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DEPARTMENT OF DEFENSE
INTERFACE STANDARD

SUBSYSTEM, EQUIPMENT, AND INTERFACE STANDARDS FOR COMMON LONG HAUL AND TACTICAL TELECOMMUNICATIONS CONTROL FACILITIES

AMSC N/A

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FOREWORD

1. This standard is approved for use by all Departments and Agencies of the Department of Defense (DoD).

2. In accordance with DoD Instruction 4630.8, it is DoD policy that all forces for joint and combined operations be supported through compatible, interoperable, and integrated command, control, communications, and intelligence (C3I) systems. Furthermore, all C3I systems developed for use by US forces are considered for joint use. The Director, Defense Information Systems Agency (DISA), serves as the DoD single point of contact for developing information technology standards to achieve interoperability and compatibility. All C3I systems and equipment shall conform to technical and procedural standards for compatibility and interoperability, as developed or recommended by DISA.

3. MIL-STDs in the 188 series (MIL-STD-188-XXX) address telecommunications design parameters based on commercial off-the-shelf (COTS) technologies and are used in all new DoD systems and equipment, or major upgrades thereto, to ensure interoperability. The MIL-STD-188 series is subdivided into a MIL-STD-188-100 series covering common standards for tactical and long haul communications, a MIL-STD-188-200 series covering standards for tactical communications only, and a MIL-STD-188-300 series covering standards for long haul communications only. Emphasis is being placed on developing common standards for tactical and long haul communications published in the MIL-STD-188-100 series. MIL-STD-188 series may be based on, or make reference to, American National Standards Institute (ANSI) standards, International Telecommunications Union - Telecommunications Standardization Sector (ITU-T) recommendations, International Standards Organization (ISO) standards, North American Treaty Organization (NATO) standardization agreements (STANAG), and other standards, wherever applicable.

4. This standard establishes physical and functional interface requirements for digital and analog equipments in telecommunications control facilities (formerly technical control facilities) for both long haul and tactical environments. This standard supersedes MIL-STD-188-154: Subsystem, Equipment, and Interface Standards for Common Long Haul and Tactical Technical Control Facilities.

5. Comments, suggestions, or questions on this document should be addressed to the preparing activity listed in the ASSIST Online database at https://assist.dla.mil.

SUMMARY OF CHANGE 1 MODIFICATIONS

1. Updated the current preparing activity contact information and changed the Uniform Resource Locator (URL) for the Acquisition Streamlining and Standardization Information System (ASSIST) database within the document.

2. Updated references to applicable current standards: ANSI C2 is replaced by IEEE C2, National Electrical Safety Code, and National Fire Protection Agency, NFPA-70-2014, National Electrical Code.

3. Removed DD Form 1426 as this form is no longer needed.

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FIGURE

1. SCOPE

1.1 Scope. This standard establishes physical and functional interface requirements for long haul and tactical telecommunications control facilities (formerly technical control facilities) in the Department of Defense (DoD). As used in this standard, the term telecommunications control facility (TCF) includes patch and test facilities (PTFs) and interfaces to locations that provide centralized monitoring and control functions for other telecommunication locations.

1.2 Applicability. This document establishes standards applicable to all facilities that perform or will perform functions associated with control of telecommunications systems. These functions are detailed in paragraph 4.1. New TCFs and those undergoing modification or rehabilitation must conform to these standards subject to the applicable requirements of current procurement regulations.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this standard. This section does not include documents cited in other sections of the standard, recommended for additional information, or as examples. While every effort has been made to ensure the completeness of the list, document users are cautioned that they must meet all specified requirements documents cited in sections 3, 4, and 5 of this standard, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein.

STANDARDS

FEDERAL

FED-STD-1037	Glossary of Telecommunications Terms

DEPARTMENT OF DEFENSE

MIL-HDBK-419 Volumes I & II	Grounding, Bonding, and Shielding for Electronic Equipments and Facilities
MIL-STD-461	Electromagnetic Emission and Susceptibility Requirements for the Control of Electromagnetic Interference

(Unless otherwise specified, the issues of these documents are those found within the Acquisition Streamlining and Standardization Information System (ASSIST) database at https://assist.dla.mil .)

2.2.2 Other government documents, drawings, and publications. The following other government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

DEFENSE INFORMATION SYSTEMS AGENCY PUBLICATIONS

DISAC 310-70-1	Defense Communications System Technical Control - Operational Policies and Procedures for FCO/NCO's and TCF/PTF's
DISAC 310-175-9	Defense Communications System Operating-Maintenance Electrical Performance Standards

(Copies of DISAC 310-70-1 and DISAC 310-175-9 are available from the Defense Information Systems Agency, 701 Courthouse Road, Arlington VA 22204-2199.)

2.3 Non-government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	National Electrical Safety Code

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI T1.101-1994	Synchronization Interface Standard
ANSI T1.210-1993	Operations, Administration, Maintenance, and Provisioning - Principles of Functions, Architectures, and Protocols for Telecommunications Management Network (TMN) Interfaces
ANSI/EIA-310-D	Cabinets, Racks, Panels, and Associated Equipment
ANSI/IEEE-488-1987	Standard Digital Interface for Programmable Instrumentation

(Application for copies should be addressed to the American National Standards Institute, 11 West 42nd Street, New York NY 10036.)

ELECTRONICS INDUSTRIES ASSOCIATION (EIA) TELECOMMUNICATIONS INDUSTRIES ASSOCIATION (TIA)

EIA/TIA-530-A	High Speed 25-Position Interface for Data Terminal Equipment and Data Circuit-Terminating Equipment

(Application for copies should be addressed to Telecommunications Industries Association, Standards and Technology Department, 2001 Pennsylvania Ave., NW, Washington DC 20006.)

NATIONAL FIRE PROTECTION AGENCY

NFPA-70-2014	National Electrical Code

(Application for copies should be addressed to National Fire Protection Association, Batterymarch Park, Quincy MA 02269.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. DEFINITIONS

3.1 Acronyms used in this standard. The acronyms used in this standard which are not included in FED-STD-1037C or are unique to this standard, are defined as follows:

a. CMCF - Centralized Monitoring and Control Facility

b. CSU - Channel Service Units

c. DISAC - Defense Information Systems Agency Circular

d. DoD - Department of Defense

e. EIA - Electronic Industries Association

f. FCO - Facility Control Office

g. GPS - Global Positioning System

h. IEEE Institute of Electrical and Electronics Engineers

i. NCC - Network Control Center

j. NMC - Network Management Center

k. NOC - Network Operations Center

l. QAVP - Quad Analog Voice Port

m. QCTC - Quality Control Test Center

n. RCC - Regional Control Center

o. RMC Remote Management Center

p. TCF - Telecommunications Control Facility

3.2 Access point. An electrical point for monitoring, testing, and rerouting of signals. This may be manual, such as patch panels, or automated, such as electronic or electromechanical patching systems. In modern equipments, it may also be a point integrated into the system.

3.3 Centralized monitoring and control facility (CMCF). A facility that provides automated monitoring and management of communications systems, normally from a location separate from the telecommunications control facility interfaces. These facilities are commonly referred to as a Network Operations Center (NOC), Network Control Center (NCC), or Remote Management Center (RMC).

3.4 Patch and test facility (PTF). A telecommunications control facility associated with a single subsystem specific to a transmission medium. It contains all the access points and equipment required to perform the functions of monitoring, testing, restoring, and rerouting circuits for that subsystem.

