EDDL Technical Description

Introduction

Intelligent devices and handheld communicators brought about a quantum leap in device parameterization and diagnostics convenience. In the past it was very difficult for technicians to support a mix of different device types because devices from different manufacturers used different handheld communicators.

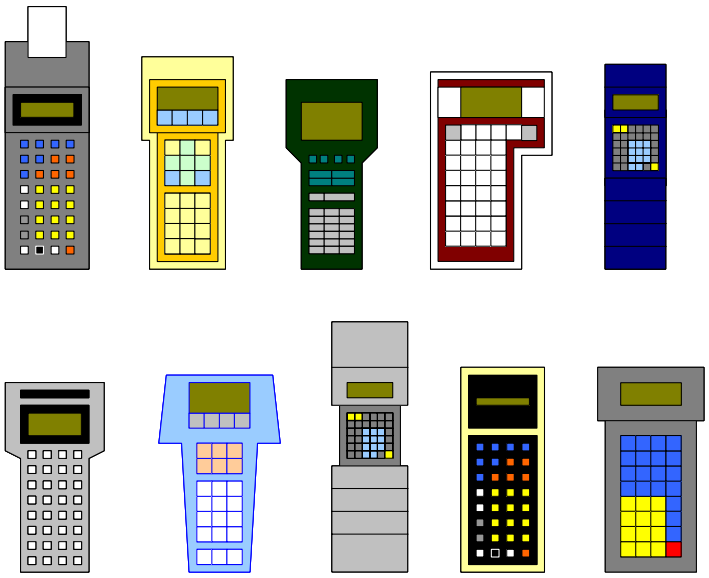


Figure 1 Before EDDL a large number of handheld communicators were required

Intelligent devices eventually used the same protocol, and laptop interfaces and multiplexers permitted use of PC software, but many sophisticated devices still had its own unique specialized configuration software not supporting any other devices. Many applications had to be purchased and installed and every application had a different look and feel even when run in the Windows operating system.

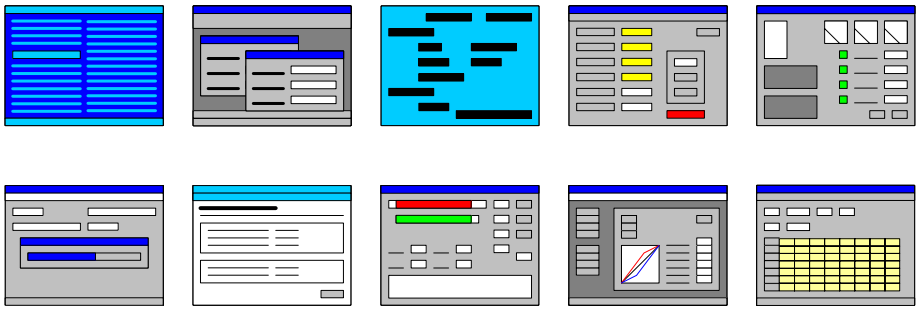
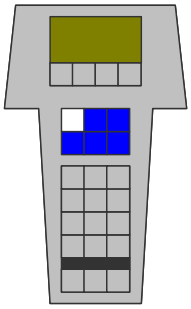


Figure 2 Before EDDL a large number of configuration software applications were required

Obviously it is important to be able to check a device from a maintenance workstation in the central control room, but also using a portable communicator while performing field service.

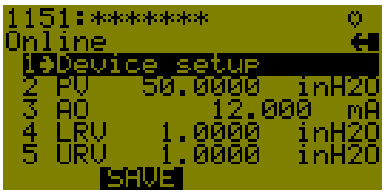
EDDL (Electronic Device Description Language) is a device integration technology that uses an electronic file written in a common language to describe an intelligent device in a machine-readable format to a handheld communicator or to software applications such as a DCS configuration tool or intelligent device management software.



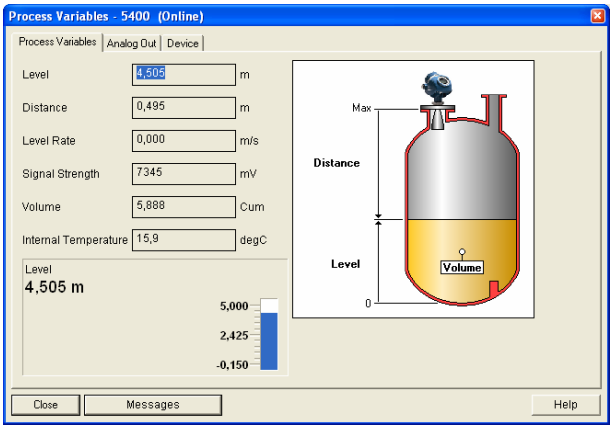
Almost every instrument technician has benefited from EDDL every day since 1992 without even knowing it.

EDDL is the most important and widely used digital communication descriptive language in the manufacturing and process industries.

The language, EDDL, is used to create the Electronic Device Descriptions (EDD) file for the intelligent devices. The EDD file is written by the device developer and tailored to the exact needs of each specific device model. EDDL declares to the software how to communicate, decode, and display the information in the device. Manufacturer know-how is scripted into interactive "methods" in the EDDL coaching the technician through complex procedures such as calibration or setup through a step-by-step prompts. Graphics are used to distill the wealth of data in a device into easy to interpret condition information. Using EDDL, device manufacturers are given an unrestricted opportunity to provide technicians access to their devices, with the full scope of their functions, where all the menus and parameters appear as intended by the manufacturer. EDDL supports sophisticated graphics functions much like an HTML web page.



Electronic Device Description Language



Visually enhanced EDDL with sophisticated graphics

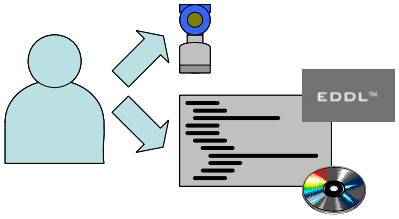


Figure 3 Developer designs device and writes EDDL to declare all functions

Technically it is possible for the device developer to write EDD using any text editor, but an Integrated Development Environment with integrated editor, tokenizer, and tester with simulation makes it easier.

EDDL is a system resident technology. It electronically describes the field device such that the control system, handheld communicator, or device manager can correctly interpret the messages exchanged with the device. The Electronic Device Description files for each of the different devices are copied into the computer or handheld communicator. A single universal tool can configure commission, diagnose, calibrate, and fine tune all the different device types based on their respective Electronic Device Description. Handheld communicators and intelligent device management software used in the day-to-day maintenance and operation of the many different devices in the plant can visually display results from partial stroke testing of safety valves, as well as performance analysis such as hysteresis, step response, and valve signature etc. Likewise, diagnostics of plugged impulse lines for a pressure transmitter is made easy by the advanced visual display provided by EDDL graphics. In the handheld communicator or software the EDD is interpreted to generate the displays for the device information much like a web page as the technician browses through the menu system. EDDL is not dependent on a particular operating system or interface and therefore EDDL can be found in everything from portable handheld communicators to large client-server based intelligent device management software as part of asset management packages.

