

## **1. DESCRIPTION AND SCOPE OF WORKS**

This specification is for the procurement and installation of the Electronic Services installation to the Trompsburg Special School for the Department of Public Works – Free State (DPW)

The electronic services installation comprises the following components:

- ❖ Fibre-Optic Network
- ❖ Wireless Local Area Network (WLAN)
- ❖ Local Area Network (LAN)
- ❖ VOIP Telephone System
- ❖ CCTV Camera System
- ❖ Security System
- ❖ Audio Visual System
- ❖ Bell Sounder System
- ❖ Intercom/Public Address System
- ❖ Fire Detection System

The project is divided into a school section and a school section. This document details the electronic services cabling and infrastructure required to the Trompsburg Special School only.

The tenderer shall allow to supply and install the complete electronic services installations and infrastructure network cabling solutions as outlined in this document. The work that is to be completed must conform to the specifications tabled below.

This document serves to provide guidance to the design of the network infrastructure systems required to complete the installation. As technology continuously evolves the guide focuses on strategies and concepts more than specific technologies.

The system must be designed to support the entire network infrastructure in a simple manner with the ability to easily maintain the infrastructure.

The performance specification is a general guideline as to how the equipment is to operate. This does not negate the duty nor responsibility of the installer to provide a high quality and high-performance solution capable of installation in any environment and to the standards as expected by the Engineer and the DPW.

Should the installer/tenderer wish to modify any components, these shall be EXPLICITLY mentioned in the covering letter. All systems and sub-systems thereof are to be designed in accordance with the relevant standards and specifications as set out below (“design supply”).

As such, all items that are deemed to be necessary to complete this installation are to be included, for both hardware and software items. It remains the tenderer’s responsibility to ensure that items, whether specified below, or not, are included in the overall architecture.

## **2. DESIGN OVERVIEW**

This document covers the supply, installation, commissioning and documentation of the electronic services installations and network infrastructure for the Trompsburg Special School, Trompsburg, Free State.

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The UTP (Unshielded Twisted-Pair) data installation shall be a conventional structured cabling system shall conform to Category 6A (10Gigabit Ethernet) cabling standards suitable for class E/f computer installations/applications.

A conventional multimode fibre optic infrastructure (OM4) shall be provided as the ICT backbone within the school between the Main Network School Server located in the school admin office to all Comms Riser cabinets and provide a link back to the Main Network School Server located in the school administration block as depicted in the Fibre Optic Network Schematic E6(2)(k) and described in this document.

The fibre optic backbone shall allow for 10 Gigabit transmission speeds.

The data cabling installation is a structured cabling system comprising:

- ❖ Patch racks within Comms cabinets for termination of data points.
- ❖ Active component racks within the Comms cabinets for the installation of fiber optic panels and access switches.
- ❖ Conventional multimode fibre optic data backbone between the Comms cabinets in the school blocks and the Main Server Cabinet located in the Administration block.
- ❖ Horizontal cabling within ceiling void.

All licenses for software and equipment required to operate and maintain the electronic services installation detailed below are to be included in the tender price.

No external copper cabling or links are to enter the school building to reduce potential damage by lightning of the electronic services. No claims for additional costs to achieve system supplier certification will be considered after tender submission.

### **3. EXCLUDED ITEMS**

The computers and related software to be operated on the network infrastructure are excluded together with any monthly subscriptions for items such as Multichoice DSTV bouquets, etc.

### **4. GUARANTEE AND CERTIFICATION**

The network infrastructure installation shall be a certified installation carrying the supplier's 20-year system warranty.

The tenderer shall review the design for conformance to system supplier requirements and include for any required modifications in the Tender bid. Any required modifications shall be fully documented in a covering letter to the Tender. The tenderer shall be responsible for all arrangements required in achieving certification of the installation. No claims for additional costs to achieve system supplier certification will be considered after tender submission.

A written undertaking from the system supplier to certify the system as described in the tender and tender drawings, if installed to system supplier standards, shall accompany the tender.

Proof of Certification of the Tenderer as a registered installer for the system supplier shall be submitted with the Tender. The CCTV, VOIP Telephone, Audio, Lighting Control and Security System shall carry a 12month guarantee from date of handover to the Client.

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The sub-contractor shall submit a priced pro-forma Service Level Agreement for all installations detailed in this specification as detailed in the provisional bills of quantities.

**5. STANDARDS**

The data and voice cabling shall conform to the current edition of the following Standards:

- ❖ ISO/IEC 11801 2008 Edition 2.1: Generic cabling for customers premises.
- ❖ TIA-942: Telecommunications Infrastructure Standard for Data Centers

All components shall comply with ISO/IEC 11801. Where contradiction exists between this Standard and the system supplier standards this shall be referred to the Client in writing.

