Chapter 4

System Architecture

FRONT END BASED

EMSs are described in this section more as a comparison as how a system of the early 1980's was designed and how it functions.

In general, these systems have field panels installed at remote locations that are wired to a central computer. Field panels accept inputs from the remote sensors and deliver output signals to devices, however, all decisions and operating parameters reside at the central computer. For the most part, the field panels are "dumb" connection points. If the central computer is off line or if the connecting transmission wire is disconnected all control is lost and the entire system stops functioning.

DISTRIBUTED INTELLIGENCE EMS

This type of system has a central computer and can control a large number of input-output points ranging from 50 to more than 2000 per system. Field interface is provided by field panels that have limited intelligence.

These systems are capable of performing all EMS functions, although, not all systems use all functions. The central computer uses varying amounts of software storage, and tape or disc storage can be added to increase data-handling capacity. Operator access through a fixed terminal keyboard is routine. An alarm/logging printer is often provided.

Field panels are equipped with read-only memory (ROM) in their software, which allows the panel to operate in a stand-alone limited mode in the event of a central computer failure. Battery backup is provided for the random access memory (RAM) content of the panel software and the real time clock.

For single building control, dedicated twisted pairs of wires are generally used for data transmission media. Where groups of buildings are controlled, dedicated telephone lines and 1200 baud MODEMs are normally used between buildings; with twisted pairs used within buildings.

FULLY DISTRIBUTED EMS

The major components in a fully distributed system are stand-alone, multi-function microprocessors that have ability to perform any combination of software functions described in Chapter 7. All necessary application software is located within the microprocessor close to the equipment being controlled. The microprocessors are powered with 120V and hardwired to all sensors and actuators with standard 24V wiring. The microprocessors are looped together using any of the data transmission methods described in Chapter 6 through either RS-232C or RS-422 communication ports. In most cases, a single communication link ties the microprocessor loop to a central operator station. This is complete stand-alone operation.

There are several advantages associated with distributed systems. With the stand-alone feature, the initial investment can be limited, while expansion is virtually unlimited. Remote microprocessors provide local digital and analog input/output ports, allowing direct communication between the microprocessors and the sensors and actuators. Information is transmitted in digital form. Direct digital control (DDC) pulse width modulation lends itself to proportional-integral-derivative (PID) control.

The central operator station that is often found with these systems is a convenient personal computer. It is used to download applications software to remote microprocessors, edit that software, troubleshoot the system, and monitor or report on conditions (See Figures 4-1 through 4-5).

