IEC TR 62453-62

Edition 1.0   2017-01

TECHNICAL
REPORT

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Field device tool (FDT) interface specification –
Part 62: Field device tool (FDT) styleguide for common language infrastructure

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FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

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FOREWORD

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IEC TR 62453-62, which is a Technical Report, has been prepared by subcommittee 65E: Devices and integration in enterprise systems, of IEC technical committee 65: Industrial-process measurement, control and automation.

The text of this Technical Report is based on the following documents:

Enquiry draft	Report on voting
65E/442/DTR	65E/515/RVC

Full information on the voting for the approval of this Technical Report can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The list of all parts of the IEC 62453 series, under the general title *Field device tool (FDT) interface specification*, can be found on the IEC website.

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

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- withdrawn,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

A bilingual version of this publication may be issued at a later date.

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

INTRODUCTION

This document is a user interface design specification for developers of FDT (field device tool) components for Function Control and Data Access within a Client/Server architecture. This document is a result of an analysis and design process to develop standard interfaces to facilitate the development of components by multiple vendors that interoperate seamlessly.

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.

To ensure the consistent management of a plant-wide control and automation technology, fieldbusses, devices and sub-systems are fully integrated as a seamless part of a wide range of automation tasks covering the whole automation life-cycle. This integration also requires a consistent look and feel of device specific components.

Figure 1 shows how IEC TR 62453-62 is aligned in the structure of IEC 62453 (all parts).
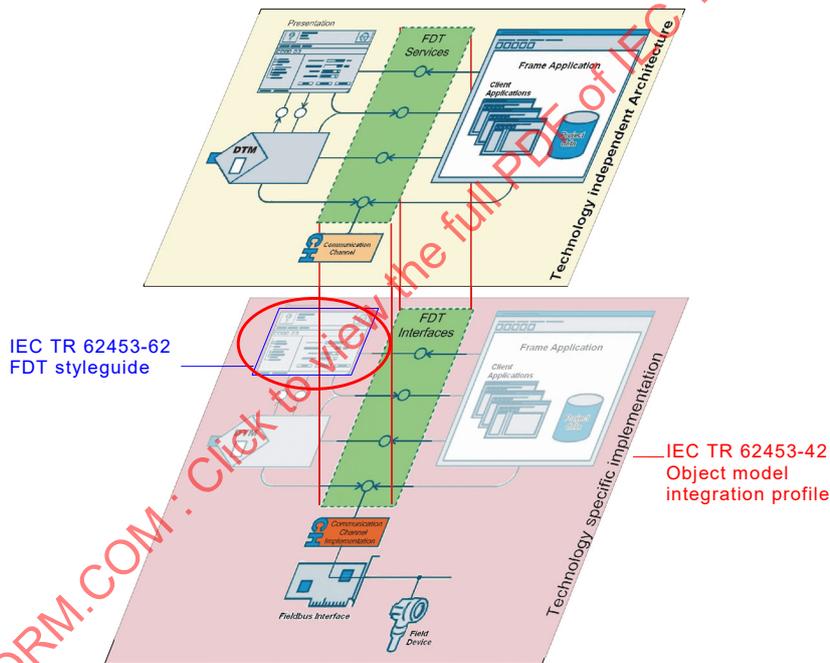
Figure 1 – IEC 62453-62 in IEC 62453 (all parts)

FIELD DEVICE TOOL (FDT) INTERFACE SPECIFICATION –

**Part 62: Field device tool (FDT) styleguide
for common language infrastructure**

1 Scope

IEC TR 62453-62, which is a Technical Report, explains the guidelines and rules for the CLI-based implementation of a Device Type Manager (DTM) and parts of a Frame Application with regard to the user interface and its behaviour. These guidelines and rules are part of the FDT specification (IEC TR 62453-42) and are intended to ensure that all users are provided with clear and consistent user interface functions and features across DTMs in a system.

This specification neither contains the FDT specification nor modifies it.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

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

IEC TR 62453-42, *Field device tool (FDT) interface specification – Part 42: Object model integration profile – Common Language Infrastructure*

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, IEC 62453-2, [7] and the following apply.

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

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

**3.1.1
Application**
DTM UI Applications and DTM UI Functions

3.2 Symbols and abbreviated terms

For the purposes of this specification the symbols and abbreviated terms given in IEC 62453-1, IEC 62453-2, IEC 62453-42 and the following apply.

UI   user interface

NAMUR   User Association of Automation Technology in Process Industries

WPF   Windows Presentation Foundation (Microsoft user interface library)

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 [7].

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"	A DTM may provide the function or behaviour depending on the task and type of the DTM. If a function or behaviour is provided, it shall follow the style guide.

3.3.3 Specific formatting

The following formatting is used to describe specific context.

CAPITAL LETTERS	Names of keys on the keyboard – for example, SHIFT, CTRL, or ALT
[Button text]	Button with the specified text
ClassName::PropertyName or InterfaceName::MethodName	Name of property or method according to definition in FDT 2.0 Technical Specification

4   Fundamentals of designing DTM user interfaces

The design of UIs for DTMs is based on the ten general principles for user interface design accepted in general public [3], [4]. They are called "heuristics" because they are more in the nature of rules of thumb than specific usability guidelines. The heuristics should give the DTM developer some general hints on how to implement a DTM. For additional fundamentals of user interface design, please see the available literature (e.g. [5], [6]). The ten general principles are the following.

Visibility of system status
The system should always keep users informed about what is going on, through appropriate feedback within an acceptable time limit (dependant on the task, e.g. 1 sec.).

Match between system and the real world
The system should speak the users' language with words, phrases and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.

User control and freedom
Users often choose system functions by mistake and need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Support undo and redo.

Consistency and standards
Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.

Error prevention
A careful design, which prevents a problem from occurring in the first place, is even better than good error messages.

Recognition rather than recall
Make objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.

Flexibility and efficiency of use
Accelerators – unseen by the novice user – may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users tailoring of frequent actions.

Aesthetic and minimalist design
Dialogue should not contain information, which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.

Help users recognize, diagnose, and recover from errors
Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.

Help and documentation
Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focus on the user's task, list concrete steps to be carried out, be context sensitive and not be too large.

5 Benefits from the FDT user's point of view

Using DTMs compliant with this style guide enables a user to operate more efficiently and more safely. The user is able to parameterize and manage the data of devices from various manufacturers in a uniform way. Therefore, the user is presented with a clearly structured concept regardless of the manufacturer or the type of the device. Details or requirements for developers of a DTM are given within the following clauses.

Guideline and rules are defined for:

- Uniform user guidance: DTM user interfaces are used and displayed in engineering systems and stand alone tools in the same manner regardless of the device or DTM manufacturer or communication protocol employed.

- Uniform behaviour of a DTM.

- Clear identification of the DTM and the assigned device.

- Ensuring users will be updated on the status and the parameterization of the configuration constantly. All changes of the configuration are marked.

- Informing users, whether UI input affects the device directly or the offline configuration.

- Executing plausibility checks of the configuration on a lexically (e.g. only certain characters are accepted), syntactically (e.g. a limited number of characters) and semantically (e.g. given value is below upper limit) correct basis.

6   DTM user interface

6.1   Objective

The user interface of a DTM application shall be designed to provide a user with a software component that is easy to use and self-explanatory. The user interface assists the user to be able to concentrate on his/her main tasks. Novel user interface elements or features should not detract the user.

6.2   Appearance

6.2.1   General

In general, a DTM user interface is divided into the following areas:

- Identification Area: contains information about the device that is handled by the DTM;

- Application Area: contains all necessary UI elements for the selected function.

These areas shall be arranged as described in the following subclauses.

In addition, the two following DTM related areas are displayed and controlled by the Frame Application:

- Action Area that contains buttons to initiate the user's choice;

- Status Area that contains status information of the DTM.

