# Keeping Systems and Communicators Up-to-date using EDDL

Christian Diedrich
Department Control System
Ifak
Magdeburg, Germany

Jonas Berge
PlantWeb Consulting
Emerson Process Management
Singapore

Ludwig Winkel
Marketing Fieldbus Communication
Siemens
Karlsruhe, Germany

Terry Blevins
Control System Development
Emerson Process Management
Austin, Texas

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## ABSTRACT

Modern control systems as well as Device Management software and field communicators use electronic device descriptions, EDD, to define the interface and supported interactions with field devices for configuration, diagnostics and calibration. Over the long life of plants, new device types and versions keep getting added as part of replacements and modifications. Thus, these systems and maintenance tools must accommodate many new types, each generation also providing new features. For example, more than 1000 EDD's are currently available from 85 different vendors. Also, many manufacturers are currently updating their device descriptions to take advantage of the visual enhancements recently introduced into the IEC61804-3 standard, Electronic Device Description Language (EDDL). Therefore, to achieve the best results, the latest electronic device descriptions should be used with your HART devices and Profibus and Foundation fieldbus devices. In this Tutorial session, we will provide some background information on EDDL and how it compares to other technologies, such as FDT/DTM, in terms of device maintenance, support for configuration and on-line use, and manufacturer support. An update will be provided on the features recently added to IEC61804-3 and how ISA SP104 is working to adopt this technology as an ISA/ANSI standard. Also, information will be provide on how the latest EDD's may be downloaded from the Internet, and used to update your maintenance tools or system engineering station keeping them current with the latest devices as they are introduced in your plant. The ease with which these tools may be updated to utilize latest device definitions will be demonstrated in this session.

# INTRODUCTION

Electronic Device Description Language (EDDL) is a universal, proven and state-of-the-art language for writing Electronic Device Descriptions (EDD) that may be used to access diagnostic, real-time and asset management information contained in more than 20 million field instruments from a host of manufacturers. EDDL is the standard for integrating intelligent field devices with systems: IEC 61804-3: Function blocks [FB] for process control–Part 3: Electronic Device Description Language. Using this technology, it is possible to provide an interoperable environment where information available in modern automation sensors and actuators may be accessed by Distributed process control systems or handheld communicator to configure, calibrate a device, diagnose problems, and provide data and alarms for user-interface displays.

Device Description technology first appeared in the early 1990's in HART instruments. The flexibility of using a universal handheld communicator to work with the instrument was a big selling point. All that was needed was the Electronic Device Description (EDD) supplied by the instrument vendors . Due to the success of this technology, end users formed a HART user group, and went on to establish the HART Communications Foundation (HCF) in 1993. Since many users wanted to obtain the data via their control system, the HART Communications Foundation standardized on EDDL to describe information in field devices. In 1994, the Fieldbus Foundation (FF), HART® Communication Foundation (HCF), Profibus Nutzer Organisation e.V. (PNO) adopted EDDL as part of their specifications.

The Fieldbus Foundation, HCF and PNO collaborated to enhance EDDL and extend the concept of interoperability beyond equipment calibration to the user interface and device diagnostics and in 2002 submitted a unified version of EDDL to the IEC. When the technology was standardized as IEC 61804-2 in March 2004 all three bus organizations adopted the common acronym EDDL, Electronic Device Description Language. As illustrated below, profiles to each of these technologies are contained in the IEC61804 standard. Thus, this standard is the basis for the creation of a single engineering environment in a host that can support any field device from any manufacturer using any communication protocol.

