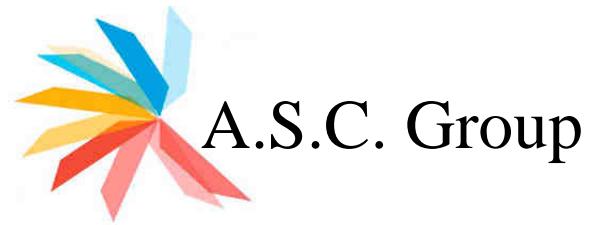
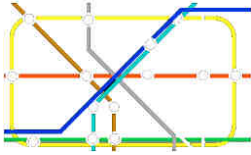


Transport Building Management System

SCADA-BMS

Technical Description
(EN) V.6

October 2015



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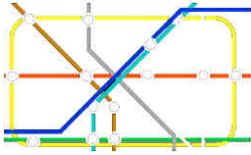
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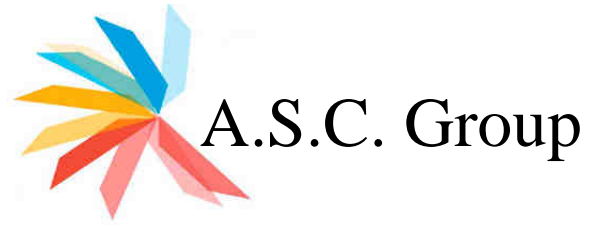
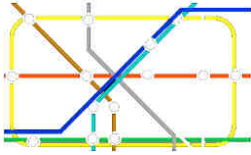
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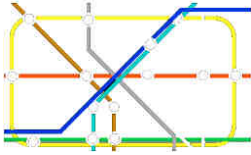


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1. Introduction

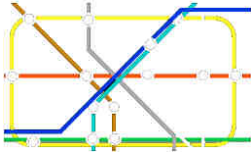
This document is intended to provide a technical description of SCADA-BMS product.

SCADA-BMS is a software/hardware product for the management of Building Automation in transport infrastructure as metro, tramway, main line rail and airports, designed by ASC and based on [PcVue HMI/SCADA](#) by Arc Informatique, one of the most advanced state-of-the-art Object-Oriented standard SCADA platforms, having about 40.000 installed licenses over the world.

Some of the information contained in this document are property of ASC Italy.

Glossary

ATC	Automatic Train Control
CDT	Tramway Depot Control
D&M	Maintenance & Diagnostic
DAC	Data Acquisition Control
RDBMS	Relational Data Base Management System
RTDB	Real Time Data Base
BA	Building Automation
BAC	Building Automation & Control
BMS	Building Management System
BE	Back End
FE	Front End
COTS	Common of the shelf
OCC	Operation Control Center



2. Main topics

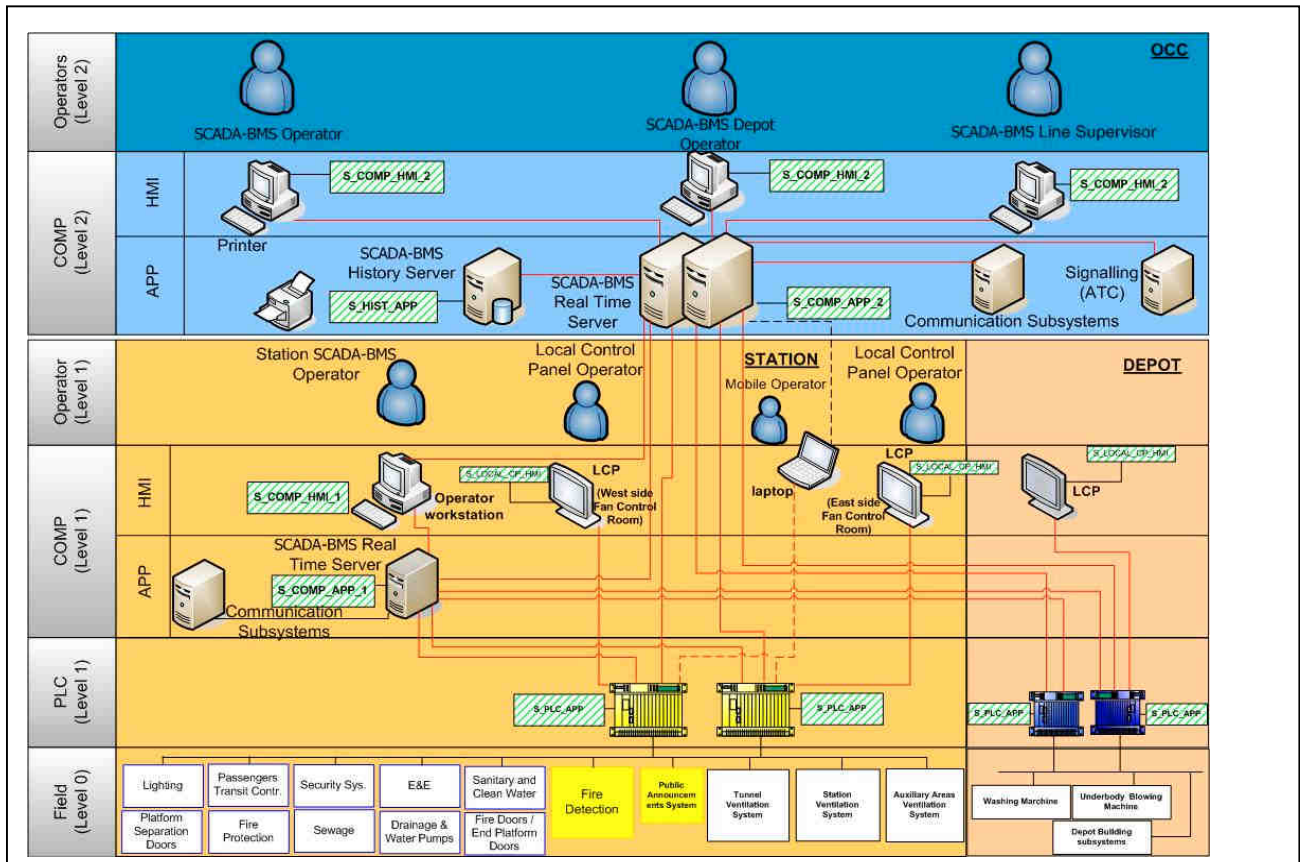
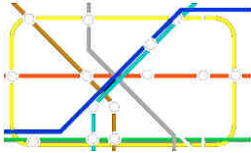
ASC offers a set of products coming from a deep experience in railway, metro and tramway systems and installations, collected over the world. Main concept is to provide a single interface to monitor and control all those heterogeneous building systems & services.

