UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021
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SECTION TABLE OF CONTENTS

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

SECTION 28 31 75.00 10

CENTRAL FIRE ALARM SYSTEM, DIGITAL ALARM COMMUNICATOR TYPE

11/08

PART 1 GENERAL

1.1 REFERENCES
1.2 SUBMITTALS
1.3 QUALITY ASSURANCE
1.3.1 Qualifications
1.3.1.1 Registered Professional Engineer
1.3.1.2 Installer
1.4 DELIVERY, STORAGE, AND HANDLING
1.5 SPECIAL TOOLS AND SPARE PARTS

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION
2.1.1 Operation
2.1.2 Alarm Functions
2.1.3 Supervisory Functions
2.1.4 Primary Power
2.1.5 Battery Backup Power
2.2 STANDARD PRODUCTS
2.3 NAMEPLATES
2.4 FIRE ALARM MONITORING CENTER
2.4.1 Digital Alarm Communicator Receiver (DACR)
2.4.2 Audible Alarm
2.4.3 Receiver Code Format
2.4.4 Visual Display
2.4.5 Receiver Memory
2.4.6 Receiver Supervision
2.4.7 Manual Battery Test
2.4.8 Telephone Line Connection
2.4.9 Power Supply
2.4.10 External Connections
2.4.11 Self-Contained Printer
2.5 MONITORING CENTER TERMINAL
2.6 MONITORING CENTER PRINTER
2.7 MONITORING CENTER POWER SUPPLIES

2.8 DIGITAL ALARM COMMUNICATOR TRANSMITTER (DACT)
2.8.1 Functional Requirements
2.8.1.1 Interfacing Indicators and Controls
2.8.1.2 Signal Transmission
2.8.2 Enclosure
2.8.3 Digital Alarm Communicator Transmitter Interface Device
2.9 DIGITAL ALARM COMMUNICATOR TRANSMITTER POWER SUPPLY
2.9.1 Battery Power
2.9.2 Battery Duration
2.9.3 Battery Supervision
2.10 PERIPHERAL EQUIPMENT
2.10.1 Conduit
2.10.2 Ground Rods
2.10.3 Wiring
2.10.4 DACT Programmer

PART 3 EXECUTION

3.1 EXAMINATION
3.2 INSTALLATION
3.2.1 Power Supply for the System
3.2.2 Wiring for Systems
3.3 OVERVOLTAGE AND SURGE PROTECTION
3.4 GROUNDING
3.5 TRAINING
3.6 TESTING
3.6.1 Performance Testing
3.6.2 Acceptance Test

-- End of Section Table of Contents --

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USACE / NAVFAC / AFCEC / NASA | **UFGS-28 31 75.00 10 (November 2008)**

Preparing Activity: USACE | **Superseding UFGS-28 31 75.00 10 (April 2006)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

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SECTION 28 31 75.00 10

CENTRAL FIRE ALARM SYSTEM, DIGITAL ALARM COMMUNICATOR TYPE
11/08

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NOTE: This guide specification covers the requirements for digital alarm communicator type central fire alarm systems.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

****

PART 1 GENERAL

****

NOTE: This Section is to be used for the installation of a central monitoring system which will monitor the status of individual building fire alarm systems and transmit indication of abnormal conditions via dial-up telephone lines to a monitoring center. The specification may be used for new installations or replacement of existing systems.

The following information, if relevant, should be on the project drawings:

1. On electrical floor plans, show location of source of power to the monitoring center location, DACT, existing fire alarm panels, batteries and

charger, and primary power supply.

2. Show single-line system riser diagram. Each device on the riser should be provided with a device number indicating building number. Indicate connection of equipment by circuit runs, or conduit runs.

