Maintenance Manual L90 5

Indoor Equipment ESTW L90 5

Hardware

ACE

Az LM, Description
### Edition and Reason of Change

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</table>
Contents

1 Introduction .................................................................................................................. 7

1.1 Overview .................................................................................................................... 7
1.2 Abbreviations ............................................................................................................. 7
1.3 Referenced Documents ............................................................................................... 9

2 General Arrangement .................................................................................................. 10

3 Principles and procedures ............................................................................................ 12

3.1 Safety principles ......................................................................................................... 12
3.2 Software ...................................................................................................................... 12
3.2.1 Avoidance of errors .............................................................................................. 12
3.2.2 Testability ............................................................................................................ 13
3.2.3 Adaptability ......................................................................................................... 13
3.2.4 Portability ........................................................................................................... 13
3.3 Basic counting logic .................................................................................................... 14
3.4 Track configurations ................................................................................................. 15
3.5 Reset procedure ........................................................................................................ 15
3.5.1 Unconditional Reset ........................................................................................... 16
3.5.2 Conditional Reset ............................................................................................... 16
3.5.3 Preparatory Reset ............................................................................................... 17
3.5.4 Preparatory Reset with Acknowledge .................................................................. 17

4 Trackside equipment ..................................................................................................... 18

4.1 Rail Contact ............................................................................................................... 18
4.1.1 Principle of operation ......................................................................................... 18
4.1.2 Mechanical aspects ............................................................................................ 19
4.2 Electronic junction box ............................................................................................... 20

5 Transmission path ......................................................................................................... 22

5.1 Optional Components ............................................................................................... 22
5.1.1 Power/data coupling ........................................................................................... 22
5.1.2 Isolation Transformer PCM ............................................................................... 22
5.1.3 Converter ISDN/V.24 ....................................................................................... 22
5.1.4 Rail contact adapter ............................................................................................ 23

6 Indoor equipment .......................................................................................................... 24

6.1 Axle Counter Evaluator ACE .................................................................................. 24
6.1.1 Vital computer module ....................................................................................... 24
6.1.2 Power Supply Module ................................................................. 24
6.1.3 Serial I/O .................................................................................. 25
6.1.4 Parallel I/O / ........................................................................... 25
6.1.5 Serial interface to an interlocking module................................. 26
6.1.6 Diagnostic interface ................................................................. 27
6.2 Cabinets ...................................................................................... 28
6.3 Configuration ............................................................................. 28
6.3.2 Redundant ACE ................................................................. 29
6.3.3 Data preparation .................................................................... 30
7 Diagnostics .................................................................................. 31
8 Reliability ..................................................................................... 32
9 Repair time .................................................................................. 33
10 Technical data ............................................................................. 34
  10.1 System .................................................................................. 34
  10.2 Axle Counter Evaluator (ACE) .................................................. 36
  10.2.1 Environmental Conditions .................................................. 36
  10.2.2 Electromagnetic Interference .............................................. 38
  10.3 Power and Data Coupling Unit .............................................. 39
  10.4 Converter ISDN/V.24 .............................................................. 40
  10.4.1 Environmental Conditions .................................................. 40
  10.4.2 Electromagnetic Interference .............................................. 41
  10.5 Detection Point........................................................................ 42
  10.5.1 Dimensions / Abmessungen ................................................ 42
  10.5.2 Environmental Conditions .................................................. 44
  10.5.3 Electromagnetic Interference .............................................. 45

Figures
Figure 1: General Arrangement................................................................. 10
Figure 2: Basic counting arrangement ......................................................... 14
Figure 3: String of sections ................................................................... 15
Figure 4: Rail contact .......................................................................... 19
Figure 5: Rail contact Sk30 resp. Sk30H .............................................. 19
Figure 6: EAK30H (including the E-Es30H) ........................................ 21
Figure 7: Basic equipment................................................................... 29
Figure 8: Basic equipment................................................................... 30
Figure 9: EAK30H ............................................................................. 43
Figure 10: Sk30 / Sk30H .................................................................... 43
1 Introduction

1.1 Overview

This document gives an overview of the product Az LM and the components of the system.

Items mentioned as an option are not yet available, and hence not yet approved by EBA.