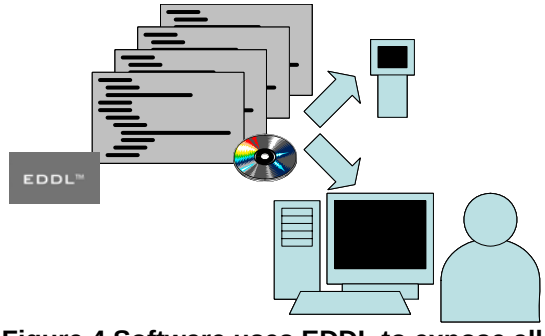


Figure 4 Software uses EDDL to expose all device functions to the user

The same EDDL used in a handheld communicator can also be used in a stand-alone application on a laptop or for the intelligent device management software in asset management software. EDDL is used to integrate data from devices

from different suppliers communicating HART, FOUNDATION fieldbus, and PROFIBUS as well as their Ethernet varieties into a single software or handheld communicator. It is applied for both wired and wireless devices. EDDL is used in for simple temperature transmitters, valve positioners, bus diagnostics modules, variable speed drives, and sophisticated machinery health monitors with more than a thousand parameters. EDDL is used to describe devices used for control as well as for devices used for functional safety, even for devices that monitors the health of the communication buses themselves. That is, a single device integration technology to integrate the plethora of device types from a variety of vendors found in a plant into a single tool.

Benefits

The EDDL device integration technology has several unique characteristics not found in other solutions. Therefore, many of the benefits that can be achieved using handheld communicators and device management software based on EDDL cannot be achieved by any other means. The EDDL technology meets the requirements of NAMUR NE 105

User Benefits

Technicians and operations people benefit from EDDL as it makes day to day device tasks such as calibration trim and maintenance easier. All these functions can now be carried out using a single handheld communicator and a single software application.

Makes Devices Easy to Use

Apart from enabling access to all devices from a single tool, EDDL has several additional benefits. EDDL is used in intelligent device management software to make information in different devices in the system easy to navigate just like HTML at the core of the World Wide Web makes information in web pages on different computers on the internet easy to access. EDDL makes information easy to navigate at a click of a button rather than through addresses, commands, and codes. A computer becomes a window into thousands of devices.

Complete functionality

EDDL improves device usability by giving technicians access to all data and functions in the device, including identification, general information, diagnostics, performance analysis, operational statistics, parameterization and ranging, simulation and override, calibration trim, monitoring, security, and reset. Performance analysis may include for example valve signature, hysteresis, step response etc. for a valve positioner. Parameterization may include advanced setup such as radar echo curve tuning.

Consistent look & feel

Because the user display is rendered by the software based on description from the device vendor, the EDDL file content, just like a web browser renders a web page, the look and feel becomes very similar even for different devices from different vendors. Individual quirks and idiosyncrasies are minimized making it easier to work with the multitude of devices in a plant. Software and handheld communicators based on EDDL are easier to use. Enhanced EDDL is a better device graphics solution than earlier technologies.

Figure 5 Handheld communicators can also show EDDL graphics

When EDDL is interpreted and rendered in a computer using the Windows operating system, the technician gets the exact same look & feel familiar from other Windows applications: command buttons, radio buttons, check boxes, text boxes, drop-down multiple choice lists and navigation trees etc. look exactly the way you are used to and working like you would expect. Similarly, in another operating system the EDDL is interpreted and rendered with visual elements familiar to that GUI. EDDL does not explicitly define how visual elements should look, rather it contains "markup" for the appearance just like XML or HTML web pages, which are then rendered accordingly just like a web browser.

Logical and Helpful

EDDL allows the device manufacturer to organize information in the form of parameters, status indicators, and menus logically according to their functionality making the device intuitive to use. Parameters are displayed with human readable labels and engineering units. Unused factory parameters are not described with EDDL and are not displayed.

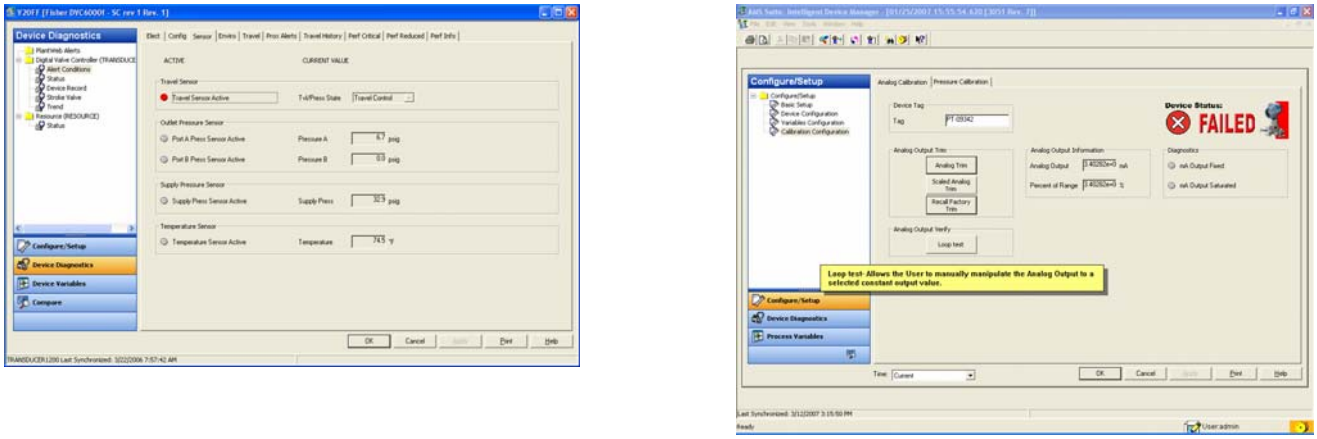


Figure 6 Organized parameters

Help text and descriptions explaining the parameters and multiple choice options is included in the EDDL by the device vendor. By providing helpful text the vendor makes their device easy to use.

Intuitive graphics

Moreover, handheld communicators and software based on EDDL also support powerful visual capabilities such as displaying diagnostics, performance results, and advanced setup in the form of charts, graphs, and table grids together with images etc. in an intuitive way.

Historical trend data can be displayed as strip chart that the device vendor includes in the display for the device.

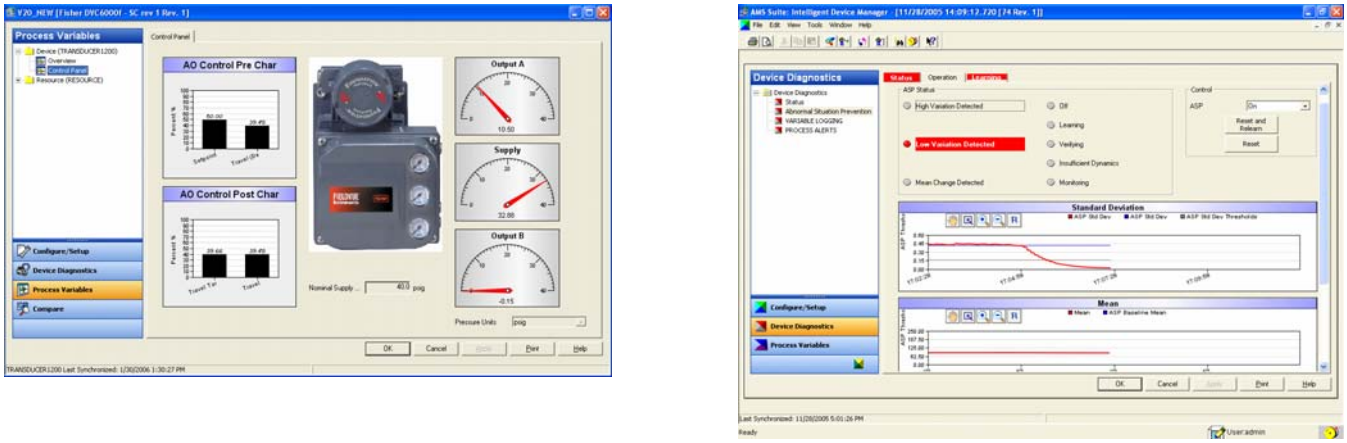


Figure 7 Charts and dials

The device vendor can include visual representation of values in the form of vertical or horizontal bar-graphs as or as a needle gauge.

