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## MILITARY SPECIFICATION

### MANUAL, TECHNICAL; CONTENT AND FORMAT REQUIREMENTS FOR EQUIPMENT, SUBSYSTEMS AND SYSTEMS

This specification is approved for use within the National Security Agency and Central Security Service, Department of the Defense, and is available for use by all Departments and Agencies of the Department of Defense.

#### 1. SCOPE.

1.1 **SCOPE.** This specification establishes the content and format requirements for military operation and maintenance manuals. This specification details the requirements for technical manuals for equipment, subsystems and systems.

1.2 **PURPOSE.** The purpose of this specification is to ensure uniformly acceptable manuals for electronic equipment, subsystems and systems.

1.3 **APPLICATION.** This specification describes format and technical content requirements for three types of technical manuals for electronic equipment, electronic subsystems and electronic systems.

#### 2. APPLICABLE DOCUMENTS.

##### 2.1 GOVERNMENT DOCUMENTS.

2.1.1 **SPECIFICATIONS AND STANDARDS.** The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation.

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Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: DIRECTOR, National Security Agency, Chief, Central Security Service, ATTN: T2134, Fort George G. Meade, MD 20755-6000 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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**SPECIFICATIONS****MILITARY**

MIL-M-008910	Manuals, Technical: Illustrated Parts Breakdown
MIL-M-38784	Manuals, Technical: General Style and Format Requirements

**STANDARDS****MILITARY**

MIL-STD-12	Abbreviations for Use on Drawings, Specifications, Standards, and in Technical Documents
MIL-STD-188	Military Communication System Technical Standards

**2.1.2 OTHER GOVERNMENT DOCUMENTS AND PUBLICATIONS.** The following other Government documents and publications form a part of this specification to the extent specified herein. Unless otherwise specified, the issues shall be those in effect on the date of the solicitation.

**DEPARTMENT OF DEFENSE**

DoD 5220.22-M	Industrial Security Manual for Safeguarding Classified Information
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**NATIONAL BUREAU OF STANDARDS**

H4-1	Federal Supply Code for Manufacturers, Name to Code
H4-2	Federal Supply Code for Manufacturers, Code to Name

(Copies of specifications, standards, and publications required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

**2.2 OTHER PUBLICATIONS.** The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted shall be those listed in the issue of the DoDISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS shall be the issue of the non-government documents which is current on the date of the solicitation.

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## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Y10.19

Letter Symbols for Units Used in Science  
and Technology

ANSI/IEEE-260-78

IEEE Standard Letter Symbols For Units  
of Measurement

(Application for copies shall be addressed to the American National Standards Institute, Inc., 1430 Broadway, NY 10018.)

## ELECTRONICS INDUSTRIES ASSOCIATION (EIA)

EIA-RS232C-69

Interface Between Data Terminal Equip-  
ment and Data Communication Equipment  
Employing Serial Binary Data Interchange

(Application for copies to be purchased shall be addressed to the Electronics Industries Association, 2001 I Street, NW, Washington, D.C. 20006, Attn: Standards Office)

2.3 **ORDER OF PRECEDENCE.** In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. **REQUIREMENTS.**3.1 **GENERAL REQUIREMENTS.**

3.1.1 **TECHNICAL MANUAL PROGRAM.** The contractor shall establish a technical manual program for the design and development of technical manuals. The contractor shall identify the procedures that will govern the planning, scheduling, preparation and delivery of the technical manuals of the types specified in this specification. This program shall establish the methodology for evolving technical manuals, procedures to assure that all pertinent design, operation, and maintenance data is adequately, accurately and clearly reflected in the manual and procedures to be used in accomplishing validation and verification. The contractor shall monitor the development of the technical manual and advise the procuring activity of the status on a periodic basis. The contractor shall show the interrelationships of the technical manuals from the component to the end item level. (See 6.2.1)

3.1.2 **TYPES OF MANUALS.**

3.1.2.1 **EQUIPMENT TECHNICAL MANUAL.** (See 6.3.2) When specified in the contract or order, an equipment or equipment group technical manual shall be prepared in accordance with the technical content requirements of 3.2 and the format requirements of this specification. (See 6.2.1)

3.1.2.2 **SUBSYSTEM TECHNICAL MANUAL.** (See 6.3.9) When specified in the contract or order, a subsystem technical manual shall be prepared in accordance

with the technical content requirements of 3.3 and the format requirements of this specification. (See 6.2.1)

3.1.2.3 SYSTEM TECHNICAL MANUAL. (See 6.3.10) When specified in the contract or order, a system technical manual shall be prepared in accordance with the technical content requirements of 3.4 and the format requirements of this specification. (See 6.2.1)

3.1.3 MANUAL DOCUMENTATION. Documentation in support of a technical manual shall be as specified in the contract or order.

3.1.3.1 MANUAL OUTLINE. (See 6.3.5)

3.1.3.2 REVIEW DRAFT. (See 6.3.8)

3.1.3.3 MANUSCRIPT COPY. (See 6.3.6)

3.1.3.4 PRELIMINARY MANUAL. (See 6.3.7)

3.1.3.5 FINAL MANUAL. (See 6.3.4)

3.2 EQUIPMENT TECHNICAL MANUAL CONTENT. The equipment manual shall contain detailed operation and maintenance information primarily intended for the operator and the maintenance technician. The manual shall contain an overall description of the equipment, installation instructions as applicable, general and detailed principles of operation, descriptions of operating controls and indicators, operating instructions, preventive and corrective maintenance procedures (including troubleshooting data), replaceable parts lists with supporting illustrations (or an Illustrated Parts Breakdown), block and functional diagrams, and schematic, logic and wiring diagrams.

3.2.1 FRONT MATTER. The front matter shall consist of a cover, list of effective pages, introduction, table of contents, list of illustrations, list of tables, and a frontispiece.

3.2.1.1 COVER. The content of technical manual front covers and spine (Figure 1) shall be limited to the following:

- a. A publications title to identify the type of publication and the equipment to which it applies.
- b. A subtitle that includes such additional information as may be needed to further identify the technical manual.
- c. A publication date that is the month and year of camera-ready copy approval.
- d. The publication identification number assigned by the procuring activity.
- e. Accession identification number assigned by procuring activity.
- f. The number of the volume when the publication consists of more than one volume.

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- g. Classification and security markings as determined by the procuring activity.

3.2.1.2 **LIST OF EFFECTIVE PAGES.** A list of effective pages (Figure 2) shall be included. In multivolume manuals, Volume I shall include a complete list of effective pages to include all volumes. Each subsequent volume shall include a list of the effective pages in that particular volume.

3.2.1.3 **INTRODUCTION.** In one or more paragraphs, introduce the manual, not the equipment. Include the following information:

- a. The general purpose and content of the manual.
- b. The particular model or models to which the technical manual pertains.
- c. The level of training of the intended reader.
- d. A general description of the manual organization and how to use it.

3.2.1.4 **TABLE OF CONTENTS.** Include all chapter numbers and titles, section numbers and headings, main paragraph numbers and headings, and first and second order subdivision designations and headings. Each volume of a multivolume manual shall contain its own table of contents. Volume I shall contain a complete table of contents for the entire set. Ensure that titles and section and paragraph numbers listed in the table of contents are identical to their corresponding titles and section and paragraph numbers in the text. Each appendix shall have an integral table of contents.

3.2.1.5 **LIST OF ILLUSTRATIONS.** List all illustrations in the manual showing figure number, title, and page numbers. List the figures in the same order and with the exact titles as used in the text.

3.2.1.6 **LIST OF TABLES.** List all tables in the manual showing table number, title, and page number. Do not list unnumbered, informal tabulations. List the tables in the same order and with the exact titles as used in the text.

3.2.1.7 **FRONTISPIECE.** Immediately following the front matter of a single volume manual or Volume I of a multivolume manual, include a photograph or conceptual drawing (3/4 perspective view preferred when practicable) of the equipment. When a full page layout is required (Figure 3), the frontispiece shall be numbered Figure 1-0, and it shall be a left-hand page (page 1-0) that faces the first page of Chapter 1. For equipments that require a half-page layout, or less, the illustration shall be numbered Figure 1-1 and integrated with the text of page 1-1 (Figure 4).

3.2.2 **CHAPTER 1. DESCRIPTION OF EQUIPMENT.** This chapter shall describe the equipment to include information necessary for managerial and administrative decisions related to facility and support requirements.

3.2.2.1 **SECURITY CLASSIFICATION.** State the security classification of the overall equipment, assemblies, subassemblies, and any ancillary equipment that is used with the basic equipment. Directions for security markings will be supplied by the procuring activity.

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**3.2.2.2 PURPOSE AND CAPABILITIES.** Describe the equipment, the intended use (why, where, when, and with what), its capabilities, and its limitations. If the manual covers more than one model, provide a statement or table stating the differences in models.

**3.2.2.3 TECHNICAL CHARACTERISTICS.** Describe the principal characteristics of the equipment, including specification data. Include physical data, electrical data, and environmental conditions/requirements. This information may be summarized in a table.

**3.2.2.3.1 PHYSICAL CHARACTERISTICS.** Include the following:

- a. Descriptive data, such as nameplate information, to identify type, model, and serial number.
- b. Overall dimensions of the uncrated unit and, if applicable, the crated unit. Also, if applicable, provide data on alternate shipping boxes. Include the height, width, and depth dimensions in both inches and centimeters (metric).
- c. Weight, crated and uncrated, in both pounds and kilograms (metric).
- d. A top view (cover removed), front view, and rear view as a composite illustration to identify major assemblies (Figure 5).

**3.2.2.3.2 ELECTRICAL CHARACTERISTICS.** Include data for the following items:

- a. Primary power requirements.
  - (1) Voltage (ac and dc) and tolerances.
  - (2) Frequency (single phase or 3-phase).
  - (3) Current.
  - (4) Power consumption.
- b. Input and output signal and control requirements (to determine interfacing requirements). Also state compatibility with standards such as EIA-RS232C-69 or MIL-STD-188.
  - (1) Levels.
  - (2) Impedances.
  - (3) Pulse characteristics.
  - (4) Frequency range and tolerance.
- c. For digital equipment, include data indicating type of logic, basic clock rate, word format, response time, and storage capacity.

3.2.2.3.3 ENVIRONMENTAL CONDITIONS/REQUIREMENTS. Include data and acceptable limits for the following items:

- a. Ambient temperature requirements.
- b. Heat dissipation.
- c. Air conditioning/cooling requirements.
- d. Humidity requirements.
- e. Altitude.
- f. Shock/vibration sensitivity.

3.2.2.4 EQUIPMENT SUPPLIED. List in tabular form all tools and equipment, including cables, wiring harnesses, test fixtures, test equipment, installation tools, that are supplied with the equipment. State the official nomenclature, common name, manufacturer's model/part number, and a brief functional description of each item supplied.

3.2.2.5 EQUIPMENT REQUIRED BUT NOT SUPPLIED. List in tabular form special tools and equipment (including test equipment) not supplied but required for operation or maintenance of the equipment. State sufficient information for the using activity to procure them. Include a common name (such as oscilloscope or signal generator), required capabilities, and recommended model data. For the recommended model, give the official nomenclature and manufacturer's name.

3.2.2.6 PUBLICATIONS REQUIRED. List publications that are required to support the equipment in the field. Include procurement data such as the formal title, identification number, and publication source.

3.2.2.7 FUNCTIONAL DESCRIPTION. Describe the equipment at the overview level to include the operational capabilities, modes of operation, and performance characteristics. Include a simplified block diagram (Figure 6) that shows the major functions of the equipment and, where possible, the relationship to the system/subsystem in which the equipment is used. Show input signals, what the unit does with them, and output signals.

3.2.3 CHAPTER 2, INSTALLATION. Provide data and instructions necessary to plan and complete the installation of the equipment covered by the manual. The instructions shall be in sufficient depth to ensure that the equipment is checked out and ready for normal operation. Include instructions for equipment inspection, location and mounting, making the proper connections, performing initial pre-operational adjustments, and checkout.

3.2.3.1 INSPECTION. Provide instructions for inspection of the crate before unpacking and for inspection of the equipment after unpacking for completeness and for possible damage. Give information for reporting incomplete and/or damaged shipments.

3.2.3.2 INPUT/OUTPUT CONNECTORS. Describe in tabular form all external Inter-connecting connectors and cables, including power and remote-control



cables. Provide an illustration with callouts to show the location of the connectors (Figure 7). References to other chapters or an appendix may be included. Also include instructions for fabricating cable/connector assemblies that are not supplied with the equipment and not readily available in prefabricated form. Supplement this information with cabling diagrams and fabrication drawings as required.

**3.2.3.3 LOCATION AND MOUNTING.** Assembly, location, and mounting instructions shall include all preparations necessary to make the equipment physically ready for operation. Also include instructions for preparing the support structure and the interfacing with other equipment and power sources, including grounding. Give step-by-step instructions whenever a specific sequence of operations or events is required. Include illustrations showing mounting and assembly techniques for complex procedures or mechanisms.

**3.2.3.4 CHECKOUT AND PRELIMINARY ADJUSTMENTS.** Provide instructions for checking out the installed equipment to ensure that it is in proper operating condition and for completing all necessary adjustments before releasing equipment for mission operations. Where possible, refer specifically to the Operating Instructions and/or Maintenance chapters of the manual. Give detailed, step-by-step instructions for any special procedures that are required for installation.

**3.2.4 CHAPTER 3, OPERATING INSTRUCTIONS.** Present the operating instructions in three parts: controls and indicators, operating instructions, and operator maintenance. The instructions shall enable an operator to start (turn on) the equipment, operate the equipment in all modes, and stop (turn off) the equipment. Include emergency operations to bypass partial equipment failure or unusual operating conditions.

**3.2.4.1 CONTROLS AND INDICATORS.** Provide a description in tabular form of each operator control, switch, and indicator. Include photographs or line art (Figure 8) with callouts (index numbers). Assign index numbers sequentially (top left, clockwise, to bottom left). Set up the table as follows:

- a. An index number that cross-references callouts on the illustration with the table descriptions.
- b. List controls and indicators exactly as they appear on the equipment (usually in capital letters). Use an appropriate functional name for unmarked controls and indicators (initial capitalized). Include reference designations in parentheses, if used.
- c. Describe the function of each control and indicator, including every possible position, setting, and indication.

**3.2.4.2 OPERATING INSTRUCTIONS.** Provide specific start, operate, standby, and stop procedures. Use step-by-step procedures in logical sequence. Write these procedures in the present active tense, imperative mood. If the equipment is fully automatic or controlled by another equipment, a statement to that effect is sufficient. Refer to controls and indicators using actual nomenclature that is consistent with the nomenclature used in illustrations and tables.



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3.2.4.2.1 **START.** Give complete instructions for energizing the equipment and making initial settings and adjustments. If timing (warmup period between power on and adjustment) is important, clearly state the minimum time required. Describe how the cabinets, units, etc., are electrically interlocked and the operation of the interlock-bypass switches, if applicable. Include a table describing the function of each interlock. Give detailed instructions (with illustrations) for conditions that require special safety precautions or procedures that cannot be covered by using notes, cautions, or warnings.

3.2.4.2.2 **OPERATE.** Give detailed instructions for each mode of operation. Give the appropriate operator reactions for each alternate equipment response. Include illustrations showing equipment responses, e.g., scope images, lamp patterns, or other indicator readings. Give complete instructions for obtaining correct readings and interpreting the readings.

3.2.4.2.3 **EMERGENCY OPERATION.** Give instructions for operating the equipment when some functions become disabled. Include only the instructions for operators (not maintenance personnel) covering partial failure or malfunction of components, or other unusual condition.

3.2.4.2.4 **STOP.** Give detailed instructions for stopping, turning off, and securing the equipment after operation.

3.2.4.2.5 **OPERATING MAINTENANCE.** Include maintenance instructions for removal and replacement of parts designated for operator repair. Parts generally consist of fuses and lamps.

3.2.5 **CHAPTER 4, PRINCIPLES OF OPERATION.** Describe how the equipment operates, using simple technical language and, where feasible, support with schematics, logic, and block diagrams. Describe the equipment at two levels: a functional block diagram level and a detailed circuit level.

3.2.5.1 **INTRODUCTION.** Briefly introduce the chapter's content. For equipment using a microprocessor, state the level of knowledge of microprocessor theory that is required for the reader to understand the description.

3.2.5.2 **BLOCK DIAGRAM DESCRIPTION.** Describe the equipment operation based on a functional block diagram, giving a brief, general explanation of major circuit functions. The block diagram and related description shall provide sufficient detail to enable the reader to relate to the detailed circuit description. Correlate the description to the functional block diagram (Figure 9), explaining the function represented by each block. The name of each functional block shall correspond with the name assigned to circuits on logic/schematic diagrams.

3.2.5.3 **DETAILED CIRCUIT DESCRIPTION.** Describe in detail the operation of each block shown on the functional block diagram. Reference the appropriate logic/schematic diagrams and timing diagrams. Use detailed block diagrams (Figure 10) that elaborate on the functional block diagram and timing diagrams (Figure 11). Where possible, integrate the timing diagrams with the text, locating them on the page of discussion or facing page. Describe custom-built circuits at the detailed-circuit description level. Do not provide detailed circuit descriptions for commercially-manufactured items such as power

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supplies, microprocessors, operational amplifiers, etc., for which documentation already exists. Also, do not describe the internal operation of integrated circuits (IC) for which manufacturer's specification data is available.

**3.2.5.4 POWER DISTRIBUTION.** Describe in detail the ac and dc power distribution circuits, including custom-manufactured assemblies for which other documentation is not available to the user. Also provide schematics for such assemblies, and provide a power distribution diagram (Figure 12) with detail as described in 3.2.9.4 of this specification. Provide a block diagram for complex assemblies and power distribution.

**3.2.5.5 FIRMWARE AND SOFTWARE DESCRIPTION.** If firmware and software documentation exists, make reference to it by title, publication and/or program number.

**3.2.6 CHAPTER 5, MAINTENANCE.** Provide all information necessary for the maintenance technician to prevent malfunctions through scheduled routines (preventive maintenance), and to correct malfunctions by troubleshooting, adjustment, and repair (corrective maintenance). Describe what must be done to restore equipment to normal operating condition following a malfunction or failure. The level of coverage is dependent on the maintenance philosophy established by the procuring activity regarding replacement of assemblies (cards, modules, etc.) or piece parts (capacitors, resistors, ICs, etc.).

**3.2.6.1 INTRODUCTION.** Briefly introduce the chapter's content. Include the maintenance philosophy and statements (e.g., references to other chapters and/or documentation) for follow-on activity to complete equipment restoration to normal operating condition. Include references to replaceable parts information, wire list and cable data.

**3.2.6.2 EQUIPMENT REQUIRED.** List all tools and test equipment required to perform maintenance instructions given or referenced. Give information to enable the using activity to either acquire the recommended models or to obtain acceptable substitutes. The list shall include a common name (e.g., wide-band oscilloscope, RF signal generator, spectrum analyzer), required capabilities (as applies to use for the subject equipment), and recommended model data. For recommended models, preference shall be given to special tools and test equipment readily available to the using activity. Recommended model data shall include official nomenclature, manufacturer's part number and model number, and the manufacturer's name. Additionally, provide fabrication data and information to locally manufacture simple, special test fixtures, harnesses, etc., as necessary. Include drawings and illustrations to support such fabrication information.

**3.2.6.3 MAINTENANCE CONTROLS AND INDICATORS.** Provide illustrations with callouts (Figure 13) together with a table to describe the function of each control and indicator used for maintenance purposes. In the table, list index number, the name of each control and indicator, and a brief functional description. Give appropriate functional names to controls and indicators not placarded on the equipment. Reference designations, in parentheses, may be included. Use placarded and assigned names consistently throughout the manual.

3.2.6.4 **PREVENTIVE MAINTENANCE**. Describe routine tasks that must be performed to prevent future equipment breakdown, such as inspection, cleaning, lubrication, and routine tests. Include recommended performance intervals. If applicable, provide step-by-step instructions for carrying out performance tests and optimum performance criteria designed to reduce equipment downtime.

3.2.6.4.1 **INSPECTION**. When periodic inspection of equipment is required for operation, cleaning, or lubrication, enumerate items to be inspected and give inspection criteria.

3.2.6.4.2 **SCHEDULE**. Provide a schedule for preventive maintenance routines. In tabular form, state the recommended frequency of performance at recommended intervals. Reference procedures that appear elsewhere in the manual.

3.2.6.4.3 **PERFORMANCE TESTS**. Include instructions for checking equipment performance at recommended intervals. Reference procedures that appear elsewhere in the manual.

