in TfL Standards Red 08 – Space Planning and adopt general principles that can be followed and applied to the specific nature of a space undergoing refurbishment or fit out. (See steps to success)

There are seven preset scenes. These are subsequently divided into various different colour moods. Each mood is given a double page spread.

4

The sample board provides photographic images of the colours and textures of materials used within the make up of the scene view.

5

The quick reference identifies key information about the product within the scene view. Its number relates back to the scene view.

6

The name of the supplier, product and colour reference are given as well as contact information. In some cases, for example bespoke items which may require fabrication rather than simply an off the shelf purchase, a possible contact is given prefixed by e.g. this indicates the contact is not prescribed.

7

A fact finder reference (FF Ref: p00) is also given that gives the page number for the fact finder data sheet on this particular product.

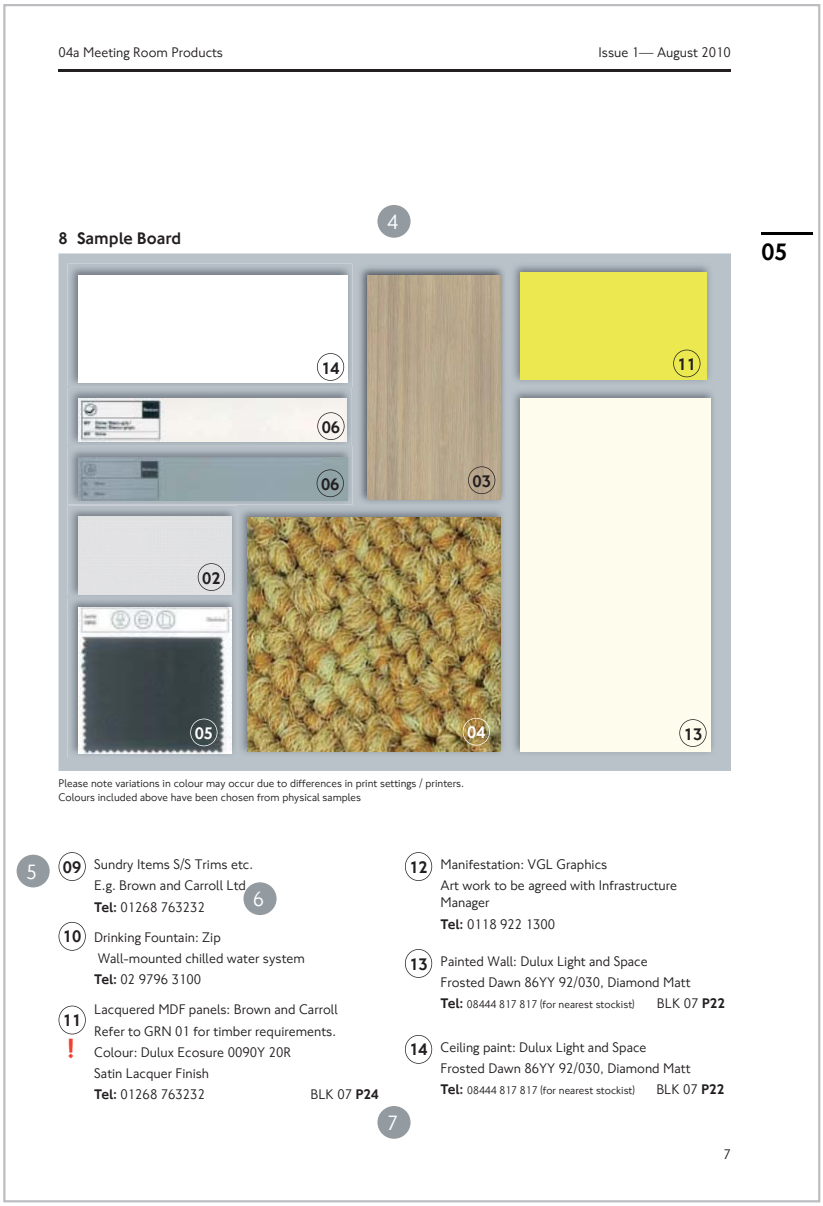


Fig 6. Typical page layout

3 Fact finder data sheets

Fact finder data sheets provide further contact information for each of the products identified within the scene views. They also provide a quick overview of the key information and characteristics of both the product and the manufacturer that have been considered in the selection process.

Alternative colour options and a secondary / alternative product are located in the fact finder sheets.

8

Product name and manufacturer details. Where different, suppliers details are also given.

9

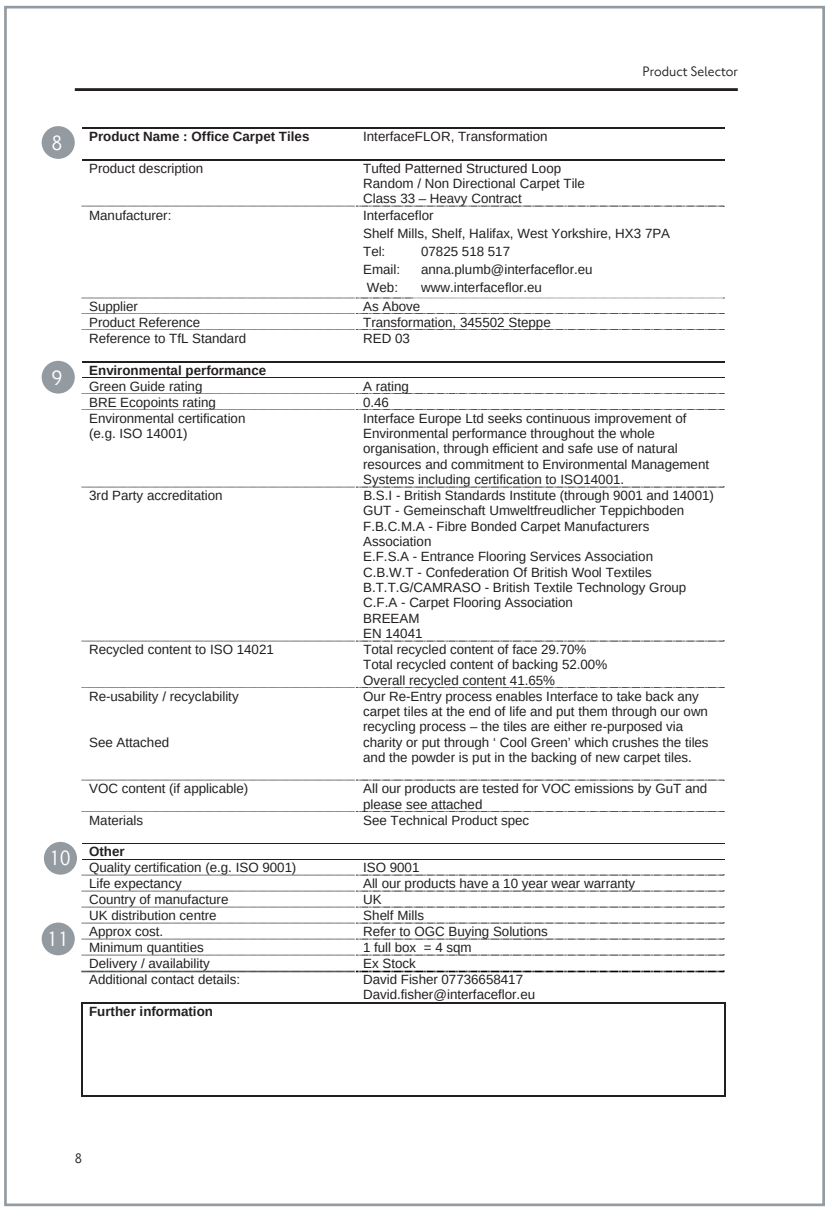
Key environmental performance data.

10

Manufacturer's environmental and quality certification.

11

Further info availability, distribution.



Product Selector

Product Name : Office Carpet Tiles	InterfaceFLOR, Transformation
Product description	Tufted Patterned Structured Loop Random / Non Directional Carpet Tile Class 33 – Heavy Contract
Manufacturer:	Interfaceflor Shelf Mills, Shelf, Halifax, West Yorkshire, HX3 7PA Tel: 07825 518 517 Email: anna.plumb@interfaceflor.eu Web: www.interfaceflor.eu
Supplier	As Above
Product Reference	Transformation, 345502 Steppe
Reference to TfL Standard	RED 03
Environmental performance	
Green Guide rating	A rating
BRE Ecopoints rating	0.46
Environmental certification (e.g. ISO 14001)	Interface Europe Ltd seeks continuous improvement of Environmental performance throughout the whole organisation, through efficient and safe use of natural resources and commitment to Environmental Management Systems including certification to ISO14001.
3rd Party accreditation	B.S.I - British Standards Institute (through 9001 and 14001) GUT - Gemeinschaft Umweltfreudlicher Teppichboden F.B.C.M.A - Fibre Bonded Carpet Manufacturers Association E.F.S.A - Entrance Flooring Services Association C.B.W.T - Confederation Of British Wool Textiles B.T.T.G/CAMRASO - British Textile Technology Group C.F.A - Carpet Flooring Association BREEAM EN 14041
Recycled content to ISO 14021	Total recycled content of face 29.70% Total recycled content of backing 52.00% Overall recycled content 41.65%
Re-usability / recyclability See Attached	Our Re-Entry process enables Interface to take back any carpet tiles at the end of life and put them through our own recycling process – the tiles are either re-purposed via charity or put through ' Cool Green' which crushes the tiles and the powder is put in the backing of new carpet tiles.
VOC content (if applicable)	All our products are tested for VOC emissions by GuT and please see attached
Materials	See Technical Product spec
Other	
Quality certification (e.g. ISO 9001)	ISO 9001
Life expectancy	All our products have a 10 year wear warranty
Country of manufacture	UK
UK distribution centre	Shelf Mills
Approx cost.	Refer to OGC Buying Solutions
Minimum quantities	1 full box = 4 sqm
Delivery / availability	Ex Stock
Additional contact details:	David Fisher 07736658417 David.fisher@interfaceflor.eu

Further information

8

Fig. 7 Typical fact finder sheet layout.

4 Steps to success

In this section a number of key steps are identified that if followed will aid in the successful production of a coherent coordinated fit out or refurbushement in line with TfL standards. These steps are included for guidance only but will detail for example how spaces should be set out to achieve uniform results over the various properties in the portfolio.

14
Diagrammatic explanation of steps to success

15
Bullet point steps to success

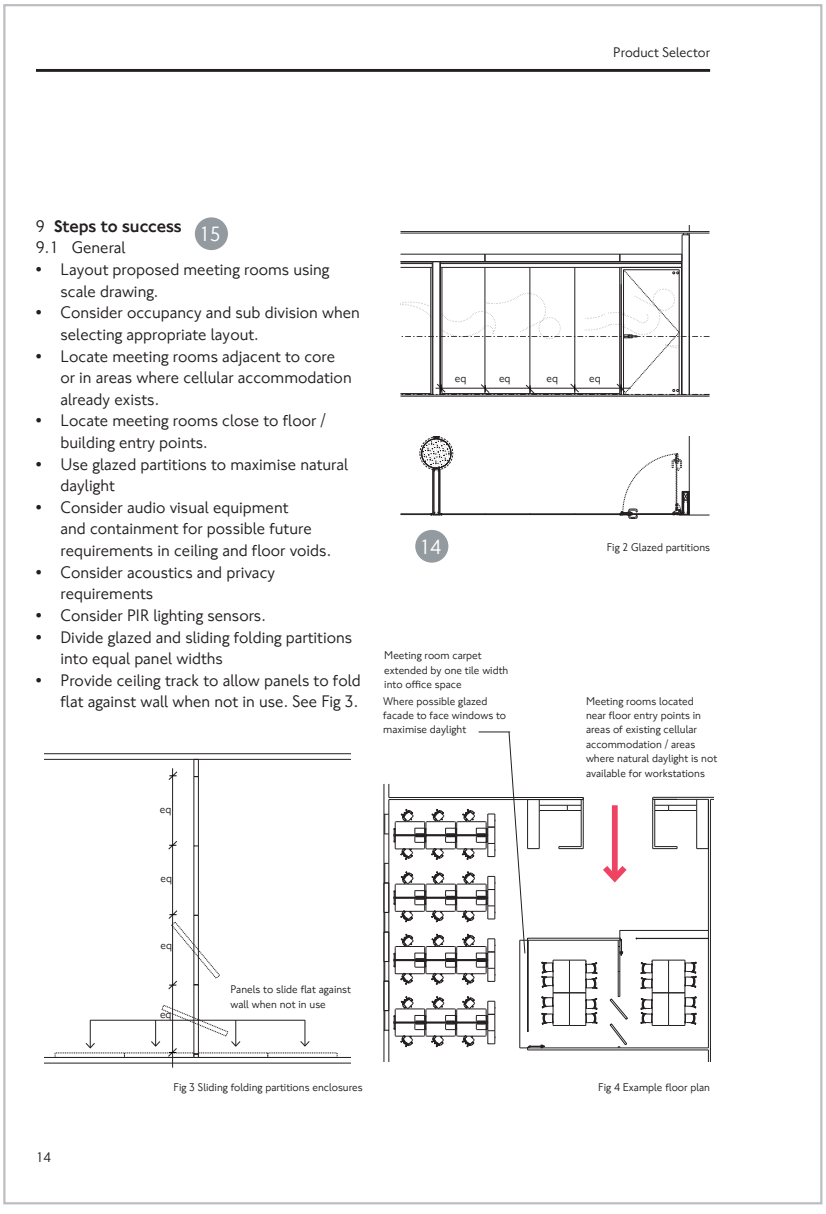


Fig. 8 Typical steps to success page layout.

Revision History:

Issue	Date	Description
1	December 2010	Document Created in conjunction with TfL Head Office Standards

TfL BMS DATALOGGING TECHNICAL NOTE

Contents

Version Control

REVISION	DATE	CHANGE
01	01/02/10	First issue including generic Trend export scripts for all meter exports.
02	09/09/10	Revision to meter nomenclature to allow separate reporting of BEEP meter data following workshop with Honeywell and Trend. Addition of meter export scripts developed at the workshop and initial timing standard to allow datalogging and meter exports to happen in the correct order each day.
03	23/12/10	Revision of timing standard for datalogging to set up specific time slots for each site, in order to avoid server overload from multiple sites datalogging at the same time.
04	11/04/11	Revision of “Archiving datalogging files” section to reflect Trend solution to avoid database reaching the 4Gb maximum size limit, implemented by BMSi on 16/02/11. Update of appendix to include all implemented meter export scripts.
05	12/03/13	Revision to datalogging section to confirm site by site script process to avoid scheduling function being overloaded with individual datalogs.

TfL Trend 963 Server Setup

This technical note augments the TfL Facilities Operations BMS standards and project specification briefing note to provide details on the set up & scheduling of datalogging and metering data output on the TfL Trend 963 server CISAPP033, located at Ashfield House.

General configuration files

All 'live' configuration files are stored under:
D:\Program Files\Trend Control Systems\963

With site specific graphics stored under:
D:\Program Files\Trend Control Systems\963\Backdrops\Transport for London

Back up of system files

Internal back ups

Currently the 963 Server backs up itself every month via the internal scheduler function, creating the following (date stamped) back up file to a separate partitioned server drive:
F:\TfL_Trend_backups\trend96X_YY_MM_DD.dat
All project manual backups are to be stored in a relevant dated & named folder under:
F:\TfL_Trend_project_backups\YYYYMMDD_ContractorName

External back ups

The following back ups are then carried out to external TfL IM systems:
Server name : CISAPP033
Backup schedule details for C:\ drive, SYSTEM DB:\, SYSTEM FILES:\, SYSTEM STATE:\ : Full backup every Sunday only.
Backup schedule details for D:\ and F:\ drives: Full backup every Sunday with incremental backups on every Tues, Thur and Sat

Datalogging

TfL BMS datalogging standard

The TfL BMS standard calls for the BMS to be configured with logging of all control points at 30 minute intervals with the data stored on the outstation. Logged data shall be automatically uploaded to the server at appropriate intervals to ensure no loss of data. Data shall be stored in an agreed location on the server in an agreed format for future dissemination and analysis. The following points shall be logged as a minimum:

- All sensors e.g. temperature, humidity, pressure, volume, level etc
- All calculated set points
- All main heating and cooling plant enable/fault signals (i.e. boilers, chillers etc)
- All meters, including utility consumption and plant run hours
- Other points as required by the specific project.

Meter consumption data logs should be a minimum of half-hourly variation data. If half-hourly totalised data is required by a project then this should be set up as a secondary log configured to reset to 0 every 10,000 units.

Datalogging Scripts

During 2012, Mitie Controls have simplified the datalogging setup process by creating scripts for each building (or day of the week for each building at larger sites). These are activated by the scheduling function at times specified for each building in Appendix A. The Trend 963 application stores these scripts in:
D:\Program Files\Trend Control Systems\963\Scripts\Weekly_datalog_scripts

Active datalogging files

The Trend 963 application stores any configured datalogs (eg sensors, alarms, scheduled actions etc) in:
D:\Program Files\Trend Control Systems\963\database\i96X_data.mdf
with accompanying SQL transactions data stored in:
D:\Program Files\Trend Control Systems\963\database\i96X_log.ldf

Archiving datalogging files

The active datalogging files have a 4Gb maximum size limit, due to the SQL version used by Trend. Data in archived files cannot be shown on the same output graphs as the current data.
On 24/12/10 this file size was 540Mb, so this limit is currently not a problem. However, following workshops with Trend, the following automated archiving process was set up by BMSi on 16/02/11 to ensure that the database never reaches its maximum size limit but still maintains 6 months of data whenever the process is implemented:

1. Current data always appears in the filenames:
\i96X_data.mdf & \i96X_log.ldf
2. Whenever the database hits 80% of maximum capacity, an alarm is generated that is then picked up by a script that automatically archives the data files, saving them to the same file path with date stamped filenames in the following format:
\i96X_data_YY_MM_DD.mdf & \i96X_log_YY_MM_DD.ldf
3. The archiving script also retains the last 180 days data in the current data files so that continuity of data is maintained for users.

Meter data exports

Meter data files

Meter data is to be exported to MS Excel files in the following shared file area to allow offsite access by Facilities Operations I&S Team for external analysis software:
D:\Program Files\Trend Control Systems\963\TfL_meter_data

Building Energy Efficiency Programme (BEEP) specific meter data will be exported to MS Excel files in the following sub-folder to allow Honeywell's auto-email scripts to email these data files offsite automatically:
D:\Program Files\Trend Control Systems\963\TfL_meter_data\BEEP_MandV_data

Meter labelling

To allow for automated meter data exports from any IQ2 (or above) controller, all meters must have their Trend Sensor labels set to the following nomenclature:
EXPMTR_##########
To allow for BEEP specific automated meter data exports, all BEEP meters must be labelled to the following nomenclature: *EXPMTR_BP_##########*

The 10 "#" characters must be used to provide a unique identifier. A 6 character building identifier has been provided (see Appendixes) and a sequential 4 character number is then to be added and recorded in a meter naming log stored in the meter data folder area:
D:\Program Files\Trend Control Systems\963\TfL_meter_data\TfL_meter_data_log.xls

This file is to be controlled by the Facilities Operations I&S Team and checked out to contractors to allow for meter set up data to be saved and agreed prior to site attendance for configuring the Trend 963 server to log the data.

Automated export scripts
In 2012, automated export scripts were rationalised to the following 3 scripts:

1. *EXPORTMTR_all_data_7day_weekly.txt*, providing the last 7 days of data for all *EXPMTR_##########* labelled meters
2. *EXPORTMTR_FLH_data_7day_weekly.txt*, providing the last 7 days of data for all *EXPMTR_##########* labelled meters at Faith Lawson House – ie the only non-BEEP site with Half hourly AMR meters being recorded through the Trend system

The scheduler will always overwrite the files created above in the export meter data folder.

3. *EXPORTMTR_BEEP_data_5day_daily.txt*, providing the last 5 days of data for all *EXPMTR_BP_##########* labelled meters.

The scheduler will not overwrite the files created by point 3 as the script defines the following file format for BEEP meter exports: *YYMMDD_BEEP_export_meters.xls*

The Trend 963 application stores these 3 scripts here:
D:\Program Files\Trend Control Systems\963\Scripts\zMetering_export_scripts

BEEP auto-email scripts
On 29/07/10 it was agreed that Honeywell would provide a proposed windows batch file script to auto-email any file contained in the folder:
D:\Program Files\Trend Control Systems\963\TfL_meter_data\BEEP_MandV_data

This script will email the file to an external Honeywell email address with copy to SustainableBuildings@tfl.gov.uk via smtp server: *cismsw003.cis.tfl.local*
Finally, the file will be moved to the following folder for any future access requirements:
D:\Program Files\Trend Control Systems\963\TfL_meter_data\BEEP_MandV_data\archive

Until this script is provided to TfL by Honeywell, and then approved and implemented by TfL IM, BEEP meter data exports will be manually accessible via Facilities Operations I&S Team.

Datalogging and exports timing standard

In order for all of the above automated functions to be sequenced correctly, the following timing standard has been set:

1. 0000 – All 963 BMS sensors configured to datalog over an 8 hour period, with:
    a. Scripts for all points at each site are set to log at pre-defined daily times (see appendix of site abbreviations and datalogging time schedules assigned to each site);
    b. Outstations capable of only 96 points require to be set up in a DAILY script;
    c. Outstations capable of 1000 points require to be set up in the relevant WEEKLY script;
    d. Contractor to issue revised scripts highlighting the new point(s) that they have set up as part of O&M handover files
2. 0800 – Trend export scripts create the relevant MS Excel file meter data exports
3. 1200 – Honeywell auto-email script runs

Appendixes

Building abbreviations for metering sensor labels & datalogging time scheduling allocations

We will always provide new sites' 6 letter abbreviation at time of order, but contact sustainablebuildings@tfl.gov.uk if any clarifications are required.

Trend 963 Server assigned datalogging timing slot	Building abbreviation for metering sensor labels	Building Name	Comments
0030-0100	**PrWk14**	14 Pier Walk (North Greenwich)	
0300-0315	**AlbHse**	Albany House	
	AlbEmb	Albert Embankment: 89	Not on BMS, and no longer in TfL Portfolio
0200-0215	**AldBTP**	Aldgate BTP	Project underway to add to BMS
0100-0130	**AlsP13**	Allsop Place: 13	"Baker St Complex" site covers 13AP, 15AP, LPO & Selbie
	AlsP15	Allsop Place: 15-17	See Allsop Place: 13
0130-0145	**AshHse**	Ashfield House	
0145-0200	**BSt210**	Baker Street: 210-212	
	BSt216	Baker Street: 216	Partially on BMS under 210-212
	BStRvC	Baker Street: Revenue Control	
	QVSBfr	Blackfriars (179 QVS)	Not on BMS, and no longer in TfL Portfolio
0215-0230	**Blkwll**	Blackwall	Project underway to add to BMS
	BonhSt	Bonhill Street: 15	Not on BMS
0230-0300	**Bdy_55**	Broadway: 55	"Broadway Complex" site covers 55Bdy, 100PF, & WoS
0315-0330	**BPR172**	Buckingham Palace Rd: 172	
0330-0345	**BPR200**	Buckingham Palace Rd: 200	
	BuckSt	Buckingham Street	Not on BMS
	ButPlc	Butler Place	Not on BMS, and no longer in TfL Portfolio
0345-0400	**CranSt**	Cranbourn Street: 20	
	EccPlc	Eccleston Place: 25	No longer in TfL Portfolio
	EcSq84	Eccleston Square: 84	Not on BMS
	EdR304	Edgware Road: 304	Not on BMS
	EngTrC	Engineering Training Centre	Not on BMS, and no longer in TfL Portfolio
0400-0415	**FthLHs**	Faith Lawson House	
	GrfRms	Griffin Rooms	Not on BMS
0415-0430	**GrfHse**	Griffith House	
	InCMWR	Innovation Centre (Marsh Wall Rd)	Not on BMS, and no longer in TfL Portfolio
0430-0445	**KgsBdg**	Kings Buildings	
	BStLPO	Lost Property Office	See Allsop Place: 13

Trend 963 Server assigned datalogging timing slot	Building abbreviation for metering sensor labels	Building Name	Comments
	LTMusm	LT Museum	Not on BMS
0445-0500	**LTMmCC**	LT Museum Collection Centre	TfL LAN connection issues
	OldBSt	Old Broad Street	Not on BMS
0500-0515	**OxCrHs**	Oxford Circus House	Project underway to add to BMS
n/a - data not stored by Trend 963 server	**Plstra**	Palestra	Tridium BMS (hyperlink only on Trend 963)
	PrnHse	Parnell House	Not on BMS
0515-0530	**PelmSt**	Pelham Street	
	BdyPtF	Petty France: 100	See Broadway: 55
	PrtHse	Portland House	Not on BMS, and no longer in TfL Portfolio
0530-0545	**PrmHse**	Premier House	
0545-0600	**PentSt**	Penton Street	
	BStSbH	Selbie House	See Allsop Place: 13
	Sthsde	Southside (6th & 7th Floors)	Not on BMS, and no longer in TfL Portfolio
0600-0615	**Templr**	Templar House	Project underway to add to BMS
0615-0630	**TwnHse**	Townsend House	
	UK_Hse	UK House	Not on BMS, and no longer in TfL Portfolio
	VndStG	Vandon Street Garage	Not on BMS
0630-0645	**VcStHs**	Victoria Station House	
	LTMW35	Wellington Street	Not on BMS
0645-0700	**WstnHs**	Western House	
0700-0730	**WndHse**	Windsor House	
	BdyWOS	Wing over station	See Broadway: 55

Transport for London

Facilities Operations | Commercial
Infrastructure & Sustainability Team

BMS Server Updates

sb-chg-ass-BMSServer

ISSUED 01/08/2013		
Author	Quinten Babcock	
Reviewer	Beata King	
Approver	Andrew Stanton	

REVISION	DATE	CHANGE	BY
Version 1	22/11/2011	First Issue	A.Stanton
Version 2	01/08/2013	Update to include I&S team graphics sign off and IM alarm information in IM SR text	Q.Babcock
Version 3	11/10/2013	Update to improve IM SR processing requirements following feedback	Q.Babcock
Version 4	24/12/2013	Update following IM SR Remedy platform change	Q.Babcock

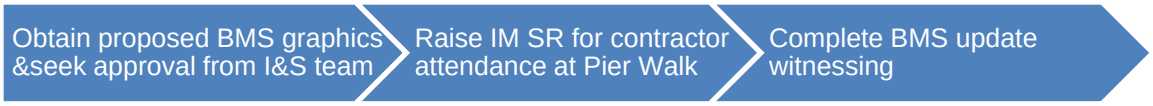
Table of Contents

Introduction

This process documents how Project Managers and Maintenance staff are to arrange BMS configuration updates of the TfL central BMS and any applicable on site head end systems.

