	UDINT	This variable contains the time in ticks that the SNTP time client in the HSE Presence waits between sending requests to the time server. A value of zero means that the device will calculate this number. Values less than 10 s are not allowed if the device cannot calculate the interval.FF-803 FS 1.19 SM Section 6.2.2.1
timeRequestTimeout	UDINT	This variable contains the time in ticks that the SNTP time client in the HSE Presence waits for the time server to answer a time request. FF-803 FS 1.19 SM Section 6.2.2.1
transmitDelayTime	UDINT	This attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the Transmit Delay Time. DEFAULT_TRANSMIT_DELAY = 0 FF-803 FS 1.19 NM Section 5.1.2
transportProtocol	USINT	This attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the Transport Protocol, and identifies the transport protocol used for the session. FF-803 FS 1.19 NM Section 5.1.2
vcrStatisticsControlDefaultValue	USINT	This element contains the default value used for the StatisticsControl attribute of the VcrStatistics entry. Its initial value is “OnOpening”. FF-803 FS 1.19 NM Section 5.2.1
vcrUserId	UDINT	This attribute contains the value of the VCR User Id attribute of the VCR entry identified by the HseVcrEntryOdIndex attribute of this entry. FF-803 FS 1.19 NM Section 5.8.2
vfdServerSelector	UDINT	This attribute is the selector for the generic server VCR for this VFD. The VFD Server Selector attribute of the HSE and H1 NMA VFDs is set to 0 to indicate that the FMS VCR Selector Connect Option cannot be used with these VFDs. See the FDA specification [FF-588]. It is assigned by the device. FF-803 FS 1.19 SM Section 6.2.4.1

The structured HSE Fieldbus Network Management definitions are listed in Table 18.

Table 18 – Structured HSE Network management data types

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
ActiveScheduleIndex	STRUCT			This attribute is the index of the domain of the currently active schedule. FF-803 FS 1.19 SM Section 6.2.5.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fdt:index	M	[1..1]	
ActiveScheduleVersion	STRUCT			This attribute specifies the version of the schedule currently executed. FF-803 FS 1.19 SM Section 6.2.5.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fftypes:versionNumber	M	[1..1]	
ActualNumberOfVFDs	STRUCT			FF-803 FS 1.19 NM Section 5.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
	actualNumberOfVFDs	M	[1..1]	
AutomaticSessionList	STRUCT			Automatic Session List element definition. FF-803 FS 1.19 NM Section 5.4.1
	ListHeader	M	[1..1]	
	ListOfSessionEndpoints	M	[1..1]	
AutomaticSessionList	STRUCT			Automatic Session List element definition. FF-803 FS 1.19 NM Section 5.4.1
	ListHeader	M	[1..1]	
	ListOfSessionEndpoints	M	[1..1]	
BridgeCharacteristics	STRUCT			Bridge Characteristics element definition. FF-803 FS 1.19 NM Section 5.9.2
	Version	M	[1..1]	
	NumberOfInterfaces	M	[1..1]	
	RootInterface	M	[1..1]	
	InterfaceStatisticsSupported	M	[1..1]	
	MaxForwardingDelayUrgent	M	[1..1]	
	MinForwardingDelayUrgent	M	[1..1]	
	MaxForwardingDelayNormal	M	[1..1]	
	MinForwardingDelayNormal	M	[1..1]	
	MaxForwardingDelayTimeAvailable	M	[1..1]	
	MinForwardingDelayTimeAvailable	M	[1..1]	
	MinRepublishingDelay	M	[1..1]	
	RepublishingDatabaseListHeaderOdIndex	M	[1..1]	
BufferSize	STRUCT			This attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the Buffer Size. DEFAULT_BUFFER_SIZE = 1460 FF-803 FS 1.19 NM Section 5.1.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	bufferSize	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
CapableTimeSyncClass	STRUCT			This variable specifies the time sync class that the SNTP time client in the HSE Presence is capable of supporting. The enumeration of time sync classes is as shown below, defined in the IEC 61158-4-1 7.6, subfield TTT. FF-803 FS 1.19 SM Section 6.2.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	capableTimeSyncClass	M	[1..1]	
ConfiguredSessionList	STRUCT			The ConfiguredSessionList is the list of Configured Session definitions. Each entry in the list may contain a defined Configured Session, or it may be empty. FF-803 FS 1.19 NM Section 5.3.1
	ListHeader	M	[1..1]	
	ListOfSessionEndpoints	M	[1..1]	
CurrentNmaConfigurationAccess	STRUCT			This attribute, when not zero, is a record object containing the identification of the HSE or H1 configurator application that currently has configuration access to any (or all) linking device NMA VFD(s). FF-803 FS 1.19 NM Section 5.9.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	NmaConfigurationAccess	M	[1..1]	
DaylightTimeDifference	STRUCT			This variable contains the number of signed ticks to add to Current Time to obtain Daylight time-stamp time. It is used instead of Standard Time Difference when Current Time is inside of the interval defined by Start Daylight Time and End Daylight Time. FF-803 FS 1.19 SM Section 6.2.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	DaylightTimeDifference	M	[1..1]	
DDDomainIndex	STRUCT			This attribute is the numeric identifier for the domain that contains any device resident DD. It is assigned by the device. FF-803 FS 1.19 SM Section 6.2.4.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fdt:index	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
DeviceContentsDomain	STRUCT			This allows for software upload and download of the device. Device manufacturers define the content of the domain. FF-803 FS 1.19 SM Section 6.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fftypes:domain	M	[1..1]	
DeviceIdentification	STRUCT			The Device Identification record contains the data for the unique identification of the physical device and the application currently assigned to it. FF-803 FS 1.19 SM Section 6.2.3
	fftypes:DeviceId	M	[1..1]	
	fftypes:PdTag	M	[1..1]	
	DeviceIndex	M	[1..1]	
	DeviceType	M	[1..1]	
DeviceIndex	STRUCT			This attribute is a site administered number that identifies the device. This index is unique within an HSE subnet. FF-803 FS 1.19 SM Section 6.2.5
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fftypes:deviceIndex	M	[1..1]	
DeviceType	STRUCT			FF-803 FS 1.19 NM Section 5.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fftypes:deviceType	M	[1..1]	
DiscardedForForwardingDelayExceeded	STRUCT			FF-803 FS 1.19 NM Section 5.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	discardedForForwardingDelayExceeded	M	[1..1]	
DiscardedForLackOfBuffers	STRUCT			This element counts the number of valid frames that should have been submitted for transmission on one or more outbound interfaces, but were discarded because of a lack of available forwarding buffers. FF-803 FS 1.19 NM Section 5.9.6
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	DiscardedForLackOfBuffers	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
DlmeBridge	STRUCT			This element defines the management of the Data Link Bridge. FF-803 FS 1.19 NM Section 5.9.1
	BridgeCharacteristics	M	[1..1]	
	CurrentNmaConfigurationAccess	M	[1..1]	
	PreviousNmaConfigurationAccess	M	[1..1]	
	InterfaceAddressArray	M	[1..1]	
	InterfaceDesiredStateArray	M	[1..1]	
	InterfaceActualStateArray	M	[1..1]	
	InterfaceStatisticsList	O	[0..1]	
	RepublishingDatabase	O	[0..1]	
	FilteringDatabase	O	[0..1]	
DomainIndex	STRUCT			This attribute is the OD index of the domain for this schedule descriptor. It is set by the manufacturer. FF-803 FS 1.19 SM Section 6.2.5.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fdt:index	M	[1..1]	
DstLinkAddress	STRUCT			This attribute contains the 16-bit destination address (HL) of the message that should be forwarded by the H1 Bridge. If the value is 0, then this entry is not configured. FF-803 FS 1.19 NM Section 5.9.5
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	dstLinkAddress	M	[1..1]	
EndDaylightTime	STRUCT			This variable contains the value of Current Time that defines the end of the Daylight Time interval. Daylight Time never starts if the value is less than Start Daylight Time. FF-803 FS 1.19 SM Section 6.2.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fftypes:timeValue	M	[1..1]	
EndpointType	STRUCT			This attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the Endpoint Type, and indicates the type of the endpoint. FF-803 FS 1.19 NM Section 5.1.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	endpointType	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
FasDllMaxConfirmDelayOnConnect	STRUCT			This element is defined in the Network Management Specification [FF-801] as FasDllMaxConfirmDelayOnConnect. FF-803 FS 1.19 NM Section 5.9.4
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fasDllMaxConfirmDelayOnConnect	M	[1..1]	
FasDllMaxDlsduSize	STRUCT			This element is defined in the Network Management Specification [FF-801] as FasDllMaxDlsduSize. FF-803 FS 1.19 NM Section 5.9.4
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fasDllMaxDlsduSize	M	[1..1]	
FasDllSDAP	STRUCT			This element is defined in the Network Management Specification [FF-801] as FasDllSDAP. . FF-803 FS 1.19 NM Section 5.9.4
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fasDllSDAP	M	[1..1]	
FbSchedule	STRUCT			FF-803 FS 1.19 NM Section 5.2.1
	ScheduleActivation	M	[1..1]	
	ScheduleListCharacteristics	M	[1..1]	
	ListOfFBScheduleDescriptors	M	[1..1]	
FBScheduleDescriptor	STRUCT			The FB Schedule objects pertain to FBs scheduled in this device. FF-589 FS 1.19 SM Section 6.2.5. This attribute is the OD index of the FB Schedule Descriptor Record. The value of this attribute is FB Schedule OD Index + 2 + offset, where offset represents the zero-based position in the list. That is, the offset of the first record in the list is zero. The offset is no greater than the number of schedules specified in the FB Schedule List Characteristics record minus 1. FF-803 FS 1.19 SM Section 6.2.5.2
	ScheduleVersion	M	[1..1]	
	fftypes:MacrocycleDuration	M	[1..1]	
	DomainIndex	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
FdaAddress	STRUCT			This attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the FDA Address. FF-803 FS 1.19 NM Section 5.1.3
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fdaAddress	M	[1..1]	
FdaGuardBand	STRUCT			This attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the Guard Band. FF-803 FS 1.19 NM Section 5.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fdaGuardBand	M	[1..1]	
FilteringDatabase	STRUCT			The NMIB FilteringDatabase is used for cascaded bridges (for links not immediately attached to this H1 Bridge). The NMA loads information from InterfaceAddressArray and NMIB FilteringDatabase into DLL Bridge filtering database. FF-803 FS 1.19 NM Section 5.2.1
	ListHeader	M	[1..1]	
	ListOfFilteringDatabaseRecords	M	[1..1]	
FilteringDatabaseListHeaderOdIndex	STRUCT			This is an instance of the ListHeader class representing the Filtering Database header. FF-803 FS 1.19 NM Section 5.9.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fdt:index	M	[1..1]	
FilteringEntry	STRUCT			This class is used to define the data routing between H1 interfaces. Each FilteringEntry may contain information for forwarding, or it may be empty (unconfigured). FF-803 FS 1.19 NM Section 5.2.1
	DstLinkAddress	M	[1..1]	
	InterfaceNumber	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
FirstConfiguredIndex	STRUCT			This element is the OD Index of the first entry in the list that is currently configured. If there are no configured entries, the value of this element is zero. Note that configured entries are not necessarily consecutive (i.e. one should not assume consecutive OD Indexes for configured entries). FF-803 FS 1.19 NM Section 5.1.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fdt:index	M	[1..1]	
FirstUnconfiguredIndex	STRUCT			This element is the OD Index of the first entry in the list that is currently not configured. If there are no unconfigured entries (all entries are configured), the value of this element is zero. Note that unconfigured entries are not necessarily consecutive (i.e. one should not assume consecutive OD Indexes for unconfigured entries). FF-803 FS 1.19 NM Section 5.1.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fdt:index	M	[1..1]	
FmsFeaturesSupported	STRUCT			This attribute indicates the services that are supported by FDA FMS for the HSE device. FF-803 FS 1.19 NM Section 5.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fftypes:fmsFeatures-Supported	M	[1..1]	
ForwardedInbound	STRUCT			This element counts the number of valid frames received by the interface that were submitted for transmission on one or more outbound interfaces. FF-803 FS 1.19 NM Section 5.9.6
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	forwardedInbound	M	[1..1]	
H1ConfiguratorAddress	STRUCT			This element contains the H1 address of the H1 configurator device. FF-803 FS 1.19 NM Section 5.9.3
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	h1ConfiguratorAddress	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
H1DlOperatFunctionalClassSupported	STRUCT			This attribute corresponds to the class supported by all H1 interfaces of a linking device. It has the same definition of DlOperatFunctionalClass attribute specified in the Network Management Specification [FF-801]. Its value is zero when the HSE device is not a linking device. FF-803 FS 1.19 NM Section 5.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	h1DlOperatFunctionalClassSupported	M	[1..1]	
H1Timeout	STRUCT			This attribute defines the amount of time, in milliseconds, that the Linking Device waits before releasing invoke ids that were allocated for FMS and/or SM requests sent on any H1 interface. FF-803 FS 1.19 NM Section 5.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	h1Timeout	M	[1..1]	
HseAutomaticVcrList	STRUCT			The HseAutomaticVcrList is the list of HSE Automatic VCR definitions. Each entry in the list may contain a defined HSE Automatic VCR, or it may be empty. FF-803 FS 1.19 NM Section 5.2.1
	ListHeader	M	[1..1]	
	ListOfHseVcrEndpoints	M	[1..1]	
HseConfiguratorIpAddress	STRUCT			This attribute is the IP Address used by the HSE configurator device. Set this attribute to 0 if the configurator device is not an HSE device. FF-803 FS 1.19 NM Section 5.9.3
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fftypes:ip	M	[1..1]	
HseConfiguredVcrList	STRUCT			The HseConfiguredVcrList is the list of HSE Configured VCR definitions. Each entry in the list may contain a defined HSE Configured VCR, or it may be empty. There should be no pre-configured HSE Configured VCR in this list if the HSE device is unconfigured, i.e. without any configuration at all. FF-803 FS 1.19 NM Section 5.6.1
	ListHeader	M	[1..1]	
	ListOfHseVcrEndpoints	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
HSEDeviceVersion	STRUCT			HSE device Version. FF-803 FS 1.19 SM Section 6.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fftypes:versionNumber	M	[1..1]	
HseNmaVfd	STRUCT			FF-803 FS 1.19 NM Section 5.2.1
	SMIB	O	[0..1]	
	NMIB	O	[0..1]	
HseSubnetMask	STRUCT			This attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the HSE Subnet Mask. FF-803 FS 1.19 NM Section 5.1.3
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	hseSubnetMask	M	[1..1]	
HseSubnetMaskBits	STRUCT			This attribute when ANDED with an IP address or HSE Subnet Mask yields the HSE subnet address defined in the Field Device Access (FDA) Agent Specification [FF-588]. It is used for HSE VCRs with the HSE Subnet Mask attribute. FF-803 FS 1.19 NM Section 5.2.1.FF-803 FS 1.19 NM Section 5.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	hseSubnetMaskBits	M	[1..1]	
HseVcrEndpoint	STRUCT			HSE VCR Entry. FF-803 FS 1.19 NM Section 7.5
	HseVcrType	M	[1..1]	
	FdaAddress	M	[1..1]	
	RelatedSessionEndpointOdIndex	M	[1..1]	
	VcrUserId	M	[1..1]	
	HseSubnetMask	M	[1..1]	
	OnChangeThreshold	M	[1..1]	
	InactivityCloseTime	M	[1..1]	
	StatisticsEntryOdIndex	M	[1..1]	
HseVcrEntryOdIndex	STRUCT			This attribute specifies the OD Index of the HSE VCR Entry object for which statistics are collected. FF-803 FS 1.19 NM Section 5.8.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fdt:index	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
HseVcrStatisticsEntry	STRUCT			This class is used to define the characteristics of a HSE VCR Statistics entry. FF-803 FS 1.19 NM Section 5.8.2
	HseVcrEntryOdIndex	M	[1..1]	
	StatisticsControl	M	[1..1]	
	StatisticsCollectionStartTime	M	[1..1]	
	VcrUserId	M	[1..1]	
	NumOfConnects	M	[1..1]	
	NumOfAborts	M	[1..1]	
	NumOfUnconfirmedMessagesSent	M	[1..1]	
	NumOfUnconfirmedMessagesReceived	M	[1..1]	
	NumOfConfirmedRequestMessagesSent	M	[1..1]	
	NumOfResponseMessagesSent	M	[1..1]	
	NumOfErrorMessagesSent	M	[1..1]	
	NumOfConfirmedRequestMessagesReceived	M	[1..1]	
	NumOfResponseMessagesReceived	M	[1..1]	
	NumOfErrorMessagesReceived	M	[1..1]	
	NumOfNonMisorderedMessages	M	[1..1]	
	NumOfDuplicatedMessages	M	[1..1]	
	NumOfLateMessages	M	[1..1]	
	NumOfMissedMessages	M	[1..1]	
	NumOfLossOfSyncMessages	M	[1..1]	
HseVcrStatisticsList	STRUCT			A list of VCR statistics information. FF-803 FS 1.19 NM Section 5.8.1
	ListHeader	M	[1..1]	
	ListOfHseVcrStatistics-Entries	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
HseVcrType	STRUCT			This attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the HSE VCR Type, and indicates the type of the HSE VCR. FF-803 FS 1.19 NM Section 5.1.3
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	hseVcrType	M	[1..1]	
IgnoredInbound	STRUCT			This element counts the number of valid frames received by the interface that the Forwarding Process determined did not need forwarding. FF-803 FS 1.19 NM Section 5.9.6
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	ignoredInbound	M	[1..1]	
InactivityCloseTime	STRUCT			This attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the Inactivity Close Time. DEFAULT_INACTIVITY_CLOSE_TIME = 30 s. FF-803 FS 1.19 NM Section 5.1.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	inactivityCloseTime	M	[1..1]	
InstalledInterfaces	STRUCT			FF-803 FS 1.19 NM Section 5.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	installedInterfaces	M	[1..1]	
InterfaceActualStateArray	STRUCT			This array of unsigned 8-bit integers is used to define the interface actual state, as described in the Data Link Protocol Specification : Bridge Operation Addendum [FF-806]. Each element in this array represents the actual state of a specific interface, which are sequentially numbered from 1 to *n*, where *n* is the number of H1 interfaces supported by the H1 Bridge. FF-803 FS 1.19 NM Section 5.9.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	interfaceStateArray	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
InterfaceAddress	STRUCT			An element in InterfaceAddressArray is the H1 Link Id.Node.00 of a specific interface. Interfaces and their indexes into this array are sequentially numbered from 1 to n, where '1' represents the first H1 interface (see List Of Version Numbers in the HSE System Management [FF-589]) and *n* is the maximum number of H1 interfaces supported by the H1 Bridge. Writing to ConfiguredLinkSettingsRecord (see Network Management Specification [FF-801]) for the H1 Bridge device does not change the ThisLink attribute, whose value is defined in InterfaceAddressArray. FF-803 FS 1.19 NM Section 5.9.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	interfaceLinkId	M	[1..1]	
	interfaceNodeId	M	[1..1]	
InterfaceAddressArray	STRUCT			This array is used to define the H1 addresses of the H1 bridge interfaces. Each element in this array is the H1 Link Id.Node.00 of a specific interface. FF-803 FS 1.19 NM Section 5.9.1
	fftypes:listCount	M	[1..1]	
	InterfaceAddress	M	[1..*]	
InterfaceDesiredStateArray	STRUCT			This non-volatile array of unsigned 8-bit integers is used to define the interface desired state. Each element in this array represents the desired state of a specific interface, which are sequentially numbered from 1 to n, where *n* is the number of H1 interfaces supported by the H1 Bridge. FF-803 FS 1.19 NM Section 5.9.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	interfaceStateArray	M	[1..1]	
InterfaceNumber	STRUCT			This attribute specifies the index into the InterfaceAddressArray for forwarding. FF-803 FS 1.19 NM Section 5.9.5
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	interfaceNumber	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
InterfaceStatisticsEntry	STRUCT			This class is used to define statistics collected for a H1 Bridge Interface. FF-803 FS 1.19 NM Section 5.9.6
	ForwardedInbound	M	[1..1]	
	IgnoredInbound	M	[1..1]	
	DiscardedForLackOfBuffers	M	[1..1]	
	DiscardedForForwardingDelayExceeded	M	[1..1]	
InterfaceStatisticsList	STRUCT			This conditional element is present if InterfaceStatisticsSupported in the BridgeCharacteristics is not zero. It represents the list of performance and fault-related statistics for the interfaces. FF-803 FS 1.19 NM Section 5.9.1
	fftypes:listCount	M	[1..1]	
	InterfaceStatisticsEntry	O	[0..*]	
InterfaceStatisticsSupported	STRUCT			This attribute specifies the index into the InterfaceAddressArray for forwarding. FF-803 FS 1.19 NM Section 5.9.5
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	interfaceStatisticsSupported	M	[1..1]	
LastSNTPMessage	STRUCT			This object holds the first 48 octets of the last SNTP message received. This object contains only dynamic data, which does not affect the calculation of version numbers. FF-803 FS 1.19 SM Section 6.2.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	lastSNTPMessage	M	[1..1]	
ListHeader	STRUCT			This is a generic header for the lists in the HSE NMA NMIB. The list header provides references to the first configured entry and the first unconfigured entry for direct access to them. It also provides the number of entries in the list to allow the user to read a series of entries from the list. FF-803 FS 1.19 NM Section 5.1.1.
	Version	M	[1..1]	
	FirstConfiguredIndex	M	[1..1]	
	FirstUnconfiguredIndex	M	[1..1]	
	MaxNumEntries	M	[1..1]	
	NumConfigured	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
ListOfFBScheduleDescriptors	STRUCT			List of Function Block Schedule Descriptors FF-803 FS 1.19 SM Section 6.4.5
	fftypes:listCount	M	[1..1]	
	FBScheduleDescriptor	M	[1..*]	
ListOfFilteringDatabaseRecords	STRUCT			This attribute is the list of Filtering Database records. Each entry in the list is an instance of the FilteringEntry class. FF-803 FS 1.19 NM Section 5.2.1
	fftypes:listCount	M	[1..1]	
	FilteringEntry	O	[0..*]	
ListOfHseVcrEndpoints	STRUCT			List of HSE VCR Entries. FF-803 FS 1.19 NM Section 7.5
	fftypes:listCount	M	[1..1]	
	HseVcrEndpoint	O	[0..*]	
ListOfHseVcrStatisticsEntries	STRUCT			It represents the list of performance and fault-related statistics for the HSE VCRs. FF-803 FS 1.19 NM Section 5.8.1
	fftypes:listCount	M	[1..1]	
	HseVcrStatisticsEntry	O	[0..*]	
ListOfLocalIPAddresses	STRUCT			This array contains the Local IP Address of each Ethernet interface supported by the HSE device. Each entry in this array is an IP6 address. The number of elements in this array depends on the number of Ethernet interfaces supported by the HSE device. FF-803 FS 1.19 SM Section 6.2.1
	fftypes:listCount	M	[1..1]	
	LocalIPAddress	M	[1..*]	
ListOfRepublishingDatabaseRecords	STRUCT			This attribute is the list of Republishing Database records. Each entry in the list is an instance of the RepublishingEntry class. FF-803 FS 1.19 NM Section 5.9.1
	fftypes:listCount	M	[1..1]	
	RepublishingEntry	O	[0..*]	
ListOfSessionEndpoints	STRUCT			List of Session Endpoints elements. FF-803 FS 1.19 NM Section 7.3
	fftypes:listCount	M	[1..1]	
	SessionEndpoint	O	[0..*]	
ListOfSessionStatisticsEntries	STRUCT			List of Session Statistics Entries elements. FF-803 FS 1.19 NM Section 5.4
	fftypes:listCount	M	[1..1]	
	SessionStatisticsEntry	O	[0..*]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
ListOfSNTPTimestamps	STRUCT			List of SNTP Time Stams. FF-803 FS 1.19 SM Section 6.2.2
	fftypes:listCount	M	[1..1]	
	SNTPTimestamp	M	[1..1]	
ListOfVersionNumbers	STRUCT			This attribute of SM Characteristics in the SMIB presents the version numbers of all the SMIBs, NMIBs, and Function Block VFDs present in the device. FF-803 FS 1.19 SM Section 6.2.1
	HSEDeviceVersion	M	[1..1]	
	MaxNumberOfInterfaces	M	[1..1]	
	InstalledInterfaces	M	[1..1]	
	MaxNumberOfVFDs	M	[1..1]	
	ActualNumberOfVFDs	M	[1..1]	
	MIBVersion	M	[1..*]	
	VFDVersion	O	[0..*]	
LocalIPAddress	STRUCT			This attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the Local IP Address. FF-803 FS 1.19 NM Section 5.1.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fftypes:ip	M	[1..1]	
MaxForwardingDelayNormal	STRUCT			This attribute is defined in the Data Link Protocol Specification: Bridge Operation Addendum [FF-806]. 1/32 ms FF-803 FS 1.19 NM Section 5.9.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	maxForwardingDelayNormal	M	[1..1]	
MaxForwardingDelayTimeAvailable	STRUCT			This attribute is defined in the Data Link Protocol Specification: Bridge Operation Addendum [FF-806]. Unit = 1/32 ms. FF-803 FS 1.19 NM Section 5.9.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	maxForwardingDelayTimeAvailable	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
MaxForwardingDelayUrgent	STRUCT			This attribute is defined in the Data Link Protocol Specification: Bridge Operation Addendum [FF-806]. Unit = 1/32 ms. FF-803 FS 1.19 NM Section 5.9.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	maxForwardingDelayUrgent	M	[1..1]	
MaxMessageLength	STRUCT			This attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the Maximum Message Length. FF-803 FS 1.19 NM Section 5.1.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	maxMessageLength	M	[1..1]	
MaxNumberOfInterfaces	STRUCT			The entry "Max number of interfaces (M)" indicates the maximum number of H1 interfaces that can be installed into the device. The maximum value for this entry is 30. See the Network Management specification [FF-803] on Bridge Characteristics. FF-803 FS 1.19 SM Section 6.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	maxNumberOfInterfaces	M	[1..1]	
MaxNumberOfVFDs	STRUCT			Maximal Number of VFDs. FF-803 FS 1.19 SM Section 6.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	maxNumberOfVFDs	M	[1..1]	
MaxNumEntries	STRUCT			This element indicates the maximum number of entries that may be defined in the list (NumConfigured + NumUnconfigured). FF-803 FS 1.19 NM Section 5.1.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	maxNumEntries	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
MaxNumOfVcrs	STRUCT			This element contains the counter for the maximum number of HSE VCRs that have been concurrently related to the Session Endpoint Entry object. This element represents the “high water mark” for the number of VCRs related to this session. This attribute may not be written. FF-803 FS 1.19 NM Section 5.5.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	maxNumOfVcrs	M	[1..1]	
MIBVersion	STRUCT			Management Information Base Version. FF-803 FS 1.19 SM Section 6.2.1
	NMIBVersion	M	[1..1]	
	SMIBVersion	M	[1..1]	
MinForwardingDelayNormal	STRUCT			This attribute is defined in the Data Link Protocol Specification: Bridge Operation Addendum [FF-806]. 1/32 ms. FF-803 FS 1.19 NM Section 5.9.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	minForwardingDelayNormal	M	[1..1]	
MinForwardingDelayTimeAvailable	STRUCT			This attribute specifies the lowest value the device supports for MinForwardingDelayTimeAvailable. Unit = 1/32 ms. FF-803 FS 1.19 NM Section 5.9.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	minForwardingDelayTimeAvailable	M	[1..1]	
MinForwardingDelayUrgent	STRUCT			This attribute specifies the lowest value the device supports for MaxForwardingDelayUrgent. Unit = 1/32 ms. FF-803 FS 1.19 NM Section 5.9.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	minForwardingDelayUrgent	M	[1..1]	
MinRepublishingDelay	STRUCT			This attribute is defined in the Data Link Protocol Specification: Bridge Operation Addendum [FF-806]. Unit = 1/32 ms. FF-803 FS 1.19 NM Section 5.9.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	minRepublishingDelay	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
MsgHdrOptions	STRUCT			This attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the Message Header Options. DEFAULT_HDR_OPTIONS = 0 FF-803 FS 1.19 NM Section 5.1.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	msgHdrOptions	M	[1..1]	
MsgHdrOptionsSupported	STRUCT			This attribute defines the message header options that are supported by the HSE device. FF-803 FS 1.19 NM Section 5.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	msgHdrOptionsSupported	M	[1..1]	
NmaConfigurationAccess	STRUCT			Network Management Agent Configuration Access object definition. FF-803 FS 1.19 NM Section 5.9.3
	H1ConfiguratorAddress	M	[1..1]	
	HseConfiguratorIpAddress	M	[1..1]	
NmaConfigurationUse	STRUCT			This attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the NMA Configuration Use. Set this attribute to zero when writing to any attribute of the SessionEndpointEntry class. FF-803 FS 1.19 NM Section 5.1.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	nmaConfigurationUse	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
NmCharacteristics	STRUCT			This model specifies the characteristics of the HSE device's Network Management. FF-803 FS 1.19 NM Section 5.2.1
	NmibRevision	M	[1..1]	
	H1DlOperatFunctionalClassSupported	M	[1..1]	
	TcpProtocolSupported	M	[1..1]	
	MsgHdrOptionsSupported	M	[1..1]	
	OnChangeRefreshRate	M	[1..1]	
	HseSubnetMaskBits	M	[1..1]	
	FmsFeaturesSupported	M	[1..1]	
	FdaGuardBand	M	[1..1]	
	H1Timeout	M	[1..1]	
	SessionMaxOutstanding	M	[1..1]	
	SessionStatisticsControlDefaultValue	M	[1..1]	
	VcrStatisticsControlDefaultValue	M	[1..1]	
	RestartStatisticsCollectionControl	M	[1..1]	
NMIB	STRUCT			Network Management Information Base FF-803 FS 1.19 NM Section 5.2.1
	NmCharacteristics	M	[1..1]	
	ConfiguredSessionList	M	[1..1]	
	AutomaticSessionList	M	[1..1]	
	SessionStatisticsList	O	[0..1]	
	HseConfiguredVcrList	M	[1..1]	
	HseAutomaticVcrList	M	[1..1]	
	HseVcrStatisticsList	O	[0..1]	
	DlmeBridge	O	[0..1]	
NmibRevision	STRUCT			This element represents the HSE NMIB Revision. The Network Management Agent automatically increments the NMIB Revision every time there is a change in any writable object of the HSE NMIB, via local updates or via FMS services. Its initial value is 0. FF-803 FS 1.19 NM Section 5.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fftypes:versionNumber	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
NMIBVersion	STRUCT			SMIB Version Number. An integer value. FF-803 FS 1.19 SM Section 6.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fftypes:versionNumber	M	[1..1]	
NumberOfInterfaces	STRUCT			This attribute defines the number of H1 interfaces of the H1 Bridge. Its maximum value is 30, because of the FasDllMaxDlsduSize attribute of Standardized Management Relationship in the Network Management Specification [FF-801]. FF-803 FS 1.19 NM Section 5.9.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	numberOfInterfaces	M	[1..1]	
NumberOfSchedule	STRUCT			This attribute contains the number of schedule domains that contain schedules. It is incremented each time that a new schedule domain is downloaded. It is decremented each time that a schedule domain is initialized. FF-803 FS 1.19 SM Section 6.2.5.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	numberOfSchedule	M	[1..1]	
NumConfigured	STRUCT			This element indicates the number of entries in the list that are currently configured (independently of whether or not they are being used). It may be written, but only the value zero should be written. Writing zero causes the list to be cleared, with three exceptions. FF-803 FS 1.19 NM Section 5.1.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	numConfigured	M	[1..1]	
NumOfAborts	STRUCT			This element contains the counter for the number of times the HSE VCR has been aborted, either by the user or by the communication stack. This attribute may not be written. FF-803 FS 1.19 NM Section 5.8.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	numOfAborts	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
NumOfConfirmedRequestMessagesReceived	STRUCT			NumOfRequestMessagesReceived This element contains the counter for the number of confirmed request messages received from the VCR. This attribute may not be written. FF-803 FS 1.19 NM Section 5.8.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	numOfConfirmedReques-MessagesReceived	M	[1..1]	
NumOfConfirmedRequestMessagesSent	STRUCT			FF-803 FS 1.19 NM Section 5.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	numOfConfirmedRequest-MessagesSent	M	[1..1]	
NumOfConnects	STRUCT			This element contains the counter for the number of times the HSE VCR has been connected, either by the user or by the communication stack. This attribute may not be written FF-803 FS 1.19 NM Section 5.8.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	numOfConnects	M	[1..1]	
NumOfDuplicatedMessages	STRUCT			This element contains the counter for the number of duplicated messages the HSE VCR has received. See Field Device Access (FDA) Agent Specification [FF-588]. FF-803 FS 1.19 NM Section 5.8.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	numOfDuplicated-Messages	M	[1..1]	
NumOfErrorMessagesReceived	STRUCT			This element contains the counter for the number of negative response messages received through the HSE VCR. This attribute may not be written. FF-803 FS 1.19 NM Section 5.8.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	numOfErrorMessages-Received	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
NumOfErrorMessagesSent	STRUCT			This element contains the counter for the number of negative response messages sent through the HSE VCR. This attribute may not be written. FF-803 FS 1.19 NM Section 5.8.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	numOfErrorMessagesSent	M	[1..1]	
NumOfInvalidMsgsReceived	STRUCT			This element contains the counter for the number of invalid FDA messages received. This attribute may not be written. FF-803 FS 1.19 NM Section 5.5.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	numOfInvalidMsgsReceived	M	[1..1]	
NumOfLateMessages	STRUCT			This element contains the counter for the number of late messages the HSE VCR has received. See Field Device Access (FDA) Agent Specification [FF-588]. FF-803 FS 1.19 NM Section 5.8.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	numOfLateMessages	M	[1..1]	
NumOfLossOfSyncMessages	STRUCT			This element contains the counter for the number of losses of sync the HSE VCR has detected. See Field Device Access (FDA) Agent Specification [FF-588]. FF-803 FS 1.19 NM Section 5.8.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	numOfLossOfSync-Messages	M	[1..1]	
NumOfMissedMessages	STRUCT			This element contains the counter for the number of messages the HSE VCR has missed. See Field Device Access (FDA) Agent Specification [FF-588]. FF-803 FS 1.19 NM Section 5.8.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	numOfMissedMessages	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
NumOfMsgsReceived	STRUCT			This element contains the counter for the number of FDA messages received. This attribute may not be written. FF-803 FS 1.19 NM Section 5.5.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	numOfMsgsReceived	M	[1..1]	
NumOfMsgsSent	STRUCT			This element contains the counter for the number of FDA messages sent. This attribute may not be written. FF-803 FS 1.19 NM Section 5.5.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	numOfMsgsSent	M	[1..1]	
NumOfNonMisorderedMessages	STRUCT			This element contains the counter for the number of non-misordered messages the HSE VCR has received. See Field Device Access (FDA) Agent Specification [FF-588]. FF-803 FS 1.19 NM Section 5.8.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	numOfNonMisordered-Messages	M	[1..1]	
NumOfOpenStateCtr	STRUCT			This element contains the counter for the number of times the Session Endpoint was opened. This attribute may not be written. FF-803 FS 1.19 NM Section 5.5.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	numOfOpenStateCtr	M	[1..1]	
NumOfResponseMessagesReceived	STRUCT			FF-803 FS 1.19 NM Section 5.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	numOfResponse-MessagesReceived	M	[1..1]	
NumOfOpenStateCtr	STRUCT			This element contains the counter for the number of times the Session Endpoint was opened. This attribute may not be written. FF-803 FS 1.19 NM Section 5.5.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	numOfOpenStateCtr	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
NumOfResponseMessagesSent	STRUCT			NumOfPositiveResponseMessagesSent. This element contains the counter for the number of positive response messages sent through the HSE VCR. This attribute may not be written. FF-803 FS 1.19 NM Section 5.8.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	NumOfResponseMessagesSent	M	[1..1]	
NumOfUnconfirmedMessagesReceived	STRUCT			This element contains the counter for the number of unconfirmed request messages received from the VCR. This attribute may not be written. FF-803 FS 1.19 NM Section 5.8.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	numOfUnconfirmedMessagesReceived	M	[1..1]	
NumOfUnconfirmedMessagesSent	STRUCT			This element contains the counter for the number of unconfirmed request messages sent from the VCR. This attribute may not be written. FF-803 FS 1.19 NM Section 5.8.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	numOfUnconfirmedMessagesSent	M	[1..1]	
OnChangeRefreshRate	STRUCT			This attribute is used for an HSE Local Publisher VCR that is not transferring due OnChangeThreshold (see Field Device Access (FDA) Agent Specification [FF-588]). It determines how many publisher execution cycles the HSE Local Publisher VCR must wait before transferring the latest published variable value. FF-803 FS 1.19 NM Section 5.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	OnChangeRefreshRate	M	[1..1]	
OnChangeThreshold	STRUCT			This attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the On Change Threshold. FF-803 FS 1.19 NM Section 5.1.3
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	OnChangeThreshold	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
OperationalIPAddress	STRUCT			This attribute defines the Selected Local IP Address that is currently being used for sending SM Find Tag Reply messages and is the source IP address for all FDA Publisher Sessions (see the FDA specification [FF-588]). It is one of the Local IP Addresses contained in the Local IP Address Array. FF-803 FS 1.19 SM Section 6.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fftypes:ip	M	[1..1]	
PreviousNmaConfigurationAccess	STRUCT			This attribute, when not zero, is a record object containing the identification of the HSE or H1 configurator application that previously had configuration access to any (or all) linking device NMA VFD(s). It is defined by the NmaConfigurationAccess Class. FF-803 FS 1.19 NM Section 5.9.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	NmaConfigurationAccess	M	[1..1]	
PrimaryTimeServer	STRUCT			This variable contains the IP address of the primary SNTP time server for this device. FF-803 FS 1.19 SM Section 6.2.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fftypes:ip	M	[1..1]	
RelatedSessionEndpointOdIndex	STRUCT			This attribute is the OD Index of the session endpoint used by the HSE VCR. It is used by the HSE VCR to get the attribute Related Session Endpoint Id, that is defined in the Field Device Access (FDA) Agent Specification [FF-588]. FF-803 FS 1.19 NM Section 5.1.3
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fdt:index	M	[1..1]	
RemoteIpAddress	STRUCT			This attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the Remote IP Address. FF-803 FS 1.19 NM Section 5.1.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fftypes:ip	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
RemotePdTag	STRUCT			This attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the Remote PD Tag. FF-803 FS 1.19 NM Section 5.1.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fdt:tag	M	[1..1]	
RepubAddress	STRUCT			This is the 32-bit republishing address: FF-803 FS 1.19 NM Section 5.9.4
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	repubAddress	M	[1..1]	
RepublishingDatabase	STRUCT			Republishing Database that consists of Republishing Database records. FF-803 FS 1.19 NM Section 5.9.4
	ListHeader	M	[1..1]	
	ListOfRepublishing-DatabaseRecords	M	[1..1]	
RepublishingDatabaseListHeaderOdIndex	STRUCT			This attribute specifies the OD index of the RepublishingDatabaseListHeader record. It is set to zero if the HSE Device does not support republishing. FF-803 FS 1.19 NM Section 5.9.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fdt:index	M	[1..1]	
RepublishingEntry	STRUCT			Republishing Entry is used to define the data routing between H1 interfaces. Each Republishing Entry may contain information for republishing, or it may be empty (unconfigured). FF-803 FS 1.19 NM Section 5.9.4
	SubAddress	M	[1..1]	
	RepubAddress	M	[1..1]	
	FasDllMaxConfirmDelay-OnConnect	M	[1..1]	
	FasDllMaxDlsduSize	M	[1..1]	
	FasDllSDAP	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
RestartStatisticsCollectionControl	STRUCT			This element is used to restart statistics collection of all entries in the specified statistics entry list. Restarting statistics collection causes the StatisticsCollectionStartTime to be updated and all statistics counters to be cleared and restarted. FF-803 FS 1.19 NM Section 5.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	restartStatisticsCollection-Control	M	[1..1]	
RootInterface	STRUCT			The interface number of the H1 Bridge which is the root interface, if any. FF-803 FS 1.19 NM Section 5.9.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	rootInterface	M	[1..1]	
ScheduleActivation	STRUCT			This is used to activate one of the FB Schedules resident in the SMIB. To activate a schedule, the Version Number of the schedule to be activated is written to this variable. FF-803 FS 1.19 SM Section 6.2.5
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fftypes:scheduleActivation	M	[1..1]	
ScheduleListCharacteristics	STRUCT			Function Block Schedule List Characteristics. FF-803 FS 1.19 SM Section 6.4.4
	NumberOfSchedule	M	[1..1]	
	ActiveScheduleVersion	M	[1..1]	
	ActiveScheduleIndex	M	[1..1]	
ScheduleSyncPeriod	STRUCT			This variable contains an argument of the modulus function described in section 4.6 that is used to determine the next start time for a macrocycle, in ticks. FF-803 FS 1.19 SM Section 6.2.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	scheduleSyncPeriod	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
ScheduleVersion	STRUCT			This attribute is the numeric identifier for a schedule. It is not necessarily used to track changes to a schedule. It is unique within a device, unless it has a value of zero. Zero indicates that the schedule has been initialized and that this domain is available for downloading a new schedule. The only value permitted to be written to this attribute is zero, and then only if this is not the active schedule. Writing zero causes the domain contents to be initialized, resulting in a zero value for Macrocycle Duration as well as Schedule Version, and also decrements the Number Of Schedules attribute of the FB Schedule List Characteristics Record. Writing any other value, or any value when this is the active schedule, causes an error response with an error class of "access" and an error code of “object access denied.” The value of this attribute will be set to the same value in the domain Schedule Summary when the download is completed. Its initial value is zero FF-803 FS 1.19 SM Section 6.2.5.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fftypes:versionNumber	M	[1..1]	
SecondaryTimeServer	STRUCT			This variable contains the IP address of the secondary SNTP time server for this device.FF-803 FS 1.19 SM Section 6.2.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fftypes:ip	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
SessionEndpoint	STRUCT			Session Endpoint element definition. FF-803 FS 1.19 NM Section 5.1.2. and 7.3
	RemotePdTag	M	[1..1]	
	LocalIPAddress	M	[1..1]	
	RemoteIpAddress	M	[1..1]	
	EndpointType	M	[1..1]	
	MsgHdrOptions	M	[1..1]	
	State	M	[1..1]	
	TransportProtocol	M	[1..1]	
	NmaConfigurationUse	M	[1..1]	
	UdpPortNumber	M	[1..1]	
	BufferSize	M	[1..1]	
	TransmitDelayTime	M	[1..1]	
	InactivityCloseTime	M	[1..1]	
	MaxMessageLength	M	[1..1]	
	StatisticsEntryOdIndex	M	[1..1]	
SessionEndpointEntryOdIndex	STRUCT			This attribute specifies the OD Index of the Session Endpoint Entry object for which statistics are collected. The value of this attribute is set by the NMA when the index of this session statistics record is written into the Configured or Automatic Session entry for which statistics are to be collected. The value 0 indicates that the entry is unused. FF-803 FS 1.19 NM Section 5.5.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fdt:index	M	[1..1]	
SessionMaxOutstanding	STRUCT			This element represents the maximum number of requests that a client or server endpoint may have outstanding at any point in time (see Field Device Access (FDA) Agent Specification [FF-588]). FF-803 FS 1.19 NM Section 5.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	sessionMaxOutstanding	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
SessionStatisticsControlDefaultValue	STRUCT			This element contains the default value used for the StatisticsControl attribute of the SessionStatistics entry. Its initial value is “OnOpening”. When a SessionStatistics entry is initialized, the value of its StatisticsControl attribute is set to this value. FF-803 FS 1.19 NM Section 5.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	sessionStatisticsControl-DefaultValue	M	[1..1]	
SessionStatisticsEntry	STRUCT			Session Statistics Entry element. FF-803 FS 1.19 NM Section 7.4
	SessionEndpointEntryOdIndex	M	[1..1]	
	StatisticsControl	M	[1..1]	
	StatisticsCollectionStartTime	M	[1..1]	
	MaxNumOfVcrs	M	[1..1]	
	NumOfMsgsReceived	M	[1..1]	
	NumOfInvalidMsgsReceived	M	[1..1]	
	NumOfMsgsSent	M	[1..1]	
	NumOfOpenStateCtr	M	[1..1]	
SessionStatisticsList	STRUCT			Session Statistics List element definition. FF-803 FS 1.19 NM Section 5.5.1
	ListHeader	M	[1..1]	
	ListOfSessionStatisticsEntries	M	[1..1]	
SmCharacteristics	STRUCT			SM Characteristics composite object, which is SM Support. FF-803 FS 1.19 SM Section 6.2.1
	fftypes:SmSupport	M	[1..1]	
	fftypes:OperationalPowerup	M	[1..1]	
	ListOfVersionNumbers	M	[1..1]	
	OperationalIPAddress	M	[1..1]	
	ListOfLocalIPAddresses	M	[1..1]	
	DeviceContentsDomain	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
SMIB	STRUCT			System Management Information Base. FF-803 FS 1.19 NM Section 5.2.1
	SmCharacteristics	M	[1..1]	
	SyncAndScheduling	M	[1..1]	
	DeviceIdentification	M	[1..1]	
	VfdList	M	[1..1]	
	FbSchedule	O	[0..1]	
SMIBVersion	STRUCT			SMIB Version Number. An integer value. FF-803 FS 1.19 SM Section 6.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fftypes:versionNumber	M	[1..1]	
SNTPTimestamp	STRUCT			This array object holds the four times used to calculate delay and offset, described in RFC-2030 as T1, T2, T3 and T4. The first element in the array holds the integer seconds part of T1. The second element holds the fractional seconds of T1. The remaining records repeat this sequence for the remaining SNTP times. This object contains only dynamic data, which does not affect the calculation of version numbers. FF-803 FS 1.19 SM Section 6.2.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	sntpTimestamp	M	[1..1]	
StandardTimeDifference	STRUCT			This variable contains the number of signed ticks to add to Current Time to obtain Standard time-stamp time. It is used instead of Daylight Time Difference when Current Time is outside of the interval defined by Start Daylight Time and End Daylight Time, or if Start Daylight Time is zero. FF-803 FS 1.19 SM Section 6.2.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	standardTimeDifference	M	[1..1]	
StartDaylightTime	STRUCT			This variable contains the value of Current Time that defines the beginning of the Daylight Time interval. Daylight Time never starts if the value is zero or greater than End Daylight Time.FF-803 FS 1.19 SM Section 6.2.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fftypes:timeValue	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
State	STRUCT			This read-only attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the State, and specifies the session endpoint state. Set this attribute to zero when writing to any attribute of the SessionEndpointEntry class. FF-803 FS 1.19 NM Section 5.1.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	state	M	[1..1]	
StatisticsCollectionStartTime	STRUCT			This attribute specifies when statistics collection started, as defined by the StatisticsControl attribute. FF-803 FS 1.19 NM Section 5.8.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fftypes:timeValue	M	[1..1]	
StatisticsControl	STRUCT			This attribute specifies when statistics collection is to be started and restarted. Restarting statistics collection causes the StatisticsCollectionStartTime to be updated and all statistics counters to be cleared and restarted. FF-803 FS 1.19 NM Section 5.8.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	statisticsControl	M	[1..1]	
StatisticsEntryOdIndex	STRUCT			This attribute is the OD Index of the HseVcrStatisticsEntry used to collect statistics for this VCR. FF-803 FS 1.19 NM Section 5.1.3
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fdt:index	M	[1..1]	
SubAddress	STRUCT			This is the 32-bit subscribe to address. If the value is 0, then this entry is not configured. FF-803 FS 1.19 NM Section 5.9.4
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	subAddress	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
SyncAndScheduling	STRUCT			The Sync and Scheduling record contains the data necessary to synchronize the clock and display diagnostic information related to synchronization. FF-803 FS 1.19 SM Section 6.2.2
	SyncAndSchedulingCharacteristics	M	[1..1]	
	LastSNTPMessage	M	[1..1]	
	ListOfSNTPTimestamps	M	[1..1]	
SyncAndSchedulingCharacteristics	STRUCT			This data type structure is used to represent the Sync and Scheduling Record. FF-803 FS 1.19 SM Section 6.2.2.1
	fftypes:CurrentTime	M	[1..1]	
	StandardTimeDifference	M	[1..1]	
	PrimaryTimeServer	M	[1..1]	
	SecondaryTimeServer	M	[1..1]	
	TimeRequestTimeout	M	[1..1]	
	TimeRequestInterval	M	[1..1]	
	CapableTimeSyncClass	M	[1..1]	
	TargetTimeSyncClass	M	[1..1]	
	ScheduleSyncPeriod	M	[1..1]	
	DaylightTimeDifference	M	[1..1]	
	StartDaylightTime	M	[1..1]	
	EndDaylightTime	M	[1..1]	
TargetTimeSyncClass	STRUCT			This variable represents the configured time synchronization class for the SNTP time client in the HSE Presence. The enumeration is the same as the Capable Time Sync Class. FF-803 FS 1.19 SM Section 6.2.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	targetTimeSyncClass	M	[1..1]	
TcpProtocolSupported	STRUCT			This attribute defines if the HSE device supports the TCP protocol or not. It is set to TRUE when the HSE device supports the TCP protocol. Otherwise, it is set to FALSE. FF-803 FS 1.19 NM Section 5.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	tcpProtocolSupported	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
TimeRequestInterval	STRUCT			This variable contains the time in ticks that the SNTP time client in the HSE Presence waits between sending requests to the time server. A value of zero means that the device will calculate this number. Values less than 10 s are not allowed if the device cannot calculate the interval.FF-803 FS 1.19 SM Section 6.2.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	timeRequestInterval	M	[1..1]	
TimeRequestTimeout	STRUCT			This variable contains the time in ticks that the SNTP time client in the HSE Presence waits for the time server to answer a time request. FF-803 FS 1.19 SM Section 6.2.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	timeRequestTimeout	M	[1..1]	
TransmitDelayTime	STRUCT			This attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the Transmit Delay Time. DEFAULT_TRANSMIT_DELAY = 0 FF-803 FS 1.19 NM Section 5.1.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	transmitDelayTime	M	[1..1]	
TransportProtocol	STRUCT			This attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the Transport Protocol, and identifies the transport protocol used for the session. FF-803 FS 1.19 NM Section 5.1.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	transportProtocol	M	[1..1]	
UdpPortNumber	STRUCT			This attribute is defined in the Field Device Access (FDA) Agent Specification [FF-588] as the UDP Port Number. FF-803 FS 1.19 NM Section 5.1.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fftypes:port	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
VcrStatisticsControlDefaultValue	STRUCT			This element contains the default value used for the StatisticsControl attribute of the VcrStatistics entry. Its initial value is “OnOpening”. FF-803 FS 1.19 NM Section 5.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	VcrStatisticsControlDefaultValue	M	[1..1]	
VcrUserId	STRUCT			This attribute contains the value of the VCR User Id attribute of the VCR entry identified by the HseVcrEntryOdIndex attribute of this entry. FF-803 FS 1.19 NM Section 5.8.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	vcrUserId	M	[1..1]	
Version	STRUCT			This element describes the version of Data Link Protocol Specification: Bridge Operation Addendum supported. FF-803 FS 1.19 NM Section 5.9.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fftypes:versionNumber	M	[1..1]	
VfdList	STRUCT			This element contains the default value used for the StatisticsControl attribute of the VcrStatistics entry. Its initial value is “OnOpening”. FF-803 FS 1.19 NM Section 5.2.1
	fftypes:listCount	M	[1..1]	
	VfdRefEntry	M	[1..*]	
VfdRefEntry	STRUCT			Virtual Field Device Reference Entry. FF-803 FS 1.19 SM Section 6.4.3
	fftypes:VfdRef	M	[1..1]	
	fftypes:VfdTag	M	[1..1]	
	VfdServerSelector	M	[1..1]	
	DDDomainIndex	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
VfdServerSelector	STRUCT			This attribute is the selector for the generic server VCR for this VFD. The VFD Server Selector attribute of the HSE and H1 NMA VFDs is set to 0 to indicate that the FMS VCR Selector Connect Option cannot be used with these VFDs. See the FDA specification [FF-588]. It is assigned by the device. FF-803 FS 1.19 SM Section 6.2.4.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	vfdServerSelector	M	[1..1]	
VFDVersion	STRUCT			VFD Version Number.
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fftypes:versionNumber	M	[1..1]	