3.2.6.4.4 **CLEANING AND LUBRICATION**. Provide instructions for routine cleaning and lubrication. Include a table listing lubrication points, the proper lubricant for each type of fitting, and the frequency of application. Key the table to one or more illustrations showing the location of all lubrication points. Include cautions and warnings on the proper handling of solvents and other cleaning materials. Identify recommended materials by both government specification number and National Stock Number (NSN).

3.2.6.4.5 **MINOR REPAIR AND ADJUSTMENT**. Provide instructions for minor repair or adjustment required for preventive maintenance routines. Minor repairs and adjustments shall be limited to those performed without special tools or test equipment and require no special training or skills.

3.2.6.5 **CORRECTIVE MAINTENANCE**. Base these instructions on a logical effect-to-cause troubleshooting philosophy and rapid parts replacement procedure to minimize equipment downtime. When appropriate, give step-by-step instructions for locating and correcting equipment malfunctions. Include such items as adjustments, troubleshooting, diagnostic testing, and repair procedures.

3.2.6.5.1 **ADJUSTMENT**. Provide instructions for adjusting the equipment, individual assemblies, subassemblies, and circuit boards to optimize equipment performance. If appropriate, state that these instructions are to be accomplished during post installation checkout, after major repair, or whenever degradation of equipment performance can be corrected by adjustment, as opposed to other levels of repair. The instructions may be in tabular form covering each equipment unit requiring adjustment or may be simply listed, step-by-step instructions. Support the written procedures with illustrations showing the location of adjustments, recommended techniques, and inputs and outputs of properly adjusted components.

3.2.6.5.2 **TROUBLESHOOTING**. Troubleshooting instructions shall include a general statement of troubleshooting philosophy applicable to the equipment. Follow this statement by providing information on symptom analysis or troubleshooting that describes the general procedure for locating malfunctions. Provide details on specific procedures or techniques for locating particular

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types of malfunctions, or any malfunctions in circuits or equipment of high complexity. Use troubleshooting tables, charts, or diagrams. Troubleshooting instructions shall include the following items as appropriate:

- a. Describe the performance standards for the overall check of equipment to determine that, with known inputs, the equipment outputs are within minimum acceptable limits. Following this, give performance standards for any special circuits. Present standards in tabular form and in logical order. Accompany performance standards with illustrations of proper connection of test inputs and test equipment, and waveforms or other illustrations of acceptable outputs, as appropriate, for the subject equipment.
- b. Waveform charts shall be provided and when necessary for troubleshooting or critical alignment, shall clearly indicate all essential characteristics of significant waveforms in the equipment (polarity, leading-edge amplitude, width, rise time, overshoot, decay time, trailing-edge amplitude, amount of ripple or ringing, and pulse spacing). Include the following information:
  - (1) Illustrations of each waveform.
  - (2) Clear notation of all pertinent conditions of test (e.g., oscilloscope sweep speed).
  - (3) Name of each waveform and any other pertinent comment.
  - (4) Notation of the test point at which each waveform is observed.
  - (5) Reference to schematic diagrams, showing the test point at which each waveform is observed.
  - (6) Dual-trace presentations, where possible, of each pair of waveforms whose time or phase relationship is critical.
- c. Provide detailed troubleshooting charts and flow diagrams.

**3.2.6.5.3 DIAGNOSTIC TESTING.** Where diagnostic programs (firmware and/or software) are not covered in any other publication, include instructions for applying them. List and describe separately each diagnostic test. Include the following:

- a. State the purpose of each test and the running order, if any.
- b. Provide a list of equipment needed to run a particular test and equipment setup instructions.
- c. Provide a step-by-step procedure for running each test.

**3.2.6.5.4 BUILT-IN TEST EQUIPMENT (BITE).** When an equipment contains built-in test equipment, include instructions for using the equipment as performance testing and troubleshooting aids. Describe the purpose and use, and include detailed procedures.

**3.2.6.5.5 REPAIR AND REPLACEMENT OF PARTS.** Include all instructions required to restore the equipment to normal operation after the cause of a malfunction has been isolated to a specific part. If repair goes beyond the replacement of defective parts, provide step-by-step procedures for accomplishing such repairs. Further, provide instructions for making emergency or temporary repairs (when repair parts are not available) that will allow equipment to operate temporarily until permanent repair can be made.

**3.2.7 CHAPTER 6, ILLUSTRATED PARTS BREAKDOWN.** This specification has provisions to prepare a Illustrated Parts Breakdown (IPB) or a parts list. Unless otherwise specified by contract, an IPB is required. Prepare its contents as described herein. If a parts list is specified by contract, prepare it as described in 3.2.8. Include the following paragraph headings and appropriate text for an IPB:

- a. Introduction.
- b. How to use the IPB.
- c. Group Assembly Parts List.
- d. Numerical Index.

**3.2.7.1 INTRODUCTION.** Briefly introduce the chapter's content.

**3.2.7.2 HOW TO USE THE IPB.** Provide information (Figures 14 and 15) for the user on how to use the IPB and the Group Assembly Parts List (GAPL).

**3.2.7.3 GROUP ASSEMBLY PARTS LIST (GAPL).** The GAPL is a breakdown of the equipment that can be disassembled, repaired, replaced, and reassembled at a major field or depot maintenance level, on board ship, or at a Repair Facility (RF). When applicable, include a breakdown of assemblies, subassemblies, ancillary devices, spare parts kits, extender cables, mountings, special test equipment, and reusable shipping cases. An IPB illustration example and a sample GAPL are shown in Figures 16 and 17.

**3.2.7.4 NUMERICAL INDEX.** Prepare the NI in accordance with MIL-M-008910. A sample Numerical Index (NI) is shown in Figure 18.

**3.2.8 CHAPTER 6, PARTS LIST.** When a parts list is specified in the contract, it shall include a list of manufacturers and a detailed parts list for all electrical parts in the equipment. Include the following paragraph headings and appropriate text.

- a. Introduction.
- b. List of Manufacturers.
- c. Parts Lists.

**3.2.8.1 INTRODUCTION.** Briefly introduce the chapter's content.

**3.2.8.2 LIST OF MANUFACTURERS.** Provide a complete list of manufacturers' names and addresses to enable the using activity to procure parts used in the

equipment. Present the list in numerical order by manufacturers' codes used in the parts list. Assign the codes according to the Federal Supply Code for Manufacturers (FSCM) Cataloging Handbooks H4-1 (Name to Code) and H4-2 (Code to Name), and their latest supplements. Alphabetical codes, such as 0000A, 0000B, 0000C, etc., may arbitrarily be assigned to manufacturers not appearing in the H4-series handbooks. In a description of the List of Manufacturers, include the foregoing information about the assignment of the codes.

**3.2.8.3 PARTS LIST.** Include a parts list (Figure 19) that defines all maintenance-significant parts for the equipment. Each assembly or subassembly shall be broken down in top down order with the part number preceding the listing. For example, a printed circuit card shall list the assembly part number first, then all component parts, as described in the following. For programmable devices (ROMS, PROMS), include the manufacturers part number for the device immediately followed by an additional part number that identifies the software program for the device. List all parts subject to wear, burnout, breakage, contamination, or deterioration during the normal life of the equipment. Do not list hardware items such as attaching parts, chassis, or frames, nor items normally supplied in bulk (wire, tubing, etc.), unless they are of a special type or critical dimension. Arrange the list in reference designation order. Start with top assembly (equipment), then break down each assembly (A1, A2, etc.), followed by chassis components. Provide sufficient information on each item to permit its acquisition from the coded manufacturer or from a commercial source. The parts list shall contain the following information:

- a. The reference designation for each part listed.
- b. A description for each part. The identifying noun or item name shall be the first part of the identifying information. Include ratings and tolerances of electrical parts.
- c. The quantity per assembly shall be included. State the total quantity of identical parts used in the assembly, subassembly, or unit.
- d. The part number designated for each item may be a true manufacturer's number, joint Army-Navy (JAN), or military (MIL) number, as applicable. (Prime contractor's numbers may be used as true manufacturer's numbers only for items altered by the prime contractor.) If a manufacturer's part number is used, state the manufacturer code.
- e. The codes of the manufacturers of commercial items. Use codes for the manufacturers' names, and supply an index to the codes in the list of manufacturers.

**3.2.8.4 COMPONENT LOCATION ILLUSTRATIONS.** To support the parts lists described herein, include the component location illustrations for all maintenance-significant parts listed in the parts list table (Figure 19).

**3.2.9 CHAPTER 7, ILLUSTRATIONS.** Explain the chapter's content and its use, e.g., its relationship to material in other chapters. Include all diagrams and associated information not included in other chapters of the manual. Include block, logic, cabling, schematic and wiring diagrams. Locate all foldout (oversize) illustrations in this chapter that relate to preceding



chapters. Provide an explanation of the logic symbol identification convention used. Describe reference system (signals, zones, sheets). Illustrate using sample logic diagram.

**3.2.9.1 FUNCTIONAL-BLOCK DIAGRAMS.** Include an overall, functional block diagram (Figure 9) of the equipment. Show all major functions of the equipment, and correlate the physical and functional groupings of the equipment (assemblies, subassemblies, printed circuit assemblies, etc.) in a logical manner. Use rectangular blocks to show the individual functional groups, and include connecting lines and arrowheads showing the direction of control and signal flow. Functional mechanisms may be represented isometrically or perspective. Identify each block and other representation by name, nomenclature, or reference designation. Identify each input and output by title. If the equipment contains a microprocessor, show how memory and input/output (I/O) devices are connected to the microprocessor buses. Show all custom-built circuits that interface with the I/O devices.

**3.2.9.2 INTERCONNECTION DIAGRAMS.** Include cabling, wiring, and other forms of interconnection diagrams (Figure 20) for the equipment. Show the cabling between assemblies and chassis components, labeled to clearly indicate the relationship between the cabling diagrams and the wiring diagrams. Show the connecting and terminating points for all intercomponent wiring and all other wiring formed into bundles or cables. The diagrams may be the physical, pictorial, highway, or point-to-point type, depending on the equipment covered; however, the physical path of each circuit must be easily traced through the equipment. Clearly indicate destination, wire number, and any other pertinent information at each connecting and terminating point. Show all connectors, terminal boards, terminal strips, connector pins, and terminals in the equipment even if they are not used. If acceptable to the procuring activity, wiring and cabling diagrams in this chapter may be replaced or supplemented in a wire list by a separate volume or in Appendix A.

**3.2.9.3 SCHEMATIC DIAGRAMS.** In schematic diagrams (Figure 21), show every circuit and detail component in the equipment. Separate diagrams for signal, power, and control circuits are preferred. Where separate diagrams are not practical, divide the diagrams into logical units clearly marked to show the relationship between diagrams, including labeled inputs, outputs, and connecting and terminating points. Prepare schematic diagrams in accordance with the instructions in 3.5.8.2.

**3.2.9.3.1 LOGIC DIAGRAMS.** In logic diagrams (Figure 22), show and identify all logic and non-logic functions, socket locations, pin numbers, test points, and any other physical elements necessary to describe the physical and electrical aspects of the logic. Indicate signal flow by symbol orientation. If necessary for clarity, use arrows superimposed on the connecting lines to indicate signal flow; however, do not place arrowheads adjacent to a symbol. Where required for clarity, place waveforms adjacent to signal lines to indicate the nature and timing of the signals. Prepare logic diagrams in accordance with instructions in 3.5.8.3.

**3.2.9.4 POWER DISTRIBUTION DIAGRAMS.** Include power distribution diagrams to depict the distribution of primary ac power, secondary ac power, and dc power from the terminal board, breaker, fuse, and power supplies to the equipment assemblies. Prepare distribution diagrams in accordance with instructions in 3.5.8.3.



3.2.10 **APPENDIXES.** In the appendixes present supplementary data not suitable for inclusion in the chapters. For example, in an equipment technical manual the appendixes may include wire lists and cable data, program lists, integrated circuit data and commercial card data.

3.2.10.1 **WIRE LISTS AND CABLE DATA.** Instead of including wiring and cabling diagrams in Chapter 7, include lists in this appendix per the condition stated in 3.2.9.2, wherein procuring activity approval must be obtained. Include specific to-and-from information and information to clearly identify the wires and cables.

3.2.10.2 **PROGRAM LISTS.** When not covered by any other publication, include program lists in this appendix. Give a complete listing of all modules with a cross-reference and symbol table; include the Source Project Number at the top of the listing page, the program listings, and the classification on each listing page.

3.2.10.3 **INTEGRATED CIRCUIT DATA.** Include integrated circuit (IC) data (Figure 23). Limit the data to that needed by the technician to understand, and thus maintain, the subject equipment. If practical, omit engineering oriented data of little or no use to the technician and, particularly, omit schematics of IC components and parameters that do not apply directly to the IC as used in the equipment. The type of data that should be included follows:

- a. Truth tables.
- b. Pin numbering scheme.
- c. Logic gate switching thresholds and waveforms of device triggering pulses.
- d. Simplified equivalent circuits of components (e.g. NAND gate used as an inverter, and a pair of inverters in series serving as a buffer with no net signal inversion.)
- e. Simplified block diagrams, especially of LSI devices (i.e., UART and microprocessor ICs).

3.2.10.4 **COMMERCIAL CIRCUIT CARD DATA.** When equipment contains commercial off-the-shelf circuit cards such as single-board computers, random access memories, interfaces, and controllers, information related to necessary alterations such as integrated circuit changes/additions, DIP switch settings, and jumper installations shall be provided. Include the following information to describe alteration/configuration data:

- a. A tabular listing of jumpers or wiring changes to be made on the circuit card.
- b. A tabular listing of integrated circuit changes/additions.

- c. Information for setting DIP switches.
- d. Appropriate references to source for program instruction data necessary for programming memories.
- e. An illustration showing the location of circuit components that require changing, DIP switches, and jumpers.

**3.3 SUBSYSTEM TECHNICAL MANUAL CONTENT.** Prepare a separate manual for each subsystem within a system. These manuals are intended for use by operations and maintenance personnel and managers. The information in the subsystem technical manual, together with accompanying equipment technical manuals, shall be sufficiently complete to enable the subsystem to be operated and maintained in a state of operational readiness. Describe the subsystem in terms of functional signal flow among the equipment units. Do not discuss individual equipment circuits unless required to add clarity and understanding to the functional signal flow description. Subsystem manuals shall present operating instructions organized by position. The maintenance chapter shall include test and illustrative material sufficient to perform preventive as well as applicable subsystem corrective maintenance. Troubleshooting information shall be sufficiently complete to enable maintenance technicians to isolate faults to the equipment (black box) level. Reference equipment-level manuals for detailed information on theory, operation, corrective maintenance, and repair for component equipments. Subsystem manuals shall contain, but need not be limited to, the elements of information described in the following paragraphs, supplemented by such illustrative material as is necessary to support the required data.

**3.3.1 FRONT MATTER.** Include the items described in 3.2.1. This included a cover, lists of effective pages, introduction, table of contents, list of illustrations, list of tables, and a frontispiece. The frontispiece shall show a composite of all the individual equipments that form the subsystem.

**3.3.2 CHAPTER 1, DESCRIPTION OF SUBSYSTEM.** This chapter shall describe the purpose, summarize the electrical and physical characteristics, and describe the capabilities of the subsystem. In the subsystem description, include the items described in the following paragraphs.

**3.3.2.1 SECURITY CLASSIFICATION.** State the security classification of the overall subsystem and its equipment and any ancillary equipment that is used with the basic equipment. Directions for security markings will be supplied by the procuring activity.

**3.3.2.2 PURPOSE AND CAPABILITIES.** Describe what the subsystem is, its intended use (why, where, when, and with what), its capabilities, and its limitations.

**3.3.2.3 TECHNICAL CHARACTERISTICS.** Describe the principal features of the subsystem, including specification data. Include physical data, electrical data, and environmental conditions/requirements. This information may be summarized in a table.

### 3.3.2.3.1 PHYSICAL CHARACTERISTICS. Include the following:

- a. Descriptive data, such as nameplate information, to identify subsystem type and model.
- b. Overall dimensions of the unit or units and, if applicable, the unit or units when crated. Include the height, width and depth dimensions in both centimeters (metric) and inches.
- c. Combined weight of the subsystem equipment, in both kilograms (metric) and pounds.

3.3.2.3.2 ELECTRICAL CHARACTERISTICS. Include data for the subsystem as a whole. Do not repeat the data already included in the equipment-level technical manuals. Give the total primary power requirements for the subsystem as a single unit. For example, if all individual equipments of the subsystem require 115 vac, 50-60 Hz, single phase, then the requirement for the subsystem should be stated as 115 vac, 50-60 Hz, single phase. If two unique primary power voltages are needed (e.g., when two equipments require 115 vac and a third equipment requires 230 vac), then state both requirements. State the cumulative current and cumulative power (wattage) data for each stated voltage. For signal and control requirements, state only those requirements necessary to interface the subsystem with an associated system, subsystem, and/or equipment. List the power, signal, and control requirements for the subsystem manual in the manner set forth in 3.2.2.3.2 of this specification.

3.3.2.3.3 ENVIRONMENTAL CONDITIONS/REQUIREMENTS. Include summarized data and acceptable limits for the subsystem as a whole for the following items:

- a. Ambient temperature requirements.
- b. Heat dissipation.
- c. Air conditioning/cooling requirements.
- d. Humidity requirements.
- e. Altitude considerations.
- f. Shock/vibration sensitivity.

3.3.2.3.4 EQUIPMENT SUPPLIED. List in tabular form each separate equipment and all accessories, including cables, wiring harnesses, test fixtures, test equipment, installation tools, pertinent optional and ancillary equipment, etc., that are supplied with the subsystem. State the official nomenclature, common name, manufacturer's model/part number, and a brief functional description of each equipment and item supplied. If not provided in other documents, identify the subsystem software data supplied.

3.3.2.3.5 EQUIPMENT REQUIRED BUT NOT SUPPLIED. List in tabular form any special tools, materials, and equipments (including test equipments) not supplied but required for operation or maintenance of the subsystem. State sufficient information for the using activity to procure them. Include a common name

(such as oscilloscope or signal generator), required capabilities, and recommended model data. For the recommended model, give the official nomenclature and manufacturer's name. Specific references to the chapters in the manual may be given instead of a detailed list.

**3.3.2.6 PUBLICATIONS REQUIRED.** List publications that are required to support the subsystem in the field. Include procurement data such as the formal title, identification number, and publication source. Include all operation and maintenance manuals for individual equipment that comprise the subsystem.

**3.3.2.7 FUNCTIONAL DESCRIPTION.** Describe the subsystem at the overview level to include the operational capabilities, modes of operation, and performance characteristics. Include a simplified block diagram (Figure 24) that shows the major functions of the individual equipments and the relationship to the system or other subsystems with which the subsystem and its equipment are used.

**3.3.3 CHAPTER 2, INSTALLATION.** Provide pertinent data and instructions necessary to plan and complete the installation of the subsystem covered by the manual. Include information to locate individual equipments, connect the equipments, and to connect the subsystem and its equipments to a system, another subsystem, and/or to other equipments, as appropriate. Include pertinent illustrations to support subsystem installation. Provide alignment and adjustment procedures necessary to ensure that subsystem is ready for operation. Reference equipment-level manuals rather than repeat the same information in the subsystem manual.

**3.3.3.1 LOCATION OF SUBSYSTEM EQUIPMENTS.** Identify equipment locations in subsystem keyed by rack location numbers to a rack layout illustration (Figure 25) and a floor plan illustration (Figure 28). Provide complete step-by-step instructions for installation of subsystem components not covered in any equipment technical manual. Include instructions to assemble and mount the component equipment, including all junction boxes, switchboards, etc., that interconnecting cables enter or leave.

**3.3.3.2 CABLING/CONNECTION DATA.** Include all installation instructions and cabling/connection illustrations (Figure 26), not contained in the component equipment technical manuals, that are required for subsystem installation and checkout. Include instructions for electrically bonding and grounding, connecting wiring and cabling, and connecting primary power distribution. Present interconnection block diagrams with each component equipment shown as a block. Identify all cables running among equipment by cable number. Include the quantity of active and spare leads. Also indicate all junction boxes, switchboards, etc., where interconnection cables enter or leave.

**3.3.4 CHAPTER 3, OPERATING INSTRUCTIONS.** Describe subsystem operating modes and procedures. Detail the descriptions to the level required for understanding the operational interfaces of the subsystem equipment and associated equipment. Include illustrations where necessary for clarity. Describe the various operating modes and procedures.

**3.3.4.1 OPERATOR CONTROLS AND INDICATORS.** Describe in tabular form the purpose/function of each meter, indicator, switch, and control. Reference component equipment manuals as necessary.