1. The server is physically located at Ashfield House and is available on the TfL Intranet via address http://10.104.15.17
2. Normal user names for access are obtained from the Facilities helpdesk team run by Alan Myers. Darren Hall is key contact for BMS access.
3. Engineering access is carried out remotely, but under the supervision of our IT colleagues from our offices in Pier Walk, North Greenwich. The staff will give access from a terminal in the office at Pier Walk
4. Requests for access are made via the online IM Service request tool which is only available from the TfL Intranet, Source.
5. Normally 10 days should be allowed but earlier slots may be available on request
6. If no BMS graphics are proposed to be changed, ie configuration works only, then the first stage in the process can be skipped

High Level Summary



Explanatory Notes

1. Obtain proposed BMS graphics & seek approval from I&S team

1. Download BMS graphics standard and BMS samples CD zip file from the Head Office Standards Sharepoint site:
   http://collab/grp_/fin_/GPF/Head%20Office%20Standards/Forms/by%20Topic.aspx

2. If the project is updating current pages from the central TfL BMS server, then a copy of the following items for the graphic page are required from the I&S team (Send request to Q.Babcock):
   - The page tss file
   - The page backdrop bmp or jpeg file

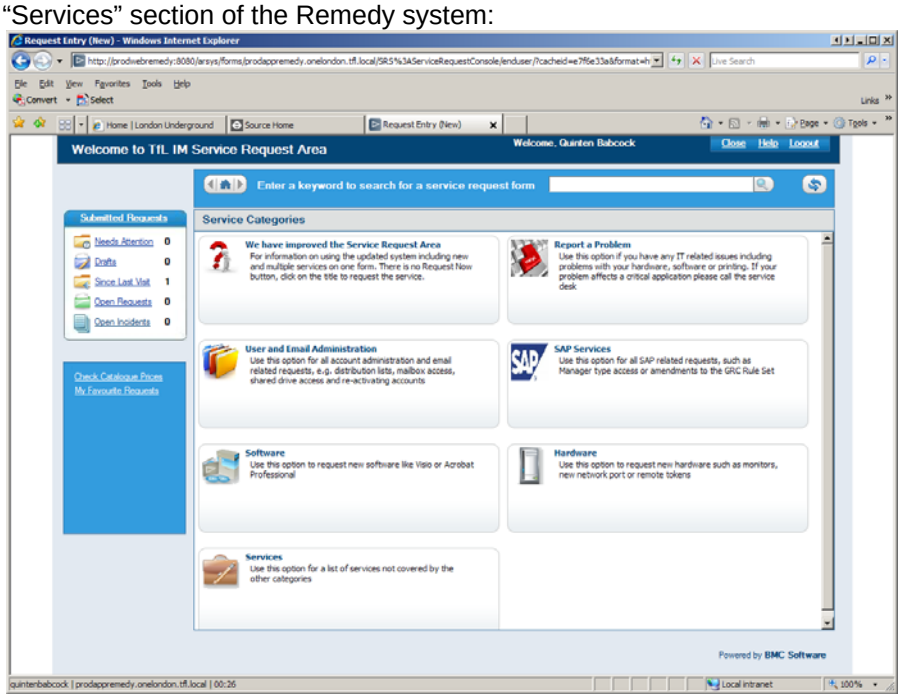
3. Send both of the above downloads on to the BMS contractor

4. Request pdf screen shots for all relevant proposed new pages from the BMS contractor

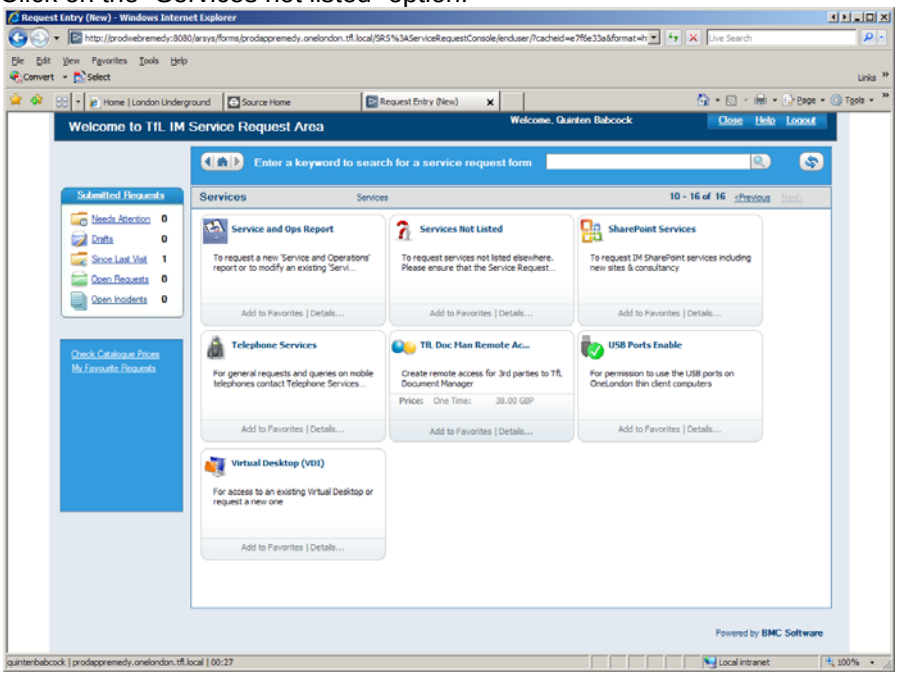
5. Send the proposed pdf files to the relevant project consultant and I&S team member for the particular building for feedback comments or approval.

2. Raise IM SR for contractor attendance at Pier Walk

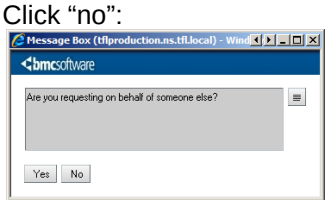
1. Once graphics are approved by the project consultant and I&S team. Raise IM Service Request using the "Services" section of the Remedy system:



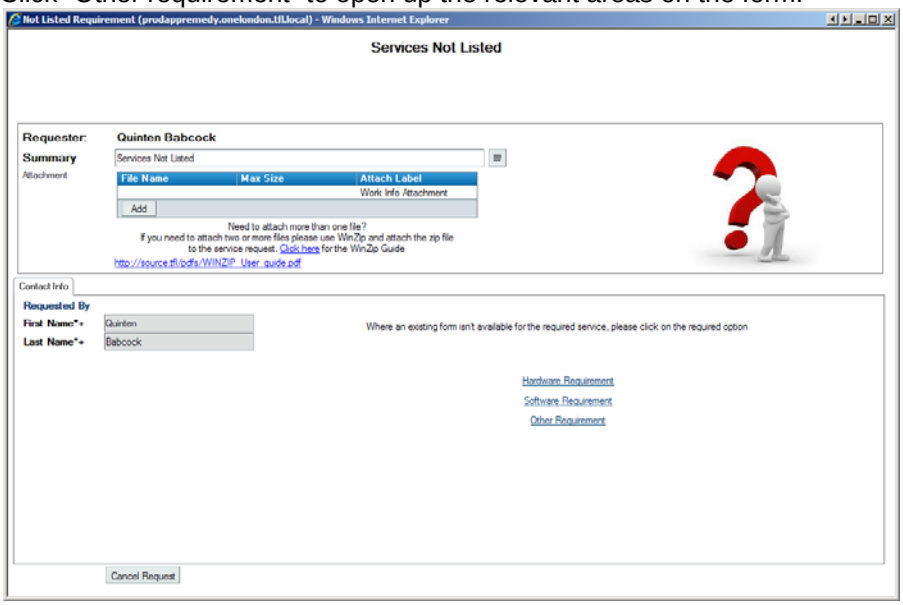
2. Click on the "Services not listed" option:



3. Click "no":



4. Click “Other requirement” to open up the relevant areas on the form:



5. Enter the following proforma text (with red text updated to be specific to your project) in the relevant sections of the form:

Summary:

Remote access to Trend 963 Building Management System (BMS) server cisapp033 under supervision from Pier Walk’s Wintel team

Is this related to a Project?: No

This relates to: Server

Cost Centre: 10740

Request Information:

01215153, server name CISAPP033, available at Ashfield House Http://10.104.15.17

Please arrange for the availability of 1 Wintel Personnel on [YOUR REQUIRED DATE HERE] in order to provide remote access for [YOUR CONTRACTOR(S) HERE] BMS contractor to the above server to allow them to alter settings, download data, take backups and/or upload revised graphics. Please inform me asap on [YOUR NUMBER HERE] if this date is not achievable.

If the BMS is to be taken off line at any point during the works then the TfL IM ETA Team must be informed in order to put their BMS Monitoring programme into maintenance mode so that no false incidents are raised during the period of the works.

BMS Contractor Information :

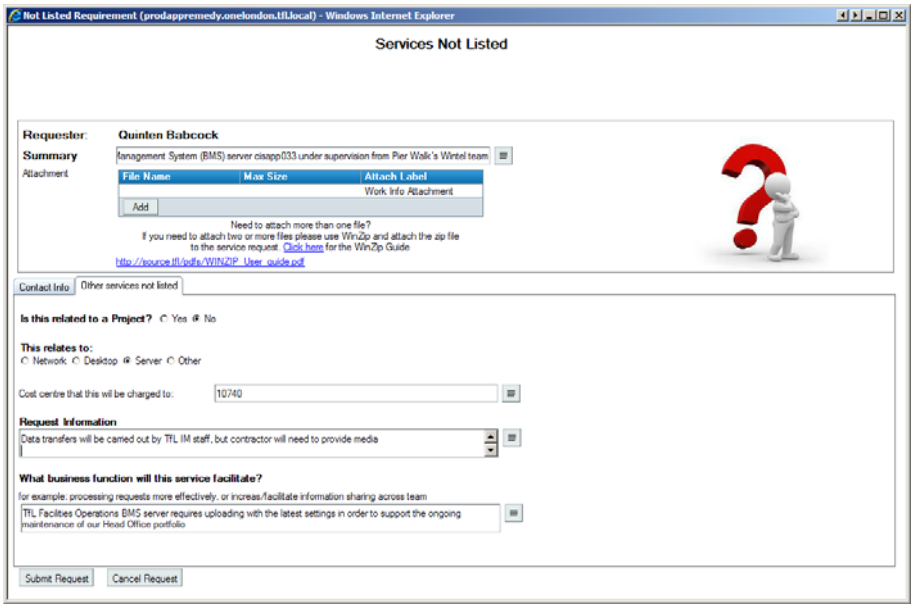
TfL IM contact at Pier Walk is Anthony Onwuka (on 07515332849), in 5th floor Green zone.

BMS Contractor is to use the following username and password to access the Trend 963 engineering pages:
Username: bms contractor ; Password: 4206

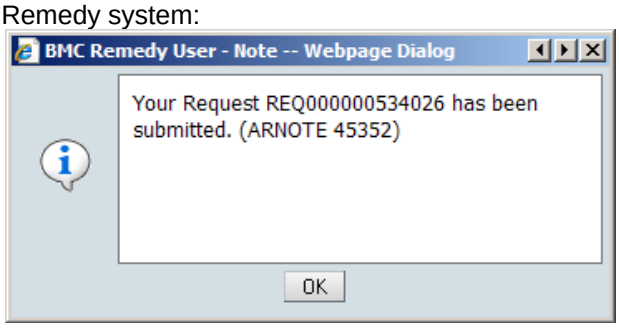
Data transfers will be carried out by TfL IM staff, but contractor will need to provide media

What business function will this service facilitate?:

TfL Facilities Operations BMS server requires uploading with the latest settings in order to support the ongoing maintenance of our Head Office portfolio



6. Click “Submit Request” and then record the IM SR reference for your records before logging out of the Remedy system:



7. Email a copy of the completed IM SR “Request Information” text to Anthony Onwuka and the project contractor for their information, with the IM SR reference in the subject line and also copy in:
    a. The “+IM IS Improvement ETA” email address from the global address list
    b. The relevant I&S team member for the building(s) affected
    c. The relevant Building Manager for the building(s) affected

8. Arrange contractor attendance on relevant date(s) to:
    a. Complete upload and reconfigurations required on the central Trend 963 server from Pier Walk
    b. Update the relevant site(s) head end PC to match

3. Complete BMS update witnessing

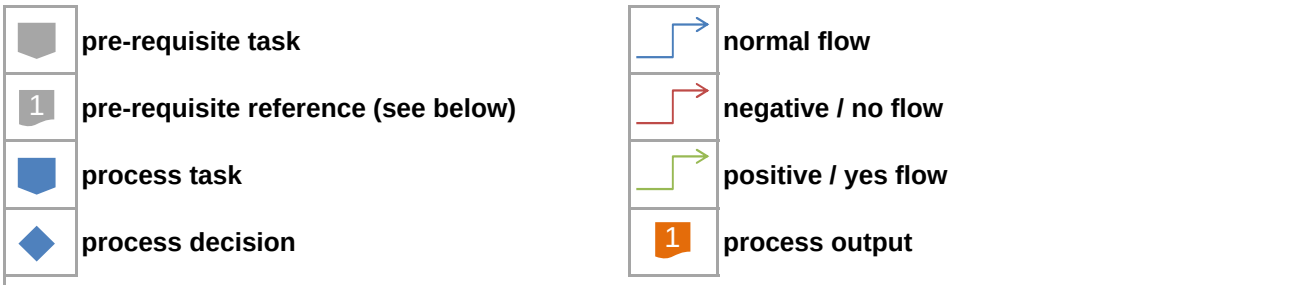
1. Once upload is complete. Arrange witnessing & sign off with:
    a. The relevant project consultant and contractor
    b. The relevant I&S team member for the building(s)

Process Flow Chart

See attached flowchart.

REFERENCE
sb-chg-ass-BMSServer

STEP	ACTIVITY	notes	references	I&S team member	Project Manager	TfL IM Service Desk	Projeect consultant	External BMS Contractor
0	**Pre-requisites**							
0.1	Download graphics standards							
0.2	Download relevant current BMS pages							
1	**Obtain updated graphics approval**							
1.1	Produce proposed graphics							
1.2	Do the proposed graphics meet standards?							
1.3	Project consultant and I&S team member approval							
2	**Reconfigure BMS via IM at Pier Walk**							
2.1	Raise IM SR (Preferably 10 days notice)							
2.2	Assign IM SR to Wintel staff							
2.3	Attend Pier Walk and reconfigure BMS							
2.4	Update relevant site head ends (if they exist)							
3	**Witness & sign off new BMS update**							



REFERENCES	
DOC	REFERENCE

OUTLINE BMS & CONTROL SYSTEMS SPECIFICATION & GENERAL REQUIREMENTS

Prepared for TfL Group Facilities by

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DATE: NOVEMBER 2007

INDEX

1. INTRODUCTION

The purpose of this document is to provide an outline brief for any new, upgrade or extension to the building management systems (BMS) and to provide continuity in the manner plant is monitored and controlled, for all Transport for London (TfL) and London Underground (LUL) office buildings, in order to ensure that a standard approach is applied.

A specialist Trend building management system contractor (BMS Contractor) shall be employed to design, supply, install, connect, test, commission, set to work and document the complete building management and controls installation.

Note: This document is not intended to be definitive and should be developed to incorporate the particular requirements of the project.

2. EXISTING SYSTEMS OVERVIEW

TfL Group Property & facilities, located at Victoria Station House (VSH), 191 Victoria Street, London are responsible for their large portfolio of office buildings located throughout the greater London area.

The various TfL buildings employ a variety of building management & control systems technologies the majority of which are networked Trend BMS systems. A capital improvement and refurbishment strategy for the buildings in the portfolio is at various stages of upgrading the existing systems to latest Trend technology, providing enhanced energy efficiency and plant control, and integrating them, on a building by building basis, with the TfL IT Intranet to provide remote interrogation and system management facilities.

The current TfL networking strategy requires each building to be provided with independent (proprietary) BMS networks with a single point of connection for the whole building network to the TfL IT intranet.

A remote Trend 963 server for all Trend sites is located at the TfL 'Global Switch' facility at Canary Wharf with remote access available for updating via the IM (Information Management) department located at VSH.

Individual sites are provided with local operator facilities in the form of separate Trend 963 head-end PC's or 963 'client' PC's using Microsoft IE, and/or local Trend IQview touch screens or NDP operator's keypads.

Currently, the systems support the full range of Trend outstations ranging from the IQ1xx, IQ2xx and IQ3-LAN series connected via Trend EINC (Ethernet Inter-network controllers). Direct connection of Trend equipment to the IT network, other than EINC (e.g. IQ3-Excite), is not permitted.

Access to the 963 server is by prior arrangement with the Group Facilities team and NDA Consulting. Subject to all approvals notice for requiring access for loading/updating the server along with the relevant paperwork shall be given at least 2 weeks prior.

The system is fully graphically driven and standard graphics backdrops have been developed for the client.

3. GENERAL STANDARDS OF WORK

Materials and equipment shall comply with current issues, including amendments, of relevant British Standard Specifications. Where a British Standard has been superseded by a European Standard and adopted within the United Kingdom (BSEN), then the replacement standard shall take precedence.

The installation shall be in accordance with drawings, schedule and specifications described within the Contract documentation.

The BMS Contractor shall include for the complete BMS and controls installation and shall liaise with the mechanical and electrical contractors, and other service contractors along with the client's representatives to ensure that all works are completed according to programme and fully co-ordinated with the building structure, mechanical & electrical services and other services and finishes.

Prior to submission of any proposal, the BMS Contractor shall make themselves fully aware of the design and construction of the building by detailed inspection of the building engineering services drawings and specifications.

BMS & Controls installations shall comply with this document along with the following requirements & standards;

- CIBSE guide H and commissioning code C
- BS 7671 & HD 384 – Electrical Installations in Buildings
- prEN 13646:1999 – Building control systems – equipment characteristics
- prEN 16484-2: Building control systems part 2 – HVAC control system functionality
- EC Directives;
    - Low Voltage Directive 73/23/EEC and amendment 93/68/EEC
    - Construction Products Directive 89/106/EEC
    - General Product Safety Directive 92/59/EEC
- EN 60439-1 – Low voltage switchgear and control assemblies
- BSEN 50160 – Voltage characteristics of electricity supplied by public distribution systems
- Electromagnetic Compatibility (EMC) Directive (89/336/EEC)
- BSEN 50081-1 – Generic emission standard and BSEN 50082 Parts 1&2: Generic immunity standard

In addition, all works shall be in accordance with the requirements of the applicable TfL standard specifications as follows;

- M001 – M003 Mechanical Systems
- M005 – Electrical Systems

- M009 – BMS
- F003 – Fire stopping, walls and service ducts

Works shall also comply with the relevant sections of the Part L building regulations.

Electrical installation work shall only be undertaken by contractors approved by the National Inspection Council for Electrical Installation Contracting (NICEIC) or ECA.

The BMS equipment shall be manufactured by Trend Control Systems Limited, P.O. Box 34, Horsham, RH12 2YF.

New outstations shall be from the Trend IQ2 or IQ3-LAN range for connection to a Trend communications network and arranged for connection to the clients IT network via a Trend EINC (one per building) unless agreed to the contrary in writing.

All network devices e.g. data points, hubs & switches shall be supplied and installed as necessary by the TfL IT department (see section 7)

4. HEALTH AND SAFETY

It is the BMS Contractors responsibility to provide and maintain, so far as is reasonably practicable, a safe and healthy working environment and to enlist the support of employees towards achieving these ends.

The BMS Contractor should have a written Health and Safety Policy, which should be signed by the employer/chief executive, to demonstrate commitment to managing health and safety. This document shall include but not be limited to the following: -

- Healthy and Safety at Work Act (1974)
- Electricity at Work Regulations (1989)
- Control of Substances Hazardous to Health Regulations (1988)
- Noise at Work Regulations (1989)

To be fully effective, the policy should detail health and safety responsibilities within the entire organisation. Where appropriate key individuals or their job titles should be named, and responsibilities defined within a job description.

This Health and Safety Policy should be submitted with any tender to allow the BMS facilities manager to review and comment on the document as necessary.

The BMS Contractor is under a statutory duty to carry out an assessment of risks present in the workplace. The risk assessment must be in writing, be carried out by a "competent person" and examine the entire company's activities to identify any hazards involved, the likelihood of those hazards causing harm and the steps required to eliminate or minimise the risks.

It is the BMS Contractor's responsibility to produce and submit the relevant site specific Risk Assessments and Method Statements prior to any work being carried out. The Construction (Design and Management) Regulations shall be complied with in the execution of the work. The instructions of the Construction Manager and the requirements of the Health and Safety Plan shall be followed.

The installation shall incorporate every reasonable precaution and provision for the safety of all those concerned in the operation and maintenance of the works and of the associated works supplied by others.

Work shall comply with the requirements of the Health and Safety Commission including Statutory Instructions and Recommendations issued by them or by the Health and Safety Executive.

Note: This is intended as a general overview of the health and safety requirements of the project. It is to be expanded for any project specific health and safety requirements.

5. PROCEDURE FOR SUBMISSION OF TENDER

Tenders shall comply with the requirements of the Contract Specification. Where the Tenderer wishes to submit an alternative for consideration it shall be submitted in an accompanying letter with a full description, including details of the variation from the Contract Specification and the cost effect for the proposal.

The proposal shall identify and include the following: -

- MCC control panel schedule or schedule of modifications to existing panels, where applicable.
- Proposed BMS Points and alarms schedule.
- Full equipment schedule, including the number and proposed type of all Trend outstations required for the project and the proposed LAN and/or V/LAN to which the new system will be connected.
- Detailed method statement for completion of the works.
- Confirmation that costs have been included for any out of hours work required for plant change-overs.
- A full schedule of rates.
- Proposed programme of works, to include all submissions for comments and testing and witnessing activities.
- The companies Health and Safety Policy.

6. SCOPE OF WORKS

The works shall comprise the detailed BMS design, selection, works testing, supply, installation, setting to work, commissioning, performance testing, documentation and handing over of the fully functional system described in the Contract Specification.

The works shall include for the production of detailed and dimensioned installation drawings and control schematics, all of which shall be fully co-ordinated with the building structure and finishes, other building services trades covered by the contract and any services provided by the clients directly employed representatives and tradesmen.

The tender shall include but not be limited to the following works:

- Design, supply, installation and commissioning of all Trend BMS equipment, software and networks, and field control equipment as required by the Contract Specification.
- All electrical installation work related to control and/or power wiring emanating from the local MCC and or control panels.
- Design, supply, installation and commissioning of any motor control panels supplied, or modifications to existing panels, where applicable.
- Off loading, positioning and storage of any motor control panels supplied, unless specifically included for by the main contractor.
- Labelling of all field mounted equipment, including sensors, valves, damper motors and isolators.
- Strip-out and removal works (as applicable) including disposal in accordance with the relevant WEEE directives.
- Production and installation of graphics on the 963 Central Supervisor Server and any local operators PC's in line with the adopted client standard.
- Submission of all technical details, panel drawings, software schematics, 963 graphics and description of operation shall be *at least* 2 weeks prior to any testing, demonstrating or witnessing of any element or elements of the BMS installation.
- Compliance with the site standard procedures for loading software and graphics onto the 963 Central Supervisor Server.
- Provision of full O&M details including updating of associated client documentation and system architecture/topology.
- Provide final test certificates, as installed drawings, documentation and description of operation on CD and hardcopy.
- All attendances including all out of hours and weekend working required and regular site progress meetings.

