CHAPTER 2

GENERAL CONSIDERATIONS

1. RELIABILITY. The independent (stand-alone) operation of the smart field panel ensures that equipment under its control will continue to operate in the absence of communications with the central station or island station. In this stand-alone mode, each smart field panel will continue to perform most functions, including data collection, time scheduled operations, space temperature adjustments, complex control algorithms and sequences of operation, and self-diagnosis. Failure of any smart field panel must not adversely affect performance of the rest of the UMCS. The only exception allowed is the condition where another smart field panel, the central station or island station require data from the failed smart field panel. An example is peak demand prediction calculations used in electrical demand management, which cannot be performed if the smart field panel which collects the electric metering data is not operating and/or communicating with the central station or island station and other smart field panels.

2. EXPANDABILITY. A UMCS is installed under contracts that provide the Government with legal rights in technical data and computer software, and specific site license agreements allowing for system expandability. Additional hardware and/or software may be required for incorporating new buildings, control points or other systems into the UMCS. The expansion of systems must be developed with great care. Particular care must be exercised in evaluating the feasibility of expanding existing EMCS, since expansion may be a cost-effective solution.

3. BENEFITS. Application of UMCS design features required by this manual, such as distributed processing, results in efficient use of the central station and island station computers, since many time-consuming operations take place in the smart field panel. The central computer systems utilize their processing time performing central alarm reporting, trend logging, electric demand limiting, global energy optimization functions, and supporting operator interface functions such as graphic displays.

4. APPLICATIONS. UMCS may perform many utility management functions, including maintenance management, monitoring of water treatment plants/ industrial facilities, and other utility related tasks, provided that agency guidelines on funding and applications are satisfied. In buildings having life safety systems utilizing UMCS controlled devices, coordination of priorities for control of the final device, such as a damper, will be determined and specified. Life safety functions and equipment will have priority over UMCS control functions. Utility system applications of UMCS include monitoring and limited control of electrical distribution systems; emergency generators and fuel storage; exterior and interior lighting systems; water treatment and distribution systems including storage tanks, distribution piping, booster pumps, and treatment plants; sanitary sewer systems including sewage lift stations; irrigation systems; hot water and steam boiler plants and heating distribution systems; chiller plants including chillers, pumps, cooling towers and chilled water distribution systems; building systems such as heating, ventilating and air conditioning systems; electric power systems; thermal storage systems; domestic water systems; cold storage and refrigeration systems; and specialty systems such as compressed air and medical gas systems. In general, the UMCS is not used for fire alarm or security systems.

5. CODES AND STANDARDS. Design of the UMCS will incorporate all applicable codes and standards. Regulations which are in effect for the specific site at the time the drawing & specifications are prepared will be incorporated.

6. FUNCTIONAL EQUIVALENCY. This manual defines the minimum needs of the Government. Some manufacturers offer systems in response to the Government's need which vary in system architecture and physical arrangements. The procuring activity must determine whether or not the system offered in response to the Government's requirements does, in fact, meet or exceed the specified arrangement. One example of functional equivalency is the use of network-compatible smart field panels which communicate directly with the island station local area network (LAN). In this system configuration all data communication management functions are handled by the network devices and the island station

computer, eliminating the need for the separate communication processor described in this manual for systems with multiple communication channels.

7. POWER LINE CONDITIONER. Power line conditioners protect UMCS equipment from power line fluctuation and noise which can result in computation error, erratic operation, loss of data, overheating, circuit burnout, and in some cases, system shutdown. The power line conditioner provides attenuation of the power line noise by using isolation transformers. It provides a regulated voltage source by using solid state devices that provide fast response to changes in incoming voltage or load conditions; however, they do not protect the UMCS from power outages. Power line conditioners will be provided for all central station equipment, island station equipment, smart field panels and remote terminal units except equipment for which the design includes an uninterruptible power system (UPS). Each power line conditioner will be sized for 125 percent of the required load for the connected equipment.

8. UNINTERRUPTIBLE POWER SYSTEM. An uninterruptible power system will be provided for UMCS equipment which must operate continuously under all conditions including loss of commercial power. Static uninterruptible power systems provide continuous, conditioned, single-phase AC power while operating either from an AC line power source or from DC storage batteries. The batteries will be sized for a minimum backup time of 15 minutes or as required by the installation and application. The UPS also protects UMCS equipment from power line fluctuation and noise similar to the power line conditioner. Uninterruptible power systems will be sized for 125 percent of the required load for the connected equipment.

9. INTERCOMMUNICATIONS SYSTEMS. An intercom system can be used to communicate with field personnel while performing checkout, maintenance, and trouble shooting tasks for UMCS. The intercom system can also facilitate the checkout and acceptance of the UMCS by providing communication between field equipment panel locations and the central station or island station. Implementation of an intercom system will require dedicated circuits between the central station or island station intercom and each intercom station, or the encoding of voice communications on the data communication systems. Hand held FM radio units are an alternative to intercommunications systems.

