Increased availability thanks to the FDS Diagnostic System

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An important task of railway infrastructure companies is the maintenance and fault clearance of their signalling systems. These activities are not only the basis for secure, reliable and punctual railway services, they also generate a significant percentage of cost and expenditure. Therefore, it has been a goal for many years to continuously increase maintenance efficiency and reduce the cost of maintenance and fault clearance. A key element for such a strategy is the use of modern diagnostics systems, which are required to support especially the following objective:

1 Objective targets

- Overall reduction of maintenance costs
- Preventive maintenance
- Fast and efficient fault clearance.

The FDS system (Frauscher Diagnostic System) was specifically developed to take the above elements into account and contributes in many respects to achieving these objectives.

1.1 Overall reduction of maintenance cost

The axle counting systems by Frauscher do require, although to rather a small extent, cyclical maintenance activities. With the support of FDS, part of these tasks can be performed comfortably "sitting on the office chair"(e. g. measurement of wheel sensor current), thereby allowing on-site maintenance to be reduced to a minimum.

1.2 Preventive maintenance

By means of pre-alarm messages (e. g. sensor current drift of a wheel sensor etc.), it is possible to alert in advance to a possible fault. If pre-alarm messages are processed in the course of cyclical or selected maintenance activities, the occurrence of the fault may possibly be averted.

1.3 Fast and efficient fault clearance

Inductive wheel sensors and processor-controlled axle counting systems are subject to a number of technical and operational influences, which may cause diverse error messages. The FDS provides maintenance staff that is not locally stationed with the possibility of remote diagnostics. This allows due preparation for the fault in question, and a target-oriented clearance without time-consuming trouble-shooting will afford a significant reduction of the effective downtime (nature and type of fault, operating failure, faulty component etc.).

A central feature of the FDS is its possibility to provide current and stored diagnostics and statistics data to any location.

This allows access to data in direct proximity of axle counting installations, level crossing applications or locally operated electric (EOW) points systems as well as in central traffic controls or control centres.

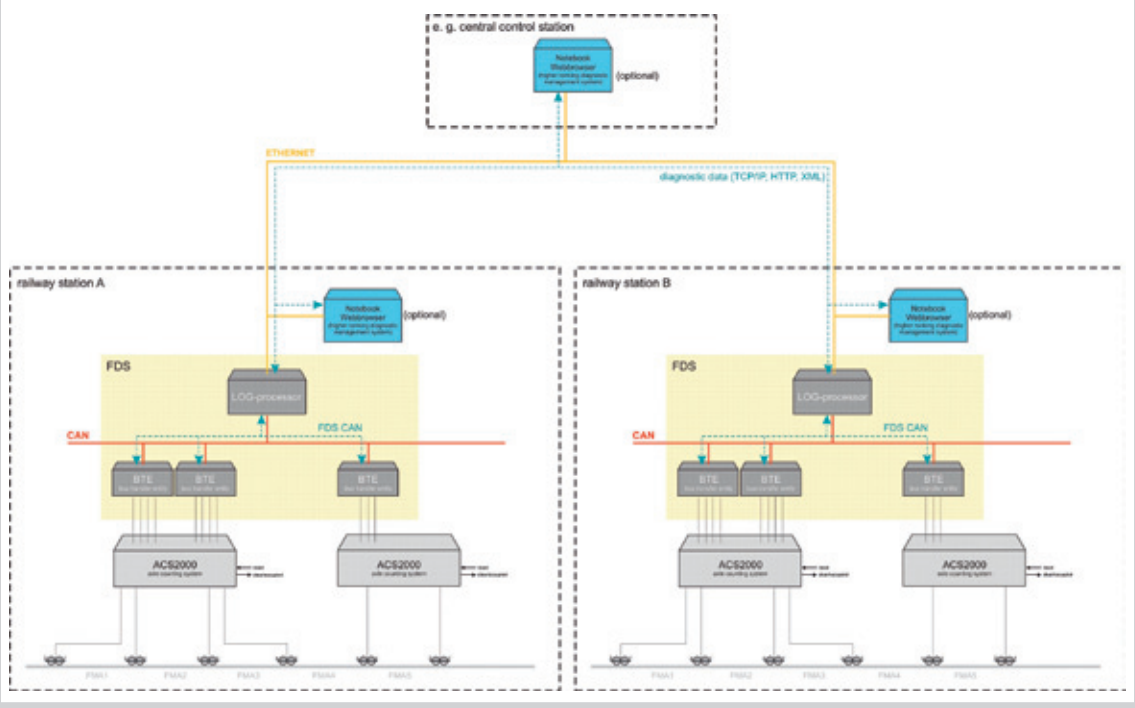


Figure 1: Topology and configuration of the Frauscher diagnostic system FDS with axle counting system ACS200

Generally speaking, during the entire development process of the FDS simplicity, language diversity, universal interfaces and intuitive user prompting were major considerations.

