

THALES

COUNTINGWORLD

The Customer Magazine for Axle Counter Systems

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Az LE Single Section Axle Counter System
Small, strong and cost-efficient



Axle Counter go Urban Rail
Moving the masses



Stuttgart 21
The myth - the facts



Dear Reader,

Axle Counter conquers the urban rail market

As megacities around the globe deal with ever increasing road traffic and severely congested roads, it has become obvious to our city managers that it is mandatory to provide fast and effective modes of transportation for people in these economic centres. Economic and urban growth has become one of the main drivers for sophisticated and highly effective technologies to manage our cities. Out of this technological evolution

a modern signalling solution has been developed to address the demand of these urban environments – globally known as CBTC. Ever since the introduction of Thales' automated signalling systems in metro applications in the 1990s in Canada, Germany and the UK, there has been a drastic increase in demand worldwide for sophisticated urban rail technology that is far beyond the limitations of relays and wayside signals.

Today, Thales has achieved world market leadership for CBTC urban rail systems with recent successes in China, the Middle East and India in addition to extensive follow-on business in the UK, Hong Kong and the USA.

The Thales Axle Counter Train Detection System has been incorporated into CBTC urban rail systems where secondary protection is desired, especially in heavy metro and high traffic systems. Axle counters are utilised to provide the following specific applications in a CBTC environment:

- Tracking of non-communicating trains for safe train separation
- Deadlocking of points
- Overspeed protection
- Support of automatic system restarts

The Thales Axle Counter Train Detection system that we're using in the metro environment continues to receive some of the most remarkable advancements in recent years as a result of the efforts already implemented in the mainline market.

While maintaining the highest level of safety, there has been a constant improvement in operational reliability and system maintainability from the application of sophisticated redundancy schemes in hardware and software. Traditional relay interfaces have made way for IP-based serial connectivity, software-based automatic fault correction systems have complemented remote monitoring functionality and innovative service concepts have reduced system downtime.

And yet, even more innovative initiatives are on their way.

[Read the latest technology updates as a member of the exclusive Counting World of Thales.](#)

Gabriel Colceag
*Vice President / MD
Urban Rail Signalling
Thales Canada*

Axle Counter goes Urban Rail

40% of London's Tube network will run on Thales Axle Counter

Transport for London (TfL) has awarded the contract to deliver the vital modernisation of the signalling and train control system on four London Underground (LU) lines to Thales.

This includes the latest state-of-the-art Multiple Section Axle Counter System (Az LM). This next major phase of the

Underground's modernisation will bring faster, more frequent and more reliable journeys to millions of passengers who use the Circle, District, Metropolitan, Hammersmith and City lines.

These improvements will boost capacity by an average of a third on the four lines and is vital in order to support London's

growing population, which is expected to increase from 8.6 million today to 10 million by 2030. Work is expected to begin later this year and the main benefits will be delivered by 2022 when the frequency of trains running during peak periods will increase to 32 trains per hour in central London – a train every two minutes.

These improvements will follow the successful modernisation of other Tube lines in recent years. On the Victoria line customers are now benefiting from up to 34 trains per hour and up to 30 trains per hour on the Jubilee line – some of the most frequent services anywhere in Europe. Since the start of this year LU has increased capacity on the Northern line, making room for an extra 12,500 passengers each hour. Once these four lines have been completed, LU will then move on to introducing new trains and control systems for the Piccadilly, Central, Bakerloo, Waterloo and City lines.





The Backbone of DB AG Infrastructure

Axle Counters for electronic and relay interlocking

Axle counters were first introduced to the German Railways in the late 1960s. Since then, many passenger carrying lines of the DB network have been modernised and migrated to the latest generation of Thales Axle Counter Systems.

Most of the main lines and high-speed lines of the German railway network are being equipped exclusively with axle counters and operated at speeds up to 300 km/h. Thales is the main supplier who will upgrade the high-speed line Erfurt–Eisenach. Some 50 km of line is being fitted with 350 detection points of the fully redundant Thales Multiple Section Axle Counter (Az LM).

Digital fault tolerant transmission and modern TCP/IP connections are used to allow for increased train speeds such as the current 200 km/h upgrade. This technology has really shown its superiority against historic modes of train detection in several projects in Germany, especially in a completely different application project: **STUTTART 21**.

Being one of the largest railway construction sites in Europe, the Stuttgart terminal station with its 16 platforms will be put 11 metres below the current track level and be transformed into a 8-track through station. All 16 platforms had to be moved forward by several hundred metres to make way for the



Az LM in Stuttgart's relay interlocking

underground construction of the new through terminal, positioned at 90° to the present terminal. A large portion of the 506 point machines, 1018 colour light signals and 699 track sections driven by approximately 70,000 signalling relays were affected by this relocation.

