

**AUTOMATIC CONTROLS SPECIFICATION  
BMS HEAD END UPGRADE**

## AUTOMATIC CONTROLS SPECIFICATION BMS HEAD END UPGRADE

Ref:

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Comments		

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## **1 AUTOMATIC CONTROLS**

The BMS specialist shall design provide, design, install, set to work test and commission a new Trend IQ vision head end supervisor complete with dynamic graphics and management user interfaces.

The hardware such as the server, display supervisor screens, keyboard and access system shall be described by the BMS specialist but the works shall be provided by the client IT team. The BMS specialist shall be responsible for the provision of all software, firmware and operating systems, construction of graphics, alarm handling, management reporting and such information required for the safe use for operation of the BMS head end supervisor.

### **1.1 Outline**

This document describes the work package required for the upgrade and replacement of the existing Trend 963 v3.30 BMS head end supervisor which is and the new system will remain as a virtual machine managed by the Client Digital Team, with an IQ vision BMS supervisor.

The FM team access route to the BMS head end supervisor server shall be from any desktop PC running a suitable web browser. This desktop PC shall be connected to the server via the client IT network system and allow all normal head end access with the exception that software configuration shall not be possible. The Client Digital team shall configure suitable access passwords to the server to allow the BMS specialist and where appropriate the Client FM team to reconfigure BMS operating software.

The hardware such as the server and all network connections shall be provided by the Client, the BMS specialist shall provide the full specification for the hardware any necessary software for the operation of the system. The BMS specialist shall provide all necessary software for the operation of the BMS server supervisor.

Although graphics can be migrated for this project this shall not be considered, all field and virtual point shall be redrawn, all alarm handling reassessed, all management interfaces reconfigured. However, all other tools provided by Trend as part of the 963 to IQ vision upgrade shall be provided by the BMS specialist and can be utilised as part of the works.

The existing 963 and the new IQ vision shall run side-by-side throughout the life of the project. When all witness testing is complete the 963 and all routing of graphics, alarms and the like shall be redirected to the IQ vision.

It is not the intention of this project that operating plant philosophy is amended however, the BMS specialist should be aware that all alarm values should both be checked with the FM team as being reasonable and where necessary additional alarm handling routines added to the remote site. These alarms will not affect the plant operation they are merely plant failure or temperatures outside of acceptable range that require to be brought to the attention of the FM team.

A separate display screen with inbuilt PC capabilities for the web browser will be provided by Client and connected to the Client network through which critical alarms shall be displayed in the security office.

The work is to the benefit of the client and the BMS specialist should allow time during the construction period for workshops in which standards of user interface, graphics, alarm handling and the like can be agreed and then implemented throughout the project life.

The existing system shall remain live. As each site is completed the works shall be migrated, tested and witnessed and then handed to the Client FM team for operation.

At the project completion the BMS specialist shall re-evaluate and demonstrate the remote field and virtual points back to the new BMS head end supervisor along with all remote alarm and management functions that have been agreed.

The BMS head end supervisor is currently a Trend 963 installed at a number of remote building locations some of which have more than one access point:

The system includes around 1000 Graphic pages with approximately 13,000 points.

## **1.2 Existing system audit**

The Client FM team have run an audit of the existing head end supervisor and this is available to the tenderers for review during the tender period.

## **1.3 Role and responsibility**

The BMS specialist shall read this document in conjunction with all sections of the Contract preliminaries.

The client does not wish to employ any contractor other than the BMS specialist for the entirety of the work. The BMS specialist shall therefore include all roles and responsibilities required for the successful completion of the project.

The technical objective of the overall project is

- To replace the existing Trend 963 supervisor with new IQ vision supervisor utilising the latest operating software (at the time of order place). The licence shall be provided to include 150,000 point database.
- To provide configuration and construction of all-new graphics based on the existing field and virtual points installed across the various sites. Migration of graphics is not the object of this project. It should be noted that some of the existing graphics are provided with jump tags that have broken links. It is a requirement of this project that all jump tags jump to the correct graphic, on project completion.
- To configure the system access for a number of different style of users each with different requirements.
- To provide configuration and construction of consistent user interfaces for every piece of plant and equipment that appears on the BMS graphic.
- To reappraise plant operating times are just as appropriate to suit the operating procedure of the areas served.
- To modify and enhance the alarm functions at each site.
- To modify and enhance the alarm handling to provide the user with groups of critical, non-critical and maintenance alarm systems.