The device manufacturer can include images such as photos or illustrations representing the product or application. This may include for example different tank geometries, dimensions and orientations. Different mounting positions and wiring terminals may be illustrated. Alarm trip points, logic, ramping, and timing diagrams can be depicted as well as hardware and software block diagrams.

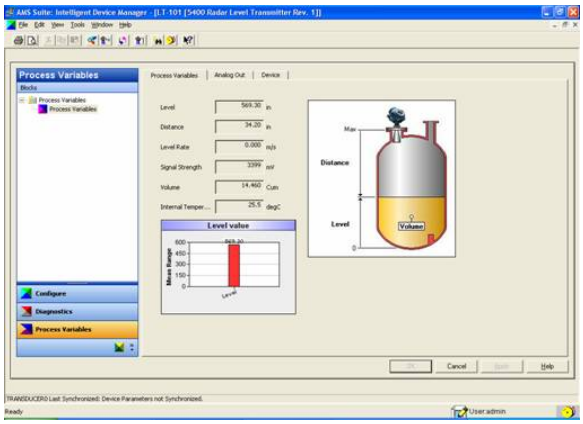


Figure 8 Images illustrate the device

Large data sets from the device can be displayed in a table. This may include tank strapping tables or a list of false echoes for radar level transmitters.

Multilingual

Most text presented from EDDL references a multi-language dictionary and text in the EDDL may also be multilingual. Therefore, messages to the technicians can be displayed in one of many languages making many devices easy to use also for non-English speakers.

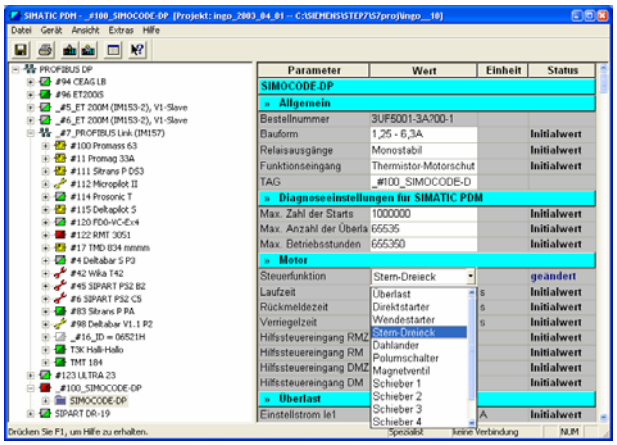


Figure 9 EDDL supports multiple languages

Portable Tools

It is possible to diagnose device problems from a central location, but eventually it is necessary to service in the field. For this reason a roving communicator that can be held with one hand while the technician operates it with the other will always be necessary in the plant.

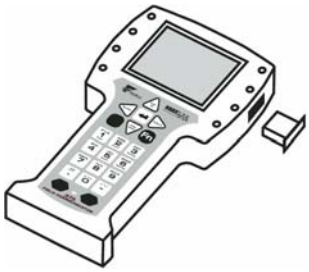


Figure 10 Handheld communicator

A handheld communicator is ideal in the field for transmitter "in-situ" calibration for example for mounting position or with applied reference input, to see valve stroking fully, wet leg cancellation, see obstacles inside tank vs. echo curve from radar. Many older systems have no device management software or multiplexer infrastructure and therefore need a one-on-one tool. A handheld communicator may be rugged and intrinsically safe and can be brought along anywhere the technician needs to go, ideal for device commissioning and substitution, and to perform calibration trim.

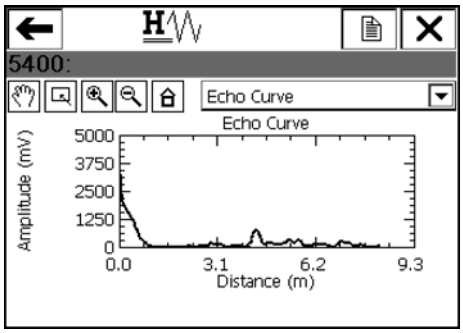


Figure 11 EDDL works for small monochrome screen as well

For verification and service work that cannot be done from the central control room, in places where laptops cannot go or are awkward to handle, technicians use EDDL-based handheld communicators that are rugged, splash proof, intrinsically safe, and meet the other demands for field use.

Figure 12 Portable tools are required for field work

Optionally a handheld communicator may also support a more visual display using the sophisticated graphics of EDDL. This provides an easy way to view radar echo curves, trends, and images in the field.

Figure 13 Diagnostics

Owner Benefits

EDDL tools are easy to use and therefore tasks such as commissioning can be finished faster and at lower cost getting the plant producing sooner. A key value of intelligent devices is information. Bus technologies transport this information, and EDDL makes sure it is presented as the device manufacturer intended. EDDL-based tools make it possible to put this information to good use and together they can be used to meet corporate objectives such as increased plant Overall Equipment Effectiveness (OEE) through increased availability, throughput, and quality. Moreover, cost of operation and maintenance can be reduced along with lower energy consumption, reduced waste and rework, and simplified compliance with safety, health, and environment regulations.

Project Savings

EDDL provides interoperability between devices and tools such as handheld communicators and intelligent device management software. EDDL reduces the risk of incompatibility between devices, system, and computers. EDDL is integral to the product.

Moreover, EDDL requires no costly or time consuming management of licenses

Also thanks to EDDL interoperability, a wide selection of tools and devices is available and the best combination of price and performance for devices and software can be selected for the best results.

Ultimately, due to the ease of use in both control room and the field, the tools based on EDDL enable faster device commissioning and loop checkout allowing an earlier startup of the plant. Other solutions do not work in the field, where work will ultimately always have to be done.

Operations & Maintenance Improvement

Similarly, EDDL allows software to make it easy to access data in devices to spot minor device problems and correct them before process variability, poor quality, waste, and rework ensues. Calibration trim and servo tuning is very interactive and easy using EDDL based tools. Subsequently, setpoints can be moved closer to what is optimal thereby improving throughput as well.

Likewise, EDDL allows software tools to make it easy for technicians to pinpoint device faults and to repair and restart quickly for great availability. Only EDDL preserves the semantics of the data in the devices and make it available to higher level systems, e.g. through OPC, thus enabling it to be propagated to CMMS and ERP systems for predictive maintenance for further increase in availability by reducing unplanned trips and reduction of cost associated with unnecessary preventive maintenance. This is not possible by other means.

Architecture

It would not be possible to efficiently manage the devices throughout the plant if each protocol and device type required different software. All data from all device types must be integrated into the same software. EDDL is used to interpret and display data from any device. The EDDL enable all the device information to be displayed. It is possible to identify the device, review the information and operational statistics, check its health and analyze performance, calibrate and set new range, parameterize, perform simulation and test, monitor, and upgrade etc.

Complete Life Cycle Solution

Because the EDDL is used in everything from handheld communicators to intelligent device management software as part of asset management packages, EDDL simplifies every part of day-to-day operation of a plant throughout its lifecycle. EDDL is the only device integration technology required throughout the life cycle:

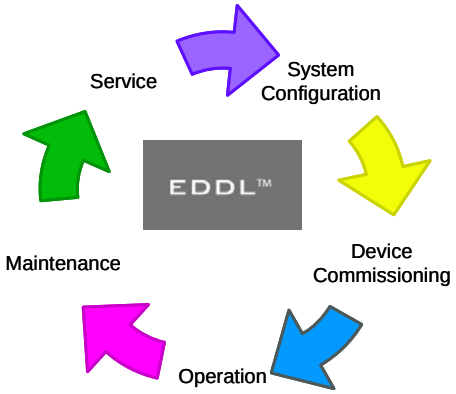


Figure 14 EDDL covers all aspects of the device live cycle

System Configuration

EDDL is used in tools with simple list-based display such as the system engineering console to build function block control strategies. The EDDL declares the linkable inputs and outputs as well as contained parameters of the function blocks. EDDL enables blocks to be selected, linked, and parameterized.