To allow for this modification to be done while maintaining passenger services a large, complex and challenging stage works programme was put in place.

By maintaining the 1977-commissioned SEL type route relay interlocking, it was only possible to move around the affected 160 track sections by introducing the flexibility of the Thales Multiple Section Axle Counter System: overlapping installation, independent

commissioning and compatible relay interface circuits.

Without this flexibility of the new Thales Axle Counter, the preparation works for the new 57 km of track and the construction of the 33 km new tunnel sections would have been a logistical nightmare. Today, this interim axle counter solution has not only increased the operational availability of the train detection system, it has also drastically reduced the maintenance efforts in this complex terminal station area.

Main facts on Stuttgart 21

Reconstruction of the Stuttgart rail node

- 3 new railway stations: Stuttgart Main Station, Flughafen/Messe and Mitnachtstraße
- 57 km total line length
- 33 km tunnel
- Max. speed: 250 km/h

New line Wendlingen–Ulm

- 59 km total line length
- 30 km tunnel
- Max. speed: 250 km/h

For more details:

www.bahnprojekt-stuttgart-ulm.de/english/



Success Story

Metro Trains (MTM) – Successful Stony Point line upgrade in Melbourne

On 30 March 2015, MTM suspended Stony Point line services indefinitely following a series of incidents where some of the 19 level crossings were not operating correctly.

Keeping the rail line in operation has always been a priority, however, the line was closed while MTM worked to implement a permanent solution to ensure the safe movement of trains and to prevent ongoing disruptions to services. Prior to the works, level crossings on this line were activated by a conventional train detection system relying on the wheel-to-rail interface.



Installed detection point at Stony Point line

MTM identified the way to fix the fault was to install axle counters, which do not rely on a wheel-to-rail interface to detect a train.

Manager, said the Thales team contributed to the project's success:

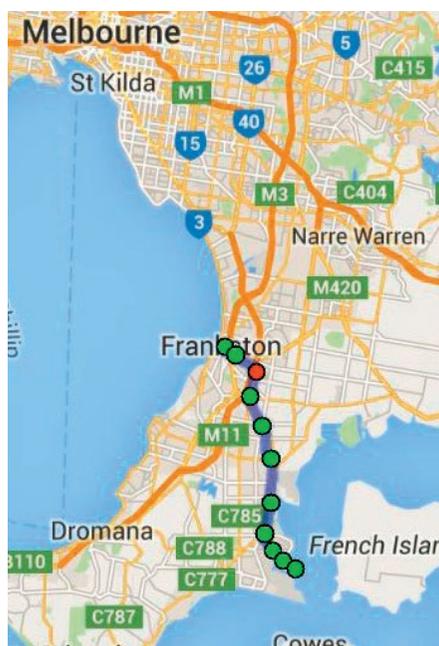
“Excellent collaboration meant that our stringent delivery requirements could be achieved, the Thales team even worked overnight to keep to the tight programme. A job well done by Tamas Nagy, Slava Petrov, Cheng Ni, Mark Brindley and the Thales Axle Counter support team in Germany.”

With confidence in the team and a highly reliable and technically advanced train detection solution, MTM awarded Thales three larger scale projects, which are currently being deployed on the Melbourne rail network.

Thales Transportation in Australia

Thales has already been supporting all Axle Counter activities in Australia with a qualified team for more than 5 years. Understanding our customer needs combined with country specific experience is key to establishing a trusted long-term partnership.

Thales looks forward to supporting all customers in Australia with outstanding products and services over the next decades to help achieve their targets and provide a safe and reliable train service. The team provides installation, commissioning, design, customer application and training with experienced and certified employees.



Stony Point line in Southern Melbourne

Following a successful trial and the confidence that all of the equipment could be delivered in time, Thales worked as a key supplier to MTM for the supply, design, training and testing/commissioning of the Thales Az LM Axle Counter Train Detection Solution. Post development, and in only three months, the project team successfully installed the new axle counter system on all level crossings to re-open the Stony Point line on 30 June 2015.

The Stony Point line customers are back on board their treasured train service, thanks to the very close cooperation between MTM and Thales. Calvin Li, the MTM Project

Small, Strong, Cost-Efficient

Az LE Single Section Axle Counter System

Known for over 50 years for its regular innovations in the field of axle counters, Thales has now extended its portfolio by a new product line: Az LE. Optimised for small and decentralised applications, Az LE provides cost-effective train detection. The new Single Section Axle Counter takes advantage of the well-proven technology of the Zp30H and Zp30K rail contacts and is fully compatible with the Multiple Section Axle Counter System (Az LM).