**3.3.4.2 OPERATING INSTRUCTIONS.** Provide specific Procedure for start-up, operation, emergency operation, and stop of the subsystem. Include control settings and indicator readings for each procedure, as applicable. Where procedures are to be performed sequentially, use a step-by-step approach. Reference equipment-level technical manuals for start and for stop procedures; however, provide complete procedures for emergency operation. Procedures for normal operation and emergency operation shall be complete procedures with the intent of providing a single source of information for the subsystem operator.

**3.3.4.3 OPERATOR MAINTENANCE.** Provide maintenance information, instructions, and procedures that are the RESPONSIBILITY of the subsystem operator. Reference to equipment-level technical manuals may satisfy this requirement. Include cautions that preclude operator use of controls intended for use only by maintenance personnel.

**3.3.5 CHAPTER 4, PRINCIPLES OF OPERATION.** Limit this chapter to an introduction and a block-diagram description of subsystem operation.

**3.3.5.1 INTRODUCTION.** Briefly introduce the chapter's content.

**3.3.5.2 BLOCK DIAGRAM DESCRIPTION.** Provide a description of subsystem operation based on a functional block diagram (Figure 27). Describe input and output signal flow and control between equipment units and the relationships to other equipment, subsystems, and systems. Describe the major functions performed by the component equipment units (i.e., receiver, interface, multiplexer, microprocessor, etc.). Include coverage of equipment or special circuitry (i.e., special interface and distribution units) only if not included in equipment-level technical manuals.

**3.3.6 CHAPTER 5, MAINTENANCE.** Include information and instructions necessary to perform preventive maintenance and corrective maintenance. Include complete coverage of such items as special interface units and distribution units that are not covered in an equipment-level technical manual. Provide complete lists, tabulations, and procedures, even though these items may be covered elsewhere. For complex procedures, reference to applicable equipment-level technical manuals is sufficient. Provide an introduction, equipment required data, and maintenance controls and indicators information, as well as information on preventive and corrective maintenance.

**3.3.6.1 INTRODUCTION.** Briefly introduce the chapter's content. Describe the maintenance philosophy. Include reference to replaceable parts information, wire lists and cable data, and the component-equipment and parent-system technical manuals.

**3.3.6.2 EQUIPMENT REQUIRED.** List all tools and test equipment required to perform all maintenance instructions given or referenced.

**3.3.6.3 MAINTENANCE CONTROLS AND INDICATORS.** List the maintenance controls and indicators and describe the function of each. Reference extensive lists to the appropriate equipment technical manual.

**3.3.6.4 PREVENTIVE MAINTENANCE.** Describe routine tasks that must be performed to minimize the possibility of subsystem breakdown. Schedule performance of preventive maintenance routines for individual equipments such that subsystem down-time is minimized. References to the equipment-level technical manuals are acceptable; however, provide instructions to accomplish preventive maintenance for special units/equipment that are not covered elsewhere. More specific requirements are described in 3.2.6.4 and its subordinate paragraphs.

**3.3.6.5 CORRECTIVE MAINTENANCE.** Provide instructions to localize subsystem faults. Confine such maintenance instructions to the subsystem level to isolate a fault to a replaceable chassis or equipment within the subsystem. Include information and instructions for repair/replacement, follow-on alignment and adjustment, diagnostic testing, and built-in test equipment (BITE). Refer to 3.2.6.5 and its subordinate paragraphs for more detailed criteria. If pertinent, include diagnostic tests where they can be applied to the system as a whole, or when such tests are not covered in other documentation. Include the items listed in 3.2.6.5.3, as well as program listings described in 3.2.10.2.

**3.3.7 CHAPTER 6, SUBSYSTEM PARTS LIST.** In the context of a subsystem technical manual, the term "parts" is defined as component equipment, assemblies, subassemblies, cables, and other parts. In preparing subsystem parts lists using this specification, provide an introduction, a list of manufacturers, and a parts list. The subsystem parts list may be provided as an appendix, as an alternate method presentation, or as a separate volume to take advantage of Automated Data Processing (ADP) preparation techniques; however, this option must be approved by the procuring activity.

**3.3.7.1 INTRODUCTION.** Briefly introduce the chapter's content.

**3.3.7.2 LIST OF MANUFACTURERS.** Provide a complete list of manufacturer's names and addresses to enable the using activity to procure parts used in the subsystem. Present the list in numerical order by manufacturer's codes used in the parts list. Assign the codes according to the Federal Supply Code for Manufacturers (FSCM) Cataloging Handbooks H4-1 (Name to Code) and H4-2 (Code to Name), and their latest supplements. In a description of the List of Manufacturers, include the foregoing information about the assignment of the codes.

**3.3.7.3 PARTS LIST.** Include a parts list for maintenance of the subsystem. List all component equipments followed by all other parts not covered in the equipment technical manuals. Do not duplicate parts lists that are included in the equipment technical manuals. Include complete lists of assemblies and chassis that are used in the subsystem but are not covered in other technical manuals. This includes distribution and interface assemblies. Where applicable, the parts list coverage shall be as described in 3.2.7.3.

**3.3.8 CHAPTER 7, ILLUSTRATIONS.** In this chapter, include foldout illustrations and other illustrations that support the descriptions and discussions contained in preceding chapters. These illustrations shall include functional block diagrams of the subsystem, interconnection diagrams, and cable diagrams that are not contained in other technical manuals. Also include diagrams for special assemblies, such as junction boxes and interface



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units, that are not otherwise available to the manual user. Locate all foldout (oversize) illustrations in this chapter that relate to preceding chapters.

**3.3.9 APPENDIXES.** Add appendixes as necessary to document subsystem unique equipment and to include commercial vendor data for subsystem equipments.

**3.4 SYSTEM TECHNICAL MANUAL CONTENT.** The system technical manual is intended for use by operations and maintenance personnel and managers. The information in a system technical manual, together with accompanying subsystem and equipment technical manuals, shall be sufficient for operation and maintenance of the system. Describe the system in terms of functional signal flow. Include operating instructions organized by system operating positions. The maintenance chapter shall include text and illustrative material sufficient to perform preventive as well as applicable system corrective maintenance. Troubleshooting information shall be sufficiently complete to enable maintenance technicians to isolate faults to the subsystem or equipment (black box) level. System manuals shall contain the elements of information described in the following paragraphs, supplemented by such illustrative and tabular material as is necessary to support the required data.

**3.4.1 FRONT MATTER.** Include the items described in 3.2.1. This includes a cover, list of effective pages, introduction, table of contents, list of illustrations, list of tables, and a frontispiece. The frontispiece (Figure 3) shall show a composite of all the individual equipment and subsystems that form the system.

**3.4.2 CHAPTER 1, DESCRIPTION OF SYSTEM.** State the purpose and summarize the electrical and physical characteristics of the system. In the system description, include the items described in the following paragraphs.

**3.4.2.1 SECURITY CLASSIFICATION.** State the security classification of the overall system and its equipment and any ancillary equipment that is used with the basic system. Directions for security markings will be supplied by the procuring activity.

**3.4.2.2 PURPOSE AND CAPABILITIES.** Describe what the system is, its intended use (why, where, when, and with what), its capabilities, and its limitations.

**3.4.2.3 TECHNICAL CHARACTERISTICS.** Describe the principal features of the system, including specification data. Include physical data, electrical data, and environmental conditions/requirements. This information may be summarized in a table.

**3.4.2.3.1 PHYSICAL CHARACTERISTICS.** Include the following:

- a. Descriptive data, such as nameplate information, to identify type and model of the system and its individual equipment.
- b. Overall dimensions of the uncrated unit or units and, if applicable, the crated unit or units as a system. Include the height, width, and depth dimensions in both centimeters (metric) and inches.



- c. Combined weight of the system equipment, in both kilograms (metric) and pounds.

**3.4.2.3.2 ELECTRICAL CHARACTERISTICS.** Include data for the system as a whole. Do not repeat the data already included in the subsystem technical manuals. Give the total primary power requirements for the system, treating the system as a single unit. For example, if all equipments in the system require 115 vac, 50-60 Hz, single phase, then the requirement for the system should be stated as 115 vac, 50-60 Hz, single phase. If two unique primary power voltages are needed (e.g., when two equipments require 115 vac and a third equipment requires 230 vac), then state both requirements. State the cumulative current and cumulative power (wattage) data for each stated voltage. For signal and control requirements, state only those requirements necessary to interface the system with an associated system, subsystem, and/or equipment. List the power, signal, and control requirements for the system in the manner set forth in 3.2.2.3.2 of this specification.

**3.4.2.3.3 ENVIRONMENTAL CONDITIONS/REQUIREMENTS.** Include summarized data and acceptable limits for the system as a whole:

- a. Ambient temperature requirements.
- b. Heat dissipation.
- c. Air conditioning/cooling requirements.
- d. Humidity requirements.
- e. Altitude considerations.
- f. Shock/vibration sensitivity.

**3.4.2.4 EQUIPMENT SUPPLIED.** List in tabular form each separate equipment, subsystem, and all accessories, including cables, wiring harnesses, test fixtures, test equipment, installation tools, pertinent optional and ancillary equipment, etc., that are supplied with the system. Give the official nomenclature, common name, manufacturer's model/part number, and a brief functional description of each equipment and item supplied. If not provided in other documents, identify the system software data supplied.

**3.4.2.5 EQUIPMENT REQUIRED BUT NOT SUPPLIED.** List in tabular form any special tools, materials, and equipment (including test equipment) not supplied but required for operation or maintenance of the system. Give sufficient information for the using activity to procure them. Include a common name (such as oscilloscope or signal generator), required capabilities, and recommended model data. For the recommended model, give the official nomenclature and manufacturer's name. Specific references to the chapters in the manual may be given instead of a detailed list.

**3.4.2.6 PUBLICATIONS REQUIRED.** List publications that are required to support the system in the field. Include procurement data such as the formal title, identification number, and publication source. Include in the list all the individual equipment and subsystem operation and maintenance manuals. Reference software publications for the system.

**3.4.2.7 FUNCTIONAL DESCRIPTION.** Describe the system at the overview level to include the operational capabilities, modes of operation, and performance characteristics. Include a simplified functional block diagram (Figure 24) that shows the major functions of the individual equipments and the relationship to other systems.

**3.4.3 CHAPTER 2, INSTALLATION.** Provide pertinent data and instructions necessary to plan and complete the installation of the system covered by the manual. Include information to locate the individual equipments, connect the equipments, and to connect the system and its equipment to another system. Include pertinent illustrations to support system installation. Provide alignment and adjustment procedures necessary to ensure that system is ready for operation. Reference equipment-level manuals rather than repeat the same information in the system manual.

**3.4.3.1 LOCATION OF SYSTEM COMPONENTS.** Identify equipment locations in the system keyed by location numbers to an illustration (Figures 25 and 28) which depicts the required (or recommended) configuration of the component subsystems, racks, and/or equipment. Provide complete step-by-step instructions for installation of the system components not covered in any of the equipment technical manuals for the equipment comprising the system. Include instructions to assemble and mount the component equipment, including all junction boxes, switchboards, etc., that interconnecting cables enter or leave.

**3.4.3.2 CABLING/CONNECTION DATA.** Include instructions and installation cabling/connection illustrations (Figure 26), not contained in the equipment technical manuals, that are required for system installation and checkout. Include instructions for electrically bonding and grounding, connecting wiring and cabling, and connecting primary power distribution. Present interconnection block diagrams with each component subsystem and equipment shown as a block. Identify all cables running among equipment by cable number. Include wiring tabulations for each cable type to show active and spare wires. Also indicate all junction boxes, switchboards, etc., where interconnection cables enter or leave.

**3.4.4 CHAPTER 3, OPERATING INSTRUCTIONS.** Describe system operating modes and procedures. Detail the descriptions to the level required for understanding the operational interfaces of the system. Include illustrations where necessary for clarity. Describe the various operating modes and procedures.

**3.4.4.1 OPERATOR CONTROLS AND INDICATORS.** Describe in tabular form all controls and indicators not described in equipment or subsystem documentation.

**3.4.4.2 OPERATING INSTRUCTIONS.** Provide specific procedures in sufficient depth to operate the system; exclude equipment start and stop procedures except where such procedures are integral parts of the system operation. Include control settings and indicator readings for each condition. Where procedures are to be performed sequentially, use a step-by-step approach. Reference equipment-level technical manuals for start and stop procedures; however, provide complete procedures for emergency operation.

**3.4.4.3 OPERATOR MAINTENANCE.** Provide maintenance information, instructions, and procedures that are the RESPONSIBILITY of the system operator. Reference to the supplied equipment-level technical manuals may satisfy this requirement. Include cautions that preclude operator use of any controls intended for use only by maintenance personnel.

**3.4.5 CHAPTER 4, PRINCIPLES OF OPERATION.** Limit this chapter to an introduction and a block-diagram description.

**3.4.5.1 INTRODUCTION.** Briefly introduce the chapter's content.

**3.4.5.2 BLOCK DIAGRAM DESCRIPTION.** Provide a description of system operation based on a functional block diagram (Figure 27). Limit the description to the extent that the reader can relate to the component equipment. Describe input and output signal flow and control among equipments, and the relationships to other equipments, subsystems, and systems. Describe other circuitry only if such descriptions are not included elsewhere in the equipment-level technical manuals.

**3.4.6 CHAPTER 5, MAINTENANCE.** Include information and instructions necessary to perform preventive and corrective maintenance at the system level. Provide complete lists, tabulations, and procedures, even though these items may be covered elsewhere. For complex procedures, reference to equipment-level technical manuals is sufficient. Provide an introduction, equipment required data, and maintenance controls and indicators information, as well as information on preventive and corrective maintenance. Provide complete coverage of such items as special interface units and distribution units that are not covered in an equipment-level technical manual.

**3.4.6.1 INTRODUCTION.** Introduce the chapter's content. Describe the maintenance philosophy. Include references to replaceable parts information, wire lists and cable data, and the equipment and subsystem technical manuals.

**3.4.6.2 EQUIPMENT REQUIRED.** List all tools and test equipment required to perform all maintenance instructions given or referenced. Prepare the list of tools and test equipment required in accordance with the requirements stated in 3.2.6.2 of this specification.

**3.4.6.3 MAINTENANCE CONTROLS AND INDICATORS.** List the maintenance controls and indicators and describe the function of each. Reference extensive lists to the appropriate equipment technical manual. Content of the list is described in 3.2.6.3.

**3.4.6.4 PREVENTIVE MAINTENANCE.** Describe routine tasks that must be performed to minimize the possibility of system breakdown. Schedule performance of preventive maintenance routines for individual equipments such that system down-time is minimized. References to the equipment-level technical manuals are acceptable; however, provide instructions to accomplish preventive maintenance for special units/equipments that are not covered elsewhere. More specific requirements are given in 3.2.6.4 and the subordinate paragraphs thereof.

**3.4.6.5 CORRECTIVE MAINTENANCE.** Provide instructions to localize system faults. Confine such maintenance instructions to the system level to isolate a fault to a replaceable chassis or equipment within the system. Include information and instructions for repair/replacement, follow-on alignment and adjustment, diagnostic testing, and built-in test equipment (BITE). Refer to 3.2.6.5 and the subordinate paragraphs thereof for more detailed criteria. If pertinent, include diagnostic tests where they can be applied to the system as a whole, or when such tests are not covered in other documentation. Include the items listed in 3.2.6.5.3, as well as program listings described in 3.2.10.2.

**3.4.7 CHAPTER 6, SYSTEM PARTS LIST.** In the context of a system technical manual, the term "parts" is defined as component equipments, assemblies, sub-assemblies, cables, and parts not documented elsewhere. In preparing system parts lists using this specification, provide an introduction, a list of manufacturers, and a parts list. The system parts list may be provided as an appendix, as an alternate method of presentation, or as a separate volume to take advantage of Automated Data Processing (ADP) preparation techniques; however, this option must be approved by the procuring activity.

**3.4.7.1 INTRODUCTION.** Briefly introduce the chapter's content.

**3.4.7.2 LIST OF MANUFACTURERS.** Provide a complete list of manufacturers' names and addresses to enable the using activity to procure parts used in the system. Present the list in numerical order by manufacturers' codes used in the parts list. Assign the codes according to the Federal Supply Code for Manufacturers (FSCM) Cataloging Handbooks H4-1 (Name to Code) and H4-2 (Code to Name), and their latest supplements. Alphabetical codes, such as 0000A, 0000B, 0000C, etc., may arbitrarily be assigned to manufacturers not appearing in the H4-series handbooks. In a description of the List of Manufacturers, include the foregoing information about the assignment of the codes.

**3.4.7.3 PARTS LIST.** Include a parts list for maintenance of the system. List all component equipment and chassis followed by all other parts not covered in the equipment technical manuals. Do not duplicate parts lists that are included in the equipment technical manuals; simply list the equipment. Include complete lists of assemblies and chassis that are used in the system but are not covered in other technical manuals. This includes distribution and interface assemblies. Otherwise, content of the parts list shall be to the extent described in 3.2.8.3.

**3.4.8 CHAPTER 7, ILLUSTRATIONS.** Include all oversize illustrations (foldouts) that support the descriptions and discussions contained in chapters 1 through 5. These illustrations shall include functional block diagrams of the system, interconnection diagrams, and cable diagrams that are not contained in other technical manuals. Also include diagrams for special assemblies, such as junction boxes and interface units, that are not otherwise available to the manual user.

**3.4.9 APPENDIXES.** Add appendixes as necessary to document system-unique equipment and to include commercial vendor data for subsystem equipments.

**3.5 ILLUSTRATION CONTENT.** In all cases where engineering drawings are technically adequate and reproducible, use them in the technical manual. Engineering drawings used shall include the title block with drawing numbers. In all cases, the Government shall determine legibility and reproducibility. Engineering drawings include assembly, logic, schematics, power distribution and wiring diagrams, printed circuit assemblies, equipment enclosures, racks (elevation views), subsystem or system layouts, and other pertinent drawings. Machine shop and manufacturing drawings not relevant to installation, operator functions, maintenance and parts replacement, shall not be included in the manual. Drawings used as part of the manual that are not part of the engineering drawing package shall be identified on the printer's assembly sheet as to source (original, manufacturer diagrams, etc.).

#### **3.5.1 FRONT MATTER ILLUSTRATIONS.**

**3.5.1.1 COVER.** An example cover is provided in Figure 1.

**3.5.1.2 FRONTISPIECE.** Provide a three-quarters view (Figures 3 and 4, photograph preferred) of the complete equipment with the accessories furnished by the manufacturer. Use callouts to identify the major assemblies of the equipment.

#### **3.5.2 CHAPTER 1, ILLUSTRATIONS.**

**3.5.2.1 PHYSICAL DESCRIPTION.** For equipment level manuals, provide a composite front, top, and rear view photograph or line drawing (Figure 5). Identify all major assemblies, circuit boards, power supplies, fuses, etc. For subsystem and system manuals, identify location of each equipment within subsystem or system.

**3.5.2.2 FUNCTIONAL BLOCK DIAGRAM.** Provide a functional block diagram (Figure 6) showing how the subject equipment functionally relates to other equipment, in terms of input and output signal and control lines. For multipurpose equipment or equipment that can be used in more than one configuration, show the most common, or typical, applications. The intent of the functional block diagram requirement is to provide the user with an overview of the equipment relative to associated equipment. Details, such as pin numbers, quantity of wires/cables, wire type, etc., may be omitted if such details are available to the user in other illustrations or other forms of conveying information.

#### **3.5.3 CHAPTER 2, ILLUSTRATIONS.**

**3.5.3.1 INPUT/OUTPUT CONNECTIONS.** For equipment-level technical manuals, provide photographs (Figure 7) or line art showing all signal, control, and power connectors. References to other chapters containing such illustrations are acceptable. For subsystem and system-level technical manuals, include such illustrations for equipment that are not covered in other manuals.

**3.5.3.2 LOCATION AND MOUNTING.** For equipment-level technical manuals, provide outline drawings that give the overall measurements of the equipment and

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all dimensions essential to its placement and mounting. Also include photographs or drawings that show the following:

- a. Methods of mounting that are unique to the equipment.
- b. All features of the rear of the equipment, including signal, control, and power connections.
- c. The position and identity of important and/or unique components, boards, switches, terminals, etc.

For subsystem and system technical manuals, include diagrams (Figure 28) showing how to locate such equipment with respect to walls, doors, desks, tables, power lines, other equipment, etc. Also include overall physical layout diagrams with dimensions that show the equipment in relation to associated equipment and the electrical connections between them. However, do not prepare duplicate diagrams when such diagrams exist in other chapters; references to those chapters will suffice.

**3.5.3.3 INTERCONNECTION DIAGRAMS.** Either include interconnection diagrams (Figure 20) or refer to those that are contained in other chapters or in other supplied technical manuals. Interconnection diagrams shall contain sufficient data to enable installation of the equipment.

