ZSB 2000

YOUR SYSTEM INTEGRATOR FOR DIGITAL SIGNALLING SYSTEMS

SCHEIDT&BACHMANN

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Your system integrator for digital signalling systems

/ Thinking ahead *THIS HAS BEEN A CENTRAL THEME OF THE SCHEIDT &*

SCHEIDT&BACHMANN

Signalling systems

Scheidt & Bachmann is among the world market leaders of innovative system solutions for mobile life. We are proud to support transportation systems at home and abroad with our products, and to keep millions of people on the move daily.

Our signalling system business area provides comprehensive track solutions with a standardised hardware configuration, a standardised service concept, standardised operation control and a centralised control and monitoring for smooth running and customer-friendly operations. Our extensive sales and service network throughout our subsidiaries and agencies, ensure that we are always present nationally and internationally.

BACHMANN COMPANY THROUGHOUT ITS ENTIRE HISTORY.

Other areas in which Scheidt & Bachmann operates:

Parking and access systems

The Scheidt & Bachmann entervo product provides integrated modular systems solutions for parking management and also cashier and access control systems for leisure centres. Customised and flexible solutions attract a wide range of clients worldwide.

Fare collection systems

Scheidt & Bachmann is a market-leading supplier of integral system solutions for all manner of fare collection systems. For more than 30 years, we have been implementing flexible solutions which we adapt to suit your individual requirements, whether for local or regional transport companies.

Fuel retail solutions

Our integrated solutions designed for the future-proof operation of petrol stations are founded on more than 80 years of experience in this field. Scheidt & Bachmann is the leading supplier of automated systems to petrol stations in Germany and a leading European supplier of system solutions.

Facts & Figures

- Founded in 1872
- About 3,000 employees
- Grew from a mechanical engineering firm into an international system vendor
- Market leader in central areas of modern mobility
- Innovative product and production solutions

ZSB 2000 – AN IECC FROM THE FIRST MOMENT

The train has always been one of the safest forms of transport. Railway signalling techniques play an important role in reliable track safety. Scheidt & Bachmann is one of the most successful manufacturers in this sector with its more than 130 years of experience.

Rail and infrastructure operators in various countries trust in this technology and operate an integrated track concept on this basis of network capable and computer-controlled systems. Subsystems and individual solutions can however also be easily realised and adapted thanks to modern and flexible technology.

The interlocking system ZSB 2000 and its electronic field components offers everything in regards of modern operation management demands, despite its very compact construction.

The clear separation between hardware and software and their modularity allow a flexible and affordable solution that can be used on main lines as well as on branch lines or on inner-city and industrial railway lines. With the consequential use of state-of-the-art technologies and perfect adaptation to the respective customer requirements, energy and life-cycle-cost optimised solutions are made possible.

Alongside the main task of controlling and monitoring train movements, other tasks that are not typically part of rail protection measures (e.g. passenger information, switches heating, station platform announcements and lighting) can be realised from the start in the track concept as well.

/ THE IECC ZSB 2000

/ Subsystems

/ THE CLEAR SEPARATION BETWEEN

OFFERS EVERYTHING, IN REGARDS OF MODERN OPERATION MANAGEMENT DEMANDS.

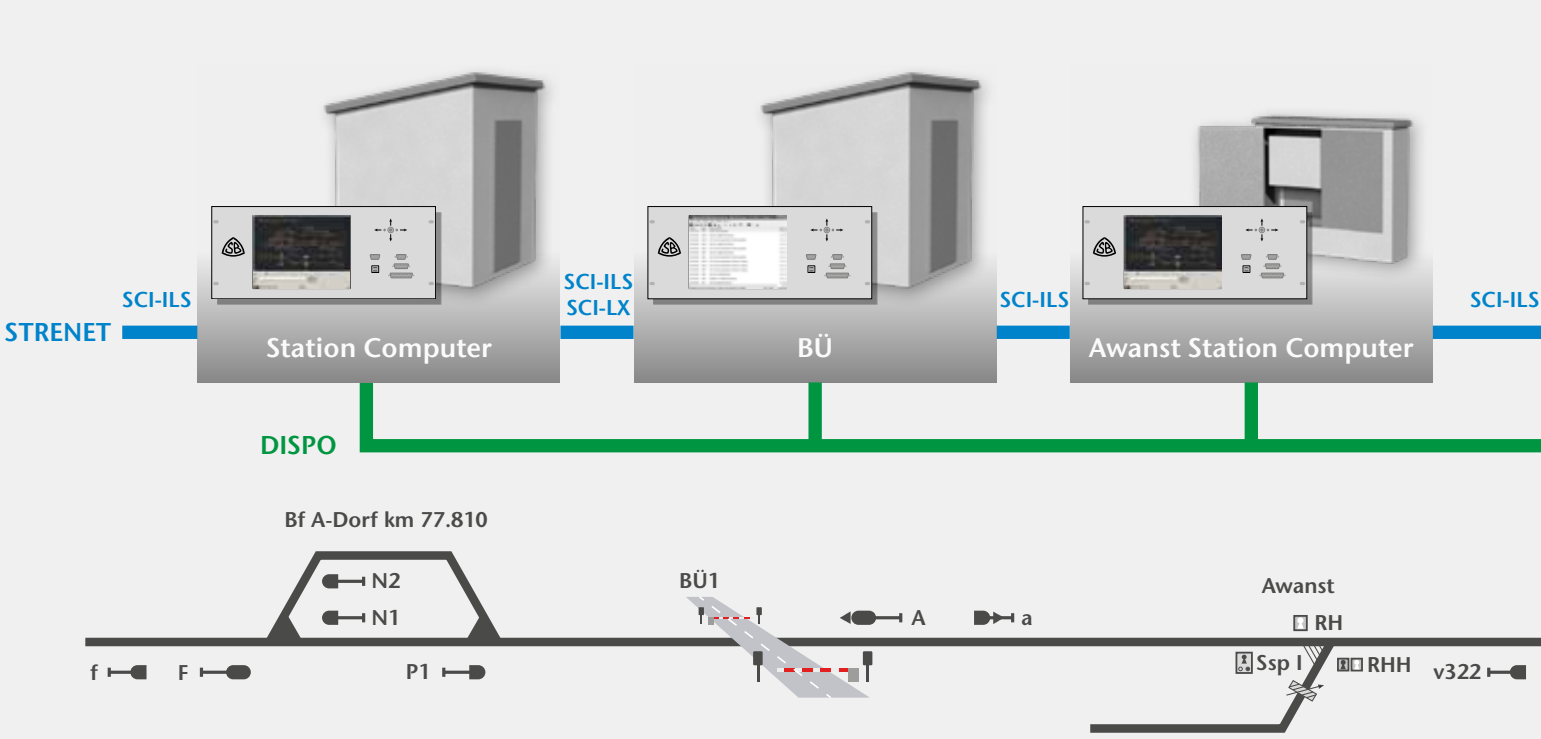
and individual solutions can be easily realised and adapted.

HARDWARE AND SOFTWARE ALLOWS A FLEXIBLE AND AFFORDABLE SOLUTION.