- Liaison with commissioning engineers and attendance at systems commissioning including electrical commissioning tests where interfacing occurs.

- Liaison with other Package Contractors and the Clients representatives and tradesmen as can be deemed necessary for the satisfactory completion of the works.

- Testing and witnessing of all BMS points, software, graphics and MCC's.

- On site instruction to nominated TFL staff including overview of works carried out and method of operation.

- A one-year warranty on the complete installation from date of practical completion. Warranty to include for site visits and replacement of any defective item originally supplied.

- Allowance for three quarterly visits to site after date of handover to verify controls are operating correctly and clarify any operator queries.

- Allowance shall be made for the liaising with NDA Consulting and the TFL GP&F team during the design period regarding the Trend outstation types, their location, outstation referencing and network interfacing to enable the site structure and capacity to be taken into account.

7. BMS COMMUNICATIONS INTEGRATION

Where the BMS Specialist Contractor intends to utilise the clients IT network, the BMS Contractor shall liaise closely with the TfL IM department to achieve a seamless integration onto the clients intranet.

The BMS Specialist Contractor shall co-ordinate with the TfL IM department to obtain from it the Sub-Net Mask and I.P. address for each Ethernet device being used, and request the installation of any IT data points and supply of the Ethernet cabling between the IT points and the Ethernet devices.

The BMS Specialist Contractor shall submit as early as possible to the IM department the MAC address of any Ethernet devices (EINC) intended to be installed, the serial number of the Ethernet device(s) and the location of the device(s) together with the appropriate works request for installation of any required new data points.

These works shall be agreed with IM and coordinated by the BMS contractor to ensure works are completed in line with the agreed project programme.

It shall be noted that the connection to the TFL IT network of any mini hubs/switches not supplied by the IT department will not be permitted.

The BMS Specialist Contractor shall be responsible for the final connection and testing of the Ethernet device back to the 963 head-end.

8. SYSTEM DESIGN

The BMS contractor shall be responsible for the final system design and selection of all components to meet the requirements of the Contract Specification and installed plant, to the satisfaction of the engineer and TFL GP & F.

Prior to commencement of work a detailed programme shall be provided identifying the proposed extent of works to be undertaken and any areas where TFL GP & F approval will be required to gain access to work.

All drawings shall be submitted to the project consulting engineer and/or the GP & F engineer (where applicable) for comment prior to proceeding with manufacture and installation on site.

A written detailed description of the proposed control strategy in plain English for each system, including control and alarm parameters, shall be submitted before application software is commenced, for comment and approval.

Unless otherwise stated all system sensor and control wiring to 0-10v actuators shall conform to the requirements as specified by Trend and be run in individual screen pair cables in dedicated galvanised steel trunking or conduits suitably identified “BMS Cables”.

Where applicable and most cost effective, any panel back plates or modifications within MCC panels shall be a direct replacement of the existing panel utilising the latest equipment available of equal quality and complying with the latest European standards.

9. CONTRACT REQUIREMENTS

9.1 MOTOR CONTROL PANELS

Design, construct and install all control panels and associated switchgear so that their operation and maintenance complies with the Electricity (Factories Act) Special Regulations (1908 & 1944); the Health and Safety Act (1974), the Electricity at Work Regulations (1989) and any subsequent revisions to the legislation, together with other safety legislation and regulations currently in force.

Construct control panels as type tested assemblies to BS EN 60439-1 with minimum internal sub-division to Form 2 Type 2 standard.

The control panel shall include the following construction requirements as a minimum: -

- The control panels shall generally be of two sections, with a “Control Section” and a “Power Section”.
- Fascia mounted Hand/Off/Auto facility for all drives controlled from the MCC along with dedicated ‘Run & Trip’ or ‘Run & Fault’ indication as applicable.
- Fascia mounted Off/Auto facility for all packaged plant controlled from the MCC along with dedicated ‘Enabled & Common Fault’ indication.
- Duty/Standby plant selection shall be provided when in Hand.
- Cluster LED type indication lamps with lamp test facility.
- 100mm plinth to be included for floor standing MCC’s.
- Internal anti-condensation heater and ventilation fans with control stat as necessary.
- Internal luminaire controlled from door micro-switch for sections in excess of 1000mm.
- Control section drop down lap-top shelf and 13A socket outlet.
- Fascia mounted Trend IQ View Touch Screen interface (Per MCC or plant room). Mounting height of displays to be 1500mm above FFL.
- The control section shall not have any voltage greater then 50v unless it is segregated from the rest of the control circuitry (by double insulated cable as a minimum), and marked with the appropriate warning labels. This section shall house the Trend IQ controller plus all necessary control interfaces.
- The power section shall house all the starter equipment associated with the control panel, and shall incorporate a door-interlocked isolator i.e. the power section panel door cannot be opened unless the door isolator is in the “OFF” position, thus isolating all hazardous voltages within the section.
- All control equipment within the control panel shall be identified on the adjacent trunking lid.

- Identifying labels shall be affixed to the panel detailing the panel reference and warning of hazardous voltages.

- Provision of rubber safety mats in front of all control panels in accordance with BS 921: 1976.

The BMS Contractor will also prepare schematic, wiring and general arrangement drawings of the control panels and all equipment connected and submit the drawings for comment at least 2 weeks prior to manufacture is required to begin. The drawings shall be A3 in size and provided electronically in PDF file format (1 PDF per panel).

Ensure the motor control panels and their internal assemblies are Type Tested to B.S. EN 60439-1: 1994. Provide copies of Type Test certificates when submitting drawings for comments.

The BMS Contractor should note that no manufacture of equipment should commence until written comments have been given. The comments do not constitute agreement that the BMS Contractor has provided correct wiring diagrams for the plant or the services they provide, or that the BMS Contractor has incorporated all the appointed specialists wiring in the correct way into his collective wiring diagrams. Neither does it constitute agreement that the BMS Contractor has provided the correct operation and function of all plant and controls in the manner specified in the Contract.

The BMS contractor shall be responsible for the off-loading, transporting and positioning of all motor control panels.

At minimum panel works shall comply with the following: -

a) The latest Edition of Regulations for the Electrical Equipment of Buildings issued by the IEE – BS.7671 (1992) Incorporating Amendments.

b) The Electricity (Factories Act) Special Regulations.

c) The Electricity Supply Regulations.

d) Relevant British Standard Specifications (BSS) and Codes of Practice (CP) for installation within the specific environment.

e) Any requirements and byelaws required by Statutory Authorities Fire Officer, as may be applicable.

f) The Health and Safety at Work Act.

9.2 CONTROL VALVES, ACTUATORS, SENSORS AND DETECTORS

The BMS Contractor shall provide control valves (complete with fittings) and actuators, and the Mechanical Contractor will fit the valves. Actuators shall be installed and connected with field wiring to the controls systems by the BMS Contractor.

The BMS Specialist Contractor shall examine all Mechanical Services drawings and select line size control valves. Upon selection and finalisation of the plant coils by the Mechanical Contractor, the BMS Contractor shall verify his selection.

Control valve sizes shall be checked by the BMS Specialist Contractor taking into account the following:

(i) Full details of the selected control valve manufacturers range of control valves.

(ii) Full details from the Mechanical Services Package Contractor selected manufacturer of the pressure loss, flow rates, connection sizes etc of all major plant.

(iii) Valve application i.e. variable volume, 2 port control etc plus associated CV values.

All control damper actuators shall be supplied and installed by the BMS Specialist Contractor. The dampers will be provided by the Mechanical Contractor. The BMS Contractor shall examine all Mechanical Services drawings and select the damper actuator or multiple actuators controlled from a common control output to provide correct torque requirement based on the damper/duct sizes indicated on the drawings.

The BMS Contractor shall supply all sensors and detectors. Sensors and detectors installed into pipework and directly into plant shall be handed to the Mechanical Contractor who will fit the items. Connections to the sensors and detectors to the field wiring shall be carried out by the BMS Contractor.

Wall, ceiling and duct mounted sensors and detectors shall be supplied and installed by the BMS Contractor.

The BMS Specialist Contractor shall liaise closely with the Mechanical Services Contractor in order to ensure that the control equipment is correctly selected. Full details of all selections are to be submitted to the engineer for comment prior to ordering the equipment.

In respect of space sensors or any item ‘on view’, samples of the proposed equipment shall be submitted to the client for approval. For tender purposes the BMS specialist contractor shall assume the ‘on view’ sensors and equipment will be of a high quality and of an aesthetically pleasing nature. Samples/colour pictures and dimensional information shall be provided as part of the tender submission.

9.3 FIELD WIRING

The BMS Contractor shall supply and install all communications and controls cabling and their containment systems between the motor control panels and the items of plant and the building management system components.

All communications and control cabling shall be installed in separate conduits and trunking to the power systems (Multi Compartment trunking shall not be utilised).

The BMS Contractor shall supply and install all power cabling and containment and support systems from the motor control panels to the mechanical plant. All mechanical plant shall have isolator devices mounted adjacent to the plant for maintenance purposes.

The cabling installation shall be carried out in accordance with BS7671, BS5588 and BS5839 and shall comply with any special requirements of the controls system manufacture.

All cabling and containment systems shall be installed by approved electricians whose employer shall be approved by the NICEIC or ECA and suitably identified "BMS Cables".

The BMS Contractor shall make all final connections to motor control panels and of field power and controls wiring to mechanical plant and controls, fire alarm interface unit, volt free contacts, electrical plant, and smoke ventilation control systems etc. as indicated within the Contract Specification.

9.4 CABLE COLOURS

In conjunction with BSI and IEE standards, the following cable colours for the motor control panels and site installation shall be used.

AC (Mains) Circuits

Three-Phase A.C. Circuit – Phase (L1)	Brown
Three-Phase A.C. Circuit – Phase (L2)	Black
Three-Phase A.C. Circuit – Phase (L3)	Grey
Three-Phase A.C. Circuit – Neutral	Blue
Single-Phase A.C. Circuit – Phase	Brown
Single-Phase A.C. Circuit – Neutral	Blue
Non-Switched (Permanent) Single-Phase A.C. Circuit - Phase	Brown (with Orange sleeve)
Non-Switched (Permanent) Single-Phase A.C. Circuit – Neutral	Blue (with Orange sleeve)

Earthing Conductors

Protective Earthing	Green & Yellow
Functional Earthing	Cream

In addition to the above, the following shall be adopted for the works;

ELV (BMS) Control Circuits

AC Control Circuit – Positive	White
AC Control Circuit – Negative	White (with Black sleeve)
DC Control Circuit – Positive	Orange
DC Control Circuit – Negative	Orange (with Black sleeve)
DC (0v to 10v) Reference Control Circuits	Pink

9.5 STANDARD APPLICATIONS

A standard philosophy shall be adopted across the sites in the manner in which key elements shall be controlled and monitored and shall be updated as part of the works for the plant control upgrade.

All life safety and equipment interlocks where possible damage to plant may occur shall be hardwired and not be reliant on BMS software to perform the function. The interlock shall be so configured that regardless of whether the plant is in the “Auto” or “Hand “ position the plant will be overridden accordingly.

Operation of the interlock will be monitored on the BMS. Examples are Fire shutdown, frost low limit, damper open on full fresh air plants before fan start up, calorifier high limit thermostat, etc.

The BMS designer shall ensure that the specification includes for: -

- Individual enabling, control and sequencing of N+1 plant e.g. Boilers, Chillers, Pumps and Fans etc where applicable.
- Individual monitoring of plant operational status. Provide as a minimum Run and common fault status for each item of plant.
- Monitoring of fans operation by differential pressure switch or current relay on low duty fans.
- Monitoring and control of auto changeover of fans on duty failure by a common differential pressure switch across the fan set.
- Monitoring of pump operation by differential pressure switch or current relay on low duty pumps.
- Monitoring and control of auto changeover of pumps on duty failure by a common differential pressure switch across the pump set.
- Monitoring of filter status by differential pressure switch (set in accordance with the filter manufacturers recommendations) across the separate filters.
- Monitoring of MCC control switches for drive ‘Out of Auto’ positions and alarming at the BMS.
- Provision of Frequency Inverters on variable speed drives. Provide BMS enable, status, speed control output, feedback and fault.
- Provision of Frequency Inverters on fixed speed drives where appropriate. Provide BMS enable, status and fault.
- Monitoring of packaged plant items e.g. Pressurisation units, Booster sets etc. Provide as a minimum plant operational (e.g. Run) status and common fault status.
- Monitoring of all safety shut-down circuits/devices e.g. gas safety, fire alarm, frost etc.

All plant having duty and standby arrangement shall include for a duty rotation/sharing changeover program.

All analogue outputs shall have the facility to be manually overridden from the BMS supervisor for maintenance, commissioning and demonstration purposes. This shall not circumvent any safety overrides or control features i.e. Frost Protection.

All plant enable signals shall have the facility to be manually overridden OFF & ON from the BMS supervisor for maintenance, commissioning and demonstration purposes. This shall not circumvent any safety overrides or control features i.e. Fire Shutdown.

9.6 ENERGY EFFICIENCY

Energy efficient plant start/stop and control strategies shall be adopted. Specific strategies shall be developed for the particular building in consultation with the engineer and TfL GP & F. Typical examples include;

- Avoid simultaneous heating and cooling. Utilise dead-bands.
- Provide demand based operation of main heating & cooling plant.
- Provide demand based speed control of fans where possible e.g. Variable volume, space CO_2 control.
- Provide demand based speed control of pumps where possible e.g. Variable volume on system differential pressure in conjunction with 2-port control valves etc.
- Limit optimum start of plant to a maximum of 3 hours before required occupancy.
- Summer/Winter shift operation based on outside air temperature.
- Utilise free heating & cooling where possible e.g. heat recovery and night purge etc.
- Scheduling of supply air or space temperature control against outside air temperature.
- Night set-back on 24hr plant operation

9.7 SYSTEM SUPERVISOR GRAPHICS

All graphics produced shall follow the standard guidelines/backdrops developed for the client. The BMS Contractor shall ensure the graphics are created and tested in line with the agreed programme.

The BMS contractor shall be responsible for familiarising himself with the site standards and hierarchy and update/loading procedures and shall make all due allowances for full compliance.

Graphics to be configured in line with established site operator privileges as follows;

Level 1 - View only

Level 2 - Reset / acknowledge alarms and operate plant

Level 3 - Time schedules, Set point changes, run time schedules

Level 4 - Override Plant controls

Level 5 - Full Engineering access

The BMS contractor shall submit the system software (in paper & electronic format) for comment at least 4 weeks prior to any demonstration or witnessing to allow the graphics to be produced. Graphics shall be issued in colour hardcopy or pdf to the engineer for comment (There shall be a 2 week approval period).

When the software and graphics have been finalised & fully populated by means of local PC or laptop connection and tested, the BMS contractor shall liaise with NDA and the GP & F team to install the software and graphics on to the 963 server located at the Canary Wharf Global Switch Facility.

Remote access to the server shall be by prior arrangement with the TfL IM department at Victoria Station House. Notice shall be given of the required access and anticipated timescales at least 2 weeks prior. The BMS contractor shall liaise with the IM department and coordinate to ensure works are completed in line with the agreed programme.

The graphics shall be based on the system schematics and layout drawings for the project. Where these are not available e.g. upgrade or refurb works, then all graphics shall be agreed with the engineer and TFL GP & F before development commences.

The dynamic graphics shall display regularly updated dynamic values required (as a minimum).

The graphics shall utilise all BMS input and output points, along with any software “knobs” and “switches”, to give a full and concise overview of plant monitoring and performance.

Where applicable, the graphics shall identify all enable signals clearly adjacent to each item of plant.

9.8 SYSTEM ALARMS

The alarm routing software shall be engineered to include multiple alarm priorities and destinations. This shall enable any single alarm generated within the system to be sent to different locations depending on priority. These shall include as a minimum;

Alarm priorities

- General maintenance alarms – e.g. Filter dirty, duty plant fault/failure etc.
- Critical alarms – Total plant failure, Temperature out of limits alarms, Life safety systems operating etc.

Alarm Routing

- The 963 head-end supervisor server for central monitoring and recording of alarm data.
- The GP & F helpdesk, either by e-mailing the alarm (via the 963 supervisor server to multiple recipients) or via their Mobile Phone / pager system.
- Other destinations as determined by the specific project requirements.

Note – The BMS Contractor shall make due allowance for the required alarm routing to be discussed and agreed with the Engineer and GP & F team prior to final commissioning. The latest Alarm Strategy Requirements Matrix is provided as an appendix to this document to form the start point for these discussions.

9.9 DATA LOGGING

Data logging shall be configured at each BMS outstation to record all required point values at intervals of 30 minutes or as directed by the engineer or TfL GP & F.

Logged data shall be automatically uploaded to the 963 server at appropriate intervals to ensure no loss of data. Data shall be stored in an agreed location on the server in an agreed format for future dissemination and analysis. The following points shall be logged as a minimum;

- All sensors e.g. temperature, humidity, pressure, volume, level etc
- All calculated set points
- All main heating and cooling plant enable signals (i.e. boilers, chillers etc)
- All meters, including utility consumption and plant run hours
- Other points as required by the specific project.

10. TESTING & WITNESSING – OFF SITE

Initial witness testing of the motor control panels, software and graphics shall be carried out at the manufacturer's works.

Colour printouts of all plant graphics associated with the software to be demonstrated shall be provided at least two weeks prior to testing.

Provided the software design packages (i.e. flow charts and all related plant graphics) have been inspected and accepted, the BMS Contractor shall demonstrate that all plant operational software, dynamic graphics, system programmes and the operators terminal functions (including all printed alarm messages etc.) are fully functional within the control panel.

Provide a test rig to include suitably labelled switches, potentiometers, indicating lamps and meters connected to the motor control panels to simulate all inputs and outputs.

The BMS Contractor shall provide copies of calibration certificates for all test equipment used.

Should the works on inspection or testing not conform to the specification, the BMS Contractor must make them so conform immediately at his own expense.

11. TESTING & WITNESSING – ON SITE

After the controls have been installed and connected, commissioning tests shall be carried out in accordance with CIBSE Commissioning Codes for Automatic Controls to ensure that all items are connected correctly, and functioning in the manner intended.

The BMS Contractor shall provide commissioning test sheets completed in full identifying all points, commands, control loops, motor starters, fusing / overloads and inverters etc have been checked. These sheets shall be submitted as part of the operation manuals for the project.

Prior to demonstration and handover the BMS Contractor shall run the plant for a minimum period of 5 days after completion in order to demonstrate "trouble-free" running under normal operating conditions supported by suitable trend logs indicating continuous stable environmental conditions on selected analogue sensors against given set points.

The BMS Contractor shall ensure that the whole installation is completed and is fully tested to their entire satisfaction prior to inviting the Engineer and TFL GP & F to witness the works undertaken. This shall include the updating to “As Installed” of all motor control panel wiring diagrams, outstation software schematics, system description of operation; the 963 supervisor graphics shall be loaded onto the 963 supervisor server (in line with site requirements). Witnessing shall include as a minimum inspection of the commissioning test sheets, point-to-point checks, random selection of sequence of operation and hardwired interlocks and viewing of trend logs over the 5-day period.

The BMS Contractor shall provide copies of calibration certificates for all test equipment used.

12. DOCUMENTATION

"As Fitted" drawings and service manuals shall be provided as part of the completed contract and a certificate of completion may not be issued until this has been done.

It is a legal requirement that operators are not permitted to work or maintain plant (or machinery) until full instructions are in their possession.

On the day of practical completion or upto a maximum of 7-days thereafter, the BMS Contractor shall provide a fully detailed operation and maintenance manual for all systems provided under the contract including record drawings, schematics, control panel wiring diagrams and full test and commissioning data and completion certificates. Electromagnetic compatibility certificates shall be supplied for all equipment installed and technical justification files shall be provided for all pre-fabricated plant e.g. motor control panels.

The manuals shall include but not be limited to the following: -

- Wiring and fascia diagrams.
- Trend network and topology schematic.
- Control strategy document written to be understood by site Maintenance Engineer.
- Control logic diagrams.
- Location of all panels, outstations and control devices.
- Control, alarm and limit for each control device.
- Copies of all demonstration monitoring & trend logs.
- All test & calibration certificates.
- Technical details of all panel equipment, outstations, controllers, control sensors etc.
- Suggested spares list with "off the shelf" times and ordering requirements.
- Maintenance regimes & schedules.
- Emergency procedures (in the form of a flow diagram).
- Fault tracing and rectification.

Manuals shall be supplied in both paper and CD format.

Two copies of the application software on CD ROM shall be handed over at Practical Completion.

The BMS Contractor shall allow for the updating of the O & M Manuals at the end of 12 months after Practical Completion, following any modifications to the control systems required and for providing two further copies of the revised application software.

13. APPENDIXES

13.1 LATEST ALARM STRATEGY REQUIREMENTS MATRIX

Transport for London GP&F BMS Graphic Standard

Introduction

It is intended that the engineering pages of the TfL GP&F Trend BMS 963 v3.1 server or any other TfL GP&F BMS system follow a standard graphics format. This will allow the presentation of the graphic pages to be viewed by a variety of clients in a standard easy to understand format.

The construction of the graphics shall use the TfL GP&F standard backdrops and bit maps as detailed below.

The standard Trend 963 server graphic pages, bmps, backdrops etc will reside on the server and are available on a CD.