System Components

The central component of the system are the section boards (SB). Each SB consists of a vital two-out-of-two controller system and provides a SIL4 train detection for up to two sections. Several of these section boards can be installed in a single 19" subrack. Each SB comprises up to four relays with volt-free contacts (forced relay contacts configurable as GF/GF or GF/GB). The four relays can be used to provide the vital information "section free" and "section not free" for up to two sections simultaneously.

In case the disturbed status of a section is required as a vital output as well, two of the four relays can be used for the status "section not disturbed" and "section disturbed" as a vital output. In this case, one SB can be used for one section only. The detection points are connected by means of the modem boards (MB). Each MB can connect four detection



Section board

points. Each MB provides four 2-wire ISDN links including the overvoltage protection for each link. Detection point power supply boards in the subrack can be used to provide remote power to the detection points over the same pair of wires. Alternatively, an external power supply can be used for the detection points, feeding into subrack and through the MB energising the detection points.

A reset can be applied to each disturbed section by using the input of the optocouplers for each SB or through two push buttons at the front panel.

Each subrack can accommodate up to 3 modem boards for max. 12 DPs and 8 sections (max. 5 DPs assigned to one section). In total, up to 3 subracks can be combined to one system.

The site specific data (comprising the configuration) is created offline by means of the Thales Data Management Tool (DMT) and transferred through a programme plug to the system.

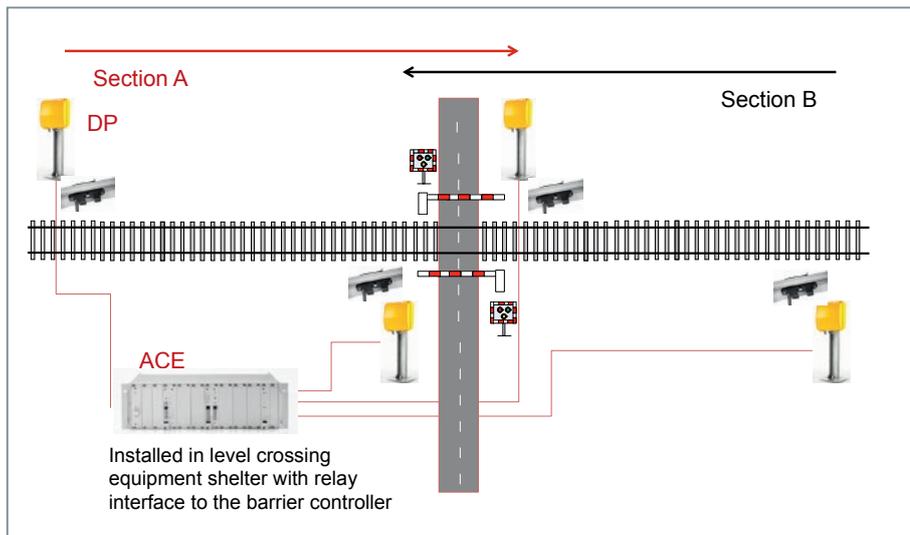
The design of the Az LE plays off its strength for small and medium-sized decentralised applications where the section information is needed at the trackside.

Typical Applications:

- Level crossings
- Single section block (section information output at both ends)
- Decentralised automatic block, intermediate block
- Loop lines, small stations and sidings

Key Features:

- Flexible installation of the evaluator unit indoors or inside trackside cabinets
- Fully compatible with all current types of detection points
- Vital and fault-tolerant data transmission from the detection point to the evaluator unit
- Integrated power supply and overvoltage protection
- Double utilisation of the DPs for both Az LE and Az LM



Application example at a level crossing



Success Story

Hyderabad Metro Rail - Thales Axle Counter System Az LM in the first CBTC project in India

India has launched numerous metro projects in its fastest growing cities in order to cope with the ever increasing demand for transportation. Hyderabad is the fastest growing fourth largest city in India. The Hyderabad population has grown from 6.8 million in 2011 to 9.5 million in 2015. Therefore, the Hyderabad Metro Rail project, beginning in 2012, is ambitious in scope and swift in execution. Following a construction period of just five years, the first phase, comprising three lines totalling 71 km with 66 stations, will be completed in 2017.

