invensys™
Rail

# From signalling to rolling stock, Invensys Rail keeps Madrid moving...

Metro de Madrid. One of the largest and fastest-growing metro systems in the world. A staggering 283km of track – with another 75km to complete by 2011. Denser than any other mass transit system, Metro de Madrid services a population of six million and is renowned for affordable fares, fast rides and efficient services.

## Invensys Rail and Metro de Madrid

Our partnership began with the contract for the installation of Automatic Train Protection (ATP) and Automatic Train Operation (ATO) systems. Initially implemented on Line 7 we were subsequently asked to do the same for Line 6 and also to install a Centralised Traffic Controller (CTC). Since this initial contract, our involvement has grown and now Invensys Rail systems are in place on each and every metro line.

## The Metro de Madrid Enhancement project

This project led to improvements including a direct connection between downtown Madrid (Nuevos Ministerios) and the airport, lengthening Line 8; and adding service to the outskirts with a huge 40km loop. This loop (MetroSur) finally provided the southern suburbs with the transport they had been clamouring for. MetroSur, one of the largest-ever civil engineering projects in Europe, opened in April 2003. It connects five towns located in the area south of Madrid – Getafe, Móstoles, Alcorcón, Fuenlabrada, and Leganés – to the main Metro de Madrid network. The project included 40km of tunnels and 28 new stations, an interchange station and an additional station on Line 10 to connect city centre and local train networks. Construction began in June 2000, yet less than three years later it was completed, on time and to budget.

## The Invensys Rail solution

WESTRACE computer-based interlockings, jointless track circuits FS2550, MD2000 point machines, Automatic Train Protection and Operations systems (ATP/ATO), TBS100 (speed codes) and TBS500 (Distance-to-Go) have been commissioned across 102.7km double track of the Metro de Madrid network.

This system allows the trains to operate either with the ATP/ATO functionality in 'speed codes' mode or in 'Distance-to-Go' mode, thanks to a variety of ATP/ATO TBS500 systems (90 of the 3000s series and 52 of 9000s series).

## Ready for today... and tomorrow

The system has been commissioned with long-term efficiency in mind. Every train on the network is prepared to evolve to the SIRIUS CBTC (Communication-based Train Control) system. In the future, digital radio transmission for bidirectional exchange of information between the trains and the fixed equipment of the track will be introduced.

Furthermore, the entire Metro de Madrid Network has been integrated into the Centralised Traffic Control (CTC) system of Alto del Arenal, allowing operators network-wide access from a single control room.

| Metro de Madrid Upgrades 2004–2009 | |
|---|---|
| LINE 1 | Extension of line by 3 stations<br>ATP/ATO/CTC |
| Line 2 | Extension of line by 1 station<br>I/L, TC 50Hz, MD2000, side signals, CTC, ATP/ATO TBS100 |
| Line 3 | Extension of line by 7 stations<br>Implementation of DTG, upgrading of I/L to WESTRACE, TC jointless 2550, side signals, ATP/ATO/DTG |
| Line 4 | Extension of line by 3 stations<br>I/L, CV 2550, side signals, md2000, CTC, ATP/ATO TBS100 |
| Line 5 | Extension of line by 3 stations<br>I/L, CV 2550, side signals, md2000, CTC, ATP/ATO TBS100 |
| Line 7 | Extension of line by 1 station<br>I/L, TC 2550, MD2000, side signals, CTC, ATP/ATO TBS100 |
| Line 8 | Extension of line by 1 station<br>I/L, TC jointless 2550, MD2000, CTC, ATP/ATO/DTG |
| Line 10 | Extension of line by 1 station<br>I/L, TC jointless 2550, MD2000, CTC, ATP/ATO/DTG |
| Line 11 | Extension of line by 3 stations<br>Installation of DTG, upgrading and extension of I/L, TC joint less 2550, side signals, ATP/ATO/DTG |
| Line 7B:<br>'Metro Este' | New line with 8 stations<br>I/L, TC jointless 2550, MD2000, CTC, ATP/ATO/DTG |
| Line 10B:<br>'Metro Norte' | New line with 11 stations<br>I/L, TC jointless, 2550, MD2000, CTC, ATP/ATO/DTG |

With Invensys Rail support, Metro de Madrid looks set to become a worldwide reference for metro systems, not only in km and services but most importantly, in safety, reliability and comfort.

As Jesús Guzmán, General Manager of Invensys Rail in Madrid says:

"We hope to be an ongoing part of Metro de Madrid's rapid expansion and growth. We are proud to provide systems that contribute to a high quality service for metro passengers, as well as representing state of the art technology and safety-critical innovations for the market."

## The Technical Details

Invensys Rail products at work in Madrid include:

- Computer-based interlockings
- Automatic Train Protection Systems (ATP)
- Automatic Train Operation Systems (ATO)
- Centralised Traffic Controller (CTC)
- Traffic Regulation and Control
- Passenger Information systems
- Communications Infrastructure

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MADRID/9250/01/0909 RAILSIDE No 0004354 ISSUE 3