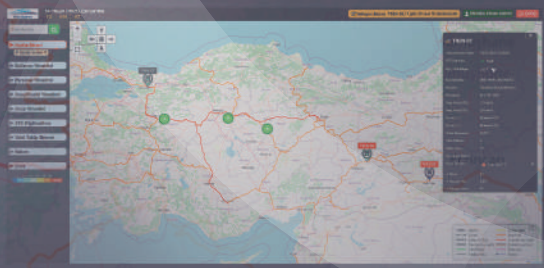
RAIL TRANSPORTATION SYSTEMS

Savronik

39 years | 2 0 2 5

LOCOMOTIVE TRACKING SYSTEM

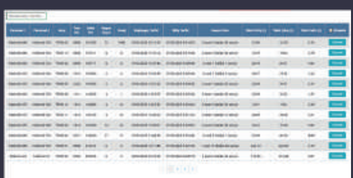
Savronik
39 years | 2 0 2 5



- Layered Architecture
- Digital/Geographic Map Option
- Locomotive Identification and Information Display
- Real-Time Locomotive Speed Display on the Map
- Display and Reporting of Vehicle Speed, Latitude-Longitude, Delay, and Position in TCDD Kilometers
- Reporting of Locomotive Historical Data, Error Analysis
- PC and Mobile Device Access via Web Browser
- Wheel Diameter Measurement System
- Fuel Monitoring System
- Email Service
- Failure Notification
- Maintenance Tracking System
- Performance Analysis
- Vehicle Usage Analysis

REPORTS

- Speed Report
- Speed Violation Report
- Livre Speed Exceeding Report
- Speed Limit Violation Report
- Regional Time Violation Report
- Red Light Violation Report
- ATS On-Off Status Report
- ATS Off Violation Notification
- Machinist Working Time Report
- Locomotive Fuel Consumption Reports:
  . Fuel Monitoring
  . Fuel/Energy Consumption Analys
  . Machinist/Fuel Consumption Reports



METEOROLOGICAL INFORMATION STATION

Savronik

39 years | 2 0 2 5

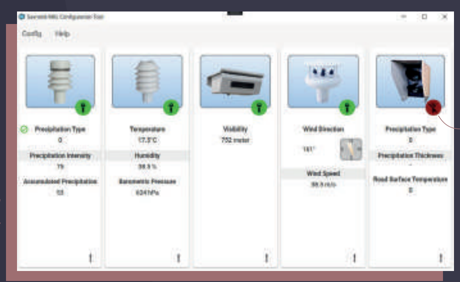
The Meteorological Information Station (MIS) enables the detection and monitoring of environmental conditions through sensors placed on highways, bridges and tunnels in order to ensure safe road transportation. In this way, it prevents the risks that may be encountered due to weather conditions.

Savronik MIS Configuration Software Tool allows to monitor the data of the sensors on the station from the control buildings in the tunnels. In addition, data transfer to SCADA systems provided by Modbus TCP/IP and by this way, it can be integrated into the related project's own control unit.

System Advantages

User Friendly Interface Design

Savronik MIS Configuration Software Tool, designed for tracking sensor data, provides a more understandable interface by supporting the road surface condition and weather conditions with visuals.

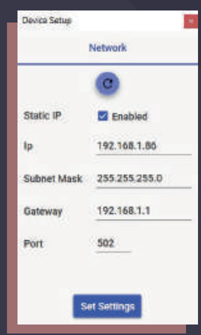


Uninterrupted Data Transmission

In the event of a sensor failure in the system, the system design that can operate independently of the defective sensor ensures that the data from other sensors are transferred to the control unit without interruption.

Configurable Design

It provides fast and easy solutions to different needs with communication protocols such as MQTT, LoRaWAN and integration of different sensor types into the system.



Adjustable Address Support

Thanks to the ability to change the IP address with the Savronik MIS Configuration Software Tool, it provides an easy integration opportunity with other control units.