1.2 Abbreviations

<table>
<thead>
<tr>
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<td>ABR</td>
<td>Axle counter reference direction</td>
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<tr>
<td>AC</td>
<td>Alternating current</td>
</tr>
<tr>
<td>ACE</td>
<td>Axle counter evaluator</td>
</tr>
<tr>
<td>Az L90M</td>
<td>Name of Thales’s multiple section axle counter (predecessor of Az LM)</td>
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<td>Name of the axle counter system described in this document</td>
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<tr>
<td>AzL 70-30</td>
<td>Name of Thales’s single section axle counter</td>
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<tr>
<td>BE</td>
<td>Earth</td>
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<tr>
<td>CAN</td>
<td>Controller area network</td>
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<tr>
<td>CPU</td>
<td>Central processing unit</td>
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<td>DB AG</td>
<td>Deutsche Bahn AG</td>
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<tr>
<td>DC</td>
<td>Direct current</td>
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<td>EBA</td>
<td>Railway Approval Authority in Germany</td>
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<tr>
<td>EBO</td>
<td>Rules of DB AG</td>
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<td>EBÜT</td>
<td>Level Crossing used at DB AG</td>
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<td>EEPROM</td>
<td>Electrically programmable, non-volatile data memory</td>
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<td>E-Es</td>
<td>Electronic unit</td>
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<td>Electromagnetic compatibility</td>
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<td>ESTW</td>
<td>Solid-state interlocking</td>
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<td>FMX</td>
<td>Analogue Transmission System</td>
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<td>Product: Track Circuit</td>
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<td>Explanation</td>
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<tr>
<td>FÜ</td>
<td>Remote supervision</td>
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<td>ISDN</td>
<td>Integrated Services Digital Network</td>
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<td>International Organisation for Standardisation</td>
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<td>Light emitting diode</td>
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<tr>
<td>MTBF₁</td>
<td>Mean time between failures (single failure)</td>
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<td>Mean time between failures (system failure)</td>
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<tr>
<td>STEK</td>
<td>Abbreviation for a department</td>
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<tr>
<td>UIC</td>
<td>Union International Chemin de Fer</td>
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<tr>
<td>UPS</td>
<td>Un-interruptable power supply</td>
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<td>USV</td>
<td>UPS</td>
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<tr>
<td>Uₚ</td>
<td>Power supply detection point</td>
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<td>Zp₃₀H</td>
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1.3 **Referenced Documents**

This document is part of a manual. Other chapters of the manual are referenced as necessary.

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<td>/2/</td>
<td>Railway Applications, Safety related electronic systems for signalling</td>
<td>EN 50129</td>
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<td>/3/</td>
<td>Requirements for safety related communication in closed transmission</td>
<td>EN 50159-1</td>
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<td>/4/</td>
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2 General Arrangement

The Az LM axle counter system consists of the following components:

► **Trackside detection point (Zp30H):**
consisting of the rail contact and the electronic unit E-Es with its housing.

► **Axle counter evaluator (ACE):**
consisting of a vital computer module with serial and/or parallel I/O. The interface to the interlocking can be configured to be either serial (Ethernet) or parallel (relay/optocoupler) or both.

► ISDN data transmission and power link between the detection point and the axle counter evaluator.

► **Serial (Ethernet) connection to N-ACE:**

  * Serial interface which can be used from the ACEs to exchange Detection Point information to build a common section with Detection Points of both ACEs.

  * This function is suitable for long sections like block sections typically to handle the long distances and to save the copper wires between the neighboring stations. Due to the enlarged reaction times for the train detection this function is not recommended for short sections.

![Figure 1: General Arrangement](image-url)
Figure 1. General Overview of Az LM Axle Counter System
3 Principles and procedures

3.1 Safety principles
The System is compliant with EN 50129 having the highest safety integrity level 4 (SIL 4).
Hazard rate 2oo2: 8.977e-11

Safety is ensured by:

► Independent computer channels
► Clearly structured software
► On-line hardware self-tests
► Defined reactions to process errors
► Vital monitoring of trackside equipment
► Vital monitoring of data communication
► Defined fault detection and disclosure times
► Use of interface protocols with code protection, multiple transmission, and many other checks
► Clearly defined verification and validation procedures, according to the EN 50129 and EN 50128.

3.2 Software
Considerable importance is attached to the ACE software, both from the point of view of reliability and of safety. The programs have been written in the high-level programming language C, which was chosen due to the high degree of availability of both tools and of standard well proven software. Using the following criteria, stringent requirements have been set on the software concept.

3.2.1 Avoidance of errors

Software safety conforms to the requirements of EN 50128. This standard defines a quality management system, a safety management and assessment procedure and procedures for the documentation of technical safety.

Software testing is extensive throughout the lifecycle phases. It comprises procedure tests, module tests, integration tests, and field testing.
3.2.2 Testability

The conditions for the testability of the software have been created by the following measures:

► Clear assignment of functions to software packages
► Decomposition into modular structures
► Definition of functions in testable tables
► Subdivision of the development documentation into several levels beginning with requirements and on through design documentation to verification and validation

3.2.3 Adaptability

By the use of structured software processes and standardised interfaces the software is adaptable to different configurations and applications. The production of site specific data is facilitated by user-friendly tools. The data is loaded in the ACE in a separate process to the loading of the system data.

3.2.4 Portability

The software uses clearly defined software interfaces. These interfaces between programs and the operating system ensure independency from processor technology, thus facilitating a migration to future processors.
3.3 Basic counting logic

The ACE evaluates the differences of the count values from the detection points of a section.

