

Why Electronic Device Description Language (EDDL) Technology is the Right Choice for Smart Plant Installations

This white paper is targeted to readers who are familiar with the device descriptor language (DDL) used for describing FOUNDATION™ fieldbus and HART® devices. This standard has been enhanced to EDDL to allow a richer, yet secure, exchange between users and intelligent field devices. You may have been exposed to FDT/DTM and alternative technology—this white paper is not intended to compare the two technologies, but instead is focused on the technical aspects and merits of EDDL.



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Introduction

When IEC 61804-2 Electronic Device Description Language (EDDL) was approved as an international standard in March 2004, the EDD source files created using EDDL were already deployed in millions of process industry field devices.

EDDL is a text-based language for describing the digital communication characteristics of intelligent field instrumentation and equipment parameters—device status, diagnostic data, and configuration details—in an operating system and human machine interface (HMI) neutral environment.

Initially developed in 1992 for use as part of the HART Communication Protocol (HART, www.hartcomm.org), EDDL-based technologies continue to evolve. EDDL is being enhanced to extend the concept of Interoperability to the HMI and diagnostic data.

Today EDDL technologies form the engineering and operating foundation on which all major digital fieldbus protocols—FOUNDATION, HART, and Profibus—construct parametric and device descriptions. And, because EDDL is an open technology with international standard status, it can be easily and effectively applied to any device and any fieldbus protocol.

The EDDL technology enables a host system manufacturer to create a single engineering environment that can support any device, from any supplier, using any communications protocol, without the need for custom software drivers for each device type.

Matching Needs

Technologies and standards appear and disappear all the time. Often, those who buy into the technology du jour have later been disappointed and incurred the unnecessary expense of replacing a “promising” (but unsupported) technology.

Today’s process industry users have become very cautious about buying “technology hype,” especially when faced with choosing a technology that must remain in place for a decade or more.

When discussing digital field automation technology architectures, users state their concerns a hundred different ways, but in the end, what users seek are assurances that the technology platform they choose provides:

- Freedom of choice in plant floor instrumentation and equipment independent of the host: valves, transmitters, motor starters, remote I/O, etc.,
- Consistency in how plant floor instrumentation and equipment are engineered,
- Flexibility and efficiency in how plant-floor data is shared throughout the enterprise,
- Ease of maintenance, and
- Quantified proof that adopting manufacturers have long-term commitments to expand and improve the underlying technology.

A seldom mentioned, yet extremely important, realization influencing a technology’s success is its dependence on other technologies. From a product manufacturer’s perspective, the less dependent a technology’s architecture is on underlying technologies, the better. Not only does such a design help manage risk, but it also frees up development resources to enhance and improve product features—something end users seek when evaluating similar products from different manufacturers.

Overall, the simple elegance, enhanced capabilities, and operating-system- and HMI-neutrality of EDDL technology equip it to provide solutions that address the engineering and operating questions, concerns, and needs of both end users and manufacturers.

Empowering Users

Frequently, marketing literature and sales presentations state that end users insist on a single engineering environment to manage, commission, and configure any field device, from any manufacturer, to any fieldbus protocol.

Similarly, the engineering environment is often the focus at industry and user group meetings in the form of a multi-part question: “During a process automation system (PAS)’s lifetime, what percentage of time will/did it take to:

- Develop the initial database and control logic?
- Perform software maintenance and upgrades?
- Make periodic engineering improvements and enhancements?”

Undoubtedly, engineering, configuring, and managing activities are important. Further, when those activities are compared to the amount of time operators use the system, experienced users also ask, “How consistent can we make our HMI systems so our operators can confidently and efficiently use them?”

Depending on the data source, it’s usually agreed that Operations personnel use the PAS 70-to-85 percent of the time, with other activities sharing the remaining 15-to-30 percent.

While engineering, installation, development, and improvement activities are fundamental, it’s equally important to understand how EDDL technology is being enhanced to meet the daily needs of operators and maintenance personnel.