****

1.1 REFERENCES

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NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C62.41.1	(2002; R 2008) Guide on the Surges Environment in Low-Voltage (1000 V and Less) AC Power Circuits
IEEE C62.41.2	(2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits
IEEE C135.30	(1988) Standard for Zinc-Coated Ferrous Ground Rods for Overhead or Underground Line Construction

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code
NFPA 72	(2019; TIA 19-1; ERTA 1 2019) National Fire Alarm and Signaling Code

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-570	(2012c) Residential Telecommunications Infrastructure Standard

UNDERWRITERS LABORATORIES (UL)

UL 6	(2007; Reprint Sep 2019) UL Standard for Safety Electrical Rigid Metal Conduit-Steel
UL 467	(2013; Reprint Jun 2017) UL Standard for Safety Grounding and Bonding Equipment
UL 797	(2007; Reprint Mar 2017) UL Standard for Safety Electrical Metallic Tubing -- Steel
UL 1242	(2006; Reprint Aug 2020) Standard for Electrical Intermediate Metal Conduit -- Steel

1.2 SUBMITTALS

****

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a “G” to an item, if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

****

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Central Fire Alarm System; G[, [_____]]

Wiring for Systems; G[, [_____]]

SD-03 Product Data

Battery

Spare Parts

Registered Professional Engineer

Training

Test Procedures

SD-06 Test Reports

Testing

SD-07 Certificates

Equipment

Installer; G[, [_____]].

SD-10 Operation and Maintenance Data

Central Fire Alarm System; G[, [_____]].

1.3 QUALITY ASSURANCE

1.3.1 Qualifications

1.3.1.1 Registered Professional Engineer

Provide the services of a Registered Professional Engineer with at least 4 years of current experience in the design of fire protection and detection systems. Submit the qualifications, with verification of experience and license number, for this engineer.

1.3.1.2 Installer

Submit written certificate demonstrating that the central fire alarm system installer has been regularly engaged in the installation of fire detection and alarm systems meeting NFPA standards for a minimum of 3 years immediately preceding commencement of this contract. Documentation shall include proof of satisfactory performance on at least three projects similar to that required by these specifications, including the names and telephone numbers of using agency points of contact for each of these

projects. Documentation shall indicate the type of each system installed and include a written certificate that each system has performed satisfactorily in the manner specified for a period of not less than 12 months following completion. Data shall be submitted 30 days prior to commencement of installation. Listing of the installer under "Protective Signaling Services - Local, Auxiliary, Remote Station Proprietary (UUJS)" or under "Protective Signaling Services - Central Station (UUFX)" of the UL Fire Protection Equipment Directory will be accepted as equivalent proof of compliance with the foregoing experience requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

Protect equipment delivered and placed in storage from the weather, humidity and temperature variation, dirt and dust, and any other contaminants.

1.5 SPECIAL TOOLS AND SPARE PARTS

Furnish special tools necessary for the maintenance of the equipment. Submit spare parts data for each different item of material and equipment specified, not later than [_____] months prior to the date of beneficial use. Data shall include a complete list of parts and supplies with the current unit prices and source of supply and a list of the parts recommended by the manufacturer to be replaced after [1] [_____] years of service. Provide spare parts as follows: One spare set of fuses of each type and size required and five spare lamps of each for each transmitter location and for the receiver location. Spare fuses and lamps shall be mounted in the equipment cabinets at each location.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

2.1.1 Operation

Provide a central fire alarm system which is a complete, supervised system consisting of remote digital transmitters connected to building fire alarm panels and a digital receiver system at a central monitoring location. The system shall be activated into the alarm mode when an abnormal condition occurs in any building fire alarm system. The system shall remain in the alarm mode until the alarm is acknowledged and reset by the operator. Configure he central fire alarm system in accordance with NFPA 72. The transmitting equipment shall be compatible with receiving equipment and shall be UL listed or FM approved or shall be approved or listed by a nationally recognized testing laboratory, in accordance with the applicable NFPA standards. Tags with stamped identification number shall be furnished for keys and locks. Locks shall be keyed alike.

2.1.2 Alarm Functions

****

NOTE: Coordinate with the local fire department or other authority responsible for the central fire alarm system to determine which signal or signals are required to be transmitted to the fire alarm monitoring center.