11 Communication data types

11.1 Common data types

The Table 19 provides FF Data Types Definitions, that are referenced as a global FF definition with namespace: fftypes

Table 19 – Simple common data types

Data type	Definition	Description
communicationReference	UUID	A unique identifier for the communication endpoint. Identifier of the virtual communication relationship used in communicating the request to the field device
ddRevision	USINT	Device Description revision as provided in the VFD – resource block
deviceIndex	UINT	This attribute is a site administered number that identifies the device. This index is unique within an HSE subnet. FF-803 FS 1.19 SM Section 6.2.5
deviceRevision	USINT	Device Revision as provided in the VFD – resource block
deviceType	enumeration (linkingDevice | ioGateway | hseFieldDevice | h1Device)	Device type specifies the capabilities of the device as described in FF-589 section 6.2.3.1
devID	STRING	The Device ID is a system independent identifier that is provided by the manufacturer. FF-880 Section 5.3
devType	UINT	Device Type as provided in the VFD – resource block
domain	ARRAY OF USINT	Domain data is provided as bin.hex data type
eventNumber	UDINT	This parameter contains the counter value identifying the event
fmsFeaturesSupported	ARRAY OF USINT	See FF-870 Section 3.3.4 - FMS services and the options supported by the server
ip	STRING	String representation of the IP address as described in RFC 791 Internet protocol (IP)
linkId	UINT	Link designator according to FF-822
listCount	UDINT	List Count
macroCycleDuration	UDINT	A period for schedule repetition. See the element description for more information
nodeId	UINT	Node designator according to FF-822
numberOfElements	UDINT	Number of elements used in Links, VCR lists, etc.
odIndex	UDINT	Object Dictionary Index
operationalPowerup	UDINT	An element describing System Management State of the device
port	UINT	Communication end point as described in RFC 791 Internet protocol (IP)
scheduleActivation	UDINT	This is used to activate one of the FB Schedules resident in the SMIB. To activate a schedule, the Version Number of the schedule to be activated is written to this variable. FF-803 FS 1.19 SM Section 6.2.5
selector	UINT	Selector according to FF-822
smServiceID	enumeration (SmSetPDTag | SmSetAddress | SmClearAddress | SmIdentify | SmFindTagQuery | SmClearAssignmentInfo | SmSetAssignmentInfo)	An enumeration attribute used for system management service identification

Data type	Definition	Description
smSupport	ARRAY OF USINT	This attribute specifies the features that are supported by the System Management Kernel in this device. For detailed description see 6.2.1 SM Characteristics Definition in FF-589 or 8. System Management Information Base Definition in FF – 880
subIndex	UDINT	Parameter sub-index value
subscriptionInvokeId	UUID	Invoke ID used in the Subscription service.It is used during the lifetime of the subscription. The client identifies the subscription data by subscriptionInvokeId
timeValue	ARRAY OF USINT	Time value provides the event time according to FF – 870
versionNumber	ARRAY OF USINT	An integer identifying the version number
versionOd	INT	Object dictionary version number
vfdRef	UDINT	VFD Reference according to FF-880 Section 8. This attribute is the numeric identifier for a VFD. It is assigned by the device. The VFD Ref is unique within the context of the NMA VFD in which it is defined. Within a linking device, if a VFD appears in the VFD List of more than one interface (HSE or H1), then its VFD Ref may be different in each. However, when qualified by its interface, it uniquely identifies the VFD. FF-803 FS 1.19 SM Section 6.2.4.1
vfdTag	STRING	An unique identifyer of the Virtual Field Device (VFD) in readable form. This attribute is the alphanumeric identifier for the VFD. It may be assigned by the user. FF-803 FS 1.19 SM Section 6.2.4.1

Table 20 defines and describes the common structured data types used by FF protocol.

Table 20 – Structured common data types

Data type	Definition			Description
	Elementary data types	Usage	Mulitplicity	
ConfiguredSessionListInfo	STRUCT			Information for the configured session list. Description of the Session list in the NM VFD of a HSE device. The list is comprised of a list header structure and a consecutive list of SessionEndpointEntry records. Corresponds to the Information read from the NM Directory object of the device or read from the capability file of the device. Refer to FF-803 section 5.1.2 for details. The attribute odIndex is the OD index of the session list in the NM VFD of a HSE device. The attribute can be obtained from the devices capability file. Refers to the ListHeader record of the session list
	odIndex	M	[1..1]	
	numberOfElements	M	[1..1]	
CurrentTime	STRUCT			Current time element, providing the time as timeValue attribute
	fdt:readAccess	O	[0..1]	

Data type	Definition			Description
	Elementary data types	Usage	Mulitplicity	
	fdt:writeAccess	O	[0..1]	
	timeValue	M	[1..1]	
DataLinkAddress	STRUCT			Denotes the Data link (DL) Addresses. For H1 see FF-822 Annex A. For HSE see FDA Address use of the specification FF-588 Field Device Access Agent - Annex B
	linkId	M	[1..1]	
	selector	M	[1..1]	
DeviceId	STRUCT			Device ID element providing the deviceID as devID attribute.
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	devID	M	[1..1]	
Index	STRUCT			Element index. Can be used for IndexList element
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fdt:index	M	[1..1]	
IndexList	STRUCT			An element including a list of parameter indexes. Values for the indexes are absolute. Block starting index offset is required for correct index value
	listCount	M	[1..1]	
	Index	M	[1..*]	
IP	STRUCT			Element denotes a full IP address comprised of the IP address denoted with the attribute "ip" and the port number denoted with the attribute "port"
	ip	M	[1..1]	
	port	O	[0..1]	
LinkobjectInfo	STRUCT			Description for the list of link objects in the function block VFD of the H1/HSE device. The element defines location of the list of link objects and the number of link object entries. The attribute odIndex is the OD index of the starting link object in the function block VFD. The OD index can be obtained from the devices capability file (see Specification FF-103 for details)
	odIndex	M	[1..1]	
	numberOfElements	M	[1..1]	
MacrocycleDuration	STRUCT			This specifies the length of the macrocycle defined for the device. See FF-880 for more details
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	

Data type	Definition			Description
	Elementary data types	Usage	Mulitplicity	
	macroCycleDuration	M	[1..1]	
OperationalPowerup	STRUCT			Operational Power Up variable controls which state the SMK will enter after power-up. See FF – 880 for details
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	operationalPowerup	M	[1..1]	
PdTag	STRUCT			Physical device tag
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fdt:tag	M	[1..1]	
SmSupport	STRUCT			This element provides the features that are supported by the System Management Kernel as smSupport attribute
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	smSupport	M	[1..1]	
SubIndex	STRUCT			Parameter SubIndex
	subIndex	M	[1..1]	
VfdIdentification	STRUCT			Provides Device VFD identification information including Device Manufacturer, Device type, revision, etc.
	ddRevision	M	[1..1]	
	deviceRevision	M	[1..1]	
	devType	M	[1..1]	
	fdt:manufacturerId	O	[0..1]	
	vfdTag	M	[1..1]	
VfdRef	STRUCT			VFD Reference according to FF-880 Section 8. This attribute is the numeric identifier for a VFD. It is assigned by the device. The VFD Ref is unique within the context of the NMA VFD in which it is defined. Within a linking device, if a VFD appears in the VFD List of more than one interface (HSE or H1), then its VFD Ref may be different in each. However, when qualified by its interface, it uniquely identifies the VFD. FF-803 FS 1.19 SM Section 6.2.4.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	vfdRef	M	[1..1]	
VfdTag	STRUCT			Virtual Field Device Tag
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	vfdTag	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Mulitplicity	
VcrListInfo	STRUCT			VCR list information. VcrListInfo provides description of the VCR list in the NM VFD of a H1 device or in the H1 link of a HSE Linking device. It corresponds to the Information read from the NM Directory object of the device or read from the capability file of the device. The actual number of static VCR entries (VcrStaticEntry) usable from the VCR list is calculated as follows: (numberOfElements - 2) / 2. The attribute odIndex is the OD index of the VCR list in the NM VFD. odIndex can be obtained from the devices capability file. Refer to FF-801 section 5.2.1 for details
	odIndex	M	[1..1]	
	numberOfElements	M	[1..1]	
HseConfiguredVcrListInfo	STRUCT			Information for the HSE configured VCR list. HseConfiguredVcrListInfo describes the HSE VCR list in the NM VFD of a HSE device. It corresponds to the Information read from the NM Directory object of the device or read from the capability file of the device. The attribute odIndex is the OD index of the VCR list in the NM VFD of a HSE device. odIndex can be obtained from the devices capability file. It refers to the ListHeader record of the HSE VCR list. Refer to FF-803 section 5.1.3 for details
	odIndex	M	[1..1]	
	numberOfElements	M	[1..1]	

11.2 FF FMS data types

The FF FMS data type definition (Table 21 and Table 22) is used as a global FF FMS definition.