**3.5.3.3.1 CABLING DIAGRAMS.** In cabling diagrams (Figure 26), show the cabling between units of the equipment, labeled to clearly indicate the relationship between the cabling diagrams and the wiring diagrams.

**3.5.3.3.2 WIRING DIAGRAMS.** In wiring diagrams, show the connecting and terminating points for all intercomponent wiring and all other wiring formed into bundles or cables. The diagrams may be the physical, pictorial, highway, or point-to-point type, depending on the equipment covered; however, the physical path of each circuit must be easily traced through the equipment. Clearly indicate destination, wire number, and any other pertinent information at each connecting and terminating point. Show all connectors, terminal boards, terminal strips, connector pins, and terminals in the equipment even if they are not used.

#### **3.5.4 CHAPTER 3, ILLUSTRATIONS.**

**3.5.4.1 CONTROLS AND INDICATORS.** Include photographs (Figure 8) or line art showing all operator controls and indicators with callouts. Callouts shall be included to account for operator front and rear panel control and indicator and be presented to permit rapid and efficient correlation with the tabular descriptions. A recommended approach is to use leader lines, one for each item if practical, and to index or number the leaders in a clockwise fashion, beginning at the top-left corner of the illustration. (In this approach, present the individual item descriptions in numerical order, corresponding to the assigned index numbers.)

**3.5.4.2 OTHER ILLUSTRATIONS.** Supplement the text with photographs or line art, with callouts, showing control/switch settings and desired indications. Where appropriate, refer to illustrations located elsewhere; do not duplicate them.



### 3.5.5 CHAPTER 4. ILLUSTRATIONS.

3.5.5.1 FUNCTIONAL BLOCK DIAGRAMS. Two levels of functional block diagrams may be used to support the narrative descriptions in the chapter; a simplified diagram and detailed diagrams. If foldout diagrams are used, locate in Chapter 7.

3.5.5.1.1 SIMPLIFIED FUNCTIONAL BLOCK DIAGRAM. Prepare the simplified functional block diagram (Figure 9) so that the component blocks are easily correlated to the detailed logic/schematic diagrams (equipment manuals). This shall be a line drawing in which essential functions of the equipment are drawn as rectangular blocks, identified by the names given to the functions performed (amplifier, buffer, mixer, converter, etc.) and with the relationship of the blocks to each other shown by interconnecting signal/control lines. A block diagram that shows all the functions (expands on the simplified block diagram) is a detailed block diagram.

3.5.5.1.2 DETAILED FUNCTIONAL BLOCK DIAGRAM. Detailed functional block diagrams (Figure 10) are used to elaborate on the relationships between major functional circuits, with a secondary emphasis on physical relationships. To illustrate circuits that use both analog and digital signals, use combination block/logic diagrams. Refer to 3.2.9.1 for additional content information pertaining to equipment-level technical manuals.

3.5.5.2 TIMING DIAGRAMS. As used in this specification, a timing diagram (Figure 11) is a graphic presentation in which a change of state is plotted against time for visualizing a sequence of events. This diagram type usually consists of waveforms of logic circuit activity. Unless critical to the operation of a logic circuit, propagation delay times through devices are usually ignored. When timing diagrams are used, indicate the point at which each can be observed in the equipment, name, appearance, duration, and relative time of occurrence.

### 3.5.6 CHAPTER 5, ILLUSTRATIONS.

3.5.6.1 MAINTENANCE CONTROLS AND INDICATORS. If applicable, provide one or more photographs (Figure 13) or line art, with callouts, to show every maintenance control and indicator, particularly those used only by the technician. It is preferable to reference other chapters than to duplicate existing illustrations; this applies, in particular, to those devices (such as may appear on the front panel) accessible to the operator and shown in the Operation chapter.

3.5.6.2 WAVEFORM DIAGRAMS. A waveform is the graphic representation of instantaneous values of electrical quantity, plotted in rectangular coordinates against time. Waveforms may be presented as photographs of oscilloscope traces, in which case they are termed "actual" waveforms, or they may be line drawings of desired traces termed "idealized" waveforms. Waveform diagrams may be used in equipment technical manuals. When waveform diagrams are used, indicate the amplitude and time base of each. Where practical, use actual waveform diagrams (photographs of oscilloscope traces) to depict optimum adjustment, normal operation, and indications of equipment trouble.



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**3.5.6.3 TEST SETUP DIAGRAMS.** Line art may be used to depict equipment test configurations. Presentation may be in the form of rectangular blocks, to represent the equipment and test units, and interconnecting lines, to represent cabling and wiring connections. Clearly identify all connectors and cables that are used.

**3.5.7 CHAPTER 6, ILLUSTRATIONS.**

**3.5.7.1 COMPONENT LOCATION DIAGRAMS.** Use two dimensional line art in equipment-level technical manuals to show component locations for all maintenance-significant parts listed in the parts list tables (Figure 19). When preparing the component location diagrams, components on the reverse side shall be shown as dashed lines.

**3.5.7.2 ILLUSTRATED PARTS BREAKDOWN DIAGRAMS.** When the Illustrated Parts Breakdown (IPB) approach is required, prepare supporting diagrams (Figures 14 through 18) in accordance with MIL-M-008910.

**3.5.8 CHAPTER 7, ILLUSTRATIONS.**

**3.5.8.1 LOGIC DIAGRAMS.** In logic diagrams (Figure 22), show and identify all logic and nonlogic functions, socket locations, pin numbers, test points, and any other physical elements necessary to describe the physical and electrical aspects of the logic. Indicate signal flow by symbol orientation. If necessary for clarity, use arrows superimposed on the connecting lines to indicate signal flow; however, do not place arrowheads adjacent to a symbol. Where required for clarity, stylized waveforms shall be placed adjacent to the applicable signal line to indicate the nature and timing of the signals. Lay out logic drawings on a functional basis for each equipment with functional flow generally from left to right and top to bottom. Identify each subunit (register, control logic, etc.) within a drawing and clearly label its function and specific destination. Make logic drawings a common vertical size. Show all inputs (used or unused) of all circuits.

**3.5.8.2 SCHEMATIC DIAGRAMS.** In schematic diagrams (Figure 21), show every circuit and detail component in the equipment. Single diagrams that cover all signal, power, and control circuits are preferred. Where single diagrams are not practical, separate diagrams into logical units clearly marked to show the relationship between diagrams, including labeled inputs, outputs, and connecting or terminating points. Each schematic shall contain the following:

- a. Dashed lines that enclose subassemblies and components for which separate schematics are provided.
- b. Reference designations for each detail part.
- c. Electrical characteristics and tolerance for each detail part.
- d. A functional or descriptive name for each stage.
- e. Labels on each component input, output, and connecting or terminating point to indicate function at that point.

- f. Solid-line boxes that enclose the names of all front-panel controls, indicators, and displays.
- g. A diagram layout that shows functional signal flow, generally from left to right or from top to bottom.
- h. Test points and associated waveforms.

**3.5.8.3 POWER DISTRIBUTION DIAGRAMS.** The content of power distribution diagrams for equipment manuals (Figure 12) is described in 3.2.9.4 of this specification. For subsystem and system manuals, provide diagrams for power distribution not covered in the equipment manuals. Show and identify the following:

- a. Motors, transformers, regulators, power supplies, assemblies, and subassemblies.
- b. All power line devices such as fuses, circuit breakers, switches and relay contacts.
- c. All connections including plugs, jacks, and terminal boards in the distribution path.
- d. All metering circuits and indicators.
- e. All grounds, common lines, neutral lines, and return lines.

**3.5.8.4 INTEGRATED CIRCUIT DIAGRAMS.** Include integrated circuit (IC) diagrams (Figure 23) in an equipment technical manual appendix. The content of IC diagrams is described in 3.2.10.3.

**3.6 FORMAT.** Format for technical manuals produced under this specification shall be in accordance with MIL-M-38784, except as otherwise described herein. Information is provided in the subsequent paragraphs for two purposes: to specify the exceptions and to clarify certain requirements that are subject to interpretation. Other information is provided in this specification for convenience.

Format requirements for the following listed items are included herein:

- a. Reproduction (Image) Area.
- b. Front Matter.
- c. Text Headings, Numbering, References, and Notes.
- d. Table Titles, Location, and Numbering.
- e. Typography.
- f. Illustration Types, Sizes, Titles, Location, and Numbering.
- g. Pagination.
- h. Abbreviations.

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**3.6.1 REPRODUCTION AREA.** In this specification, the reproduction area is that portion of a full-size page within which the text, tables, and artwork shall be confined; this area excludes marginal copy (the page number and sometimes the publication number). For this description, a full-size page and a foldout page are those which require no reduction for printing. The two reproduction areas, the full-size page (full page) and the foldout page, are described.

**3.6.1.1 FULL PAGE.** The reproduction area for a full page shall be 165 mm wide by 222 mm high (6-1/2 inches wide by 8-3/4 inches high) (top to bottom). The reproduction area shall be related to the page number as follows:

- a. **RIGHT-HAND PAGE.** The page number shall be located as shown in Figure 31 justified to the right-hand margin.
- b. **LEFT-HAND PAGE.** The page number shall be located as shown in Figure 31 justified to the left-hand margin.

**3.6.1.2 FOLDOUT PAGE.** The maximum reproduction area for a foldout page shall be 603 mm wide by 222 mm high (23-3/4 inches wide and 8-3/4 inches high) (top to bottom). However, the preferred width for a foldout is 400 mm (15-3/4 inches). The reproduction area for a foldout shall be related to the page number for a right-hand page as shown in Figure 29. Foldup and folddown pages are not acceptable.

**3.6.2 FRONT MATTER.** Format for the Table of Contents, List of Illustrations, and List of Tables is shown in Figures 30 and 31. Do not include listings and procedural steps in the Table of Contents.

**3.6.3 TEXT.** Type bodies of text for review draft material double-spaced to allow for review comments. Type bodies of text for manuscript and final copy material single-spaced. Avoid blank pages and spaces wherever possible to conserve space without lessening the usefulness or clarity of material presented therein. The following requirements also apply:

- a. Do not divide a paragraph so that the first line is alone ("widow" line) at the bottom of the page or that the last line begins a new page.
- b. Do not place paragraph headings on the last line of a page.
- c. Do not divide notes, cautions, or warnings.
- d. Type at least five lines of text on pages containing both text and illustrations (or tables). There are two exceptions: (1) when the page is the last in a chapter, and (2) the paragraph heading would be on the last line of a page.
- e. Leave sufficient space between mathematical expressions (equations, formulas, etc.) and the body of the adjacent text.
- f. Do not end a page with hyphen. Also do not end three consecutive lines in a paragraph with hyphens.

- g. Do not make more than five one-word corrections (white opaque) on a page and do not have more than five mortised lines of text on a page.

Requirements for chapter and paragraph identification and typing, referencing, and the use of notes are given in the subsequent paragraphs.

**3.6.3.1 CHAPTERS.** Number the chapters consecutively within each volume with Arabic numerals beginning with the number 1. Type the word "CHAPTER" in capital letters, followed by the appropriate Arabic numeral, at the top center of the reproduction area. Type the chapter title in capital letters on the center of the page two lines below the chapter designation. The chapter titles are given in the paragraphs covering equipment, subsystem, and system technical manual content. Begin each chapter on a new right-hand page (Figure 32).

**3.6.3.2 PARAGRAPHS.** Paragraph division shall consist of four basic elements: primary, first subordinate, second subordinate, and third subordinate paragraphs. Each of these paragraphs shall be assigned a heading (paragraph title) that specifically relates to the paragraph's subject content. The hierarchical order of the paragraphs is determined by the type of heading assigned. Further, the use of untitled paragraphs is permitted. All paragraphs shall be numbered using a two-part Arabic numeral separated by a hyphen. The first part corresponds to the chapter number, and the second part is the sequential number of the paragraph within the chapter. For example:

<u>Number</u>	<u>Denotes</u>
1-1	Chapter 1, Paragraph 1
1-2	Chapter 1, Paragraph 2
2-1	Chapter 2, Paragraph 1
2-2	Chapter 2, Paragraph 2

Specific paragraph formats are described in the paragraphs that follow.

**3.6.3.2.1 PRIMARY PARAGRAPHS.** Type the paragraph number followed by a period. Skip two spaces and type the paragraph title in all capital letters followed by a period. Skip two spaces and begin text on the same line. Type the second and all succeeding lines of text flush with the left margin.

**3.6.3.2.2 FIRST SUBORDINATE PARAGRAPHS.** First subordinate paragraphs shall be lettered "a, b, c, -- z." The paragraph letter shall be indented two spaces and followed by a period. Skip two spaces and type the paragraph title. The first word and each principal word shall be capitalized, and the title shall be underscored followed by a period. Skip two spaces and begin text on the same line. Type the second and all succeeding lines of text flush with the left margin.

**3.6.3.2.3 SECOND SUBORDINATE PARAGRAPHS.** Second subordinate paragraphs shall be numbered "(1), (2), (3), etc." The paragraph number shall be indented six spaces. Skip two spaces and type the paragraph title. The first word shall be capitalized, and the title shall be underscored followed by a period. Skip two spaces and begin text on the same line. Type the second and all succeeding lines of text flush with the left margin.

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**3.6.3.2.4 THIRD SUBORDINATE PARAGRAPHS.** Third subordinate paragraphs shall be numbered "(a), (b), (c), etc." The paragraph number shall be indented eleven spaces. The paragraph title and format shall be prepared in the same manner as second subordinate paragraphs.

**3.6.3.2.5 UNTITLED PARAGRAPHS.** Untitled paragraphs may be used when the paragraph content does not warrant assignment of a paragraph heading. Untitled paragraphs may follow any of the four basic paragraph elements' and shall be indented the same number of spaces as the parent paragraph. Type the second and all succeeding lines of text flush with the left margin. Do not assign numbers to untitled paragraphs.

**3.6.3.2.6 LISTINGS.** Item listings within a paragraph shall be set apart from the text and/or paragraph headings by line spacing and indentation. Listings shall begin two line spaces below the associated text or paragraph heading and be indented the same number of spaces as the associated text or paragraph heading. To conserve space and maintain conciseness, listings consisting of single line items shall be typed single-spaced. However, for clarity, listings consisting of one or more multiple line items shall be typed single-spaced with a line space separating each item. Multiple line items shall be typed in "block" style, that is, type the first word of successive lines directly under the first word of the first line. Listing items shall not be given a number or letter designation.

**3.6.3.2.7 PROCEDURAL STEPS AND SUBSTEPS.** Procedural steps within a paragraph shall be set apart from the text and/or paragraph headings by line spacing and indentation. Procedural steps shall begin two line spaces below the associated text or paragraph heading and be indented the same number of spaces as the associated paragraph heading sequentially, beginning with an alpha a, followed by a period, and continuing with b, c, d, etc. The procedural steps shall be typed in block style, in the same manner described for listings in

**3.6.3.2.6.** Lower-order steps, or substeps, shall begin two line spaces below the associated procedural step and be indented four spaces from the previous higher-order step. Substeps shall be lettered sequentially, beginning with a (1) and continuing with (2), (3), (4), etc. Substeps shall be typed in block style, in the same manner described for listings in 3.6.3.2.6.

### **3.6.3.3 REFERENCES.**

**3.6.3.3.1 REFERENCE TO ILLUSTRATIONS.** Refer the text directly to illustration(s) that support it. When reference is made to figures, reference the figure number, not the page number. When reference is made to items shown on figures by index numbers (or reference designation), indicate the index numbers (or reference designation) and figure number in the following manner: "The HF POWER switch (34, Figure 2-6) on the communications panel controls the HF radio." Where references are made in a paragraph to several items in the same figure, as in instructions detailing work procedures, give the figure number only once (usually at the beginning of the paragraph) with index numbers of the items in parentheses in the body of the text where pertinent. Take care to make references entirely clear.

**3.6.3.3.2 REFERENCE TO TABLES.** When reference is made to tables, reference the table numbers.

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**3.6.3.3.3 REFERENCE TO PARAGRAPHS.** When reference is made to paragraphs, reference the paragraph numbers. Do not use the words "above" and "below" to refer to relative position of the text.

**3.6.3.3.4 REFERENCE TO OTHER CHAPTERS OF A PUBLICATION.** Make direct references to material in other chapters of a technical manual if the chapter is in the same manual.

**3.6.3.3.5 REFERENCE TO OTHER PUBLICATIONS.** Make maximum use of cross-references to other publications if the publications referenced are available to users of manuals. Do not reference specific paragraphs in other manuals.

**3.6.3.3.6 USE OF REFERENCE DESIGNATIONS.** Refer to electrical and electronic parts in text and illustrations by their reference designations. Do not use punctuation in reference designations (for example, resistor R14, not resistor R-14). If reference designations are not assigned, generate a system for component identification with adequate explanation for use.

**3.6.3.4 NOTES, CAUTIONS, AND WARNINGS.** Notes, cautions, and warnings are special entries that call attention to essential information. When an instruction can result in both equipment damage and personnel injury, insert both a warning and a separate caution before the instruction. Do not refer to a preceding caution or warning, repeat it if necessary. Do not number notes, cautions, and warnings. Center these forms of notes within the reproduction area and indent at least the equivalent of 15 characters.

**3.6.3.4.1 NOTES.** Use notes to highlight conditions or procedures when required for clarity or emphasis. A note generally precedes the applicable text. Do not include regular procedural steps in a note, but present the step as usual, with the note following to emphasize any unique aspects of the step. For example;

**NOTE**

Hold PUSH TO TEST switch depressed  
while performing steps g through m.

**3.6.3.4.2 CAUTIONS.** Use cautions as emphatic notices of specific practices necessary to avoid damage to equipment. A caution precedes the applicable text. Include the reason for each caution to prevent the assumption of a different and possible less urgent reason. For example:

////////////////////  
/      CAUTION      /  
////////////////////

Take care not to short pin 3 to ground  
when connecting test equipment as this  
results in uncontrolled movement of the  
antenna and possible damage to the antenna  
drive system.

**3.6.3.4.3 WARNINGS.** A warning is an operating or maintenance procedure, practice, condition, statement, etc., which, if not strictly observed, could



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result in injury to or death of personnel. Warnings may be worded positively or negatively and shall state the hazard and result or reason, unless obvious. Warnings shall precede the text to which they apply. For example:

```
*****
*   WARNING   *
*****
```

To avoid fatal electrical shock, use the shorting bar to discharge capacitor C14 before connecting test equipment.

3.6.4 **TABLES.** Include information in the form of ruled tables in accordance with the following criteria and the subsequent paragraphs:

- a. Use capital letters and center column headings above the pertinent columns.
- b. Completely rule tabular material with vertical and horizontal lines. Completely encompass the body of the entire table.
- c. Consider curves and charts to be illustrations rather than tabular data.

Imprint copy for tabular matter directly on the page or prepare it separately on the same grade of paper stock and permanently affix it to the reproduction page. When it is necessary to prepare tabular material oversized, affix photo prints (reduced to reproduction size, 1:1) to the page. Ensure that the final print size meets the minimum size requirements specified in 3.6.5 and 3.6.6.3.

3.6.4.1. **TITLES.** Table titles shall be initial capital letters and centered within the reproduction area above the ruled body of the table. If the title exceeds one line, the second line shall be aligned beneath the first letter of the first word.

3.6.4.2 **LOCATION.** Locate tables as near as possible following the paragraph in which the table is first introduced (referenced). If a table exceeds one page, the continuation on succeeding pages shall be headed with the table number and title followed by the parenthetical expression "(Continued)". Repeat headings on continued pages.

3.6.4.3 **NUMBERING.** Number tables consecutively within each chapter using two-part Arabic numerals separated by a hyphen (similar to page and figure numbers). The first part designates the chapter in which the table appears, and the second part is the sequence number of the table. For example, designate three tables in Chapter 1, "Table 1-1", "Table 1-2", and "Table 1-3." Present the table number with initial capital letters (i.e., Table 1-1), and center within the page reproduction area with the table title.

3.6.5 **TYPOGRAPHY.** Use 10-point type for final text material. Use no less than 6-point lettering for final size tables and illustrations.



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**3.6.6 ILLUSTRATIONS.** For reproduction pages containing illustrations, provide the required marginal copy and text. Reduce all line art to final size and paste in place. Provide separate board art for photographic art.

