Pepperl+Fuchs GmbH – Lilienthalstrasse 200 – 68307 Mannheim – Germany

Please quote the following contact information when publishing:
Tel.: +49 621 776-2222, Fax: +49 621 776-27-2222, www.pepperl-fuchs.com, pa-info@de.pepperl-fuchs.com

Editorial contact: Christa Blas (extension: -1420, fax: -1108), cblas@de.pepperl-fuchs.com

Fieldbus integration

Fieldbus diagnostics – Plant Asset Management tool

The PROFIBUS PA and H1FOUNDATION fieldbus connect up to 31 field devices to the control system via a cable. The fieldbus physical layer is monitored by the Plant Asset Management through diagnostics. A complete integration also includes the automatic configuration of the control technology for fieldbus diagnostics. This article provides an overview of the alternatives for the integration and highlights the latest methods.

Fieldbus is widely accepted because it fulfills the requirements for explosion protection and enables maximum cable lengths in process systems. The High-Power Trunk concept has proven itself as a break-through technology. Because the communication signals and power are transmitted via the same cable, a multimeter cannot be used to measure the signals.

The breakthrough of fieldbus technology was achieved with the help of fieldbus diagnostics, which ensures the clarity and visibility of fieldbus communication – not just in a hand-held instrument, but also as a monitor installed in the fieldbus power supply. It enables predictive fault recognition and thereby proactive strategies for plant maintenance. Not only is the availability of the electrical installation noticeably increased by the fieldbus diagnostics, but also the maintenance costs are lowered by avoiding unnecessary and unplanned work. The physical layer itself can now be monitored and integrated in the Plant Asset Management (PAM): from the power supply through the cables and distributor to the termination resistor. All providers of fieldbus infrastructure, technology which connects the control system to the field devices, confirm this through their sales figures, which have risen at an above-average rate.

Further advantages of fieldbus technology are:

- Simple application of multivariable field devices: They can be used seamlessly and without additional effort, compared to several parallel 4…20 mA connections.
- Additional analog/digital and digital/analog conversion on the barrier and in the control system are not required.
- Elimination of measuring circuit calibration: the measured value is converted only once from an analog into a digital value. The fieldbus ensures perfect transmission of the digital data between the control technology and the field device.
- Elimination of scaling: the measured value is available at a higher resolution and in a practically unlimited measurement range.

Function and benefit of fieldbus diagnostics

Fieldbus diagnostics monitors the physical layer, whereby a large number of measured values are recorded per segment and per field device. Correctly interpreted, these values represent the state of health of the physical layer. Departments responsible for installation and commissioning, are pleased that their work can be checked and documented clearly and distinctly through automatically generated reports. These records take the place of test procedures from the past, which were prepared manually, more complicated, and more costly. The commissioning phase alone can be shortened by a few days or weeks through the automatic testing of the physical layer – higher revenues through earlier plant start-up.

The fieldbus shows its robustness and strengths during actual operation: one single-occurring fault, such as a creeping or hard short circuit to ground, is typically not critical for the stability of communication – the system continues to run smoothly. If this state is not discovered and other unwanted conditions come up, this could lead to a sudden and unexpected plant shutdown. The fieldbus diagnostics supplies the plant operator with a complete picture of the system. The state of health of the fieldbus itself is visible and manageable. The plant operator remains in control, particularly because only summary information and warnings are shown at the operating station.

Notifications are also simultaneously sent to the maintenance team. The fieldbus diagnostics supports maintenance and troubleshooting by interpreting the measured data and translating it into clear text: the system describes possible fault scenarios and shows how they can be handled. Detailed knowledge of the fieldbus physical layer is no longer necessary. All details are available to the maintenance technician at his workstation in the safety of the maintenance room. Unnecessary work or even troubleshooting activities in a potentially hazardous area of the process plant is reduced or avoided entirely. The maintenance technician decides whether the fault requires immediate attention, can be handled during the

next routine maintenance run or during the next planned plant shutdown. In the case of persistent faults, the protocols and messages can be made available to experts (by E-Mail or online) who can assist the plant without incurring travel expenses and losing time during the diagnostics.

