



**“PROCUREMENT AND INSTALLATION OF THE  
BUILDING AUTOMATION AND CONTROL SYSTEM  
(BACS) OF PIRAEUS EXTENSION PHASE B”**

**RFP-384/20**

**TECHNICAL DESCRIPTION**

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## **1. INTRODUCTION**

This document provides the technical description of the Building Automation and Control System (BACS) of the Metro Extension to Piraeus-Phase B'. It includes information and the technical requirements that have to be met regarding the design and construction of the Project; it also specifies and clarifies the scope of the Project to be read in conjunction with the contract documents and drawings handed over by ATTIKO METRO AE (henceforth called AM).

Piraeus extension – Phase B' includes three (3) new Stations: Maniatika Station, Piraeus Station and Dimotiko Theatro Station. It also includes three (3) intershafts (Tzavela, Mela, Roloj), a terminal shaft (Panepistimio) and a recess for electrical equipment at the forestation of Dimotiko Theatro terminal station, as well as the tunnel sections extending from the temporary forestation of Nikea station up to the forestation of Dimotiko Theatro station.



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## **2. SCOPE OF THE CONTRACT**

The scope of the contract includes the supply, design, installation and commissioning of a Building Automation and Control System (BACS), which shall monitor and control the ventilation system of the tunnels, the HVAC system and the building electromechanical systems in Stations, ventilation shafts, recesses and tunnels of the Extension to Piraeus – phase B’ both locally from the workstation in the Station Master Room (SMR), in each Station and centrally from the existing workstations in operation in the Operation Control Center (OCC) at SYNTAGMA and from the maintenance workstation located in Sepolia area.

The scope of the contract shall also include the necessary upgrading of the existing and operating equipment and software of the BACS system at the OCC level and at local level in the stations operating in Lines 2 and 3, as required, except the Base Project stations (Monastiraki – Ethniki Amaryna and Sepolia – Dafni). In this framework, required shall be the upgrading of the EBI system in the OCC and in the Station Master Rooms, to which the local BACS equipment must be connected.

The contract shall also include the design, construction, supply and commissioning of the Fireman Boxes (FB), as well as the design, construction, supply and installation of the PLC switchboards related to the E/M systems covered by this Contract.

This Technical Description is presented in more detail in the Design, Performance, Materials and Workmanship Specifications.



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### **3. DESCRIPTION OF WORK OF THE BACS SYSTEM CONTRACTOR**

The Contractor’s scope of work, as regards the BACS system, shall include, without being limited to, the following works:

- Preparation of the Detailed Final Design for the necessary works to be performed per sectional installation and commissioning of the new BACS system, so as to ensure that no disturbance is caused to the Metro revenue service; the aforesaid DFD shall comply with the time schedule.
- In particular, as part of the Detailed Final Design, is a design for the interconnection of the BACS system to be installed with the already installed equipment in local and central level, as required.
- Provision of all data and information required for both the communication protocols and parameters of the entire software for the interconnection of the Contractor’s systems and equipment with the other Contractors’ systems and equipment, as required for the execution of the Project.
- Coordination, as regards all works, including the interfaces, as well as timely provision of information for any relevant clarifications to AM, if requested.
- Supply, installation, testing and commissioning of whole BACS equipment.
- Supply, installation, testing and commissioning of all the necessary equipment for the interconnection of the BACS system with the currently in operation central servers of the EBI system, as it is mentioned in the Technical Specifications.
- The precise determination of the energy consumption requirements of the entire BACS equipment for the supply of the System from the Station’s UPS shall be required as part of the Detailed Final Design (DFD).
- Design, construction, supply, installation and commissioning of the Fireman Boxes.
- Design, construction, supply, internal wiring and commissioning of the PLCs to control the operation of the foreseen E/M systems in the stations and shafts of the Extension to Piraeus – phase B’.
- Supply and installation of fiber optics of the local LAN network in a ring-form in the Station, Shafts and Tunnels.
- Site Acceptance Tests and commissioning of the BACS systems.
- Participation in the Tests and the Commissioning of E/M systems belonging to other contractors, as required.
- Participation and Support of the Trial Run.
- Maintenance related activities for the entire Warranty Period.
- Provision of the necessary spare parts, tools and equipment related to the performance of tests.
- Training of the maintenance and operation personnel, including the provision of a certification that the said personnel can operate, maintain the system and intervene in its software, on an as required basis.



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- Provision of the necessary documentation with the appropriate structure, including the operation and maintenance manuals, as well as the “as built” documentation.
- To upgrade all the existing and operating hardware and software to the latest version of EBI. In this framework, all pertinent works have to be executed on all sixteen (16) installed and fully operational servers, as well as on twenty two (22) workstations, respectively.
- In addition, the Contractor shall replace the existing five (5) servers of the BACS system with the appropriate Rack Servers, depending on the needs of the area where these will be installed, further to AM’s approval.
- The Contractor shall add two (2) screens in the existing OCC’s Workstations.
- The Contractor shall make a series of modifications in the operating EBI system.