IEC = International Electrotechnical Commission (Standard)  
 TIA = Telecommunications Industry Association (Standard)  
 ISO = International Organization for Standardization (Standard)

**6. FIBRE OPTIC NETWORK SYSTEM**

The entire school shall be covered by an enterprise grade network system to accommodate adequate wireless access ports, wired data points, VOIP telephones and CCTV cameras for staff and learners within the school.

4 Core, OM4, Multimode Fibre cabling must be used for the fibre backbone to connect server core switches in the Main Network Cabinet in the School administration block server room to the Main Network Cabinet in the School admin office and to the field access switches in network cabinets in the Comms Risers within the school.

The Main Network Cabinet in the administration office shall be at least a lockable 42U floor standing cabinet positioned as indicated on the drawings. Each link shall comprise fiber optic cable (MM) to suit equipment requirements and conforming to the following:

Classification	Optical Fiber Type	Performance
OM4 (Optical Multimode)	50/125 um 850 nm laser optimized Multimode	Minimum bandwidth of 2000 and 500 MHz•km at 850 and 1300 nm operating wavelength, respectively

All splicing of fibre shall be undertaken using a core alignment splices (V groove alignment is not acceptable). The maximum permissible through joint loss shall be 0.30dB. OTDR testing of all fiber links shall be undertaken. OTDR plots for all links shall be included in As Built documentation.

Cables shall be properly glanded with connectors. Connector type to suit equipment. The tender shall be based on LC connectors which will be the default connector type for the project. Connectors shall be color coded (White) All fibers shall be terminated.

The number of fibers of each type and connectors required will be confirmed after tender award. The data contractor shall request confirmation of fiber quantities prior to procurement.

### **Racks**

Rack color shall be black.

Racks shall be equipped with perforated lockable doors front and rear where required (Refer to bill of materials for rack breakdown).

Power strips in the Server room cabinets shall be a 2xRack PDU (230v, 32A, 20x IEC 320 C13, 4x C19) or approved equivalent.

Use lockable 12U cabinets in the school Comms Risers to house field access switches and other network equipment.

These cabinets must be wall mounted, supported by brackets and installed at +1400mm AFFL to underside.

### **Network Switches**

The 10G LAN backbone shall implement a mesh network topology with two 48-port server core switches installed in the Main Network Server Room of the school (located in the school admin office) as indicated on the drawings. The two 48-port server core switches shall be trunked and aggregated to provide fault tolerance and high-speed links between them. This also provides redundancy in the event of one of the server core switches being faulty or going down.

The 10G (i.e. the up-link side must be 10G) field access switches in the school comms risers shall be connected to the school server core switches in the school server room in the school admin office using 4 core, OM4 multimode fibre installed on cable trays within the ceiling void.

The school server switches shall be connected to the school server switches in the school server room (in the Admin block) using 4 core, OM4 multimode fibre installed in PVC sleeves.

8-Port switches are to be supplied and installed in the comms risers within the school in 12U cabinets. Provide 2 additional 24-port switches as spare units together with 4 additional 8-port switches for the school.

### **UPS Units**

Install a 3kVA UPS (uninterruptible power supply) in the Admin office server room to supply the equipment in the server room (in the 42U cabinet) for one hour.

The following criteria must be met by the UPS unit:

- ❖ The UPS must be capable of supplying 3kVA for 60 minutes
- ❖ An internal hot swappable static by-pass switch
- ❖ UPS has modular battery units
- ❖ Batteries **MUST** be sealed for life
- ❖ Batteries **MUST** be swappable

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- ❖ UPS batteries *must* have a battery monitoring system to alarm thermal runaway protection (the monitoring and alarming of batteries in the event of thermal runaway)
- ❖ UPS System and battery condition monitoring **MUST** be installed. Event Alarms/Alerts **MUST** trigger a logged with date stamp. The battery condition monitoring must take place per battery.
- ❖ A cooling system **MUST** maintain the battery environment at  $22.5^{\circ}\text{C} \pm 2.5^{\circ}\text{C}$
- ❖ UPS batteries design life to be a minimum of 5-10 years

The tenderer shall allow to supply an inline rack mounted 800VA UPS for all 24-port and 8-port network switches.

Note the requirement for POE (power over Ethernet) switches, CCTV cameras, wireless access points and VOIP telephones. All the ICT equipment in the various blocks will thus be supplied from the UPS in the 12U cabinet in each of the blocks.