SCADA-BMS is designed to manage subsystems of metro and rail related infrastructure like for example:

- Stations and Tunnels Ventilation
- Stations and Line Lighting
- LV Power supply distribution
- HVAC
- Air Handling Units / Air Exhaust Units
- Water Supply and Drainage
- Fire Alarm and Fire Extinguishing System
- Access Control System (Intrusion Alarm System)
- Escalators / Elevators
- AFC and Toll equipment
- Wastewater and sanitary water
- Emergency Lighting
- Depot Buildings
- Depot Washing Machine
- Depot Underbody Blowing Machine
- Communication subsystems

and many others

In the following picture, a schematic representation of the logical architecture of the SCADA-BMS is provided.



Picture 1 – SCADA-BMS logical architecture

SCADA-BMS is able to manage equipment and subsystem from different manufacturer brands, different industry standards and communication protocols.

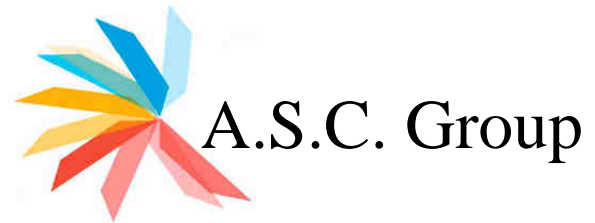
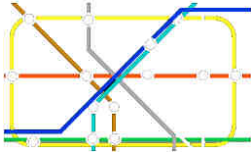
SCADA-BMS can interface the E&M and the Auxiliary subsystems of a Metro or Railway line through RTUs or PLCs connected to the control equipment (serial/Ethernet connections) and/or to the control cabinets (hardwired connections) of each of such subsystem.

It is, in fact, a fully integrated tool, at building manager and operator disposal, in order to run their facilities by fully efficient tools and features, by using industrial standards (i.e. protocols commonly used and accepted for addressing control system applications and real time SCADA), such as:

- Lonworks (Echelon)
- BACnet
- OPC
- Modbus

and many others. SCADA-BMS includes also direct interfacing to the E&M and Auxiliary subsystems through hardwired connections.

SCADA-BMS by ASC can be provided with a **Configuration Tool** that enable the Customer to make data configuration changes by itself (provided as an option).



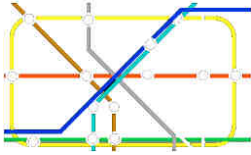
This **Configuration Tool** enables Customer technicians (upon suitable training) to change, without ASC intervention, the system configuration. Such activity is performed starting from entity models and pre – configured data set (template).

In this way, Customer does not need to spend time in studying SW details or programming languages: ASC Configurator simply allows for implementing the desired modifications, working at high level with a really powerful tool.

Thanks to this unique feature, Customer (after the first configuration made by ASC) can autonomously perform all the following activities:

- Easy Data configuration changes
- Data Configuration changes validation
- Changes deployment and commissioning
- Flexible adaptation for future process extension

Obviously, ASC guarantees fully availability for these activities and an Help Desk services during all the life span also locally.

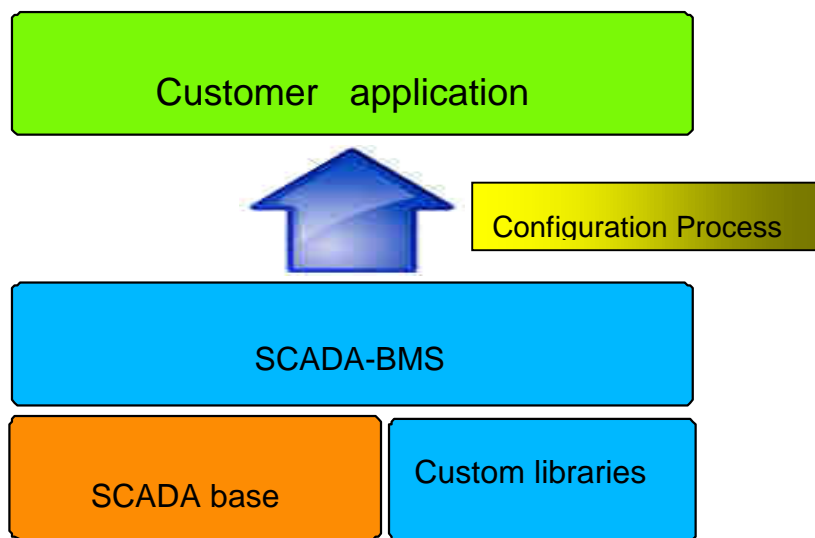


2.1 SCADA-BMS Automation, Supervision & Control system

SCADA-BMS is mainly designed to manage subsystems related to Building Management (E&M and Auxiliary subsystems).

As SCADA-BMS is built-up on the general purpose SCADA PCVue, it can natively manage a wide spread of equipment and data protocols.

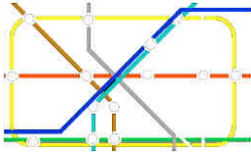
The following picture shows the architecture model of the proposed solution:



Picture 2 –SCADA-BMS Level 2 model

Since the BMS systems experience frequently minor changes during their life (about 15 years) we need to guarantee the followings:

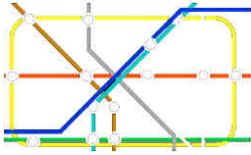
- Proposed solution must enable data configuration changes, in easy and controlled way, without stop the operation of the system. With SCADA-BMS is very ease to do changes, no programming background is required and the SCADA-BMS configuration tool allow to do changes in high level and controlled environment and using a live dissemination of changes.
- Underlined platform as operative system, Data Base Management Systems, and the SCADA product itself must be manned during all this period and should evolve to manage future assets and subsystems. SCADA-BMS is based on standard the facto base software as Microsoft o.s., MySQL or Oracle DBMS, PCVue as SCADA.
- System should be modular, powerful, easy to manage and open so the End Customer can decide to maintain the system by itself, even after several years from the initial deploying. With SCADA-BMS minor changes can be done directly by the end customer. For large changes (if and when needed) Customer can select among hundreds of System integrators from the market.



SCADA-BMS solution is based on the strong hardware/software architecture which allows the information to be elaborated in one (or more) of the network nodes, and recorded in an other one.