Additionally, the Contractor:

- During the preparation of the Detailed Final Design (DFD) and construction, testing, installation and commissioning of the equipment, he shall participate in all meetings with AM, as required.
- Shall proceed the risk assessment and safety assessment processes, as well as the verification of the safety of the BACS system to be provided by him, including all related interfaces; he shall provide evidence that the system is in compliance with the safety integrity level (SIL), as required for the purposes of the system under any potential operation conditions. He shall provide both general and special safety analyses for any application regarding the systems to be provided by him.
- Shall certify the RAMS performance, in accordance with the European Standard EN 50126.
- Shall compose and follow a Health and Safety Plan.



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#### **4. GENERAL DESCRIPTION OF THE BACS SYSTEM**

##### **General**

Existing central computerized facilities for the Control Systems (SICLIMAT X and EBI R410.2) currently housed at the OCC at Syntagma station, control all the Tunnel Ventilation and HVAC systems of the Base Project and the future Metro Extensions, through two independent systems, provided by independent manufacturers (SIEMENS for the Base Project and HONEYWELL for the future Metro extensions). In the Metro extensions, the E/M systems in buildings (lifts, escalators, pumps, lighting etc.) shall also be checked.

As far as ventilation is concerned, individual fan and other HVAC equipment controls are also provided in each station at the local ventilation switchboards (with integrated PLC's), at the Fireman Box (FB) and at the Station Master Room (SMR).

From the FB installed in each station of the Base Project, as well as in the first stations of the future extensions, predetermined scenarios can be activated for a fire in the local station and at the two adjacent tunnels.

In the extension to Piraeus – Phase A', feasible will be only the activation of fire scenarios from the FB for the station.

The same concept shall be also applicable for the extension to Piraeus – Phase B'.

##### **4.1 Extension to Piraeus – Phase B'**

For the Extension to Piraeus – Phase B', the monitoring and control shall be executed locally by the new BACS System, and, centrally, by the control and monitoring system (EBI) already installed to be upgraded in the framework of this contract.

The exact number of the necessary control and monitoring data digital/analogue points for the extension to Piraeus shall be finalized during the Detailed Final Design by the Contractor, in cooperation with the main contractor of the extension. It is clarified that the cabling and connection of all auxiliary power and control cables from the local ventilation switchboards and E/M equipment switchboards to all respective field equipment and to the PLC-panels are already included in the scope of works of the main contractor.

A Fireman Box (FB) shall be installed at the concourse or street level of every station easily accessible to firemen. The supply and installation of the FB falls within the scope of works of this Contractor. From the FB it shall be possible to activate the “Fire at Platform” and “Fire at Concourse” scenarios only. The involved ventilation systems of the local station shall be controlled through cabling (hardwired). In case that the above mentioned scenario needs to activate an additional equipment in a neighbouring shaft, the activation will be done through the communication network.

It shall be possible to activate predetermined fire scenarios from the workstation in the SMR and/or the OCC, depending on the nature and location of the emergency incident, using combined actions of several system fans for optimized response.



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The predetermined scenarios shall be developed by the designers of the ventilation system and shall contain all the necessary procedures (Scenario and Emergency Mode Tables) for the activation or deactivation of all related fans.

The BACS Contractor shall have the obligation to implement all the scenarios mentioned above in the system software and to ensure that the software logic of the emergency scenarios will be always available (backed-up) in case of loss of any PLC, of any Workstation and any Server.

With regard to the operating stations and the extension to Piraeus interface scenarios in particular, upgrading of the software shall be also required ensuring activation of the equipment of the operating stations and of the equipment of the stations under construction.

It is also stressed that it is necessary to interconnect the BACS system with the fire detection and fare collection gates' systems to ensure the automatic opening of the gates for passenger evacuation in case of emergency/fire.

#### **4.2 PLC Switchboards**

The Contractor shall be responsible for the design, construction, supply, wiring and commissioning of the PLC switchboards, which shall control the operation of the foreseen E/M systems in each station, shaft and tunnels' recess of Piraeus Extension – Phase B'.

PLCs shall be equipped with all I/O modules necessary for the monitoring and control of the entire equipment related to this module.

PLCs and the related equipment shall be housed in a metal switchboard with safety rating no less than IP 54. PLCs shall be installed next to the switchboards of the systems under control (HVAC, Ventilation systems, E/M systems).

The functional design (Normal operation and predetermined fire/emergency scenarios) for a typical station-tunnel-station configuration shall be developed by the designer of the ventilation system of the main contractor in order to be incorporated by the Contractor into the System's software.