Sensor Technical Specifications

	Temperature,Humidity, Pressure Sensor	Wind Speed and Direction Sensor	Precipitation Sensor	Visibility Sensor	Road Condition Sensor
Operating Temperature Range (˚C)	-40 ˚C ~ +70 ˚C	-40 ˚C ~ +70 ˚C	-40 ˚C ~ +70 ˚C	-50 ˚C ~ +60 ˚C	-40 ˚C ~ +70 ˚C
Operating Humidity Range (RH)	%0 ~ %100	%0 ~ %100	%0 ~ %100	%0 ~ %100	%0 ~ %100
Measurement Range	Temperature: -40 ˚C ~+80 ˚C Humidity: 0 % ~100% Pressure: 150 hPa ~1100 hPa	Direction: 0 ˚ ~+360 ˚ Speed: 0 m/s ~ 70 m/s	0.01 mm/h ~ 500 mm/h	10 mt ~ 2000 mt	Water: 0 mm ~ 10 mm Ice: 0 mm ~ 10 mm Snow: 0 mm ~ 10 mm
Accuracy/ Resolution	Temperature: ± 0.5˚C Humidity: ± 2% Pressure: ± 1 hPa	Direction: ± %3 Speed: ± %2	0.1 mm	± %2	0.01 mm
IP Protection	IP65	IP67	IP65	IP65	IP68

INTEROPERABILITY SYSTEM

RailLink Interoperability System is a gateway structure that provides efficient and fast communication among radios, IP based telephones and GSM network forming a single network.

System provides conversion of radio analog signals to digital signals and transmits the digital signals in IP based form. Also, system converts received IP based digital signals to analog audio form and transmits analog audio signals to radios.

Its distributed architecture allows institutions/organizations to operate independently and also provides central administration for supplies. System enables creating virtual groups and ability to share applications or application-specific data among group members.

With the voice recording solution with a Turkish/English interface, which is a part of the communication system, the voice communication carried out within the network is recorded in the campuses. Records can be accessed and listened to according to the recorded parameters.

System enables creating virtual groups and ability to share applications or application-specific data among group members. With the Command/Control interface software, operators have the opportunity to create and monitor call groups.

RailLink Interoperability System comprises of Equipment Cabinet and sub-units. Compact usage of IP Gateway and Radio Gateway sub-units is provided in Savrolink Equipment Cabinet.

Equipment Cabinet includes

- Radio Gateway
- IP Gateway
- GMS Command/Control Interface Software
- Led Based Lightning ve Fan Cooling
- Power Panel

TECHNICAL SPECIFICATIONS

IP Protocol Support	: IP, Multicast/Unicast RTP, SIP, RoIP, VoIP
Analog Radio Port	: 4 x DB-15
Network Inteface	: 2 x 10/100/1000base-T, IPv4, IPv6
Ethernet Interface	: RJ45
Serial Port Interface	: RS-232
USB Port	: 3x USB
Audio Compression	: G.711 (64 Kbps PCM) µ-law, G729 Annex B, Linear 16
Power Requirement	: 100-240 VAC @ 50/60 Hz

RADIO INTEGRATION

Impedance	: 600 Ohm
Termination	: Balanced or Unbalanced
Max Input/Output Level	: 1 Vpp, (800 mV RMS 0 dBm)
Integration Types	: PTT Wire Interface (E&M), 2/4 Wire EIA Tone
Control Input/Output	: 5VTTL, In - COR, TX Grant, Out - PTT

ENVIRONMENTAL SPECIFICATIONS

Temperature	: 0-60°C
Vibration	: 2.17 G (5-700 Hz)
Shock	: 1,5 G, 0.5 ms

SCADA

Savronik
39 years | 2 0 2 5

SCADA (Supervisory Control and Data Acquisition) is a type of automation system used for monitoring, controlling, collecting data, analyzing, and reporting processes. It enables the automatic or user-commanded control, supervision, and reporting of all units within a facility or operation, ranging from equipment control to production planning, and environmental control units to auxiliary operations.

In a SCADA system, data is presented to operators through a graphical user interface (GUI) to ensure fast and easy usability.

USAGE AREAS

- Energy Sector
  Power generation facilities such as hydroelectric power plants, thermal power plants, and wind power
- Water and Wastewater Treatment
  Water treatment plants, water distribution systems, and wastewater treatment plants
- Oil and Gas Industry
  Oil, and gas production sites, pipelines, and storage facilities
- Transportation Systems
  Highways, railways, airports, and subway systems
- Manufacturing Industry
  Manufacturing facilities such as automotive, food and beverage, chemical, pharmaceutical, metalworking
- Buildings and Infrastructures
  Energy management, HVAC (Heating, Ventilation, and Air Conditioning) control, lighting management, security systems, and fire detection systems in large building complexes (hospitals, shopping malls, hotels)