Icons of the FDT icon library should be used for all FDT tools and states that are described in this document.

6.2.2   DTM user interface categories

6.2.2.1   General

Three categories of DTM user interfaces are specified.

- Standard layout, where one presentation object displays one application with no or only with limited navigation capability.

- Advanced layout, where one presentation object displays one application with advanced navigation capability.

- Wizard layout, where one presentation object displays a guided input user interface.

6.2.2.2   Standard user interface

Figure 2 describes the required areas for the Standard user interface of a DTM.
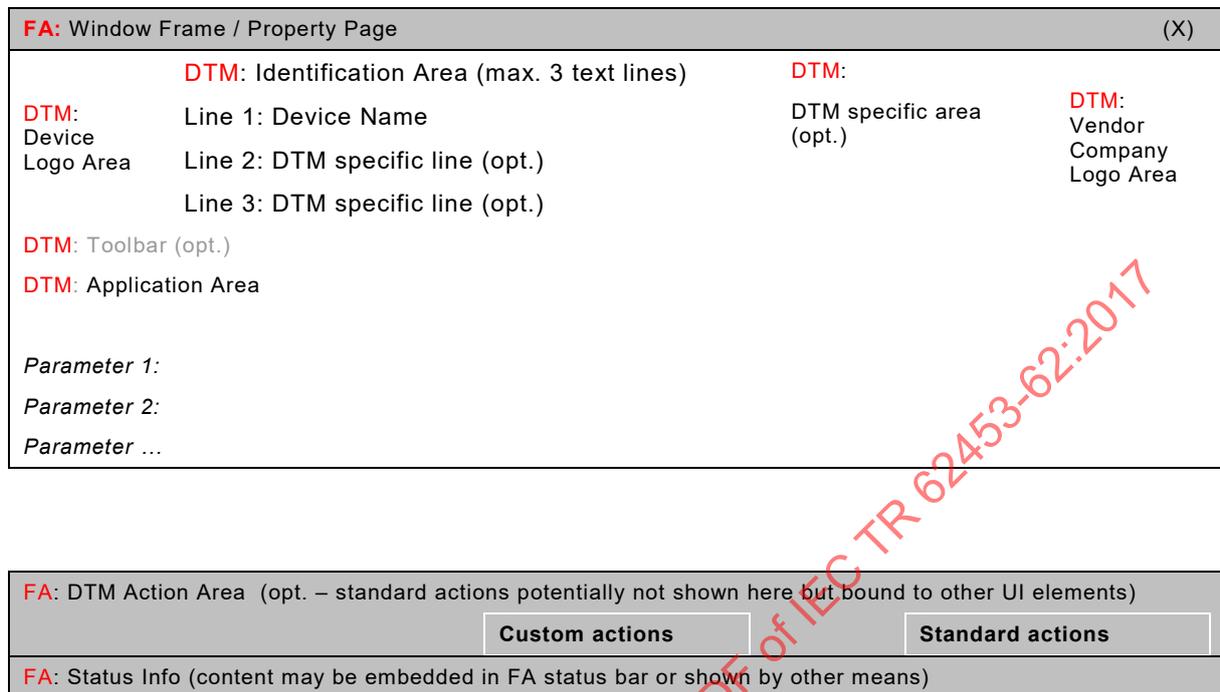
Figure 2 – Areas of a Standard user interface

Additional to the mandatory elements (Identification Area, Application Area), the UI may contain a toolbar.

All areas marked with a red DTM label are controlled and displayed by the DTM itself. The areas marked with the red label FA are related to a certain DTM but controlled and displayed by the Frame Application according to its rules. The DTM provides interfaces and actual values that are used by the Frame Application in order to present the correct buttons and status information.

A description of Custom actions and Standard actions can be found in 6.2.3.6.

6.2.2.3   Advanced user interface

Depending on the complexity of a device and the required functionality, the DTM user interface may additionally provide navigation.

The Navigation Area as showed in Figure 3 provides an access to applications and/or the parameter subsets that are related to the current application. The Navigation Area is described in detail in chapter 6.2.3.4.

FA: Window Frame / Property Page			(X)
DTM: Device Logo Area	DTM: Identification Area (max. 3 text lines) Line 1: Device Name Line 2: DTM specific line (opt.) Line 3: DTM specific line (opt.)	DTM: DTM specific area (opt.)	DTM: Vendor Company Logo Area
DTM: Toolbar Area (opt.)			
DTM: Navigation Area Settings Group A Page A.1 Page A.2 Page A.3 Settings Group B Page B.1 Page B.2 Page B.3 …	DTM: Application Area Parameter 1: Parameter 2: Parameter …		
FA: DTM Action Area (opt. – standard actions potentially not shown here but bound to other UI elements)			
	Custom actions		Standard actions
FA: Status Info (content may be embedded in FA status bar or shown by other means)			

Figure 3 – Areas of an Advanced user interface

Additional to the mandatory elements (Identification Area, Navigation Area, Application Area) the UI may contain a toolbar.

All areas are controlled and displayed by the DTM and Frame Application as described for the standard user interface.

6.2.2.4   Wizard user interface

Wizard user interfaces are used to guide the user step by step through a sequence of actions. A Wizard UI shall be implemented as DTM modal dialog.

The Wizard user interface shall have the structure showed in Figure 4.

FA: Window Frame / Property Page			(X)
DTM: Device Logo Area	DTM: Identification Area (max. 3 text lines) Line 1: Device Name Line 2: DTM specific line (opt.) Line 3: DTM specific line (opt.)	DTM: DTM specific area (opt.)	DTM: Vendor Company Logo Area
DTM: Wizard Application Area *Step 1* *Step 2* *Step 3* *…*			
DTM: Wizard Action Area		**Wizard actions**	

Figure 4 – Areas of a Wizard user interface

The Wizard Application Area can be completely designed to the needs of the DTM vendor. It is recommended to provide a sequence flow either on the top or on the left side of the Wizard Application Area (for example "Step i of n – File Selection").

The Wizard Application Area is the container for wizard pages. The Wizard Action Area contains all buttons that are needed for controlling the sequence of steps. Refer to 6.2.3.6 for further details.

6.2.3 DTM user interface areas

6.2.3.1 General

In general, the user shall be informed if modifications of parameters are applied into the data set of the DTM or into the device. Also, the behaviour of the UI may vary depending on whether the UI supports Block Mode (see 7.2.2) or Direct Mode (see 7.2.3).

6.2.3.2 Identification Area

The structure of the Identification Area shall be as shown in Figure 5.

Device picture	Device name	DTM specific area (optional)	Company logo
	DTM specific line (opt.)		
	DTM specific line (optional)		

Figure 5 – Structure of the Identification Area

This area contains information about the device that is handled by the DTM (see Table 1).

Table 1 – Contents of Identification Area

Contents (read only)	Availability
First column: Device picture	Mandatory
Second column	
1st line: Property ProductName of DeviceTypeInfo	Mandatory
2nd line: DTM specific line (can be fetched from the device, too)	Optional
3rd line: DTM specific line (can be fetched from the device, too)	Optional
Third column: Display of DTM specific Information	Optional
Forth column: Company logo (right side, optional home page link: use company logo to directly open a web page in an internet browser)	Mandatory

The DTM can provide the possibility to hide or show the Identification Area (refer to Table 2).

Additionally the Frame Application can control the visibility of the identification area. The control by Frame Application has a higher priority than the DTM based control (refer to [7] chapter 6.4 DTM user interface, IDTMUIfunction).

Editable parameters within the Identification Area are allowed only if they can also be edited in the Application Area.

6.2.3.3   Toolbar (optional)

The toolbar should contain only items that are directly related to the current Application.