CD Contents:

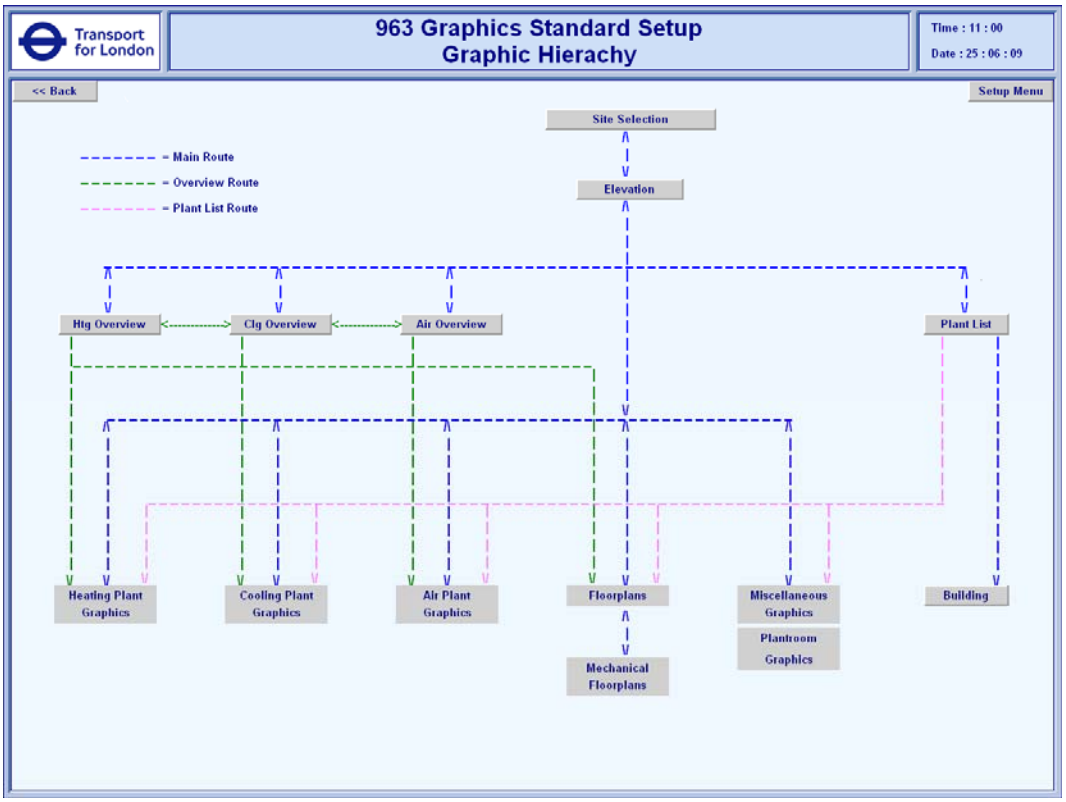
Transport for London BMS Graphic Standard v04.doc

- **Pages**
  - TfL 963 Graphics Standard Setup
    - Standard Setup
    - Sample Standard Graphics
    - Sample Site
  - Transport For London
    - Standard Folders (Use for Graphic Creation)
- **Backdrops**
  - TfL 963 Graphics Standard Setup
    - Sample Site
    - Standard Backdrops
  - Transport For London
    - Standard Folders (Use for Graphic Creation)
- **Bmp**
  - Overview Bitmaps (to assist with creating overviews)
  - Setup (for sample pages only)
  - Transport For London
    - Standard Bitmaps (Use for Graphic Creation)
- **Analogue** (Use for Graphic Creation)
- **Animation**
  - Templates (Use for Graphic Creation)

Contents

1 TfL BMS Graphics Standard Setup

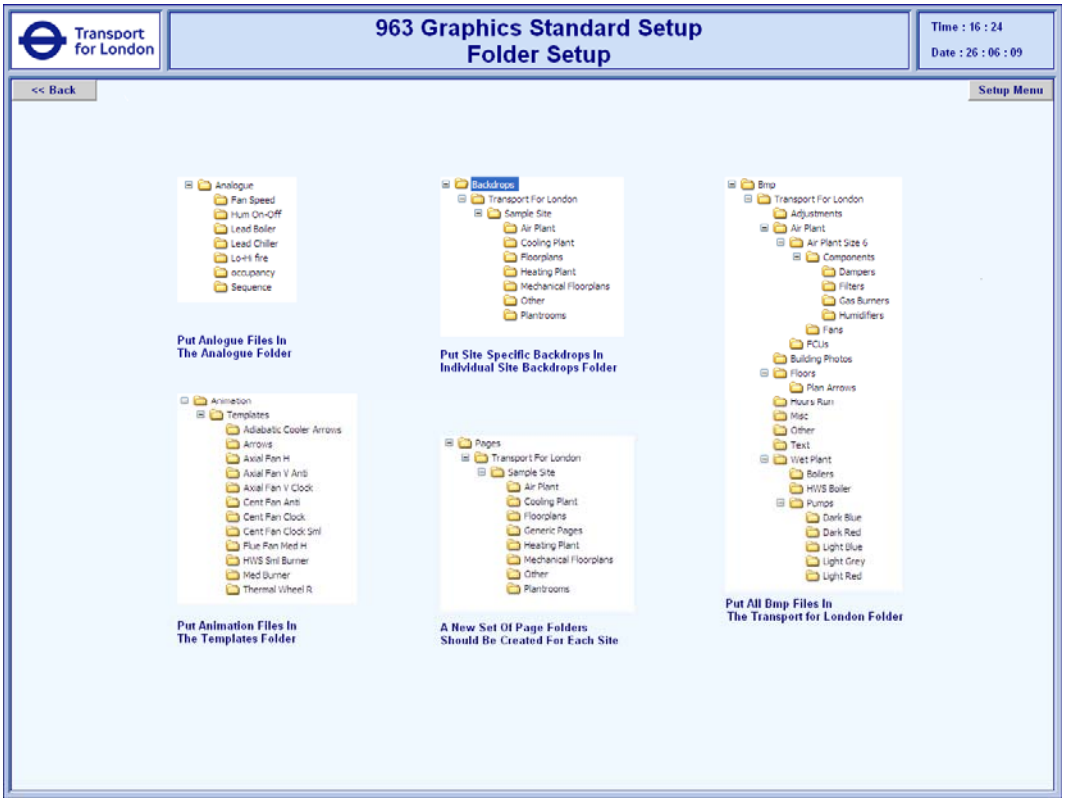
1.1 Graphic Hierarchy



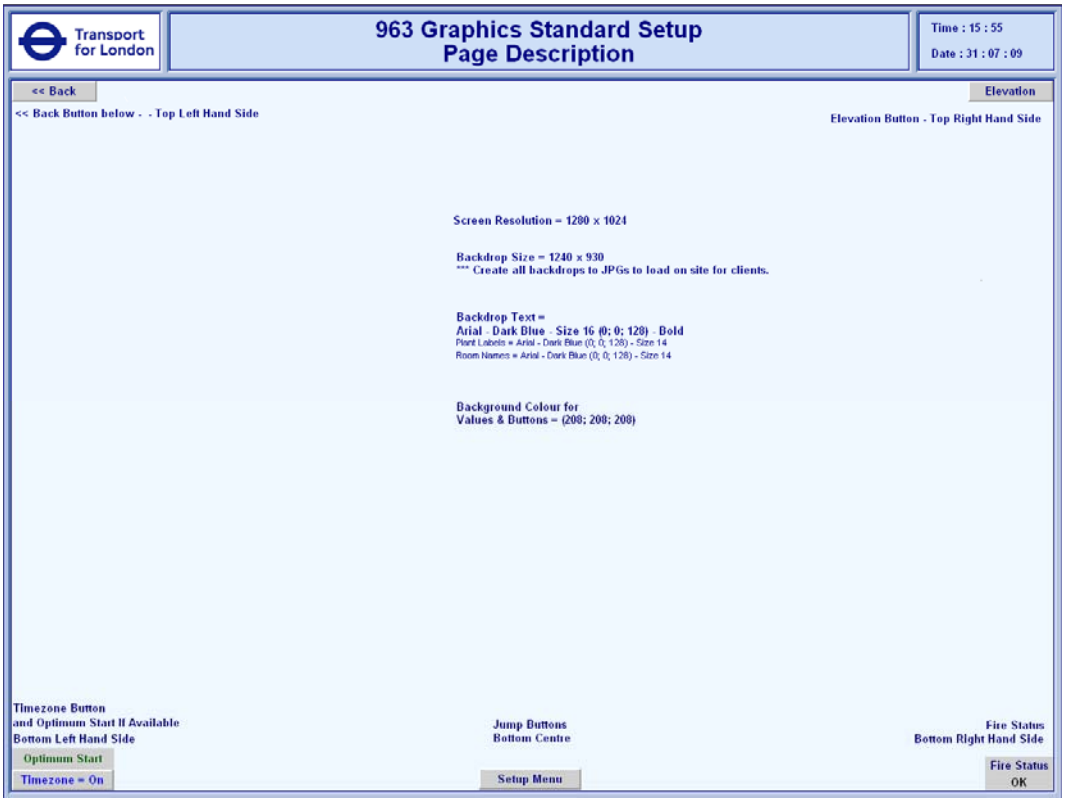
1.2 Page & Folder Setup

A new set of page and backdrop folders should be created for each new site.
Use standard backdrops where possible.
Use existing bmp folders where possible

Create Backdrops as jpgs to load onto server for clients.

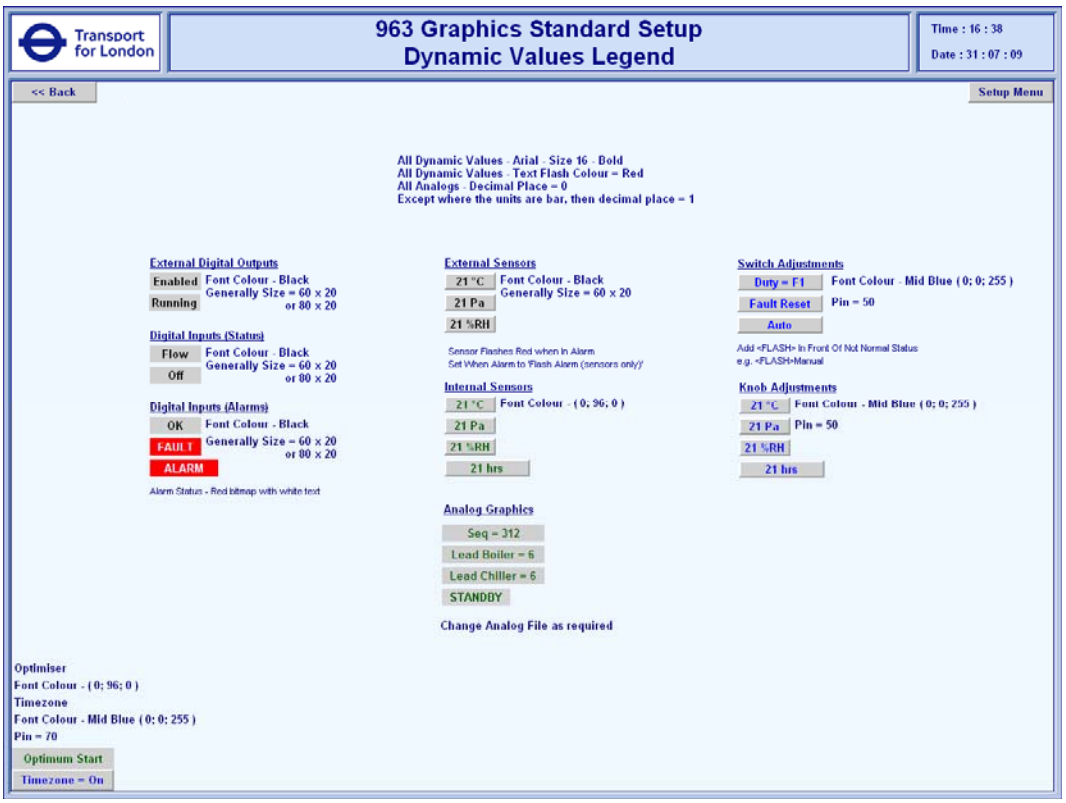

Transport for London
963 Graphics Standard Setup
Folder Setup
Time : 16 : 24
Date : 26 : 06 : 09
<< Back
Setup Menu
Analogue
Fan Speed
Hum On-Off
Lead Boiler
Lead Chiller
Lo-Hi fire
occupancy
Sequence
Put Anlogue Files In
The Analogue Folder
Backdrops
Transport For London
Sample Site
Air Plant
Cooling Plant
Floorplans
Heating Plant
Mechanical Floorplans
Other
Plantrooms
Put Site Specific Backdrops In
Individual Site Backdrops Folder
Bmp
Transport For London
Adjustments
Air Plant
Air Plant Size 6
Components
Dampers
Filters
Gas Burners
Humidifiers
Fans
PCUs
Building Photos
Floors
Plan Arrows
Hours Run
Misc
Other
Text
Wet Plant
Boilers
HWS Boiler
Pumps
Dark Blue
Dark Red
Light Blue
Light Grey
Light Red
Put All Bmp Files In
The Transport for London Folder
Animation
Templates
Adiabatic Cooler Arrows
Arrows
Axial Fan H
Axial Fan V Anti
Axial Fan V Clock
Cent Fan Anti
Cent Fan Clock
Cent Fan Clock Sml
Flue Fan Med H
HWS Sml Burner
Med Burner
Thermal Wheel R
Put Animation Files In
The Templates Folder
Pages
Transport For London
Sample Site
Air Plant
Cooling Plant
Floorplans
Generic Pages
Heating Plant
Mechanical Floorplans
Other
Plantrooms
A New Set Of Page Folders
Should Be Created For Each Site

1.3 Page Setup

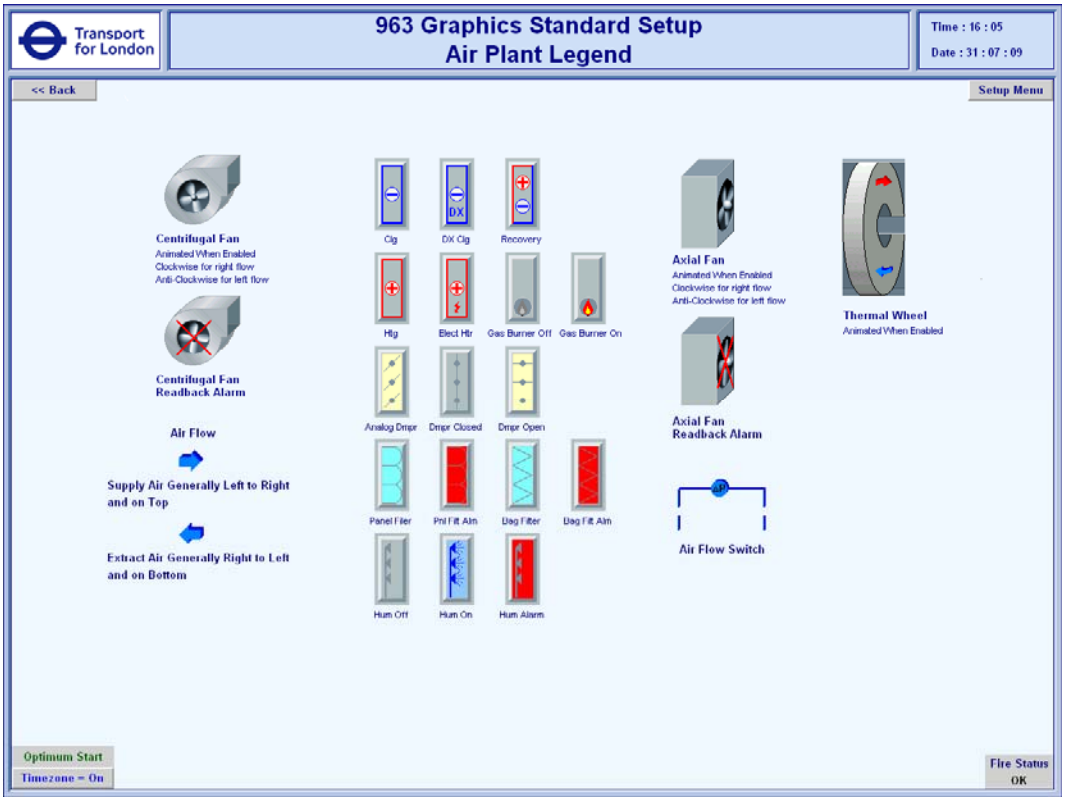


1.4 Dynamic Values

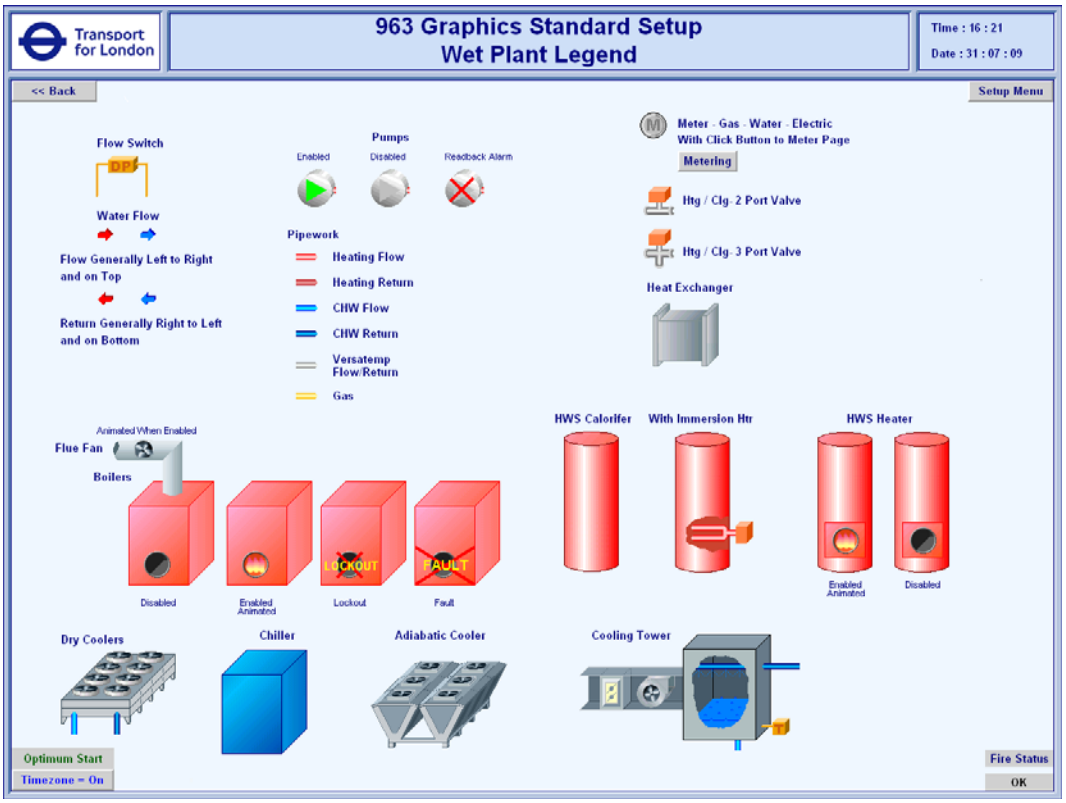
Copy similar dynamic values from standard pages and drag new point onto it.