**3.6.6.1 HALFTONES.** Use Leroy lettering guides or equivalent to letter call--out (index numbers, reference designators, nomenclature, or any combination thereof) required to identify or direct attention to specific portions of a photograph. Prepare the lettering on transparent, dimensionally stable material which is securely fastened to each illustration board to serve as an overlay. Do not place callouts directly on any photographic print. Place two registration marks not more than 127 mm (1/2 inch) beyond the edge on each side of the mounted print to ensure accurate alignment of the overlay and photograph. Use adhesive-backed leaders and special symbols on overlays for photographs. Protect each mounted photograph with an inner flap of vellum and an outer flap of heavy Kraft paper. Each flap shall be free of wax or grease. Do not use paper made transparent or translucent by oil treatment or similar process. Securely fasten all photographs to a white illustration board exceeding the size of the print by at least 750 mm (3") in each direction. Mount each 210 mm X 297 mm (8" X 10") print on a separate board, with the edges of the print parallel to the edges of the board. The method of mounting may be any reasonably permanent and secure dry process that does not discolor or distort the photograph and which assures its remaining flat, free from wrinkles and blisters. Mount smaller prints on separate boards. Make all mounting boards approximately the same dimensions to facilitate handling and storage.

**3.6.6.2 LINE ART.** Mount line art on the reproduction page along with text, or furnish the artwork separately in form.

**3.6.6.3 SIZE.** Make all lettering on illustrations of such size that when oversized artwork is reduced to the final printed size, the smallest lettering will be no smaller than 15 mm (0.06 inch) in height (6 point; Leroy template No. 60).

**3.6.6.4 TITLES.** Assign a figure title (caption) to each illustration. The figure title shall consist of the figure number followed by a very brief, descriptive caption. For example, the title of the frontispiece for the XYZ Equipment is stated: "Figure 1-1. XYZ Equipment". Include the sheet number in the title of multisheet illustrations as in the following example for a foldout:

Figure 7-3. XYZ Equipment Logic  
Diagram (Sheet 1 of 3)

If appropriate, each sheet of a multisheet illustration shall also contain a short, descriptive subtitle based on function consistent with text and block diagrams. This subtitle shall describe the circuitry contained on that sheet. For example: CLOCK CIRCUIT, CONTROL CIRCUIT, or INPUT CIRCUIT. For full-page illustrations, locate the title at the bottom of and within the reproduction area, and within 952 mm (3-3/4 inches) of the right vertical edge of the reproduction area. Format the title as shown in the previous example (for "Figure 7-3").

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**3.6.6.5 LOCATION.** Arrange illustrations in numerical order by figure number throughout the manual. Each illustration shall occupy space on the same page, or the page facing that which contains the reference to the illustration, wherever possible. Place foldouts in Chapter 7.

**3.6.6.6 NUMBERING.** Identify each illustration by a figure number consisting of the chapter number and a sequence number. For example:

<u>Chapter No.</u>	<u>Sequence No.</u>
-	-
1	1
1	2
1	3
2	1
2	2
2	3

Present complete figure numbers in text thus: Figure 1-1, Figure 1-2, Figure 1-3, etc.

**3.6.7 PAGINATION.** Number each page of the material submitted. Consecutively number the front matter, beginning with the introduction page and ending before the frontispiece, with lowercase Roman numerals. In review draft form, all subsequent pages (beginning with the first page of Chapter 1) may consist of simple sequential Arabic numerals, beginning with 1, 2, 3, ..., etc. Locate each page number at the bottom, center of the page, approximately 177 mm (1/2 inch) above the bottom edge of the page. In manuscript, preliminary, and final form number each page of each chapter with a two-part page number. The number shall consist of the chapter designation, a hyphen, and a serial number. For example:

<u>Page Number</u>	<u>Description</u>
1-1	Chapter 1, First Page
1-2	Chapter 1, Second Page
1-3	Chapter 1, Third Page
2-1	Chapter 2, First Page
2-2	Chapter 2, Second Page
2-3	Chapter 2, Third Page
A-1	Appendix A, First Page
A-2	Appendix A, Second Page
B-1	Appendix B, First Page

Also in manuscript, preliminary, and final form, locate the page numbers on the page according to the nature of the page sequence numbers: for odd-numbered pages (right-hand pages), position the numbers beneath the right edge of the reproduction area; for even-numbered pages (left-hand pages), position the numbers beneath the left edge of the reproduction area (Figure 29). Account for all pages, including blank pages, in this numbering system. Include blank page numbers in parentheses with the previous page number. For example: v (vi blank), 1-7 (1-8 blank), and 2-3 (2-4 blank).

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**3.6.8 ABBREVIATIONS.** Use abbreviations in text and in illustrations and diagrams in accordance with the following requirements as applicable;

- a. Use abbreviations in text sparingly, and unless long custom has established their use, identify them the first time they appear. In tabular presentation where space is at a premium, abbreviations may be used as necessary to conserve space.
- b. Use abbreviations in text and on illustrations in accordance with MIL-STD-12, ANSI Y10.19 and ANSI/IEEE-260-78 as applicable.
- c. Spell out unusual and nonstandard abbreviations when first used in each chapter followed by the abbreviation in parentheses. Thereafter, use the abbreviation by itself, but consistently, throughout subordinate text.
- d. Do not use punctuation in any abbreviations unless the abbreviation spells a word. If the abbreviation spells a word, the following rules shall apply:
  - (1) If the abbreviation is used to abbreviate one word, the abbreviation shall be followed by a period. For example, when "number" is abbreviated it shall appear as "No."
  - (2) If the abbreviation is used to abbreviate two or more words, use upper case letters. For example, when "intermediate frequency" is abbreviated, it shall appear as "IF."

Use uppercase letters on illustrations except where the use of lower case letters has been established by long practice, and recognition of an uppercase abbreviation might be difficult.

**3.6.9 SIGNAL NAMES.** When used in text, signal names shall be consistent with the style and usage on drawings and shall be all capital letters.

**3.6.10 VOLUME CONTENT.** The primary considerations related to creating two or three volume technical manuals are final printed binding size (page count) and the number of illustrations in Chapter 7. The usability of a technical manual is enhanced when it is not too large or cumbersome. The subparagraphs that follow specify the chapter arrangement for two and three volume manuals.

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3.6.10.1 **TWO-VOLUME SEQUENCE.** The chapter arrangement within a two-volume technical manual may be in accordance with any of the three examples that follow:

EXAMPLE 1:	EXAMPLE 2:	EXAMPLE 3:
<u>Volume I</u>	<u>Volume I</u>	<u>Volume I</u>
Chapter 1	Chapter 1	Chapter 1
Chapter 2	Chapter 2	Chapter 2
Chapter 3	Chapter 3	Chapter 3
Chapter 4	Chapter 4	Chapter 4
Chapter 5		Chapter 5
Chapter 6	<u>Volume II</u>	Chapter 6
		Chapter 7
<u>Volume II</u>	Chapter 5	<u>Volume II</u>
Chapter 7	Chapter 6	
Appendixes	Chapter 7	Appendixes
	Appendixes	

3.6.10.2 **THREE-VOLUME SEQUENCE.** The chapter arrangement within a three-volume technical manual may be in accordance with either of the two examples that follow:

<u>Volume I</u>	<u>Volume I</u>
Chapter 1	Chapter 1
Chapter 2	Chapter 2
Chapter 3	Chapter 3
Chapter 4	Chapter 4
<u>Volume II</u>	<u>Volume II</u>
Chapter 5	Chapter 5
Chapter 6	Chapter 6
	Chapter 7
<u>Volume III</u>	<u>Volume III</u>
Chapter 7	Appendixes
Appendixes	

3.6.11 **REVISIONS AND CHANGES.** Revisions and changes to existing publications shall be accomplished in accordance with MIL-M-38784.

#### 4. QUALITY ASSURANCE PROVISIONS.

4.1 **RESPONSIBILITY FOR INSPECTION.** Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in

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the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

**4.1.1 RESPONSIBILITY FOR COMPLIANCE.** All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

**4.2 SUBMISSIONS, REVIEWS AND APPROVAL.** Requirements detailing the scheduling of submissions and identifying the reviewing and approving activities for data procured under this specification shall be as specified in the contract.

**4.3 VALIDATION.** The contractor shall validate the technical accuracy and adequacy of technical data produced under the terms of this specification. In accomplishing the validation effort for the technical manual, the equipment performance is not to be jeopardized (degradation or other damage), particularly in respect to performing installation and maintenance procedures delineated by the technical manual. Do not include a validation effort for government-furnished equipment (GFE) or government-approved equipment for which a validation effort has already been completed unless otherwise specified by the procuring activity. (See 6.2.1)

**4.3.1 VALIDATION SCHEDULING.** Schedule the validation effort to begin after the equipment has undergone successful performance testing. Advise the procuring activity of the time and place of the event at least four weeks in advance to permit the procuring activity to witness the validation effort if they desire to do so.

**4.3.2 PERSONNEL FACILITIES REQUIREMENTS.** The contractor shall provide technically qualified personnel, including quality assurance personnel, and adequate facilities to conduct validation. The procuring activity shall provide qualified witnesses to support the validation of technical documentation.

**4.3.3 CERTIFICATION.** The contractor shall provide written certification of the completion of technical manual validation in accordance with 4.3, and shall document that errors found during validation have been corrected.

**4.3.4 VALIDATION PROCESS.** The contractor shall validate all information contained in the technical manual. This includes operation, calibration, and performance check procedures. All procedures shall be examined (through practical experience) in addition to employing a "desk top" review. The manuals shall be corrected and refined as performance testing progresses. The contractor shall provide corrected data and information to current users (such as training and installation personnel who may have preliminary copies) of the manual. Technically qualified personnel shall certify satisfactory reviews of the manual before manuals are submitted to the procuring activity for the verification process.

**4.3.5 VERIFICATION PROCESS.** After compliance with the validation requirements, the contractor shall perform verification jointly with the procuring activity. Demonstrate to the procuring activity that all procedures are technically accurate and adequate for their intended use. Accomplish this by performing procedures exactly as delineated by the technical manual. If failure is encountered during the verification process, the procuring activity may require that the corrective maintenance procedures of the manual be used to restore normal operation. To further verify the manual, the procuring activity may also require that previously failed or degraded components be installed and require the contractor to use the manual to detect, locate, and replace such faulty components. Equipment disassembly and "bench" procedures normally need not be performed; however, the procuring activity may require the contractor to perform selected procedures to demonstrate the adequacy of unusual or complex procedures.

**4.4 GOVERNMENT INSPECTION.** In addition to any in-process review, all material furnished in accordance with this specification shall be subject to Government inspection prior to acceptance by the Government.

## **5. PREPARATION FOR DELIVERY**

**5.1 IDENTIFICATION MARKING.** Prior to packaging, all board art will be identified with labels on the outside cover or flap. The label shall contain figure number, title, document identification (number or title) and photoeducation information. Standard size repro shall be protected with a piece of art board front and back.

**5.2 PRINTER'S ASSEMBLY SHEET.** A printer's assembly sheet (Figure 33) shall be prepared in duplicate and shall be packaged with the reproducible copy.

**5.3 PACKAGING.** Package material furnished in accordance with this specification to assure delivery without damage and to conform to the requirements of the security regulations for the highest classification involved. Store and ship manuscript flat. The original manuscript or copies thereof which have been rolled, folded, stapled, or are not clearly legible may not be accepted. Unboarded artwork may be rolled if it is not damaged in any way. Wrap boarded art and text separately when they are shipped in the same container. The size of unboarded art governs the method of wrapping and packaging for shipment.

**5.4 MARKING.** Mark each package within a shipping container with the publication short title, the type of material it contains, the contract or order number, the purchase description (PD) number, and the classification.

**5.5 CLASSIFIED MATERIAL HANDLING.** Classified material shall be packed, shipped, and marked according to the provisions of DoD 5220.22-M, Industrial Security Manual for Safeguarding of Classified Information.

**5.6 LETTER OF TRANSMITTAL.** A packing list or letter of transmittal shall be enclosed in one of the cartons. The carton containing the list or letter of transmittal shall be so marked on the package or label.

## **6. NOTES**



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6.1 INTENDED USE. Technical manuals prepared to this specification are used to support equipment, subsystem, and system operation and maintenance.

## 6.2 ORDERING DATA.

6.2.1 DATA REQUIREMENTS. When this specification is used in an acquisition and data are required to be delivered, the data requirements identified below shall be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved Contract Data Requirements List (CDRL), incorporated into the contract. When the provisions of DOD FAR Supplement, Part 27, Sub-part 27.410-6 (DD Form 1423) are invoked and the DD Form 1423 is not used, the data specified below shall be delivered by the contractor in accordance with the contract or purchase order requirements. Deliverable data required by this specification are cited in the following paragraphs.

<u>Paragraph no.</u>	<u>Data requirements title</u>	<u>Applicable DID no.</u>	<u>Options</u>
3.1.2.1	Equipment Technical Manual	DI-TMSS-80188	--
3.1.2.2	Subsystem Technical Manual	DI-TMSS-80189	--
3.1.2.3	System Technical Manual	DI-TMSS-80190	--
3.1.1	Technical Manual Publication Plan	DI-TMSS-80185	--
3.1.1	Scheduling Letter for Technical Publications	DI-TMSS-80186	--
3.1.1	Technical Publications Structure Report	DI-TMSS-80187	--
4.3	Technical Manual Quality Assurance Data	DI-M-2051	--

(Data item descriptions related to this specification, and identified in section 6 will be approved and listed as such in DOD 5010.12-L. Copies of data item descriptions required by the contractors in connection with specific acquisition functions should be obtained from the Naval Publications and Forms Center or as directed by the contracting officer.)

## 6.3 DEFINITIONS.

6.3.1 EQUIPMENT. A unit of equipment is a multicomponent configuration such as an assemblage of parts and/or assemblies, electrically or mechanically packaged together as a specific individual identity. Units of equipment may be building blocks for equipment group, subsystem, or system. Examples of equipment (sometimes called "black boxes") are amplifiers, demodulators, radio receivers, and radio transmitters.

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**6.3.2 DIGITIZED TEXT.** Digitized text consists of all textual matters for a manual recorded on a floppy disk as a deliverable. Either 8" (preferred) or 5" disks can be used. The format preferred is XEROX 860 or VERSATEK STAR. Other acceptable formats are as follows:

<u>Word Processor</u>	<u>Capability/Limitation</u>
WANG 8-Inch, Hard Sector Disk	
IBM DISPLAY WRITER	8-Inch, SS/SD Disk
IBM DISPLAY WRITER	8-Inch, DS/DD Disk
CPT models 8000, 8100, 6000	8-Inch, SS/SD Disk
DEC WPS-78, DECMATE I	8-Inch, SS/SD Disk
IBM Office System/6 (OS/6)	
IBM P.C.	5 1/4-Inch, WORDSTAR MS-DOS
IBM P.C.	5 1/4-Inch, WORDSTAR PC-DOS
NBI Models, 3000, 4000 Series	DS/DD or SS/DD Level - PS-G Program Levels
DEC DECMATE II	8-Inch, DS/DD Disk
Xerox STAR 80 Terminal	8-Inch

SS/SD - Single Side/Single Density

DS/DD - Double Side/Double Density

**6.3.3 EQUIPMENT GROUP.** An equipment group is a collection of equipments that can not perform a complete operational function; it may be a division of a subsystem.

**6.3.4 FINAL MANUAL.** The final manual prepared to the requirements of the contract specification, issued by the procuring activity for use by consumer activities, is termed the final manual.

**6.3.5 MANUAL OUTLINE.** A manual outline is a sentence outline of the manual that also provides an estimated page count; defines the proposed content of the publication; lists proposed illustrations (with captions keyed to the text); lists the proposed type of illustrations (halftone, line, etc., size and content); and, under primary paragraph headings, details the type of coverage planned for each major breakdown in the text.

**6.3.6 MANUSCRIPT.** The manuscript consists of complete, edited text and illustrative material comprising the final publication. The text is type-written and double spaced. The artwork is in all respects camera ready for reproduction by off-set lithographic processes.

**6.3.7 PRELIMINARY MANUAL.** A preliminary manual is a double-spaced copy of the required manual that is fully representative in technical content of the final publication. It shall, unless specifically waived by the COR or his duly authorized representative, also meet the requirements of the applicable specification. Preliminary manuals are issued to consumer activities to perform verification and validation and to support the initial training of operations maintenance personnel.

**6.3.8 REVIEW DRAFT.** The review draft (or draft copy) is a document for in-process technical and editorial review. This document consists of all available text and illustrative material and has been checked by the procuring activity for conformity with the applicable specifications, general editorial

style, content of illustrations, and technical accuracy of subject matter. The text is typewritten, double spaced, and reproduced to provide legible copy. Copies of illustrations need not be reduced and may be provided as a separate enclosure suitably keyed to the text. These illustrations may be engineering drawings or detailed sketches. As noted, all data must be presented in a manner sufficient for editorial and technical content review.

**6.3.9 SUBSYSTEMS.** A subsystem is a collection of equipments or equipment groups that perform an operational function. Generally, a subsystem is a major subdivision of a system.

**6.3.10 SYSTEM.** A system is an assemblage of subsystems, equipments, equipment groups, or a combination thereof, that might be separately located, arranged to perform a specific mission.

**6.3.11 VALIDATION.** Validation is that process whereby the contractor authenticates the technical accuracy and adequacy of all operations and maintenance procedural information through the performance of such procedures on the associated equipment(s) and the detailed technical and editorial quality review of all publications information elements (i.e., content) by the contractor for (1) technical accuracy and adequacy; and (2) conformance to the content, editorial, format, and quality assurance requirements of the applicable specifications.

**6.3.12 VERIFICATION.** Verification is that process whereby the procuring activity representative substantiates the technical accuracy and adequacy of all operations and maintenance procedural information through the performance, or witnessing the contractor's performance, of such procedures on the associated equipment(s) and review of the content of all publications for: (1) technical accuracy and adequacy; and (2) conformance to the content, editorial, format, and quality assurance requirements of the publications specifications prescribed by the contract.

**6.4 SUBJECT TERM (KEY WORD) LISTING.**

- Description of equipment
- Electrical characteristics
- Environmental conditions
- Equipment Technical Manual
- Illustrated parts breakdown
- Illustrations
- Installation
- Maintenance
- Manual Outline
- Operating instructions
- Parts list
- Physical characteristics
- Principles of operation
- Subsystem technical manual
- System technical manual
- Technical characteristics
- Technical manual

Preparing activity:  
NSA  
(Project: TMSS-A210)

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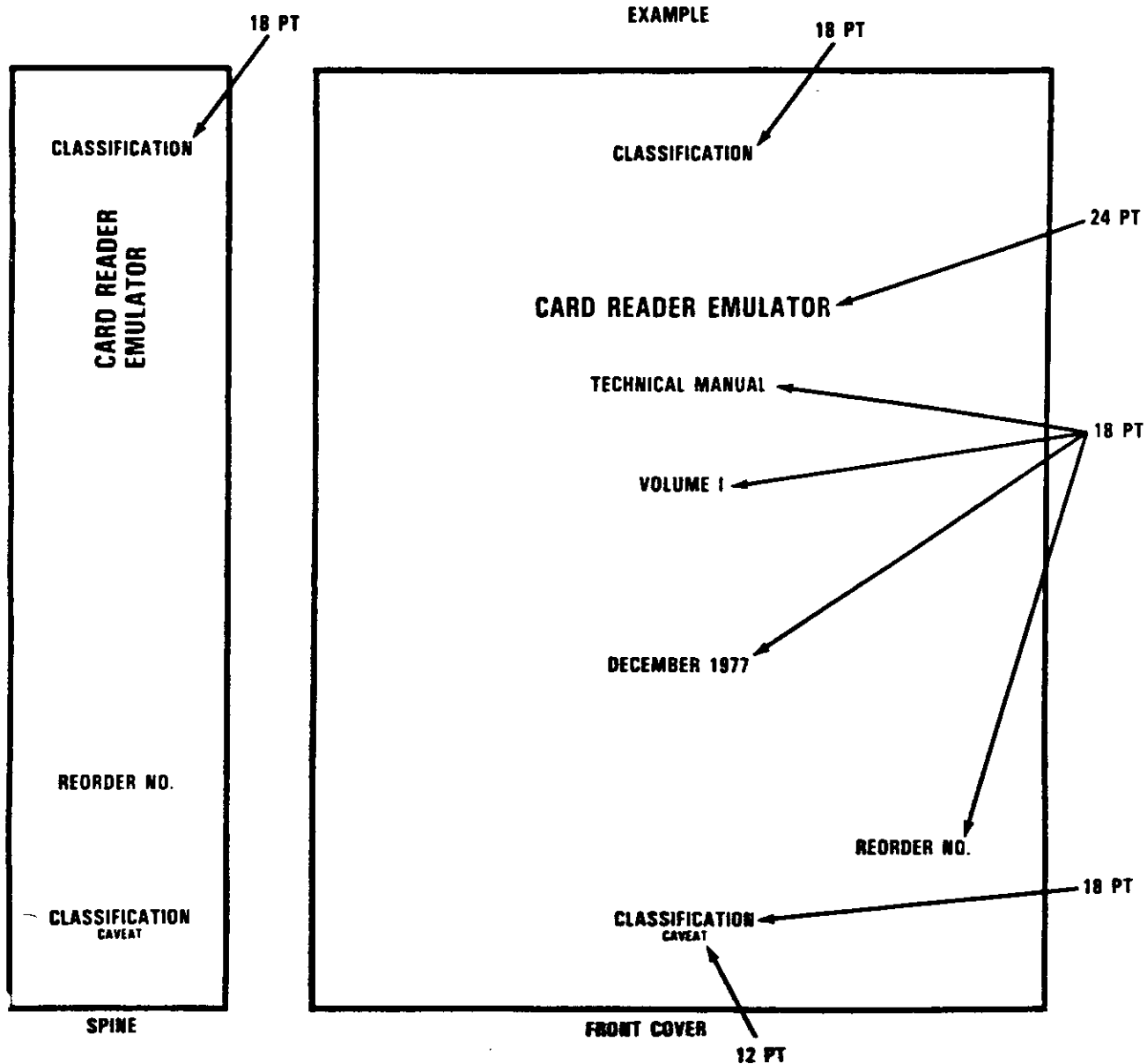


Figure 1. Equipment Manual Cover Example

## EXAMPLE

INSERT LATEST CHANGED PAGES.  
DESTROY SUPERSEDED PAGES.