Fibre optic and other cabling must be installed in conduit, sleeves, covered galvanized trunking (P8000 in ceilings) and on cable trays as required.

Fibre optic and other cables and conductors straining around corners, especially corners with sharp edges, in galvanized trunking will not be accepted. Sharp edges must be covered with a suitable insulating material.

Manholes will be kept to a minimum.

Socket outlets shall be installed next to the 12U network cabinets in the school comms risers to power these cabinets.

### **Patch Cords/Fly Leads**

Pre-terminated factory molded UTP patch and work area cords shall be supplied with lengths as indicated in the Bill of Quantities.

Patch and work area cords shall conform to Category 6A cabling standards suitable for Class E/F computer installations/applications.

Server room patch and work area cords shall conform to Category 6A cabling standards suitable for Class E/F computer installations/applications.

### **Testing**

Each cable between the data rack and consolidation point, and between data rack and final outlet (permanent link) shall be fully tested and documented in accordance with TIA 568 including TSB67 and the system supplier requirements.

The tester shall be suitable for Cat 6A as applicable. System supplier confirmation shall be forwarded confirming test instrument approval. Testing of UTP links shall comprise full Level 3 tests performed from both ends.

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OTDR testing of all fibre optic links shall be undertaken. OTDR test plots shall be included in the As Installed documentation. In addition, all multimode optical fibre links shall be tested for; Propagation delay, Optical attenuation of link 2 x wavelengths – 2 x direction, Continuity and maintenance of polarity.

Test results shall be submitted both as hard copy and CD in original format.

All points must be tested by a standard approved minimum Level 3 cable tester. The following tests are required:

- ❖ Wire map
- ❖ Length
- ❖ Attenuation
- ❖ NEXT – NEAR END CROSSTALK LOSS
- ❖ PSNEXT – POWER SUM NEAR END CROSSTALK
- ❖ FEXT – FAR END CROSSTALK LOSS
- ❖ ELFEXT – EQUAL LEVEL FAR END CROSSTALK
- ❖ PSELFEXT – POWER SUM EQUAL LEVEL FAR END CROSSTALK
- ❖ ACR – ATTENUATION TO CROSSTALK RATIO
- ❖ PSACR – POWER SUM ATTENUATION TO CROSSTALK RATIO
- ❖ Insertion Loss
- ❖ Return Loss
- ❖ Delay
- ❖ Delay skew

Test standard to be EIA/TIA, ISO Category 6A Permanent Link.

Other settings required on the test equipment:

- ❖ Nominal Velocity of Propagation (NVP) to be set at 69% on category 6 and 65% on category 6A
- ❖ Fault anomaly threshold to be set at 15%.

Full test results must be supplied on disk with the files saved to “Text” format. A hard copy summary print-out is supplied with all documentation.

A computer-generated floor plan must be provided including all patch rooms and the data centre on completion of installation with the following detail:

- ❖ All walls, both internal and external.
- ❖ Office numbers (if applicable).
- ❖ Cable routes.
- ❖ Exact location of each point with the actual point number.

The date and method of last calibration of Category 6 tester used for testing this installation must be supplied to the system supplier as well as the details of the company that performed the calibration.

## **7. WIRELESS ACCESS NETWORK (WLAN)**

Wireless access points must be installed in the school blocks, Multimedia centre, Hall and the Administration Offices within the school.

All wireless access points (and network switches, CCTV cameras and VOIP phones) must be of the POE (power over internet) type.

Flush with the ceiling wireless access points are preferred to the types that clip onto the tees of suspended ceilings.

Suspended ceiling panels (1200mm x 600mm) must, if required due to the weight of the wireless access points, be reinforced with wooden supports (brandering may be fit for this purpose) when fitting wireless access points that are not supported by the suspended ceiling tees. The wooden supports must be cut to almost the same width as the suspended ceiling panels to rest on the suspended ceiling tees. The wireless access points must be screwed/bolted onto the wooden supports.

The Wireless Access Network will be **dependent** on the fibre optic network described under the Fibre Optic Network heading.

Cat 6a cabling must be used to connect end devices such as wireless access points (also CCTV cameras, data points and VOIP telephone points) to the field access switches.

Cabling must be installed in conduit, sleeves or covered galvanized trunking (P8000 in the ceilings) as required. See note above about sharp edges in galvanized trunking.

Colour coded patch leads must be used when patching data points in the cabinets to differentiate between data / VOIP / CCTV camera / wireless access points.

## **8. WIRED LOCAL AREA NETWORK DATA POINTS (LAN)**

One network data point, wired with Cat6a cabling, must be provided in all school staff accommodation, administration offices and the dining hall.