Namespace: fms

Table 21 – Simple FF FMS data types

Data type	Definition	Description
connectOption	enumeration (VCRSelector | NMAAccess | FBAPConnect)	
allAttributes	BOOL	
startFlag	BOOL	
moreFollows	BOOL	

Data type	Definition	Description
numberOfObjectDescriptions	USINT	
versionOdCalling	INT	
profileNumberCalling	UINT	
accessProtectionSupportedCalling	BOOL	
passwordAndAccessGroupsCalling	ARRAY OF USINT	
maxFmsPduSendingCalled	USINT	
maxFmsPduReceivingCalled	USINT	
profileNumberCalled	UINT	
accessProtectionSupportedCalled	BOOL	
passwordAndAccessGroupsCalled	UINT	
accessProtection	ARRAY OF USINT	
logicalStatus	enumeration (stateChangesAllowed| limitedServicesPermitted | odLoadingNonInteracting | odLoadingInteracting)	
physicalStatus	| partiallyOperational | inoperable | needsCommissioning)	
localDetail	ARRAY OF USINT	
modelName	STRING	
revision	STRING	
responseType	enumeration (FmsWrite | FmsDeleteVariableList | FmsGenericInitiateDownloadSequence | FmsGenericDownloadSegment | FmsAbort | FmsAcknowledgeEventNotification)	
finalResult	BOOL	
additionalCode	UINT	
additionalDescription	STRING	
errorCode	SINT	
errorClass	SINT	
abortReason	USINT	
abortIdentifier	enumeration (FMSUSER | FMS | FAS | DLL)	
locallyGenerated	BOOL	
abortDetail	ARRAY OF USINT	

Table 22 – Structured FF FMS data types

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
VariableName	STRUCT			
	fdt:name	M	[1..1]	
VariableListName	STRUCT			
	fdt:name	M	[1..1]	
DomainName	STRUCT			
	fdt:name	M	[1..1]	
EventName	STRUCT			
	fdt:name	M	[1..1]	
PiName	STRUCT			
	fdt:name	M	[1..1]	
StartIndex	STRUCT			
	fdt:index	M	[1..1]	
AccessSpecificationVar	STRUCT			
	choice of	M	[1..1]	
	fftypes:Index	S	[1..1]	
AccessSpecificationVL	STRUCT			
	choice of	M	[1..1]	
	fftypes:Index	S	[1..1]	
	VariableListName	S	[1..1]	
VariableListItem	STRUCT			
	choice of	M	[1..1]	
	fftypes:Index	S	[1..1]	
	VariableName	S	[1..1]	
AccessSpecificationOd	STRUCT			
	choice of	M	[1..1]	
	fftypes:Index	S	[1..1]	
	VariableName	S	[1..1]	
	VariableListName	S	[1..1]	
	DomainName	S	[1..1]	
	EventName	S	[1..1]	
	PiName	S	[1..1]	
	StartIndex	S	[1..1]	
AccessSpecificationDomain	STRUCT			
	choice of	M	[1..1]	
	fftypes:Index	S	[1..1]	
	DomainName	S	[1..1]	
ErrorDescription	STRUCT			
	fdt:EnumeratorEntry	M	[1..1]	
	fdt:EnumeratorEntry	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
ErrorInfo	STRUCT			
	errorClass	M	[1..1]	
	errorCode	M	[1..1]	
	additionalCode	O	[0..1]	
	additionalDescription	O	[0..1]	
	ErrorDescription	O	[0..1]	
CommonErrorType	STRUCT			
	ErrorInfo	M	[1..1]	
OdErrorType	STRUCT			
	ErrorInfo	M	[1..1]	
	fftypes:Index	M	[1..1]	
FmsInitiateRequest	STRUCT			
	connectOption	M	[1..1]	
	fftypes:communication-Reference	M	[1..1]	
	fdt:tag	M	[1..1]	
	versionOdCalling	O	[0..1]	
	profileNumberCalling	O	[0..1]	
	accessProtectionSupported-Calling	O	[0..1]	
	passwordAndAccess-GroupsCalling	O	[0..1]	
	fftypes:DataLinkAddress	M	[1..1]	
	fftypes:VfdTag	M	[1..1]	
FmsInitiateResponse	STRUCT			
	fftypes:communication-Reference	M	[1..1]	
	fftypes:versionOd	O	[0..1]	
	profileNumberCalled	O	[0..1]	
	accessProtectionSupported-Called	O	[0..1]	
	passwordAndAccess-GroupsCalled	O	[0..1]	
FmsInitiateError	STRUCT			
	fftypes:communication-Reference	M	[1..1]	
	maxFmsPduSendingCalled	O	[0..1]	
	maxFmsPduReceiving-Called	O	[0..1]	
	fftypes:fmsFeatures-Supported	O	[0..1]	
	CommonErrorType	M	[1..1]	
FmsAbortRequest	STRUCT			
	fftypes:communication-Reference	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
	abortIdentifier	M	[1..1]	
	abortReason	M	[1..1]	
	abortDetail	O	[0..1]	
FmsAbortIndication	STRUCT			
	fftypes:communication-Reference	M	[1..1]	
	locallyGenerated	M	[1..1]	
	abortIdentifier	M	[1..1]	
	abortReason	M	[1..1]	
	abortDetail	O	[0..1]	
FmsStandardResponse	STRUCT			
	fftypes:communication-Reference	M	[1..1]	
	responseType	M	[1..1]	
FmsServiceError	STRUCT			
	fftypes:communication-Reference	M	[1..1]	
	choice of	M	[1..1]	
	CommonErrorType	S	[1..1]	
	OdErrorType	S	[1..1]	
FmsStatusRequest	STRUCT			
	fftypes:communication-Reference	M	[1..1]	
FmsStatusResponse	STRUCT			
	fftypes:communication-Reference	M	[1..1]	
	logicalStatus	M	[1..1]	
	physicalStatus	M	[1..1]	
	localDetail	O	[0..1]	
FmsIdentifyRequest	STRUCT			
	fftypes:communication-Reference	M	[1..1]	
FmsIdentifyResponse	STRUCT			
	fftypes:communication-Reference	M	[1..1]	
	fdt:vendor	M	[1..1]	
	modelName	M	[1..1]	
	revision	M	[1..1]	
FmsReadRequest	STRUCT			
	fftypes:communication-Reference	M	[1..1]	
	AccessSpecificationVar	M	[1..1]	
	fftypes:SubIndex	O	[0..1]	
FmsReadResponse	STRUCT			

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
	fftypes:communication-Reference	M	[1..1]	
	fdt:CommunicationData	M	[1..1]	
FmsWriteRequest	STRUCT			
	fftypes:communication-Reference	M	[1..1]	
	AccessSpecificationVar	M	[1..1]	
	fftypes:SubIndex	O	[0..1]	
	fdt:CommunicationData	M	[1..1]	
FmsDefineVariableList Request	STRUCT			
	fftypes:communication-Reference	M	[1..1]	
	accessProtection	M	[1..1]	
	fdt:byteArray	O	[0..1]	
	fftypes:listCount	M	[1..1]	
	VariableListItem	M	[1..*]	
	VariableListName	O	[0..1]	
FmsDefineVariableList Response	STRUCT			
	fftypes:communication-Reference	M	[1..1]	
	fftypes:Index	M	[1..1]	
FmsDeleteVariableList Request	STRUCT			
	fftypes:communication-Reference	M	[1..1]	
	AccessSpecificationVL	M	[1..1]	
FmsGetOdRequest	STRUCT			
	fftypes:communication-Reference	M	[1..1]	
	allAttributes	M	[1..1]	
	startFlag	M	[1..1]	
	AccessSpecificationOd	M	[1..1]	
FmsGetOdResponse	STRUCT			
	fftypes:communication-Reference	M	[1..1]	
	moreFollows	M	[1..1]	
	numberOfObject-Descriptions	M	[1..1]	
	fdt:CommunicationData	M	[1..1]	
FmsGenericInitiateDownloadSequenceRequest	STRUCT			
	fftypes:communication-Reference	M	[1..1]	
	AccessSpecificationDomain	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
FmsGenericDownloadSegmentRequest	STRUCT			
	fftypes:communication-Reference	M	[1..1]	
	moreFollows	M	[1..1]	
	AccessSpecificationDomain	M	[1..1]	
	fdt:CommunicationData	M	[1..1]	
FmsGenericTerminateDownloadSequenceRequest	STRUCT			
	fftypes:communication-Reference	M	[1..1]	
	AccessSpecificationDomain	M	[1..1]	
FmsGenericTerminateDownloadSequenceResponse	STRUCT			
	fftypes:communication-Reference	M	[1..1]	
	finalResult	O	[0..1]	
FmsInformationReport	STRUCT			
	fftypes:communication-Reference	M	[1..1]	
	fftypes:subscriptionInvokeId	M	[1..1]	
	fftypes:Index	M	[1..1]	
	fftypes:SubIndex	O	[0..1]	
	fdt:CommunicationData	M	[1..1]	
FmsEventNotification	STRUCT			
	fftypes:communication-Reference	M	[1..1]	
	fftypes:subscriptionInvokeId	M	[1..1]	
	fftypes:eventNumber	M	[1..1]	
	fftypes:Index	M	[1..1]	
	fdt:CommunicationData	M	[1..1]	
FmsAcknowledgeEventNotificationRequest	STRUCT			
	fftypes:communication-Reference	M	[1..1]	
	fftypes:subscriptionInvokeId	M	[1..1]	
	fftypes:eventNumber	M	[1..1]	
	fftypes:Index	M	[1..1]	

11.3 H1 communication data types

Used at:

- Connect.Request
- Connect.Response
- Disconnect.Request
- Disconnect.Response
- Transaction.Request

- Transaction.Response

The H1 Communication Definitions (Table 23 and Table 24) contain the address information and the communication data.

Namespace: ffh1

Table 23 – Simple H1 communication data types

Data type	Definition	Description
sequenceTime	UDINT	Period of time in [ms] for the whole sequence
delayTime	UDINT	Delay time in [ms] between two communication calls
clearPDTag	BOOL	System management related attributes
reasonCode	enumeration (success | serviceNotSupported | invalidParameter | errorDLLInsufficientResources | errorDLLSendingQueueFull | errorDLLErrorTimeOutBeforeTransmission | errorDLLReasonUnspecified | deviceFailedRespondSetPDTag | deviceFailedRespondWhoHasPDTag | deviceFailedRespondSetAddress | deviceFailedRespondIdentify | deviceFailedRespondEnableSMOp | deviceFailedRespondClearAddress| mutipleResponsefromWhoHasPDTag | nonMatchingPDTagfromWhoHasPDTag | nonMatchingPDTagfromIdentify | nonMatchingdevIDfromIdentify | remoteErrorInvalidState | remoteErrorPDTagMatch | remoteErrordevIDMatch | remoteErrorSMIBWriteFailed | remoteErrorStartingSMOperational)	Reason code according to FF-880 Section 7
smAPClockSyncInterval	USINT	Application clock synchronization interval for the link on which the field device resides. See system management service Set Address FF-880 Section 5.2.1.2.2
smPrimaryAPTimePublisher	USINT	This is the address of the primary application clock time publisher for the link on which the field device resides. See system management service Set Address FF-880 Section 5.2.1.2.2
elementID	UDINT	Used by system management service Find Tag Query according to FF-880 Section 5.5.2.1 This is the unsigned 32-bit integer that, when present, together with the Tag identifies the element (e.g. FB parameter) to be located. See also element SmQueryFB and SmFindTagQuery
moreVCRL	BOOL	Used by system management service Find Tag Reply according to FF-880 Section 5.5.2.2. This Boolean flag is true when there are additional communication relationships in the remote device which may be used for the communication path. See also elements SmReplyVFD, SmReplyFB and SmFindTagReply
extension	ARRAY OF USINT	Extension attribute used in program invocations
executionArgument	ARRAY OF USINT	Execution argument attribute used in program invocations

Data type	Definition	Description
reusable	BOOL	reusable attribute used in program invocations

Table 24 – Structured H1 communication data types

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
SmQueryPhysicalDevice	STRUCT			Designates the type of query for PD Tag. Used by element SmFindTagQuery
	fdt:tag	M	[1..1]	
SmQueryVFD	STRUCT			Designates the type of query for VFD Tag. Used by element SmFindTagQuery
	fdt:tag	M	[1..1]	
	fftypes:vfdTag	M	[1..1]	
SmQueryFB	STRUCT			Designates the type of query for Function block/ Function block parameter. Used by element SmFindTagQuery
	fdt:tag	M	[1..1]	
	elementID	O	[0..1]	
SmReplyPhysicalDevice	STRUCT			Denotes type of reply for a PD Tag find tag query. Refer to element SmFindTagReply
	fftypes:devID	M	[1..1]	
SmReplyVFD	STRUCT			Denotes type of reply for a VFD Tag find tag query. Refer to element SmFindTagReply
	fftypes:vfdRef	M	[1..1]	
	moreVCRL	O	[0..1]	
	fftypes:versionOd	M	[1..1]	
	fftypes:IndexList	M	[1..1]	
SmReplyFB	STRUCT			Denotes type of reply for a Function block or Function block parameter find tag query. Refer to element SmFindTagReply
	fftypes:vfdRef	M	[1..1]	
	moreVCRL	O	[0..1]	
	fftypes:versionOd	M	[1..1]	
	fftypes:Index	M	[1..1]	
	fftypes:IndexList	M	[1..1]	
ConnectRequest	STRUCT			Context management see FF-870 Section 3.3.4 and Section 10.1.7
ConnectResponse	STRUCT			Context management see FF-870 Section 3.3.4 and Section 10.1.7
	fftypes:communication-Reference	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
DisconnectRequest	STRUCT			Context management see FF-870 Section 3.3.4 and Section 10.1.7
	fftypes:communication-Reference	M	[1..1]	
DisconnectResponse	STRUCT			Context management see FF-870 Section 3.3.4 and Section 10.1.7
	fftypes:communication-Reference	M	[1..1]	
AccessSpecification	STRUCT			Access Specification Element used in program invocations
	fftypes:Index	M	[1..1]	
CreatePIRequest	STRUCT			Create program invocation request element
	fftypes:communication-Reference	M	[1..1]	
	fms:accessProtection	M	[1..1]	
	fms:AccessSpecification-Domain	O	[0..*]	
	fdt:name	O	[0..1]	
	extension	O	[0..1]	
	reusable	O	[0..1]	
CreatePIResponse	STRUCT			Create program invocation Response element
	fftypes:communication-Reference	M	[1..1]	
	fftypes:odIndex	M	[1..1]	
DeletePIRequest	STRUCT			Delete program invocation request
	fftypes:communication-Reference	M	[1..1]	
	AccessSpecification	M	[1..1]	
StartPIRequest	STRUCT			Start Program Invocations
	fftypes:communication-Reference	M	[1..1]	
	AccessSpecification	M	[1..1]	
	executionArgument	O	[0..1]	
StopPIRequest	STRUCT			Stop program invocation request
	fftypes:communication-Reference	M	[1..1]	
	AccessSpecification	M	[1..1]	
ResumePIRequest	STRUCT			Resume Program Invocations
	fftypes:communication-Reference	M	[1..1]	
	AccessSpecification	M	[1..1]	
	executionArgument	O	[0..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
ResetPIRequest	STRUCT			Reset Program Invocation Request
	fftypes:communication-Reference	M	[1..1]	
	AccessSpecification	M	[1..1]	
KillPIRequest	STRUCT			Kill Program Invocation Request
	fftypes:communication-Reference	M	[1..1]	
	AccessSpecification	M	[1..1]	
SmStandardResponse	STRUCT			System management services see FF-880 Section 5
	fftypes:communication-Reference	M	[1..1]	
	reasonCode	M	[1..1]	
	fftypes:smServiceID	M	[1..1]	
SmSetPDTagRequest	STRUCT			System management service Set PD-Tag see FF-880 Section 5.2.1.1.2
	fftypes:communication-Reference	M	[1..1]	
	fdt:tag	M	[1..1]	
	fftypes:nodeId	M	[1..1]	
	fftypes:devID	M	[1..1]	
	clearPDTag	O	[0..1]	
SmSetAddressRequest	STRUCT			System management service Set Address see FF-880 Section 5.2.1.2.2
	fftypes:communication-Reference	M	[1..1]	
	fdt:tag	M	[1..1]	
	fftypes:nodeId	M	[1..1]	
	smAPClockSyncInterval	M	[1..1]	
	smPrimaryAPTime-Publisher	M	[1..1]	
SmClearAddressRequest	STRUCT			System management service Clear Address see FF-880 Section 5.2.1.3.1
	fftypes:communicationReference	M	[1..1]	
	fdt:tag	M	[1..1]	
	fftypes:nodeId	M	[1..1]	
	fftypes:devID	M	[1..1]	
SmIdentifyRequest	STRUCT			System management service SM Identify see FF-880 Section 5.3.1
	fftypes:communication-Reference	M	[1..1]	
	fftypes:DataLinkAddress	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
SmIdentifyResponseEntry	STRUCT			System management service SM Identify see FF-880 Section 5.3.1
	fdt:tag	M	[1..1]	
	fftypes:devID	M	[1..1]	
SmIdentifyResponse	STRUCT			
	fftypes:communication-Reference	M	[1..1]	
	SmIdentifyResponseEntry	O	[0..*]	
SmFindTagQuery	STRUCT			System management service Find Tag Query see FF-880 Section 5.5.2.1 if the SmFindTagQuery could not be transmitted, a SmStandardResponse with reasonCode will be received
	fftypes:communication-Reference	M	[1..1]	
	fftypes:DataLinkAddress	M	[1..1]	
	choice of	M	[1..1]	
	SmQueryPhysicalDevice	S	[1..1]	
	SmQueryVFD	S	[1..1]	
	SmQueryFB	S	[1..1]	
SmFindTagReply	STRUCT			System management service Find Tag Reply see FF-880 Section 5.5.2.2
	fftypes:communication-Reference	M	[1..1]	
	fftypes:DataLinkAddress	M	[1..1]	
	fftypes:DataLinkAddress	M	[1..1]	
	fftypes:nodeId	M	[1..1]	
	choice of	M	[1..1]	
	SmReplyPhysicalDevice	S	[1..1]	
	SmReplyVFD	S	[1..1]	
	SmReplyFB	S	[1..1]	
H1SubscribeRequest	STRUCT			H1SubscribeRequest is used to request for subscription by DTM/BTM
	fftypes:communication-Reference	M	[1..1]	
	choice of	M	[1..1]	
	H1TrendSubscriptionInfo	S	[1..1]	
	H1Parameter-SubscriptionInfo	S	[1..1]	
	H1EventSubscriptionInfo	S	[1..1]	
H1SubscribeResponse	STRUCT			H1SubscribeResponse is the response to the subscription Request
	fftypes:communication-Reference	M	[1..1]	
	fms:CommonErrorType	O	[0..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
H1UnSubscribeRequest	STRUCT			H1 Unsubscribe request is used to terminate a subscription
	fftypes:communication-Reference	M	[1..1]	
	fftypes:subscription-InvokeId	M	[1..1]	
H1UnSubscribeResponse	STRUCT			Response to H1 Unsubscribe request
	fftypes:communication-Reference	M	[1..1]	
	fms:CommonErrorType	O	[0..1]	
H1TrendSubscriptionInfo	STRUCT			H1 Trend subscription used in Subscribe request
	fftypes:nodeId	M	[1..1]	
	fftypes:vfdRef	M	[1..1]	
	fftypes:odIndex	M	[1..1]	
	fftypes:LinkobjectInfo	M	[1..1]	
	fftypes:VcrListInfo	M	[1..1]	
	fftypes:Index	M	[1..1]	
H1ParameterSubscriptionInfo	STRUCT			H1 Parameter subscription used in Subscribe request
	fftypes:nodeId	M	[1..1]	
	fftypes:vfdRef	M	[1..1]	
	fftypes:LinkobjectInfo	M	[1..1]	
	fftypes:VcrListInfo	M	[1..1]	
	fftypes:Index	M	[1..1]	
	fftypes:SubIndex	O	[0..1]	
H1EventSubscriptionInfo	STRUCT			H1 Event subscription used in Subscribe request
	fftypes:nodeId	M	[1..1]	
	fftypes:vfdRef	M	[1..1]	
	fftypes:LinkobjectInfo	M	[1..1]	
	fftypes:VcrListInfo	M	[1..1]	
	fftypes:Index	M	[1..1]	
SequenceBegin	STRUCT			General sequence support see FDT spec communication sequence processing
	sequenceTime	O	[0..1]	
	delayTime	O	[0..1]	
	fftypes:communication-Reference	M	[1..1]	
SequenceEnd	STRUCT			General sequence support see FDT spec communication sequence processing
	fftypes:communication-Reference	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
SequenceStart	STRUCT			General sequence support see FDT spec communication sequence processing
	fftypes:communication-Reference	M	[1..1]	
Abort	STRUCT			Describes the abort
	fftypes:communication-Reference	M	[1..1]	

11.4 HSE communication data types

Used at:

- Connect.Request
- Connect.Response
- Disconnect.Request
- Disconnect.Response
- Transaction.Request
- Transaction.Response

The HSE Communication Definitions (Table 25 and Table 26) contain the address information and the communication data.

Namespace: ffhse

Table 25 – Simple HSE communication data types

Data type	Definition	Description
sequenceTime	UDINT	Period of time in [ms] for the whole sequence
delayTime	UDINT	Delay time in [ms] between two communication calls
configurationUseNMA	BOOL	NMA configuration use - see FF-588 6.5.1.1.1
queryType	enumeration (queryPrimaryPD queryVFD | queryFB | queryElementId | queryVFDRef | queryDeviceIndex | querySecondaryPD)	Indicates the type of query for SM Find Tag Query service See FF-588 Section 6.5.2.1 and FF-589 5.3.1
duplicateDetectionState	USINT	indicates duplicate detection state received with SM Find Tag Reply See FF-588 Section 6.5.2.2 and FF-589 5.3.2
stateSMK	USINT	State of HSE SMK as define with FF-589
redundantCapability	enumeration (D1 | D2 | D3)	Redundant Device Type Capability - see FF-588 Section 6.5.2.7.1 used with response to SM Identify service
deviceRedundancyState	USINT	Device Redundancy State - see FF-589 and FF-588 Section 6.5.2.7.1 used with response to SM Identify service

Data type	Definition	Description
repeatTimeHSE	UDINT	HSE Repeat time for device annunciations see FF-589
maxDeviceIndex	UINT	maximum value that the device index may have. See the Redundancy specification FF-593
versionAnnunciation	UDINT	version number of SM Annuciation message – see FF 589
versionHSEDevice	UDINT	Version of the list of version numbers in SM characteristics in the SMIB
interfaceToClear	USINT	identifies the HSE interface to be cleared. see FF-589
noError	BOOL	Indicates that no error occurred. Used by SmStandardResponse to encode a SM service response with no error
msgHdrOptions	USINT	Message Header Options
bufferSize	UDINT	Needed for session endpoint configuration
maxMessageLength	UDINT	needed for session endpoint configuration

Table 26 – Structured HSE communication data types

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
SourceIP	STRUCT			IP address from which a request was sent
	fftypes:IP	M	[1..1]	
OperationalIP	STRUCT			Operational IP address of the device responding
	fftypes:IP	M	[1..1]	
OpenSessionRequest	STRUCT			Open Session Request
	fdt:tag	M	[1..1]	
	configurationUseNMA	M	[1..1]	
	fftypes:IP	M	[1..1]	
SmQueryVFDRef	STRUCT			Designates the type of query for VFD Reference. Used by element SmFindTagQuery
	fdt:tag	M	[1..1]	
	fftypes:vfdRef	M	[1..1]	
SmQueryDeviceIndex	STRUCT			Designates the type of query for a device index. Used by element SmFindTagQuery
	fftypes:deviceIndex	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
SmFindTagQuery	STRUCT			See FF-588 Section 6.5.2.1 and FF-589 5.3.1
	fftypes:communication-Reference	M	[1..1]	
	queryType	M	[1..1]	
	fftypes:IP	M	[1..1]	
	fftypes:DataLinkAddress	M	[1..1]	
	choice of	M	[1..1]	
	ffh1:SmQueryPhysicalDevice	S	[1..1]	
	ffh1:SmQueryVFD	S	[1..1]	
	ffh1:SmQueryFB	S	[1..1]	
	SmQueryVFDRef	S	[1..1]	
	SmQueryDeviceIndex	S	[1..1]	
SmFindTagReply	STRUCT			See FF-588 Section 6.5.2.2 and FF-589 5.3.2
	fftypes:communication-Reference	M	[1..1]	
	queryType	M	[1..1]	
	duplicateDetectionState	M	[1..1]	
	fftypes:linkId	M	[1..1]	
	fftypes:nodeId	O	[0..1]	
	fdt:tag	M	[1..1]	
	SourceIP	M	[1..1]	
	OperationalIP	M	[1..1]	
	choice of	M	[1..1]	
	ffh1:SmReplyPhysicalDevice	S	[1..1]	
	ffh1:SmReplyVFD	S	[1..1]	
	ffh1:SmReplyFB	S	[1..1]	
DeviceInformation	STRUCT			This element specifies the capabilities of the device. It is defined in the FDA specification [FF-588]. FF-803 FS 1.19 SM Section 6.2.5
	redundantCapability	M	[1..1]	
	fftypes:deviceIndex	O	[0..1]	
	maxDeviceIndex	O	[0..1]	
RedundancyInformation	STRUCT			Encodes redundancy state/information of HSE device - used with SM Identify service. See element SmIdentifyResponse
	deviceRedundancyState	M	[1..1]	
	fftypes:port	M	[1..1]	
H1LiveListVersion	STRUCT			This element provides the Version of the H1 Live List
	fftypes:linkId	M	[1..1]	
	fftypes:versionNumber	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
H1NodeAddressVersion	STRUCT			This element provides the Version of the H1 Node address
	fftypes:nodeId	M	[1..1]	
	fftypes:versionNumber	M	[1..1]	
VersionInformation	STRUCT			Encodes optional version information of device - used with SM Identify service. See element SmIdentifyResponse
	versionAnnunciation	M	[1..1]	
	versionHSEDevice	M	[1..1]	
	fftypes:listCount	M	[1..1]	
	choice of	O	[0..*]	
	H1LiveListVersion	S	[1..1]	
	H1NodeAddressVersion	S	[1..1]	
SmIdentifyRequest	STRUCT			See FF-588 Section 6.5.2.3 and FF-589 5.3.3
	fftypes:communication-Reference	M	[1..1]	
	fftypes:IP	M	[1..1]	
	fftypes:DataLinkAddress	M	[1..1]	
SmIdentifyResponseEntry	STRUCT			HSE specific SM Identify Response Entry
	fftypes:deviceType	M	[1..1]	
	fdt:tag	M	[1..1]	
	fftypes:devID	M	[1..1]	
	stateSMK	M	[1..1]	
	repeatTimeHSE	O	[0..1]	
	duplicateDetectionState	O	[0..1]	
	fftypes:ip	O	[0..1]	
	fftypes:IP	M	[1..1]	
	fftypes:DataLinkAddress	M	[1..1]	
	DeviceInformation	M	[1..1]	
	RedundancyInformation	O	[0..1]	
	VersionInformation	O	[0..1]	
SmIdentifyResponse	STRUCT			See FF-588 Section 6.5.2.3 and FF-589 5.3.3
	fftypes:communication-Reference	M	[1..1]	
	SmIdentifyResponseEntry	O	[0..*]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
SmStandardResponse	STRUCT			See FF-588 Section 6.5.2.3 and FF-589 5.3.3
	fftypes:communication-Reference	M	[1..1]	
	fftypes:smServiceID	M	[1..1]	
	noError	O	[0..1]	
	fftypes:IP	M	[1..1]	
	fftypes:DataLinkAddress	M	[1..1]	
	fms:CommonErrorType	M	[1..1]	
SmClearAddressRequest	STRUCT			See FF-588 Section 6.5.2.4 and FF-589 5.3.4
	fftypes:communication-Reference	M	[1..1]	
	fdt:tag	M	[1..1]	
	fftypes:devID	M	[1..1]	
	interfaceToClear	O	[0..1]	
	fftypes:IP	M	[1..1]	
	fftypes:DataLinkAddress	M	[1..1]	
SmClearAssignmentInfoRequest	STRUCT			See FF-588 Section 6.5.2.6 and FF-589 5.3.5
	fftypes:communication-Reference	M	[1..1]	
	fdt:tag	M	[1..1]	
	fftypes:devID	M	[1..1]	
	fftypes:IP	M	[1..1]	
	fftypes:DataLinkAddress	M	[1..1]	
SmSetAssignmentInfoRequest	STRUCT			See FF-588 Section 6.5.2.5 and FF-589 5.3.6
	fftypes:communication-Reference	M	[1..1]	
	fdt:tag	M	[1..1]	
	fftypes:devID	M	[1..1]	
	fftypes:deviceIndex	O	[0..1]	
	maxDeviceIndex	O	[0..1]	
	repeatTimeHSE	O	[0..1]	
	fftypes:ip	O	[0..1]	
	duplicateDetectionState	O	[0..1]	
	fftypes:nodeId	O	[0..1]	
	fftypes:IP	M	[1..1]	
	fftypes:DataLinkAddress	M	[1..1]	
	RedundancyInformation	O	[0..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
SmSetAssignmentInfoResponse	STRUCT			See FF-588 Section 6.5.2.5 and FF-589 5.3.6
	fftypes:communication-Reference	M	[1..1]	
	repeatTimeHSE	O	[0..1]	
	maxDeviceIndex	O	[0..1]	
	fftypes:IP	M	[1..1]	
	fftypes:DataLinkAddress	M	[1..1]	
ConnectRequest	STRUCT			Context management see FF-588 Section 6.5.3.2 and FF-870 Sections 3.3.4 and 10.1.7
	OpenSessionRequest	O	[0..1]	
ConnectResponse	STRUCT			Context management see FF-588 Section 6.5.3.2 and FF-870 Sections 3.3.4 and 10.1.7
	fftypes:communication-Reference	M	[1..1]	
	fms:CommonErrorType	O	[0..1]	
DisconnectRequest	STRUCT			Context management see FF-588 Section 6.5.3.2 and FF-870 Sections 3.3.4 and 10.1.7
	fftypes:communication-Reference	M	[1..1]	
DisconnectResponse	STRUCT			Context management see FF-588 Section 6.5.3.2 and FF-870 Sections 3.3.4 and 10.1.7
	fftypes:communication-Reference	M	[1..1]	
HSESubscribeRequest	STRUCT			HSE Subscribe request
	fftypes:communicationReference	M	[1..1]	
	msgHdrOptions	M	[1..1]	
	bufferSize	M	[1..1]	
	maxMessageLength	M	[1..1]	
	fftypes:ip	M	[1..1]	
	choice of	M	[1..1]	
	HSETrendSubscriptionInfo	S	[1..1]	
	LocalTrendSubscriptionInfo	S	[1..1]	
	HSEParameterSubscriptionInfo	S	[1..1]	
	LocalParameterSubscription-Info	S	[1..1]	
	HSEEventSubscriptionInfo	S	[1..1]	
	LocalEventSubscriptionInfo	S	[1..1]	
HSESubscribeResponse	STRUCT			HSE Subscribe Response
	fftypes:communicationReference	M	[1..1]	
	fms:CommonErrorType	O	[0..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
HSEUnSubscribeRequest	STRUCT			HSE Unsubscribe request is used to terminate a subscription
	fftypes:communication-Reference	M	[1..1]	
	fftypes:subscriptionInvokeId	M	[1..1]	
HSEUnSubscribeResponse	STRUCT			HSE Unsubscribe response.
	fftypes:communication-Reference	M	[1..1]	
	fms:CommonErrorType	O	[0..1]	
HSETrendSubscriptionInfo	STRUCT			HSE Trend subscription used in Subscribe request
	fftypes:linkId	M	[1..1]	
	fftypes:vfdRef	M	[1..1]	
	ffh1:H1TrendSubscriptionInfo	M	[1..1]	
	fftypes:VcrListInfo	M	[1..1]	
	fftypes:HseConfiguredVcrList-Info	M	[1..1]	
	fftypes:ConfiguredSessionList-Info	M	[1..1]	
LocalTrendSubscriptionInfo	STRUCT			Local Trend subscription used in Subscribe request
	fftypes:vfdRef	M	[1..1]	
	fftypes:odIndex	M	[1..1]	
	fftypes:LinkobjectInfo	M	[1..1]	
	fftypes:HseConfiguredVcrList-Info	M	[1..1]	
	fftypes:ConfiguredSessionList-Info	M	[1..1]	
	fftypes:Index	M	[1..1]	
LocalParameterSubscriptionInfo	STRUCT			Local Parameter subscription used in Subscribe request
	fftypes:vfdRef	M	[1..1]	
	fftypes:LinkobjectInfo	M	[1..1]	
	fftypes:HseConfiguredVcrList-Info	M	[1..1]	
	fftypes:ConfiguredSessionList-Info	M	[1..1]	
	fftypes:Index	M	[1..1]	
	fftypes:SubIndex	O	[0..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
HSEParameterSubscriptionInfo	STRUCT			HSE Parameter subscription used in Subscribe request
	fftypes:linkId	M	[1..1]	
	fftypes:vfdRef	M	[1..1]	
	ffh1:H1ParameterSubscription-Info	M	[1..1]	
	fftypes:VcrListInfo	M	[1..1]	
	fftypes:HseConfiguredVcrListInfo	M	[1..1]	
	fftypes:ConfiguredSessionList-Info	M	[1..1]	
HSEEventSubscriptionInfo	STRUCT			HSE Event subscription used in Subscribe request
	fftypes:linkId	M	[1..1]	
	fftypes:vfdRef	M	[1..1]	
	ffh1:H1EventSubscriptionInfo	M	[1..1]	
	fftypes:VcrListInfo	M	[1..1]	
	fftypes:HseConfiguredVcrList-Info	M	[1..1]	
	fftypes:ConfiguredSessionList-Info	M	[1..1]	
LocalEventSubscriptionInfo	STRUCT			Local Event subscription used in Subscribe request
	fftypes:vfdRef	M	[1..1]	
	fftypes:LinkobjectInfo	M	[1..1]	
	fftypes:HseConfiguredVcrList-Info	M	[1..1]	
	fftypes:ConfiguredSessionList-Info	M	[1..1]	
	fftypes:Index	M	[1..1]	
SequenceBegin	STRUCT			General sequence support see FDT spec communication sequence processing
	sequenceTime	O	[0..1]	
	delayTime	O	[0..1]	
	fftypes:communication-Reference	M	[1..1]	
SequenceEnd	STRUCT			General sequence support see FDT spec communication sequence processing
	fftypes:communication-Reference	M	[1..1]	
SequenceStart	STRUCT			General sequence support see FDT spec communication sequence processing
	fftypes:communication-Reference	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
Abort	STRUCT			Describes the abort
	fftypes:communication-Reference	M	[1..1]	

11.5 FDT FF standard block communication data types

Used at:

- Connect.Request
- Connect.Response
- Disconnect.Request
- Disconnect.Response
- Transaction.Request
- Transaction.Response

The definitions in Table 27 provide information for the communication between a BTM and a DTM.