Table 2 shows a list of possible toolbar items of a DTM. It is not mandatory to provide all items by a DTM – each item is optional. A tool can have a list of items provided by a drop down list.

If a DTM provides a specific function that could not be mapped to an element of the table, a customized item can be used for this function. This item should be integrated logically from the user's point of view.

Table 2 – Toolbar

Toolbar Icon	Comments
	Enable/Disable Identification Area. Enabled only if Frame Application allows the display of this area.
	Enable/Disable Navigation Area
a	Edit function undo within a user interface
a	Edit function redo within a user interface
a	Edit function cut within a user interface
a	Edit function copy within a user interface
a	Edit function insert within a user interface
a	Edit function search within a user interface
	Load the application related part of the parameter set from the device
	Store the application related part of the parameter set to the device
	Trend display of specific parameters
	Starts a dialog for resetting the device
	Load the application related part of the parameter set from the data set
	Store the application related part of the parameter set to the data set
a	DTM specific print preview[b]
a	DTM specific print function[b]
a	Properties, e.g. the visual representation of a user interface
	Help for handling of the device
a	Help for handling of the DTM
a	Standard Microsoft Windows®[1] icons should be used.
b	This has no effect on the documentation function offered by the Frame Application (see IEC 62453–2).

The tools in the toolbar should be placed in a certain order if available: the tool "Enable/Disable areas" in the table should be left aligned, tools of the group "Help" should be right aligned. The "Load from device" tool shall be left from the "Store to device" tool. Tools can be grouped by separators.

6.2.3.4   Navigation Area

The Navigation Area is used in Advanced user interface.

The Navigation Area contains a navigation control, for example a navigation tree. Each element of the navigation control represents either a subset of an application parameter set (including single parameters) or an application.

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[1] Microsoft Windows® is the trade name of a product supplied by Microsoft Corporation (Redmond, USA). This information is given for the convenience of users of this document and does not constitute an endorsement by the IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

Elements representing parameter subsets should be grouped to appropriate parameter groups. When selecting such an element, the corresponding parameter group shall be displayed in the Application Area.

The Navigation Area can contain scroll bars in order to get access to all items. The DTM can provide the possibility to resize, hide or show the Navigation Area.

6.2.3.5   Application Area

The content of this area depends on the selected application. When the application allows handling of parameters, refer to Clause 7 for additional details.

The Application Area can contain scroll bars and could be resizable.

6.2.3.6   Action Area

6.2.3.6.1   General

Rendering of the Action Area is in the responsibility of the Frame Application. The presentation depends on the implementation of the Frame Application.

The Action Area can be divided into two parts:

- Standard actions
- DTM application specific buttons.

6.2.3.6.2   Frame Application Standard actions

The content of this part of the action area is controlled by information provided by the methods of the DTM UI described in Table 3 and Table 4. The Frame Application is informed about the DTM UI mode.

DTM UI using Block Mode (IDtmUIFunctionNonModal property UiOperationMode=BlockMode) will support the actions as shown in Table 3.

Table 3 – Methods for UI using Block Mode

Action	Data source[a]	Condition	Description
<Apply>		DTM enables and supports <Apply action>	Values changed in user interface shall be applied on the instance data set, only, UI remains open; action can be refused.
		DTM enables and supports <Apply action>	All changed device values shall be transmitted to the device, only, UI remains open; action shall be refused if data is invalid. If the user interface contains data set values according to 8.2.1, these values shall be transmitted to the instance data set only.
		DTM enables and supports <Apply action>	Values changed in user interface shall be applied on the instance data set and device, UI remains open; action shall be refused if data is invalid.
<Close>	All	Parameters are changed	User will be asked by Frame Application whether the parameter changes should be applied or discarded; UI will be closed.
		Parameters are not changed	UI will be closed.
<Help>	All	No condition	Opens help for handling of the DTM.
[a] The icons are explained in Table 8.			

If the Frame Application displays an [OK] button, Actions <Apply> and <Close> are executed. If a [Cancel] button is provided, <Close> Action is executed only.

DTM UI using Direct Mode or without changeable values (IDtmUIFunctionNonModal property UiOperationMode = DirectMode) will support the actions as shown in Table 4.

Table 4 – Methods for UI using Direct Mode

Action	Data source	Condition	Description
<Close>	All	No condition	UI will be closed
<Help>	All	No condition	Opens help for handling of the DTM

6.2.3.6.3 Custom actions

Custom actions can be represented by application specific buttons. Application specific buttons provide appropriate tools that support the user in executing the current application of a specific DTM. Application specific buttons shall be placed below the DTM UI. The content of the application specific button area depends on the information of the interface IApplicationSpecificActions of the DTM UI. This interface allows enabling, disabling, visibility and localization of the button labels.

The button texts shall be adapted to the configured language. The definition of shortcuts for custom actions is not allowed.

6.2.3.6.4 Wizard actions

Standard actions for a wizard UI are described in Table 5.

Table 5 – Wizard actions

Application	Supported methods	Description
Wizard user interface	buttons of the following set: [Back], [Next], [Finish], [Cancel], [Restart], [Help]	A subset of the buttons should be used in a commonly order according to the specific wizard sequence.

6.2.3.7 Status Area

The Status Area contains global status information about the DTM and the device. This area is displayed and controlled by the Frame Application.

Elements of Status Area are listed Table 6. Some elements are related to the whole DTM, some elements are related to a single user interfaced only.

Table 6 – Contents of Status Bar

Contents in field number (read only)	Related to	Icon/Text
1. DTM connection state	DTM	See Table 7
2. Communication in progress	DTM	⟳ displayed during communication only. recommended: ⟳ and ⟲ alternating
3. Data Source	User interface	See Table 8 – Possible data source and target states (for icon and text)
4. State of instance data set	DTM	See Table 8 (for Icon)
5. Summarized status for all parameters used by the current application, that shall be displayed if any parameter status is set	User interface	**?** , **!** , ✎ icon and tool tip according to the definition in Table 10
6. Optional: Device diagnosis status. According to NAMUR (icons with tool tips)	DTM	See Table 11 – Possible device diagnostic states (see [1])
7. Service mode	DTM	Standard text: **Service mode**. More detailed explanation can be provided by DTM, e.g. for a tool tip that is shown by Frame Application

Possible DTM connection states (regardless of application) in field number 1 of the status bar are defined in Table 7. Columns DTM States and OnlineState of the DTM are described in chapter DTM State Machine of [7].

Table 7 – Possible connection states

Icon and Text (see Annex A section T1.)	Tooltip	DTM States	OnlineState of the DTM
Disconnected	DTM not connected with device	Running, created, initialized, configuring, releasing, released	
Disconnected	DTM not connected with device	CommunicationAllowed	Inactive
Stand by	DTM is ready for connection	CommunicationAllowed	NotConnectedStandyBy
Connecting	DTM is going to connect to device	CommunicationAllowed	Connecting
Checking	DTM is checking the connected device	CommunicationAllowed	ConnectedCheckingDevice
Connected	DTM is connected to device	CommunicationAllowed	ConnectedOnline
Disconnecting	DTM is going to stop connection with device	CommunicationAllowed	Disconnecting
Disturbed	DTM not connected: Wrong device type found or connection aborted	CommunicationAllowed	NotConnectedDisturbed

Possible Data Source and Target states in field number 3 of the status bar are described in Table 8.

Table 8 – Possible data source and target states

Icon and Text (see Annex A section T1)	Behaviour	DataSource
Data set	Displayed values are from initial data set or loaded from the instance data set only. Changed values will be affected on the instance data set only.	InstanceDataSet
Data set locked	Displayed values are loaded from the instance data set only. Data set is locked by another DTM instance in a multi user environment.	InstanceDataSetLocked
Device	This icon is displayed for all applications that contain online information (data or commands).	Device
Device locked	This icon is displayed for all applications that contain online information (data or commands). Device is write protected, because it is e.g. in use by a local user interface or because of security reasons.	DeviceLocked
Device and data set	The application stores all parameter values to both data sources.	Both
Device and data set locked	Data set is locked by another DTM instance in a multi user environment or device is write protected, because it is e.g. in use by a local user interface or because of security reasons.	BothLocked

The Frame Application can get the current data source from the interface IDtmUiFunctionNonModal of the DTM UI.