Network data points must be grouped with socket outlets and telephone points (preferably be combined with telephone points) where applicable.

### **UTP network cabling installation**

Cabling between the local UTP/dual representation rack and final outlet shall be 4 pair Category 6A 100ohm unshielded twisted pair (UTP) cable conforming to ISO/IEC DIS 11801 (Cat 6A). Wiring connections shall conform to TIA 568-B.2-1 Schedule B.

Cabling shall be fully terminated, tested and documented. Test results shall be submitted for all links from rack to final outlet. Cables shall be installed so as not to exceed the minimum bend radius.

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For bend radius applications, obtain the system supplier’s approval before installation.

Provision is made for wireless access points as required to support wireless LAN. To enable wireless technology to be supported where required as an overlay to the structured cabling system, a category 6A telecommunications outlet and power point shall be provided. Power outlet by others.

Data network connectivity to the work area shall be via Category 6A factory manufactured work area cords.

Work area cables shall be fitted with a sleeved printed label on both ends corresponding to the patch panel numbering.

### **Data Centre/Server installation**

The server room UTP (Unshielded twisted pair) installation shall conform to Category 6A (10Gigabit Ethernet) cabling standards suitable for class E/F computer installations/applications.

A structured cabling system shall be installed with 24 port patch panels located at the bottom rear of the rack position and points presented on patch panels (with dual representation) in local UTP/dual representation rack.

Cabling between the local UTP/dual representation rack and final outlet shall be 4 pair Category 6A 100ohm unshielded twisted pair (UTP) cable conforming to ISO/IEC DIS 11801 (Cat 6A). Wiring connections shall conform to TIA 568-B.2-1 Schedule B.

Cabling shall be fully terminated, tested and documented. Test results shall be submitted for all links from rack to floor patch panel.

All cabling between the Local UTP/dual representation rack and floor patch panel shall be strapped on wire basket within raised floor and individually labeled at each end with an approved labeling system.

Each outlet point shall be equipped with a fixed “Graphoplast” label. Cables shall be installed so as not to exceed the minimum bend radius.

For bend radius applications, obtain approval from the system supplier before installation.

### **Data Outlets**

- ❖ Data points must be installed in the school as indicated on the electrical drawings and in accordance with the provisional Bills of Quantities.

**General**

The wired data point network shall be implemented with Cat6a cabling which must be installed in conduit, sleeves, covered galvanized trunking (P8000 in ceilings) or power skirting as required. See note above about sharp edges in galvanized trunking.

The wired data point network will be dependent on the network described under the Fibre Optic Network heading.

Wired data points shall be as far as possible be grouped with VOIP telephone points (can use one outlet with two points for VOIP telephones and wired data points) and socket outlets.

Colour coded patch leads shall be used when patching data point in the cabinets to differentiate between data / VOIP / CCTV camera / wireless access points.

**9. VOIP TELEPHONE SYSTEM**

The tenderer shall allow to supply, install and commission a VOIP PABX/Telephone System with sufficient capacity for both the school and the hostel. The VOIP headend equipment is to be installed in the administration office and linked to the school server.

Telephone points and VOIP telephones must be provided for the telephone outlets detailed on the drawings and the provisional Bills of Quantities. In addition, 4 x telephone outlets and VOIP telephones are to be provided for public use.

Telephone points will be grouped with network data points and socket outlets where applicable.

The telephone system shall accommodate 4 outgoing lines (Telkom lines) for the hostel.

The VOIP telephone system will be **dependent** on the network described under the Fibre Optic Network heading. If the network or PABX go down, the PABX must automatically switch through a Telkom line to each of the school facilities managers office so that these phones still function.

All VOIP phones (and network switches, wireless access points and CCTV cameras) must be of the POE (power over internet) type. Telephone points must be grouped with data points (or preferably be combined with data points) and socket outlets.

Cabling must be installed in conduit, sleeves and covered galvanized trunking (P8000 in ceilings) as required. See note above about sharp edges in galvanized trunking.

Colour coded patch leads to be used when patching data point in the cabinets to differentiate between data / VOIP / CCTV camera / wireless access points in the patch cabinets located in each comms riser.

## **10. CCTV CAMERA SYSTEM**

### **General Description**

Wireways for a CCTV system shall be provided to monitor the school. It is proposed that the School Governing Body (SGB) will arrange for the supply and installation of the CCTV installation at the school.

Colour coded patch leads must be used when patching data point in the cabinets to differentiate between data / VOIP / CCTV camera / wireless access points.