Main functions are listed in the following:

- Acquiring information from peripheral devices (remote monitoring) from RTU's/PLC that interface the field by wired digital and analogue Input and Output and via intelligent interfaces based on standard and legacy data protocols;
- Automation functions performed at PLC/RTU SCADA-BMS level;
- Sending commands to peripheral devices (remote control). They are intended to execute an action on remote side and to change the configuration data (i.e. a set point of a remote equipment).
- Giving an overall view of the state of the E&M and Auxiliary subsystem by synoptic by means of:
 - Local Operator Workstation (OWS) having 1 up to 4 monitor for each OWS
 - Large display up to 10.000 x 10.000 pixel resolution
 - Central Operator Workstation (OWS)
 - Data pad terminal and messaging like: smart phone, I-Pad, SMS, MMS, paging systems
- Providing a detailed view of the system by means of video pages displaying:
 - Buildings / stations / Tunnels
 - E&M and auxiliary Subsystem details
 - Ancillary subsystems details
 - Alarms / events list
- Recording chronological events on mass memory (Service Journal) also with the unique function called VDR (video digital recorder) that can be used to "replay" what's happened during a selected period on a dedicated OWS.
- User rights management
- Maintenance workstation
- Strong integration: SCADA-BMS may communicate with external systems in order to exchange information related to alarms and events. For example:
 - CCTV system to automatically set the display of particular video cameras in case of a fire alarm or an intrusion alarm;
 - ATC system to acquire fire alarms in trains or to send to the ATC fire alarms in one of the stations;
 - AFC system to send commands to open the gates in case of fire in a station;
 - Public Address system to command station evacuation announcements in case of fire;
 - etc.
- Management of emergency scenarios including fire in stations and tunnels. The management of emergency scenarios by the SCADA-BMS implies that the system puts into action automation and co-ordination functions to command the E&M and Auxiliary systems involved in the safety strategies, to be activated as consequence of emergency conditions. The emergency scenarios

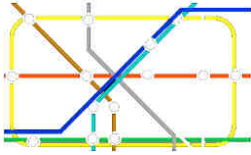


can be automatically activated as SCADA-BMS response to a fire alarm. Moreover, the emergency scenarios can be manually activated by the operators.

In the following, main functionality for E&M and Auxiliary subsystem, are listed.

2.1.1 STATIONS AND TUNNELS VENTILATION

- ✓ Management of the stations and tunnels ventilation subsystem in normal and emergency situations. For the ventilation functions in emergency situations a SIL 2 safety level is typically required.
- ✓ In normal conditions the tunnels ventilation subsystem is managed by the SCADA-BMS in order to guarantee the required air quality in tunnels sections. If tunnel average air temperature excess design temperature over a delta gap, tunnel ventilation fans will be activated to suction fresh air from outside and to discharge hot air for reinforcing train's piston effect until the design temperature is reached.
- ✓ Emergency conditions in tunnels mainly refer to fire conditions involving trains or tunnels infrastructures. In case of underground fire, the tunnel ventilation system shall provide fresh and cold air in the area where the fire is located in order to decrease its effect and to remove combusting products, to reduce air temperature and to provide a safe escape for personnel and passengers. The tunnels ventilation system fans will be activated by the SCADA-BMS to control airflow as follow:
 - Tunnel ventilating fans of the tunnel section where the fire is located will be started in push-pull mode. In order to establish the required fresh airflow in the tunnel, several fans may be started in feeding and discharging modes simultaneously according to the S.E.S. (Subway Environmental Simulation) studies.
 - The air speed shall be maintained to the "critical speed" value in order to preventing smoke collection and to force flow forwarding in a requested direction;
 - Tunnels fans operational mode shall be co-ordinated with the stations passengers section ventilation system considering different evacuation and fire fighting scenarios.
- ✓ SCADA-BMS is able to implement the tunnel ventilation procedures for different fire and crowded scenarios and to co-ordinate tunnel ventilation operational modes with those of the station passengers section of the ventilation system.
- ✓ In normal conditions, the station ventilation subsystem shall guarantee comfortable environmental condition for passenger and personnel in the station. For this reason, filtered fresh air will be provide in the ticket hall, public open areas and along the platforms, in the meanwhile the contaminated exhaust air will be discharged. The SCADA-BMS is able to manage the station ventilation subsystem to guarantee comfortable environmental conditions taking into account the station platforms average temperature and the external temperature.



- ✓ In station fire emergency conditions the SCADA-BMS is able to manage the station ventilation subsystem taking into account the location of the fire and the its severity level.

2.1.2 LV POWER SUPPLY

- ✓ Macro Views of the LV Electrical Distribution in each site;
- ✓ Single Line Diagram
- ✓ Banner for real time alarm information
- ✓ Fault and Power consumption Analysis and Reporting

2.1.3 STATIONS and Line LIGHTING

- ✓ Time table & Manual Lighting Control to allow the manual or control calendar commands to turn on and off the stations and line lights
- ✓ Single line diagram of the stations and line lighting cabinets showing the status of each feeder switch

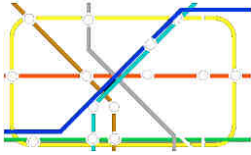
2.1.4 HVAC

- ✓ Cooling & secondary Ventilation Management is performed by the SCADA-BMS.

2.1.5 ELEVATORS & ESCALATORS

SCADA-BMS can provide:

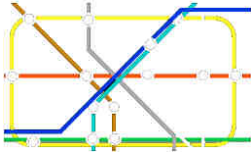
- ✓ Working conditions and main alarms relevant to each escalator, i.e.:
 - "working uphill";
 - "working downhill";
 - "stopped";
 - "stopped by means of emergency stopping button"
 - "working locally"
 - "No energy"
- ✓ Operational commands including remote commands to stop and to change the movement direction of the escalators, i.e.:



- “work upward”,
 - “work downward”
 - “stop”
- ✓ Elevators operating status and alarms, i.e.:
- Emergency alarm,
 - Service status (in/out of service),
 - Power supply status (normal/fault),
 - Doors blockage warning,
 - Lower oil level warning,
 - High temperature warning,
 - Safety Mechanism put into operation,
 - In maintenance and test condition
- ✓ Operational commands including remote commands to put in and out of service each elevator
- ✓ Automatic Walkways control

2.1.6 WATER SUPPLY AND DRAINAGE

- ✓ SCADA-BMS is used to remotely monitor and control the stations and tunnels clean water pumping systems equipment including anti-fire water plant. SCADA-BMS centralises the alarms and status information of these subsystems:
- Operational status of each pump;
 - Water pressure and flow;
 - Water levels in storage tanks;
 - Alarms in case of sprinkler activation or hydrants opening
- ✓ SCADA-BMS monitor the stations and tunnels drainage system acquiring the alarms relevant to the water levels in the storage tanks and the operational status of the drainage pumps.

