Chapter 9

Operator/Machine Interface

For direct access to an EMS, the operator's station usually consists of a personal computer with a monochrome or color monitor (CRT), keypad, and printer. This combination of equipment would be considered the primary input/output device (I/O) or Operator Workstation.

Most all vendors have standardized on use of an IBM Personal System 2 (IBM-PS/2) Model 60 or 80 computer, as well as a number of similar computers operating MS-DOS. Regardless if the user elects to purchase a color graphics package (described herein), for the small cost difference, the color monitor is recommended over the monochrome unit. A software supported optical mouse should also be supplied.

Since EMSs can be monitored from a remote terminal, modems should be installed. A Hayes Smartmodem 1200 or equivalent is recommended.

IBM-PS/2 Model 80 computers have more than sufficient memory to hold the EMS operating system, color graphics program, maintenance management programs, and reports storage. Plus, they can be used for inventory control, graphing, general typing and a host of other uses.

The color CRT could be furnished with a color graphics package, however, this feature is optional and in most instances is an expensive option. Vendors tend to lean very heavily on this feature, with many colorful brochures showing all the various arrangements available.

GRAPHICS

Color graphics provides the user with EMS point information displayed on customized dynamic color graphics. Use of static graphics or 35 mm slides is not recommended. The system, upon command, will display the current measured variables associated with the equipment or area. Off-normal conditions and alarms will be displayed instantly. Alphanumeric data would be a standard feature as well as the associated keyboard including all standard ASCII characters.

Refer to Figure 9-1 for typical graphic displays.

The printer should be an 80-column hard copy type interface that supports full graphic features and is rated at no less than 100 cps. Standard form fold paper with tractor feed would be required. IBM Proprinter II or equal should be considered.

DATA UTILIZATION

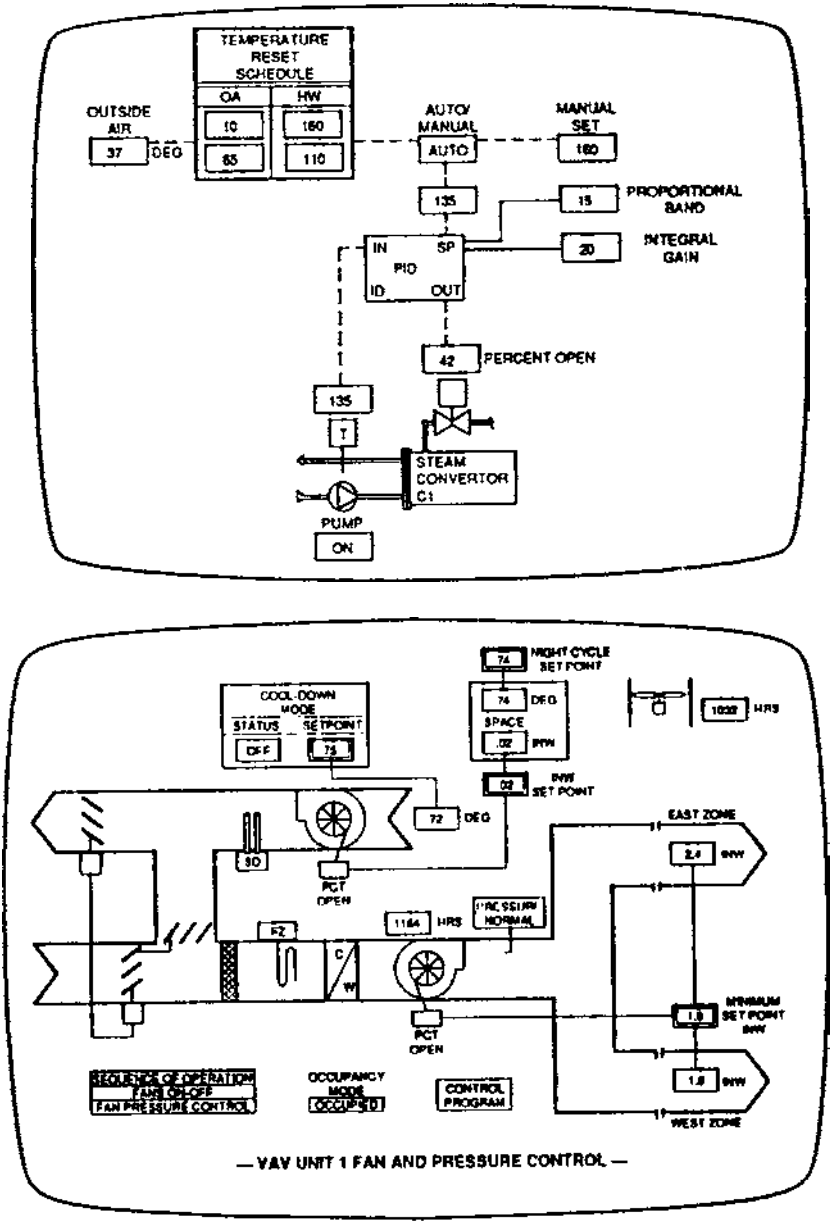
User friendly is a phrase sometimes misused and often does not mean what it implies. The real test of being user friendly is the time and effort required to understand and utilize the full capabilities of a system without being a computer genius or being constantly dependent on so-called "outside experts."