- To provide routing of particular alarms to a separate display screen (dashboard) mounted in the security office.
- To provide automatically generated emails of particular alarms with sufficient information regarding the alarm including the site, date/time, services system, alarm state to particular email accounts.
- To provide configuration of all trend and history points including sensor values, valve positions and plant on-off monitoring.
- To provide dynamic graphics in HTML 5 format freely scalable for any sized display screen for all field and virtual points associated with the site wide project.
- To provide enterprise level data archiving using MS SQL Server 2016.
- To provide 3 year maintenance contract maintenance and upgrade.
- To provide O and M manual for the project.
- To provide IQ vision specific training for 8 users.
- To provide site specific training for 10 users.
- To provide specific site user manuals along with simple crib sheet for use by the operator.
- To provide new PDF copies of all existing plant operating procedures and load these onto the server and provide jump tags from the appropriate graphic to the system description of operation.
- To provide new PDF copies of all existing panel wiring diagrams and load these onto the server and provide jump tags from the appropriate graphic to the panel wiring diagrams.

### **1.4 Design responsibility**

The BMS specialist, although not responsible for the complete system design, shall take on board the design and management in conjunction with the Client FM team for various aspects of the development of the dynamic graphics and user interfaces.

It is a requirement that all of the graphics be redrawn to a standard agreed between the BMS specialist and the Client FM team. To achieve this the BMS specialist may use standard library symbols however the BMS specialist shall include sufficient time to run and manage workshops with the Client FM team to agree the format principle. It should be noted however that as graphics are very difficult to approve until they are dynamic the BMS specialist shall recognise that changes may continually be required but on a minor basis throughout project development.

The BMS specialist shall in conjunction with the Client FM team develop the alarm handling procedures. Although alarms are currently existing and grouped these shall be amended in agreement with the Client FM team.

### **1.5 Phasing strategy**

The work shall be carried out to a program and phasing to be agreed with the Client FM team. It is likely that buildings will come online on a piecemeal basis and the BMS specialist shall provide full-time attendance after the first system has gone live to ensure that the facilities team has full support throughout the life of the project.

### **1.6 Project programme**

The BMS specialist shall develop the project programme in conjunction with the FM team with a start date anticipated as January 2021 the completion date of July 2021.

The BMS specialist may develop their own work sequence however the following should be considered as a logical progression.

- Visiting each site uploading any necessary database.
- Back up the existing system and store this securely such that in the event of a major system failure the 963 could be reinstated.
- Provide the specification for a dedicated BMS server.
- Establishing with the FM team an agreed format for the graphics.
- Establishing with the FM team an agreed alarm handling routine, values, and routing along with English-based descriptors.
- Establishing with the FM team an agreed user interface method for such things as: Manual plant control, trend logging, automatic report generation.
- Purchase, install and set to work, in conjunction with the Digital Team all necessary operating software.
- Modify remote sites where necessary for enhanced alarm handling.
- Modify remote sites where necessary for trend and history logging.
- Construct all graphics and user interfaces and test these off-site. Site specific graphics shall be generated on a site by site basis tested and then uploaded to the new IQ vision.
- Installing the graphics (on a site by site basis) and verifying field to graphic continuity.
- Setting the system to work.
- Demonstrating the operation of each site.

### **1.7 Technical documentation returned with tender**

The contractor shall provide with the tender return a method statement describing the work content the proposed method of construction and commissioning and an outline programme describing the work sequence.

These documents a summary of which are described below, shall be further developed by the BMS specialist during the course of the contract.

The lump sum tender price shall include all works necessary for the project including pre-contract surveys BMS specialist.

- An outline design and construction programme. This should have durations and sequence rather than specific dates.
- A method statement explaining how a survey of the existing field and virtual points shall be established.
- A method statement outlining the approach to the construction of new graphics.
- A method statement outlining the procedure for developing alarm set points, alarm messages and implementation of alarms.
- A method statement outlining the involvement with the FM team.
- A method statement outlining the development of user interfaces.
- A method statement outlining the procedure for off-site testing of dynamic graphics and user interfaces
- A method statement to describe the sequence of handover on a system by system basis and the support that will be provided to the FM team from the point of the first handover to the project completion.
- A method statement describing how existing operating and maintenance information will be collated and uploaded to the new server.
- A method statement describing how missing or incorrect existing plant operation could be produced. Such as backward engineering from the uploaded plant operating strategy.
- A schedule of rates.

### **1.8 Outline scope**

The client does not wish to employ any contractor other than the BMS specialist for the entirety of the work. The BMS specialist shall therefore include all necessary activities such as: liaison with the client, management of all third-party specialists, all insurances required during the project period, delivery and distribution of all equipment, strip out and disposal of all redundant equipment, all making good that are required for the complete project.

### **1.9 Project overview**

This specification describes the roles and responsibilities of the BMS specialist provider in developing and implementing the replacement Trend IQ vision BMS head end supervisor for the existing Trend 963 supervisor.

