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GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

Handbook on
Installation, Maintenance & Troubleshooting of Siemens ACM 200 Axle Counting System

CAMTECH/S&T/2023-24/ACM 200/1.0
April 2023
End Users : SSE/JE (Signal) & Signal Maintainers of Indian Railways

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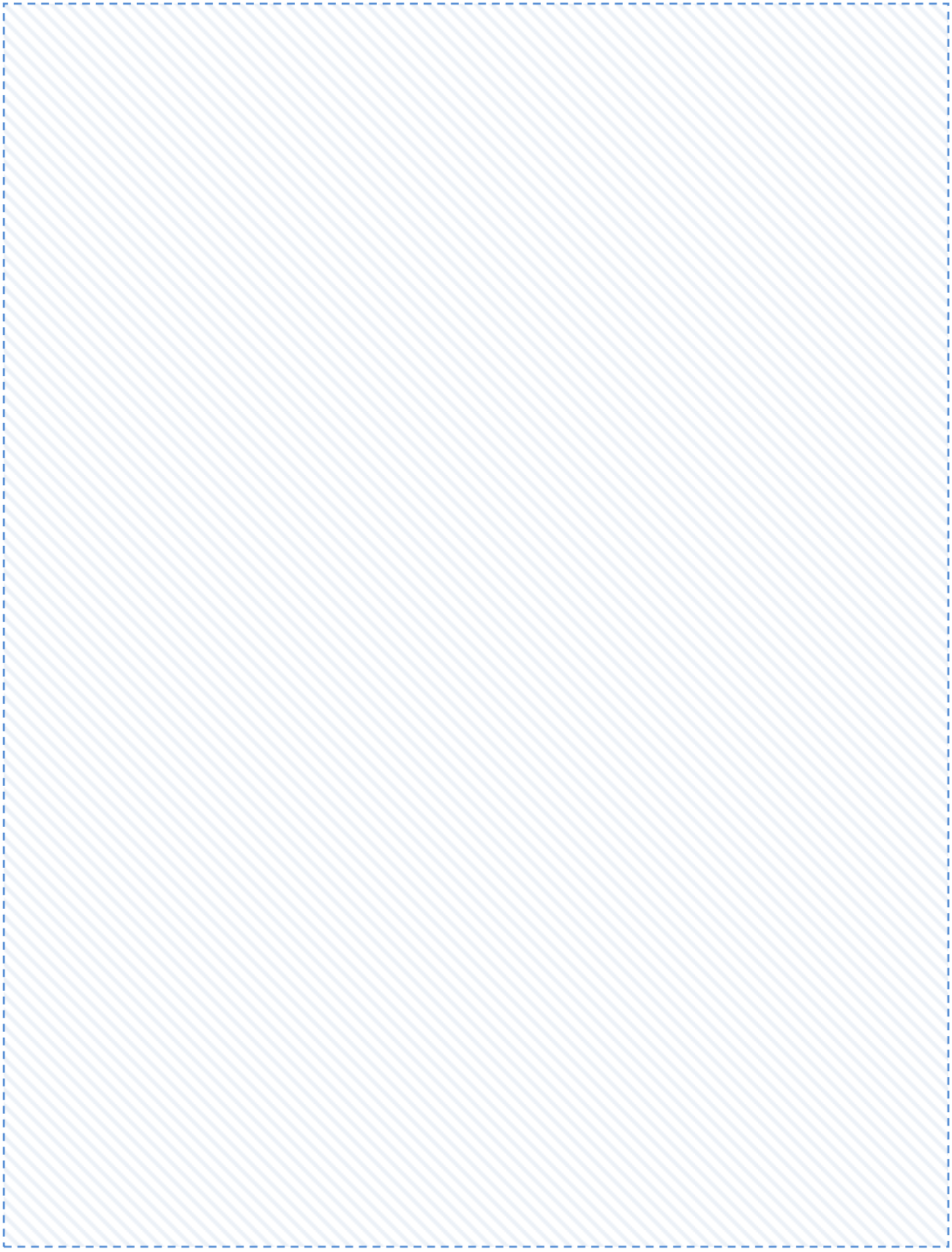

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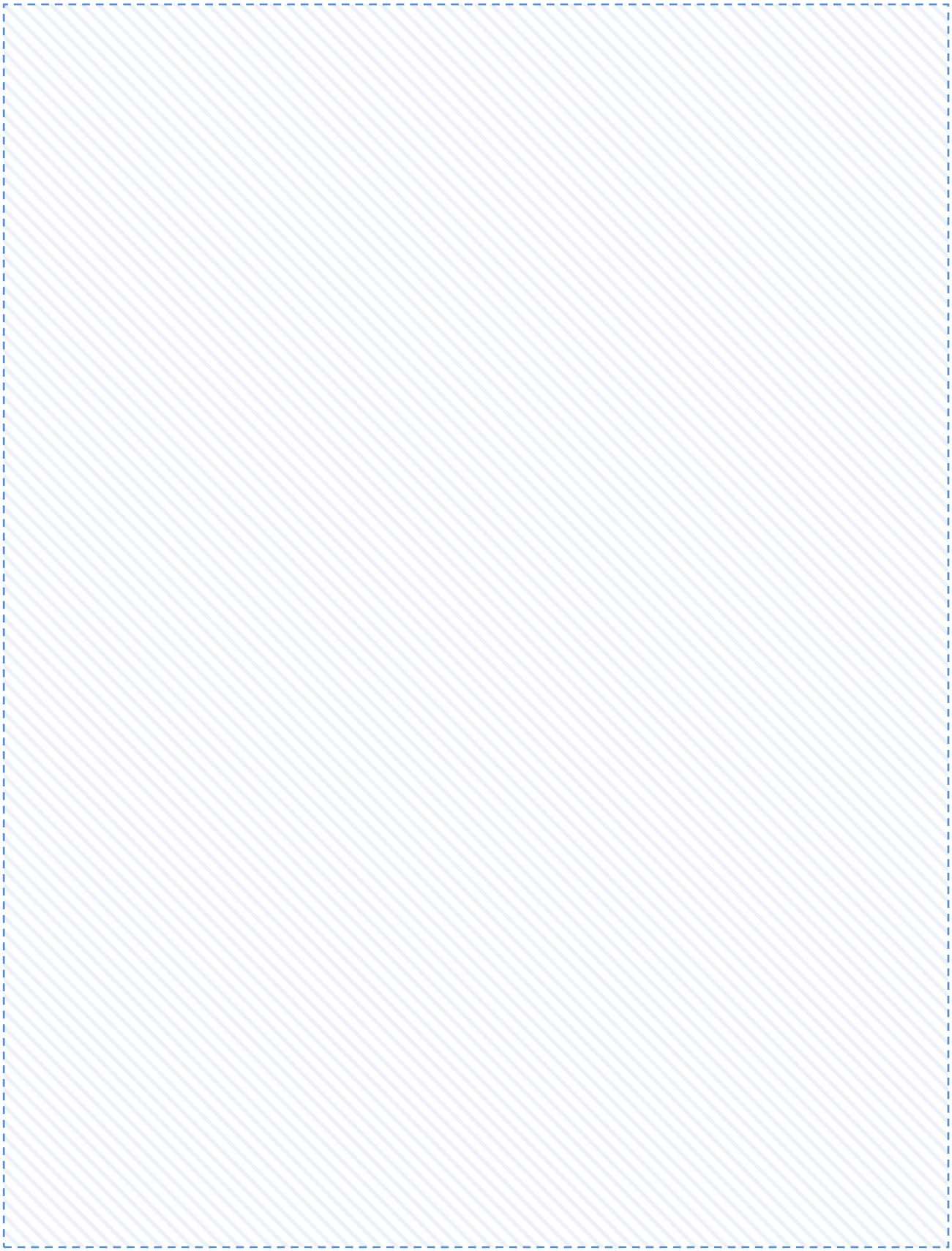


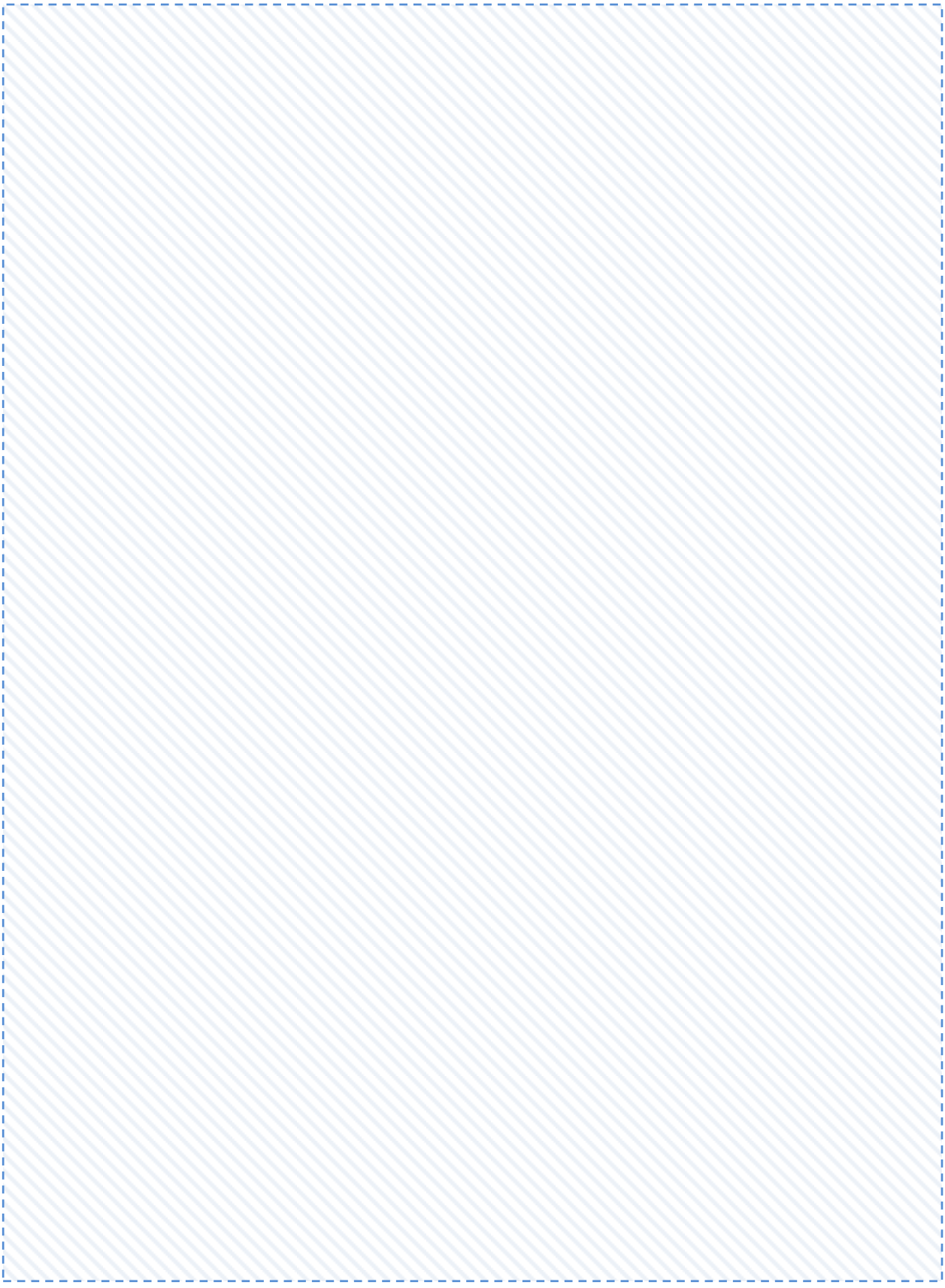
Foreword

Digital Axle Counters are the integral part of today's modern signalling which detect the presence of train vehicle on specified portion of track. Digital Axle Counters are being progressively installed in Indian Railways due to their advantages over conventional track circuits, wide applications and inherent safety features. Some examples are elimination of insulated rail joints on tracks, no effect of track length, ballast condition and drainage, diagnostic through error codes and modular design.

However there is always a growing demand of safe and reliable, maintenance free equipments which have user friendly features and longer Mean Time Between Failure (MTBF). As each generation of technology is better than the last, it builds new technology faster. The S&T Directorate of Research Designs & Standards Organisation (RDSO) undertakes introduction of new signalling technologies and upgradation of existing technologies through research, design, exhaustive trials, vendor development and approval. The ACM 200 is the improved version of Digital Axle Counter developed by M/s Siemens and approved by RDSO. Keeping pace with the current technology trends, CAMTECH has prepared this handbook containing the details of this Axle Counting System. I hope that this handbook will be useful in dissemination of information among Signal Supervisors and Technicians of Indian Railways concerned with this System. I wish them all the success.

CAMTECH Gwalior

Jitendra Singh
Principal Executive Director



Preface

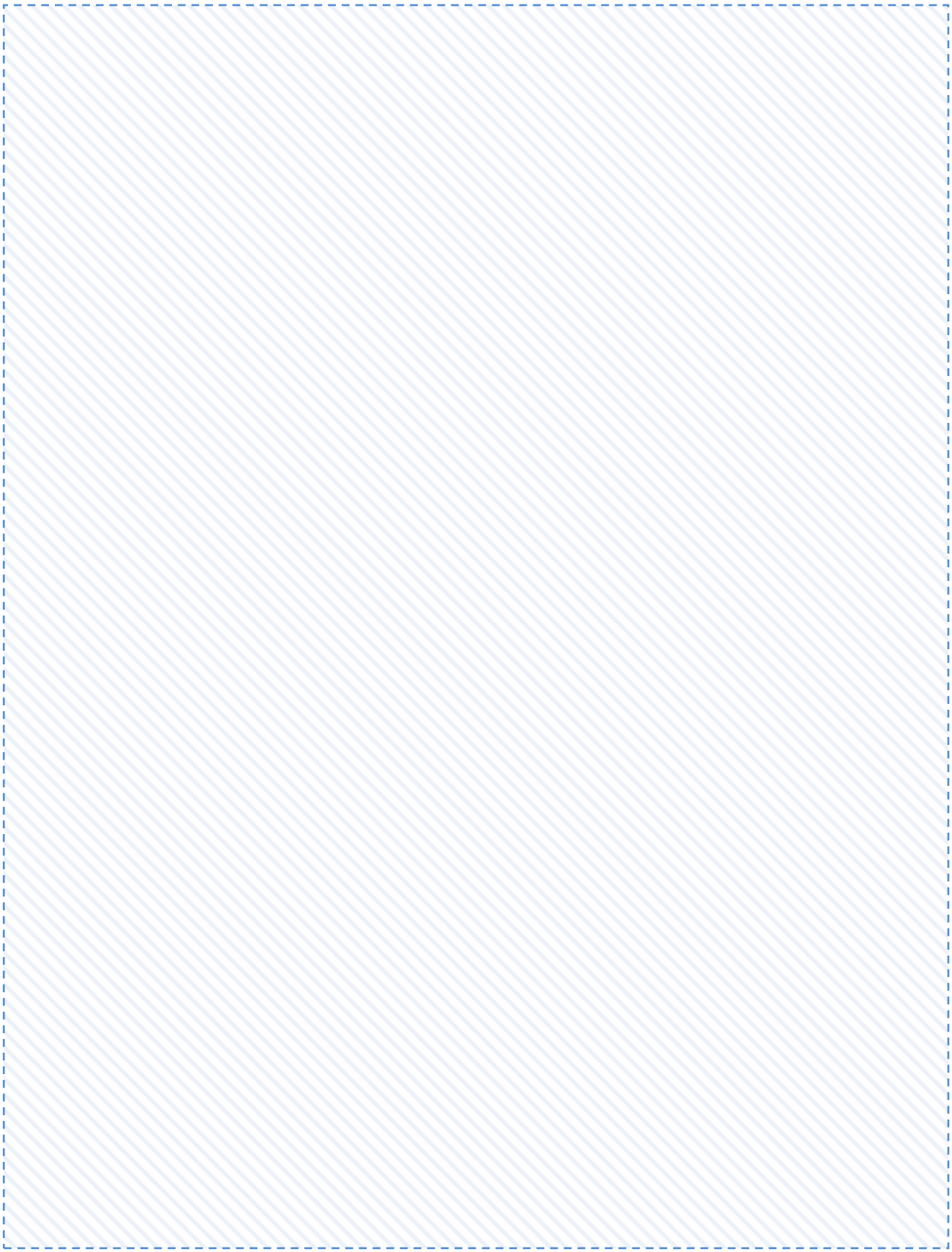
Axle Counters find a wide range of applications in railway signalling like points & crossings, ABS, IBS, BPAC etc. The signal Maintenance staff is quite familiar with Digital Axle Counters as these have been installed all over Indian Railways. However technology is improving at a fast pace in every field and railway signalling is no exception to this. Various manufactures across the world are upgrading their products to meet the future demands of high speed trains and expansion of new lines. ACM 200 is the latest version of Digital Axle Counter from M/s Siemens with enhanced features like programming through ID Plug, remote diagnostics, calibration etc. CAMTECH has prepared this handbook to make the users familiar with the system.

Although all the information like system structure, components, installation guidelines, maintenance instructions and troubleshooting has been covered in the handbook, relevant RDSO Specifications, PCCL and OEM manuals have also been embedded in the "Reference" page for detailed study.

We are sincerely thankful to S&T Directorate RDSO and M/s Siemens Ltd., Mumbai who have provided valuable inputs for preparing this handbook. Since technological upgradation and learning is a continuous process, you may feel the need for some addition/modification in this handbook. If so, please give your comments on email address dirsntcamtech@gmail.com or write to us at Indian Railways Centre for Advanced Maintenance Technology, In front of Adityaz Hotel, Airport Road, Near DD Nagar, Maharajpur, Gwalior (M.P.) 474005.

CAMTECH Gwalior

Avadhesh Kumar Yadav
Director (S&T)



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Amendments & Revisions

The amendments/revisions to be issued in future for this report will be numbered as follows:

CAMTECH/S&T/2023-24/ACM 200/1.0 # XX date .....

Where "XX" is the serial number of the concerned amendment/revision (starting from 01 onwards).

Sr. No.	Date of issue	Amendment/Revision	Remarks
1.00	25.04.2023	First Release	--

Disclaimer & Our Objective

Disclaimer

It is clarified that the information given in this handbook does not supersede any existing provisions laid down in the Signal Engineering Manual, Railway Board and RDSO publications. This document is not statuary and instructions given are for the purpose of guidance only. If at any point contradiction is observed, then Signal Engineering Manual, Telecom Engineering Manual, Railway Board/RDSO guidelines may be referred or prevalent Zonal Railways instructions may be followed.

Our Objective

To upgrade Maintenance Technologies and Methodologies and achieve improvement in Productivity and Performance of all Railway assets and manpower which inter-alia would cover Reliability, Availability and Utilisation.

If you have any suggestion & any specific comments, please write to us:

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CAMTECH Publications

CAMTECH is continuing its efforts in the documentation and up-gradation of information on maintenance practices of Signalling & Telecom assets. Over the years a large number of publications on Signalling & Telecom subjects have been prepared in the form of handbooks, pocket books, pamphlets and video films. These publications have been uploaded on the internet as well as railnet. For viewing/downloading these publications

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A limited number of publications in hard copy are also available in CAMTECH library which can be got issued by deputing staff with official letter from controllong officer. The letter should be addressed to Director (S&T), CAMTECH, Gwalior.

