

i n v e n s i s <sup>TM</sup>  
Rail

SIRIUS  
CBTC technology



GREENWICH  
AT WEMBLEY PARK, UNTIL FEBRUAR  
12:42:55



## Who we are

Invensys Rail, a division of the global technology group Invensys plc, is a multinational leader delivering state of the art railway control and communication solutions.

We enable the world's railways to meet the ever increasing demand for rail services by providing a range of solutions that safely increase the capacity of their networks by increasing frequency and maximising operational effectiveness.

Employing over 3,250 employees worldwide, Invensys Rail operates through a network of regional offices and delivers products and solutions from some of the most famous names in the rail industry, Westinghouse Rail Systems, Dimetronic Signals and Safetran Systems.

We design, manufacture, supply, install, commission and maintain a range of safety related rail automation and control systems and equipment. Our broad offering ranges from highly complex integrated control centre solutions that supervise and control complete railways, sophisticated train based systems that automate train operation and protection, interlocking systems that ensure safe running across a network and a complete range of trackside products.

# SIRIUS

SIRIUS is Invensys Rail's Communication Based Train Control (CBTC) solution for all types of Mass Transit and Suburban Railways - conventional, driverless or fully automatic/ unmanned. SIRIUS is based on moving block principles, and uses the latest state-of-the-art digital radio transmission techniques.

### Proven success

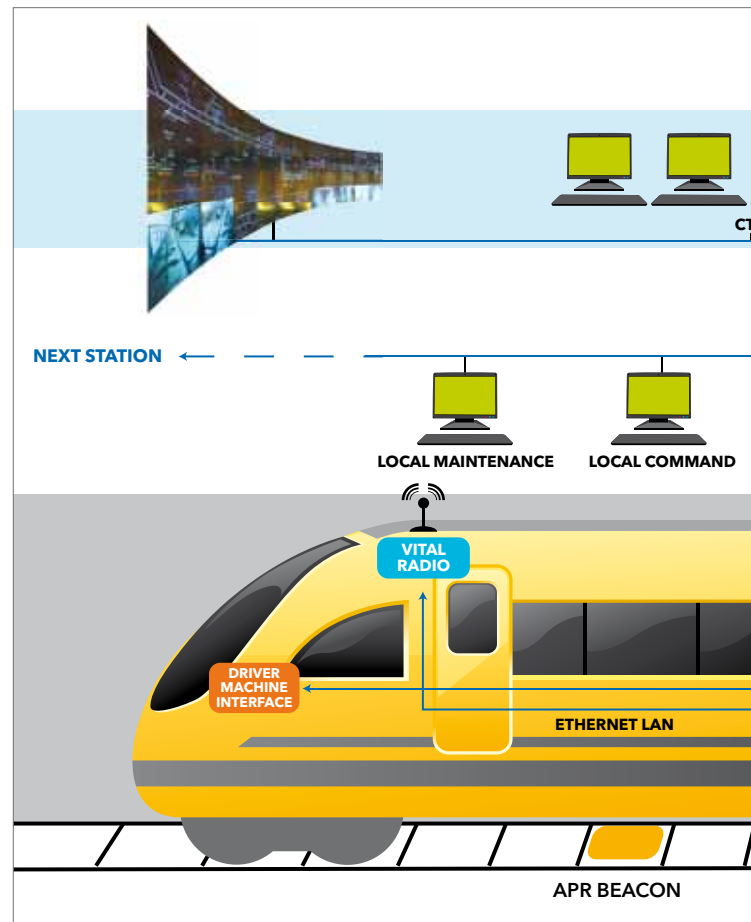
Invensys Rail have been developing and delivering ATP, ATO and ATS systems for Mass Transit railways for the last 40 years.

Well over 1,000km of track and more than 1,200 trains are currently in revenue service with ATC systems designed, manufactured, installed and commissioned by Invensys Rail.

ATC systems designed by Invensys Rail, use common safety principles and shared technological platforms and have been installed in many Mass Transit and suburban railways around the world, including major network operators in London, Madrid, Barcelona, Valencia, Beijing, Singapore, Bucharest and Manila.

### Maximum transport capacity

SIRIUS has been specifically designed for high density lines. By optimising headway the operator is able to reach maximum transport capacity and optimise rolling stock usage.