Operator Information and Interaction

EDDL technology creates source files containing only content relevant to a specific manufacturer’s intelligent field instrument or device. This is an important aspect of the EDDL technology design philosophy that insists that EDD files remain OS- and HMI-neutral.

For manufacturers of intelligent field instrumentation and equipment, this philosophy eliminates the need to expend resources designing and writing software to support operator interfaces—specifying fonts, sizing windows, selecting colors, etc.—for different manufacturers’ HMI products and platforms.

For end users, EDDL’s neutrality philosophy ensures that operators are provided information with a look and feel that is consistent with other information being presented.

Some might argue that content is more important than consistency; this may be correct for operating information that users access several times an hour. However, EDD file content provides access to “normal” and “abnormal” operating information. EDD file content is about access to information contained in intelligent field devices and equipment, the sort of information viewed by operators during all sorts of process operations.

Because abnormal process operations occur infrequently—every few days, weeks, or months—presentation consistency does become important. For example, most of us have experienced the “use-it-or-lose-it” software phenomenon: the one where we revisit a software application we once knew well, only to find we’ve forgotten a lot of what we once knew.

That’s exactly what the EDDL design philosophy avoids. Most people would agree that, when faced with efficiently evaluating and acting on information, a familiar presentation format provides users with considerable confidence that they are making the correct decisions.

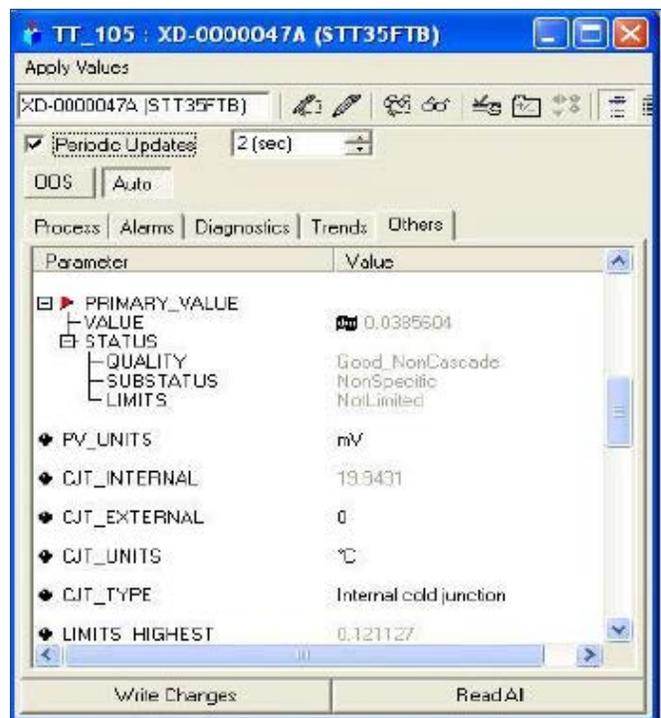


Figure 1 — Parameters in a temperature transmitter read directly from the EDD without any organization applied.

There’s no doubt that a technology for deploying digital field instrumentation or equipment should provide efficiencies in addressing the development of the initial database and logic, aid maintenance, and support enhancements. As previously noted, those functions are employed about 15-to-30 percent of the time.