Integration of hardware and software

While the mobile diagnostic modules, which service technicians like to use, are connected in parallel through test terminals at the site, stationary versions are integrated in the fieldbus power supply for permanent monitoring. In both cases, supportive software ensures access and the interpretation of data.

Data transmission from the stationary module to the control room can be realized in different ways. Various criteria have to be taken into consideration because of the high number of required measured values:

- The running process must not be disturbed
- Length of the data cycle times
- Bandwidth of the transmission medium used
- Easy integration of the data in the control technology and PAM
- Easy operation for the plant operator and the maintenance personnel

Various versions have been developed for the hardware integration of the internationally widespread H1 FOUNDATION fieldbus (FF): **Data transfer through …**

… the H1 bus: The diagnostic module is integrated as an additional node in the H1 bus. Data are directly integrated through the usual methods (EDDL or FDT/DTM). The diagnostic module then appears as a node in a segment. Because the module can monitor up to four segments simultaneously, the messages must be assigned manually to the respective segments during the engineering phase. A serious disadvantage is the use of fieldbus, the medium itself for transmission. If an error occurs, the diagnosis is also fails. This disadvantage can be eliminated by using a separate H1 bus just for the diagnostic modules.

… the HSE bus: The fast FF-HSE-Bus (High-speed Ethernet) is used here. Data integration takes place in an identical way for the H1 bus. The FF-HSE bus is physically independent from the H1 bus and, as a rule, offers enough bandwidth. The manual assignment of data must also be performed here in the control system.

… dedicated Ethernet line: Data of the diagnostic modules are transmitted separately. The already installed company network can be used. The diagnostic function is fully retained in case of a possible performance weakness of the segment. Summary alarms are transmitted

to the control system through the open OPC interface, i.e., only the information required by the plant operator. An external fieldbus expert can receive limited access from remote to the fieldbus diagnostics through further open interfaces in order to find and repair faults that are difficult to locate.

In this case, the PAM is FDT/DTM-based in order to be able to implement the functions mentioned and to use the fieldbus diagnostics. This involves the presentation of possible causes and suggestions for solutions in clear text, software assistants for the review and documentation, or an integrated oscilloscope.

In PAM, the topology view has to be configured: the diagnostic modules show the assigned segments. By using software functions, the equipment data, which are required for commissioning and monitoring the fieldbus physics, can be read automatically.

Modern methods of integration

For the first time, Yokogawa and Pepperl+Fuchs are jointly offering a complete integration of fieldbus diagnostics into the PAM. Plant Resource Manager (PRM) is a key component of the Yokogawa VigilantPlant® Asset Excellence Initiative. PRM integrates and administers maintenance information, monitors the state of the system during operation, and offers a history for assets from field equipment to the sub-system. The Advanced Diagnostic Module (ADM) from Pepperl+Fuchs is a plug-in module for monitoring the physical layer of up to four fieldbus segments. The ADM is integrated in the FieldConnex® Power Hub, the fieldbus power supply.

The data are transmitted to the control system through an independent line. With only a few mouse clicks, the segments are selected for monitoring the information and alarms. The messages are then integrated, and the PRM automatically configured. Plant operators and maintenance personnel benefit from the information which is customized with the right amount of detail for their workstation. It is not necessary to learn a separate user interface and handling is easier. The fieldbus is fully integrated in the Plant Asset Management.

Key words: Fieldbus, PROFIBUS PA, FOUNDATION fieldbus H1, Physical Layer, Diagnostics, Asset Management

Author: Dipl.-Ing./MBA Andreas Hennecke
Product Marketing Manager Fieldbus-Infrastructure
Division Process Automation

Characters: 7,693, without space characters
Characters short text: 431 without space characters
Pictures: No. MC7522_080827_02, No. MC7522_080821_02, No. MC7522_080821_03, No. NC7522_080307_03, No. 93_1228_18