****

An alarm, trouble or supervisory condition in any building which reports

to the fire alarm monitoring center shall automatically initiate the following functions:

a. Transmission of a signal by the digital alarm communicator transmitter (DACT). The DACT shall dial the programmed telephone number of the digital alarm communicator receiver (DACR) at the fire alarm monitoring center, and upon completion of the connection shall transmit the abnormal condition information. Upon failure to connect with the DACR, the DACT shall attempt to connect via the secondary telephone line.

b. Upon receipt of the signal at the fire alarm monitoring center the signal shall be decoded and status information shall be displayed on the monitoring center visual display indicating the nature of the status change.

c. An audible signal shall sound at the monitoring center until the alarm is acknowledged.

d. The alarm information shall be printed on the system printer at the monitoring center.

2.1.3 Supervisory Functions

Each DACT shall transmit a test signal a minimum of once every 24 hours. A trouble signal indicating that the test signal from any DACT is delinquent shall be annunciated at the monitoring center for any DACT test signal which is not received within 24 hours of its previous signal.

2.1.4 Primary Power

****

NOTE: Verify the existence of emergency power at the monitoring center location. Emergency power is mandatory at the monitoring center location but not required at transmitter locations.

****

Provide operating power as required by paragraph Power Supply for the System. Where emergency power is available at transmitter locations, transfer from normal to emergency power or restoration from emergency to normal power shall be fully automatic and shall not cause transmission of a false alarm. Loss of ac power at transmitter locations shall not prevent transmission of a signal to the monitoring center upon alarm from any building fire alarm system. Loss of ac power at the monitoring center shall not prevent reception and annunciation of received signals.

2.1.5 Battery Backup Power

Battery backup power for transmitting equipment and receiving equipment shall be through use of rechargeable, sealed-type storage batteries and battery charger.

2.2 STANDARD PRODUCTS

Provide material and equipment which are the standard products of a manufacturer regularly engaged in the manufacture of digital alarm communicator systems and that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service

organization that can provide service within 24 hours.

2.3 NAMEPLATES

Major components of equipment shall have the manufacturer's name, address, type or style, voltage and current rating, and catalog number on a noncorrosive and nonheat-sensitive plate which is securely attached to the equipment.

2.4 FIRE ALARM MONITORING CENTER

2.4.1 Digital Alarm Communicator Receiver (DACR)

Provide two identical DACR systems. Each system shall be completely assembled, wired and tested at the factory, and delivered ready for installation. The DACR shall be solid state design with receiver, signal to message decoder, audio alarm signaling devices, audio alarm silence switch, visual display, alarm reset switch, alarm recording printer, primary and emergency power supplies, power supply monitors, memory devices and necessary interconnecting cables. The DACRs shall be configured as one active unit and one backup unit. Provide programming, connections and switching such that the backup unit may be switched into service within 30 seconds of detection of failure of the active unit.

2.4.2 Audible Alarm

The audible alarm signaling devices used to indicate the receipt of fire alarm messages shall produce a unique sound. The device shall be internally mounted in the DACR and shall be activated upon receipt of all fire alarm signals. The audible device shall also be used to indicate the receipt of DACT trouble messages, including fire alarm system trouble and supervisor signals. The audible device shall continue to sound until acknowledged with the silence switch by the operator.

2.4.3 Receiver Code Format

The DACR shall be capable of receiving and decoding any of the following code formats:

Code Format	Speed (pulses per second)
3 X 1	20
4 X 1	20
4 X 2	20
3 X 1	10
3 X 1	40

2.4.4 Visual Display

****

NOTE: Listed displays are minimum requirements; if additional visual displays are required, they must

be added to the list.
****

Visual display shall be alphanumeric [LED or LCD] [cathode ray tube (CRT)] type. Display shall indicate as a minimum the originating transmitter identity code number and shall include the following message designations:

1. Fire
2. Trouble
3. Battery
4. Test
5. Tamper
6. Zone [_____] thru [_____]

2.4.5 Receiver Memory

Receiver shall have a history buffer capable of retaining a minimum of [64] [_____] Digital Alarm Communicator Transmitter (DACT) codes, together with the specific message designations associated with each DACT. The system shall annunciate any received message not matching the programmed DACT codes where such message identification code is not stored in the system. Upon command, the console shall display and print a summary of DACT which have transmitted a low-battery or trouble message, or failed to transmit a message during the previous 24 hour test period. Submit substantiating battery calculations for supervisory and alarm power requirements. Ampere-hour requirements for each monitoring center system component and each transmitter panel component; and the battery recharging periods shall be included. Battery calculations shall substantiate both NFPA 72 and specification requirements. Any incoming DACT signal shall pre-empt the command display and printout function, and shall be processed, displayed, and printed. The memory shall not be purged and shall always be current and available. Transmitter data memory shall not be lost in the event of a total loss of operating or emergency power supplies.

2.4.6 Receiver Supervision

The supervisory system shall provide constant supervision of the operating conditions of the DACR. Indicators shall be provided for each major component, and an audible signal shall be produced in the event of failure of any major component. A switch shall be provided to silence the audible trouble signal.

2.4.7 Manual Battery Test

A self-contained or externally-mounted switch shall manually place the receiver on emergency battery power for test purposes.

2.4.8 Telephone Line Connection

The DACR shall have connections for a minimum of 2 incoming telephone lines. Connections shall be 6-position, 4-conductor modular jacks as described in TIA-570.

2.4.9 Power Supply

****
NOTE: Locations with automatic backup power generation shall require as a minimum 4 hours

battery backup. Other locations shall require 48 hours.
****

The operating power for the DACR shall be single phase taken from the building electric service as specified in paragraph Power Supply for the System. Emergency backup power shall be provided by sealed lead-calcium type batteries requiring no additional water. The charging system shall recharge fully discharged batteries within 12 hours and maintain the batteries in the fully charged state. The battery shall have the capacity to operate the system for not less than [48] [4] hours under maximum normal load with the power supply to the charger disconnected.

2.4.10 External Connections

The DACR shall be provided with connections for an external printer and CRT terminal or personal computer (PC).

2.4.11 Self-Contained Printer

The DACR shall include a self-contained printer. Printer shall output a minimum of 32 characters per line and shall record all displayed transaction information including time and date.

2.5 MONITORING CENTER TERMINAL

****
NOTE: Monitoring center terminal should be used with large systems only.
****

The monitoring center terminal shall be PC based and shall be provided with an applications program to allow it to be connected to the DACR. The terminal shall display additional information about the building from which an alarm is received, detailed description of the current alarm, and alarm histories. The terminal shall provide operator interface with the Central Fire Alarm System. The terminal shall include a central processing unit with minimum 32 bit processor, 2 megabytes of Random Access memory, 355 mm 14 inch color monitor, 101 key keyboard, 89 mm 3-1/2 inch floppy disk drive and hard disk drive with sufficient capacity to store 6 months of transaction information.

2.6 MONITORING CENTER PRINTER

****
NOTE: Monitoring center printer should be used with large systems only.
****

The monitoring center printer shall be compatible with the monitoring center terminal and shall be used to record all transaction information and history reports. Printer shall be dot matrix type with minimum 9 pin printhead, shall use 216 mm 8-1/2 inch wide pin feed paper and shall print a minimum of 80 characters per line. Print speed shall be minimum 120 characters per second.

2.7 MONITORING CENTER POWER SUPPLIES

****

NOTE: Ensure that the monitoring center is provided with emergency backup power.
****

Each component of monitoring center equipment shall be provided with a self-contained power supply. An uninterruptible power supply (UPS) shall be provided for equipment which does not have a self-contained battery backup, such as the terminal and printer. The UPS shall provide all power requirements for the connected equipment for a period of 15 minutes. The UPS shall be in accordance with Section 26 33 53 STATIC UNINTERRUPTIBLE POWER SUPPLY (UPS).