3.5 Telecommunications control facility (TCF). A physical location providing a central point for user equipment interface, trunk distribution, and quality control of the communications circuits in a network. It contains all the access points and equipment required to perform the functions of monitoring, testing, restoring, and rerouting circuits for the supported network(s).

3.6 Transmission access. An access point at which all circuits have been conditioned for equal transmission level point. Digital circuits are conditioned to equal levels and balanced and unbalanced operation. These standard levels permit like VF circuits to be rerouted or multiplexed without additional conditioning. This access is electrically located between conditioning equipment and the next applicable equipment item.

3.7 User access. The access providing the first appearance of local digital and analog circuits in the Telecommunications Control Facility.

4. GENERAL REQUIREMENTS

4.1 General description of a telecommunications control facility. This section contains general information on the functions and requirements for those facilities serving both long haul and tactical communications systems.

4.1.1 General. Telecommunications control is a key element of any communications system or network. TCFs are the focal points for control functions such as distribution of trunks, equipment interfaces, and quality control of the communications circuits in a network. These functions may be contained in a single facility or at interconnected facilities. As equipment reliability has improved and automation has increased, the monitoring of these control functions are being done at Centralized Monitoring and Control Facilities (CMCF). This has allowed many facilities to become unmanned.

4.1.2 Functions. Telecommunications control functions are performed at the interfaces between all major transmission media and subscriber equipment (switchboards, data devices, modems, and telephone instruments used for point-to-point circuits). The following paragraphs detail the primary functions of TCFs.

4.1.2.1 Facility capabilities. TCFs are configured and engineered to facilitate use of the equipment resources to efficiently perform daily functions of coordination, fault isolation, quality control, and restoral and rerouting of circuits. These facilities enable personnel to effectively satisfy the requirements of DISAC 310-70-1 including:

a. Knowing the status and quality of designated transmission links, trunks, circuits, and communications equipment.

b. Taking immediate action on any deterioration or failure within the communications system.

c. Restoring service expeditiously.

d. Responding to changes in mission requirements.

4.1.2.2 Network management. The traditional functions performed by TCFs support the broader goals of modern network management. As these traditional functions continue to become more automated, they will become more integrated into network management concepts. New installations should take into consideration automation when developing requirements. This will help to ensure a smooth transition. ANSI T1.210-1993 describes network management functions in terms of the five categories of the OSI network management model:

a. Performance management consists of a set of functions to monitor, evaluate, and report on the behavior of managed network elements.

b. Fault management consists of a set of functions to detect, isolate, and correct abnormal operations.

c. Configuration management consists of a set of functions to exercise control over, identify, collect data from, and provide data to network elements for the purpose of providing continuous operation of services.

d. Accounting management consists of a set of functions to measure the use of network services.

e. Security management is a set of functions to protect the network and systems from unauthorized access.

4.1.2.3 Relationships between facilities. The TCF serves as the focal point for connection to all types of users and systems. For example, the TCF provides the interface between long haul and tactical communications systems. TCFs typically provide major reconfiguration and restoral capabilities on a system basis. Within these large networks, many large subsystems (such as telephone switches, message switches, satellite terminals, etc.) are provided with their own control capabilities through a PTF. The PTF is normally associated only with that subsystem and contains the equipment needed to monitor and test that subsystem for maintenance purposes. Many TCF and PTF telecommunications control and monitoring functions are commonly handled at CMCFs.

4.1.3 Organization. TCFs shall serve as the focal points for system control in long haul and tactical communications systems. TCFs shall be designed to enable system control personnel to effectively exercise assigned responsibilities. TCFs may perform both Defense Communications System (DCS) and non-DCS system control functions.

4.1.4 Design baseline. The ultimate goal of the design baseline criteria is to establish an operational environment to optimize circuit quality, reliability, and restoration. Primary consideration shall be given to the following:

a. Capability to determine, log, and report status information of circuits, links, and trunks within the assigned area of responsibility by providing orderwire circuits, status monitoring, and quality monitoring equipment.

b. Rapid restoral and rerouting on a priority basis in accordance with established procedures.

c. Interface of circuit segments.

d. Quality control and fault isolation capability including incorporation of test points to allow for the rapid test and replacement of circuit segments or elements at all levels in the communication hierarchy.

e. Use of automated telecommunications control test and monitoring equipment.

f. Voice and data interface requirements with other system control elements.

4.1.5 Major elements. The facility may include, but is not limited to:

a. Digital and analog equipment with automated and manual access points.

b. Conditioning capabilities.

c. Orderwire circuits and intercommunications systems capabilities.

d. Circuit distribution frame capability.

e. Internal alarm system capabilities.

f. Power sources - alternating current (AC) and direct current (DC) capabilities.

g. Communications security capabilities.

h. Digital signal timing.

4.2 General considerations. The following provisions shall apply to long haul and tactical TCFs.

4.2.1 General configuration. The electrical configuration of all TCFs within a given system shall be the same whether the facility is located at a transmission nodal point or terminal point. However, the electrical and physical configuration of TCFs serving long haul and tactical systems may differ due to system missions and space limitations.

4.2.1.1 Electrical configuration. Figure 1 illustrates the prescribed electrical configuration for a modern digital TCF. The configuration of equipment illustrated in this figure shows the interrelationship among major equipment and patching facilities and the signal flow involved in the overall telecommunications control function. TCFs may have some or all functions automated or remotely controlled. This is a design objective for long haul TCFs and should be developed for both long haul and tactical environments. Electronic equipment may combine several telecommunications control functions in one physical unit.

4.2.1.2 Physical configuration. TCF equipment and facilities shall be configured to make effective use of available space while allowing for human engineering considerations (see 4.2.6), cost, technical considerations, and expansion capabilities.