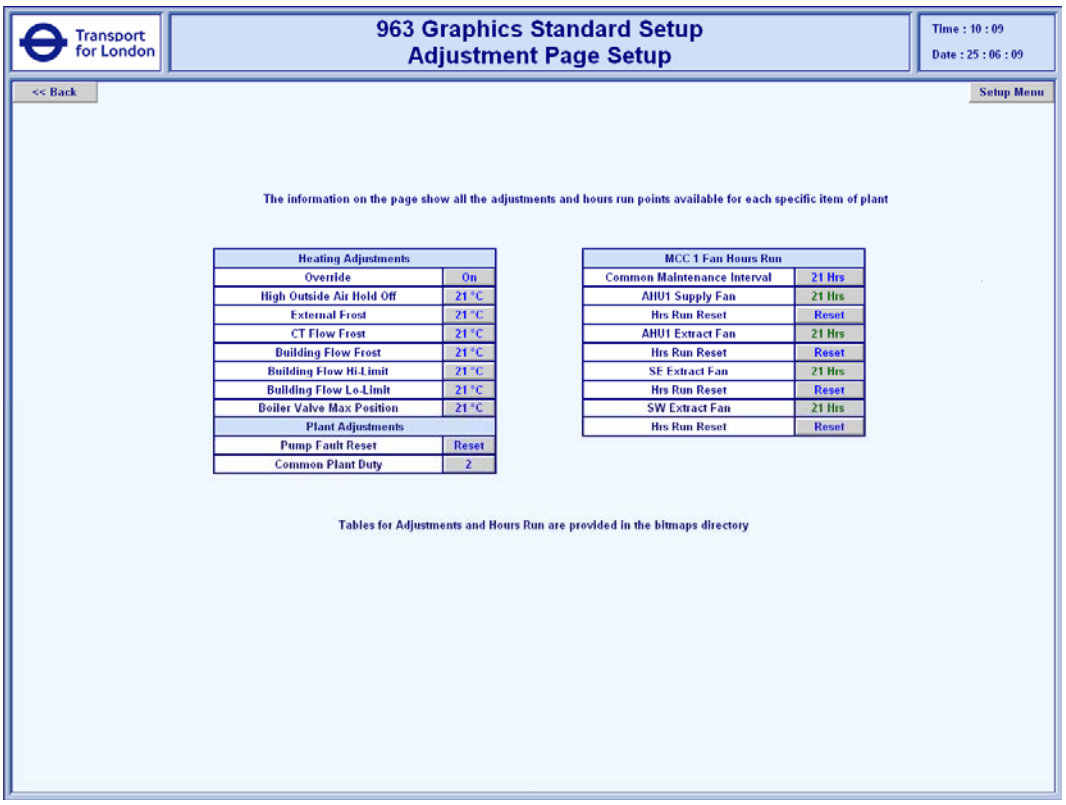
1.5 Air Plant Legend



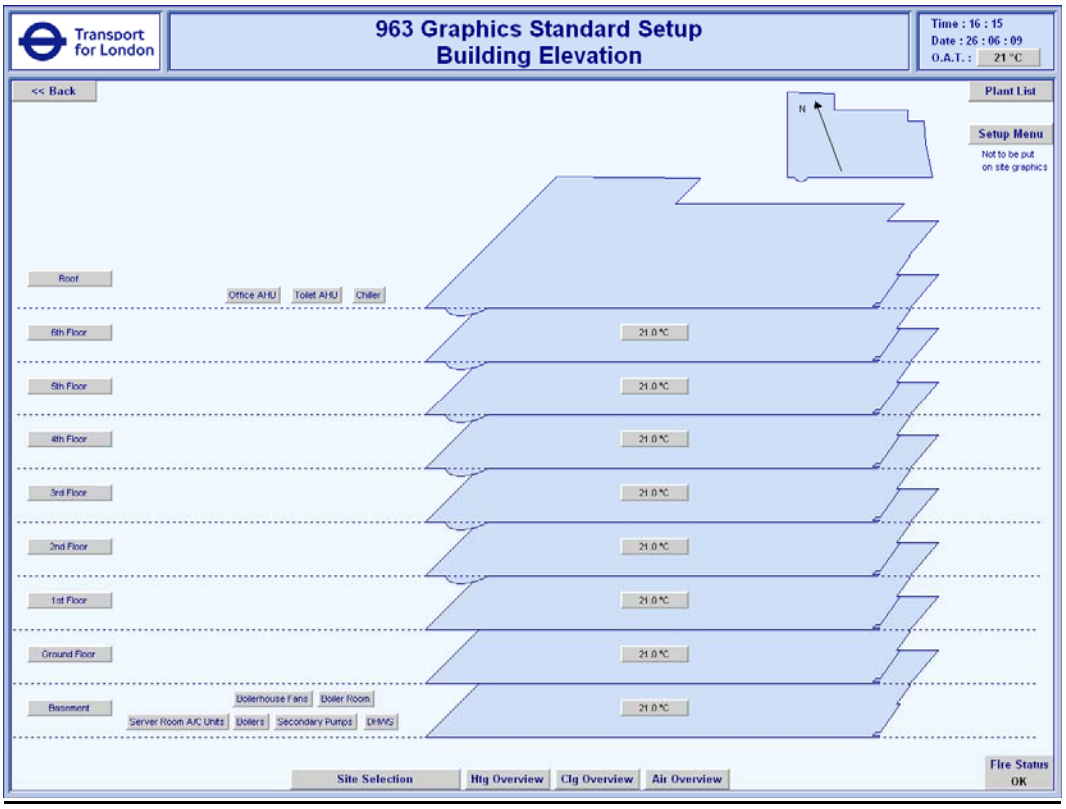
1.6 Wet Plant



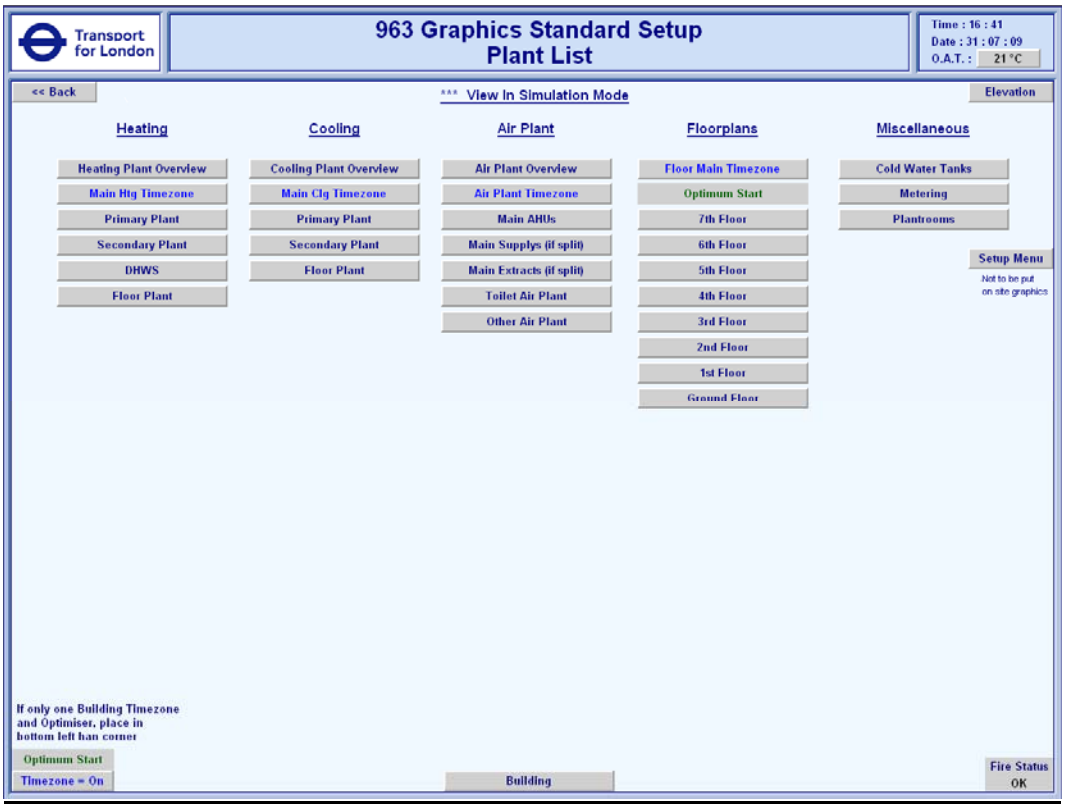
1.7 Adjustment Pages



1.8 Building Elevation

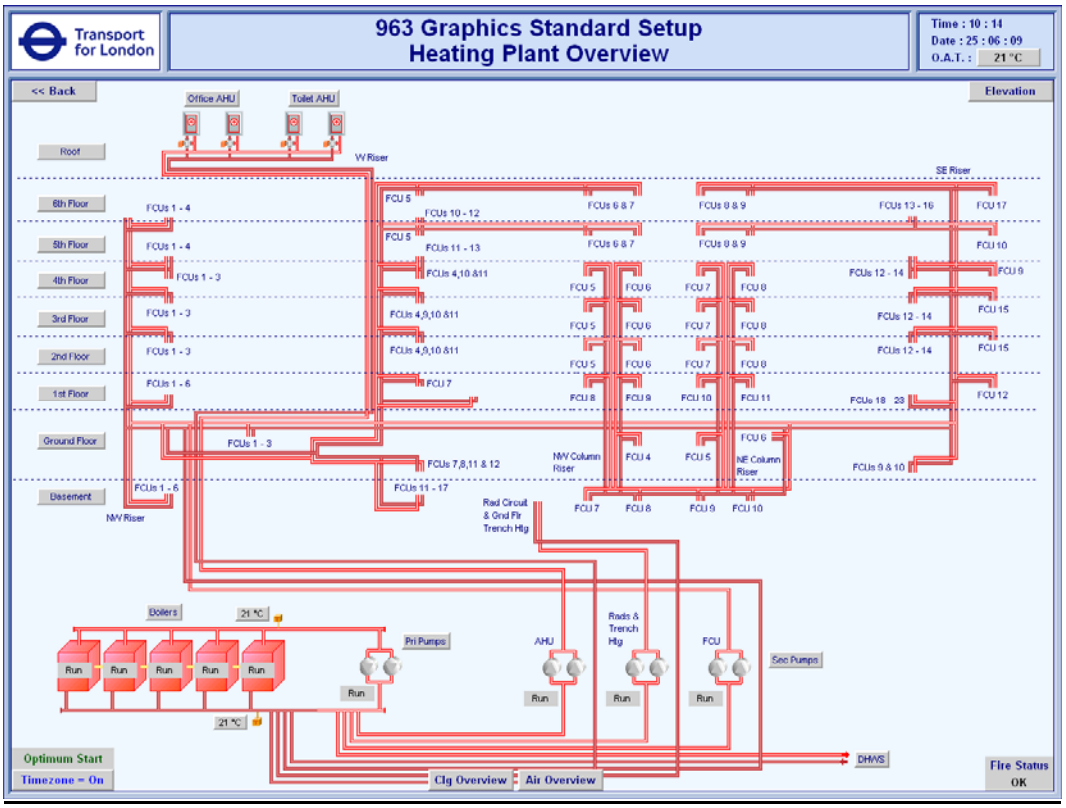


1.9 Plant List

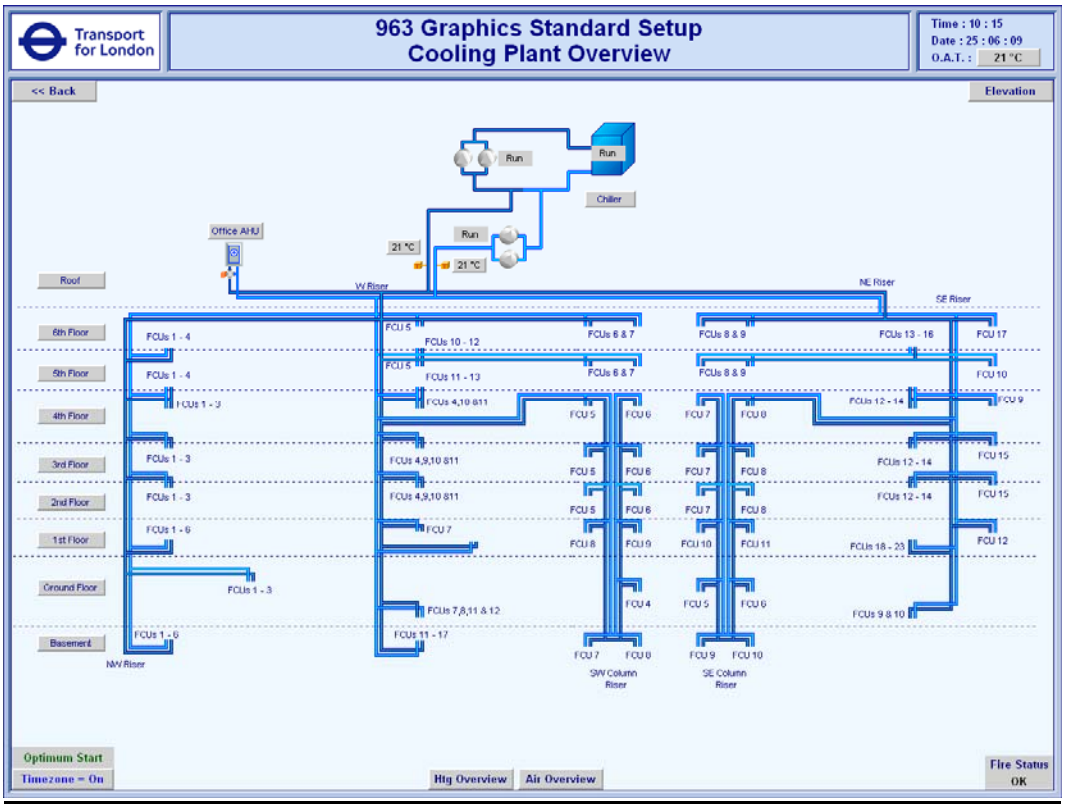


1.10 Building

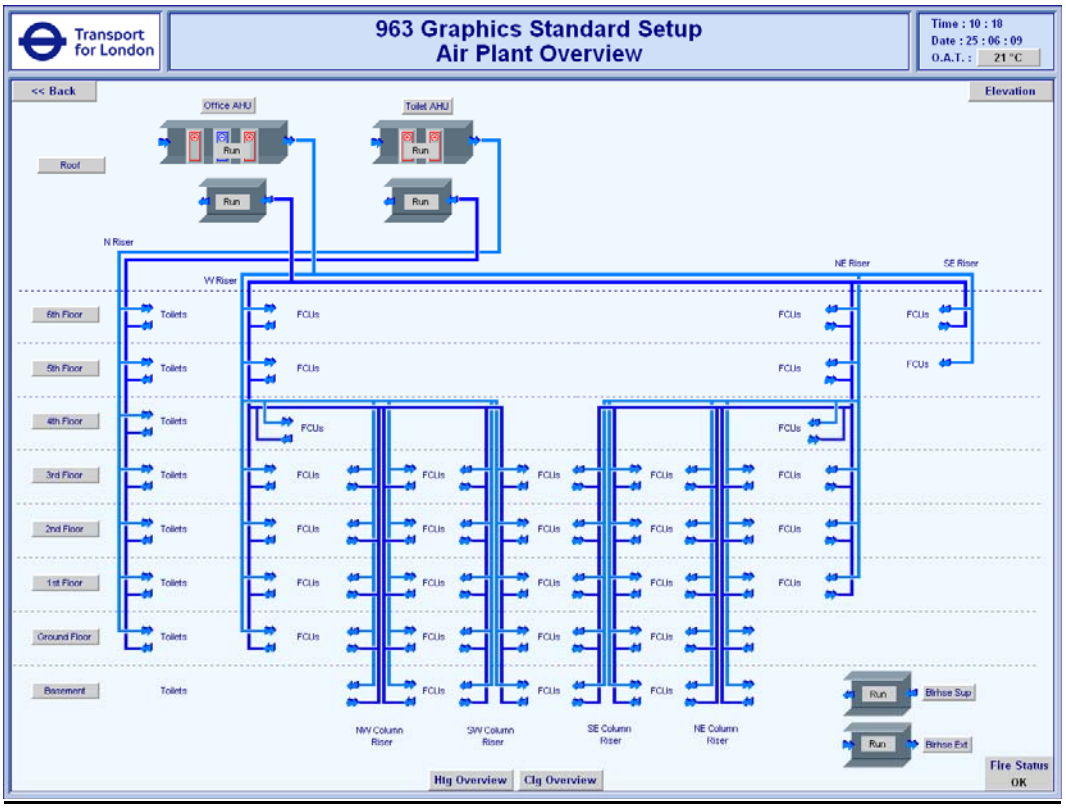
1.11 Heating Plant Overview



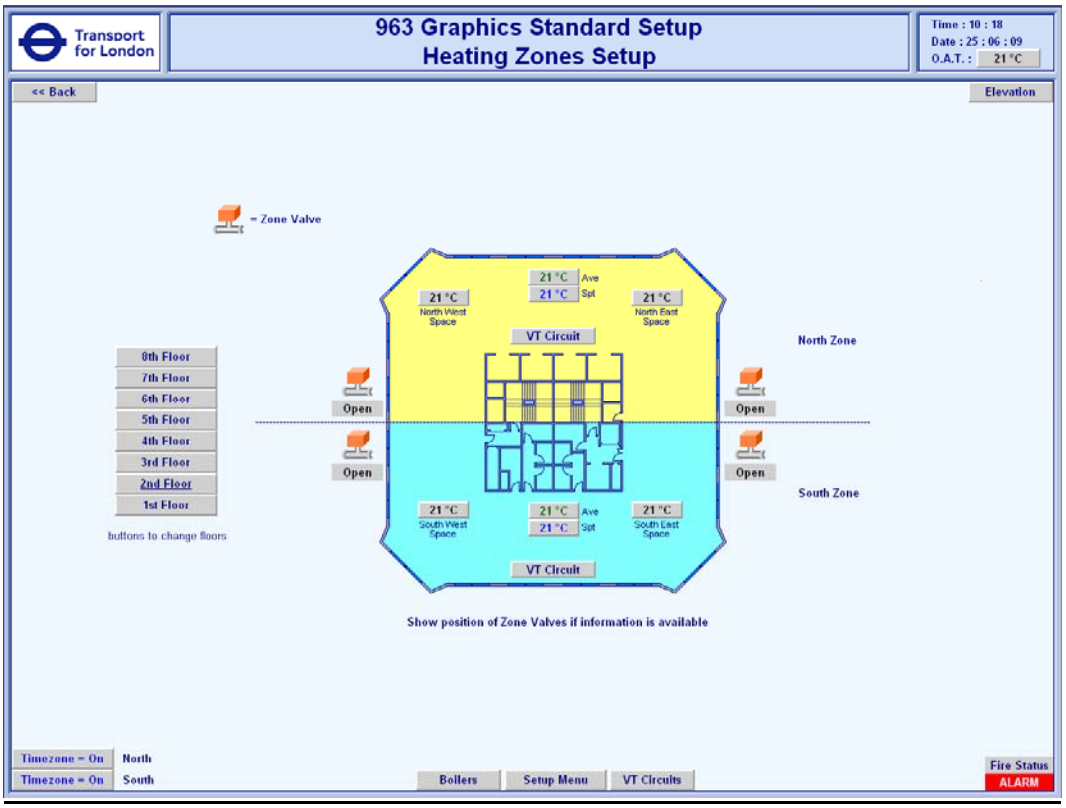
1.12 Cooling Plant Overview



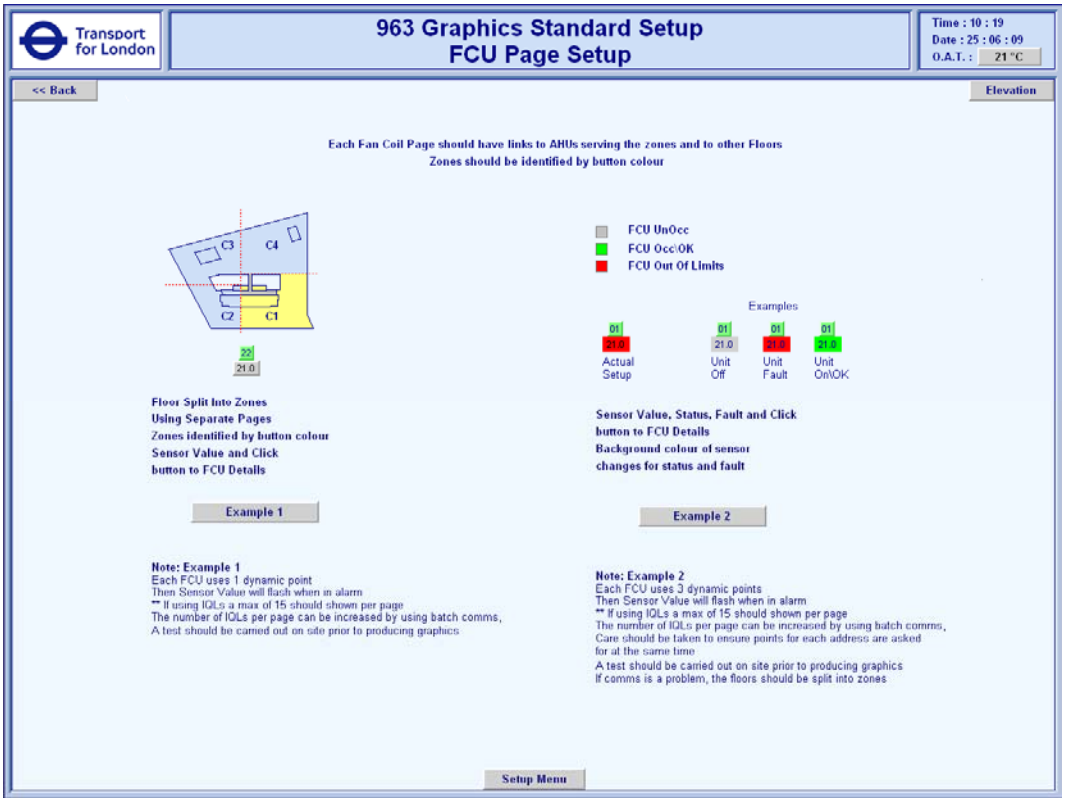
1.13 Air Plant Overview



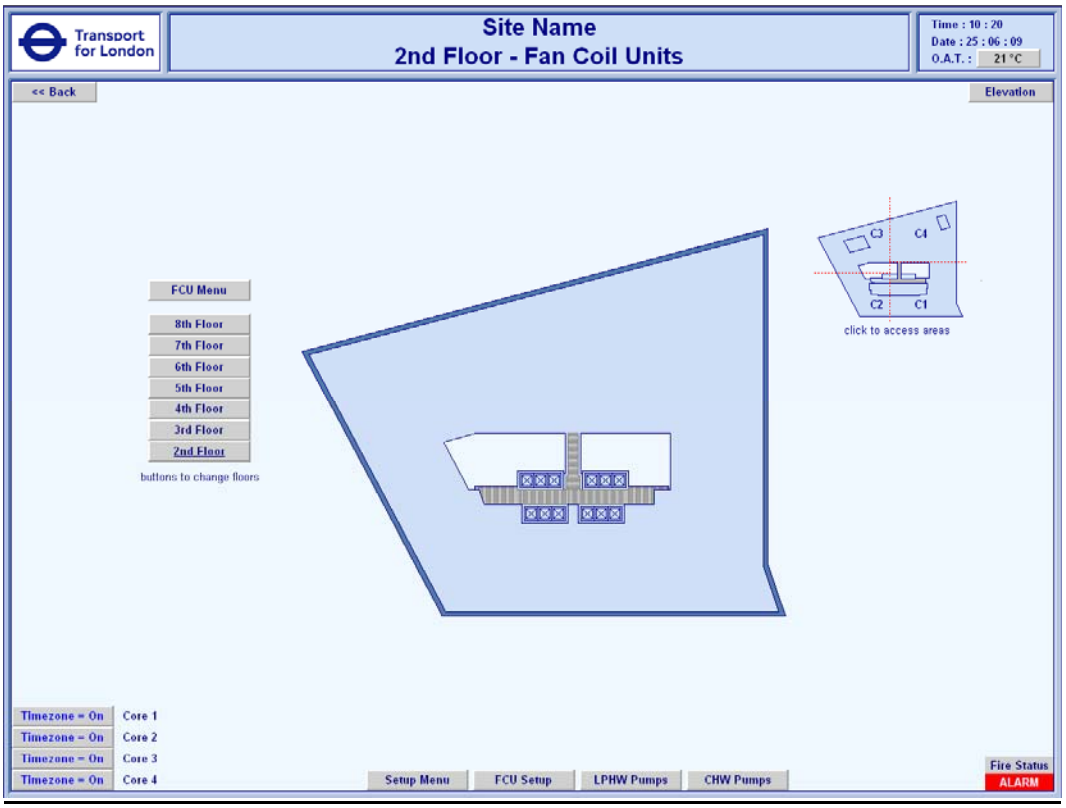
1.14 Heating Zones



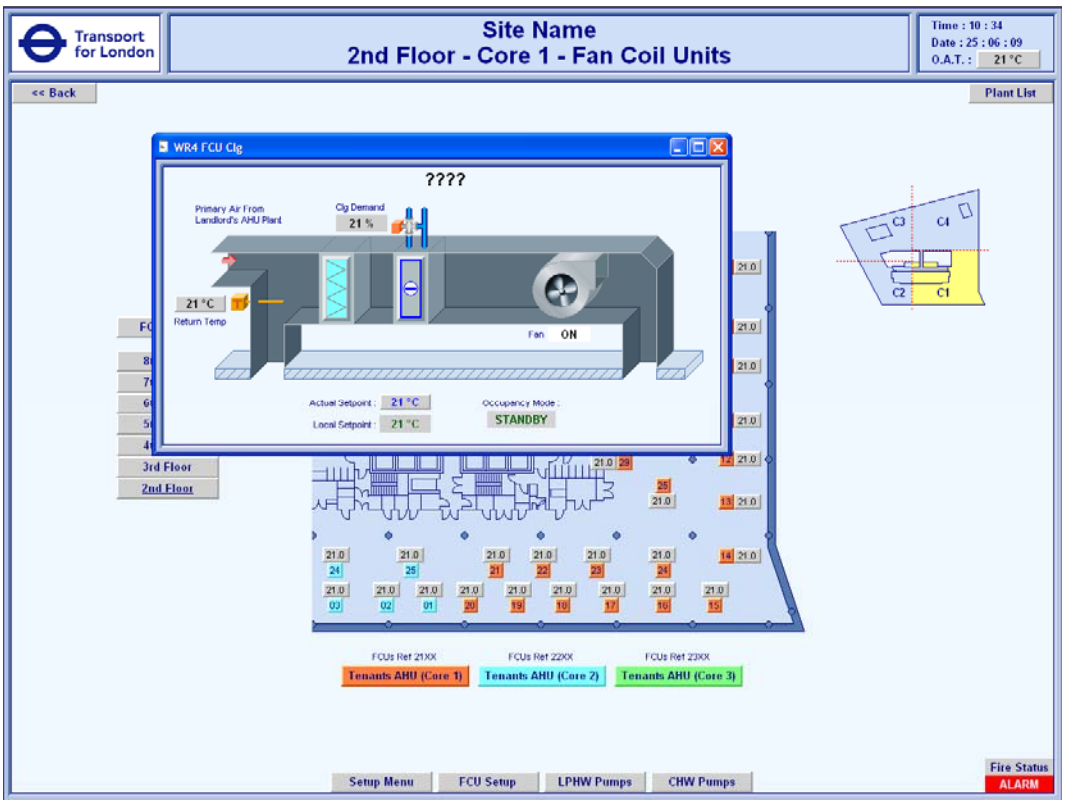
1.15 FCU Page Setup



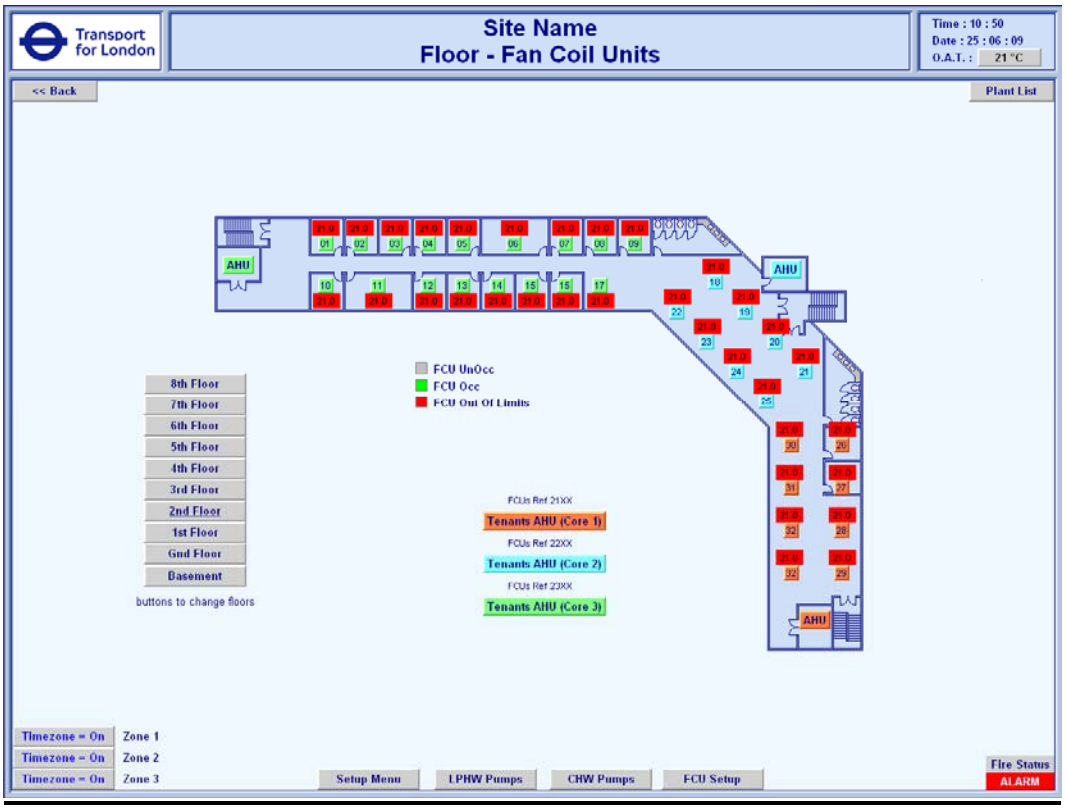
1.16 FCU Page Setup – Example 1



