



Amtrak Acela in service at NEC (Courtesy of Amtrak)

PTC

A PTC TURNKEY SOLUTION FOR AMTRAK

A TRUSTED SYSTEM TO LAUNCH HIGH SPEED RAIL

In order to allow high-speed rail operation on the Northeast Corridor (NEC), the Federal Railroad Administration mandated Amtrak to add enhanced protection functionality to their signaling system. The existing 4-aspect cab signal system did not provide this protection, so in 1997 Alstom's Advanced Civil Speed Enforcement System (ACSES) was selected to operate in Amtrak's network as they expanded its cab signal to a 9-aspect system.

As a result of the project, the solution was deployed on three lines of the NEC including over 50 interlockings and over 400 on board systems installed on various types of vehicles. Alstom's solution provided the mandatory requirements for high-speed rail operation and added new monitoring capability to the overall system to ensure safe train separation and enforce "signal" speeds.

The ACSES solution has been in operation for over 10 years and is still in place today in the NEC.

ACSES is in compliance with the requirements and final rule for Positive Train Control systems as it reliably performs the functionalities required by the FRA.

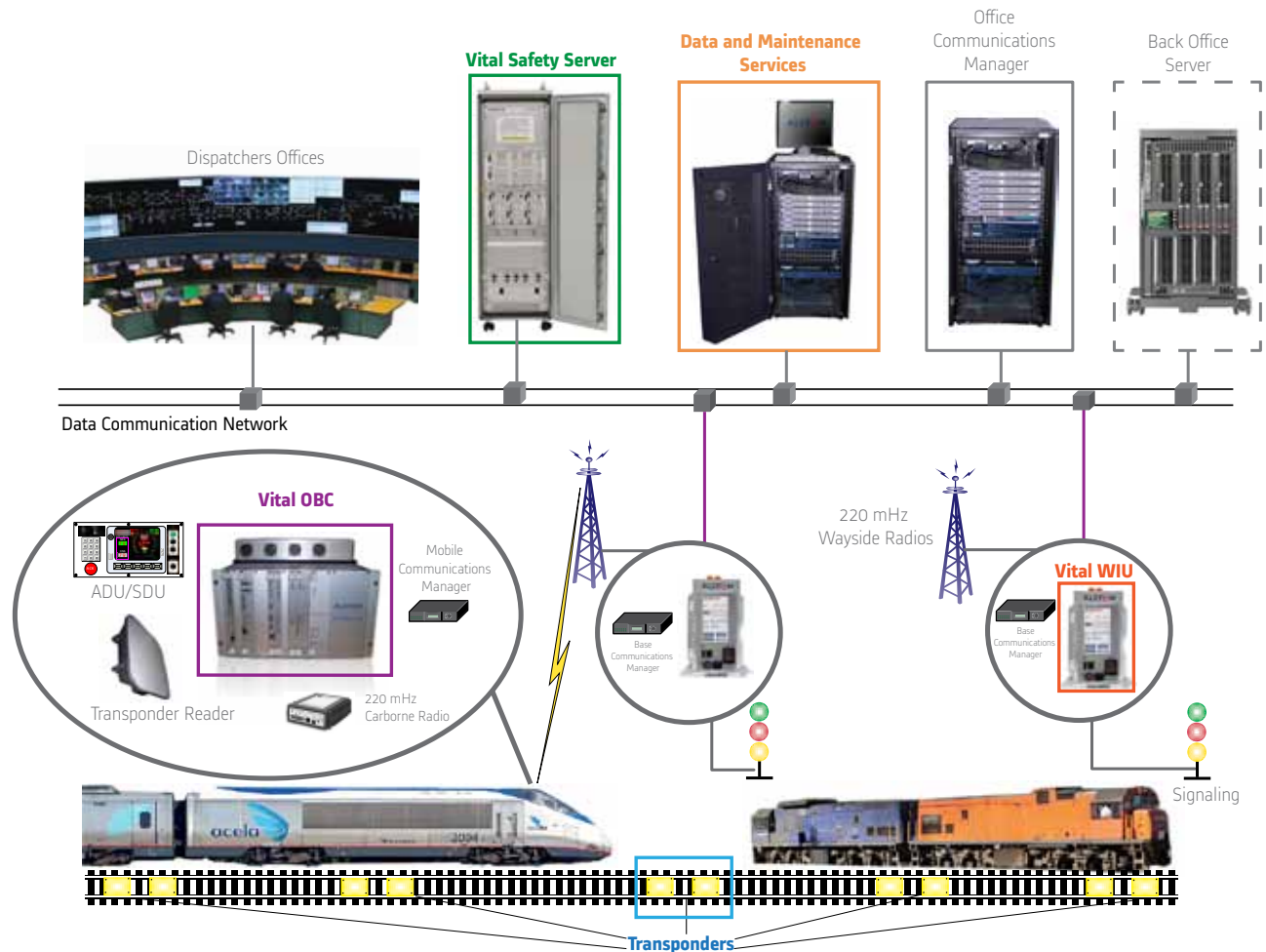
Only available fully functional PTC solution with FRA Type Approval (49CFR236 subpart I) in revenue service since 2000.