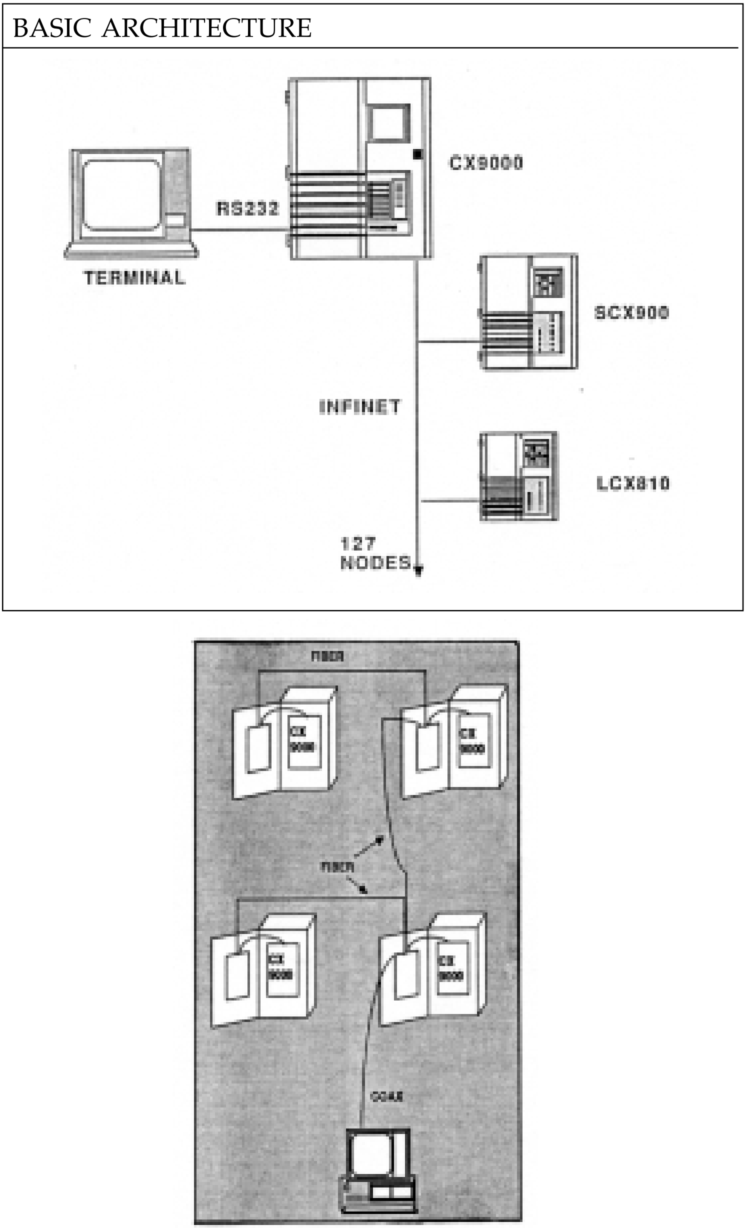

Figure 4-1. Andover Architecture

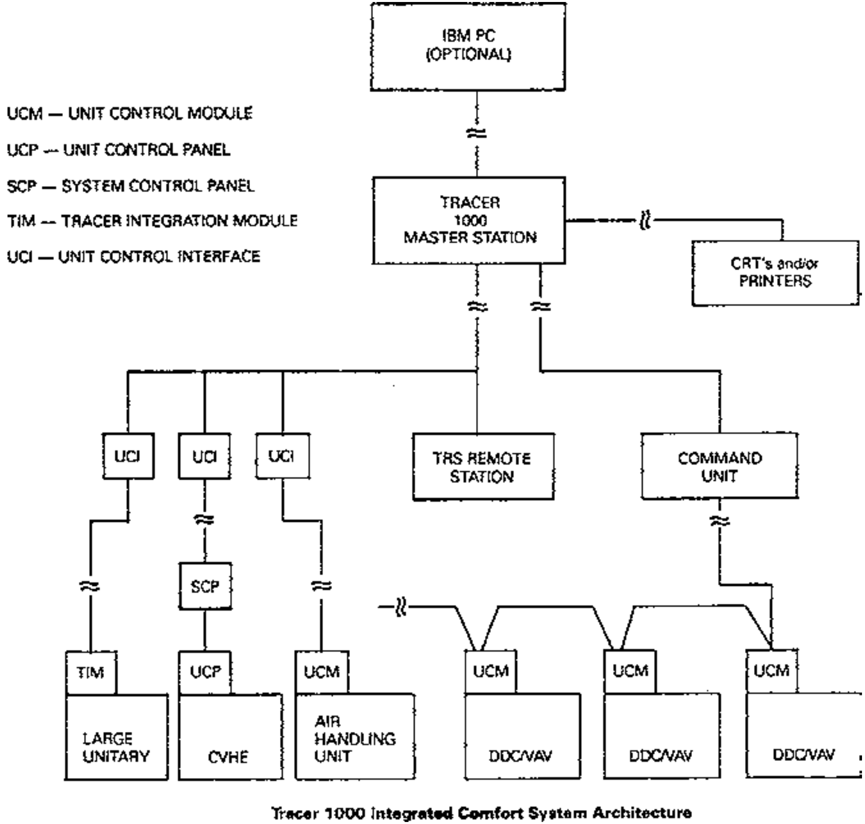

Figure 4-2.
Trane Architecture

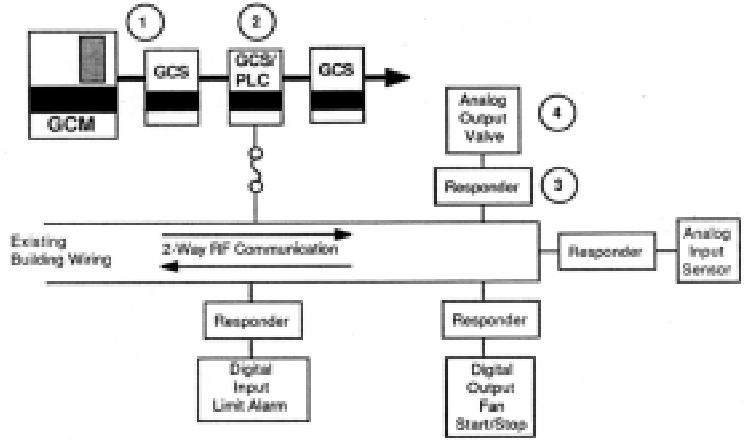

Figure 23. HOW IT WORKS.
With PLC there's no additional hard wiring required between the control devices (sensors, etc.) and the NETWORK 8000. Energy Management and Direct Digital Control programs operate in the GCM (1). Two-way, RS-485 communication through a transmitter/receiver (2) via a responder (3) links the remote analog and digital control devices (4) to the GCM using existing wiring.

