When Business needs to manage the energy efficiency of its buildings…

…it trusts Carbon Numbers to Take Control
Building Energy Management Systems

Continuing Professional Development Programme
BEMS System Components

- Supervisors
- Networks
- Engineering Tools
- Controller
- Inputs
- Data Logging
- Alarms
- Applications
- Energy
- Control
- Outputs
- Displays

User Interfaces
Field Devices
Controllers
Networks
Course Content

1. Controllers
   - Controller types
   - Applications

2. Field Devices
   - Inputs & Outputs
   - Analogue & Digital
   - Field Devices

3. Networks
   - System architecture
   - Network standards

4. User Interfaces
   - Displays
   - Supervisors
   - Engineering Tools
   - Remote Services
Trend BEMS System Components

Management Level

Network Level

Device Level

Field Level
Controllers
What it does

Inputs

- Analogue
  - Temperature
  - Pressure
  - Humidity
- Digital
  - Status
  - Fault
- Pulse
  - Meters

Outputs

- Analogue
  - Valves
  - Dampers
  - VSD
- Digital
  - Pumps
  - Fans
  - Boilers

Alarms

Logs

Maths

Logic

Control

Times
Typical BEMS Applications

- Chillers
- AHU’s
- Boilers
Trend IQ Controller summary

- Controllers selected to match I/O
- Freely programmable to suit application
- Distributed to reduce installation cost

- Flexible modular design eliminates need for spare capacity
- Stand-alone resilience - no single point of failure

- Systems can be easily expanded
- Backward compatible for seamless operation with legacy systems
Field Connections
Analogue inputs

- Sensors measure different types of environments
- They provide an electrical signal to the controller
  - Input signals are typically 0-10v, 4-20mA, or Resistance
- The controller then calculates the ‘real’ value from the incoming electrical signal
- Accuracy needs to be specified in accordance with the application
- Sensor location can be critical
Importance of sensor location
Digital Inputs

- On/Off signal switch - plant status
- Simple temperature thermostat
- Others include
  - Differential pressure switches for air and liquid
  - Designed for monitoring/control purposes
  - Movement sensors for room occupancy
Digital inputs - Pulsed

- Meters interfacing to BEMS via pulsed signal
- Each pulse corresponds to a certain amount of energy passing through the meter
  - Scaled accordingly e.g. 1 pulse = 2kWh
- The BEMS will need to know the scaling of the meter used for accurate recording
Output

- Analogue outputs
  - They provide an electrical signal from the controller
  - Output signals are typically 0-10v, 4-20mA
  - Actuators turn controller output signal into real life mechanical movement

- Digital outputs
  - On/Off signals, often via switching relay
  - Fan enable
  - Lights on/off
Networks
BEMS Basics - Architecture

TrendLAN

TCP/IP Ethernet

TCP/IP Ethernet

LonWORKS

BACnet
Networks – Why network?

- Link to Ethernet network
- Outside air temperature
- Basement
- Hub
- Pump
- Boilers
Networks – Practical application

- Ethernet backbone
- Floor 1 – FCU's
- Floor 2 – FCU's
- Roof - Chillers
- Basement - Boilers
- Boilers
User Interfaces

- Room Displays
- Controller Displays
- On-board Web Server
- Network Displays
- Supervisors
Supervisors

- Operators access into the Building Energy Management System (BEMS)
- Graphical real-time view of system parameters
  - Temperature, pressure, plant status etc
  - Animated and dynamic graphics giving real-time visibility
- Adjustment of parameters
  - Time zones, set points, switches
  - Diary function for pre-programming of future events, bank holidays etc
- Data logging
- Alarm Management
  - System faults instantly reported
  - Alarms can be routed easily - Bureau
- User friendly
  - Flexible & intuitive
Example AHU Graphics

- **Extract Damper:** 100%
- **Extract Fan:** 69.2%  
  - **Return Temp:** 18.46 °C
- **Bag Filter:** 35.0%
- **Outside Air Temp:** 13.24 °C
- **Fresh Air Mixing:** 77%
- **Supply Air Temp:** 20.36 °C
- **Intake Damper:** 23%
- **Filter:** 95.0%  
  - **Heating Coil:** 65%  
    - **Supply Fan:** 69.2%  
    - **Cooling Coil:** 0%
Example Dashboard Graphics
Engineering Summary

- BEMS applications engineered with standard software modules
- Strategy library to allow standard plant strategies to be quickly implemented
  - Remove human error
  - Reduce time & costs by automation of repetitive tasks
  - Self learning options picks up system points automatically
  - Software strategy macros for common control applications
- Strategy can be easily modified at a later date, for changes in building application or plant
- One standard software tool for all engineering requirements
- Future proof control: today’s innovation working seamlessly with legacy systems
Engineering Summary

- Multiple installations across multiple sites can be easily linked onto a common network
  - Ethernet
  - PSTN phone lines
  - Wireless
Why connect buildings together?

• Provides centralised management of multiple sites
  • Alarm management
  • Condition based monitoring
  • Remote interrogation
  • Energy management
• Provides infrastructure for enhanced estate management
  • Bureau services
  • Facilities management
  • Energy services
• Allows monitoring of unmanned sites
Why connect buildings together?

- Controllers
  - Distributed intelligence for building services applications
- Field Connections
  - Converting real conditions into real actions
- Networks
  - Connecting multiple systems together
- User Interfaces
  - Providing users with useful information about their building
  - Translating applications into strategy programming
- Remote connectivity
  - Centralised estate management
Thank you