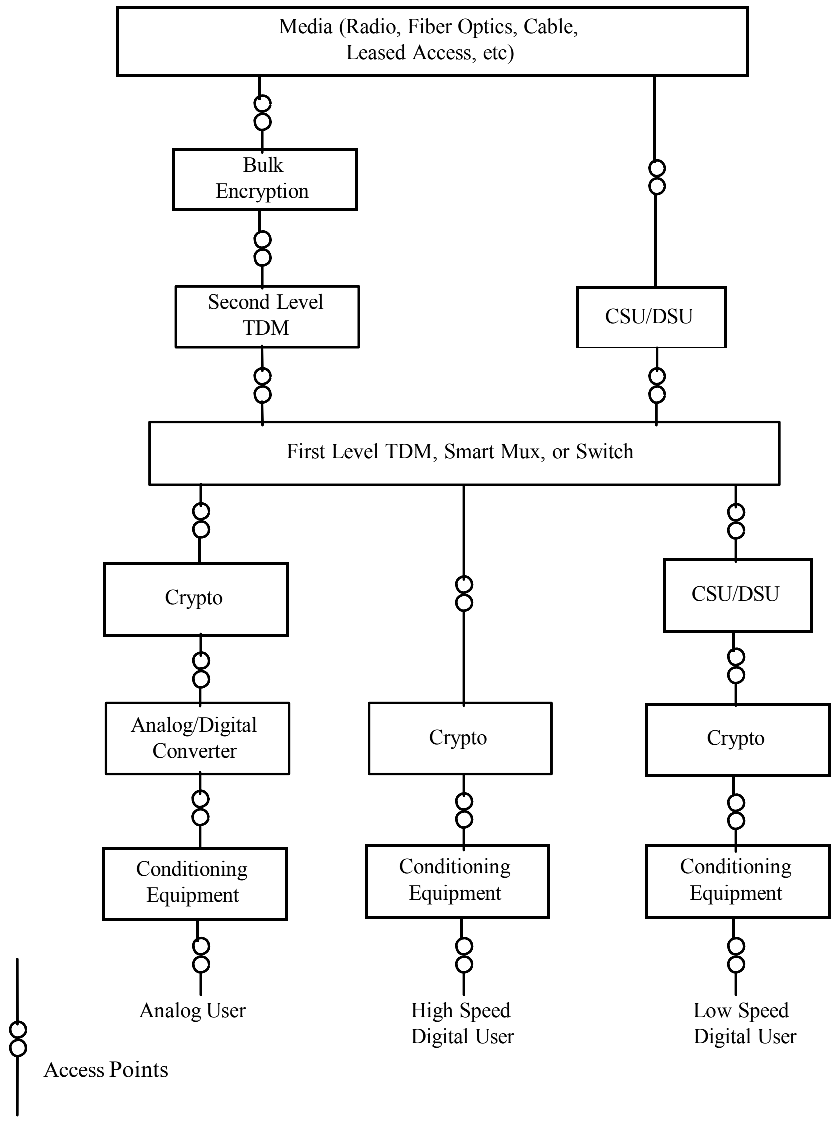

FIGURE 1. Modern telecommunication control facility electrical configuration.

4.2.2 Installation, fabrication, and construction. The construction standards in the following paragraphs shall apply to all TCFs.

4.2.2.1 Modularity. All patching facilities, test equipment, conditioning equipment mounting shelves, and paneled equipment such as orderwire circuit terminations, alarm panels, and fuse panels shall be designed to mount in standard electrical cabinets and racks conforming to ANSI/EIA-310-D.

4.2.2.2 Physical access. Electronic equipment shall be operable in extended position (as with an extender card) for maintenance.

4.2.2.3 Test equipment. Where practical, all test equipment shall employ digital readout displays and be capable of providing a serial or parallel data communications interface allowing remote control and remote reporting of test results. Serial data communication interfaces shall conform to EIA/TIA-530. Parallel interfaces shall conform to ANSI/IEEE 488-1987. For those cases where the quantity being measured is continuously variable in nature, conventional scale and pointer instruments may be provided. Where practical, automated performance monitoring equipment and measurement instruments with recording capability shall be used.

4.2.2.4 Cabling. Signal, clock, and control cables employed in the TCF shall have a minimum of one overall shield per cable. Power distribution lines shall not be contained in the same cable as lines carrying information signals. TEMPEST test results or unique equipment or system characteristics may dictate additional special cable requirements.

4.2.2.5 Cabinet cabling. Cable clamps and ties shall be used to bundle the cables and attach them to cabinet frame members. The cabling shall be installed to permit all doors and sliding units to operate freely without binding, scraping, or in any way wearing or damaging the cables.

4.2.2.6 Interconnecting cables. All cables entering or leaving equipment cabinets shall go through the top or bottom of the cabinets. In instances in which cabinets are butted together (either with or without side panels), cables may be passed in a bundle through the sides of the cabinets. All cables entering or leaving cabinets shall be numbered. The number shall be clearly marked on or attached to each end of all cables.

4.2.2.7 Connectorized cables. Connectorized cables shall be used to the fullest extent practical.

4.2.2.8 Cabling layout plans. The cabling layout plan shall allow for routing of signal, power, and grounding cables between the various equipment cabinets, patch facilities, distribution frames, and power plant equipment. Cables shall be routed in overhead or sub-floor, open or enclosed, raceways, racks, or ducts.

4.2.3 Criteria for facility equipment. Facility plans shall support current circuit installations and all identified programmed requirements.

4.2.3.1 Expansion. Expansion capability shall be provided for long haul TCFs. Expansion rates should be based on all determinable factors, including:

a. Life expectancy (station and equipment).

b. Circuit growth.

c. Technological forecasts.

d. Long range plans.

e. In the absence of determinable factors, use 25% as the factor for growth in floor space, frame space, utilities, and station battery, up to the total transmission media capacity entering or exiting the facility.

4.2.3.2 Standbys. Manual or automated access, circuit conditioning, interfacing, and ancillary equipments shall be furnished and installed to:

a. Allow for the substitution of units that are out of service because of facility test and maintenance. Proportions of standbys for this purpose shall be based on the quantity of station equipment and the schedule for test and maintenance.

b. Allow for the substitution of equipment strings (circuit or wideband segments) as they occur between patch panel appearances. Because such equipment shall be used to replace strings of equipment, numbers are not to be calculated on a per unit basis for this requirement. Long haul TCFs shall be so wired and equipped that there shall be at least one standby string for every 10 strings (or portions thereof) of the same configuration, with a minimum of two standby strings of each configuration that has at least three strings.

4.2.4 Grounding, bonding, and shielding. The construction of the facility ground system shall comply with the approved grounding, bonding, and shielding methods and techniques. Guidance for grounding, bonding, and shielding may be found in MIL-HDBK-419.

4.2.5 Electromagnetic compatibility. Electromagnetic compatibility and interference control shall be considered in all stages of TCF design. New systems, subsystems, and equipment procured for use in TCFs shall satisfy the applicable requirements of MIL-STD-461.

4.2.7 Equipment interfaces. Equipment items or systems within a TCF shall have a common interface to meet restoration and rerouting criteria. Interface standards for common requirements have been developed by several organizations. These include TIA/EIA-530-A, TIA/EIA-422, TIA/EIA-433, ITU-TSS V.35, or MIL-STD-188-114A. Within a facility, common interface standards shall be selected for each patching application. When specific equipment items or transmission media interfaces must be used, converters shall be installed to keep all physical patching identical within the facility.

4.2.8 Station power. The TCF shall be provided with a power generating source, an auxiliary power source, and a power distribution system to accommodate technical and non-technical requirements. All electrical power subsystem installations shall adhere to NFPA-70, National Electrical Code, and applicable regulations imposed by host nation or local authority. The TCF shall be provided with sufficient AC and DC power sources, both in quantity and capacity, to satisfy all power requirements for installed equipments and planned expansion capability (see paragraph 4.2.3). Electrical power shall be provided at all voltages necessary, and, when required, shall support separate RED and BLACK systems. The equipment comprising the critical technical load within the facility shall be supplied with no-break power sufficient to maintain operation for at least 60 minutes in manned facilities and at least 8 hours at unmanned locations. Certain equipment with critical power requirements in excess of these times may be equipped with separate uninterruptible power supplies. Tactical TCFs are not required to meet these no-break power standards but shall have as much battery backup as weight and space constraints allow. When storage batteries of the acid or alkaline electrolyte type are employed, the provisions of ANSI C2-1997 shall be followed.

5. DETAILED REQUIREMENTS

5.1 General. This section contains detailed installation requirements for subsystems, equipment, and communications interfaces in TCFs.

5.1.1 Automation. There shall be a centralized TCF for connection to long haul media, but, this also may be controlled from the central control facility. As facilities continue to change to modern automated systems, telecommunications control concepts will become more integrated with the network management functions described in paragraph 4.1.2.3.