Possible icons in field number 4 of the status bar in relation to the state of IInstanceData and IDeviceData (refer to [7], chapter 6.3.1) are defined in Table 9.

Table 9 – Possible states of the instance data set

		IInstanceData.ModifiedInDTM		
		State	Default	ModifiedInDTM	DataLoaded
IDeviceData. ModifiedInD		ModifiedOnline	≠	≠	≠
		NoKnownChanges	≠	≠	=

Tooltip P14 shall be used in case of ≠, tooltip P15 in case of =.

The "equal" icon will only be shown after the complete data set of a device is loaded to the DTM or vice versa. Refer to Clause 8.5.

No icon shall be displayed in case no device data set is available (e.g. CommDTM).

Possible icons in field number 5 of the status bar in relation to the property CurrentParameterSummaryState of IDtmUiFunctionNonModal are defined in Table 10.

Table 10 – Possible modification states

Icon	State	Description
?	Uncertain	One or more parameter values are insecure
✎	Modified	One or more parameter values have been modified
!	Invalid	One or more parameter values are indicated invalid
<empty>	NoIndication	All parameter values are default or read from device or database

The Frame Application can read the diagnosis state via the IOnlineOperations interface of the DTM.

Possible device diagnosis states in field number 6 are defined in Table 11.

Table 11 – Possible device diagnostic states (see [1])

Icon	Device diagnosis states	Explanation
✖	Failure	Output signal invalid due to malfunction in the field device or its peripherals. Examples: Sensor break in T transmitters, no echo from a radar L transmitter, defective lamp in a photometer, gas analyzer is not receiving any sample gas flow.
▼	Check function	Output signal temporarily invalid (e.g. frozen) due to on-going work on the device. Examples: Read-out of parameters from a digital field instrument, tank offset L transmitter, calibration of gas analyzer, electrode cleaning of pH measuring instrument.
⚠	Out of specification	Device is operating outside its specified range or internal diagnosis indicates deviations from measured or set values due to internal problems in the device or process characteristics Example: Bubble formation in flow metering
◆	Maintenance required	Although the output signals are valid, the wear reserve is nearly exhausted or a function will soon be restricted due to operational conditions. Examples: Weak echo from the radar L transmitter, low lamp intensity in the photometer, consumable reagent in the analyzer is running low.
✔	Diagnosis active	Device status checked. No error reported.
▭	Diagnosis status not known	Device status not yet read.
Empty	Not supported	Diagnosis status not supported. (IOnlineOperations not implemented)

6.3   General behaviour

6.3.1   General

The user interface of a DTM should be based on the Microsoft Windows Style Guide (see [2]). It is recommended to use Windows common controls. Windows common controls shall act in the way defined by Microsoft.

That means, it is not allowed to change the behaviour of common controls like buttons, combo boxes and edit controls. For example, it is not allowed to change the behaviour of common shortcuts like Ctrl-C and Ctrl-V.

6.3.2   WPF user interfaces

The Frame Application is responsible for the styles and templates.

A DTM should not change the common controls. Especially, it means that it is not allowed to write a ControlTemplate for a common control. This ensures that the look of all DTMs is equal to the Frame Application.

If a DTM creates its own control, it should use the SystemColors, SystemFonts, and SystemParameters. These system resource keys should be added in a dynamical resource binding.

EXAMPLE 1 <Object property="{DynamicResource {x:Static SystemColors.ControlBrushKey}}"/>

If the Frame Application wants to change its general look, it should use the SystemColors, SystemFonts, and SystemParameters.

EXAMPLE 2 <SolidColorBrush x:Key="{x:Static SystemColors.ControlBrushKey}" Color="LightBlue" />

6.3.3   UI navigation

Elements of the DTM user interface shall be selectable by a pointing device (e.g. mouse) and should be possible with keyboard. The keyboard shortcuts for navigation among UI areas and objects should be supported.

TAB-key and SHIFT-TAB combination is used for navigation between Application Area and optional Navigation Area. The navigation between objects in Application Area should be possible also with the same shortcuts.

The focus should change from Navigation Area to Application Area and vice versa, if TAB-key is pressed on the last element of current area.

The TAB-order of elements within the Application Area is in logical order normally from upper left to lower right corner.

Navigation within a tree view should be possible with arrow keys.

6.3.4   UI resize

A DTM user interface shall be implemented in a resizable way. In this case, the DTM is responsible for supporting re-arrangement of the inner controls and inserting scroll bars in Navigation Area and Application Area if necessary.

6.3.5   Display of information

The display of any information in a graphical user interface is accomplished in textual, symbolic or graphic manner.

Only one font family (system font is recommended) should be used to optimize the readability of texts. Only a minimum variation of the font size and font style should be used.

Icons defined in this document shall be used only in the defined meaning (see 6.2.3.7 and 7.3.2). Icons used in addition to the defined icons should be plain and unambiguous and oriented towards existing specifications (e.g. operation system common icons). Tool tips are mandatory for all used icons.

Color should only be used as secondary information. The color set should be kept small. Flashing information should not be used as a further display attribute.

All definitions and descriptions inside this document are related to "left-to-right" languages. Middle Eastern languages such as Hebrew and Arabic are written predominantly right-to-left. Consequently, Middle Eastern user interfaces require an appropriate layout.

In case of a long running action, the mouse pointer shall be changed to for example an hour glass within the Application Area and Navigation Area. Additionally, IFrameUI.ShowProgress shall be used at the same time.

6.3.6 Use of modal user interfaces

A DTM and a Frame Application shall never use a modal user interface to display progress information.

7 Parameter handling

7.1 Representation within Application Area

If it is necessary to display a large number of parameters in the Application Area, they should be arranged within groups. Grouped parameters should be displayed with a headline.

7.2 Change of parameter values

7.2.1 Relation between parameters

Change of one parameter value may affect other parameter values. The affected parameters should be adapted to the changed parameter value.

For example, changing the unit of a parameter could change units of other parameters, and the corresponding values are converted according to the new unit. In case of conversion, all adapted parameters shall be indicated as changed.

7.2.2 Block mode

7.2.2.1 General

In Block mode, users can edit/change one or more parameter value(s). All modified parameter values shall be applied using a button (i.e. [Apply]) in the Action Area. Therefore, it is possible to modify more than one parameter value before affecting the instance data set and/or the device data.

7.2.2.2 Application-oriented Block mode

The user can edit all parameter values of a complete application before changes are applied or discarded.

7.2.2.3 Page-oriented Block mode

A page is the content of the application area that belongs to a certain item of the Navigation Area.

In Advanced user interfaces with page-oriented editing, the user has to apply or discard the changes of the current Application Area before selecting another item in the Navigation Area.

When the user selects another item in the Navigation Area while the current Application Area contains changes, he/she has to be asked whether he/she wants to apply these changes or not, before displaying the new page. The possibility to select [Cancel] and return to the current page shall also be available.

7.2.3 Direct Mode

In Direct Mode, only a single parameter can be applied at a time. Changes have a direct effect on the instance data set and/or to the device.

This feature is optional. It should be implemented only if, for example,

- a DTM does not support all business rules of a device, or

- special functions are supported (e.g. inching mode).

If an additional action is required to apply the value (e.g. pressing enter), the user shall be advised how to apply a changed value or to discard changes. This shall be described in the Application Area (e.g. tooltip or textbox).