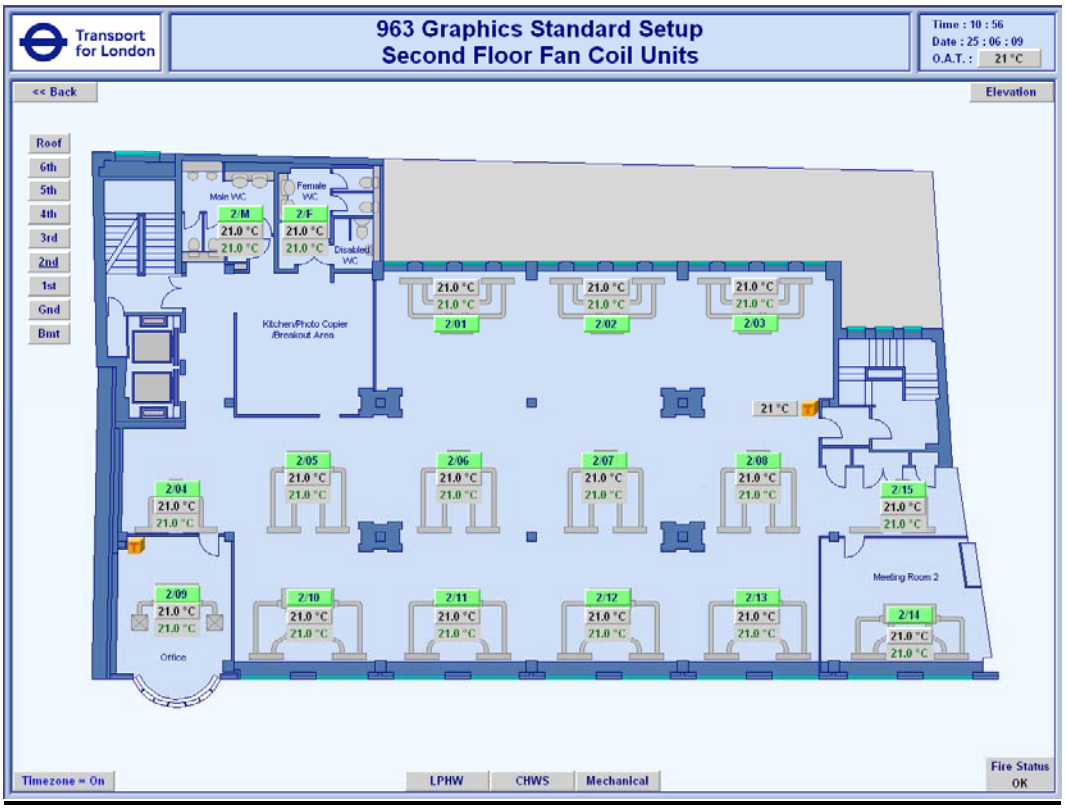
1.17 FCU Page Setup – Example 1



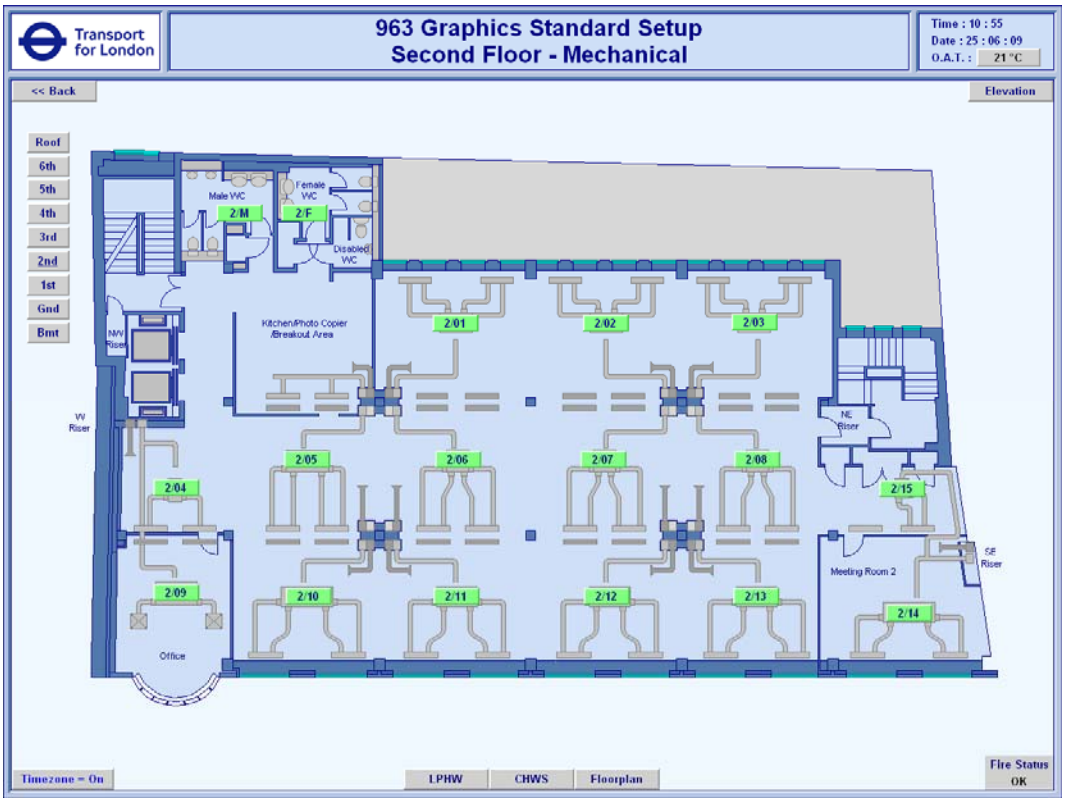
1.18 FCU Page Setup – Example 2



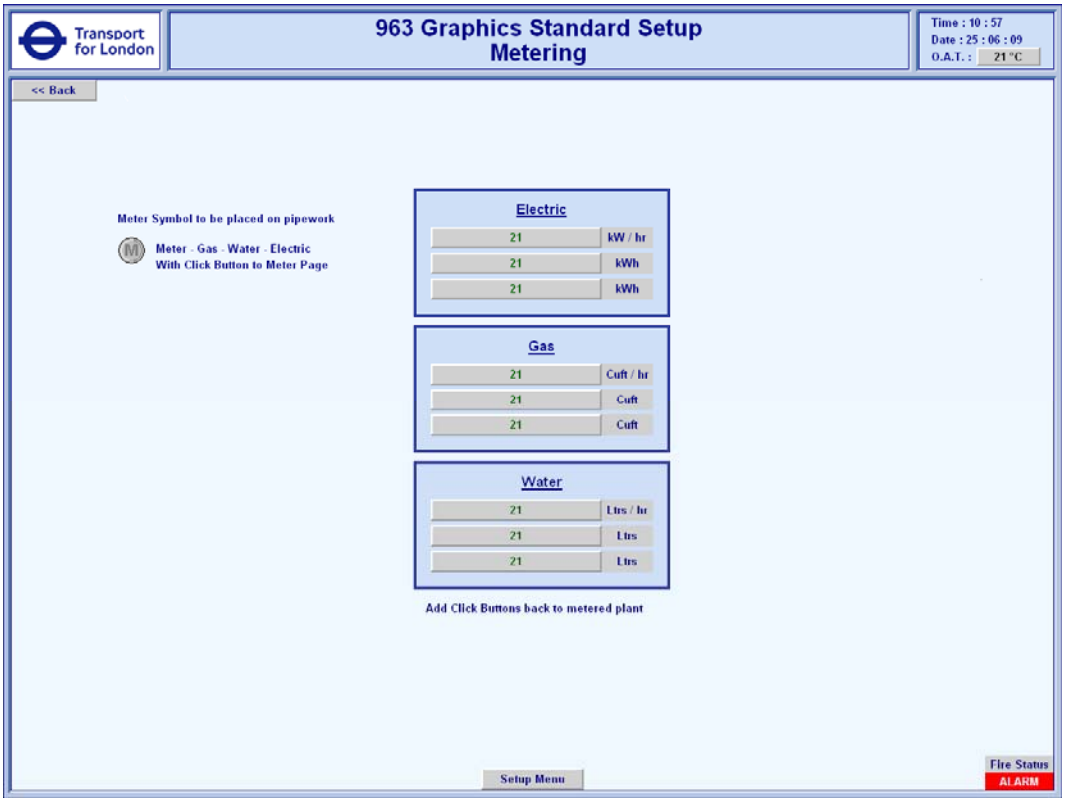
1.19 Floorplan



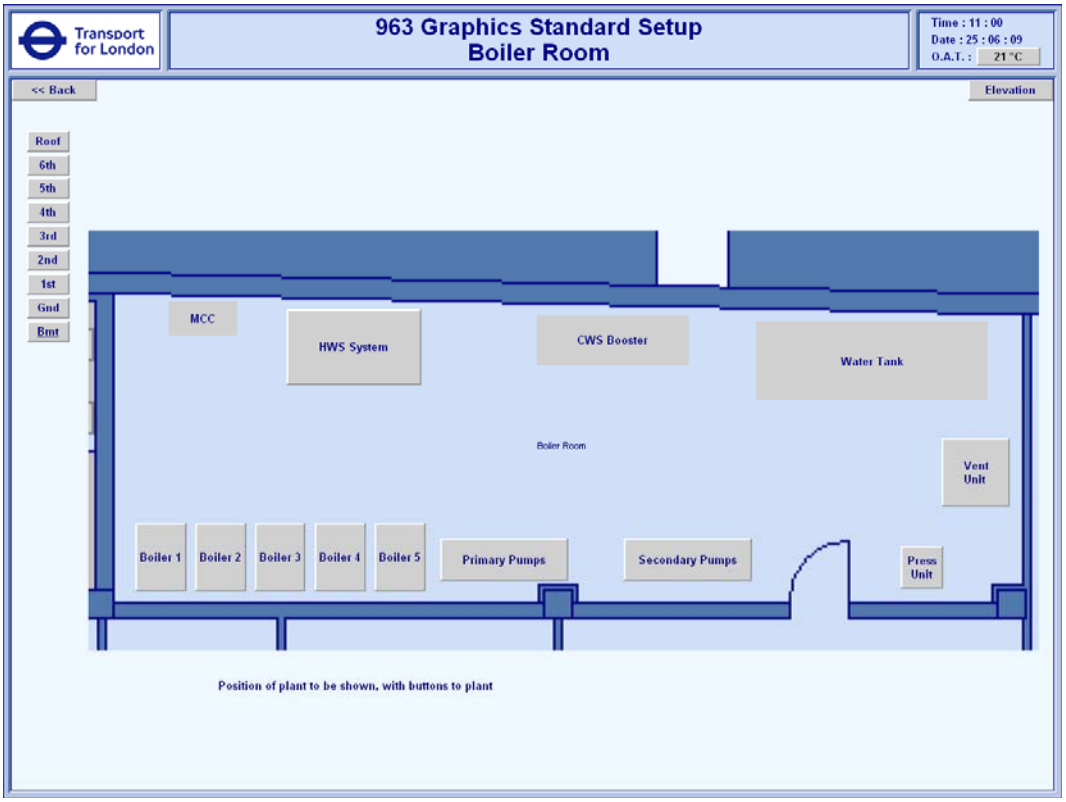
1.20 Mechanical Floorplan



1.21 Metering

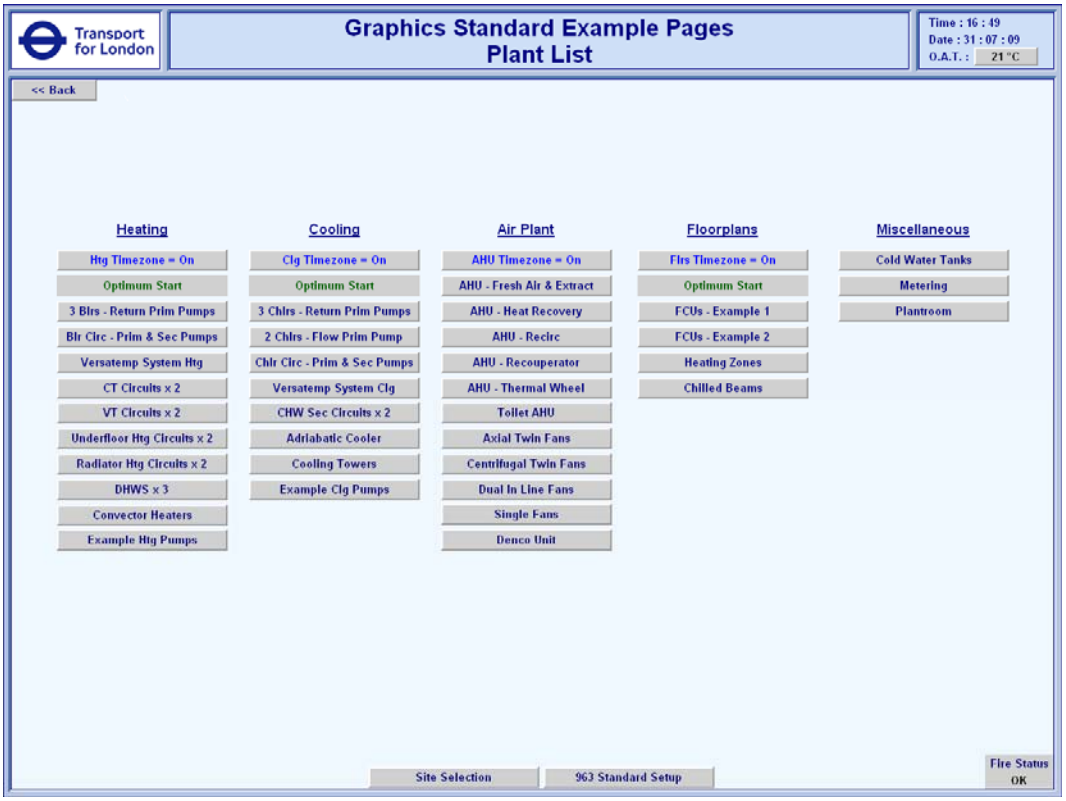


1.22 Plantroom



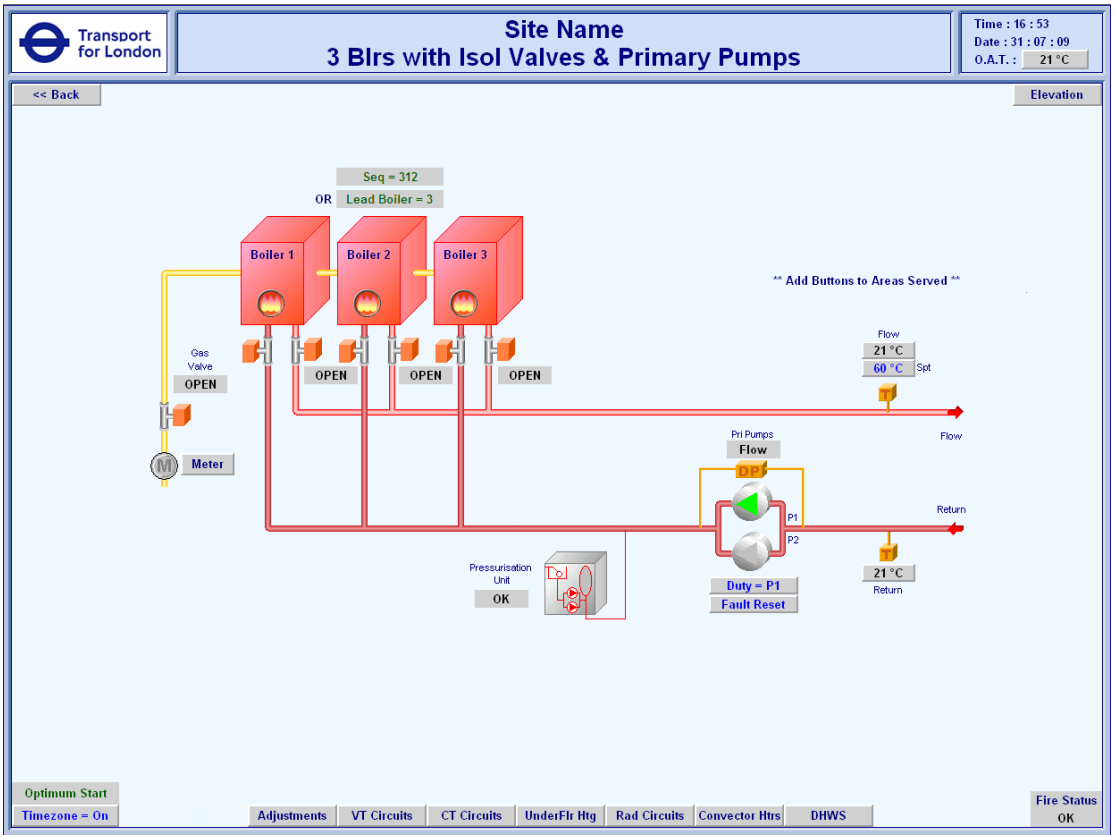
1.23 Site Selection

2 Sample Graphics Menu

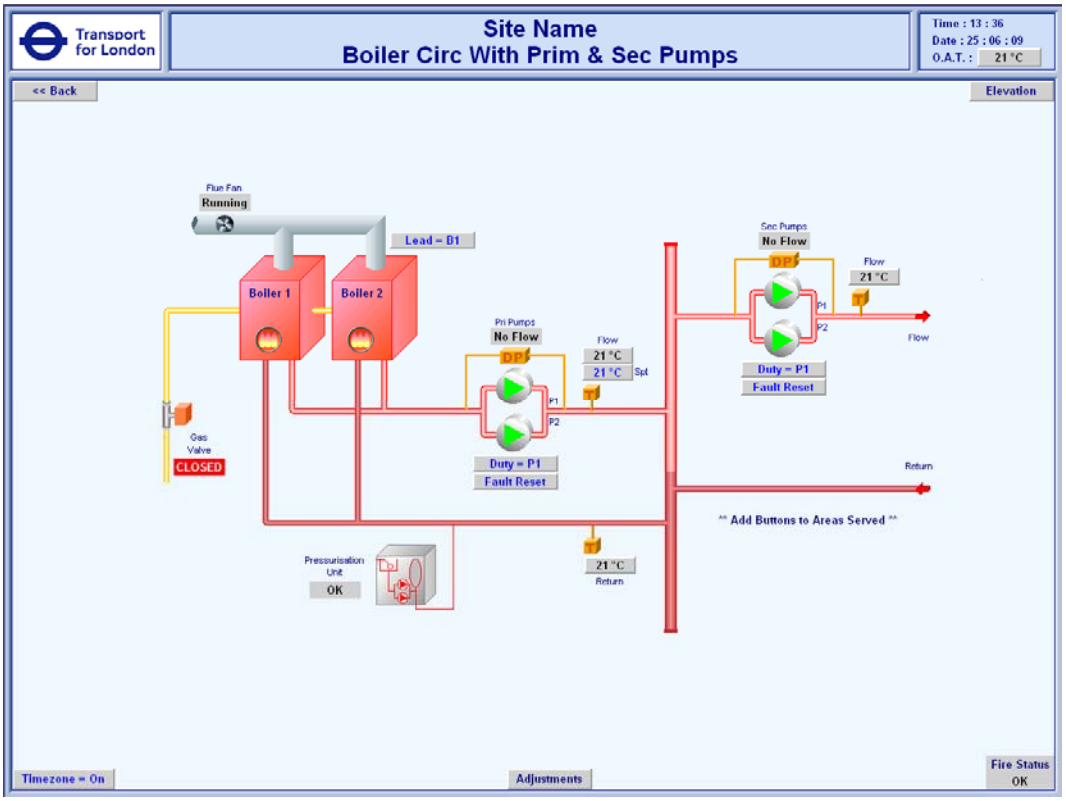


3 Sample Heating Plant

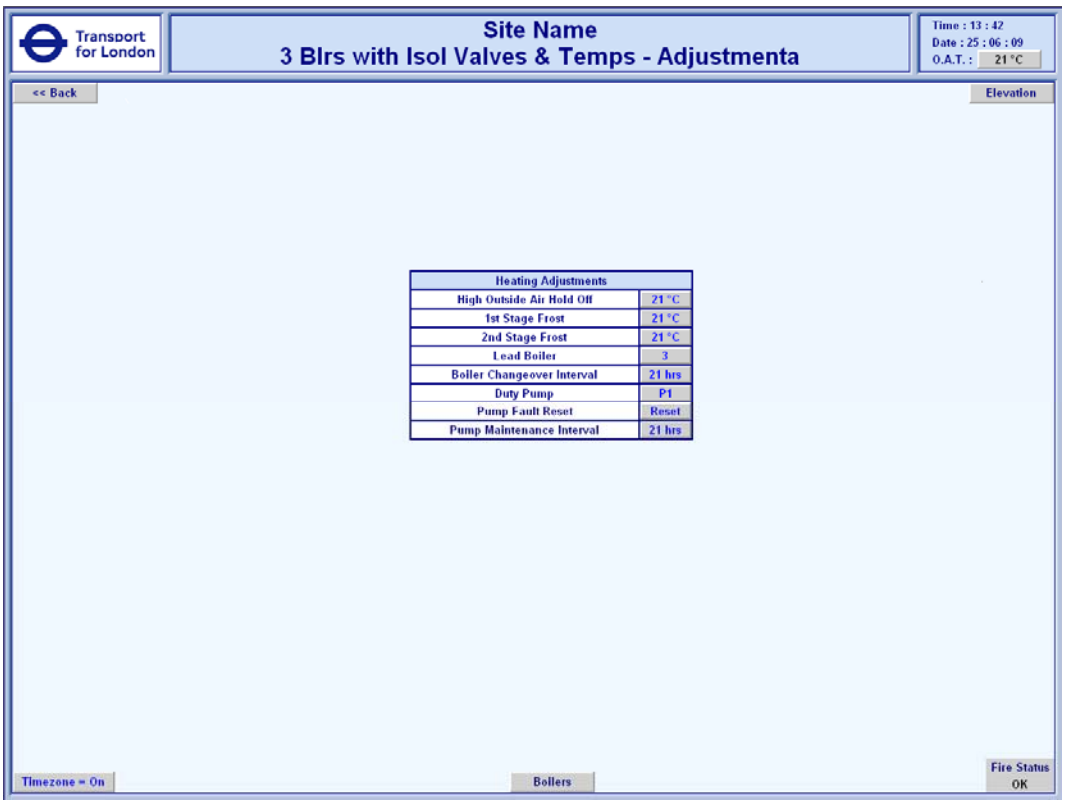
3.1 Boiler Plant with Primary Pumps & Gas Valve



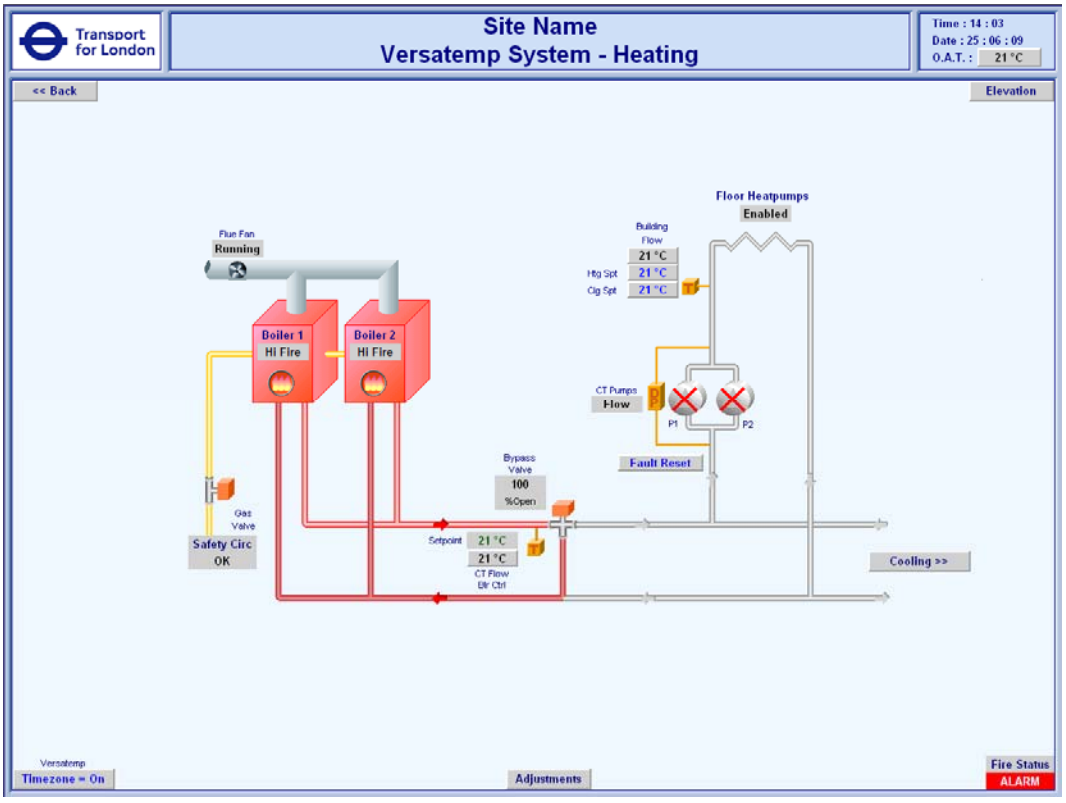
3.2 Boiler Plant with Primary Pumps, Secondary Pumps & Flue Fan