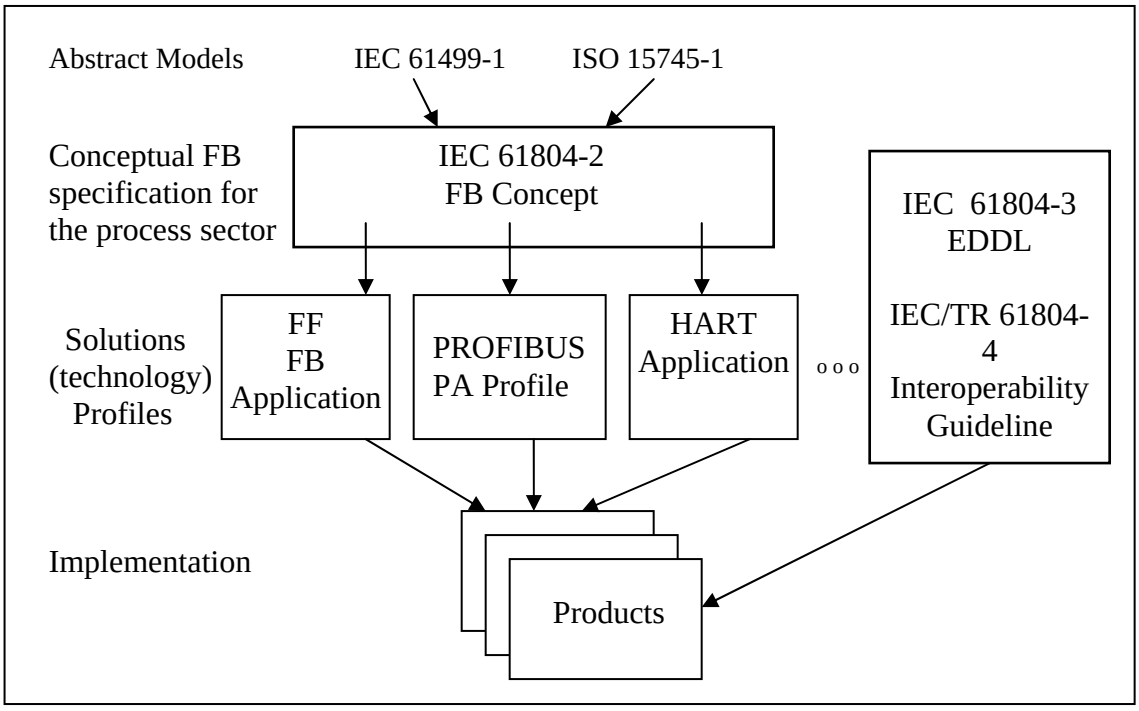


**Figure 1 IEC61804 Standard for Electronic Device Description**

The EDDL Cooperation Team (ECT) was founded at the Hannover Fair in April 2004 to promote and enhance EDDL technology. The team comprises of Foundation, HCF and PNO and the OPC Foundation in one association. Through the efforts of this team, the capabilities of EDDL were extended to provide an industry standard solution for graphical visualization and persistent data storage. The visual elements were added without deviating from the original concept. All information to define the window, the presentation of data within the window, and interaction with the device is described entirely within the EDD. The goal in enhancing Device Description Language was to simplify the process of integrating smart devices with control systems for both users and manufacturers. Graphs (stored waveform), charts (continuous trend), grids (tables), and images were added along with better menus and methods. The capability for persistent long term storage of data and retrieval for comparison was also added. In July, 2005, during the HCF General Assembly Meeting in St. Petersburg, Russia, Emerson Process Management, Siemens and Honeywell individually announced plans to fully support the EDDL enhancements in their host systems. These enhancements to EDDL were approved in 2006 as a normal part of the IEC 61804-3 maintenance cycle.

In 2005, the OPC Foundation announced its adoption of EDDL as the descriptive technology used in its Unified Architecture (UA). The OPC effort will allow OPC UA-based software to access fieldbus instruments – plus devices running on Ethernet, other networks, and under operating systems other than Windows – by using EDDL descriptions to gain access to instrument data. The goal is to provide a service oriented architecture that allows for exchanging data/information between manufacturing and business systems.

The ISA SP104 committee was formed in 2006 to adopt EDDL as an ANSI/ISA standard for a Descriptive Language designed for use in industrial automation applications. The target applications include devices such as generic digital and analogue input/output modules, motion controllers, human machine interfaces, sensors, valves, closed-loop controllers, encoders, hydraulic valves, and programmable controllers. EDDL was selected since it is a generic language that is capable of describing the properties of automation system components such as:

- Device parameters and their dependencies;
- Device functions;
- Graphical representations, for example charts;
- Interactions with control devices.

Also, the EDDL Standard specifies the language semantics and lexical structure. Even though a specific syntax is defined by the standard, it is possible to use the semantics define by the standard with a different syntax.

