The AURA Positive Train Control System

A Revolutionary CBTC / PTC Alternative For Transit Applications

METROM RAIL

The AURA Positive Train Control System (PTCS)

Providing comprehensive control system functionality

The Metrom Rail Advantage

Metrom Rail is a supplier of advanced sensor solutions. We offer a complete turn-key process in designing, manufacturing, servicing, and supporting products that provide unique functionality and return on investment based on individual customer needs.

AURA PTCS Core Technologies

Ultrawide Band Ranging System (UWB)

- UWB technology allows the AURA PRCS to provide accurate and reliable range measurements between train cars and signals without being affected by multi-path distortion effects that affect current systems on the market.
- The AURA UWB system ensures accuracy by broadcasting over a wide range of frequencies and filtering only the most optimal returns.
- UWB technology is enhanced in tunnels or urban environments thanks to a natural amplification of the system in these environments.
- Metrom Rail is the exclusive supplier of UWB technology to the railway industry.

RFID Integration

- Determines track identification
- Used to program localized train behaviors such as speed limits, berthing locations, work zones, etc.

Mesh Communication Network

- Facilitates communication between track-based assets
- Operates with 128-bit AES encryption
- Used to program localized train behaviors such as speed limits,

METROM RAIL OFFERS A PRACTICAL PTC APPROACH

The greatest obstacles to upgrading a train control system are cost and implementation. The Metrom Rail Positive Train Control System (PTCS) offers a modular, simple to install system at a fraction of the cost of conventional PTC/CBTC approaches. The PTCS utilizes intelligent nodes linked to key train systems connected through a mesh network, effectively eliminating the difficulties of installing a traditional PTC/CBTC system.

PTCS nodes integrate into trains, signals, and any other portion of the network which requires data transfer and communication. This approach offers signal compliance, speed limit adherence, and collision avoidance. Additional modules are available for precision berthing, worker protection, and train position.

PTCS will warn an operator to take action if any operating rule is violated. If no action is taken within a set period of time, the System will either decelerate or stop the train. A data recorder monitors all PTCS and train activity for event reconstruction or auditing purposes.

The System utilizes several sensor technologies, including a proprietary time of flight radio ranging system that calculates distances between assets in all environments to accuracies within +/- 1". All communication channels used incorporate 128 bit AES encryption for security.

The PTCS provides an open-architecture approach to integration. New nodes can be introduced at any time, providing customers with the ability to launch a System with limited capabilities and easily expand at any time. Expandability also extends into existing infrastructure such as signals or other track-based assets, as PTCS can connect to virtually any pre-existing hardware.

The installation process is greatly simplified by not requiring that the entire system to be integrated into a "back office" environment. This allows for a deployment schedule spanning months, rather than years. The PTCS is designed to accommodate existing agency rules and protocols, and will not adversely affect throughput or vehicle spacing.

AURA PTCS KEY FEATURES AND ADVANTAGES

- **Scalability** - Can be installed as an overlay on all or just a few trains in a system.
- **Time** - Installation and implementation on a full light rail system is accomplished over a matter of months, not years.
- **Cost** - Deployed at a fraction of the cost of traditional CBTC systems.
- **Efficiency** - As an overlay, AURA PTCS can supplement legacy systems without the need for costly replacements of infrastructure or modification of vehicles. Maintenance and installation is simplified by separation of key sub-systems.
- **Integration** - Minimal footprint of system components allow for installation in all vehicle types, without reducing passenger volume. Low power consumption reduces the need for vehicle power supply modifications.
- **Modular Configuration** - distributed approach allows for simple customization of system, additional system features or future expansion does not require hardware upgrades.
- **Extensive Testing -** All modules are designed and tested to both rail-specific and Mil-Std specifications.

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SYSTEM COMPONENT FEATURES

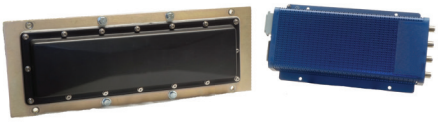
- Modular-distributed approach allows for customization of each system. Additional system features or future expansion does not require hardware upgrades
- Minimal footprint of system components allow for installation in all vehicle types, without reducing passenger volume
- Maintenance and installation is simplified by separation of key sub-systems
- All modules are designed and tested to both rail and Mil-Std specifications
- An additional Vehicle Interface Module (VIM) includes sensors and interfaces for monitoring and gathering information on key vehicle parameters required for system operation

Train Control Module
The TCM is a small, lightweight control center that serves as the main interface for all modular on-board functions.