In This Section:

- ACSES
- microWIU
- Onboard Computer (OBC)
- 7R Switch Circuit Controller
- Train Life Services

> ACSES - Advanced Civil Speed Enforcement System

ACSES SYSTEM DIAGRAM



FEATURES

- > **Maintenance information from the onboard and the wayside equipment is provided directly to the maintainers' stations via the communications network**
- > **Network management system monitors the state of the communications network, radios and WIU's**
- > **Can easily connect to your control enter, or a TSR local control station can be provided for the TSR entry function**

Alstom's **Advanced Civil Speed Enforcement System (ACSES)** is a service proven Positive Train Control (PTC) solution. It is a continuous speed control system with intermittent transmission of data from transponders and radios. ACSES core functionality utilizes Alstom's worldwide products for PTC systems. ACSES is in operation on the Northeast Corridor (NEC), the busiest rail segment in North America, allowing high-speed train travel up to 150 mph.

> ACSES - Advanced Civil Speed Enforcement System

MODULARITY

- > The technology is adaptable to meet customer needs
- > ACSES is a cost-effective upgrade of signaled territories to include enforcement and is suitable for non-cab signaled territories

SUBSYSTEMS

Transponder to Train Transmission Subsystem

- > Location, speed control and auxiliary data sent to train at regular intervals along the track
- > Simple, safe and accurate location determination system
- > Passive transponders powered by the antenna located under the train
- > Data from transponders stays available in case of radio unavailability

Vital On-Board Subsystem

- > Acts upon the data received from the transponders, WIU's and safety TSR server
- > Determines precise location of train
- > Builds and enforces maximum speed envelope
- > Manages interfaces with customizable ACSES display unit, cab signaling system and other vehicle equipment
- > Can manage other miscellaneous functions such as propulsion voltage breaks
- > Embedded in Micro Cabmatic OBC platform with or without ATC

- > ACSES can be added to a separate and independent existing cab signal system, successfully merging two rail road safety technologies, or as a standalone train protection system

- > ACSES is a modular system that can be deployed in stages

- > Used where an interface to signaling is required

- > Safely encodes and transmits to train signal status and route data

Communications System

- > An onboard to wayside radio system used to transmit TSR, signaling, and maintenance data to/from the train

- > Redundant communications equipment at a central location to control message routing and delivery between equipment

- > Radios and communications system are used for the NEC application. ACSES application messages are self-protecting and ACSES can use various types of communication subsystems depending on the communications services required by each application

Safety Server

- > A centralized server safely manages all temporary speed restriction data to/from train and to/from dispatchers

- > The safety server is a standard Alstom product designed for use in the rail industry that can be utilized for various vital server applications

> microWIU - PTC Wayside Interface Solution

 **NEW**



FEATURES

- > **Very small footprint for I/O capability**
- > **Low-power design for solar/alternative energy compatibility**
- > **Integrated color touch-screen display**
- > **Embedded web server**
- > **16 vital digital inputs and 2 non-vital outputs per unit**
- > **Simultaneous AAR ITC and ACSES protocol operation**
- > **Stackable system**

A compact, standalone vital **Wayside Interface Unit** where low-cost, scalable capability is required to monitor vital input sources and interoperate with the PTC network.