5.1.2 Access points. The TCF shall employ specific digital and analog access points throughout the circuit path to permit routing, testing, and monitoring functions. These access points shall be grouped by the function to be performed. As a design objective, patch panels should only be used when there are no other means available. Figures in this section that refer to integrated access points are referring to those access points that are part of the automated equipment but not necessarily physically accessible.

5.2 System interoperability. The TCF is the primary location for interfacing between communications systems. The capability for interoperating different systems may be required for alternate routing or extending communications circuits.

5.2.1 System interconnections. TCFs serving as system interconnect points shall be able to provide physical and electrical conditioning to ensure proper interface among the systems being connected. This conditioning shall be accomplished so that the circuit parameters resulting from the interconnection will conform to the established standards of the connected system.

5.2.2 Interfacing methods. Systems will normally be interfaced at the circuit or bit-stream level.

5.2.2.1 Digital circuit interfacing. Digital circuit interfacing may require protocol and interface converters (e.g., unbalanced to balanced interfaces). This equipment shall be located as close to the source of the nonstandard equipment as possible to limit the nonstandard circuit access appearances in the station.

5.2.2.2 Analog circuit interfacing. Analog circuit interfacing may require conditioning equipment such as amplifiers, pads, transformers, repeat coils, amplitude and delay equalizers, and analog/digital converters. This equipment shall be installed in accordance with paragraph 5.3.1.2.

5.2.2.3 Bit-stream interfacing. Bit-stream interfacing shall use matrix switching equipment or smart multiplexing equipment.

5.2.3 Tactical interfaces. Tactical systems can interface with the DCS through either High Frequency (HF) DCS entry stations, satellite, or direct physical connection to a cable entry panel. TCFs designated as HF DCS entry stations shall be provided with the equipment necessary to interface HF circuits to voice and data systems. Fixed TCFs required to directly connect to tactical control facilities shall provide an outside cable entry panel to terminate interconnect cables. The cable entry panel shall be located to allow transportable vehicles housing tactical control facilities ready access to the panel.

5.3 Facility circuit configurations. Where both digital and analog media support is required, the circuits shall be wired dependent on the media used for each circuit or circuit segment. In most cases, incoming analog circuits are converted to digital format to enable multiplexing and switching equipment to be used to reduce patch panel requirements. Throughout this section, the terms distribution frame and access point are used. Distribution frame refers to a traditional cross connect wiring frame, wall-mounted punch blocks, or circuit connection points for automated circuit distribution equipment such as the digital access cross connect system (DACCS). Access points may be either a traditional patch panel line jack or an electronic test and monitoring access point. Electronic access points shall be used wherever possible. In modern digital equipment, the access point may also be integrated to the equipment.

5.3.1 Digital circuits. The following paragraphs describe the specific interface points at which access to digital circuits shall be employed.

5.3.1.1 User connections. Local digital circuits normally first appear at the station at a commercial point of presence (POP) or on a distribution frame. Circuits originating within the station should be cabled directly to the distribution frame. From the distribution frame, the circuit shall be wired to a circuit access point to allow circuit quality control testing between the TCF and the user. The equipment side of the circuit access point shall be wired back to the distribution frame for cross-connection to the required interface equipment string. Figure 2 shows the normal circuit flow for the user access portion of a commercial circuit, a circuit entering the facility via base cable, and a circuit originating on in-station equipment. All circuit leads shall be cross connected and shall appear at the user access point.

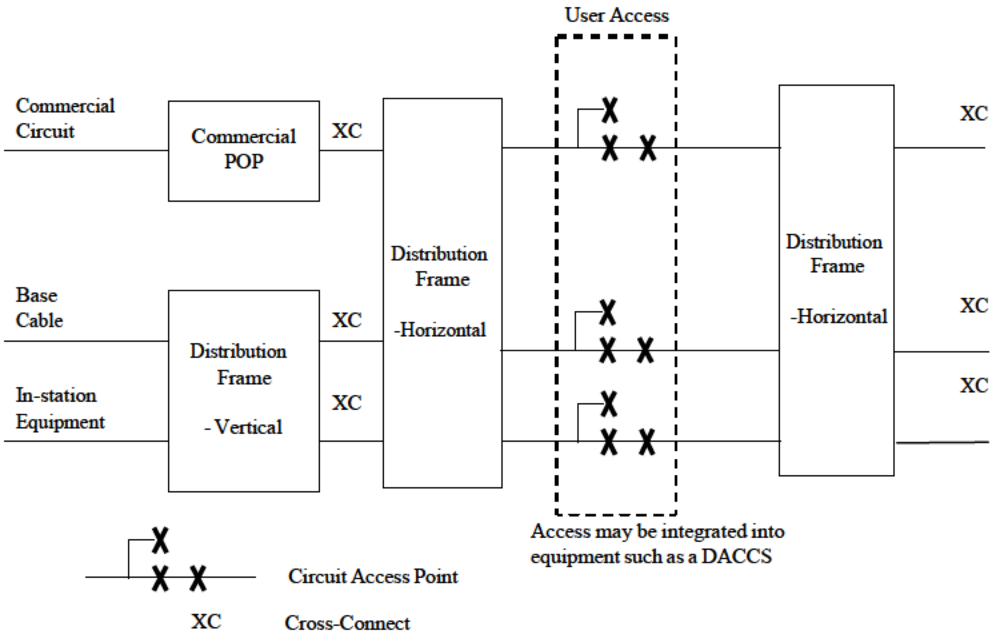

FIGURE 2. Digital circuit - user access portion.

5.3.1.2 Interface equipment. The circuit shall be wired from the distribution frame to the required interface equipment string. This string shall include line access equipment (channel service units/data service units (CSU/DSUs), modems, line drivers, etc.), conditioning equipment (regenerative repeaters, protocol converters, etc.), and cryptographic equipment as required. Capabilities for circuit testing and patching shall be provided between each piece of equipment to allow for fault isolation and equipment substitution. This may be achieved by wiring back to a distribution frame for connection to manual patch panels or electronic access points or by using access points integral to the installed equipment. After transiting the interface string, the circuit will be in a format suitable for connection to a multiplexer, digital switch, cable access equipment, or commercial access equipment. The circuit shall then be wired to the distribution frame for connection to the next applicable equipment item. Figure 3 shows the normal circuit flow for the interface equipment portion of a digital circuit. All circuits leads shall be cross connected and shall appear at the circuit access point.