User Interface Module (UIM)
The User Interface Module is located in the cab, provides interface between the operator and the PTCS. User Interface module can be configured with an application specific interface (as shown) or as a 7” full graphic version.

Signal Module
An Integrated Signal Assembly containing communication radios for transmission of signal presence and state.

Antenna Module
The Antenna Module is located on the train exterior, and contains communication and GPS hardware



RFID Modules
RFID Modules consist of processing unit and antenna, which is flush mounted to the exterior of the train.

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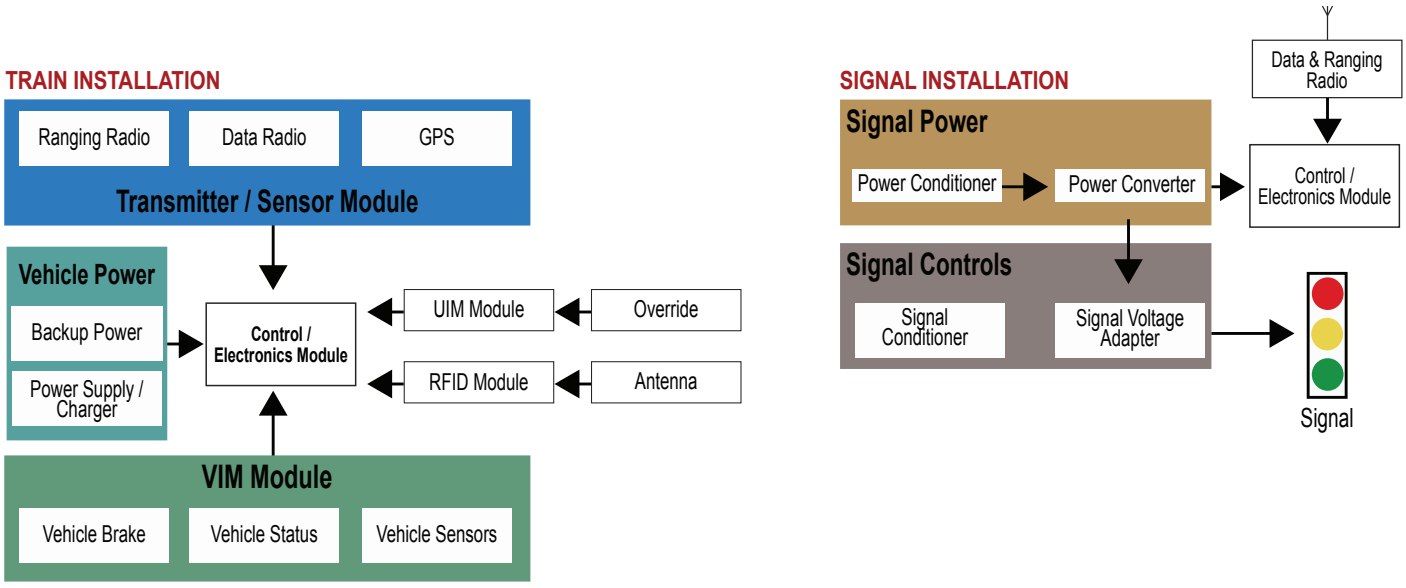
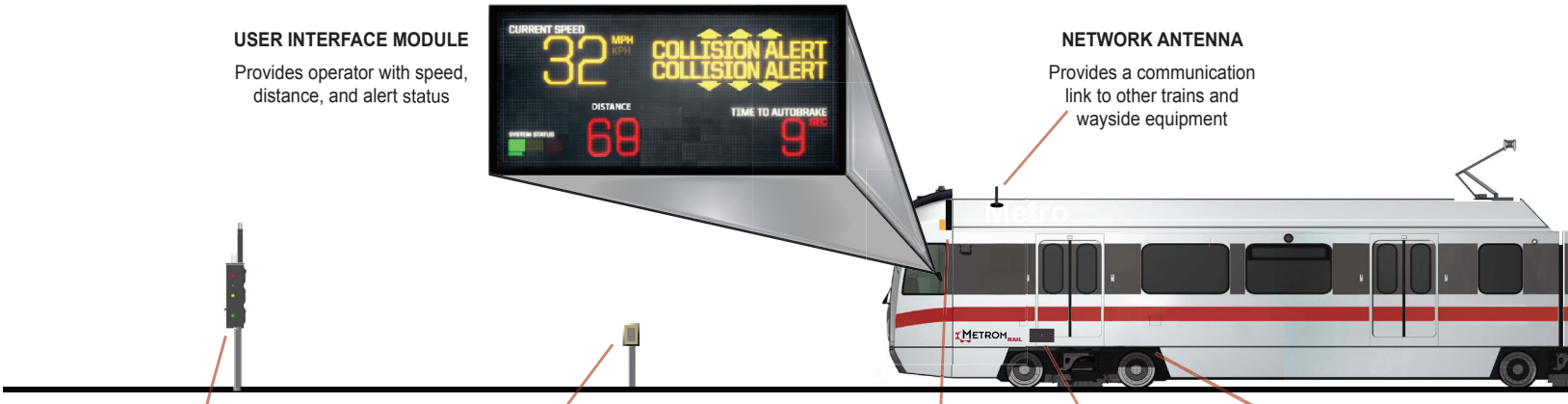
SYSTEM INTEGRATION

