



Public Works and
Government Services
Canada

Travaux publics et
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Place du Portage 8B1 Personal Environmental Control (PEC) System Technical Review



PEC Concept Overview

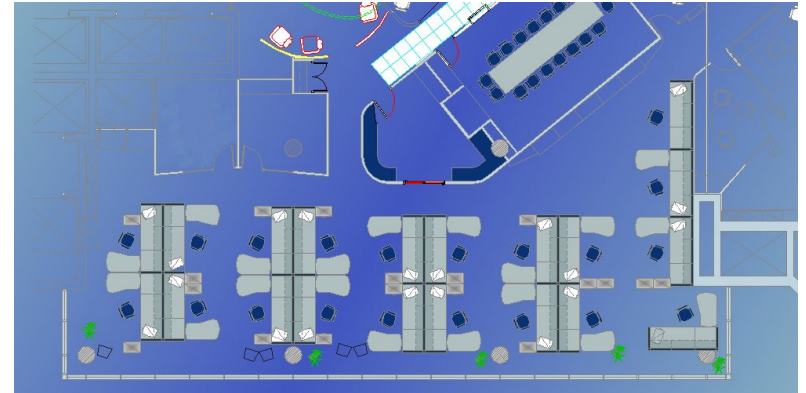
- Enables office workers to:
 - Adjust the lighting level for their immediate workspace
 - Adjust ventilation levels for their thermal comfort



- To provide these functions each system is zoned to accommodate individual choices for
 - Lighting and ventilation

PEC Physical Description of Space

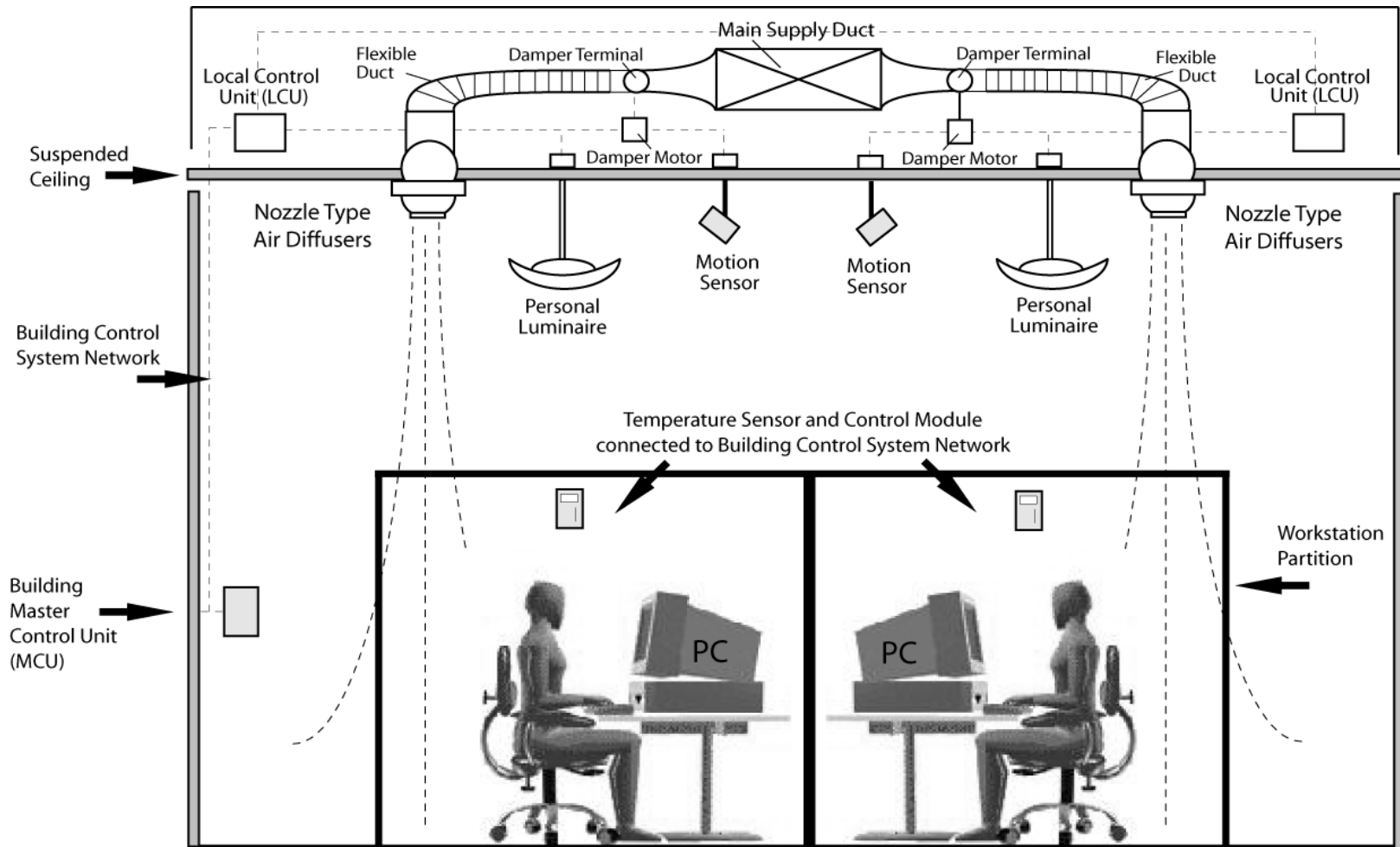
- The space dimensions for southern half PDP III 8B1 floor are 90' x 20' with an 8' 2" ceiling
- Designed open office environment
- There are 19 (10' x 8') workstations
- The furniture uses 52" high panels