2 Design and configuration

Design and configuration of the FDS conform to the principles of simplicity and scalability. The FDS can be tailored to the size of the installation. The application can be quickly and easily expanded, without any restrictions.

The components to be diagnosed (axle counting board ACB, evaluation board IMC etc.) are connected to a bus transfer entity (BTE) using a RJ45 patch cable (figures 1 and 2).

The main task of the BTE is to ensure galvanic isolation and the absence of side effects on the axle counting system. Upon request this unit, which can diagnose up to four components, will process the information received for the logging processor (LOG processor).

The LOG processor may rightfully be called the “core“ of the FDS. This industrial computer based on a PC104 industrial system acquires all data and edits them for the “outside world“.

The LOG processor is connected to the different BTEs by means of a CAN bus. The CAN link is quite simply implemented using a DIN rail.

The “Embedded Linux“-operating system, which is loaded on a “CompactFlash“ card, stores the data and makes it available by means of a Web browser. No costly licenses or updates are necessary. Thus, autonomous data storage based on the specific installation size is secured for months or years.

3 Interfaces and compatibility

During the entire development stage particular attention was paid to universal interface compatibility. The Ethernet interface used represents a conventional and multi-purpose link, which affords, by means of a Web browser (Internet Explorer, Mozilla Firefox etc.), the retrieval of all current and stored diagnostics and statistics data (figures 3 and 4).

Furthermore, the data can be comfortably accessed via Internet, WLAN, GPRS, etc. Notification by SMS or e-mail completes the range of capabilities of the FDS interfaces (figure 9).

The diagnostics and statistics data acquired may additionally be edited and sent as XML telegrams to higher-ranking diagnostics management systems (e. g. ESDIS in Austria).

Figure 2: Bus transfer entity – BTE” – Combined LOG processor and CAN bus

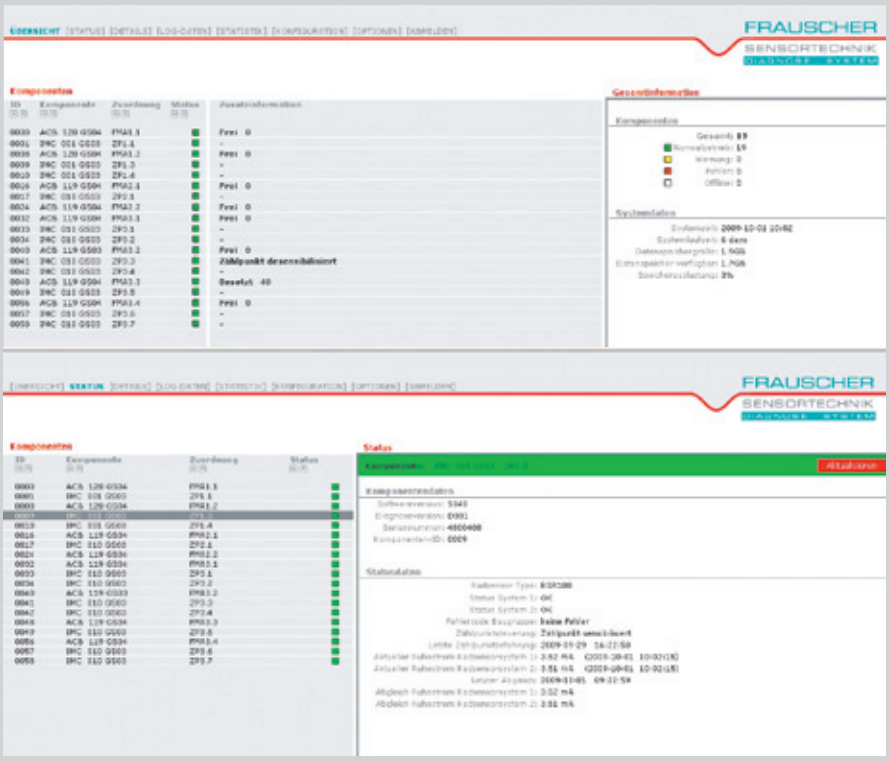
Voltage supply requirements and compatibility requirements in regard to the installation environment (temperature range, EMC interferences, etc.) conform to the indoor installation requirement for track vacancy detection systems from Frauscher.