For any further information regarding publications please contact:

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Abbreviations

AC	Alternating Current
ACM	Axle Counter Module
AFTC	Audio Frequency Track Circuit
ASM	Assistant Station Master
AWS	Automatic Warning System
AZG	Immediate Axle Counter Reset or Hard Reset
AZGH	Auxiliary Axle Counter Reset
CENELEC	European Committee for Electrotechnical Standardization
CT	Cable Termination
CP	Configuration Process
Cu NYY-O	Cable with a Copper core, Inner & Outer PVC insulation, without grounding core
DC	Direct Current
DEK	Double Wheel Detector
DP	Detection Point
ERL	Equipment Revision Level
EBA	Federal German Railways Office
GND	Ground
ID	Identification
KHZ	Kilo Hertz
IP	Internet Protocol
IPS	Integrated Power Supply
Kmph	Kilometer per Hour
LED	Light Emitting Diode
MSDAC	Multi Section Digital Axle Counter
mV	Milli Volt
NS	Terminals applicable to Standard usage variant
OEM	Original Equipment Manufacturer
PE	Protective Earth
PC	Personal Computer
PCCL	Pre-Commissioning Check List
RDSO	Research Designs & Standards Organisation
RE	Railway Electrified
RJ45	Registered Jack 45
RR	Reset Restriction
SEM	Signal Engineering Manual
SIL	Safety Integrity Level
SM	Station Master
SRI	Safety Related Information
TCB	Trackside Connection Box
TVDS	Track Vacancy Detection Section
VAZG	Preparatory Axle Counter Reset
WDE	Wheel Detection Equipment
WSD	Wheel Sensor Double
ZP D 43	Wheel Detection Equipment Module

Section I
Siemens ACM 200 Axle Counting System

1.1 Introduction

This handbook covers brief overview and functions of ACM 200 Axle Counting System comprising indoor equipment and outdoor equipment. In addition to this, the document also covers brief installation guidelines for indoor and outdoor equipment, maintenance instructions and information on diagnostics via ACM Front Panel and website or web application. For detailed study, relevant RDSO Specifications, Pre-Commissioning Check List (PCCL) and OEM Manuals can be viewed or downloaded through the hyperlinks provided on Reference page.

The Clearguard ACM 200 axle counting system is part of the Clearguard track vacancy detection system product line from Siemens. The ACM 200 axle counting system is made up of ACM 200 modules, which are programmed via an ID plug and combined with the Ethernet bus and counting heads of the ZP product family (ZP D 43,) into a fail-safe axle counting system. ACM 200 Axle Counting System shall conform to RDSO Specification RDSO/SPN/176/2013 Ver. 3.0 or latest.

1.2 Function of ACM 200

The main function of the ACM is the issuing of fail-safe clear and occupied indications for track vacancy detection sections. The fail-safe clear and occupied indications are established based on the signals transmitted by the wheel detection equipment.

The outdoor equipment consists of ZP D 43 counting heads; which detect the passing wheels. The ZP D 43 generates an electromagnetic field around the rail (wheel detection according to the transmitter/receiver principle). Any change in the electromagnetic field is detected by the ZP D 43 and passed on to the ACM. The pulses are transmitted via a two-core trackside cable to the indoor ACM 200 module installed in the interlocking building/station. ACM 200 module performs the following functions:

- Evaluation of the signal pulses transmitted from the wheel detection components.

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- Comparison of the number of axles entering a track vacancy detection section with the number of axles leaving it.
- Monitoring the track vacancy detection sections and transmission of clear or occupied indications to the interlocking.
- Optional transmission of sensor and / or block information via ACM–ACM Ethernet communication.

ACM provides further features:

- Flexibly usable floating relay outputs.
- Flexibly usable floating opto-coupler inputs.
- Output of a "pulse detected" indication of the wheel detection equipment.
- Easy diagnostics and configuration via the website or a web application.

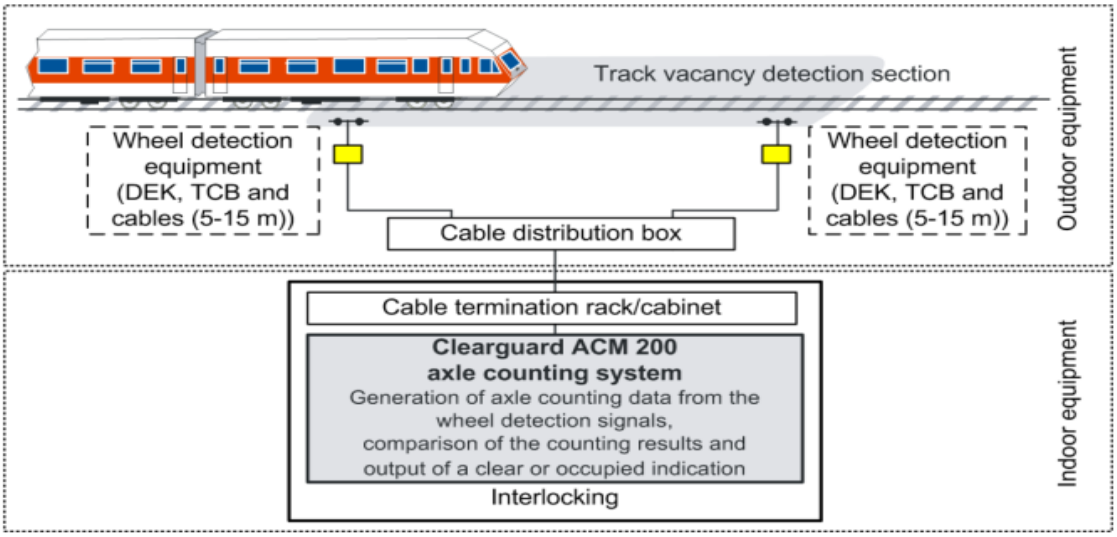

Figure 1 : General overview of ACM 200

1.3 Relay outputs of ACM

The ACM has two fail-safe, monitored dual-channel relay outputs. How they are used is defined by configuration. The following information can be output via the relays:

- Clear and occupied indications (fail-safe)
- Safety-related information (fail-safe)
- "Pulse detected" indication of locally connected wheel detection equipment (informative only)

"Pulse detected" indication of wheel detection equipment

The "pulse detected" indication of the wheel detection equipment contains the information that the relevant set of wheel detection equipment is currently being traversed or is faulty. This indication is purely informative. The indication can be output via a relay and used, for example, to support decentralized electric points.

The ACM has five informative single-channel relay outputs. The following information is output via the relays:

- Operability of the ACM (module is OK)
- Reset restriction (informative only)
- Reset acknowledgment (informative only)

1.4 Optocoupler inputs of ACM

The ACM has four fail-safe dual-channel optocoupler inputs for free usage. The optocoupler inputs can be used for the following tasks:

- Axle count reset (AZG, VAZG)
- Auxiliary axle count reset (AZGH)
- Commissioning operation
- Read-in of binary safety-related information (SRI)

1.5 Applications

ACM 200 is suitable to be used in following types of lines:

- Main line
- Metros & Trams
- Freight lines & depots
- Main and secondary lines, station areas, and point areas
- Single- and multiple-track lines
- Lines with and without a block system
- Track sections of any length
- Train speeds of up to 400 km/h

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1.6 Salient Features

Following are the salient features of ACM 200:

Fail Safety

The axle counting system has been developed according to the safety requirements stipulated by the European CENELEC standards for railway applications and meets the highest safety integrity level, SIL 4, in accordance with the CENELEC standards EN 50126, EN 50128 and EN 50129. It also complies with the Technical Principles for the Approval of Safety-related Systems for Signaling of the Federal German Railways Office (EBA).

Modular hardware architecture

ACM 200 has a redundantly designed hardware core with a 2-out-of-2 configuration. This computer unit consists of two independent microcomputers of identical design which are identically programmed and work synchronously with each other.

The axle counting system comprises one or more ACMs. The modular architecture of the axle counting system permits it to be individually configured to satisfy the most diverse customer requirements. The axle counting system permits easy extension and modification. Hardware replacement and extension or configuration updates can be carried out in a very short space of time.

Easy Installation

The entire electronics, including the interfaces and control and display elements, is integrated into the ACM. This eliminates time consuming wiring. The ACM 200 module can be quickly installed by simply locking it on to a mounting rail. This reduces commissioning times and cuts installation costs. The installation of outdoor sensors on rail web is similar to that of other version of Siemens MSDAC (AzS250U) which is compatible with all common rail profiles.

Easy module replacement

An ACM can be replaced with the power on without switching off the system components and interrupting the operation. The configured data of the ACM can be transferred to a spare ACM simply by removing and then reinserting a programmable connector (ID plug). System components need not be switched off.

Programming via ID Plug

The data is stored on the ID plug provided on ACM 200 module that can, be removed and plugged onto another ACM 200 module if required. Thus, faults can be quickly rectified and downtimes minimized.

Availability

ACM 200 modules can be connected to an Ethernet network via switches. Each module has its own IP address and an integral website and is thus addressable via Ethernet. This enables the maximum possible availability.

Minimized building space requirements

One single module type is used for all applications. All the electronics accommodates in one module, hence requires less space**.**

Floating Relay interface

The ACM has a floating relay interface for connection to any type of interlocking or sub-system, permitting its flexible adaptation to different operating conditions. The fail-safe clear or occupied indication status information is transmitted via the floating relay interface of the ACM to any interlockings or subsystems. If one of the two relay interfaces of the ACM is not being used for the output of clear/occupied indications, it can be used for the output of safety-related information (SRI). The information is input via the opto-coupler inputs of a partner ACM.

Connection to new and existing interlocking

The floating relay interface permits transmission of the data about clear and occupied track vacancy detection sections to a wide range of interlocking systems of any type. The ACM can be connected to new and existing electronic and relay interlockings.

The relay interface permits flexible use under a wide range of operating conditions. In addition to the clear and occupied indications, the ACM can optionally transmit safety-related information (SRI) via the relay interface.

Intelligent diagnostics

Remote diagnostics is possible via a network from any location at any time.

LED indicators on the ACM 200 module permit simple diagnostics, at site**.**

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With the integrated website, which is accessed via a standard PC, rapid and simple diagnostics are possible. As an alternative to the website, a web application featuring the same functions as the website can be used.

Control distance

The control distance (standard) between the ACM and connected ZP 43 wheel detection equipment is up to 6.5 Km and with additional measures it is 21 km.

Connectivity of ACM to ZP43

Two ZP43 can be connected to an ACM directly and the ACM can monitor two track vacancy detection sections. In the lower part of the ACM front panel, there is an Ethernet interface for the connection of additional ACMs, diagnostics and loading of configuration data.

Combination of ACM with other ACMs

The Ethernet interface of an ACM allows further ACMs to be connected to build up a net-work of ACMs. A maximum of four further partner ACMs can be connected to each ACM. Modules of the ACM 200 or the ACM 250 and ACM 100 axle counting systems can be partner ACMs. Using this 1-plus-4 combination, a total of ten ZP43 can be connected.

For the purpose of exchanging wheel signal data, the ACMs are connected to each other via a switch.

The 1-plus-4 combination implements the following:

- **One ACM monitors the wheel signal data from the two directly connected ZP 43.**
- The four partner ACMs monitor the wheel signal data from the eight "remote" ZP 43 or WSD wheel detectors which are connected.

Extension of axle counting system by further 1-plus-4 combinations

- Each ACM can be connected to up to four further partner ACMs (in accordance with the principle of the maximum 1-plus-4 combination). Axle counting systems of any size can be formed by this "cascade" arrangement.

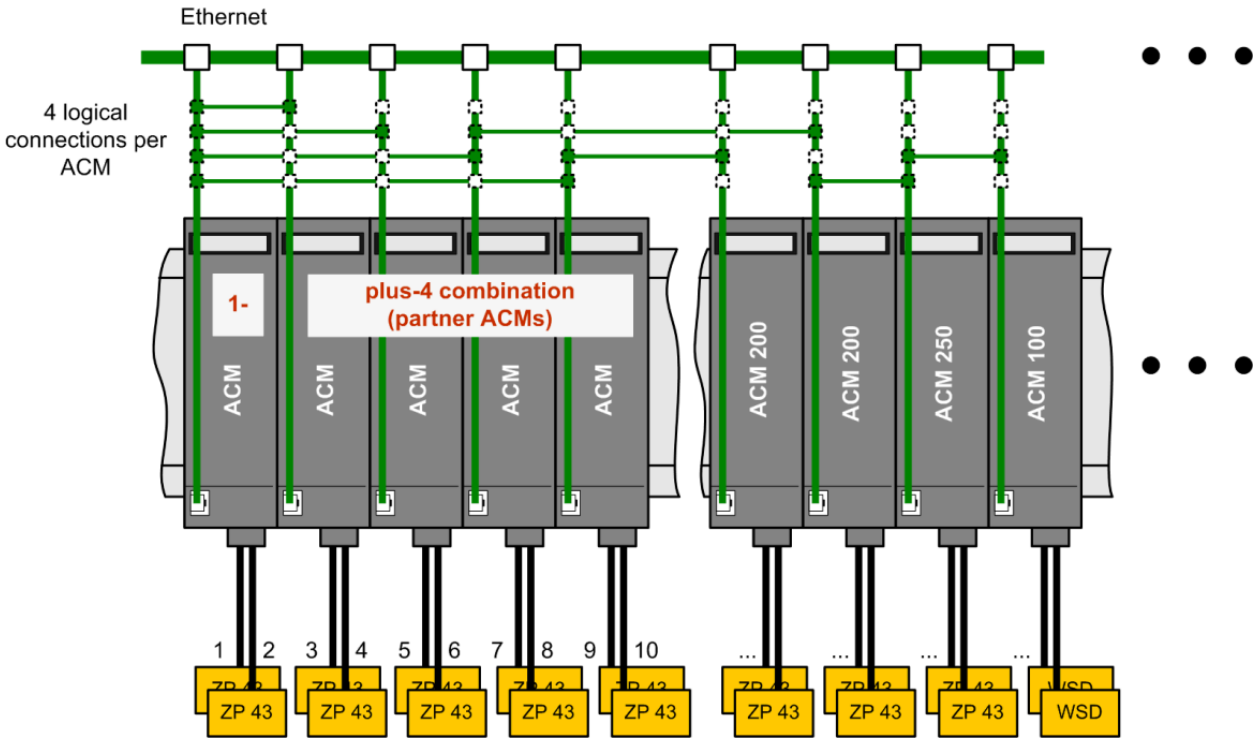

Figure 2 : Combination of ACMs with other ACMs

Calibration of ACM

Due to application-specific conditions (e.g. different control distances, cable types and lengths), the ACM must be adaptable to existing on-site situations. The ACM can be automatically calibrated by pressing the "CAL" button on its front panel.

Variable direction reversal of wheel detection equipment

When the wheel detection equipment is installed on site, the mounting location (to the left or right of the track) may have to be changed as compared to the configured location. This can be easily configured by pressing the "DIR1" and "DIR2" buttons on the ACM front panel.

Diagnostics using LEDs on ACM

On-site diagnostics is performed using the LEDs on the front of the ACM. The current status of the ACM can be easily diagnosed by reference to the different coloring of the LEDs.

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On-site diagnostics using website or web application

For additional on-site diagnostics, a standard PC can be connected via the Ethernet interface. The website or web application enables the current status data to be requested via its graphical user interface. The clear display provides optimal support for all maintenance tasks.

Remote diagnostics using website or web application

The website or web application enables remote diagnostics via an appropriately configured network from any location at any time of day. The graphical user interface clearly shows status and diagnostic data in graphical form and as a list.

1.7 Axle Counter Reset Options

For the ACM, the type of axle count reset can be customized using the website or web application. The following can be configured for each track vacancy detection section:

- Preparatory axle count reset (VAZG) with or without reset restriction (RR)
- Immediate axle count reset or Hard reset (AZG) with or without reset restriction (RR)
- Auxiliary axle count reset (AZGH).

Immediate Axle Count Reset (AZG)

With immediate axle count reset (AZG), the respective track vacancy detection section is indicated as clear immediately after the axle count reset operation has been performed.

Note: This type of reset should be performed only after verifying (through line verification box or any other approved mean) that the respective track section is not occupied by any vehicle.

Preparatory Axle Count Reset (VAZG)

With preparatory axle count reset (VAZG), the respective track vacancy detection section remains occupied for a certain time after the axle count reset operation has been performed. The track vacancy detection section is indicated clear only after the passage of a train as per station working rules, with the axles counted in matching those counted out.

Auxiliary Axle Count Reset (AZGH)

The Immediate or Preparatory axle count reset operation is rejected if a reset restriction is present (when a reset restriction (RR) is configured). A reset restriction (RR) is activated

if the last axle counted by the ACM in the respective section was an axle counted 'IN' and no 'OUT' counts were registered.

A reset restriction can be cancelled by checking the track vacancy detection section (proceed-on-order run) or executing an auxiliary axle count reset operation (AZGH). After removing the reset restriction, the track vacancy detection section can be reset by an axle count reset operation.

An authorized person must first check the operating department regulations and cancel the reset restriction (RR) with the AZGH auxiliary axle count reset button and then actuate the AZG or VAZG button.

1.8 Power Supply

If a 24 V DC power supply is available which meets the ACM supply voltage requirements and the ambient condition at the installation site, a separate power supply is not necessary for the axle counting system. The supply voltage must be between 21.6 V DC and 31.2 V DC. For optimum, long-term availability, recommended with a tolerance range of max. ±10%.

1.9 Data transmission

For data transmission via Ethernet, the ACMs are connected using switches. The ACMs are connected to the switch via RJ45 sockets. For diagnostic purposes, a service PC can be connected to the switch. The operating and display elements (LEDs, buttons) depend on the type of switch used.

1.10 Modes of usage

Standard Usage

Wheel detection equipment signals are available to the evaluation computer.

Double Usage*

Wheel detection equipment can be used by two adjacent evaluation computers. Double usage means that a set of wheel detection equipment is used by two different ACMs, i.e. is operated as double-usage wheel detection equipment. When using the double-usage option, one ACM must be connected as usual to the wheel detection equipment, i.e. with fuse. The other ACM is connected via the double-usage output or the double-usage board (depending on the type of wheel detection equipment) without fuse.

External supply and dual usage*

External supply means that the wheel detection equipment is powered via two additional cores. When using the external supply option, the fuses for the relevant wheel detection equipment must be removed in the axle counting system. ZP D 43 can be powered from an external AC or DC supply (if distance > 6.5 km). Wheel detection equipment can be used by two adjacent evaluation computers.

**Note: Double Usage and External Supply & Dual Usage modes are not currently used in Indian Railways*

1.11 System Structure

From the figure it can be seen that the indoor equipment consists of a combination of partner ACMs. Partner ACMs of the ACM 250, ACM 100 and ACM 200 axle counting systems can be combined to form a network. The process data (passage of a wheel) is detected by the ZP D 43, processed and transmitted to the assigned ACM. The ACM processes and evaluates the wheel detection equipment information and transmits the results to the interlocking.

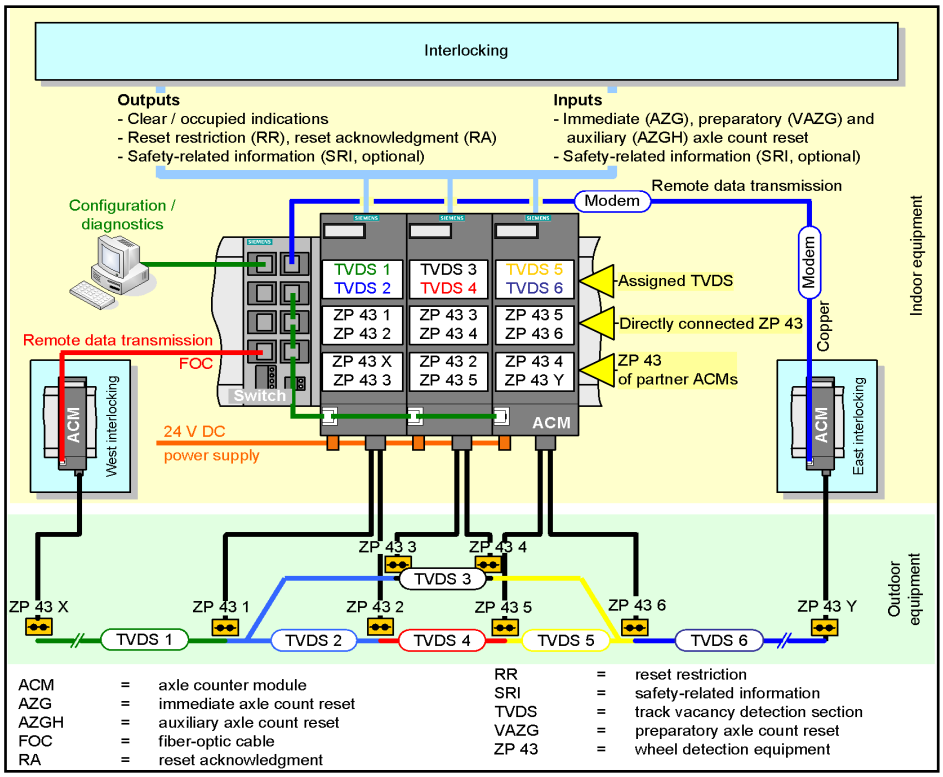

Figure 3 : ACM 200 System Structure

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In addition to the output of clear and occupied indications, it is possible, for each track vacancy detection section, to output a reset restriction and a reset acknowledgment on a single channel.

