IEC 62769-3

Edition 3.0 2023-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Field device integration (FDI®) – Part 3: Server

Intégration des appareils de terrain (FDI®) – Partie 3: Serveur

IEC 62769-3:2023-04(en-fr)

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Field device integration (FDI®) – Part 3: Server

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CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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FIELD DEVICE INTEGRATION (FDI®) –

Part 3: Server

FOREWORD

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IEC 62769-3 has been prepared by subcommittee 65E: Devices and integration in enterprise systems, of IEC technical committee 65: Industrial-process measurement, control and automation. It is an International Standard.

This third edition cancels and replaces the second edition published in 2021. This edition constitutes a technical revision.

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

a) added interactive transfer to device.

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

Draft	Report on voting
65E/856/CDV	65E/913/RVC

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

A list of all parts in the IEC 62769 series, published under the general title *Field device integration (FDI®)*, can be found on the IEC website.

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

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- withdrawn,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

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FIELD DEVICE INTEGRATION (FDI®) –

Part 3: Server

1 Scope

This part of IEC 62769 specifies the FDI®[1] Server. The overall FDI® architecture is illustrated in Figure 1. The architectural components that are within the scope of this document have been highlighted in this figure. Annex A provides a functional description of the FDI® Server.

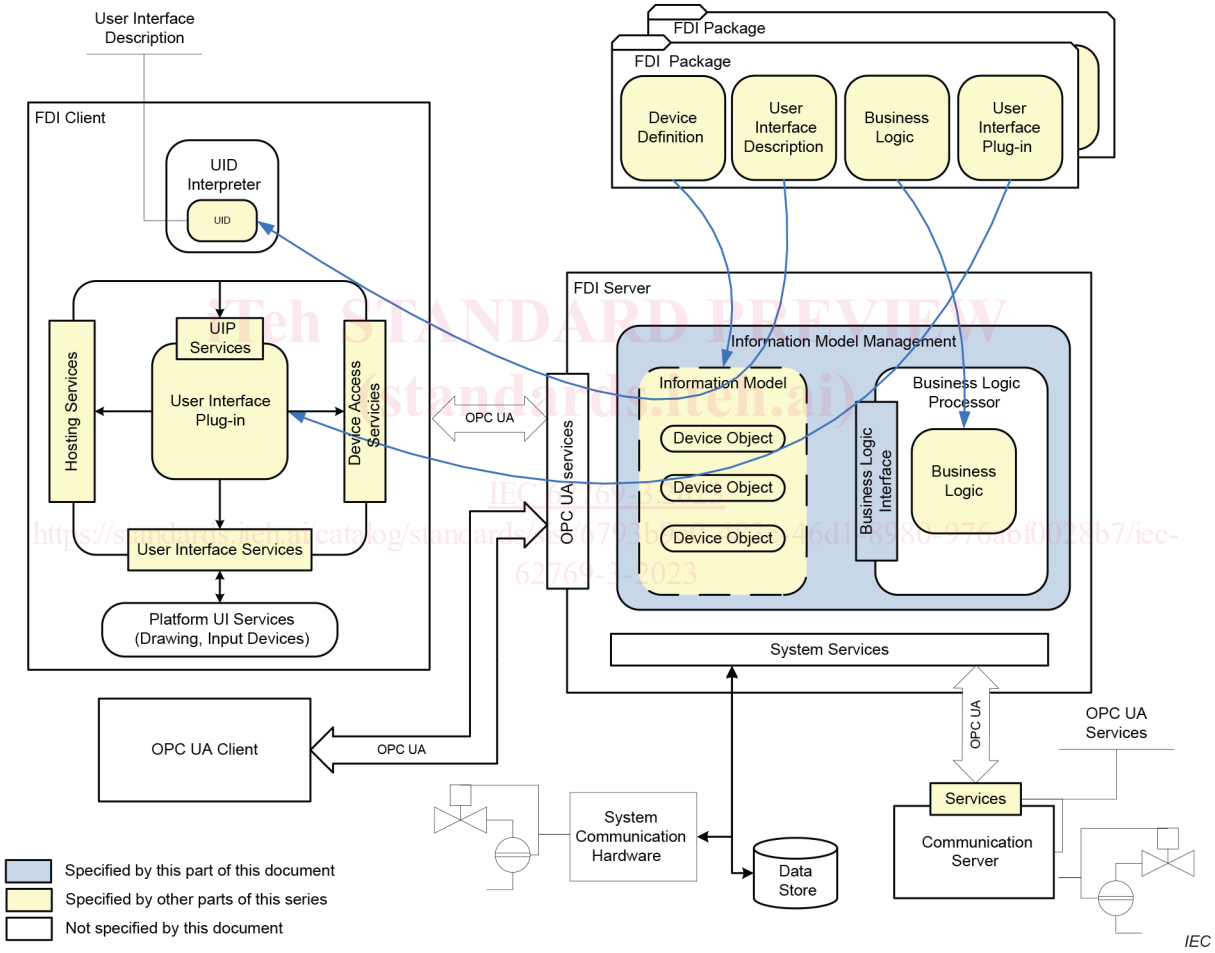

Figure 1 – FDI® architecture diagram

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.

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[1] FDI® is a registered trademark of the non-profit organization Fieldbus Foundation, Inc. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the trademark holder or any of its products. Compliance does not require use of the trade name. Use of the trade name requires permission of the trade name holder.

For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61804-3, *Devices and integration in enterprise systems − Function blocks (FB) for process control and electronic device description language (EDDL) − Part 3: EDDL syntax and semantics*

IEC 61804-4, *Devices and integration in enterprise systems − Function blocks (FB) for process control and electronic device description language (EDDL) − Part 4: EDD interpretation*

IEC 61804-5, *Devices and integration in enterprise systems − Function blocks (FB) for process control and electronic device description language (EDDL) − Part 5: EDDL Builtin library*

IEC 62541-4, *OPC unified architecture – Part 4: Services*

IEC 62541-7, *OPC unified architecture – Part 7: Profiles*