The elevated metro is being built in six phases under a design, build, finance, operate and transfer PPP concession. Larsen & Toubro Metro Rail (Hyderabad) Ltd is the concessionaire and has outsourced complete operation and maintenance to one of the major operators who will operate services under a contract running for eight years with an optional three year extension. Ultra modern rolling stock of 57 three-car trainsets designed for a top speed of 80 km/h is being developed on this project.

Hyderabad Metro Rail is the first Indian metro, which is implementing a Communication-based Train Control (CBTC) System.

The SelTrac® CBTC technology being deployed for Hyderabad Metro Signalling Systems has evolved over time and various operators continue to benefit from the low operating, energy and maintenance costs, optimal life-cycle costs and proven driverless technology.

The SelTrac® CBTC System has been proven worldwide on over 56 projects to date and operates on over 1,300 km of track in major urban centres around the world, carrying an estimated 3 billion passengers annually.

The main operation control centre located in Uppal depot is the nerve centre for remote controlling and operation of the entire Hyderabad Metro Rail System. The total Hyderabad Metro Rail System is divided into six zones, each controlled by a zone controller (ZC).

The SelTrac® CBTC System is a radio communication-based moving-block automatic train control system, which controls the movement of trains through continuous two-way digital communication. Each train transmits its identity, location, direction and speed to the respective zone controller. The ZC calculates the safe distance between two trains, breaking distance and authorised train speed with the automatic application of brakes in case of overspeeding. Trains will initially run in automatic train operation mode with minimum headways of 90 seconds and the system will support eventual migration to unattended train operation.

The location of each train is supervised by Thales Multiple Section Axle Counter Systems (Az LM). Each Az LM Axle Counter Evaluator (ACE) transmits the track occupancy information and the axle count simultaneously to the zone controller as well as to the vehicle control centre via an IP interface.

Hyderabad Metro Rail is using standard-gauge, UIC60 head hardened rails with ballastless track throughout and is electrified at 25 kV AC 50 Hz. More than 500 slimline Sk30K wheel sensors will be mounted on the 71 km of track. The Az LM Axle Counter System provides Hyderabad Metro Rail with reliable train detection and axle counting. The Sk30K sensor can be mounted in less time as no mechanical adjustment is required.

The Hyderabad Metro Rail Project will transform Hyderabad into one of India's most modern integrated urban transport systems. This landmark project introduces the latest CBTC and axle counting technology for the first time in India.

About



Larsen & Toubro Metro Rail (Hyderabad) Limited is a subsidiary of Larsen & Toubro Infrastructure Development Projects Limited. The Larsen & Toubro Group is an Indian multinational conglomerate engaged in technology, engineering, construction, manufacturing and financial services with over USD 15 billion in revenue. It operates in over 30 countries worldwide. A strong, customer – focused approach and the constant quest for top-class quality have enabled Larsen & Toubro to attain and sustain leadership in its major lines of business over seven decades.

Populating an Island with Axle Counters

Thales - the main provider for Taiwan's main line applications

Taiwan Railways has maintained its leading position in the Asia Pacific region by constantly developing its railway infrastructure to ensure a high level of efficiency of its services.

With constantly growing passenger numbers, Taiwan's operator, Taiwan Rail Administration (TRA), along with its engineering counterpart, Railway Reconstruction Bureau (RRB), continuously assess safety, reliability and service quality of the existing infrastructure. Thales supports these activities by providing the well-proven Axle Counter Systems for

Multiple Section (Az LM) and Single Section (Az LS), installed in large quantities all over the island.

With more than 7000 detection points, TRA is one of the largest operators using Thales Axle Counters in the world. The Multiple Section Axle Counter Az LM is very efficient in larger applications like stations and yards, whereas Az LS has its strength in applications on block sections and level crossings. This combination allows TRA to make use of the advantages of a SIL4 system with very cost-efficient lifecycle costs. Although axle counters were initially

installed as a secondary system overlaying existing track circuits, the axle counter system today is used as the primary train detection system because of its excellent performance. New installations of axle counter systems are these days very often designed exclusively in a fully redundant configuration. Since 2013 TRA have been using the new slimline Zp30K detection point in combination with the Az LM Software Version 6.3. They are about to upgrade existing installations to the latest software version to benefit from new additional functions like the automated reset and other useful features.



TRA Tze Chiang Express Train

Thales is supporting all these activities with an excellent qualified and experienced local team to ensure a smooth integration of the Thales Axle Counter Systems into new projects and to provide high-quality customer support. Thales provides a full range of services from planning, engineering, maintenance support to providing all levels of training by certified local trainers.