FUNCTIONAL FEATURES

- Desktop and web support
- Industrial communication protocol support (Modbus, OPC DA, SNMP, MQTT, etc.)
- Custom protocol support through a public API
- Integration support with SCADAs from different brands using thirdparty software
- Dynamic language support
- Customizable control infrastructure
- Certificatebased security
- Advanced authorization system
- Scripting language support
- Reporting and trend tools
- Detailed data logging and analysis capabilities
- Automatic updates
- Dynamic visual changes during usage
- Distributed architecture support

DESIGN CRITERIA

- Security
- Flexibility and Scalability
- UserFriendliness and Simplicity
- Innovative and Contemporary Design Approach
- EventDriven Approach
- Modular Structure
- Event Bus Communication
- Container Support
- Microservices Architecture
- Distributed Architecture

Savronik
39 years | 2 0 2 5

STM
SPECIFIC TRANSMISSION MODULE

The Specific Transmission Module (STM), is the interface equipment that enables the vehicles equipped with the ERTMS system to be operated on the lines equipped with conventional signaling systems. STM ensures the ERTMS system to perform four main functions safely on railways equipped with conventional signaling systems:

- Communication between the line-side antennas and train-side antennas.
- Warning of the train driver according to the signal information on the line-side.
- Determination of whether the train driver reacts according to the warning or not.
- In cases where the train driver does not react to the warning, necessary intervention is done by the system.

* STM can be operated in ATS Mode on locomotives without ETCS.

GENERAL FEATURES

SIL certified
High reliability and stability
Compliance with railway standards
Expandable architecture
Complete compatibility with ETCS
Capable of working in ATS Mode

COMMUNICATION PROTOCOLS

PROFIBUS
CANBUS
GSM(4G / LTE)
ETHERNET

BASIC TECHNICAL PARAMETERS

Rated Operating Voltage	: 72Vdc, 110Vdc
Operating Temperature	: -25ºC to +85ºC
Cover Rating	: IP20
Standard Compliance	: EN50155, EN50128, EN50129, En45545
EMC	: EN50121
UNISIG Standards	: SUBSET 27/35/56/57/58
Mechanical Dimensions	: 84HP Subrack & 3U PCB

Subsystems

Main Control Unit

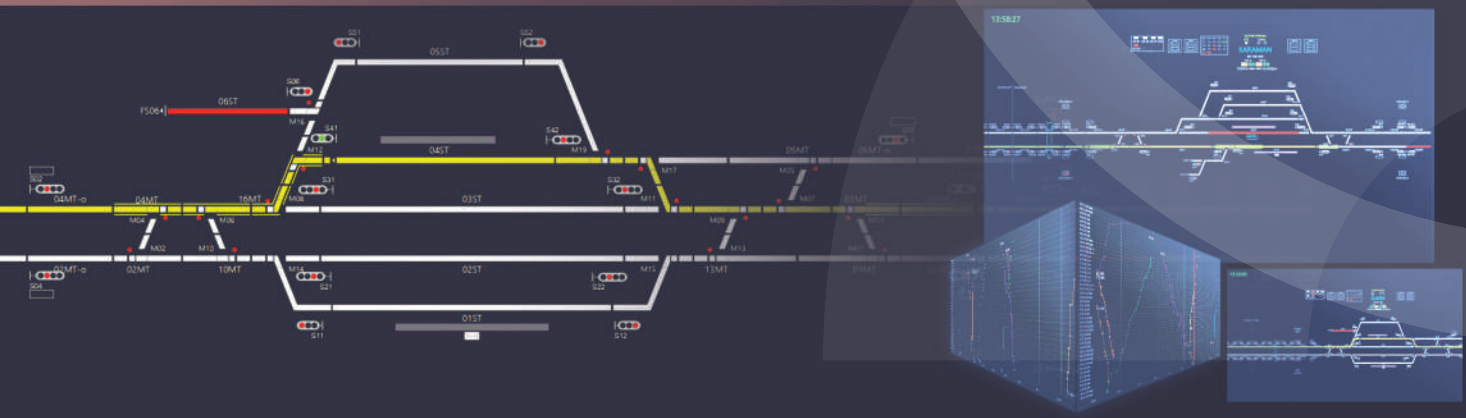
- Processing Module
- Signal Generation Module
- Signal Detection Module
- I/O Isolation Module
- Communication Module
- Power Supply Module

DMI (in ATS Mode)

CTC

CENTRALIZED TRAIN TRAFFIC CONTROL SYSTEM

Savronik
39 years | 2 0 2 5



Train Traffic Control System (TTRAKS) is a railway operating system. The function of the TTRAKS is to control and direct the signaling and field equipment over a certain line through the interlocking system. Furthermore, it controls records and store the malfunction and maintenance situation of the line equipment. It directs the train routes by controlling the line equipment. The operator directs and controls the system.