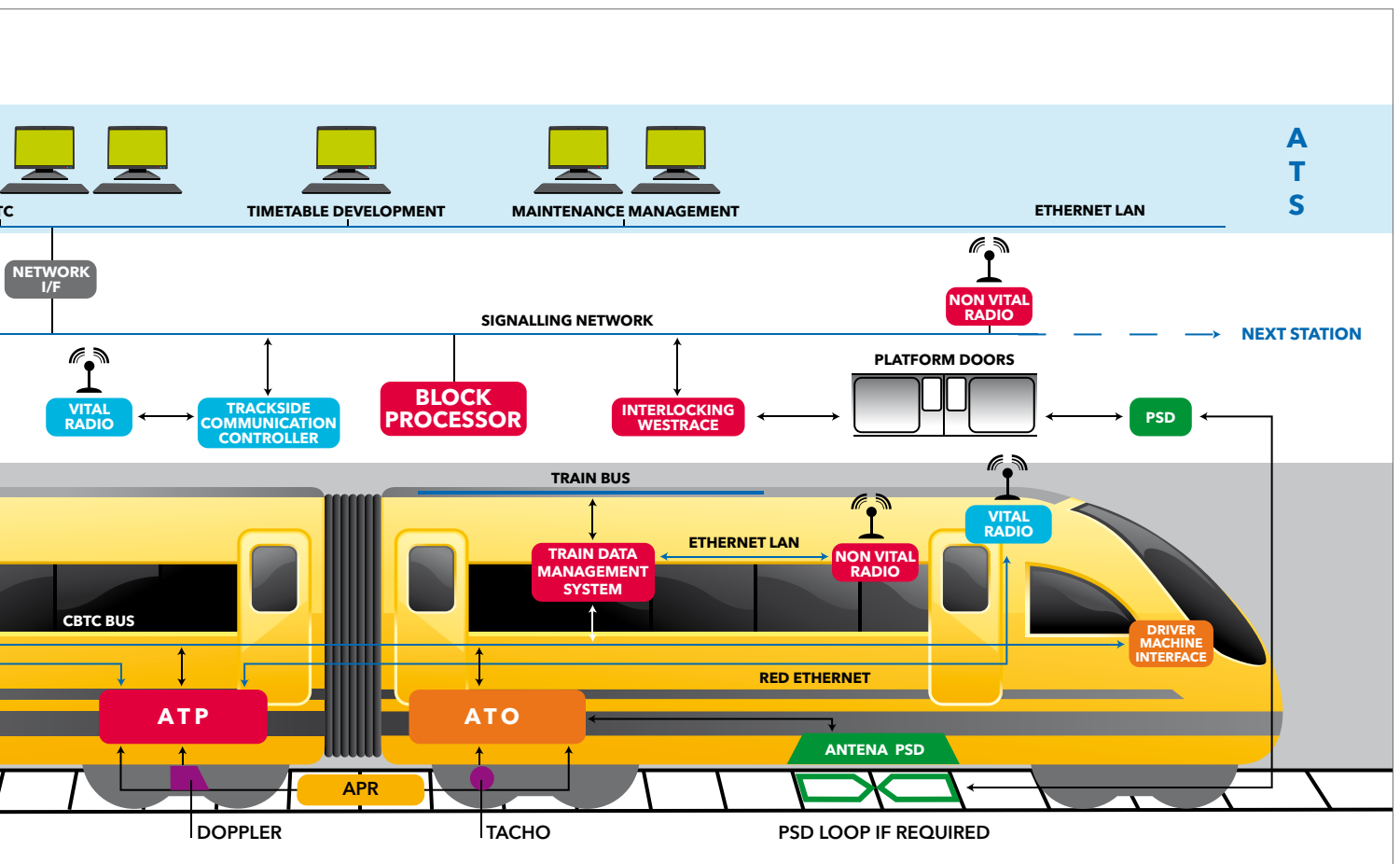
### Operating principles

SIRIUS is an Automatic Train Control system designed on a virtual moving block principle using Communications Based Train Control (CBTC) technology. SIRIUS uses a digital radio system to provide a continuous, high capacity, bi-directional train-to-trackside data communication link.