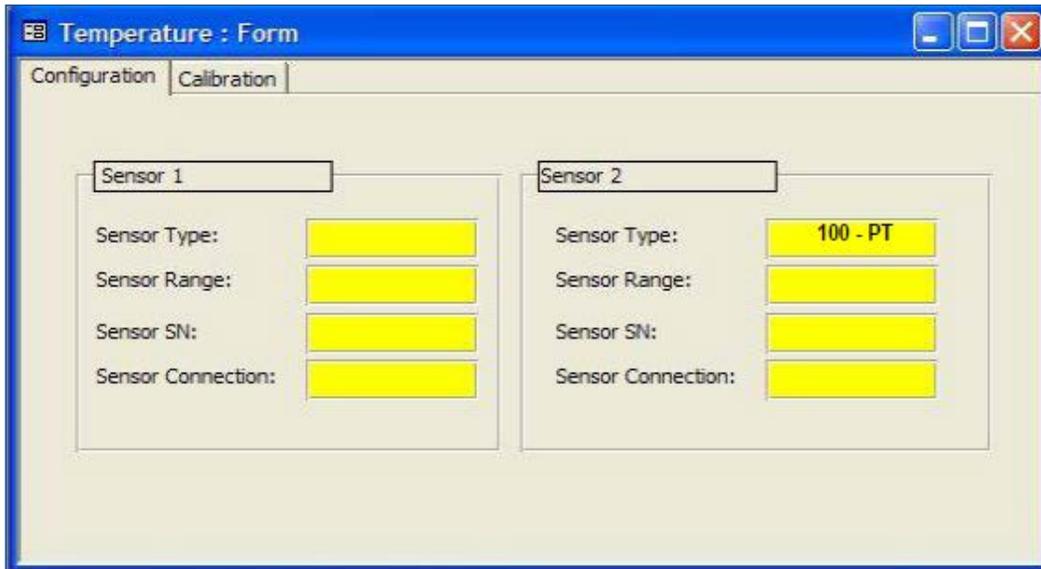


Figure 2 — Parameters in a temperature transmitter organized via the enhancements of EDDL and the look and feel of the HMI.

Most of the time, the efficiency and effectiveness of the technology are being “realized” by process operators and maintenance technician; therefore, the technology must do its work in a way that makes these individuals comfortable.

Consider a FOUNDATION fieldbus-based temperature transmitter as an example. Figure 1 shows the parameters as they would appear on an HMI, if read directly from the EDD without any parametric organization applied. Figure 2 shows how those same parameters could be organized on the HMI by using the EDDL enhancements. In this case, the host system supplier has chosen to use dialog boxes with identifying tabs.

Figure 3 shows an alternate display organization of the parameters using the exact same EDD. In this case, an explorer view of the temperature transmitter contents is shown. With the enhancements to EDDL, the host system supplier is provided the flexibility to organize the parameters of a field device in the manner optimal for the field device, but consistent with the look and feel of the host system’s HMI.

EDDL technology is designed to address engineering, startup and daily operations requirements, with special emphasis on ensuring that operators and maintenance technicians are comfortable using the technology to make critical operational decisions.

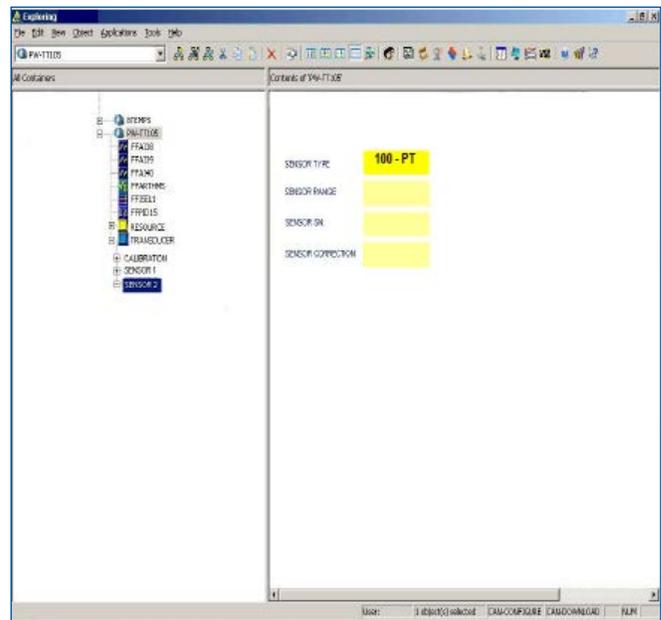


Figure 3 — Same EDD as Figure 2; different look and feel as determined by the HMI.