TRAINGRAPH

- Detailed station view or general view
- Customizable color scheme
- All data accessible up to 3 years
- Adjustable detail level down to miliseconds up to days
- Shared and stored train notes
- Precise lateness/early arrival time calculation
- Fast and responsive user interface

TTRAKS
TREN TRAFiK KONTROL SiSTEMi

- Can be easily modified based on end user requirements/needs
- Multi-language HMI support
- User friendly graphical interface
- Modularized and flexible software design, to meet user needs
- Recording, monitoring and replaying interlock events
- Easy to customize software design to SIL 0, SIL 1 and SIL 2 safety integrity levels
- Ease of routing through multiple interlocking zones
- Automatic train identification
- Time synchronization within the whole system
- A relational data base used to provide a historical data recording.
- Visible and audible alarms to the dispatcher
- Customizable alarm priorities
- Diagnosis function that reduce system maintenance time
- Architectural design that can be easily integrated into any interlocking system
- Standard user interface adaptable to country needs
- Access and management capability for the line by the dispatcher

VKB

DATA RECORDING UNIT

Savronik
39 years | 2 0 2 5

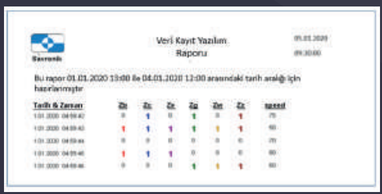
Event Recorder (Data Recording Unit) is a on-board equipment that records data such as speed and ATS (Automatic Train Stopping) system data. The data is intended for use in the investigation incidents, but is also used to monitor the performance of competence of drivers. Event Recorder includes communication interfaces such as CAN and USB 2.0 serial ports. Event Recorder is designed to fit all locomotive. Data can be recorded along with the date and time.

GENERAL FEATURES

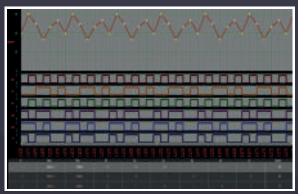
- 72 VDC supply
- Secure (encrypted) data storage feature
- Graphical or tabular display for recorded data
- Creating reports for the selected format
- User friendly HMI design
- Expandable architectural design based on Customer new requirements

FUNCTIONAL FEATURES

- Data recording such as speed and ATS (Automatic Train Stopping) system data.
- Data can be retrieved at any time via the USB-stick
- Analyze capability for recorded data
- Audio and visual warnings notification
- Recorded data can be analyzed by authorized operator only


Veri Kayıt Yazılım Raporu

Data Analysis Software Report



Data Analysis Software Graphical Interface

Savronik

39 years | 2 0 2 5

VKB

CRASH PROTECTED DATA RECORDING UNIT

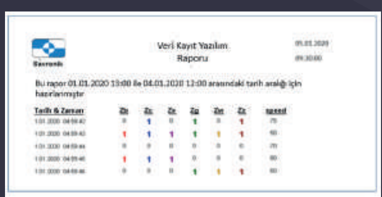
The Crash Protected Data Recording Unit provides forensically valuable data to be recorded in railway vehicles (trains, subways and trams, etc.) and is also a shock and collision resistant product designed to store the recorded data. The unit is designed to protect data in the event of an accident and is resistant to fire, impact shock, penetration, static crush, fluid immersion and hydrostatic pressure in accordance with the requirements of International Standards. The recorded data can be retrieved using a PC-based software tool and used for investigation in case of accidents and incidents.