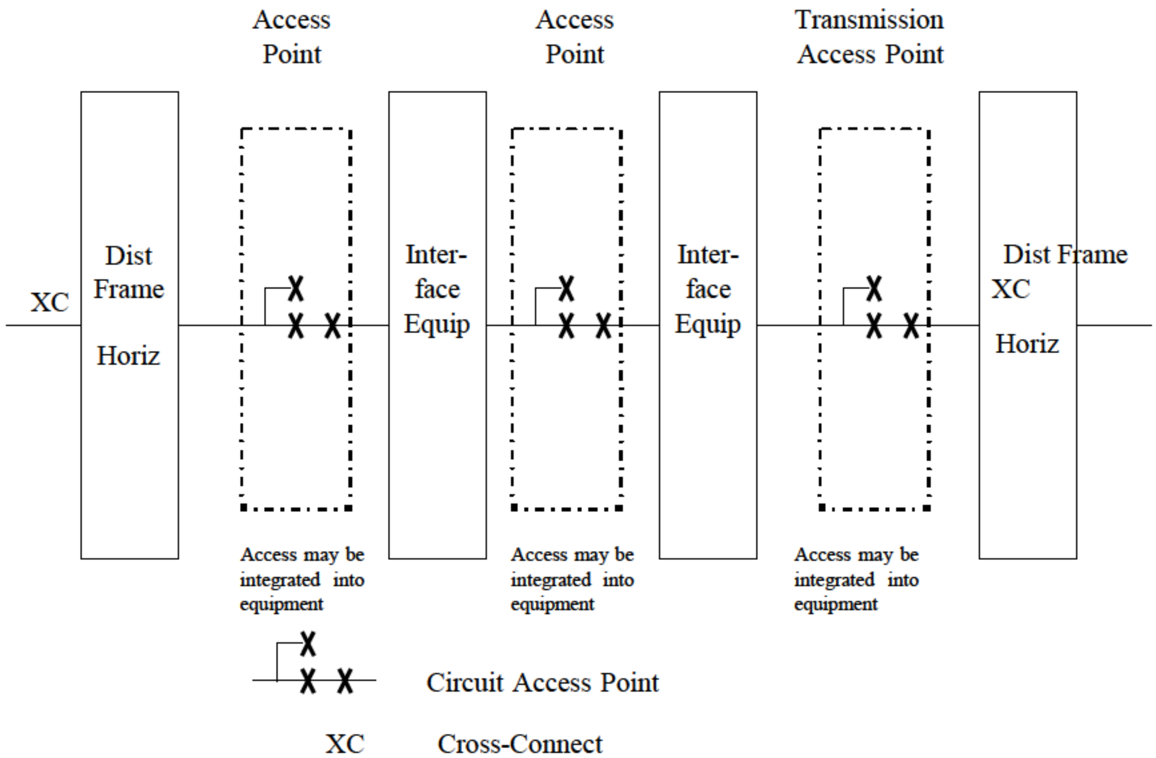

FIGURE 3. Digital circuit interface equipment string.

5.3.1.3 Switches. Digital switches used as terminating or routing switches shall be wired from the distribution frame to the circuit access port of the switch. Provisions shall be made for testing both the circuit traffic and the physical path. The output from the switch will be wired to the distribution frame for connection to a multiplexer, access equipment, or local user distribution equipment. Figure 4 shows the normal circuit flow and required access points for installation of a digital switch.

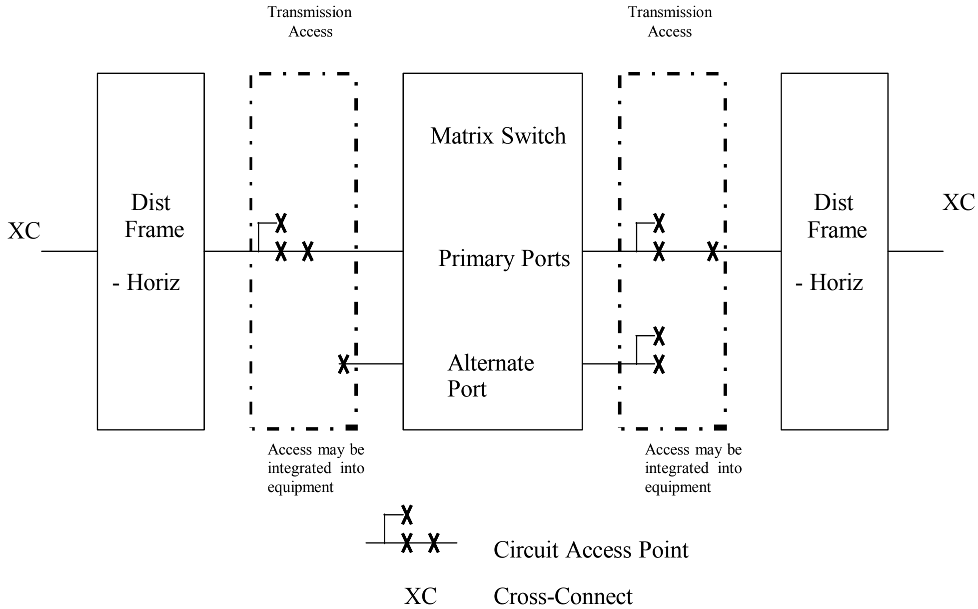

FIGURE 4. Matrix switch and required access points.

5.3.1.4 Multiplexers. The type of multiplexer used on a circuit depends on the circuit characteristics and the eventual routing of the circuit.

5.3.1.4.1 Multiplexing. Low speed circuits may be routed to multiplexer equipment to be combined with other circuits. The circuit shall be wired from the distribution frame to the circuit access point associated with the proper port of the multiplexer. Provisions shall be made for testing both the circuit traffic and the physical path. The output of the multiplexer shall be wired to a distribution frame for connection to a higher level multiplexer, matrix switch, cable access equipment, commercial access equipment, or interface equipment for distribution to a local user. Figure 5 shows the normal circuit flow and access required for connection to a multiplexer.

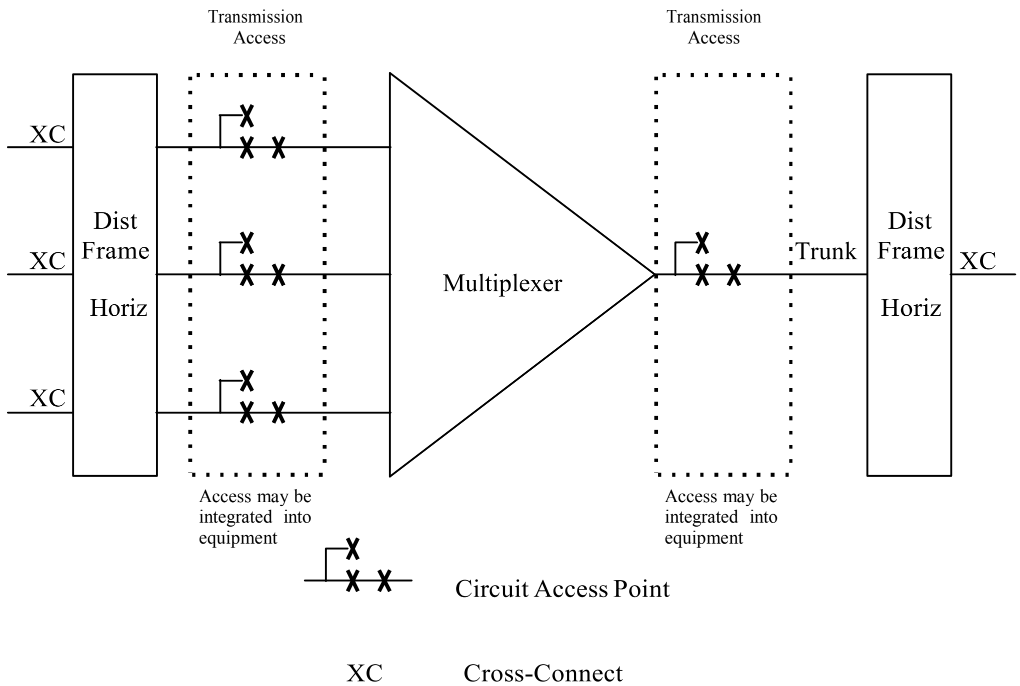

FIGURE 5. Multiplexer connections.