The basic operating principle of SIRIUS is that each train is granted its own Limit of Movement Authority (LMA). From the information contained in the LMA, the on-board equipment continuously supervises train speed, to safely ensure that the LMA cannot be exceeded.

In order to do this, each train continuously reports its position over the digital radio to the trackside Block Processor (BP). The BP uses the position information from the trains and track status information from the interlocking to recalculate the LMA for each train.

The LMA is sent, together with track profile data, via the Trackside Communications Controller (TCC), based on moving block principles.



Passive Absolute Position Reference (APR) beacons, located along the track, are activated by the train as it passes over them. They provide information which allow the trains to determine their position to the optimum level of precision as they move along the line. The train's movement is fully automatically controlled by the Automatic Train Operation (ATO) equipment.

For lines that are not entirely driverless, a train attendant - not necessarily in the driver's cab - will control the train doors and train start functions through a touch-screen device acting as Driver Machine Interface (DMI).

SIRIUS can also interface with Platform Screen Doors (PSDs) by means of a bidirectional data exchange between the trains and trackside equipment. This allows open/close commands to be coordinated between the PSDs and train doors in a safe way and to provide accurate train stopping.

To operate such a system a wide set of automatic command and control functionalities must be available. To this end SIRIUS includes an Automatic Train Supervision (ATS) system, specifically developed by Invensys Rail for its CBTC solution.

The ATS integrates a set of programs and tools to implement a wide range of functionality, including traffic control, depot management, train wake/sleep, automatic regulation, integrated maintenance, incident report/replay and operation simulators.

The ATS is also constructed using an open architecture allowing it to provide simple integration with other railway control systems such as Traction Power Control, Passenger Information Systems, Building Management, Environmental Control or any kind of telecommunication system.

## "SIRIUS: Invensys Rail's communication based train control system"

# Main characteristics

## Digital Radio Communications

SIRIUS uses a powerful bi-directional data transmission system for vital information. This uses digital radio based on Spread Spectrum technology and Internet Protocol (IP) communication.

## Architecture

The system architecture is open and distributed, allowing for easy application of SIRIUS and its interfaces with other systems.

## Flexibility

SIRIUS can operate on lines equipped with other Invensys Rail systems - speed signalled, or Distance to Go.

## Modularity

All of the subsystems of SIRIUS perform specific functionality. This enhances reliability and makes maintenance easier, but it also allows each sub-system to be upgraded without affecting the overall system.

## Connectivity

SIRIUS uses Profibus and TNC standards for train carried equipment and IP based communication for trackside equipment and track to train communication.

## Safety and reliability

SIRIUS has been designed in accordance with European standards CENELEC 50126, 50128 and 50129. Vital functions are performed in both train-borne and trackside processors. Train location is determined to high resolution through the use of passive beacons.

## Availability

SIRIUS uses a 2 out of 3 architecture. This configuration, combined with the high level reliability of the individual components, results in availability figures in excess of 99.99%.

## Maintainability

SIRIUS includes a centralised Maintenance Aid System (MAS) to facilitate diagnostic work, both train-borne and trackside. All fault and incident information is stored within the relevant equipment and transmitted to the central maintenance system through a non-vital radio link.

"Sirius embraces all the features expected in a modern effective, automated train control system"







# i n v e n s y s<sup>TM</sup>

## Rail

Tel: +44 (0)1249 441 441

Fax: +44 (0)1249 441 442

Email: [marketing@invensysrail.com](mailto:marketing@invensysrail.com)


[www.invensysrail.com](http://www.invensysrail.com)

Invensys Rail | PO Box 79 | Pew Hill | Chippenham | Wiltshire | SN15 1JD

Invensys Rail is a trading division of Invensys plc, a company registered in England and Wales.

Every effort had been made to ensure that the information contained in this brochure was correct at the time of going to press. However, the Company retains the right to change any specification without notice.

Registered Office: Portland House, Bressenden Place, London, SW1E 5BF  
Registered in England and Wales No. 1641421.

 These text pages are printed on 9 lives paper made from 80% recycled fibres sourced entirely from post consumer waste.

© Invensys Rail 2009. All rights reserved.  
Specification subject to change.