**LIST OF EFFECTIVE PAGES**

Dates of issue for original and changed pages are:  
Original ... 0 ... April 1978

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 76  
CONSISTING OF THE FOLLOWING:

Page No.	*Change No.	Page No.	*Change No.
A .....	0	A-3 .....	0
B blank .....	0	A-4 blank .....	0
i .....	0	A-5 .....	0
ii blank .....	0	A-6 blank .....	0
iii - vi .....	0	A-7 .....	0
1-1 - 1-4 .....	0	A-8 blank .....	0
2-1 - 2-3 .....	0	A-9 .....	0
2-4 blank .....	0	A-10 blank .....	0
3-1 - 3-5 .....	0	A-11 .....	0
3-6 blank .....	0	A-12 blank .....	0
4-1 - 4-8 .....	0	B-1 .....	0
5-1 - 5-10 .....	0	B-2 blank .....	0
6-1 - 6-17 .....	0	B-3 .....	0
6-18 blank .....	0	B-4 blank .....	0
A-1 .....	0	B-5 .....	0
A-2 blank .....	0	B-6 blank .....	0

\* Zero in this column indicates an original page.

A (B blank)

Figure 2. List of Effective Pages Example

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EXAMPLE

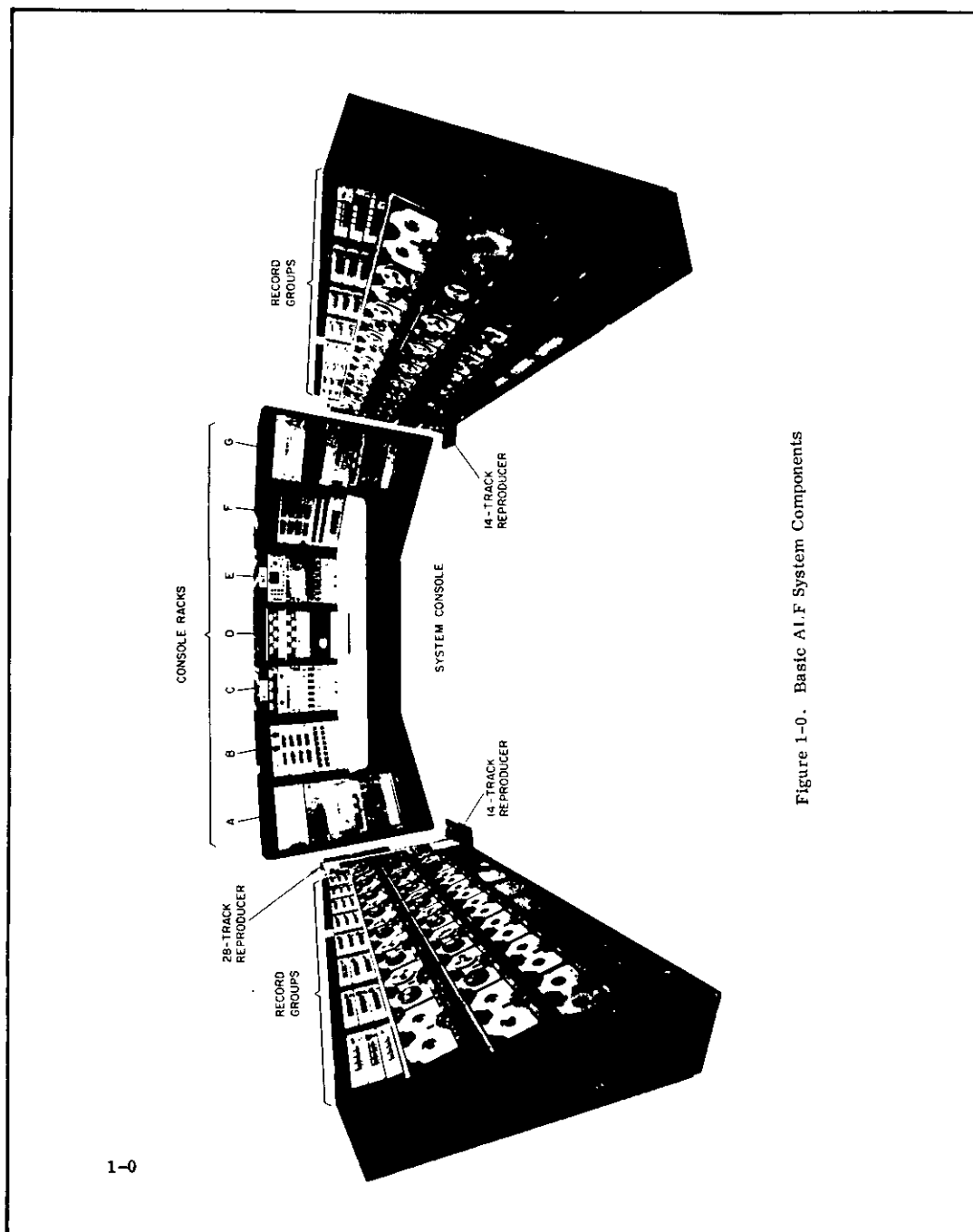


Figure 1-0. Basic A1.F System Components

Figure 3. System Manual Frontispiece Example



## EXAMPLE

### CHAPTER 1

#### DESCRIPTION OF EQUIPMENT

1-1. **CLASSIFICATION.** The message multiplexer (MUX) Unit (figure 1-1) and this technical manual are UNCLASSIFIED. However, in use, the equipment assumes the classification of companion equipment or data being processed and/or stored. The microprocessor program stored in the equipment memory is also UNCLASSIFIED.

1-2. **PURPOSE.** The message MUX unit (MMU) accepts messages from four, 300-baud bit synchronous (clock and data) International Teletype Association #2 (ITA #2) Baudot Code data lines and transmits the incoming data to a Model 40 printer on a message available basis. Transfer of the data to the printer is at 2400 bauds and is controlled by the printer.

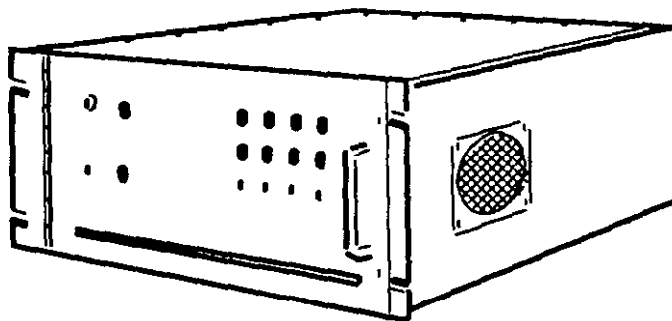


Figure 1-1. Message MUX Unit

1-3. **PHYSICAL CHARACTERISTICS.** The MCU is housed in a chassis that is 8.72 inches high, 17.50 inches wide and 16.50 inches deep. All controls and indicators are on a 19.00-inch wide, hinged front panel assembly. Cooling and air circulation is supplied with a fan on the side of the unit.

1-1

Figure 4. Equipment Manual Frontispiece Example

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## EXAMPLE

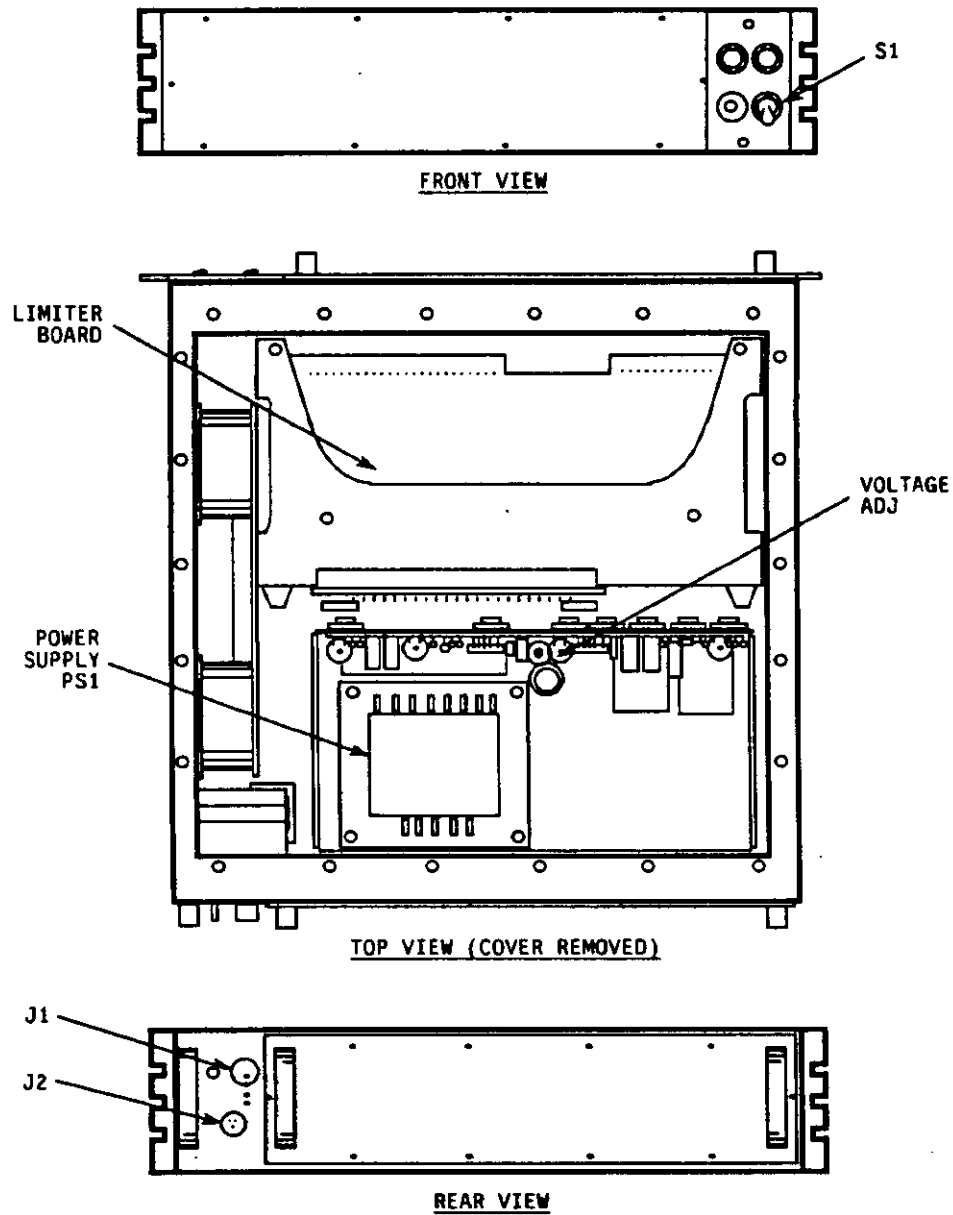


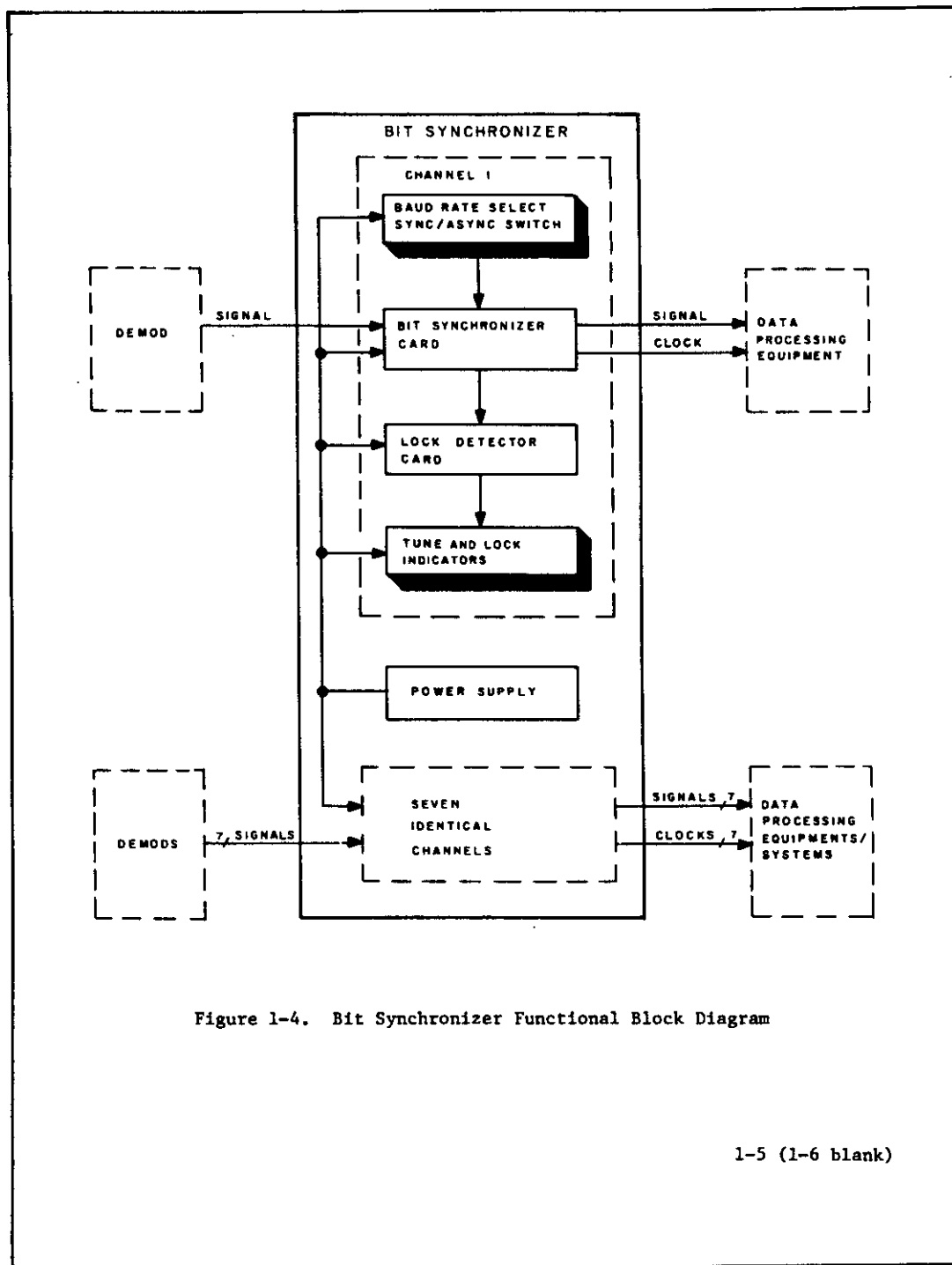
Figure 1-2. Front, Top, and Rear Views

1-2

Figure 5. Equipment Manual Front, Top, and Rear Views Example

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## EXAMPLE



1-5 (1-6 blank)

Figure 6. Simplified Equipment Block Diagram Example

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## EXAMPLE

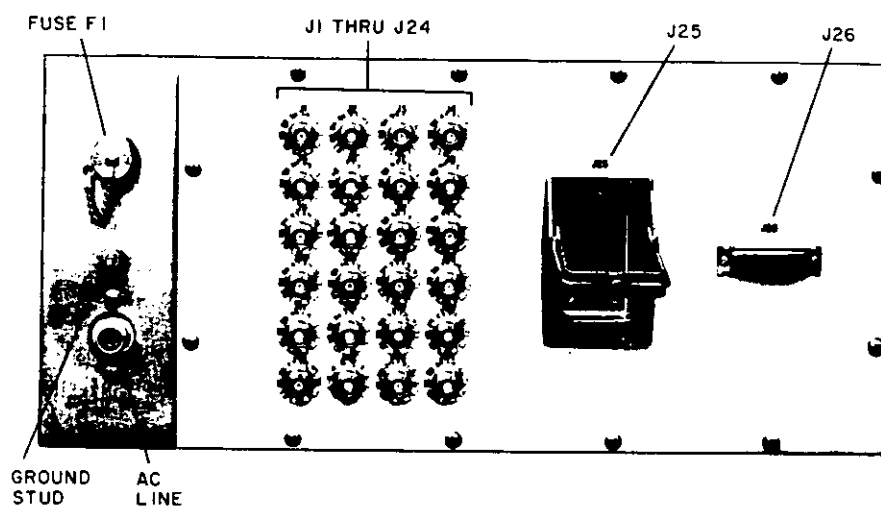


Figure 2-2. Rear Panel Components and Connectors

Table 2-1. Input/Output Connectors

CONNECTOR	FUNCTION	CONNECTS TO
AC line	Receives ac power.	Ac power source
J1 through J24	Receives 24 channels of serial input data.	Data sources
J25	Receives 8-bit parallel input data.	CP-818 Computer
J26	Interfaces serial I/O (RS-232) channel to system controller.	PDP 11/44 Computer

2-4

Figure 7. Location of Equipment Connectors Example

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## EXAMPLE

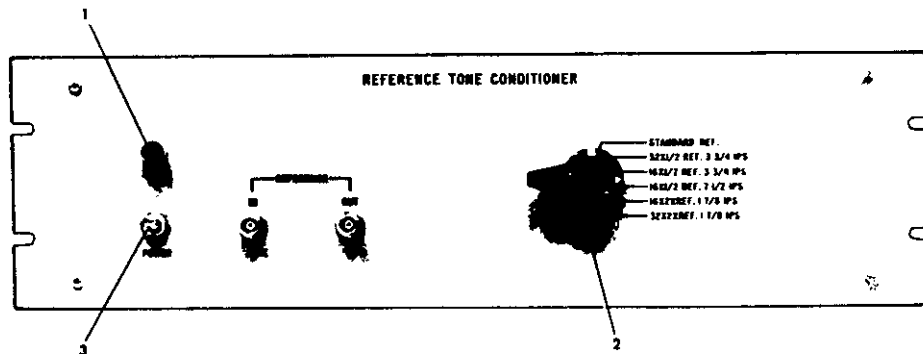


Figure 3-1. Controls and Indicators

Table 3-1. Controls and Indicators

FIG. AND INDEX NO.	CONTROL/INDICATOR	FUNCTION
3-1 -1	Power (DS1)	Lights when AC power is applied to unit.
-2	Mode (S1)	Selects frequency division, multiplication, or no change in frequency of input reference signal.
-3	POWER (S2)	Applies AC power to unit.

**NOTE**

For equipment with more complex front-panel controls and indicators, the controls and indicators should be grouped and/or indented under a major title as appropriate.

3-1

Figure 8. Equipment Controls and Indicators Example

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The digital copy of DOD-M-86001, dated 2-July-1986 does not include the foldout pages 55/56, 57/58, 59/60, 61/62, 71/72, 73/74, 75/76, 77/78, 79/80, 83/84 and 85/86. Please call ASSIST Help Desk at 215-697-6396 for copies of these pages.