5.3.1.4.2 Smart multiplexer. A circuit connected to a smart multiplexer shall be wired from the distribution frame to the circuit access point associated with the proper port of the multiplexer. High priority circuits may be provided with automatic switchover to an alternate port, in lieu of a physical patch. Provisions shall be made for testing both the circuit traffic and the physical path. The inputs to the multiplexer may be original digital circuit, output of the conditioning string, multiplexed output from another multiplexer, output of a matrix switch, or interswitch trunk output of a digital switch. The output of the multiplexer shall be wired to a distribution frame. Figure 6 shows the normal circuit flow and access required for connection to a smart multiplexer.

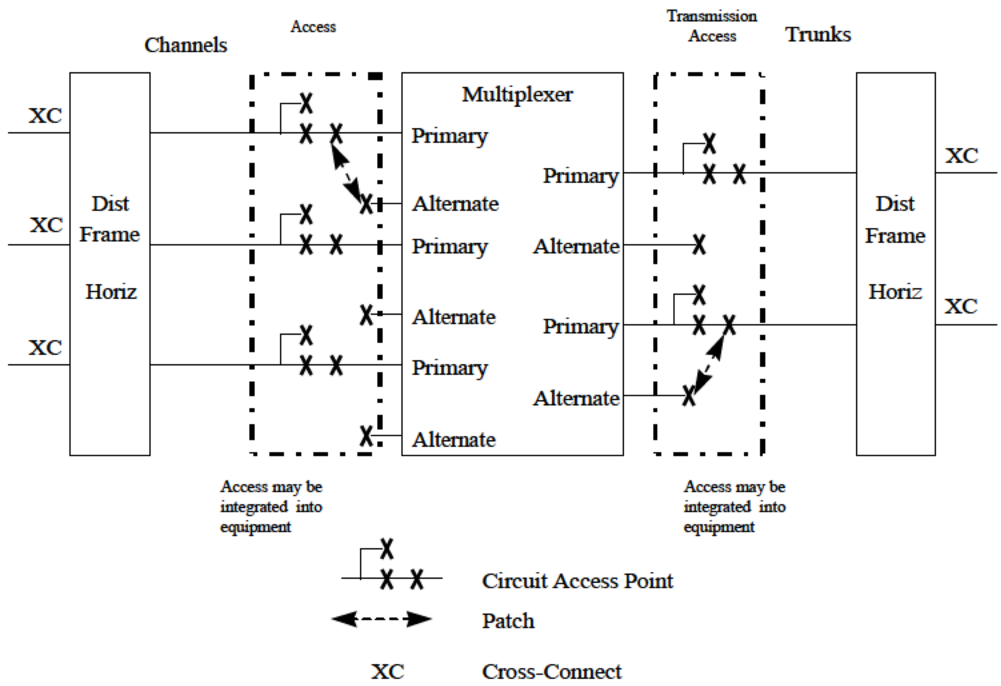

FIGURE 6. Smart multiplexer connections.

5.3.1.5 Media access. Media access can be provided via CSU/DSU, fiber modem, commercial interface equipment, or a second-level TDM. Transmission encryption equipment may be used with any of these. Circuits shall be wired from the distribution frame to the circuit access point associated with the media access equipment. If transmission encryption equipment is used, access points shall be available for quality monitoring and equipment patching. Circuits shall then be routed to the appropriate distribution frame or commercial POP for connection to the transmission media. Figure 7 shows the normal circuit flow for connection through media access equipment.

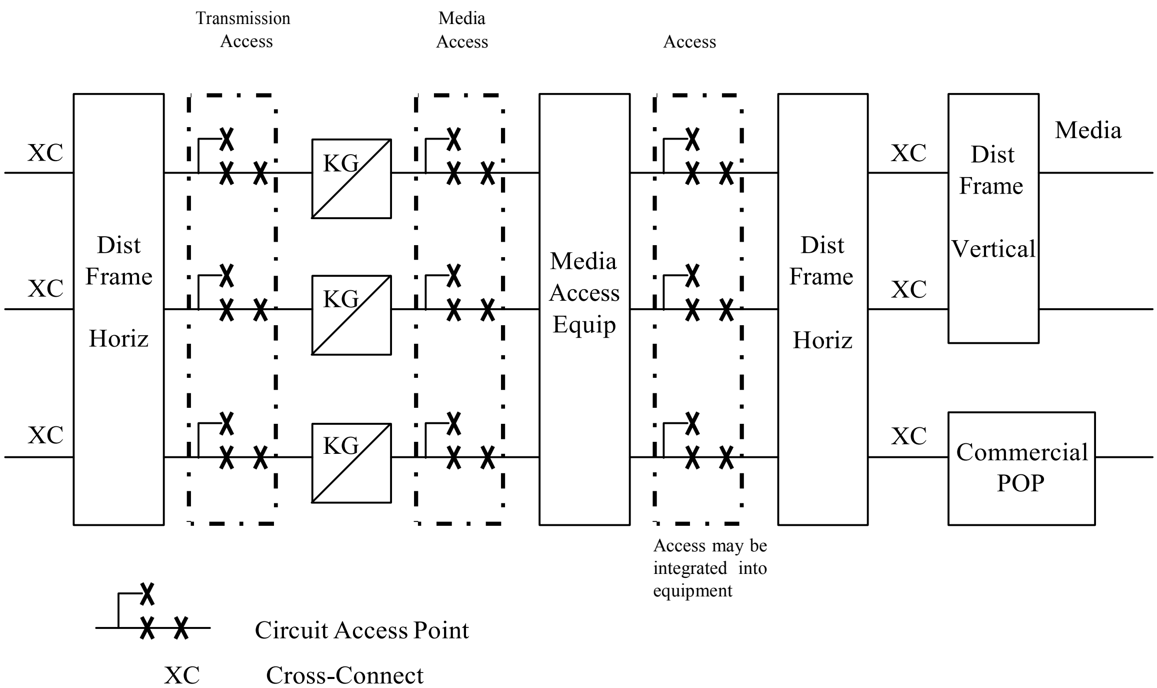

FIGURE 7. Media access connections.

5.3.2 Analog (VF) circuits. The analog VF circuits in most TCFs are directly connected to the analog users. The most common analog circuit is voice service, however, modem tone packs may also be in use. These circuits shall be converted to digital format unless the circuit is only traversing the TCF and breaking down of the signal is not required. An example of this is when the circuit is routed directly to modern digital switching equipment that provides for the analog/digital conversion. All analog circuits traversing the TCF shall be conditioned to provide equal transmitting and receiving levels.

5.3.2.1 User connections. All VF users shall access the TCF via a user access. Local analog circuits normally first appear at a commercial POP or on a distribution frame. From the distribution frame, the circuit shall be wired to a user access point to allow circuit quality control testing between the TCF and the user. Figure 8 shows the required circuit flow for the user access portion of the circuit.

5.3.2.2 Interface circuits. All circuits shall be wired from the user access to the required interface string. This string may include signaling equipment, conditioning equipment (amplifiers, equalizers, etc.), analog/digital conversion (modems), and cryptographic equipment as required. Capability for circuit testing and patching through an access point will be provided between each piece of equipment to allow for fault isolation and equipment substitution. After transitioning through the interface string, the circuit shall be in digital format suitable for connection to a time division multiplexer, digital switch, cable access equipment, or commercial access equipment. In modern digital facilities, switches provide some or all of the interfacing requirements, including analog/digital conversion. These switches shall be used, when possible, to reduce the amount of equipment required in the interface string. Figure 8 shows the interface string circuit and access requirements.