Device Configuration

Complete device configuration and setup including remote range setting is supported in software and portables based on EDDL.

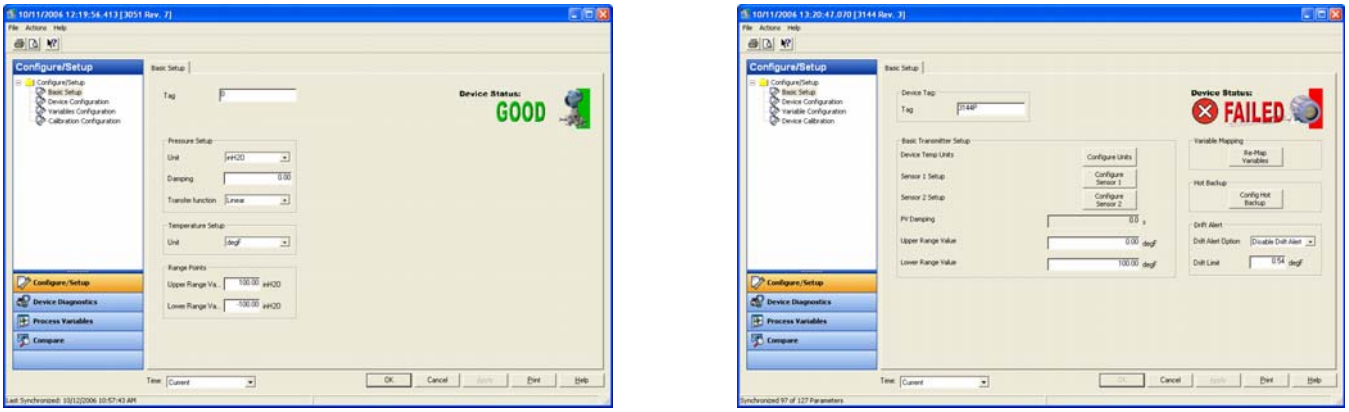


Figure 15 Configuration and setup

Device Commissioning

Using a handheld communicator based on EDDL it is possible to commission a device in the field before returning to the control room without the assistance from other persons in the control room.

Figure 16 Figure 10 Use handheld communicator for work in the field

After a device is installed, the range can easily be adjusted in the field to correct for wet leg etc. using a handheld communicator based on EDDL without the need to radio the control room.

Operation

Process variables and all other relevant internal variables are displayed dynamically in numerical or visual form as designed by the device vendor to make work as easy as possible and to allow users to take advantage of all device features.

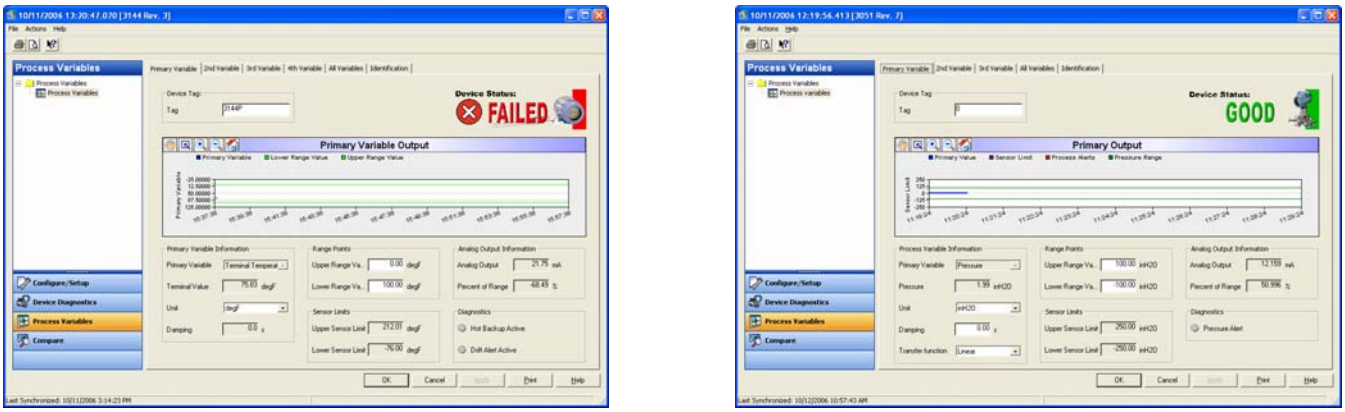


Figure 17 Process variable monitoring

Maintenance

In a device management tool, diagnostics for predictive maintenance, operational statistics, and performance analysis results are presented using EDDL based tools. The information is presented using values organized by the device vendor and may be presented as values, text, gauges, bar-graphs, plots, text, status indicators, and images etc. making work for technicians much easier.

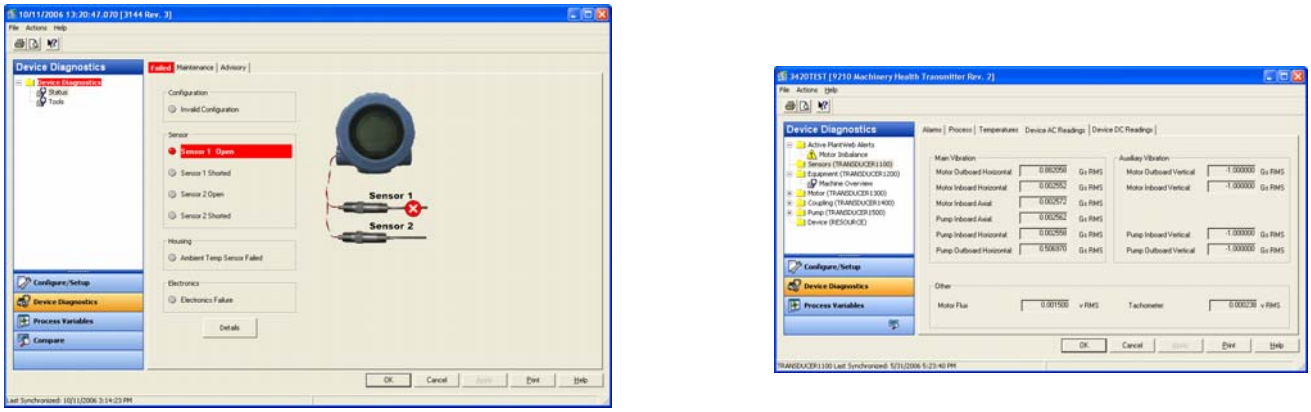


Figure 18 Diagnostics and troubleshooting

Using a handheld communicator based on EDDL it is possible to work in the field as well, while observing actual device behavior such as valve movement and turning transmitter manifold valves.

Transmitter calibration trim, not to be confused with remote range setting, by definition requires an input to be applied. This may be done in the workshop or in the field. EDDL method scripts coach the technician through the procedure step-by-step. Even if calibration trim has been done in the workshop, minor adjustment for mounting position may be required in the field. For these tasks a handheld communicator is the ideal tool, and this is not a problem since handheld communicators support EDDL.

Figure 19 Calibration

Similarly, when stroking a valve positioner you may want to watch the valve actually move the full travel to make sure it is not mechanically obstructed or misaligned. Bringing an EDDL-based handheld communicator to the field this becomes easy.

Single Universal Solution

Just like XML and HTML web pages, EDDL technology is operating system independent. It works with different generations of Windows, Windows CE, Linux, Palm or any other. It works with different microprocessors and there is no minimum screen size, color or monochrome. Therefore EDDL is the single universal technology solution for handheld communicators, configuration software, and intelligent device management software part of asset management packages, and even inside embedded devices. EDDL eliminates the need for additional solutions. Different applications use EDDL in different ways. Intelligent device management software may use all features of EDDL for performance

analysis, operator process visualization software may use EDDL only to display the process variables, and a configuration tool may use EDDL to build a function block control strategy. These diverse tasks may not always be performed by the same person or using the same tool.