- Equipment Installation requires a Transmitter / Sensor Module and network antenna, Integrated vehicle sensors (monitor speed, consist status, etc.), RFID module, power supply module, and User Interface Module. Components are installed where most efficient in each vehicle, allowing for best utilization of available space.
- Signal Installation can consist of either an integrated Metrom Rail signal, (which contains all communication elements for use with AURA PTCS), or an independant package for legacy signals.
- AURA PTCS communicates with integrated signal elements to determine the signal state, or with wayside-based RFID tags which indicate train position / track, direction, limits, local track conditions, and provide location-based stopping awareness.
- System redundancy is established through multiple communication and data channels, as well as duplication of critical hardware component functions.





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AURA POSITIVE TRAIN CONTROL SYSTEM PRIMARY FUNCTION

FOUR MAIN FUNCTIONAL TARGETS

AURA PTCS serves four primary functions for standard configurations. These functions include signal compliance, speed limit enforcement, separation enforcement, and position monitoring.

Signal Compliance

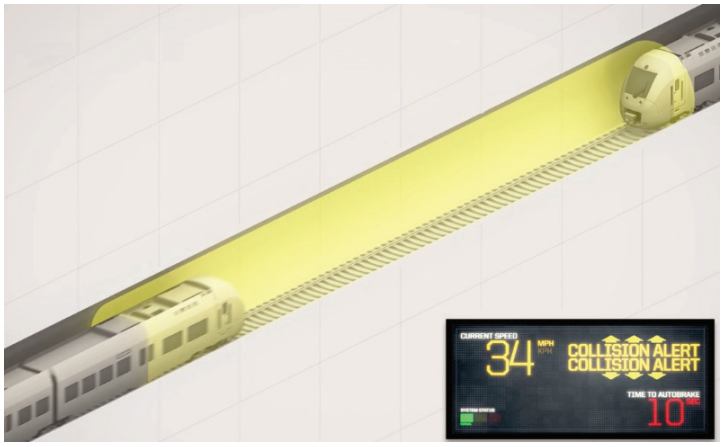
AURA PTCS will identify when a train is approaching a signal indication which requires operator action. A speed and distance calculation is used to determine the required safe stopping distance for the train. If this zone is compromised, the system will alarm, indicating the need to slow or stop. If appropriate action is taken, the system will automatically be silenced. If no action is taken, the system will initiate an automatic braking procedure to ensure the vehicle stops or slows in accordance with the signal indication.

Speed Limit Enforcement

Prior to any critical point in the track, such as a curve or station, AURA PTCS will alert operators to speed limit violations. The system will silence automatically when action is taken to comply with a speed limit. Non-compliance will result in an automatic braking procedure.

Separation Enforcement

AURA PTCS will identify when two trains are approaching each other where speed and distance do not provide a safe margin for stopping. The train speed, closing speed, and separation distance are processed to calculate a required safety zone. If this zone is compromised, the system will alarm, indicating the need to slow or stop. If appropriate action is taken, the system will automatically be silenced. If no action is taken, the system will initiate an automatic braking procedure to ensure the appropriate vehicle stops to prevent a collision.



Position Monitoring

Each AURA PTCS creates a local network which communicates with wayside equipment and other passing trains. Information is exchanged between systems and equipment, including position, speed, alarm history, and diagnostic information. This data can then be transmitted for analysis and real-time position awareness of vehicles within a system.

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