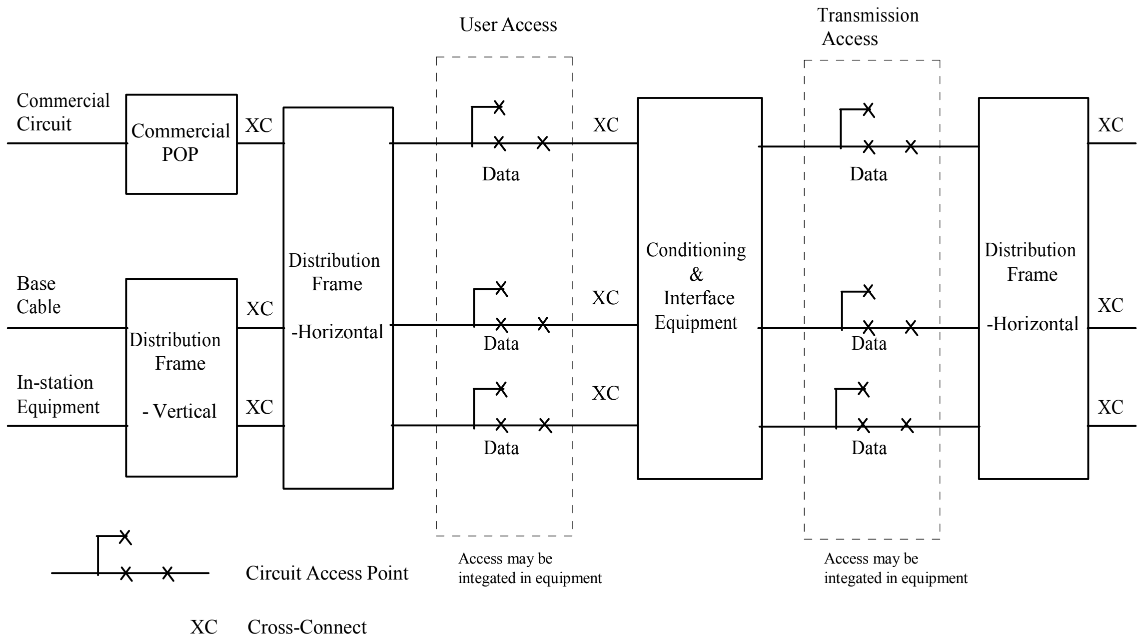

FIGURE 8. Analog circuits user access and interface equipment.

5.4 Centralized monitoring and control facilities. Centralized monitoring and control facilities may be used to manage either unmanned TCFs or to manage networks or subnetworks. Examples of the latter are the DISN Level II Network Operations Center (NOC) and Local Area Network (LAN) management facilities. All alarm and status displays necessary to provide full status are extended to the centralized monitoring and control facility. A network management facility shall have full configuration control over the managed network, including full reroute and restoration capability. This capability is also recommended, where possible, for unmanned facility management. Physical and electrical standards for a centralized monitoring and control facility are identical to those for any other TCF.

5.5 Internal subsystems. The configuration and minimum performance standards for internal subsystems in TCFs are as follows:

5.5.1 Distribution facilities. Distribution facilities used in TCFs include traditional cross-connect wiring frames, punch blocks functioning as distribution frames or circuit concentration facilities, and automated circuit distribution access points. Distribution facilities shall be used, as required, to provide the ability to cross-connect between permanent wiring terminations. Permanent wiring shall be terminated with solderless connection techniques such as wire wrap, punch down, or connectorization. Cross-connects may be electronic, wire wrap, solder, punch, or connectorized, but using automated circuit distribution or quick connect/disconnect wiring is preferred. Frames are categorized by their purpose and placement in the station wiring scheme. Each of the following types may also be separated into RED and BLACK installations. The RED frame may be further subdivided by classification level.

5.5.1.1 Main distribution frame (MDF). Surge protector blocks and other required protection devices shall be located on this frame. Where equipped with vertical and horizontal terminal blocks, the left vertical side shall terminate the lines entering the facility, and the bottom horizontal side shall terminate the tie cables to the intermediate distribution frames and the circuit concentration facilities (see paragraphs 5.5.1.2 and 5.5.1.4). Cross-connects shall be made between the right vertical and top horizontal sides.

5.5.1.2 Intermediate distribution frame (IDF). IDFs are used, as required, to provide termination points for and the means of interconnecting in-house tie cables, in-station equipment, and circuit monitoring and patching facilities. The tie cable can connect the IDF to MDFs, combined distribution frames (CDF) (see paragraph 5.5.1.3), circuit concentration facilities, or other IDFs. Out-of-station connections shall not be made on an IDF. Where equipped with vertical and horizontal terminal blocks, the left vertical side shall terminate the tie cables and station equipment, and the bottom horizontal side shall terminate the circuit monitoring and patching facilities. Required battery terminations shall also be on the bottom horizontal side. Cross-connects shall be made between the right vertical and top horizontal sides.

5.5.1.3 Combined distribution frame (CDF). A commercial POP may be present on the CDF for terminating commercial access lines. If one frame is sufficient to support mission requirements, using a CDF is preferred over a separate MDF and IDF. Where equipped with vertical and horizontal terminal blocks, the left vertical side shall terminate the transmission facilities, tie cables and station equipment, and the bottom horizontal side shall terminate the circuit monitoring and patching facilities. Required battery terminations shall also be on the bottom horizontal side. Cross-connects shall be made between the right vertical and top horizontal sides.

5.5.1.4 Circuit concentration facility (CCF). CCFs may be used for locally terminating or interconnecting high speed circuits that would be impaired or degraded by excessive cable runs to other distribution facilities.

5.5.2 Station timing equipment. TCFs shall be provided with a timing system for network synchronization which is traceable to a primary reference source, as required, by ANSI T1.101. The timing system shall provide clocking signals at all rates required by the station equipment. The Global Positioning System (GPS) satellite network is the recommended primary reference source.

5.5.3 Signaling supplies. Digital signaling (A/B bit, out-of-band, etc.) will normally be supplied by the switching or smart multiplexing equipment. Analog and DC signaling units shall be provided, as required, to support installed circuits.

5.5.4 Orderwire circuits. Orderwire circuits shall be provided in all TCFs, as required, to support control of all communications links, trunks, channels, and circuits. Orderwire circuits are normally classified as link, express, or system depending on the configuration and purpose.

5.5.4.1 Link orderwire circuits. A link orderwire circuit shall be installed on every government-owned DCS wideband radio or cable link. This orderwire circuit shall appear at both the TCF and at the radio and shall be used to troubleshoot link faults and for required maintenance coordination. The link orderwire circuit may appear in either the 0-4 kHz or 8-12 kHz portion of the supervisory baseband on analog radio systems and on channel 1 of the 3-channel supervisory multiplex on digital radio systems. Link orderwire circuits shall be bridged through sites with no channel breakout.

