

Pepperl + Fuchs Advanced Diagnostics Self Validates Health of Fieldbus Networks

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Keywords

Advanced Diagnostic Module, Online Physical Layer Diagnostics, Asset Management, Foundation Fieldbus, Profibus PA, Process Automation, Interfaces, Interoperability, Field Device

P+F's Advanced Diagnostic Module for Fieldbus enhances the communication and data-gathering capabilities of Fieldbus by allowing users to comprehensively monitor the health of Fieldbus networks efficiently in real-time while reducing the cost of ownership.

Summary

Pepperl + Fuchs (P+F) a leading supplier of factory and process automation solutions is successfully expanding its reach into fieldbus and engineered solutions to fill emerging user needs due to the increasing adoption of fieldbus automation systems. The acceptance of Fieldbus has increased the use of sophisticated sensor technology and process diagnostics.

P+F's Advanced Diagnostic Module (ADM) applies similar diagnostic strategies by comprehensively monitoring the health of Fieldbus networks efficiently in real-time while reducing the cost of ownership for the end user. The enhanced online diagnostic capability of ADM allows early detection of potential faults and provides users an intelligent foundation to deploy a plant-wide proactive maintenance strategy that includes the Fieldbus network.

Analysis

Fieldbus networks can allow users to significantly reduce wiring costs, and afford more flexibility in monitoring and controlling plant functions. With the increasing adoption of fieldbus networks, organizations are looking for solutions to help the shrinking workforce install, commission, and maintain these more complex communication networks. Advanced online diagnostic systems that provide a rich set of diagnostic data and help predict and pinpoint network faults and failures will become a necessary solution as process industries become increasingly more digital. Organizations that



use Fieldbus should consider installing advanced online diagnostic systems to boost maintenance efficiency and reduce operating costs, and maintain the availability of plant resources.

Fieldbus Diagnostic Capabilities Have Evolved

Diagnostic capabilities for Fieldbus networks have evolved significantly over the years. Rudimentary tests such as instrument elevated zero outputs and simple I/O health checks gave way to superior instrument and process diagnostics with the introduction of HART, which had its limitations due to bandwidth restrictions. The advent and acceptance of Fieldbus has in-

creased the use of sophisticated sensor technology and process diagnostics. Until recently, it was cost prohibitive to monitor the health of the entire Fieldbus network. However, that has changed with the introduction of more sophisticated Fieldbus hardware and advanced diagnostic systems.

Diagnostic Features	Advanced Online Diagnostics	Typical Online Diagnostics
No need to track down terminals or interfere with cable	Yes	Limited
Trunk current measurement	Yes	No
Jitter measurement	Yes	No
Data signal amplitude	Yes	Yes
Shield to pole AC and DC unbalance	Yes	No
Direct pole to pole short circuit	Yes	Yes
Full spectral frequency analysis	Yes	Some
High frequency noise measurement	Yes	Yes
Digital storage oscilloscope	Yes	No
Trunk voltage	Yes	Yes
Advanced software analysis and hardcopy printout	Yes	No
'Signal inverted' warning	Yes	Yes
Separate diagnostic information bus- operation not affected by any segment failure	Yes	No
Draws zero current from the bus	Yes	No
Trending and logging provide early warning	Yes	Yes
Simultaneous monitoring of all segments	Yes	Yes

New Advanced Online Fieldbus Diagnostic Information Provides a Complete View of the Entire Network

P+F Advanced Diagnostic Module for Fieldbus

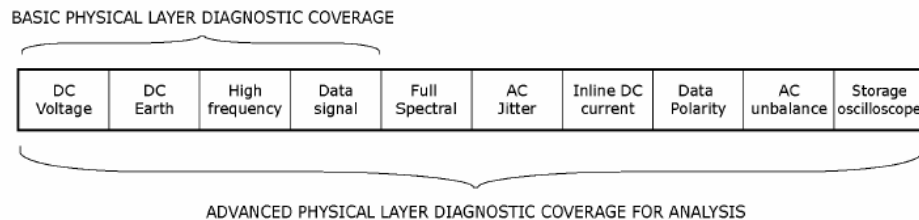
P+F's Advanced Diagnostic Module for Fieldbus allows users to monitor the entire physical layer of Fieldbus networks which includes the cable infrastructure, terminals, Fieldbus power supplies, device interface hardware, fault protection equipment, and communication—the signal transmitted across the network. The system is designed for Foundation Fieldbus and Profibus PA networks.