Intelligent Device Management Software

Device management software includes device configuration capabilities based on EDD services.

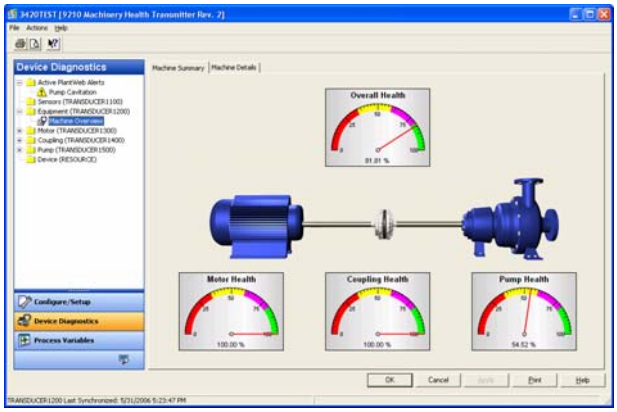


Figure 20 Device management software

Control System Configuration

The DCS engineering console includes device configuration capabilities based on EDD services

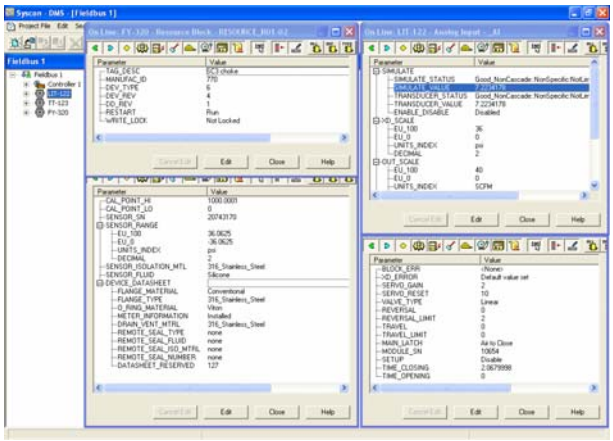


Figure 21 Control system configuration software

Handheld Communicator

EDDL is supported in handheld communicators using different embedded operating systems. The handheld communicator includes device configuration capabilities based on EDD services.

Embedded Devices

A HTTP web server embedded in an interface device loaded with EDDL files enables configuration of the underlying devices from a regular web browser. No special tool is required.

Figure 22 EDDL can be used by embedded devices

The device includes device configuration capabilities based on EDD services.

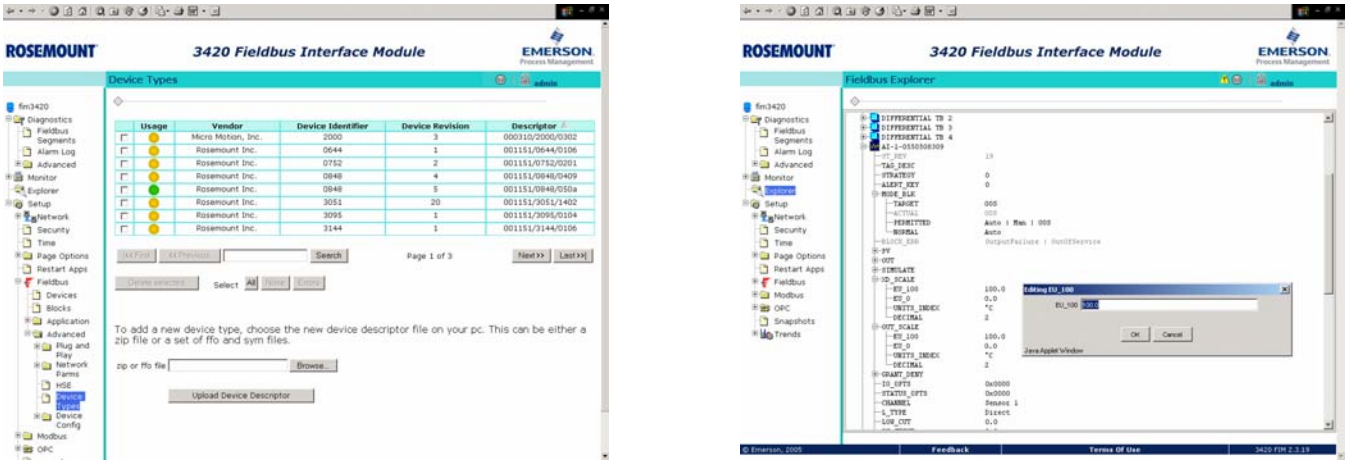


Figure 23 EDDL used in embedded web server

Web Enabling

Just like state-of-the-art web page "markup" languages such as HTML and XML, as well as SGML before it, EDDL is web friendly because the file is a host platform independent document and it does not involve remote procedure calls between computers or across the Internet and therefore also more secure. EDDL is a state-of-the-art technology, for the Internet age.

Easy Integration and Removal

When a new version of a device becomes available, an additional file is created for it by the manufacturer. Each version of each device type from every vendor has its own dedicated EDDL file. The addition of a new device or version simply means the addition of a file without removing or overwriting existing files. Thus a new version does not conflict with an old. EDDL as applied to HART, FOUNDATION fieldbus, and PROFIBUS etc. protocols and to different device types from different manufacturers are managed in the same basic way, files are downloaded, copied or delete as required just like a document. EDDL is a markup language similar to an XML, HTML web page, or SGML document. EDDL is not like the driver software used for printers in the Windows operating system. A computer uses only one or two types of printers while device management software must during its life time often work with many dozens or even hundreds of device types and versions. EDDL provides a very scalable solution with a rigorous version management scheme supporting the constant addition of new versions.

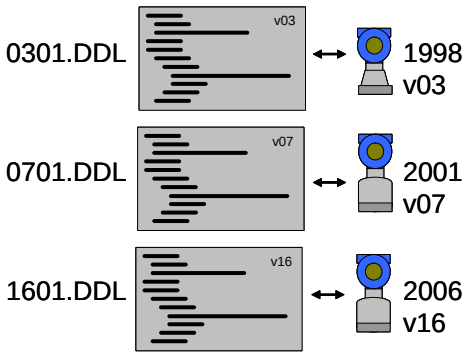


Figure 24 Each version of the device has a corresponding EDDL file

Because new EDDL is a declarative technology, not a program, adding support for a new devices is as easy as copying a file. There is no need to uninstall old program components or to install new program components. No registry entries are made and therefore no special privileges are required. There are no shared DLLs software components distributed and thus version incompatibilities and conflicts are avoided. There will be no problems due to components refusing to uninstall. This is important since computers are today "locked down" for cyber security reasons to a degree they were not only a few years ago. Today technicians cannot walk up to a computer and install software. EDDL makes version management easier.

Add

When EDDL-based software is purchased it is typically already loaded with EDD files for hundreds of devices from dozens of suppliers. EDDL is a very "thin" solution. No device-specific programs need to be installed on each and every client computer. This drastically reduces time to manage the system. As new versions of devices become available every year, and since a plant can have a hundred different device types, adding support for new device types or new versions of these devices to a handheld communicator or software using EDDL is easy, simply copy and paste the EDDL files - often just once on a single central server rather than on multiple machines. Unlike software solutions, there is no need for software component installation, uninstall, or in some cases reboot and no trouble with registry and other access rights. EDDL files are small and therefore very quick to download from the Internet. Updates and additions are therefore easily

done during operation, without disturbing the device management software or other applications running on the same machine. Therefore, device management software based on EDDL technology is easier to maintain over the long term.

