



Fundamentals of HVAC

Controls Network Integration



What you will Learn in this Lesson

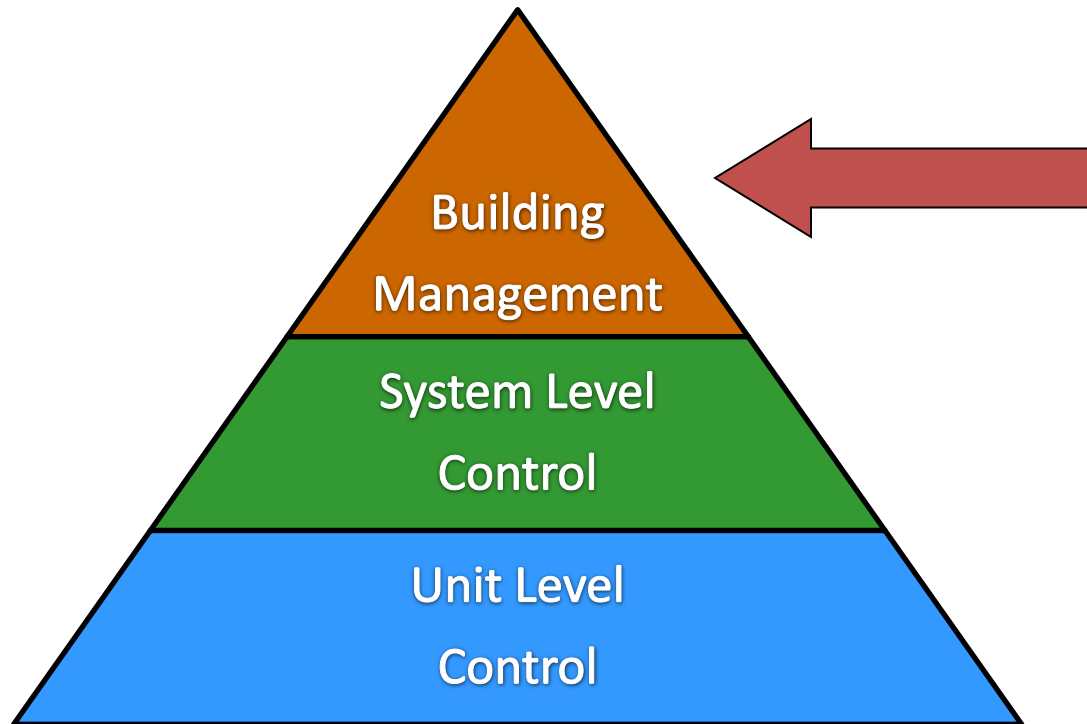
- What is a BAS
- BAS Functions
- Communication Network Concepts

What is a BAS

- Building Management
- Components of a Typical BAS
- McQuay Controls and Integration

What is a BAS

Building Management



What is a BAS

- Components of a Typical BAS
 - Hardware
 - Controllers
 - Communication interface to network
 - Operator interface

What you will Learn in this Lesson

- What is a BAS
- **BAS Functions**
- Communication Network Concepts
- Communication Protocols

BAS Functions

Provide Remote Access

- Alarming
- Preventative maintenance
- Troubleshooting

BAS Functions

Integration with Other Systems

- HVAC into other building systems
- Connection to multiple sites

What you will Learn in this Lesson

- What is a BAS
- BAS Functions
- **Communication Network Concepts**

Communication Network Concepts

- Network Architecture Basics & Terminology
- Communication Protocols
- Network Devices
- Network Addressing

Network Structure

- Dedicated vs. shared networks
- Local area network (LAN) vs. wide area network (WAN)
- Internet, intranet
- Tiered and flat architecture

Communication Protocols

1. Types of Communication Protocols

- Proprietary
- Open
- Standard

2. Gateways and Interoperability

3. Communication Options for McQuay Units

- BACnet
- LonWorks
- Modbus – Chillers only

Communication Protocols - BACnet

What is BACnet?