PEC HVAC System

- 8B1 area is served by central building HVAC air handling systems
- The interior supply air is delivered through a 10" high pressure duct which is used to distribute to all PEC nozzles
 - At up to 6" static pressure
- 3 pressure reducing valves reduce supply pressure in a staged fashion
 - To enhance flow control to meet the three areas supply air quantity
 - To serve low pressure VAV boxes
- Delivered locally by moveable air nozzles

PEC HVAC System



Typical Workstation or Private Office
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Why Air Nozzles

- Delivers air directly to the occupant
 - including outdoor air component
- No short circuiting of supply air back to return without passing through user space
- Air plume dilutes VOCs at floor level
 - Helps to flush them out before concentrations become health matters
- Facilitates individual temperature control
- Suitable for easy relocation to accommodate furniture repositioning



PEC Sensors & Devices

- An example of the sensors and devices required for the workstations

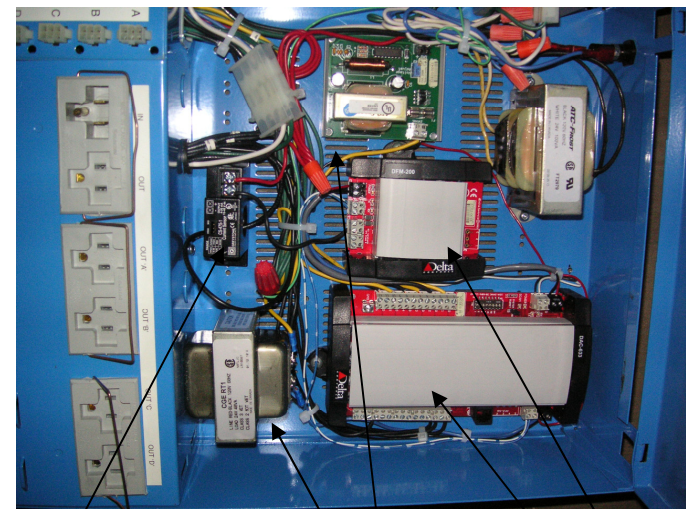


Air Nozzle Motion/Light Detector



Room Temperature Control and display

NOCOM Modular Wiring System



Energy Measuring Device

Transformers

Delta Controllers

PEC Supporting Devices

- HVAC:
 - Damper actuator – increase or decrease air flow in response to temperature requirements
 - Room air temperature sensor
 - Air flow indicates quantity being delivered to zone
 - Motion sensor – determines occupant presence (serves lighting as well)