DIGITAL COMMUNICATION

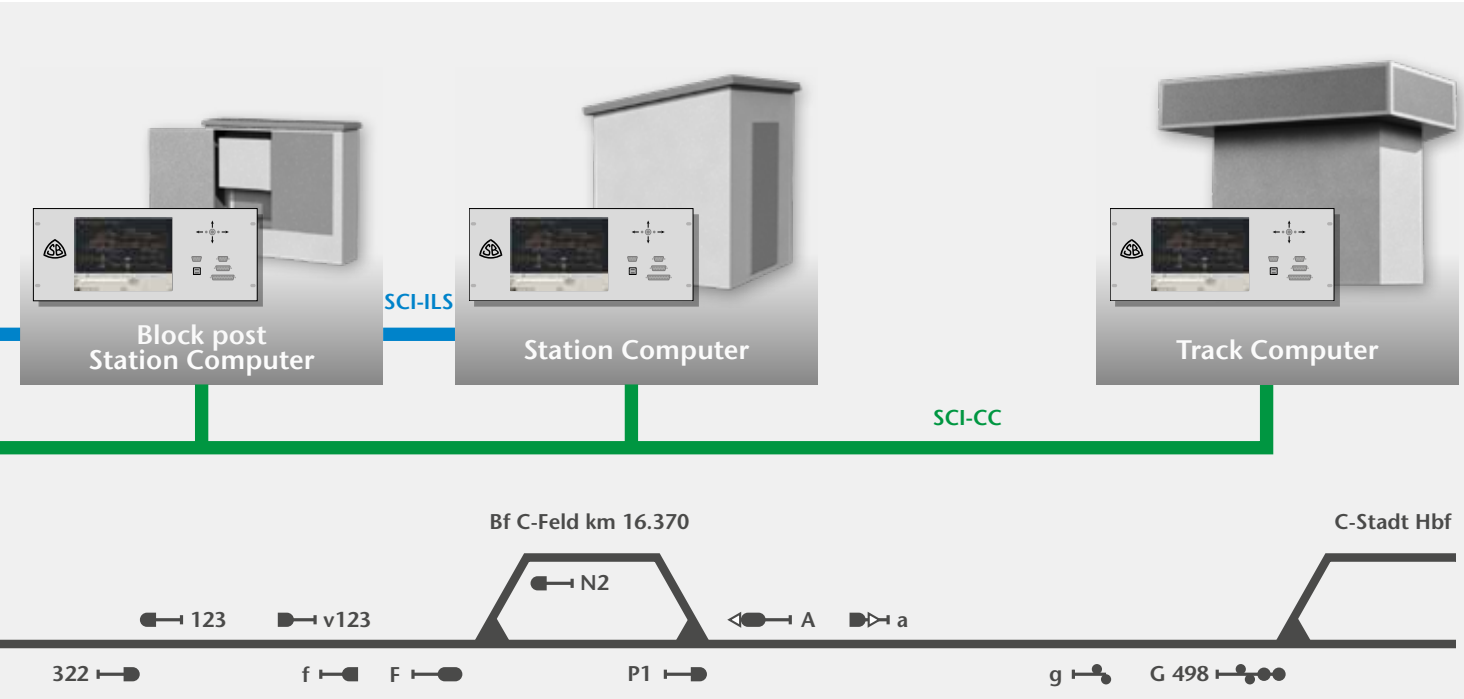
The interlocking system ZSB 2000 from Scheidt & Bachmann is suitable for operating procedures according to train operating regulations and for train control operation, and has the corresponding approval for use on main lines and branch lines in several countries.

With the modular system concept and the consequential software-based realisation of functions, the interlocking system ZSB 2000 is very flexible and can quickly be adapted to customer requirements. All of the usual traction types on tracks equipped with the ZSB 2000 can be used, and operation on electrified tracks is also possible. In general there are digital communication interfaces available for time and cost optimised connections between all operating points found on the track. These are listed as digital interfaces (bus) and with the data exchange based on telegrams, a very large information depth with minimum cabling work is possible between the operating interfaces along the whole track. Alongside the operating points of the train station, passing point junctions (AWANST) and block adaptations, level crossings (BUES 2000) can also be directly connected to these interfaces. This means that continuous track cabling using rail flange cabling for the first time makes sense, and therefore opens up for potential savings in investment costs. Due to the contents to be transmitted, “intelligent” interfaces designed as a bus are used. While all operating points along the track and the neighbouring train stations communicate safely with each other technically via the track network bus (**STRENET**) using logical point-to-



point connection and encryption algorithms, secure data exchange with the operating or servicing control centre is realised via the dispatching bus (**DISPO**) using secure display proceeding.

The future of communication is secured with standardised interfaces **SCI** (Standardised Communication Interface) through **RASTA** (Rail Safe Transport Application) via a secured **IP** based network. All necessary hardware and software additions have already been developed.



OPERATIONAL MANAGE
CONTROL AND OPERA

Central operating, displaying, dispatching and interlocking functions:
In the system concept of the interlocking ZSB 2000, a central operating console (operating position for dispatcher) is set up for the normal operational management of a track. Via SCI-CC (Standard Communications Interface command and control) the dispatching and diagnostic bus (DISPO) and the station computers are linked with the track computer, which in turn can also serve as the DiB (Design integrated Dispatching centre) and thus the central operating console for the dispatcher. This operating console provides a central display and operating desk for the tracks assigned to him. The dispatcher desk is designed according to safety integrity level SIL 0.

The safety in respect of signalling is achieved with approved procedures not only for the communication between a particular local interlocking and the DiB, but also for the operating and displaying functions. The operating and displaying of the track is realised in accordance with customer wishes In accordance with the project, the display can be distributed to several monitors so that both the zone overview and the station loupe screen can be active at the same time. The station loupe screen images are generated automatically by the required information being called in from the stations, i.e. the individual track images are transmitted from the stations to the track centre. As a result, only the configuration of the complete track from the individual station loupe screen images has to be designed.

Updating of the display images is carried out automatically each time there is a change in the station computer of the interlocking ESTW. In addition an update can be initiated by the track centre if necessary.

It is also possible for the dispatcher to call in the setting of routes and to carry out individual- and auxiliary operations, these being safely displayed, processed and transmitted in signalling terms with the aid of various processes such as display, input and command safeguards. Diagnostic information can also be displayed at the dispatcher operating desk.

To enable operations to be carried out automatically, a ZSB 2000 track can be equipped with a dispatching system. This system outside the safety core is based on the system which is safe in signalling terms and accordingly is at the same level as the operating console. When dispatching is running , assistance of the dispatcher is not necessary for the normal progress of the operations. As a result the movement operations are progressed automatically and the 13 routes needed are set automatically and in good time. To enable these tasks to be realised, the overall ZSB 2000 system is divided into two parts:

- Safeguarding of the roadway. This fulfils the tasks of an interlocking system. These are the safeguarding of the train movements in stations and along the tracks
- Train control system. This fulfils the dispatching tasks such as locating and identifying the trains in the network and actuating train routes

The selection of routes is controlled by the timetable control, which sets the routes automatically via a timetable stored in the system.

MENT
TING WITH COTS

Local operating and display functions:
All ZSB 2000 systems are equipped in the respective setting unit with a dispatching and diagnostic computer which is decoupled from the safety level. This unit, which is designated a station computer, permits the local system to be operated and displayed, and is primarily for maintenance and service. The operational possibilities for the operating service can be made available with the auxiliary keys arranged in the outer area. In addition auxiliary actions with responsibility for the safety thereof or the shunting route requirements (ÖVA) can be carried out from this device.