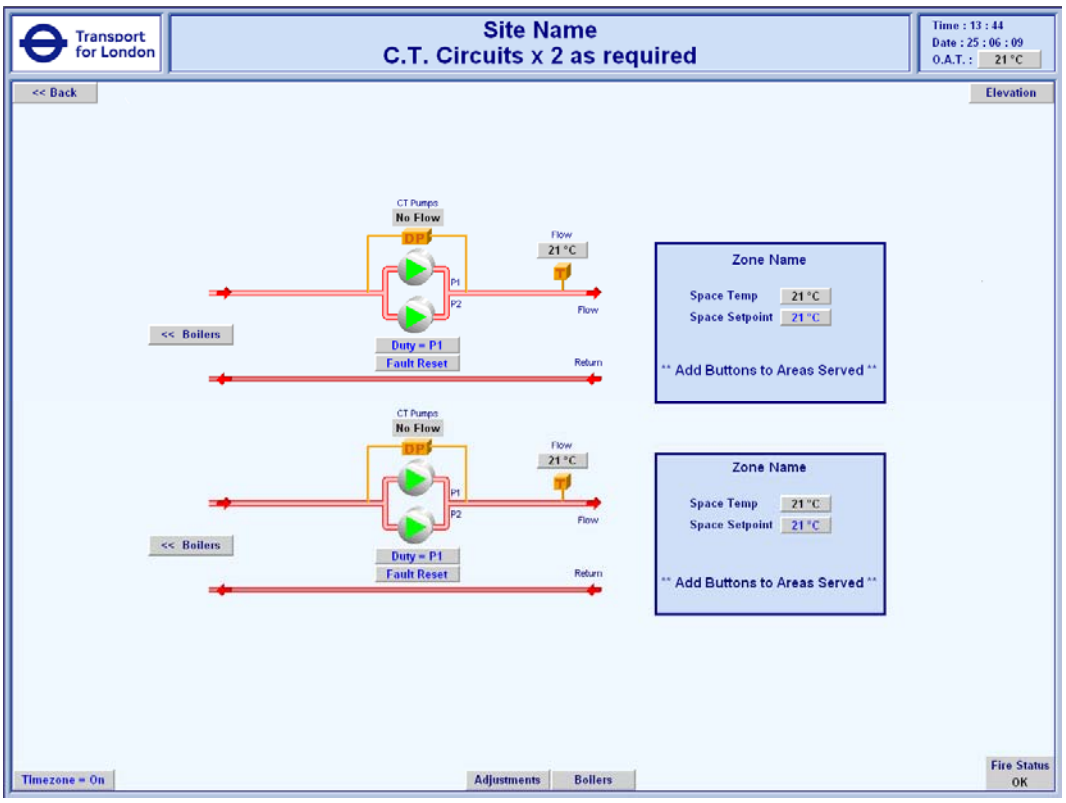
3.3 Adjustments



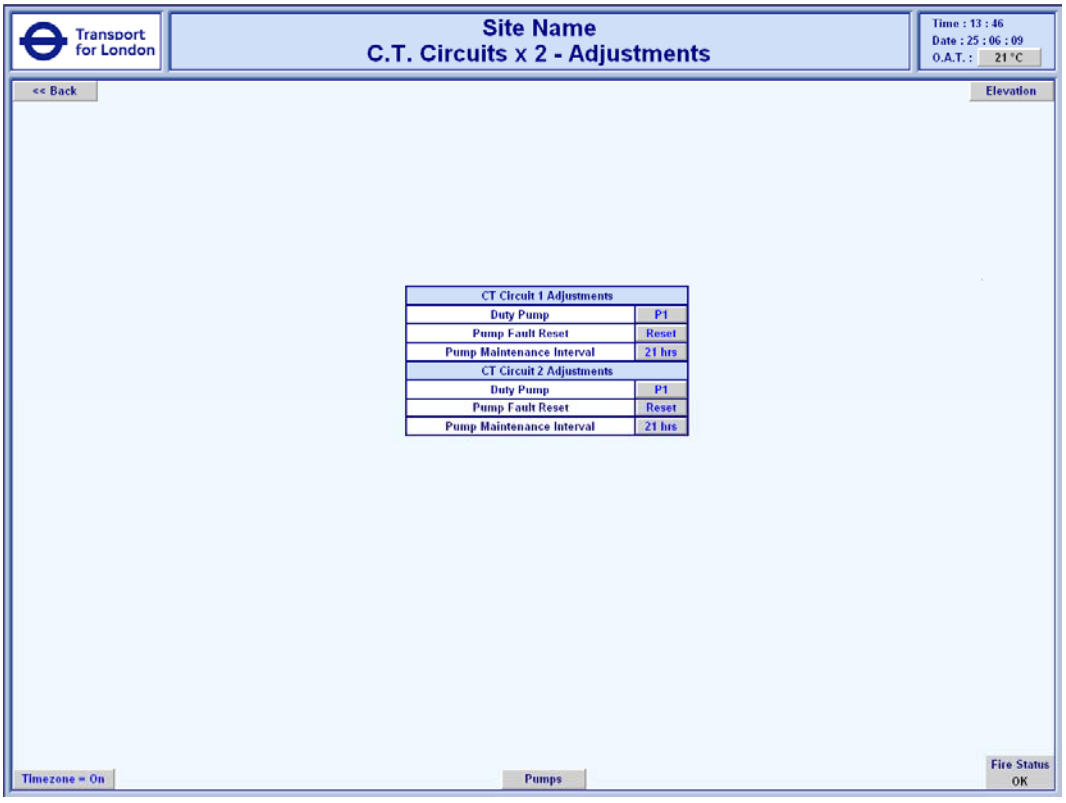
3.4 Versatemp Heating System



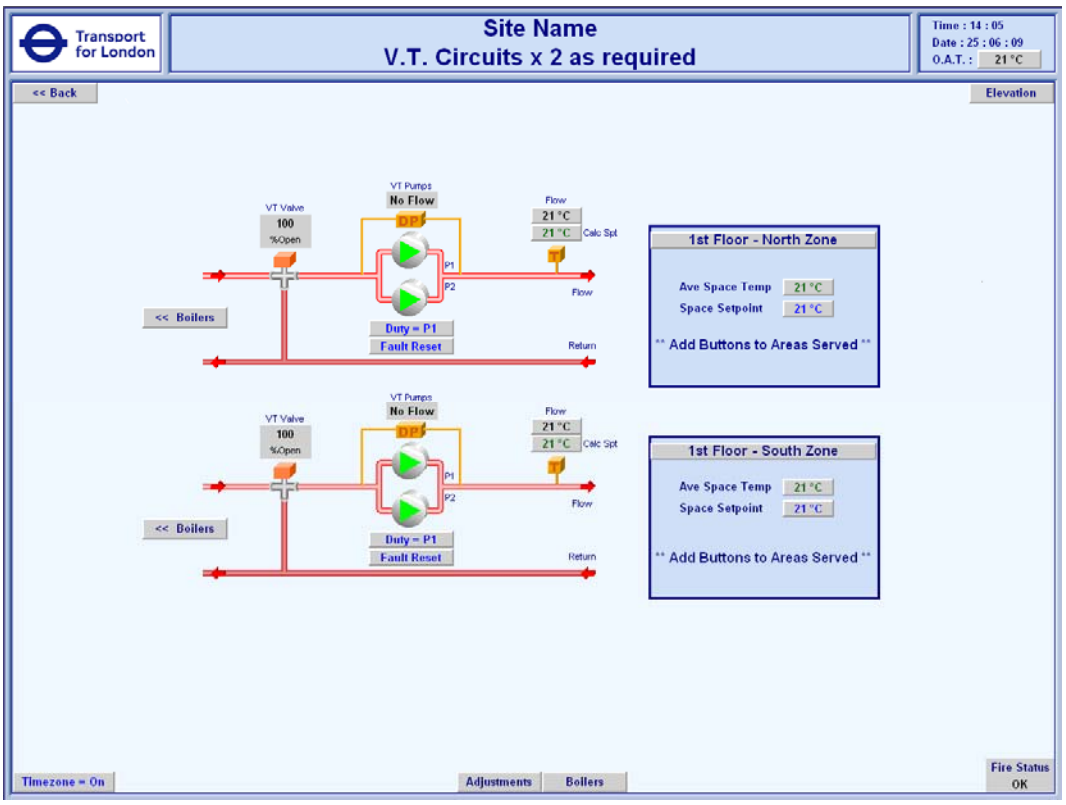
3.5 Typical Secondary CT Heating Circuits



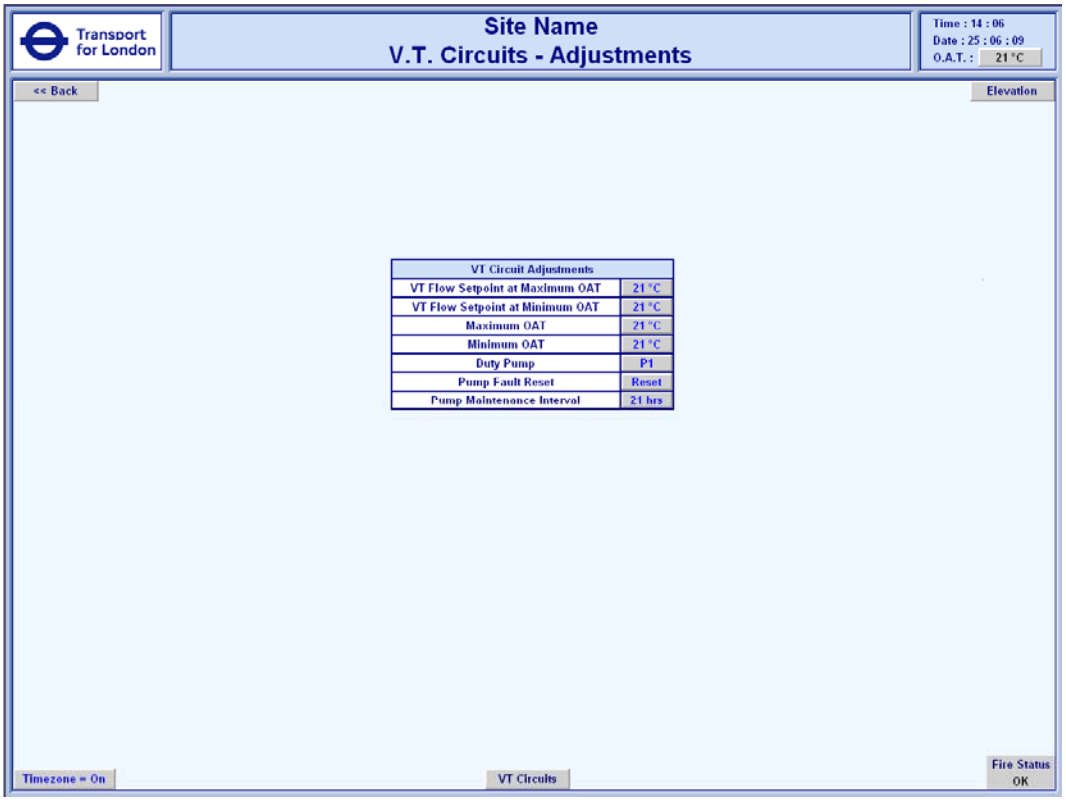
3.6 Adjustments



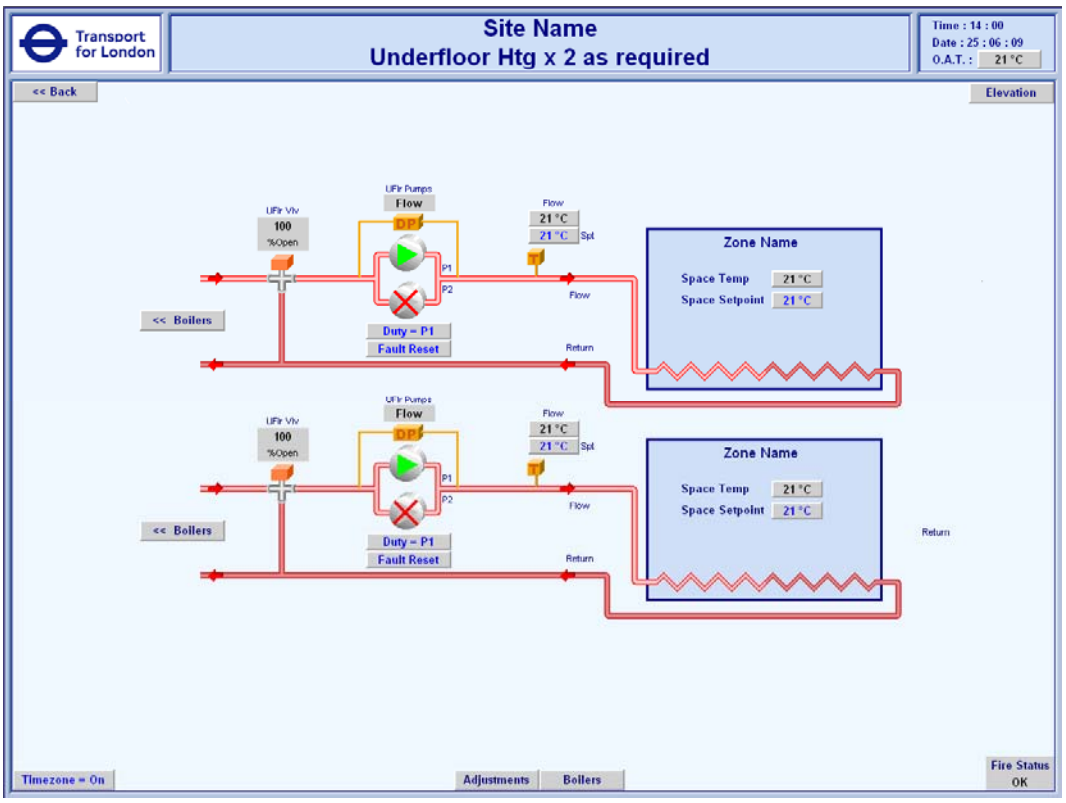
3.7 Typical Secondary VT Heating Circuits