Namespace: ffbtm

Table 27 – Block communication data types

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
BlockAddress	STRUCT			Block Address element. Note that Block Tag may be empty if the block tag is not known. The Index is used to identify the block in this case
	btm:blockTag	M	[1..1]	
	fdt:index	M	[1..1]	
ConnectRequest	STRUCT			Describes the communication request to establish a connection
	BlockAddress	M	[1..1]	
ConnectResponse	STRUCT			Describes the communication response to the connect request
	fftypes:communication-Reference	M	[1..1]	
	BlockAddress	M	[1..1]	
DisconnectRequest	STRUCT			Describes the communication request to release a connection
	fftypes:communication-Reference	M	[1..1]	
DisconnectResponse	STRUCT			Describes the communication response
	fftypes:communication-Reference	M	[1..1]	
BtmSubscribeRequest	STRUCT			Subscription Request definition
	fftypes:communication-Reference	M	[1..1]	
	choice of	M	[1..1]	
	BtmTrendSubscription-Info	S	[1..1]	
	BtmParameter-SubscriptionInfo	S	[1..1]	
	BtmEventSubscription-Info	S	[1..1]	
BtmSubscribeResponse	STRUCT			Subscription Responce
	fftypes:communication-Reference	M	[1..1]	
	fms:CommonErrorType	O	[0..1]	
BtmTrendSubscription-Info	STRUCT			Trend Subscription definition
	fftypes:Index	M	[1..1]	
BtmParameter-SubscriptionInfo	STRUCT			Paramter subscription definition
	fftypes:Index	M	[1..1]	
	fftypes:SubIndex	O	[0..1]	
BtmEventSubscription-Info	STRUCT			Event Subscription definition
	fftypes:Index	M	[1..1]	

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
BtmUnSubscribeRequest	STRUCT			Subscription termination request
	fftypes:communication-Reference	M	[1..1]	
	fftypes:subscription-InvokeId	M	[1..1]	
BtmUnSubscribeResponse	STRUCT			Subscription termination response
	fftypes:communication-Reference	M	[1..1]	
	Fms:CommonErrorType	O	[0..1]	

12 Channel parameter data types

The definitions in Table 28 and Table 29 are used at services related to Channel objects:

- ReadChanelInformation
- WriteChanelInformation
- ReadChanelData
- WriteChanelData

Namespace : fdtffchprms

Table 28 – Simple FF channel data types

Data type	Definition	Description
dataType	enumeration (Boolean | Integer8 | Integer16 | Integer32 | Unsigned8 | Unsigned16 | Unsigned32 | FloatingPoint | Visible | String | Octet | String | Date | TimeofDay | Time | DifferenceBit | TimeValue | ValueStatusFloat | ValueStatusDiscrete | ValueStatusBitstring | Scaling | Mode | AccessPermissions | AlarmFloat | AlarmDiscrete | EventUpdate | AlarmSummary | AlertAnalog | AlertDiscrete | AlertUpdate | TrendFloat | TrendDiscrete | TrendBitstring | FBLink | SimulateFloat | SimulateDiscrete | SimulateBitstring | Test | Action | Custom | other)	
frameApplicationTag	STRING	Frame Application-specific tag used for identification and navigation. The DTM/BTM should display this tag at channel-specific user interfaces
gatewayBusCategory	UUID	Unique identifier for a supported bus type (H1 or HSE) according to the specific CATID
index	UDINT	Address information – Index of the parameter in the OD
invalidBit	UDINT	Bit position of the invalid status channel
logic	enumeration (positive | negative)	Additional data type information: positive 0=FALSE; 1=TRUE

Data type	Definition	Description
number	UDINT	Address information
protectedByChannelAssignment	BOOL	TRUE if the channel is set to Read Only by the Frame Application. Usually set to TRUE if a channel assignment exists
simulationBit	UDINT	Bit position of the simulation status channel
statusChannel	BOOL	TRUE if the channel is for status information only
subIndex	UDINT	Subindex of the parameter in the OD, used for parameter addressing
substituteValueBit	UDINT	Bit position of the substitute status channel

Table 29 – Structured FF channel data types

Data type	Definition			Description
	Elementary data types	Usage	Multiplicity	
FDTChannel	STRUCT			Description of the channel
	fdt:tag	M	[1..1]	
	fdt:id	M	[1..1]	
	fdt:descriptor	O	[0..1]	
	protectedByChannelAssignment	M	[1..1]	
	number	M	[1..1]	
	dataType	M	[1..1]	
	fdt:signalType	M	[1..1]	
	frameApplicationTag	O	[0..1]	
	appId:applicationId	O	[0..1]	
	logic	O	[0..1]	
	fdt:SemanticInformation	O	[0..*]	
	fdt:BitEnumeratorEntries	O	[0..1]	
	fdt:EnumeratorEntries	O	[0..1]	
	fdt:Unit	O	[0..1]	
	ParameterAddress	O	[0..1]	
	fdt:Alarms	O	[0..1]	
	fdt:Ranges	O	[0..1]	
	fdt:Deadband	O	[0..1]	
	fdt:SubstituteValue	O	[0..1]	
FDTChannelType	STRUCT			Description of the channel component in case of channels with gateway functionality
	fdt:VersionInformation	M	[1..1]	
	gatewayBusCategory	O	[0..1]	
	statusChannel	O	[0..1]	
ParameterAddress	STRUCT			Address of parameter
	fftypes:communicationReference	M	[1..1]	
	index	M	[1..1]	
	subIndex	O	[0..1]	

13 Device identification

13.1 Protocol specific handling of data type STRING

Encoding of Fieldbus Foundation data type VisibleString:

The encoding of parameters or structure members of Fieldbus Foundation data type VisibleString follows the standard ISO 646. Refer to FF-870 chapter 9.3.1.5 for a detailed definition and byte sequence. ISO 646 corresponds directly to the ASCII character set. Leading spaces of a VisibleString (for instance with the PD Tag) may be significant and cannot be trimmed. The data type Visible String always specifies a length. If the actual string to be represented by the data type VisibleString is smaller than the length the unused characters in the Visible String are set to ASCII space (0x20) characters.

In VisibleStrings, invisible characters provided by a device have to be replaced by '?'

13.2 Common device type identification data types

Table 30 lists the identification relevant data, source and format for FF H1 communications.

Table 30 – FieldbusFoundation H1 table

FDT-Attribute name[7]	Semantic element name[8]	Data request in physical device[9]	FF protocol specific name	FF data format	XML-FDT format (display format)	Specification Reference / Remark
deviceAddress	IdAddress	Node Address parameter is the data link address of the device. Node Address is held in the Data Link Layer and is available to SM via local NM. Its value is set through SET_ADDRESS service	Node address	Unsigned8	ui1 (string)	FF-581 – System Architecture chapter 7.4 – "Node-Address" FF-880 – System Management chapter 5.2 Address Assignment
busProtocol	IdBusProtocol	"FF-H1"	FF Bus Protocol	Enumeration : "FF-H1", "FF-HSE", "FF-Block"	enum	
manufacturerID	IdManufacturer	MANUFAC_ID Resource Block Parameter at Index 10	MANUFAC_ID	Unsigned32	ui4	Refer to FF-891 chapter 3.1. Can be retrieved from the resource block of the device at relative index 10 or from the device ID [1,)] (DEV_ID)
dev_type	IdTypeID	DEV_TYPE Resource Block parameter at Index 11	DEV_TYPE	Unsigned16	ui2	Refer to FF-891 chapter 3.1. Can be retrieved from the resource block of the device at relative index 11 or from the device ID [2,)] (DEV_ID)

7 FDT-Atribute Name defines the FF specific definition of the attribute.

8 Semantic Element Name defines the Protocol independent semantic element name.

9 This column defines source of the information.

FDT-Attribute name[7]	Semantic element name[8]	Data request in physical device[9]	FF protocol specific name	FF data format	XML-FDT format (display format)	Specification Reference / Remark
device_dd_Revision	IdSoftwareRevision	DEV_REV (Resource Block parameter at Index 12) multiplied by 256 + DD_REV (Resource Block parameter at Index 13)	DEV_REV and DD_REV	Unsigned16	ui2	Device revision (DEV_REV) and DD revision (DD_REV) Refer to FF-891 chapter 3.1. DEV_REV can be retrieved from the resource block of the device at relative index 12. DD_REV can be retrieved from t he resource block of the device at relative index 13. Device revision and DD revision are only present if the device contains a Function block VFD.
pd_tag	IdTag	Physical device tag is kept in the System Management Information Base. Its value can be determined by using the SM_IDENTIFY service and its value is set through SET_PD_TAG service.	PD Tag	VisibleString of length 32 (bytes). Encoding rules see section 12	string	Refer to FF-581 – System Architectureand FF-880 – System Management chapter 5.3.1. Is used for device identification with the SM Identify service and address assignment with the Set PD-Tag service (see FF-880 section 5.2.1.1.2).
dev_id	IdSerialNumber	Device ID is a system independent identifier that is provided by the manufacturer.	DEV_ID	VisibleString of length 32 (bytes). Encoding rules see section 12	string	The Device ID is a unique identifier for a device instance rather than a device type. For each device of a certain device type there is a different Device ID. Refer to FF-581 – System Architecture section 7.4.2. The structure of the DEV_ID is detailed with technical note TN002-1.1.

NOTE 1 The first six (6) octets of the device ID (DEV_ID) represent a string of hexadecimal characters expressing the Manufacturer's ID (MANUFAC_ID), a 24-bit binary number already registered with FF.

NOTE 2 The four (4) octets of the device ID (DEV_ID) beginning with octet resp. byte offset 6 represent a string of hexadecimal characters expressing the Device Type (DEV_TYPE), a 16-bit binary number assigned by the manufacturer.

Table 31 lists the identification relevant data, source and format for FF HSE communications.

Table 31 – FieldbusFoundation HSE

FDT-Attribute name	Semantic element name	Data request in physical device	FF protocol specific name	FF data format	XML-FDT format (display format)	Specification Reference / Remark
dataLinkAddress	IdAddress	16 Bytes	IP Address	OctetString of length 16	string	Refer to FF-588 Field Device Access Agent section 1.3.17. May reference a IPv4 or IPv6 IP address. A conversion to a textual representation of the IP address shall be provided. The textual representation of the IPv6 address is standardized with RFC 3513
busProtocol	IdBusProtocol	"FF-HSE"	FF Bus Protocol	Enumeration : "FF-H1", "FF-HSE", "FF-Block"	enum	
manufacturerID	IdManufacturer	MANUFAC_ID Resource Block Parameter at Index 10	MANUFAC_ID	Unsigned32	ui4	Refer to FF-891 chapter 3.1. Can be retrieved from the resource block of the device at relative index 10 or from the device ID [1.)] (DEV_ID)
dev_type	IdTypeID	DEV_TYPE Resource Block parameter at Index 11	DEV_TYPE	Unsigned16	ui2	Refer to FF-891 chapter 3.1. Can be retrieved from the resource block of the device at relative index 11 or from the device ID [2.)] (DEV_ID)
device_dd_Revision	IdSoftwareRevision	DEV_REV (Resource Block parameter at Index 12) multiplied by 256 + DD_REV (Resource Block parameter at Index 13	DEV_REV and DD_REV	Unsigned16	ui2	For device revision (DEV_REV) and DD revision (DD_REV) refer to FF-891 chapter 3.1. DEV_REV can be retrieved from the resource block of the device at relative index 12. DD_REV can be retrieved formt he resource block of the device at relative index 13. Device revision and DD revision are only present if the device contains a Function block VFD

FDT-Attribute name	Semantic element name	Data request in physical device	FF protocol specific name	FF data format	XML-FDT format (display format)	Specification Reference / Remark
pd_tag	IdTag	Physical Device Tag	PD_TAG	VisibleString of length 32 (bytes). Encoding rules see section 12	string	Refer to FF-588 Field Device Access (FDA) Agent and FF-803 FS 1.19 NM Section 5.2.1 – Physical device tag. Is used for device identification with the SM Identify service and address assignment with the SM Set Assignment Info service (see FF-588 section 6.5.2.5)
dev_id	IdSerialNumber	DeviceID is a system independent identifier that is provided by the manufacturer	DEV_ID	VisibleString of length 32 (bytes). Encoding rules see section 12	string	The Device ID is a unique identifier for a device instance rather than a device type. For each device of a certain device type there is a different Device ID. Refer to FF-581 – System Architecture section 7.4.2. The structure of the DEV_ID is detailed with technical note TN002-1.1
Attributes without semantic identification						
deviceClass			Device Class	Unsigned8	enum	Refer to FF-588 section 6.5.2.7.1 (Device Type)

NOTE 1 The first six (6) octets of the device ID (DEV_ID) represent a string of hexadecimal characters expressing the Manufacturer's ID (MANUFAC_ID), a 24-bit binary number already registered with FF.

NOTE 2 The four (4) octets of the device ID (DEV_ID) beginning with octet resp. byte offset 6 represent a string of hexadecimal characters expressing the Device Type (DEV_TYPE), a 16-bit binary number assigned by the manufacturer.

Table 32 lists the identification relevant data, source and format for FF blocks.

Table 32 – FieldbusFoundation blocks

FDT -Attribute name	Semantic element name	Data request in physical device	FF protocol specific name	FF data format	XML-FDT format (display format)	Specification Reference
busProtocol	IdBusProtocol	"FF-Block"	FF Bus Protocol	Enumeration : "FF-H1", "FF-HSE", "FF-Block"	enum	
manufacturerID	IdManufacturer	CommChannel shall provide the devices manufacturerID (H1 or HSE) in this attribute. Block manufacturer ID is the same as device manufacturer ID	MANUFAC_ID	Unsigned32	ui4	Refer to FF-891 section 3.1
dev_type	IdTypeID	CommChannel shall provide the devices deviceType (H1 or HSE) in this attribute. Block dev_type is the same as device dev_type	DEV_TYPE	Unsigned16	ui2	Refer to FF-891 section 3.1
device_dd_Revision	IdSoftwareRevision	CommChannel shall provide the devices device_dd_Revision (H1 or HSE) in this attribute. The sdevice_dd_RevisionBlock is the same as device_dd_Revision.	DEV_REV and DD_REV	Unsigned16	ui2	The block device_dd_Revision is the same as device device_dd_Revision
blockTag	IdTag	FMS Read at the Block Index with SubIndex = 1	Block Tag	VisibleString of length 32 (bytes). Encoding rules see section 12	string	Block tag. Refer to FF-890 section 5.14.1. Block structure
Attributes without semantic identification						
blockIndex		Block Index	Block Index	Unsigned32	ui4	Block index in Object Dictionary. Refer to FF-890 section 5.4. Directory Object
DDMemberID		FMS Read at the Block Index with SubIndex = 2	DD Member Id	Unsigned32	ui4	DD Member Id of the block structure. Refer to FF-890 section 5.14.1

FDT -Attribute name	Semantic element name	Data request in physical device	FF protocol specific name	FF data format	XML-FDT format (display format)	Specification Reference
DDItemId		FMS Read at the Block Index with SubIndex = 3	DD Item Id	Unsigned32	ui4	DDItemId of the block structure. Refer to FF-890 section 5.14.1
DDRevision		FMS Read at the Block Index with SubIndex = 4	DD Revision	Unsigned16	ui2	DDRevision of the block structure. Refer to FF-890 section 5.14.1
profile		FMS Read at the Block Index with SubIndex = 5	Profile	Unsigned16	ui2	profile of the block structure. Refer to FF-890 section 5.14.1
profileRevision		FMS Read at the Block Index with SubIndex = 6	Profile Revision	Unsigned16	ui2	Profile Revision of the block structure. Refer to FF-890 section 5.14.1
NOTE The assumption here is that there is only one Function block VFD.						

13.3 Scan identification data types

This clause defines data types that are used to provide protocol specific scanning (see Table 33).

Table 33 – Simple Fieldbus Scan definitions

Attribute	Description
IdAddress	All elements contain exactly one attribute each including the value of the scanned physical device. Use of the same element name than in FDTFieldbusDeviceIdentDefinition makes FDTFieldbusIdentTransformation.xsl task simpler. All elements with semantic meaning have a prefix “Id” for better identification
IdBusProtocol	
IdManufacturer	
IdTypeID	
IdSoftwareRevision	
IdHardwareRevision	
IdTag	
IdSerialNumber	
DataLinkAddress	
DeviceClass	
VendorName	
ModelName	
Revision	
ManufactureSpecificExtension	Element defining the manufacture specific extensions provided for device identification
ScanIdentification_FF_HSE	Identification information for HSE devices
ScanIdentification_FF_H1	Identification information for H1 devices
ScanIdentification_FF_Block	Identification information for FF blocks
ScanIdentifications	Collection of ScanIdentification elements
BlockIndex	Block Index
DDMemberId	DD member Id
DDItemId	DD Item Id
DDRevision	DD revision
IdProfile	Profile
IdProfileRevision	Profile Revision

13.4 Device type identification data types – provided by DTM

This clause defines data types that are used to provide protocol specific device type identification (see Table 34).

Referenced Namespaces:

- fieldbusident
- fdt

Table 34 – Device identification data types

Attribute	Description
IdDeviceAddress	All elements contain exactly one attribute each including the value of the scanned physical device. Use of the same element name than in FDTFieldbusDeviceIdentSchema makes FDTFieldbusIdentTransformation.xsl task simpler. All elements with semantic meaning have a prefix “Id” for better identification.
IdBusProtocol	
IdBusProtocolVersion	
IdManufacturer	
IdTypeID	
IdSoftwareRevision	
IdHardwareRevision	
IdTag	
IdSerialNumber	
DeviceClass	
VendorName	
ModelName	
Revision	
ManufactureSpecificExtension	Element defining the manufacture specific extensions provided for device identification
DeviecIdentification_FF_HSE	Identification information for HSE devices
DeviceIdentification_FF_H1	Identification information for H1 devices
DeviceIdentification_FF_Block	Identification information for FF blocks
DeviceIdentifications	Collection of Device Identification elements. Contains all Fieldbus specific identification elements of scanned physical devices
BlockIndex	Block Index
DDMemberId	DD member Id
DDItemId	DD Item Id
DDRevision	DD revision
IdProfile	Profile
IdProfileRevision	Profile Revision

Annex A
(informative)

Implementation hints

A.1 Hints for configuration of trend subscription

The subscription mechanism described within this standard requires a COM DTM to perform a wide range of configuration actions before a trend subscription is actually established. These configuration actions shall interfere as little as possible with a running control application.

This constraint requires a COM DTM to follow certain rules when performing configuration actions for subscription:

1) If a link object (service operation = Trend report) with a local index is already configured that references the trend object for which to subscribe this link object should be reused. This will also imply that the corresponding VCR is reused.
2) If a link object (service operation = Trend report) with a local index = 0 is already configured this link object should be reused. This will also imply that the corresponding VCR is reused.
3) If no link object can be allocated for a trend subscription, the COM DTM should indicate an error.
4) If a trend VCR can be reused, the group address defined with this VCR should be reused.
5) If a VCR has to be configured for trend purposes and no static VCR entry can be allocated, the COM DTM should indicate an error.
6) In the case of HSE Trend subscription the reusage as denoted with 1) 2) and 4) may imply that additional HSE VCR's and SessionEndpointEntries have to be configured.
7) If a HSE VCR has to be configured for trend purposes and no HSE VCR entry can be allocated, the COM DTM should indicate an error.
8) If a SessionEndpointEntry has to be configured for trend purposes and no entry can be allocated, the COM DTM should indicate an error.

Configuration of the trend object is not part of the trend subscription. Before trend subscription can be performed, the associated trend object needs to be configured (Block index, Relative index, Sample Type, Sample Interval). This is done by standard FMS Writes.

These configuration actions highly depend on the objective of the application resp. the device DTM and shall be performed by the device DTM.

A.2 Hints for configuration of parameter subscription

The subscription mechanism described with this document requires a COM DTM to perform a wide range of configuration actions before a parameter subscription is actually established. These configuration actions shall interfere as least as possible with a running control application. This constraint requires a COM DTM to follow certain rules when performing configuration actions for subscription:

1) If a link object has a service operation PUB and the local index of this link object matches the index of the parameter to subscribe this link object should be reused. This will also imply that the corresponding VCR is reused.
2) If no link object can be allocated for a parameter subscription, the COM DTM should indicate an error.
3) If a Publisher VCR can be reused, the local address defined with this VCR should be reused.
4) If a Publisher VCR has to be configured for parameter subscription purposes and no static VCR entry can be allocated, the COM DTM should indicate an error.

5) In the case of HSE Parameter subscription, the reusage as denoted with 1) and 3) may imply that additional HSE VCR's and SessionEndpointEntries have to be configured.

6) If a HSE VCR has to be configured for parameter subscription and no HSE VCR entry can be allocated, the COM DTM should indicate an error.

7) If a SessionEndpointEntry has to be configured for parameter subscription and no entry can be allocated, the COM DTM should indicate an error.

A.3 Hints for configuration of event subscription

The subscription mechanism described within this standard requires a COM DTM to perform a wide range of configuration actions before an event subscription is actually established. These configuration actions should interfere as least as possible with a running control application. This constraint requires a COM DTM to follow certain rules when performing configuration actions for subscription:

1) If a link object (service operation = ALERT) with a local index is already configured that references the event object for which to subscribe this link object should be reused. This will also imply that the corresponding VCR is reused.

2) If a link object (service operation = ALERT) with a local index = 0 is already configured this link object should be reused. This will also imply that the corresponding VCR is reused.

3) If no link object can be allocated for an event subscription, the COM DTM should indicate an error.

4) If a QUU VCR can be reused, the group address defined with this VCR should be reused.

5) If a QUU VCR has to be configured for event purposes and no static VCR entry can be allocated, the COM DTM should indicate an error.

6) In the case of HSE event subscription, the reusage as denoted with 1) 2) and 4) may imply that additional HSE VCR's and SessionEndpointEntries have to be configured.

7) If a HSE VCR has to be configured for event purposes and no HSE VCR entry can be allocated, the COM DTM should indicate an error.

8) If a SessionEndpointEntry has to be configured for event purposes and no entry can be allocated, the COM DTM should indicate an error.

Some necessary configuration actions are not part of the event subscription:

- writing a correct value to the parameter FEATURE_SEL of the resource block of the FBAP VFD to enable events;
- writing a value to the parameter CONFIRM_TIME of the resource block in order to set the time for event acknowledgement;
- configuring the alarm limit parameter in a block, for instance HI_LIM in an Analog Input block;
- configuring the alarm priority parameter in a block, for instance HI_PRI in an Analog Input block.

These configuration actions highly depend on the objective of the application resp. the device DTM and should be performed by the device DTM

Annex B
(normative)

Levels of support

B.1 General

DTMs for FF devices may provide different levels of support as defined in Table B.1.

Table B.1 – Levels of support

Services	HSE					H1				
Support level	Level 0	Level 1	Level 2	Level 4	Level 8	Level 0	Level 1	Level 2	Level 4	Level 8
SmSetPDTag	N/A	N/A	N/A	N/A	-	O	-	M	-	-
SmSetAddress	N/A	N/A	N/A	N/A	-	O	-	M	-	-
SmFindTag	O	-	M	-	-	O	-	M	-	-
SmIdentify	M	-	M	-	-	M	-	M	-	-
SmClearAddress	O	-	M	-	-	O	-	M	-	-
SmClearAssignmentInfo	O	-	M	-	-	N/A	N/A	N/A	N/A	-
SmSetAssignmentInfo	O	-	M	-	-	N/A	N/A	N/A	N/A	-
fms:FmsInitiate	M	M	-	-	-	M	M	-	-	-
fms:FmsAbort	M	M	-	-	-	M	M	-	-	-
fms:FmsStatus	O	M	-	-	-	O	M	-	-	-
fms:FmsIdentify	O	M	-	-	-	O	M	-	-	-
fms:FmsRead	M	M	-	-	-	M	M	-	-	-
fms:FmsWrite	M	M	-	-	-	M	M	-	-	-
fms:FmsGetOd	O	M	-	-	-	O	M	-	-	-
fms:FmsDefineVariableList	O	-	-	M	-	O	-	-	M	-
fms:FmsDeleteVariableList	O	-	-	M	-	O	-	-	M	-
fms:FmsGenericDownload	O	-	-	M	-	O	-	-	M	-
Device Initiated Data Transfer – Parameter subscription	-	-	-	-	M	-	-	-	-	M
Device Initiated Data Transfer – Trend subscription	-	-	-	-	M	-	-	-	-	M
Device Initiated Data Transfer – Event subscription	-	-	-	-	M	-	-	-	-	M

Key

M – Mandatory O – Optional N/A - Not Applicable

Level 0: Minimal Support Level 1: FMS Mandatory services support Level 2: SM Address assignment support

Level 4: Download (Domain and Variable List) Services support

Level 8: Device Initiated Data Transfer Support – Subscription for parameters and parameter trends and alarms and events.

FF H1 and HSE support levels for DTMs are a combination of the levels defined in the Table B.1. The levels in the table are defined in a way that the sum of different levels always yields a unique resulting level number.

EXAMPLE 1
Mandatory services on Level 0 are always implemented.

EXAMPLE 2
A fully functional HSE DTM is level HSE-7, since it supports levels HSE-1, HSE-2, and HSE-4 additional to the basic HSE level 0.

EXAMPLE 3
An H1 DTM, that supports all mandatory FMS services and also allows Address and Tag Assignment is of level H1-3, since it supports levels H1-1 and H1-2 additional to the basic H1 level 0.

EXAMPLE 4
SM services SetPDTag and SetAddress are H1 specific and therefore not listed in the HSE levels 0 and 2.

EXAMPLE 5
SM services ClearAssignmentInfo and SetAssignmentInfo are HSE specific and therefore not listed in the H1 levels 0 and 2.

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FF-593, FS 1.2, September 21, 2001, *High Speed Ethernet Redundancy*

FF-803, FS 1.2, September 21, 2001, *High Speed Ethernet Network Management*

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SOMMAIRE

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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SPÉCIFICATION DES INTERFACES DES OUTILS DES DISPOSITIFS DE TERRAIN (FDT) –

Partie 301: Intégration des profils de communication – IEC 61784 CPF 1

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Cette version consolidée de l'IEC 62453-301 porte le numéro d'édition 1.1. Elle comprend la première édition (2009-06) [documents 65E/125/FDIS et 65E/138/RVD] et son amendement 1 (2016-05) [documents 65E/336/CDV et 65E/395A/RVC]. Le contenu technique est identique à celui de l'édition de base et à son amendement.

Dans cette version Redline, une ligne verticale dans la marge indique où le contenu technique est modifié par l'amendement 1. Les ajouts sont en vert, les suppressions sont en rouge, barrées. Une version Finale avec toutes les modifications acceptées est disponible dans cette publication.

La Norme internationale IEC 62453-301 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.

Chaque partie de la série IEC 62453-3xy est destinée à être lue conjointement à l'IEC 62453-2.

La version française de cette norme n'a pas été soumise au vote.

Cette publication a été rédigée selon les Directives ISO/IEC, Partie 2.

Une liste de toutes les parties de la série IEC 62453, sous le titre général *Spécification des interfaces des outils des dispositifs de terrain (FDT),* peut être consultée sur le site web de l'IEC.

Le comité a décidé que le contenu de la publication de base et de son amendement ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous "http://webstore.iec.ch" dans les données relatives à la publication recherchée. A cette date, la publication sera

- reconduite,
- supprimée,
- remplacée par une édition révisée, ou
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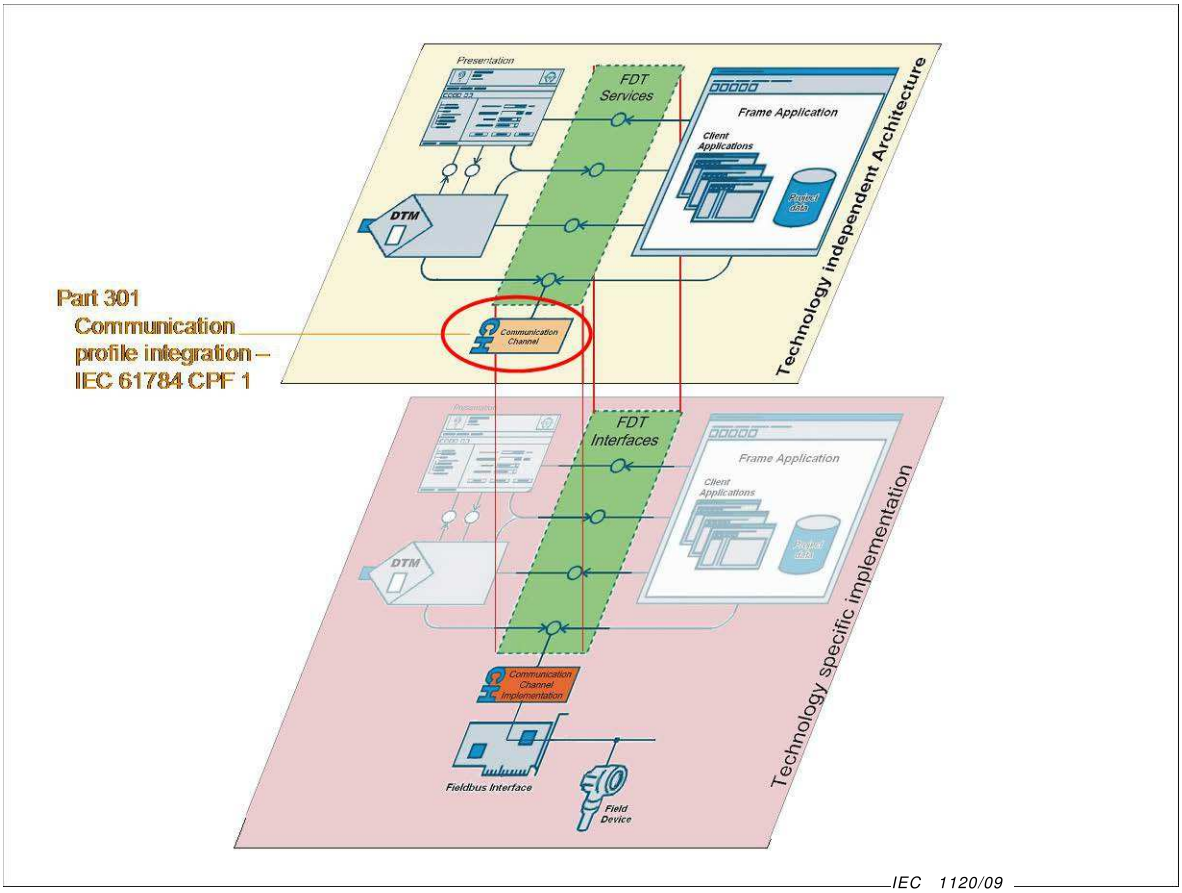
INTRODUCTION

La présente partie de l'IEC 62453 est une spécification d'interface à l'attention des développeurs de composants FDT (Field Device Tool) pour le contrôle de fonctions et l'accès aux données au sein d'une architecture client/serveur. La spécification résulte d'un processus d'analyse et de conception pour développer des interfaces normalisées et faciliter le développement de serveurs et de clients par plusieurs fournisseurs qui ont besoin d'interfonctionner sans problème.

