Retail Unit Controls & Monitoring System

Solution for southern countries

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RETAIL UNIT CONTROLS & MONITORING SYSTEM

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1 General

1.1 SYSTEM INTEGRATION

The system provider shall furnish and install a fully integrated Retail Unit Controls & Monitoring System, incorporating distributed control techniques and standard open communication networks. The system shall be implemented as an integrated, open solution, which enables Service Center connectivity through a standard interface.

The integrated systems shall include controls, monitoring and Service Center connectivity for the whole building (BMS) and for each retail unit as follows. Retail unit automation, lighting controls and security systems shall be integrated with BMS as specified herein.

Common Building Management and Security Systems shall include the following subsystems:

- Building automation (including cooling/heating unit control, FCU controls in common areas, ventilation control, pumps, smoke exhaust fans, etc)
- Lighting control of common areas
- Irrigation control
- Consumption measurements of water, electricity and cooling/heating energy
- Access control system for common areas
- Intruder alarm system for common areas
- Video monitoring system for common areas
- Fire alarm system
- Central battery system
- Elevator alarms
- Public addressing system

Retail Unit Controls & Monitoring System shall include the following subsystems:

- Cooling control
- Ventilation control
- Consumption measurements of water, electricity, gas and cooling energy
- Lighting control
- Other electrical controls
- Leakage/moisture alarms
- Gas alarms
- Access control
- Intruder alarms
- Video monitoring system (optional)

All systems in the building shall be integrated with a standard based, generic software platform, which facilitates integration and interoperability of all building systems (COBA Building Operating System platform, later referred to as "BOS") as described in the System Architecture. The Platform shall provide standard connectivity to the Service Center, which shall be capable of providing advanced maintenance and security services.

This specification covers Retail Unit Controls & Monitoring. Please refer to a separate specification for details of Common BMS and Security Systems (“BMS Specification”).

1.2 USER INTERFACES

The retail unit user shall be able to use the system easily with a graphical browser-based User Interface, launchable with a normal web browser. The User Interface shall comply with requirements defined in the System Architecture.

The browser-based User Interface shall be generated automatically using the structure of the building defined in the Building Information Model. The browser-based User Interface shall utilise latest web technologies, such as AJAX. The user interfaces shall provide easy access to frequently needed

functionality, such as lighting controls, temperature setpoint modifications and alarms. The User Interface shall be capable of showing consumption values, temperature value and FCU setpoint. It shall enable changing the setpoint and controlling the lights.

Retail Unit Controls & Monitoring system shall be accessed through the BOS. The BOS shall also enable integration of the Retail Unit Controls & Monitoring System with BMS.

The system shall also enable a client-based professional User Interface for central monitoring of systems (Main User Interface or Service Center usage). Main user capability and central monitoring shall utilize the BOS as defined in the System Architecture.

The professional User Interface shall be implemented as a client application, which includes an automatically adapting tree structure of the building, building's parts, individual spaces, different systems and parts of systems. The tree structure can be used for navigation through the system.

All systems connected to the BOS can be accessed through the same graphical User Interface. The client software can be installed to unlimited number of remote computers or laptops. The client software shall allow for remote Internet usage of several sites using the same client.

The professional User Interface shall show system views, floor plan views, trend view, alarm view and event log view per building and system layer. Any alarm shall be shown in red color in both graphical views and tree structure. Each alarm message shall include shortcut to relevant graphical system and floor plan view.

1.3 SYSTEM ARCHITECTURE

The System Architecture shall consist of three levels:

- Control Level
- Management Level
- Service Level

The system offered shall be completely modular in structure and freely expandable at any stage. Each level of the system shall operate independently of the next level up as specified in the system architecture. For example, Control Level shall operate independently without support from Management Level.

The system shall be fully consistent with the latest industry standards. To enable efficient functional system integration and to provide maximum flexibility and to respond to changes in the building use, the system offered shall support the use of LonWorks, Ethernet TCP/IP and Internet communication technologies.

1.3.1 Control Level

The Control Level shall consist of a distributed network of smart control nodes, which are connected to LON field bus. Nodes shall include all the intelligence of the system. Each node shall be capable of handling several different systems in parallel through flexible distribution of I/O points. Nodes shall be capable of operating autonomously independently of Management Level. For example, all systems must be able to react to alarms on the Control Level without interference from upper levels. All communication shall be event based.

1.3.2 Management Level

Management Level shall provide a uniform view to all systems through the open BOS. All the systems - controls of cooling, ventilation and lighting, consumption measurements, access controls, intruder alarms, fire alarms and DVR systems - shall be integrated with the BOS using device drivers.

The BOS shall offer at least the following common services to be used by all connected systems:

- Alarms
- Historical trending

- Logs and reporting
- User profile and role management

To ensure fault-tolerant system functionality, the Management Level shall not be responsible for any controls. The Control Level shall function independently also without the Management Level. The Management Level shall enable existence of Service Level as specified herein.