4 User interface

After input of the address (IP, URL) of the LOG processor into a Web browser the FDS login screen is displayed. This screen affords a three-level user access with different access rights. The language option can also be selected in this screen.

The following overview screen provides a general summary regarding status and present conditions of the overall system. Besides the components implemented (ACB, IMC etc.), the status (ok, alarm, fault) is provided by a semaphore function. Additional information such as alarm and error codes or the current number of axles counted in is also displayed.

Clicking a component line will display further component-specific information (last reset performed, last adjustment, last traversing etc.). In case of a pending alarm or error message, the detailed error code or fault information of the corresponding component is displayed. This display affords valuable information on the possible cause of the



Figures 3 and 4: Web-based user interface offering numerous navigation and display options

Figure 5: Frauscher diagnostic system FDS – Bus transfer entity – BTE

Figure 6: Frauscher diagnostic system FDS – LOG processor

Figure 7: Frauscher diagnostic system FDS – GSM/GPRS modem

alarm or fault and simultaneously provides hints/clues for its clearance. Unlimited diagnostics down to field level is now possible.

Based on this primary information, the maintenance staff can optimise their preparations (necessary spare, operative failure, maintenance problems etc.).

Obviously all messages and data are recorded, in order to allow later investigations and evaluations.

The button “LOG data” allows retrieval of the data stored. Comprehensive filter functions allow target-oriented search & find of the information requested.

5 Details of diagnostic and statistical data

Each component linked to the FDS provides abundant diagnostics data, which the user can display, such as:

- Component (type, software, serial number)
- Component state (number of axles, alarm or error code)
- Availability of components (in %)
- Last axle counter count (number of axles, time)
- Last traversing (time)
- Last reset performed (time)
- Last component adjustment performed (adjustment current, time)
- Effective wheel sensor current (in mA).

Among others, the following information is edited for statistical processing:

- Traversing of counting heads (number of axles, running direction, period of observation, time of last traversal)
- Counting head occupancy detections (number of traversings, period of observation, time of last counting head occupancy detection)
- Component adjustment (number, period of observation, time of last adjustment procedure)
- Error status (number, period of observation, time of last error status)
- Reset (restricted or simple reset, number, period of observation, time of last reset procedure).

Practical example of the statistics application:

One of the maintenance requirements for track vacancy detection systems by Frauscher is, for example, a minimum traversing cycle of one counting head within a period of two years (CENELEC-Considerations regarding failure detection).

However, how can the user keep track of that cycle or period of time?

This is where the FDS comes into play, because it is able to provide the answer to this requirement effortlessly based on statistical data. Notifications may be linked individually and occasionally even to the event mentioned above. Thus, the FDS will send an SMS or an e-mail, when traversing of a counting head is required.

Another example of the statistics application:

Points or other track mounted equipment requiring maintenance after a certain number of traversals of axles or trains (lubrication, cyclical inspection etc.). Here too, the FDS statistics, which may optionally send a message as mentioned above, are again a comfortable means to secure such requirement.

Figure 8: Frauscher diagnostic system FDS combined with axle counting system ACS2000

6 Data management and storage

The universal *.csv format (text file) provides a compatible basis for the FDS’s data management and storage. Every day a compressed working file is generated, which can be downloaded and processed locally. The *.txt working files can be imported and comfortably evaluated, e. g. under Excel.