New Analogue Board available

Completing the compatibility of Sk30K and EAK30H

Existing installations using the well-proven Sk30H detection point are suffering from the incompatibility between the new Sk30K rail contact and the existing EAK30H electronic unit. These installations cannot benefit from the advantages of the new slimline Sk30K rail contact without exchanging the electronic unit. Due to this incompatibility, the Thales Axle Counter (Az LS) could not make use of the new rail contact so far. However, with the new analogue board, developed for the proven



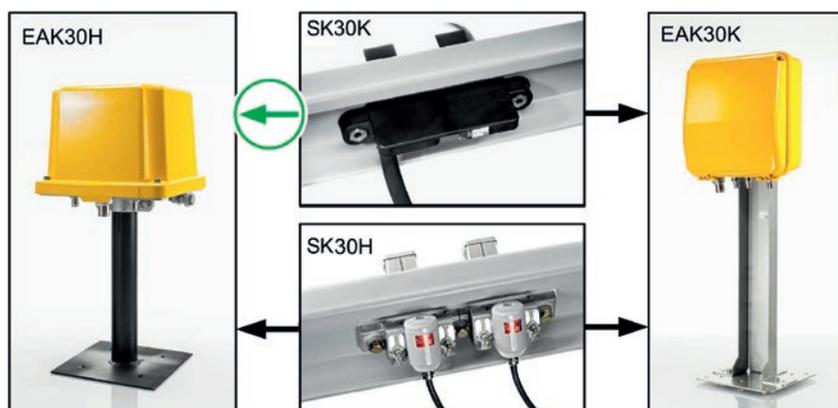
Sk30K mounted over sleeper

EAK30H, it is now possible to upgrade any existing Zp30H installations with the new Sk30K rail contact only by exchanging the analogue board of the EAK30H with

the latest type. The new board is fully compatible with both types of Sk30H and Sk30K rail contacts and can now be used for both Az LM and Az LS product lines.

Advantages of Sk30K:

- Less mechanical parts (only four parts)
- Easier to install and maintain
- Enhanced signal / Noise ratio
- No mechanical adjustment required
- No need to enter the track side area for re-adjustment
- Enhanced clearance height between the rail contact and rail head
- Installation over the sleeper possible
- Practically no dismantling during tamping and grinding necessary
- Quick clamp device (for UIC60) available



Possible configuration of detection points and sensors

The position of the mounting holes in the rail web of the Sk30 and Sk30H are compatible with the Sk30K.

Quality Production tailored for Customer Requirements

Pre-assembly of Axle Counter Equipment

Infrastructure projects are getting more complex whilst at the same time having reduced implementation times. In addition to this, the availability of shutdown periods for installations are reduced. Therefore, it is important to find appropriate solutions for this trend as a system provider.

approach. Starting with value stream mapping every installation, every step was rated and checked primarily with the focus on possible on-site interruptions. In a second step, the new target process had to be designed to move all steps, which were unnecessary on site to an industrial pre-assembly. This

Advantages of this approach are:

- Industrial process with skilled workers and a wide range of tool support will lead to a consistent and high quality
- Reduced installation effort and time on site
- Reduced storage area and administration effort
- Less dependent on weather conditions
- Complexer units will reduce the number of items to order and avoid missing fittings for the mounting.

Apart from these advantages, there are also benefits to logistics, transport and reduced risk of missing or damaged parts.

This industrial pre-assembly service is available for customers worldwide and has been used for many years in various countries (e.g. Germany, Portugal, Latvia, Saudi Arabia, Norway).



Pre-assembly of an axle counter with a configuration scan

Installing the outdoor equipment for axle counters is a critical path on site. Especially regarding rail contacts, electronic units and housing with a pedestal. Challenges are mounting the rail contact to the track (heavy installation tools) on the one hand and feeding cables through a waterproof passage and electrical connections of individual copper wires (precision mechanics) on the other hand. Often accompanied by unpredictable weather conditions.

Solution for industrial pre-assembly

Based on this analysis, Thales developed a solution for industrial pre-assembly to simplify the critical installation process on site. Led by the industrial engineering department of our industrial competence centre, the whole process was reengineered by using the LEAN

was done simultaneously by introducing a LEAN manufacturing flow characterised by a pull principle with the KANBAN logistic. A special challenge within this project was also to find the appropriate packaging to minimise transport volume and to ease on-site handling.

Manufacturing cell

In the newly designed and dedicated manufacturing cell the rail contacts and the electronic unit will be mechanically and electrically connected (in the case of Sk30H also the mounting of the protective tube). Furthermore, the assembly will also include the housing pedestal and accessories. These configured, pre-assembled units are built according to the customer's order and shipped on time for the final installation.



Pre-assembly of an Sk30H wheel sensor