The BOS shall collect trends from defined points, collect and forward alarms from the systems. The BOS shall enable efficient management of user rights. The BOS shall be capable of forwarding alarms to mobile phones using SMS, local alarm printers or to Service Center. It shall be possible to browse the alarm history for reporting and statistical purposes.

The BOS shall provide standard connectivity to the Service Center, which is capable of providing advanced maintenance and security services.

The BOS shall include a structured XML object model of the building, its parts and spaces, its connected systems, system parts and effect areas of each system. The XML object model shall comply with commonly accepted XML schema.

The BOS shall include an open interface for other applications to interact with the connected systems. Communication method between BOS and Client applications shall include at least Java Messaging Service (JMS). Web interfaces shall be used for light-weight clients, e.g. automatically generated browser-based user interfaces in residences for Panel PC's, PDA's or IPTV.

The network technology shall be based on the IT standards, such as TCP/IP, and be compatible with latest LAN/WAN technology. The operating system of the BOS server shall preferably be Linux, also Windows 2000, Windows XP or later are acceptable. The BOS shall be capable of supporting current and future building management protocols through implementation of network interface drivers. The BOS shall be capable of current and future systems and devices through implementation of device drivers.

1.3.3 Service Level

Service Level shall allow the systems to be connected without additional software to one or several Service Center(s), for providing centralized remote monitoring, alarm and fault detection of connected building management and security systems.

The Service Center will be built to the Service Island and it shall be capable of accessing remotely the systems through a standard interface through the BOS. The standard connectivity shall enable providing advanced maintenance and security services, such as security alarm monitoring, maintenance alarm monitoring, remote diagnostics, main user capability, remote control and optimization of all systems, energy optimization, trending and reporting services.

The Service Center shall support connectivity of multiple sites in multi-operator environment. Predefined alarms from connected sites – e.g. intruder alarms, dirty filter notifications or leakage alarms, for example – shall appear in the alarm list with a specified priority. Alarms shall be stored in the central database.

Remote diagnostics of site systems and devices shall enable proactive maintenance of technical systems, energy optimization and efficient management of the infrastructure. Centralized monitoring of all connected sites with main user capability shall enable e.g. set point changes, manual overdrives and camera controls by using the remote connection.

2 Retail Unit Control System

2.1 DISTRIBUTED INTELLIGENCE

The intelligence of the systems shall be distributed into Smart Control Nodes, which are connected to LON field bus. The following systems shall be monitored and controlled by Smart Control Nodes: cooling, ventilation, lighting, consumption measurements and intruder alarms.

Smart Control Nodes must be commonly used during past 10 years not only in retail units but also in large scale commercial facilities, such as offices, business centers, hotels and residential buildings. Control nodes, which have not been used in large scale implementations are not acceptable.

It shall be possible to integrate the systems on Control Level without interference of Management Level, according to System Architecture.

Communication between Smart Control Nodes shall be peer-to-peer communication via a Free Topology (FTT-10) Local Operating Network (LON) with the Standard Network Variables Types (SNVT). All communication shall be event based. Nodes shall be intelligent modules, capable of operating autonomously independently of Management Level. For example, all systems must be able to react to alarms on the Control Level without interference from upper levels.

Each node shall have about 10 I/O points to achieve maximum reliability and flexibility. Each node shall be capable of handling several different systems in parallel through flexible distribution of I/O points. The I/O points of the Control nodes shall be as follows:

- DI: Digital indication, from potential free contact
- DO: Digital control, open collector
- AI: Analog input, standard measurements 0-10 VDC, PT1000 or Ni1000-LG.
- AO: Analog control, 0-10 VDC or 20 mA

The Control nodes shall include PID controllers and ON/OFF (thermostat) functions for implementing the control loops used in engineering system process controls. Logical functions shall be implemented using configurable software objects in the Control nodes.

Field devices are connected to Control nodes using the common industry standards:

- PT-1000 for temperature
- 0-10 V for other sensors and actuators
- Potential free contacts for ON/OFF indications and push buttons
- 24 V relays for ON/OFF controls
- Impulses for consumption measurements

To guarantee openness, flexibility and cost-efficient maintenance of the integrated systems, the field devices shall not include independent control logic.

Control nodes are placed to the nearest electric cabin, side of air-handling units or in separate cabins when adequate. All systems shall use the same control network cabling, which uses free topology to maximize flexibility for future modifications and to minimize the need for cables. Electrical design utilizes free or star topology cabling to maximize flexibility for changes and to minimize the use of cables.

2.2 INDOOR AIR QUALITY (IAQ) CONTROLS

Chilled water and fresh air for ventilation are supplied centrally for each retail unit from district cooling network and Fresh Air Handling Units (FAHU) as described in the BMS Specification.

Indoor Air Quality controls shall be integrated with Fresh Air Handling Unit controls, lighting controls, security systems and fire alarm system as specified in the System Architecture. Indoor Air Quality controls shall be integrated with BOS.

2.2.1 Ventilation Control

Ventilation of each retail unit is controlled by VAV dampers. VAV damper setpoints are varied based on modes/situations. The target of VAV controls is to optimize amount of ventilation in each situation.