The ECT continues to promote and develop further technical definitions to increase the productivity of their members and customers. For example, The EDDL Cooperation Team (ECT) and the FDT Group announced at the Hanover Fair on April 17th, 2007 that they have reached agreement to work toward a unified solution for device integration that will use a subset of the OPC UA technology[1] within client-server architecture. The subset is based on the upcoming OPC UA technology, providing EDDL based integration. Also, some provisions are made to integrate software applications for highly complex requirements. Thus, this work preserves backward compatibility and operating system independence. As part of this agreement, the FDT Group joined the ECT. The developments that have lead to the development and standardization of EDDL are summarized in the illustration below.

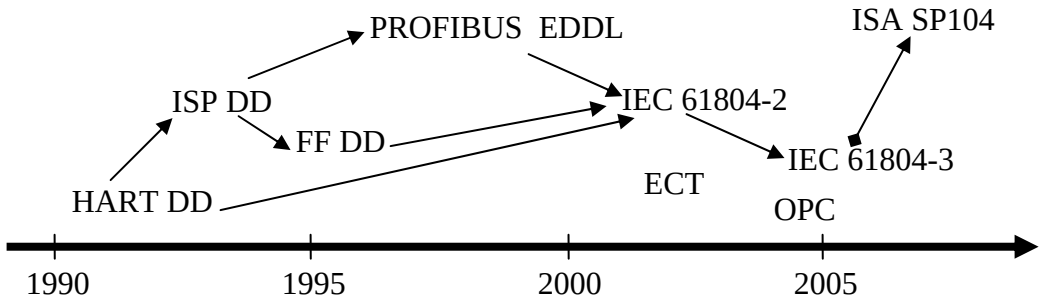


**Figure 2 EDDL standardization process**

[1] OPC UA (Unified Architecture) is a technology of the OPC Foundation

# EDDL TECHNOLOGY

The Electronic Device Description Language (EDDL) is a text-based language that may be used to describe the characteristics of field devices. Device suppliers use EDDL to create Electronic Device Description (EDD) files that provide a standardized form and structure for host systems and handheld communicators to access and display information in field instruments independent of the communication protocol or device operating system. Through the use of this technology, it is possible for users to choose best-in-class instruments that can be used on the network no matter what control system the plant is using. Because EDDL is required for Foundation Fieldbus (FF) certification and is the only device description language supported by the HART Communication Foundation, EDDL is supported by virtually every Process Control Systems vendor worldwide, and EDD's are available for any FOUNDATION, HART, and some Profibus based field device.

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. The EDD file created by an instrument or device designer uses EDDL syntax to describe a device and all its parameters in detail. This can include parameters such as process variable, setpoint, high-low limits, ambient temperature, etc. Also, EDDL supports Methods, a scripting language based on a subset of ANSI C that is used to support step-by-step, interactive setup and calibration procedures. Device designers can define where all the important parameters should appear on an UI display, such as in columns or bar charts, and in which order. 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. Designing an EDDL UI display is much like defining a web page. The designer can also define the conditions under which certain graphics are to be displayed, and what the UI should do about it; for example, if a pump bearing temperature exceeds a certain point, the pump icon should be high-lighted.

Toolkit are available through the FF, HCF, and PNO foundations that permit a device developer to easily checks for syntax or logical errors in EDDL source files and to convert source files into a compressed binary file format. The file written using EDDL is processed ("tokenized") to a compressed binary to prevent tampering and subsequent problems. 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. If any mistakes in the EDD are detected, the tool provides error messages that the designer can use to help trace and correct the syntax. The developer can use the method debugger feature of the tool to help test and debug the methods. This type of development environment allows the device developer to do more complete testing, to simulate user interaction, and results in improved quality assurance for the product. EDD files created by the device developer are registered together with the device as part of the device interoperability registration process. This EDD development process is illustrated below.