The detection points count the number and direction of axles passing the rail contacts and transmit this data to the ACE. With this information, the logic of the ACE defines the section to be “clear” or “occupied”. In case of a failure of the equipment, the section will be treated as “failed”. This information can be provided to the interlocking logic and MMI, e.g. via a connection to the interlocking module.

A standardised axle counter reference direction (see Figure 2), is defined to give a fixed correlation of the direction of travel and the count direction for all detection points of the line independent of the track.

Axles are counted into the section 1 (see Figure 2), when:

► section when a train passes Zp1 in the direction of the arrow
   or
► a train passes Zp2 in the opposite direction to the arrow

Axles are counted out of the section when:

► a train passes Zp1 in the opposite direction of the arrow
   or
► a train passes Zp2 in the direction to the arrow
3.4 Track configurations

A detection point is positioned at each end of a track section. At each boundary between track sections a detection point utilised by both sections is needed.

Figure 3: String of sections

The track section arrangements can be complex. The following are examples of possible configurations of track sections:

► Simple section (without crossings or points)
► Terminus track
► Points
► complex point arrangements
► crossings
► string of sections
► string of points, a crossing and block lines

3.5 Reset procedure

The reset is required to clear an axle counter section during commissioning or when it has a malfunction, i.e. when there is no train in the section but the axle counter indicates occupied for safety reasons as the result of a malfunction. The reset is carried out manually.

Resetting axle counter sections is a safety relevant operational procedure which must be clearly defined in rules for the operator and maintainer.

Four variants of reset are supported by the equipment.
In the axle counter with serial interface to the interlocking the variants are selected by different commands from the interlocking. Site specific data for the reset in the ACE are not required.
In the axle counter with parallel interface the reset variant is defined in the site specific data.

It is possible to define different reset variants for one section using the key switch/button and the optocoupler inputs at the parallel I/O board. The operator must prepare operational rules governing the use of the resets and shall define the reset types which shall be used. In the operator rules the usage of the reset and the check that a section is free shall be regulated. The completeness of the operational rules shall be proven in a application specific safety case. These rules shall be strictly adhered to in order to ensure that operational safety requirements are met.

3.5.1 Unconditional Reset

The operator must ensure that there is no vehicle in the section before executing the reset.

On receipt of the reset command, the ACE checks that there are no technical reasons why the reset should not be carried out, e. g. a persisting fault, before executing the reset of the track section.

The unconditional reset is not available in the axle counter with serial interface.

3.5.2 Conditional Reset

The operator must ensure that there is no vehicle in the section before executing the reset.

On receipt of the reset command, the ACE checks that there are no technical reasons why the reset should not be carried out, e. g. a persisting fault, before it carries out the reset internally and clears the section concerned.

When the section is occupied, the reset will be carried out only if the last counting action was a count out of the section (conditional reset).

When a section is in the state “disturbed”, the reset will be carried out without considering the last counting action.

This check is performed to reduce the risk of operator errors.
The key switch and the button or an optocoupler input on the parallel I/O card can be defined in the site specific data to deactivate this restriction.

Options:
In the site specific data it is possible to define whether the restriction should always be activated when
a) an ACE is started (Standard: No)
b) a section is disturbed (Standard: No)

3.5.3 Preparatory Reset

On receipt of the reset command, the ACE checks that there are no technical reasons why the reset should not be carried out, e.g. a persisting fault. Then a train has to pass through the track section. The ACE checks the correct function of the detection points, and only if the count into and out of the section agree, will the ACE clear the section (for sections with one detection point it has to be count in and count out over this detection point).

**Option:** Preparatory Reset with condition
When the section is not disturbed but correctly occupied, the reset will be carried out only if the last counting action was a count out of the section

3.5.4 Preparatory Reset with Acknowledge

On receipt of the reset command, the ACE checks that there are no technical reasons why the reset should not be carried out, e.g. a persisting fault. Then a train has to pass through the track section. The signaller is required to acknowledge a correct train movement through the section. This means the signaller must ensure that the vehicle has completely cleared the section and then send an acknowledgement (by technical means, orally or in written form)

The ACE checks the correct function of the detection points, and if there has been a correct count into and out of the section the ACE will clear the section when the acknowledgement is received.

**Option:** Preparatory Reset with acknowledge and condition

When the section is not disturbed but correctly occupied, the reset will be carried out only if the last counting action was a count out of the section.
4 Trackside equipment

The Detection Point Zp30H consisting of the Electronic Junction Box EAK30H and the rail contact Sk30H resp. Sk30.

The main features of the detection point Zp30H are (for details see chapter 10.5):

► Double rail contact which can be adjusted to fit commonly used rail profiles
► Detects all commonly used wheels of main lines
► Extremely high counting reliability
► Immunity to AC and DC traction current and harmonic interference
► Immunity to magnetic and eddy current vehicle track brakes
► Fault tolerant data transmission to the evaluator (ACE)
► Straightforward installation procedure

Vehicles whose wheels do not meet the specification can cause axle counter faults or may not be recorded or detected. The operator must take measures (e.g. blocking the track) to ensure that vehicles with unspecified wheel types and vehicles that reach the section without crossing over a section detection point do not cause any hazards. The operator must prepare specific operational rules to cover this issue.