The BMS specialist shall provide a fully configured BMS head end Trend IQ vision. The server shall be provided by the Client although all operating software to be provided by the BMS specialist.

The BMS specialist shall provide and configure the operating software that shall be the latest version at the time of. The system shall be configured to interface to Microsoft Excel and SQL database.

The primary objective of the contract is the replacement of the existing supervisor that is the FM teams window on to the local and remote sites and displays the MEP plant and



equipment. The work shall include the decommissioning of the existing Trend 963 and the re-routing of all traffic from the remote sites to the new head end supervisor.

The BMS specialist shall provide complete new graphics and management interfaces all based upon a common strategy. Where jump tags, dialogue boxes, user overrides and the like are required the BMS specialist shall construct and test these such that existing jump tag and dialogue boxes that currently have broken links are all complete and operational at project handover.

The head end supervisor audit report identifies issues with networks, missing alarm links, retry configuration and other items. The BMS specialist shall include within the project costs sufficient time to evaluate these issues and provide solutions. Where the solutions require additional hardware these shall be identified by the BMS specialist but are not part of the current project cost. The BMS specialist shall however include costs within the project to resolve the technical software issues.

Although the hardware shall be provided by the Client the BMS specialist shall provide a full specification and shall work in conjunction with the Client IT team to develop all necessary routing between the sites, the new head end supervisor and all subsequent remote display panels.

The BMS specialist shall back up the existing system and when agreed with the client shall backward engineer the control strategy to determine the detailed plant operation, reference shall also be made to the existing O and M manuals. The costs for the backward engineering is a below the line cost and described in the schedule of rates.

It should be noted that the existing and remote sites are live and that the BMS specialist shall work closely with the Client FM team to maintain continuity of communications between the existing FM office and all remote sites throughout the duration of the project.

It is anticipated that the existing Trend 963 shall remain active throughout the project with each site coming online in sequence. The 963 shall remain the primary source to be used by the FM team throughout the project period with the IQ vision running alongside and being reviewed on a daily basis by the BMS specialist to check that the existing and new dynamic information are identical with respect to plant operation, alarm handling and management control.

### **1.10 Preferred Supplier**

The BMS specialist shall be a Trend Technology Centre alternatively a Trend System Integrator approved for use by the Client.

### **1.11 Continuity of service**

The Contractor should note that the work will be carried out in a live environment and as such due diligence shall be taken to ensure that the FM team continue to have full and uninterrupted access to all existing sites via the existing Trend 963 supervisor. Whenever the BMS specialist requires access to the live system it shall be at agreed times with the Client FM team.

### **1.12 Work sequence**

It is envisaged that the existing head end supervisor and the new head end supervisor run side-by-side during the construction period. The BMS specialist shall propose the solution for partial handover of systems as each site becomes alive. Generally when the site has been proven to provide accurate information the existing graphics associated with that site although remaining visible on the existing Trend 963 shall have a clear banner placed in front of them describing that this site is now active on the new system. This banner should not hide any information but it should be sufficiently obvious to the operator that access should now be via the new BMS head end supervisor.

### **1.13 Point to Graphic**

It is anticipated that as each site becomes live it should remain running in a duplicated mode for perhaps 2 weeks during which time the BMS specialist shall demonstrate to themselves remote point to graphic, this will include physical trips to the remote site to test at least 25% of each point type and confirm this back to the BMS head end supervisor. If these point to graphic test fail but the point described is the same as that on the existing Trend 963 then the BMS specialist shall highlight this in a defect report to the Client along with an outline cost to solve and rectify the issues.

### **1.14 Handover sequence**

The BMS specialist shall note that although the systems are being handed over on a site by site basis they shall remain responsible for the data being provided at the new BMS head end supervisor until the project completion. It is anticipated that at each handover the FM team will make use of the system and as such are likely to have issues perhaps with use and/or data being provided. The BMS specialist should include within the project cost for sufficient time to accommodate the FM team questions, record the points raised, propose and implement the solution.

The BMS specialist shall provide at each stage handover, test certificates describing the work carried out, the tests results achieved and note any revised plant operating procedures.

The plant operating procedures and panel wiring diagrams shall be uploaded to the BMS server by the BMS specialist and shall be accessible by use of jump tags from the appropriate BMS graphic.

At project closure the complete system including all previously handed over sections shall be retested, witnessed and demonstrated as a homogenous installation and all documentation provided.

### **1.15 BMS field instruments and actuators**

It is not the intention of this project that the existing BMS field instruments and actuators are changed or modified. However, the BMS specialist shall draw the attention of the FM team to any areas and systems that may be better served if additional sensors are installed or where possible actuators/instruments required to be replaced.