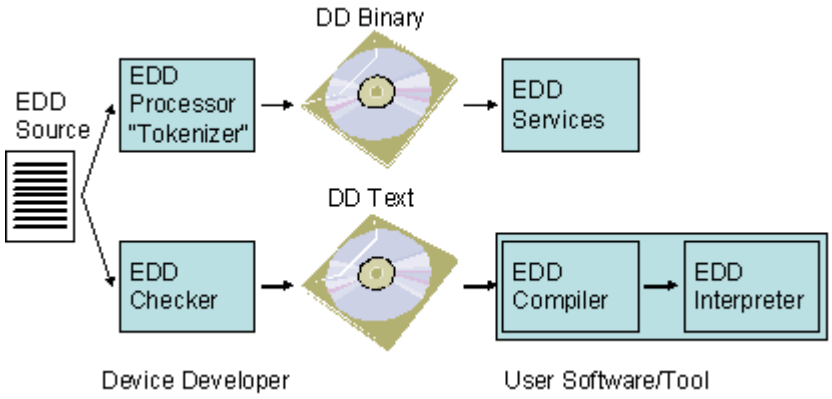


**Figure 3 EDD Development Process**

The manufacturer of control systems may add EDD support through the integration of a Description Services Toolkit. This provides the control system with the capability to read the EDD files and implement what is described. For a given project, the control system supplier obtains the EDD for every instrument and field device in the plant, no matter the vendor. Once the EDD files have been loaded into the control system, the field devices can be set up with the UI displays as described by the field device designer.

## BENEFITS OF APPROACH

EDDL has several unique characteristics not found in other device integration technologies. It provides a well-defined structure for supporting the most simple to the very complex field device. Since EDD's are text-based that are interpreted by the host system, these files are independent of operating systems and control platforms. This structure allows the same EDD to have a common look and feel across applications, which reduces the learning curve and supports multiple host applications. Also, this enables field device additions to be incorporated without affecting the runtime stability of the control system. Taken together, these technology advantages of EDDL provide significant benefits over other approaches such as FDT/DTM in terms of longevity and stability of the instrumentation and control system over the plant lifecycle.

One of the greatest benefits that EDDL provides the process industry is interoperability across multiple hosts, devices and technologies. This flexibility allows the end user to choose the best combination of price and performance for devices and software. EDDL allows instrument suppliers to define their products in a single, open and consistent format. This format is readable by handheld communicators, control systems and other process interface devices that are EDD-enabled. This interoperability simplifies the control system integration process, because all a systems integrator or end user has to specify in the bid process is that all instrumentation and control equipment conform to the International

Standard, EDDL. Competitive bids are easier to evaluate, because the end user does not have to worry if specific software packages are available to support various devices; with EDDL, all comparable EDDL devices can be supported by all control systems. Finally, interoperability means that operators and maintenance personnel can easily find the calibration and diagnostic information needed for a particular device, and all EDDL-compatible devices will provide the necessary information in a 'look and feel' of the host system.

EDDL is a declarative technology, not a software program like FDT/DTM . The EDD file format is readable by many devices including handheld communicators, control systems, PC's and other process interface devices that are EDD-enabled. An EDD is a text based description of the field device and its properties. As a result, EDDL offers significant advantages over technologies that rely on any code from the device manufacturer to enable data to be displayed or printed. EDDL, being text-based, is independent of operating systems and control platforms. Operating system and platform independency, along with backward compatibility are some of the biggest advantages of the technology, Through the use of EDDL, it is possible to avoid problems caused by operating system upgrades, control system revisions, and new versions of the device software from multiple suppliers different than that of the host system. Some of the benefits that come directly from the use of EDDL are summarized in table 1.

EDDL provides all the information operations and maintenance personnel need in an understandable and useful format. It also gives engineers the ability to use charts, plots and diagrams. That ability, plus the expanded help capability within the EDD (electronic device description) make it easier for users to access device information. EDDL provides a well-defined structure for supporting the most simple to the very complex field device. This structure allows the same EDD to have a common look and feel across applications, which reduces the learning curve and supports multiple host applications.

The EDDL enhancements enable device manufacturers to describe the complete user interface for all device requirements, eliminating the need for device specific software applications to set-up or diagnose radar level gauges, valve controllers and other complex sophisticated devices. The many support features of EDDL, such as the "Methods" construct, may be used by the manufacturer of a device EDD to automate procedures to ensure set-up, maintenance and diagnostic functions are performed properly. EDDL can be used to handle or show field device status via parameters that come through a device's intelligent diagnostic functions. For example, EDDL may used to indicate when pH sensors are coated.

