

FDI Meets Plant's Device Integration Needs

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ABSTRACT

The future is digital, and digital should be intuitive and easy to use. Some users of 4-20 mA/HART, FOUNDATION fieldbus, and PROFIBUS devices have to grapple with two sets of files to integrate their devices; EDD files and DTM software drivers to integrate devices into their systems. Field Device Integration (FDI) is a new device integration technology combining EDDL, with elements of FDT2, providing a single device package that can be used on any system. The NAMUR chemical industry user organization has released seventeen new user requirements for FDI over and above the circa 35 device integration technology requirements in their NE105 recommendation. The FDI technology has been designed to meet these plant needs, which includes investment protection, robustness, easy system administration, easy to use devices, interoperability, and easy migration.

INTRODUCTION

The FDI technology is a device integration technology that plays a key role in addressing device management in an operating plant, as illustrated in figure 1.



Figure 1 Field Device Integration (FDI)

In this paper we touch on each of these areas.

ENABLING TECHNOLOGY

At the core of the FDI technology is the Device Package and the Common Host Components.

DEVICE PACKAGE

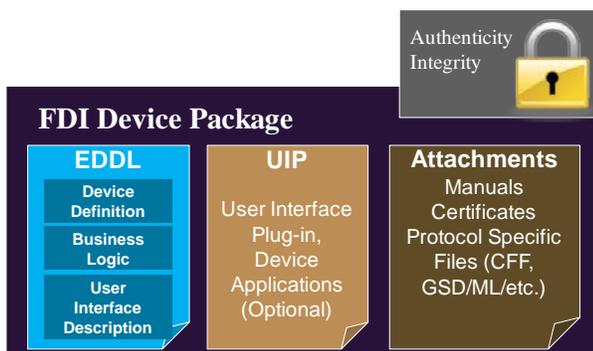


Figure 2 FDI Device Package

A *Device Package* is a file created by the device manufacturer which allows the device to be integrated in a system. FDI has a user-friendly file name convention. With FDI it will be very easy to identify the right package for the right device. The base technology of FDI is EDDL. A device package contains an EDDL file. Optionally the device package may also include a Plug-In and other integration files such as the PROFIBUS GSD file or FOUNDATION fieldbus CFF file. Even a file containing the User Manual can be included.

Table 1 Contents of a FDI Device Package

Device Definition	Description of all device parameters, including label, data type and localized help text
Business Logic	Wizards that step a user through the processes. Conditionals to hide internal dependencies
User Interface Description (UID) “Device Pages”	Visualization graphics and task/role-based hierarchical menu system
User Interface Plug-in (UIP) “Plug-In”	Optional software component for setup and diagnostics not available in the device
Attachments	Other optional integration files and manuals etc.

A digital signature provides standard means to verify the integrity and authenticity of the package for security.

COMMON HOST COMPONENTS

The *Common Host Components* is software used in the host system.

If a FDT2 based host were implement a DTM2 to read a Device Package, it too must implement the common FDI host components. The subset of the FDT2 specification utilized by the Plug-In would already be supported.

INVESTMENT PROTECTION

System workstations have to be upgraded to new versions of Windows over its many years of operation to be compatible with new software. The FDI technology was designed such that life of the system can be extended, and is not shortened by the rapid pace of development in the IT world. This is because of its EDDL base technology.

SYSTEM INVESTMENT PROTECTION

Since the EDDL base technology of the FDI packages is text based, much like HTML or XML, it is independent of the Windows operating system, and therefore compatible not only with all versions of Windows, but also other operating systems. There is no need to upgrade Windows etc. when a new device type or version is integrated to the system as part of expansion or replacement. The system is not rendered obsolete by new FDI packages. The FDI technology protects system investment.