- It is a protocol; a language used by unit controllers for communicating to a building automation system (BAS)
- Building Automation and Controls Networks
- It is an open standard

Communication Protocols - BACnet

McQuay Supports:

- BACnet MS/TP
- BACnet IP
- BACnet Ethernet

BACnet Standard object types

- | | |
|---------------------|----------------|
| •Analog input | •Group |
| •Analog output | •Binary input |
| •Analog value | •Binary output |
| •Multi-state input | •Binary value |
| •Multi-state output | •Loop |
| •Device | •Command |
| •Event enrollment | •File |
| •Notification class | •Calendar |
| •Trend | •Schedule |

Communication Protocols - BACnet

- Protocol Implementation Conformance Statement (PICS)
 - Defines vendor and product
 - Describes how device conforms to BACnet standard
 - Assists in interoperability
 - PIC statement is required for BACnet integration

Communication Protocols - BACnet

Key Specification Items

- Products must meet the ASHRAE BACnet standard
- Required communications media (MS/TP, Ethernet)
- BTL (BACnet testing lab) listing
- PICS (Protocol Implementation And Conformance Statement) furnished at bid time and with submittals
- List Of Desired Points (For control, Display, Troubleshooting) - points list is even more important for BACnet since no functional profiles.

Communication Protocols - LonWorks

- What is LonWorks?

It is a standard protocol; a language used by unit controllers for communicating to a building automation system (BAS)

- What is LonTalk?

- LonMark International

Communication Protocols - LonWorks

Example of a LonMark MicroTech III RTU Functional Profile

Mandatory Network Variables

- Inputs
 - Duct Static Pressure Setpoint
 - Building Static Pressure Setpoint
- Outputs
 - Duct Static Pressure
 - Building Static Pressure
 - Space Temp
 - Discharge/Return Air Temp
 - Outdoor Air Temp

Optional Network Variables

- Inputs
 - Occupancy Scheduler Input
 - Occupied Cooling Setpoint
 - Occupied Heating Setpoint
 - Discharge Heating/Cooling Setpoint
- Outputs
 - Occupancy
 - Heating/Cooling Capacity
 - Alarm Description

Communication Protocols

BACnet and LonWorks – Addressing Comparison

Data Point	BACnet Object	LonWorks Variable
Occupancy Scheduler Input	CurrentState, NextState & TimeToNextState	nviOccSchedule
Application Mode	ApplicCmd	nviApplicCmd
Supply Fan Capacity Input	SupFanCapNetIn	nviSupFanCap
Outdoor Air Temperature	OutdoorTempInput	nviOutdoorTemp
Space Temperature	SpaceTempInput	nviSpaceTemp
Primary Cool Enable	nviPrmClgEnV & nviPrmClgEnS	nviPriCoolEnable
Primary Heat Enable	nviPrmHtgEnV & nviPrmHtgEnS	nviPriHeatEnable
Economizer Enable	nviEconEnaV & nviEconEnaS	nviEconEnable
Exhaust Fan Capacity Input	ExhFanCapNetIn	nviExhFanCap
Return Fan Capacity Input	RetFanCapNetIn	nviRetFanCap
Water Flow Switch Input	WaterflowSwitch	nviCWFlow
Space Indoor Air Quality (IAQ) Input	SpaceIAQNetIn	nviSpaceIAQ
Relative Humidity Input	SpaceRHNetIn	nviSpaceRH

Refer to ED 15112 for a complete list of points available for MicroTech III

Communication Protocols - LonWorks

- eXternal Interface File (.XIF) & .NXE (application) Files
 - XIFs are text files that contain the names/types of variables used by each node (communication module)
 - .NXEs are application files
 - Available on www.mcquay.com