/ *DISPATCHING*

/ *DISPATCHER OPERATING DESK*

/ *TIMETABLE CONTROL*

/ *LOCATING AND IDENTIFYING TRAINS*

/ *AUTOMATIC MODE*

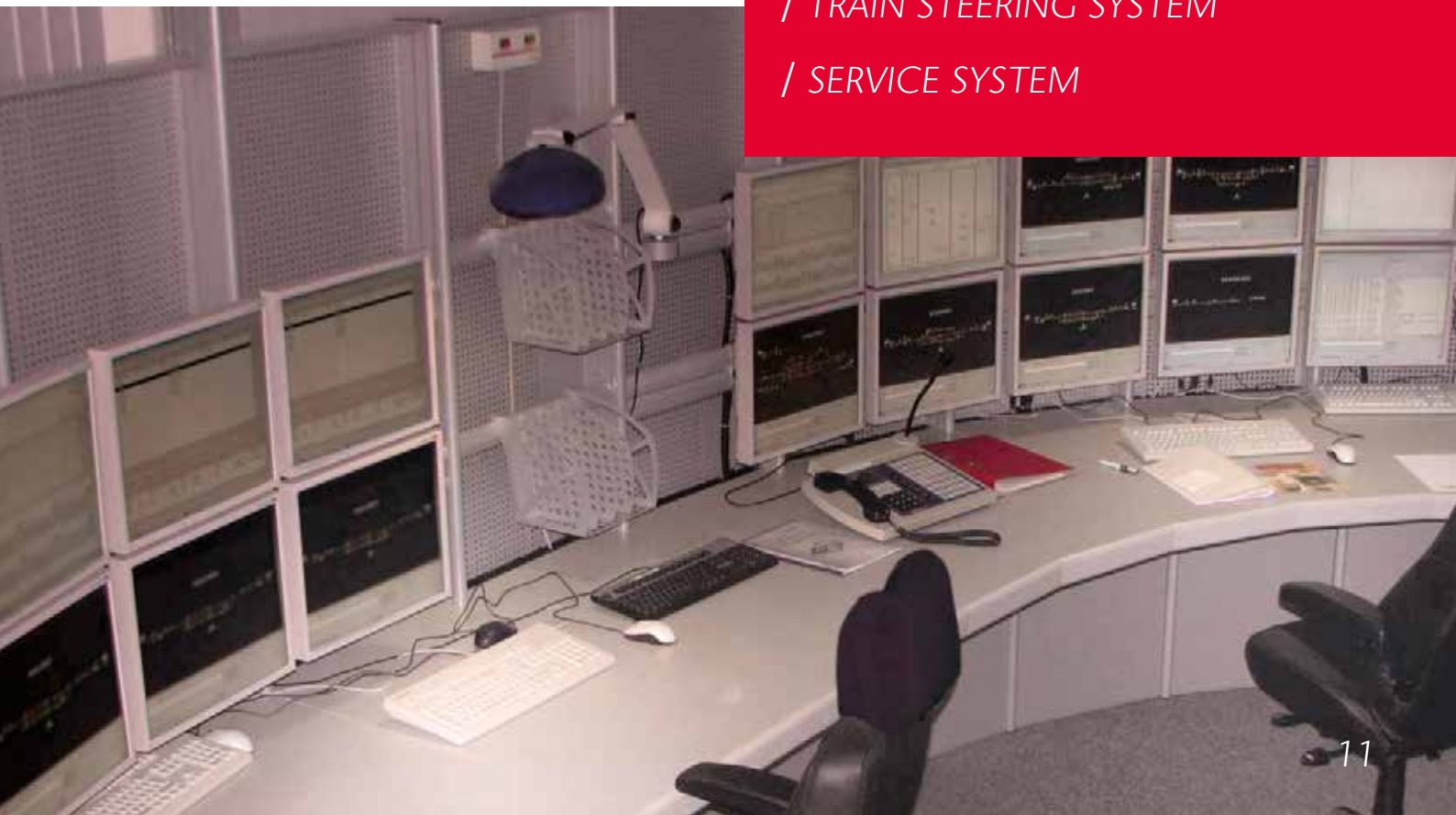
/ *AUXILIARY OPERATIONS MODE*

/ *TRAIN SAFEGUARDING SYSTEM*

/ *DIAGNOSTIC SYSTEM*

/ *TRAIN STEERING SYSTEM*

/ *SERVICE SYSTEM*



DECENTRALISED SYSTEM WITH OPTIMISED ADAP

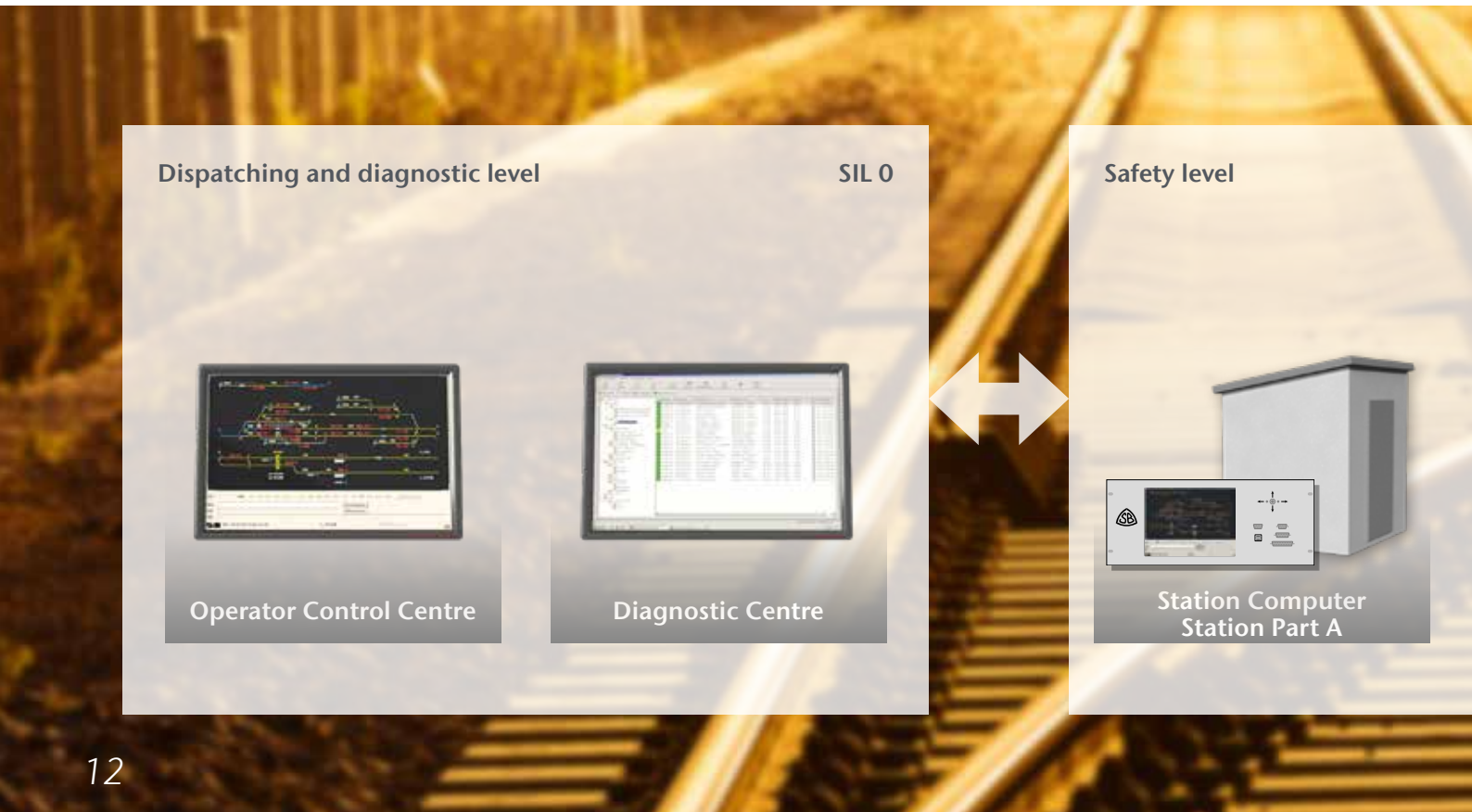
The Interlocking system ZSB 2000 can be installed in various versions and are suitable for main and branch lines.

Among others it is EBA approved, and will be installed along the track as a decentralised system concept and linked via standard interfaces. Which operating points along the track are to be used and which modules are required is specific to the project and customer, whereby each system is generally implemented on the same platform and can be divided into three levels. The comprehensive track tasks are listed in the dispatching and diagnostics level. Communication between the safety level of operating points along the track takes place via the SCIILS (Standard Communication Interface interlocking systems) or the SCI-LX (Standard Communication Interface level crossing) or the STREckenNETz bus (**STRENET**) as a logical point-to-point connection. The individual ZSB 2000 operating points control and monitor the local operating processes at the safety- and field levels. The elements of the field level are linked with the interlocking level by a serial standard interface; the element bus (EBUS) as a CAN bus.

On lines with ZSB 2000 the following operation points may be applied:

- Station
- Block post
- Passing point junction
- Block adaptation at the start and end of the section

Each of these operation points works in a stand-alone manner with a safe system core and controls a project-dependant number of field elements. Very big stations are built with several operation points.