Switching from Block Mode to Direct Mode or vice versa during the runtime of an application is explicitly forbidden.

7.2.4 Continuous Check and One Time Check

Plausibility checks are performed on a lexical base (e.g. only certain characters are accepted), syntactical base (e.g. a limited number of characters are allowed) and semantically base (e.g. given value shall be below upper limit).

In Continuous Check, while editing parameter values, the plausibility is evaluated after every change of the value, e.g. after every new character. Figure 6 describes the Continuous Check.
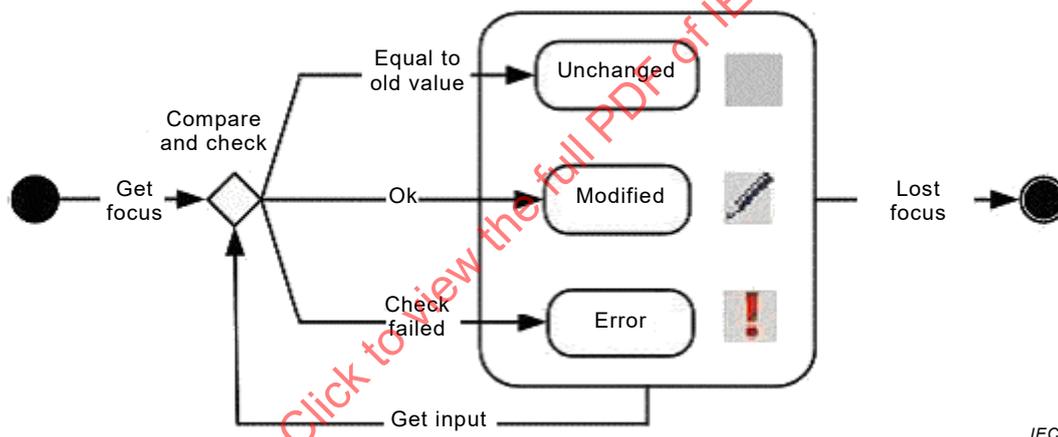
Figure 6 – State diagram: Continuous Check

"Lost focus": the input element lost the keyboard focus, for example if another control of the user interface is selected. Mouse pointer or TAB can perform selection.

Icons are defined in Table 13.

With One Time Check, the plausibility of the new value is evaluated when editing of the value is finished. This includes lexical, syntactical and semantical checks.

Figure 7 describes One Time Check.
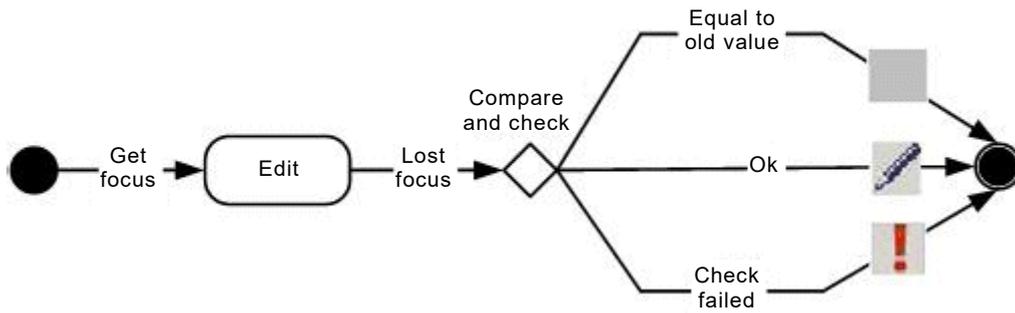
Figure 7 – State diagram: One Time Check

In general, Continuous Check should be implemented. If Continuous Check cannot be provided, One Time Check shall be implemented.

7.3 Representation of parameters

7.3.1 Parameter value and associated information

A parameter value shall be displayed with context and status information. The context consists of a label with the parameter name, a status icon, an input element and a label with a unit (if unit is available).

An example is showed in Figure 8.

Figure 8 – Parameter value and associated information

- The parameter label shall be left aligned.
- The status icon shall be in front of the input element.
- Inadmissible data shall be displayed as shown in Table 12.
- The label for the unit should be left aligned.

Table 12 – Display of inadmissible data

Data status	Display
Not a number	-/- or NaN
Plus infinite	>>>
Minus infinite	<<<

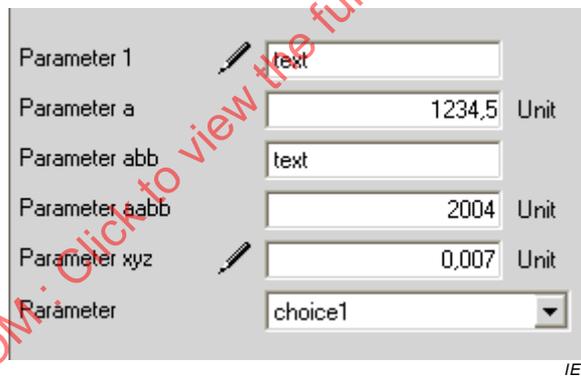Where a parameter group displays directly depending parameters (e.g. a group of radio buttons), the group shall display the status information. The status icon should be right from the label for the group.

A short help item (explanation in one sentence, e.g. tool tip) should be available for every parameter, or at least for a group of parameters. A complete help (e.g. via key F1 or hyperlink) for the parameter or parameter group should also be accessible.

7.3.2   Parameter value modifications

Parameter values that are displayed in the application area can be changed by user input or reading data from device or data base. The presentation of each parameter shall identify whether it is modifiable by user input according to Microsoft style guide, for example [2].

After or during change of a parameter value, the status icon informs the user about the kind of change and – if required – of the data source. In addition, the summarized status displayed in the status bar (refer to Table 6) shows any change of parameters simultaneously.

The status of a parameter value is displayed using icons according to the priority defined in Table 13.

Table 13 – Priority of parameter value states

State	Priority	Status Icon	Tooltip text (see T3.)	Availability
Insecure value Parameter is insecure because update is missing for given time period or parameter is not yet loaded from device	1	?	Insecure value	Recommended
Invalid value (e.g. not plausible)	2	!	Invalid value	Mandatory
Changed value Parameter value is changed (not equal) to data source	3		Modified	Mandatory
Not changed Parameter value is equal to data source value (data base or field device).				
If user changeable parameter values from data set are displayed in an online application, these values shall be uniquely marked by the data set icon.	4		Data set	Mandatory
Dynamic parameter value is updated with polling frequency	5		Cyclic refresh	Optional
Not changed	6	(none)	(none)	Mandatory

Besides the mandatory text, additional explanations should be included in tool tips.

Within a navigation control of the Navigation Area, it should be possible to identify changed and/or invalid parameters.

8   Applications of a DTM

8.1   General

According to [7], a DTM exposes the complete set of available functions with respect to the current state returned by IFunctions::FunctionInfo property. The Frame Application is responsible for presenting these functions within its overall user interface in a homogeneous

way. There should be no break between the DTM based functions and the FDT Frame Application functions.

In general, the Frame Application is responsible for identifying the DTM instance and starting the current function performed by the DTM instance. Such a function can be handled by a specific user interface provided by the DTM. In this case, the Frame Application starts this DTM user interface as integrated application. The Frame Application then shows identification information in the title of this application.

See [7] for a list of predefined ApplicationId enumerations. Refer to [7], Annex A.3, about information on use cases related to the predefined ApplicationId.

A DTM that allows changing the parameter of a device should provide UiFunctions for parameterization (ApplicationIds OfflineParameterize and OnlineParameterize).

8.2   Application categories

8.2.1   Online application/data source: device

A DTM user interface that needs online access to a device (e.g. for ApplicationId OnlineParametrization, Observe, Diagnosis) is called online application. Setting the appropriate data source icon "device" in the status bar shall indicate this. Online access to a device shall be provided only if the instance data set is locked by the DTM. If no lock is granted, all user input controls have to be disabled.