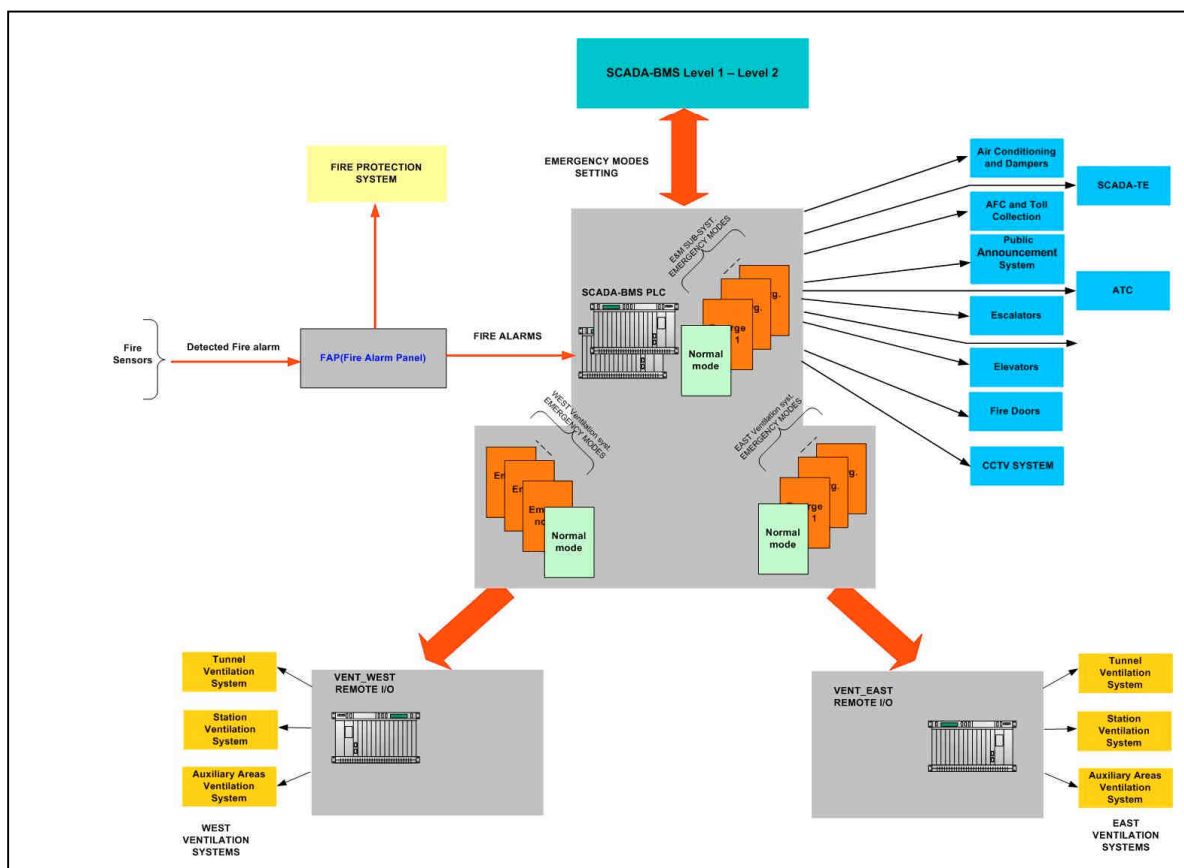


2.1.7 FIRE ALARM AND FIRE EXTINGUISHING SYSTEM

The Fire Alarm System ensures the detection and the verification of fire conditions by means of smoke and fire detectors distributed in the stations. The reaction to detected fire conditions and the relevant control functions, with the exclusion of the actions performed by the Fire Protection system (start of fire extinguishing devices), will be ensured by the SCADA-BMS.

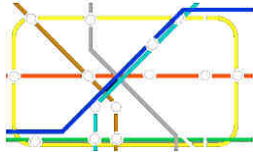
In case of fire alarms received from various detectors or from flow switches or manually activated through the fire alarm pushbuttons, the Fire Alarm system will trigger the SCADA-BMS to activate the related protection functions, including the warning of the station personnel and line controller, the start of the station evacuation, the start of the station ventilation systems, the release of the locks of the barriers, etc.

Automatic reaction to fire conditions is assured by the Fire Alarm System through the SCADA-BMS.



Picture 3 –SCADA-BMS – Station Fire Scenario management

The SCADA-BMS is used to remotely monitor the functionality of the Fire Alarm and Fire Protection equipment. The SCADA-BMS will acquire the fire alarms conditions detected by the Fire Alarm System and the operational status of its devices, including detectors and control devices, showing to the local and central operators these information.



Moreover, the SCADA-BMS will monitor the operational status of the devices of the Fire Protection System in order to detect failures that can compromise the reaction to fire conditions.

In case of fire alarm, the SCADA-BMS will put each of the E&M and Ventilation system, in a defined working condition assumed to be safe for passengers and staff. A working condition for each E&M and Ventilation system will be defined for each specific emergency fire scenario and managed by SCADA-BMS.

The SCADA-BMS operator workstations will display the information relevant to the fire alarms conditions and diagnostic information of the equipment and sensors composing the station Fire Alarm and Protection Systems.

Faults on SCADA-BMS equipment not avoid the Fire Alarm System to perform its tasks relevant to the activation of the Fire Protection System.

2.1.8 FIRE ALARMS IN TUNNELS

Fire conditions in tunnels can be detected in two way: through a fire detection subsystem (i.e. thermo - sensitive cable) or by the train onboard fire alarm system or both.

In the first case, SCADA-BMS will acquire the fire condition in tunnel through the interface with the tunnel fire detection subsystem. In the latter case, the fire condition in tunnel is provided to the SCADA-BMS by the interface with the ATC system. In both cases, the fire alarm indication includes the position along the tunnel where the fire is detected and, if acquired by the ATC interface, the train stopped condition.

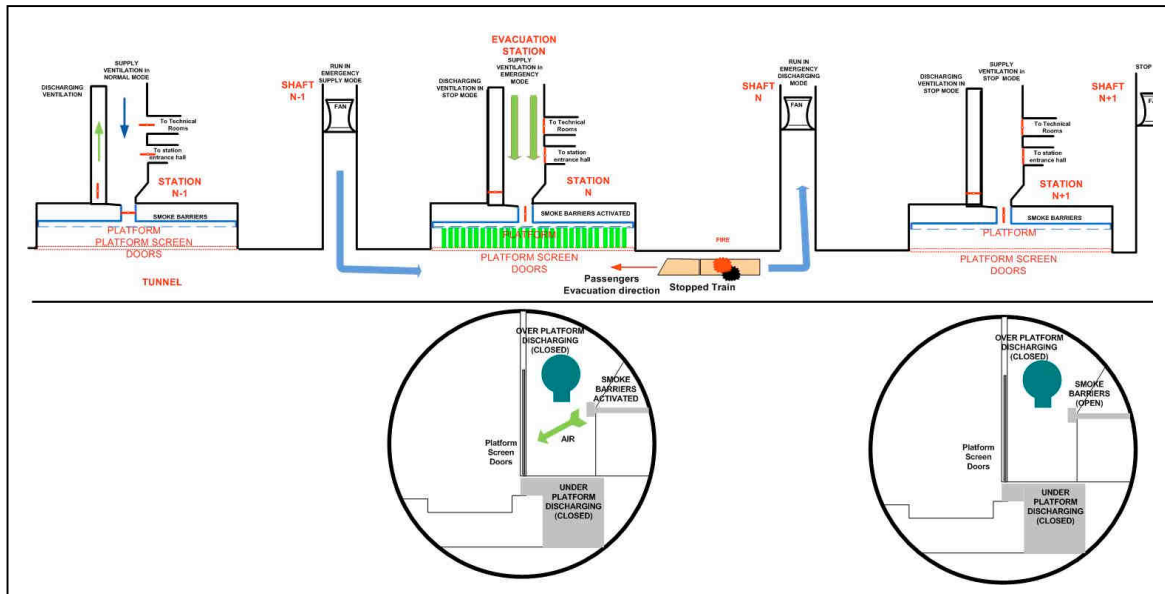
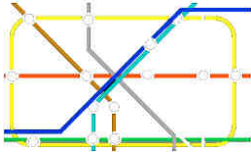
Using these information, SCADA-BMS will automatically define the passenger evacuation station taking into account the location of the fire along the tunnel and the emergency scenario to manage the emergency situation.