IEC 62769-1, *Field Device Integration (FDI®) – Part 1: Overview*

IEC 62769-2, *Field Device Integration (FDI®) – Part 2: Client*

IEC 62769-4, *Field Device Integration (FDI®) – Part 4: FDI® Packages*

IEC 62769-5, *Field Device Integration (FDI®) – Part 5: FDI® Information Model*

IEC 62769-7, *Field Device Integration (FDI®) – Part 7: Communication Devices*

3 Terms, definitions, abbreviated terms and acronyms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62769-1 as well as the following apply.

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

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

3.1.1
Actions Proxy
internal FDI® Server entity that encapsulates all the EDD Methods specified in an EDD Action definition

3.1.2
Connection Point
logical representation of a connection of a communication end point to a communication network

3.2 Abbreviated terms and acronyms

For the purposes of this document, the abbreviated terms and acronyms given in IEC 62769-1 apply.

3.3 Conventions

Capitalization of the first letter of words is used in the IEC 62769 series to emphasize an FDI® defined term.

4 Overview

The structure for an FDI® Server is shown in Figure 1.

FDI® Servers that support connectivity with third-party FDI® Clients shall support OPC UA. A vendor can provide both an FDI® Server and one or more FDI® Clients. In this case, the FDI® Clients can communicate with the FDI® Server through proprietary protocols.

An FDI® Server communicates with devices via Native Communication (see 7.2.1) and/or Communication Devices (see IEC 62769-7).

An FDI® Server provides information to FDI® Clients through an Information Model (see IEC 62769-5) as follows.

- The Information Model includes information about Device Types and Device Instances. The information for a Device Instance includes offline data (engineering data), as well as online data (values from the physical device).
- The Information Model is created using information from FDI® Packages. However, not all of the information in an FDI® Package is reflected in the Information Model.
- Referential integrity of the Information Model is maintained using information from FDI® Packages.
- FDI® Packages can contain Attachments that contain device manuals and protocol specific information (see IEC 62769-4). Those Attachments, including device manuals and protocol specific support files, are exposed via the Information Model.
- FDI® Device Packages contain information about device types (see IEC 62769-4). Each device type defined in a package is mapped to a distinct DeviceType node in the Information Model.
- FDI® Profile Packages are used to provide interaction with devices for which an FDI® Device Package does not exist (see IEC 62769-4).
- Multiple revisions of an FDI® Package generate distinct DeviceType nodes in the Information Model (see IEC 62769-4).

FDI® Packages contain digital signatures that allow an FDI® Server to authenticate their contents (see IEC 62769-4).

An FDI® Server shall verify the FDI® Technology Version (see IEC 62769-1) of any FDI® Package it uses to ensure the FDI® Package is compatible with the FDI® Server.