Parameters are loaded from device. User changeable parameters from the instance data set shall be marked with the data set icon. All changed device values shall be transmitted to the device only. All marked data set values shall be transmitted to the instance data set only.

8.2.2   Offline application/data source: data set

A DTM user interface that needs only data from the instance data set (e.g. for ApplicationId OfflineParametrization, Configuration) is called offline application. Setting the appropriate data source icon "data set" in the status bar shall indicate this. If parameters can be changed, the instance data set shall be locked by the DTM. If no lock is granted, all user input controls have to be disabled.

All changed values shall be transmitted to the instance data set only.

8.2.3   Synchronized application/data source: data set and device

The DTM is only allowed to provide synchronized application behaviour if the DTM has write access for all change enabled parameters to both the device and instance data set. Hint: in expert user role, the DTM might have limited write access.

- In order to have consistency between the data of the device and in the instance data set, a synchronized application is defined.

- All changed parameters shall be stored to the device and into the instance data set at the same time.

- DTMs that implement synchronized application should provide function with ApplicationID MainOperation.

- If the application is started while the DTM is not connected to the device (in state "running"), the application should behave like an offline application (e.g. for ApplicationId OfflineParametrization, see 8.2.2). Data source shall be "data set" only in this case.

- When the application is started and the DTM is in the state "communicationAllowed" or the state changes from "running" to "communicationAllowed", the instance data set and device data shall be compared automatically (e.g. for ApplicationId OnlineParametrization).

- If data sets are unequal, the user shall be asked which of both data has to be displayed in the UI. If the user decides to take the device data, dependant on the user role instance, data set is overwritten with the device data. If the user decides to take the instance data set, device data are overwritten with values from instance data set. If the user is not sure which data set has to be taken, he/she shall be able to close the UI without any action.

- Icon "Data set and Device" shall be displayed in field 3 of the status bar.

8.3   User role related default application

The DTM shall define an appropriate FunctionInfo::DefaultFunctionId, depending on the current user role.

The Frame Application defines how this default application is started (e.g. double click on the DTM entry in a project structure). A recommendation for the default application is shown in Table 14.

Table 14 – Recommended default application

Actor	Offline	Online
Observer	OfflineParameterize or MainOperation (read only)	Diagnosis
Expert	OfflineParameterize or MainOperation	Diagnosis
Engineer	OfflineParameterize or MainOperation	OnlineParameterize or MainOperation

After starting the default application in state "communicationAllowed", it is recommended to provide a device status overview.

8.4   Main Operation

A DTM can have a "main operation" function. This is a special application, which aggregates one or more DTM applications (e.g. parameterize, observe, diagnosis, simulation). On opening of Main Operation, the DTM should show a customized application area to realize a DTM specific entry point. This may be for example a simple description of all contained applications, a first steps guide or summarized diagnosis of the device with suggestions how to proceed.

For providing "main operation", the ApplicationId MainOperation shall be used (see IEC 62453-2). The content of the applications is displayed in the Application Area of Main Operation user interface.

8.5   Typical workflow

8.5.1   General

Figures 9 to 12 show usage of status information of typical workflow. User actions are described on the right side, and DTM statuses are shown on the left side of the diagrams.

8.5.2   Parameterize device offline

ApplicationIDs: OfflineParameterize or MainOperation

Read device data from project storage or use default data after instantiation of a DTM, occasionally modify data and store them to project storage again.

DMT status area   Workfow

IEC

Key
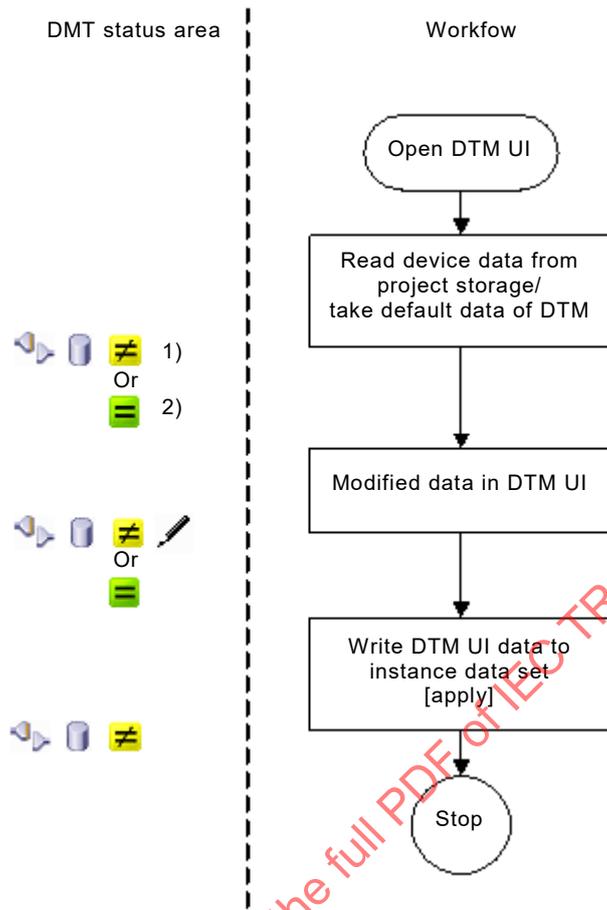
≠   1) Default data used or data previously modified.

≡   2) Instance data set and device data were synchronized before last project storage.

Figure 9 – Parameterize device offline

The user has two options to store offline-changed data to device:

1) use frame application function to store parameter set to device;

2) if a DTM allows to use offline parameterize application in online state, the workflow below shows the behaviour.

DMT status area | Workfow

Open DTM UI

Read device data from
project storage/
take default data of DTM

Modified data in DTM UI

Write DTM UI data to
instance data set
[apply]

Use starts download

Write instance data to device

Stop

IEC

Key

≠ 1) Default data used or data previously modified.

= 2) Previously synchronized.