The dual-channel immediate (AZG) or preparatory (VAZG) axle count reset is realized as an input from the interlocking. The reset restriction can be canceled from the interlocking using an optional dual-channel auxiliary axle count reset (AZGH) operation. This is also possible directly on the ACM.

1.12 System description

The axle counting system consists of two parts:

(i) Indoor equipment

(ii) Outdoor equipment

1.12.1 Indoor Equipment

The indoor equipment of the axle counting system comprises ACM, power supply module, switches, a cable termination rack and connecting cables, permitting an axle counting system of any size to be implemented.

The main component of the axle counting system is the axle counter module (ACM). The entire electronics, including the interfaces and control and display elements, is integrated into the ACM.

Figure 4 : ACM 200 Module

Axle Counter Module ACM 200 consists of following interfaces:

- ID plug
- RJ45 socket
- Ethernet Switch
- Power Supply module (optional)
- Housing cabinet for ACM
- Cable Termination Rack

ID plug

ID Plug is a 9 pin programmable configuring connector located in the upper front section of the ACM. The ID plug has a non-volatile memory. The configuration data specific to each ACM is loaded onto the ID plug via the website or web application. The associated track vacancy detection section can be written on the front of the ID plug. The ID plug can be removed and inserted without a tool. When an ACM is replaced, the data configured on the ID plug can be transferred to the spare ACM by simply removing ID plug from the old ACM and inserting into the spare ACM. The spare ACM is then immediately ready for use again with the same device configuration.

Figure 5 : ID Plug

RJ45 socket

An Ethernet interface is available in the lower front section of the ACM which is used for connection to a network. Switches are used for interconnecting a number of ACMs. Using the Ethernet interface, configuration data can be loaded via the ACM onto the ID plug. The interface can also be used to output diagnostic data. For the optional connection of a local diagnostic PC, one RJ45 socket per cabinet or rack should be kept free on a switch. When using two ACMs, a direct connection without a switch can be set up between the ACMs. A diagnostic interface is not available when using this type of connection.

Figure 6 : RJ45 Connection Port

Ethernet Switch

For data transmission via Ethernet, the ACMs are connected using switches. The ACMs are connected to the switch via RJ45 sockets. For diagnostic purposes, a service PC can be connected to the switch. The operating and display elements (LEDs, buttons) depend on the type of switch used.

Figure 7 : Ethernet Switch

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Figure 8 : ID Plug Socket & Ethernet Interface

Process connector

On the underside of the ACM, there is a 96-pin male connector for connecting a system cable. The ACM is connected to control elements, an interlocking and the wheel detection equipment via its process connector.

Power Supply Module (optional)

The power supply modules supply the power required for the ACMs. From the input voltage, they generate a supply voltage of 24 V DC.

If a 24 V DC power supply is available which meets the ACM supply voltage requirements, a separate power supply is not necessary for ACMs.

The supply voltage must be between 21.6 V DC and 31.2 V DC.

Note : The Power Supply Module is not used at present in Indian railways

Housing Cabinet for ACM

A number of ACMs can be installed directly side by side on a 122 mm mounting rail in a space-saving arrangement since all interfaces are located in the lower section of the ACM housing. Maximum 15 ACM modules can be installed per cabinet.

Figure 9 : Installation of ACM in Housing Cabinet

Cable Termination Rack

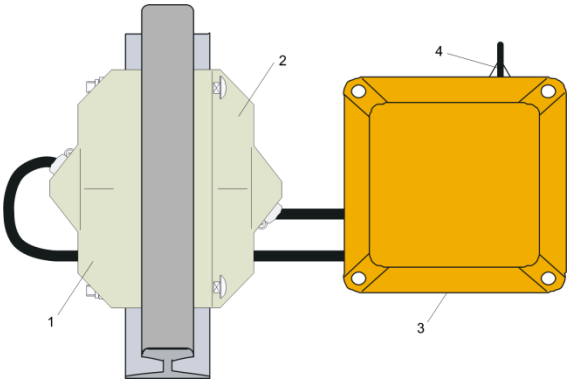
The cable distributor is the installation interface between the indoor and outdoor components. The connecting cables between the ACM and the cable termination rack or

cabinet must be shielded. Star-quad or paired signaling cables are used in the outdoor equipment.

1.12.2 Outdoor Equipment

The outdoor equipment of the axle counting system consists of ZP D 43 wheel detection equipment. The ZP D 43 wheel detection equipment is installed at the limits of a track vacancy detection section. A set of wheel detection equipment consists of the DEK 43 double wheel detector and a trackside connection box (TCB). The trackside connection box accommodates the electronics for evaluation of the wheel pulses.

The DEK 43 double wheel detector consists of a transmitter section and a receiver section. The transmitter section is installed on the outer side of the rail and the receiver section on the inner side of the rail. The DEK 43 double wheel detector is connected to the trackside connection box by means of two connecting cables permanently attached to the detector. The cables are optionally 5 m, 10 m or 15 m long. The DEK 43 double wheel detector is bolted to the rail web.



1 -- DEK Receiver
2 -- DEK Transmitter
3 -- Trackside Connection Box with Evaluation Electronics
4 -- Signalling Cable

Figure 10 : Connection of DEK 43 with Track Side Connection Box

Trackside connection box

It contains the evaluation electronics of the wheel detection equipment. The two connecting cables of the wheel detector and the trackside cable enter the box through cable glands.

Figure 11 : Outdoor equipment consisting of Transmitter, Receiver, Track side Connection Box with connecting cable

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Section II
Installation of ACM 200

2.1 Installation of Indoor equipment

The ACMs are installed indoors side by side by latching onto a 122 mm mounting rail. For connecting a number of ACMs, switches are mounted on the mounting rail. The ACM is connected to a supply voltage of 24 V DC.

2.1.1 Installation in Cabinets

All components are accommodated in racks or cabinets.

A number of mounting rails, shield buses, terminal strips and cable ducts can be installed underneath each other in racks or cabinets. The mounting rail can also be mounted on a wall. Maximum 15 number of ACM Modules can be installed in a standard cabinet.

The ACM may be installed outside buildings if it is accommodated at a weather-protected location in a switchgear cabinet or container.

The ACM indoor equipment is installed on a 122 mm mounting rail. The latch fixing on the rear of the ACM permits rapid installation by latching into place. The ACM 200 module can be quickly installed by simply locking it on to a mounting rail.

As per the requirements of the site and the approved SIP, an ACM plan is prepared. In reference to the same, ACM cabinet is finalized.

There are three types of cabinets that are presently available for installation purposes.

- 15 ACM Type :- 30 DP and 30 Track Section module
- 10 ACM Type :- 20 DP and 20 Track Section module
- 5 ACM Type :- 10 DP and 10 Track Section module

Figure 12 : Installation in Cabinet - 5 ACM modules per row

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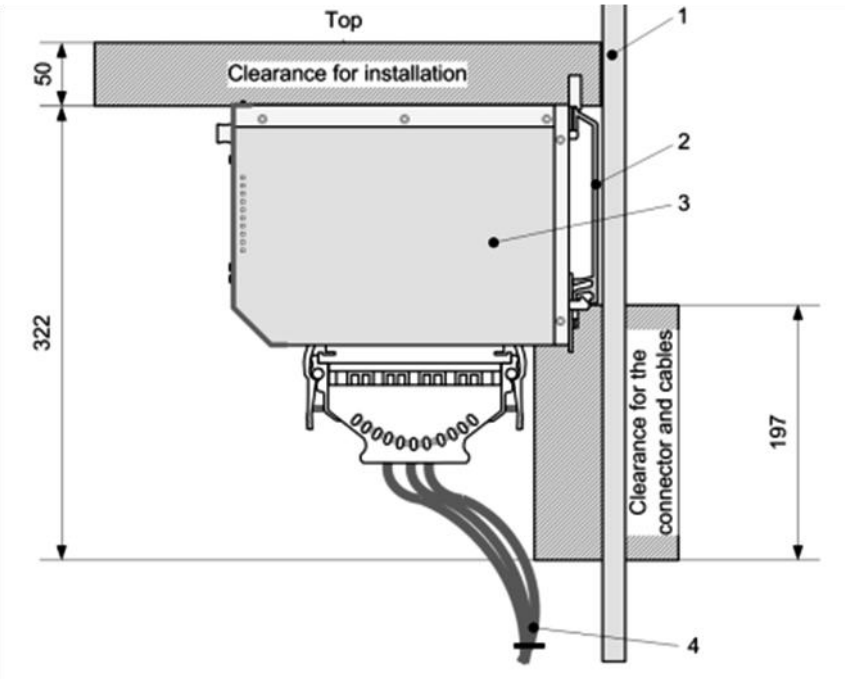
2.1.2 ACM 200 process connector

The ACM process connector is used for connection to the 96-pin male connector on the underside of the ACM. The ACM is connected to control elements, an interlocking and the wheel detection equipment via its process connector. The system cable is used to connect the process connector of the ACM to the cables from these elements. It is mechanically secured by means of clamps.



1	Rack or Cabinet
2	122 mm Mounting Rail
3	ACM
4	System Cable

Table 1 : Components of Rack or Cabinet

Figure 13 : Side view of ACM 200 Module

2.1.3 Cable Termination Rack

The cable Termination Rack is the installation interface between the indoor and outdoor components. This is where the cables for the outdoor components are connected and from here, further connecting cables lead to the indoor components

The connecting cables between the ACM and the cable termination rack or cabinet must be shielded.

Star-quad or paired signaling cables are used in the outdoor equipment.

2.1.4 Cabling requirements for indoor equipment

(a) Cable for feeding (Power Supply)

(i) 24 or 60 V DC to the busbar from main power supply (IPS/Battery Charger) - Minimum 10 sq.mm multi-strand copper cable

(ii) Busbar to ACM Module - 2 core shielded cable

(iii) ACM Module to CT rack - 24 cores shielded cable, single strand, 0.5 mm dia. shielded telecom cable (Shield of the cable should be earthed)

(b) Indoor cables on process connector

All cables laid in the indoor equipment are electrically connected to the process connector of the ACM. The cable termination rack provides electrical isolation between the indoor and outdoor equipment.

The length of the connecting cable must not exceed 100 m.

Table 2 : Core assignment of ACM 200 System Cable

DS1 (+)	DS1 (-)	DS2 (+)	DS2 (-)
yellow	green	grey	pink

DS1 –Double Wheel Detector 1

DS2 – Double Wheel Detector 2

(c) Laying of power supply cables

The power supply cables of the individual ACMs must be routed from the star point as an Y configuration (separate cable to each ACM). The length of the power supply cable between the ACM and the power supply module must not exceed 3 m. The power supply cables may only be laid indoors. The negative pole of the power supply must be earthed or, in an earth-free arrangement, connected to rack potential.

Table 3 : Core assignment of the power supply cable

White (1), White (2)	+24 V (24 V DC power supply)
White (3), White (4)	0 V (24 V DC Power Supply)
Green-Yellow (5), Green-Yellow (6)	PE/GND (Earth/Rack potential)

Earthing & Protective Measures

When the ACMs are being installed, all conductive housing parts must be earthed for reasons of operator safety. The conductive parts also include the mounting rail. The ACM housing is earthed via the power supply connector. It is recommended that the cables connected to the outdoor equipment are protected against overvoltage by a lightning protection module and a block varistor.

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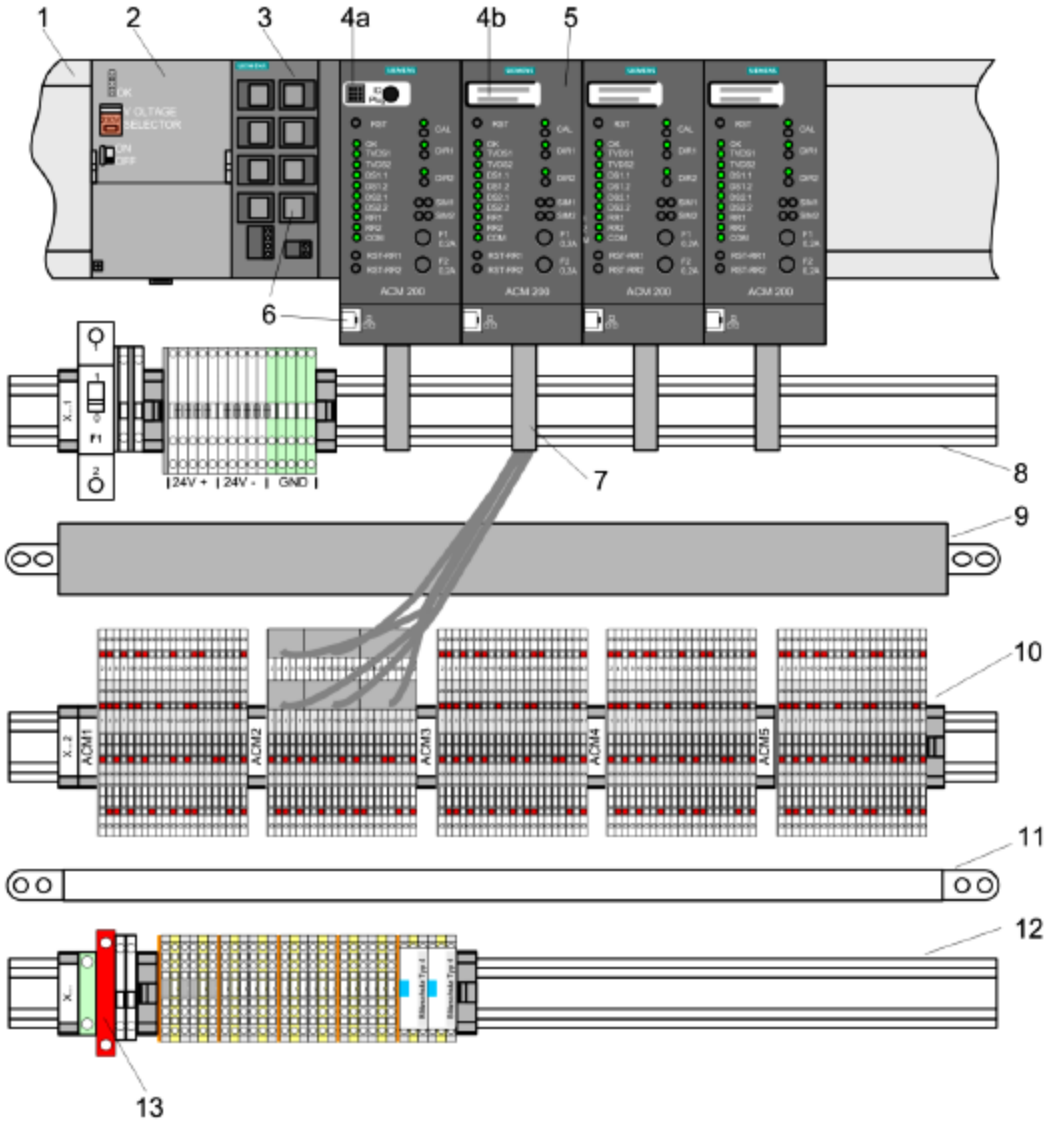

Figure 14 : Example of an Indoor Installation

Table 4 : Components of Indoor installation

1	122 mm mounting rail	7	System Cable
2	Power Supply Module (optional)	8	Power Supply Terminal Strip
3	Switch	9	Cable duct
4a	Socket for ID Plug	10	Process Connection Terminal Strip
4b	ID Plug for ACM	11	Retaining Rail
5	ACM (Axle Counter Module)	12	WDE Terminal Strip
6	RJ45 Socket (Ethernet Interface)	13	Block Varistor

2.2 Installation of Outdoor equipment

The ZP D 43 wheel detection equipment is installed at the limits of a track vacancy detection section. A set of wheel detection equipment consists of the DEK 43 double wheel detector and a trackside connection box (TCB). The trackside connection box accommodates the electronics for evaluation of the wheel pulses.

2.2.1 DEK 43 Double Wheel Detector

The DEK 43 double wheel detector consists of a transmitter section and a receiver section. The transmitter section is installed on the outer side of the rail and the receiver section on the inner side of the rail. The DEK 43 double wheel detector is connected to the trackside connection box (TCB) by means of two connecting cables permanently attached to the detector. The cables are optionally 5 m, 10 m or 15 m long. The DEK 43 double wheel detector is bolted to the rail web.

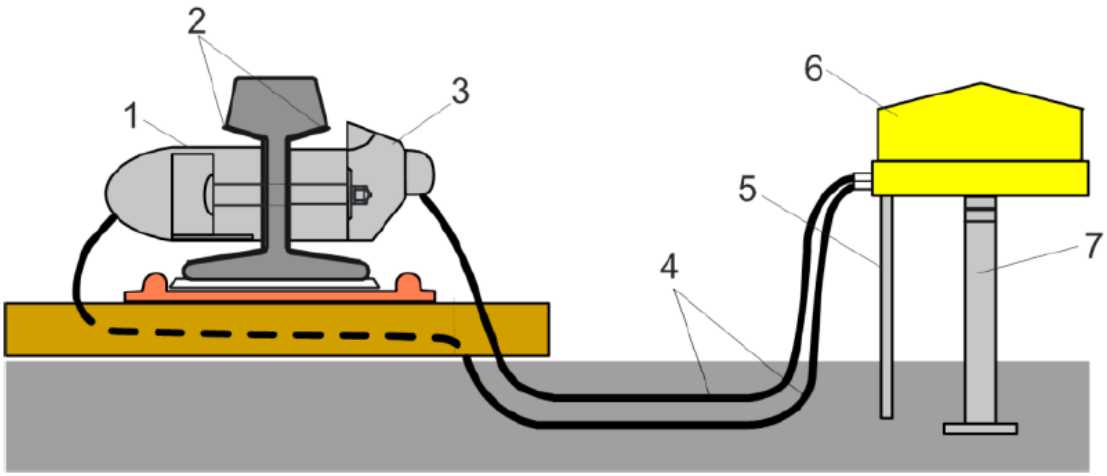

Figure 15 : Components of outdoor installation

Table 5 : Components of outdoor installation

1	Receiver
2	Reducing plates
3	Transmitter
4	Transmitter & Receiver cables with flexible tubing
5	Flexible tubing for signalling cable
6	Trackside connection box
7	Pedestal

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2.2.2 Tools Required for outdoor installation

The following tools are required for outdoor installation:

Table 6 : Tools required for outdoor installation

Sr. No.	Description	Specification	Quantity
1	Fluke Multimeter	Model 287/289	1 No.
2	Torque Wrench	with Reversible Rachet & 19 mm socket	1 No.
3	Screw Driver	0.6*3.5	
4	Screw Driver	0.6*2.8	
5	Flat Screw Driver Big	8X250 mm	
6	Fix Spanner	24X30	
7	Nose Plier	Big	
8	Wire Cutter	Small	
9	Wire Stripper	--	
10	Combination Plier	--	
11	Dummy Wheel	--	
12	Marking Jig	52 Kg, 60 Kg Rail Profile	
13	Drilling Machine	--	
14	Twist drill	Ø 13 mm	
15	Countersink	90°, Ø 25 mm	

Figure 16 : Drilling Machine

Figure 17 : Marking Jigs for 52 Kg & 60 Kg rails

Figure 18 : Torque Wrench 19 mm socket

2.2.3 Drilling holes on the Rail Web

- Determine the position of the web holes. Observe distance X.(Refer ***Figure 19***)
- Clean the rail web thoroughly at the installation site using a wire brush. Grind off any rail identification markings.
- Remove sufficient ballast at the installation site to ensure that the connecting cables are not damaged by passing wheels. On ballastless track, leave sufficient clearance to allow for routing of the connecting cables including the flexible tubing without crimping.
- The following steps depend on the drilling machine used:

  Drilling machine **without** a drilling template:

  (i) Mark the position of the web holes using the reducing plate.