Addressing Engineering Requirements

EDDL technology addresses the engineering requirements of end users and intelligent field device and equipment manufacturers. Though their reasons differ, the engineering requirements of both groups are similar, each seeking solutions that:

- Ensure operating system independence
- Support multiple fieldbus protocols
- Avoid special, proprietary, or executable files* for different host system platforms
- Supports multiple country codes and international languages
- Use standardized testing and validation procedures and tools
- Allow efficient configuration entry
- Use a robust, consistent, easy-to-identify revision control methodology
- Include third-party testing and registration
- Ensures that .exe files (or .dll's) do not interface with one another

Besides meeting all of these engineering requirements, EDDL technology also has international standards status as IEC 61804-2.

The EDDL design philosophy provides end users and intelligent field device product manufacturers a consistent and rich engineering environment.

Maintenance and Upgrades

When control and automation systems adopted “open system” technologies, software maintenance, with mandatory and voluntary software upgrades, increased dramatically. Today it’s not uncommon to install mandatory software upgrades and/or OS security patches two or more times a month. However, EDDL neutrality to OS and HMI technologies eliminates the need for end users to worry about what happens to EDD files as a result of software upgrades.

Everyone who’s upgraded a computer from Microsoft Windows 98 to Windows 2000 and later to Windows XP appreciates the complexities of relinking applications, reloading device drivers, reestablishing network communications, and dealing with incompatible executable files. EDDL technology does not install or create any executable files in the HMI host application; therefore, EDDL-based technologies eliminate the need to relink applications or communications, and incompatible EDD files simply don’t exist.

One feature PC users have come to appreciate is the “plug-and-play” technology known as universal serial bus (USB). From a user’s perspective, USB appears quite simple and, regardless of the device manufacturer or device type that’s been plugged in, what appears on the user’s screen is consistent for Windows users and different, yet consistent, for Macintosh users. Behind the scenes, USB shares a number of similarities with EDDL technology. Both use device-description files and both make use of device-descriptor services embedded in the host platform that is designed to provide users with a consistent information presentation format.

**Potential for carrying viruses is great.*

Similar to the efforts that produced USB, representatives of Fieldbus Foundation (FF) www.fieldbus.org, HART Communication Foundation (HCF) www.hartcomm.org, and Profibus Nutzerorganisation e.V. (PNO) www.profibus.com met in February 2003 to extend the capabilities of the IEC 61804-2, Electronic Device Description Language standard.

Among EDDL extensions are: improved device data organization, graphical visualization consistency, and support for persistent data storage.

From a system administrator's perspective, the simplicity, longevity, robustness, and OS and HMI platform neutrality of field devices conforming to IEC 61804-2 simplify software maintenance activities. For already overworked control system engineers/technicians, eliminating software maintenance worries is a welcome benefit of deploying safe, secure, easy-to-use EDDL-based fieldbus technologies.

For intelligent field device manufacturers, knowing that EDD files are always operating-system- an HMI-neutral permits each manufacturer to release a new product when the product is ready and not have to wait until the product completes compatibility testing with a variety of different HMI manufacturers and/or operating system revisions.

Platform and Protocol Independence

Everyone is aware of the difficulties of getting device software drivers to work following a host platform operating system upgrade. EDDL was specifically designed for the EDD file to avoid this issue. The IEC 61804-2 standard is not only operating-system- and HMI-independent, but also fieldbus-communication-protocol-neutral.

It's this extended neutrality that allows device manufacturers to confidently develop a single EDD source file for a given fieldbus-based device and be assured that it will safely and consistently perform on a variety of host application platforms.

From an end-user perspective, it's equally reassuring to know that a host workstation change from UNIX to LINUX or from Windows NT to Windows XP or a port to Windows CE does not require modification of the existing EDD files.

The way EDDL technology retains its platform and protocol independence is really quite simple. Each EDD file is uniquely numbered and contains only the descriptions needed by the host application. Any methods included in the EDD file are interpreted by the host application using a method interpreter, thus providing a safe area or "sandbox" where methods execute.