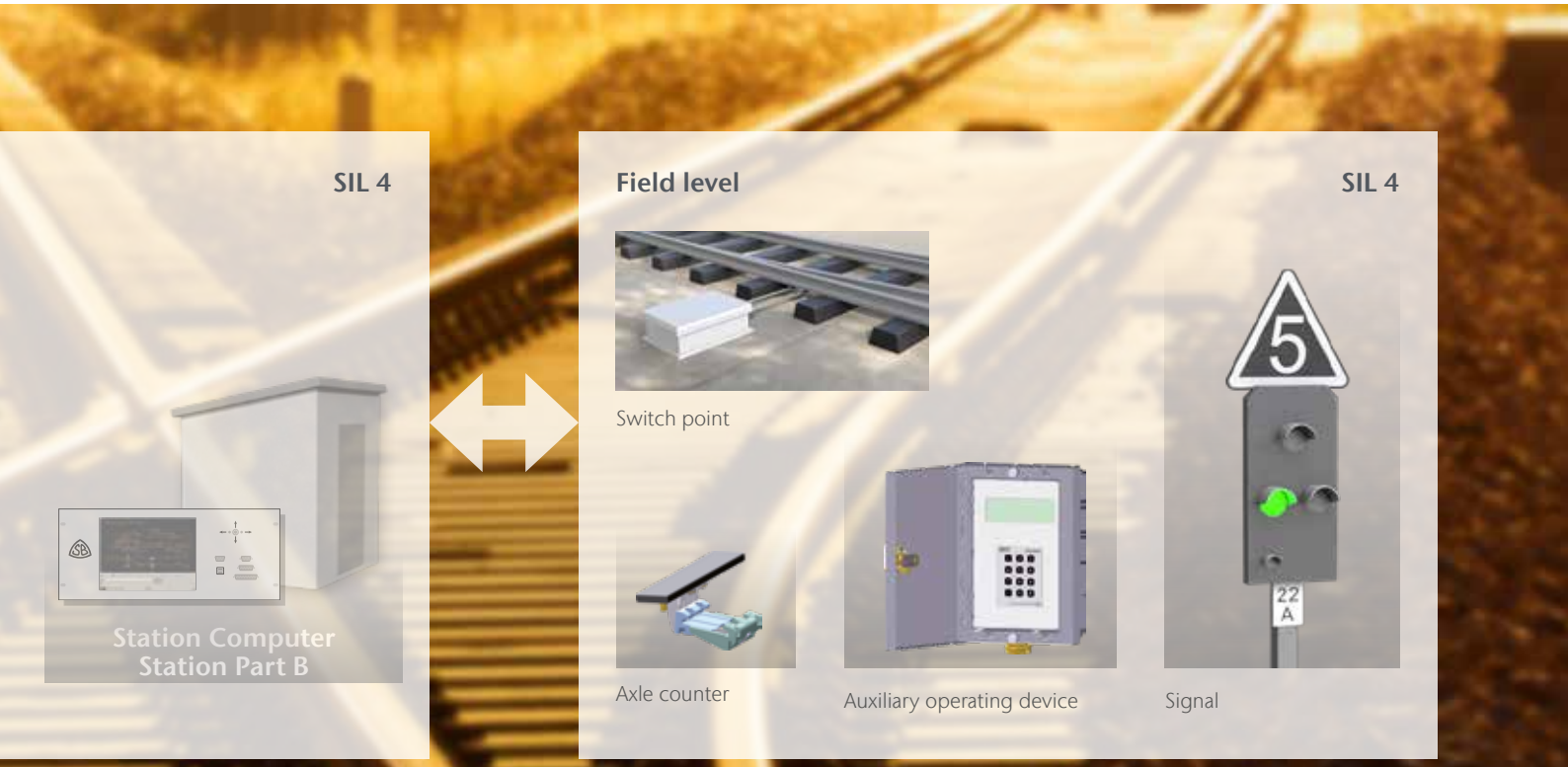


ARCHITECTURE
TATION

The ZSB 2000 processes the following elements:

- Electrically remote-operated switches
- Electrically remote-operated scotch blocks
- Single-slip and double-slip switches
- Spring switches (trailable points)
- Fallback switch
- Electrically locally operated switches and scotch blocks
- Manually operated switches and scotch blocks with key requirement
- Train routes
- Shunting routes
- Close operation areas
- Interlocking route safety
- Overrun length paths
- Main signals
- Presignals
- Multi-section signals
- Speed indicators
- Shunting signals
- Protection and obstruction signals
- Supplementary signals
- Automatic train control
- Track clear detection with axle counters
- Blocks
- Auxiliary operation equipment
- Various block adaptations to 15 signal box systems
- Adaptation to relays block

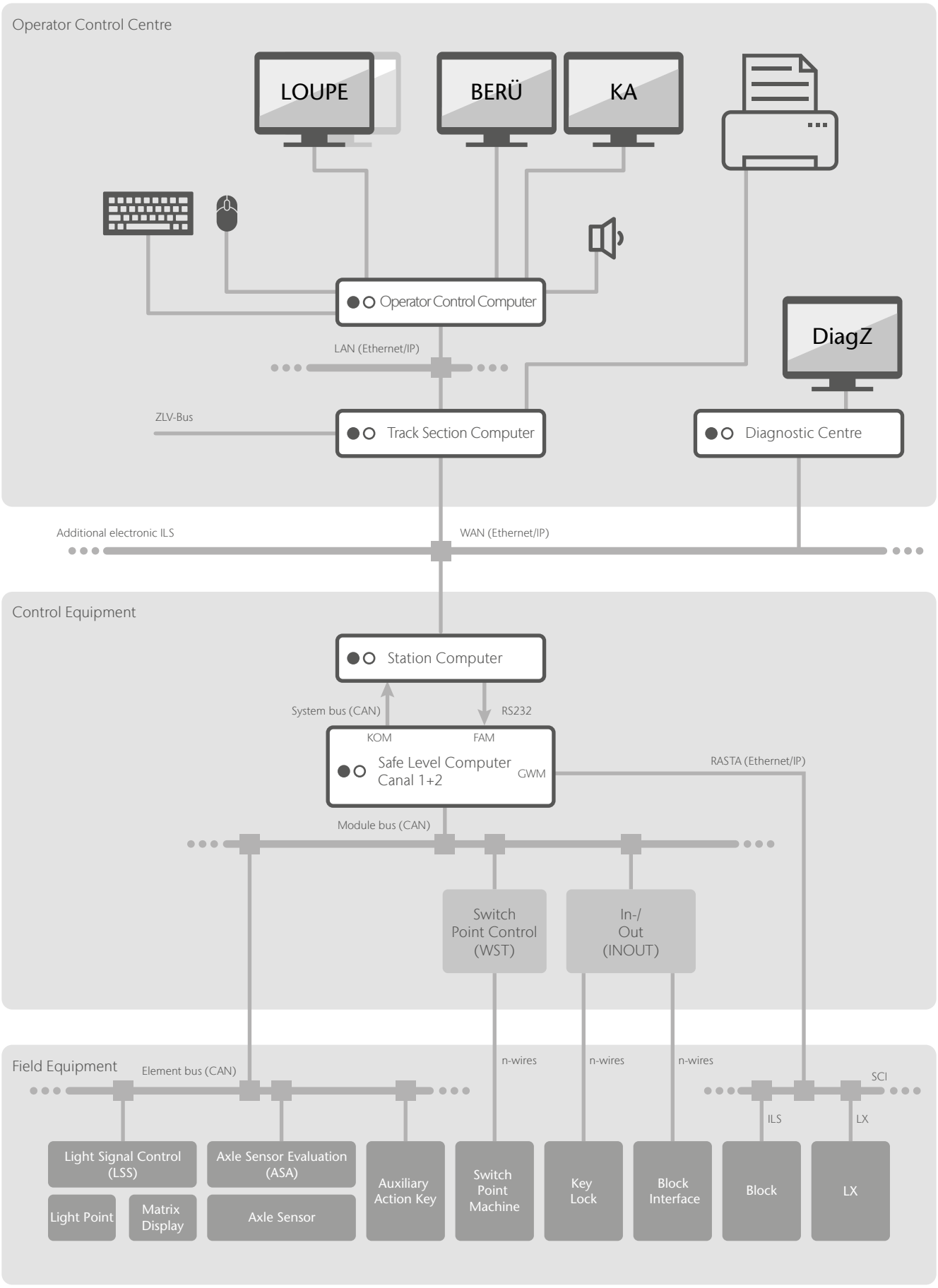
All elements are configured in accordance with the specific project and topography.



MODULAR PLATFORM CONCEPT

The safety level of the ZSB 2000 is the safe data processing centre of the ZSB 2000 interlocking.

It consists as a rule of three modules (two communication and one route module), each having a duplicated computer system. In addition a service keyboard and a duplicated program and system data memory are provided in the safety level. Only data is processed in the safety level and no currents are set. The release of energy is carried out locally at the actuating element.