  (ii) Punch-mark the points.

  Drilling machine **with** a drilling template:

  (i) Insert the drilling template with the two shaped plates matching the rail profile into the web space.

  (ii) Fix the drilling template on the rail web using two clamps
- Drill the web holes as shown in ***Figure 19* & *Table 7***
- Countersink the web holes on both sides. To do so, use a countersink (90°, Ø 25 mm) and an extended MK2-2 1.5 × 45° drill socket. This corresponds to a countersink depth of 1.5 mm.

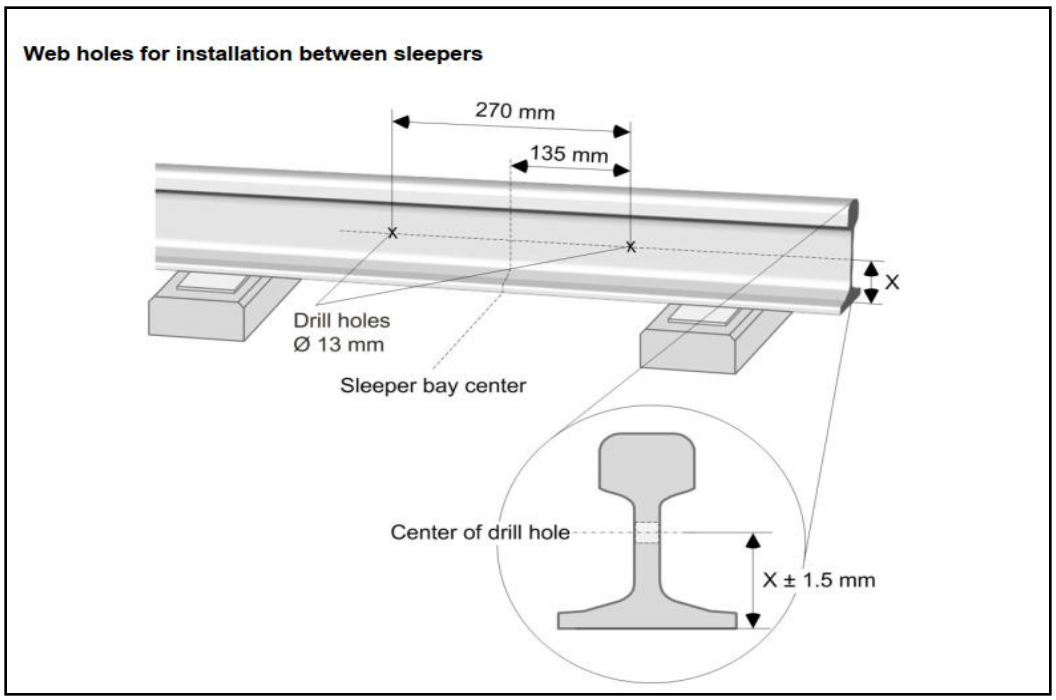

Figure 19 : Dimensions for installing the DEK 43 in the centre of a space between sleepers

Table 7 : Different rail profiles and the associated distances X

Sr. No.	Rail profile	Value of X
1	60 Kg	85 mm ± 1.5
2	52 Kg	69 mm ± 1.5
3	90 R	56 mm ± 1.5

2.2.4 Fixing of DEK 43 Electronic Double Wheel Detector

After drilling, bolt both the transmitter and the receiver of the DEK 43 Electronic Double Wheel Detector to the rail web as per the following procedure referring Fig.3.6:

1. Attach a reducing plate (3), which matches the rail profile, together with the receiver (4) and mushroom-head bolts (6) with the square washers **(5)** to the inner side of the rail (2).
2. Next put the second reducing plate (3) and the transmitter (9) on the bolts on the outer side of the rail (1). The shape of the reducing plates is determined by the rail profile. It

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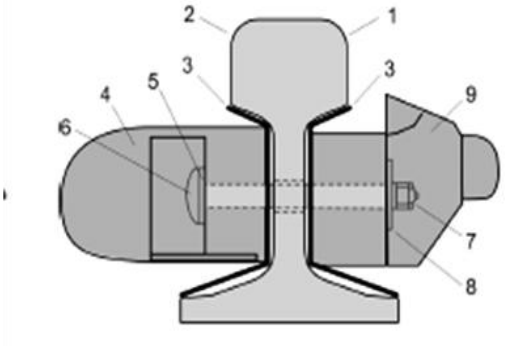
is not permitted to change the shape or length of the reducing plates in order to adapt them to another rail profile or special rail fastening accessories.

3. Slip-fit the plain washers **(8)** and the M12 prevailing torque-type hexagon nuts **(7)** onto the bolts
4. Make sure that the reducing plates are flush with the edges of the double wheel detector
5. Tighten the prevailing torque-type hexagon nuts (7) using a torque wrench with a width across flats of 18 or 19 (tightening torque of 45 Nm).



1. Outer side of rail
2. Inner side of rail
3. Reducing Plates
4. Receiver
5. Square washer
6. Mushroom Head Bolt
7. M12 prevailing torque-type hexagon nut
8. Plain Washer
9. Transmitter

Figure 20 : Components of DEK 43

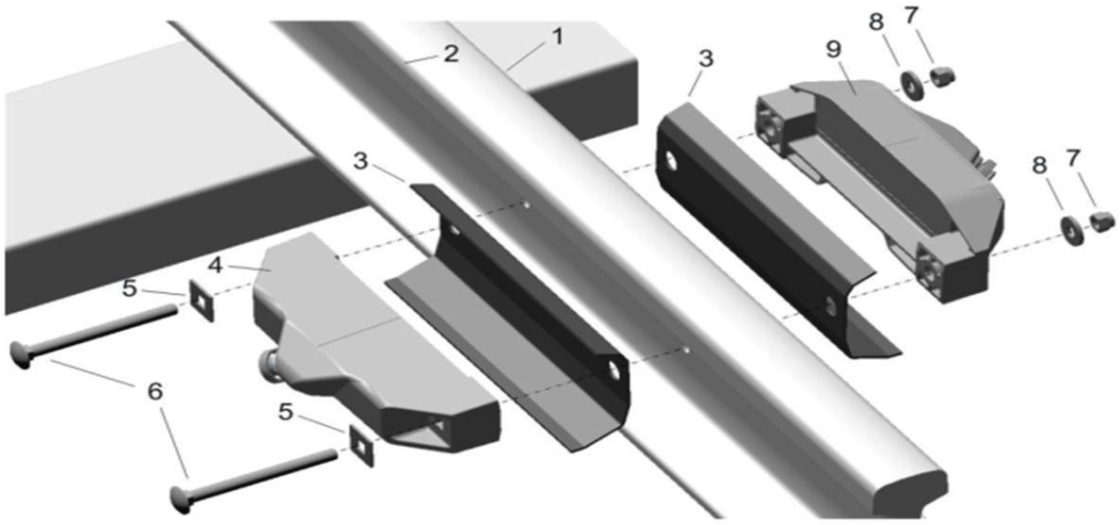


Figure 21 : Components of DEK 43 - Exploded view

2.2.5 Installation of Deflectors

- Install the deflectors in the next space between sleepers before and after the DEK 43 Electronic Double Wheel Detector.
- The slots of the deflectors permit a vertical adjustment of the oblique plates.
- On the outer side of the rail, adjust the oblique plate to 5 mm + 5 mm below the top of rail and on the inner side of the rail to 40 mm + 5 mm below the top of rail (see ***Figure 22***).
- Distance of deflector plates shall be more than 450 mm from center of sensor on either side.

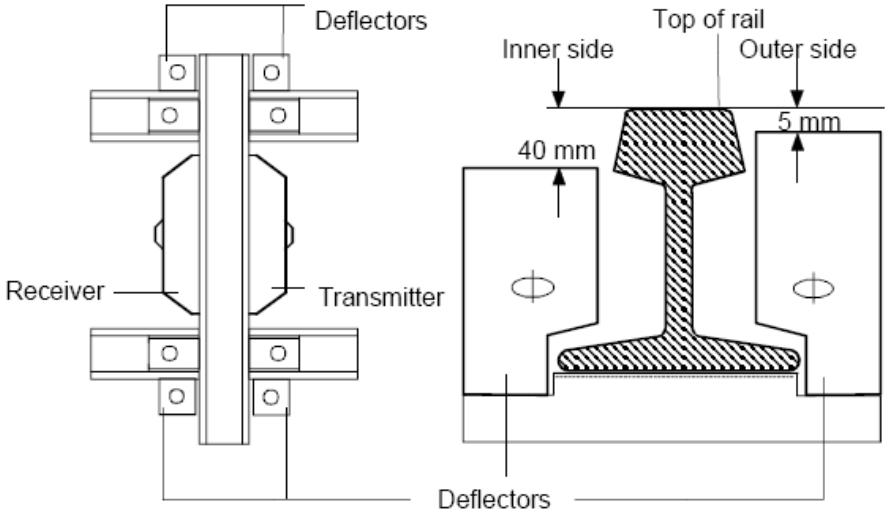


Figure 22 : Installation of Deflectors

2.2.6 Installation of Trackside Connection Box (TCB)

- Determine the installation site for the trackside connection box:
- The trackside connection box must be installed outside the clearance guage.
- The flexible tubing for the incoming signaling cable must extend into the ground or into the ballast. This ensures maximum protection of the signaling cable.
- The distances between double wheel detector and trackside connection box must be observed as per Schedule of Dimensions and availability of sensor cable length (5m, 10m & 15m).
- The following arrangements of trackside connection box are possible:

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Table 8 : Arrangements for installation of Trackside Connection Box

Operating conditions	**Arrangements**
Standard Conditions	Horizontal arrangement, installation on pedestal
	Vertical arrangement, installation on pedestal or inside location box
Limited space in tunnels and on bridges	Vertical arrangement, installation on a wall
	Vertical arrangement, installation on a slim or lattice post

Figure 23 : Trackside connection box vertical arrangement, installation on pedestal

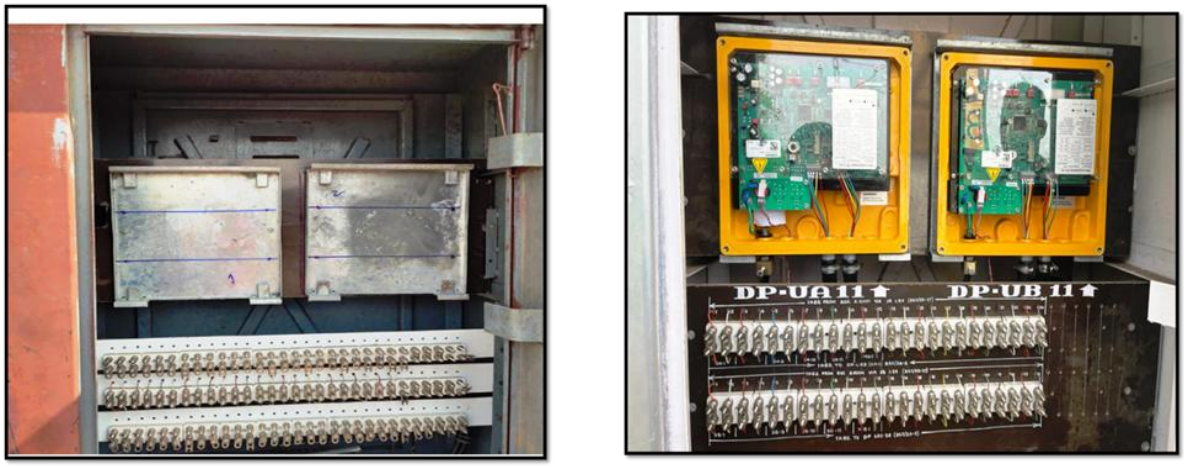

Figure 24 : Trackside Connection Box installation in location box (before & after)

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2.2.7 Laying of connecting cables of double wheel detector

The connecting cables must not be laid in a common cable route or cable trough with cables that carry traction return current. Laying on the rail base is not permitted.

The connecting cables must be laid outside the clearance guage.

The connecting cables must be laid in parallel, closely held together by cable straps, along the edge of the sleeper bay. These should be laid and clamped with a slight curvature so as to avoid unnecessary strain on the sensors as shown in ***Figure 25*** below.

The connecting cables should be laid without rings or loops (risk of tripping). Ensure that, the trackside connection box can be moved within the specified distances in parallel to the track axis and can be rotated by 90º.

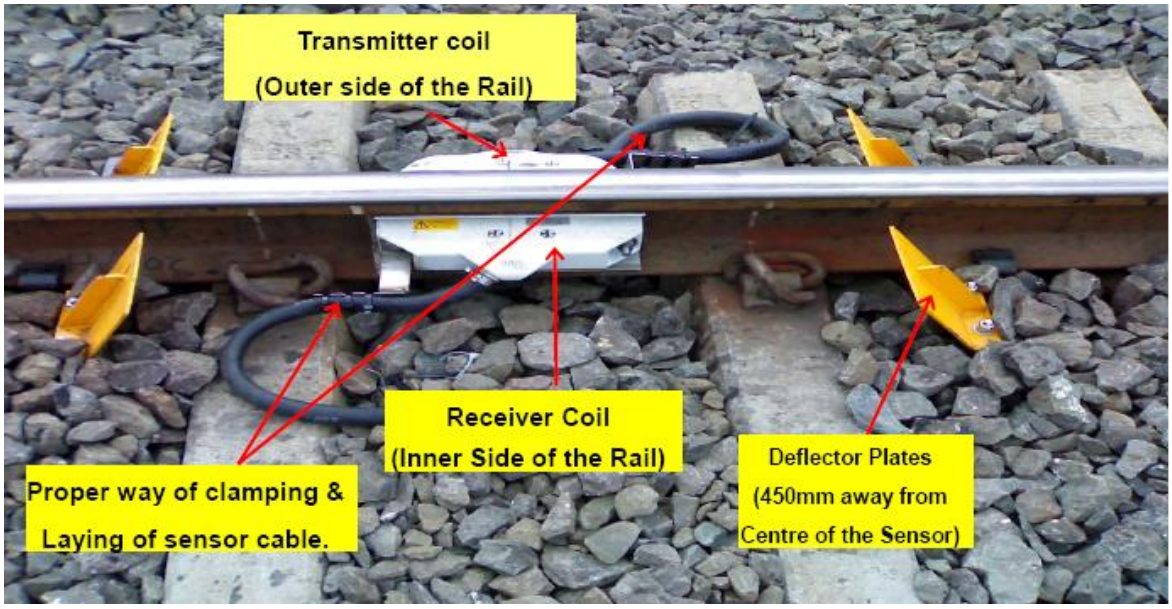

Figure 25 : Installation of ZP D 43 (actual view)

2.2.8 Connection of double wheel detector to trackside connection box

On delivery, the connecting cables are already connected to the transmitter and receiver of the double wheel detector and provided with flexible tubing.

Cut the flexible tubing approx. 60 mm before the neck of the cable. Pay attention not to damage the connecting cable

Fit a tube clip at each of the free ends

Undo the four screws on the cover of the trackside connection box and remove the cover.

Insert the two connecting cables into the trackside connection box. Use entries C and D of the trackside connection box for this purpose.

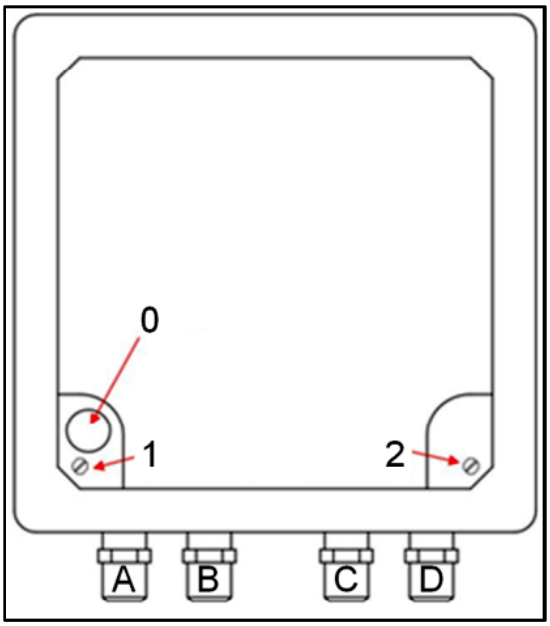

Figure 26 : Trackside Connection Box entries & terminals

Table 9 : Trackside Connection Box entries & terminals

0	Entry 0
1,2	Earth Terminals
A,B,C,D	Entries

Fix the flexible tubing of the connecting cables with the tube clips to the trackside connection box.

2.2.9 Terminal assignment in Trackside Connection Box

Connect the individual cores in accordance with the terminal assignment.(See ***Figure 29, Figure 28*** & ***Figure 27***)

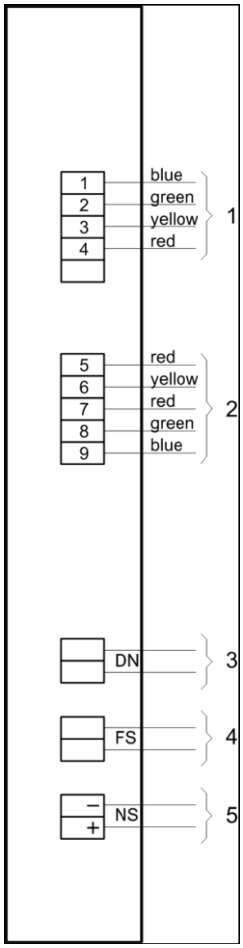

Fig. 29

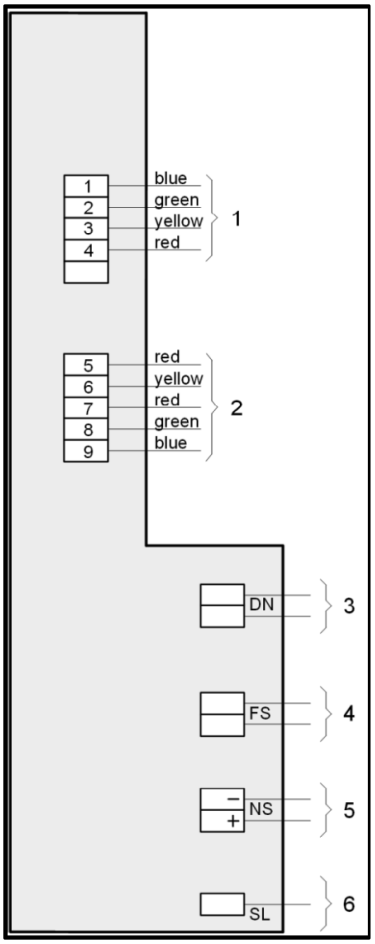

Fig. 28

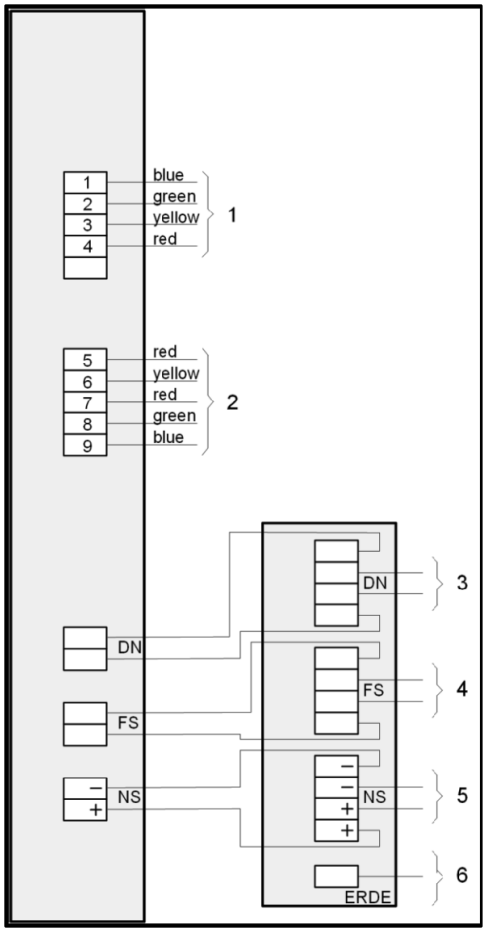

Fig. 27

Figure 29 : Trackside connection box, terminal assignment with an integrated overvoltage protection module.