Avec l'intégration des bus de terrain dans des systèmes de commandes, il existe quelques autres tâches qu'il est nécessaire d'accomplir. Outre les outils spécifiques à un bus de terrain et à un dispositif, il existe la nécessité d'intégrer ces outils dans des outils d'études ou de planification de plus haut niveau à l'échelle d'un système. En particulier, pour l'utilisation dans des systèmes de commande étendus et hétérogènes, généralement dans le secteur de l'industrie de transformation, il est d'une grande importance de définir sans ambiguïté d'interfaces d'étude qui soient faciles à utiliser pour tous ceux qui sont impliqués.

Un composant logiciel spécifique à un dispositif, appelé DTM (Device Type Manager, «gestionnaire de type de dispositif»), est livré par le fabricant de dispositif de terrain avec son dispositif. Le DTM est intégré dans des outils d'études par l'intermédiaire des interfaces FDT définies dans la présente spécification. L'approche à l'intégration est en général ouverte pour toutes les sortes de bus de terrain et, donc, satisfait aux exigences pour intégrer des types différents de dispositifs dans des systèmes de commande hétérogènes.

La Figure 1 montre comment l'IEC 62453-301 est alignée dans la structure de la série IEC 62453.



Légende

Anglais	Français
Part 315 Communication profile integration –IEC 61784 CPF 15	Partie 315 Intégration des profils de communication – IEC 61784 CPF 15
Technology Independant Architecture	Architecture indépendante vis-à-vis de toute technologie
Technology specific implementation	Mise en œuvre spécifique à une technologie
FDT services	services FDT
FDT interfaces	Interfaces FDT
Frame Application	Application-cadre
Client Applications	Applications client
Communication channel	Voie de communication
Communication channel implementation	Mise en œuvre de la voie de communication
Fielbus interface	Interface de bus de terrain
Field device	Dispositif de terrain
Presentation	Présentation

Figure 1 – Partie 301 de la série IEC 62453

SPÉCIFICATION DES INTERFACES DES OUTILS DES DISPOSITIFS DE TERRAIN (FDT) –

Partie 301: Intégration des profils de communication – IEC 61784 CPF 1

1 Domaine d'application

La Famille de profils de communication 1 (communément appelée FOUNDATION™ Fieldbus[1]) définit les profils de communication basés sur l'IEC 61158-2, Type 1, l'IEC 61158-3-1, l'IEC 61158-4-1, l'IEC 61158-5-5, l'IEC 61158-5-9, l'IEC 61158-6-5, et l'IEC 61158-6-9. Les profils de base CP 1/1 (FF H1) et CP 1/2 (FF HSE) sont définis dans l'IEC 61784-1.

La présente partie de l'IEC 62453 donne des informations pour intégrer le protocole FOUNDATION™ Fieldbus (FF) dans la norme FDT (IEC 62453-2).

La norme décrit des définitions de communication, des extensions spécifiques à un protocole et les moyens pour une représentation en blocs (par exemple: transducteur, ressources ou blocs fonctionnels).

Les nouvelles définitions spécifiques à un protocole sont basées sur les spécifications FF pour les protocoles H1 et HSE. En outre, les définitions contiennent des informations dont les systèmes ont besoin pour configurer les dispositifs FF.

Le domaine d'application est limité aux définitions spécifiques à un système et à un dispositif FOUNDATION™ Fieldbus.

2 Références normatives

Les documents de référence suivants sont indispensables pour l'application 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 61158-2, *Industrial communication networks – Fieldbus specifications – Part 2: Physical layer specification and service definition (disponible en anglais uniquement)*

IEC 61158-3-1, *Industrial communication networks – Fieldbus specifications – Part 3-1: Data-link layer service definition – Type 1 elements (disponible en anglais uniquement)*

IEC 61158-4-1:2007, *Industrial communication networks – Fieldbus specifications – Part 4-1 Data-link layer protocol specification – Type 1 elements (disponible en anglais uniquement)*

IEC 61158-5-5, *Industrial communication networks – Fieldbus specifications – Part 5-5: Application layer service definition – Type 5 elements (disponible en anglais uniquement)*

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1 FOUNDATION™ Fieldbus est un nom de marque de l'organisation à but non lucratif Fieldbus Foundation. Cette information est donnée à l'intention des utilisateurs de la présente Norme internationale et ne signifie nullement que la CEI approuve ou recommande l´emploi exclusif du produit ainsi désigné. La conformité à la présente norme n'exige pas l'utilisation du nom commercial Foundation Fieldbus™. L'utilisation du nom commercial FOUNDATION™ Fieldbus exige la permission de la Fieldbus Foundation.

IEC 61158-5-9, *Industrial communication networks – Fieldbus specifications – Part 5-9: Application layer service definition – Type 9 elements (disponible en anglais uniquement)*

IEC 61158-6-5, *Industrial communication networks – Fieldbus specifications – Part 6-5: Application layer protocol specification – Type 5 elements (disponible en anglais uniquement)*

IEC 61158-6-9, *Industrial communication networks – Fieldbus specifications – Part 6-9: Application layer protocol specification – Type 9 elements (disponible en anglais uniquement)*

IEC 61784-1, *Industrial communication networks – Profiles – Part 1: Fieldbus profiles (disponible en anglais uniquement)*

IEC 62453-1:2009, *Field Device Tool (FDT) interface specification – Part 1: Overview and guidance (disponible en anglais uniquement)*

IEC 62453-2:2009, *Field Device Tool (FDT) interface specification – Part 2: Concepts and detailed description (disponible en anglais uniquement)*

ISO/IEC 646, *Technologies de l'information – Jeu ISO de caractères codés à 7 éléments pour l'échange d'information*

3 Termes, définitions, symboles, abréviations et conventions

3.1 Termes et définitions

Pour les besoins du présent document, les termes et définitions donnés dans l'IEC 62453-1 et l'IEC 62453-2 s'appliquent.

3.2 Termes abrégés

Pour les besoins du présent document, les abréviations données dans l'IEC 62453-1 et l'IEC 62453-2 ainsi que les suivantes s'appliquent.

SM	System Management (Gestion de système)
FDA	Federation Drug Association
FF	Foundation™ Fieldbus
FMS	Fieldbus Message Specification (Spécification de message de bus de terrain)
DTM	Device Type Manager (Gestionnaire de type de dispositif)
BTM	Block Type Manager (Gestionnaire de type de bloc)
H1	Low speed version of FF (Version faible débit de FF)
HSE	High Speed Ethernet (Ethernet haut débit)

3.3 Conventions

3.3.1 Noms de type de données et références aux types de données

Les conventions de dénomination et de référencement des types de données sont expliquées dans l'IEC 62453-2, Article A.1.

3.3.2 Vocabulaire pour les exigences

Les expressions suivantes sont utilisées pour spécifier des exigences.

Utilisation de "doit" ou "obligatoire" Aucune exception tolérée.

Usage de "il convient de" ou Forte recommandation. Il peut être légitime,

"recommandé"	dans des cas particuliers exceptionnels, de s'écarter du comportement décrit.
Usage de "peut" ou "facultatif"	La fonction ou le comportement peut être donné(e), selon des conditions définies.

3.3.3 Utilisation de l'UML

Les figures dans la présente norme utilise la notation UML telle que définie dans l'Annexe A de l'IEC 62453-1.

4 Fondamentaux

4.1 Système et topologie FDT

La présente norme donne des définitions de communications, des extensions spécifiques à un protocole et les moyens pour la configuration de dispositifs et de blocs (par exemple: bloc ressources, bloc transducteur, ou blocs fonctionnels).

Les définitions de communications fournissent une communication de gestion de système (SM) et de spécification de message de bus de terrain (FMS).

Les définitions séparées sont conçues pour prendre en charge les différents paramètres et structures de gestion pour les dispositifs H1 et HSE.

Les définitions spécifiques à un protocole peuvent être utilisées pour identifier les dispositifs FOUNDATION™ Fieldbus et leur structure interne.

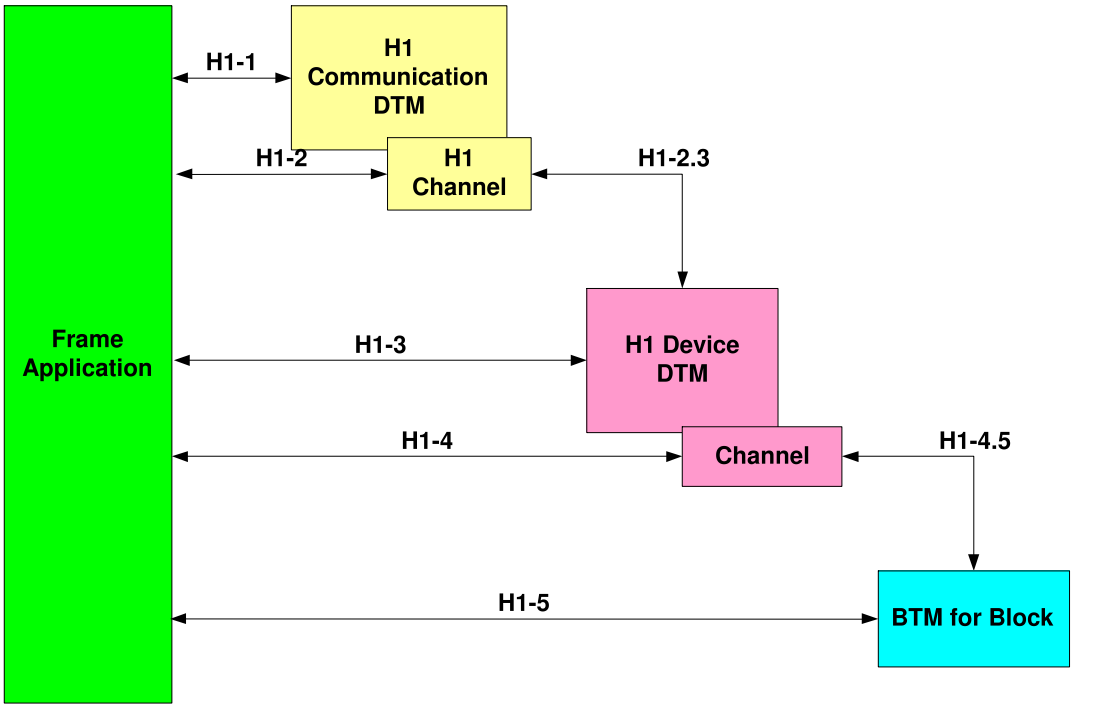
Un dispositif FOUNDATION™ Fieldbus est représenté par un Device Type Manager (DTM) accompagné d'un groupe de Block Type Managers (BTM). Chaque BTM représente la fonctionnalité d'une fonctionnalité de bloc dans un dispositif FF.

4.2 Topologie FDT pour dispositifs H1

Une topologie H1 de FF peut contenir un DTM de communication, un DTM de dispositif et des BTM.

EXEMPLE

La topologie type de FDT pour des dispositifs H1 est montrée à la Figure 2 et dans le Tableau 1.



Légende

Anglais	Français
Frame Application	Application-cadre
BTM for Block	BTM (gestionnaire de type de blocs) pour bloc
H1 Communication DTM	DTM (gestionnaire de type de dispositifs) de communication H1
H1 Channel	Voie H1
H1 Device DTM	DTM (gestionnaire de type de dispositifs) de dispositif H1
Channel	Voie

Figure 2 – Relations d'objets pour DTM de dispositif H1

Tableau 1 – Relations d'objets pour DTM de dispositif H1

Relation	Type d'information	Définitions utilisées
H1-1	Accès aux paramètres de gestion	Types de données de gestion H1 (voir 10.2) Types de données communs à FF (voir 11.1)
H1-2	Topologie de réseau	Types de données communs à FF (voir 11.1) Types de données d'identification (voir 13.4) Types de données d'identification de balayage (voir 13.3)
	Accès aux paramètres de voie	Types de données de paramètres de voie (voir Article 12)
H1-3	Accès aux paramètres de gestion	Types de données de gestion H1 (voir 10.2) Types de données communs à FF (voir 11.1)

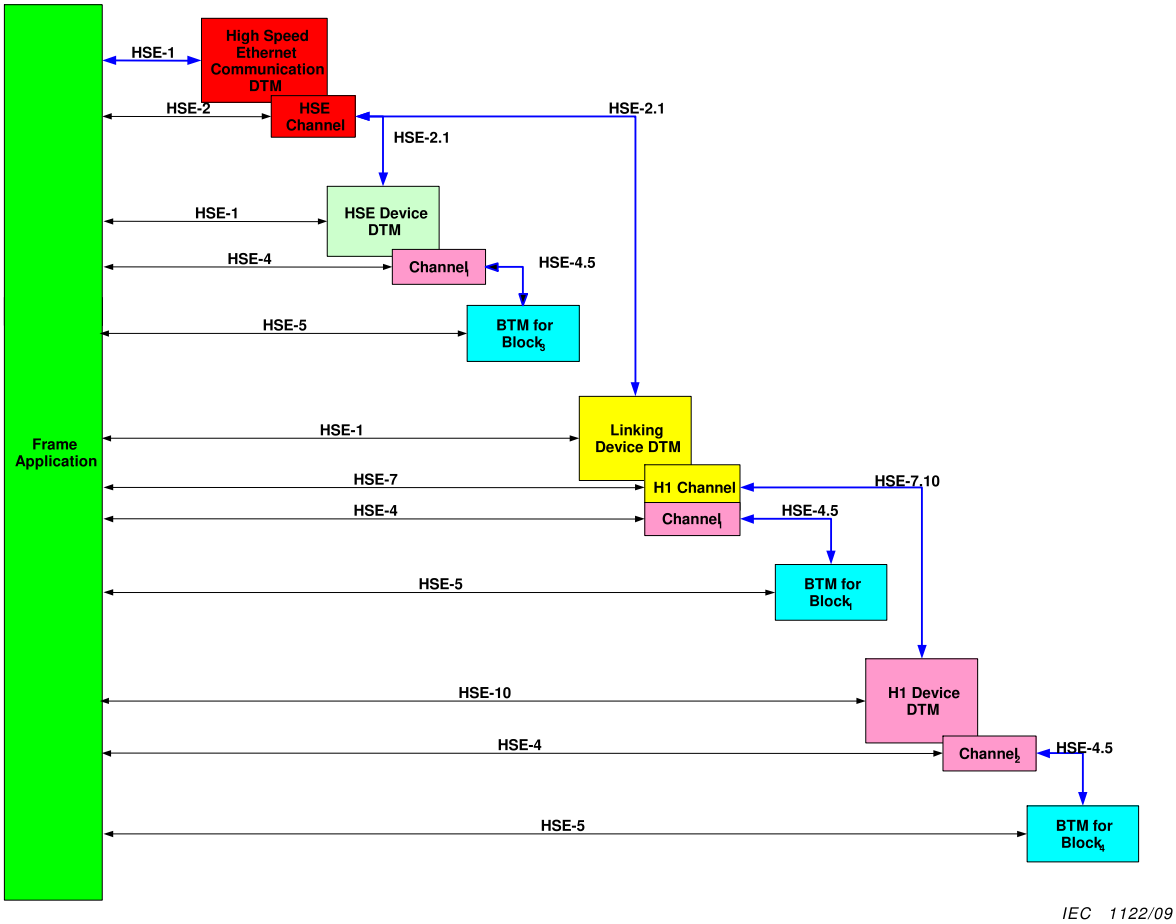
Relation	Type d'information	Définitions utilisées
H1-4	Liste de blocs instanciés	Types de données communs à FF (voir 11.1) Types de données de BTM (voir l'IEC 62453-2) Types de données de blocs FF (voir 9.2.2) Types de données d'identification (voir 13.4) Types de données d'identification de balayage (voir 13.3)
	Accès aux paramètres de voie	Types de données de paramètres de voie (voir Article 12)
H1-5	Informations de bloc	Types de données informations de BTM (voir l'IEC 62453-2) Types de données de BTM (voir l'IEC 62453-2) Types de données d'identification (voir 13.4) Types de données d'identification (voir 13.4)
	Initialisation de BTM	Types de données Init de BTM (voir l'IEC 62453-2) Types de données de BTM (voir l'IEC 62453-2)
	Accès aux paramètres	Types de données de paramètre de BTM (voir l'IEC 62453-2) Types de données de BTM (voir l'IEC 62453-2)
H1-2.3	Communication	Types de données de FMS de FF (voir 11.2) Types de données de communication H1 (voir 11.3) Types de données communs à FF (voir 11.1)
H1-4.5	Communication de bloc	Types de données de FMS de FF (voir 11.2) Types de données de communication de bloc FF (voir 11.5) Types de données de BTM (voir l'IEC 62453-2) Types de données communs à FF (voir 11.1)

4.3 Topologie FDT pour dispositifs HSE

Une topologie HSE de FF peut contenir un DTM de communication, un DTM de passerelle, un DTM de dispositif et des BTM.

EXEMPLE

La topologie type de FDT pour un système basé sur HSE est montrée à la Figure 3 et dans le Tableau 2:



Légende

Anglais	Français
Frame Application	Application-cadre
High Speed Ethernet Communication DTM	DTM de communication Ethernet haut débit
HSE Channel	Voie HSE
HSE Device DTM	DTM de dispositif HSE
$Channel_1$	$Voie_1$
Linking Device DTM	DTM de dispositif de liaison
BTM for $Block_3$	BTM pour $Bloc_3$
BTM for $Block_1$	BTM pour $Bloc_1$
BTM for $Block_4$	BTM pour $Bloc_4$
H1 Channel	Voie H1
H1 Device DTM	DTM de dispositif H1
$Channel_2$	$Voie_2$

Figure 3 – Relations d'objets pour application HSE avec des DTM et des BTM

Dans cette figure, les lignes bleues montrent la hiérarchie d'objets telle qu'elle est gérée dans l'application cadre de FDT («FDT Frame Application»).

Tableau 2 – Relations d'objets pour application HSE avec des DTM et des BTM

Relation	Type d'information	Définitions utilisées
HSE-1	Accès aux paramètres de gestion	Types de données de gestion HSE de FF (voir 10.3)
HSE-2	Topologie de réseau	Types de données communs à FF (voir 11.1) Types de données d'identification (voir 13.4) Types de données d'identification de balayage (voir 13.3)
	Accès aux paramètres de voie	Types de données de paramètres de voie (voir Article 12)
HSE-2.1	Communication	Types de données de FMS de FF (voir 11.2) Types de données de communication HSE de FF (voir 11.4) Types de données communs à FF (voir 11.1)
HSE-4.5	Communication de bloc	Types de données de FMS de FF (voir 11.2) Types de données de communication de bloc FF (voir 11.5) Types de données communs à FF (voir 11.1) Types de données de BTM (voir l'IEC 62453-2)
HSE-4	Liste de blocs instanciés	Types de données communs à FF (voir 11.1) Types de données de BTM (voir l'IEC 62453-2) Types de données d'identification (voir 13.4) Types de données d'identification de balayage (voir 13.3)
	Accès aux paramètres de voie	Types de données de paramètres de voie (voir Article 12)
HSE-5	Informations de bloc	Types de données informations de BTM (voir l'IEC 62453-2) Types de données de BTM (voir l'IEC 62453-2) Types de données d'identification (voir 13.4)
	Initialisation de BTM	Types de données Init de BTM (voir l'IEC 62453-2) Types de données de BTM (voir l'IEC 62453-2)
	Accès aux paramètres	Types de données de paramètre de BTM (voir l'IEC 62453-2) Types de données de BTM (voir l'IEC 62453-2)
HSE-7	Topologie de réseau	Types de données communs à FF (voir 11.1) Types de données de communication HSE de FF (voir 11.4) Types de données de communication de bloc FF (voir 11.5)
	Accès aux paramètres de voie	Types de données de paramètres de voie (voir Article 12) Types de données de gestion H1 (voir 10.2)
	Accès aux paramètres	Types de données de paramètre de BTM (voir l'IEC 62453-2)
HSE-10	Accès aux paramètres de gestion	Types de données de gestion H1 (voir 10.2) Types de données communs à FF (voir 11.1)
HSE-7.10	Communication	Types de données de FMS de FF (voir 11.2) Types de données de communication H1 (voir 11.3) Types de données communs à FF (voir 11.1)

4.4 Communication imbriquée

Les blocs FF normalisés peuvent être traités par des BTM mettant en œuvre le comportement normalisé. Ces BTM peuvent être connectés au DTM correspondant qui fournit le support d'un protocole de communication “FDT FF STANDARD BLOCK” (Bloc normalisé FF de FDT).

Pour les BTM spécifiques à un dispositif, une catégorie de bus (il peut être unique) spécifique à un dispositif (CATID) doit être définie pour le protocole entre DTM et BTM.

La Frame Application («application cadre») peut utiliser cette catégorie pour identifier les blocs spécifiques à un dispositif et elle peut empêcher qu'un bloc spécifique à un dispositif provenant du Dispositif A ne soit affecté à un Dispositif B qui ne prend pas en charge le bloc.

Les différents protocoles de communication définis dans le présent document (H1, HSE, Standard Block) peuvent utiliser les mêmes demandes de communication (FMS).

5 Catégorie de bus

Les protocoles FF sont identifiés dans l'élément protocolId du type de données structuré 'fdt:BusCategory' par les identificateurs uniques suivants (Tableau 3):

Tableau 3 – Identificateurs de protocole spécifiques à FF

Protocol Id (Identificateur de protocole)	Nom de ProtocolId	Description
036D1691-387B-11D4-86E1-00E0987270B9	‘FF H1’	L'objet prend en charge le protocole H1 de FF
036D1692-387B-11D4-86E1-00E0987270B9	‘FF HSE’	L'objet prend en charge le protocole HSE de FF
036D1693-387B-11D4-86E1-00E0987270B9	‘FF Standard Block’	Pour le protocole des blocs normalisés FF FDT

Les protocoles FF utilisent les identificateurs uniques suivants dans les membres physicalLayer au sein du type de données PhysicalLayer (Tableau 35 pour H1):

Tableau 35 – Identificateurs de couche physique pour H1

Valeur d'identificateur	Nom	Description
0D8FB517-1D8D-4455-9CE1-1B4A5DD4A0D2	FF H1	Couche physique H1 de la FOUNDATION Fieldbus™, telle que décrite dans “FF 816 - 31,25 kbit/s Physical Layer”

Le Tableau 36 définit quelle DataLinkLayer doit être utilisée en combinaison avec les valeurs de BusCategory définies dans le Tableau 3.

Tableau 36 – Identificateurs de couche DataLink

Valeur d'identificateur	Nom	Description
63D4C62E-91A9-4904-BCFC-3D3479C2EBAD	FDL	FF - 822 H1 Data Link Protocol (Protocole de liaison de données) et FF – 821 H1 Data Link Services (Services de liaison de données)

6 Accès aux données d'instances et de dispositifs

6.1 DTM

L'ensemble minimal de données fournies doit être:

- pour les dispositifs FF, les paramètres System Management (gestion de système) et Network Management (gestion de réseau) peuvent être fournis par le DTM tels que spécifiés à l'Article 10;
- le DTM doit fournir le support pour les données décrites en 9.1.2;
- pour chaque bloc dans le dispositif, tous les paramètres de blocs normalisés doivent être fournis par l'objet BTM correspondant comme spécifié dans l'IEC 62453.2.

Il convient que tous les paramètres de blocs non normalisés soient également fournis tels que spécifiés en 9.2.

Un DTM de dispositif doit fournir l'accès aux groupes suivants de paramètres s'ils sont présentés à l'utilisateur:

- paramètres de liaison;
- paramètres d'action;
- paramètres d'alerte;
- paramètres de tendance;
- objets de domaine;
- objets d'invocation de programme.

6.2 BTM

Les BTM bâtis conformément à la spécification des blocs fonctionnels doivent exposer tous les paramètres pour le bloc correspondant tels que définis pour le DTM. Tous les paramètres normalisés définis pour un bloc dans la spécification FF doivent être exposés. Les paramètres spécifiques à un fabricant peuvent être ajoutés pour allonger la liste. Les paramètres définis par l'utilisateur doivent être exposés s'ils existent.

7 Comportement spécifique à un protocole

7.1 Gestion de connexion

Le service Connect établit une connexion FDT. La connexion FDT agit comme un conteneur pour des connexions FMS, comme un conteneur pour des services sans connexions de SM et comme conteneur pour des sessions FDA.

La connexion FMS doit être maintenue distincte de la connexion FDT sous-jacente.

7.1.1 Connexion FMS

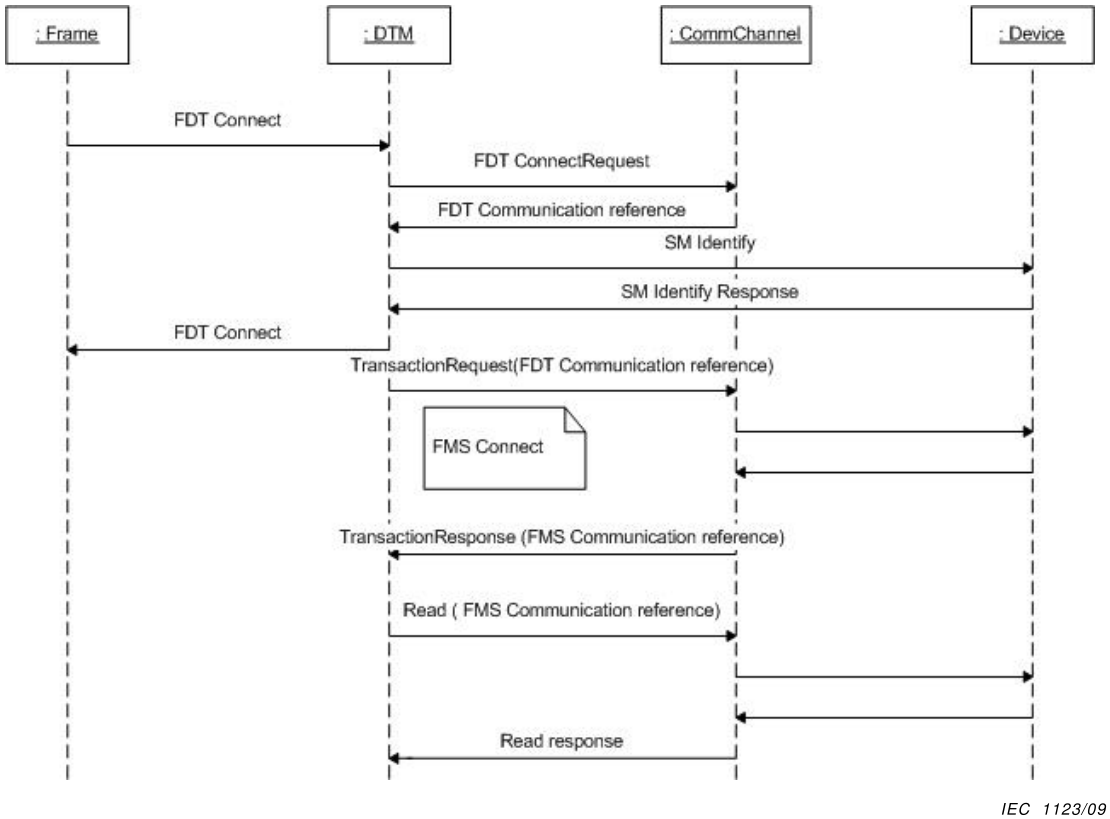
FDT met en œuvre tous les services FMS et SM comme transactions dans les protocoles respectifs. Cela inclut les services pour la gestion de connexions FMS. La transaction FmsInitiate et la transaction FmsAbort gèrent la durée de vie d'une connexion FMS.

Afin d'ouvrir plusieurs connexions FMS sur la même connexion FDT, une demande de service Transaction est appelée avec un élément FmsInitiateRequest comme argument.

La référence de communication passée avec l'élément FmsInitiateRequest identifie la connexion FDT devant être utilisée. L'élément FmsInitiateResponse retourné par la réponse

de service Transaction fournit une référence de communication utilisée pour tous les autres services FMS sur la connexion FMS en question.

Cette mise en correspondance permet plusieurs connexions FMS sur une même connexion FDT.



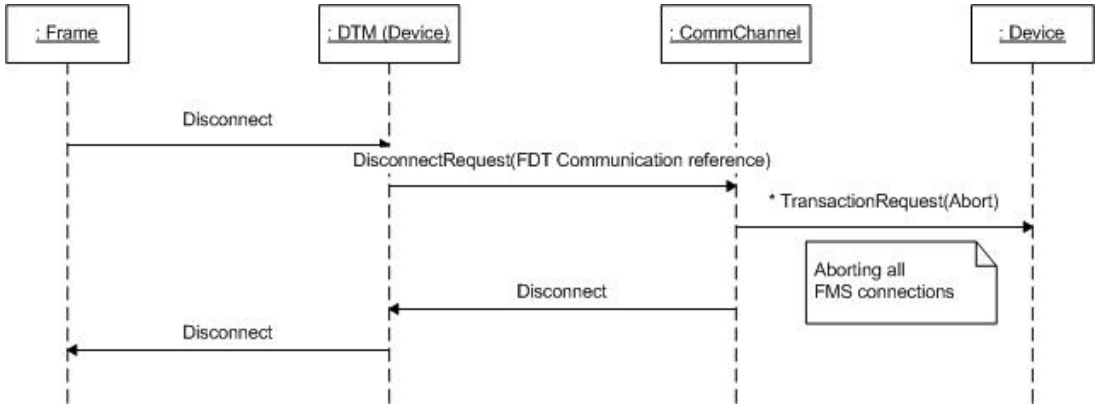
Légende

Anglais	Français
FMS Connect	Connexion FMS

Figure 4 – Mise en correspondance de FMS dans la connexion FDT

Si la connexion FDT est fermée, les connexions FMS sont également fermées automatiquement (par la voie de communication) avant que le service Disconnect de FDT n'ait été achevé.

Toute transaction demandée après cela échouera. Aucun service en cours ne sera traité.



CEI 1124/09

Légende

Anglais	Français
Aborting all FMS connections	Abandon prématuré de toutes les connexions FMS
(FDT Communication reference)	(Référence de communication FDT)

Figure 5 – Service Disconnect de FDT

La demande de service FMSAbort ferme une seule connexion FMS.

7.1.2 Connexion FDT

La connexion FDT utilise la demande de service Connect:

- pour établir une connexion FDT destinée aux services de System Management (gestion de système) seulement. Lorsque des connexions FDT pour des services SM seulement sont établies, l'élément OpenSessionRequest ne fait pas partie de la ConnectRequest. Toute demande d'établir une connexion FMS sur ce type de connexion FDT doit être rejetée;
- pour établir une connexion FDT qui représente une session telle que décrite avec la spécification FF-588 Field Device Access Agent ("agent d'accès aux dispositifs de terrain). Des connexions FMS peuvent être établies en utilisant la référence de communication FDT retournée comme résultat de l'établissement de connexions FDT. Noter que les services SM en multidiffusion ne sont pas autorisés dans cette connexion.

Si un dispositif HSE a besoin des deux types de connexions, il a besoin de créer des connexions System management et Session de FDT.

Lorsqu'une Frame Application demande au DTM de se déconnecter, il doit être mis fin à toutes les connexions FMS et à toutes les connexions FDT (SM et Session).

7.2 Abort (Abandon)

7.2.1 Indication "OnAbort"

À tout moment de la durée de vie de la connexion (FDT ou FMS), une indication d'un événement OnAbort peut être reçue par le DTM/BTM en provenance de la voie de communication. Il peut y avoir deux raisons pour l'événement OnAbort:

- FMS Connection Abort (Abandon d'une connexion FMS);
- FDT Connection Abort (Abandon d'une connexion FDT).

La référence de communication identifie de façon univoque la connexion devant être abandonnée. Si un FDT Connection Abort est indiqué, il doit être mis fin à toutes les connexions FMS de la connexion FDT correspondante. Aucune demande de Abort n'est émise vers la voie de communication. Toutes les demandes en cours doivent être annulées.

Si un FMS Connection Abort est indiqué, seule la connexion FMS identifiée par cette Communication Reference est arrêtée.