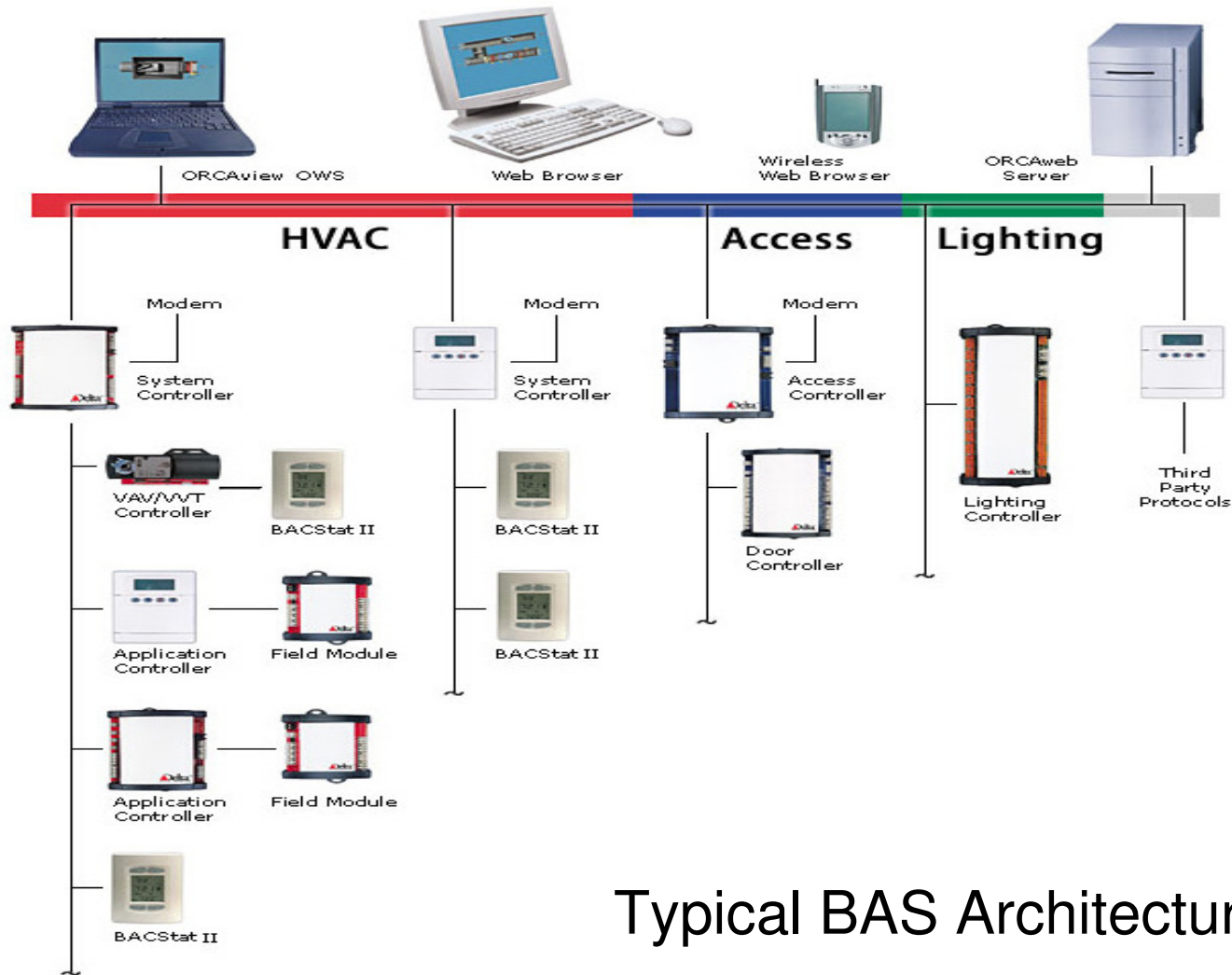


PEC Supporting Devices

- Lighting:
 - Light sensor – mounted at ceiling measuring reflected light from desk
 - Dimming ballast to increase or decrease light output
 - Light ON/OFF low voltage RR7 relay
 - Light status - required by system to confirm on/off action
 - Local switch – physical or through ICON



PEC Building Automation System



Typical BAS Architecture

PEC Building Automation System

- Building Automation System (BAS)
 - Delta DCU1616 and DCU50
- BAS provides time of day scheduling for all area functions
 - Including lighting schedule
- PEC ventilation control functions are dependent on services provided by the building primary HVAC systems
 - Coordinated by monitoring pressure > 20 PA



BAS PEC Requirements

During daytime operation:

- Lighting will be switched ON
 - Between 6:30 – 18:00
- To detect presence at a workstation
 - Active motion detectors at each workstation
- While no presence is detected
 - Lighting and HVAC functionality will remain at minimum settings as predefined in controllers
- In case of network communication failure the local stat will provide back up interaction for user



BAS PEC Requirements Continued

- When a motion sensor detects a presence at a workstation
 - It shall indicate occupied state
 - Trigger the HVAC to go to occupancy user defined preferences stored from previous settings
 - Lighting to respond similarly
- The motion sensor will reset workstation timer continuously as long as motion is detected
- When workstation motion is no longer detected the motion timer will be permitted to time out
 - Lighting and HVAC functions will revert to the minimum settings



BAS PEC Requirements Continued

- During nighttime operation (schedule OFF):
 - Motion detectors will continue to sense motion in the user workstation space
 - When motion is detected the timer will be set to predefined setting (as for daytime – 15 Minutes)
 - This will activate the lighting system for that user workspace
 - Lighting will be set to user preferred setting
 - For safety reasons the corresponding Sector Isle lights will also be activated and will remain on as long as motion is detected in space
 - User wall stats plus IStat must be active and available to user during this time

BAS PEC Requirements Continued

- Daylight Harvesting (DH) is in operation for all window workstations
 - Including window isle fixtures in each Sector
- DH will only function during day operation
 - While functional the DH will use the ceiling light sensor to sense adequate light levels on the workspace surface
 - The associated controller will change the signal to the dimming ballast to achieve the required setpoint
 - Where DH is in operation the user through the IStat or wall stat will be able to override the automatic adjustment of light levels to the user's preferences
 - DH will then be limited to workstations where user preferences are not overriding
- DH is not active while workspace is unoccupied

