



SIEMENS

Ingenuity for life



Trainguard[®] Sentinel

Communications-based Train Authority and Protection System

Trainguard Sentinel provides safe, efficient train control in signaled and unsignaled territories; either as an independent train control system or as an overlay onto an existing signaling system.

By producing electronic movement authorities, Trainguard Sentinel fulfils the main requirements of a positive train control system by:

- preventing train-to-train collisions
- enforcing speed restrictions
- protecting track work zones
- preventing movements over a set of points set in a wrong position

Trainguard Sentinel interfaces to office and wayside systems via a range of communication options such as GSM-R, TETRA, VHF, UHF, LTE, WIMAX, etc.

With over 1,600,000 train kilometers of successful operation, Trainguard Sentinel is a proven, reliable choice for today's modern train control.

Benefits

Faster, more efficient and safer than manual systems

Mimic and train graph-based authority generation

Prevents conflicting authorities

Points controlled, locked and position-detected via data circuits

Complete fleet monitoring

Authority exchange via data radio (with optional voice communications)

Operation over different communication bearers

Driver receives written and graphical authorities

Prevents exceeding movement and speed authorities

Automated movement authority roll-up after train has passed

Simple, flexible and compact to retrofit into locomotives and other rail equipment

Retrofit capability for dark territories and CTC systems

Completely scalable solution, i.e. from a stand-alone, on-board solution to a fully integrated system

Capacity for logistics and fleet management

Fuel consumption estimation and fuel-saving profile selection (optional)

Trainguard[®] Sentinel components

Boosted capacity

Trainguard Sentinel is the ideal solution to increase the capacity of manual track warrant systems.

A train control center equipped with Trainguard Sentinel automatically prepares authorities using mimic route diagrams and train graphs. It sets, detects and locks track points before authorities can be issued.

Increased safety

Trainguard Sentinel generates and enforces non-conflicting movement and speed authorities. It can enforce penalty brake applications if the driver is not able to conform to speed limits or exceeds limits of authority.

Correct track points alignment and locking is checked by Trainguard Sentinel before permitting train movements over them.

- Using the in-cab display, the driver can at all times view all authorities, approaching track conditions, warnings and alarms.
- Operators can apply our portable on-board kit for use by track maintenance gangs for personnel and machinery protection.

Trainguard Sentinel can also add authority enforcement to existing centralized traffic control systems.

Affordable

Safety and capacity improvements are achieved with minimal wayside infrastructure, cost-effective in-cab equipment and lower-cost installation.

Description

Now is the time to move beyond paper-based track warrant systems with Trainguard Sentinel. This modular solution delivers electronic train orders with protection against exceeding authorities.

Control center

Trains and routes are displayed and controlled on a traditional mimic track diagram, supported with an electronic train graph. Train controllers can call short and long routes (long routes can be through multiple passing loops) using entrance / exit mouse commands or drop-down menus. Controllers can also stack routes for future moves where they cannot be immediately set.

Temporary speed restrictions and locking out of any track segment are possible to protect maintenance teams and on-site workers.

The exchange of text messages is possible between the train control center and any connected trains.

Communications

Trainguard Sentinel communicates with wayside track point controllers to detect, set, and lock track points. Once the route is available and free from conflicting moves, Trainguard Sentinel proposes a train order for acceptance by the train controller, followed by electronic delivery to the train with confirmation of acceptance from the train driver.

Voice licensing is always available when data communications may be unreliable or lost.

Trackside

Trainguard Sentinel works with wayside electronic interlocking object controllers such as Westrace / GEO. The object controllers receive commands from the train control center, operate over point track circuits, and set and detect the track points. The track points are set and locked with the over point track and time locking function. The object controllers then convey the status to the control center and to trains.

Existing CTC systems will use the electronic interlocking to detect authorized routes and transmit them to the train.

On-board equipment

The on-board equipment consists of the following modules:

- control module (CM)
- head-of-train module (HOT)
- brake interface module (BIM)
- human-machine interface (HMI)

The train driver uses the HMI, a compact, full-color touch-screen display for train movement authorities, messaging, track topography information and driver-assist functions. The HMI can be used by itself as a portable unit.

The Trainguard Sentinel compact on-board control module communicates with the train control center and also with object controllers at passing loops and other wayside infrastructure. The Siemens end-of train (EOT) and head-of-train (HOT) modules ensure that train integrity is intact at all times. Movement authorities, messages and locations are displayed on the HMI unit which shows real-time present locations on the railway network map.

Drivers operate the trains through the messaging and information displayed on the HMI display. This will show the current authorities, the limits of authority, permanent and temporary speed restrictions, ruling gradients and track topographical features. The progress of the train and that of other trains is also monitored. Speed and limit of movement authorities are enforced with early audible and visual driver warnings. If fitted, the optional brake interface module (BIM) will intervene and apply a full penalty brake application where driver reaction to the warnings does not occur.

Trainguard Sentinel can integrate with other proprietary driver-assist functions to optimize train operations.

Technical data	
Physical	
Module sizes	(S-9101 standard)
All modules	235 mm / 9.25" height
All modules	292.1 mm / 11.5" depth
Control unit	90.42 mm / 3.56" width
HOT module	64.77 mm / 2.55" width
BIM module	64.77 mm / 2.55" width
HMI display size	9.75" x 6.2" x 2.5" (w x h x d)
Mass	
Control module	7.8 lb / 3.5 kg
HOT module	6.8 lb / 3.1 kg
BIM module	6.5 lb / 3.0 kg
HMI display unit	4.5 lb / 2.0 kg
Environmental temperature	
Operating range	-40 °C to +70 °C
Storage range	-55 °C to +85 °C
Humidity range	0 % to 95 %
Vibration	5 to 10 Hz, 0.3" p-p 10 to 200 Hz, 1.5 g
Shock	11 ms, 10 g
EMS emissions	
FCC Part 15	109 Class B
ESD immunity	8000 V pulse MIL-HDBK-217F
Electrical	
Input voltage	74 V (40 V to 110 V)
Surge	125 V
Interruption	300 ms
Power consumption	
47 W (nominal)	
Speed and location	
GPS	12 V supply to receiver
Tachometer	20 / 60-pole axle
Tachometer	250-pole axle
Communications	
Wireless data	VHF radio @2400 bps
Carriers	satellite, GPRS and other external systems

End of train	
S-5701-complaint	
Human-machine interface	
Display screen	640 x 480 color backlit LCD
Keypad	
Touchscreen or keypad	
External interfaces	
Power	2 x 12 V source
Communications	3 x Ethernet, 2 x RS232 1 x CAN
Discrete I/O	
Input	8 digital 0 to 74 V DC
Output	digital 0 to 74 V
Brake interface	
Penalty	74 V
Emergency	4 V
Local cutout switch	
Remote cutout switch	
Protocols	
Messaging	S-9280.0111 (ITC EMP) S-9356 (ITC Class D) Qualcomm and Skywave ISATM2M
Back office	S-9252A (ITC office to locomotive ICD) and Siemens Rail 9000
Wayside	S-9253 (ITC wayside to locomotive ICD)
Installation and maintenance	
Mounting	
Modules	standard S-9101 rack mounts
Display	fitted in or mounted on control console
Trainguard Sentinel installation kits are available including mounting cables and radios as required.	
Diagnostics	
Local event storage	
USB file transfer	
LED panel indicators	
RS 232 maintenance port	
Siemens provides train control project delivery and engineering services for the office, wayside, locomotive and communication subsystems.	

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