ADVANTAGES

- > **Configurable with or without a computer**
- > **Faster installation and maintenance through use of touch screen**
- > **Local and remote configuration and monitoring**
- > **Low cost to capability ratio**
- > **Provides support for ITC and ACSES in one application tool**
- > **Ease of application**
- > **User-friendly design tool for defining configuration data and boolean application logic**

Lowest Cost, Smallest size
(3.5" w x 7" h x 11" d) for
communication I/O and
field I/O capability.

Touch-screen for convenient
configuration and
status interface.

> microWIU - PTC Wayside Interface Solution

APPLICATIONS

- > Small to medium scale overlay of existing signaling locations
- > Hand Throw Switch and Hazard (e.g. slide fence) monitoring in dark territory
- > Up to seven microWIU units can be interconnected (one master and six slaves)
- > Up to two external IP communication paths such as radio, fiber



Allows multiple units to be interconnected and appear to a PTC network as a single, large WIU.

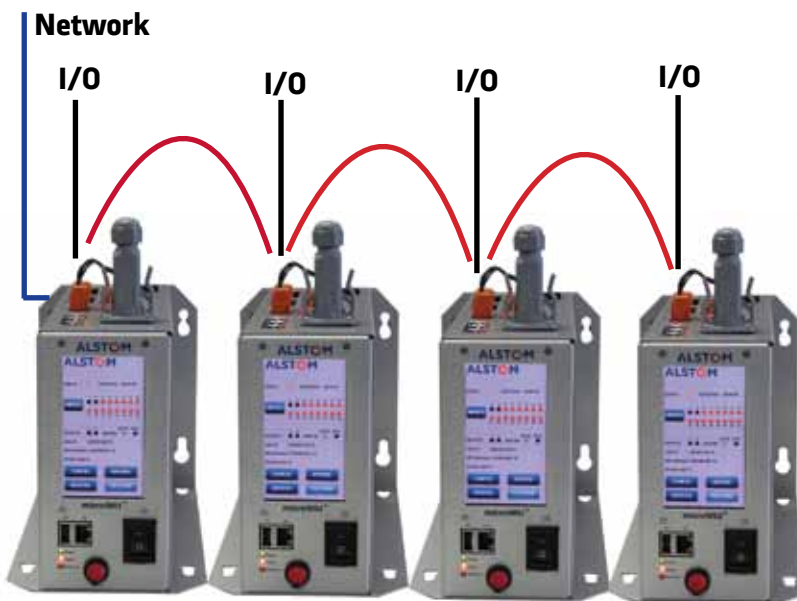
Ability to increase input count up to 112 inputs and 14 outputs with 7 stacked units.



Front View



TopView



Stacked microWIU System (master and 3 slaves)

> OBC - Alstom's PTC Onboard Computer



NEW PTC - OBC Synthesys

ADVANTAGES

Micro Cabmatic™ Platform

- > Compact, package – half the space of relay-based systems
- > Reliable, economical solid-state microprocessor design
- > Uses modular, expandable “building block” approach
- > Designed for maintainability – Removable modules, Eurocard-standard PC boards, front-mounted status LEDs, test points, diagnostic menus and serial diagnostic tool connections
- > May be custom-configured to meet operating requirements for transit, commuter or railroad operations

ACES Enhancements

- > A cost-effective upgrade to enforcement in signaled territories, including non-cab signaled territory
- > Can function with cab signals or serve as a standalone system



Micro Cabmatic™ III - OBC with full ATC/ACES functionality

Interfaces

- > ATP Receiver Coils
- > Speed Sensors
- > Transponders
- > Carborne Systems
- > Aspect Display Unit
- > WIUs
- > Safety Server
- > Communications System (Radio Network)