DEVICE INVESTMENT PROTECTION

Being independent of the Windows operating system also means FDI packages need not be upgraded; devices are not rendered obsolete, every time a new version of Windows or .NET framework, or a

service pack is released. Therefore FDI packages and their devices are not rendered obsolete by new versions of Windows or .NET. Moreover, system support for an existing device is not lost when a new Windows version or hot fixes etc. are installed. However, the optional Plug-In is dependent on the Windows operating system. Suppliers may include ancillary features in the Plug-In. The base technology of FDI packages is intrinsically unaffected by the rapid obsolescence in the IT world. An additional benefit is that there is no need to wait for new FDI packages before new Windows versions and language editions etc. can be used on the system. New technology can be adopted faster. A system can operate without having to obtain updated FDI packages each time Windows is upgraded. Devices will not go obsolete since their FDI package does not go obsolete. The FDI technology protects device investment.

Moreover, to pass the registration process, new versions of systems will have to be compatible also with older versions of FDI packages. That is, FDI packages are backwards and forwards compatible.

GREATER ROBUSTNESS

In the past, installing many driver programs resulted in version conflicts causing system problems, a substantial source of risk. FDI packages do not overwrite system files or make registry entries. Thus FDI packages do not impact system robustness.

Typically, an FDI package for one device type has a dedicated folder on the system and a unique version name and therefore does not overwrite other files. Adding support for a new device does not break an existing device enabling multiple versions of the same device type to coexist.

INTEGRATED DEVICE DIAGNOSTICS

Since FDI base technology does not interfere with other software, FDI packages can be permitted onto the DCS itself, enabling intelligent device management to be integrated within the DCS operator workstations, in addition to separate maintenance workstations. The operator can thus verify device health to distinguish device problems from process problems, take action for the process and inform instrument technician, in only three clicks or less, without moving to a separate maintenance workstation. Using predictive diagnostics becomes a natural part of daily operations and maintenance.

INTEGRATED DEVICE CONFIGURATION

Similarly, FDI packages can be loaded on the DCS engineering station enabling system and device configuration from the same workstation. Thus making it easy to check ranges and other settings match.

EASY SYSTEM ADMINISTRATION

New types and versions of devices come into the plant over its many years of operation. FDI packages ensure the system can be kept up to date with these new devices. Thanks to FDI, existing and future devices can easily be integrated into systems. FDI is a single common technology for all systems and devices, instead of grappling with multiple standards and different system administration.

EASY TO KEEP SYSTEM UP TO DATE

FDI packages for registered devices can be downloaded from the respective bus organization website. Because the EDDL portion of FDI packages is encrypted text, packages are copied onto the system, not installed programs, there is no need for the technician, who commissions a new device, to install driver programs or have IT skills. Non-experts can integrate new device types and versions into the system. There is also a security benefit in that all technicians need not be given 'administrator' level access to the system to commission new devices. Reboot of the workstation is also not required. The wizard that loads the FDI packages for new types and versions of device onto the system is part of the system itself (not the individual packets), ensuring all FDI packages are loaded the same way regardless of device manufacturer or protocol.

Loading of FDI Device Packages is flexible. When the device package is loaded on the system, the technician has the option to integrate the device with both Device Pages and Plug-In, or just with the EDDL text-based Device Pages.

Just like EDDL, each version of a device has its own FDI package ensuring new versions of a device can be integrated by adding its FDI package without removing the FDI packages from prior versions of the device, thus ensuring multiple version of the device can coexist in the system without conflicts. A system can display a "library" of device types and versions for which the associated FDI package has been loaded, thus providing an overview of which devices are supported by the system. Each device type has its own FDI package, allowing the FDI package for a single device to be loaded without having to load FDI packages for other devices from the same manufacturer. This allows the system administrator to maintain a minimalist set of FDI packages if so desired, and prevent overwriting existing devices. The FDI package can include the GSD and CFF files required for integration of the device into the system. This saves system integration time. An FDI package can be loaded on one workstation, and then can be automatically copied to other workstations in the system. Host may provide services to automatically download the FDI files.