P+F's solution uses advanced physical layer diagnostic functions that go well beyond basic voltage, signal amplitude, and noise level measure-

ments, which could miss the signs of an impending fault in Fieldbus equipment. Advanced diagnostic measurements include many more AC and DC measurements to analyze the condition of Fieldbus devices, such as data polarity, inline DC current, and AC jitter, which is used to detect minute changes caused by impending equipment failure.

Advanced Diagnostics Provide a Rich Data Set

Advanced online physical layer diagnostics provide a richer set of data that supports more comprehensive reporting systems and helps to identify any developing faults before they affect production. This ability to detect and process early warning signs enables organizations to practice proactive, rather than reactive maintenance. Online monitoring also significantly reduces the time to troubleshoot problems. Users can pinpoint the source of equipment problems without having to refer to wiring diagrams or dismantle control room cabinet wiring or junction boxes to do “exploratory” testing.



Basic and Advanced Physical Layer Diagnostic Coverage

Reporting Diagnostic Information

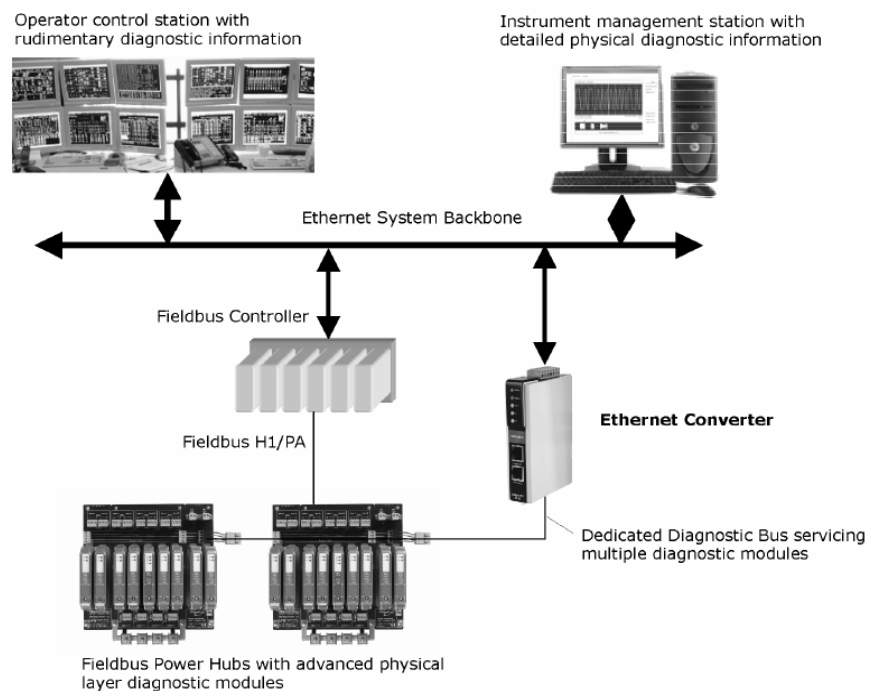
P+F’s Advanced Diagnostic Module analytical software can tailor reports to meet the needs and skill levels of different plant users. These reports are used in the plant construction phase to guide engineers as they work to identify and assess failures, minor faults, and faults that would not appear until plant operation had begun. Once production is underway, reports can give operators the basic information they need to decide whether to alert maintenance immediately when a fault is detected, or to wait until the next shift change or scheduled shutdown to have maintenance performed. Reports can also include more detailed technical information to help maintenance personnel to diagnose specific equipment problems.

A key tool in P+F’s ADM software is the Fieldbus oscilloscope function, which can display and record the wavelength and amplitude of the Field-

bus signal. The online oscilloscope, used by engineers to visually diagnose complex network faults, eliminates the need to open junction boxes to connect actual oscilloscopes, and the recording function allows information to be shared with remote experts to assist with troubleshooting.