## **11. SECURITY ALARM SYSTEM**

The tenderer shall allow to supply, install and commission an intruder alarm system in the Admin Block, Multi-Purpose School Hall and Multimedia Centre as indicated on the drawings.

The system must conform to the following requirements:

- ❖ Internal passive detectors for the security alarm system must be installed to fully cover the areas as indicated on the drawings.
- ❖ Panic buttons must be installed in the following locations: Admin Block, Multimedia Centre and Multi-Purpose School Hall.
- ❖ Each area shall have a localized alarm system.
- ❖ A keypad with multiple programmable functions shall be provided for every localized alarm system.
- ❖ The keypads shall be at the exit doors next to the exit light switch.
- ❖ There must be LED lights outside each block front door which indicates the state of the alarm, e.g. a red LED means the alarm is armed and a green LED means the alarm is not armed.
- ❖ Each localized alarm system will have a siren installed in the ceiling of the area that is audible across the full extent of the school terrain and the surrounding area to the school.

The described arrangement would enable the facility manager to be in control of the alarm system in his/her areas or blocks. There is then also a need to provide for a centralized main control panel to cater for the various operational scenarios, such as when the responsible person is coming late, leaving early, not at the school, etc.

Below is a list of requirements for the main control panel of the school security system:

- ❖ The main control panel of the school security system must be installed in the server room in the school admin office as indicated on the drawings.
- ❖ The keypad that interfaces to the main control panel must be next to the front door on the inside of the administration building. An officer must be able to arm and disarm each localized alarm from this keypad.

- ❖ A display panel with an LED for each localized alarm system must be installed near the school building keypad. The display panel must mimic the school layout and it must have engraved names for alarm zone. A red LED in a zone means the alarm of the zone is armed and a green LED means the alarm is not armed. It must not be possible to view the display panel from the outside of the school building.
- ❖ The school zone display panel must be powered from the main control panel.
- ❖ The school will have a siren that is audible across the full extent of the school terrain and the surrounding area to the school.
- ❖ The main control panel shall have the means or provision for remote/external communication via a network cable (control via network/internet) or radio transmitter.
- ❖ When any of the localized alarms are activated SMS notifications are to be sent to a pre-programmed list of responsible persons.

A display panel like the one in the school must be installed in the guard house.

The security personnel in the guard house must only be able to arm every localized alarm but not to disarm the alarms from the guard house keypad. This is for the operational scenario where the school facilities manager or supervisor forgets to set the alarm.

All the expander and control panels must have battery backup for up to 48 hours.

The system components shall be of a type that enjoys excellent product support in South Africa by more than one firm that has been in operation supporting the product for more than 5 years.

The security system shall be comprehensively provided with surge protection.

Cabling shall be installed in conduit, sleeves and covered galvanized trunking (P8000 in ceilings) as required. See note above about sharp edges in galvanized trunking.

The security system shall function independently of other electronic systems and the ICT network (but it must also be possible to set the alarm system up in such a manner that it can be controlled via the ICT network).

The Intruder Alarm System shall comply with SANS 60839-2-6:2010 as amended.

## **12. AUDIO-VISUAL SYSTEM**

The tenderer shall allow to supply, install and commission an audio-visual and lighting control system for the Trompsburg Special School as indicated on the drawings and detailed in the specifications.

### **Audio System**

The audio system will be restricted to the Multi-Purpose Hall for the school.

The system must conform to the following requirements:

**Audio Speakers**

Install audio speakers on the front wall of the hall on each side of and on each of the sidewalls of the hall (four speakers in total) as indicated on the drawings.

Audio speaker shall consist of 4 x fixed 2-way 300W 8ohm speakers mounted as indicated on the drawings.

Speakers shall be high definition audio 2-way 300W 8ohm speakers to provide suitable audio resolution within the hall.

**Amplifiers**

The amplifier(s) and supporting equipment must be secured against theft and vandalism and must be installed in a lockable AV cabinet in the dining hall.

The tenderer shall allow for a suitable amplifier or similar approved suitable to drive the 4 x 300W speakers. Socket outlets as required will be provided for the amplifier and speakers of the sound system.

The tenderer is to liaise with the electrical sub-contractor for the installation of outlets.

**Audio Cabling**

Audio cables shall be high quality twisted pair screened cables suitable for indoor use.

**Microphone Point**

A microphone point shall be provided in a box installed flush to the wall in front of the hall. The tenderer is to allow to supply 1 x high-quality hand-held microphone as part of this tender.

**Overhead projector and screen**

An overhead projector shall be supplied and installed against the roof of the Hall as part of this contract.