EASY DEVICE DATABASE BUILD

FDI is a single common technology for all systems and devices, instead of grappling with files and programs for multiple device integration standards. The FDI package includes the codes for device manufacturer, device type, and version thus enabling both the control system and intelligent device management software to automatically pick the correct FDI package for a device without manual binding. As with EDDL, FDI technology thus avoids a substantial amount of system configuration work. FDI technology is designed to be plug & play.

NO LICENSE KEYS

The FDI package is made available with the device. The EDDL portion of FDI packages require no license key, making system administration easier and lower cost. The optional Plug-In may be licensed. There is only one interoperability registered FDI package per device type. There is no need to "tier up" to another FDI package to access full functionality. Common functions like save, print, export, and reconcile are provided entirely by the system and therefore available for all devices, not just some. This makes it possible to take full advantage of all devices. The device manufacturer development for an FDI package is short and the cost very low as special consultant programmers need not be hired. This matter to plants because it ensures FDI packages will be available soon, without additional cost.

EASY TO USE DEVICES

Device manufacturers provide FDI packages for their devices, with a user interface designed to make the device easy to use. FDI is a single common technology for all systems and devices, instead of grappling with different ways of device setup, calibration, and diagnostics etc.

COMMON SOFTWARE

FDI compliant systems use standard FDI Host Components ensuring devices are displayed as intended by the device manufacturer and removes the need for host specific files. FDI enables all devices to be managed the same way regardless of the communication protocol. This gives plants freedom to choose systems and devices.

USER GUIDANCE

Device manufacturers create FDI packages defining the step-by-step guidance provided by setup and calibration wizards etc. as well as text and illustration for diagnostics and other help. The visible dialog box interaction for wizards is provided entirely by the system and therefore consistent for all devices. Configuration/setup therefore becomes easier. Similarly, troubleshooting tips for diagnostic alarms are presented consistently.

Wizards, already familiar to many EDDL system users, make complex procedures such as device setup and calibration easy, reducing mistakes, and at the same time make sure all technicians perform these tasks the same way. Device manufacturers impart their know-how to technicians in the form of text, images, and context sensitive help to make their devices easy to use. Only relevant information and valid options based on prior selections and images based on actual state etc. are presented, thus shielding the technicians from the internal dependencies and complexities of devices.

Audit trail logging, display, and print is provided entirely by the system and therefore supported for all devices, not just some. Similarly, printing of documentation and export of device parameterization are provided entirely by the system and therefore possible for all devices. Display and edit of parameter

values is handled entirely by the system ensuring that when multiple users change device parameterization from different workstations, data synchronization issues do not arise.

CONSISTENT LOOK & FEEL

Device manufacturers create base FDI packages using EDDL to define the content & structure of how parameters, trend charts, waveform graphs, and wizard buttons for information and features in their devices are organized in system displays to make their device easy to use. Graphics rendering of the Device Pages (i.e., the EDDL portion of the FDI package) is provided entirely by the system and therefore the look & feel is the same for all devices. For instance, parameters are flagged or color coded for “read-only”, and to remind technician to “commit” changes, or to “reconcile” parameter settings the same way for all devices. Similarly, all trend charts and waveform graphs are rendered entirely by the system, and therefore panned and zoomed the same way using the same toolbox for all devices. Likewise, common buttons for committing parameter changes, access help, reconcile, and print etc. are rendered the same size, color, with the same label or icon in the same screen location for all devices. This ensures consistency among devices of different types, from different manufacturers, and using different protocols, which make work easier for technicians who has to manage a mix of devices.

A standard multilingual EDDL dictionary of parameter labels, options, help, and common wizard phrases further promotes consistency.

EASY DEVICE NAVIGATION

Device manufacturers separate commonly used features and parameters from special features and parameters such as advanced diagnostics. The structured menu system makes navigating large sets of parameters intuitive and easy. Device manufacturers provide an at-a-glance device overview and access to key features readily accessible from the top-level menu ("home page") for the device. Less often used advanced information and special features are located deeper in the menu system to prevent clutter at the top level of the menu display where only the commonly used information and features are displayed. Even unique manufacturer-specific features are provided by the FDI package.