4.1 Rail Contact

4.1.1 Principle of operation

The rail contact consists of two physically offset coil sets, Sk1 and Sk2, on the same rail. On the outside of the rail are the two Tx coils generating an electromagnetic field with two slightly different frequencies of approx. 30 kHz around the rail. On the inside of the rail are two Rx coils. These supply two time-offset induced voltages with which the presence and direction of passing wheels is determined in the electronic unit. For reliability reasons, there are no other electronic components other than coils in the heads.

Both voltage and phase in the receiver coil are evaluated to ensure extremely high wheel detection reliability.

The frequencies used, the shape and material of the receiver housing and the corresponding coil arrangement of the heads are chosen to ensure that interference from the harmonics of traction current and track brakes will not disturb the wheel detection process.

Further protection against severe electromagnetic interference such as catenary shorts and the magnetic fields of track brakes is provided through a variety of measures such as phase sensitive rectification, frequency shift keying and the use of non-ferrite coils in the heads (available rail contact variants see Parts List Az LM).
4.1.2 Mechanical aspects

The rail contact is fitted by three bolts to the web of the rail. The vertical position of the respective mounting holes depends on the rail profile. The Tx heads are adjustable to adapt the system to a wide variety of rail profiles.

Each Tx/Rx head is equipped with fixed cables of 4 m length for connection to the electronic unit. Longer cable lengths are available on request (see document Az LM: Parts List).
4.2 Electronic junction box

The electronic junction box contains the electronic to drive and supervise the rail contact, to detect the wheels and count the passing axles, to run self tests and to transmit telegrams containing count and supervision information to the ACE.

The counting, supervision and telegram generation functions are performed by two independent microcontrollers supervised by the vital module in the ACE.

Power is conveyed from the interlocking room to the trackside equipment on the same two wires used for data transmission to the ACE. Alternatively local power may be used. The Detection Point operates over a wide range of DC input voltage to allow for the voltage drop over long cables.
The Zp30H is supplied with a **Uninterruptible** power supply with a nominal voltage of normally 60 V ... 120 V\(_{\text{DC}}\). This supply voltage must be indirect-connected to the battery voltage by a DC/DC converter.

If a trackside 24 V battery is available, the Zp30H can be equipped for this as an option.

![Diagram of Zp30H dimensions](image)

**Dimensions**

- \(a = 320 \text{ mm}\)
- \(b = 240 \text{ mm}\)
- \(c = 400 \text{ mm}/900 \text{ mm}\)
- \(d = 250 \text{ mm}\)
- \(e = 90 \text{ mm}\)

**Total weight**: approx. 12 kg

*Figure 6: EAK30H (including the E-Es30H)*
5 Transmission path

The system has been designed to use standard communication cable - twisted pair or star quad for the communication link between the trackside equipment and the ACE. The security of data transmission is guaranteed by the special security code in the telegram. The protocol used is equally suitable for transmission over multiplexed digital transmission systems.

The data transmission to the ACE uses the physical and the communication layers of ISDN.

The protocol conforms with EN50159–1.

5.1 Optional Components

5.1.1 Power/data coupling

A power/data coupling PDCU unit with separate fuses and additional overvoltage protection is available for installation at the cable termination frame. The PDCU serves the following purposes:

1. Isolation of the trackside cables at the cable termination frame
2. Power to data line coupling including fusing of the Zp supply
3. Overvoltage protection

Alternatively the power may be coupled via the ACE internal transformers, or supplied locally to the trackside equipment. In this case it is necessary to fuse the Zp supplies separately.

5.1.2 Isolation Transformer PCM

If the induced voltages in the cable network exceed the specified limits isolation transformers may be required to split the cable into smaller isolated sections.

PCM transformers, qualified for ISDN transmission and for railway applications can be used.

If this power transformer is used, a remote power feed may not be used for the detection point.

5.1.3 Converter ISDN/V.24

If transmission systems other than copper cable are used for the link between ACE and detection point, an ISDN/V.24 converter is available to convert the ISDN signals to a V.24 interface or vice versa.
5.1.4 Rail contact adapter

For applications e.g. in tunnels there is a rail-contact adapters available. This can be used in order to enlarge the possible distance between EAK and rail contact. Depending on the used cable type an additional cable length of around 25 m can be achieved.
6 Indoor equipment

6.1 Axle Counter Evaluator ACE

The basic indoor equipment consists of the ACE comprising:

► Vital computer module
► Power supply
► Serial I/O
► Parallel I/O

The ACEs are designed for installation in both open racks and enclosed cabinets.