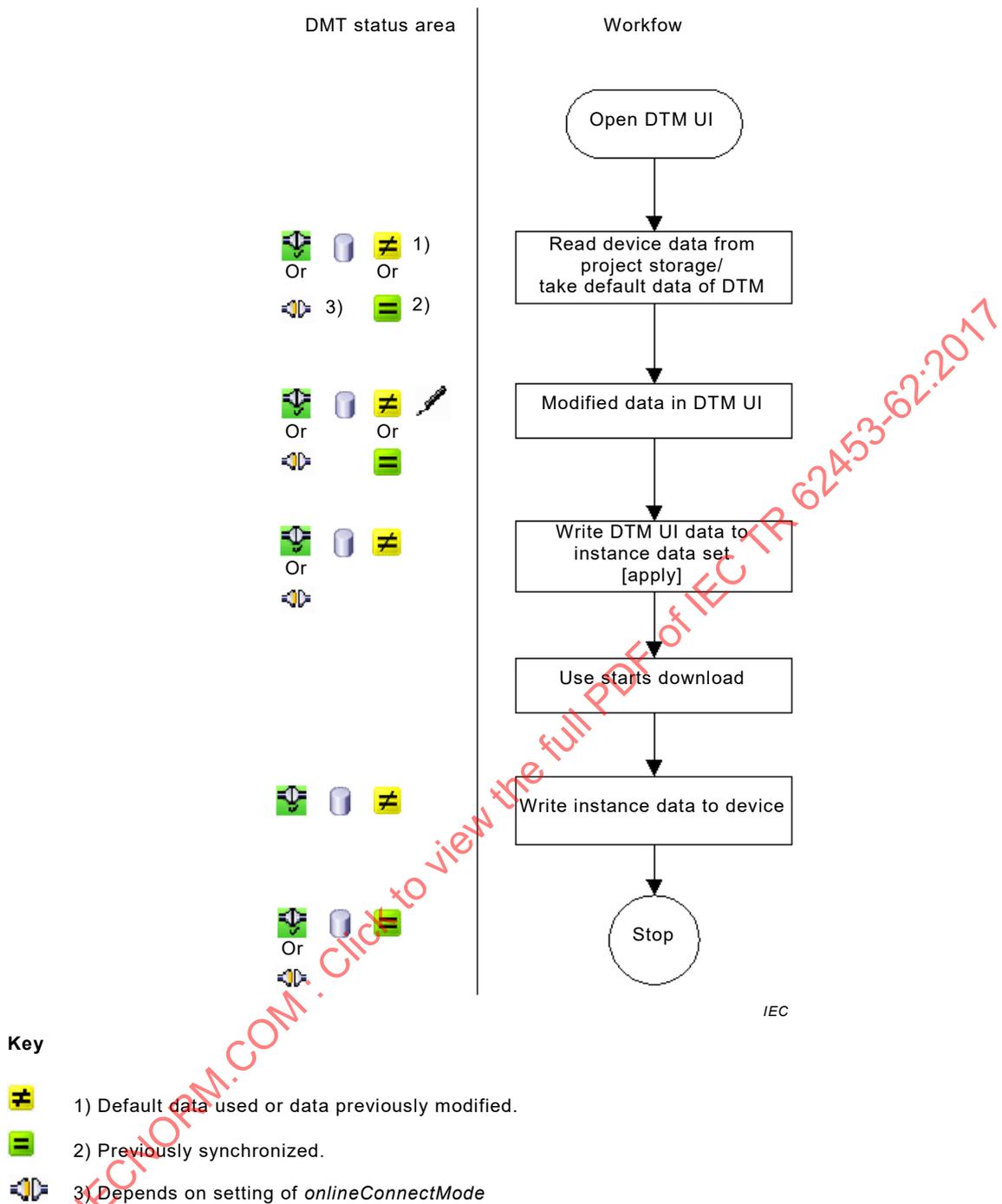3) Depends on setting of *onlineConnectMode*

**Figure 10 – Parameterize device with offline
parameterize and subsequent download**

8.5.3   Parameterize device with online connection (synchronized)

ApplicationID: MainOperation

Modify device data after synchronization and update data in data set and device again.
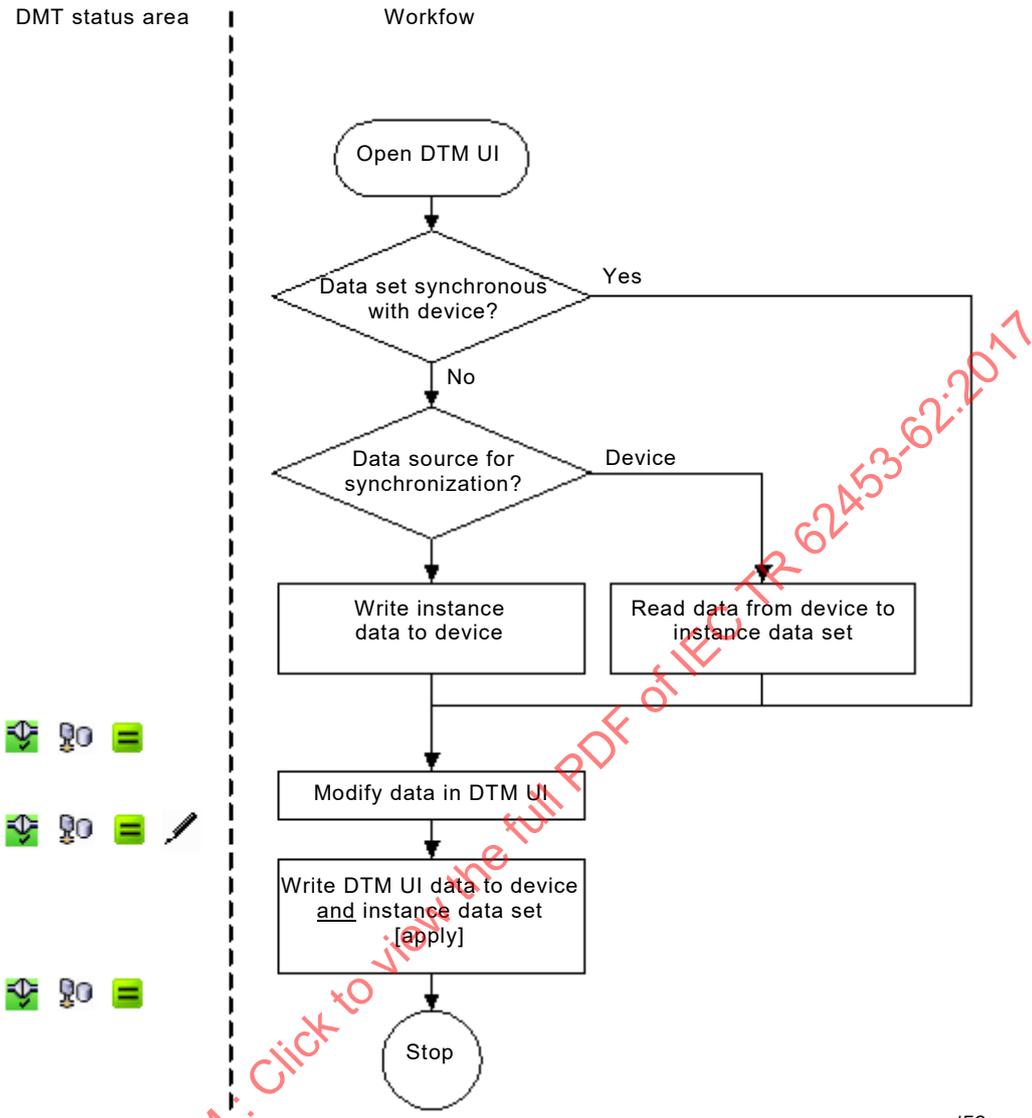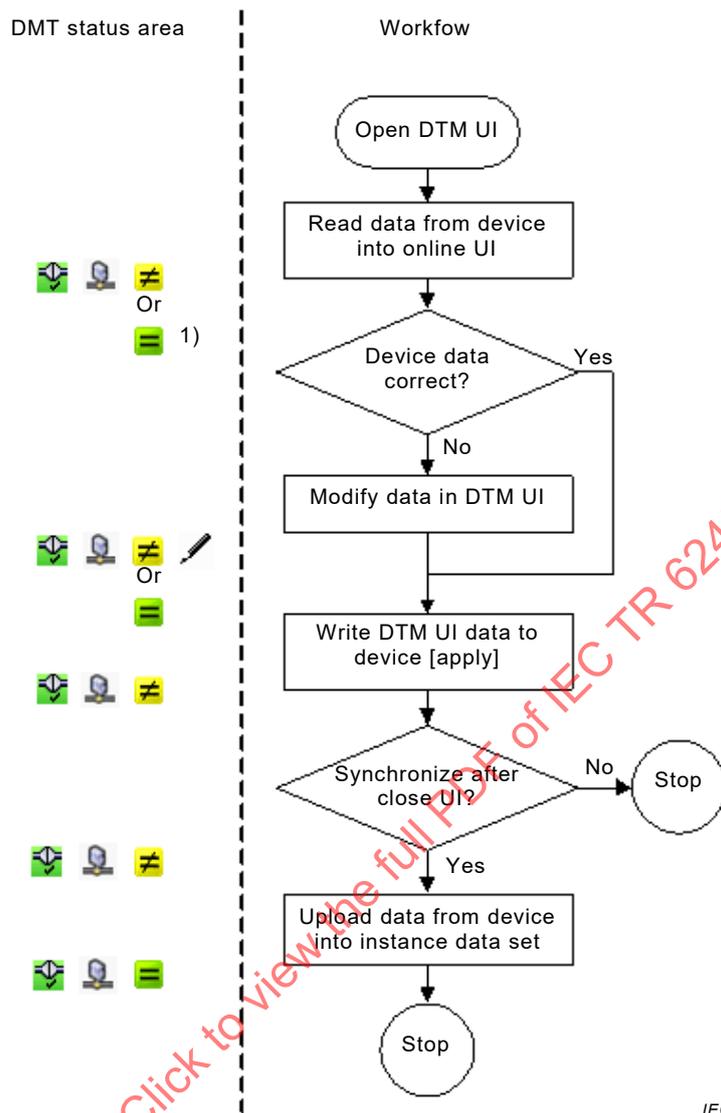
IEC

Figure 11 – Parameterize device with online connection (synchronized)

8.5.4 Parameterize device with online connection (non synchronized)

ApplicationID: OnlineParameterize

Open UI after for example offline parameterization and connect DTM to device. Write data of DTM UI to device and synchronize data set and device according to users choice.