Operator Control Centre
LOUPE
BERÜ
KA
Operator Control Computer
LAN (Ethernet/IP)
DiagZ
ZLV-Bus
Track Section Computer
Diagnostic Centre
Additional electronic ILS
WAN (Ethernet/IP)
Control Equipment
Station Computer
System bus (CAN)
RS232
KOM
FAM
Safe Level Computer
Canal 1+2
GWM
RASTA (Ethernet/IP)
Module bus (CAN)
Switch
Point Control
(WST)
In-/
Out
(INOUT)
Field Equipment
Element bus (CAN)
n-wires
n-wires
n-wires
SCI
ILS
LX
Light Signal Control
(LSS)
Axle Sensor Evaluation
(ASA)
Auxiliary
Action Key
Switch
Point
Machine
Key
Lock
Block
Interface
Block
LX
Light Point
Matrix
Display
Axle Sensor

NEW STANDARDS IN ENERGY EFFICIENCY

In times of scarce resources and rapidly increasing energy costs, energy optimised solutions are more at the forefront of forward-thinking technology than ever before.

At the time of developing the interlocking system ZSB 2000, particular importance was attached to the use of modern and energy-saving technologies. The consequential separation of energy and information was implemented in the control principle of field elements of this reason. The use of LED signal transducers was favoured from the very beginning, whereby saving potentials can be optimally used with light control via a separate computer in the light, and the loss of energy monitored and minimised.

The full interlocking system ZSB 2000 hardware has been designed so that it can be used without additional heating or air conditioning facilities. The actual control is optimised as a multi-computer system so that use of energy below 100 W is the rule of thumb.

This means that the necessary overall power of a train station for all field elements and control in the basic position, performances below 0.5 kW can be easily achieved. This means that the uninterruptible power supply (UPS) can also be kept very streamlined. Crossing stations with a battery capacity of 100 Ah are not an exception and still allow uninterrupted operations management if the power supply network fails.

The use of a standard mobile single-phase power unit as an uninterruptible power supply (UPS) is therefore possible without any difficulty.

Element	Power requirements
LED signal transducer red 200mm	11,5 W
LED signal transducer yellow 200mm	10 W
LED signal transducer green 200mm	15 W
LED signal transducer white 80mm	6 W
LED signal transducer red 80mm	6 W
LED supplementary signal transducers	26 W
Axle Sensor AZSB 300	3 W
Passing Track / Block Interface	71 W
Example: Station with/up to 4 switch points, 11 axle sensors, 3 pre-signals, 1 multiple block signal, 4 main signals	Ø 400 W

LIFE CYCLE COSTS OPTIMISED AND SUSTAINABLE

For efficient operations management, railway and infrastructure operators require optimised life-cycle costs and sustainable systems alongside favourable investment costs.

The issue of the availability of spare parts (obsolete parts) to achieve the expected periods of use for interlocking and level crossing systems has become a fundamental topic over the past years, especially in electronic systems in control and safety technology.

Scheidt & Bachmann offers long term backward compatibility of its assemblies in the area of signalling components. The continuously growing performance capacity of electronic components is used to be able to integrate function upgrades easily in the future and allow pin compatible replacement of existing assemblies.

In order to be able to turn these two aspects into reality, the corresponding strategic parameters were already created in the basic design. The system architecture of the ZSB 2000 and BUES 2000 technology is therefore based on a standardised platform strategy, which exchanges data via a standard communication bus between the internal system and the external system components. Constant functional extension and long-term operating capacity are ensured by the strict separation of hardware and software with backward compatible assemblies but ones that can be permanently developed technologically.

The tools common in the micro-electronics market are used for this. One of these is the FPGA (Field Programmable Gate Array), which can be used to personally produce the fundamental and critical elements of an interlocking system via personal programming. Delivery problems caused by component discontinuation can therefore be targeted and sustainably ruled out as these modules ensure all control and logical functions of the interlocking or level crossing system. This software can therefore be used and upgraded in the long term.

This means that Scheidt & Bachmann is capable of producing components in signalling areas in the long term and therefore solving obsolescence problems.

/ SCHEIDT & BACHMANN OFFERS
IN THE AREA OF SIGNALLING COM

LONG TERM BACKWARD COMPATIBILITY OF ITS ASSEMBLIES PONENTS.

/ THE USE OF FPGA'S ELIMINATES DELIVERY PROBLEMS DUE TO COMPONENT OBSOLESCENCE.

SIGNALLING CONCEPT

Used in the interlocking system ZSB 2000 are LED signal transducers. Actuation of the signals is brought via a safe electronic subassembly, namely the LSS-BG (Light-Signal-Control Subassembly), which is installed at each main signal location.

This subassembly is connected to the safe interlocking level on the EBUS (element bus executed as CAN-bus) and gets transmitted the data for the signal aspects (images) to be displayed. For this the LSS-BG communicates via the SCAN (SignalCAN bus) with the safe processors of the individual LED light points of the main and advance signals and – in so far as these are present – with the auxiliary signals and speed displays at the location of the specific signal.
Here the individual light points are brought together in a logical signal group and actuated via the SCAN bus per telegram. Thus each optical device possesses its "own intelligence" for the actuation and monitoring of the particular light point. In the case of an interruption in the link to the relevant interlocking level, an appropriate relapse management system in the LSS subassembly is processed.

Light signal control subassembly LSS / intermittent automatic train control subassembly PZB

The individual signal aspects from the interlocking level are transmitted to the light signal control subassembly LSS-BG via the EBUS (CAN-Bus). Then, via the SCAN-Bus (SignalCAN-Bus) the LSS-BG actuates the individual light points per telegram. In addition the PZB (intermittent automatic train control subassembly) solenoids required can be connected in 500/1000/2000 Hz to the LSS-BG or, as the case may be, PZB-BG for advance and auxiliary signals.

LED signal transducer

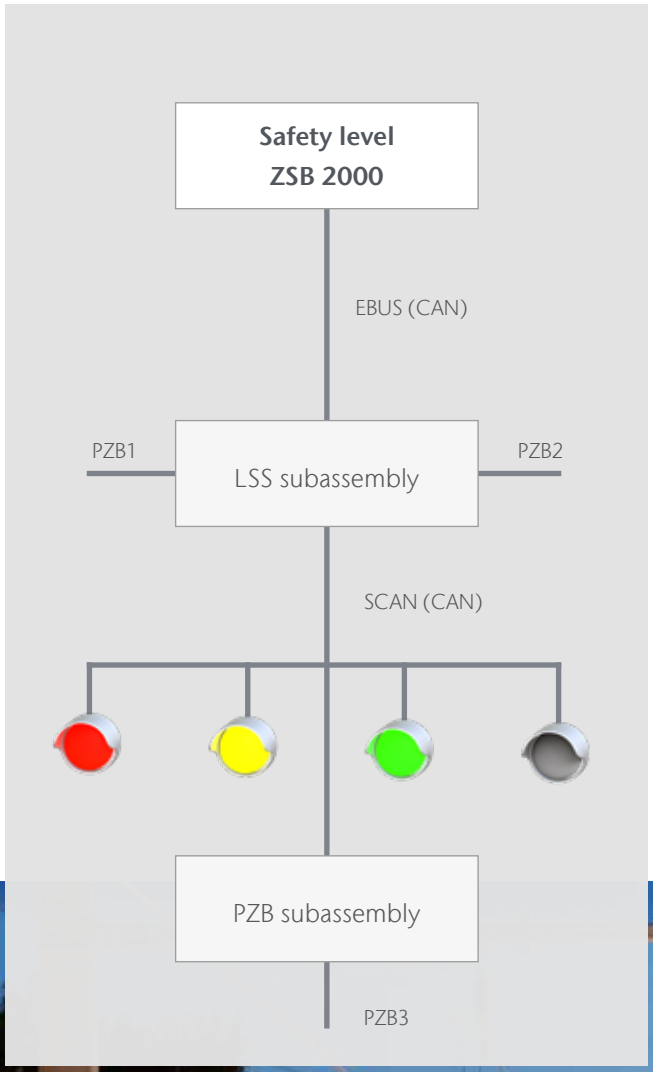
The main signal light points are executed as a 200 mm LED optical system. The safe processor for controlling and monitoring is executed together with the optical system as a pluggable unit. The 200 mm light point consists of 64 LEDs, each having a separate lens. The LEDs are monitored and actuated in 8 chains, each of 8 LEDs.