Control systems in process plants stay operational as long as 15 years or more. During this life-cycle new versions of devices will become available. Taking all manufacturers, models, and versions into account the required library can grow into hundreds of devices. Including new device types or versions is a matter of copying the EDDL files which have very manageable sizes. Every version has a different file name, and is stored in hierarchical folders and subfolders for each manufacturer and device type, to prevent mix-up. Many files are easily copied, moved, and managed. EDDL files can be downloaded from the manufacturer's web site. Because EDDL files are small, it is technically possible to store them in the device itself, and uploading the file it case it is missing from the configuration tool.

Remove

There is no need to remove old revisions of EDDL, those files remain in place as they do no harm and do not prevent newer versions from being loaded, or optionally simply delete at a click of a button. Since EDDL is a document, not software, there is no problems with programs that will not uninstall and new programs that will not install or register because the old version did not uninstall completely. This is particularly important since scores of vendors are supported in state-of-the-art systems and tools. Thanks to a good versioning system, new and improved EDDL files for existing devices can easily be added just like EDDL for new devices. Thus EDDL ensures robustness of multi-vendor environment.

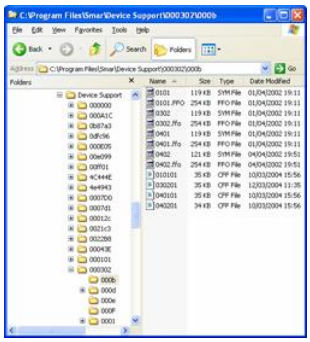


Figure 25 One EDDL file for each version of the device avoids conflicts

Long-Term Viability and Investment Protection

Control systems and device management software remain in service for 15 years or more. During this time they cannot become obsolete requiring replacement or unnecessary effort to due to software conflicts. EDDL eliminates the need for constant upgrades yet does not hamper technology advancement.

An EDDL file need not be upgraded because it is a document, like a web page, not software. It is not affected by operating system or software upgrades. The same EDDL files used in one application today can be used in new applications in the future even if the software, computer operating system, and CPU changes.

EDDL eliminates the problem of cascading software and hardware incompatibilities where a new device version requires a new driver version, and in turn the new driver requires new operating system version, and subsequently the new operating system requires new software version. That is, buying a new device does not mean replacing the entire system.

Cross-platform Compatibility

Software and handheld communicators today work with EDDL files for device introduced yesterday and tomorrow, backward and forward compatibility. An EDDL file need not be changed because the operating system changes. This provides peace of mind for operating system upgrades and patches.

- The EDDL files for a new field device works on existing operating systems, there is no need for system upgrade
- The EDDL files for existing field devices work on new operating systems, there is no need to obtain new EDDL
- The EDDL files for existing field devices work on new software and handheld communicators, there is no need to obtain new EDDL

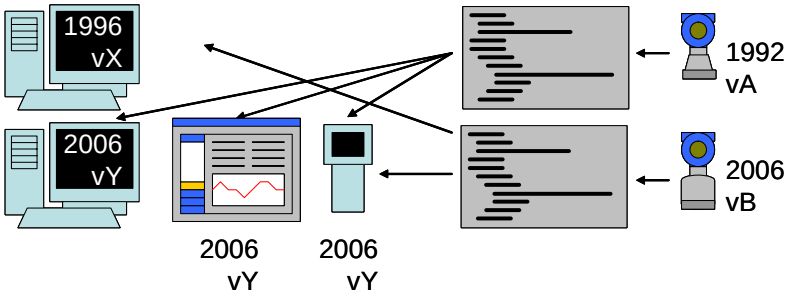


Figure 26 Old EDDL files work with new versions of the operating system

New devices and EDD are compatible with EDDL tools several years old, DD since 1992 continues to work on handheld communicators and software today. Existing EDDL tools will work with future devices and their EDD, just like you can see old and new web pages. Devices that don't even exist yet can be added to the software years into the future simply by copying the EDDL files. This is important since firmware download makes it easy to upgrade devices in the field, and EDDL makes it easy to keep software and tools current. Present and future field devices can be integrated in the existing software or handheld communicator.

Since EDDL is independent of operating system, it is not affected by changes in operating system versions. This means software and operating system changes does not render old EDDL incompatible. As an analogy, it is possible to upgrade the operating system, and upgrade the browser, without concerns of being able to view web pages.

No Version Conflicts

Similarly, an EDDL file need not be changed because the software changes. This also provides peace of mind for software upgrades.

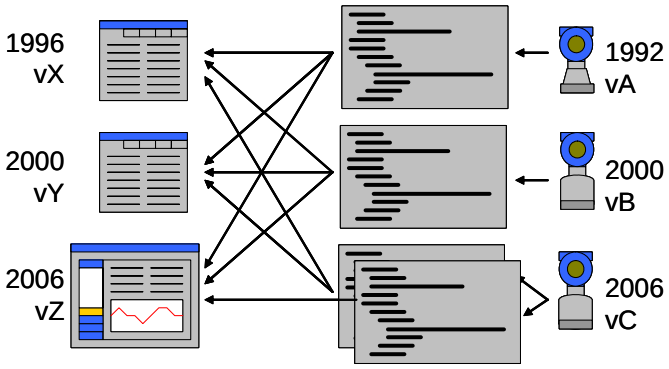


Figure 27 Backwards and forward compatibility of devices and software

- New software and handhelds works with EDDL files for existing devices
- EDDL files for new devices works with existing software and handhelds
- As the EDDL technology develops, old and new EDDL files can be provided. This happened with enhanced EDDL in 2006.

Consistent Display of Devices

EDDL supports simple as well as sophisticated devices using different protocols including ensuring that devices using different protocols not only appears within the same software framework, but also appear and work in the same basic way.

EDDL is like a web page, it is only a description. The display is rendered by the interpreter. Therefore, for EDDL the look and feel (style) comes from the control system or device manager, only the content comes from the device manufacturer. Therefore the look and feel of the control system or device management software is preserved also when working on devices from other vendors. Menus and buttons etc. work as expected. Status indicators appear with consistent icons and color schemes etc. across all devices, for example according to NAMUR NE 107. Look and feel does not change for every vendor. Unlike software programs, EDDL makes no assumption how data will be rendered, or printed, in the software: no color, no font, no display size, and no screen resolution etc. are defined in the EDDL itself - just like XML and HTML web pages. EDD is only a description; EDDL keywords are interpreted and rendered or printed according to an application software internal style just like a web browser renders a web page. The look and feel (style) comes from the system, the content comes from the device manufacturer. Controls such as frames, text and check boxes, drop down lists, and grids (matrix of data) for every device type thus get rendered or printed the same way and are used the same way. Similarly, the way in which newly entered values are applied and sent to the device is also the same. For example after changing a parameter value, the steps to get it sent to the device is the same for all devices. The feel for any device type is thus controlled in the software which ultimately controls how the device appears to the technician. This ensures look & feel consistency not possible with software programs as the technician uses the software to move attention from one device type to another, and also consistency with the rest of the asset management package or control system since

the software renders device displays with the same feel as for other applications. Along with the EDDL interpreter built into the software comes a standard dictionary of shared message strings referenced by device developers that ensures uniform manufacturer independent terminology for parameter names, enumerated and bit enumerated parameter options, labels, help, manufacturer names, block names, descriptions, and units etc. This library can be made available in different languages permitting the technician to interact with the device in their native language even though the EDDL was developed in a language neutral editor.

Although one manufacturer's application is different from another, various device types appear consistent within each application. For example, a handheld communicator with a small monochrome screen can obviously not render as rich display as a large full color workstation monitor.

Using EDDL all the menus and parameters appear as intended by the manufacturer. The device manufacturer may use EDDL to display data continuously collected online as a gage (dial), horizontal or vertical bar graph, as a strip chart trend, or various other formats. However, the exact rendition on the display is controlled by the software. Similarly, the manufacturer may enable retrieval and display of a complex data set (for example waveform) retrieved from storage in a device such as a radar echo curve or valve signature.