The emergency scenario defines the operational status that the E&M and tunnel ventilation equipment shall undertake to guarantee the passengers evacuation in safety way from the tunnel.

The SCADA-BMS calculated emergency scenario is shown to the operator workstation in order to allow the operator to accept or refuse the proposed emergency scenario.

If the operator accepts the proposed scenario, the SCADA-BMS will automatically send to the involved stations and ventilation shafts an "emergency scenario command" that will be managed by the SCADA-BMS PLC level to set the E&M and station/tunnel ventilation subsystems operational status according to a pre-defined configuration to react to the emergency.

In the following picture, a summary representation of station and tunnel ventilation operational status activated by the SCADA-BMS to react to a fire alarm in a train stopped along the tunnel is shown.



Picture 4 –SCADA-BMS – Tunnel Fire Scenario management

2.1.9 INTRUSION ALARM SYSTEM

SCADA-BMS acquires and display on the operator workstations alarms relevant to intrusion into reserved areas and diagnostic information relevant to the intrusion sensors and other subsystem equipment.

2.1.10 AFC AND TOLL EQUIPMENT

SCADA-BMS acquires and display on the operator workstations the operational status of each barrier and of the toll equipment (ticketing vending machines, validators). For each station, a graphical representation of the position and of the operational status of station barriers is provided.

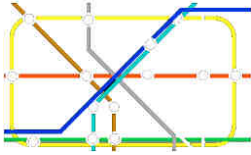
2.1.11 EMERGENCY LIGHTING

The operational status and the relevant alarms of each emergency lamp in the stations areas and along the lines is provided by the SCADA-BMS in dedicated video-pages where the position on the station and lines lay-out is shown.

2.1.12 MAINTENANCE SUPPORT

SCADA-BMS collects alarms relevant to the E&M and Auxiliary equipment faults and supports a set of maintenance functions to manage these faults:

- ✓ Intervention teams are set up with time schedule of each individual;



- ✓ Call the person on duty and concerned by the event;
- ✓ Calls are logged and monitored online;
- ✓ SMS messages, beeper, phone call with pre - recorded voice, emails;
- ✓ Acknowledgement of the message;
- ✓ Archived faults data are compiled to generate reports;
- ✓

2.1.13 Data acquisition

Data can be collected from several sources and using several data protocol.

All standard data protocol for Building automation are natively managed by SCADA-BMS as for example:

- BAC-net
- Lonworks
- Modbus RTU
- Modbus TCP

Also many other protocols typical of automation Industry are managed as for example:

- Profibus
- IEC 60870-5-101/104
- SNMP

and many hundreds more¹. Therefore, SCADA-BMS can manage practically every kind of data source. When a wired connection to the field is required, SCADA-BMS is able to manage these types of interfaces through its remote RTUs (Remote Terminal Unit) and PLCs (Programmable Logic Controller).

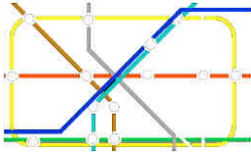
The use of PLCs as RTU, enables to implement local control logic that can operate even when the OCC is disconnected due to some fault.

Data coming from the field (via the RTUs or PLCs) are collected by the FE. FE is in charge to manage connection lines, RTU/PLC data alignment and RTU/PLC polling.

Data may be of several types like:

- DI = digital Input (single point or double point entities)
- DO: Digital Output (simple or double point, CBO (Check Before Operate) entities)
- AI: Analogue Input (0-20 mA, 4 – 20 mA, 0 -10 Vcc, etc.)

¹ For a list of managed protocol, please see "Pcvue data protocol library"



In this context, Data Acquisition of these signals is operated for field entities as for example:

- low voltage distribution cabinet
- HVAC variables
- Start / Stop command
- Remote set point

2.1.14 Remote monitoring

Plant supervision is made possible by means of several video terminals, providing overall views (Synoptic Panel) and detailed views (Command Pages):

- ✓ Display of the State of field elements;
- ✓ Forcing: possibility of simulating commands;
- ✓ Device Masking - makes it possible to exclude a device from scansion;
- ✓ Monitoring and control of the automatically or manually started emergency scenarios.

2.1.15 Alarm management

Several types of alarms may be collected from the field:

- ✓ Unknown position (not open & not closed; not run & not stopped or both at the same time);
- ✓ Spontaneous (Not commanded) entity movement (for example an escalator not in local mode is moving without any command was issued to it);
- ✓ Equipment faults;
- ✓ Analogue value exceed normal range value (for example a temperature or a voltage);
- ✓ Auxiliary equipment fault.
- ✓ SCADA-BMS auto diagnosis fault;

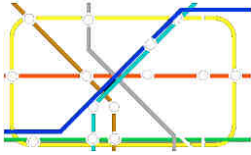
Alarm Management includes:

- ✓ Alarm Display (optic and acoustic);
- ✓ Alarm registration on the Service Journal;
- ✓ Alarm Display on the Alarm List page from which it is possible to filter and organise views of different alarms.;
- ✓ Alarm management from the operator
- ✓ Historical recording;

2.1.16 Remote Command Operation

Remote control: possibility of remote control for all devices:

- ✓ directly by using an hardwired connection between the SCADA-BMS PLC/RTU and the device control cabinet;



- ✓ by issuing the command to the specific subsystem via a data communication line between the SCADA-BMS PLC/RTU and the device controller.

2.1.17 Generation of commands sequences

SCADA-BMS enables the operators (under specific privileges) to define a sequence of commands. This feature supports operators in issuing specific pre-defined command sequences, for example to start a set of fan or lights. Commands can be issued to any field element.

2.1.18 Emergency Scenarios Commands

SCADA-BMS allows the operators to send "emergency scenarios commands" in order to activate at PLC/RTU, level specific control procedures to set the operational status of E&M and Auxiliary subsystem according to specific emergency conditions suitable to protect passengers and properties.

2.1.19 Chronological event recording (RCE).

SCADA-BMS enables operator to record all chronological events.

Resolution depends upon selected RTU/PLC. Typically value is 1mS

RTU/PLC are synchronised by a central Master Clock located in the Operation Control Center, driven by a reference GPS receiver.

SCADA-BMS is able to use remote tagged time information (data time tag from the subsystems).