July 2008

Eye-catcher No. 1

Eye-catcher No. 2

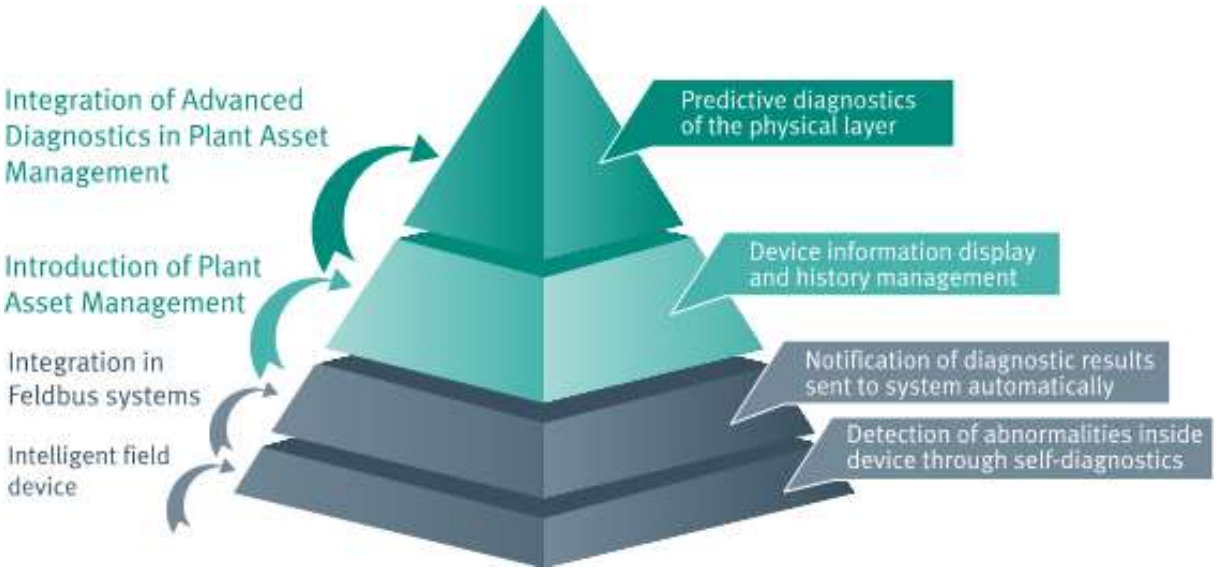

Fig. 1: The course of development: Device and diagnostic integration enables modern Asset Management. Now including FieldConnex Advanced Diagnostics for fieldbus physics.

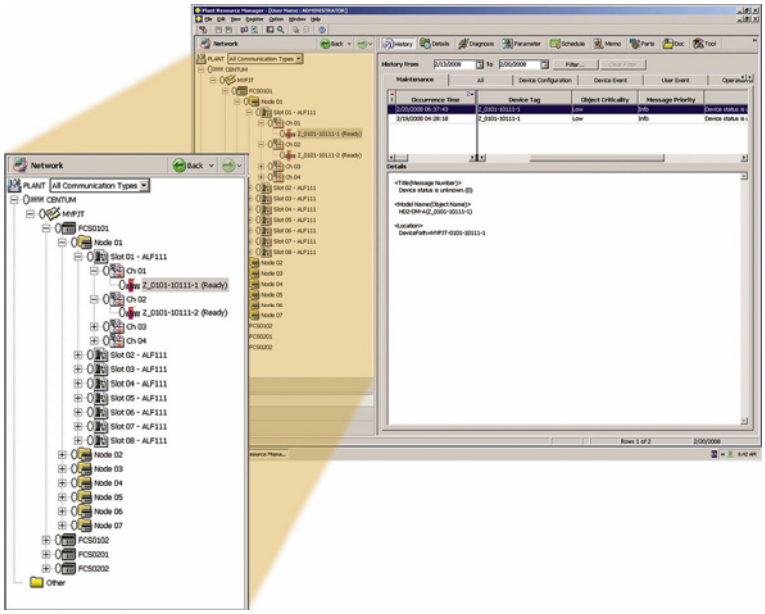

Fig. 2: At a glance. The fieldbus diagnostics integrated in the PRM System provides messages from the fieldbus physics in the correct context. This is in addition to the corresponding messages of the field equipment which are connected to the segment. The required configuration of the control system is generated automatically with a few mouse clicks.

Fig. 3: FieldConnex Power Hub with redundant power supply and integrated Advanced Diagnostic Module.