## **1.16 Extent of Work**

The BMS specialist to be responsible for the complete works, the only exception is that the Client IT team will provide the network configuration.

## **1.17 Services to be Provided**

### 1.17.1 Definitions

Provide – includes design, supply, deliver, off load, move to work location, install, set to work test and commission and documentation.

Supply – includes purchase, provide warranty for product, transport to site, unload, move to and fix in final location.

Design – includes the review of the specification with positive suggestions for improvement of the works, the provision of the User Requirement Document and the subsequent Functional Design Specification.

Install – includes all software, outstation configuration, integration to the head end, routing and configuration, graphics and management reports.

Set to work (BMS) – includes operational strategy documentation, software and testing procedures.

Commission – includes commissioning plan, co-ordination and management of third party suppliers, testing the system and demonstration to the client.

Documentation – includes all operating and maintenance manuals.

### 1.17.2 Technical work scope

The controls system shall interface to and control the building services equipment shall include but is not limited to the following:

#### 1.17.3 Stage 1

1. Provide a backup of the operating and configuration software that exists at each remote site.
2. Provide a backup operating and configurations strategy for the existing Trend 963.
3. Review the existing Trend upgrade audit report and propose solutions to the issues raised.
4. Provide the User Requirement Document that shall include an outline of the work scope, proposed graphic library with graphics for specific systems, proposals for the alarm handling, proposals for user interface at the graphic, proposals for remote alarm indication, proposals for user groups and user rights.
5. Arrange workshops with the Client FM team to develop the User Requirement Document.
6. Develop and expand upon the method statements identified as being required to be supplied with the tender return.

7. Provide the Functional Design Specification, following agreement of the User Requirement Document that shall include the agreed graphic format, alarm values, alarm handling, alarm routing, points to be trend logged with sampling times and duration, user interfaces such as manual control of points.
8. Provide the Functional Design Specification for any additional hardware or communication system that require to be provided by the Client FM/IT team.
9. Provide the outline commissioning and handover procedures.

#### 1.17.4 Stage 2

Provide and set to work the BMS head end supervisor upgrade.

The work shall include all necessary strip out and system replacement.

1. Provide new dynamic graphics across the entire portfolio for all field and virtual points.
2. Provide alarm handling strategies.
3. Provide management and user interfaces.
4. Provide network routing configuration from field to dynamic graphic point.
5. Provide all operating software, firmware and licences. Licences shall be provided to allow a 200% expansion of the system at project closure.
6. Provide the complete BMS head end supervisor engineering and configuration.
7. Provide cyber security software for the BMS head end supervisor.
8. Provide a fully integrated BMS/controls and plant testing regime.
9. Provide 25% field to graphic demonstration of every point on a site by site basis and a subsequent 10% across the whole project.
10. Provide a full witness of the complete BMS.
11. Provide return visits to modify and adjust system operations based on information provided by the user.
12. Provide a completion report of the installation, testing and demonstration of the BMS
13. Provide the BMS Operating and maintenance manuals.
14. Provide training of operators for both general IQ vision use and specifically use of this system.
15. Provide all necessary consumables for the project.

#### **1.18 Standards, Codes and Regulations**

The Automatic Controls will be designed, installed, tested and commissioned in accordance with the following:

- Statutory Acts
- Local Standards and Standard Codes of Practice

- Local Authority Building Regulations
- Health & Safety at Work Act
- The requirements of the relevant Local Authority
- The requirements of the relevant Water Authority
- The requirements of the relevant Fire Authority
- The fire officers committees/the loss prevention councils rules and recommendations
- The Factories Act
- Current Institute of Plumbing Standards
- The current Electrical Regulations with amendments
- The Environmental Health and Safety Office
- Manufacturers Recommendations for Installation Testing Commissioning and
- The Landlord's Regulations and Approvals.

Reference will be made to BS 7002, BS EN 55022, BS EN 61000, BS EN 55014, BS EN 60439, CIBSE Guides and Commissioning Code C, BS EN ISO 9000 and the Controls Group Publications.

### **1.19 Quality Control**

The contract will be carried out under following the principles of the BMS specialist's Quality Assurance documentation.

### **1.20 Responsibilities**

#### 1.20.1 Management

The BMS specialist shall manage the entire works and shall include coordination with the Client to ensure continuity of service throughout the project.

#### 1.20.2 Design

The BMS specialist will examine all documentation and will produce for approval the basis of design.

#### 1.20.3 Supply

The BMS specialist shall supply all Labour, materials and equipment necessary to be installed for the complete BMS head end supervisor upgrade. The only exception is that the Client will provide the server and the network configuration but all to the specification of the BMS specialist.

