

Most plants already have a large installed base of intelligent devices. The intelligent device can make hundreds of different parameters available to the operator, technician, inspector and engineer or plant manager. This data about the process or instrumentation are valuable, but only if the information reaches the right person in time to be useful.

Plants realise efficiency by providing timely and easily useable data for operations and maintenance personnel. Effective integration of engineering, configuration, maintenance, and operational displays into the operations and maintenance work stations of a plant's digital control centre make it easier to use the power of field intelligence to improve plant performance.



Electronic Device Description Language (EDDL) with enhancements is the key technology for seamless integration of devices into a digital plant architecture that uses their diagnostic intelligence for predictive asset management solutions. EDDL now makes it easier than ever before to use intelligent devices.

Stumbling Blocks

Plants want to benefit from the diagnostics available in intelligent devices, but may in the past have struggled to achieve use of it by their personnel for several reasons.

Devices do their part by continuously monitoring their own health using internal self-diagnostics. However, the digital automation and asset management

systems must in turn continuously monitor the status from the self-diagnostics. This is where many older systems fail - as device diagnostics simply do not get delivered.

In some systems this is because the I/O cards use proprietary device communication protocols. In others there is no device communication at all. Although the devices in these plants generally communicate in standard HART protocol, the proprietary systems can't access their intelligence. The diagnostics are 'stranded' in the devices.

Most modern control systems support open communication protocols like HART or Foundation fieldbus. They must also have device management software installed to enable the diagnostic intelligence to reach those that can act on it.

Plant Asset Management:

SPEAKING

EDDL

EDDL allows seamless integration of devices into a digital plant architecture that uses diagnostic intelligence for predictive asset management solutions. By **Jonas Berge**, director of PlantWeb Consulting, Emerson Process Management

Furthermore, if diagnostics are only displayed on a maintenance console, it may not be seen in a timely manner since maintenance technicians are often in the field rather than in front of the computer. For this reason, the operator must be able to open an integrated detail device screen to access diagnostics of devices from any operations and maintenance/engineering workstation. Operators are in front of their consoles and will see the device alerts.

A third possible stumbling block in the past could be devices that were too difficult to use, and device management software that was not user friendly.

Integrated Device Management

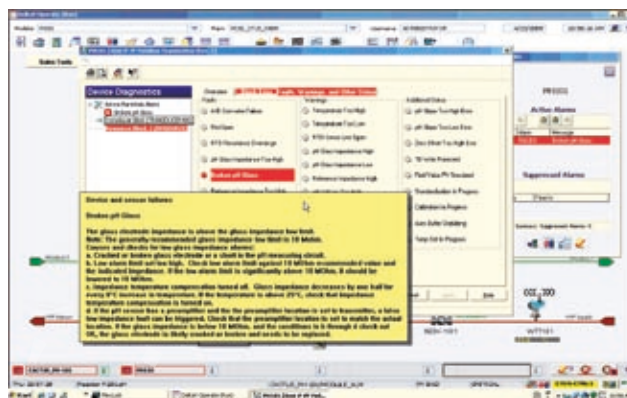
For effective device management the control system

should be capable of commissioning, setup, and maintaining all devices. This function should be integrated into the control system and available from workstations.

- **Connect**

To interoperate with the field devices that plants use, the system must have HART I/O cards or Foundation fieldbus interface cards which in turn pass device communication through to the intelligent device management software. This is available with most modern control architectures.

If the plant has a traditional Distributed Control System (DCS) that does not support HART communication, the only solution available until now has been to connect a HART multiplexer in parallel with the DCS I/O cards to tap into device communication and pass it through to the intelligent device management software.



Critical device diagnostics serves as an early warning to process operators. In this example, broken glass on a pH meter is noted and the cause along with troubleshooting guidance is delivered so the problem can be quickly corrected

BY UPGRADING TO NEW ENHANCED EDDL RATHER THAN DRIVER-BASED TECHNOLOGY, PLANTS MAKE USING INTELLIGENT DEVICES EASIER

Fortunately there is now an easier way to integrate diagnostics of intelligent devices connected to traditional DCS's into device management software. For this purpose, a WirelessHART adaptor is screwed into an unused conduit entry on the existing HART device and connected to its terminals. As a result, all device intelligence including setup and diagnostics is now accessible wirelessly.

With this wireless approach, adapters on the existing devices form a wireless mesh network communicating digital data to a WirelessHART gateway. This wireless solution is significantly easier to deploy than earlier wired HART multiplexer approach, making WirelessHART a good way out of the strangle hold of proprietary device protocols of traditional DCS.

Having established this WirelessHART infrastructure, the plant can deploy WirelessHART transmitters for pressure, level, flow, temperature, valve position feedback, pH, and vibration etc.

- **Integrate**

A device problem, if not acted upon, will eventually lead to a process problem. It could take minutes or hours. Device diagnostics are an early warning that gives operators advance notice to take evasive action before their process is affected.

Depending on the device fault, they may put the loop in manual or send somebody to hand operate the

valve. Once the process is taken care of, they can alert maintenance technicians to fix the device. However, for operators to make use of the device diagnostics this way requires easy and convenient to access.