5 Information Model

5.1 General

The FDI® Server shall use the Device Definition of an FDI® Package to maintain the Information Model.

The Device Definition can contain conditional expressions. Conditional expressions are used when a certain aspect of the Device Definition is not static but rather is dependent on the state of the device. Whenever the online or offline values of a Device Instance are modified, the FDI® Server shall re-evaluate the relevant conditional expressions and modify the Information Model accordingly.

The evaluation of conditional expressions can invalidate variables in the Information Model. The FDI® Server shall change the AccessLevel attribute of invalidated variables such that they are neither readable nor writable and the status of these variables shall be set to bad. Read and write service requests for invalidated variables shall return a failure.

The Device Definition can specify relationships between variables in a device. These relationships can impact the value of variables in the Information Model.

The FDI® Server shall generate DataChange Notifications to any FDI® Clients that are subscribing to Information Model elements that have changed.

FDI® Packages provide Business Logic that is used by the FDI® Server to maintain the integrity of the Information Model. The Business Logic specified in an FDI® Package can invoke built-in functions that shall be implemented by the FDI® Server. The built-in functions that shall be implemented by the FDI® Server are specified in IEC 61804-5.

5.2 Online/Offline

5.2.1 Overview

The Information Model maintained by the FDI® Server contains online and offline values. The online values reflect values in a physical component/device. The offline values reflect values stored in a configuration database.

The offline values are updated through write service requests from an FDI® Client or Business Logic executed by the FDI® Server. The offline values are not updated when the FDI® Server reads data from the device or writes data to the device.

The online values in the Information Model are not updated through write service requests. Successful write service requests through the Information Model result in value changes in the physical devices. The online values in the Information Model will then be updated as a result of read service requests or subscriptions.

FDI® Servers can provide a server-specific mechanism for creating Device Instances without the presence of physical hardware. The FDI® Server creates these instances using information in FDI® Packages. All read/write requests for online values for Device Instances with no physical device shall return an error.

The transfer of information between the offline values and the physical device is supported through the TransferToDevice, TransferFromDevice in the Information Model, and the INTERACTIVE_TRANSFER_TO_DEVICE_ACTION implementing the transfer including user interaction. These Methods shall implement the download and upload procedures, respectively, as specified in IEC 61804-4. When no implementation is provided based on IEC 61804-4, then these Methods shall return Bad_NotSupported, as per IEC 62541-4.

The Device shall have been locked prior to invoking these methods, as specified in IEC 62769-5.

5.2.2 Transfer to device

The TransferToDevice method shall implement the download procedure as specified in IEC 61804-4. This transfers the offline values to the physical device.

As a general rule, the FDI® Server should not change the Online variable node when writing a value to the device. The Online variable node should be updated only in the process of read operations or subscriptions. Notwithstanding, as specified in IEC 62769-5, the FDI® Server will reset any cached Value for the target Nodes in the Information Model so that they will be re-read next time they are requested.

The status information returned for each variable included in the write service request is used to compose the TransferResult, as specified in IEC 62769-5.

5.2.3 Transfer from device

The TransferFromDevice method shall implement the upload procedure as specified in IEC 61804-4. This transfers the values from the physical device to the offline values.

If any read operations from the device fail during upload, the corresponding offline value shall not be modified.

The status information returned for each variable included in the read service request is used to compose the TransferResult, as specified in IEC 62769-5.

5.2.4 Interactive Transfer to device

The FDI® Server implements the Interactive Transfer to Device as specified in IEC 61804-4. This transfers the offline values to the physical device. In contrast to the non-interactive download performed with the TransferToDevice method, the interactive download may invoke user interaction just before the download starts and after the download has been performed. The Interactive Transfer to device is started by an invocation of the INTERACTIVE_TRANSFER_TO_DEVICE_ACTION by the FDI® Client using the InvokeAction service.

As a general rule, the FDI® Server should not change the Online variable node when writing a value to the device. The Online variable node should be updated only in the process of read operations or subscriptions. Notwithstanding, as specified in IEC 62769-5, the FDI® Server will reset any cached Value for the target Nodes in the Information Model so that they will be re-read next time they are requested.

5.3 Access privileges

Systems implement security and access policies based on a number of characteristics such as user role and plant area. FDI® Servers use these policies, along with information in FDI® Packages, to determine the access privileges granted to the user.