6.1.1 Vital computer module

The computer module is designed as a vital and redundant 2 out of 3 computer system. As an option, a lower cost 2 out of 2 computer version is available without redundancy for reliability but with the same safety standard.

Vital processing by means of software comparison is achieved by exchanging messages between the computer channels. After exchanging messages the computers perform a voting procedure to determine if all the computer channels are in agreement. If not, a safety reaction is executed. This mechanism also serves to synchronise the computers. In order to reduce failure disclosure times, RAM, ROM and CPU tests are run in background mode and the results compared as above.

In the case of the 2 out of 3 version, loss of one of the computer channels due to a fault means that the module continues working as a 2 out of 2 module maintaining the full functionality and allowing a repair to be planned as a routine measure.

6.1.2 Power Supply Module

Each CPU channel has its own DC/DC converter which feeds the electronics with 5 V and 12 V.
6.1.3 Serial I/O

Data from the trackside equipment is received via serial I/O modules. These are preprocessor boards which convert the serial data from the detection points to the I/O busses of the vital module. The industrial standard CAN bus is used to interface the preprocessors to the vital module.

Each detection point preprocessor is assigned to one (Redundant ACE) or two detection points (Non redundant ACE). It occupies one I/O-slot in the ACE.

To use a Detection Point in more than one ACE it is possible to daisy chain the telegrams of a Detection Point to an additional ACE. In the case of the 2002-ACE, the number of Detection Points which can be connected to a Detection Point preprocessor is then reduced to one.

Loss of a detection point due to a fault will result in the disturbance being restricted to those sections associated with that specific detection point.

6.1.4 Parallel I/O

The track occupancy information is output from the vital module via parallel I/O preprocessor modules via the same CAN bus as used for the serial I/O. The serial and parallel I/O modules are electrically compatible and inserted in the required combination in the I/O slots provided in the evaluator subracks. The parallel I/O module occupies one I/O-slot per section.

6.1.4.1 Vital output for track occupancy

Each parallel I/O module outputs two relay contacts (double cut) for one section. These are checked internally by the vital module. Track clear is indicated by two closed contacts or two antivalent contacts. The relays used have forced contacts complying with EN 50205.

To increase the number of contacts it is possible to use up to 4 parallel I/O modules to output the track clear indication of one section. The number of sections which can be supervised is thereby decreased.
6.1.4.2 Vital input track section reset

Each parallel I/O module has one or two vital optocoupler inputs and a vital input via key switch and button in the front panel to input reset commands. The reset is initiated when an input is activated between 0.5 seconds and 6.0 seconds.

In the site specific data a reset procedure can be assigned to each of the 3 inputs. The use of an input can also be deactivated completely.

6.1.4.3 Non vital output

On each parallel I/O module there are two non-vital outputs available. The first two are available at optocoupler outputs and LEDs, the third and fourth at LEDs in the front panel of the board only.

The information which is output is defined in the site specific data:
- Acknowledgements and rejections of reset commands
- Information to distinguish between occupied and disturbed of a section
- Indication whether a reset command were accepted for a section

6.1.5 Serial interface to an interlocking module

The computers of the vital module are equipped with an Ethernet port.

Data communication is protected by a protocol suitable and approved for vital single channel data communication.

The interface is redundant to ensure high availability.

6.1.5.1 To an interlocking module

Data received from interlocking module:
- state-, diagnostic- and version-requests
- section reset commands

Data send to interlocking module:
- state of section
- diagnostic information
- version information
• acknowledgements of reset commands

6.1.5.2 To a neighbour ACE

Data received from N-ACE:

• State of external detection points
• Number of axles counted by external detection points

Data send to N-ACE:

• State of internal detection points
• Number of axles counted by the internal detection points

6.1.6 Diagnostic interface

An Ethernet port and one (2oo2) or two (2oo3) serial interfaces are used for the diagnostics of the ACE and the connected detection points.

Communication to the serial interface is via a portable PC including a special diagnostics software.

The diagnostic data are shown in a clear form on the PC suitable for fault finding with regard to the ACE and the trackside equipment.
6.2 Cabinets

Cabinets are available for the ACEs.

In Thales's solid-state interlockings the ACEs can be installed in a cabinet together with other compatible modules.

A cabinet with the following characteristics is available for other interlockings:

- **Height**: 2000 mm
- **Width**: 600 mm
- **Depth**: 600 mm

**Contents (Examples)**
- 8 * ACE 2oo2 with 10 detection points
- 2 * ACE 2oo2 with 42 detection points
- 2 * ACE 2oo3 with 32 detection points
- ...

Cable inlet on top of cabinet

The ACE may also be installed in relay racks.
See also chapter 10.2.1 Environmental conditions.