## EXAMPLE

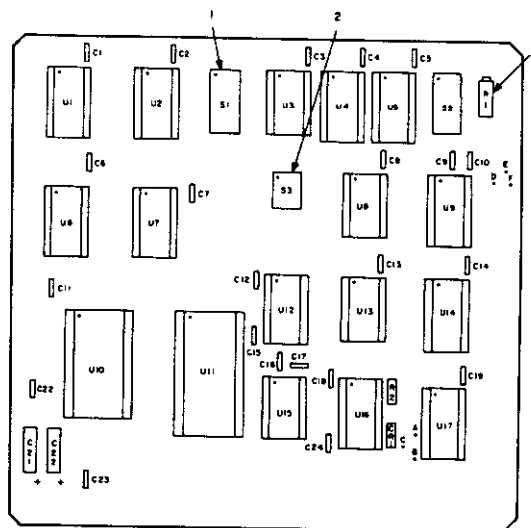


Figure 5-2. Location of Maintenance Controls

Table 5-2. Maintenance Controls

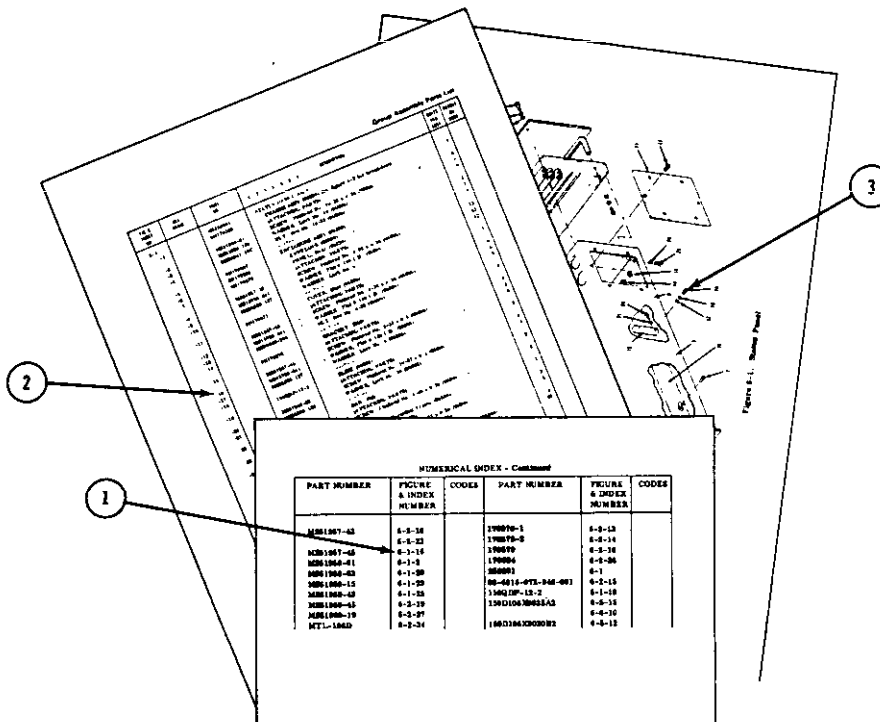
FIG. AND INDEX NO.	CONTROL/INDICATOR	FUNCTION
5-2-		
-1	A2S1, 7-section DIP switch	<p>Programs test character to be used in place of parallel tape reader data. Switch sections versus character bits are as follows:</p> <p>S1-1 = Bit 1  S1-2 = Bit 2  S1-3 = Bit 3  S1-4 = Bit 4  S1-5 = Bit 5  S1-6 = Bit 6  S1-7 = Bit 7</p> <p>Program S1 for positive logic (except S1-7, which should be programmed for negative logic). Switch OFF (open) provides high, ON (closed) provides low.</p>
-2	A2S3, section 1	<p>OFF (open) selects test character programmed by A2S1.  ON (closed) selects tape reader data.</p>
-3	A2R1, Threshold, adjust	<p>Adjusts positive threshold for EIA RS-422/RS-423 receivers.</p>

Figure 13. Equipment Maintenance Controls and Indicators Example

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## EXAMPLE

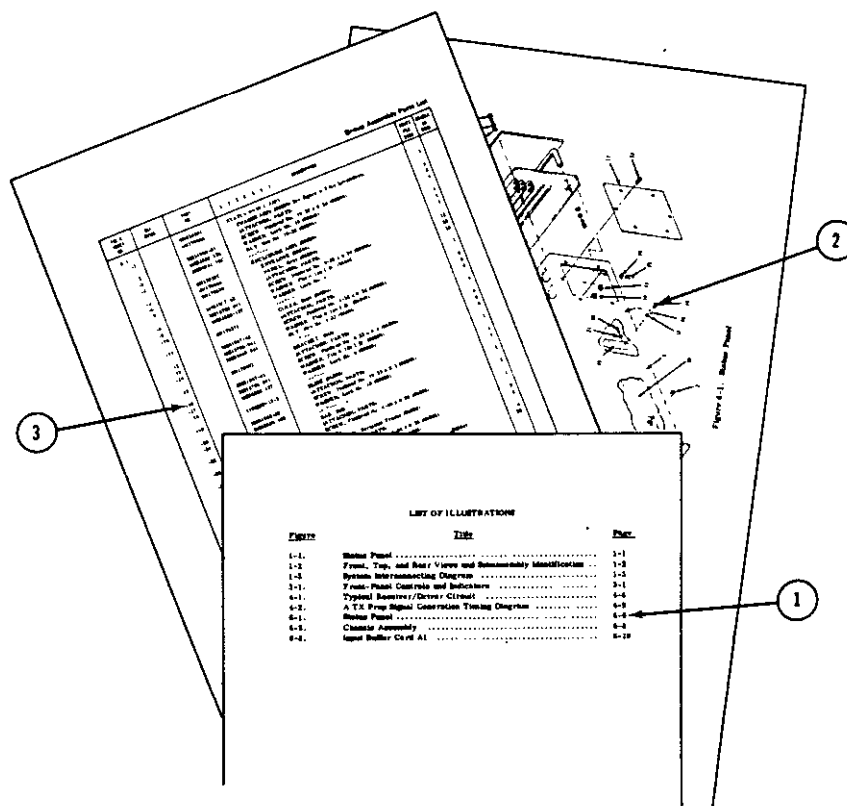
## HOW TO USE THE ILLUSTRATED PARTS BREAKDOWN



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## EXAMPLE

## HOW TO USE THE ILLUSTRATED PARTS BREAKDOWN



## WHEN THE PART NUMBER IS NOT KNOWN

1. Determine the function and application of the part required. Turn to the List of Illustrations and select the most appropriate title. Note the illustration page number.
2. Turn to the page indicated and locate the desired part on the illustration.
3. From the illustration, obtain the index number assigned to the part desired. Refer to the accompanying description for specific information regarding the part.

6-4

Figure 15. How to Use the IPB, Example 2  
(Part Number Unknown)

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## EXAMPLE

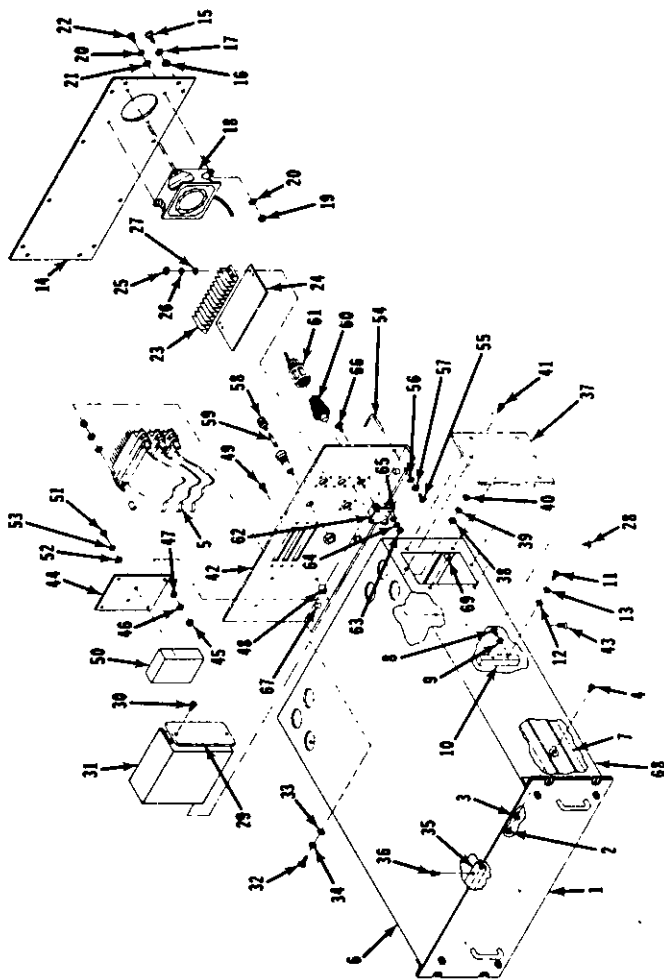


Figure 6-1. Digital-to-Digital Converter Assembly

6-5

Figure 16. Illustrated Parts Breakdown Illustration  
Example (Sheet 1 of 2)

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## EXAMPLE

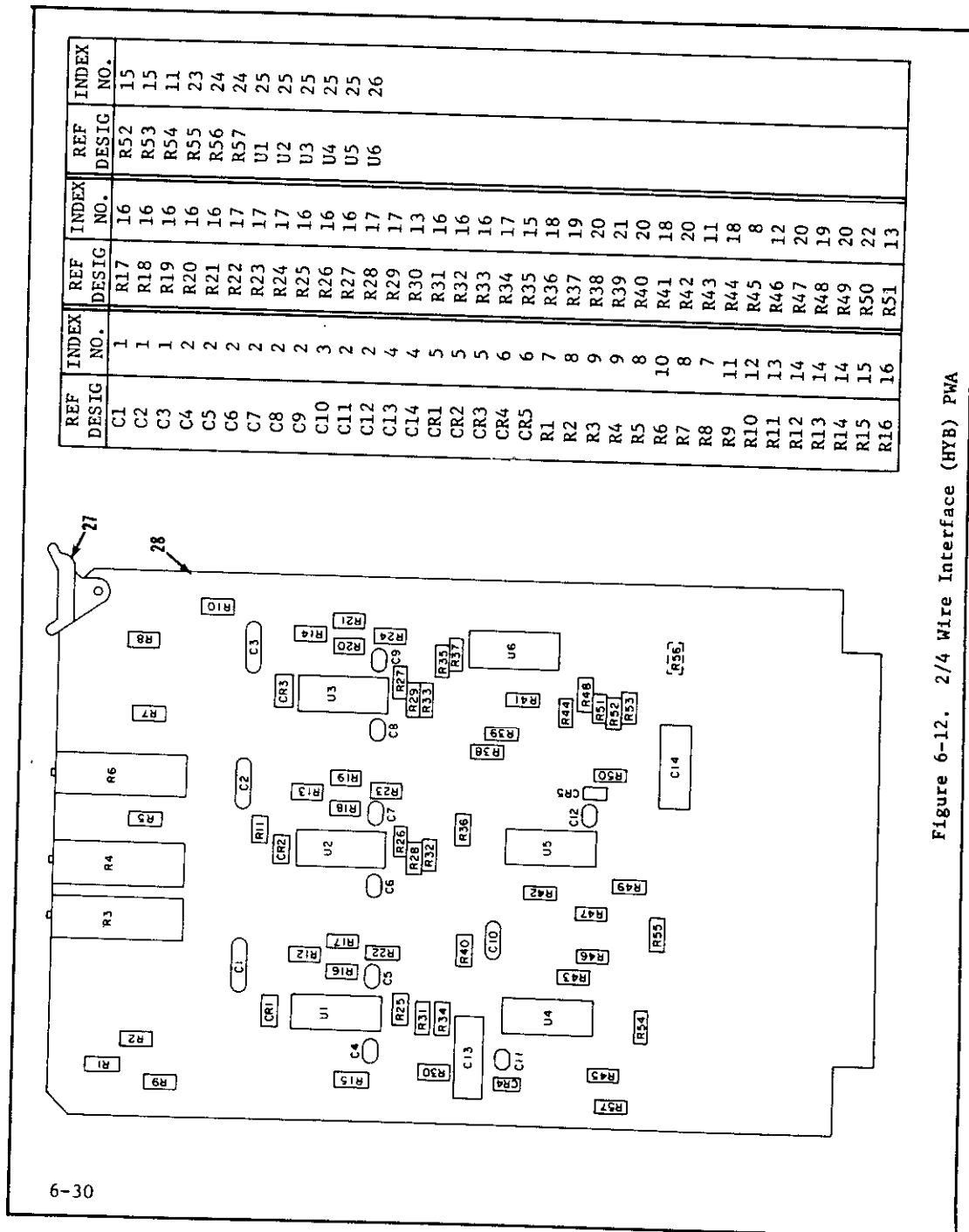


Figure 6-12. 2/4 Wire Interface (HYB) PWA

Figure 16. Illustrated Parts Breakdown Illustration Example (Sheet 2 of 2)

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## EXAMPLE

Group Assembly Parts List

FIG. & INDEX NO	REF DESIG	PART NO.	1	2	3	4	5	6	7	DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
6-1-		100320								CONVERTER ASSY, DIGITAL-TO-DIGITAL (12345) .....	REF	
-1		100321								CHASSIS ASSY (See Figure 6-2 for breakdown)(12345) .....	1	
										(ATTACHING PARTS)		
-2		MS20341-10C								NUT, Plain hexagon (96906) .....	6	
-3		MS35338-138								WASHER, Lockspring (96906) .....	8	
-4		MS51958-61								SCREW, Panhead (96906) .....	8	
										-----		
-5		C142442-24								FLAT WIRING ASSY, Triple-layer (26394) .....	1	
-6		100500								ENCLOSURE ASSY (12345) .....	1	
-7		110QDP-12-2								SLIDE (05236) .....	1 PR	
										(ATTACHING PARTS)		
-8		MS51958-63								SCREW, Panhead (96906) .....	8	
-9		MS35338-138								WASHER, Lockspring (96906) .....	8	
										-----		
-10		100501								BRACKET, Slide (12345) .....	4	
										(ATTACHING PARTS)		
-11		MS51957-43								SCREW, Panhead (96906) .....	8	
-12		MS35338-137								WASHER, Lockspring (96906) .....	8	
-13		MS15795-841								WASHER, Flat (96906) .....	8	
										-----		
-14		100502								PANEL, Rear (12345) .....	1	
										(ATTACHING PARTS)		
-15		MS51957-43								SCREW, Panhead (96906) .....	12	
-16		MS15795-841								WASHER, Flat (96906) .....	12	
-17		MS35338-137								WASHER, Lockspring (96906) .....	12	
										-----		
-18	B1	8500								FAN, Miniature (23936) .....	1	
										(ATTACHING PARTS)		
-19		MS25649-264								NUT, Plain hexagon (96906) .....	4	
-20		MS35338-136								WASHER, Lockspring (96906) .....	8	
-21		MS15795-806								WASHER, Flat (96906) .....	4	
-22		MS51957-30								SCREW, Panhead (96906) .....	4	
										-----		
-23	TS1	37TB-11								STRIP, Terminal (75382) .....	1	
-24		100503								STRIP, Designator (12345) .....	1	
										(ATTACHING PARTS)		
-25		MS35649-264								NUT, Plain hexagon (96906) .....	2	
-26		MS35338-136								WASHER, Lockspring (96906) .....	2	
-27		MS15795-806								WASHER, Flat (96906) .....	2	
-28		MS51959-43								SCREW, Flathead (96906) .....	2	
										-----		
-29		100504								COVER, Terminal strip (12345) .....	1	
										(ATTACHING PARTS)		
-30		MS51959-15								SCREW, Flathead (96906) .....	2	
										-----		
-31	PS2	211								POWER SUPPLY (24230) .....	1	
										(ATTACHING PARTS)		
-32		MS51957-30								SCREW, Panhead (96906) .....	4	
-33		MS35338-136								WASHER, Lockspring (96906) .....	4	
-34		MS15795-806								WASHER, Flat (96906) .....	4	
										-----		
-35		100505								BAR, Rub (12345) .....	2	
										(ATTACHING PARTS)		
-36		MS51959-15								SCREW, Flathead (96906) .....	6	
										-----		
-37		100506								COVER, Dust (12345) .....	1	
										(ATTACHING PARTS)		
-38		MS35649-284								NUT, Plain hexagon (96906) .....	6	
-39		MS35338-137								WASHER, Lockspring (96906) .....	6	
-40		MS15795-841								WASHER, Flat (96906) .....	6	
										-----		

6-6

Figure 17. Group Assembly Parts List (GAPL) Example (Sheet 1 of 2)



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## EXAMPLE

Group Assembly Parts List									
FIG. & INDEX NO.	REF DESIG	PART NO.	1	2	3	4	5	6	7
DESCRIPTION									UNITS PER ASSY.
									USABLE ON CODE
6-12-		PM1967	2/4 WIRE INTERFACE (HYB) PWA (See figure 6-1 for NHA).....						REF
-1	C1-C3	8141-050-Z5U-225M	CAPACITOR, Fixed, 2.2 uF $\pm 20\%$ , 50V (72982).....						3
-2	C4-C9, C11, C12	CE-103	CAPACITOR, Fixed, 0.01 uF $\pm 10\%$ , 600V (71590).....						8
-3	C10	8131-050-Z5U-105M	CAPACITOR, Fixed, 1 uF $\pm 20\%$ , 50V (72982).....						1
-4	C13, C14	69F935	CAPACITOR, Fixed, 100 uF $\pm 20\%$ , 35V (06001).....						2
-5	CR1-CR3	1N625A	DIODE (13715).....						3
-6	CR4, CR5	1N4734A	DIODE (13715).....						2
-7	R1, R8	RCR07C223JS	RESISTOR, Fixed, 22K $\pm 5\%$ , 1/4W (81349).....						2
-8	R2, R5, R7, R45	RCR07C242JS	RESISTOR, Fixed, 2.4K $\pm 5\%$ , 1/4W (81349).....						4
-9	R3, R4	M39015/1-008YP	RESISTOR, Variable, 20K (81349).....						2
-10	R6	RT11C2P503	RESISTOR, Variable, 50K (81349).....						1
-11	R9, R43, R54	RCR07G122JS	RESISTOR, Fixed, 1.2K $\pm 5\%$ , 1/4W (81349).....						3
-12	R10, R46	RCR07G621JS	RESISTOR, Fixed, 620 ohms $\pm 5\%$ , 1/4W (81349).....						2
-13	R11, R30, R51	RCR07G393JS	RESISTOR, Fixed, 39K $\pm 5\%$ , 1/4W (81349).....						3
-14	R12-R14	RCR07G102JS	RESISTOR, Fixed, 1K $\pm 5\%$ , 1/4W (81349).....						3
-15	R15, R35, R52, R33	RCR07G104JS	RESISTOR, Fixed, 100K $\pm 5\%$ , 1/4W (81349).....						4
-16	R16-R21, R25-R27, R31-R33	RCR07G203JS	RESISTOR, Fixed, 20K $\pm 5\%$ , 1/4W (81349).....						12
-17	R22-R24, R28, R29, R34	RCR07G562JS	RESISTOR, Fixed, 5.6K $\pm 5\%$ , 1/4W (81349).....						6
-18	R36, R41, R44	RCR07G222JS	RESISTOR, Fixed, 2.2K $\pm 5\%$ , 1/4W (81349).....						3
-19	R17, R48	RCR07G432JS	RESISTOR, Fixed, 4.3K $\pm 5\%$ , 1/4W (81349).....						2
-20	R38, R40, R42, R47, R49	RCR07G103JS	RESISTOR, Fixed, 10K $\pm 5\%$ , 1/4W (81349).....						5
-21	R39	RCR07G200JS	RESISTOR, Fixed, 20 ohms $\pm 5\%$ , 1/4W (81349).....						1
-22	R50	RCR07G561JS	RESISTOR, Fixed, 560 ohms $\pm 5\%$ , 1/4W (81349).....						1
-23	R55	RCR07G301JS	RESISTOR, Fixed, 300 ohms $\pm 5\%$ , 1/4W (81349).....						1
-24	R56, R57	RCR07G101JS	RESISTOR, Fixed, 100 ohms $\pm 5\%$ , 1/4W (81349).....						2
-25	U1-U5	UAA136PC	IC, Quad Op Ampl (07263).....						5
-26	U6	Q2T2222	IC, Quad Transistor Array, NPN (01295).....						1
-27		S202	EJECTOR, Card (18677).....						1
-28		X3810	Board, P.W. (98230).....						1

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Figure 17. Group Assembly Parts List (GAPL) Example (Sheet 2 of 2)