Compliance with Main Standards:

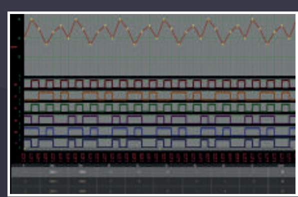
- EN50155 — Electronic Equipment of Railway Vehicles
- IEEE1482 — Registration, Display and Error detection
- IEC 62625-1 — Recording Systems System Specifications
- GM/RT2472 — Recorders System Features
- Crash Protected Memory (IEC 62625-1 Table 1, Parameter A)

PHYSICAL PROPERTIES

- Physical communication interfaces: Ethernet, CAN
- Dimensions: 207 x 281 x 129 mm
- Weight: 3.5 kg
- It has different mounting interfaces for 3U Rack Cabinet or standalone



Data Analysis Software Report



Data Analysis Software Graphical Interface

RAILWAY POINT HEATER CONTROL SYSTEMS

The system is designed to prevent snow accumulation and icing on the railway in order to ensure uninterrupted and safe railway transportation. The system functions automatically by analyzing environmental conditions utilizing the data collected from the sensors. Hence, it provides energy saving and precise control.

SYSTEM FEATURES

- Configurable design suitable for the number and type of points
- IP65 protection class
- Multiple operating modes suitable for different cases
- Flexible architecture with support for different sensors
- Possibility to monitor resistance fault conditions
- Control of the resistance groups in the point zones individually or as a group
- Data transfer interface support to different systems via Modbus TCP/IP and OPC
- Data transfer support via optional Modbus RTU or dry contact (Optional)
- Communication support over fiber optic cable
- Design suitable for ambient temperatures between -40ºC and +55ºC

Savronik Point Heater Control Unit allows monitoring of sensor data.

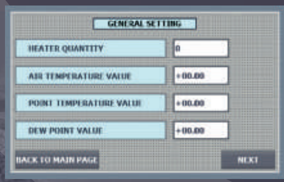
It is also possible to control the Point Zones manually or automatically.
In addition, operating and fault conditions can be monitored via the HMI.

Savronik

39 years | 2 0 2 5

RAILWAY POINT HEATER CONTROL SYSTEMS

Savronik
39 years | 2 0 2 5



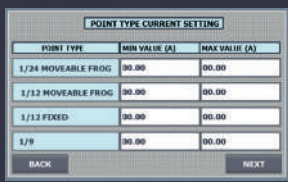
User Friendly Design

Sensor values can be easily calibrated / customized for requirements.

TECHNICAL SPECIFICATIONS

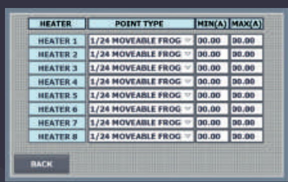
Supply Voltage : 170 ... 264 VAC
Line Frequency : 47-63 Hz
Ambient Temperature
- **Operating Temp. Range** : -40°C to +55°C
- **Storage Temp. Range** : -40°C to +85°C

Relative Humidity : Max %95
Communication Detail : 10/100 Mbit/s RJ45 Ethernet Port x2
: 100 Mbit/s single-mode SC Fiber Optical Port x2
Interface : Modbus TCP
: OPC-DA
: Dry Contact (Optional)
: Modbus RTU (Optional)
Panel Protection Class : IP 65
Point Zone Output (230 VAC) : to 2/4/6/8 heater zone (Optional)
: Power distribution according to 2 phase
Control Method : Manual Control
: Automatic Control
: Operator Control



Adjustable Current Support

Depending on the point types and their powers, current control and fault monitoring can be adjusted.



Configurable Design

System outputs can be configured in the field and provide quick and easy solutions to different needs.

Equipment Selection Table

✓ Common
o Optional

x: 2 type of panel enclosure options are provided.
• H: 2000x800x400 (WxHxD) • L: 1400x1200x400 (WxHxD)

EQUIPMENT CODE	CAPACITY of HEATER ZONES	HMI	MODBUS TCP/OPC-DA	MODBUS RTU	DRY CONTACT	SNOW/ICE SENSOR	AMBIANT TEMP./HUMIDITY SENSOR	POINT TEMPERATURE SENSOR
DMI-1MB00-T1x-00	1	✓	✓	o	o	o	o	o
DMI-2MB00-T1x-00	2	✓	✓	o	o	o	o	o
DMI-3MB00-T2x-00	3	✓	✓	o	o	o	o	o
DMI-4MB00-T2x-00	4	✓	✓	o	o	o	o	o
DMI-5MB00-T3x-00	5	✓	✓	o	o	o	o	o
DMI-6MB00-T3x-00	6	✓	✓	o	o	o	o	o
DMI-7MB00-T4x-00	7	✓	✓	o	o	o	o	o
DMI-8MB00-T4x-00	8	✓	✓	o	o	o	o	o

TCMS

TRAIN CONTROL MANAGEMENT SYSTEM

Train Control Management System (TCMS): TCMS is a computer system which had designed in accordance with EN and UIC norms that records data, monitors and controls on-board information, human-machine interface and subsystems, and controls safety functions. Train Control Management System, with its high speed serial communication capability, allows all train subsystems to be managed from a single control point.