7.2.2 Demande Abort

À tout moment de la durée de vie des connexions (FDT ou FMS), un DTM/BTM peut émettre une demande Abort vers une voie de communication (Communication Channel). Il peut y avoir deux types de références de communication (Communication Reference) dans la demande Abort:

- FMS Communication Reference (référence de communication FMS);
- FDT Communication Reference (référence de communication FDT).

La référence de communication identifie de façon univoque la connexion devant être abandonnée.

Si un FDT Connection Abort est demandé, il doit être mis fin à toutes les connexions FMS connexes dans la voie de communication. Aucune demande Abort séparée n'est émise vers la voie de communication pour les connexions FMS individuelles. Toutes les demandes en cours doivent être annulées.

Si une FMS Communication Reference est indiquée dans la demande Abort, seule la connexion FMS identifiée par cette Communication Reference est arrêtée.

7.3 Relation des demandes FMS et des réponses FMS

Si un DeviceDTM (client de communication) émet une demande FMS comme dans le Tableau 4, il doit s'attendre à une réponse telle que montrée dans le tableau.

Tableau 4 – Relation des demandes FMS et des réponses FMS

Demande	Réponse(s)
FmsInitiateRequest	FmsInitiateResponse FmsInitiateError
FmsAbortRequest	FmsStandardResponse
FmsReadRequest	FmsReadResponse FmsServiceError
FmsWriteRequest	FmsStandardResponse FmsServiceError
FmsStatusRequest	FmsStatusResponse FmsServiceError
FmsIdentifyRequest	FmsIdentifyResponse FmsServiceError
FmsDefineVariableListRequest	FmsDefineVariableListResponse FmsServiceError
FmsDeleteVariableListRequest	FmsStandardResponse FmsServiceError
FmsGetOdRequest	FmsGetOdResponse FmsServiceError
FmsGenericInitiateDownloadSequenceRequest	FmsStandardResponse FmsServiceError
FmsGenericDownloadSegmentRequest	FmsStandardResponse FmsServiceError
FmsGenericTerminateDownloadSequenceRequest	FmsGenericTerminateDownloadSequenceResponse

Demande	Réponse(s)
	FmsServiceError
fms:FmsInformationReport	fms:FmsInformationReport
fms:CreateProgramInvocation	FmsStandardResponse FmsServiceError
fms:DeleteProgramInvocation	FmsStandardResponse FmsServiceError
fms:Start	FmsStandardResponse FmsServiceError
fms:Stop	FmsStandardResponse FmsServiceError
fms:Resume	FmsStandardResponse FmsServiceError
fms:Reset	FmsStandardResponse FmsServiceError
fms:Kill	FmsStandardResponse FmsServiceError
H1SubscribeRequest	H1SubscribeResponse
H1UnSubscribeRequest	H1UnSubscribeResponse
HSESubscribeRequest	HSESubscribeResponse
HSEUnSubscribeRequest	HSEUnSubscribeResponse
Any Service (n'importe quel service)	fdt:CommunicationError

Un DTM ou un BTM peut recevoir une réponse FDT CommunicationError normalisée à la place d'une réponse FMS Transaction pour indiquer une erreur générale de communication. Les clients de communication doivent être préparés à traiter une telle réponse.

Si la connexion FMS dans le DTM de dispositif est partagée entre plusieurs BTM, toutes les connexions recevront un événement OnAbort lorsque la connexion FMS du dispositif est abandonnée.

7.4 Mécanisme d'abonnement

Le mécanisme d'abonnement FF est basé sur les règles du transfert de données déclenché par le dispositif. Pour un DTM qui prend en charge le transfert de données déclenché par le dispositif (Device Initiated Data Transfer), il peut y avoir un ou plusieurs abonnés attendant simultanément les données.

7.4.1 Généralités

Pour prendre en charge le transfert de données déclenché par le dispositif pour l'IEC 61784 CPF 1, des demandes de transaction et des réponses de transaction supplémentaires sont définies. Deux demandes de transaction sont utilisées pour déclencher la connexion d'abonnement FMS et quatre réponses sont associées aux abonnements FMS. Ces transactions sont détaillées ci-dessous:

- demande de transaction pour abonnement;
- réponse de transaction pour abonnement;
- demande de transaction pour désabonnement;
- réponse de transaction pour désabonnement;
- transaction détaillant le rapport d'informations FMS (FMS Information Report);

- réponse de transaction détaillant la FMS EventNotification (notification d'événement FMS).

7.4.2 Transactions pour abonnement H1

Le DTM/BTM de dispositif peut s'abonner à des données en appelant la transaction H1SubscribeRequest. Il peut s'abonner pour

- des données recueillies dans un objet de tendance [H1TrendSubscriptionInfo];
- un paramètre de dispositif seul [H1ParameterSubscriptionInfo];
- une alarme ou un événement [H1EventSubscriptionInfo].

Des informations complémentaires pour identifier le dispositif sont fournies dans la demande de transaction. Ces informations peuvent être utilisées par le fournisseur de communication (Communication Provider) pour accélérer le processus d'abonnement.

Le résultat du mécanisme d'abonnement est donné dans la transaction H1SubscribeResponse. La référence de communication utilisée est la référence de communication de la connexion FDT.

L'InvokeID de la demande d'abonnement sera utilisé pour assurer l'association entre l'abonnement et la transaction FmsInformationReport ou FmsEventNotification.

L'InvokeID reçu pendant l'abonnement sera utilisé pour le désabonnement (Unsubscribing).

L'InvokeID identifie de façon univoque toutes les transactions relatives à l'abonnement créé et ne doit être utilisé pour aucune autre transaction au cours de la durée de vie de l'abonnement.

7.4.3 Transactions pour abonnement HSE

Le DTM de dispositif de liaison HSE (HSE Linking Device DTM) peut s'abonner à des données en appelant la transaction HSESubscribeRequest. Les DTM peuvent mettre en correspondance l'abonnement issu d'un DTM H1 avec un abonnement HSE.

L'abonnement HSE peut être utilisé pour s'abonner pour des données provenant

- d'un dispositif H1 par le biais d'un dispositif de liaison HSE;
- d'un dispositif HSE.

Il peut s'abonner pour

- des données dans un objet de tendance sur un dispositif H1 (HSETrendSubscriptionInfo);
- des données dans un objet de tendance sur un dispositif HSE (LocalTrendSubscriptionInfo);
- un paramètre seul issu d'un dispositif H1 (HSEParameterSubscriptionInfo);
- un paramètre seul issu d'un dispositif HSE (LocalParameterSubscriptionInfo);
- un événement issu d'un dispositif H1 (HSEEventSubscriptionInfo);
- un événement issu d'un dispositif HSE (LocalEventSubscriptionInfo).

Des informations complémentaires relatives au dispositif sont fournies dans la demande de transaction. Ces informations peuvent être utilisées par le fournisseur de communication (Communication Provider) pour accélérer le processus d'abonnement.

Le résultat du mécanisme d'abonnement est donné dans la transaction HSESubscribeResponse.

La référence de communication utilisée est la référence de communication de la connexion FDT.

L'InvokeID de la demande d'abonnement sera utilisé pour assurer l'association entre l'abonnement et la transaction FmsInformationReport ou FmsEventNotification. Le même InvokeID identifiera l'abonnement au cours du désabonnement (Unsubscribing).

L'InvokeID identifie de façon univoque toutes les transactions relatives à l'abonnement créé et ne doit être utilisé pour aucune autre transaction au cours de la durée de vie de l'abonnement.

7.4.4 Transactions pour abonnement BTM

Un BTM peut s'abonner pour des données en appelant la transaction BtmSubscribeRequest. Le DTM parent peut mettre en correspondance l'abonnement issu d'un BTM avec un abonnement H1 ou HSE.

Le BTM peut s'abonner pour

- un paramètre seul (BtmParameterSubscriptionInfo);
- des données recueillies dans l'objet Device Trend (BtmTrendSubscriptionInfo);
- une alarme ou un événement (BtmEventSubscriptionInfo).

Le DTM de dispositif doit fournir l'association et la configuration de l'objet de tendance si un abonnement pour des données de tendance est demandé.

Le résultat du mécanisme d'abonnement est donné dans la transaction BtmSubscribeResponse.

La référence de communication utilisée est la référence de communication de la connexion FDT.

L'InvokeID de la demande d'abonnement sera utilisé pour assurer l'association entre l'abonnement et la transaction FmsInformationReport ou FmsEventNotification. Le même InvokeID identifiera l'abonnement au cours du désabonnement (Unsubscribing). L'InvokeID ne doit être utilisé pour aucune autre transaction au cours de la durée de vie de l'abonnement.

Si plus d'un BTM est abonné pour le même objet, le DTM de dispositif doit propager l'information à tous les BTM abonnés.

8 Usage spécifique à un protocole des types de données généraux

8.1 Adresse

Pour tous les paramètres exposés dans des DTM et dans des BTM, l'adresse (définie dans la Partie 2) doit être construite selon le modèle suivant:

VFD:xx.INDEX:yyy[.SUBINDEX:zz],

où

- xx est l'étiquette du VFD ("Virtual Field Device" c'est-à-dire «Dispositif de terrain virtuel») ou un nombre représentant l'indice du VFD (compté à partir de 1);
- yy est un nombre représentant l'indice de paramètre à partir du début du VFD;
- zz est un nombre montrant le sous-indice de paramètre.

Les valeurs de xx, yy et zz doivent être des nombres entiers (certaines peuvent être de 32 bits) et sont présentées sous forme de chiffres décimaux. Il convient qu'il n'y ait pas de zéros de tête pour les nombres.

La partie sous-indice de l'adresse est facultative et peut être absente ou mise à 0.

La fourniture de cette information avec l'ensemble de données du dispositif suffit pour accéder aux paramètres de dispositif/bloc et une définition de voie de processus pour les BTM n'est pas nécessaire.

8.2 protocolID

Voir Article 5.

8.3 applicationDomain

L'attribut applicationDomain est fixe: FDT_FoundationFieldbus.

8.4 semanticId

Le semanticId pour paramètre relatif à FF respecte les règles suivantes:

- le semanticId doit être construit sur la base des noms définis dans la spécification FF;
- les paramètres structurés doivent être combinés avec un '.';
- les espaces dans la définition du profil doivent être remplacés par un trait de soulignement ("underscore");
- il convient d'utiliser seulement des lettres majuscules.

8.4.1 Définitions spécifiques à un bloc

Pour la description détaillée, se référer à 9.2.2 pour des définitions spécifiques à un bloc.

EXEMPLES

OUT.STATUS

OUT.VALUE

OUT

8.4.2 Définitions de gestion de bus de terrain

Le SemanticID pour le paramètre de gestion de bus de terrain FF doit être créé selon la règle suivante:

'FDT.UserDefinedBus' suivi de la structure des définitions de types de données du paramètre de gestion. Chaque élément doit être séparé par un '.'.

EXEMPLE

FDT.UserDefinedBus.ListOfH1NmaVfds.H1NmaVfd.SMIB.SmAgent.T1.t1

définit l'ID sémantique pour le paramètre T1.

8.4.3 Définitions spécifiques à un bus de terrain

Pour les paramètres utilisés pour l'identification de dispositif/bloc (voir Article 12), un jeu d'ID uniques est défini.

- Pour les dispositifs H1, un jeu d'ID sémantiques fixes est défini comme suit:
  - IdAddress – Adresse de nœud affectée au dispositif;
  - IdManufacturer – Identificateur du fabricant du dispositif;
  - IdTypeID – Type de dispositif;
  - IdSoftwareRevision – Révision du dispositif et du descripteur de dispositif;
  - IdTag – Étiquette de dispositif physique;
  - IdSerialNumber – Identificateur de dispositif physique. Il s'agit d'un identificateur unique de l'instance de dispositif;
- Pour les dispositifs HSE, ces identificateurs (ID) sont définis comme suit:
  - IdAddress – Adresse du dispositif HSE;
  - IdManufacturer – Identificateur du fabricant du dispositif;
  - IdTypeID – Type de dispositif;
  - IdTag – Étiquette de dispositif physique;
  - IdSerialNumber – Identificateur de dispositif physique. Il s'agit d'un identificateur unique de l'instance de dispositif;
  - numberOfLinks – Nombre de liaisons;
  - linkeId[0.. (numberOfLinks-1)] – Identificateur de liaison pour la liaison H1 correspondante;
- Pour le dispositif HSE avec Application VFD, les identificateurs requis sont:
  - IdManufacturer – Identificateur du fabricant du dispositif;
  - IdTypeID – Type de dispositif;
  - IdSoftwareRevision– Révision du dispositif et du descripteur de dispositif;
- Pour les blocs FF, les ID sémantiques fixes suivants sont définis:
  - IdTag – Étiquette de bloc telle que définie dans BLOCK.BLOCK_TAG;
  - IdManufacturer – L'identificateur de fabricant de bloc est le même que l'identificateur de fabricant de dispositif;
  - IdTypeID – Le type de dispositif de bloc est le même que le type de dispositif;
  - IdSoftwareRevision – La révision de bloc est la même que la révision de dispositif;
  - Profile – Les informations de profil de bloc telles que définies dans BLOCK.PROFILE;
  - profileRevision – Les informations de révision de profil de bloc telles que définies dans BLOCK. PROFILE_REVISION;
  - blockIndex – L'indice de début du bloc.

9 Types de données spécifiques à un protocole

9.1 DTM

9.1.1 Définitions de balayage de topologie

Comme résultat du balayage, le DTM détecte les DTM et les objets de BTM qui sont connectés à l'objet voie. Comme résultat du balayage de topologie, un DTM peut exposer des informations relatives aux dispositifs de liaison FF, aux instruments FF et aux Blocs dans les instruments.

9.1.2 Accès aux paramètres

9.1.2.1 Généralités

Les services de DTM pour accéder à des données d'instance permettent l'accès Frame Application à des paramètres de dispositif. Le DTM fournit sa représentation actuelle en mémoire interne de ses données d'instance.

Les services de DTM pour accéder à des données de dispositif permettent l'accès Frame Application à des paramètres spécifiques dans le dispositif.

Un DTM de dispositif FF peut fournir l'accès aux groupes suivants de paramètres:

- paramètres de liaison;
- paramètres d'action;
- paramètres d'alerte;
- paramètres de tendance;
- objets de domaine;
- invocation de programmes;
- objets "vues".

L'allongement de la liste des paramètres de dispositif est du ressort d'un DTM et dépend du type de dispositif et du type de bus de terrain.

9.1.2.2 Structure Action

La structure d'action Action permet qu'une instance d'un bloc ou d'objet soit créée ou supprimée dans une ressource supportant l'objet action. Par le service FB_Action, une demande d'écriture peut être émise vers l'objet Action. Si l'action demandée est prise en charge pour la fonction identifiée, les objets ou blocs associés (et l'objet "vues" associé) seront créés ou supprimés dans le dictionnaire d'objets.

Cette structure de données est constituée d'un identificateur d'action et des informations associées concernant le type, la fonction et l'occurrence pour leur objet ou bloc connexe.

Le Tableau 5 ci-après fournit la mnémonique des paramètres structurés d'action Action (basée sur les spécifications FF-890 de la FOUNDATION™ Fieldbus) ainsi que la mise en correspondance des paramètres structurés Action avec les types de données FDT. Il convient d'utiliser la mnémonique pour la structure et chaque paramètre comme valeur d'attribut de nom pour la définition de paramètre:

Tableau 5 – Définitions d'objets Action (se référer à la FF-890):

Structure [2]	Mnémonique des paramètres de membre	Structure/type de données de la Fieldbus Foundation
ACTION_STRUCTURE	ACTION_STRUCTURE	DS-86
	ACTION_INDEX	-
	ACTION	Unsigned8
	FUNCTION	Unsigned32
	OCCURRENCE	Unsigned16

[2] Les noms pour les membres sont définis par le schéma: nom de la variable structurée „.“ Nom du membre (voir la définition de StructuredVariable dans la définition des FDTDataTypes – les membres des structures sont référencés dans la définition.). Par exemple, TARGET de DS-69 s'étendrait à MODE_BLK.TARGET.

9.1.2.3 Structure de liaison Link

Les objets structures de liaison assurent une mise en correspondance entre les ressources et les informations échangées par l'intermédiaire d'un réseau de communication. Les données et événements de processus devant être échangés entre des blocs fonctionnels au sein d'une ressource ou entre des ressources peuvent être définis par le biais d'objets de liaison. En outre, l'échange de communication pour la prise en charge de tendances et d'alertes peut être défini avec l'aide d'objets de liaison.

Les paramètres avec une classe de sorties et d'entrées sont connectés par des liaisons de blocs fonctionnels.

Les liaisons entre des dispositifs de terrain et des dispositifs d'interface peuvent être définies pour accéder à des objets de tendance et pour les rapports d'alarmes. Les objets de liaison identifient les paramètres de bloc, les objets de tendance et les caractéristiques de communication qui définissent comment ils échangent des données. À travers la définition des objets de liaison, les alertes et les tendances peuvent être acheminées vers différents dispositifs en vue de leur traitement.

Le Tableau 6 ci-après fournit la mnémonique des paramètres structurés de liaison Link (basée sur les spécifications FF-890 de la FOUNDATION™ Fieldbus) ainsi que la mise en correspondance des paramètres structurés Link avec les types de données FDT. Il convient d'utiliser la mnémonique pour la structure et chaque paramètre comme valeur d'attribut de nom pour la définition de paramètre.

Tableau 6 – Définitions d'objets de liaison Link

Structure	Mnémonique des paramètres de membre	Structure/type de données de la Fieldbus Foundation
LINK_STRUCTURE	LINK_STRUCTURE	DS-81
LINK_STRUCTURE (HSE)	LINK_STRUCTURE	DS-165
	LINK_TYPE	-
	LOCAL_INDEX	Unsigned32
	VCR_LINK_ID	Unsigned16
	VCR_NUMBER	Unsigned16
	REMOTE_INDEX	Unsigned32
	SERVICE_OPERATION	Unsigned8
	STALE_COUNT_LIMIT	Unsigned8
	H1_SUBSCRIBER_INDEX	Unsigned16

9.1.2.4 Structure d'alerte Alert

Les objets structurés Alert sont utilisés pour communiquer des messages de notification en cas de détection d'alarmes ou d'événements. Un événement est une occurrence instantanée qui est importante pour la programmation de l'exécution de blocs et pour la vue opérationnelle d'une application. Une alarme est la détection d'un bloc lorsqu'il quitte un état particulier et lorsqu'il retourne à cet état. L'instant auquel l'état d'alerte a été détecté est inclus comme marqueur temporel dans le message d'alerte. En outre, la priorité est incluse pour indiquer s'il s'agit d'une alerte d'avertissement ou d'une alerte critique.

Les ressources ont chacune un notificateur d'alerte chargé de rendre compte des apparitions de leur alerte. Les alertes peuvent aussi être acquittées. Les objets Alert sont utilisés pour rapporter les apparitions d'alarmes et d'événements sous forme de messages de notification

d'événements. L'acquittement indique que l'alerte a été traitée par un dispositif d'interface pour satisfaire aux exigences opérationnelles des interfaces.

Selon le type des informations d'alarmes et d'événements qui peuvent être rapportées par des blocs contenus dans une ressource, jusqu'à trois classes d'alertes peuvent être définies dans la ressource:

- alerte analogique - alerte utilisée pour rapporter des alarmes ou événements dont la valeur associée est le point flottant;
- alerte discrète - alerte utilisée pour rapporter des alarmes ou événements dont la valeur associée est discrète;
- alerte de mise à jour - alerte utilisée pour rapporter un changement dans les données statistiques du block.

Le Tableau 7 fournit la mnémonique des paramètres structurés d'alerte (basée sur la spécification FF-890) ainsi que la mise en correspondance des paramètres structurés d'alerte avec les types de données FDT. Il convient d'utiliser la mnémonique pour la structure et chaque paramètre comme valeur d'attribut de nom pour la définition de paramètre.

Tableau 7 – Définitions d'objets d'alerte Alert

Mnémonique de la structure	MNÉMONIQUE DE PARAMÈTRE DE MEMBRE	Structure/type de données de la Fieldbus Foundation
ALERT_ANALOG	ALERT_ANALOG	DS-75
ALERT_ANALOG (HSE)	ALERT_ANALOG	DS-167
	BLOCK_INDEX	Unsigned16/Unsigned32
	ALERT_KEY	Unsigned8
	STANDARD_TYPE	Unsigned8
	MFR_TYPE	Unsigned8
	MESSAGE_TYPE	Unsigned8
	PRIORITY	Unsigned8
	TIME_STAMP	TimeValue
	SUBCODE	Unsigned16
	VALUE	Float
	RELATIVE_INDEX	Unsigned16/Unsigned32
	UNITINDEX	Unsigned16
ALERT_DISCRETE	ALERT_DISCRETE	DS-76
ALERT_DISCRETE(HSE)	ALERT_DISCRETE	DS-168
	BLOCK_INDEX	Unsigned16/Unsigned32
	ALERT_KEY	Unsigned8
	STANDARD_TYPE	Unsigned8
	MFR_TYPE	Unsigned8
	MESSAGE_TYPE	Unsigned8
	PRIORITY	Unsigned8
	TIME_STAMP	TimeValue
	SUBCODE	Unsigned16
	VALUE	Unsigned8
	RELATIVE_INDEX	Unsigned16/Unsigned32
	UNITINDEX	Unsigned16
ALERT_UPDATE	ALERT_UPDATE	DS-77

Mnémonique de la structure	MNÉMONIQUE DE PARAMÈTRE DE MEMBRE	Structure/type de données de la Fieldbus Foundation
ALERT_UPDATE(HSE)	ALERT_UPDATE	DS-169
	BLOCK_INDEX	Unsigned16/Unsigned32
	ALERT_KEY	Unsigned8
	STANDARD_TYPE	Unsigned8
	MFR_TYPE	Unsigned8
	MESSAGE_TYPE	Unsigned8
	PRIORITY	Unsigned8
	TIME_STAMP	TimeValue
	STATIC_REVISION	Unsigned16
	RELATIVE_INDEX	Unsigned16/Unsigned32

9.1.2.5 Structure de tendance Trend

Les objets de structure Trend prennent en charge la gestion et la commande de blocs fonctionnels en assurant la visibilité dans les informations historiques pour la revue de leur comportement. Selon le type des informations recueillies, trois classes d'objets de tendance peuvent être définies.

- trend float - objet trend utilisé pour recueillir les valeurs et le statut des paramètres d'entrée et de sortie à virgule flottante;
- trend discrete - objet trend utilisé pour recueillir les valeurs et le statut des paramètres d'entrée et de sortie discrets;
- trend bit string - objet trend utilisé pour recueillir les valeurs et le statut des paramètres d'entrée et de sortie bit string (chaîne de bits).

Les objets trend permettent la prise en charge de données historiques de court terme à rassembler et à stocker dans une ressource. Un tel rassemblement peut être accessible efficacement par des dispositifs d'interface ou dispositifs temporaires qui rassemblent ces informations pour fournir des données historiques de long terme. À travers la configuration des objets de liaison, certains ou tous les objets trend dans une ressource peuvent être automatiquement rapportés à un dispositif d'interface chaque fois qu'un nouveau jeu de données est recueilli. En plus, les objets trend peuvent être lus à tout moment par un dispositif d'interface utilisant les services "read" du FMS.

Le Tableau 8 fournit la mnémonique des paramètres structurés de tendance Trend (basée sur la spécification FF-890) ainsi que la mise en correspondance des paramètres structurés Trend avec les types de données FDT. Il convient d'utiliser la mnémonique pour la structure et chaque paramètre comme valeur d'attribut de nom pour la définition de paramètre.

Tableau 8 – Définition des objets Trend

Mnémonique de la structure	Mnémonique des paramètres de membre	Structure/type de données de la Fieldbus Foundation
TREND_FLOAT		DS-78
TREND_FLOAT (HSE)		DS-170
	BLOCK_INDEX	Unsigned16/Unsigned32
	PARAMETER_RELATIVE_INDEX	Unsigned16
	SAMPLE_TYPE	Unsigned8
	SAMPLE_INTERVAL	Unsigned32
	LAST_UPDATE_TIME	TimeValue
	STATUS[0]	Unsigned8
	SAMPLES[0]	Float
	. . . . .	. . . .
	STATUS[15]	Unsigned8
	SAMPLES[15]	Float
TREND_DISCRETE		DS-79
TREND_DISCRETE (HSE)		DS-171
	BLOCK_INDEX	Unsigned16/Unsigned32
	PARAMETER_RELATIVE_INDEX	Unsigned16
	SAMPLE_TYPE	Unsigned8
	SAMPLE_INTERVAL	Unsigned32
	LAST_UPDATE_TIME	TimeValue
	STATUS[0]	Unsigned8
	SAMPLES[0]	Unsigned8
	. . . . .	. . . .
	STATUS[15]	Unsigned8
	SAMPLES[15]	Unsigned8
TREND_BIT_STRING		DS-80
TREND_BIT_STRING (HSE)		DS-172
	BLOCK_INDEX	Unsigned16/Unsigned32
	PARAMETER_RELATIVE_INDEX	Unsigned16
	SAMPLE_TYPE	Unsigned8
	SAMPLE_INTERVAL	Unsigned32
	LAST_UPDATE_TIME	TimeValue
	STATUS[0]	Unsigned8
	SAMPLES[0]	BitString
	. . . . .	. . . .
	STATUS[15]	Unsigned8
	SAMPLES[15]	BitString

9.1.2.6 Structure de vue View

Les objets View prennent en charge la gestion et la commande de blocs fonctionnels en assurant la visibilité dans leur configuration et leur fonctionnement. Le premier paramètre de chaque objet View est un code de révision statique. En conséquence, les paramètres restants qui sont inclus dans la définition des blocs de vue suivront séquentiellement le code de révision statique selon l'ordre de leur indice associé au sein du bloc fonctionnel. Les objets View permettent la prise en charge du regroupement des données dynamiques et statiques associées au fonctionnement, au diagnostic et à la configuration. Ce regroupement permet la prise en charge du transfert et du traitement efficaces des données.

Le Tableau 9 fournit la mnémonique des paramètres structurés de vue View (basée sur la spécification FF-890) ainsi que la mise en correspondance des paramètres structurés de vue View avec les types de données FDT. Il convient d'utiliser la mnémonique pour la structure et chaque paramètre comme valeur d'attribut de nom pour la définition de paramètre.

Tableau 9 – Définition de View

Mnémonique de la structure	Mnémonique des paramètres de membre	Structure/type de données de la Fieldbus Foundation
VIEW		
	VIEW_INDEX	Unsigned16/Unsigned32
	ELEMENT_1 (1. . . NUMBER OF ELEMENTS)	Unsigned16/Unsigned32

9.1.2.7 Objet Domain (domaine)

Un domaine est une partie intégrante de la mémoire. Il peut contenir des programmes ou des données. La spécification FF détermine que les données de domaine doivent être du type de données “octet string”. Le codage des informations dans le domaine n'est pas défini par la spécification FF. Le nombre maximal d'octets d'un domaine doit être défini dans l'objet "domain". Noter que l'état de domaine représente une estimation de DTM de l'état réel du domaine dans le dispositif. La définition complète du membre d'objet de domaine peut être consultée dans la FF-870 Spécification de messages de bus de terrain.

Le Tableau 10 fournit la mnémonique des paramètres structurés de domaine Domain (basée sur la spécification FF-870) ainsi que la mise en correspondance des paramètres structurés de domaine Domain avec les types de données FDT. Il convient d'utiliser la mnémonique pour la structure et chaque paramètre comme valeur d'attribut de nom pour la définition de paramètre.

Tableau 10 – Définitions d'objets Domain

Mnémonique de la structure	Mnémonique des paramètres de membre	Structure/type de données de la Fieldbus Foundation
DOMAIN_DESCRIPTION		-
	INDEX	Unsigned32
	MAX_OCTETS	Unsigned32
	DOMAIN_STATE	Unsigned8
	UPLOAD_STATE	Unsigned8
	COUNTER	Integer8
	DOMAIN_DATA	OctetString

9.1.2.8 Objet d'invocation de programme (Program invocation)

Le modèle d'invocation de programme fournit des services pour lier un domaine à un programme, pour démarrer ce programme, l'arrêter et le supprimer. Plus d'une invocation de programme peut être créée dans un dispositif.

La liste de domaines associée à l'objet PI ("Program Invocation") est fournie en donnant l'indice dans l'OD ("object dictionary", c'est-à-dire "dictionnaire d'objets) pour chaque domaine énuméré dans la liste. Le nombre de domaines peut être calculé en comptant les éléments avec la valeur de nom d'attribut égale à "domain" dans l'objet PI.

Le Tableau 11 fournit la mnémonique des paramètres structurés PI (basée sur la spécification FF-890) ainsi que la mise en correspondance des paramètres structurés PI avec les types de données FDT. Il convient d'utiliser la mnémonique pour la structure et chaque paramètre comme valeur d'attribut de nom pour la définition de paramètre.

Tableau 11 – Définitions de l'objet "Program invocation" (invocation de programme)

Mnémonique de la structure	Mnémonique des paramètres de membre	Structure/type de données de la Fieldbus Foundation
PROGRAM_INVOCATION		-
	PI_INDEX	Unsigned32
	REUSABLE	Integer8
	DELETABLE	Integer8
	PI_STATE	Integer8
	DOMAIN	Unsigned32

9.1.3 Types de données des dispositifs FF

Le Tableau 12 ci-après spécifie les types de données des dispositifs FF et donne des informations de description relatives aux dispositifs FF.

Espace de noms: fdtffdevice

Tableau 12 – Types structurés de données des dispositifs FF

Type de données	Définition			Description
	Types de données élémentaires	Usage	Multiplicité	
BlockList	STRUCT			Fournit la liste des blocs dans le dispositif
	ffblock:BlockInformation	O	[0..*]	
HSEDeviceInformation	STRUCT			HSEDeviceInformation décrit les dispositifs compatibles avec Ethernet haut débit (High Speed Ethernet), y compris la révision du dispositif, la redondance, etc.
	ffhse:stateSMK	M	[1..1]	
	ffhse:repeatTimeHSE	O	[0..1]	
	ffhse:duplicateDetectionState	O	[0..1]	
	fftypes:ip	O	[0..1]	

Type de données	Définition			Description
	Types de données élémentaires	Usage	Multiplicité	
	fftypes:IP	M	[1..1]	
	ffhse:DeviceInformation	M	[1..1]	
	ffhse:RedundancyInformation	O	[0..1]	
	ffhse:VersionInformation	O	[0..1]	
FoundationFieldbusH1 Device	STRUCT			FoundationFieldbusH1Device inclut les informations décrivant les dispositifs compatibles avec H1
	fftypes:deviceType	M	[1..1]	
	fdt:tag	M	[1..1]	
	fftypes:devID	M	[1..1]	
	fftypes:VfdIdentification	M	[1..*]	
	fftypes:DataLinkAddress	M	[1..1]	
FoundationFieldbus-HSEDevice	STRUCT			Décrit les dispositifs compatibles avec HSE, y compris l'adresse du dispositif, les informations de VFD, etc.
	fftypes:deviceType	M	[1..1]	
	fdt:tag	M	[1..1]	
	fftypes:devID	M	[1..1]	
	fftypes:VfdIdentification	M	[1..*]	
	HSEDeviceInformation	M	[1..1]	
	fftypes:DataLinkAddress	M	[1..1]	

9.2 BTM

9.2.1 Généralités

Dans le cas d'un BTM, les définitions suivantes sont utilisées à la place des définitions spécifiques à un DTM indiquées dans la spécification FDT.

9.2.2 Accès aux paramètres - Définitions spécifiques à la FF

Les paramètres de bloc peuvent être accessibles par l'intermédiaire des services suivants:

- services pour accéder à des données d'instance;
- services pour accéder à des données de dispositif.

Il convient que les BTM utilisent des attributs de nom normalisés pour les paramètres de bloc normalisés. Le tableau ci-après donne la liste de la mnémonique des paramètres de bloc normalisé Standard Block (basée sur les spécifications FF-890, FF-891, FF-892, FF-893 et FF-894) et leur mise en correspondance avec les types de données FDT.