> OBC - Alstom's PTC Onboard Computer

FEATURES

ATC

- > Cab Signal Reception and Decoding
- > Speed Sensing
- > Overspeed Detection
- > Digital Brake Assurance
- > Zero Speed Detection
- > Unintentional Movement Detection
- > Rollback Detection
- > Data Logging

Transponder Transmission Subsystem

- > Location, civil speed limits and auxiliary data sent to train at intervals along the track
- > Simple, safe and accurate location determination
- > Passive transponders are powered by the antenna mounted under the train

ACSES

- > Acts upon data received from Transponders, WIUs and the Safety Server
- > Determines the precise location of the train
- > Builds and enforces maximum speed envelope
- > Provides Positive Train Stop protection even if radio is unavailable
- > Protects against signal overruns, train-to-train collisions and overspeed incidents
- > Enforces Temporary Speed Restrictions
- > Can manage tasks such as tilting authorization, voltage breaks and grade crossing functions

Specifications

Data	Value
Operating Conditions	
Temperature Range	-40°C to +70°C
Relative Humidity	0 to 95%
Vibration	5-20 Hz, 0.070" p-p
Vibration	20-100 Hz, 1.4g
Mechanical Shock	4g
Storage Conditions	
Temperature Range	-55°C to +85°C
Relative Humidity	0 to 100% non-condensing

> 7R Switch Circuit Controller



7R Switch Circuit Controller in service at customer location



As part of a comprehensive PTC Solution, Alstom introduces the first **Rail-Mounted Switch Circuit Controller**. The electro-mechanical unit is derived from the original 7K design, but now includes improved features such as IP-67 frost-protected Limit Switches, Vibration Isolation mounts, and a robust design profile that allows it to clamp to the rail base.

This new design can be used on Mainline, Yard, or Dark Territory applications, as needed for PTC or independent detection requirements. Its value is evident in the reduced Man-Hours needed to install the unit (compared to a conventional tie-mounted unit) and the reduction of department coordination involved in doing so (no track crew needed).

Positive, dual-point detection independently verifies both normal and reverse positions - reducing derailments and improving velocity. The unit can be quickly clamped to the rail and is an ideal product for concrete-tie locations, rotted wood-tie track, and new construction needs. It is also designed in such a way that it can be mounted directly to wood ties if needed.



7R Switch Circuit Controller being installed at customer location

When coupled with Alstom's microWIU, you have an ideal PTC solution for wayside equipment.

The 7R Switch Circuit Controller is proof positive that Alstom leads the industry with innovative designs and ground-breaking PTC technology.

FEATURES



Rail-Mounted

- > One unit for normal and reverse detection
- > Eliminates extended ties used for conventional circuit controller mounting
- > Unit sits minimum of 1" below Head of Rail
- > Will mount to all rails 115# and Higher

Perfect for Dark Territory Environment

- > Rail Mounted "Between the Tie" design minimizes impact of Rail-Creep on poor track beds

New Limit Switches

- > No springs or contact fingers
- > Field replaceable, compact design
- > Environmentally Sealed: IP67

Easy Adjustment

- > Same, proven adjustable cam & rocker design as the 7K
- > Updated Centering Attachment
- > New Cover-Gasket Tension Bolt