**Parameter reconciliation**. A host can use the EDD to compare data in any device against data stored in an external database

**Offline configuration and save.** The host does not rely on any code from the device manufacturer. Thus a host can support offline configuration and save for all devices.

**Configuration printing.** EDDL describes the data and how it should be displayed. Thus a host can render displays and print-outs for all devices.

**Help text support.** The host does not rely on for example the Windows help system. EDDL describes the data including labels and help text.

**Robust architecture** There are no program components with procedure calls that could fail.
**Cyber security. EDD** is compressed text documents with method scripts which are interpreted, not executed programs. Thus malicious code cannot be embedded in downloaded files.

**Access to external information**. The host can use the information about the attributes declared by EDDL to present data as well as making it available through to other applications.

**Support for computer workstations and handheld communicators** EDD is platform independent and may be used with workstations or handheld field communicators

**Support for Different Communications Protocol** EDDL theoretically works with any bus or Ethernet protocol. So far it is being used with devices communicating HART, FOUNDATION fieldbus, and PROFIBUS.

**Support for a broad range of instruments** EDDL applies to simple as well as sophisticated devices including valve positioners and variable speed drives.

**Compatible with future versions of Windows** Because EDDL is a declarative technology, , it is platform independent not affected by changes in operating system.

**Full Capability** EDDL handles all aspects of the device and system life cycle from configuration and commissioning to advanced diagnostics and performance analysis.

**Consistent Interface to Devices from different vendors** Since EDDL is a declarative technology, the style (look & feel) comes from the host. This ensures that colors are used consistently and that buttons and other controls function uniformly.

**Prevents Conflicts between different Versions of a device.** Each version of each device type from every vendor has its own dedicated EDD file. Thus device versions do not conflict.

**Complies with NAMUR NE 105** Most of those requirements are met simply because EDDL is a declarative technology avoiding problems associated with hardware drivers.

**Quick installation of new devices** When a new type of device or a new version of a device is added, a corresponding EDDL file is copied into the host.

**No Special expert knowledge/privilege Required** 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 and thus version conflicts are avoided. There will be no problems due to components refusing to uninstall.

**No additional Cost** The intention is that EDD files are an integral part of the whole product at no additional cost. The EDD file is expected to be free.

**Table 1 Advantages of EDDL Approach**

# RECENT EDDL ADVANCEMENTS – EXAMPLES

Through the work of the ECT, EDDL enhancements have been developed that may be used to improve the capabilities of user interfaces and add support for data storage. These enhancements were submitted to the International Electrotechnical Commission (IEC), and a revision to the International Standard was approved in 2006 as IEC 61804-3. The enhancements defined in the new IEC standard 61804-3 substantially increase performance in the following areas:

- Improved data visualization and display capabilities, such as for waveforms and valve signatures
- A standardized method to access historic measurement or device performance information
- Enhanced tools for display and use of high-level information such as algorithmic relationships for Complex device parameters.
- Improved user interface with support for menus (windows, tabs and groups) and added graphic support for graphs, charts and dial indicators.

EDDL's graphical visualization enhancements such as graphs and charts take full advantage of the rich graphic capabilities of the host automation system. These capabilities benefit engineers and maintenance personnel by providing a consistent look and feel during device configuration and maintenance. Also, they benefit process operators during periods of abnormal operation by enabling accurate and timely decision-making.

The enhancements provide users with more information about the connected device while giving developers the tools they need to provide a consistent look and feel, regardless of the host application. The interface may be defined to include the familiar "tree menu" structure on the same screen with new graphic Windows-like menu structures, which will make the setup of a device easier to understand. In addition, device developers can describe not only the device features but also soft-tools that will allow the user and host to better analyze the digital information coming from the device. EDDL technology helps eliminate the need to use separate and standalone device-specific software applications or add-ons to meet host system integration requirements.