2.1.20 Graphic User Interfaces

SCADA-BMS GUI offer a plants representation spread over multiple levels:

General views

At this level an overall and brief view is displayed. Available information can be:

- Building (Stations/Depot) view;
- E&M and Auxiliary equipment views;
- Multi-layers views (each layers showing a type of subsystems in the same picture),
- Alarm summary calculation and display.

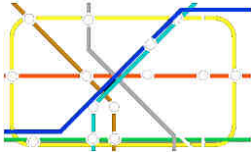
Detailed views

At this level all the details can be displayed. We have several type of display like:

- Building (Stations) section view;
- Plant detailed views;
- Process detailed views.

Emergency scenario views

SCADA-BMS GUI provides a set of video pages where the operating conditions of each E&M and Auxiliary subsystem involved in an emergency scenario are summarized. Through these video



pages the operator is able to monitor the evolution of the actions automatically performed by the SCADA-BMS PLC level to set the operational status of the equipment of each of such subsystem according to the safety configuration foreseen for the particular emergency scenario. Through these video pages, the operator can manually activate one of the pre-defined emergency scenarios.

2.1.21 Historical archive

SCADA-BMS enables user to record all relevant alarms and events in dedicated set of archives. On these archives it is possible to perform multiple actions like for example:

- Archive selection
- Filtering
- List ordering criteria selection
- Purge

2.1.22 Operators account management

User privilege management:

operator can access to the system by a regulated procedure, allowing to digit Username and Password; each operator has got his own access code (User and Password), unique within the system.

A certain profile is attached to each operator. The system can handle more than 4 different types of profile:

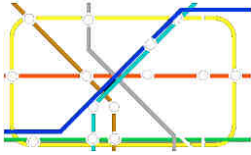
- Administrator,
- SCADA-BMS Operator,
- Maintenance Operator,
- Training.

SCADA-BMS implements a specific function in order to manage privileges of different domain, such as geographical or others. Operator privileges can be managed by the Administrator in a really simple way.

2.1.23 Control of plausibility

Before some commands are carried out, the supervisory control system applies a test of plausibility so that illogical and dangerous outages can be avoided. For example:

- the start command of a tunnel ventilation fan with the associate damper in closed position,
- the start command of a tunnel ventilation fan with an high vibrations alarm active,
- the start command for an escalator without the visualisation on the CCTV monitor of such escalator,
- etc..



2.1.24 Reduction of routine tasks

Using the automatic handling and recording of messages and switching actions, the control station staff is freed from repetitive tasks.

The scheduler engine allows to automatically send commands and recipes, and to execute programs on schedule. One or more fully configurable tasks may be assigned to a certain time on a certain day while exception periods for special days and other calendar events can be taken into account. Tasks may also appear in a recurrent scheme. Depending on the user-rights the parameters of a task could be modified during runtime.

2.1.25 System self diagnostic

Self diagnostic: feature allowing operators to monitor actual working state of the SCADA-BMS equipment.

2.1.26 Operational aspects

SCADA-BMS system is extremely simple and intuitive to operate.

Elements or functions are selected by the mouse; the keyboard is used only for access to the system or to enter optional comments concerning the events recorded.

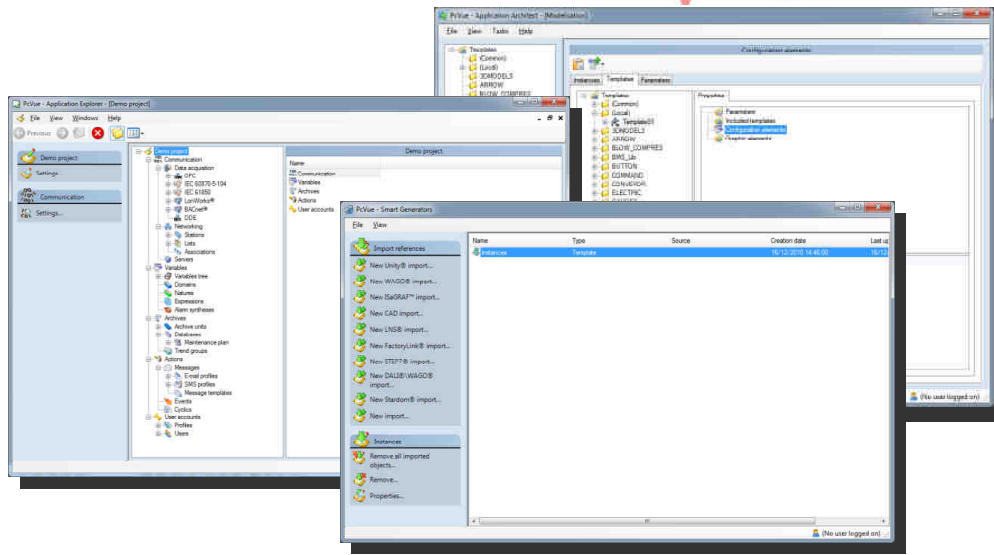
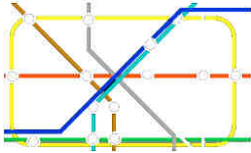
The operator can choose how to allocate the video pages (control pages, synoptic panel, window for handling events) among up to 4 monitors. All printouts requested by the operator are sent to the network printer. The system also handles acoustic signals associated with the activation of an alarm or with the spontaneous status variation of a device.

2.1.27 Engineering work station (EWS)

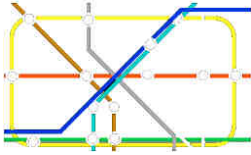
SCADA-BMS is provided with an EWS. By using EWS, Customer's engineers and operators, after a suitable training course, can perform the usual system maintenance activity, like for example:

- Performing ordinary minor changes,
- fixing set points and similar,
- managing archives.

The system is extremely simple and intuitive to operate. Elements or functions are selected with the mouse; the keyboard is used only for access to the system or to enter optional comments concerning the events recorded.



Picture 5 - EWS interface example



FE Server

The FE Server hosts the communication software. It's made of:

- n. 1 PC Computer (server class) quad – processor + keyboard + mouse. Redundancy configuration with two PC is supported.
- n. 1 console monitor 17"

PLC/RTU Equipment

The PLC/RTU are real COTS equipment. It spreads from several vendors depending on specific requirements.

One of the requirements to be fulfilled refers to the Safety Integrity Level of some functions as, for example, the stations and tunnels ventilation in emergency conditions.

