Taking The Safe And Easy Approach:

A New Year's tune up of your instrument practices

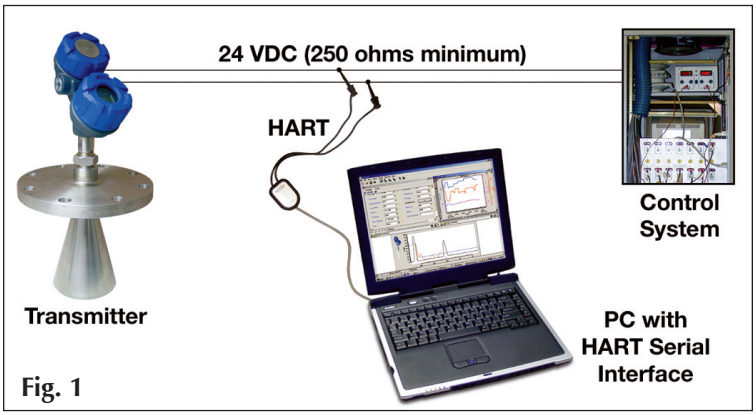

Fig. 1

Want to make your process instrumentation installations safer, more reliable, and easier to use? Then read on for a few insiders tips distilled down from Magnetrol customer seminars across Canada. Go ahead and get out your highlighter so you can pick up some tips to impress the boss.

Ease of use

If I was asked to name one thing that has made an instrument user's life easier, I would have to say it is the FDT (Field Device Tool) standard. The FDT standard is a software package that allows users to communicate with transmitters utilizing their local PC. It is supported by most major instrumentation manufacturers, yet, surprisingly, some users have not yet heard of this breakthrough.

These days most transmitters (level flow, etc.) are smart microprocessor based devices. They have extensive internal information and advanced diagnostic capability that is not easily seen nor used. Implementation of the FDT standard in transmitters basically unleashes that advanced capability. Fortunately there is free software out there that you can use to implement it. This approach saves the user from having to purchase expensive and limited, hand-held configurators and gives them sophisticated troubleshooting capability from a laptop, PDA, or directly from the control system. It works with all those brands that support the standard regardless of communication protocol, and is most commonly used with HART capable instruments over a standard 4-20 mA loop. However, use on Foundation Fieldbus, Profibus and other communication standards is becoming more common.

The main software is known as a "frame application" and works with drivers called DTMs. You can often download the DTMs you need or request them on CD. There is one for the instrument type, and one for the communication protocol yielding excellent flexibility.

The official, rather utopian-sounding FDT definition is as follows:

- A single device integration environment to manage, commission and configure any field device (simple and complex), from any device manufacturer connected to any fieldbus communications protocol.
- Flexibility to select any supplier's product and not be restricted to a specific vendor.
- Open technologies that preserve the investment in installed field devices and avoid replacement of installed base.

An example using a standard 4-20mA device is shown in Fig. 1. Here, we have connected across a 4-20maA loop located conveniently back at the control room. There is no need to climb a tank in the field to get to an instrument. We can now see, save, manipulate, and even e-mail information from a comfortable and safe location. We can now see all the variables we can adjust in the instrument. We can save this to document the instrument configuration or make changes as needed to the instrument settings.

Next we move on to trending, which provides a convenient tool for tracking down intermittent process or instrument performance issues. For example, with this level instrument we can track the Quality (amplitude) of the return signal to establish a performance profile.

Now we are getting some really good information. In Fig. 2, we see an echo curve of this radar level transmitter – seeing exactly what the instrument sees. In this case we see numerous reflections including the Level signal and the Fiducial (baseline reflection). The False Target Profile in red shows reflections from obstructions in the vessel that have been recognized and mapped out. We can make any desired changes, and see the result; simple, powerful, and easy to document.

Of course, because everything is familiar and Windows-based, we can do all the standard stuff like printing and sending over the network; even a remote control link from a factory technician. We can even run this software in the new Ultra Mobile PCs (UMPC) for a compact and convenient solution.

If you want to do further investigation on the subject, I suggest you start by reading the Automation Research Councils (ARC) report at the following link:
http://www.fdt-jig.org/_PDF/download_information/ARC-FDT_WhitePaper.pdf

If you use liquid level instrumentation in your plant (Magnetrol's area of expertise), you can e-mail the author for a free copy on CD of the software you need to get started.

Safety and reliability

No point in making things easy if they are not also safe and reliable. Let's take a look at a couple of aspects of that requirement.

I will get the buzz word out of the way up front. It is FMEDA (Failure Modes, Effects, and Diagnostic Analysis). It helps you mange risk to people, the environment and your equipment. It was originally developed for critical safety related systems, such as Emergency and Process shutdown equipment. Details of this layered safety approach are covered in Magnetrol's SIL (Safety Integrity Level bulletin 41-299.0) publication, available free on request.

An instrument itself does not have a SIL rating, as that applies to the entire loop. Rather each instrument has a Failure Modes Effects and Diagnostics Analysis (FMEDA) done to determine key reliability characteristics. The FMEDA analysis of a given instrument results in two key reliability parameters known as SFF (Safe Failure Fraction) and PFD (Probability of failure on Demand). The lower of the two SIL numbers for these parameters determines the "SIL Suitability" for a given instrument. SFF normally is the limiting parameter.