At the 2005 ISA Show, the Fieldbus Foundation exhibited a multi-vendor demonstration of EDD's that utilize EDDL enhancements. Emerson Process Management, Endress + Hauser, Siemens and Smar demonstrated pressure transmitters, temperature transmitters and a machinery health. During the EDDL Enhancements Interoperability Workshop (Duesseldorf, Germany, July 12-14, 2005 ) 11 different HCF member companies used HCF standard EDDL tools to assess the interoperability of enhanced EDD files for their devices across different EDD-enabled host platforms. HCF member companies participating in the Interoperability Workshop were: ABB, Emerson, Endress+Hauser, Exalon Delft, Foxboro-Eckardt, Honeywell, Krohne, Saab, Samson, Siemens and VEGA. On May 15th, 2006 the HART® Communication Foundation (HCF) announced that the first EDD utilizing the advanced capabilities of enhanced Device Description Language had been registered in the HCF EDD Library. Since that time, many systems suppliers have added support for enhanced EDD and many device suppliers have registered enhanced EDDs for their devices.

New data storage functionalities are added that further improve archiving. With persistent data storage, manufacturers can now store data from the device in a host application without requiring the device to recognize conventions for saving the data under the host system. In this instance, the EDDL interpreter works as a go-between, taking instructions from the EDD and initiating the archiving procedure. EDDL can also automatically provide data suitable for asset management and maintenance purposes. For example, EDDL can specify that certain data from the instrument – such as a valve signature – should be maintained as 'persistent data' for diagnostic purposes. This keeps the data available for comparison to the current valve signature for problem analysis and allows instrument data to be plotted, displayed in a chart, or compared to other instrumentation. Thus, applications that can be supported include visualization of complex data, radar gage level configuration, valve curves, analyzers and motor controls – all without writing custom code.

Only the data-relevant aspects are standardized by a device EDD, not the shape and color of the elements. Thus, systems and tool developers can achieve a look and feel reflecting their own product and design philosophy. For users of a tool or operating system, this means all their devices can be represented with a consistent look and feel. However, the information accessed and displayed using an EDD is completely determined by the supplier of the device EDD. With EDDL, a user doesn't have to configure a display: EDDL will produce a display for a device. For example, the UI screen for a Radar Level Gauge is illustrated in figure 4 for two different Hosts. For both systems, the data is read directly from the EDD file without any modifications or organization. The EDD represents how the transmitter manufacturer thinks the data should be organized. In this example, the same information is displayed, with a different 'look and feel.' In other words, the device determines what will be displayed, while the host control system determines how it will look. This ensures that all displays on a given process control system have the same 'look and feel,' regardless of the device supplier. For example, the information in the label 'Process Variables' is identical on both hosts. It is described in the EDD file and looks a little different on each host, but the content is the same.

Displays based on EDDL also contain conditional images that may change under different conditions. For example, if a machinery health transmitter is monitoring a motor, drive coupling and pump, then the pump image can be highlighted (Figure 5) to indicate the detection of pump cavitation. Such variation in the display presentation requires no intervention or decision-making from the control system, because the capability is built into EDDL technology. Likewise, if a motor controller is designed to support diagnostics then EDDL can be used to display the associated information in an interoperable manner as shown in Figure 6.

## UPDATING SYSTEMS AND COMMUNICATORS

It is common in many plants for both handheld communicators and intelligent device management software to be used in the day-to-day maintenance and operation of the many different devices in the plant. These tools can configure commission, diagnose, calibrate, and fine tune all the different device types based on their respective Electronic Device Description. The EDD source file created for an instrument never requiring an upgrade, revision, or patch to work with a new or upgraded control