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## **5. TECHNICAL DESCRIPTION OF THE BACS SYSTEM**

### **5.1 General**

The purpose of the BACS is to control and monitor all Tunnel Ventilation systems, station HVAC systems and E&M systems within the station and shafts of the Extension to Piraeus, under all normal and emergency conditions as described below:

Tunnel Ventilation System:

- Blast Shaft fans (BSF)
- Under & Over Track Exhaust fans (UPE)
- Tunnel ventilation Jet fans (JF)
- Roller Shutter Doors (RSD)
- Motorized Dampers (MOD)
- Fireman box (FB)

HVAC System:

- Exhaust Fans (EXF)
- Air Supply Fans (SAF)
- Motorized Dampers (MOD)
- Chillers, their pumps and associated installations
- Heat Pumps (HP)
- Fan Coil Units (FCU)

E/M Systems:

- Uninterruptible Power Supplies (UPS)
- Normal and Emergency Lighting
- Pumping and drainage systems
- Hydrants, hose reel systems and deluge valves (DEV)
- Lifts
- Escalators
- Interface with the Fire Detection Switchboards
- Interface with the Intrusion Detection System (IDS)
- Interface with the Automatic Fare Collection System

The central control and monitoring of all the above systems in the entire Metro network shall be conducted from the workstations in OCC, while the local control and monitoring shall be conducted from the workstations in the Station Master Rooms.

### **5.2 BACS structure to be provided by the Contractor**

The Contractor shall install systems in the following areas:



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**5.2.1 Operation Control Center (OCC)**

The Contractor shall perform all necessary upgrading-modification-replacement of equipment and software works – to the extent required - in the Central Control and Monitoring System, so that the new stations of the extension may be integrated in the said system.

All control points shall be transmitted to OCC through WAN (Wide Area Network).

The Contractor should take into consideration the fact that works executed inside OCC should be carried out following the pertinent permit to be granted by STASY S.A.

**5.2.2 Station Master Room (SMR)**

Inside the Station Master Room (SMR), the Contractor shall supply and install one complete workstation, in order to control and supervise the station and the tunnels, in accordance with the Technical Specifications.

The Contractor should also supply and install the necessary printers, as per the Technical Specifications, inside the Station Master Room in each Station.

**5.2.3 Stations Technical Rooms – Shafts – Tunnel Recesses**

In the technical rooms of the Station, Shafts and Recesses, next to the switchboards of the controlled systems (HVAC, Tunnel Ventilation Systems, E/M Systems), the Contractor shall install an appropriate switchboard, fitted with the all necessary PLC equipment, in order to collect all control points (I/O).

The Contractor shall be responsible for the design, construction, supply, internal cabling and commissioning of PLC switchboards.

Moreover, the Contractor shall be responsible for the design, construction, supply, internal cabling and commissioning of the Fireman Box, whose location inside each Station shall be defined by AM, in accordance with the architectural requirements.

**5.2.4 Communication Networks**

The Contractor shall install communication-data transmission networks as presented in detail below:

**Wide Area Network (WAN)**

The WAN network is used for the transmission of data to/from the stations, as well as to/from the OCC. The works for the installation thereof do not constitute the scope of BACS Contractor, but the responsibility of the main contractor responsible for this specific project. The system in question is already installed in the existing sections of Lines 2 & 3. WAN is a fiber optic network with a stand-by ring layout, used by other systems as well, such as Signaling and Fare Collection etc. through the respective communication ports.



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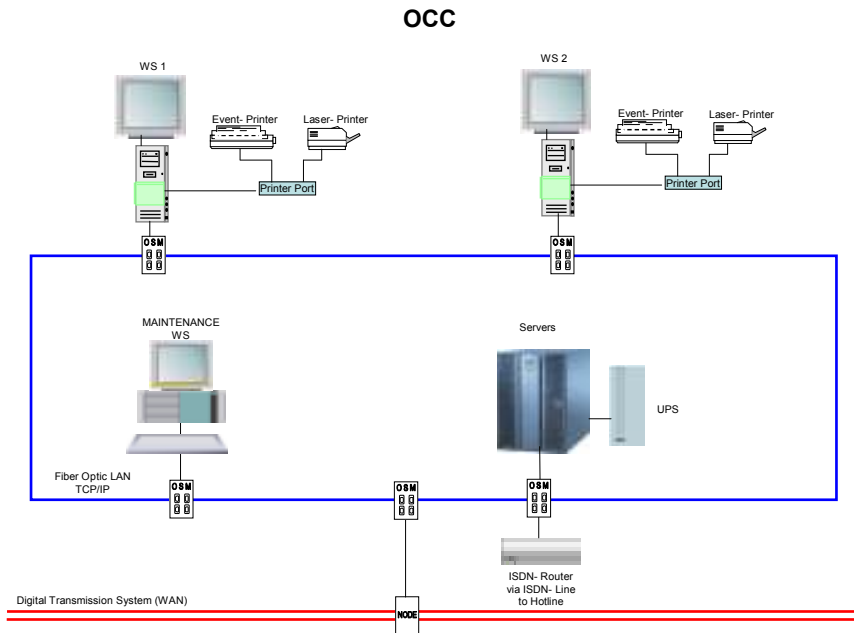
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The Contractor shall define the number and the type of the communication ports as regards the specific project of the extension to Piraeus.