DMT status area

Workfow

Key

1) After previous upload

Figure 12 – Parameterize device with online connection (non synchronized)

9 DTM behaviour

9.1 Close of user interface

9.1.1 Close of user interface with modified parameter values

When parameter values have been modified within a user interface, and a request is received to close the user interface, the FA shall ask the user if the changed parameter values should be applied. Refer to Annex B, category P1, for dialog text.

- If "no", the changed parameter values will NOT be applied and the user interface will be closed.

- If "yes", the changed parameters will be applied according to the behaviour of the [Apply] action.

- If "cancel" (default case), dialog box will be closed only.

This action shall be implemented

- for a [Close] button in the Action Area, and

- if the Frame Application initiates a close of the user interface (IDtmUiFunction::BeginClose()).

9.1.2 Synchronization on close of user interface

9.1.2 applies only if the DTM has write access for all change enabled parameters to both the device and instance data set. Hint: in expert user role, the DTM might have limited write access.

At least after the user requests to close the last DTM user interface, and instance data set and device data are different, and the DTM is in state "communicationAllowed" dependant on the user role, the DTM shall ask the user if the instance data set and the current device configuration should be synchronized (the dialog shall provide the buttons [Yes] and [No]).

This action may overwrite already existing parameter modifications within the instance data set (online application) or device data (offline application).

In case of an online application, the user dialog shall display the message defined in Annex B, category P4.

In case of an offline application, the user dialog shall display the message defined in Annex B, category P3.

If the user confirms that the data should be synchronized, the DTM shall upload/download all parameters into the instance data set/device. If the DTM can guarantee consistency of device data and instance data set, the DTM is allowed to upload/download only the modified parameters under consideration of device-specific business rules.

If the user does not confirm the synchronization ([No]), data shall not be synchronized.

9.2 Data set

9.2.1 Parameter in multiple user interfaces

When modifying data that is simultaneously displayed in multiple user interfaces of the same DTM instance (same DTM business object), a consistent display shall be ensured by this DTM. The consistent display is triggered at the end of modification of a parameter value in the instance data set.

9.2.2 Locking mechanism

9.2.2.1 General

For description of the locking mechanism, refer to [7].

If the data set could not be locked (IDataset::StartTransaction() was not successful), data set modification shall be prevented and the corresponding icon within the status bar shall be shown.

Disabling all input controls on Application Area shall prevent data set modification or disabling functions to accept the modifications, for example disabling Action Area buttons, Direct Mode or menu entries.

9.2.2.2   DTM synchronization in multi-user environments

When an event is received regarding changed parameters (IDtmUiMessaging:: TransactionCommitted Event), the DTM shall take over the new parameter values into the data set. All input controls in all opened user interfaces shall be updated in order to display the new parameter values.

When an event is received regarding an unlock of the data set (IDtmUiMessaging:: TransactionClosed Event), the DTM shall change the status regarding the locked data set within the status bar (refer to Table 8). If the access rights of the user allow parameter modifications, the DTM shall ask the user if he wants to have write access. When the user wants to have write access, the DTM has to lock the data set. The DTM shall enable the input controls only if the DTM can lock the data set (successful IDataset::StartTransaction()).

9.3   Error handling

If an error occurs, the default action shall be safety-oriented according to device functionality. For example, if the user has been requested to confirm a device reset, the default answer should be "No".

Data marked as invalid shall not be transmitted to the device. User shall be informed.

Every DTM should insert error number, error description, device type and TAG name or SystemGuiLabel in all error messages that are sent to Frame Application.

9.4   Localization

The dictionary (see Annexes A and B) contains all standard phrases that shall be used by DTMs with respect to the style guide. The list contains entries in several languages.

9.5   Global report information

Report generation is described in [7], chapter 5.14.

It is recommended that each report fragment starts with the following information: tag name, device name, device description, device version and device vendor.

Frame Application generates header and footer information of a report. Each page of a report shall contain date of report generation, page number an total number of pages (i.e. page x of y).

Annex A
(normative)

Dictionary of standard terms

The following dictionary contains terms that shall be used by DTMs with respect to the style guide. The list contains entries in several languages.

English-US	French-FR	Spanish-ES	Italian-IT	German-DE
T1. Status bar				
Connection state	Etat de la connexion	Estado de la conexión	Stato di connessione	Verbindungsstatus
Connecting	Connecter	Conectando	Connessione	verbinden
Checking	Vérifier	Comprobando	Verifica	Typ prüfen
Connected	Connecté	Conectado	Connesso	verbunden
Disconnecting	Déconnecter	Desconectando	Disconnessione	trennen
Disconnected	Déconnecté	Desconectado	Disconnesso	getrennt
Stand by	Stand by	Stand by	Stand by	bereit
Disturbed	Perturbé	Interrumpido	Disturbato	gestört
Communication in progress	Communication en cours	Comunicación en curso	Comunicazione in corso	Datenübertragung läuft
Data set	Jeu de données	Conjunto de datos	Serie Dati	Datensatz
Data set locked	Jeu de données verrouillé	Conjunto de datos bloqueado	Serie Dati bloccata	Datensatz gesperrt
Device	Appareil	Dispositivo	Dispositivo	Gerät
Device locked	Appareil verrouillé	Dispositivo bloqueado	Dispositivo bloccato	Gerät gesperrt
Device and data set	Appareil et jeu de données	Dispositivo y registro de datos	Dispositivo e serie dati	Datensatz und Gerät
Device and data set locked	Appareil et jeu de données verrouillés	Dispositivo y registro de datos bloqueados	Dispositivo e serie dati bloccati	Datensatz und Gerät gesperrt
T2. Device diagnosis states (see [1])				
Failure	Echec	Error	Errore	Ausfall
Function check	Contrôle du fonctionnement	Función de control	Verifica funzionale	Funktionskontrolle
Out of specification	Hors spécification	Fuera de la especificación	Fuori specifica	Außerhalb der Spezifikation
Maintenance required	Maintenance requise	Mantenimiento requerido	Richiede manutenzione	Wartungsbedarf
Output signal valid	Signal de sortie valable	Señal de salida válida	Segnale di uscita valido	Ausgangssignal gültig
Diagnosis deactivated	Diagnostic désactivé	Diagnóstico desactivado	Diagnostica disattivata	Diagnose deaktiviert
T3. Parameter states				
Insecure value	Valeur non-sécurisée	Valor inseguro	Valore incerto	Unsicherer Wert
Invalid modified	Modification non valide	Modificación no válida	Modifica non valida	Unzulässig geändert
Modified	Modifié	Modificado	Modificato	Geändert
Cyclic refresh	Mise à jour cyclique	Actualización cíclica	Aggiornamento ciclico	Zyklisches aktualisieren