In seconds you should be able to change or delete a point, revise a schedule or create and display a color graphic on the operator's console. It should be versatile, user programmable, and be operated by simple English language.

PACKAGING

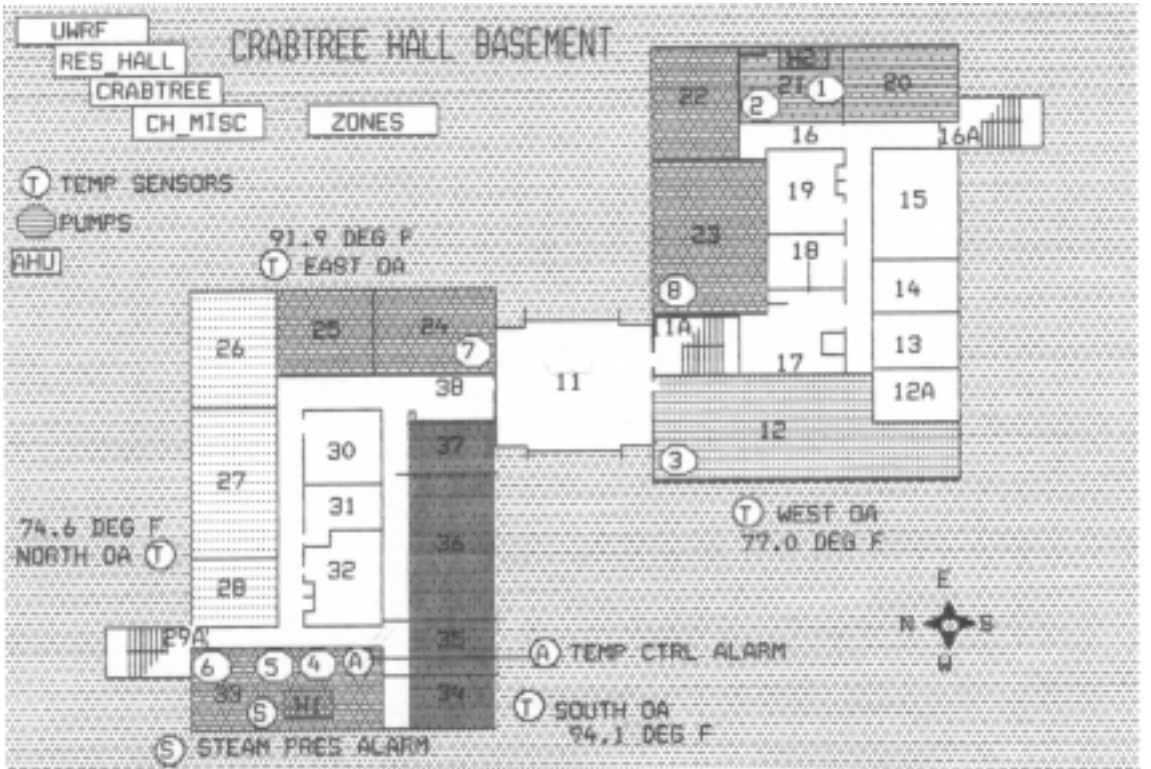
With most systems you can oversee your entire operation from a central location regardless of whether you manage a single building or multiple buildings. By creating this central operators station, you can supervise regular and emergency maintenance, monitor intrusion and fire alarm, control temperature, generate financial an operational data and much more.

