THE SIGNAL BOX

Welcome to the new issue of Signal Box

Quarterly News and Updates from Fenix

October 2016

We're delighted to bring you the latest news from a productive quarter for Fenix Signalling.

August saw the successful commissioning of the technical interface between the Network Rail Banbury Resignalling and the new Banbury Depot works.

Our team has put in a lot of hard work and overtime on the RETB (Radio Electronic Token Block) project. The result is that the far north interlocking has passed the stage of complex testing that we were responsible for.

We also attended Innotrans in September – more about this below. Finally, our Jargon Buster series focuses on the Digital Railway, enabling you to pick your way through the specific consequences for signalling.

We understand that, to many, signalling is still something of a mysterious discipline in the rail industry and we aim to shed some light. We are looking to run some new training courses for both signalling novices and signalling design engineers.

We hope you enjoy this issue of Signal Box and look forward to bringing you more news at the end of the year.

Newsflash

Fenix Signalling has announced a new international working relationship with CAF Signalling (based in Madrid). Further news of this exciting opportunity to follow in the coming weeks.

Innotrans 2016

In September, the exhibition grounds in Berlin saw 144,470 trade visitors from more than 140 countries. There was a total of 2,955 exhibitors from 60 countries presenting their products and solutions. Fenix Signalling was pleased to be part of what is the leading event in the marketplace. We had great success in meeting a lot of new contacts, and it was also a great opportunity for both Craig Purcell and Eddie Murphy to renew some old working relationships.

We were delighted to receive an invitation to attend the event as part of Pintsch Tiefenbach's exhibition stand – and we look forward to building a stronger working partnership, bringing their products to the UK market.

A Pintsch of German engineering in Banbury

Fenix Signalling has successfully commissioned the technical interface between the Network Rail Banbury Resignalling and the new Banbury Depot works during the blockade in August this year. The points at the entrance to the depot were also installed, as well as two stop boards at the depot boundaries.

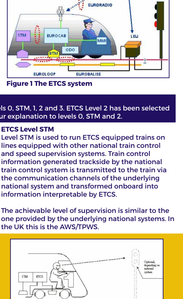
The testers worked in the August sunshine to install the points machine with a Pintsch Tiefenbach points fitter. The four-foot mounted points machine took just 80 minutes to install, much quicker than any UK type point machine, as there is no drilling of the rail required in order to fit the lock and drive rod connections.

Work is now underway to allow the first two roads of the depot to be used for stabling purposes after Christmas this year. This will involve the installation of a further three point machines and a bespoke control unit to allow movements onto the sidings

The Pintsch Tiefenbach signalling system uses PT 111 point machines from fellow German manufacturer Wolber. Mounted with a distinctive yellow cover, the system is highly robust and, with an IP66 rating, is fully resistant to the dust and grime of the railway and protected against water jets.

Although not usually a practice in the UK, the machines are trailable, meaning that a move through a set of trailing points in the wrong position does not damage the machine. There is also only one cable required, unlike most UK mechanisms which require two, as the PT 111 provides the 400V three-phase supply and also the control in one cable.

Approved to bring the former train depot in Banbury back into use after almost 50 years was given by Cherwell District council in February 2015. A multi-million-pound investment from Network Rail and Chiltern Railways followed.



Jargon Buster

Digital Railway What does it mean for signalling?

The European Railway Traffic Management System (ERTMS) is going to be progressively fitted to the UK rail network, starting with the key main lines (Great West Main Line and East Coast Main Line) over the coming decades. It has already been put into service (ETCS Level 2) on the Cambrian Coast Line in Wales, replacing the legacy Radio Electronic Tokenless Block (RETB) system and was commissioned in March 2011.

ERTMS has two key components:

1. European Train Control System (ETCS).
2. Global System for Mobile Communications – Railway (GSM-R).

In addition, the digital railway will also include Automatic Train Operation (ATO).

ERTMS/ETCS

ERTMS/ETCS (hereafter called "ETCS") is a train control system designed to replace all existing national systems on the Trans European Rail Network. It enables trains equipped with onboard units from different suppliers to operate freely over track equipped by the same/different suppliers. It consists of both onboard and trackside sub-systems, with a choice of transmission system for the communication between the two.
The functional and system requirements for ETCS are contained in two documents, the Functional Requirements Specification (FRS) and the System Requirements Specification (SRS). The FRS is produced by the operators (EEIG) and in theory is the base document for the creation of the SRS by the suppliers (UNISIG) but in some cases the relationship has been the other way round.

Different levels (STM, 0, 1, 2 and 3) have been defined to allow each individual railway administration to select the appropriate ETCS application trackside, according to their strategies, to their trackside infrastructure and to the required performance. These levels mainly differ in the trackside and communication systems that are used, and in which functions are processed in the trackside and in the on-board equipment respectively. The functionality from a user point of view is, however, very similar in all application levels. A line is always equipped to a specific ETCS level, with double equipping being possible.

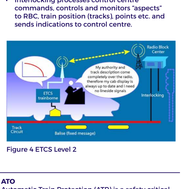


Figure 1 The ETCS system

ETCS Application Levels
There are five application levels to be considered: levels 0, STM, 1, 2 and 3. ETCS Level 2 has been selected as the chosen level for Network Rail so we will limit our explanation to levels 0, STM and 2.