The projector shall be UHD suitable for the use in a Multi-Purpose Hall, complete with mounting and fixing brackets, etc. A socket outlet for the overhead projector shall be provided against the ceiling of the Hall. The tenderer shall allow to liaise with the electrical sub-contractor for the final positioning of this outlet.

It must be possible to stream videos via the projector from a laptop computer, control the projector with a laptop computer via a plug-in jack next to the microphone point in front of the Hall or via “Bluetooth” connectivity.

The projector screen must be mounted above and in front of the Dining Hall at a suitable height/position to project onto the screen.

**Light Control Console**

A lighting control system is to be provided for the control of the lighting within the hall as part of this contract.

Lighting control will consist of a dimmer panel for the control of the hall lighting.

**13. BELL SOUNDER SYSTEM**

An electronic bell sounder system shall be provided throughout the school premises as indicated on the drawings and detailed in the provisional Bills of Quantities.

The bell sounder headend equipment shall be in the Administration Block reception as detailed on the drawings. The sounder system shall be adequate to provide audio communications to all blocks within the school.

**14. INTERCOM/PUBLIC ADDRESS SYSTEM**

An intercom/public address communications system shall be provided throughout the school premises as indicated on the drawings and detailed in the provisional Bills of Quantities.

The intercom headend equipment shall be in the Administration Block reception as detailed on the drawings. Communications initiation shall be from the Administration Block reception only. And shall provide adequate communications to all blocks within the school.

**15. FIRE DETECTION SYSTEM**

The tenderer shall allow to supply, install and commission an automated fire detection system throughout the school building in accordance with SANS 10400, and SANS 10139.

The tenderer shall allow to supply and install a zoned automated analogue addressable fire detection system as indicated on the drawings.

The system shall conform to the following requirements:

**General Conditions**

The system shall be provided in accordance with the local Municipal regulations, SANS 10139 and (EN) BS 5449.

The system design shall comply with BS5839. The fire alarm contractor shall review equipment siting as indicated on the drawings and highlight non-compliant aspects at tender stage.

The system installed shall be of the analogue addressable type.

**Equipment Description and Constraints**

The control panel used shall be of the analogue addressable type. All detectors shall be individually addressable.

The control panel shall be able to accommodate 4 loops. The fire detection system shall be so designed that it is possible to connect up to 128 detectors per line.

The system shall permit all types of detectors (light-scattering smoke detectors and rate-of-rise temperature detectors) to be operated within one zone.

All wiring shall be configured as a loop. Spur wiring shall not be permitted.

Detectors shall be spaced as per specified manufacturer's recommendations and according to the FOC/NFPA standards.

#### Detectors

##### General

All detectors shall have a built-in response indicator (signal lamp) and the means to connect a remote response indicator (externally mounted). Remote response indicators shall be provided for all detectors mounted in concealed locations. The indicator mounting position shall be as agreed with the Engineer.

All detectors shall be designed for a 20-30V DC operating voltage and shall be suitable for being connected to an addressable controller. All detectors shall be of the analogue addressable type, whereby the value of each detector output is monitored and a pre-alarm condition due to contamination of the detector is reported by the fire alarm panel.

The address of each detector shall be clearly indicated by means of a trafficite or other approved label mounted on the detector.

##### Detector Mounting bases

The detector mounting bases shall be Universal Twist Lock Bases. Each mounting base shall be equipped with a manual operating switch used to establish initiating circuit continuity without a detector head. Plugging in a detector head shall automatically reset the switch so that the subsequent head removal will cause an open circuit to initiate a trouble signal at the Control unit.

The optical and heat detectors shall all use this common base. It shall be possible to lock all detectors into position once installed.

##### Photo Electronic (Optical) Smoke Detector

The smoke detector heads shall be two wire photo electronic detectors that operate on the light scattering principle using a pulsed LED light source and a silicon photodiode sensing technology. The omni-directional sensing chamber shall be protected by an insect screen and be unaffected by ambient light.

The detector shall mount to a common Twist Lock Base and be electrically interchangeable with detectors using different technologies.

The detector shall operate between 0 and 50 degrees centigrade with an operating air velocity of between 0.15 and 25m per second. The sensors shall be calibrated to the sensitivity requirements of (EN) BS 5445: Pt 7

##### Rate of Rise Temperature detector

This detector shall give an alarm both for a rapid rise in temperature and when a maximum temperature is exceeded (approx. 60°C). Detector sensitivity shall be appropriate for ceiling height and normal response time.