2.2.1.1 Humidity control

To reach the target level (setpoint) of relative humidity in each zone, the air amount will be increased through adjusting the VAV damper opening according to measured relative humidity of the return air.

2.2.1.2 CO2 control

To reach the target level (setpoint) of carbondioxide (CO2) concentration in each retail unit, the air amount will be increased through adjusting the VAV damper opening according to measured carbondioxide (CO2) concentration of the return air.

2.2.2 FCU controls

The FCU control node shall automatically change the FCU motor speed based on temperature deviation. It shall regulate the cooling valve to meet the desired temperature conditions. FCU control nodes shall communicate on LON field bus and shall be integrated with BMS system to enable energy optimization and reporting. The mode/situation of the retail unit shall influence FCU controls as follows:

- Comfortable temperature setpoint and predefined fan speed (Shop open)
- Predefined higher setpoint and predefined lower fan speed (Staff in or Cleaning)
- Predefined higher setpoint and fan stopped upon leave to achieve energy-savings (Away)

For each FCU there shall be a room panel for deviating the setpoint and changing the fan speed.

Each FCU shall include a specially designed High Efficiency Particulate Air (HEPA) filter for capturing all sizes of air-borne particles to improve indoor air quality. Filter must be able to filter both particulate and gaseous contaminants efficiently with low pressure drop. This will provide healthy indoor air by preventing particulate matter, VOCs, ozone, odours, bacteria and viruses from entering the room air. Low pressure drop and long and long loading capacity will provide low operating cost. Filter shall be monitored via pressure difference sensor. Alarm limits shall be sliding according to fan speed.

2.3 LIGHTING CONTROLS

Lighting shall be controlled by by Smart Control Nodes connected to LON field bus. Lighting controls shall be integrated with other automation and security systems. Lighting groups are on/off controlled and dimmed as follows:

- In connection with modes of the Retail Unit (Staff in, Shop open, Cleaning, Away)
- Using local push buttons (on/off, on/off/up/down, lighting scenes)
- On movement detection (occupancy)
- Time schedules
- Using the browser user interface

Lighting controls shall be integrated with the BOS.

2.4 CONSUMPTION METERING

2.4.1 Water consumption

Water consumption shall be measured for each retail unit. The water meter shall give potential free impulses to control node(s). The control nodes shall count the impulses and collect consumption measurements of each retail unit.

Cumulative consumption shall be shown in the Main User Interface and in the Browser User Interface.

2.4.2 Electricity consumption

Electricity consumption shall be measured for each retail unit. The kWh meter shall give potential free impulses to control node(s). The control nodes shall count the impulses and collect consumption measurements of each retail unit.

Cumulative consumption shall be shown in the Main User Interface and in the Browser User Interface.

2.4.3 Cooling energy consumption

Cooling energy consumption shall be indicated for each retail unit. The consumption can be either measured with BTU meters with potential free impulse output or calculated using trend data from BMS.

Cumulative consumption shall be shown in the Main User Interface and in the Browser User Interface.

2.4.4 Reporting

Cumulative consumption measures shall be possible to show in the Main User Interface and in the Browser User Interfaces in each unit.

2.5 FIRE ALARMS

Alarm indications shall be received from the fire alarm system. The alarm shall trigger the following functionality:

- Turn on the local alarm siren
- Shutdown of ventilation in the area concerned
- Forward the alarm to Service Center for further actions

2.6 ACCESS CONTROL

Access control shall be implemented with proximity readers, control nodes, electronic keys and electronic locks. Users are classified so that they have access only to the spaces they are allowed to enter. The access control system is connected to BOS for full control and reporting and integrated into graphical user interface.

Access control system shall be integrated with cooling and ventilation controls, lighting and electrical controls as well as with other security systems using the BOS as the integration platform. Access rights can be managed centrally from the Service Center.

2.7 INTRUDER ALARMS

Intruder alarm system shall include cover protection and indoor surveillance. Doors and windows are monitored with magnetic contacts. Movement detection with presence indicators are also used for indoor surveillance. Movement detectors shall be sensitive enough for presence detection of a single person, so that they can also be used for lighting controls and air-conditioning controls.

In case of burglary the system gives an alarm, which is relayed through the BOS to Service Center and/or to specified mobile phones. Granted access disarms the alarm zones automatically. Arming the zones change automatically the mode of the residence into Away mode. Intruder alarms shall be integrated with cooling and ventilation controls, lighting and curtain controls as well as with security systems using the BOS as the integration platform.

2.8 VIDEO MONITORING

Camera surveillance shall be implemented with conventional digital and IP-cameras. Camera surveillance shall be implemented with Digital Video Recording (DVR) system. The DVR system shall be integrated to BOS so that e.g. an intruder alarm event can trigger DVR recording and prerecording or other functions. Usage can be done both via DVR system's own User Interface Client and the integrated User Interface of the BOS. When equipped with DVR, the system shall record digital images of events caused by intruder alarm system, access control, CCTV or any other system integrated to BMS.

------END OF SECTION------