BAS PEC Objects

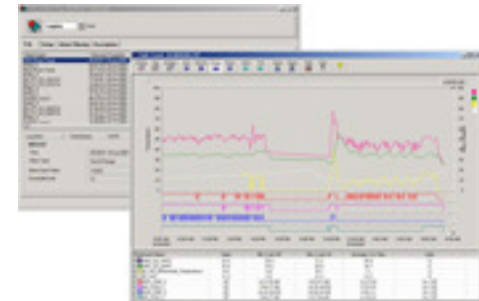
- Each PEC zone consists of the following point object types; Als, Bls, BOs and AOs
- HVAC:
 - AO - signal to damper actuator – increase or decrease air flow in response to temperature
 - AI - Room Air temperature sensor
 - AI – Air flow quantity being delivered to zone
 - BI – Motion sensor – occupant presence (serves lighting as well)

BAS PEC Objects

- Lighting:
 - AI - Light measuring sensor – mounted at ceiling
 - AO - Control signal to ballast to increase or decrease light output
 - BO - Light ON/OFF function
 - BI – Light status - required by system to confirm BO function
 - BI – Local switch – physical or through ICON
 - BO - Mode status - occupied or unoccupied status (point in software which responds to the schedule action)

PEC Data Collection

- Trending is collected by local Controllers and stored by Delta Historian in SQL Server
- Currently trended items include:
 - Light level/percent level set-point [interior/exterior zones]
 - Photocell output level (%)
 - Occupancy sensor status (occupied)
 - Lamps minimum dimming level set-point
 - Lamps maximum dimming level set-point
 - Temperature at the main air valve
 - Temperatures sensed at each work station
- Trending will still being carried out on items such as user set point changes and air flow to nozzles as these are utilized for making performance adjustments



Note: A complete demonstration of Trends and SQL Database will follow at end of presentation

PEC Area Monitoring

- Two monitoring stations measure temperature stratification in the vertical plane, humidity and CO₂
 - Installed in 2 locations to measure the local environment

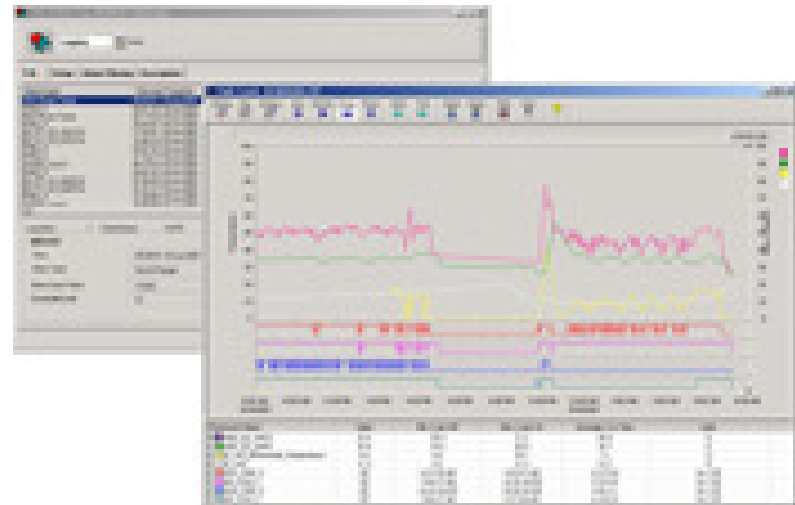


PEC Area Monitoring

- Each has mounted 4 temperature sensors
 - 1 @ 6 in from floor
 - 1 @ 36 inches from floor (normal sitting body height)
 - 1 @ 64 inches, head height when standing
 - 1 @ 84 inches from floor (where ceiling is 8' 2")
- Structure also includes 1 humidity sensor
 - Mounted at normal 54 inch height
- 1 CO2 sensor at each location
 - positioned such that the air measured would be from that zone only

Energy Use Recording

- Energy meters are installed to measure lighting load and plug load for the workstations
- Additionally calculations are being done for:
 - Individual workstation lighting load
 - Section lighting load
 - Total lighting load



BAS GCL+ Coding

- GCL+ Code allows for precise control
- The system handles all scheduled operations and motion sensors for each workstation
- Customized code for each user workstation has been created
- Additional code for daylighting and after hour operation has been incorporated

PEC Issues

- **PEC HVAC designed to work within Treasury Board guidelines**
 - Temperature range 19°C - 26°C
- **Areas within 3 meters of windows will experience influence from outdoor weather conditions.**
 - Temperature, humidity, and the sky conditions (sun or no sun, dark storm clouds).
 - Systems supplying this area are separate from interior space supply systems and have increased cooling and heating capacities.