All materials and equipment either manufactured by the BMS specialist or bought from an outside source will conform to all relevant Local Standards.

### 1.20.4 Submittals

The BMS specialist shall submit for comment the User Requirement Document followed by the Functional Design Specification. Approval of the documents will not relieve the BMS specialist of any responsibility in the respect of providing services suitable for purpose.

### 1.20.5 Installation

The BMS specialist shall provide all necessary configuration, graphics and the like for the complete operation of the new Trend IQ vision BMS head end supervisor.

### 1.20.6 Setting to work the BMS supervisor

The BMS specialist shall be responsible for setting to work the BMS supervisor and all associated operation and peripherals.

### 1.20.7 Return visits

The BMS specialist shall include in the contract costs three return visits after contract completion, these shall last for a minimum of two days at a nominal 2 month cycle.

During these visits the BMS specialist shall modify graphics, management interfaces, alarm handling and general system operation to suit comments that have been raised by the FM team user. The purpose of this recommissioning period is necessary as it is not possible at handover to have fully checked system operations and often challenges and problems only become visible as systems are used and interrogated by the FM team.

### 1.20.8 Handover

The project will be handed over on a system by system/area by area basis to enable continuity of building operation. At each handover the BMS specialist shall provide completed contract documents such as plant operating procedures, test plan and results and system training. The systems shall have been set to work tested and commissioned by the BMS specialist.

At the final handover the BMS specialist shall demonstrate the complete system including all previously handed over sections such that all systems work homogenously.

The final handover documentation shall include the close out report that incorporates all necessary documentation required of the operation of the project.

### 1.20.9 Operating and maintenance manual

The BMS specialist shall provide the O & M manuals associated with his works to the standard described in the contract.

### 1.20.10 Training

The BMS specialist shall train the user's staff in all aspects of the automatic controls and BMS.

The training should include general instructions on the use of the Trend IQ vision head end supervisor, specifically for this project and will include such activities as: restarting the system from scratch, reloading all databases, turn the system on and off, resetting from

power loss, defining user passwords and privileges, navigation through the system, manual control of field points, setting reviewing and deleting trend logs, setting reviewing and changing alarm values, initiating automatic reports via Excel, adjustment of field operating set points.

### **1.21 Alarm handling**

The existing alarm functions and programmes held in the remote outstations or on the 963 supervisor shall all be reviewed as part of this project.

The BMS specialist shall propose alarm handling package such that all systems provide similar alarms with similar set points and that the alarm messages are clear, site-specific and grouped to suit the FM team requirement.

In preparation for this the BMS specialist shall organise and manage workshops with the Client FM team in which agreement of level of alarm, style of alarm message, alarm values, alarm resets, routing and the like shall be discussed and agreed.

All critical alarms are to be brought to the attention of the user immediately. A clear alarm banner is to be placed in front of any current display. Acknowledgement of this display shall be logged and the system graphic containing the alarm is to be automatically displayed on the screen. The appropriate graphic shall have a alarm reset hotspot that shall reset all alarms displayed on that graphic.

All alarms shall be recorded in the alarm history and grouped as appropriate for critical and non-critical, site, type. The alarm program will print when the alarm is received at the CPU an information message. This message will have a minimum text length of 256 characters. The operator will easily be able to change or define each message. Initially each message will be entered by the BMS specialist from the agreed schedule. The BMS shall be configured to transmit the alarm and an English language message to specific email address and mobile phones.

The following is a proposed outline of alarms, these should not be considered as finite or definitive they are given as examples to be built upon during the workshops. In the first instance the FM team shall be encouraged to identify alarms that they consider important along with particular messages that they wish to have associated with the alarms.

The alarm shall be grouped perhaps system by system, site by site, critical non-critical again however these alarm grouping shall be discussed and agreed at the alarm group workshop.

Some of these agreements may require modification at the remote outstation controllers some of this will be handled at the BMS head end supervisor. The BMS specialist shall advise the FM team during the workshops of limitations and perhaps additional costs that may be incurred for some or all of these implementations.

#### **1.21.1 Plant Mismatch Alarm**

Every point will have mis-match alarms set. These include fans and pumps running when told to stop, fans and pumps stopped when called to run, temperature values outside of acceptable range e.g. supply air temperatures < 8°C >30°C room temperatures < 16°C >

26°C, chilled water temperatures 2°C above set point, heating systems 5°C above or below set point, HWS flow and return temperatures >65°C or below 55°C.

#### 1.21.2 Alarm Inhibition

When an alarm condition is displayed, it will be independent of any other possible alarm or cause that may initiate a string of further alarms. Where such circumstances occur, the software will inhibit any such sequential alarms. The BMS specialist will co-ordinate such sequences in his detailed design and submit details sufficient to demonstrate compliance with requirements.