Many EMSs do not, by definition, require a PC connected to it to operate. This would be considered a stand-alone system. The EMS

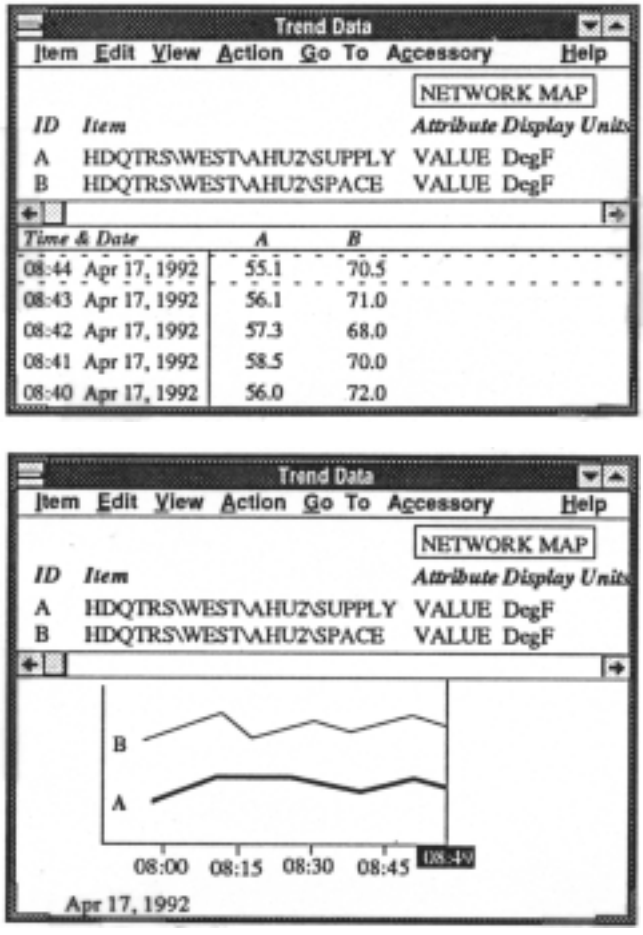


9-1. Graphic Displays

(*Continued*)



9-1. Graphic Displays (*Continued*)



9-1. Graphic Displays (*Continued*)

should allow information access throughout the system to each local panel in each mechanical equipment room. All information can then be displayed constantly on a portable plug-in computer to allow servicemen to quickly diagnose, troubleshoot and remedy comfort problems in a building.

Auto-dial/auto-answer communications will allow your EMS to be monitored from remote locations, certain types of maintenance and other functions can be accomplished from a remote location.

Simply by adding sensors, controls, and peripherals the system can easily expand to manage any targeted area, often without the need for additional hardware. The same skills, techniques and procedures are re-utilized for each new use. The system can even be used to document the Return On Investment (ROI) potential of a targeted management area. The movement toward total facility automation thus becomes an ongoing process of evaluation and response.

Refer to Table 9-1 for EMS functions.

SOFTWARE PROGRAMMING

Although EMS vendors may use different names for the method they use to program their systems, the two basic names or types are line programming (or textual language) and control block technology.

In line programming, a series of statements leads the programmer through a control sequence. Refer to following example:

```
Program HW    PUMP2  3     Status:  Wait        Size:   158 Bytes
1  SWait 30
2  ;C1=[SU.AH1     TC;OC]+[SU.AH2     TC;OC]+[SU.AH3    TC;OC]
3  ;OC=[SU.AH4     TC;OC]+;C1
4  If [OAT;CV]<;OA       Then 5     Else 10
5  If;OC>0               Then 6     Else 8
6  [SU.HWP2      SS;CV]=1\[SU.HWP3     SS;CV]=0
7  Goto 1
8  [SU.HWP2      SS;CV]=0\[SU.HWP3     SS;CV]=1
9  Goto 1
10 If [OAT;CV];OA+2.0       Then 11 Else 1
11 [SU.HWP2      SS;CV]=0
12 [SU.HWP3      SS;CV]=0
13
```

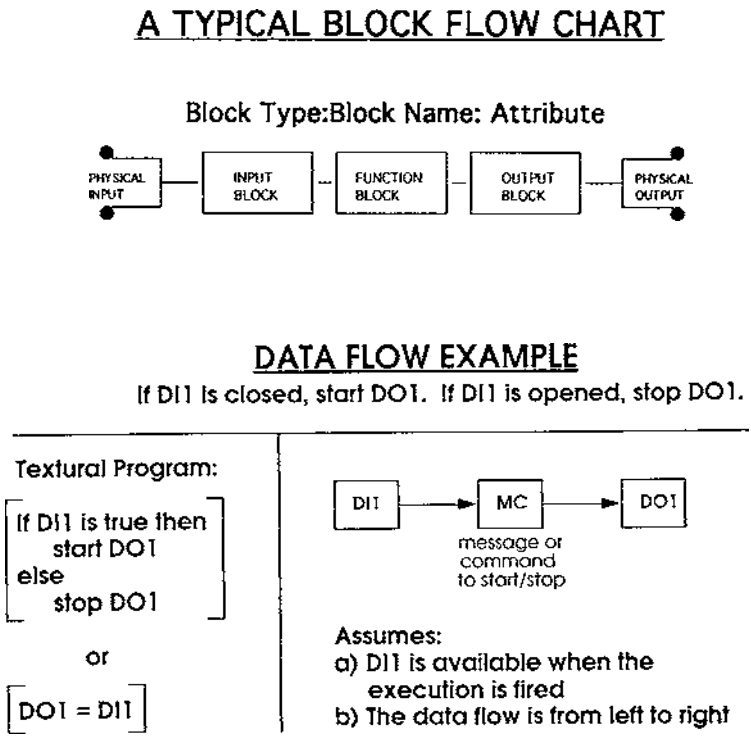
As can be seen by the example, it is actually difficult to identify the process or access the program. Only the sequential control flow is shown in this one dimensional view. It is hard to visualize what's going on without drawing a diagram of the text program.