Communication Protocols - LonWorks

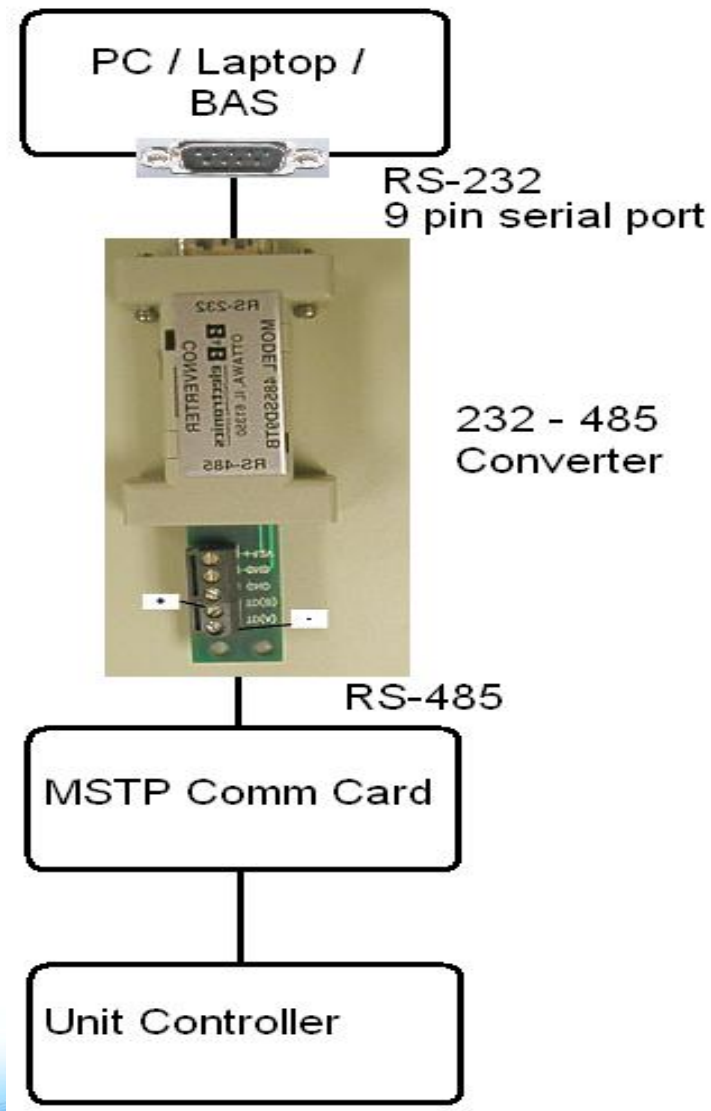
Key Specification Items

- LonTalk technology by Echelon
- FTT-10A Transceivers (RS-485)
- Appropriate functional profile (SCC, DAC, WSHP or Chiller)
- LONMARK certification (www.lonmark.org)
- Vendor must supply XIF file
- List of desired variables

Network Devices

BACnet MS/TP Hardware

- RS-485 with +, - (and sometimes ground)
- PCs typically have RS-232 comm (9-pin serial port)
- RS 232–RS 485 converter



Network Devices

LonWorks Hardware

- Specific interface adapter, connector, & hardware
 - UB 10 from Echelon (shown)
 - Other types available

Network Addressing

BACnet MS/TP Addressing

- Slower
- Fewer address options
- Generally for smaller systems

Parameters Required for BAS Communication

- **Baud Rate:** 9600,19200,38400, or 76800 bps
- **MS/TP MAC (Media Access Control) Address:** 0-127, prior versions addressed with switches
- **Device Instance:** large range 0-4194302

Network Addressing

BACnet IP Addressing

- Parameters Required for BAS Communication:
 - **Device instance:** large range 0-4194302
 - **IP Address:** Each device on the IP network must have a unique (but similar) IP Address with four segments (“octets”) with three digits each. Example 172.100.120.140
 - **Subnet Mask:** All devices on the network must have identical subnet mask. Example 255.255.0.0 Subnet Mask means all IP addresses on network must have same first two octets, octets 3 and 4 may differ

Wrap-Up: Lessons Learned

- What is a BAS
- BAS Functions
- Communication Network Concepts

End of Lesson

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