6.3 Configuration

Configuration of the ACE is divided into hardware configuration and data preparation. The main features of the cost effective, user-friendly possibilities for hardware configuration are described in the following chapters. Non-redundant ACE

To customise the hardware to the respective application case, ACEs may consist of one to three subracks.
6.3.1.1 Basic equipment

![Diagram of basic equipment layout]

Figure 7: Basic equipment

- Single 19" subrack
- Vital module (2 out of 2)
- 10 I/O-slots, usable for:
  - serial I/O preprocessors or
  - Relay interface to interlocking

6.3.1.2 Expanded equipment

The basic equipment may be expanded to either a twin subrack or a triple subrack with 26 respectively 42 I/O slots by using additional I/O subracks, each with 16 slots.

6.3.2 Redundant ACE

The redundant ACE is available for applications where a higher availability is required.

The ACE consists of three to four racks.
The computers and the power supplies are fully redundant.
For reasons of availability each detection point is connected to its own detection point preprocessor.
Figure 8: Basic equipment

- Triple 19" subrack
- Vital module (2 out of 3)
- 32 I/O-slots, usable for Serial I/O preprocessor
- Serial interface to a Solid State Interlocking module (Ethernet)

6.3.3 Data preparation

The basis for the data preparation is the configuration of detection points required. This is based on the track layout, positions of signals, overlaps, level crossings etc. Tables are prepared containing e.g. the following data:

- names and element numbers of the sections supervised by the ACE
- Names and addresses of the detection points
- Assignment of the detection points to the sections

Details are described in “Specification of site specific data”

After checking, the data is stored in the FLASH in the ACE. This is performed by the supplier.
7 Diagnostics

A diagnostic interface on each central computer is used to scan the diagnostic data stored on the central computer by means of a standard PC with a special software.

The information extracted from the CPUs is evaluated and displayed in a readable form and is used for fault finding both with regard to the ACE and the trackside equipment.

A second means of diagnostics is the use of LEDs which indicate the correct operation of significant functions both in the ACE and in the trackside equipment.
8 Reliability

Hardware reliability is ensured by:

► Use of commercial industrial standard microprocessors

► Factory burn-in\(^1\) of the complete equipment

► Quality management conforming to the requirements of ISO 9001

Fault tolerant data transmission from the detection points to the ACE considerably reduces the possibility of axle counter disturbances due to electromagnetic interference on the cabling (e. g. lightning or catenary short).

The use of cage clamp terminals improves the reliability of connections in comparison to screw terminals.

The trackside and the indoor equipment are maintenance-free. An annual inspection of the equipment is sufficient to ensure reliable and safe performance.

The reliability of counting is extremely high. Many years of experience with Thales axle counters used on main lines with mixed passenger and goods traffic in Germany and abroad indicate an expected rate of miscounts which easily complies with the requirements of UIC. A reliability figure of 0.05 disturbances per section and year is achievable in practice.

This forecast only considers device-related malfunctions. Safety reactions and malfunctions caused by certain operational circumstances and non-standard wheels and equipment, such as may be found on track maintenance vehicles and similar, are not considered.

Values for an ACE 2oo2 with parallel interface:

\[ \text{MTBF}_F = 7.2 \text{ years (Functional failure of one section)} \]

\[ \text{MTBF}_S = 12.5 \text{ years (System failure)} \]

Values for an ACE 2oo3 with 16 Detection Points and serial interface to SSI:

\[ \text{MTBF}_F = 1.3 \text{ years (Functional failure without consequence for a section owing to the redundancy)} \]

\[ \text{MTBF}_S = 466.0 \text{ years (System failure)} \]

\(^1\) A burn-in is a test procedure to find and eliminate early defects of electronic components before delivery.
9 Repair time

Repair times are kept short by

► The small number of boards used in the vital computer module
► The modular system concept
► The detailed PC supported diagnostics of internal ACE faults, communication deterioration and faults in the trackside equipment.

MRT = 0.5 h
10 Technical data

10.1 System

Highest safety integrity level (SIL 4) compliant with EN 50129.

Hazard rate 2oo2: 1.3e-10 /h  
Hazard rate 2oo3: 3.04e-10 /h

The hazard rate defines the case that the output of the ACE shows unoccupied while the section is occupied with a vehicle. It is the responsibility of the operator to ensure that the fail-safe equipment is protected from unauthorized access.

Software compliant with EN 50128. The product Az LM is designed for a life time of 20 years.