5.5.4.2 Express orderwire circuits. Express orderwire circuits are the primary connections for telecommunications control troubleshooting. Express orderwire circuits shall be assigned within the mission baseband/bit stream and configured for party line operation among interconnected TCFs. Where two facilities have a high volume of coordination, a dedicated point-to-point express orderwire circuit shall be provided to relieve the traffic load on the party line orderwire. When more than one express orderwire circuit is used in a facility, the capability shall be provided to conference among the orderwire circuits. Express orderwire circuit appearances shall be provided in unmanned facilities for the use of visiting test/maintenance teams. Providing access to alternate communications (e.g., a commercial telephone system) is encouraged to provide communications in the event of station isolation.

5.5.4.3 System orderwire circuits. System orderwire circuits shall be installed for facility control office (FCO) coordination. System orderwire circuits shall be assigned within the mission baseband/bit stream. All FCOs shall have access to at least one system orderwire circuit. The FCOs may be connected together in smaller groups on multiple system orderwire circuits within the local theater of operation to limit the traffic on each party line. In this case, the capability shall be provided to conference among the system orderwire circuits. The system orderwire circuit shall not be used for coordinating routine circuit problems.

5.5.5 Intercommunications systems. TCFs shall be provided with intercommunications systems allowing connections between facility workstations, between the facility and major user facilities, and between the station and appropriate maintenance work centers (including maintenance control). This service may be provided by using administrative telephone systems with intercom features or by providing a multi-station intercom system. Any station within the TCF must be capable of signaling any station on the intercom system. Unmanned TCFs may be provided with an intercom system for use by visiting test/maintenance teams. Tactical TCFs shall be equipped with alternate intercommunications systems to provide backup to the site voice switch.

5.5.6 Alarm systems. An alarm system shall be provided to alert the technical control and maintenance technicians of equipment degradation or failures that effect the communications status. Information presented by the alarm system shall facilitate prompt action toward restoring or rerouting the service and repair of faulty equipment. These alarms shall be visual but should be both audible and visual and shall have a self-test capability. Audible alarms shall have the capability of being disabled. Alarms may be presented on a computerized display, on a display integral to the local equipment installation, or on a centralized remote equipment alarm display.

5.5.6.1 Computerized alarm systems. Computerized alarm displays are normally provided with networked systems (e.g., smart multiplexer networks, switched networks, or local area networks). Where practical, this is the preferred method of alarm display. These systems provide a real time status of all networked equipment down to the port level for all circuits and equipment on the network. Additionally, a visual alarm shall accompany any degradation in status, however, an audible alarm should also be used. Since this type of alarm display can be accessed at any point on the network, it is ideal for centralized monitoring and control facilities.

5.5.6.2 Local equipment alarm displays. Telecommunications equipment usually has integral internal alarm displays. In continuously manned facilities, where equipment is located so that these displays are both visually and audibly apparent from the facility operations area, these alarm displays are sufficient. If the facility is not continuously manned, these alarms shall be remoted to the central monitoring and control facility with oversight responsibility. It may also be necessary to provide parallel presentations of these alarms in the appropriate maintenance areas.

5.5.6.3 Remote equipment alarm displays. Those alarms which do not meet the criteria of the preceding paragraphs shall be displayed at a central location in the facility operating area. These alarms may also be simultaneously activated at a centralized monitoring and control facility or to the appropriate maintenance areas.

5.5.7 Monitoring equipment. TCFs shall be provided the capability to monitor installed circuits. Facilities with analog circuits shall be provided with an audio amplifier and analog speaker assembly. These shall be rack mounted with the input terminated on the miscellaneous patch panel. Those facilities having clear text digital data circuits installed shall have equipment available to monitor these circuits. This equipment can be any appropriate combination of protocol analyzers with data capture capability, computer terminals, or printers. The monitoring devices shall be configured for low-level operation, capable of printing or displaying several pages, and be able to operate at all provided service data speeds. The inputs shall be terminated on the miscellaneous patch panel serving the digital circuits.

5.5.8 Testing. Provisions shall be made to allow circuit testing as outlined in DISAC 310-70-1 and DISAC 300-175-9. Traditionally, it was necessary to physically access each circuit for testing at each local facility. Modern automated equipment allows for built-in-service diagnostic capabilities and remotely controlled automated testing, often without interrupting user service.

5.5.8.1 Remote access testing. Remote access testing, particularly when coupled with automated circuit rerouting, is the preferred method for circuit testing. Testing shall be controlled from a central location (e.g., a Network Management Center (NMC) or FCO). All required network management systems and control channels shall be wired to the central location. If required, non-integral test equipment shall be wired to designated test ports of the equipment under test.

5.5.8.2 Local access testing. The preferred method of local access testing for manned facilities is through a centralized Quality Control Test Center (QCTC) containing all equipment and patching capabilities for circuit testing. Interbay trunks shall connect the QCTC to all appropriate patch bays and to the test circuit outputs of all switches. Duplicate items of test equipment or test equipment used only in one area may be mounted in the same cabinets with the patch bays. When floor space or operational considerations do not allow a QCTC to be installed, portable test equipment shall be used for circuit testing. Unmanned facilities will normally be tested using portable equipment carried by the visiting maintenance team.

5.5.9 Interbay trunks and additional access points.

5.5.9.1 Interbay trunks. Interbay trunks shall be provided, as required, for rerouting, restoring, and equipment patching requirements. These interbay trunks will connect those physical patch panels providing a like service (e.g., all 64 kbps media access panels). Additionally, in facilities using a QCTC, interbays shall be provided to connect the QCTC to all appropriate patch bays. The interbay trunks shall be positioned so that no patch will require a patch cord longer than six feet.

5.5.9.2 Additional access points. Miscellaneous access points shall be provided, as required, on both digital and analog patch panels. The jack positions shall be clearly marked to identify their functions. Digital access points shall be provided for any monitoring and test equipment mounted in the patch bays. Analog patch bays shall have miscellaneous access points installed to provide all required testing and terminating functions.

6. NOTES

6.1 Military Unique Rationale. The requirements of this standard provide for the interface of telecommunications control facilities with military communications equipment, both long haul and tactical. The equipment uses some data rates that are not commercially available and methods of connecting the equipment within the facility are designed uniquely for military applications where rapid restoration of circuits in the event of an outage are of paramount importance.

The requirements in this standard provide for the interfaces of telecommunications control facilities to military communications equipment, both long haul and tactical. This equipment uses some data rates that are not commercially available and the methods of connecting equipment within a facility are designed to provide for rapid restoration of circuits in the event of a communication outage caused by acts of aggression.

6.2 RED/BLACK engineering criteria. The criteria in this publication are applicable for both RED and BLACK TCFs. The inclusion of any RED provision in the facility requires the compliance with both this document and current RED/BLACK engineering criteria established by the National Security Telecommunications and Information Systems Security Advisory Memoradum 2-95.

6.3 International agreements. Certain provisions of this standard are the subject of international standardization agreements STANAG 4206 through 4214. When amendment, revision, or cancellation of this standard is proposed which will modify the international agreement concerned, the preparing activity will take appropriate action through international standardization channels including departmental standardization offices to change the agreement or make other appropriate accommodations.

6.4 Subject term (key word) listing.

Patch and test facility
Telecommunications control
Telecommunications control facility

6.5 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

CONCLUDING MATERIAL

Custodians:
Air Force - 02
Army - AC
Navy - EC

Review Activities:
Army - CR
Navy - AS, MC, OM
Air Force - 11
DISA - DC
NSA - NS

Preparing Activity: Air Force - 02
(Project TCSS-2014-006)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at https://assist.dla.mil.