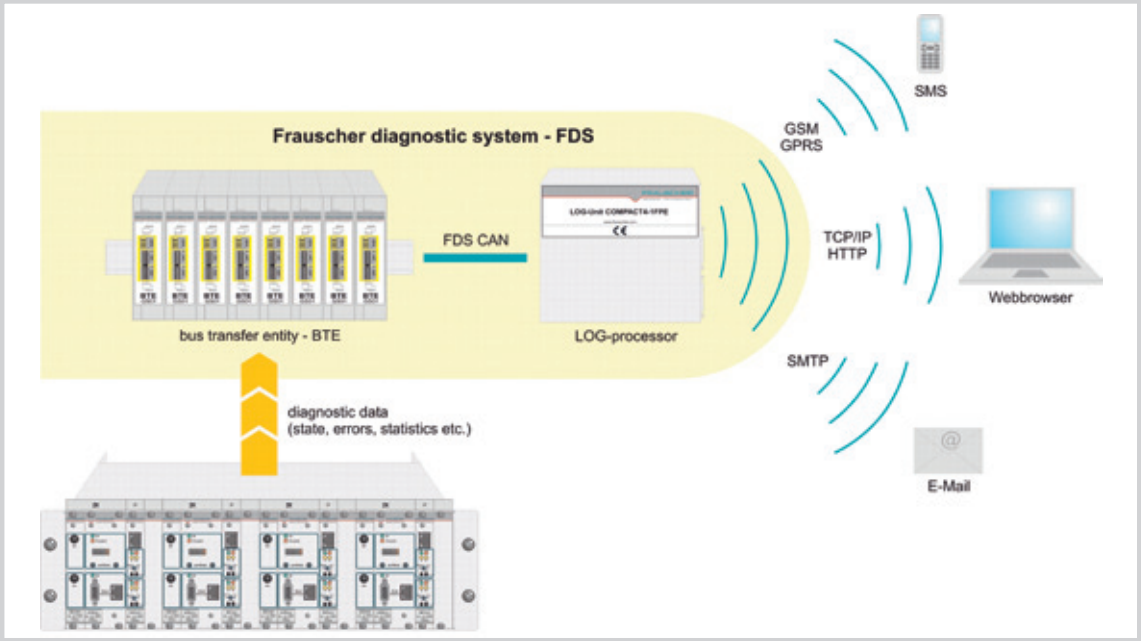


Figure 9: Interfaces of the Frauscher diagnostic system FDS

Given a traffic density of about 150 trains for approx. 30 axle counting sections, the daily data volume amounts to about 2 MB. Given a memory capacity of about 2 GB, which only depends on the capacity of the "CompactFlash" card selected, it is possible to store the data for up to 2 years without any problem.

7 Technical data

Hardware:
- Bus transfer entity – BTE
- PC104 based industrial LOG processor

Software:
- Web browser

Components suitable for connection:
- Axle counting board ACB
- Evaluation board IMC
- Digital signals (optional)

Interfaces:
- Ethernet (TCP/IP)
- GSM/GPRS
- E-mail
- SMS
- XML (optional) or user-specific adaptations

8 Future perspectives

The FDS by Frauscher is currently under trial. Comprehensive field tests in various countries as well as pilot projects have proven its suitability for daily use and its cost reduction effects with the users.

In future the FDS by Frauscher will be offered as a client-specific configurable component and deployed in combination with the axle counting system ACS2000 by Frauscher.

Due to the application of state-of-the-art technologies and interfaces, the system will also be capable of integration into future generations of axle counting systems by Frauscher.

We are at your disposal for further information or answers to your questions regarding the FDS diagnostics system by Frauscher.

9 Summary

The new FDS (Frauscher Diagnostic System) complies with present-day requirements regarding diagnostics and service support for all areas of maintenance and fault clearance. The availability of modern and pioneering communication links will allow the processing of all conceivable internal system data of Frauscher's axle counting systems according to client-specific requirements.

In future, the FDS will be offered as an optional component for the axle counting system ACS2000.

REFERENCES

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ZUSAMMENFASSUNG

Erhöhung der Verfügbarkeit durch Einsatz des Diagnosesystems FDS

Das neue Diagnosesystem der Frauscher GmbH erfüllt die heutigen Anforderungen hinsichtlich Diagnose- und Serviceunterstützung in allen Teilbereichen der Instandhaltung und Entstörung. Mit der Möglichkeit moderner und zukunftsträchtiger Kommunikationsanbindungen lassen sich alle denkbaren systeminternen Daten der Frauscher Achszählsysteme nach kundenspezifischen Anforderungen aufbereiten. Das System wird zukünftig als optionaler Baustein der ACS2000 Achszählsysteme angeboten.