Typical reaction times to occupy a section

- 2oo2 with parallel interface: 230ms
- 2oo3 with serial interface: 275ms

Maximum train speed: 380 km/h

Option: 440 km/h

Data transmission between axle counter and axle counter (N-ACE):

▸ fault tolerant
▸ conforms to EN 50159-1 (closed networks)

Data transmission between axle counter and SSI:

▸ Fault tolerant
▸ Conforms to EN 50159-1 (closed networks)

Data transmission between Detection Point and ACE:

▸ fault tolerant (Configurable interruption time will be tolerated)
▸ conforms to EN 50159-1 (closed networks)

2 wires for communication between Detection Point and ACE

Power supply to the Detection Point via the same two wires

Maximum distance from power supply and ACE to the detection point:
► Limited by the central power supply voltage 100 V and the wire diameter: 4.2 km (wire diameter 0.9 mm)

► Limited by the communication link: typically 8 km (wire diameter 0.9 mm)

Power consumption ACE

► 2oo2: 55W - 135 W (depending on size)
► 2oo3: 116 W

Power consumption ISDN-V24 converter

► 3 W

Max. amount of axle within section:

► 32767
10.2 **Axle Counter Evaluator (ACE)**

The following ACE configurations are available:

Non-redundant (2 out of 2) or redundant (2 out of 3) vital computer Interfaces to 1 ... 32 detection points Supervision of 1 ... 32 track sections

Serial interface to neighbour ACE for transmitting data of detection points

Serial interface to solid state interlocking module with compatible interface to the ACE of Az LM (e. g. Thales ESTW L90-5)

Parallel relay/optocoupler interface to other interlocking or block equipment

The following power supply options are available (UPS or battery):

- 60 V +20 % –10 %
- 48 V +20 % –10 %
- 24 V +20 % –10 %

10.2.1 **Environmental Conditions**

Environmental temperature of the ACE:

–25 °C ... +55 °C, this range includes class T1 according to EN 50125-3

Humidity:

- 95% relative humidity, no condensing
- Class T1 according to EN 50125-3

Pollution (ACE subrack):

- PD2 according to EN 50124-1
- 3C2, 3B1, 3S1 according to EN 50125-3

Protection against splash water and dust:

ACE:

- Category IP 20 according to IEC 529

Cabinet, cable inlet at the top:

- Category IP 40 according to IEC 529

Cabinet, cable inlet at the bottom:

- Category IP 42 according to IEC 529

Cabinet with gaskets:

- Category IP 52 according to IEC 529

Vibration: (EN 50125-3)

- Vertical: 2.3 m/s²
- Transversal: 2.3 m/s²
- Longitudinal: 2.3 m/s²

Shock: (EN 50125-3)
Typical: 20/11 m/s²/ms
Maximum: 20/11 m/s²/ms
10.2.2 Electromagnetic Interference

Noise emission on power supply cables:
(150 kHz – 30 MHz)
Criteria A according to EN50121-4

Noise emission, housing
(30 MHz – 1000 MHz)
Criteria A according to EN50121-4

Electrostatic Discharge:
6 kV contact discharge
8 kV air discharge
Criteria A according to EN50121-4

Immunity against electric fields (AM):
(80 MHz – 1000 MHz)
10 V/m, criteria A according to EN50121-4

Immunity against electric fields (PM):
(895 MHz – 905 MHz)
20 V/m, criteria A according to EN50121-4

Burst:
2 kV, criteria A according to EN50121-4

Surge (power supply): 1 kV sym. /2 kV asym., criteria A according to EN50121-4

Surge (Other interfaces):
2 kV, criteria A according to EN50121-4

Conducted RF disturbances:
(150 kHz – 80 MHz)
10 V, criteria A according to EN50121-4
10.3 Power and Data Coupling Unit

Dimensions:
(W x H x D): 45 mm x 75 mm x 60 mm

Ambient temperature range:
–25°C ... +70°C (housing incl. electronic)

Humidity:
► 15% ... 100 % relative humidity
► Class T1 and T2 according to EN 50125-3

Pollution:
► PD2 according to EN 50124-1

Protection against sprayed water and dust:
► category IP 20 according to IEC 60529

Vibration:
► EN 50125-3, Position outside the track (from 1m to 3 m from the rail)
► Vertical: 2,3 m/s²
► Transversal: 2,3 m/s²
► Longitudinal: 2,3 m/s²

Shock:
► EN 50125-3, Position outside the track (from 1m to 3 m from the rail)
► Typical: 20/11 m/s² / ms
► Maximum: 20/11 m/s² / ms

Isolation:
Primary - Secondary 4,0 mm

Attenuation:
3 dB
10.4 Converter ISDN/V.24

Dimensions:
(W x H x D): 215 mm x 128 mm x 50 mm

Use cases:
► Connection of ACE and Detection Points to transmission systems
► Repeater on ISDN cables

Transmission distance:
► Cable length up to 24 dB attenuation (at 40 kHz)

Power supply:
► 48 V ... 120 V +5%
► 2,5 W

Isolation:
► Power supply – Elektronic: 3,6 mm
► ISDN – Elektronic: 3,6 mm
► ISDN – ISDN 4,0 mm

10.4.1 Environmental Conditions

Ambient temperature range:
► −40°C ... +60°C (housing incl. electronic)
► This range includes class T1 and T2 (External ambient) according to EN 50125-3
► Additional to the maximum ambient temperature (of the air) the maximum solar radiation may occur

Humidity:
► 15% ... 100 % relative humidity
► Class T1 and T2 according to EN 50125-3
Pollution:
► PD2 according to EN 50124-1