The elements of an FDI® Package can be associated with one or more usage attributes. The FDI® Server uses these attributes to set the UserAccessLevel attribute of Variables and the UserExecutable attribute of Methods. The usage attributes in an FDI® Package are simply hints to be used by the FDI® Server, i.e., they may be disregarded or overridden by the FDI® Server. See also Annex B.

5.4 Private Parameters

The Parameters and Actions specified in an FDI® Package can be declared private. Private Parameters and Actions shall not be browsable; they shall only be accessible through references from other elements of an FDI® Package.

More specifically, the FDI® Server shall support private Parameters and Actions as follows.

- The FDI® Server shall create nodes in the Information Model for the private Parameters and Actions.
- The FDI® Server shall not include information about private Parameters and Actions in a response to a Browse, BrowseNext, QueryFirst, or QueryNext service request.
- The FDI® Server shall return the NodeIds of private Parameters and Actions when the name of a private Parameter or Action is passed to TranslateBrowsePathsToNodeIds.
- The FDI® Server shall process a read/write service request for a private Parameter in the same way as it does for public (browsable) Parameters (see 5.7 and 5.8).

- The FDI® Server shall execute private Actions in the same way as it does public (browsable) Actions (see 5.12).

An example of private parameters is parameters that should only be modified through an Action. These parameters should not be visible to FDI® Clients to prevent direct access. FDI® Clients invoke Actions to access these private parameters.

5.5 Locking

The FDI® Server provides locking services to grant FDI® Clients exclusive access to Device and Network elements in the Information Model. The locking services consist of a set of Methods and status information. The methods, and their behaviour, are specified in IEC 62769-5.

The following behaviour shall be implemented by the FDI® Server to support locks.

- Locking applies to both online and offline nodes.
- Once locked by one FDI® Client, any attempt to write to a Parameter or to execute an Action by another FDI® Client shall be rejected.
- Locking is not required for read services.
- Parameters that are locked by one FDI® Client can still be read by other FDI® Clients, i.e., read requests on a Parameter that is locked are not rejected.

Internal use of the locking mechanism for maintaining the Information Model integrity is FDI® Server vendor specific.

Figure 2 illustrates a locking sequence with multiple service invocations during the locked state.

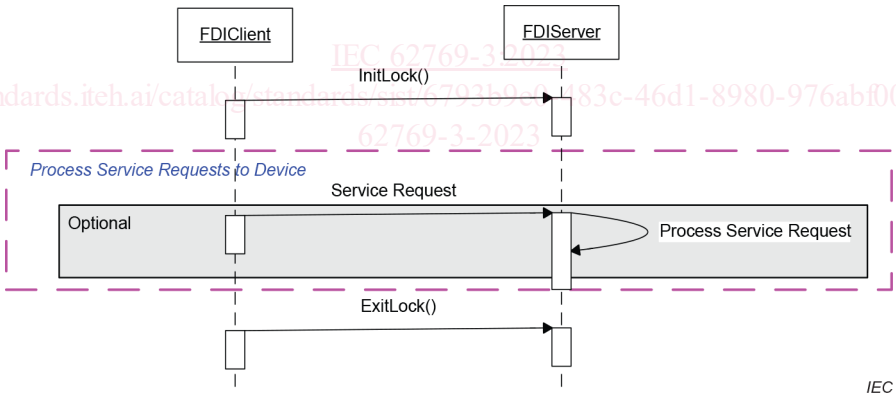

Figure 2 – Locking services

A service request that requires locking shall fail either partially or completely if no lock has been acquired by the FDI® Client via InitLock prior to requesting the service. The FDI® Client has to release the lock via ExitLock after all service requests have been completed.

NOTE A write operation will partially fail, i.e., it will return a status code for each variable in the set of variables to be written since some can belong to devices that are locked and some to devices that are not locked.

FDI® Servers may queue InitLock requests until a service for which a lock has been created completes and the lock has been released. However, such an optimization is not part of the standard behaviour required of an FDI® Server.

5.6 EditContext

5.6.1 Concept and usage model

The FDI® Server provides the EditContext model to interact with Clients during their editing task. The concept is closely related to UIDs and fulfills the needs for Server-driven UI dialogs based on EDDL rules.