Duct mounted detectors

Duct mounted detectors if require, shall comprise a dedicated housing accommodating an optical smoke detector conforming to 1.3.3 above.

Beam smoke detectors

The beam smoke detectors if required, shall consist of separate transmitter and receiver units. The transmitter shall transmit an infra-red signal which is detected and monitored by the receiver unit.

The transmitter receiver pair shall be suitable for operation at a maximum range of 100m.

The fire alarm system shall monitor separate fault and alarm volt free contacts from each receiver unit. The receiver unit shall automatically compensate for signal deterioration due to dust and alignment. A fault alarm shall be provided should the signal deteriorate to a point where the automatic compensation is not effective.

A time delay shall be provided to avoid false alarms due to temporary obstruction of the beam (less than 10 seconds). An obstruction of the beam for more than 10 seconds shall result in a fault indication.

The receiver and transmitter shall be powered from the fire alarm system at low voltage including battery back-up for 48 hours. Power supply costs shall be included in the receiver/transmitter rate.

Beam detectors shall be supplied with a set of filters to test sensitivity/operation.

Beam detectors shall conform to BS5839 Part 5.

Technical detail of the beam detectors offered shall be submitted at tender stage. The tenderer shall verify at tender stage that the detectors offered are suitable for the distance/spacing indicated on the tender drawings.

Sprinkler flow switches

Sprinkler flow switches if required, shall be supplied and installed by the Sprinkler Contractor. Flow switches shall incorporate a NO volt free contact. Wiring to the flow switch shall be by the Fire Alarm Contractor.

The fire alarm system shall incorporate a time delay to prevent false alarms on non-activated runs arising from the pressure surge on activation of the sprinkler jockey or main pumps.

**Manual Call Points**

The manual call point shall be constructed from ABS Plastic in fire red to BS5252. 20mm conduit entries shall be provided. The call point shall conform to BS5839 Part 1 Fire Detection and Alarm Systems.

Manual call points shall be semi-flush mounting, resettable type, without a break-glass unless otherwise indicated. The fire alarm contractor shall supply outlet boxes to the electrical contractor for installation.

Manual call points shall have a positive visual indication of operation.

All manual call points shall contain a key operated test feature to test the actual operation of the switch. All manual call points shall be provided with a resettable key operation for the end user.

**Output devices**

*AHU interfaces*

The AHU interfaces if required, shall comprise a set of NC volt free contacts rated at **240V 1A** and wired to a terminal strip provided by others in the AHU motor control centre. Where necessary an interposing relay shall be provided by the fire alarm contractor to achieve the above contact rating.

The tenderer shall obtain confirmation in writing from the MCC supplier that it is safe to terminate the fire signal and undertake commissioning tests in conjunction with the MCC supplier.

*Fire Damper interfaces*

The Fire dampers, if required, shall require **240V 10A** relay to be supplied by the tenderer to control power to the fire damper motor. The fire dampers shall be configured to fail-safe close.

*Lift interfaces*

The lift interfaces, if required, shall comprise a set of NC volt free contacts rated at **240V 1A** and wired to a terminal strip provided by others in the lift control panel.

Where necessary an interposing relay shall be provided by the tenderer to achieve the above contact rating.

**Fire Control Unit / Main Fire Panel**

The Fire Control Unit shall provide audible and visual annunciation of critical system conditions and primary system operating controls.

Visual indication shall be provided for common alarm and trouble, AC Power and silenced alarms.

An integral trouble buzzer shall provide audible notification of system trouble conditions. Individual switches shall be provided for alarm and trouble signal silence, lamp test and system reset.

Silence switches shall be provided with a subsequent alarm resound feature, with provisions for remote alarm silencing. Detection of a trouble condition shall cause the Trouble Indicator to flash, the Trouble Buzzer to sound and the Trouble relay to operate. Operation of the Trouble Silence switch shall silence the Trouble Buzzer.

The control panel shall support a minimum of 4 loops unless otherwise indicated.

The Control Unit shall have green supply off indicator lamps, automatic fault monitoring for open circuit detector lines, alarm lines, mains failure, battery disconnection, charger failure and battery or supply fuse failure. Silence alarms key switch, lamp test, reset key switch.

The panel shall incorporate an LCD display of not less than 2 lines of 40 characters. This display shall indicate the device address in addition to an easily understood device type and location description for any device in alarm, pre-alarm or trouble condition. Panel controls shall be protected by key switch or lockable cover.

A history log of at least the last 100 events shall be stored in the controller.

The controller shall continuously monitor the status of detectors and report detectors where contamination has reached a level where maintenance is required. It shall be possible to adjust the sensitivity of individual devices (within the limits imposed by the applicable standards) from the control panel.