Le domaine d'application pour les paramètres de bloc FF doit être “FDT_FFBlock”.

Il convient d'utiliser la mnémonique du paramètre comme la valeur d'attribut de nom et comme ID sémantique pour la définition de paramètre telle que donnée dans le Tableau 13:

Tableau 13 – Mnémonique de paramètre

Mnémonique de paramètre	Structure/type de données de la Fieldbus Foundation
ACCEPT_ALM	DS-72
ACCEPT_D	Unsigned8
ACCEPT_PRI	Unsigned8
ACK_OPTION	Bit String
ALARM_HYS	Float
ALARM_SUM	DS-74
ALERT_KEY	Unsigned8
ALGORITHM_SEL	Unsigned32
ALM_RATE_DN	Float
ALM_RATE_UP	Float
ARITH_TYPE	Unsigned8
AUTO_CYCLE	Unsigned8
BAL_TIME	Float
BIAS	Float
BIAS_IN_1	Float
BIAS_IN_2	Float
BIAS_IN_3	Float
BKCAL_HYS	Float
BKCAL_IN	DS-65
BKCAL_IN_1	DS-65
BKCAL_IN_2	DS-65
BKCAL_IN_D	DS-66
BKCAL_OUT	DS-65
BKCAL_OUT_D	DS-66
BKCAL_SEL_1	DS-65
BKCAL_SEL_2	DS-65
BKCAL_SEL_3	DS-65
BLOCK	DS-64
BLOCK_ALM	DS-72
BLOCK_ERR	Bit String
BYPASS	Unsigned8
CAS_IN	DS-65
CAS_IN_D	DS-66
CFM_ACT1_TIME	Float
CFM_ACT2_TIME	Float
CFM_PASS_TIME	Float
CHANNEL	Unsigned16
CHARACTERISTICS [3]	DS-64
CLOCK_PER	Float
CLR_FSTATE	Unsigned8

3 Représente la structure en bloc du bloc tel que défini en 5.14.1 de la spécification FF-890.

Mnémonique de paramètre	Structure/type de données de la Fieldbus Foundation
COMB_TYPE	Unsigned8
COMP_HI_LIM	Float
COMP_LO_LIM	Float
CONFIRM_TIME	Unsigned32
CONTENTS_REV	Unsigned32
CONTROL_OPTS	Bit String
CRACK_TIME	Float
CRACK_TIMER	Float
CURVE_X	Float
CURVE_Y	Float
CYCLE_SEL	Bit String
CYCLE_TYPE	Bit String
DC_STATE	Unsigned8
DD_RESOURCE	Visible String
DD_REV	Unsigned8
DEAD_TIME	DS-65
DELAY_TIME	Float
DELAY_TIMER	Float
DEV_REV	Unsigned8
DEV_TYPE	Unsigned16
DEVICE_OPTS	Bit string
DISABLE_1	DS-66
DISABLE_2	DS-66
DISABLE_3	DS-66
DISABLE_4	DS-66
DISC_ALM	DS-72
DISC_LIM	Unsigned8
DISC_PRI	Unsigned8
DURATION	DURATION_TYPE (10 Float) [4]
DV_HI_ALM	DS-71
DV_HI_LIM	Float
DV_HI_PRI	Unsigned8
DV_LO_ALM	DS-71
DV_LO_LIM	Float
DV_LO_PRI	Unsigned8
EXPAND_DN	Float
EXPAND_UP	Float
FAIL	Unsigned16
FAIL_ALM	DS-72
FAIL_PRI	Unsigned8
FAULT_STATE	Unsigned8

4 Défini comme une matrice de 10 valeurs float dans la spécification FF-892 de la Fieldbus Foundation et sera mis en correspondance avec une StructuredVariable contenant les éléments de la matrice.

Mnémonique de paramètre	Structure/type de données de la Fieldbus Foundation
FCF_LOCATOR	LOCATOR (Unsigned32 Array) **5**
FDD_LOCATOR	LOCATOR (Unsigned32 Array)
FEATURE_SEL	Bit String
FEATURES	Bit String
FF_GAIN	Float
FF_SCALE	DS-68
FF_VAL	DS-65
FIELD_VAL	DS-65
FIELD_VAL_D	DS-66
FILE_LOCATOR	LOCATOR (Unsigned32 Array)
FILE_REV	Unsigned32
FOLLOW	DS-66
FREE_SPACE	Float
FREE_TIME	Float
FSTATE_STATUS	Unsigned8
FSTATE_TIME	Float
FSTATE_VAL	Float
FSTATE_VAL_D	Unsigned8
FSTATE_VAL_D1	Unsigned8
FSTATE_VAL_D2	Unsigned8
FSTATE_VAL_D3	Unsigned8
FSTATE_VAL_D4	Unsigned8
FSTATE_VAL_D5	Unsigned8
FSTATE_VAL_D6	Unsigned8
FSTATE_VAL_D7	Unsigned8
FSTATE_VAL_D8	Unsigned8
FSTATE_VAL1	Float
FSTATE_VAL2	Float
FSTATE_VAL3	Float
FSTATE_VAL4	Float
FSTATE_VAL5	Float
FSTATE_VAL6	Float
FSTATE_VAL7	Float
FSTATE_VAL8	Float
GAIN	Float
GAIN_IN_1	Float
GAIN_IN_2	Float
GAIN_IN_3	Float
GOOD_LIM	Float
GRANT_DENY	DS-70

5 Défini comme une matrice de trois valeurs Unsigned32 dans la spécification FF-894 de la Fieldbus Foundation et sera mis en correspondance avec une StructuredVariable contenant les éléments de la matrice.

Mnémonique de paramètre	Structure/type de données de la Fieldbus Foundation
HARD_TYPES	Bit String
HI_ALM	DS-71
HI_BIAS	Float
HI_GAIN	Float
HI_HI_ALM	DS-71
HI_HI_BIAS	Float
HI_HI_LIM	Float
HI_HI_LIMX	Float
HI_HI_PRI	Unsigned8
HI_LIM	Float
HI_LIMX	Float
HI_PRI	Unsigned8
HYSTVAL	Float
IGNORE	Bit String
IGNORE_ALM	DS-72
IGNORE_PRI	Unsigned8
IGNORE_TIME	Float
IN	DS-65
IN_1	DS-65
IN_2	DS-65
IN_3	DS-65
IN_4	DS-65
IN_5	DS-65
IN_6	DS-65
IN_7	DS-65
IN_8	DS-65
IN_ARRAY	Float
IN_D	DS-66
IN_D1	DS-66
IN_D2	DS-66
IN_D3	DS-66
IN_D4	DS-66
IN_LO	DS-65
INPUT_OPTS	Bit string
INTEG_OPTS	Bit string
INTEG_TYPE	Unsigned8
INTERLOCK_D	DS-66
INVERT_OPTS	Bit string
IO_OPTS	Bit string
ITK_VER	Unsigned16
L_TYPE	Unsigned8
LAG_TIME	Float
LEAD_TIME	Float

Mnémonique de paramètre	Structure/type de données de la Fieldbus Foundation
LIM_NOTIFY	Unsigned8
LO_ALM	DS-71
LO_BIAS	Float
LO_GAIN	Float
LO_LIM	Float
LO_LIMX	Float
LO_LO_ALM	DS-71
LO_LO_BIAS	Float
LO_LO_LIM	Float
LO_LO_LIMX	Float
LO_LO_PRI	Unsigned8
LO_PRI	Unsigned8
LOCKVAL	Unsigned8
LOW_CUT	Float
MANUFAC_ID	Unsigned32
MAX_NOTIFY	Unsigned8
MEMORY_SIZE	Unsigned16
MIN_CYCLE_T	Unsigned32
MIN_GOOD	Unsigned8
MO_OPTS	Bit string
MODE_BLK	DS-69
N_RESET	Float
N_START	Unsigned16
NV_CYCLE_T	Unsigned32
OP_CMD_INT	Unsigned8
OP_CMD_SPG	Unsigned8
OP_SELECT	DS-66
OUT	DS-65
OUT_1	DS-65
OUT_1_RANGE	DS-68
OUT_2	DS-65
OUT_2_RANGE	DS-68
OUT_3	DS-65
OUT_4	DS-65
OUT_5	DS-65
OUT_6	DS-65
OUT_7	DS-65
OUT_8	DS-65
OUT_ALM	DS-66
OUT_ALM_SUM	Unsigned8
OUT_ARRAY	Float
OUT_D	DS-66
OUT_D5	DS-66

Mnémonique de paramètre	Structure/type de données de la Fieldbus Foundation
OUT_D6	DS-66
OUT_D7	DS-66
OUT_D8	DS-66
OUT_EXP	DS-65
OUT_HI_LIM	Float
OUT_LO_LIM	Float
OUT_PTRIP	DS-66
OUT_RANGE	DS-68
OUT_REM	DS-65
OUT_SCALE	DS-68
OUT_STATE	Unsigned16
OUT_TRIP	DS-66
OUTAGE_LIM	Float
PAUSE	DS-66
PAUSE_CAUSE	Unsigned8
PCT_INCL	Float
PERMISSIVE_D	DS-66
PI_POINTER	Unsigned32
PRE_OUT	DS-65
PRE_OUT_ALM	DS-66
PRE_OUT_D	DS-66
PRE_TRIP	Float
PSP	DS-65
PULSE_VAL1	Float
PULSE_VAL2	Float
PV	DS-65
PV_D	DS-66
PV_FTIME	Float
PV_SCALE	DS-68
PV_STATE	Unsigned16
QUIES_OPT	Unsigned8
RA_FTIME	Float
RANGE_HI	Float
RANGE_LO	Float
RATE	Float
RCAS_IN	DS-65
RCAS_IN_D	DS-66
RCAS_OUT	DS-65
RCAS_OUT_D	DS-66
READBACK	DS-65
READBACK_D	DS-66
RESET	Float
RESET_CONFIRM	DS-66

Mnémonique de paramètre	Structure/type de données de la Fieldbus Foundation
RESET_D	Unsigned8
RESET_IN	DS-66
RESTART	Unsigned8
RESTART_TIME	Float
REV_FLOW1	DS-66
REV_FLOW2	DS-66
ROUT_IN	DS-65
ROUT_OUT	DS-65
RS_STATE	Unsigned8
RTOTAL	Float
SEL_1	DS-65
SEL_2	DS-65
SEL_3	DS-65
SEL_TYPE	Unsigned8
SELECT_TYPE	Unsigned8
SELECTED	DS-66
SET_FSTATE	Unsigned8
SHED_OPT	Unsigned8
SHED_RCAS	Unsigned32
SHED_ROUT	Unsigned32
SHUTDOWN_D	DS-66
SIMULATE	DS-82
SIMULATE_D	DS-83
SP	DS-65
SP_D	DS-66
SP_HI_LIM	Float
SP_LO_LIM	Float
SP_RATE_DN	Float
SP_RATE_UP	Float
SPG_STATE	Unsigned8
SRTOTAL	Float
SSP	Float
ST_REV	Unsigned16
START	DS-66
START_TYPE	Unsigned8
START_VAL	START_VAL _TYPE (11 Float) **6**
STATUS_OPTS	Bit string
STEP_POSN	DS-66
STOTAL	Float
STRATEGY	Unsigned16

6 Défini comme une matrice de 11 valeurs float dans la spécification FF-892 de la Fieldbus Foundation et sera mis en correspondance avec une StructuredVariable contenant les éléments de la matrice.

Mnémonique de paramètre	Structure/type de données de la Fieldbus Foundation
SWAP_2	Unsigned8
TAG_DESC	Octet string
TEST_RW	DS-85
TIME_POSN	DS-65
TIME_POSN_T	DS-65
TIME_UNIT1	Unsigned8
TIME_UNIT2	Unsigned8
TIME_UNITS	Unsigned8
TIMER_SP	Float
TIMER_TYPE	Unsigned8
TOTAL_SP	Float
TRAVEL_TIMER	Float
TRIP_TIME	Float
TRK_IN_D	DS-66
TRK_SCALE	DS-68
TRK_VAL	DS-65
UNCERT_LIM	Float
UNIT_CONV	Float
UPDATE_EVT	DS-73
WRITE_ALM	DS-72
WRITE_LOCK	Unsigned8
WRITE_PRI	Unsigned8
X_RANGE	DS-68
XD_SCALE	DS-68
XD_STATE	Unsigned16
Y_RANGE	DS-68

Le Tableau 14 décrit les définitions de structures (conformément à la spécification FF) et leur mise en correspondance avec les définitions de types de données FDT:

Tableau 14 – Mnémonique de types structurés de données

Structure	Mnémonique des paramètres de membre	Structure/type de données de la Fieldbus Foundation
DS-64		DS-64
DS-64		DS-166
	BLOCK_TAG	Visible String
	DD_MEMBER	Unsigned32
	DD_ITEM	Unsigned32
	DD_REVIS	Unsigned16
	PROFILE	Unsigned16
	PROFILE_REVISION	Unsigned16
	EXECUTION_TIME	Unsigned32
	EXECUTION_PERIOD	Unsigned32

Structure	Mnémonique des paramètres de membre	Structure/type de données de la Fieldbus Foundation
	NUM_OF_PARAMS	Unsigned16
	NEXT_FB_TO_EXECUTE	Unsigned16/ Unsigned32
	VIEWS_INDEX	Unsigned16/ Unsigned32
	NUMBER_VIEW_3	Unsigned8
	NUMBER_VIEW_4	Unsigned8
DS-65		DS-65
	STATUS	Unsigned8
	VALUE	Float
DS-66		DS-66
	STATUS	Unsigned8
	VALUE	Unsigned8
DS-67		DS-67
	STATUS	Unsigned8
	VALUE	Bit String
DS-68		DS-68
	EU_100	Float
	EU_0	Float
	UNITS_INDEX	Unsigned16
	DECIMAL	Integer8
DS-69		DS-69
	TARGET	Bit String
	ACTUAL	Bit String
	PERMITTED	Bit String
	NORMAL	Bit String
DS-70		DS-70
	GRANT	Bit String
	DENY	Bit String
DS-71		DS-71
	UNACKNOWLEDGED	Unsigned8
	ALARM_STATE	Unsigned8
	TIME_STAMP	Time value
	SUB_CODE	Unsigned16
	VALUE	Float
DS-72		DS-72
	UNACKNOWLEDGED	Unsigned8
	ALARM_STATE	Unsigned8
	TIME_STAMP	Time value
	SUB_CODE	Unsigned16
	VALUE	Unsigned8
DS-73		DS-73
	UNACKNOWLEDGED	Unsigned8

Structure	Mnémonique des paramètres de membre	Structure/type de données de la Fieldbus Foundation
	UPDATE_STATE	Unsigned8
	TIME_STAMP	Time value
	STATIC_REVISION	Unsigned16
	RELATIVE_INDEX	Unsigned16
DS-74		DS-74
	CURRENT	Bit String
	UNACKNOWLEDGED	Bit String
	UNREPORTED	Bit String
	DISABLED	Bit String
DS-82		DS-82
	SIMULATE_STATUS	Unsigned8
	SIMULATE_VALUE	Float
	TRANSDUCER_STATUS	Unsigned8
	TRANSDUCER_VALUE	Float
	ENABLE_DISABLE	Unsigned8
DS-83		
	SIMULATE_STATUS	Unsigned8
	SIMULATE_VALUE	Float
	TRANSDUCER_STATUS	Unsigned8
	TRANSDUCER_VALUE	Float
	ENABLE_DISABLE	Unsigned8
DS-84		
	SIMULATE_STATUS	Unsigned8
	SIMULATE_VALUE	BitString
	TRANSDUCER_STATUS	Unsigned8
	TRANSDUCER_VALUE	BitString
	ENABLE_DISABLE	Unsigned8
DS-85		DS-85
	VALUE_1	Boolean
	VALUE_2	Integer8
	VALUE_3	Integer16
	VALUE_4	Integer32
	VALUE_5	Unsigned8
	VALUE_6	Unsigned16
	VALUE_7	Unsigned32
	VALUE_8	Float
	VALUE_9	Visible String
	VALUE_10	Octet String
	VALUE_11	Date
	VALUE_12	Time of Day
	VALUE_13	Time Difference
	VALUE_14	Bit String

Structure	Mnémonique des paramètres de membre	Structure/type de données de la Fieldbus Foundation
	VALUE_15	Time Value
DS-141		
	Reserved	OctetString
	Status	Unsigned8
	Value	Boolean
DS-142		
	Reserved	OctetString
	Status	Unsigned8
	Value	Integer8
DS-143		
	Reserved	OctetString
	Status	Unsigned8
	Value	Integer16
DS-144		
	Reserved	OctetString
	Status	Unsigned8
	Value	Integer32
DS-145		
	Reserved	OctetString
	Status	Unsigned8
	Value	Unsigned16
DS-146		
	Reserved	OctetString
	Status	Unsigned8
	Value	Unsigned 32
DS-147		
DS-148		
DS-149		
DS-150		
DS-151		
DS-152		
	Reserved	OctetString
	Status	Unsigned8
	Value	VisibleString
DS-153		
	Status	Unsigned8
	Value	Date
DS-154		
	Reserved	OctetString
	Status	Unsigned8
	Value	TimeOfDay
DS-155		

Structure	Mnémonique des paramètres de membre	Structure/type de données de la Fieldbus Foundation
	Reserved	OctetString
	Status	Unsigned8
	Value	TimeDifference
DS-156		
	Reserved	OctetString
	Status	Unsigned8
	Value	Time
DS – 157		
DS – 158		
	Reserved	OctetString
	Status	Unsigned8
	Value	BitString(32)/ BitString(64)
DS – 159		
	Reserved	OctetString
	Status	Unsigned8
	Value_1	Unsigned8
	. . . .	
	Value_8	Unsigned8
DS – 160		
	Reserved	OctetString
	Status	Unsigned8
	Value_1	Unsigned8
	. . . .	
	Value_16	Unsigned8
DS – 161		
	Reserved	OctetString
	Status	Unsigned8
	Value_1	Unsigned8
	. . . .	
	Value_32	Unsigned8
DS – 162		
	Reserved	OctetString
	Status	Unsigned8
	Value_1	Float
	. . . .	
	Value_8	Float
DS – 163		
	Reserved	OctetString
	Status	Unsigned8
	Value_1	Float
	. . . .	
	Value_16	Float

Structure	Mnémonique des paramètres de membre	Structure/type de données de la Fieldbus Foundation
DS – 164		
	Reserved	OctetString
	Status	Unsigned8
	Value_1	Float
	. . . .	
	Value_24	Float
DURATION_TYPE	DURATION_1 -	Float
	DURATION_10	Float
START_VAL _TYPE	START_VAL _1	Float
	START_VAL _11	Float
LOCATOR	KEY	Unsigned32
	LENGTH	Unsigned32
	LOCATION_INDEX	Unsigned32

Le Tableau 15 décrit les types de données communs simples (conformément à la spécification FF) et leur mise en correspondance avec les définitions de types de données FDT:

Tableau 15 – Types de données communs simples

Définition du type de données FF	Type de données FDT	Note
Boolean	Int	Définition: == 0 est False != 0 est True
Integer 8	Int	Noter que seuls les huit premiers bits (LSB, poids faible) seront utilisés
Integer 16	Int	Noter que seuls les 16 premiers bits (LSB) seront utilisés
Integer 32	Int	
Unsigned 8	Unsigned	Noter que seuls les huit premiers bits (LSB) seront utilisés
Unsigned 16	Unsigned	Noter que seuls les 16 premiers bits (LSB) seront utilisés
Unsigned 32	Unsigned	
Floating Point ("Virgule flottante")	Float	
Visible String	ascii	Voir la FF-870, 9.3.1.5 pour une définition détaillée et la séquence d'octets
Octet String	hexString	Voir la FF-870, 9.3.1.6 pour une définition détaillée et la séquence d'octets de Octet string
Date	dateAndTime	Le type de données normalisé dateTime sera utilisé pour présenter la valeur
Time of Day	dateAndTime	Le type de données normalisé dateTime sera utilisé pour présenter la valeur
Time Difference	hexString	Voir la FF-870, 9.3.1.9 pour une définition détaillée et la séquence d'octets de Time Difference
Bit String	bitString	NOTE Des énumérations de bits seront utilisées, si possible

Définition du type de données FF	Type de données FDT	Note
Time value	hexString	Voir la FF-870, 9.3.1.11 pour une définition détaillée et la séquence d'octets de Time Value

10 Types de données de gestion de réseau

10.1 Généralités

Les définitions de gestion seront utilisées comme définition en ligne dans une instance de DTMParameterDefinition au niveau de l'élément 'BusInformation\UserDefinedBus' comme une définition en ligne.

10.2 Définitions de gestion de réseau H1

Les types de données de gestion de bus de terrain H1 (Fieldbus Management) sont définis dans le Tableau 16 et utilisés avec l'espace de noms: ffH1Mngmnt:)

Tableau 16 – Types de données H1 Fieldbus Management

Nom	Description
ListOfH1NmaVfds	Liste des VFD de gestion de réseau
H1NmaVfd	L'agent de gestion de réseau (Network Management Agent (NMA)) est un processus d'application modélisé par le VFD de gestion. Le VFD Management est partagé entre le NMA et le System Management Kernel (noyau de gestion système) et contient la NMIB et la SMIB
NMIB	Network Management Information Base (Base d'informations de gestion de réseau)
SMIB	System Management Information Base (Base d'informations de gestion de système)

10.3 Types de données de gestion de réseau HSE

Les définitions simples de gestion de bus de terrain HSE (Fieldbus Management) sont énumérées dans le Tableau 17 et utilisées avec l'espace de noms: ffhsemngmnt

Tableau 17 – Définitions simples de gestion de bus de terrain HSE (Fieldbus Management)

Type de données	Définition	Description
actualNumberOfVFDs	UDINT	Nombre réel des VFD. FF-803 FS 1.19 SM Section 6.2.1
bufferSize	UDINT	Cet attribut est défini dans la Spécification d'agent d'accès aux dispositifs de terrain (Field Device Access (FDA)) [FF-588] comme étant la taille du tampon (Buffer Size). DEFAULT_BUFFER_SIZE = 1460 FF-803 FS 1.19 NM Section 5.1.2.
capableTimeSyncClass	UDINT	Cette variable spécifie la classe de synchronisation du temps que le client de temps SNTP dans la HSE Presence est capable de prendre en charge. L'énumération des classes de synchronisation de temps est telle que montrée ci-dessous, définie dans l'IEC 61158-4-1, 7.6, sous-champ TTT. FF-803 FS 1.19 SM Section 6.2.2.1.
daylightTimeDifference	DINT	Cette variable contient le nombre de tops signés à ajouter à l'heure courante (Current Time) pour obtenir l'heure du marqueur d'heure diurne (Daylight time). Elle est utilisée à la place de la différence temporelle normalisée (Standard Time Difference) lorsque l'heure courante (Current Time) se situe dans l'intervalle défini par l'heure diurne de départ (Start Daylight Time) et l'heure diurne de fin (End Daylight Time). FF-803 FS 1.19 SM Section 6.2.2.1
discardedForForwardingDelayExceeded	UDINT	
discardedForLackOfBuffers	UDINT	Cet élément compte le nombre de trames valides qu'il convient d'avoir présentées pour émission sur une ou plusieurs interfaces de sortie, mais qui ont été rejetées en raison de l'insuffisance de tampons de transmission disponibles. FF-803 FS 1.19 NM Section 5.9.6
dstLinkAddress	UDINT	Cet attribut contient l'adresse de destination 16 bits (HL) du message qu'il convient de transmettre par le pont H1. Si la valeur est 0, cette entrée n'est pas configurée. FF-803 FS 1.19 NM Section 5.9.5
endpointType	USINT	Cet attribut est défini dans la Spécification d'agent d'accès aux dispositifs de terrain (Field Device Access (FDA)) [FF-588] comme étant le type Endpoint et indique le type de point d'extrémité. FF-803 FS 1.19 NM Section 5.1.2
fasDllMaxConfirmDelayOnConnect	UINT	Cet élément est défini dans la Spécification de gestion de réseau [FF-801] comme étant FasDllMaxConfirmDelayOnConnect. FF-803 FS 1.19 NM Section 5.9.4
fasDllMaxDlsduSize	UINT	Cet élément est défini dans la Spécification de gestion de réseau [FF-801] comme étant FasDllMaxDlsduSize. FF-803 FS 1.19 NM Section 5.9.4
fasDllSDAP	USINT	Cet élément est défini dans la Spécification de gestion de réseau [FF-801] comme étant FasDllSDAP. . FF-803 FS 1.19 NM Section 5.9.4
fBScheduleDescriptor		Cet attribut est l'indice OD de l'enregistrement de descripteur de programme de blocs fonctionnels (FB Schedule Descriptor Record). La valeur de cet attribut est FB Schedule OD Index + 2 + offset, où "offset" (décalage) représente la position base zéro dans la liste. Autrement dit, le décalage du premier enregistrement dans la liste est zéro. Le décalage n'est pas supérieur au nombre de programmes spécifiés dans l'enregistrement FB Schedule List Characteristics moins 1. FF-803 FS 1.19 SM Section 6.2.5.2
fdaAddress	ARRAY OF USINT	Cet attribut est défini dans la Spécification d'agent d'accès aux dispositifs de terrain (Field Device Access (FDA)) [FF-588] comme étant l'adresse FDA (FDA Address). FF-803 FS 1.19 NM Section 5.1.3

Type de données	Définition	Description
fdaGuardBand	UDINT	Cet attribut est défini dans la Spécification d'agent d'accès aux dispositifs de terrain (Field Device Access (FDA)) [FF-588] comme étant la bande de garde (Guard Band). FF-803 FS 1.19 NM Section 5.2.1
filteringDatabaseListHeaderOdIndex	UDINT	Il s'agit d'une instance de la classe ListHeader représentant l'en-tête de la base de données de filtrage (Filtering Database). FF-803 FS 1.19 NM Section 5.9.1
forwardedInbound	UDINT	Cet élément compte le nombre de trames valides reçues par l'interface qui avaient été présentées pour transmission sur une ou plusieurs interfaces de sortie. FF-803 FS 1.19 NM Section 5.9.6
h1ConfiguratorAddress	UDINT	Cet élément contient l'adresse H1 du dispositif de configuration H1. FF-803 FS 1.19 NM Section 5.9.3
h1DlOperatFunctionalClassSupported	USINT	Cet attribut correspond à la classe prise en charge par toutes les interfaces H1 d'un dispositif de liaison. Il a la même définition que l'attribut DlOperatFunctionalClass spécifié dans la Spécification de gestion de réseau [FF-801]. Sa valeur est zéro lorsque le dispositif HSE n'est pas un dispositif de liaison. FF-803 FS 1.19 NM Section 5.2.1
h1Timeout	UDINT	Cet attribut définit la durée, en millisecondes, pendant laquelle le Linking Device (dispositif de liaison) attend avant de publier des id d'invocation qui ont été alloués pour les demandes FMS et/ou SM envoyées sur n'importe quelle interface H1. FF-803 FS 1.19 NM Section 5.2.1
hseSubnetMask	ARRAY OF USINT	Cet attribut est défini dans la Spécification d'agent d'accès aux dispositifs de terrain (Field Device Access (FDA)) [FF-588] comme étant le masque de sous-réseau HSE (HSE Subnet Mask). FF-803 FS 1.19 NM Section 5.1.3
hseSubnetMaskBits	ARRAY OF USINT	Cet attribut, lorsqu'il est soumis à une opération ET logique avec une adresse IP ou un masque de sous-réseau HSE (HSE Subnet Mask), donne l'adresse de sous-réseau HSE définie dans la Spécification [FF-588] d'agent d'accès aux dispositifs de terrain (FDA). Il est utilisé pour les VCR («Virtual Communication Relationship» c'est-à-dire «relation de communication virtuelle») HSE avec l'attribut HSE Subnet Mask. FF-803 FS 1.19 NM Section 5.2.1
hseVcrType	UDINT	Cet attribut est défini dans la Spécification d'agent d'accès aux dispositifs de terrain (Field Device Access (FDA)) [FF-588] comme étant le type HSE VCR et indique le type de HSE VCR. FF-803 FS 1.19 NM Section 5.1.3
ignoredInbound	UDINT	Cet élément compte le nombre de trames valides reçues par l'interface que le processus de transmission (Forwarding Process) déterminé n'avait pas besoin de transmettre. FF-803 FS 1.19 NM Section 5.9.6
inactivityCloseTime	UDINT	Cet attribut est défini dans la Spécification d'agent d'accès aux dispositifs de terrain (Field Device Access (FDA)) [FF-588] comme étant le temps de fermeture d'inactivité (Inactivity Close Time). DEFAULT_INACTIVITY_CLOSE_TIME = 30 s FF-803 FS 1.19 NM Section 5.1.2
installedInterfaces	ARRAY OF USINT	Interfaces installées. L'entrée "Installed" (installé) signifie que le matériel est en place et fonctionne. Chaque bit dans l'entrée correspond à une interface H1, le bit k correspondant à l'interface k. Bit 1 est le MSB (bit de poids de fort). FF-803 FS 1.19 SM Section 6.2.1
interfaceLinkId	UINT	
interfaceNodeId	USINT	
interfaceNumber	USINT	Cet attribut spécifie l'indice dans la matrice InterfaceAddressArray pour transmission. FF-803 FS 1.19 NM Section 5.9.5
interfaceStateArray	ARRAY OF USINT	

Type de données	Définition	Description
interfaceStatisticsSupported	ARRAY OF USINT	La valeur de cet élément indique les statistiques d'interface prises en charge. FF-803 FS 1.19 NM Section 5.9.2
lastSNTPMessage	ARRAY OF USINT	Cet objet contient les 48 premiers octets du dernier message SNTP reçu. Cet objet contient seulement des données dynamiques, qui n'altèrent pas le calcul des numéros de version. FF-803 FS 1.19 SM Section 6.2.2
maxForwardingDelayNormal	UINT	Cet attribut est défini dans la Spécification de protocole de liaison de données (Data Link Protocol Specification): Bridge Operation Addendum [FF-806]. 1/32 ms FF-803 FS 1.19 NM Section 5.9.2
maxForwardingDelayTimeAvailable	UINT	Cet attribut est défini dans la Spécification de protocole de liaison de données (Data Link Protocol Specification): Bridge Operation Addendum [FF-806]. Unité = 1/32 ms. FF-803 FS 1.19 NM Section 5.9.2
maxForwardingDelayUrgent	UINT	Cet attribut est défini dans la Spécification de protocole de liaison de données (Data Link Protocol Specification): Bridge Operation Addendum [FF-806]. Unité = 1/32 ms. FF-803 FS 1.19 NM Section 5.9.2
maxMessageLength	UDINT	Cet attribut est défini dans la Spécification d'agent d'accès aux dispositifs de terrain (Field Device Access (FDA)) [FF-588] comme étant la longueur maximale de message (Max Message Length). FF-803 FS 1.19 NM Section 5.1.2
maxNumberOfInterfaces	UDINT	L'entrée "Max number of interfaces (M)" (nombre maximal d'interfaces (M)) indique le nombre maximal d'interfaces H1 qui peuvent être installées dans le dispositif. La valeur maximale pour cette entrée est 30. Voir la Spécification de gestion de réseau [FF-803] sur les caractéristiques des ponts. FF-803 FS 1.19 SM Section 6.2.1
maxNumberOfVFDs	UDINT	Nombre maximal des VFD. FF-803 FS 1.19 SM Section 6.2.1
maxNumEntries	UDINT	Cet élément indique le nombre maximal d'entrées qui peuvent être définies dans la liste (NumConfigured + NumUnconfigured). FF-803 FS 1.19 NM Section 5.1.1
maxNumOfVcrs	UDINT	Cet élément contient le compteur pour le nombre maximal des VCR de HSE qui peuvent être reliées simultanément à l'objet Session Endpoint Entry (entrée de point d'extrémité de session). Cet élément représente le "repère supérieur d'eau" pour les VCR reliées à cette session. Cet attribut ne peut pas être écrit. FF-803 FS 1.19 NM Section 5.5.2
minForwardingDelayNormal	UINT	Cet attribut est défini dans la Spécification de protocole de liaison de données (Data Link Protocol Specification): Bridge Operation Addendum [FF-806]. 1/32 ms. FF-803 FS 1.19 NM Section 5.9.2
minForwardingDelayTimeAvailable	UINT	Cet attribut spécifie la valeur la plus faible que le dispositif prend en charge pour MinForwardingDelayTimeAvailable. Unité = 1/32 ms. FF-803 FS 1.19 NM Section 5.9.2
minForwardingDelayUrgent	UINT	Cet attribut spécifie la valeur la plus faible que le dispositif prend en charge pour MaxForwardingDelayUrgent. Unité = 1/32 ms. FF-803 FS 1.19 NM Section 5.9.2
minRepublishingDelay	UINT	Cet attribut est défini dans la Spécification de protocole de liaison de données (Data Link Protocol Specification): Bridge Operation Addendum [FF-806]. Unité = 1/32 ms. FF-803 FS 1.19 NM Section 5.9.2
msgHdrOptions	ARRAY OF USINT	Cet attribut est défini dans la Spécification d'agent d'accès aux dispositifs de terrain (Field Device Access (FDA)) [FF-588] comme étant les options d'en-tête de message (Message Header Options). DEFAULT_HDR_OPTIONS = 0 FF-803 FS 1.19 NM Section 5.1.2
msgHdrOptionsSupported	ARRAY OF USINT	Cet attribut définit les options d'en-tête de message qui sont prises en charge par le dispositif HSE. FF-803 FS 1.19 NM Section 5.2.1

