

DATA ITEM DESCRIPTION		Form Approved OMB No. 0704-0188 Exp. Date: Jun 30, 1986	
1. TITLE TEST PROGRAM MANUAL		2. IDENTIFICATION NUMBER DI-TMSS-80007	
3. DESCRIPTION/PURPOSE 3.1 This manual is used in the testing of a Printed Wiring Assembly (PWA) by technicians trained in the use of Automatic Test Equipment (ATE) to perform piece-part fault isolation.			
4. APPROVAL DATE (YYMMDD) 850528	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR) G/V27	6a. DTIC REQUIRED	6b. GIDEP REQUIRED
7. APPLICATION/INTERRELATIONSHIP 7.1 This data item description contains the format and content preparation instructions for that data generated under the work task described by paragraph 3.3 of NSA DS-56 and prepared on magnetic tape conforming to Federal Specification No. W-T-0051. 7.2 This data item may be applied in any contract or program phase which contains the requirement for a Test Program Manual. 7.3 This DID supersedes DI-M-5492C.			
8. APPROVAL LIMITATION	9a. APPLICABLE FORMS	9b. AMSC NUMBER AMSC G3572	
10. PREPARATION INSTRUCTIONS 10.1 <u>Source document</u> . The applicable issue of the document cited herein, including its approval date and dates of any applicable amendments and revisions, shall be as reflected in the contract. 10.2 <u>General</u> A Test Program Manual (TPM) shall be prepared as described herein. 10.2.1 Test Program Manual information which is computer generated shall be provided on IBM-compatible magnetic tape conforming to Specification No. W-T-0051, Class III, Size II (2,400 ft. long) with the following characteristics: a. 1600 bpi density/nine-track b. EBCDIC character code c. Logical record length equal to 133 characters. (1) Text shall contain equal no dollar signs. (2) Text shall contain no underscoring. (3) The 1st column is for carriage control characters only. Text will start in the 2nd column.			

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10. PREPARATION INSTRUCTIONS (Continued)

d. Block size equal to 3990 characters or fixed length to an integer multiple of the logic record in c. above.

e. No recorded labels.

f. A gummed label indicating the document title, the date, logical record length, and the block size shall be affixed to the reel.

Tape with other than the above characteristics shall not be used without Government approval.

10.2.2 The front cover (Handling Instructions), Summary of Contents Page, Record of Amendments Page, Table of Contents, List of Illustrations, List of Tables, and Introduction will be prepared by the Government at the time of final publication and are not deliverable times in accordance with this Data Item.

10.3 Format and content. The manual shall contain 14 Chapters titled and arranged as follows:

<u>Chapter No.</u>	<u>Title</u>
1	Support Documentation
2	ATE Building Blocks
3	Waived Faults
4	Test Philosophy
5	Program Flow Chart
6	Test Plan
7	Label Definition
8	All-Results Printout
9	Program Printout
10	Internal Node Information
11	UUT Schematic Including Manual Probe Point Information
12	UUT Assembly Drawing Including Manual Probe Point Information
13	Channel-to-Pin Assignment
14	Interconnection Schematic

Where a Chapter is not applicable to the TPM for the UUT, the Chapter shall be accounted for with the notation "Not Applicable." No Chapter shall be omitted without Government approval. For Example:

Chapter 1 - Not Applicable

10.3.1 Chapter 1, Support Documentation. Provide a list of support items and documentation used in the testing, installation, operation and maintenance associated with the UUT covered in the Test Program Manual. The list shall include the following:

a. Equipment: Short and long title(s) of equipment(s) which employ the UUT. Include "Top Assembly" nomenclature.

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10. PREPARATION INSTRUCTIONS (Continued)

- b. UUT: Trigraph, nomenclature and modification level of the UUT.
- c. Maintenance Manual: Short and long title(s), of the maintenance manual(s) covering the equipment(s) which employ the UUT.
- d. Test Program: Short and long title, nomenclature, and revision level.
- e. ATE Interface Hardware Manual: Short and long title.
- f. Runtime: The minimum and maximum runtime to execute the program on the tester. Minimum runtime is for a good UUT and Maximum is for a faulty UUT through the longest isolation part of the program.

10.3.2 Chapter 2, ATE Building Blocks. Provide a list, in tabular form, of all ATE system hardware components which will be utilized during any part of test program execution. This list is intended to provide the ATE operator with enough information to determine whether the test system is in an operational status for that particular test program. This list shall include the following:

- a. Programmable Power Supplies (D1 through D7, AC supply).
- b. Digital Stimulus Channels (Channels 1 through 80).
- c. Digital Measurement Channels (Channels 1 through 160).
- d. Set Ground Channels (Channel 8 through 144)
- e. Clocks (CM, CE, CI, CA through CH, CA' through CH'), CS and CW).
- f. External Sync. Digital.
- g. External Gate. Digital.
- h. Parametric Unit.
- i. Relay Drivers (Drivers R1 through R8)
- j. Waveform Generators (WG1, WG2).
- k. Auto-Prober.
- l. Sampling Measurement System.
- m. Counter.
- n. External Gate SMS.
- o. Analog Stimulus Channels.
- p. Analog Measurement Channels.