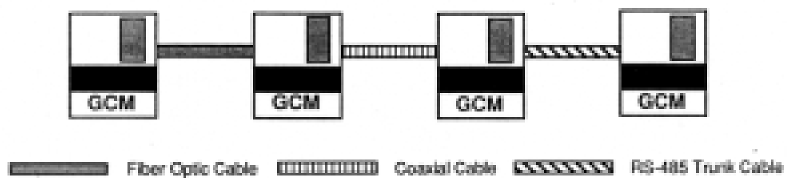

Figure 4-3.
Barber Colman Architecture

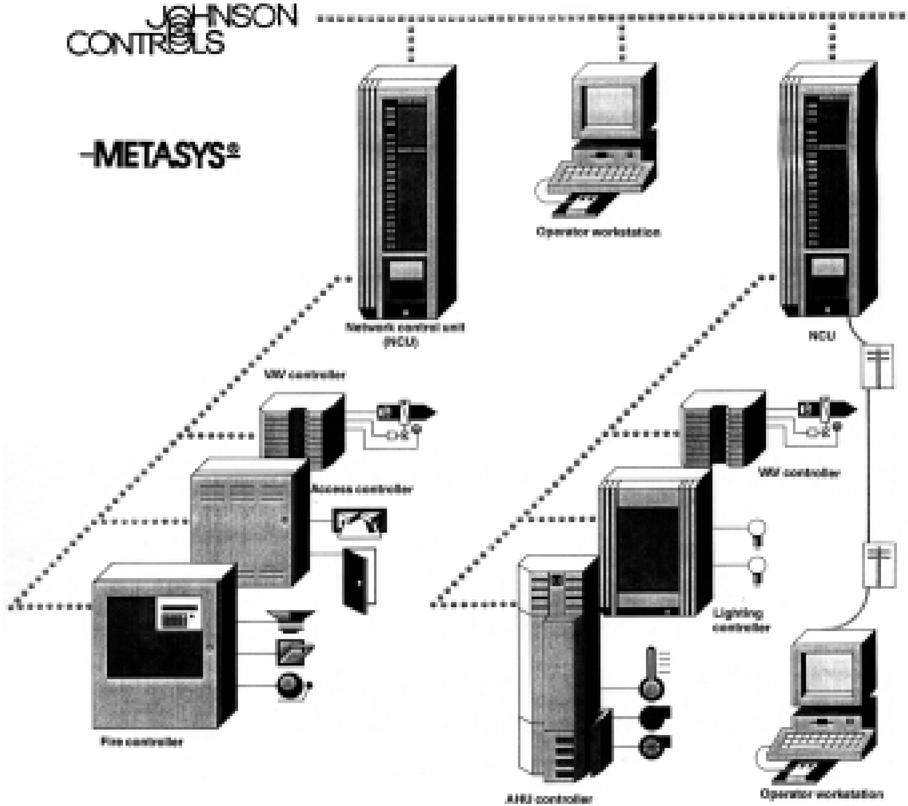

Figure 4-4. Johnson Controls Architecture

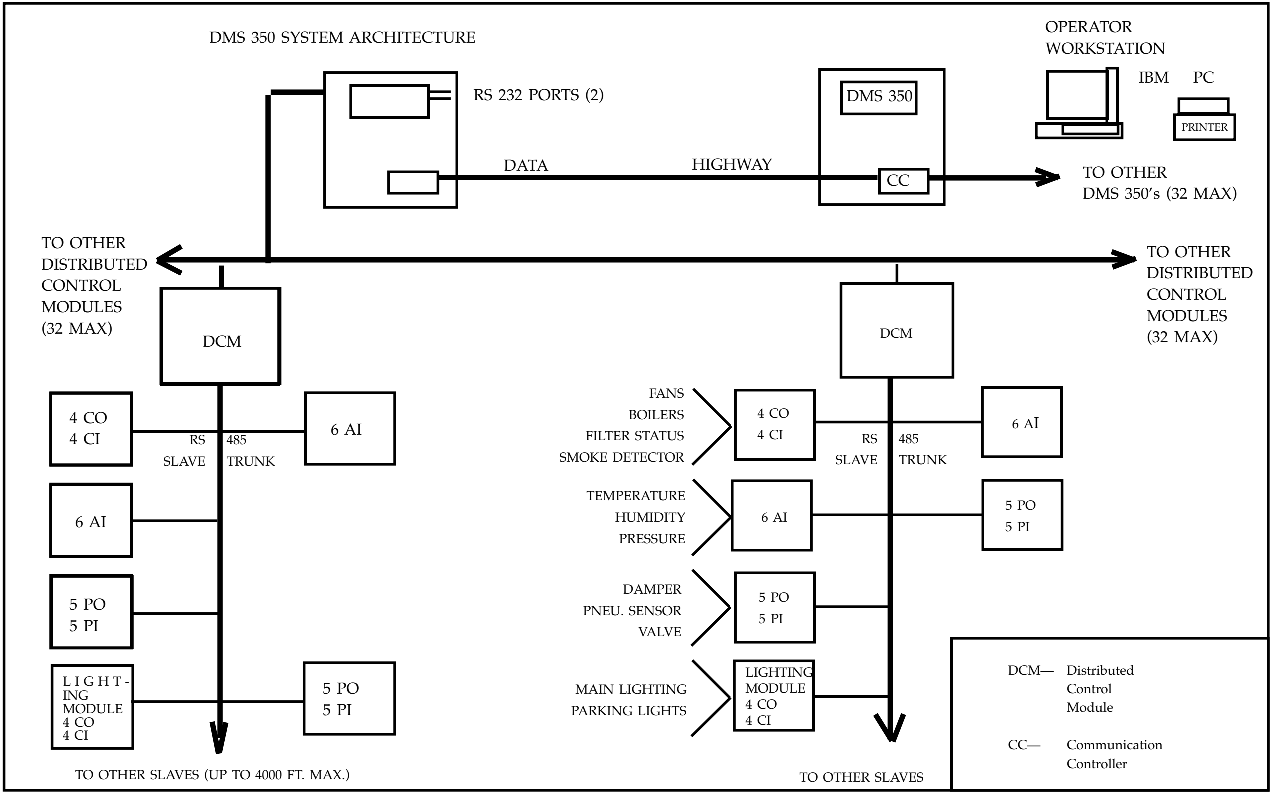

Figure 4-5. Robertshaw Architecture