2.8 DIGITAL ALARM COMMUNICATOR TRANSMITTER (DACT)

The DACT shall be compatible with the DACR, and shall comply with all requirements of NFPA 72. Each DACT shall be the manufacturer's current commercial product completely assembled, wired, tested at the factory, and delivered ready for installation and operation.

2.8.1 Functional Requirements

2.8.1.1 Interfacing Indicators and Controls

The DACT shall incorporate the provisions for auxiliary interconnection to existing building fire alarm systems. Connections shall be via screw terminals.

2.8.1.2 Signal Transmission

****
NOTE: Determine the availability and applicability of public switched telephone network lines or local PBX service for use in each project. Local PBX must be loop-start configuration to allow the DACT to operate properly. Telephone lines connected to the DACR must be configured for sequential hunting. Show the telephone lines to be used, on the Drawings.
****

The DACT shall initiate transmission using a loop-start format. The DACT shall connect to 2 telephone lines, shown on the Contract Drawings. To initiate a transmission, the DACT shall seize the primary telephone line, disconnecting any telephones, obtain a dial tone and dial the DACR. The DACT shall make a minimum of five attempts to connect to the DACR. If a connection is not made, the DACT shall attempt to connect to the DACR via the second telephone line. A failure of one telephone line shall report a trouble condition at the building fire alarm panel and at the monitoring center via the secondary telephone line. When the DACT makes a connection to the DACR, the required alarm or test information shall be transmitted. Confirmation of the signal shall be accomplished by repetition of the signal, parity checks or equivalent checksum-type transmission. Each DACT shall transmit a test signal a minimum of once every 24 hours. The DACT shall provide a minimum of 4 alarm input connections from the building fire alarm control panel.

2.8.2 Enclosure

****
NOTE: Show on the Contract Drawings specific

locations where a NEMA 4 (weatherproof) enclosure is to be used in lieu of NEMA 1.
****

A locking enclosure shall be provided for each DACT. The enclosure shall be of the NEMA type indicated on the Contract Drawings, or NEMA 1 where not indicated. The enclosure shall provide sufficient space for mounting the DACT, interfaces, power supply and backup batteries, wiring and terminal strips, including adequate space for maintenance access.

2.8.3 Digital Alarm Communicator Transmitter Interface Device

****
NOTE: If a DACT interface device is not required, delete this paragraph.
****

The DACT interface device shall provide a means of converting the signals available from the local control equipment into a form that is compatible with the DACT inputs, while still maintaining electrical supervision of the entire system. Interface devices shall be utilized when direct connection between local fire alarm control equipment and the DACT is not possible.

2.9 DIGITAL ALARM COMMUNICATOR TRANSMITTER POWER SUPPLY

Digital alarm communicator transmitters shall be powered by a combination of locally available 120 Vac, and sealed lead-calcium type batteries requiring no additional water. In the event of loss of 120 Vac power, the transmitter shall automatically switch to battery operation. The switchover shall be accomplished with no interruption of protective service, without adversely affecting the battery-powered capabilities, and shall cause the transmission of a trouble message in no less than [30] [_____] seconds. Upon restoration of ac power, transfer back to normal ac power supply shall be automatic and the battery shall be recharged. The battery charger shall be capable of restoring the batteries from full discharge to full charge within 12 hours. The converter/battery charger shall be installed within the transmitter enclosure. Power supply transient voltage surge suppression shall be provided.

2.9.1 Battery Power

The battery package shall be capable of supplying all the power requirements for a given DACT and DACT interface device.

2.9.2 Battery Duration

Digital alarm communicator transmitter standby battery capacity shall provide sufficient power to operate the transmitter in a normal standby status for a minimum of 48 hours and shall be capable of transmitting alarms during that period.

2.9.3 Battery Supervision

Each DACT shall constantly monitor and supervise its own battery-powered supply. A low-battery condition shall be reported when battery voltage falls below 75 percent of the rated voltage.

2.10 PERIPHERAL EQUIPMENT

2.10.1 Conduit

Conduit and fittings shall comply with UL 6, UL 1242, and UL 797.