A style guide IEC 61804-4 is currently going through the international standardization process

Robust

EDDL is a declarative technology that provides a higher level of robustness by design due to its very loosely coupled architecture. There are no program components with procedure calls that could fail. In case of the unlikely event of a fault in the EDDL file, the interpreting application will not fail because the EDDL is simply a document, it doesn't run as an executable program. That is, EDDL has no influence on runtime stability. This compares favorably against executable programs, where in the event of a fault in the software component for one device type, the entire application may crash. EDDL methods are interpreted in a "sandbox" environment and access is limited to data for the current tag. No access is granted to the file system, memory space, operating system, or networking etc.

No Licensing

Because EDDL is a document, not a software program, it does not need a license or key to be used. This means that when replacing a device no additional time or cost is accrued to manage and activate license.

Testing

The device developers write device descriptions using EDDL development toolkit that includes a checker and translator that will first capture mistakes in the device description itself. Second, the device description is tested against the actual device as part of the rigorous communication protocol interoperability testing and registration of the device.

Full Support of Device Functionality

EDDL is written by the device vendor because only the device vendor is familiar with the unique features of the device and is therefore best qualified to develop the description to extract the data and presenting it in a meaningful way. That is, the content of the display in the software or communicator is determined by the field device supplier. The device vendor embeds their expertise in the form of visual presentation and interactive methods to compute results and coach users step by step through complex procedures.

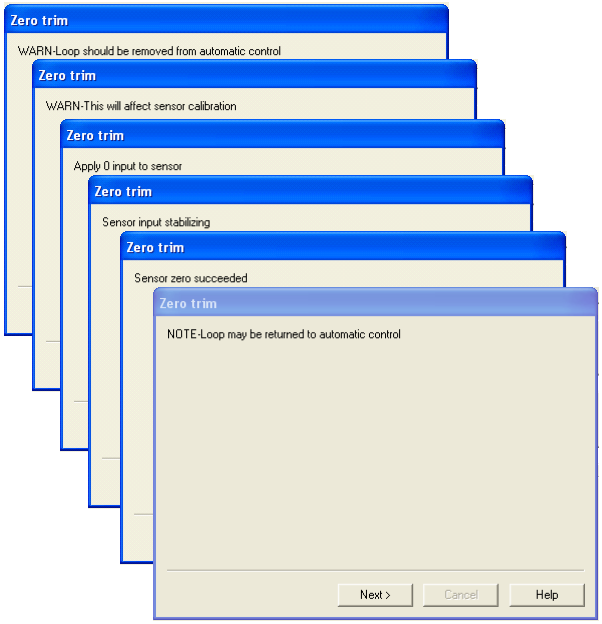


Figure 28 Interactive methods take technicians through procedures step-by-step

Access is given to all information and all features in device, and displays as intended by the device manufacturer. No configuration is required by the system integrator to create displays. In depth device analysis and calculations such as tank geometry is tailored by the device vendor who creates visual presentation for advanced device management. The device vendor can use EDDL to create a rich visual display capable of displaying anything that has to be shown to the user: images, charts, and grids. The possibilities are endless.

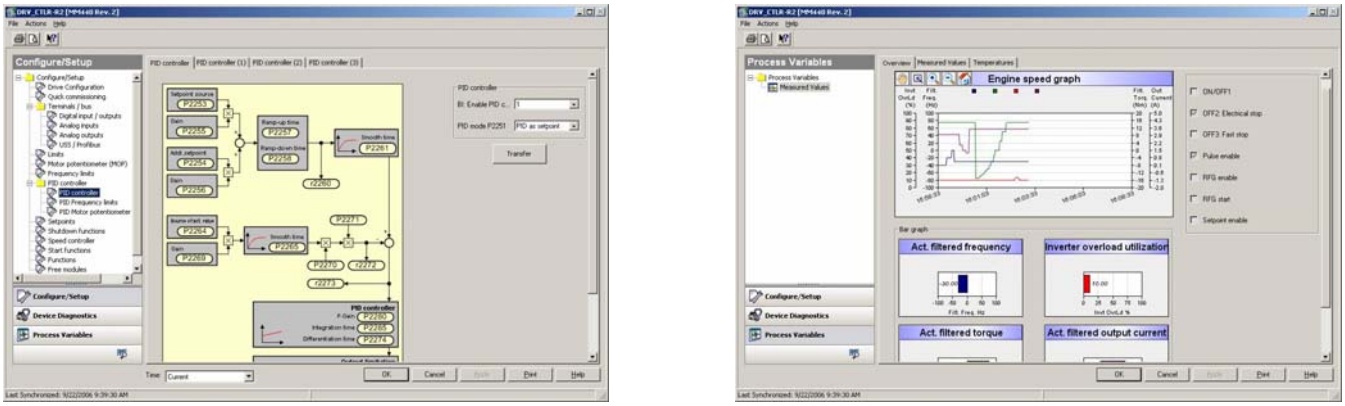


Figure 29 EDDL user interface for variable speed drive

EDDL exists in the software or handheld communicator, not in the device itself. It has no impact on the device and therefore EDDL can be developed for existing devices that either have the older DD without visual elements or no EDDL at all. The device vendor uses the mathematical and logical functions of the interactive EDDL methods to perform data analysis not already done by the device itself.

EDDL enables persistent storage for data sets on the host computer. This enables for example comparison of an new valve signature against an earlier collected signature stored on the system.

Standard

EDDL technology is defined in the international standard IEC 61804-3 and EN 50391 European standard and included in specifications for HART, FOUNDATION fieldbus, and PROFIBUS protocols as well as OPC-UA but can conceivably be applied to any other bus technology as well. Support in the USA is provided by the ANSI/ISA SP104 committee. EDDL also meets the requirements of the NAMUR NE 105 specifications for device integration.

Figure 30 EDDL is an international standard

Profiles

EDDL supports the device profiles defined by HART Communication Foundation, Fieldbus Foundation and PROFIBUS International etc. That is, generic EDDL for different device types such as pressure and temperature transmitters as well as for standard function blocks can be written and be used as a template for devices belonging to that profile. This enhances the “common look and feel” across devices from different vendors.

HART is based on commands to transfer data so EDDL contain keywords to describe which parameter. FOUNDATION fieldbus uses block, index, and sub-index to transfer data so EDDL contain keywords to describe which parameter goes were. Profibus uses slot and index to transfer data so EDDL contains keywords to describe which parameter goes were. OPC-UA uses identifier to transfer data and so on.

Style Guide

IEC 61804-4 is an emerging international standard to ensure commonality in the menu arrangement among devices from different vendors and to ensure commonality in the way which the user interface is rendered by different software. For example, parameters and other information will be organized and rendered in menus, windows, dialog boxes, tables, pages, groups, variables, methods, edit displays, graphs, charts, images, static text, and separators in a similar way for a common look and feel.

Security

EDDL is a document, not an executable program. EDDL provides all the functionality a device developer needs to expose the full set of device features and to build-in the know-how to make it easy to use, but no more. Functions like disk format

or registry changes are not available. Interactive EDDL methods are scripts interpreted by the software running in a "sandbox", they are not executable applications.

A plant typically has more than a hundred different device types from dozens different manufacturers. Device support files are usually downloaded or copied from different locations into the control system when new devices are commissioned. Therefore security associated with the files is very important.

Unlike software driver, EDDL does not include code that accesses operating system or database functions directly and subsequently is unable to maliciously tamper with files, registry, or other applications. When EDDL is loaded on the computer it does not install EXE or DLL files or modify the Windows registry. Using EDDL is therefore secure. Therefore EDDL can be distributed over the Internet and on disks. Electronic Device Description files can be downloaded from the manufacturer's web site.