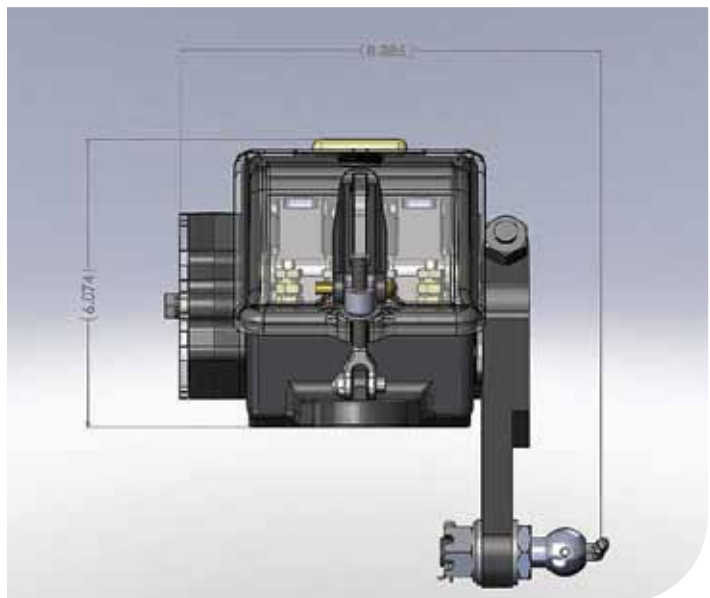
Environmental

- > - 40 to 70 Celsius temperature range
- > AREMA Class G vibration (10G)



Dimensions

- > Length: 15" (Back, from Base-Edge of Rail)
- > Width: 8.9" (Arm & Centering device incl.)
- > Depth: 2" (From Bottom of Stock Rail)
- > Height: 7.6" (From bottom of mntg. Bracket)
- > Weight: 47 Pounds



> PTC Kitting and Logistics Customized Solutions

PTC RAPID WAYSIDE DEPLOYMENT

Alstom's PTC deployment support takes advantage of extensive global resources and Alstom developed system tools to offer full supply chain and logistics management, as well as kitting third-party products into immediately available and site-ready PTC solutions available from warehouses across the country.

- > **Complete supply chain management services**
- > **Kitting, packaging and off the shelf delivery**
- > **Installation and technical support services**

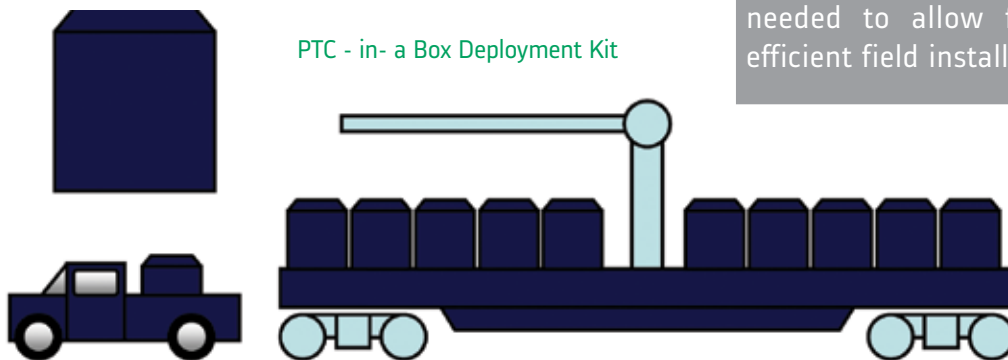


PTC IN A BOX APPROACH

For your convenience, Alstom also offers a PTC-in-a-Box Solution that enables integration of the necessary materials for a smooth PTC deployment.

The PTC-in-a-Box solution is a convenient and reusable package that can include Alstom's microWIU or 3rd party products as required and determined by your Railroad.

In addition, the PTC-in-a-Box will include all the ancillary equipment needed to allow for a quick and efficient field installation.



> PTC Kitting and Logistics Customized Solutions

BENEFITS

- > **No need to issue multiple purchase orders**
- > **On-time delivery of the complete set of required materials**
- > **Support of your RR's PTC material sourcing strategy**
- > **Assistance with PTC wayside installation**
- > **Management of short and long term costs of PTC wayside deployment**
- > **Ease of installation**
- > **Customized Configuration**
- > **Integration of sub-kits for applications requiring WIU and radio only**
- > **Reusable packaging creating a "green" deployment solution**



Dark Territory Wayside Installation - PTC -in-a-Box

As the final architecture and component design are brought together, the wayside WIUs are contained in the enclosure shown in the field image below. The enclosure is mounted to a pole which has its own power supply and communication antenna.

Convenient Package		
Contents	Ancillary Equipment	Services
WIU USB memory stick Enclosure Data Radio Antenna Solar Panel Batteries Pole and base	Tools Safety equipment Calibration equipment First Aid kit Foundation	Pre-wiring Testing Commissioning