For the purposes of this brief introduction to one aspect of the topic, we will point out how to statistically reduce potential dangerous undetected failures of instrumentation in the plant. We can even use this same data as a reliability value for non safety related applications.

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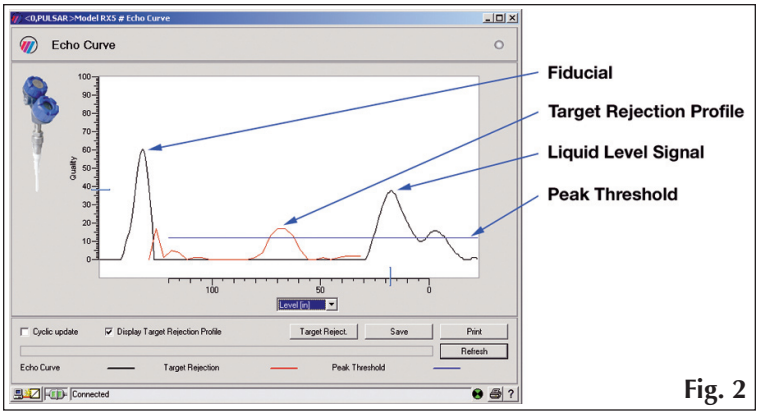

Fig. 2

from exida data book "Safety Equipment Reliability Handbook"

Model	Analog/ Digital	Sensor Type	Fail Dangerous Undetected Failure Rate FIT's (10^9 hours)	Fail Safe Undetected FIT's	Fail Low FIT's	Fail High FIT's	Fail no effect FIT's	Fail Detected FIT's	SFF (%)
Unknown	Digital	Level - Displacement	3600	2400					40
Unknown	Analog	Level-Displacer	1250		1650	100			58.3
ECLIPSE 705-51Ax-xxx	Analog	Level-Guided Wave Radar	106		629	21	393	488	91
ECHOTEL 961	Digital	Level - Ultrasonic	36		86				92

Fig. 3

From the chart in Fig. 4, you can see some of the data FMEDA can provide. Those working on safety related systems would likely focus in on the Safe Failure Fraction (SFF). However, we are going to look at something we all want to avoid – "Dangerous Undetected Failures".

You can also see that by removing a displacer level transmitter and replacing it with an Eclipse Guided Wave Radar (GWR) transmitter we can decrease potential dangerous undetected failures from 1250 to 106 – more than 10 times improvement! Moving from a mechanical level switch to an Echotel 961 electronic level switch with diagnostics can give you a 100 times improvement. We encourage you to get this information from your instrument suppliers or subscribe to a data base of this information such as those provided by Exida.com.

Canadian Registration Numbers

Next up on the safety list is the requirement for Canadian Registration Numbers (CRN) on all instruments installed in applications over 15 PSI. Measuring instruments become part of the pressure boundary separating the potentially hot and nasty process and you. It is therefore a legal requirement in Canada to have a CRN for the province of the installation. This means a provincial authority like TSSA in Ontario, ABSA in Alberta or ACI in Atlantic Canada has reviewed the construction and determined it is safe at the stated temperature and temperature conditions. Most instruments contain under 1.5 cu. ft. of volume and are therefore treated as a fitting, rather than a pressure vessel.

You can get the CRN number or certificate from the instrument manufacturer. In some provinces you can look up the information on-line. For example for Atlantic Canada you can select a manufacturer and check CRN details using the following link: http://www.acicrn.com/MainPage.aspx

Unfortunately many other provinces have not yet provided this helpful tool, and I would encourage other bodies like TSSA or ABSA to implement it. Public availability of safety data is always helpful.

If your supplier cannot give you a CRN for the instrument, you should not install it in any application where there may be pressure over 15 PSI.

Do you use 4-20mA signals?

Here is one last tip. It relates to the common 4-20mA signal which has been used with field instrumentation for a very long time. It has been around so long, in fact, that the standard has been updated; it is no longer just 4-20mA! No, I am not talking about some new digital communication just something known as Namur NE 43 compliance.

This standard suggests that the old 4-20 signal with fail low or high capability is obsolete. Consider using this old approach under a fail high condition on a level transmitter. If diagnostics detect a problem the output would go to 20mA but you would not know if you have a full tank or a failed instrument. If you make the logical assumption the tank is full of liquid when it is really empty with a failed measurement device you could be in big trouble.

On the other hand a Namur NE 43 compliant device uses a 3.8 to 20.5 signal for the measurement span, with 21mA or higher and 3.6 mA or lower, to indicate a diagnostic failure. Most receiving systems can recognize this failure warning and take very different action than they would on a full tank.

This simple step increases safety and reliability yet many companies do not specify this requirement. Tremendous progress has been made in instrument diagnostics and Namur NE 43 compliance with a 3.6-21mA capability is a great way to take advantage of these improvements.

Summary

Let's summarize the points covered in this article in a check list format. When you are doing instrument evaluation does the instrument have:

- Canadian Registration Number (CRN)
- Compliance with Namur NE 43 – 4-20mA should really be 3-8-20.5mA with 3.6 or 21mA as a diagnostic indication.
- FMEDA with third party review, that gives you a SFF in the 80-90 range or higher. (Higher is better if you are comparing brands)
- FDT compliant, for free and easy software support.

I hope we stimulated some interest so you can do further investigation. Feel free to contact the author (kmartyn@magnetrol.com) with comments, questions, or to be notified of a free seminar in your area.

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