In the case of a device failure the operator shall be advised via an alert, able to launch a more detailed analysis via device management software. That is, it shall be possible to open a detail device diagnostics screen integrated in the operator console; this ability to get to diagnostics in two clicks, and actionable help in another two clicks, saves time as compared to having to search in a separate maintenance station.

The device diagnostics must at the time of system engineering be prioritised based on the criticality of the device to the process and the severity of the fault such that only the critical alerts, that have an effect on the process, are routed to the operators. This ensures operators are not flooded with irrelevant alarms. Moreover, the operator station shall only be able to see device diagnostics, not change device configuration or perform calibration.

All device alerts, including less urgent predictive alerts for failures which have not yet occurred, are logged in the maintenance station. That is, condition-based maintenance functions should be carried out from dedicated workstation or be integrated into the engineering station. However, the operator shall have the ability to launch device management software directly from the operator console.

Integration of device diagnostics into the operator console can be achieved using EDDL which is an integral part of HART, Foundation fieldbus, Profibus, and WirelessHART. Because EDDL device integration is based on compressed text files, not software drivers, the solution is robust and can be integrated on the control system itself. Other device integration

solutions are not suitable for integration on operator consoles.

Similarly, for simplicity, display of commissioning and maintenance screens shall be possible from the engineering workstation. For example, it is convenient to configure the devices from the same console as the system database. Therefore, only one engineering workstation shall be necessary to perform system database and Foundation fieldbus device configuration and editing.

However, maintenance technicians should not disturb operators at their consoles. Therefore a system can provide for a separate maintenance workstation to allow for device diagnostics and configuration separate from operating functions.

That is, the system shall have flexibility for both integrated and separate device diagnostics. However, a dedicated maintenance station may not replace commissioning and maintenance function integrated into the control system.

It is only the control system operator clients and intelligent device management software clients which are integrated. The servers are kept separated. For security reasons, the maintenance station and functions shall be maintained on a separate server with access only from a controlled area.

This will prevent changes from being made to the network, thus affecting the entire control system, without proper control and management of change procedures in place.

• Simplify

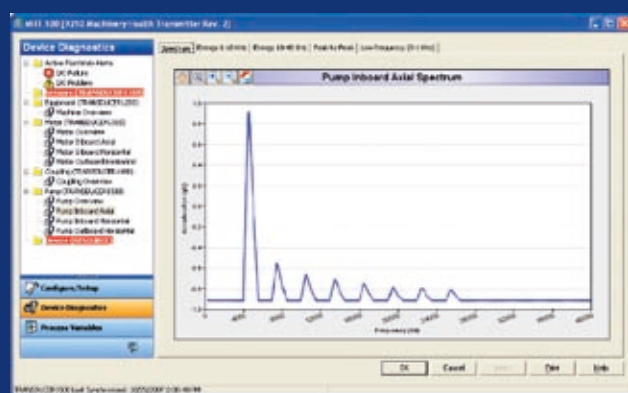
Another intrinsic benefit of EDDL is that all devices are displayed consistently. The device manufacturer creates an EDDL file for their device in which they define how they want the system to display their device.

This includes the definition of the menu structure, graphical display of advanced diagnostics and complex setup functions, step-by-step wizards to make calibration and other complex tasks easy, as well as help text and images to guide the user. This makes sense because the manufacturer knows the device best.

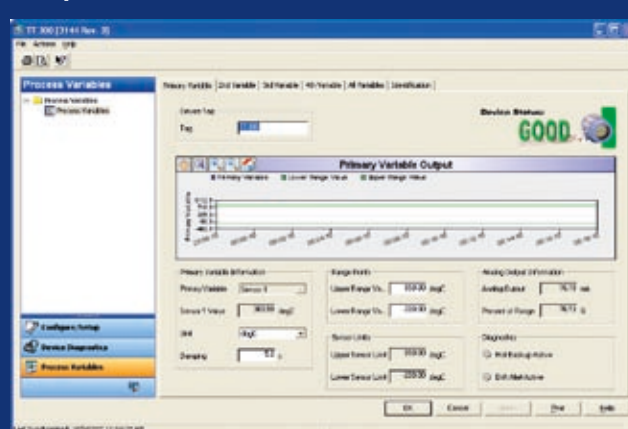
Since the content and structure of the display is controlled by the device manufacturer, not the system manufacturer, full interoperability and access to all device functionality is achieved. Yet at the same time the system controls the look and feel of the display.