Figure 28 : Trackside connection box, terminal assignment without an overvoltage protection module.

Figure 27 : Trackside connection box, terminal assignment with a separate overvoltage protection module.

Terminal No.	**Description**	**Applicable to**
1 to 2	Terminals for Double Wheel Detector, 1=Receiver, 2=Transmitter	Fig.27,28 & 29
3 to 5	Terminals for the signalling cable to the interlocking: 3 = double usage (DN), optional 4 = external supply (FS), optional 5 = standard usage (NS)	Fig. 27,28 & 29
6	Earthing (SL) or (ERDE)	Fig.27 & 28

2.2.10 Earthing of Trackside Connection Box

In RE section/Substation area : The earth should be Connected to negative earth rail only with at least 33 sq mm copper wire.

In Non-RE Section : The earth Should be connected to earth pit whose value should be less than equal to 2 ohm.

Earthing of Quad cable and Indoor cabinet shall be less than and equal to 1 ohm.

Drill a hole into the rail web for connection of the earth conductor:

- Minimum distance from any other rail web hole: 500 mm
- Use a suitable earth conductor with the following characteristics:
- Drilled in the neutral zone of the rail, corresponds to dimension **X** in the associated order number list.
- Material Cu NYY-O or any other material with an equivalent current-carrying capacity.
- Connect one end of the earth conductor to earth terminal 1 of the trackside connection box.
- Connect the other end of the earth conductor to the railway earth conductor or the return system

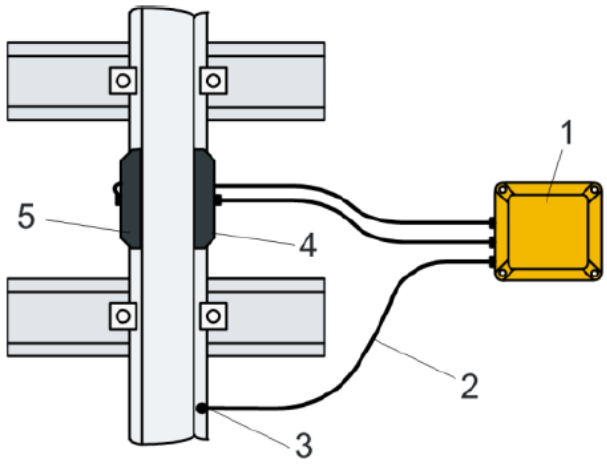

Figure 31 : Earthing arrangement of Trackside Connection Box

Table 10 : Details of earthing of Trackside Connection Box

1	Trackside Connection Box
2	Earth Conductor
3	Railway Earth Conductor (Negative Earth Rail)
4	Transmitter
5	Receiver

Figure 30 : Connection to Negative Earth Rail

2.2.11 Earthing of overvoltage protection module

- Undo earth terminal 2 in the lower part of the trackside connection box.(Refer ***Figure 26***)
- Move earth terminal 2 with the two associated washers to the position of earth terminal 1
- Connect earth terminal 1 of the trackside connection box and the earth terminal of the overvoltage protection module using the supplied green/yellow earth core.
- Tighten earth terminal 1 of the trackside connection box to fix the earth core.

2.2.12 Installation of Signalling Cable

The signaling cable is used for information transmission between the wheel detection equipment and the evaluation computer at the interlocking. In the standard-usage variant, it is also used to power the wheel detection equipment.

A star-quad signaling cable is used. As an alternative, a paired signalling cable can also be used.

Prepare entry 0 at the bottom of the trackside connection box. The flexible tubing is attached to it on delivery. (Refer ***Figure 26***)

- Loosen the tube clip of the supplied flexible tubing.
- Remove the flexible tubing and the cable gland.
- Remove the metal plate.

Note: the gasket ring must be kept in place.

- Route the signaling cable though the flexible tubing.
- Slide a tube clip onto the flexible tubing

For installation on a wall**,** use the separately ordered flexible tubing

Insert the signalling cable into the trackside connection box:

- Use entry 0 when installing the trackside connection box on a pedestal.
- Use entry A when installing the trackside connection box on a wall.

Slip-fit the flexible tubing onto the cable gland and fix it using a tube clip

2.2.13 Permissible distances

(i) Minimum Track section lengths

If track section lengths are implemented which are shorter than the distance between the two axles of a vehicle running on that section, then automatic procedures such as release of a route are not initiated. Hence track section lengths should always be greater than the maximum distance between the two axles of a vehicle running on that section.

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(ii) Fouling Mark protection

All points and crossings have defined fouling marks to avoid infringement to the fixed standard dimension by any portion of the vehicle. A track section shall extend beyond fouling marks on both straight road and diversion portions to afford protection to the standing vehicles. Wheel detectors should thus be installed away from the fouling mark at a distance of not less than 3 metres towards divergence. {Ref. SEM Para 17.2.4(a)}.

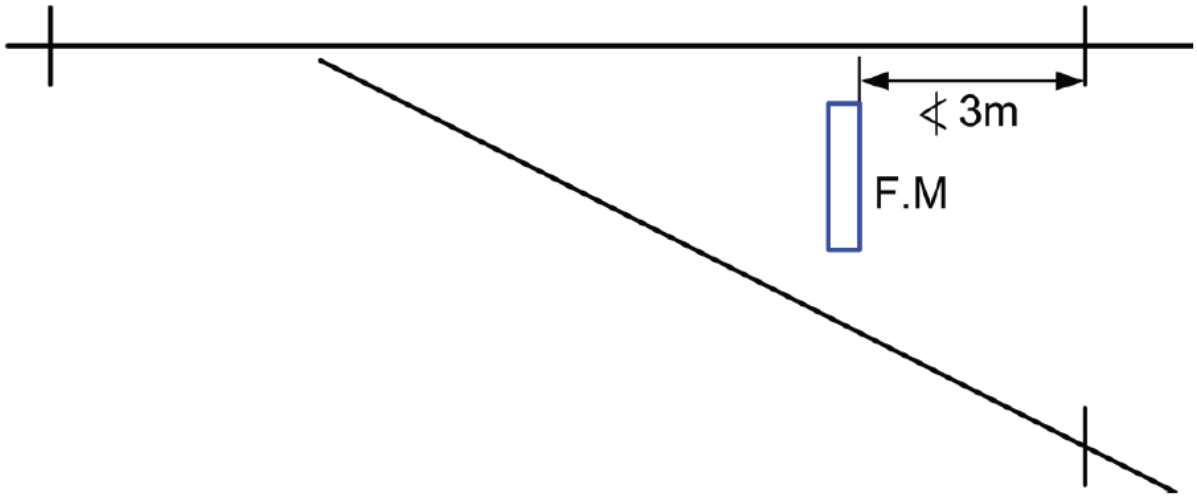

Figure 32 : Fouling Mark Protection

(iii) Permissible distance of wheel detector in the vicinity of other wheel detectors

DEKs of the same type must be arranged at a distance of **min. 1.2 m.**

The double wheel detector and other wheel detectors must be arranged at a distance of **min. 0.5 m**.

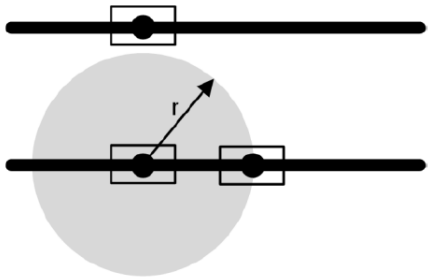

Figure 33 : Permissible distance between two wheel detectors

Permissible distances in accordance with the ***Figure 33*****:**

r ≥ 1200 mm with two DEK 43 double wheel detectors

r ≥ 500 mm with one DEK 43 double wheel detector and a second double wheel detector (not a DEK 43)

(iv) Permissible distances between double wheel detectors in point zone

If the double wheel detector is located in the point area or in front of facing ends of points:

- There must be no metal objects within a radius of **min. 320 mm** from the center of the double wheel detector.
- The double wheel detector must not be installed on the movable parts of points

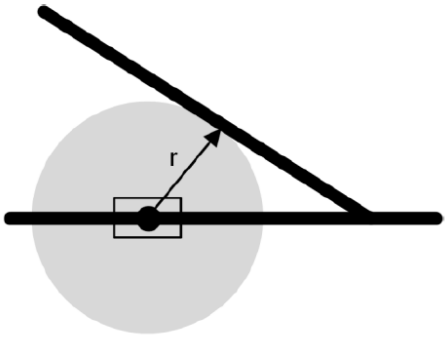

Figure 34 : Double wheel detector in point zone

Permissible distance in accordance with the ***Figure 34***: r ≥ 320 mm

(v) Detection gaps

Where the axle counting system and other track vacancy detection systems meet, the systems have to be arranged so as to overlap in order to ensure there are no detection gaps (see the ***Figure 35*** below).

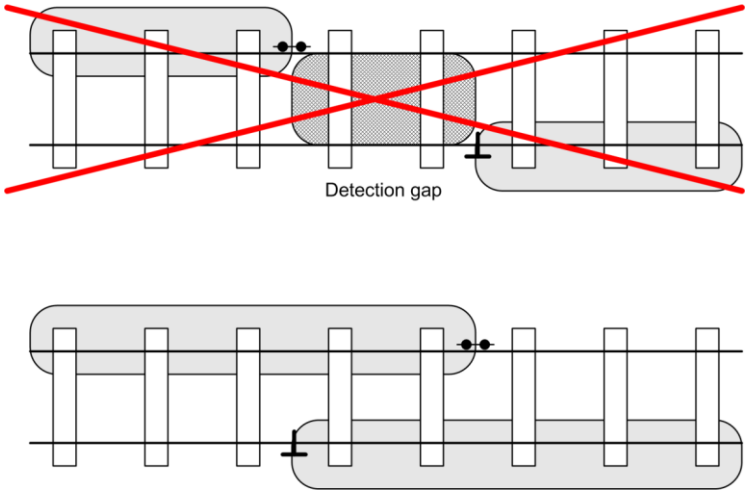

Figure 35 : Eliminating Detection gaps

(vi) Permissible distances between double wheel detectors and track magnet of AWS

The double wheel detectors should be installed more than 0.7 metre away from the track magnet of AWS.

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(vii) Permissible distances between double wheel detectors and tuning unit of AFTC

The double wheel detector should be installed more than 1 metre away from the boundary of tuned zone of tuning unit. The distance between two wheel detectors on either side of the tuning unit shall not be less than 5 metre.

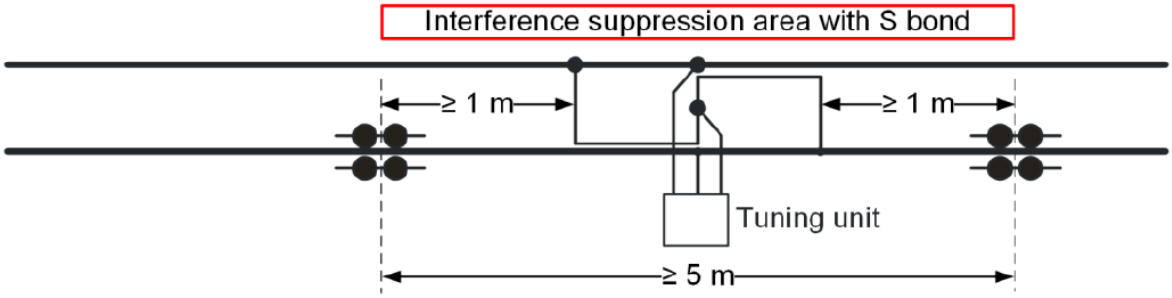


Figure 36 : Double Wheel Detector in the vicinity of AFTC

Permissible distance in accordance with ***Figure 36*****:**

≥1m from the boundary of tuned zone of tuning unit.

≥5m between the two double wheel detectors.

(viii) Permissible distance between double wheel detector and rail joints

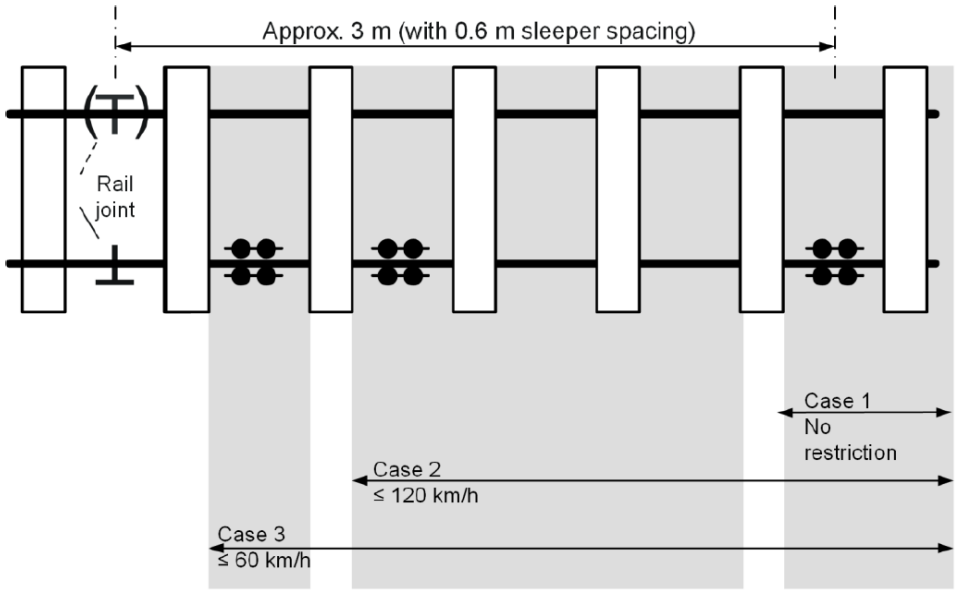


Figure 37 : Permissible distances between Double Wheel Detector and rail joint

Table 11 :Permissible distances between Double Wheel Detector and rail joint

No restriction	Case 1: Distance between the center of the double wheel detector and the rail joint > 3 m
< 120 Kmph	Case 2: Distance between the center of the double wheel detector and the rail joint > 1.2 m
< 60 Kmph	Case 3: Distance between the center of the double wheel detector and the rail joint > 0.6 m

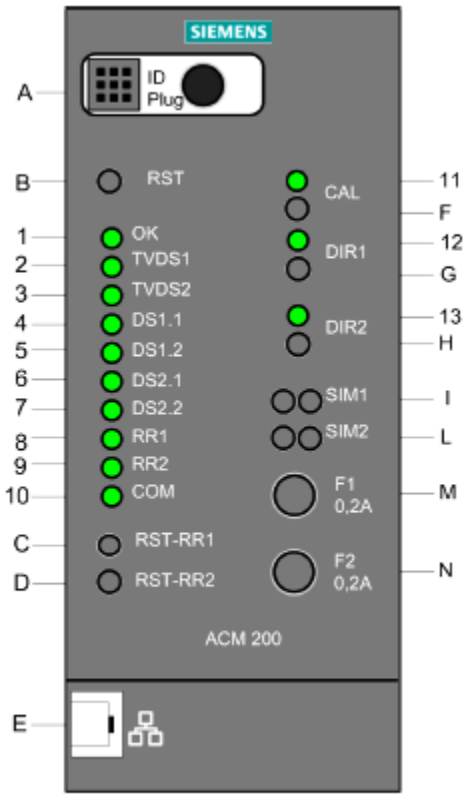
Section III
Maintenance

3.1 Controls & Indications on ACM Front Panel

On the front panel, there are LEDs which show either a steady or flashing green, yellow or red light. These LEDs give a rapid overview of the operating statuses.

In addition, there are buttons to reset the ACM, to cancel the reset restriction of a track vacancy detection section, to calibrate the ACM, and to reverse the counting direction of the wheel detection equipment.

When an ACM is replaced, the data configured on the ID plug can be transferred to the spare ACM. To do this, the ID plug is simply removed from the old ACM and inserted into the spare ACM.



A- ID Plug (To configure ACM data)
B - RST button –Resets the ACM
1 – OK LED –ACM is OK
2,3 – TVDS1 & TVDS2 LEDs (TVDS Status – Clear/Occupied/Faulty)
4,5,6,7 - DS1.1, DS1.2, DS2.1, DS2.2 LEDs [Status of wheel detection equipment (per detector subsystem and channel): no passing wheel/passing wheel/faulty]
8 – RR1 LED (Reset restriction 1 (RR/button fault)
9 – RR2 LED (Reset restriction2 (RR/button fault)
10 – COM LED (Status of communications)
C,D – RST-RR1, RST-RR2 Buttons [Buttons for AZGH (cancellation of the RR]
E –RJ45 Socket (Ethernet Interface)
11, F – CAL LED, Button (Indication & button for calibration of wheel detection equipment)
12,G,13,H – DIR1, DIR2 LED & Buttons (Indications & buttons for Direction reversal)
I,L – SIM1,SIM2 Sockets (No Function)
M,N – F1 0,2A, F2 0,2A fuses (Power supply of wheel detection equipment)

Figure 38 : Controls & Indications of ACM Front Panel

Table 12 : Details of Indications of ACM Front Panel

Label	Indication	Status & Description
1	"OK" LED	• Steady green : ACM is OK • Flashing green: Configuration acceptance mode • Flashing yellow : Configuration mode • Flashing red : ACM is not OK • Steady red light: safety shutdown
2	"TVDS1" LED	Track vacancy detection section 1 (TVDS 1): • Steady green: Clear • Flashing green : Clear and WDME (Wheel Detection Equipment Monitoring Error) • Steady yellow : occupied • Flashing yellow: occupied and WDME • Steady red : occupied (restart, commissioning); AZG required • Flashing red : occupied (faulty, e.g. minus axle), AZG required For safety-related information: • Steady green: safety-related information active • Steady yellow: safety-related information inactive • Flashing red : connection failure For WDE "pulse detected" indication: • Steady green light: WDE with pulses • Steady yellow light: WDE pulse-free
3	"TVDS2" LED	Track vacancy detection section 2 (TVDS 2); meanings as for LED 2
4	"DS1.1" LED	Double wheel detector 1 (channel 1): • Steady green: pulse-free • Flashing green: pulse-free and WDME • Steady yellow : with pulses • Flashing yellow: with pulses and WDME • Steady red: WDE or cable fault
5	"DS1.2" LED	Double wheel detector 1 (channel 2); meanings as for LED 4
6	"DS2.1" LED	Double wheel detector 1 (channel 2); meanings as for LED 4
7	"DS2.2" LED	Double wheel detector 1 (channel 2); meanings as for LED 4
8	"RR1" LED	**Reset restriction 1 (RR indication for TVDS 1):** • Steady yellow light: RR present • Flashing red light: button fault and RR **For safety-related information and WDE "pulse de-tected" indication:** • Steady green light: no button fault • Steady red light: button fault **For no TVD and no safety-related information:** • Steady red light: button fault

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Label	Indication	Status & Description
9	"RR2" LED	**Reset restriction 2 (RR indication for TVDS 2)**; meanings as for LED 8
10	"COM" LED	**Communication:** • Steady green light: all fail-safe connections OK • Steady yellow light: at least one fail-safe connection to a partner has failed • Steady red light: fault in computer unit • Flashing red light: no physical connection
11	"RST-RR1" button	**Reset button for reset restriction 1:** Cancelation of RR for TVDS 1 (AZGH)
12	"RST-RR2" button	**Reset button for reset restriction 2:** Cancelation of RR for TVDS 2 (AZGH).
13	"CAL" LED, button	**Control & Display element for calibration**
14,15	"DIR1", "DIR2" LEDs, buttons	**Control and display elements for direction reversal:** During operation: • Off: counting direction corresponds to the config-ured setting • Steady green light: counting direction reversed with respect to the configured setting With the counting direction reversed, the LEDs have a different meaning
16	"SIM1", "SIM2" sockets	Must not be used
17	F1 0,2 A and F2 0,2 A fuses	Power supply of wheel detection equipment Medium time-lag fuses must be used.
18	Identification number	Field for the board identification number; the last two digits indicate the equipment revision level
19	RJ45 socket	Ethernet interface

3.2 Maintenance of Indoor Equipment

3.2.1 Replacement of ACM

Precautions before Replacement of faulty ACM

Before replacement:

Check the Equipment Revision Level (ERL) of the spare ACM.