Advanced Diagnostics Infrastructure

A single P+F Advanced Diagnostics Module is capable of supporting up to four Fieldbus segments simultaneously. This is accomplished by integrating the diagnostic module with the Fieldbus power supply system. While diagnostic information could be transferred through the Fieldbus itself, P+F recommends a dedicated network that allows several diagnostic modules to be connected to the system via Ethernet. This allows availability of information should the Fieldbus segment experience a fatal error. In addition, the Fieldbus does not have the bandwidth to send the amount of diagnostic information needed.



P+F Advanced Physical Layer Diagnostic Structure

P+F's Advanced Diagnostic Module can detect a wide range of Fieldbus network problems, including: pole-to-shield and pole-to-pole faults; crosstalk, noise and interference; terminator faults; over/under termination; power supply drift or impedance failures. The system can also detect de-

vice failures in surge suppressors, noise filter capacitors, signal polarity inversion in devices that have been accidentally cross-wired, and power supply failures. Of all the diagnostic measurements, jitter deviation is the most accurate as an indicator of an impending fault in a Fieldbus power supply, because it can reveal even very slight changes that would not normally generate data retransmissions or alarms.

Reduced Construction, Operation Costs

Fieldbus technology can significantly reduce the manpower needed to install a Fieldbus network, compared to an equivalent 4-20mA system. Applying advanced Fieldbus diagnostics allows a further cut in construction manpower levels, and can reduce construction and commissioning costs, as well as operating expenses over the life of a plant. Where Fieldbus

Network Lifecycle
Construction
Commissioning
Operation
Maintenance

ADM Reduces Cost Throughout Network Lifecycle

technology reduces the amount of manual testing needed during the construction of a new system, implementing advanced diagnostics performs automatic checks, and eliminates the labor cost for testing. During pre-commissioning instrument checks, advanced diagnostics compress the time needed to test each network segment, from roughly 60 minutes per segment without a diagnostic system to 8 minutes per segment. Once operations begin, the reduced testing requirement for each segment remains in effect.

The potential for cost savings on labor using advanced diagnostics is enormous: on a 100 segment Fieldbus network with 1,000 devices, operational maintenance time could conceivably be cut from 12.5 man days without diagnostics to 1.6 man days with advanced online diagnostics. Construction and commissioning time could be compressed from 21.5 man days to 2.6 man days.

Value and Benefits

P+F's Advanced Diagnostic Module for Fieldbus offers users a quick return on their investment. It has the potential to substantially reduce construction, commissioning and maintenance costs over the life of a Fieldbus network. The more efficient and comprehensive diagnostic capabilities of the system more than prove their worth by automatically detecting minor faults that could go unnoticed by basic diagnostic systems, and cause

Fieldbus network segments to go offline, or worse yet, stop the production process.

Because diagnostic modules are permanently embedded into the network infrastructure, testing and troubleshooting can be done quickly, and without interrupting the process. Advanced online diagnostics provide a richer diagnostic data set than traditional manual testing methods, enabling better decision making in operations and easier troubleshooting in maintenance. With better information about the nature and severity of detected faults, the time and frequency of both reactive and scheduled maintenance can be reduced. Advanced online diagnostic tools like P+F's ADM system allow users to constantly monitor the health of Fieldbus networks, reduce operating and maintenance costs, and help to maintain the reliability and availability of a plant's production resources.

Recommendations

- ARC believes that users should consider adopting P+F's Advanced Diagnostic Module in new Fieldbus installations. ADM is an important asset management tool that can provide value across the entire lifecycle of a plant. Not only can it reduce the costs of installing Fieldbus networks, but it helps operations and maintenance to quickly resolve issues by pinpointing and predicting potential problems.
- Users deploying a Plant Asset Management solution to help maintain and optimize assets should not forget the Fieldbus network and consider adding ADM in legacy Fieldbus installations.
- Fieldbus is here to stay. Adopting highly capable information technology solutions like ADM will help users maximize the availability of the network and the potential of the instruments connected to their Fieldbus network.

This paper was written by ARC Advisory Group on behalf of Pepperl + Fuchs. The opinions and observations stated in the paper are ARC's. For further information or to provide feedback on this paper, please contact the author.