LED universal matrix indicator

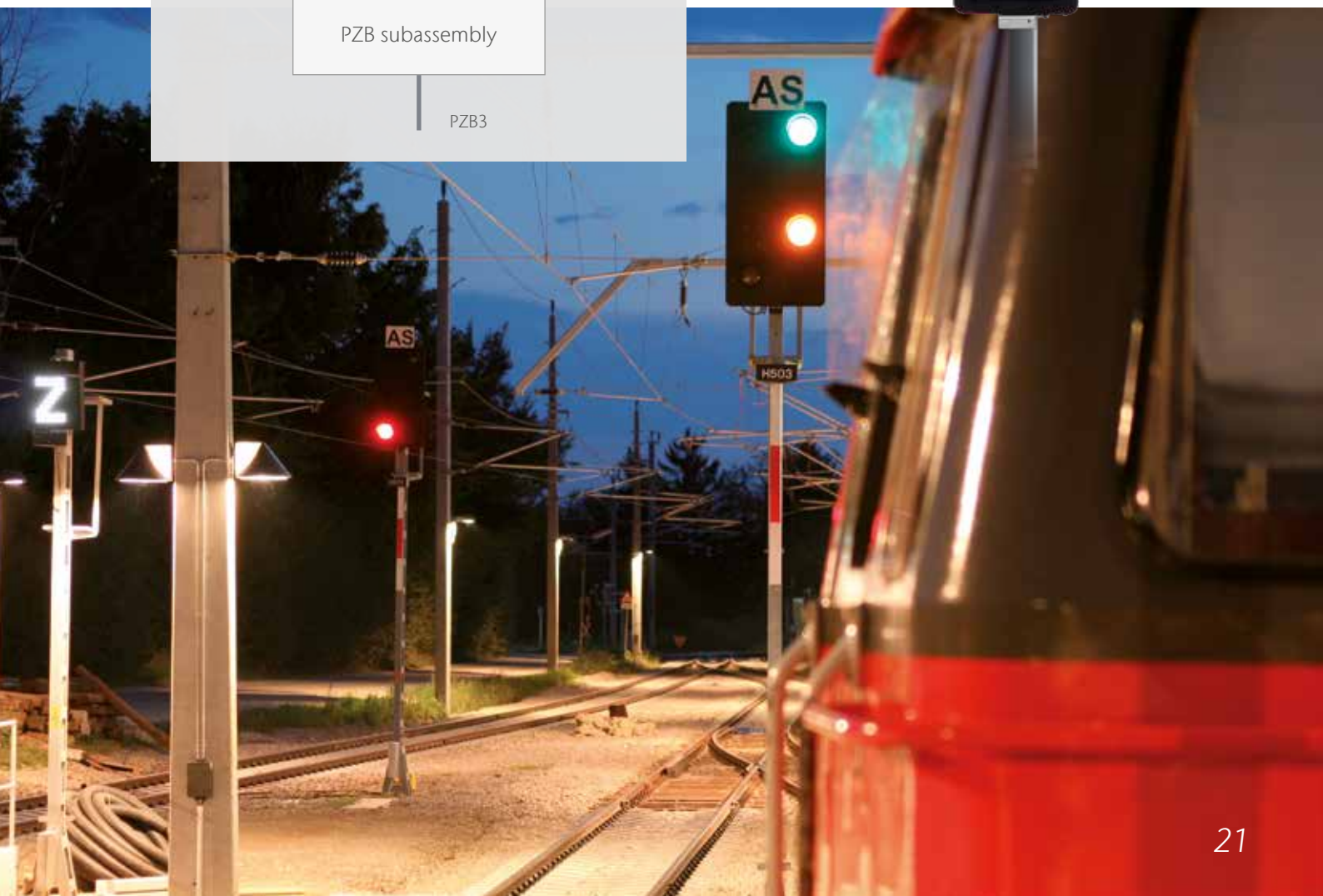
The matrix displayer is a 10 x 14 LED light point matrix which is safely actuated and monitored in signalling respects by a safe processor whereby each of the 140 LEDs can be switched on and off in a freely programmable manner. In this way each character able to be represented in the matrix can be defined, actuated and monitored per software configuration with one matrix displayer.

LED supplementary signal transducers

Available for supplementary signals is an 80 mm LED optical system. This can be used, for example, for replacement, light barricade- and mini-signals. These are also actuated by a LSS-BG via the SCAN-Bus per telegram with each optical system being equipped with a safe processor for actuation and monitoring of the particular light point. The 80 mm light point consists of 32 LEDs, each having a separate lens. The LEDs are monitored and actuated in 4 chains, each of 8 LEDs.


Safety level
ZSB 2000
EBUS (CAN)
PZB1
LSS subassembly
PZB2
SCAN (CAN)
PZB subassembly
PZB3

Signal


AS
Z
AS
H503

VEHICLE DETECTION CONCEPT

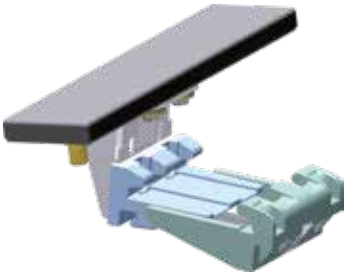
Axle counting is an integral component of the ZSB 2000 logic

Axle counting is not formed as a separate functional unit but as software. Accordingly the sensor system needed for capturing the axles only provides the information “axle and direction” to the ZSB 2000 interlocking level.
The evaluation of the “axle” information is carried out safely in the interlocking level with the formation of appropriate sections. The transmission of the information between sensor and interlocking is carried out with the aid of EBUS, executed as CAN-Bus (Controller Area Network bus). The axle counter consists of:

- Axle sensor AS
- Axle sensor evaluation subassembly for interlocking system, ASA BG

Axle sensor with universal fastening system

The axle sensor consists of an impact resistant and waterproof welded plastic housing with an universal fastening system for clamping to the rail.