Protection against sprayed water and dust:
► category IP 20 according to IEC 60529

Vibration:
► EN 50125-3, Position outside the track (from 1m to 3 m from the rail)
  ► Vertical: 2.3 m/s²
  ► Transversal: 2.3 m/s²
  ► Longitudinal: 2.3 m/s²

Shock:
► EN 50125-3, Position outside the track (from 1m to 3 m from the rail)
  ► Typical: 20/11 m/s² / ms
  ► Maximum: 20/11 m/s² / ms

10.4.2 Electromagnetic Interference
See chapter 10.2.2
10.5 Detection Point

The detection point is designed for use on a large variety of rail profiles, such as:

UIC54, UIC54E, UIC 60, S41, S49, S54, S64, R50, R65, 90R, SBB 1, B, C, T, 50T, 63T, 50 kg, 60 kg

Compatibility informations for other rail profiles are available on request. It is suitable for all commonly used steel wheels with the following dimensions in accordance with the Eisenbahn Bau- und Betriebsordnung (EBO DS300) for DB AG:

Meas. circle diameter of wheels >= 330 mm
Width of tyre/wheel rim 130 … 150 mm
Height of wheel flange 26 … 38 mm
Width of wheel flange 20 … 33 mm

Compatibility information for other wheels is available on request.

Nominal supply voltage:

► 60 V ...120 VDC central supply
► 24 V DC local supply

Power consumption Detection Point

► 9 W (Standard transmitter power)
► 11.5 W (High transmitter power)

Rail contact:

Cables without halogen according to VDE 472-815

10.5.1 Dimensions / Abmessungen

EAK30H:
Figure 9: EAK30H

Sk30 / Sk30H:

Figure 10: Sk30 / Sk30H
10.5.2 Environmental Conditions

Temperature range

EAK:
► –40 °C ... +60 °C (housing temperature of the electronics unit)
► This range includes class T1 and T2 according to EN 50125-3
► Additional to the maximum ambient temperature (of the air) the maximum solar radiation may occur

Rail contact:
► –40°C ... +80°C
► Contact temperature to rail: +85°C

Humidity:
► 15% ..100 % relative humidity
► Class T1 and T2 according to EN 50125-3

Pollution:
► PD4A according to EN 50124-1

Protection against splash water and dust:
Electronic unit (EAK):
► category IP 65 (Zp30H) / IP67 (Zp30K) according to IEC 60529

Rail Contact Adapter:
► category IP 65 according to IEC 60529

Rail contact:
► Equivalent to category IP 67 according to IEC 60529

Vibration:
Electronic unit:
► EN 50125-3, Position outside the track (from 1m to 3 m from the rail)
► Vertical: 2.3 m/s²
► Transversal: 2.3 m/s²
► Longitudinal: 2.3 m/s²
Rail Contact Adapter:
► EN 50125-3, Position on ballast
► Vertical: 10 m/s²
► Transversal: 10 m/s²
► Longitudinal: 10 m/s²

Rail contact:
► EN 50125-3, Position on rail
► Vertical: 280 m/s²
► Transversal: 140 m/s²
► Longitudinal: 50 m/s²

**Shock:**

EAK:
► EN 50125-3, Position outside the track (from 1m to 3 m from the rail)
► Typical: 20/11 m/s² / ms
► Maximum: 20/11 m/s² / ms

Rail Contact Adapter:
► EN 50125-3, Position on ballast
► Typical: 50/11 m/s² / ms
► Maximum: 100/8 m/s² / ms

Rail contact:
► EN 50125-3, Position on rail
► Typical: 420/6 m/s² / ms
► Maximum: 2500/1 m/s² / ms

### 10.5.3 Electromagnetic Interference

**Noise emission on power supply cables:**
(150 kHz – 30 MHz)
Criteria A according to EN50121-4

**Noise emission, Housing:**
(30 MHz – 1000 MHz)
Criteria B according to EN50121-4

**Electrostatic Discharge:**
- 6 kV contact discharge
• 8 kV air discharge
• criteria A according to EN50121-4 fulfilled
  (EN50121-4 requires criteria B only)

Immunity against electric fields (AM):
• 80 MHz – 1000 MHz: 10 V/m
• 800 MHz – 1000 MHz: 20 V/m
• 1,4 GHz – 2,1 GHz: 10 V/m
• 2,1 GHz – 2,5 GHz: 5 V/m
• 2,5 GHz – 2,7 GHz: 1 V/m
• criteria A according to EN50121-4

Immunity against electric fields (PM):
  (895 MHz – 905 MHz, 1,89 GHz ± 10 MHz)
  20 V/m, criteria A according to EN50121-4

Burst:
  2 kV, criteria A according to EN50121-4

Surge:
  2 kV, criteria A according to EN50121-4

Conducted RF disturbances:
  (150 kHz – 80 MHz)
  10 V, criteria A according to EN50121-4