**Local Area Network**

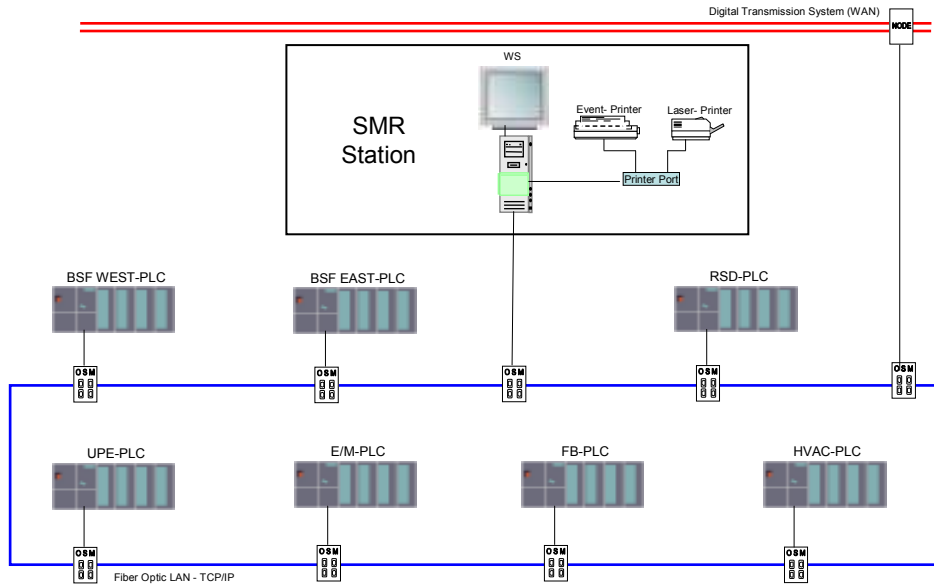
The Contractor shall be responsible for the supply, installation and commissioning of a ring-layout fiber optics local area network (LAN) in each station and the adjacent shafts of the extension for communication among the PLCs, for communication with the local workstations as well as for transmission of control points to the OCC via WAN network.

An indicative general layout of LAN network in the OCC and in a typical station, is presented below; the accurate architecture thereof shall be designed by the Contractor.



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**Typical Station**



**5.2.5 Software Development**

The Contractor shall develop and properly operate the software at local level (PLC) as well as at monitoring and control level (workstations in the OCC and the SMR) for all controlled systems (HVAC, Tunnel Ventilation System, E/M Systems).

The BACS shall have a level of safety, which is as a minimum equivalent to that of an SIL 2 system.

AM shall provide to the Contactor with the Detailed Final Designs (e.g. equipment spatial layout, cable routing trays, input/output (I/O) points, fire scenarios etc.) of the extension to Piraeus prepared by the main contractor, which shall form the basis for the development of the BACS software.



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**6. DEVELOPMENT OF IMPLEMENTATION PROCEDURE AND SCHEDULING**

The Contractor shall submit a complete plan for the development of the implementation procedure defining clearly the detailed steps of designs and works for the implementation of the project in both the extension and the OCC, including the necessary pre-conditions and works to be required by the main contractor and in compliance with the contract documents and the Project time schedule.

The Contractor’s scope shall include all necessary temporary and permanent works, the equipment and software facilities, the interfaces with other systems, the testing, commissioning, training and documentation for the various completion stages, as well as the necessary spare parts.

All works within the operational Metro system shall be executed in a manner not disrupting revenue service and to ensure always a safe and reliable operation after modifications of in service equipment.

The Contractor shall coordinate the implementation strategy and work planning with the main contractor of the extension, as well as with individual contractors of radio telecommunication (TETRA – for the execution of tests) and fare collection systems, STASY S.A. company and shall consider the scheduled activities and work progress required by any other contractor involved, as necessary for the successful execution of his works.



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**7. TECHNICAL DATA DELIVERABLE TO THE BIDDERS BY AM**

In the framework of this tender, AM shall make available to the Bidders the technical data presented below:

1. Technical Description of the BACS System.
2. Design, performance, material and workmanship specifications of the BACS System.
3. General Specifications – Volume I.
4. Drawing Office Manual, Project Work Breakdown Structure System and Equipment Codification.
5. A CD with the coordination drawings of Piraeus extension phase B.