The program will inhibit analogue alarms when the associated plant is switched off by the BMS. The program will inhibit analogue alarms during the start up of each plant item. This delay time period will be for a maximum of ten minutes to enable the building service installation to reach stable conditions.

Digital alarms will similarly be delayed at plant start up times for one minute. During normal operation every alarm point will have a timer than can be set during commissioning to eliminate nuisance alarms.

#### 1.21.3 Alarm Priority

Alarm Priority will be as indicated below.

#### 1.21.4 Critical Alarm

Urgent operator action required. A clear alarm banner and appropriate message shall appear on top of any current screen visible on the VDU. The alarm shall be emailed to an appropriate address, added to the alarm history log and shall not be eliminated until alarm is acknowledged.

These alarms will include but not be limited to the following:

- Heating fault, that forces a shut down.
- HWS high or low flow temperatures
- HWS Heat generation fault
- Cooling fault that forces a shut down.
- Critical motor fault such as primary chilled and heating pumps, comms rooms systems.
- AHU motor faults.
- Smoke extract fans not available.
- Gas valve closed.
- Fire alarm.
- MCC power failure.
- Generator fault.
- Switch room high temperatures.
- Comms room high temperatures
- DX cooling unit failure.



- Water leak detected.

#### 1.21.5 General Non-Critical Alarm

May be remedied under planned maintenance and servicing. The alarm shall be added to the alarm history log and displayed on the appropriate graphic.

- Minor motor faults such as secondary heating pumps, fans or pumps with standby dives.
- Chiller fault.
- Heating warning fault.
- Cooling warning fault.
- Critical room conditions out of range.

#### 1.21.6 General Alarms

These will be indicated on the VDU and shall clear automatically on a return to normal state.

These alarms are all others not previously described for example and will include but not be limited to the following:

- Sensors out of range.
- Air filter alarms.
- Water filter alarms.

#### 1.21.7 Head End Alarm Reset

A single reset 'button' will be displayed on each graphic. This will allow any alarm on the displayed system to be reset. This reset action will be recorded in the alarm history along with the fault, its unique identifier and the operator who reset and the date and time.

#### 1.21.8 Run time totalisation program

A run time totalisation program will be provided for application to all items of plant. The system will initiate an identifiable alarm output whenever the pre-set limit has been exceeded for the particular item. The run time will be determined from positive use of the plant such as differential pressure or running signals from packaged plant.

The run total will be accessible by command from the operator, who will also be able to reset the limits or zero the count for each item, using suitable password access.

Sufficient BMS hard disk storage will be provided to hold all data, for two years.

#### 1.21.9 Trend logging

The BMS specialist shall set to work all trend logging across the project should include all sensor values and all set points. These shall be recorded continuously at 15 minute intervals. Sufficient BMS hard disk storage will be provided to hold all data, for two years.

## 1.22 Graphic

Every field and virtual point of the system is to be displayed as a dynamic value on the appropriate system graph. The graphic display is to be as clean as possible and constructed in a simple to read form.

The BMS specialist shall provide dynamic graphics for all plant that the BMS controls and monitors.

The operator interface to the BMS will normally be through the dynamic graphic route. It is therefore important that the structure of the layers is simple to follow and meaningful. The BMS specialist may suggest any reasonable solution. The following is for general guidance.

- The log-on page will be a simple and clear text driven page with fields for the operator name and passwords. This will then access a text table that shall list each of the existing sites along with a jump tag to the alarm handling page.
- The alarm handling page shall display not the alarm history but individual site by site critical alarms that are currently active in the system.
- The site by site jump tags shall move the user to the particular site where the overview graphic shall be first displayed. From this graphic jump tags shall be provided to the major plant and equipment, building floors and particular service areas.
- In addition to all the necessary major plant graphics each floor will be accessible. The floor selected will be shown in plan view on the screen. Each area is to be identified either by a room number or name. Where terminal devices are installed to service the various areas these will be accessed by active click boxes in the areas served. The click box will not be positioned where the plant is located.
- The floor plan overview will show the current values of any field mounted sensors. If the floor plans are too large to be easily shown on one screen then multiple screens will be used. The terminal temperatures in each office or core area are to be displayed in the appropriate space on the floor plan.

### 1.22.1 Movement between the Graphics

Each graphic will have click boxes to allow logical movement within the system. Every graphic will allow access to be gained to the overview graphic, HWS system, primary heating, primary cooling, associated air handling systems, return to previous and the home page.

Large systems that require multiple graphics will also have click boxes to route to the next part of the system.