## EXAMPLE

Numerical Index					
PART NUMBER	FIGURE & INDEX NUMBER	CODES	PART NUMBER	FIGURE & INDEX NUMBER	CODES
CA2896-7S	6-2-33		MS35338-137	6-1-12	
CA3066-1	6-2-32			6-1-17	
CL-832-2	6-1-67			6-1-39	
	6-1-69			6-2-29	
C142442-24	6-1-5			6-2-38	
DM8820AN	6-3-16		MS35338-138	6-1-3	
	6-3-19			6-1-9	
	6-3-22		MS35649-244	6-1-63	
DM8830N	6-3-21			6-2-2	
LZS-10	6-1-50		MS35649-264	6-1-19	
MK4007P	6-6-4			6-1-25	
	6-6-9			6-1-45	
MR220	6-4-2		MS35649-284	6-1-38	
	6-4-3		MS51957-15	6-1-51	
	6-5-2		MS51957-18	6-2-12	
	6-5-3		MS51957-30	6-1-22	
MS15795-804	6-1-52			6-1-32	
MS15795-805	6-1-47			6-1-55	
	6-1-56		MS51957-31	6-1-49	
	6-1-64			6-1-66	
MS15795-806	6-1-21		MS51957-43	6-1-11	
	6-1-27			6-1-15	
	6-1-34			6-1-28	
MS15795-841	6-1-13			6-1-41	
	6-1-16			6-2-28	
	6-1-40			6-2-35	
	6-2-30		MS51958-61	6-1-4	
	6-2-39		MS51958-63	6-1-8	
MS20341-10C	6-1-2		MS51959-15	6-1-30	
MS3057-4A	6-1-61			6-1-36	
MS3102A10SL-3P	6-1-62		MS51959-43	6-1-43	
MS3106A10SL-3C	6-1-60		MS51959-45	6-2-17	
MS35336-17	6-2-18		MS51960-19	6-2-4	
MS35338-135	6-1-53			6-2-15	
	6-2-3		RCR07G514JS	6-7-4	
	6-2-13		RCR20G101JS	6-3-12	
MS35338-136	6-1-20			6-3-13	
	6-1-26		RCR20G331JS	6-3-10	
	6-1-33		RCR42G100JS	6-3-9	
	6-1-46			6-3-14	
	6-1-57				
	6-1-65				

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Figure 18. Numerical Index (NI) Example

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## EXAMPLE

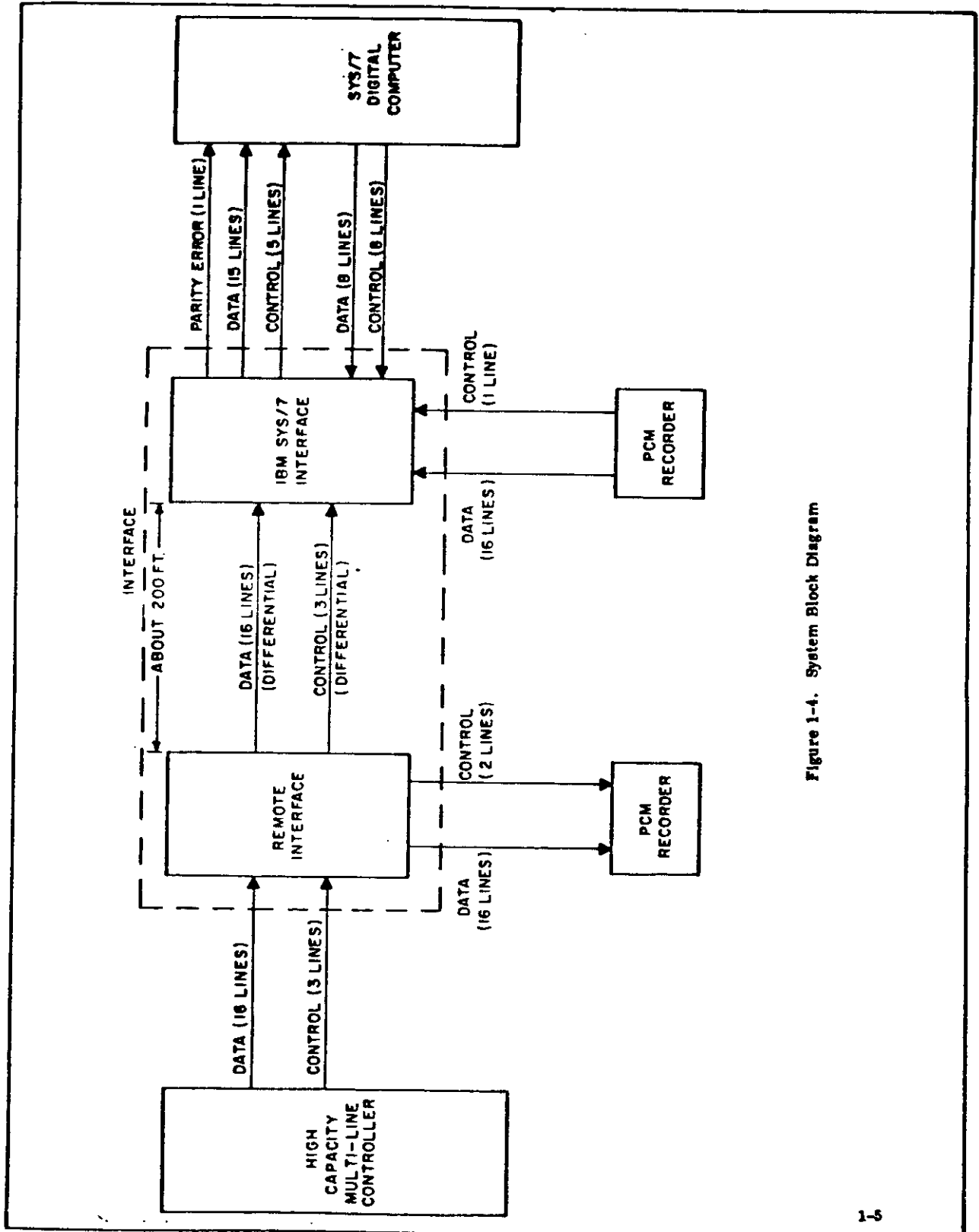


Figure 1-4. System Block Diagram

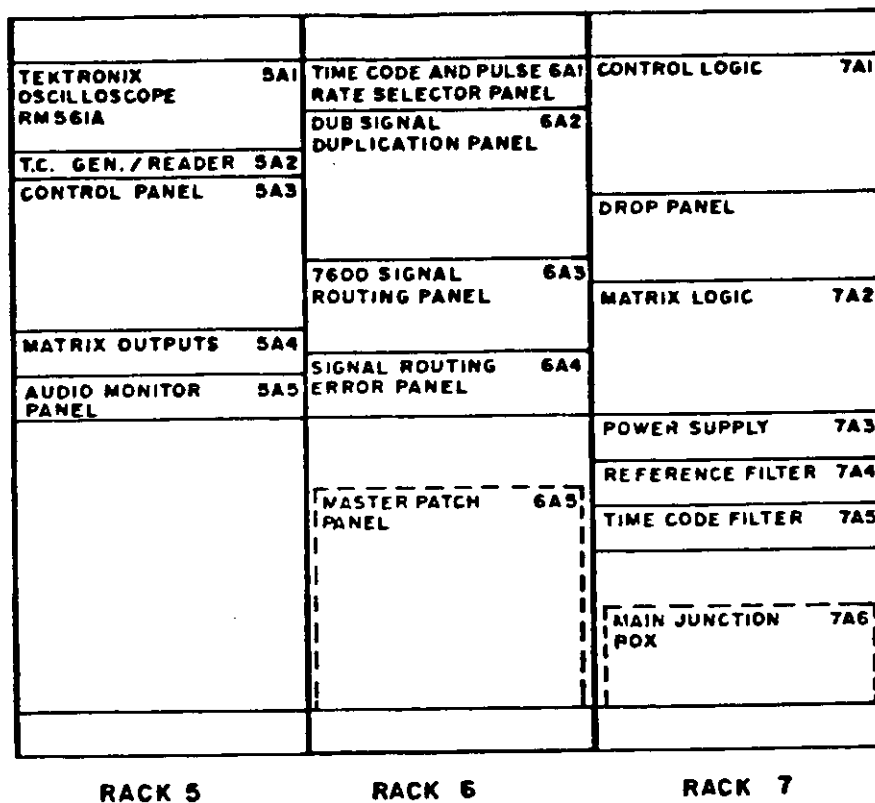
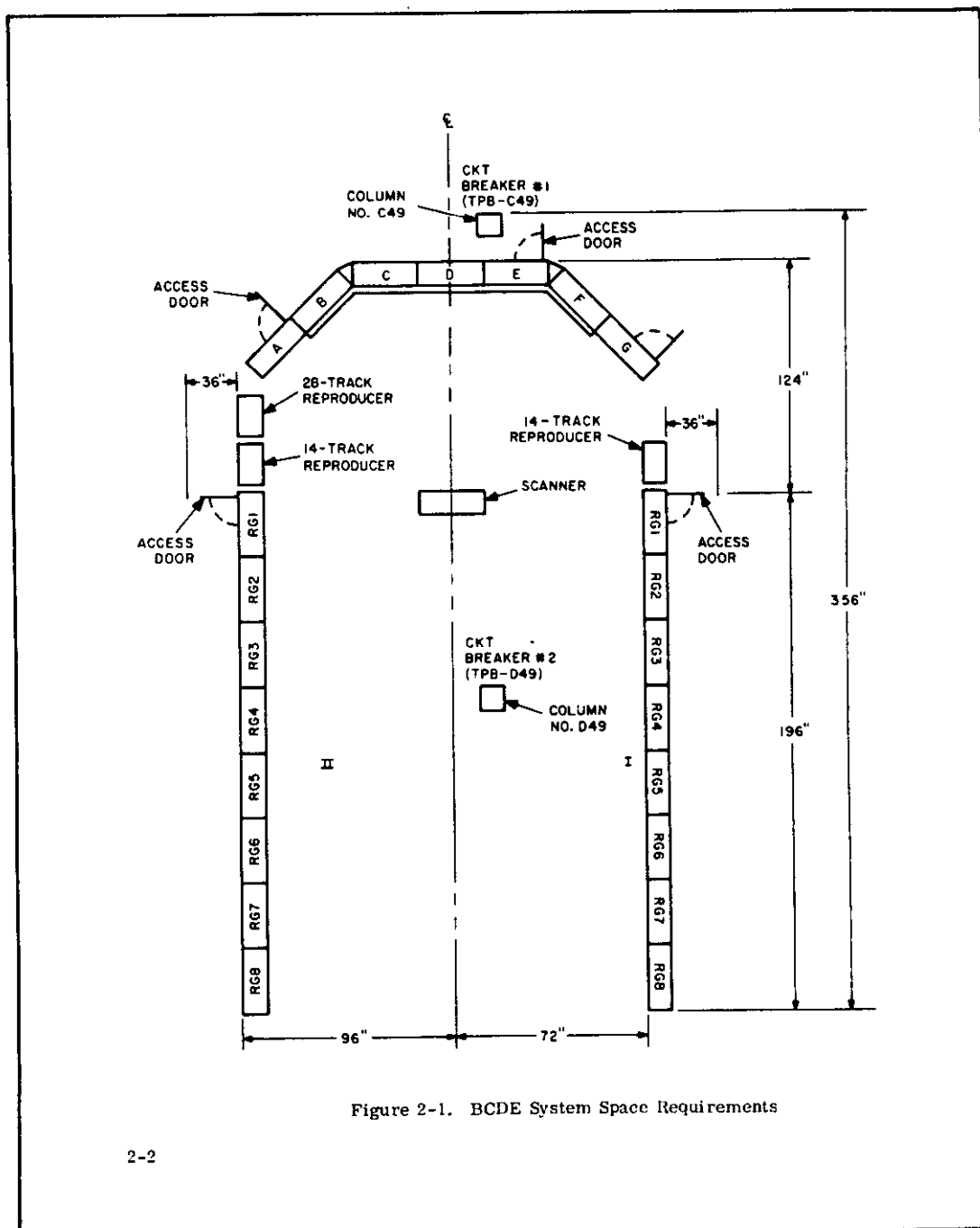
**EXAMPLE**

Figure 2-2. XYZ System Rack Layout Diagram

## EXAMPLE



2-2

Figure 28. Location of System Equipment Example

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**EXAMPLE**

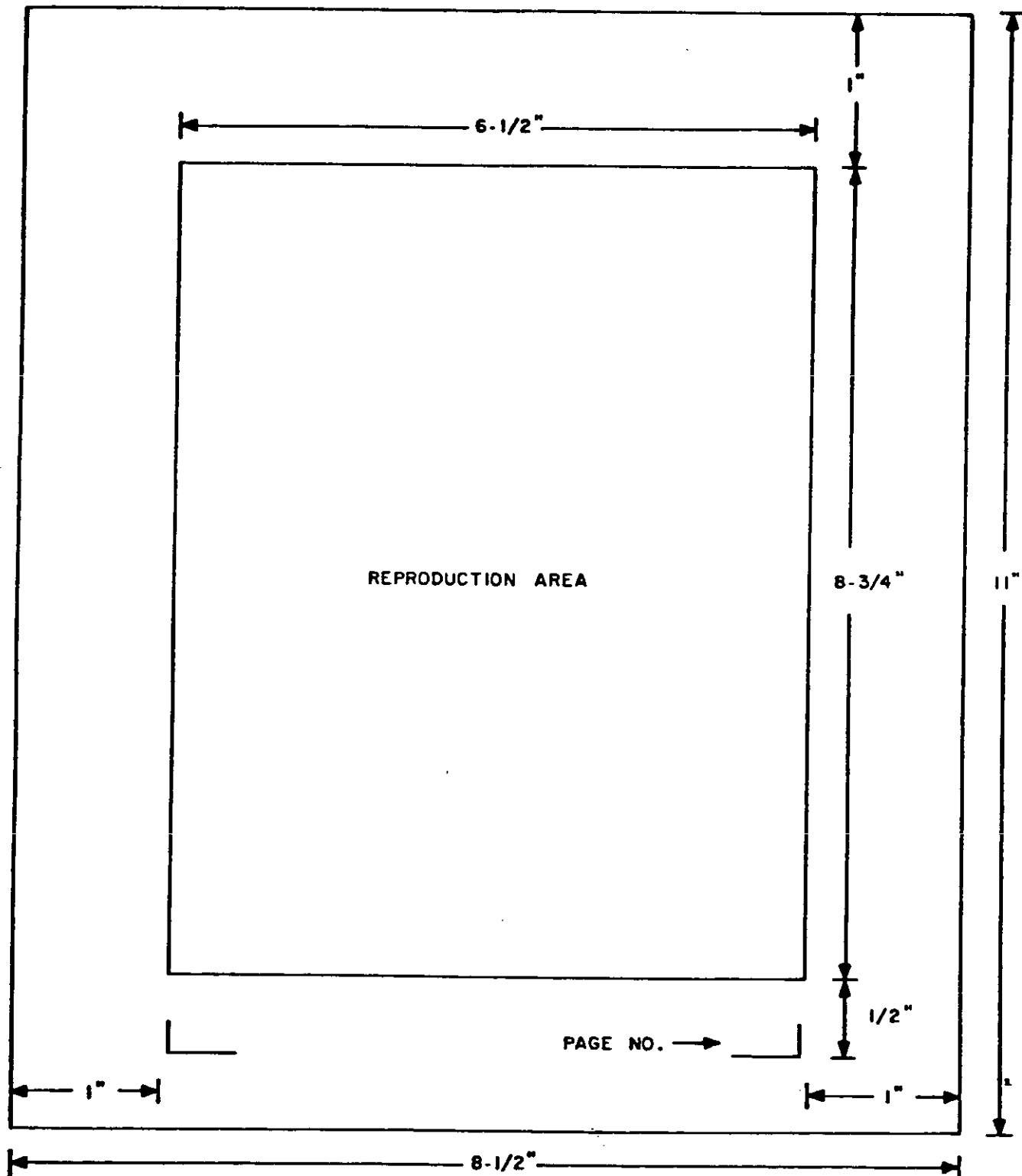


Figure 29. Full-Page Reproduction Area Dimensions

## EXAMPLE

TABLE OF CONTENTS		
<u>Chapter</u>		<u>Page</u>
INTRODUCTION .....		i
LIST OF ILLUSTRATIONS .....		v
LIST OF TABLES .....		vi
1.	DESCRIPTION OF EQUIPMENT	
1-1	CLASSIFICATION .....	1-1
1-2	PURPOSE AND CAPABILITIES .....	1-1
1-3	TECHNICAL CHARACTERISTICS .....	1-2
1-3a	Physical Characteristics .....	1-2
1-3b	Electrical Characteristics .....	1-3
1-4	ENVIRONMENTAL CONDITIONS .....	1-5
1-5	FUNCTIONAL DESCRIPTION .....	1-6
2.	INSTALLATION	
2-1	INSPECTION .....	2-1
2-2	INPUT/OUTPUT CONNECTORS .....	2-1
2-3	LOCATION AND MOUNTING .....	2-2
3.	OPERATING INSTRUCTIONS	
3-1	CONTROLS AND INDICATORS .....	3-1
3-2	OPERATING INSTRUCTIONS .....	3-2
3-2a	Start Procedure .....	3-3
3-2b	Operating Procedure .....	3-3
3-2c	Stop Procedure .....	3-5
4.	PRINCIPLES OF OPERATION	
4-1	INTRODUCTION .....	4-1
4-2	BLOCK DIAGRAM DESCRIPTION .....	4-1
4-2a	Timing Generation .....	4-1
4-2b	Input Section .....	4-2
4-2c	Output Section .....	4-4
4-3	DETAILED CIRCUIT DESCRIPTION .....	4-6
4-3a	AGC Circuit Card A1 .....	4-6
4-3a(1)	Operational Amplifier U1 .....	4-7
4-3a(2)	Feedback Amplifier U1 .....	4-8
4-3b	IF Amplifier Card A2 .....	4-10
4-3c	Digital-Analog Input Card A3 .....	4-10
4-3c(1)	Digital Data Multiplexers .....	4-10
4-3c(1)(a)	Data Input .....	4-10
4-3c(1)(b)	D/A Conversion .....	4-11
4-3c(2)	Analog Output Drivers .....	4-12

Figure 30. Format for Table of Contents



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## EXAMPLE

## LIST OF ILLUSTRATIONS

<u>Figure</u>	<u>Title</u>	<u>Page</u>
1-1	XYZ Unit Frontispiece .....	1-1
1-2	Top View (Chassis Extended) .....	1-2
1-3	Rear View .....	1-3
1-4	Simplified Functional Block Diagram .....	1-6
2-1	Rear Panel Connector Locations .....	2-3
2-2	Installation Cabling .....	2-7
4-1	XYZ Unit Block Diagram .....	4-3

.  
 .  
 .  
 ETC.

## LIST OF TABLES

<u>Table</u>	<u>Title</u>	<u>Page</u>
1-1	List of Equipment Supplied .....	1-3
2-2	Rear Panel Connector Descriptions .....	2-4
3-1	Operator Control and Indicator Descriptions .....	3-3

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 .  
 .  
 ETC.

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Figure 31. Format for List of Illustrations and List of Tables

## EXAMPLE

## CHAPTER 1

## CHAPTER HEADING

1-1. PRIMARY PARAGRAPHS. Type the paragraph number followed by a period. Skip two spaces and type the paragraph title in all capital letters followed by a period. Skip two spaces and begin text on the same line. Type the second and all succeeding lines of text flush with the left margin.

a. First Subordinate Paragraphs. Type the paragraph letter indented two spaces from the left margin, followed by a period. Skip two spaces and type the paragraph title. Capitalize the first word and each principal word. Under score the title followed by a period. Skip two spaces and begin text on the same line. Type the second and all succeeding lines of text flush with the left margin.

(1) Second subordinate paragraphs. Type the paragraph number indented six spaces. Skip two spaces and type the paragraph title. Capitalize the first word, and underscore the title followed by a period. Skip two spaces and begin text on the same line. Type the second and all succeeding lines of text flush with the left margin.

(a) Third subordinate paragraphs. Type the paragraph letter indented 11 spaces from the left margin. The paragraph title and format shall be prepared in the same manner as second subordinate paragraphs.

Untitled paragraphs may be used when the paragraph content does not warrant assignment of a paragraph heading. Untitled paragraphs may follow any of the four basic paragraph elements, and shall be indented the same number of spaces as the parent paragraph. Type the second and all succeeding lines of text flush with the left margin. Do not assign paragraph numbers to untitled paragraphs.

1-2. LISTINGS. Item listings within a paragraph shall be set apart from the text and/or paragraph headings by line spacing and indentation.

First item

Second item

1-3. PROCEDURAL STEPS. Procedural steps within a paragraph shall be set apart from the text and/or paragraph headings by line spacing and indentation.

a. Procedural steps shall be lettered sequentially, followed by a period.

b. Procedural steps shall be indented the same number of spaces as the associated text or paragraph heading.

(1) Substeps shall be numbered sequentially and enclosed in parentheses.

(2) Substeps shall be indented four spaces from the previous higher-order step.

1-1

Figure 32. Format for Text

[illegible]

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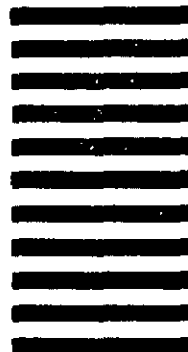
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