For example, the device manufacturer may define that the machinery health transmitter shall have a display including a vibration spectrum in the form of a graph with frequency along the x-axis and acceleration along the y-axis. But the system defines the toolbox that goes along with the graph, including the ability to zoom in on a particular area. As a result, all graphs

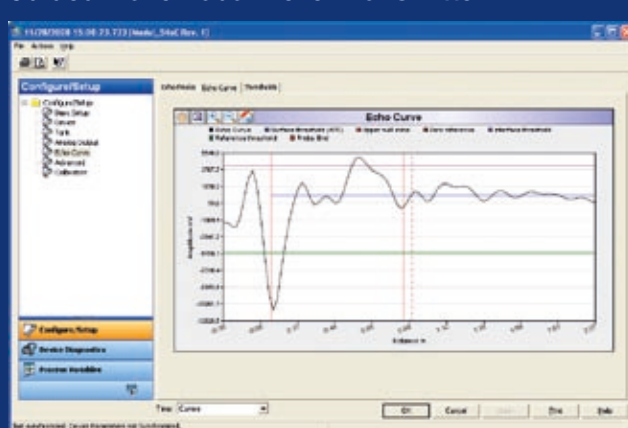
Machinery Health Transmitter



Temperature Transmitter



Guided Wave Radar Level Transmitter

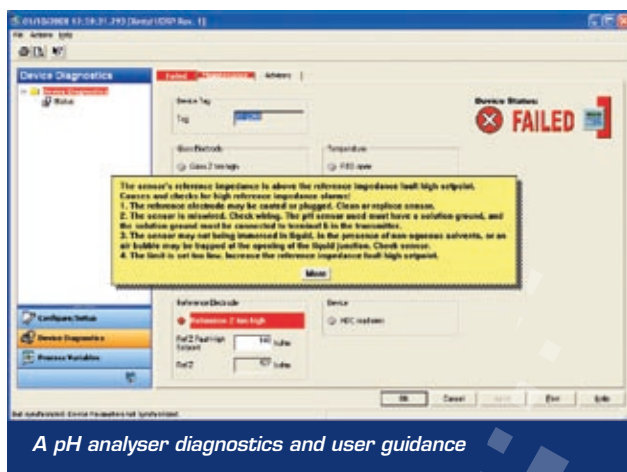


Thanks to EDDL graph and chart tools pan and zoom the same way for any device

function the same way which makes working with a mix of devices and learning new devices intuitive.

As another example, a valve signature graph for a positioner is zoomed in exactly the same way even if this device comes from another manufacturer and uses another protocol. The same goes for the setup of an echo curve in a radar level transmitter. The same toolbox is again used in all trend charts, so the technician pans backwards and forwards in time the same way for any device type.

Such consistency cannot be enforced by device drivers, and provides unparalleled ease of use for EDDL. Likewise, device problems are flagged the exact same way for all devices eliminating ambiguity.



Applying Device Diagnostics

A simple temperature transmitter will detect sensor failure or broken sensor wires giving operators minutes or hours to take action before the process is affected. A more advanced temperature transmitter will detect sensor drift by comparing two sensors or will detect thermocouple degradation by also monitoring its resistance giving technicians days or weeks to schedule maintenance at an opportunity with minimum impact on the process.

A control valve has many moving mechanical parts subject to wear and tear. A valve positioner counts the number of travel direction reversals and tracks the total accumulated travel. These numbers are good indicators of how 'hard' the valve is working, far more accurate in estimating wear of the stem packing than is calendar days.

Alerts can be configured in the positioner, for instance to notify maintenance technicians when the cycle count one million valve reversals is reached if this is what the valve/actuator package manufacturer recommends for replacement of moving parts.

This and other valve diagnostics allows technicians to spend their time and resources on valves that need

attention, and avoid unnecessary removal, tear-down, rebuild, and installation of valves that do not need maintenance yet.

An electromagnetic flow meter detects grounding fault if flow tube grounding is lost over time for instance due to corrosion. This enables the problem to be corrected rather than letting a poor quality measurement negatively affect the process.

A machinery health transmitter detects imbalance and other problems in motor-pump trains. It is used on critical pumps to detect problems to schedule maintenance before they fail.


Some pH analysers have sophisticated diagnostics that continuously measure the impedance of the pH glass electrode and the reference electrode to detect sensor failure or degradation online, for instance if the junction is plugged or if the filling solution or gel is depleted (dry). A cracked glass electrode which would produce erroneous pH readings is also detected so it can be replaced to ensure process is not affected or regulations are not broken.

A simple pressure transmitter will detect sensor failure such as corroded diaphragms. A more advanced pressure transmitter use Statistical Process Monitoring (SPM) to detect process and installation problems like plugged impulse line, entrained air, compressor or pump problems, and loss of agitation etc which enables abnormal situations to be prevented, rather than managed after they have already occurred.

Deployment & Administration

Most plants today rely on the traditional DD technology to work with their intelligent devices. By upgrading to new enhanced EDDL rather than driver-based technology, plants make using intelligent devices easier.

EDDL meets all the requirements of NAMUR NE 105, for instance investment protection in view of new operating system versions, easy loading of EDDL files for integration of new device types and update of new device versions saves you time, there are no license keys for devices, and interoperability testing is done by an independent third-party. Moreover, EDDL as a single technology can be used in intelligent device management software, DCS, and handheld field communicators.

By integrating device diagnostics into the operator consoles using intelligent device management software based on EDDL, device failures are alerted to those that can act on it, before the process is affected. Once integrated, using device diagnostics becomes a natural part of the daily job which is the essence of a successful predictive maintenance programme. 

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