The equipment revision level is indicated to the right of the Siemens code number.

If ERL = 2, Spare ACM can be used

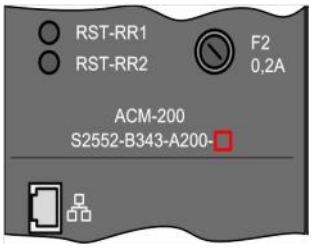

Figure 39 : Equipment Revision Level (ERL) on Front Panel of ACM

If ERL = 1, Spare ACM can be used, if the ACM to be replaced also has equipment revision level 1.

Record the status of the LEDs of faulty ACM.

The ACM can be replaced with the power on. Proceed as described below:

Remove the connector of the Ethernet connection from the ACM.

Unlatch the lower/upper ACM fixing from the mounting rail by inserting and turning the screwdriver into the opening of the retention plate as shown in figure on next page.

Remove the process connector.

Swing the ACM up until it can be removed from the mounting rail.

Remove the ID plug from the old ACM and insert it into the socket of the spare ACM.

Hook the spare ACM with the upper housing guide onto the mounting rail.

Insert the process connector. This restarts the ACM.

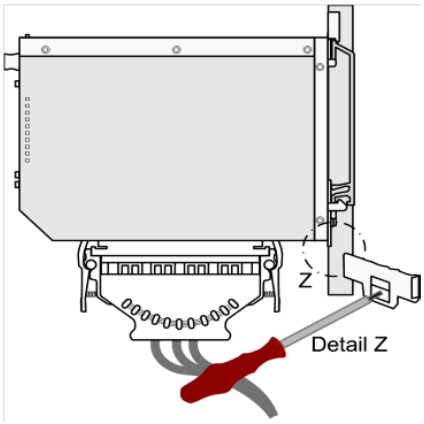

Figure 40 : Replacement of ACM

Latch the ACM with the retention plate into place.

Insert the connector of the Ethernet connection.

If the ACM has equipment revision level 1, restart it by pressing the "RST" button on the front panel for min. 2 s.

Calibrate the ACM as soon as it is operational.

If the "OK" LED shows a flashing green light and if it is sure that original ID plug has been inserted into the spare ACM:

- Simultaneously press the "RST-RR1" and "RST-RR2" buttons on the ACM's front panel for min. 3 s until the "OK" LED no longer shows a flashing green light.
- Repeat the operation if it proves to be unsuccessful.
- If the operation is still unsuccessful even after several attempts, then replace the ACM.
- If the operation proves to be successful, request the ASM/Panel operator to perform an axle count reset.

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3.2.2 Calibration of ACM

Requirements

The ACM must be calibrated if one of the following events has occurred:

- The ACM has been replaced.
- The ID plug of the ACM has been replaced.
- There is no calibration data in the ACM (the "CAL" LED shows a steady red light)
- The cabling between the wheel detection equipment and the ACM has been modified.
- The wheel detection equipment has been replaced.
- The transmission level of the wheel detection equipment has been changed.
- The ACM should be calibrated to increase availability if the following event has occurred:

The wheel detection equipment has been recalibrated

Calibration procedure

- During the process, it is to be ensured that there is no movement of trains over the wheel detection equipment associated with the ACM under calibration.
- Press the “CAL” button on the ACM for approx. 3 secs. until the “CAL” LED shows a steady yellow light.
- After releasing the button, the “CAL” LED shows a flashing green light indicating that the ACM is in calibration mode. If any further action is not performed, calibration mode is exited after 15 secs.
- In calibration mode indications of “DIR1/DIR2” LED show:
- A steady green light - calibration data is available but can be old or incorrect.
- A steady Red light - no calibration data available.
- If ACM for wheel detector DS1 is required to be calibrated-Press “DIR1” for approx. 3 secs.
- If ACM for wheel detector DS2 is required to be calibrated-Press “DIR2” for approx. 3 secs.
- If in the above process, wrong “DIR1/DIR2” buttons have been pressed, continue to hold the button down. Calibration is aborted after 7 secs. (“CAL” LED no longer shows flashing green light)
- As soon as the "DIR1" or "DIR2" LED shows a steady yellow light, release the "DIR1" or "DIR2" button.
- The ACM calibrates itself to the level of the assigned wheel detection equipment. After calibration has been completed, the result is indicated for 5 secs as per following details:
- "DIR1/DIR2" LED shows a steady green light: calibration successful

- "DIR1/DIR2 LED" shows a steady red light: calibration not successful. In this case, the wheel detection equipment detects wheel pulses or the settings of the wheel detection equipment are not correct.
- "DIR1/DIR2" LED shows a flashing yellow light: calibration values could not be saved on the ID plug Repeat Step 3. If this step fails several times, replace the ID plug.

3.2.3 Reversal of Counting Direction

Requirement

If, in deviation to the configured mounting location, a double wheel detector is installed on the opposite side of the rail, the counting direction changes with respect to the counting direction configured in the ACM.

In order to enable operation until new configuration data is available for the changed mounting location, the counting direction of the ACM can be reversed.

Procedure

Press the "RST" button for approx. 3 secs. to restart the ACM.

Hold down the "DIR1" or "DIR2" button while the ACM is being restarted until the "OK" LED shows a steady yellow light and the "DIR" LED a flashing yellow light. Use the "DIR1" button to reverse the counting direction of wheel detector DS1 and the "DIR2" button to reverse the counting direction of wheel detector DS2.

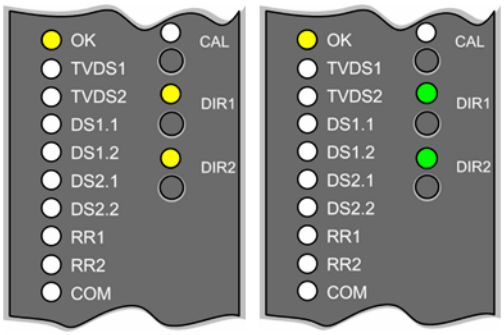

Figure 41 : Indications on ACM front panel during reversal of counting direction

The "DIR1" or "DIR2" LED shows the state of reversal:

- Steady yellow light: counting direction reversed with respect to the configured setting
- Steady green light: counting direction corresponds to the configured setting.

Press the "RST" button for approx. 3 s to restart the ACM.

The setting is adopted. The "DIR1" and "DIR2" LEDs show the state of reversal:

- Steady yellow light: counting direction reversed with respect to the configured setting
- Off: counting direction corresponds to the configured setting

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3.2.4 Simulation of Wheel Traversal

Requirement

Each set of ZP D 43 wheel detection equipment must be traversed at least once in 12 months by simulating wheel traversal by means of a test plate.

Procedure

- As a test plate, use a ferromagnetic sheet-steel plate with a minimum size of 350 mm x 150 mm. Such a test plate has a similar effect on the wheel detection equipment as a wheel.
- Take a time interval in which there are no train movements with the consent of ASM/Panel operator.
- Check that the track vacancy detection sections adjacent to the wheel detection equipment are clear.
- Place the test plate horizontally on the rail head
- Move the test plate in longitudinal direction over the wheel detector and have the response of the ACM observed.
- Wheel traversal must be detected on the ACM when doing so.
- After completion of the work, request the ASM/Panel operator to perform an axle count reset of the affected track vacancy detection sections.
- Accordingly, a traversal in the opposite direction can also be simulated

3.3 Maintenance of Outdoor Equipment

3.3.1 Checking of Wheel Detection Equipment supply voltage

Measure the supply voltage (DC) at the NS terminal block.(Applicable to variant without external supply)

Supply voltage range without external supply – 30 V to 70 V DC

3.3.2 Measurement of Transmitter frequency

Measure the transmitter frequency at the transmitter terminal block, terminals 6 and 7 or terminals 8 and 9.

Permissible range - 41.5 kHz to 44.5 kHz

3.3.3 Measurement of Receiver voltages

The wheel detection equipment cannot be calibrated if the receiver voltage is not permissible. Wheels are not detected if the receiver voltage is too low. Deviating receiver voltages indicate detachment of the double wheel detector from the rail or wheel detection. To ensure their reliable detection, wheels must produce a receiver voltage which is at least 1.9 times higher.

- Measure receiver voltage 1 at the receiver terminal block, terminals 3 and 4.
- Measure receiver voltage 2 at the receiver terminal block, terminals 1 and 2

Permissible range

- Receiver Voltages 1 & 2 – 54 mV to 180 mV AC
- Difference between Receiver Voltage 1 & Receiver Voltage 2 - $\leq$ 10 mV

3.3.4 Calibration of Wheel Detection Equipment

Requirement

Calibration of the wheel detection equipment is required to adjust it to the relevant rail (rail profile, rail material, and level of wear of the rail). Calibration is required in the following cases:

- After the wheel detection equipment or double wheel detector has been installed for the first time
- After the wheel detection equipment or double wheel detector has been dismantled and installed again. If the trackside connection box is to be earthed, calibration is only to be performed afterwards, after connection of the earthing.

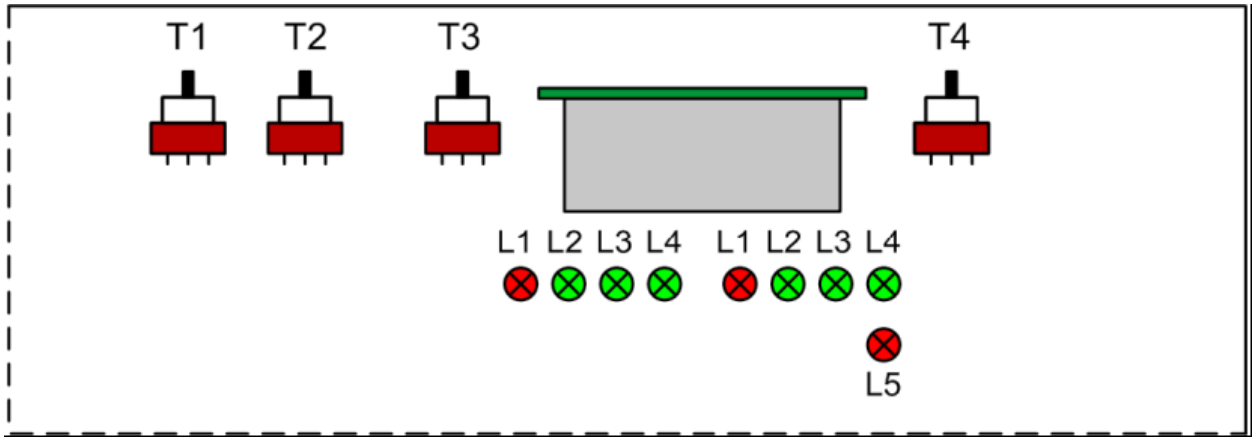

Figure 42 : Controls & Indications on Wheel Detection Equipment

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Procedure

Simultaneously press the two T3 and T4 calibration buttons until both L4 LEDs show a steady green light.

Release the calibration buttons.

Both L3 LEDs and both L4 LEDs continue to show a steady light for a few seconds.

Wait a few seconds until the behavior of the LEDs changes.

Check the indications:

- Both L4 LEDs are off and both L3 LEDs show a flashing light: calibration has been completed correctly
- If one or both L4 LEDs show a flashing light: calibration has failed

Failure of calibration

Perform the following measures. Check after each step whether the fault has been rectified.

- Example 1: the first calibration has failed without a traversal. The adjacent track sections are not occupied.
- Example 2: calibration is aborted by a traversal. The adjacent track sections are permanently occupied.

Follow the steps given below:

1. Make sure that there is no wheel in the effective range of the double wheel detector
2. Recalibrate the wheel detection equipment.
    - The second calibration is successful: proceed with Step 5.
    - The second calibration has failed: the adjacent track sections are permanently occupied. The wheel detection equipment has no calibration data. Proceed with Step 3
3. Check the environment of the double wheel detector for compliance with the interference suppression areas and recalibrate the wheel detection equipment.
4. Replace the wheel detection equipment module.
5. If the adjacent track sections are occupied, request an axle count reset of these track sections.
6. Consult the Siemens Customer Service

3.3.5 Replacement of Wheel Detection Equipment module

For the wheel detection equipment modules with an integrated overvoltage protection module, the modules must be replaced with versions of the same type.

For wheel detection equipment modules without an integrated overvoltage protection module, the modules must be replaced with wheel detection equipment modules with an integrated overvoltage protection module.

Removal of wheel detection equipment module

Disconnect the cores to the interlocking from power:

- At the indoor equipment (cable termination rack) or
- At the next junction box

Open the trackside connection box

Disconnect the cores of the signaling cable from the NS terminals (applicable to standard usage variant).

When using an integrated overvoltage protection module, also disconnect the green-yellow core from the earth terminal.

Disconnect the double wheel detector cores from the transmitter and receiver terminal blocks.

Undo the four TORX TX20 screws in the base plate which hold the wheel detection equipment module in the trackside connection box.

Remove the wheel detection equipment module.

Installation of wheel detection equipment module

Fit a wheel detection equipment module with an integrated overvoltage protection module.

Tighten the four TORX TX20 screws in the base plate which hold the wheel detection equipment module in the trackside connection box.

Connect the double wheel detector cores to the transmitter and receiver terminal blocks.

Connect the cores to the interlocking to the NS terminals.

Connect the cores to the interlocking to power again.

Commission the wheel detection equipment.

Close the trackside connection box.

Send the faulty wheel detection equipment module to Siemens for repairs

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3.3.6 Replacement of Double Wheel Detector

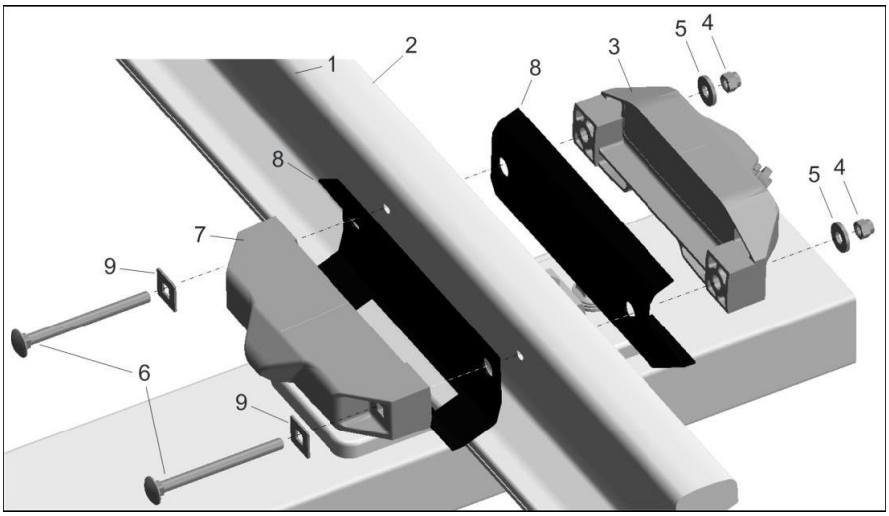

Figure 43 : Components of Double Wheel Detector

Removal of double wheel detector (Refer *Figure 43*)

Undo the hexagon nuts **(4)** and remove the plain washers **(5)**.

Remove the mushroom-head bolts **(6)** and the square washers **(9)**.

Remove the transmitter **(3)** and the receiver **(7)**.

Keep the reducing plates **(8)** at hand. They can be reused.

Installation of double wheel detector

Install a double wheel detector of the same type.

Commission the wheel detection equipment.

3.4 Inspection & Maintenance Schedule recommended by OEM

Table 13 : Inspection & Maintenance Schedule

Item	Activity	Periodicity
Wheel detection equipment ZP D 43	• Simulation of wheel passage*	Once in 12 months
	• Visual inspection of earth connections, connecting. cables, cabling and all parts for damage and secure fit.	Once in 12 months
	• Check of required electrical references values. • If necessary recalibration of the wheel detection equipment and the ACM.	Once in 12 months
Grounding of all equipment	• Visual inspection of the shield connections of the cables	Once in 24 months
Cabinet door and rear panel	• Check of the upper and lower filter mats • Replace any dirty mats	Once in 24 months
Signalling cable to wheel detection equipment	• Perform a core-to-earth insulation measurement	Once in 24 months

Note:

If the wheel detection equipment is traversed regularly, wheel passage does not need to be simulated.

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Section IV
Troubleshooting

4.1 Diagnostics facilities

Troubleshooting of ACM 200 can be done through the diagnostics facilities provided through the LEDs on the ACM's front panel and through the website.

Diagnostics via front panel of ACM

After a fault has occurred, it is displayed via the LEDs on the relevant ACM's front panel. The LED indications permit fault diagnostics. After the fault has been rectified, the ACM's operability can be checked via its LEDs.

Diagnostics via website or web application

Diagnostics is supported by an online diagnostic function via a website. As an alternative to web browsers, a web application featuring the same functions as the website can be used. The different diagnostic options are selected via the "Diagnostics" menu item. The diagnostic information of the selected ACM is displayed on the diagnostic website. Additional diagnostic data can be called up via status, statistics and fault tables.

Website

The website is programmed as a Java applet which is executed via a web browser using a Java plug-in. Some web browsers do not support Java applets any longer or their execution is blocked by (company-specific) web browser settings. For this reason, a web application is available as an alternative.

Web application

As an alternative to the website, a web application featuring the same functions as the website can be used. The web application has been programmed as a Java application. Java Version 8 or higher must be installed on the computer. The language can be selected when starting up the web application.

Basic functions of website and web application

The graphical user interface of the website and web application is user-friendly and easy-to-operate.

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The following functions are available:

- Display and logging of diagnostic data (Status, Fault, Statistics, Version, and Trac-ing)
- Display, modification, saving and loading of configuration data
- Read-back of the ACM configuration data for plan verification

Structure of website
The figure below shows the structure of the website:

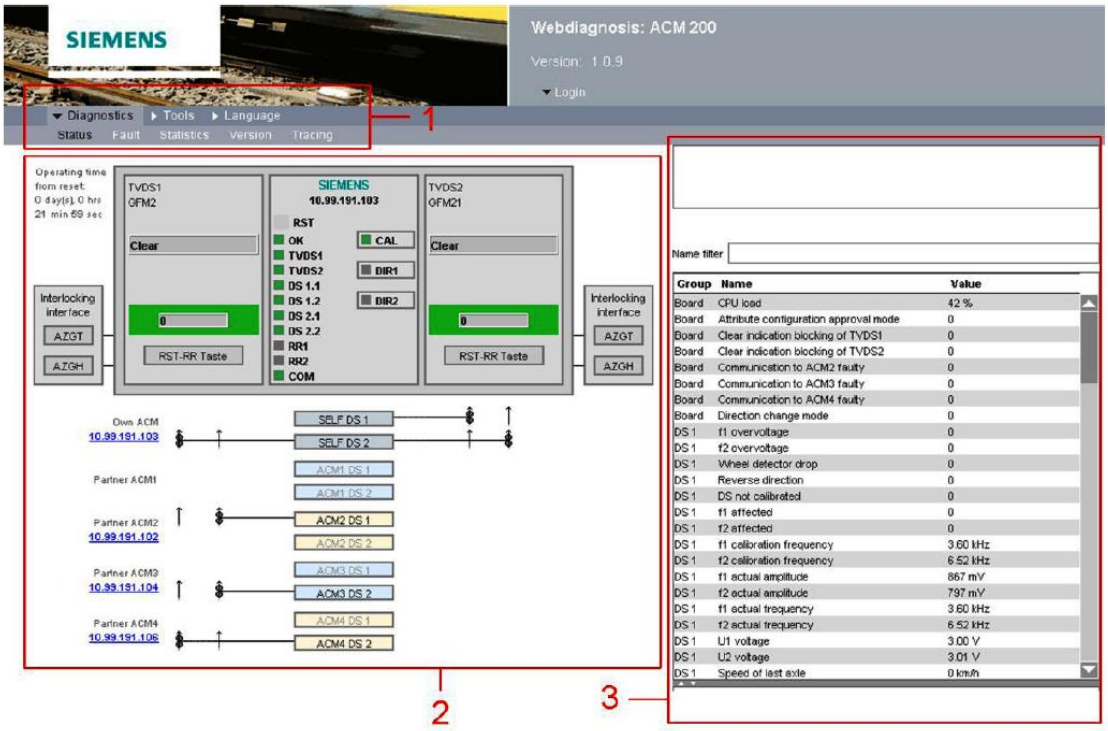

Figure 44 : Structure of website for diagnostics

In reference to ***Figure 44*** above

1. Menu bars : Two levels - a higher-level one and a lower-level one.
2. Diagnostic area : Schematically represents the functional units of the axle counting system
3. Functional area : Different items of information can be displayed here in tabular form via the "Diagnostics" or "Attribute configuration data" menu (e.g. status, configuration data or settings).

