Trainguard Futur 1300
Level 1 ERTMS solution
Within the range of the Trainguard Futur family of train control systems made by Siemens, Futur 1300 is the Level 1 solution which provides great performance for operation and enhanced maintenance features for railway operators around the world.

Harmonized community transport policies are essential in a European Union of 28 countries. The ability to circulate from one member state to another using interoperable driving systems is becoming a fundamental requirement.

Achieving a single automatic driving system is crucial for the optimization of rail transport efficiency not only on a European scale but also for other countries outside the European Union (i.e. Saudi Arabia, Kazakhstan, etc.) which are considering this standard as a basis for their railway operation.

In order to develop such a system, it is necessary to establish common standards for on-board systems, the connection and communication interfaces between the different elements and the development of common procedures. In order to fulfil these requirements, the European Rail Traffic Management System (ERTMS) has been developed and is now being deployed worldwide.

Siemens has developed a full range of ERTMS equipment and systems, all of which are designed to deliver interoperability with the highest safety standards: the Siemens ERTMS solution is Trainguard Futur 1300.

Trainguard Futur 1300 complies with the latest versions of the technical specifications for interoperability, functionality requirement specifications (FRS), system requirement specifications (SRS) and all UNISIG-related specifications.
Key features
The Level 1 Trainguard Futur 1300 ERTMS system has the following features:

Operability
Trainguard Futur 1300 allows dynamic management of temporary speed restrictions (TSRs). Operator posts are used locally and at central and zone levels, thus enhancing system availability.

Modularity
Modularity in both hardware and software components makes enhancement of the system an easy task for future updates.

Connectivity
Interfacing with the interlocking may be done either in series via a safety integrity level (SIL) 4 data link, or in parallel through discrete fail-safe indications.

Reliability
The components employed in the Trainguard Futur 1300 system have been selected because they comply with the highest levels of reliability. They include components that are widely available, which means manufacturer support is available throughout the system’s lifetime and updates to newer versions are easier to implement.

Maintainability
Maintainability is provided through a maintenance assistance system allowing real-time access to system data – either locally or centrally.

Safety
The Trainguard Futur 1300 design adheres to the European standards CENELEC EN 50126, EN 50128 and EN 50129.

Localization
National functions and local requirements can be easily integrated with the Trainguard Futur 1300 equipment.

Architecture
The serial Trainguard Futur 1300 system can be based on centralized or distributed LEU architecture. LEUs are either located in the SER or along the line and are connected to a centralized LEU controller (usually an interlocking). This ensures great flexibility, providing high performance especially with regard to temporary speed restriction (TSR) management.

Serial interfaces are implemented through a TCP/IP network for communication with other systems – local and central ERTMS controls, temporary speed restrictions (TSR) management system, MAS, etc.

Very high availability is achieved through the design of architecture by means of a hot-stand-by configuration. The number of transparent-data balises controlled by each LEU is limited to four, so that in the rare event of a LEU failure the affected area is reduced to the minimum.

LEUs are based on a 2-out-of-2 architecture, with diversity at each processor.

System operation
Trainguard Futur 1300 is made up of:
- line equipment unit (LEU)
- fixed-data and transparent-data Eurobalises
- temporary speed restrictions manager (TSRM)
- ETCS local control panel (LCP)
- central ERTMS control (CEC)
- interface control (PCI)
- maintenance terminal (MaT)
- juridical recorder unit (JRU)

Trainguard Futur 1300 is a complete automatic train control (ATC) system which is based on information being sent to the train when passing over balises. Each balise receives telegrams containing the corresponding movement authority from the LEU associated with it.

To define the movement authority, the LEUs analyze the status of the outdoor elements – whether centralized via a link to the interlocking or by obtaining direct fail-safe inputs from points and wayside signals.
Centralized architecture
The Trainguard Futur 1300 system consists of the following basic elements:

**LEU – line equipment unit**
The LEU sends the movement authority to the balises. It is a redundant computer working in a 2-out-of-2 architecture with distributed software.

Each LEU is capable of controlling up to four balises. Signaling information comes from the interlocking, temporary speed restriction information comes from the TSR manager.

**LCP – ETCS local control panel**
The LCP is the subsystem allowing the operator to safely operate the Trainguard Futur 1300 system and to manage the temporary speed restrictions (TSRs). For this purpose, the operator uses a mouse and keyboard. All commands are registered in the juridical recorder unit (JRU) and all relevant information is displayed to the operator.

**TSRM – TSR Manager**
A specific system is used to handle all temporary speed restrictions, whether static or dynamic. Distributed software is used to create the tables with the messages containing the TSRs for the LEUs.

**PCI – interface PC**
A PCI machine is used to manage communications between the local equipment and the central ERTMS control (CEC) via the real-time operating network (RTON). This provides total isolation of the private signaling network to which the LEUs and CLCs are connected. A hot-standby configuration is used to guarantee communication availability.

**JRU – juridical recorder unit**
An accident-resistant “black box” unit is allocated to a number of LEUs, permanently recording all messages to and from each LEU, including faults and incidents related to the LEU and its communications. There is also a JRU associated with each LEC.

**CEC – central ERTMS control**
This subsystem manages all functionality available at ERMTS Levels 1 and 2 from a single control center.

Temporary speed restrictions are set safely via the CEC and then sent to the trains via the CLCs and TSRM.

A CEC may work independently or integrated within an operations control center (OCC). Any particular railway line may be split between several CECs, the transfer of commands between them being another available functionality.

The CEC is designed in a modular architecture for both hardware and software, allowing easy upgrades in the future.

**MaT – maintenance terminal**
The LEUs send maintenance information to a system designed for data storage and maintenance assistance, including fault location and communications health monitoring.

The MaT system is common to both Level 1 and Level 2 systems, providing real-time communication with maintenance staff through automatic e-mails, SMS, pop-up windows (to name just a few).

**Temporary speed restrictions (TSRs)**
Trainguard Futur 1300 includes an advanced system to manage temporary speed restrictions on the line. TSRs can be established and canceled by an operator simply and safely.

The system allows the operator to choose the TSR based on distance or track circuit location. Available speeds are set from 0 to 300 Km/h in increments of 5 km/h.

TSRs may be established through requests from several operating posts: ERTMS central and local units and OCCs. This provides a high degree of flexibility to the operator, allowing efficient and coordinated network management.
Trainguard Futur 1300 includes a powerful tool for testing and simulations in the test environment. This tool allows data validation for both Level 1 and Level 2. Tests in the field are then limited to correspondence tests between data and actual hardware.

Tests with this tool can be automated, thus saving engineering hours and testing times in the field. The system also proposes alternative solutions to the initial settings, thus enhancing final performance of the system and improving line utilization.

Data previously programmed at the LEUs – or RBCs – may also be checked and verified in a controlled environment.

The simulator is also capable of emulating several types of rolling stock and their corresponding characteristics, thus improving system performance.
The information in this document contains general descriptions of the technical options available. The required features should therefore be specified in each individual case at the time of closing the contract. For the secure operation of Siemens products and solutions, it is necessary to take suitable preventive action and integrate each component into a holistic, state-of-the-art security concept. Third-party products that may be in use should also be considered.