2.10.2 Ground Rods

****

NOTE: Determine the size, type and number of ground rods to be used based on local conditions, earth resistivity data, and on the size and type of the electrical installation. Copper-clad steel rods will be specified for normal conditions. Zinc-coated steel or stainless steel rods will be used where low soil resistivities are encountered and galvanic corrosion may occur between adjacent underground metallic masses and the copper-clad rods. Stainless steel rods have a longer life than the zinc coated steel, but their use must be justified due to higher cost. Rods 16 mm 5/8 inch in diameter and 2.4 meters 8 feet in length are generally acceptable; however, in rocky soils 19 mm 3/4 inch rods must be specified. In high resistivity soils, 3 meter 10 foot or sectional rods should be used to obtain the required resistance to ground. Where rock is encountered, additional rods, a counterpoise, or ground grid may be necessary. Coordinate and standardize rod selection for individual facilities with other specification sections.

****

Ground rods shall be of [copper-clad steel conforming to UL 467] [zinc-coated steel conforming to IEEE C135.30] [solid stainless steel not less than [16] [19] mm [5/8] [3/4] inch in diameter by [2] [2.5] m [8] [10] feet in length] [of the sectional type].

2.10.3 Wiring

Wiring for 120 Vac power shall be No. 12 AWG minimum. Wiring for low voltage dc circuits shall be No. [16] [14] AWG minimum. Power wiring (over 28 volts) and control wiring shall be isolated. All wiring shall conform to NFPA 70. System field wiring shall be solid copper and installed in metallic conduit or electrical metallic tubing. Conductors shall be color coded. Conductors used for the same functions shall be similarly color coded. Wiring code color shall remain uniform throughout the circuit.

2.10.4 DACT Programmer

A programming device shall be provided for programming the required information in each DACT, if programming capability is not an integral part of the DACT. Required programming equipment, including the programmer, interconnect cables and adaptors, and power supply shall be provided. [Six] [_____] spare program chips shall be provided if removable program chips are used.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the work, verify all dimensions in the field and advise the Contracting Officer of any discrepancy before performing the work.

3.2 INSTALLATION

Work shall be installed as shown and in accordance with the manufacturer's recommendations. Necessary interconnections, services, and adjustments required for a complete and operational system shall be provided. Electrical work shall be in accordance with NFPA 70 and Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

3.2.1 Power Supply for the System

A single dedicated 120 volt, single phase branch-circuit connection for supplying power to the monitoring center equipment shall be provided as shown on the Contract Drawings. The backup power supply shall be automatically energized upon failure of the normal power supply. The primary power shall be supplied from a panelboard circuit breaker or disconnect switch which shall be red in color and locked in the energized position. Panel shall be marked "FIRE ALARM CIRCUIT CONTROL" with a rigid plastic nameplate. Transmitter 120 Vac power shall be extended from each building's fire alarm panel.

3.2.2 Wiring for Systems

Submit detailed point-to-point wiring diagram, signed by the registered professional engineer, showing all points of connection. Diagram shall include connections between monitoring center devices, transmitter location appliances, control panels, supervised devices, interfaces between building fire alarm equipment and transmitting equipment, and all equipment that is activated or controlled by the monitoring center equipment. Wiring for systems shall be installed in rigid conduit, intermediate metallic conduit, or electric metallic tubing. The conductors for central station alarm system shall not be installed in conduits, junction boxes, or outlet boxes with conductors of lighting and power systems. Conduit shall be 13 mm 1/2 inch minimum in accordance with NFPA 70. No more than one conductor shall be installed under any screw terminal. Circuit conductors entering or leaving any mounting box, outlet box enclosure or cabinet shall be connected to screw terminals with each terminal marked in accordance with the wiring diagram. Connections and splices shall be made using screw terminal blocks. Wire nut type connectors shall not be used in the system. Wiring within control equipment shall be readily accessible without removing component parts. Submit wiring diagrams as specified in the Submittals paragraph.