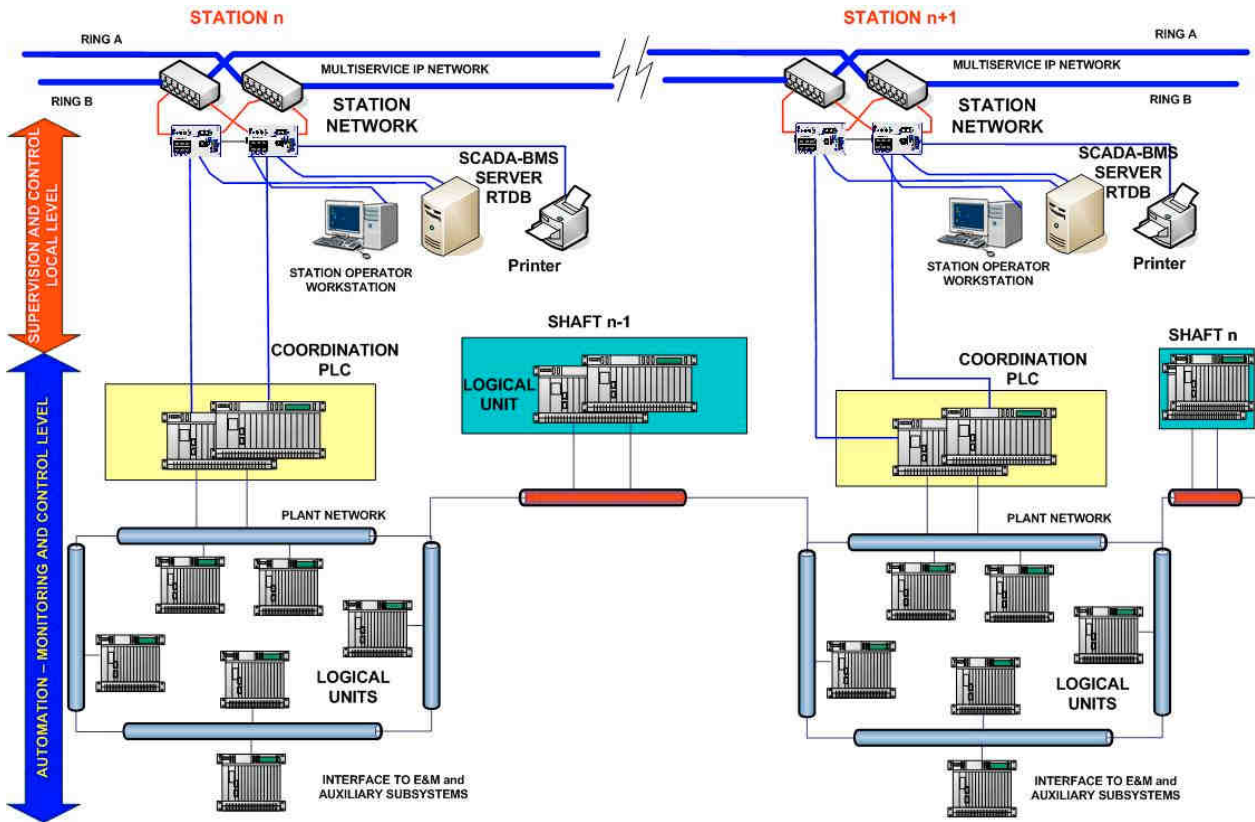
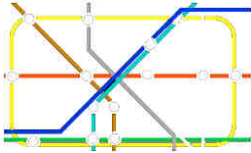
For these functions a SIL 2 is usually required. Even if it is not mandatory to use already SIL 2 certified PLC/RTU for implementing these functions, it is preferable to use SIL 2 certified PLC/RTU in order to speed-up the application certification process.

Suitable PLC/RTU vendors for this application can be: Siemens, Schneider, Rockwell Automation, General Electric, and others.

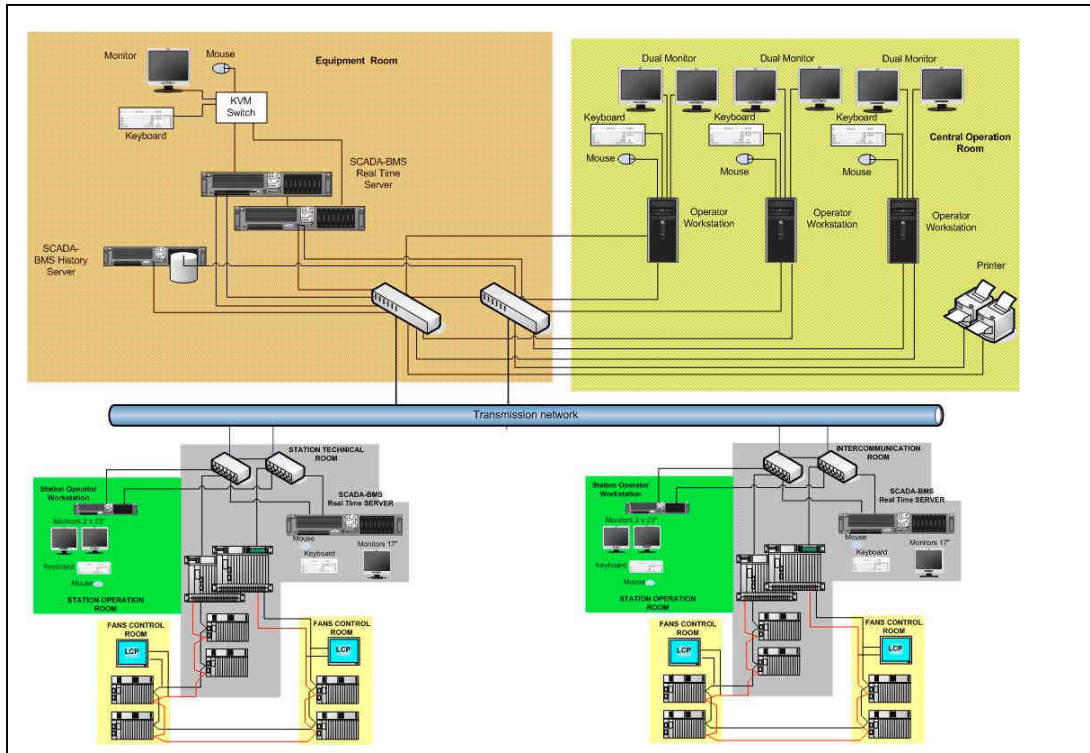
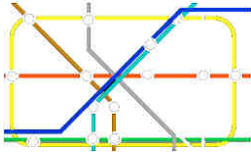
By using a COTS PLC/RTU, it is always assured a high quality level at low cost.

By using IEC 60870-5 standard protocol, it is also assured complete interoperability between different equipment, in future expansions.

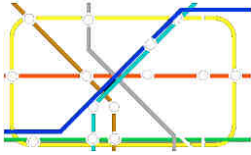
In the following figures two typical RTU/PLC configurations are shown.



Picture 7 –SCADA-BMS – Station typical Hardware architecture (1)



Picture 8 –SCADA-BMS – Station typical Hardware architecture (2)



4. SW Architecture

SCADA-BMS is based on COTS SCADA product. Starting from this SCADA a specific functions set has been implemented:

- Field entity library (as for ex. Escalator, Elevator, Pump, Ventilation Fan, etc);
- Specific algorithms implementation (for example to calculate the arrangement of the tunnels ventilation fans to guarantee the suitable air temperature in tunnels);
- Data Acquisition integration by using several field protocols, such as IEC 60870 –5-*, Modbus RTU/TCP, HDLC, Profibus, BACnet, Lonworks as common examples.
- Graphic user interfaces entity libraries to display standardised object to the operators.