An EditContext can be used to make changes to Variable Values visible to the Server without applying them to the online or offline representation of a Device. The Server will apply business logic associated to the edited Variable which – in some cases – causes changes to other Variable Values (e.g. if an engineering unit is changed) or the UID (e.g. a Variable becomes invisible). Thus, the Client can use an EditContext to modify (edit) Parameters like engineering units, ranges and more, verify any side effects, and re-adjust the settings before applying the changes.

An FDI® Server may implement different EditContext strategies:

- A single EditContext instance for all dialogues of an FDI® Client;
- Multiple EditContext instances;
- Hierarchical EditContext instances.

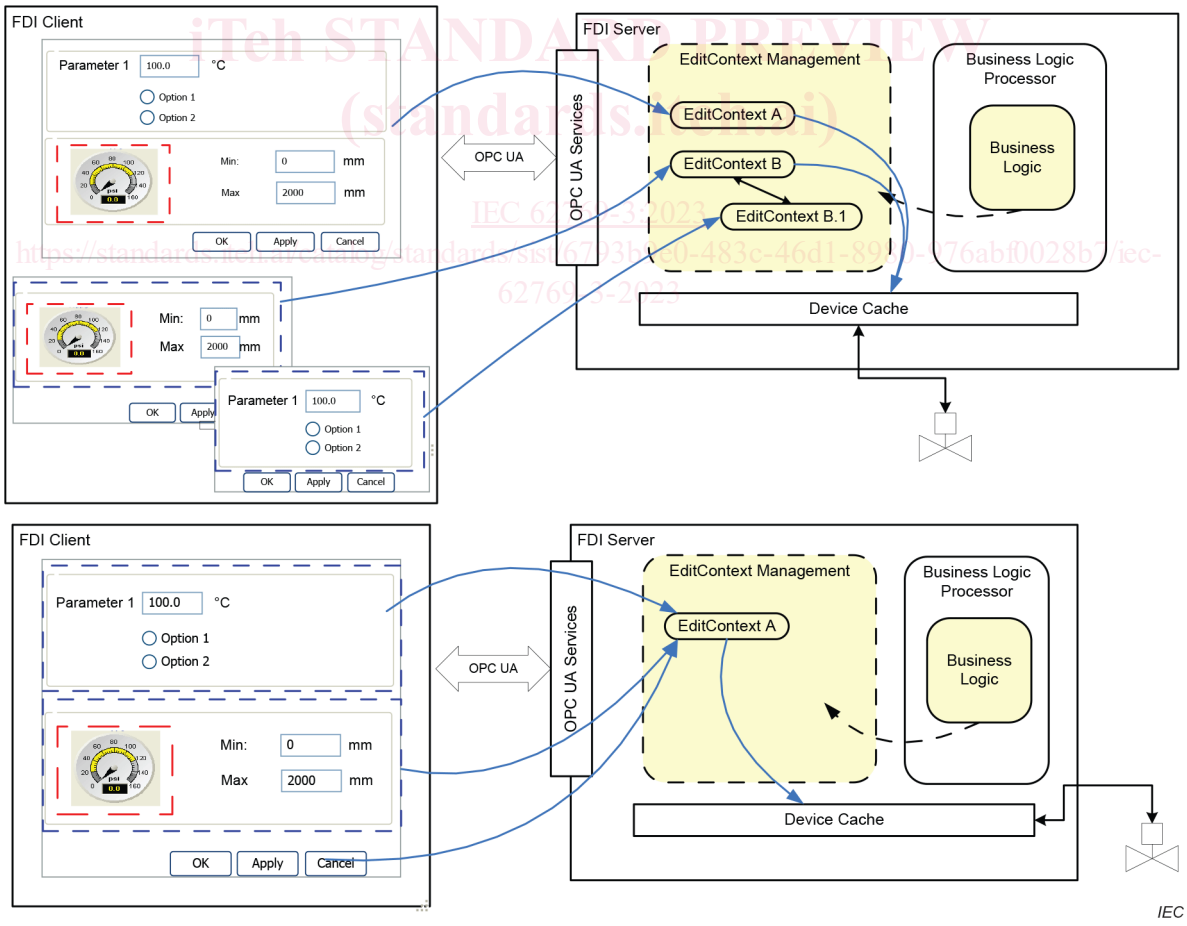

Figure 3 – EditContext models

Figure 3 shows two possible Server strategies and how the Client can adapt. In the lower scenario, the Server provides a single EditContext instance for all dialogs. Here, the Client groups all dialogs and exposes a single set of buttons to Apply and Cancel, because it always concerns all edits.