### 1.22.2 Alarm page graphic

The alarm page graphic shall show for each site any current critical alarms. It should be noted this is not just a display of the alarm history, it is the site specific critical and non critical alarms.

It should be possible via simple click box to jump from a particular critical alarm to the dynamic graphic of that system showing that alarm

### 1.22.3 Site overview graphic

The site overview graphic shall be constructed for each site generally as a text box page. This should list all the major plant and equipment on the site and show whether it is running, normally off or in fault. Generally systems should be grouped such that for example the HWS will show healthy when the pumps, heat exchangers and the like are operating normally (it is not necessary to show every individual item) along with the general HWS flow return temperature. Jump tags shall immediately take the user to the main HWS system in this instance and to the main plant as appropriate for other systems.

### 1.22.4 Data Display

Wherever possible information is to be provided by means of colour change. All devices in their normal off state are to be orange. All devices in their normal on state are to be green. All devices in an alarm state are to be red. Wherever possible the command and feedback status are to be linked on the screen. For instance, a fan/pump that is shown graphically as a triangle within a circle will be dynamically activated as follows.

The triangle will represent the command with the remainder of the circle indicating the feedback.

### 1.22.5 Specific graphic displays

The configuration of proprietary Building management System head end supervisors are each slightly different and it is recognised that each may have particular operations peculiar to its self. The following set out the minimum requirement from each system, further standard enhancements that are available will not be disabled even if they are not described below.

Each plant item will be displayed on a separate graphic. The graphic display will be as clean as possible and indicate only the current plant status such as:

- Drive status – on/off/fault.
- Valve and damper status – open/closed/modulating position.
- Sensor status – current values.
- If the devices are currently under 'manual' command from the head end via an operator instruction this will be clearly indicated alongside the device, or a colour change.
- Alarm reset button.

A text table at the bottom of the graphic will show the current desired status of the controlled devices.

- The reason that the plant is operating, this may include: Manual override from the head end, frost protection, warm up, cool down, occupied time, remote system demand, fire.
- Fixed set points such as air or water temperatures: system differential pressures which the system is attempting to achieve.
- If set points are automatically adjusted by the operating software these set points will be indicated.

- Any current system alarms.
- The CHW temperature serving the plant.
- The heating water temperature serving the plant
- If the device is a terminal unit such as a fan coil unit or fan powered mixing box, the primary air temperature serving the plant will be displayed.

An associated engineering table or pop up dialogue boxes will describe the following features and allow, with suitable passwords, the adjustment of the operating parameters.

- Systems comprising run and standby drives, the display will indicate the present lead drive.
- Operator ability to change duty or prevent duty rotation, change the time and date of next rotation.
- Drive run hours since last reset, maintenance run hour intervals, reset run hours to zero, adjust maintenance run hour intervals.
- Operator ability to change between limits the system operating set points such as return air temperature, room air temperature, return air RH, room air RH.
- It should be noted that it will not be possible to adjust, without changing the software coding such parameters as; air quality set point, maximum CO set point, maximum CO2 set point.
- Operator adjustment between limits of heating and chilled water set points.
- Operator ability to manually set valves and dampers to fixed positions.
- Operator ability to set motor speed to a fixed value.
- Operator ability to set motors to auto/manual state on or off. When plant is mainly set to ON it shall remain in that mode for (4) hours and then revert to automatic control.
  - This operation merely bypasses the normal BMS demands; it will not negate any safety interlocks. If the plant is operating and 'manual off' is set the plant will shut down through its normal shut down routine. If the plant is off and the 'manual on' is set the plant starts through its normal start routine including opening necessary isolation valve and dampers.
- If an optimiser is provided, operator adjustment of the optimiser set points. This will include the calendar and the set points to be achieved during the optimised period; and
- If the plant has a fixed time start/stop operator adjustment of the calendar.
- Operator adjustments to the alarm set points, the routing of alarm messages, the alarm message, enable/disable the alarm block. This final function will be applicable to measured values only such as temperatures, humidity, and pressure.

### **1.23 Controls Commissioning**

The commissioning of the BMS head end supervisor shall be the responsibility of the BMS specialist.

The BMS specialist will allow for all costs in connection with the setting to work and commissioning of the complete control system. The BMS specialist shall formulate and issue the test method statements indicating the testing to be carried out and the expected results. At the completion of any test, the BMS specialist shall issue the result sheets, signed and annotated with relevant comments.

The BMS specialist will demonstrate to the complete satisfaction of the Client Representative that the installation or any portion thereof, which has been set to work, complies with the requirements of the specification.