4.1 Functional options

The following Functional module are optionally available:

Redundancy

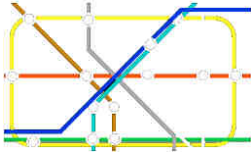
SCADA-BMS fully supports redundancy at each level of his architecture: local and central supervision and control and plants interface and automation levels.

At local and central supervision and control level, redundancy may be based on no. 2 machines, acting (A) as master and (B) as slave, or, alternatively, on a virtual distributed machine.

Switch-over operation can be performed in automatic mode or, manually, by operator's request (having administration privilege).

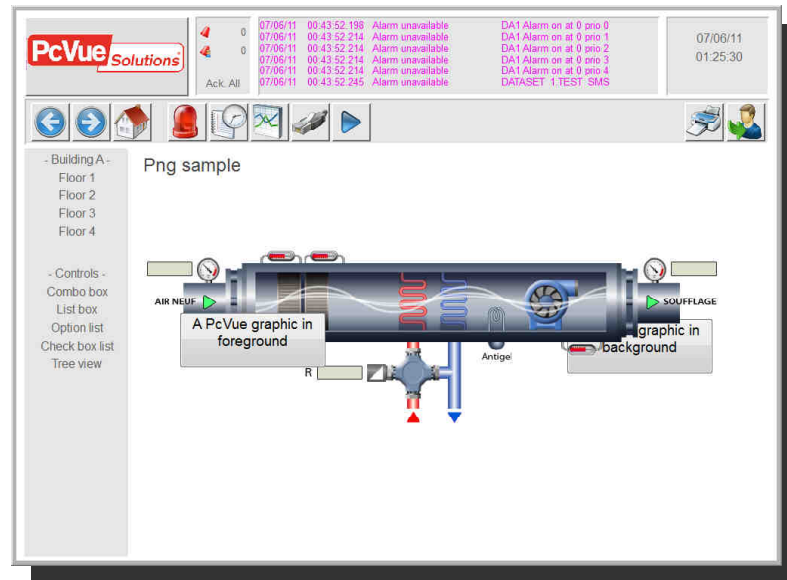
- Master BE performs plant management in normal conditions;;
- Slave BE takes the control when the Master might fall down.

At plants interface and automation level, redundancy is made by 2 RTU/PLC in active/hot stand-by configuration and redundant communication architectures (redundant serial lines, Ethernet plant network in ring configuration).

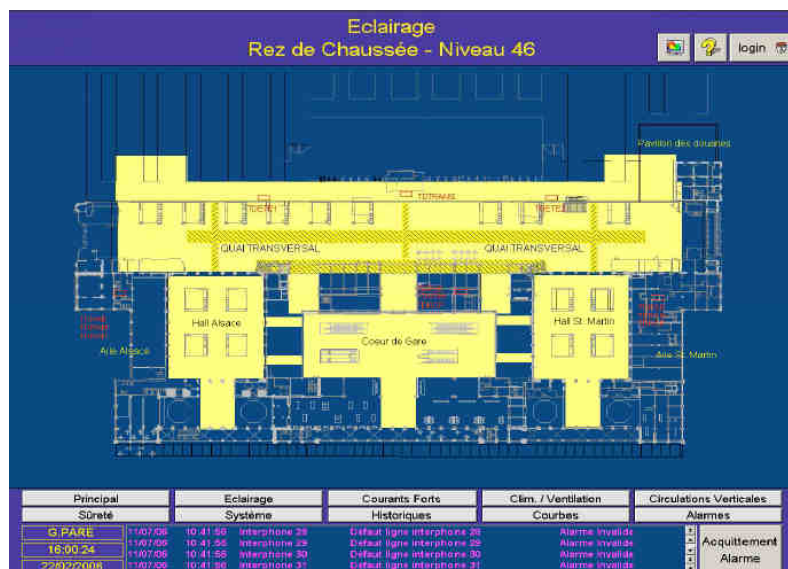


4.2 Operator Interface (Graphic user Interface)

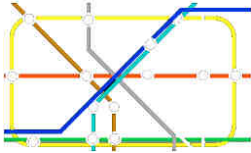
In this section some samples of Video Display pages are shown.



Picture 13 - HVAC Display example



Picture 14 - Lighting display example



5. Configuration Tools

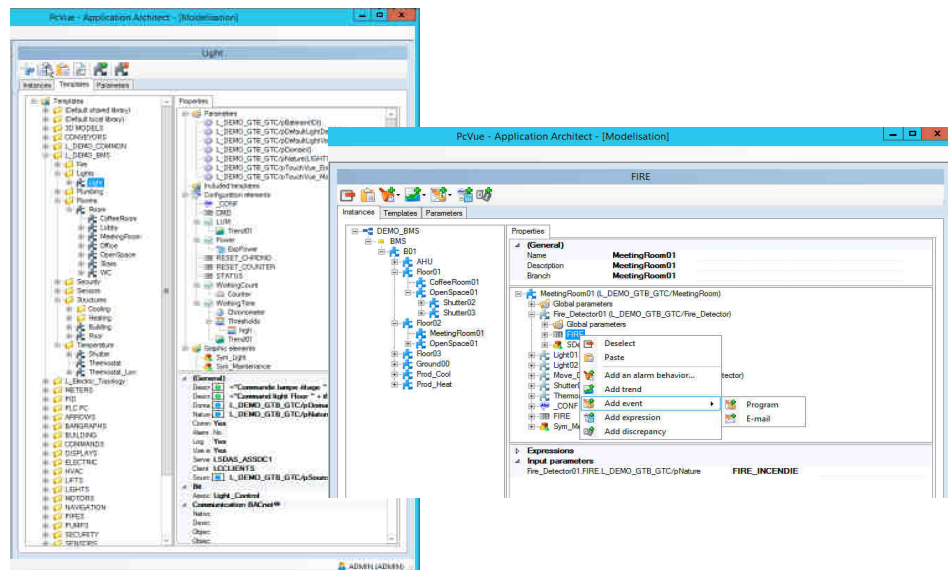
A software component (usually in the form of a “Wizard”) developed specifically to meet the customer’s requirements. Its primary function is to simplify configuration of the application by presenting options in the customer’s own terminology.

For example, selection of the equipment from a simple list of pre-defined templates with configurable parameters entered using a purpose designed dialog box. Templates used by the configuration tool are stored in a database. This approach allows the templates to evolve without making any changes to the configuration tool.

The configuration tool (“Configurator”) is an off-line tool performing data configuration features.

Configurator enables user:

- To populate the system with relevant data (graphic and alpha numeric);
- To validate the data set before put they in run-time;
- To deploy the changes



Picture 17: Configurator Interface