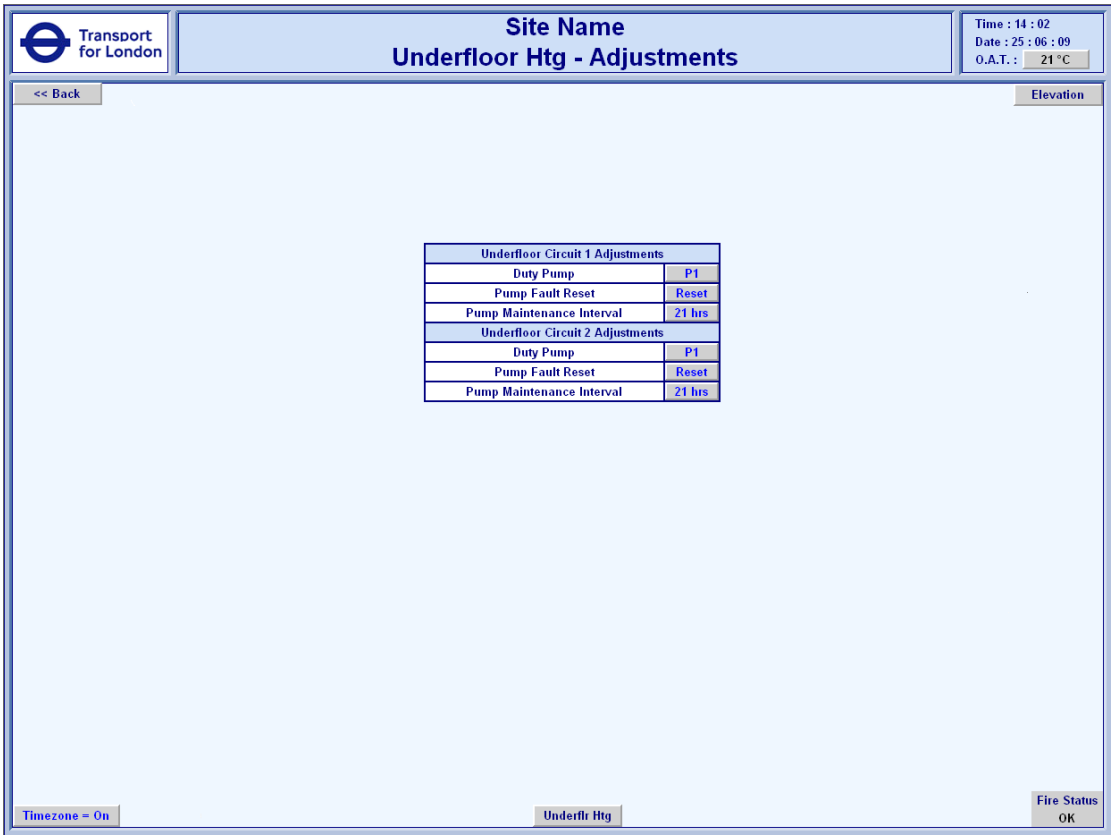
3.8 Adjustments



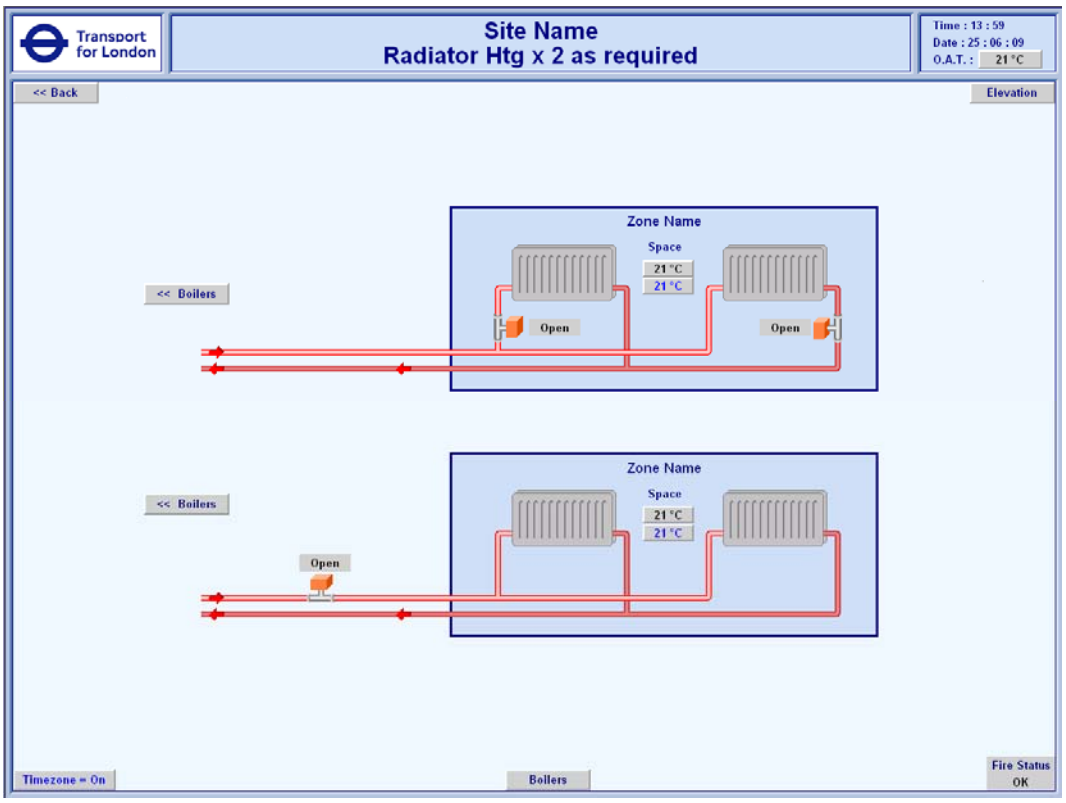
3.9 Underfloor Heating



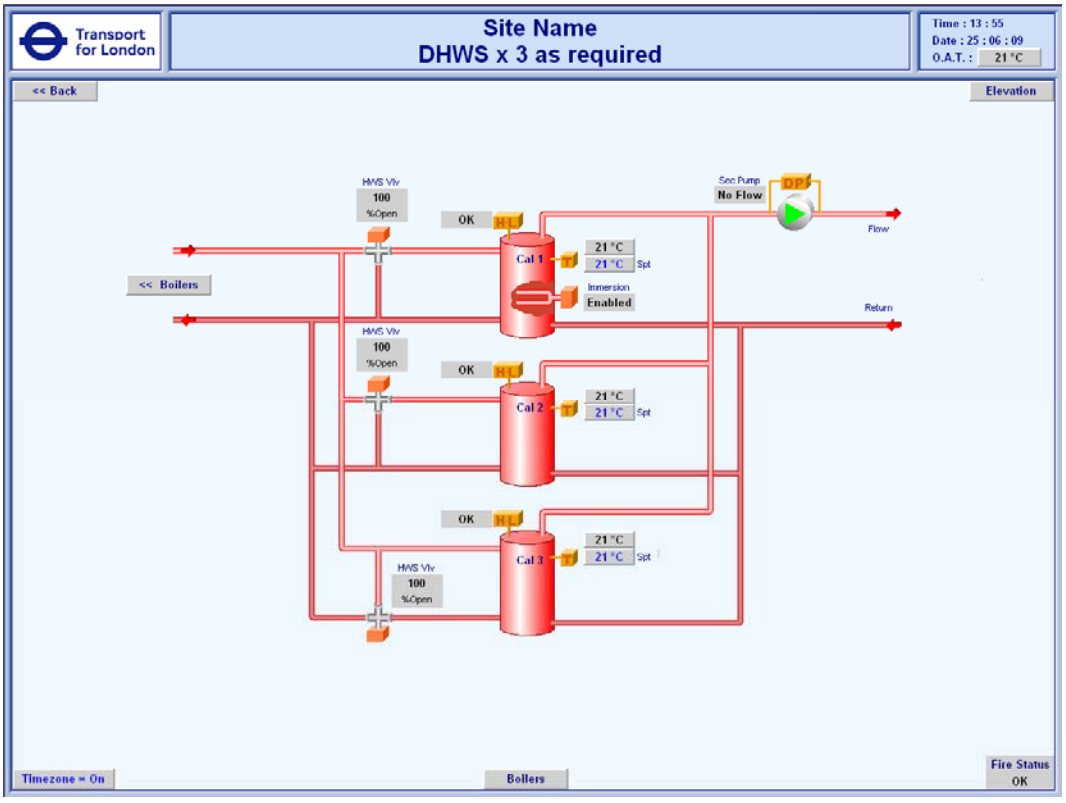
3.10 Adjustments



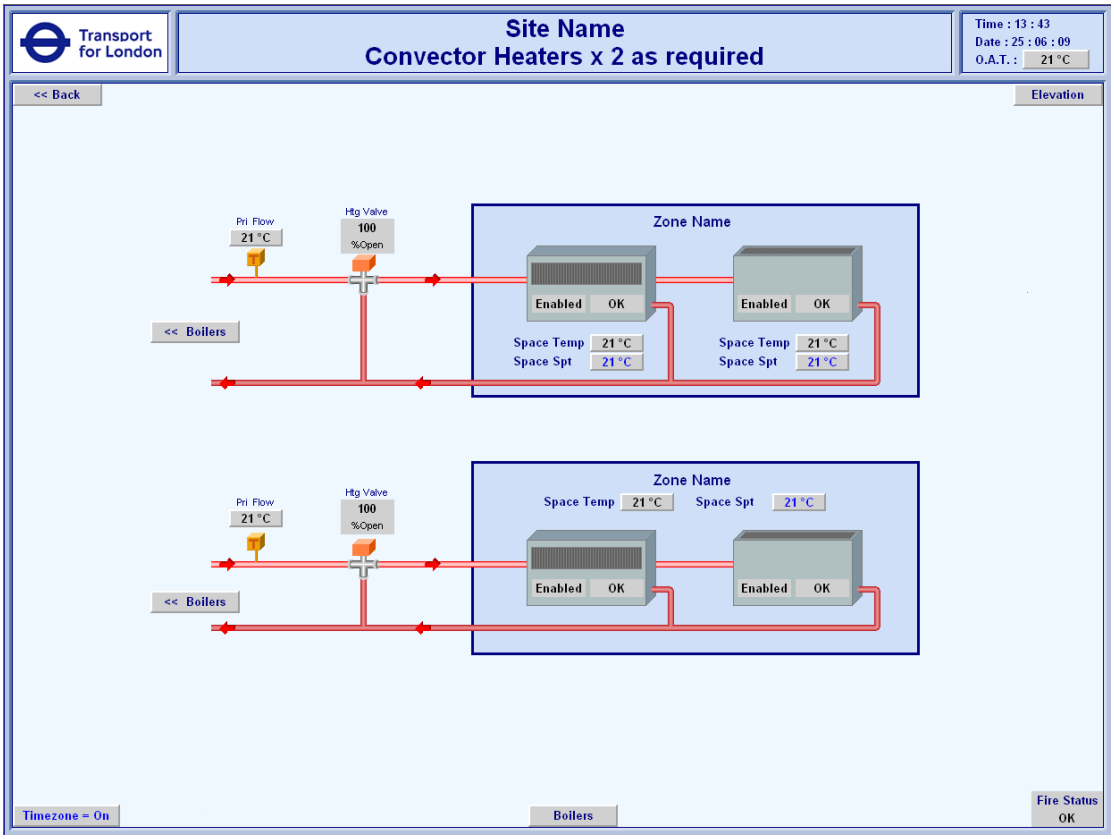
3.11 Radiator Heating Circuit



3.12 DHWS

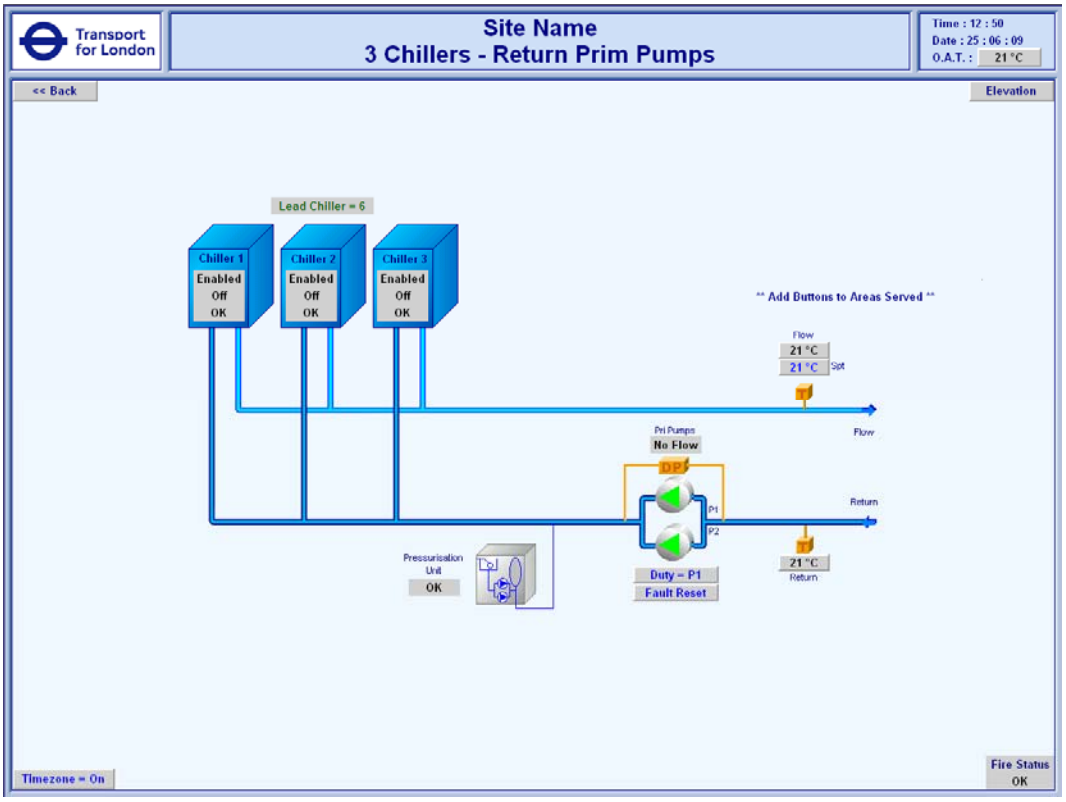


3.13 Convector Heater

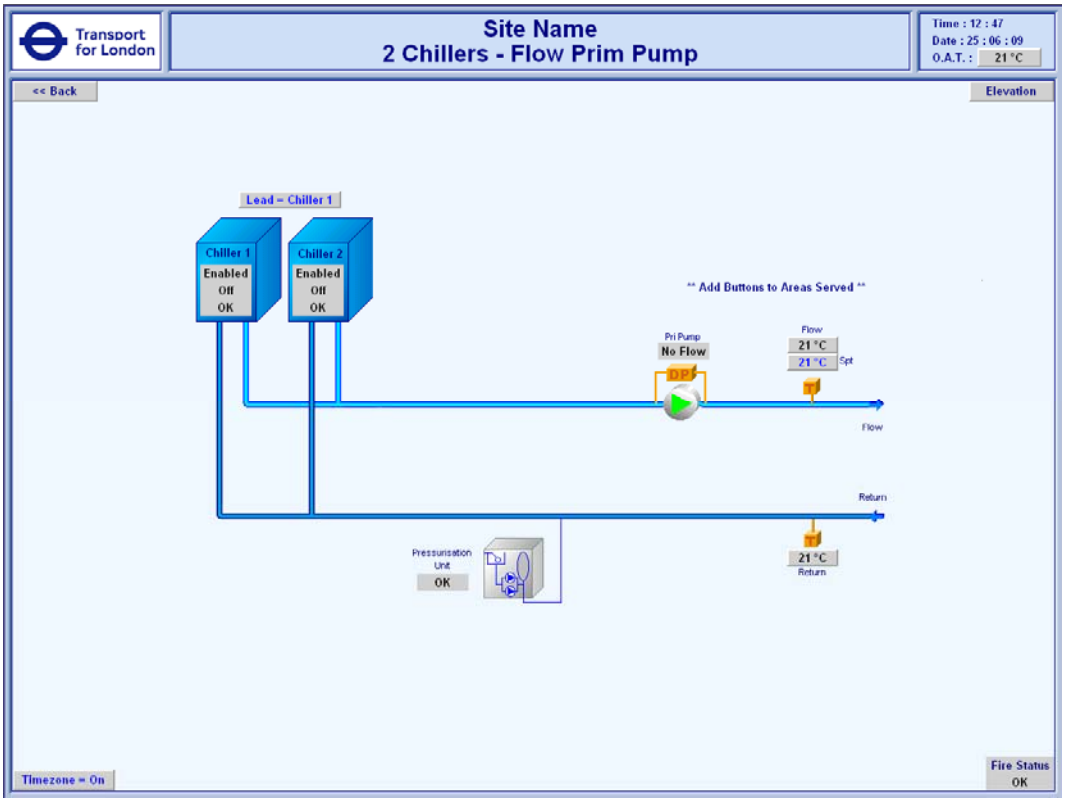


4 Sample Cooling Plant

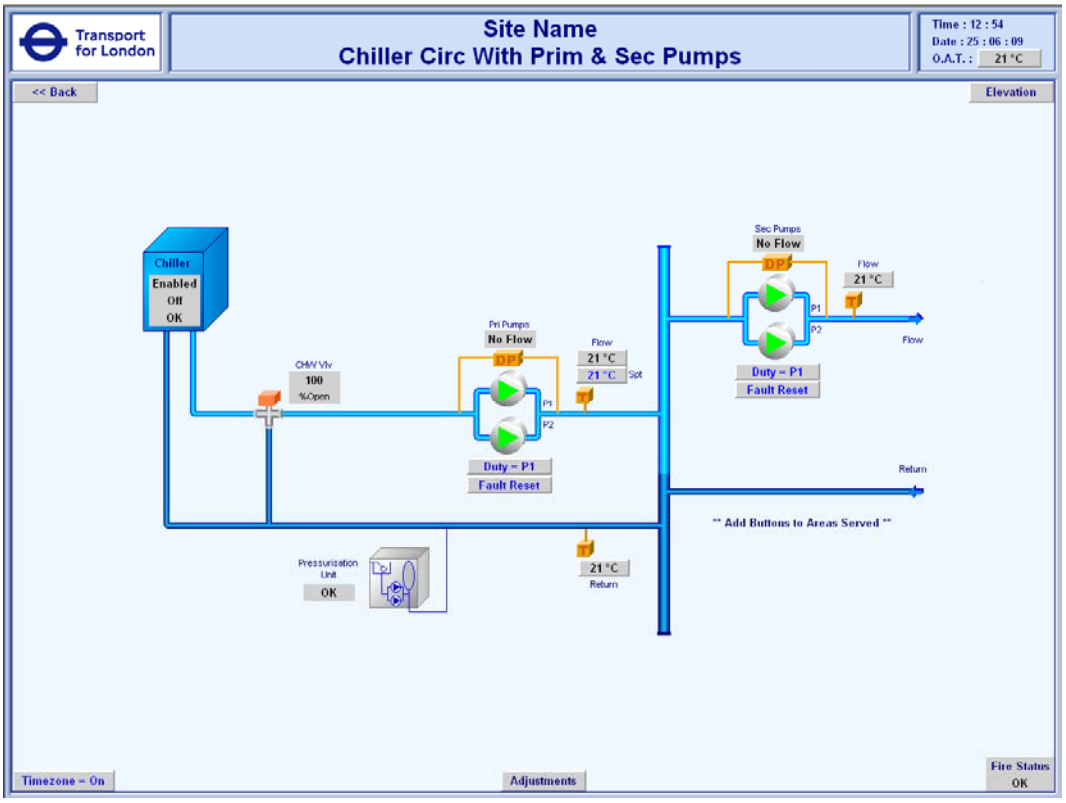
4.1 3 Chillers – Return Primary Pumps



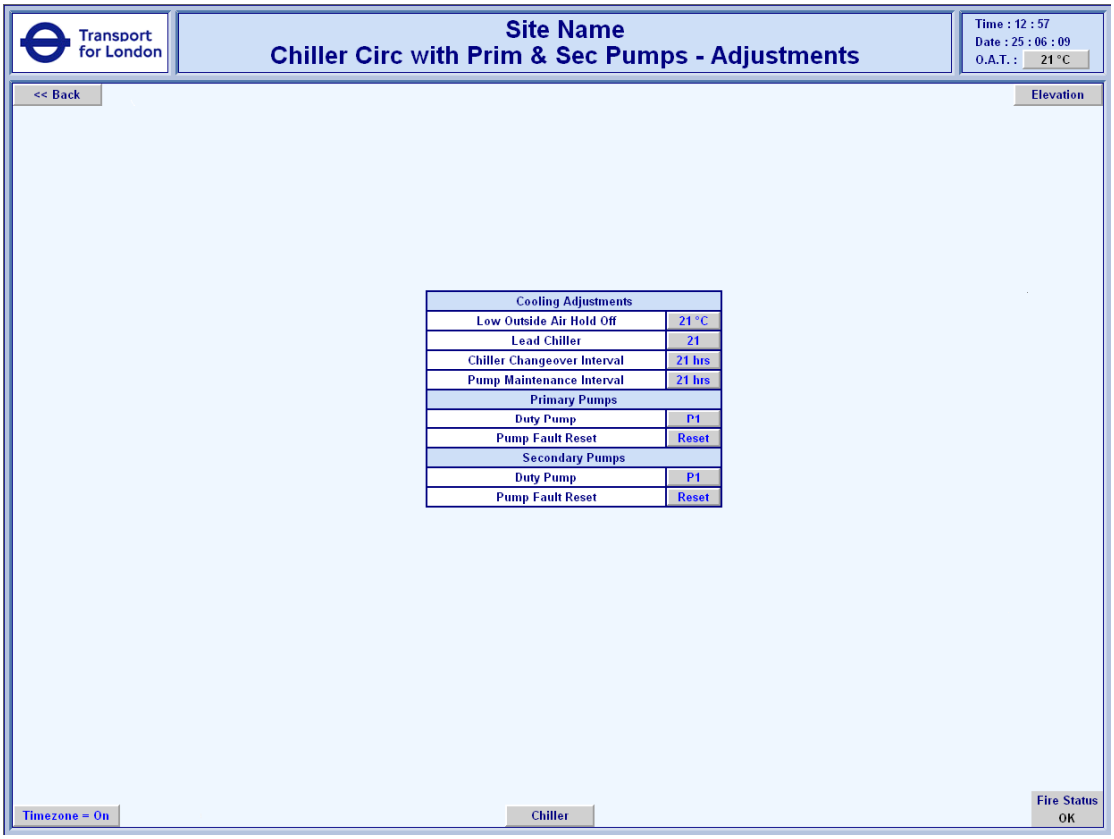
4.2 2 Chillers – Flow Primary Pumps



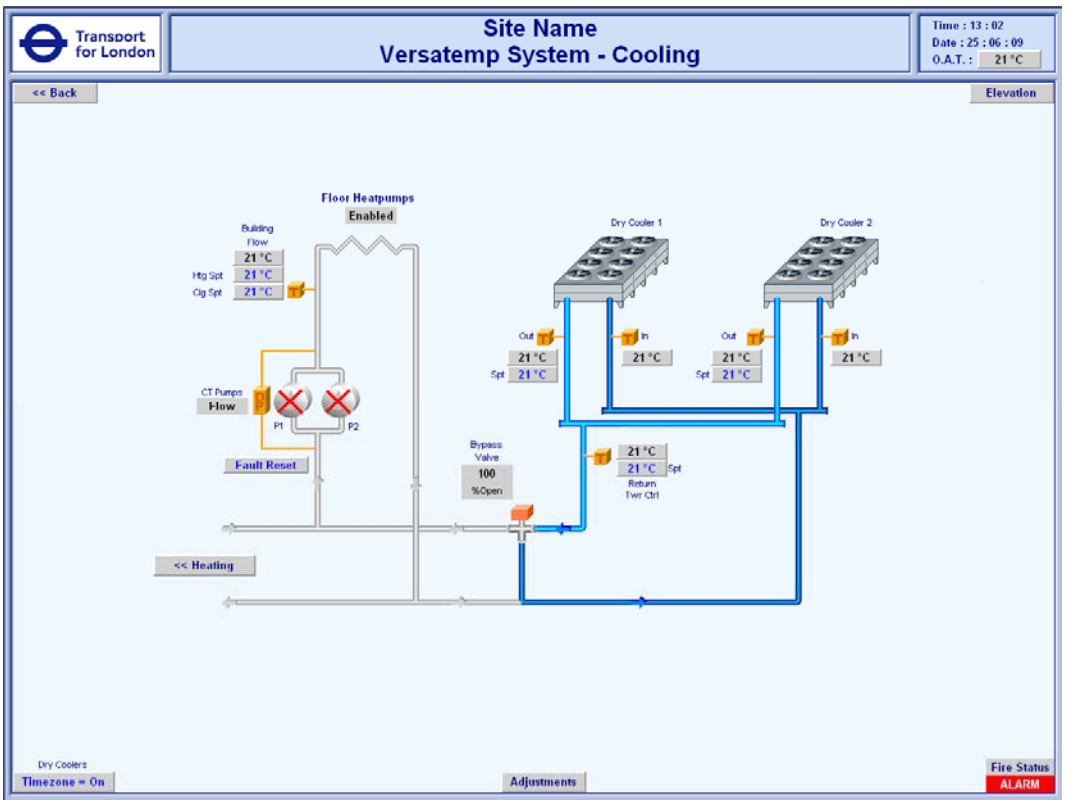
4.3 Chiller Circuit – Primary & Secondary Pumps



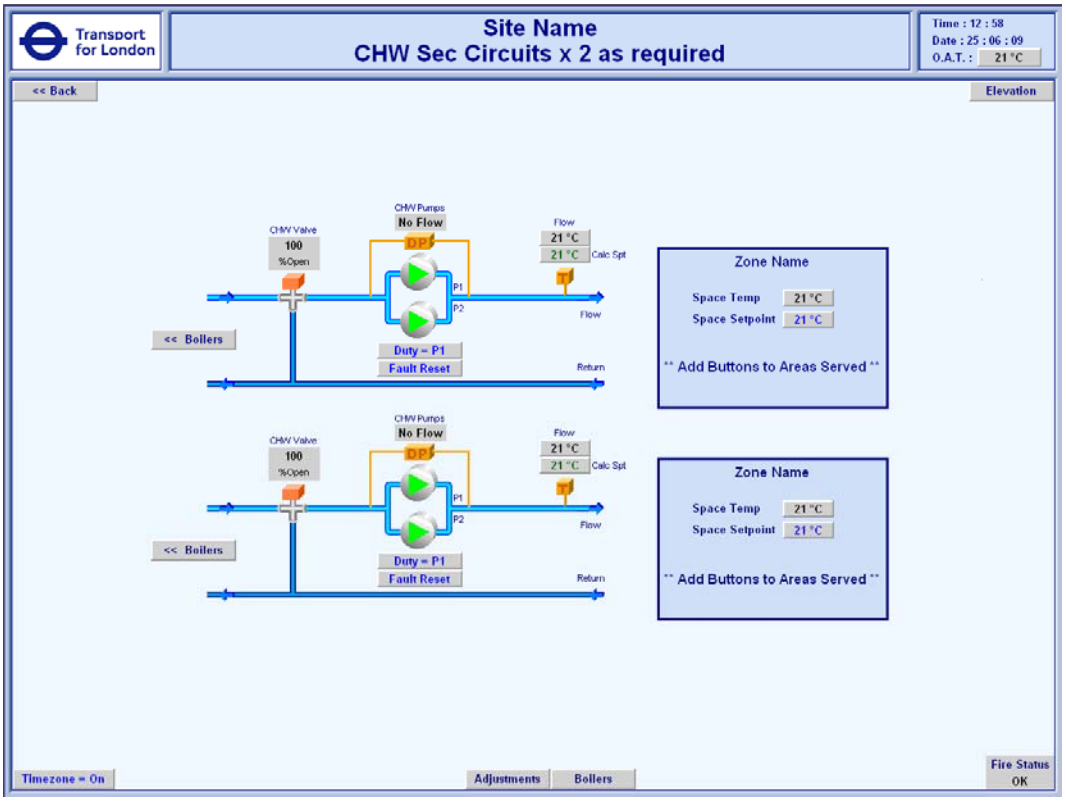
4.4 Adjustments



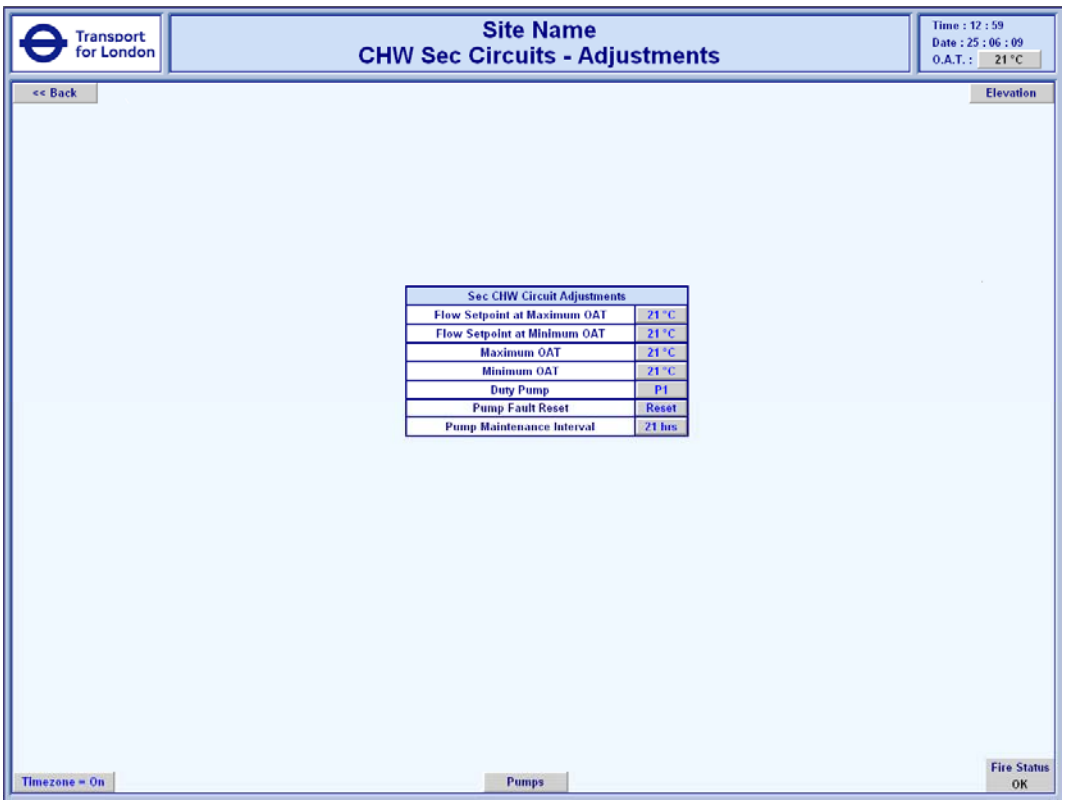
4.5 Versatemp System Cooling



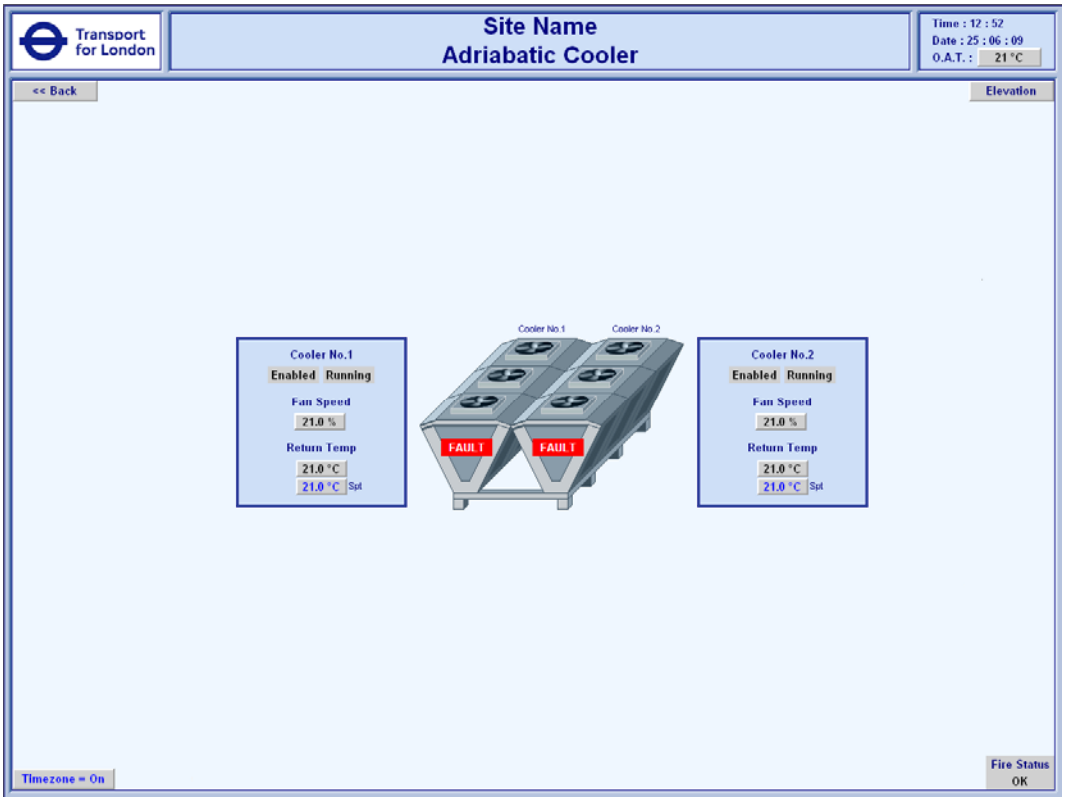
4.6 ChW Secondary Circuits



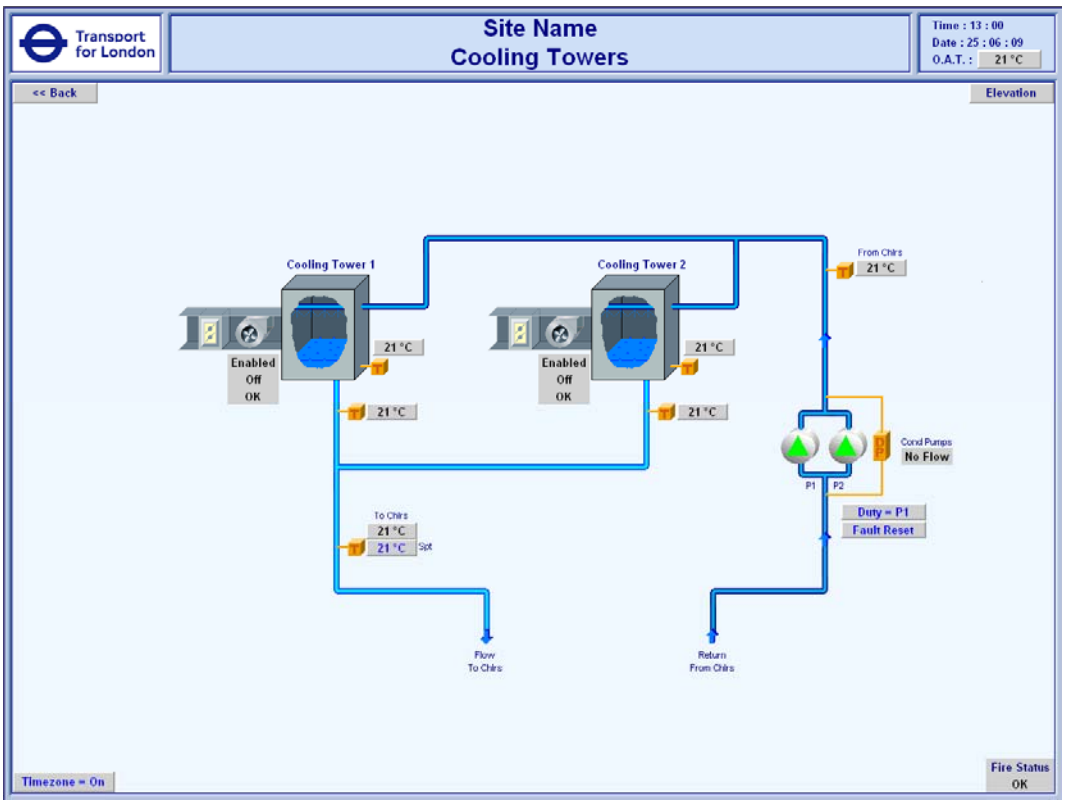
4.7 Adjustments



4.8 Adiabatic Cooler

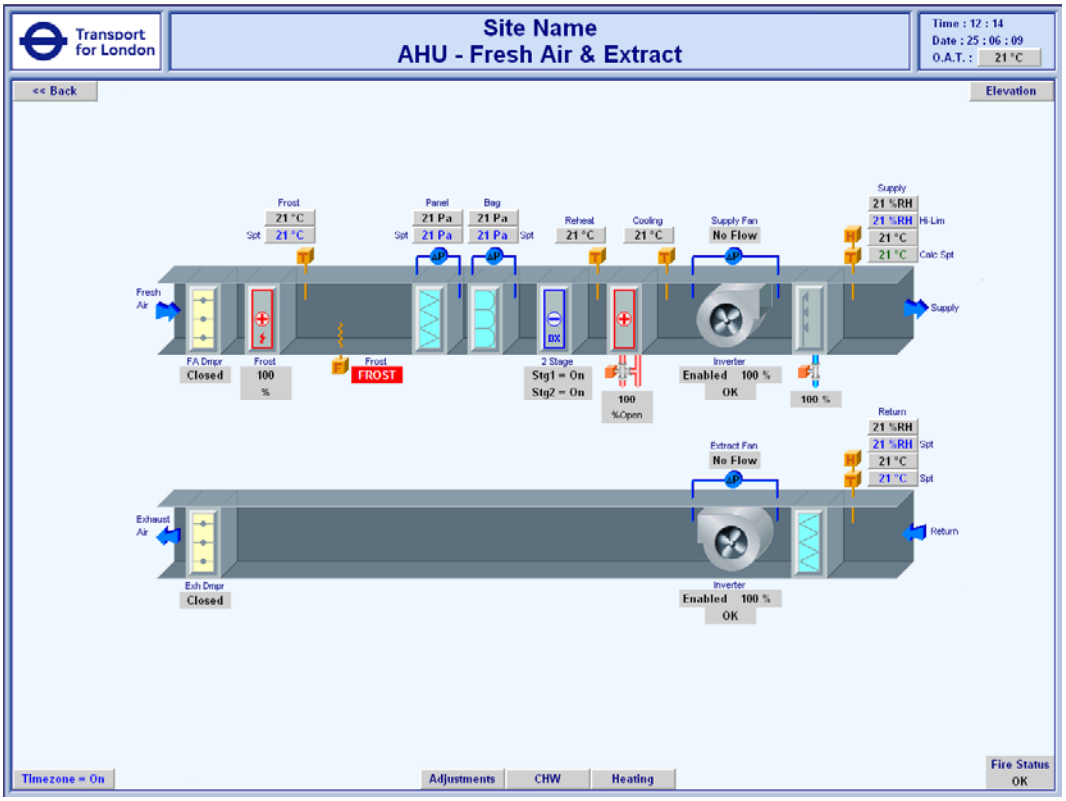


4.9 Cooling Towers



5 Sample Air Plant

5.1 Typical AHU



5.2 AHU – Heat Recovery