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10. PREPARATION INSTRUCTIONS (Continued)

10.3.3 Chapter 3, Waived Faults. Provide a list of all faults, in the applicable fault classes, that have been contractually waived. These shall be identified by reference designator and shall include pin number or other input or output (e.g., base, collector) and faulty condition (open, stuck-at-one, stuck-at-zero). This list shall be arranged in ascending alphanumeric order of reference designators. The reason for the waived fault shall be included for each waived fault.

If no faults are waived, the statement, "No Faults Waivered", shall be the contents of this chapter.

10.3.4 Chapter 4, Test Philosophy. This chapter shall be presented in sections, as follows: The first section shall provide the test station operator with some insight into the functions performed by the UUT. It shall include a description of the electrical functions performed by the UUT and a brief description of the inputs and outputs of the UUT during normal operation. The second section shall be devoted to an explanation of the ATE program. The explanation shall provide insight into: program features, program flow and options, UUT alignment, and special handling or rework instructions. The program flow explanation shall: first, provide a description of the procedures an operator performs in order to run the program, including set-up instructions and identification of the program and mechanical hardware; and second, provide a description identifying specific groups of tests in the ATE program as they relate to the UUT. And third, include a description of the program options that the test station operator can select and a description of each of these options. If any electrical alignment is required during execution of an ATE program, the procedures which an operator would perform shall be described. And last, describe instructions that the operator must follow in handling the UUT before, during, and after testing to prevent damage to the UUT. This section shall also include warnings when testing could be dangerous to the operator (e.g., the presence of high voltages or large currents).

10.3.5 Chapter 5, Program Flow Chart. The program flow chart shall present a brief visual representation of the different program branches/options that can be selected by a test station operator. The flow chart shall identify each of the major sections of the program and how they fit into the flow of the program and their relationships to a particular branch or option. A major section is a group of Automatic Test Language (ATL) instructions which accomplish a specific task. These include but are not necessarily limited to: I.D. checks, set-up instructions, parametric tests, functional tests or diagnostic tests. The beginning statement number of each major section shall be included in the block that identifies the section in the flow chart. In addition, wherever ATL program linking (Re: ATL programmer's manual - link instruction) occurs, the flow chart shall identify the entry and exit points for each program. Any additional unique ATL programs which are "linked to" shall also be described in a flow chart. Standard flow chart template designs and descriptions shall be used in the program flow chart.

10.3.6 Chapter 6, Test Plan. The Test Plan shall be divided into two sections: Program Format and Tabular Test Plan.

10.3.6.1 The Program Format section shall present a cross reference between groups of statement numbers and parts of the program. The different parts of the program shall not be limited to major sections (see Chapter 4, test

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10. PREPARATION INSTRUCTIONS (Continued)

Philosophy) but rather should identify any group of statements that are executed for a single purpose. Examples of such groups would be: reserve label section, set-up instruction section, I.D. check section, test vector section, special test sections or fault dictionary section. The program format shall be located on the first page of the test plan chapter.

10.3.6.2 The Tabular Test Plan (TTP) shall provide a method of documenting measurements and tests that relate to the test and the UUT. The TTP shall address all tests (the 'T' instruction and digital measures) in the following sections: I.D. checks, stimuli test, parametric tests, functional tests, and alignment tests. A horizontal line shall be typed between sections to allow each visual grouping. The TTP shall not address the diagnostic tests. The TTP shall be ordered so that it reflects the flow of the automated test program as executed by the test stations. The TTP shall be organized into 8 columns, with the total line length not to exceed 102 characters, as follows (See Figure 1 attached):

a. The first column shall be labeled STAT NO and shall be 6 spaces wide, leaving column 1 blank, 4 for the statement number and 1 for spacing. The statement number written in this block shall reflect in all cases the location of the Test that is being documented.

b. The second column shall be labeled STIM DEV and shall be 10 spaces wide, 8 for the documentation of the stimulus device and 2 for spacing. This column shall describe all the unique stimulus devices being used for a particular test, such as Power Supplies, WGI, or Digital Drivers. If a stimulus device is constant for a consecutive group of tests, the device does not have to be included for the consecutive tests following the first one. For example, a stimulus device constant over a group of tests would be a power supply. The stimulus device shall be included for each test if it is the first time it is used, if the value of the setting of the device changes, or if the device is dropped to zero (turned off) after being used for a group of tests.