All programming functions shall be password protected. A serial port for connection of a notebook computer for downloading of system programming shall be provided. System programming shall be stored in non-volatile memory which shall be unaffected by complete loss of normal and reserve supply to the unit. A soft copy of the programming shall be included in the manuals in diskette and CD ROM format.

A serial port shall be provided for high level communication between the Fire Alarm and any BMS systems. An SMS notification feature shall be provided to relay alarms to responsible personnel or other response organizations.

The School Main Fire Panel shall be linked to the School Main Fire Panel and to the common Guard House providing a general common alarm only.

#### **Power Supply unit**

The power supply unit for the Fire Alarm System shall have ample capacity to operate the complete control system, bells, audible signals, detectors, etc. At the same time the Power Supply Unit shall be able to provide current to charge the batteries from trickle charge to 2.5 amps for restoring flat batteries. The power supply unit shall indicate a fault in the event of a mains failure or battery failure.

#### **Batteries**

The batteries shall either be of the nickel cadmium type or sealed lead cell type and shall have ample capacity to provide power for 48 hours under normal conditions plus one hour under evacuation conditions.

#### **System operation**

Any actuated Detector shall automatically and simultaneously sound alarm signals at the Control Panel and illuminate a display at the Control Panel.

Unless otherwise specified in the detailed specification the evacuation system shall be automatically activated. A trouble signal in the Control Panel shall be actuated by a fault in the wiring system or by the removal of a detector and be silenced by a disconnecting switch & pilot light.

#### **Installation**

The tenderer shall connect equipment in a manner approved by the Engineers. The equipment shall be wired in strict accordance with the Manufacturers wiring diagrams and instructions.

Before any materials are installed, the final locations and the method to be used shall be discussed with the Engineer. No surface cabling will be permitted in the public areas and all cabling shall be installed in P8000 trunking or on cable trays in ceiling voids.

#### **Cable types**

##### **Detector and sounder cabling**

All cabling shall comply with SANS standards and local Municipal requirements.

All surface cabling shall be either FP200 Fire Resistant Cable, MICC (Mineral Insulated Copper Clad Cable) or any other equal and approved alternative.

All cabling shall be installed and terminated according to the Manufacturer's instructions. The cabling shall conform to BS5839 Fire Alarm System, BS5266 Emergency Lighting Systems and BS6387 Fire Performance.

The cabling shall pass the performance criteria of IEC 331 Fire Resistance Test, IEC 332 Alarm Retardance Test and CEGB specification GDCD195 which requires that working voltage shall be maintained in a flame of 1000 degrees centigrade for at least 20 minutes.

Power cabling

All power cables between the control panels, the detector zones, the audible alarm units, the evacuation sounders, the mimic panels and the battery pack shall be as follows:

- ❖ Mineral insulated metal sheath cable, which shall comply with BS6207.
- ❖ Fire resistant cable in compliance with SANS 150 and SANS method 494 resistance to cables to Fire Propagation. This cable shall comply with BS5839 and BS6387.
- ❖ PVC SWA PVC fire retardant cables and terminations complying with SABS 150 shall be allowed where cabling passes between buildings and is embedded in the ground. This cabling however will not be permitted along the surface of the building.

Related work

This tender shall include for the provision of a 230V supply for the control panel, as well as the removal, cutting and replacement of ceiling tiles, making all penetrations and the final making good in all areas worked.

An allowance has been made for the provision of any additional power supplies or wireways required for the electronic systems included in this tender.

**Maintenance & Operation**

Testing and maintenance of Fire Safety Systems shall be in accordance with the manufactures instructions or as otherwise specified by the Governmental Authority having jurisdiction.

The statement certifying that such testing and maintenance has been performed shall be signed by the Engineer and by either the Maintenance Company Representative conducting the test or by an individual trained to perform such maintenance and testing.

All statements certifying such tests shall be kept retained on site.

The sub-contractor shall allow for training of five members of the Clients staff to be fully conversant with the operation and troubleshooting of the system. The sub-contractor shall allow for training of five members of the Clients security staff to be fully conversant with the operation of the system.

Three bound copies of each of the maintenance and the operating instructions of the system shall be provided by Tenderer at handover of the system together with three soft copies.

**16. ELECTRONIC SYSTEMS MAINTENANCE**

All pricing must include for monthly site visits during the maintenance period of 12 months. Non-functioning electronic services equipment shall be repaired or replaced during these visits.

The SGB shall be required to conclude service level agreements for all electronic services installations with approved suppliers following the 12-month maintenance period.