With control block technology, or graphical programming, the user draws a diagram or picture to design a control system. Both data flow

Table 9-1. EMS Functions

	Category		*Function*	*Description*
1.	Data Acquisition	a.	Monitor environment	Controlled space temperatures, humidities, etc.
		b.	Monitor equipment status	Verify flow/no flow, run/stop, etc.
		c.	Safety and maintenance alarms	Firestat/freezestat, boiler temperature/pressure, compressor oil levels, run times, etc.
		d.	Climate	Outside air temp., humidity, wind, etc.
		e.	Analysis	Reports of trends, limits, averages, etc.
2.	On/Off Control	a.	Scheduled operation	Run equipment only when needed; defer low priority loads to off-peak periods.
		b.	Demand limiting:	
			(1) Load shedding	Equipment shutdowns in reverse priority order.
			(2) Duty cycling	Rotating brief outages among selected loads.
3.	Optimization	a.	Optimized start/stop	Adjust operating schedules by daily conditions.
		b.	Control point reset	Fine-tune local loops based on conditions.
		c.	Economizer	Optimum use of outside air to reduce heating/cooling.
		d.	Plant optimization	Operate equipment near optimal loading.
4.	Man-Machine Interface	a.	Operator console	Interactive communication for operator efficiency.
		b.	Intercom	Voice link from console to remote locations.
		c.	Report/alarm generator	Data products to assist in maximum system use.
5.	Offline Functions	a.	Software generation	User-defined programs and modifications.
		b.	Maintenance support	Scheduling, diagnosis, analysis, records, etc.
		c.	Operational summaries	Verify consumption & savings, profile facility, etc.

and control flow are used by connecting blocks with arrows pointing in the direction of flow. In general, no special software language experience is required since each control block has a direct pneumatic equivalent. Refer to following figures 9-2 and 9-3.



9-2. Block Programming

DATA FLOW EXAMPLE

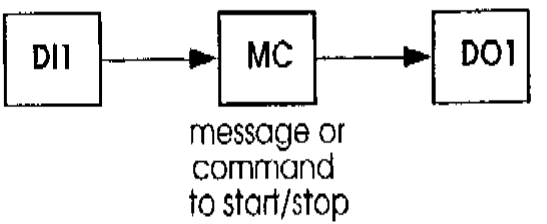
If DI1 is closed, start DO1. If DI1 is opened, stop DO1.