TKYS has Central Control Unit (CCU), Driver Display Unit (DDU), Safety Functions Control Unit (SFCU) and Juridical Recording Unit (JRU), Antenna, Ethernet and MVB units. TCMS is a computer system developed in a modular structure that can provide solutions to all systems and needs.

Modular Design	Extensible System Architecture	Remote Diagnostic Monitoring	Configurable components	Remote Installation	Special protocol design for TCMS system	Small footprint	Fully integrated with hardware, performance

FUNCTIONAL FEATURES

- EN 50155 Compliant System
- UIC 612 Compliant HMI
- EN 62625 Compliant Secure Data Recording and Data Transfer
- SIL - Control and Monitoring of Safety Critical Functions Assigned Safety Integrity Level
- Safety Operations with Unique Software and Hardware
- Locomotive System and Subsystems Monitoring and Control
- Current and High Voltage Protection
- Easy Installation and Maintenance Screen
- Diagnostic

Savronik

39 years | 2 0 2 5

TCMS

TRAIN CONTROL MANAGEMENT SYSTEM

Savronik

39 years | 2 0 2 5

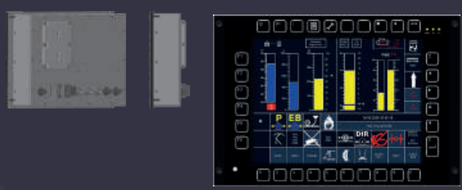
Central Control Unit (CCU)

It is a system consisting of Central Control Unit, Power Supply Module (PSM) and compact PCI-E modular 19" rack cabinet type, GWM, SCM, DIM, DOM modules. CCU monitors and controls vehicle/locomotive system and subsystem signals by communicating with train gateways such as MVB-WTB.

- **Power Supply Module (PSM)**: the module that provides the input voltage with EMI protection, filter and instantaneous voltage protection circuits.
- **Gateway Module (GWM)**: the module that supports communication protocols and communicates with the Train Communication Network (MVB, WTB).
- **System Control Module (SCM)**: the module that controls the input and output signals and realizes the operating scenarios.
- **Digital Input Module (DIM)**: DIM is a configurable, diagnostic protocol support module that monitors input signals.
- **Digital Output Module (DOM)**: DOM is a configurable, diagnostic protocol support module that monitors output signals.
- **Analog Input Module (AIM)**: AIM is a configurable, diagnostic protocol support module that monitors analog input signals.

Driver Display Unit (DDU)

- Designed compatible with UIC612 norms,
- Flexible system architecture that can work with Ethernet protocol,
- Informing the driver by making sense of the data coming from vehicle systems such as CCU and CCTV,
- Management of subsystems over ethernet protocol via touch and physical buttons.



Safety Functions Control Unit (SFCU)

- Performing the safety critical functions assigned SIL Safety Integrity Level in a way that will reduce the intolerable hazards on the vehicle and the TCMS system to an acceptable risk level,
- Compatible with related CENELEC standards in terms of software and hardware,
- Flexible architectural design that can meet the new functions determined as a result of risk analysis.

Juridical Recording Unit (JRU)

- Designed in accordance with TSI norms,
- Ethernet, CAN, MVB, I/O physical communication interfaces,
- Recording of juridically critical, digital and analog data defined in EN 62625 requirements,
- Memory unit resistant to all impacts that may occur in the during an accident,
- Secure data recording and transfer,
- It has security measures against unauthorized access.

Multifunction Vehicle Bus (MVB)

MVB consists of MVB/Ethernet Converter and WTB/Ethernet/MVB Gateway units. The system and some subsystems are interconnected via MVB. TCMS controls and monitors subsystems via MVB.

Ethernet Switch

The Ethernet switch provides communication between the CCU and the DDU, JRU and Remote I/Os over GWM. The Ethernet switch is connected via GWM, allowing it to be included in the data network as a unit within the CCU.

GPS/WiFi Antenna

Vehicle location determination and remote control functions are used with the roof-top antenna supporting MAIN/DIV/GPS/WIFI protocols in the system.