ETCS Level 0
Level 0 covers operation of ETCS equipped trains running on lines or sections of a line not equipped with ETCS. For example ,an unfitted line being upgraded in stages will have already upgraded sections of Level 1 track with the yet to be upgraded sections as Level 0.

Only a few basic functions are implemented, e.g. level transition and supervision of maximum train speed. No ERTMS/ETCS trackside equipment is used except for Eurobalises to announce level transitions and other specific commands.

Figure 2 ETCS Level 0

ETCS Level STM
Level STM is used to run ETCS equipped trains on lines equipped with other national train control and speed supervision systems. Train control information generated trackside by the national train control system is transmitted to the train via the communication channels of the underlying national system and transformed onboard into signals interpretable by ETCS.

The achievable level of supervision is similar to the one provided by the underlying national systems. In the UK this is the AWS/TPWS.

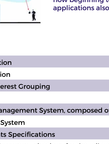


Figure 3 ETCS Level STM

ETCS Level 2
ETCS Level 2 is a fixed block continuous speed supervision system. The trackside equipment consists of centralised Radio Block Centres (RBCs) and distributed Eurobalises. GSM-R radio is used to transmit information to the train. Eurobalises are used as a means of initialising and periodically recalibrating the onboard odometer.

The RBC takes information directly from the interlocking on the aspects displayed (and therefore the status of the line ahead). The RBC is programmed with fixed infrastructure information and combines this with the variable information taken from the interlocking to select and then pass a serial message to the GSM-R radio for transmission to the train.
As GSM-R provides bi-directional (duplex) data transmission, real time data regarding train locations and speeds can be made available to the signalling control and train describer functions.

The RBC which provides the information to the trains knows each ETCS controlled train individually.

It provides continuous speed supervision and also protects against overrun of movement authority. Train detection and train integrity supervision are performed by the trackside equipment of the underlying signalling system (interlocking, track circuits etc.).

The system does not require trackside signals but they are often retained as a backup in case of system failure or in case not all trains operating on the line are ETCS equipped.

To summarise ETCS Level 2:

- Eurobalise tells train where it is.
- RBC tells train how far it can via GSM-R (Movement Authority) up to a fixed block marker board, permitted speed, target speed and distance data etc. Continuous updates by radio as train is detected moving.
- Onboard computer calculates maximum safe speed, braking curve speed, advises and warns driver by display in cab.
- Driver obeys cab indications.
- Onboard computer takes over control of vehicle if required.
- Control centre controls and monitors trains via interlocking.
- Interlocking processes control centre commands, controls and monitors "aspects" to RBC, train position (tracks), points etc. and sends indications to control centre.

Figure 4 ETCS Level 2

RTMS/GSM-R
The global system for mobile communications for the railway (GSM-R) provides digital radio secure and dependable communication between drivers and signallers.

In addition, it is a key component for ETCS Level 2 being the transmission medium for the signalling data. The GSM-R data radio interfaces to the ETCS system via a Radio Transmission Module (RTM).

A GSM-R ground network currently providing digital radio communication only, as is currently the case in the UK, will normally need to be upgraded to support the higher requirement for ETCS data transmission.

Figure 5 GSM-R network

ATO
Automatic Train Protection (ATP) is a safety critical system that protects against driver error and as described earlier is a key component of ETCS.

Automatic Train Operation (ATO), however, is a non-safety critical system that takes over the main driving tasks of accelerating and braking though with the driver typically retaining responsibility for closing of doors and station departure. At its most basic level, ATO enables trains to run automatically from one station to the next, only stopping between stations if required by the signalling system.

In short, ATP makes the train stop safely when needed whilst ATO is all about making the train go. If ATO is provided, ATP must be also as the ATP is the 'safety net' in the case that the ATO does not behave as it should.

ATO provides significant benefits in improving capacity as well as increasing the driver's flexibility, optimising train running, reducing energy and operating costs. It has been used in Metro applications for many years but is only now beginning to be considered for main line applications also.

Terminology

ATP	Automatic Train Protection
ATO	Automatic Train Operation
EEIG	European Economic Interest Grouping
EOA	End Of Authority
ERTMS	European Rail Traffic Management System, composed of ETCS + GSM-R
ETCS	European Train Control System
FRS	Functional Requirements Specifications
GSM-R	Global System for Mobile communications for the railway
Level	The different ETCS application levels (in short: levels) are a way to express the possible operating relationships between track and train, principally related to the trackside equipment used, to the way trackside information reaches the on-board units and to which functions are processed in the trackside and in the on-board equipment respectively
RBC	Radio Block Centre
SRS	System Requirements Specifications
STM	Specific Transmission Module
UNISIC	The seven ERTMS suppliers Alstom, Ansaldo STS, Bombardier, Siemens, Thales, CAF and AZD Praha

Far East mission for Eddie

In a government-supported initiative, our Project Director Eddie Murphy will be joining an RIA rail mission to the Far East. Eddie head off at the end of October and we wish him all the best!

RETB Update

Fenix Signalling's work on the far north interlocking has passed the stage of principles testing, completed in Harrogate and Stockport. The combination of short timescales and a large amount of testing saw our team working overtime to ensure we met the deadline. This required an additional principles tester and assistant testers to meet the demands of the project.

Testers are currently working on site on the TPWS commissioning – the next stage in the far north interlocking. Completion is expected imminently.

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