External Information Access

EDDL is fundamentally different from software that present data on a computer screen. EDDL declares all the attributes of variables and datasets in the device including how the device manufacturer would like it to be displayed. Applications can therefore use EDDL to present data on the computer screen, but can also do so much more with it. Complex datasets are declared as records and arrays for storage and use by many different applications in a uniform manner.

For example, intelligent device management software based on EDDL can provide device parameters as items in an OPC-DA server together with several attributes such as range and unit etc. Special support for audit trail, database reconciliation, offline parameterization, save, or printing etc. does not have to be coded into the EDDL. As long as the device management software supports the respective function it becomes available for any device.

Just like XML and HTML web pages, EDDL technology works best in synergy with other technologies. For example, because EDDL describes data it is also used to automatically configure OPC servers, including creating the namespace and data attributes. That is, the data is not trapped in the software, in parallel it can be provided to other applications.

With EDDL, data format and semantics are readily available for onward process. OPC-UA servers make use of EDDL to provide attributes such as labels, help text, range and limits, unit, display format, validity, default value, and handling etc. for the information in devices enabling display and plausibility checks on data entry. OPC-UA with EDDL decodes information for other applications.

All object structures, data types, parameter names, and menu names for the device even at the lowest level are preserved all the way up to the client software at the operator, MES, or ERP level.

Audit Trail

No special coding has to be done in EDDL to support audit trail of parameter changes. If an EDDL application supports audit trail, it will do so with any device for which EDDL is provided. This compares favorably against software solutions where an audit trail interface may or may not be available for a given device.

Implementation

It is not necessary to understand how EDDL works in order to enjoy the benefits. However, understanding the technology may be helpful when choosing EDDL over inferior technology. EDDL is a structured textual declaration similar to an XML, HTML web page, or SGML document. EDDL is not like the printer driver concept in the Windows operating system.

The purpose of EDDL is decoupling the device developers from the software developers. Device developers need not worry about configuration tools, and software developers need not worry about each individual device type.

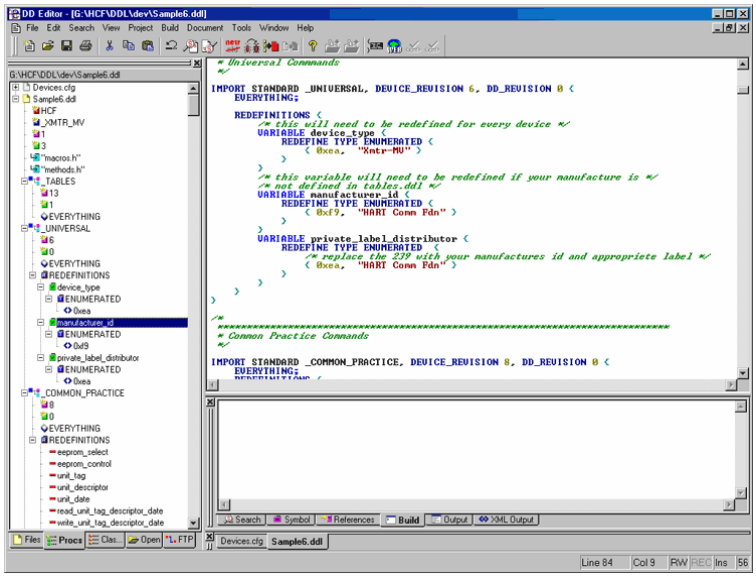


Figure 31 Tool to simplify EDDL development

EDDL can theoretically be used with any protocol. EDDL declares device parameters and their dependencies, visual representations, user interactions, and how system accesses information etc. EDDL hides complex logic and decisions such as Bayesian networks and conditionals using method scripts

Semantics described through EDDL automatically make cryptic codes and complex data structures human readable. Different menu hierarchies can be defined, one for large-screen computer software and another for small display handheld communicator included in the same DD

EDDL

EDDL is a precise declaration of data available in the device, how to communicate it and how to display it; it is not device driver software. The declaration is based on keywords similar to XML or HTML web page tags and includes data type, label, and help text in many languages, classification, unit, range, and other aspects. EDDL also includes interactive methods, which are scripts based on a subset of ANSI C to guide the technician through steps requiring interaction.

An EDDL file contains the following information about the parameters of a device:

- Attributes like coding, name, engineering unit, write protection, how to display etc.
- The arrangement of the parameters in a menu structure, names of menus and submenus.
- Information about the relation of parameters to others.
- Information about help texts and help procedures.
- Information about necessary operating interactions (e.g. calibration), also called methods.
- Information about visualization tools (i.e.: charts and graphs)

Each version of the device has one file that only deals with that version. There is no need to incorporate more and more functionality within one file to cover exception and conditions for every new version of the device with the consequence of reduced robustness and increasing effort for development, test and maintenance.

The Electronic Device Description file is distributed in either text or binary format depending on what the chosen software or tool requires.

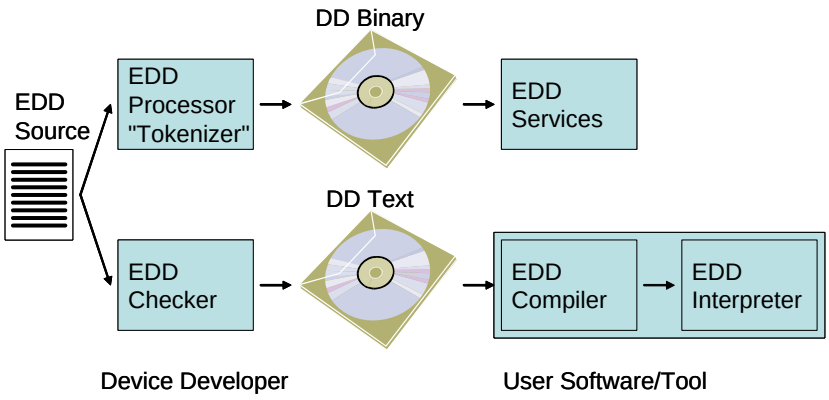


Figure 32 EDDL can be used in text form or compressed form

Text EDD

Text EDDL is verified using a checker tool before it is distributed for use.

Binary EDD

Binary EDDL is processed ("tokenized") to a compressed binary to prevent tampering and subsequent problems. The compilation process also includes checking of EDDL syntax etc. The tokenized files are relatively small and therefore files for many types and versions of devices can be stored also in the limited flash memory of a handheld communicator or in the device itself from where it can be uploaded by the software.

Display Rendering & Communication

EDDL is not software and therefore imposes no restrictions on software architecture. EDDL is suitable for use with software having client-server architecture. EDDL is used by both client-type, such as device management stations, and server-type, such as OPC server, programs. Client applications and server applications may use different aspects of EDDL. The client application may use the graphics description, the data type descriptions, methods to simplify maintenance, and the logic related to parameter dependencies. Server applications may use the data type descriptions and the command descriptions and other information related to communication. That is, data communication and monitoring of underlying devices may continue even if the user interface display is closed. EDDL is also suitable for use with software having Service oriented Architecture (SOA)

EDDL applications render the display based on EDDL keywords and interactive method scripts - just like a web browser renders a display from an HTML web page or like a reader.

EDDI

Text-based EDD are interpreted by EDDI (Electronic Device Description Interpreter) in the software whenever the data is used, to render the display or when it is printed, just like a web browser.

DD Services

Binary EDD are decoded by DD services, just like a reader for PDF files.

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2. IEC 61804-3, Edition 1.0 (2006-09), Function blocks (FB) for process control - Part 3: Electronic Device Description Language (EDDL)

3. NAMUR Recommendation, Version: 24.08.2004, NE 105, Specifications for Integrating Fieldbus Devices in Engineering Tools for Field Devices