Type de données	Définition	Description
nmaConfigurationUse	USINT	Cet attribut est défini dans la Spécification d'agent d'accès aux dispositifs de terrain (Field Device Access (FDA)) [FF-588] comme étant l'utilisation de la configuration de l'agent de gestion de réseau (NMA Configuration Use). Mettre cet attribut à zéro lors de l'écriture dans tout attribut de la classe SessionEndpointEntry. FF-803 FS 1.19 NM Section 5.1.2.
numberOfInterfaces	USINT	Cet attribut définit le nombre d'interfaces H1 du pont H1. Sa valeur maximale est 30, en raison de l'attribut FasDllMaxDlsduSize de la relation de gestion normalisée (Standardized Management Relationship) dans la Spécification de gestion de réseau [FF-801]. FF-803 FS 1.19 NM Section 5.9.2.
numberOfSchedule	UINT	Cet attribut contient le nombre de domaines de programmes qui contiennent des programmes. Il est incrémenté chaque fois qu'un nouveau domaine de programmes est téléchargé vers l'aval. Il est décrémenté chaque fois qu'un nouveau domaine de programmes est initialisé. FF-803 FS 1.19 SM Section 6.2.5.1
numConfigured	UDINT	Cet élément indique le nombre d'entrées dans la liste qui sont actuellement configurées (indépendamment du fait qu'elles soient en cours d'utilisation ou non). Il peut être écrit mais il convient de n'écrire que la valeur zéro. L'écriture de zéro fait vider la liste, à trois exceptions près. FF-803 FS 1.19 NM Section 5.1.1
numOfAborts	UDINT	Cet élément contient le compteur pour le nombre de fois que la VCR HSE a été abandonnée prématurément, soit par l'utilisateur, soit par la pile de communication. Cet attribut ne peut pas être écrit. FF-803 FS 1.19 NM Section 5.8.2
NumOfConfirmedRequestMessagesReceived	UDINT	NumOfRequestMessagesReceived Cet élément contient le compteur pour le nombre de messages de demande confirmés reçus en provenance de la VCR. Cet attribut ne peut pas être écrit. FF-803 FS 1.19 NM Section 5.8.2
NumOfConfirmedRequestMessagesSent	UDINT	Cet élément contient le compteur pour le nombre de messages de demande confirmés envoyés en provenance de la VCR. Cet attribut ne peut pas être écrit. . FF-803 FS 1.19 NM Section 5.8.2
numOfConnects	UDINT	Cet élément contient le compteur pour le nombre de fois que la VCR HSE a été connectée, soit par l'utilisateur, soit par la pile de communication. Cet attribut ne peut pas être écrit. FF-803 FS 1.19 NM Section 5.8.2
numOfDuplicatedMessages	UDINT	Cet élément contient le compteur pour le nombre de messages en doublons que la VCR HSE a reçus. Voir la Spécification [FF-588] d'agent d'accès aux dispositifs de terrain (FDA). FF-803 FS 1.19 NM Section 5.8.2
numOfErrorMessagesReceived	UDINT	Cet élément contient le compteur pour le nombre de messages de réponse négative reçus par l'intermédiaire de la VCR HSE. Cet attribut ne peut pas être écrit. FF-803 FS 1.19 NM Section 5.8.2
numOfErrorMessagesSent	UDINT	Cet élément contient le compteur pour le nombre de messages de réponse négative envoyés par l'intermédiaire de la VCR HSE. Cet attribut ne peut pas être écrit. FF-803 FS 1.19 NM Section 5.8.2
numOfInvalidMsgsReceived	UDINT	Cet élément contient le compteur pour le nombre de messages FDA non valides qui ont été reçus. Cet attribut ne peut pas être écrit. FF-803 FS 1.19 NM Section 5.5.2
numOfLateMessages	UDINT	Cet élément contient le compteur pour le nombre de messages tardifs que la VCR HSE a reçus. Voir la Spécification [FF-588] d'agent d'accès aux dispositifs de terrain (FDA). FF-803 FS 1.19 NM Section 5.8.2
numOfLossOfSyncMessages	UDINT	Cet élément contient le compteur pour le nombre des pertes de synchronisation que la VCR HSE a détectées. Voir la Spécification [FF-588] d'agent d'accès aux dispositifs de terrain (FDA). FF-803 FS 1.19 NM Section 5.8.2

Type de données	Définition	Description
numOfMissedMessages	UDINT	Cet élément contient le compteur pour le nombre de messages que la VCR HSE a manqués. Voir la Spécification [FF-588] d'agent d'accès aux dispositifs de terrain (FDA). FF-803 FS 1.19 NM Section 5.8.2
numOfMsgsReceived	UDINT	Cet élément contient le compteur pour le nombre de messages FDA reçus. Cet attribut ne peut pas être écrit. FF-803 FS 1.19 NM Section 5.5.2
numOfMsgsSent	UDINT	Cet élément contient le compteur pour le nombre de messages FDA envoyés. Cet attribut ne peut pas être écrit. FF-803 FS 1.19 NM Section 5.5.2
numOfNonMisorderedMessages	UDINT	
numOfOpenStateCtr	UDINT	Cet élément contient le compteur de nombre de fois que l'extrémité de session (Session Endpoint) a été ouverte. Cet attribut ne peut pas être écrit. FF-803 FS 1.19 NM Section 5.5.2
numOfResponseMessagesReceived	UDINT	Cet élément contient le compteur pour le nombre de messages de réponse positive reçus par l'intermédiaire de la VCR HSE. Cet attribut ne peut pas être écrit. FF-803 FS 1.19 NM Section 5.8.2
numOfResponseMessagesSent	UDINT	NumOfPositiveResponseMessagesSent. Cet élément contient le compteur pour le nombre de messages de réponse positive envoyés par l'intermédiaire de la VCR HSE. Cet attribut ne peut pas être écrit. FF-803 FS 1.19 NM Section 5.8.2
numOfUnconfirmedMessagesReceived	UDINT	Cet élément contient le compteur pour le nombre de messages de demande non confirmés qui sont reçus en provenance de la VCR. Cet attribut ne peut pas être écrit. FF-803 FS 1.19 NM Section 5.8.2
numOfUnconfirmedMessagesSent	UDINT	
onChangeRefreshRate	USINT	Cet attribut est utilisé par la HSE Local Publisher VCR (VCR d'éditeur local HSE) qui n'effectue pas de transfert en raison de l'OnChangeThreshold (voir la Spécification [FF-588] d'agent d'accès aux dispositifs de terrain (FDA)). Il détermine le nombre de cycles d'exécution d'éditeur pendant lesquels la HSE Local Publisher VCR (VCR d'éditeur local HSE) doit attendre avant de transférer la plus récente valeur de variable éditée. FF-803 FS 1.19 NM Section 5.2.1
onChangeThreshold	UDINT	Cet attribut est défini dans la Spécification d'agent d'accès aux dispositifs de terrain (Field Device Access (FDA)) [FF-588] comme étant l'On Change Threshold (Seuil de changement). FF-803 FS 1.19 NM Section 5.1.3
repubAddress	UDINT	Il s'agit de l'adresse de réédition 32 bits: FF-803 FS 1.19 NM Section 5.9.4
republishingDatabaseListHeaderOdIndex	UDINT	
restartStatisticsCollectionControl	USINT	Cet élément est utilisé pour relancer la collecte de statistiques de toutes les entrées dans la liste spécifiée d'entrées de statistiques. La relance de la collecte de statistiques a pour effet de mettre à jour le StatisticsCollectionStartTime et d'effacer et redémarrer tous les compteurs de statistiques. FF-803 FS 1.19 NM Section 5.2.1. 0 Ne rien faire 1 Relancer la collecte de statistiques pour toutes les entrées de la liste des statistiques de session (Session Statistics List). 2 Relancer la collecte de statistiques pour toutes les entrées de la liste des statistiques de VCR HSE (HSE VCR Statistics List). 3 Relancer la collecte de statistiques pour toutes les entrées de la liste des statistiques de session (Session Statistics List) et de la liste des statistiques de VCR HSE (HSE VCR Statistics List)

Type de données	Définition	Description
rootInterface	USINT	Le numéro d'interface du pont H1 qui est l'interface-racine, le cas échéant. FF-803 FS 1.19 NM Section 5.9.2
scheduleSyncPeriod	UDINT	Cette variable contient un argument de la fonction modulus décrite dans la section 4.6 qui est utilisée pour déterminer la prochaine heure de départ pour un macrocycle, en tops d'horloge. FF-803 FS 1.19 SM Section 6.2.2.1
sessionMaxOutstanding	UDINT	Cet élément représente le nombre maximal de demandes qu'un point d'extrémité client ou serveur peut avoir en cours à un instant quelconque (voir la Spécification [FF-588] d'agent d'accès aux dispositifs de terrain (FDA)). FF-803 FS 1.19 NM Section 5.2.1
sessionStatisticsControlDefaultValue	USINT	Cet élément contient la valeur par défaut utilisée pour l'attribut StatisticsControl de l'entrée SessionStatistics. Sa valeur initiale est “OnOpening”. Lorsqu'une entrée SessionStatistics est initialisée, la valeur de son attribut StatisticsControl est mise à cette valeur. FF-803 FS 1.19 NM Section 5.2.1
sNTPTimestamp	UDINT	Cet objet matrice contient les quatre temps utilisés pour calculer le retard et le décalage, décrits dans la RFC-2030 comme étant T1, T2, T3 et T4. Le premier élément dans la matrice contient la partie «secondes entières» de T1. Le deuxième élément contient les secondes fractionnaires de T1. Les enregistrements restants répètent cette séquence pour les temps SNTP restants. Cet objet contient seulement des données dynamiques, qui n'altèrent pas le calcul des numéros de version. FF-803 FS 1.19 SM Section 6.2.2
standardTimeDifference	DINT	Cette variable contient le nombre de tops signés à ajouter à l'heure courante (Current Time) pour obtenir l'heure du marqueur d'heure normalisée (Standard). Elle est utilisée à la place de la différence d'heure diurne (Daylight Time Difference) lorsque l'heure courante (Current Time) se situe à l'extérieur de l'intervalle défini par l'heure diurne de départ (Start Daylight Time) et l'heure diurne de fin (End Daylight Time) ou si la Start Daylight Time est zéro. FF-803 FS 1.19 SM Section 6.2.2.1
state	USINT	Cet attribut en lecture seule est défini dans la Spécification d'agent d'accès aux dispositifs de terrain (Field Device Access (FDA)) [FF-588] comme étant le State (état) et spécifie l'état du point d'extrémité de session. Mettre cet attribut à zéro lors de l'écriture dans tout attribut de la classe SessionEndpointEntry. FF-803 FS 1.19 NM Section 5.2.1
statisticsControl	USINT	Cet attribut spécifie le moment où la collecte de statistiques doit être lancée et relancée. La relance de la collecte de statistiques a pour effet de mettre à jour le StatisticsCollectionStartTime et d'effacer et redémarrer tous les compteurs de statistiques. FF-803 FS 1.19 NM Section 5.8.2
subAddress	UDINT	Il s'agit de l'adresse d'abonnement 32 bits. Si la valeur est 0, cette entrée n'est pas configurée. FF-803 FS 1.19 NM Section 5.9.4
targetTimeSyncClass	UDINT	Cette variable représente la classe de synchronisation du temps configurée pour le client de temps SNTP dans la HSE Presence. L'énumération est la même que la "Capable Time Sync Class" (classe de synchronisation de temps capable). FF-803 FS 1.19 SM Section 6.2.2.1
tcpProtocolSupported	BOOL	Cet attribut définit si, oui ou non, le dispositif HSE prend en charge le protocole TCP. Il est mis à TRUE lorsque le dispositif HSE prend en charge le protocole TCP. Autrement, il est mis à FALSE. FF-803 FS 1.19 NM Section 5.2.1
timeRequestInterval	UDINT	Cette variable contient le temps en tops d'horloge pendant lequel le client de temps SNTP dans la HSE Presence attend entre des envois de messages vers le serveur de temps. Une valeur de zéro signifie que le dispositif calculera ce nombre. Les valeurs inférieures à 10 s ne sont pas autorisées si le dispositif ne peut pas calculer l'intervalle. FF-803 FS 1.19 SM Section 6.2.2.1

Type de données	Définition	Description
timeRequestTimeout	UDINT	Cette variable contient le temps en tops d'horloge pendant lequel le client de temps SNTP dans la HSE Presence attend que le serveur de temps réponde à une demande de temps. FF-803 FS 1.19 SM Section 6.2.2.1
transmitDelayTime	UDINT	Cet attribut est défini dans la Spécification d'agent d'accès aux dispositifs de terrain (Field Device Access (FDA)) [FF-588] comme étant le temps de retard d'émission (Transmit Delay Time). DEFAULT_TRANSMIT_DELAY = 0 FF-803 FS 1.19 NM Section 5.1.2
transportProtocol	USINT	Cet attribut est défini dans la Spécification d'agent d'accès aux dispositifs de terrain (Field Device Access (FDA)) [FF-588] comme étant le protocole de transport (Transport Protocol) et identifie le protocole de transport utilisé pour la session.FF-803 FS 1.19 NM Section 5.1.2
vcrStatisticsControlDefaultValue	USINT	Cet élément contient la valeur par défaut utilisée pour l'attribut StatisticsControl de l'entrée VcrStatistics. Sa valeur initiale est “OnOpening”. FF-803 FS 1.19 NM Section 5.2.1
vcrUserId	UDINT	Cet attribut contient la valeur de l'attribut "VCR User Id" de l'entrée VCR identifiée par l'attribut HseVcrEntryOdIndex de cette entrée.FF-803 FS 1.19 NM Section 5.8.2
vfdServerSelector	UDINT	Cet attribut est le sélecteur pour VCR serveur générique pour ce VFD. L'attribut VFD Server Selector des VFD NAMA de HSE et de H1 est mis à 0 pour indiquer que l'option "FMS VCR Selector Connect" ne peut pas être utilisée avec ces VFD. Voir la Spécification FDA [FF-588]. Il est attribué par le dispositif. FF-803 FS 1.19 SM Section 6.2.4.1

Les définitions des types structurés de données de gestion de réseau de bus de terrain HSE (HSE Fieldbus Network Management) sont énumérées dans le Tableau 18.

Tableau 18 – Types structurés de données de gestion de réseau HSE

Type de données	Définition			Description
	Types de données élémentaires	Usage	Multiplicité	
ActiveScheduleIndex	STRUCT			Cet attribut est l'indice du domaine du programme actuellement actif. FF-803 FS 1.19 SM Section 6.2.5.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fdt:index	M	[1..1]	
ActiveScheduleVersion	STRUCT			Cet attribut spécifie la version du programme exécuté actuellement. FF-803 FS 1.19 SM Section 6.2.5.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fftypes:versionNumber	M	[1..1]	
ActualNumberOfVFDs	STRUCT			FF-803 FS 1.19 NM Section 5.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	actualNumberOfVFDs	M	[1..1]	
AutomaticSessionList	STRUCT			Définition d'élément de la liste de

Type de données	Définition			Description
	Types de données élémentaires	Usage	Multiplicité	
				sessions automatiques. FF-803 FS 1.19 NM Section 5.4.1
	ListHeader	M	[1..1]	
	ListOfSessionEndpoints	M	[1..1]	
AutomaticSessionList	STRUCT			Définition d'élément de la liste de sessions automatiques. FF-803 FS 1.19 NM Section 5.4.1
	ListHeader	M	[1..1]	
	ListOfSessionEndpoints	M	[1..1]	
BridgeCharacteristics	STRUCT			Définition d'élément de caractéristiques de pont (Bridge Characteristics). FF-803 FS 1.19 NM Section 5.9.2
	Version	M	[1..1]	
	NumberOfInterfaces	M	[1..1]	
	RootInterface	M	[1..1]	
	InterfaceStatisticsSupported	M	[1..1]	
	MaxForwardingDelayUrgent	M	[1..1]	
	MinForwardingDelayUrgent	M	[1..1]	
	MaxForwardingDelayNormal	M	[1..1]	
	MinForwardingDelayNormal	M	[1..1]	
	MaxForwardingDelayTimeAvailable	M	[1..1]	
	MinForwardingDelayTimeAvailable	M	[1..1]	
	MinRepublishingDelay	M	[1..1]	
	RepublishingDatabaseListHeaderOdIndex	M	[1..1]	
BufferSize	STRUCT			Cet attribut est défini dans la Spécification d'agent d'accès aux dispositifs de terrain (Field Device Access (FDA)) [FF-588] comme étant la taille du tampon (Buffer Size). DEFAULT_BUFFER_SIZE = 1460 FF-803 FS 1.19 NM Section 5.1.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	bufferSize	M	[1..1]	
CapableTimeSyncClass	STRUCT			Cette variable spécifie la classe de synchronisation du temps que le client de temps SNTP dans la HSE Presence est capable de prendre en charge. L'énumération des classes de synchronisation de temps est telle que montrée ci-dessous, définie dans

Type de données	Définition			Description
	Types de données élémentaires	Usage	Multiplicité	
				l'IEC 61158-4-1, 7.6, sous-champ TTT. FF-803 FS 1.19 SM Section 6.2.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	capableTimeSyncClass	M	[1..1]	
ConfiguredSessionList	STRUCT			ConfiguredSessionList est la liste des définitions des sessions configurées (Configured Session). Chaque entrée de la liste peut contenir une Configured Session définie ou être vide. FF-803 FS 1.19 NM Section 5.3.1
	ListHeader	M	[1..1]	
	ListOfSessionEndpoints	M	[1..1]	
CurrentNmaConfigurationAccess	STRUCT			Lorsqu'il n'est pas zéro, cet attribut est un objet enregistrement contenant l'identification de l'application de configuration HSE ou H1 qui a actuellement un accès en configuration à tout ou partie des VFD NMA de dispositif de liaison. FF-803 FS 1.19 NM Section 5.9.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	NmaConfigurationAccess	M	[1..1]	
DaylightTimeDifference	STRUCT			Cette variable contient le nombre de tops signés à ajouter à l'heure courante (Current Time) pour obtenir l'heure du marqueur d'heure diurne (Daylight time) . Elle est utilisée à la place de la différence temporelle normalisée (Standard Time Difference) lorsque l'heure courante (Current Time) se situe dans l'intervalle défini par l'heure diurne de départ (Start Daylight Time) et l'heure diurne de fin (End Daylight Time). FF-803 FS 1.19 SM Section 6.2.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	DaylightTimeDifference	M	[1..1]	
DDDomainIndex	STRUCT			Cet attribut est l'identificateur numérique pour le domaine qui contient tout dispositif résident DD. Il est attribué par le dispositif. FF-803 FS 1.19 SM Section 6.2.4.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fdt:index	M	[1..1]	
DeviceContentsDomain	STRUCT			Cela permet la prise en charge du téléchargement, aval et amont, de logiciel par le dispositif. Les fabricants de dispositif définissent le contenu du domaine. FF-803 FS 1.19 SM Section

Type de données	Définition			Description
	Types de données élémentaires	Usage	Multiplicité	
				6.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fftypes:domain	M	[1..1]	
DeviceIdentification	STRUCT			L'enregistrement Device Identification contient les données pour l'identification univoque du dispositif physique et de l'application qui lui est actuellement assignée. FF-803 FS 1.19 SM Section 6.2.3
	fftypes:DeviceId	M	[1..1]	
	fftypes:PdTag	M	[1..1]	
	DeviceIndex	M	[1..1]	
	DeviceType	M	[1..1]	
DeviceIndex	STRUCT			Cet attribut est un numéro administré de site qui identifie le dispositif. Cet indice est unique au sein d'un sous-réseau HSE. FF-803 FS 1.19 SM Section 6.2.5
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fftypes:deviceIndex	M	[1..1]	
DeviceType	STRUCT			FF-803 FS 1.19 NM Section 5.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fftypes:deviceType	M	[1..1]	
DiscardedForForwardingDelayExceeded	STRUCT			FF-803 FS 1.19 NM Section 5.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	discardedForForwardingDelayExceeded	M	[1..1]	
DiscardedForLackOfBuffers	STRUCT			Cet élément compte le nombre de trames valides qu'il convient d'avoir présentées pour émission sur une ou plusieurs interfaces de sortie, mais qui ont été rejetées en raison de l'insuffisance de tampons de transmission disponibles. FF-803 FS 1.19 NM Section 5.9.6
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	DiscardedForLackOfBuffers	M	[1..1]	
DlmeBridge	STRUCT			Cet élément définit la gestion du Data Link Bridge. FF-803 FS 1.19 NM Section 5.9.1

Type de données	Définition			Description
	Types de données élémentaires	Usage	Multiplicité	
	BridgeCharacteristics	M	[1..1]	
	CurrentNmaConfigurationAccess	M	[1..1]	
	PreviousNmaConfigurationAccess	M	[1..1]	
	InterfaceAddressArray	M	[1..1]	
	InterfaceDesiredStateArray	M	[1..1]	
	InterfaceActualStateArray	M	[1..1]	
	InterfaceStatisticsList	O	[0..1]	
	RepublishingDatabase	O	[0..1]	
	FilteringDatabase	O	[0..1]	
DomainIndex	STRUCT			Cet attribut est l'indice dans l'OD du domaine pour ce descripteur de programme. Il est établi par le fabricant. FF-803 FS 1.19 SM Section 6.2.5.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fdt:index	M	[1..1]	
DstLinkAddress	STRUCT			Cet attribut contient l'adresse de destination 16 bits (HL) du message qu'il convient de transmettre par le pont H1. Si la valeur est 0, cette entrée n'est pas configurée. FF-803 FS 1.19 NM Section 5.9.5
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	dstLinkAddress	M	[1..1]	
EndDaylightTime	STRUCT			Cette variable contient la valeur de l'heure courante (Current Time) qui définit la fin de l'intervalle d'heure diurne (Daylight Time interval). L'heure diurne ne démarre jamais si la valeur est inférieure à Start Daylight Time (heure diurne de départ). FF-803 FS 1.19 SM Section 6.2.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fftypes:timeValue	M	[1..1]	
EndpointType	STRUCT			Cet attribut est défini dans la Spécification d'agent d'accès aux dispositifs de terrain (Field Device Access (FDA)) [FF-588] comme étant le type Endpoint et indique le type de point d'extrémité. FF-803 FS 1.19 NM Section 5.1.2
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	

Type de données	Définition			Description
	Types de données élémentaires	Usage	Multiplicité	
	endpointType	M	[1..1]	
FasDllMaxConfirmDelayOnConnect	STRUCT			Cet élément est défini dans la Spécification de gestion de réseau [FF-801] comme étant FasDllMaxConfirmDelayOnConnect. FF-803 FS 1.19 NM Section 5.9.4
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fasDllMaxConfirmDelayOnConnect	M	[1..1]	
FasDllMaxDlsduSize	STRUCT			Cet élément est défini dans la Spécification de gestion de réseau [FF-801] comme étant FasDllMaxDlsduSize. FF-803 FS 1.19 NM Section 5.9.4
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fasDllMaxDlsduSize	M	[1..1]	
FasDllSDAP	STRUCT			Cet élément est défini dans la Spécification de gestion de réseau [FF-801] comme étant FasDllSDAP. . FF-803 FS 1.19 NM Section 5.9.4
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fasDllSDAP	M	[1..1]	
FbSchedule	STRUCT			FF-803 FS 1.19 NM Section 5.2.1
	ScheduleActivation	M	[1..1]	
	ScheduleListCharacteristics	M	[1..1]	
	ListOfFBScheduleDescriptors	M	[1..1]	
FBScheduleDescriptor	STRUCT			Les objets FB Schedule appartiennent aux FB programmés dans ce dispositif. FF-589 FS 1.19 SM Section 6.2.5. Cet attribut est l'indice dans l'OD de l'enregistrement de descripteur de programme de blocs fonctionnels (FB Schedule Descriptor Record). La valeur de cet attribut est FB Schedule OD Index + 2 + offset, où "offset" (décalage) représente la position base zéro dans la liste. Autrement dit, le décalage du premier enregistrement dans la liste est zéro. Le décalage n'est pas supérieur au nombre de programmes spécifiés dans l'enregistrement FB Schedule List Characteristics moins 1. FF-803 FS 1.19 SM Section 6.2.5.2
	ScheduleVersion	M	[1..1]	

Type de données	Définition			Description
	Types de données élémentaires	Usage	Multiplicité	
	fftypes:MacrocycleDuration	M	[1..1]	
	DomainIndex	M	[1..1]	
FdaAddress	STRUCT			Cet attribut est défini dans la Spécification d'agent d'accès aux dispositifs de terrain (Field Device Access (FDA)) [FF-588] comme étant l'adresse FDA (FDA Address). FF-803 FS 1.19 NM Section 5.1.3
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fdaAddress	M	[1..1]	
FdaGuardBand	STRUCT			Cet attribut est défini dans la Spécification d'agent d'accès aux dispositifs de terrain (Field Device Access (FDA)) [FF-588] comme étant la bande de garde (Guard Band). FF-803 FS 1.19 NM Section 5.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fdaGuardBand	M	[1..1]	
FilteringDatabase	STRUCT			La NMIB FilteringDatabase est utilisée pour les ponts en cascade (pour des liaisons qui ne sont pas immédiatement attachées à ce pont H1). Le NMA charge des informations issues de InterfaceAddressArray et NMIB FilteringDatabase dans la base de données de filtrage DLL Bridge. FF-803 FS 1.19 NM Section 5.2.1
	ListHeader	M	[1..1]	
	ListOfFilteringDatabaseRecords	M	[1..1]	
FilteringDatabaseListHeaderOdIndex	STRUCT			Il s'agit d'une instance de la classe ListHeader représentant l'en-tête de la base de données de filtrage (Filtering Database). FF-803 FS 1.19 NM Section 5.9.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fdt:index	M	[1..1]	
FilteringEntry	STRUCT			Cette classe est utilisée pour définir l'acheminement des données entre des interfaces H1. Chaque FilteringEntry peut contenir les informations pour transmission ou peut être vide (non configurée). FF-803 FS 1.19 NM Section 5.2.1
	DstLinkAddress	M	[1..1]	
	InterfaceNumber	M	[1..1]	
FirstConfiguredIndex	STRUCT			Cet élément est l'indice dans l'OD de la première entrée dans la liste qui est configurée actuellement. S'il n'y a pas d'entrée configurée, la valeur de cet élément est zéro. Noter que les

Type de données	Définition			Description
	Types de données élémentaires	Usage	Multiplicité	
				entrées configurées ne sont pas nécessairement consécutives (à savoir: il convient de ne pas présupposer des indices OD successifs pour les entrées configurées). FF-803 FS 1.19 NM Section 5.1.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fdt:index	M	[1..1]	
FirstUnconfiguredIndex	STRUCT			Cet élément est l'indice dans l'OD de la première entrée dans la liste qui n'est pas configurée actuellement. S'il n'y a pas d'entrée non configurée (toutes les entrées sont configurées), la valeur de cet élément est zéro. Noter que les entrées non configurées ne sont pas nécessairement consécutives (à savoir: il convient de ne pas présupposer des indices OD successifs pour les entrées non configurées). FF-803 FS 1.19 NM Section 5.1.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fdt:index	M	[1..1]	
FmsFeaturesSupported	STRUCT			Cet attribut indique les services qui sont pris en charge par la FDA FMS pour le dispositif HSE. FF-803 FS 1.19 NM Section 5.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fftypes:fmsFeatures-Supported	M	[1..1]	
ForwardedInbound	STRUCT			Cet élément compte le nombre de trames valides reçues par l'interface qui avaient été présentées pour transmission sur une ou plusieurs interfaces de sortie. FF-803 FS 1.19 NM Section 5.9.6
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	forwardedInbound	M	[1..1]	
H1ConfiguratorAddress	STRUCT			Cet élément contient l'adresse H1 du dispositif de configuration H1. FF-803 FS 1.19 NM Section 5.9.3
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	h1ConfiguratorAddress	M	[1..1]	
H1DlOperatFunctionalClassSupported	STRUCT			Cet attribut correspond à la classe prise en charge par toutes les interfaces H1 d'un dispositif de liaison. Il a la même définition que l'attribut DlOperatFunctionalClass

Type de données	Définition			Description
	Types de données élémentaires	Usage	Multiplicité	
				spécifié dans la Spécification de gestion de réseau [FF-801]. Sa valeur est zéro lorsque le dispositif HSE n'est pas un dispositif de liaison. FF-803 FS 1.19 NM Section 5.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	h1DlOperatFunctionalClassSupported	M	[1..1]	
H1Timeout	STRUCT			Cet attribut définit la durée, en millisecondes, pendant laquelle le Linking Device (dispositif de liaison) attend avant de publier des id d'invocation qui ont été alloués pour les demandes FMS et/ou SM envoyées sur n'importe quelle interface H1. FF-803 FS 1.19 NM Section 5.2.1
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	h1Timeout	M	[1..1]	
HseAutomaticVcrList	STRUCT			HseAutomaticVcrList est la liste des définitions de HSE Automatic VCR. Chaque entrée de la liste peut contenir une HSE Automatic VCR définie ou être vide. FF-803 FS 1.19 NM Section 5.2.1
	ListHeader	M	[1..1]	
	ListOfHseVcrEndpoints	M	[1..1]	
HseConfiguratorIpAddress	STRUCT			Cet attribut est l'adresse IP utilisée par le dispositif de configuration HSE. Mettre cet attribut à 0 si le dispositif de configuration n'est pas un dispositif HSE. FF-803 FS 1.19 NM Section 5.9.3
	fdt:readAccess	O	[0..1]	
	fdt:writeAccess	O	[0..1]	
	fftypes:ip	M	[1..1]	
HseConfiguredVcrList	STRUCT			HseConfiguredVcrList est la liste des définitions de HSE Configured VCR. Chaque entrée de la liste peut contenir une HSE Configured VCR définie ou être vide. Il convient qu'il n'y ait pas de HSE Configured VCR préconfigurée dans la liste si le dispositif HSE est non configuré, c'est-à-dire sans configuration du tout. FF-803 FS 1.19 NM Section 5.6.1
	ListHeader	M	[1..1]	
	ListOfHseVcrEndpoints	M	[1..1]	
HSEDeviceVersion	STRUCT			Version de dispositif HSE. FF-803 FS 1.19 SM Section 6.2.1
	fdt:readAccess	O	[0..1]	