Security and reliability are also assured, because the installation of an EDD file does not initiate installation of Win32-based DLL (dynamic linking library), ActiveX, or similar executable software, thus avoiding the problems associated with incompatible versions, revised path names, and/or "file missing" error messages.

EDDL technology is designed to encourage worldwide use and includes support for multiple languages as defined by the International Organization for Standardization (ISO).

Under the EDDL architecture, developers write a single EDD file that incorporates multiple language text strings, each conforming to ISO 639 for language codes, and ISO 3166 for country codes. The EDD host application selects the appropriate language from the EDD file to display user information.

Avoiding host application conflicts and maintaining a consistent look and feel are paramount for operators/users. To this end EDD files do not specify fonts, window sizes, color, or other aspects of the host interface.

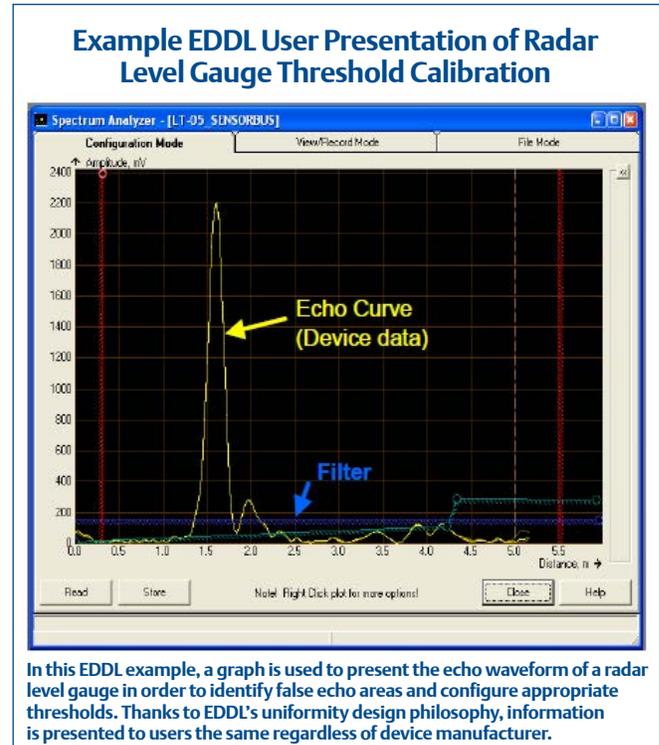


Figure 4 — Example EDDL user presentation of radar level gauge threshold calibration.

Because of the wide number of host application types—PAS with a rich graphic interface to a simple handheld unit with a limited capability display—the host application generates the screens based on constructs provided by EDD file content. This permits information contained in the EDD files to seamlessly integrate with a specific host application’s capabilities.

For intelligent device manufacturers, the platform and communication protocol independence of the IEC 61804-2 Electronic Device Description Language standard ensures that:

- Specifications exist for defining the architecture of the application, syntax (form), semantics (meaning), and user interface structure
- Capabilities exist to implement a single version of a product-specific EDD file containing the device’s configuration, maintenance, and functionality
- Flexibility exists for deploying the same product, and its associated EDD file, on different fieldbus protocols

For end users, knowing that manufacturers of IEC 61804-2-conforming devices are developing, testing, and maintaining a minimum number of EDD files provides additional peace of mind when facing PAS upgrades, patches, and even operating system changes.

Testing & Validation

As an international standard, EDDL technology marks a major advancement toward achieving interoperability of intelligent field instrumentation incorporating different fieldbus protocols.

EDD file testing is a multi-part activity. The intelligent field device manufacturer conducts the first series of tests. The second series of tests is conducted by the appropriate protocol organization—Fieldbus Foundation (FF), HART Communication Foundation (HCF), or Profibus Nutzerorganisation e.V (PNO)—with each organization applying similar EDD file testing and registration procedures.