10. INTERFACE AND FUTURE EXPANSION. When specifying the central station or island station, provision must be made for additional peripherals such as workstations which may be required in the future when expanding or modifying the UMCS. In addition, provision may be necessary for a central station to communicate with additional island stations which may be required in the future. Hardware and software communication protocol documentation, required to implement a system expansion, must be provided by the original system manufacturer via appropriate license agreements. If future planning at the facility indicates an expansion and the potential need for both a central station and one or more island stations, costs for the system can be deferred to the future project by installing the field equipment with only a single island station; or, depending on agency criteria and cost tradeoffs, it may be more prudent to initially procure the central station and one or more island stations.

11. CONSOLE AND ACCESSORIES. The central station and each island station will contain necessary accessory equipment to support operation of the system, including a desk type console, swivel chairs with casters, paper trays for printers, and storage enclosures for test equipment, magnetic cartridge tapes, printer paper and other supplies. The console will contain sufficient surface area for the operator's workstations and work area. Equipment cabinets and accessories will be color coordinated. Figure 2-1 is typical for a central station or island station equipment room.

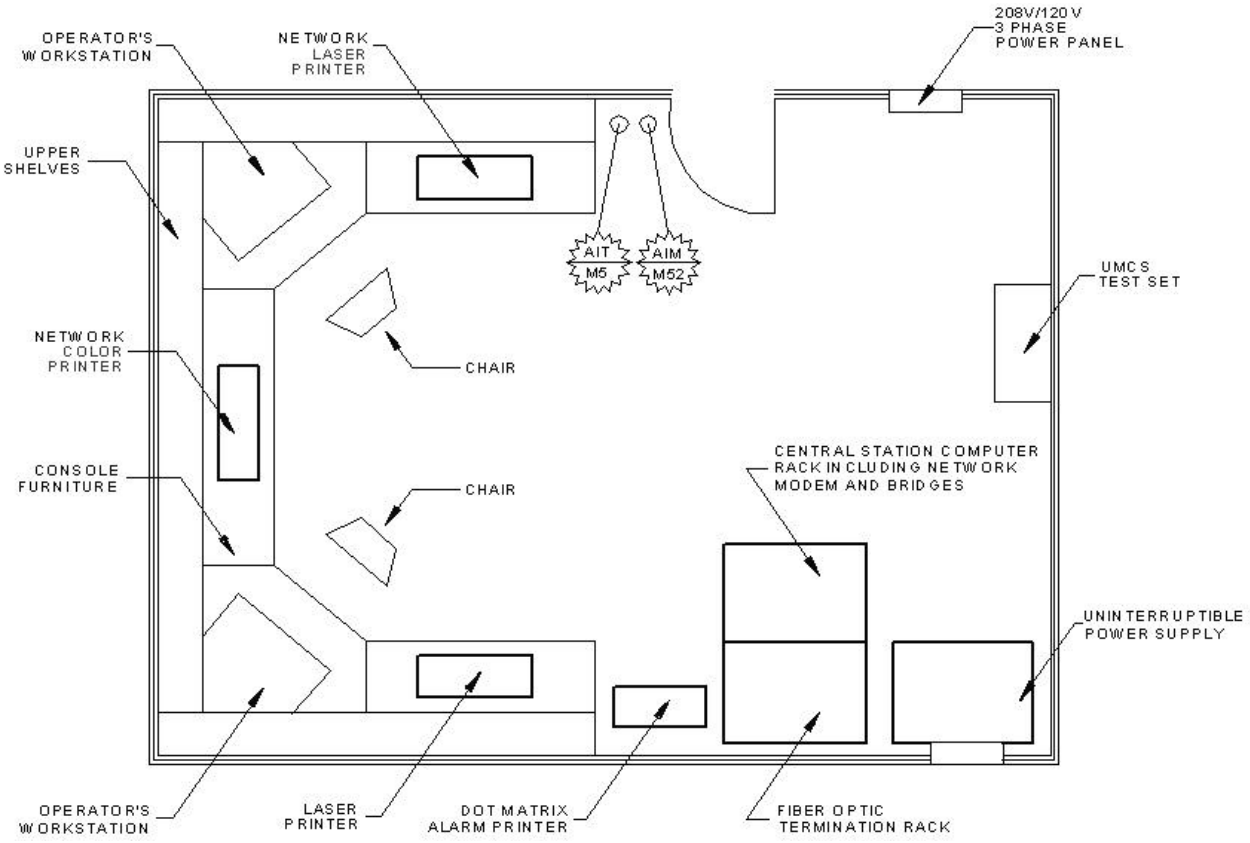

Figure 2-1. Typical Central Station or Island Station Equipment Room.