Textural Program:

```
If DI1 is true then
    start DO1
else
    stop DO1
```

or

```
DO1 = DI1
```

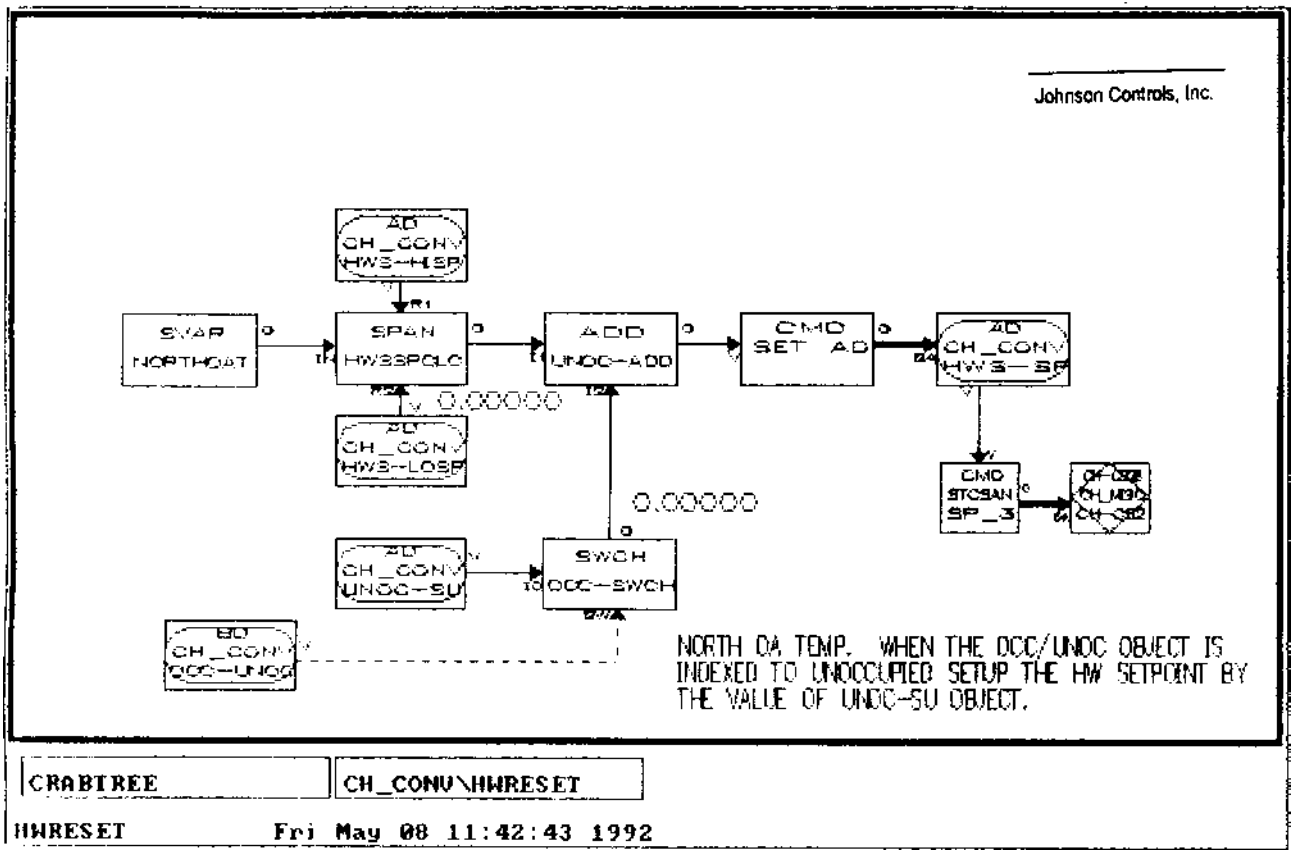


Assumes:

a) DI1 is available when the execution is fired

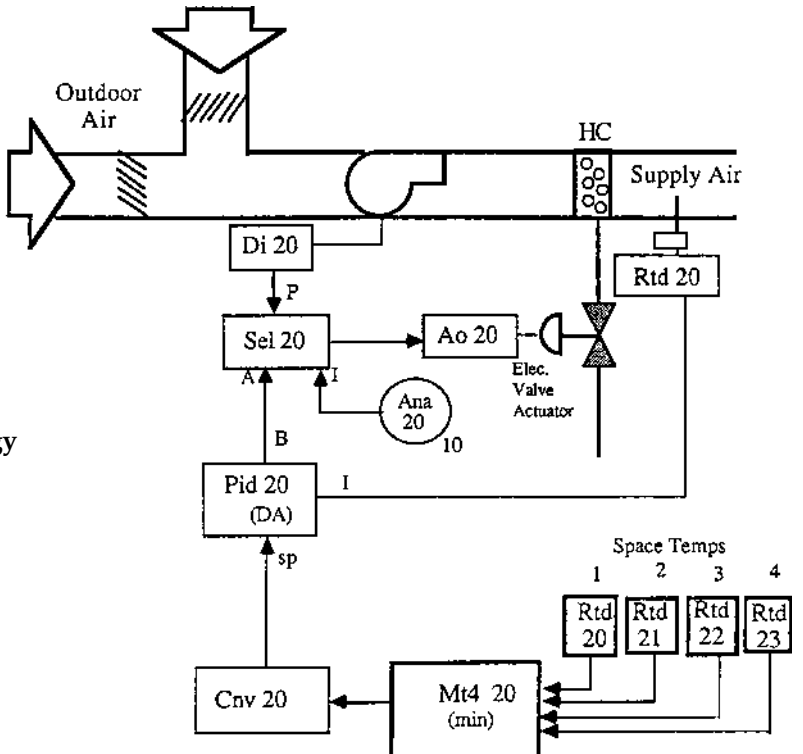
b) The data flow is from left to right

9-2. Block Programming (*Continued*)



9-3. Control Block Technology

9-3. Control Block Technology
(*Continued*)



Supply Air Reset With Interlock Example

Staefa Control System Inc.