Details of Menu bars
The following menus and menu items can be selected via the menu bars:

Diagnostics
- Status
- Fault
- Statistics
- Version
- Tracing

Attribute configuration data
- ACM configuration
- Saving and loading

Tools
- Download of checkfile of attribute configuration data
- Version

Language
- English, German

Login

Structure of web application
The web application has the same functions and structure as the website, the only difference being that the language has already to be selected when starting up the web application.

Online or offline mode of website and web application
The website and web application can be used in the following modes:
- Online mode
- Offline mode (as a copy of the online mode)

Online mode
Online mode can be used for diagnosing and modifying the configuration data of a selected ACM. All functions of the website and web application are available.

Offline mode
In offline mode, some functions of the website and web application are disabled. In offline mode, the configuration data can be modified and saved (independent of online mode).

To view the details of configuration and diagnostics via website or web application please refer:

Operating Instructions Website and Web Application - Clearguard ACM 200 Axle Counting System.

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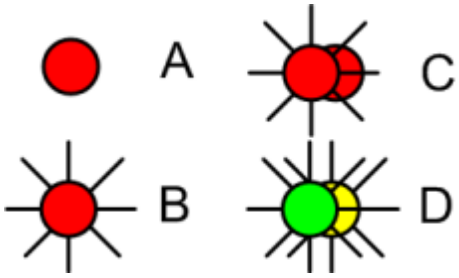
4.2 Indications on front panel of ACM during fault

Indications on front panel of ACM during different fault conditions along with possible causes and suggested remedies are given on following pages:



Legends

A: LED shows a steady red light

B: LED shows a flashing red light

C: LED shows a steady or flashing red light

D: LED shows a flashing green or yellow light

Figure 45 : LED Indications on front panel during fault conditions & their legends

Table 14 : Fault Condition 1- LED indications on ACM Front Panel

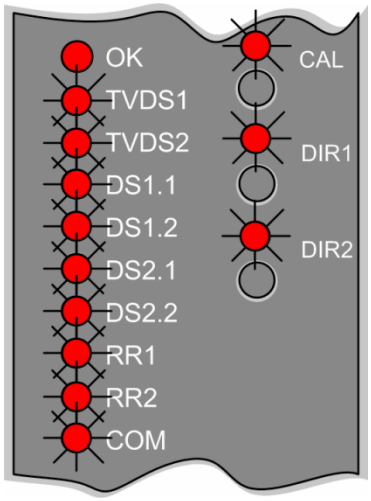
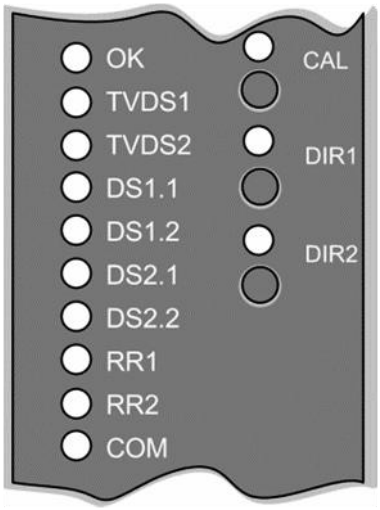
	**Display**	The "OK" LED shows a steady red light and all other LEDs show a flashing red light.
	Possible causes	The ID plug is missing. The ID plug is faulty.
	Remedy	If an ID plug with verified configuration data is available for the slot then replace the failed ID plug with new ID plug. Inform the SM that ACM is required to restart. To restart the ACM, press the "RST" reset button of the affected ACM for min. 2 secs. • Wait 15 s until the LEDs are on. • Request the SM to perform an axle count reset for the affected track vacancy detection section. If an empty ID plug is available, then Program the spare ID plug with the associated configuration data via the website as per Configuration Process (CP) Request an authorized person to perform correspondence checking and plan verification in accordance with CP.

Table 15 : Fault Condition 2- LED indications on ACM Front Panel



Display	All LEDs OFF
Possible causes	The power supply has failed. The ACM has failed. The cable connection is interrupted.
Remedy	If all LEDs are also off on other ACMs, then Check the power supply module and replace it, if required. If all LEDs are off on only one ACM then Replace the ACM If there are still no indications on the ACM : Check the cable connection between the ACM and the power supply module for such as connectors and any damage (kinks, cable jammed, insulation damaged) and replace any faulty parts.

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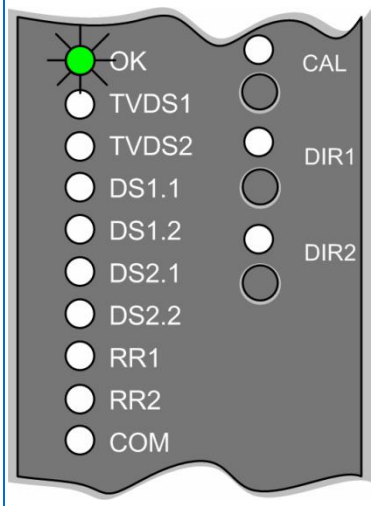
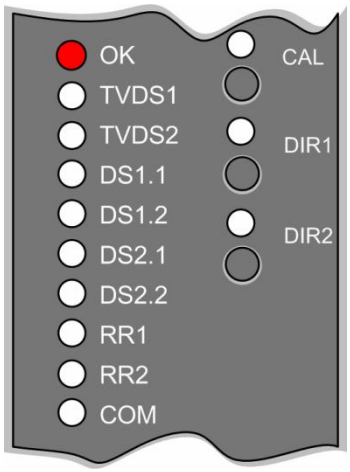
Table 16 : Fault Condition 3- LED indications on ACM Front Panel		
	**Display**	The "OK" LED shows a flashing green light.
	Possible causes	The ACM is in configuration acceptance mode (attribute configuration approval mode). An ID plug with a new configuration has been detected.
	Remedy	If the ACM has been replaced and it is ensured that the original ID Plug has been inserted into the spare ACM then : Simultaneously press the "RST-RR1" and "RST-RR2" buttons of the affected ACM for min. 3 s until the "OK" LED does not show a flashing green light any longer. If this proves to be unsuccessful then repeat this operation. If it is not possible to exit configuration acceptance mode even after several attempts to do so then Replace the ACM If it is not sure whether the ACM or ID plug has been replaced then request an authorized person to perform correspondence checking and plan verification in accordance with [CP].

Table 17 : Fault Condition 4 - LED indications on ACM Front Panel		
	**Display**	The "OK" LED shows a steady red light. All other LEDs are off.
	Possible causes	The ACM has failed or switched off (safety shutdown). The ACM is faulty.
	Remedy	The ACM must be restarted Press the "RST" button of the affected ACM for min. 2 s and observe which status results. (i) If the "OK" LED shows a steady green light after restart then inform the SM that restart has been successful. The SM must perform an axle count reset. (ii) If the "OK" LED shows Steady red light or OFF after restart, then replace the ACM. (iii) If the "OK" LED shows flashing red light after restart then Check the other LED indications (iv) If the affected ACM switches off frequently then replace the ACM.

.

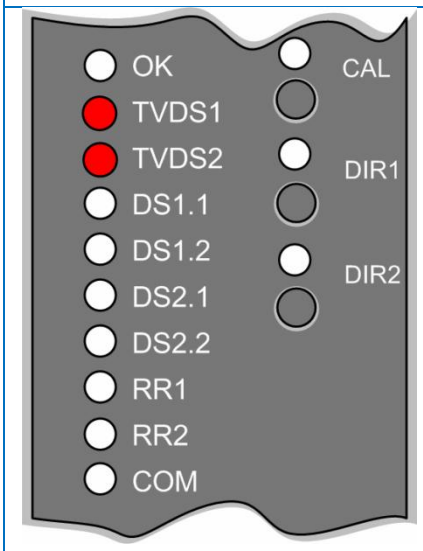
Table 18 : Fault Condition 5 - LED indications on ACM Front Panel		
	**Display**	The "TVDS1" and/or "TVDS2" LEDs show a steady red light. The "RR1" and/or "RR2" LEDs do not show a steady green light.
	Possible causes	The track vacancy detection section is permanently occupied. There is no fault. Possible cause: • The affected ACM has been restarted and has not been reset yet. • The commissioning operation has been activated.
	Remedy	Request the SM to perform an axle count reset for the affected track vacancy detection section.

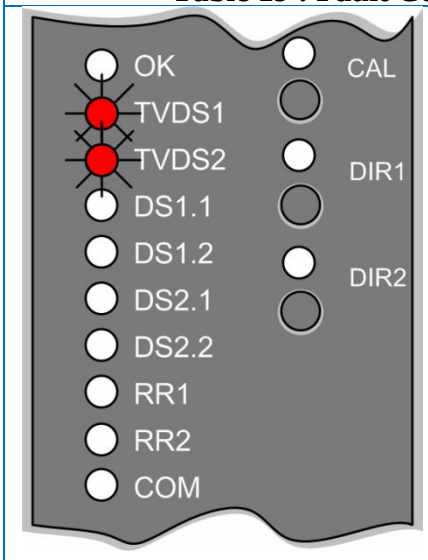
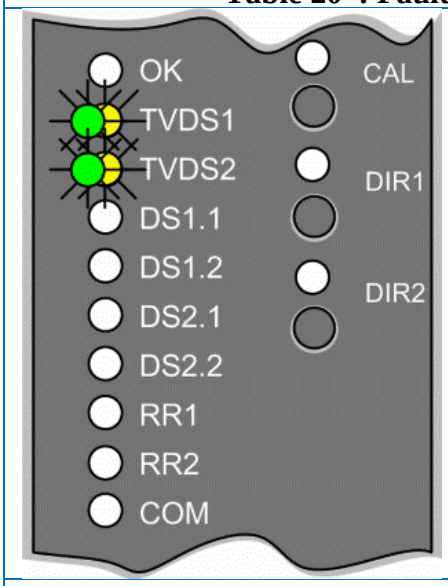
Table 19 : Fault Condition 6- LED indications on ACM Front Panel		
	**Display**	The "TVDS1" and/or "TVDS2" LEDs show a flashing red light.
	Possible causes	The track vacancy detection section is faulty
	Remedy	Request the SM to perform an axle count reset for the affected track vacancy detection section.

Table 20 : Fault Condition 7- LED indications on ACM Front Panel



Display	The "TVDS1" and/or "TVDS2" LEDs show a flashing green or yellow light.
Possible causes	There is count monitoring error (not a fault: the wheel detection equipment has detected pulses on a single channel, for example). Possible cause: • The wheel detection equipment has detected pulses without a train movement (e.g. due to a lightning strike or a metal object). • Wheels could not be detected unambiguously during a train movement (e.g. only one subsystem of the wheel detector has been traversed during a shunting movement).

Remedy

Request the SM to perform the following procedure:

1. Establish the section's sets of wheel detection equipment for which there is a count monitoring error.
2. Have a train movement performed over the affected set(s) of wheel detection equipment or perform a functional test of the affected set(s) of wheel detection equipment by simulating a train movement (move a test plate over the wheel detector).
3. The simulation of a train movement results in counting errors. The sections must then be reset by means of an AZGH auxiliary and AZG immediate axle count reset operation.
4. Observe which status is indicated:
   - If the "TVDS1" and/or "TVDS2" LEDs show a steady green light then the train movement or simulation has successfully eliminated the count monitoring error.
   - If the "TVDS1" and/or "TVDS2" LEDs continue to show a flashing green or yellow light, then the affected wheel detection equipment must be calibrated. The affected wheel detection equipment is faulty and must be replaced.

Restart of operation

Cancel the reset restriction (RR) by means of an AZGH auxiliary axle count reset operation and request the SM to perform an axle count reset for the affected track vacancy detection sections.

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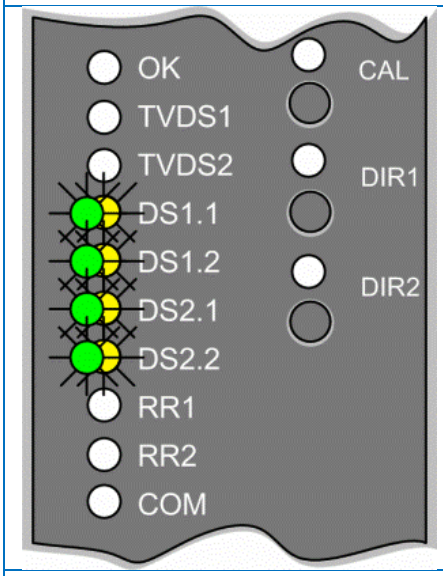
Table 21 : Fault Condition 8 - LED indications on ACM Front Panel



Display	The "DS1.1/DS1.2" and/or "DS2.1/DS2.2" LEDs show a flashing green or yellow light.
Possible causes	There is count monitoring error (not a fault: the wheel detection equipment has detected pulses on a single channel, for example). Possible cause: • The wheel detection equipment has detected pulses without a train movement (e.g. due to a lightning strike or a metal object). • Wheels could not be detected unambiguously during a train movement (e.g. only one subsystem of the wheel detector has been traversed during a shunting movement).

Remedy

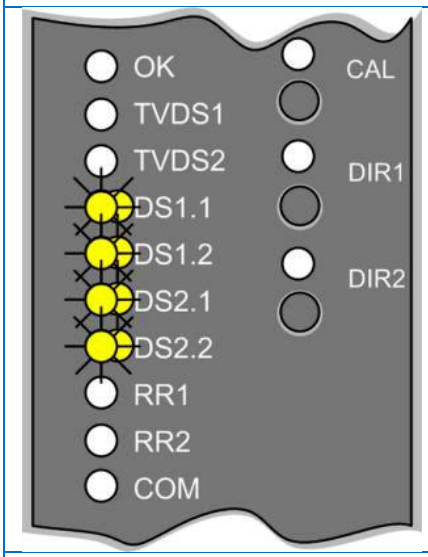
Request the SM to perform the following procedure:

1. Establish the section's sets of wheel detection equipment for which there is a count monitoring error.
2. Have a train movement performed over the affected set(s) of wheel detection equipment or perform a functional test of the affected set(s) of wheel detection equipment by simulating a train movement (move a test plate over the wheel detector).
3. The simulation of a train movement results in counting errors. The sections must then be reset by means of an AZGH auxiliary and AZG immediate axle count reset operation.
4. Observe which status is indicated:
   - If the "DS1.1/DS1.2" and/or "DS2.1/DS2.2" LEDs show a steady green light then the train movement or simulation has successfully eliminated the count monitoring error.
   - If the "DS1.1/DS1.2" and/or "DS2.1/DS2.2" LEDs continue to show a flashing green or yellow light, then the affected wheel detection equipment must be calibrated. The affected wheel detection equipment is faulty and must be replaced.

Restart of operation

Cancel the reset restriction (RR) by means of an AZGH auxiliary axle count reset operation and request the SM to perform an axle count reset for the affected track vacancy detection sections.

Table 22 : Fault Condition 9 – LED Indications on ACM Front Panel



Display	The "DS1.1/DS1.2" and/or "DS2.1/DS2.2" LEDs show a steady or flashing yellow light.
Possible causes	• A wheel has come to a halt on the wheel detector (not a fault). • Fuse F1 for wheel detector DS1 or F2 for wheel detector DS2 is faulty. • The wheel detection equipment is faulty. • There is a cable fault.

Remedy

1. Check that no wheel has come to a halt on the wheel detector. This is not a fault and does not require any action.
2. Check fuse F1 for wheel detector DS1 or F2 for wheel detector DS2 and re-place it by a new fuse. Wait 15 s to see whether the "DS" LEDs change over to a steady or flashing green light.
   - If they show a steady or flashing green light, the wheel detection equipment is working again. Request the SM to perform an axle count reset.
   - If they continue to show a steady or flashing yellow light, check the new fuse. If the new fuse is also faulty, there is a short-circuit on the cable route to the wheel detection equipment or the wheel detection equipment is faulty. If the new fuse is OK, there is an open circuit or the wheel detection equipment is faulty.
3. If the fault persists:
   Check the affected wheel detection equipment and/or cable connection to the wheel detection equipment. If there is a fault, replace the wheel detection equipment.

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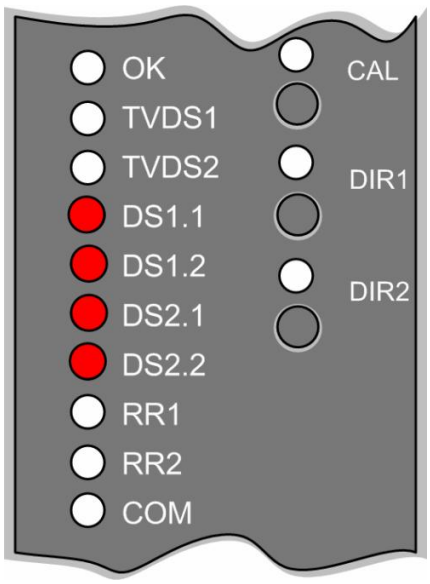
Table 23 : Fault Condition 10 – LED Indications on ACM Front Panel		
. 	**Display**	The "DS1.1/DS1.2" and/or "DS2.1/DS2.2" LEDs show a steady red light.
	Possible causes	• The ACM is faulty. • The transmission level of the relevant set of wheel detection equipment is altered. • The calibration is not correct. • The wheel detection equipment is faulty. • There is a cable fault.
	Remedy	Check the ACM. To do so, query the current wheel detection equipment status via the website. Calibrate the wheel detection equipment Calibrate the wheel detection equipment and the ACM. Replace the ACM if required. If the fault persists: Check the affected wheel detection equipment and/or cable connection to the wheel detection equipment. If there is a fault, replace the wheel detection equipment.

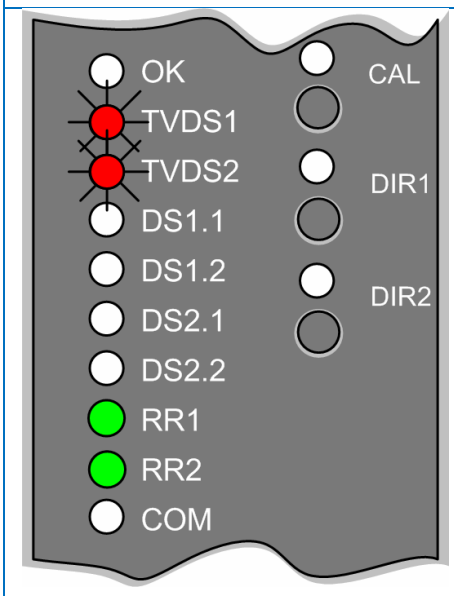
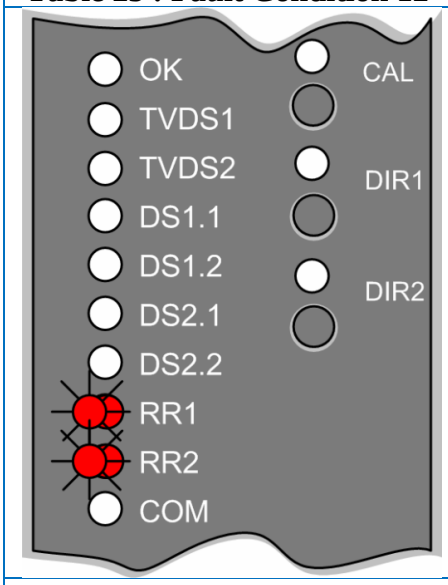
Table 24 : Fault Condition 11 – LED Indications on ACM Front Panel		
	**Display**	The "TVDS1" and/or "TVDS2" LEDs show a flashing red light and the "RR1" and/or "RR2" LEDs show a steady green light.
	Possible causes	• The transmission of safety-related information (SRI) has failed. • The connection to the partner ACM has failed.
	Remedy	Check the connection to the partner ACM: • Check the cables of the Ethernet connection. • Check the connectors, in particular with regard to their secure fit. • Perform a visual inspection to see if there is any damage (kinks, cable jammed, insulation damaged). • Replace any faulty parts. • Check the connected switches and/or modems and replace them, if required.