For example, after an intelligent field device manufacturer creates an EDD source file for use with FF protocol, the developer uses a tokenizer tool to validate the syntax, dependencies, and other protocol and language rules. Once all checks are verified and validated, the tokenizer tool generates an EDD binary file that organizes the information into a format accessible by host HMI applications. Besides providing a compressed, easier to transfer file, the binary format provides protection against accidental changes using a simple text editor.

The manufacturer then submits the EDD binary file to FF for additional testing and registration.

Before FF registers the submitted EDD binary file, it is subjected to a series of tests using FF’s Interoperability Test Kit (ITK).

The first test loads the EDD binary into a test system to validate that correct identification information exists.

Next the file is subjected to multiple test cases to ensure that the EDD file content matches its device and follows protocol rules for maintaining interoperability between hosts and device.

Finally, FF logs the EDD file information, including name, date, size, and the 32-bit cyclic redundancy checksum value. These become the files available for download from the FOUNDATION’S website at www.fieldbus.org.

For end users and intelligent field device manufactures, the simple elegance of EDDL technology, combined with the testing and validation tools developed and maintained by each fieldbus organization, provide an unprecedented level of confidence that robust, protocol interoperable solutions perform as designed and desired. It reflects over 10 years of accumulated experience.

EDDL Architecture

The architecture of EDDL technology makes it easy to use multiple communication protocols within the same HMI host application, requires no custom tools for configuration, and maintains a common look and feel for operators and maintenance technicians, regardless of the intelligent field instrumentation or equipment being viewed. The EDDL technology enables a host system manufacturer to create a single engineering environment that can support any device, from any supplier, using any communications protocol, without the need for custom software drivers for each device type.

With HMI host systems ranging from large process automation systems, with rich graphic displays, to simple handheld devices with limited display capabilities, EDDL's consistent-look-and-feel philosophy represents a great advantage when it comes to operator and maintenance personnel user training.

Because EDDL technology was designed to eliminate the need for special or proprietary files in host systems, a single EDD file created for a full-featured PAS works equally well in the handheld device.

This important design feature eliminates the expense and burden for intelligent field instrument manufacturers to create, test, register, and maintain different files for different HMI host systems, or a different operating system for a different revision of the same host system.

For users, this feature of EDDL technology greatly simplifies changing, adding, upgrading, and evolving HMI host systems.

Verification that EDDL design philosophy works occurred in 2002 when Infracore Hochst established a multi-vendor laboratory, incorporating six FOUNDATION fieldbus host systems and 42 field devices from 11 instrument suppliers.

Infracore Hochst developed and applied a variety of tests to evaluate the interoperability of the FOUNDATION fieldbus technology.

In its final report, delivered to the NAMUR General Assembly in Lahnstein, Germany, Infracore Hochst stated that 100% of the EDD files worked correctly between each host system and the respective devices. Infracore Hochst's tests further validate an important aspect of EDDL technology: that system-wide interoperability is best achieved using a well-defined specification and rigorous testing procedures.

EDDL Extensions

In February 2003, representatives of FF, HCF, and PNO met in a collaborative project to extend the capabilities of the IEC 61804-2 standard.

The scope of the cooperative project is to add robust organization and graphical visualization of device data as well as support for persistent data storage features to IEC 61804-2. Sophisticated devices with hundreds of configuration, calibration, and diagnostic parameters, such as control valves, radar level gauges, and variable frequency drives, will greatly benefit from the new user interface enhancements.

Once implemented, the new extensions will further unify the HMI environment and eliminate the need for custom configuration software packages.

Through the use of familiar dialog boxes, text, dynamic variables, pictures, charts, and archived data are presented to users in a consistent, familiar format. Graphs, such as control valve signatures, may incorporate pan/zoom functionality for inspecting specific detail. Additionally, EDDL extensions support user interaction with device content, such as permitting adjusting filter values.

By providing a standard, platform-independent means for displaying graphical information, device suppliers using EDDL technology can focus resources on increasing product features to better meet user requirements and know that developed solutions will be consistently delivered across a variety of platforms and operating systems.