3.3 OVERVOLTAGE AND SURGE PROTECTION

Submit certified copies of current applicable approvals or listings issued by UL, FM or other nationally recognized testing laboratory showing compliance with specified NFPA standards. Equipment connected to alternating current circuits shall be protected from surges in accordance with IEEE C62.41.1, IEEE C62.41.2 and NFPA 70. Cables and conductors which serve as communications links, except fiber optics, shall have surge protection circuits installed at each end. Fuses shall not be used for

surge protection.

3.4 GROUNDING

Grounding shall be provided to building ground. Maximum impedance to ground shall be 25 ohms. If the maximum impedance to ground exceeds 25 ohms, ground rods shall be driven. Ground rods shall not protrude more than 150 mm 6 inches below grade and shall be bonded to building ground.

3.5 TRAINING

Provide training course for the operations and maintenance staff. Conduct the course in the building where the monitoring center is installed or as designated by the Contracting Officer. Submit lesson plans and training data, in manual format, for the training course. The operations training shall familiarize designated Government personnel with proper operation of the system. The maintenance training course shall provide the designated Government personnel adequate knowledge required to diagnose, repair, maintain, and expand functions inherent to the system. The training period shall consist of [3] [_____] training days (8 hours per day) and shall start after the system is functionally completed but prior to final acceptance tests. Training shall be provided for [_____] personnel. The instructions shall cover all of the items contained in the operating and maintenance instructions.

3.6 TESTING

Notify the Contracting Officer 30 days before the performance and acceptance tests are to be conducted and submit the detailed test procedures to be used, signed by the registered professional engineer for the central fire alarm system [30] [_____] days prior to performing system tests. The test procedures shall be signed by the Registered Professional Engineer. Perform the tests in the presence of the Contracting Officer under the supervision of the central fire alarm system manufacturer's qualified representative. Furnish all instruments and personnel required for the tests.

a. Submit detail drawings, signed by the registered professional engineer, consisting of a complete list of transmitting and receiving equipment, auxiliary equipment and material, including manufacturer's descriptive and technical literature, catalog cuts, description of the procedure for switching from the primary DACR to the backup DACR, and installation instructions. The detail drawings shall also contain transmitting equipment panel layout, monitoring center equipment layout, and any other details required to demonstrate that the system has been coordinated and will properly function as a unit.

b. Submit [6] [_____] copies of operating instructions outlining step-by-step procedures required for system startup, operation, and shutdown. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of the equipment and basic operating features.

c. Submit [6] [_____] copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs and troubleshooting guide. The instructions shall include conduit layout, equipment layout, simplified wiring control diagrams of the system as installed, and programming of DACT and DACR equipment. Instructions shall be approved prior to training.

d. Submit test reports in booklet form showing field tests performed to prove compliance with the specified performance criteria, upon completion and testing of the installed system. Each test report shall document readings, test results, and indicate the final position of controls.

3.6.1 Performance Testing

Upon completion of the installation, subject the system to a complete functional and operational performance test to determine that the system is free from grounded, shorted, or open circuits. When all corrections have been made, the system shall be retested to assure that it is functional. Submit copies of performance test reports in accordance with paragraph SUBMITTALS.

3.6.2 Acceptance Test

****

NOTE: Listed tests are minimum required. If additional tests are required such tests must be added to the list.

****

Testing shall be in accordance with NFPA 72. The recommended tests in NFPA 72 shall be considered mandatory and shall verify that all previous deficiencies have been corrected. The tests shall include the following:

a. Tests to indicate there are no grounded, shorted, or open circuits.

b. Tests of each input to each digital alarm communicator transmitter, including transmission of trouble and alarm signals across both the first and second telephone lines at each location and proper reception at the monitoring center.

c. Tests of DACR, terminal and printer for all required functions.

d. Tests of normal and emergency power supplies, including batteries. Tests shall include verification of complete system operation at extreme end of the required emergency power duration, and verification of recharging time.

-- End of Section --