12. SUPPORT EQUIPMENT.

a. A UMCS test set, consisting of a smart field panel and input/output simulator, is part of the system that enables the operator to simulate and display the operation of a smart field panel. Analog and digital sensor input conditions are adjustable from the simulator's control panel. The simulator receives a control signal from the smart field panel and returns a feedback signal, simulating the performance of various analog sensors or digital monitors. By use of this device, the operator will be able to study system response when new control algorithms are implemented, and verify the performance of programs.

b. A UMCS portable tester provides diagnostics, programming, and database entry functions through connection to a field equipment panel. The tester will include a keyboard, display, and mass storage device sufficient to perform all required diagnostics and exercise all points.

13. TRANSIENT PROTECTION REQUIREMENTS.

a. UMCS equipment is susceptible to interference from two types of transients: functional and damaging upsets.

(1) Functional upsets are transients which may be caused by inductive or capacitive coupling between data lines, control lines, and monitor lines that result in loss of data or improper control actions.

(2) Damaging upsets are transients which may be caused by voltage surges and indirect lightning strikes that physically damage the equipment.

b. Power lines serving the system, nearby electrical and electro-mechanical devices, and lightning strikes are sources of transients.

c. Power line variations, due to transients from large starting loads or other disturbances, may cause temporary low voltage conditions to exist. Power line conditioners or uninterruptible power systems protect UMCS equipment from the effects of powerline variations.

d. Communication links except fiber optic cables, between the central station and island station, between the island station and smart field panels, and between smart field panels and remote terminal units or unitary controllers must have surge protection circuits installed at each end. Triple electrode gas surge arrestors must be installed within 3 feet of the building cable entrance and connected to the building grounding system.

e. Power circuits serving UMCS equipment must be surge protected.

f. Control and sensor lines connected to UMCS equipment must be surge protected.

14. TRANSIENT PROTECTION DEVICES. Surge arresters provide low impedance paths to ground for surge voltage and near-lightning strikes which exceed threshold voltages ranging from 6.8 volts to 100,000 volts. A variety of different devices are available to protect against lightning and other transients in power supplies, data transmission lines, digital hardware, controllers, and instruments. Fuses and circuit breakers will be used to limit current in power supplies from overcurrent and short circuits. Transient protection devices will be used to protect electronic circuits. Types of transient protection are enumerated below.

a. Spark gap surge protection devices, such as gas filled tubes, are generally used to handle surges due to lightning or other transients. Gas filled tubes are available for a range of threshold voltages to meet various applications, such as power or signal lines. Gas filled tubes are relatively slow to react when compared to semiconductor devices, thus requiring that they be used in conjunction with other faster acting protection devices, such as zener diodes. These faster acting devices protect the circuit until the overvoltage is shunted to ground by the gas filled tube.

b. Solid state surge protection devices, such as varistors, silicon avalanche diodes, zener diodes and double anode zeners are semiconductor devices that provide low voltage clamping for high speed transients. Double anode zeners are also used across relay coils to eliminate coil generated electromagnetic interference (EMI). Solid state surge protection devices are used in conjunction with spark gap surge protection devices, to provide protection against overvoltage in excess of the solid state device ratings.

c. Crowbars consist of an electronic circuit that rapidly senses an overvoltage and provides a low impedance path to ground. The overvoltage setpoint of crowbar circuits is adjustable to suit the application. One use of crowbars is to limit the voltage output of DC power supplies.

d. Optical isolators provide DC isolation between interconnecting wiring and input circuits by the use of LEDs and photocells. These circuits are used primarily to isolate control and sensor wiring circuits from the UMCS input circuits. Optical isolators prevent damaging transients from passing through them, but are still subject to failure when large surges occur. Optical isolators typically provide up to 2500 volts RMS isolation.

e. Inductor-capacitor-resistor passive filter networks are used in input/output circuits to attenuate high frequencies associated with fast rise times in voltage transients.

15. GROUNDING. The ideal grounding system is one which provides a zero impedance path for currents at all frequencies the system is expected to encounter. The most common type of grounding system consists of a grounding circuit that is terminated by rods or pipes driven into the ground. Use of

underground well casings and building structural steel members in accordance with the National Fire Protection Association No. 70 are other acceptable means of grounding. To meet grounding resistance requirements, it may be necessary to combine several grounding techniques. Instrumentation systems typically require a single point signal ground in addition to a power ground. The signal ground will be connected to the power ground only at the building entrance. Signal grounding conductors which run parallel to primary power or lightning conductors must be avoided. Floating signal grounding systems are not acceptable because of lack of operating stability and shock hazard. All enclosures will be tied to an equipment ground, which will be separate from communications and instrumentation grounds. Grounding will be in accordance with IEEE Standard 142 and IEEE Standard 1100. Additional grounding and power requirements exist for use in computer equipment areas such as the central station or island station. These additional requirements, defined in FIPS-94, "Guidelines for Electrical Power for ADP Installations", will be incorporated in the central station and island station design in addition to other stated requirements.

16. SHIELDING. Electronic circuits sensitive to EMI will be protected by electrical shielding. Shielding is used in telephone lines, twisted pairs, and other circuits to reduce the strength of interfering electric or magnetic fields. Shielding will be grounded only at one end to preclude ground loops.