Table 25 : Fault Condition 12 –LED Indications on ACM Front Panel



Display	The "RR1" and/or "RR2" LEDs show a flashing or steady red light.
Possible causes	The buttons for AZG and/or AZGH or SRI are blocked. The cause can be: • The buttons have been operated incorrectly. • The cabling is faulty.

Remedy

The ACM must be restarted

Press the "RST" button of the affected ACM for min. 2 s and observe which status results.

1. If the "OK" LED shows a steady green light after restart then inform the SM that restart has been successful. The SM must perform an axle count reset.
2. If the "RR1" and/or "RR2" LEDs still show:
   - a steady red light or
   - a flashing red light

Replace the ACM.

3. If fault continues to be displayed although ACM has been replaced then proceed as described below.

The cable connection to the AZG and/or AZGH or SRI buttons must be checked:

- Locate the status of the affected buttons via the website.
- To do so, select the status table. The blocked buttons are displayed. The status of the blocked buttons is displayed (operated/not operated).

4. If The status "operated" is displayed for the blocked button on the website then an inter-core short-circuit may be present:
   - Check the connectors, in particular with regard to their secure fit.
   - Perform a visual inspection to see if there is any dam-age (kinks, cable jammed, insulation damaged).
   - Replace any faulty parts.
5. If the status "not operated" is displayed for the blocked button on the website then a core may be broken:
   - Check the connectors, in particular with regard to their secure fit.
   - Perform a visual inspection to see if there is any dam-age (kinks, cable jammed, insulation damaged).
   - Replace any faulty parts

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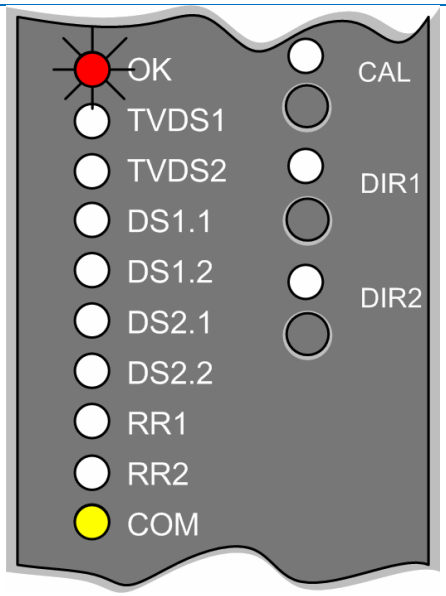
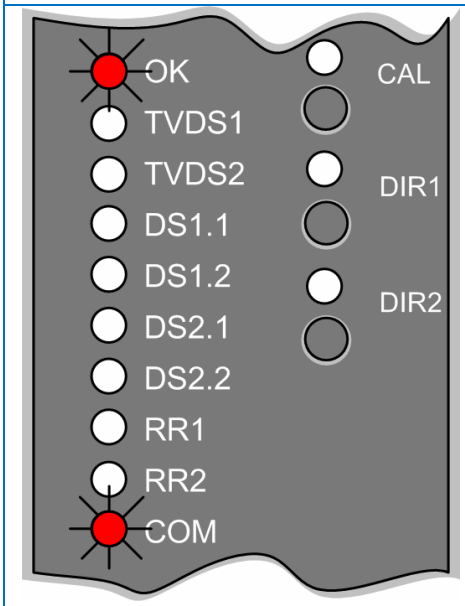
Table 26 : Fault Condition 13 –LED Indications on ACM Front Panel



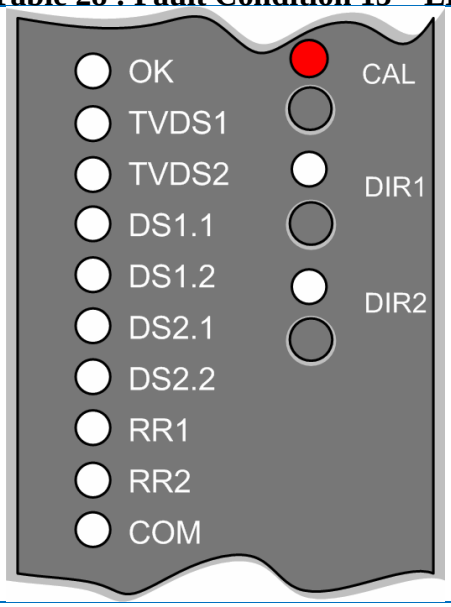
Display	The "OK" LED shows a flashing red light and the "COM" LED shows a steady yellow light.
Possible causes	• The partner ACM has failed. • Data exchange with one or more partner ACMs is faulty. • The connection to the partner ACM has failed.
Remedy	The fault is in a partner ACM: the LEDs of this ACM are off or show a flashing red light. Proceed as follows to locate the fault in the affected partner ACM: • Check the cables of the Ethernet connection. • Check the connectors, in particular with regard to their secure fit. • Perform a visual inspection to see if there is any damage (kinks, cable jammed, insulation damaged). • Replace any faulty parts. • Check the connected switches and/or modems and replace them, if required.

Table 27 : Fault Condition 14 – LED Indications on ACM Front Panel



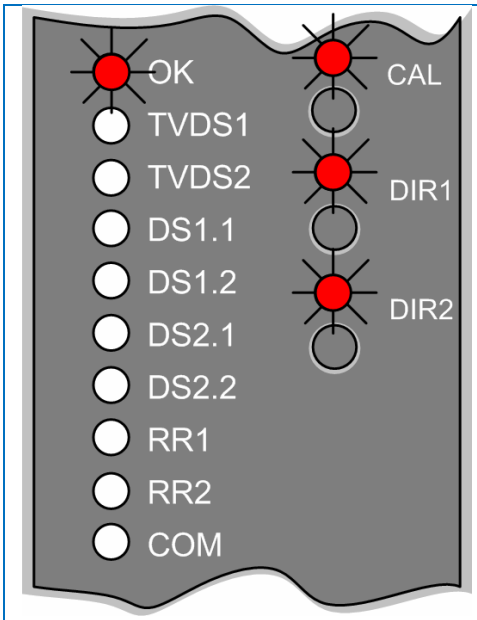
Display	The "OK" and "COM" LEDs show a flashing red light.
Possible causes	The Ethernet connection is interrupted.
Remedy	(i) Check the power supply of the switch connected to this ACM. (ii) Check the cables of the Ethernet connection: • Check the connectors, in particular with regard to their secure fit. • Perform a visual inspection to see if there is any damage (kinks, cable jammed, insulation damaged). • Replace any faulty parts. (iii) Replace the affected ACM. (iv) Check the connected switches and/or modems and replace them, if required.

Table 28 : Fault Condition 15 – LED Indications on ACM Front Panel



Display	The "CAL" LED shows a steady red light.
Possible causes	The ACM is not calibrated.
Remedy	Calibrate the ACM.

Table 29 : Fault Condition 16 –LED Indications on ACM Front Panel



Display	The "OK", "CAL", "DIR1" and "DIR2" LEDs show a flashing red light.
Possible causes	The "CAL", "DIR1" and/or "DIR2" buttons are blocked. The cause can be: • The buttons have been operated incorrectly. • The ACM is faulty.
Remedy	The ACM must be restarted: • Inform the SM that ACM is required to be restarted • Press the "RST" reset button of the affected ACM for min. 2 s. • Wait 15 s until the LEDs are on. • Observe the status. If the "OK" LED shows a steady green light then: • Inform the SM that restart has been successful. • Request the SM to perform an axle count reset. If the "CAL", "DIR1" and/or "DIR2" LEDs continue to show a flashing red light then: • Replace the ACM

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4.3 Troubleshooting of outdoor equipment

4.3.1 Troubleshooting through measurement of parameters

(i) Wheel detection equipment Supply Voltage

Specified Supply voltage range at the NS terminal block – 30 V to 70 V DC (Applicable to variant without external supply)

Observation
Wheel detection equipment supply voltage not correct

Possible causes & remedy

- Check the signaling cable (no visible damage, fuse in the indoor equipment OK).
- Check the indoor equipment.
- If the fuse of the interface boards in the evaluation computer is faulty, check whether there is a short-circuit of the wheel detection equipment supply voltage.
- Check the overvoltage protection module:
- Variant with an integrated overvoltage protection module: replace the wheel detection equipment module.
- Variant with a retrofitted separate overvoltage protection module: replace the separate overvoltage protection module

(ii) Transmitter frequency

Specified range at the transmitter terminal block, terminals 6 and 7 or terminals 8 and 9. - 41.5 kHz to 44.5 kHz

Observation
Transmitter frequency not correct

Possible causes & remedy
Transmitter faulty - Replace the Double Wheel Detector

If fault persists, then replace the Wheel Detection Equipment Module.

(iii) Receiver Voltage

Specified range:

Receiver voltage 1 at the receiver terminal block, terminals 3 and 4 & Receiver voltage 2 at the receiver terminal block, terminals 1 and 2 = 54 mV to 180 mV AC

Difference between Receiver Voltage 1 & Receiver Voltage 2 - $\leq$ 10 mV

Case 1 : Receiver voltage 1 and/or receiver voltage 2 < 54 mV

Possible causes & remedy

Check the rail profile: if the rail profile is high (e.g. UIC 60 or higher), the receiver voltages may be below 54 mV. If it is possible to calibrate the wheel detection equipment, no further measures are necessary.

If not rectified, replace the double wheel detector.

If frequency faults persist, install the wheel detection equipment at a different location on the track.

Case 2 : Receiver voltage 1 and/or receiver voltage 2 > 180 mV

Possible causes & remedy

Check the rail profile: if the rail profile is low, the receiver voltages may be above 180 mV. If it is possible to calibrate the wheel detection equipment, no further measures are necessary.

If not rectified, replace the double wheel detector.

If frequency faults persist, install the wheel detection equipment at a different location on the track.

Case 3 : Difference between receiver voltage 1 and receiver voltage 2 > 10 mV

Possible causes & remedy

Check the installation of Double Wheel Detector.

Replace the Double Wheel Detector

4.3.2 Troubleshooting through LED indications of Wheel Detection Equipment module

The elements of Wheel Detection Equipment Module (Controls & LED indications) and their description are given below for troubleshooting purpose.

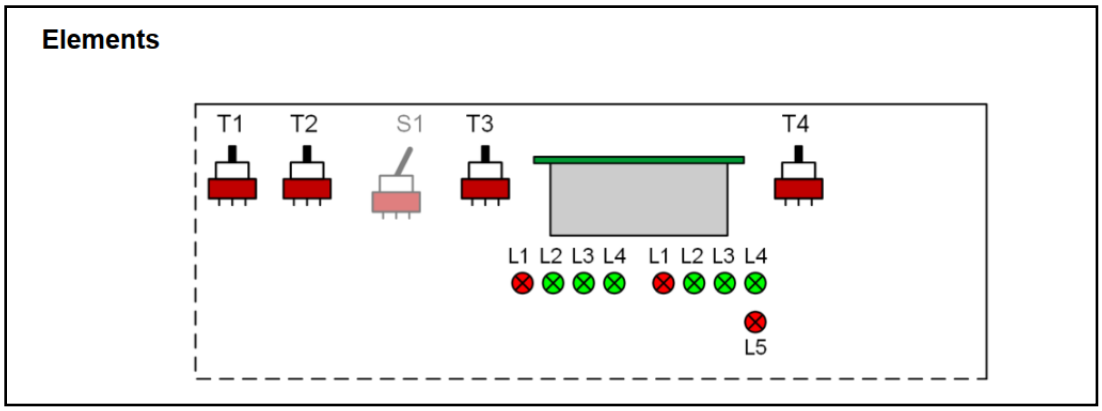

Figure 46 : Elements of Wheel Detection Equipment module

Table 30 : Elements of Wheel Detection Equipment and their description

Item	Element	Description
S1	For Siemens Customer Service only	In the ex-works state, switch S1 is in the FR position. This switch position must not be changed during operation. Switch S1 is not present in wheel detection equipment variants with an integrated overvoltage protection module.
T1, T2	Reset buttons	Restart of the wheel detection equipment
T3,T4	Calibration buttons	Start of calibration
L1	L1 LEDs	Detachment detection: The LEDs show a steady light when the double wheel detector has become detached from the rail.
L2	L2 LEDs	Wheel detection: The LEDs show a steady light when a wheel has entered the effective range of the double wheel detector.
L3	L3 LEDs	Processor: The LEDs show a flashing light when the processor of the wheel detection equipment module works properly.
L4	L4 LEDs	Calibration: The LEDs show a steady light when calibration is running.
L5	L5 LED	Fault: The LED shows a steady light when the wheel detection equipment module is faulty.

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LED indications of Wheel Detection Equipment module during fault condition

(i) Fault condition 1: L3 LEDs show flashing green light and L2 LEDs show steady green light

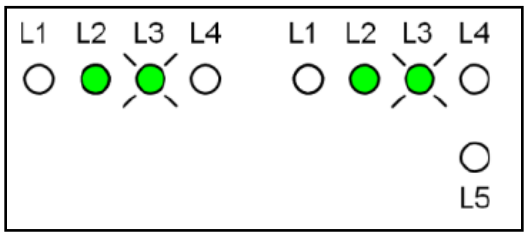

Figure 47 : WDE Fault Condition 1 - LED indications

Possible causes
It is only if the wheel detection equipment is not occupied that there is a fault:

- Switch S1 (if any) is in the incorrect position.
- The wheel detection equipment module is faulty.

Measures
If switch S1 is present: check whether switch S1 is in the FR position.

If the fault persists, calibrate the wheel detection equipment.

(ii) Fault condition 2: L5 LED shows steady red light

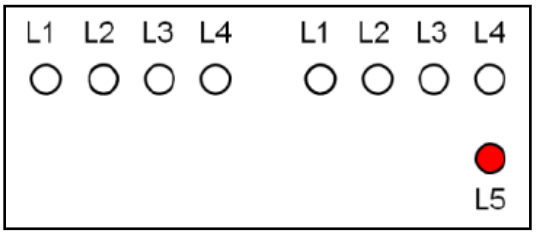

Figure 48 : WDE Fault Condition 2 - LED Indications

Possible causes
The configuration of the two channels differs and is incorrect.

Measures
Check after each step whether the fault has been rectified:

- Briefly remove the coding plug.
- Simultaneously press the two T1 and T2 reset buttons.
- Recalibrate the wheel detection equipment.
- Replace the wheel detection module.

(iii) Fault condition 3: L2 LEDs show steady green light and L1 LEDs show steady red light

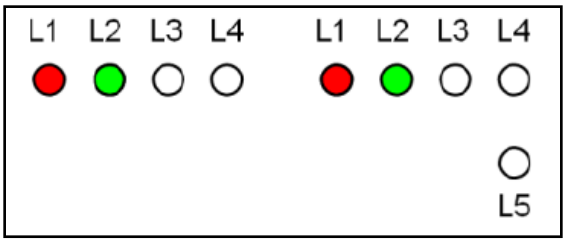

Figure 49 : WDE Fault Condition 3 - LED Indications

Possible causes
There is a runtime error in the software.

Measures
Simultaneously press the two T1 and T2 reset buttons.

If fault persists, replace wheel detection equipment module.

(iv) Fault condition 4: L3 and L4 LEDs show flashing green light and L2 LEDs show steady green light

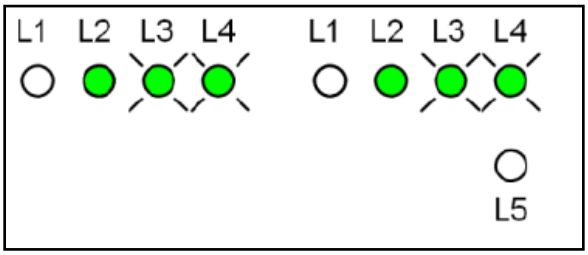

Figure 50 : WDE Fault Condition 4 - LED Indications

Possible causes
The second calibration has failed, the adjacent track section is occupied, there is no valid calibration data in the memory.

Measures
Calibrate the wheel detection equipment.

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Technical data

Parameter	Specified range
ACM	
Maximum number of wheel detectors connectable per ACM	4 (2 directly connected ZP D 43 and 2 ZP D 43 of partner ACM)
Maximum number of Track Vacancy Detection Sections (TVDS) per ACM	2 TVDS (1 TVDS formed by 2 directly connected ZP D 43 & 1 TVDS formed by 2 ZP D 43 of partner ACM)
ACM Input Supply Voltage	24 V DC (21.6 V to 31.2 V DC) (Standard variant)
Maximum number of partner ACMs which can be combined with one ACM.	4 partner ACMs
Maximum number of sets of wheel detection equipment per ACM	Total 10 sets of wheel detection equipment can be monitored: ➢ 2 sets of wheel detection equipment directly connected to ACM ➢ 8 sets of wheel detection equipment to four adjacent ACMs
Power consumption (ACM)	Typically 10 W + 4 W per set of wheel detection equipment
Maximum cable length in indoor equipment	100 M
Type of connecting cable	Star-quad or paired signalling cable
Maximum control distance	Standard - 6.5 Km, With additional measures – 21 Km*
Maximum number of ACMs per standard cabinet	15
Wheel Detection equipment	
Length of double wheel detector connecting cables	Available in Approx. 5 m, Optionally approx. 10 m or approx. 15 m
Attachment of DEK wheel detector	On rail web in sleeper bay Drill holes in rail web: diameter 13 mm, distance 270 mm, Height from the foot of rail 85 mm +1.5 (60 Kg), 69 mm + 1.5 (52 Kg), 56 + 1.5 (90R) Tightening torque of fastening nuts: 45 Nm
Rail Profiles	60 Kg, 52 Kg & 90R
Operating frequency of DEK	43 KHz
Signal frequencies (double wheel detector not traversed)	f1 = 3.60 kHz f2 = 6.52 kHz
Power consumption of wheel detection equipment	Approx. 2.5 W (without cable losses)
Required traversal cycle ZP D 43	Once a year

*Application not used at present in Indian Railways

References

The documents listed below were referred for preparation of this handbook. To view or download any document please click on the name of the document:

- RDSO Specification No. RDSO/SPN/176/2013 Ver. 3.0
- RDSO Pre Commissioning Check List for Multi Section Digital Axle Counter MSDAC Model: ACM 200 of M/s Siemens India Ltd., Mumbai.
- Information Brochure - Clearguard ACM 200 Axle Counting System.
- Presentation slides on Siemens Axle Counting System ACM 200 & ZP D 43
- System Description - Clearguard ACM 200 Axle Counting System.
- Maintenance Instructions - Clearguard ACM 200 Axle Counting System.
- Operating & Service Manual – Clearguard ZP D 43 Wheel Detection Equipment
- Operating Instructions Website and Web Application - Clearguard ACM 200 Axle Counting System.
- Configuration Instructions - Clearguard ACM 200 Axle Counting System
- Data Sheet - Clearguard ACM 200 Axle Counting System

Other related manuals

- Standard Design Document - Clearguard ACM 200 Axle Counting System
- Configuration Process using Website - Clearguard ACM 200 Axle Counting System.
- Safety-related Application Conditions for Operators - Clearguard ACM 200 Axle Counting System.

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