***Host 1*** ***Host 2***

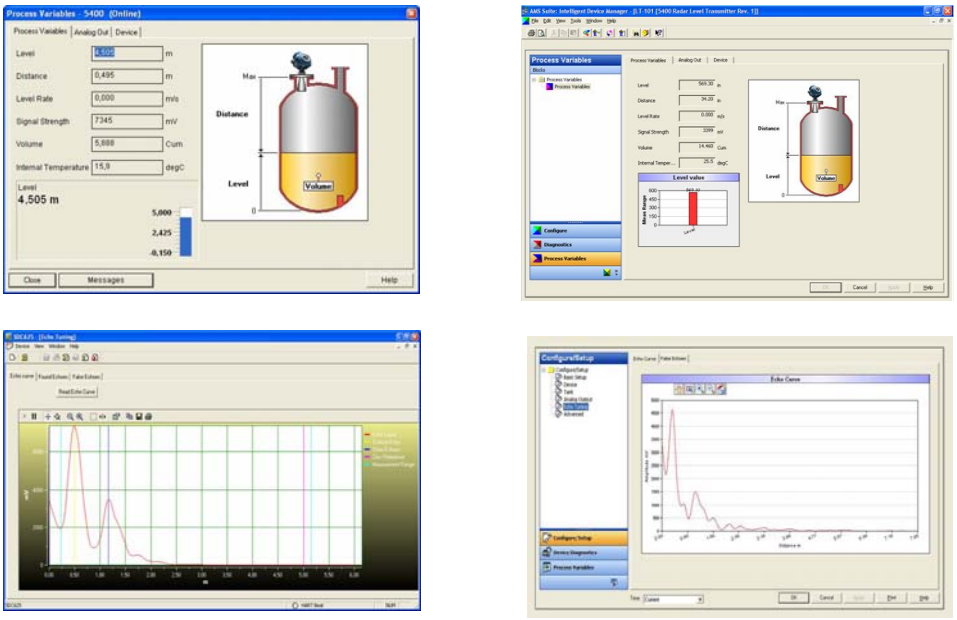


**Figure 4: Radar Level Gauge Diagnostics**

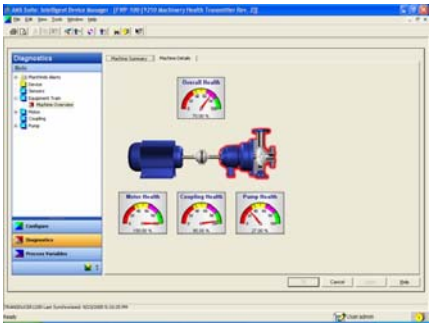

**Figure 5: Cavitation in the pump is highlighted.**

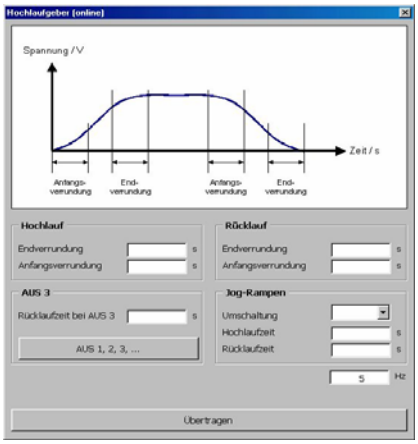


**Figure 6: Motor Controller Diagnostic**

system or handheld. However, to take advantage of the latest enhancements that manufactures have implemented in the device EDD, it is best to periodically verify that the latest EDD is being used in device maintenance and support. If a manufacturer has introduce a new EDD for a device, then it is a simple matter to incorporate the latest EDD into the control system and handheld.

Since the EDD is a text file written with EDDL, this file may be imported into the DCS by simply copying Electronic Device Description files for each of the different devices into the computer or handheld communicator. Such an update can be done at any time it is needed, and once loaded the EDD file many be automatically utilized by the EDDL interpreter. Since EDD is completely independent of the operating system, such an update has no impact on system runtime stability.

The latest version of the EDD for a device may be obtained through the device manufacturer. Also, the latest EDD files for a device are available through the Fieldbus Foundation, HART and Profibus International web sites. For example, the EDD files for the devices registered by the Fieldbus Foundation may be downloaded from their web in its compressed binary format. The Electronic Device Description (EDD) files are also available through control system supplier and the device vendor via a download or a CD-ROM.

## SUMMARY

EDDL is the international standard tool in the process industry for field device diagnostics, setup, and online information access. The latest enhancements to this technology are contained in the IEC61804-3 standard. The ISA SP104 committee has been established to adopt IEC61804-3 as an ISA/ANSI standard. None of these enhancements, or their usage, affects existing description files. So data from more than 20 million EDDL-compatible instruments installed in the field — plus all the new field instruments — can now be readily accessed. EDDL is transparently backward compatible to 1990. Moreover, since virtually every control system on the market today has access to asset management software, all the stored data or online data of the devices described with EDDL is easily accessible.

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