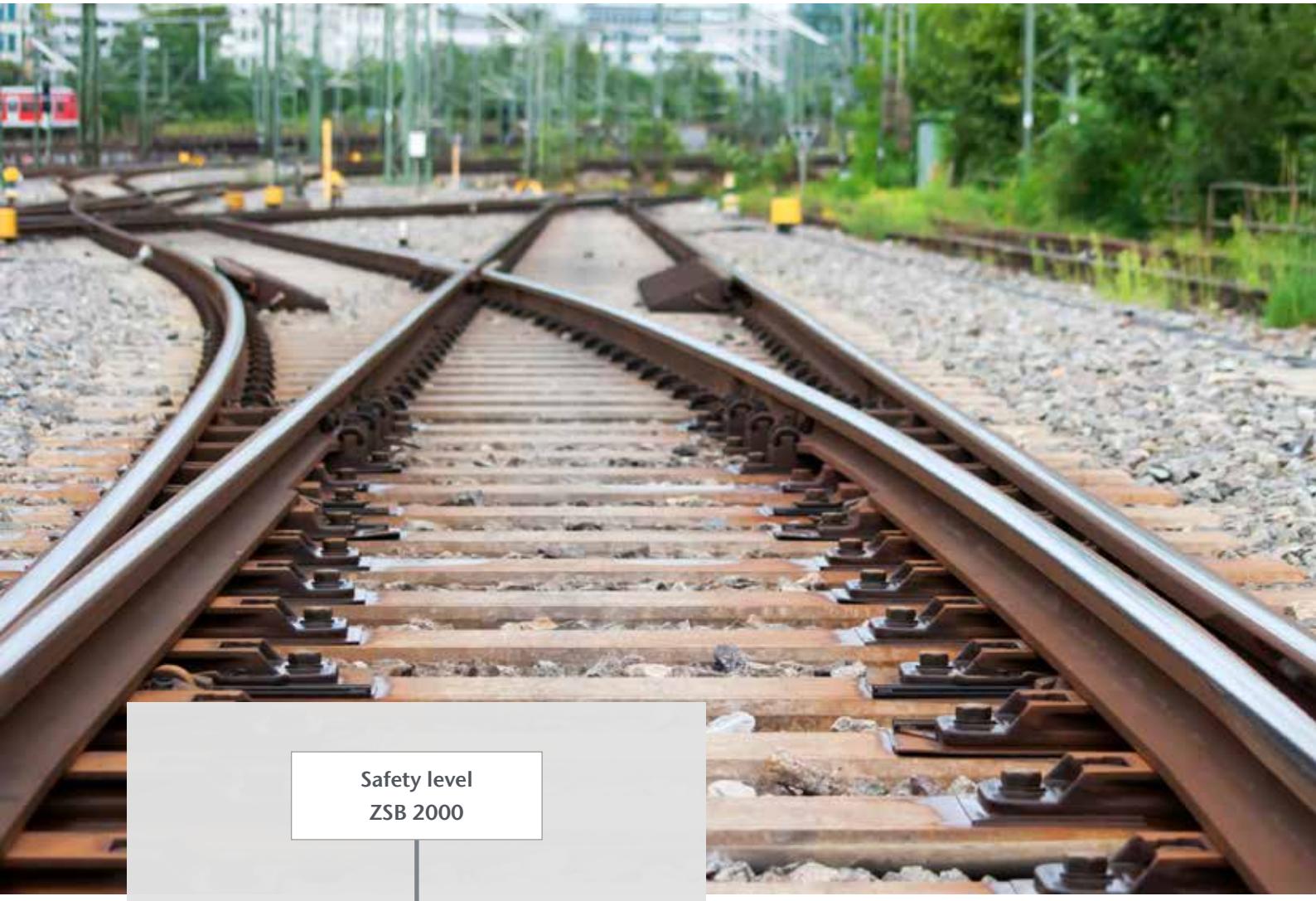


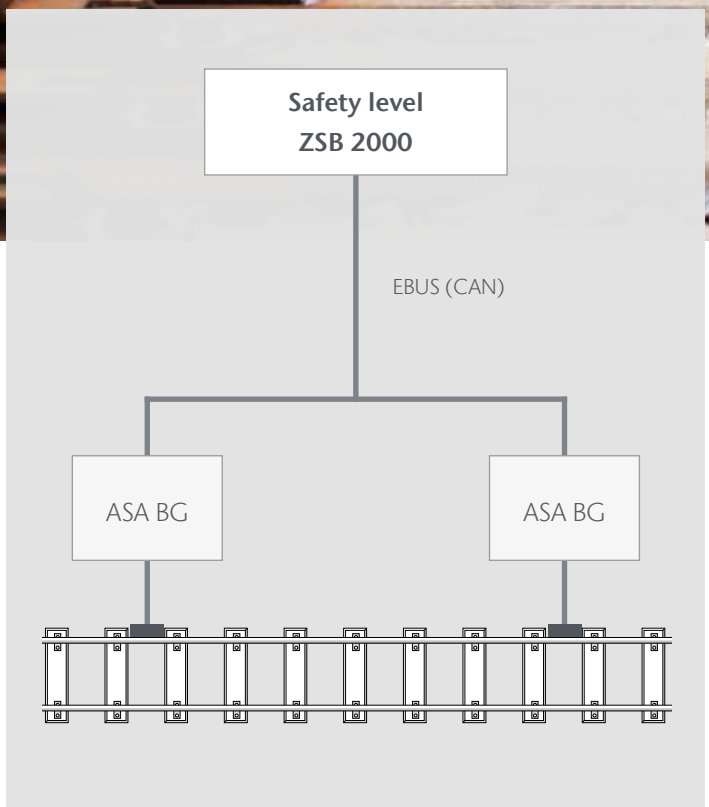
Axle sensor evaluation subassembly ASA

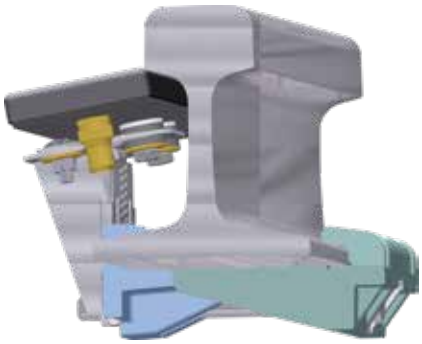
The axle sensor evaluation subassembly evaluates the data from axle sensor and transmits each axle that is captured from train together with the related direction via the CAN bus. The counting of the axles is carried out in the ZSB interlocking level. This subassembly is identical in terms of construction to that in the level crossing system BUES 2000.

Axle sensor in the track

The axle sensor consists of 2 small induction loops which are integrated in a compact housing, which is screwed to the rail, and which is evaluated in an axle-sensitive manner on the basis of their longitudinal extension. The axle sensor is identical in terms of construction to that in the level crossing system BUES 2000.







Axle sensor on the rail

LOCAL OPERATION USER INTERFACE CONCEPT

In the interlocking system ZSB 2000 additional display and operating devices are provided and used for particular operating situations or for variances from normal operations.

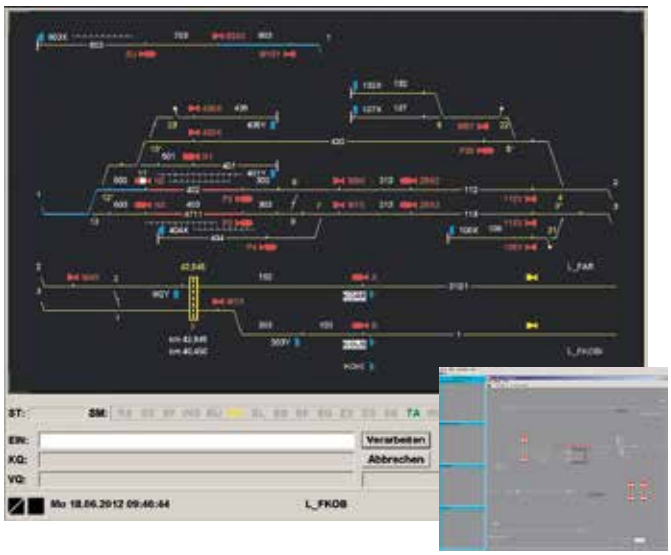
For operating at local level, so-called local operation user interface equipment (ÖBE) can be used. Here a HST subassembly (Key switch for local operation) is used, this being also connected to the EBUS (element bus as CAN bus). The use of key buttons and operating on the dispatching and diagnostic system are also possible.

Local operation user interface

A local display and operating device can be provided for maintenance and service. The functions of this device are restricted exclusively to the adjusting range of the related ZSB 2000 system and permit the requesting of routes. The device is combined with the diagnostic system that is present.

User interface

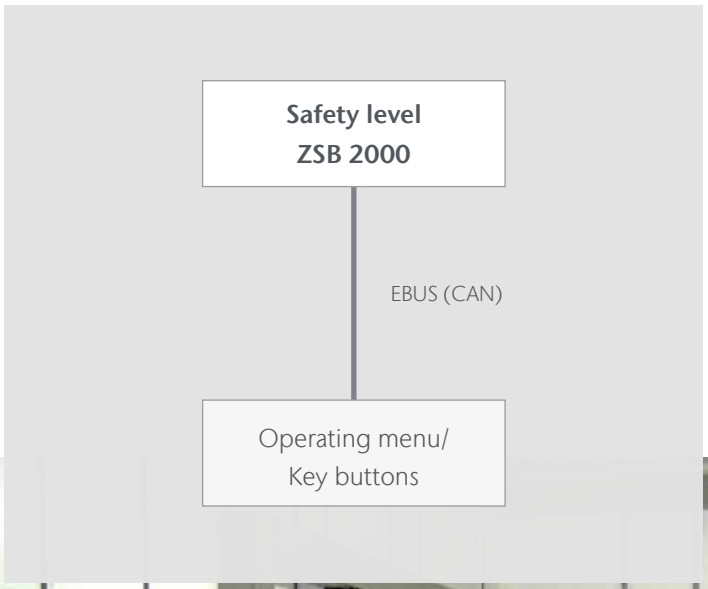
Where requested by the customer, magnified images can be called up and controlled on the station computer belonging to the particular station. To do this the local operator logs on at the station computer. Here the operating possibilities and procedures depend on the particular customer's display and operating system (e.g. EBO2)



Key buttons

For particular cases of application such as passing point junctions (e.g. set of switch), a key blockade device can be fitted. After the device has been enabled, the user can set the roadway on local site via key dependencies. Integration for the operating of mechanical barrier systems is possible.

Operating menu



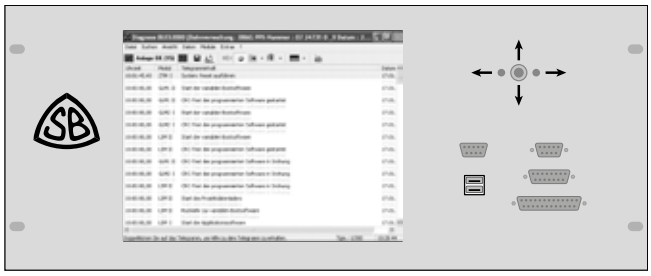
SERVICE CONCEPT

Each interlocking system ZSB 2000 has a station computer for dispatching and diagnostic tasks. The station computer is linked with the safe system on the one hand in a reaction free manner and on the other hand via a dispatching interface (DISPO).