Any defects of workmanship, materials, performance, maladjustment's, non-compliance with this specification, or other irregularities which become apparent during the tests will be rectified by the BMS specialist, at no additional cost to the contract, and the cost of the original test together with any repeat tests will be at the BMS specialist expense until the whole is proved free from defects and in complete working order to the complete satisfaction of the Client Representative. All systems will be left sound and correct.

The BMS specialist will pursue his own claims against others in respect of tests that fail due to his work being damaged by others. Damage to other work caused by failures under test will be made good at the Contractor's expenses and BMS specialist will make provision for meeting claims made against him for damage to other trades works as a result of failure of the controls installations undergoing tests.

After the above-mentioned conditions have been met in full and the system is fully operational, it shall be guaranteed for the defects liability period stated herein.

Following the completion of the works, the BMS specialist shall allow for a minimum of three additional separate visits to site to check on continued satisfactory performance.

The BMS specialist shall commission the project in a number of phases to suit

- The off site construction.
- The site by site handover.
- The continuous inspection of site by site systems
- The homogenous handover of the complete system.

The BMS specialist shall propose a test plan, test duration and witnessing agreement for this part of the project.

The test plan that should be agreed by all parties will include such items as:

- the offsite testing that shall include
  - management user interfaces such as adding/deleting users, setting user privileges,
  - alarm messages
  - alarm routing
  - adding and deleting alarms
  - adding, viewing and deleting trend logging

- layout of graphic, is the graphic clean and clear
- values displayed on graphic such as
  - correct units
  - resolution of values
  - information from other systems that are useful on this graphic
- jump tags to other graphics
- user interaction and limits for manual adjustment
- access to O & M manuals
- the site by site handover includes
  - remote site to graphic demonstration for 25% of the field points
  - sanity check that the values being displayed are realistic
  - generally repeating the offsite testing
- continuous site by site inspection includes
  - sanity check that the values being displayed are realistic
  - review alarm handling and user interfaces

these activities should be carried out as a comparison between the existing Trend 963 system and the new IQ vision graphics, the BMS specialist should check each site at least once per week during the project period.

- Homogenous handover of complete system shall include
  - remote site to graphic demonstration for 10% of the field points, these should be different points to those previously tested
  - sanity check that the values being displayed are realistic
  - generally repeating the offsite testing

On completion of the commissioning procedure the BMS specialist shall provide a report detailing all of the testing carried out along with the nonconformities, although these shall be resolved prior to practical completion.

### **1.24 Handover procedure**

The handover procedure shall be as defined in the contract terms and conditions. The BMS specialist shall develop the handover procedure that will demonstrate the primary purpose of the project and shall be inclusive of a close out report.

The BMS close out report shall demonstrate that the plant and equipment has been installed and any defects closed out or agreed with the client with suitable procedure for rectification and that the plant and equipment is operating as intended. This shall include but is not limited to the following

- Describe the purpose of the project and the methodology adopted to achieve the client's goals and aspirations.

- Describe the work carried out.
- Describe any new hardware provided in the contract.
- Describe and advise further enhancements that are required to resolve BMS data issues that have been found during the works but have been excluded from the project.
- Describe the construction and testing procedure.
- Include all test and comment sheets.
- Include hard copy printout of each graphic.
- Include a full database backup of both the head end supervisor configuration and all remote outstation software configuration, for every site.
- Include documentation for the operation of plant and components using the new management tools.
- Include documentation for the configuration of new users and user privileges.
- Include documentation describing how set points, time channels, trend logging, history logging is set up, run, archived and deleted.

Although some of these actions are within Trend catalogues and these catalogues can be included, it is a requirement that project specific information is provided separately eliminating the need for the user to plough through copious catalogue information.

### **1.25 Schedule of rates**

Although the project is a lump sum price there may be changes required to the work scope. Within the contract documents the standard schedule of rates for engineers, software, project management and the like described.

Over and above this and to provide the client with a level of possible expenditure the BMS specialist shall in the tender include costs for the following:

#### **1.25.1 Reconfiguration of crossed point**

To visit one site and spend one day reconfiguring points that have been crossed. This does not require extensive cabling and is not the requirement to provide additional instrumentation but is based upon information seen at the BMS head end that shows that particular points in the field are not wired to the correct terminal or that the point in the controller is crossed. It is anticipated that this will be a commissioning engineer with the support engineer for perhaps one day at the site.

#### **1.25.2 Generation of plant operating procedure**

Although plant operating procedures are available it would be beneficial that these are revisited and perhaps rewritten in a simplified format and then loaded onto the server.

It is anticipated that the BMS specialist would be required to download the existing control strategy, backward engineer this and produce a simple English version of the operating procedure. It is anticipated that the backward engineering should be carried out by project engineer with assistance from a commissioning engineer.

It may be assumed system comprises 50 field points and perhaps 50 high-level points.