ACCESS TO FULL DEVICE FUNCTIONALITY

Powerful graphics including trend charts and waveform graphs with multiple simultaneous values as well as table grids allow advanced setup and advanced diagnostics of sophisticated (complex) devices like control valve positioners, vibration transmitters, variable speed drives, gas chromatographs, and radar level transmitters using the same common software as simple pressure and temperature transmitters. Various software and tools based on FDI technology are suitable for all phases of the life-cycle, including DCS operator console, DCS engineering console, Intelligent Device Management (IDM) software part of Asset Management Systems (AMS), laptop/tablet, handheld field communicator, and documenting calibrator. FDI packages make devices fully interoperable, since they are displayed as intended by their manufacturers, nothing hidden.

INTEROPERABILITY REGISTRATION

Interoperability testing applies to both devices and systems to ensure interoperability between systems and devices from different manufacturers.

INTEROPERABLE DEVICES

The EDDL based Device Definition, Business Logic and Device Pages part of the FDI package are mandatory, ensuring devices can be commissioned. The HART Communication Foundation, Fieldbus Foundation, and PROFIBUS organizations test the FDI package together with the interoperability testing of devices. This independently verifies the FDI package is correct and matches the device, thus ensuring interoperability for the respective protocol. Registration applies to every type and version of a device before release on the organization website. Mandatory and optional features of the FDI package are tested and registered. Devices which have passed the HART Communication Foundation, Fieldbus Foundation, or PROFIBUS organizations interoperability registration test are permitted to carry their respective registration checkmark. Since FDI packages are part of the interoperability test, the checkmark also means FDI interoperability for the respective protocol. Full device and system interoperability registration results are available on the respective organization website. Registration details include manufacturer, device type, device version, FDI package version, and tester version. An FDI package uses harmonized EDDL.

FDI package compliance with style guide criteria such as menu structure can be automatically tested as part of the interoperability registration process.

INTEROPERABLE SYSTEMS

Systems must implement common FDI host components; EDD Engine and UI Engine. The EDD Engine and UI Engine software components used in FDI-based systems are maintained by the FDI organization ensuring interoperability. For systems, intelligent device management software part of asset management systems is tested to ensure it interprets FDI packages correctly. Mandatory and optional features of the system are tested and registered.

EASY MIGRATION

The FDI technology enables many migration solutions for existing systems, at the same time protecting existing investment in devices.

EASY SYSTEM MIGRATION

Existing system software can be upgraded to a version supporting FDI without making changes to underlying system hardware or network infrastructure. There are migration paths for both EDDL based

systems and FDT based systems, no investment is lost. Both EDDL and FDT based system can be upgraded to support FDI.

NO DEVICE REPLACEMENT

Devices communication is independent of FDI. There is no “EDDL device”, “FDT device”, “DTM device”, or “FDI device”. Devices are 4-20 mA/HART, FOUNDATION fieldbus, or PROFIBUS. FDI can be deployed without replacing devices or upgrading device firmware. Device manufacturer may provide FDI packages for existing devices, enabling the full benefit of FDI also for older devices. The system may also support EDDL and FDT technologies in parallel with the new FDI technology, for devices without FDI package.

CONCLUSION

FDI technology provides a single common device package for device integration on any system. Thanks to the base EDDL technology, the FDI solution meets plant needs such as investment protection, robustness, easy system administration, easy to use devices, and interoperability. Moreover, existing system can easily be migrated to FDI technology. FDT Group, Fieldbus Foundation, HART Communications Foundation, PROFIBUS & PROFINET International, and the OPC Foundation have been working aggressively to develop the FDI specification. Migration to FDI should be in the long-term plans of any plant.

WEBLIOGRAPHY

<http://www.fdi-cooperation.com/>

<http://www.eddl.org/>

<http://www.fieldbus.org/>