For diagnosis the CAN telegrams that have been sent on the system bus can be read and displayed with the aid of an analysis program.

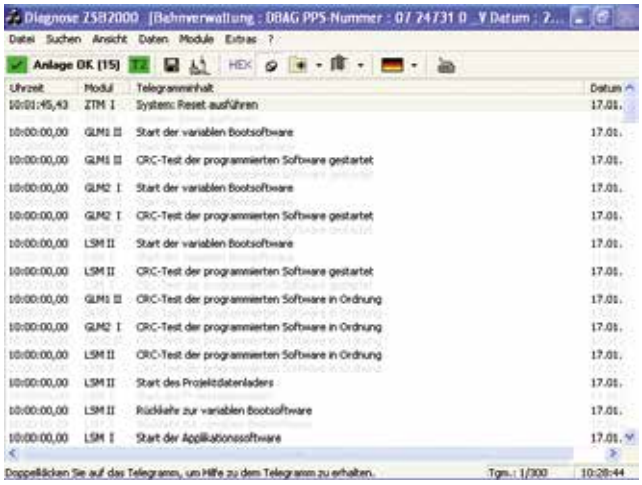
Local diagnosis

A Windows-based diagnostics program is installed on the local PC. This program decodes and stores the telegrams received from the interlocking system ZSB 2000.
With the aid of a corresponding data management system, errors and disruptions are prepared and stored for the service and maintenance personnel. The subassembly is identical in terms of construction with the diagnostic system of the level crossing system BUES 2000.



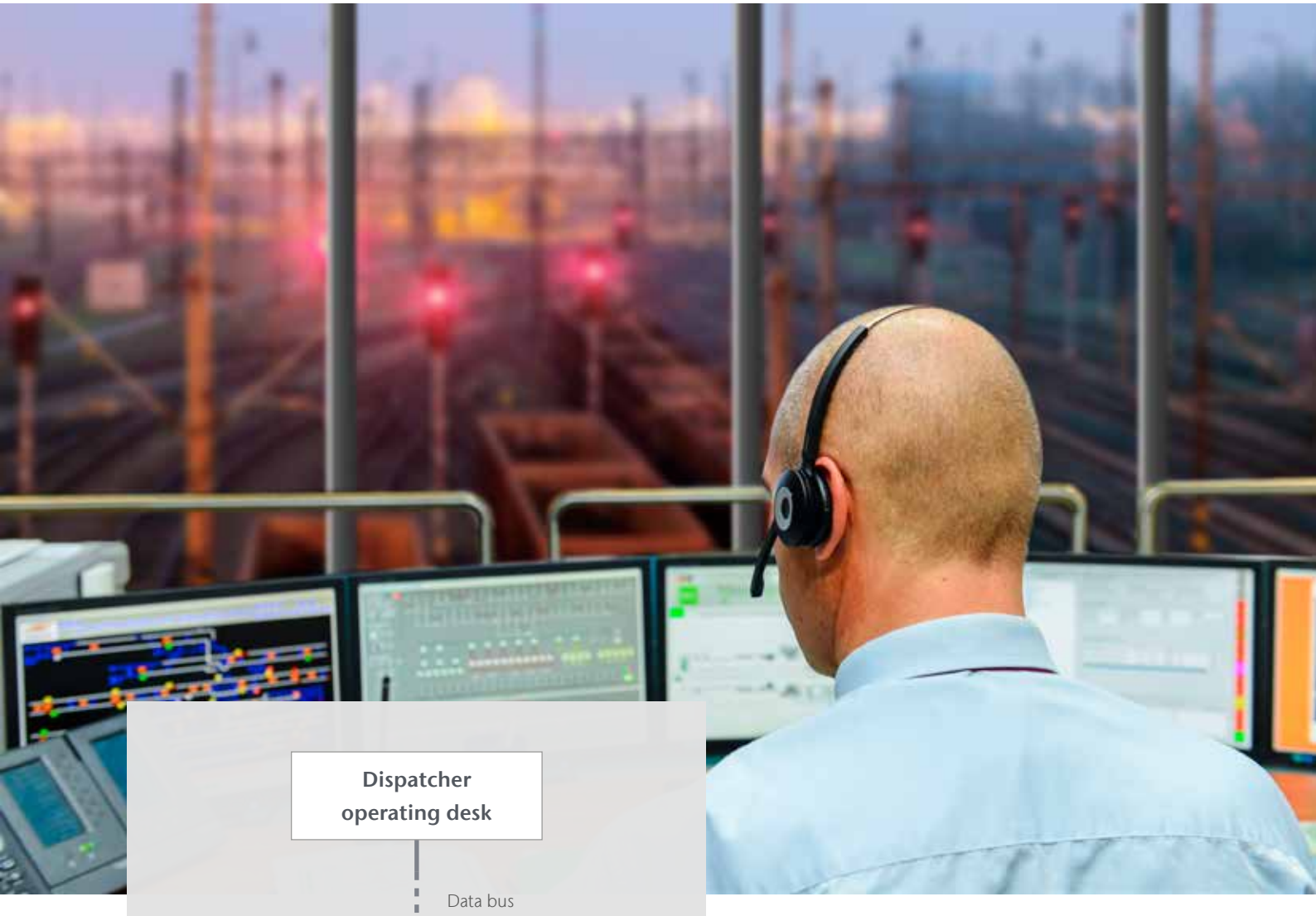
Diagnostic user interface

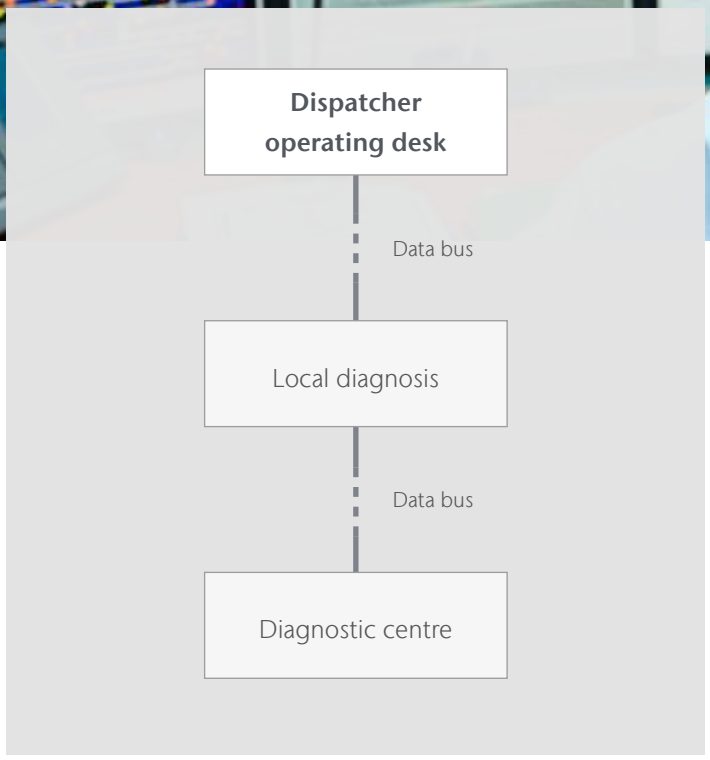
All data, which is in clear text form and has a time-stamp, is stored in a buffer on the user interface of the diagnostic system. The latest 1,000 events can be displayed in a window. The stored data can also be displayed and evaluated via menus.

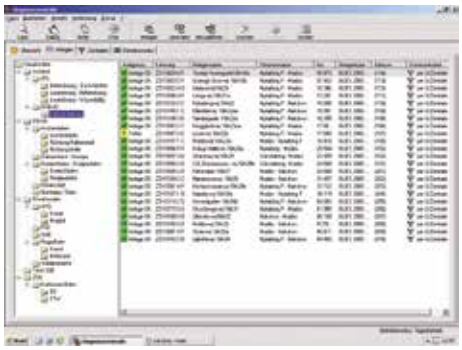


Dedicated line modem

All operation points are linked with the diagnostic centre via a dedicated line modem. In this way data, which has been stored in the local diagnostic system, can be transmitted to the diagnostic centre. Transmission is made on the basis of international standards and standard protocols such as TCP/IP are used.







Diagnostic centre user interface

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