One EDDL extension that end users asked to be included is the support for persistent data storage. This new feature permits device manufacturers to instruct the host application to store device or local data. This implementation method relieves the intelligent device manufacturer of having to learn the underlying file system nuances of different host applications; how data is stored is left up to the host application.

Persistent data storage enables a variety of new applications using EDDL technology. For example, valve diagnostic software, developed using EDDL technology, can archive valve signatures for later review by support personnel.

The benefit of IEC 61804-2's neutrality is again revealed with the addition of the new EDDL extensions.

For example, an intelligent field instrumentation manufacturer who previously developed products for use on the FF protocol isn't required to begin using the new EDDL tokenizer, viewer, and services tools until its products begin using the new EDDL extensions. In fact, for simple devices, EDD file developers may continue writing EDDL files the same way they do today, using either the existing tools or a new tool.

For more complex devices, developers can use an existing EDD file as the starting point to create the extended EDD file. EDDL is being enhanced, but it is maintaining backward compatibility with the millions of devices that have been installed over the past 10 years.

Because an extended EDD file contains additional field device information, PAS host systems must be updated with a new EDDL host services module. It is available from the respective fieldbus protocol organization and can be procured by all PAS suppliers. More importantly, the host service module provides backward compatibility for plant floor devices using older EDD files.

This simple, yet eloquent, ability to extend EDDL technology without “touching” existing EDD files provides end users the much sought-after peace of mind that deploying a new intelligent field instrument with extensions carries minimum risk.

Conclusion

With EDDL technology used by millions of installed field instruments, EDDL is the process industry de facto standard for ensuring that information about intelligent field devices is consistently available for use by operators, engineers, and maintenance technicians. And the beauty of it is, the EDD source file created for instrument number one works right alongside the EDD source file for instrument number 5 million, or 10 million, and so on—never once requiring an upgrade, revision, or patch of any kind.

Name another software technology that can make that claim!

Appendix A: Key features of EDDL technology

Device Descriptor Language (DDL) technology first appeared in 1990 and, because of its flexibility and reliability, it has become a significant technology in many industries including telecommunications, mainframe and personal computing applications, and instrumentation and control.

The HART Communication Protocol (HART) first began using DDL technology in 1992. HART’s advancement of the DDL technology eventually led to the development of the International Electrotechnical Commission’s IEC 61804-2 standard, Electronic Device Description Language (EDDL).

Key elements that continue to make EDDL technology a secure, reliable workhorse for instrumentation and control applications include:

- **Operating system independence:** EDD files do not contain specific operating system commands or instructions; therefore, they remain transportable and operating-system-independent.
- **Consistency and uniformity:** EDDL technology’s architecture supports multiple protocols within the same host application and requires no custom tools to maintain a common look and feel.
- **Single engineering environment:** EDDL technology enables a host system manufacturer to create a single engineering environment that can support any device, from any supplier, using any communications protocol, without the need for custom software drivers for each device type.
- **Revision control:** Device revision is used to identify the revision level of a device. This permits manufacturers to improve an existing device’s implementation, such as adding support for additional parameters or enhanced diagnostics.
- **Testing and registration:** Testing includes validating the syntax, dependencies, and other protocol and language rules using toolkits and registering the EDD binary file with the appropriate fieldbus organization.
- **International standard support:** EDDL technology is an international standard approved by the International Electrotechnical Commission (IEC) and is available as standard number 61804-2. It also makes use of ISO standards for language and country codes.
- **Security:** EDDL files are ASCII-based and, as such, are less likely to bear virus attachments as .exe and .dll files.

Appendix B: Additional reading

Visit the following web sites to learn more about the use of EDDL technology and fieldbus protocols.

- ARC Advisory Group www.arcweb.com
- Fieldbus Foundation www.fieldbus.org
- HART Communication Foundation www.hartcomm.org
- International Electrotechnical Commission <http://www.iec.ch>
- Profibus Nutzerorganisation e.V. www.profibus.com

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