c. The third column shall be labeled MEAS and shall be 13 spaces wide, 11 spaces for nomenclature and 2 for spacing. The nomenclature in this column shall be used to describe the programmed settings of the stimulus device, the parameter (for example: volts DC (VDC), volts peak (VP), and milliamps (MA), and then the plus and minus allowable tolerance. For multiple parameter devices, such as WGI, all the parameters shall be listed in order of importance. The tolerance indicated should be reflected by the ATE program. For Digital Drivers, the high and low voltages for the logic settings shall be followed by a list of the channels using those parameters. Short form techniques can be used to reduce the print by using such nomenclature as 1-10, 13, 15-20. This indicates that Channels 1 through 10, 13, and 15 through 20 are stimulus channels.

d. The fourth column shall be labeled FROM TO and shall be 10 spaces wide, 8 for nomenclature and 2 for spacing. The FROM TO column is used to indicate the connection made between the stimulus device and the UUT. Two types of connections can be shown, UUT pins or tester channels. Selection between them shall depend on which one offers the most information. In most cases this will probably be UUT pins. To differentiate between UUT pins and tester channels, the UUT pins or tester pins should be prefixed with the connector

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10. PREPARATION INSTRUCTIONS (Continued)

reference designator, for example J1-102. When the information is too lengthy to fit into the number of spaces provided, the TO nomenclature shall be on the next line after the FROM nomenclature, but shall be right-justified. For digital tests, this column should reference the Channel-to-Pin Chapter of the Test Program Manual.

e. The fifth column shall be labeled MEAS DEV and shall be 10 spaces wide, 8 for nomenclature and 2 for spacing. This column should indicate the measuring device that is performing the measurement. The measuring device should be on a one-to-one correspondence with statement numbers, except when the device is being used to measure a consecutive group of tests. Typical measurement devices would be: SMS, counter, digital receiver, or parametric unit. When a measurement device is not used to determine the tested parameter (e.g., arithmetic computation), this column shall be left blank and a corresponding note should be included in the remarks column.

f. The sixth column shall be labeled MEAS and shall be 13 spaces wide, 11 spaces for nomenclature and 2 for spacing. The nomenclature in this column shall be used to indicate the expected measured value, the parameter, and the plus and minus tolerance. The expected measured value could also be the nominal value. For the digital receivers, the threshold voltage setting shall be followed by a list of the channels using this parameter. Short-form techniques can be used to reduce the print for this column in the same way as for column three.

g. The seventh column shall be labeled FROM TO and shall be 10 spaces wide, 8 for nomenclature and 2 for spacing. This column shall be used to indicate the connections made between the measurement device and the UUT. In most cases, UUT pins should be used. However, tester channels shall be used when they will provide more information. When the tested value is determined in some way other than by using a measurement device, this column should be left blank and a corresponding note should be included in the remarks column. For digital tests, this column should reference the Channel-to-Pin Chapter of the Test Program Manual.

h. The eighth column shall be labeled REMARKS and shall be the remaining characters wide. This column shall be used to provide additional information about the test that cannot be gained by reading the other columns. For digital tests, this column should indicate: master clock period, strobe timing, clock phasing, and any other pertinent information. It also shall include the range of the vectors in the digital test and the statement numbers where these vectors are defined in the Automated Test Program. The section heading should also be identified in this column (e.g., I.D. Checks, Functional Tests). For the I.D. Checks, the component's reference designator shall be included in this column. When arithmetic calculations are performed to determine the value of the parameter being tested, this column shall include the arithmetic function being tested.

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STAT NO	STIM DEV	MEAS	FROM TO	MEAS DEV	MEAS	FROM TO	REMARKS
2050	PARA	100 ma	J1-102 J1-22	PARA	4.3 volts ±/21	J1-102 J1=22	UUT I.D. Check R1
2100	D1 D4 DIG DRIV	+5.2vdc -4.3vdc HI=+2.4 LO=-2.1 CHAN 1-5, 7,10-15	J1-3 J1-2 J1-5 J1-2 *	DIG REC	TH=+.2 CHAN 1-24	*	FUNCTIONAL TEST CM=10.us SST=4.us TV508 thru TV761 TV's are defined starting at stat. No. 4012
2120	DIG DRIV	HI=2.4 LO=-2.1 CHAN 1-7	*	DIG REC	TH=+.2 CHAN 1-32		CM=12.us SST=-11.5us TV5 thru TV22 TV's are defined starting at stat. No. 3400
2150	DIG DRIV	HI=+2.4 LO=-2.1 CHAN 1-7	*	DIG REC	TH=+.2 CHAN 1-7		CM=15.us SST=14.5us TV17 thru TV25 TV's are defined starting at stat. No. 3412
2170	WGI	SQ WAVE 2.4vp-p freq 66.666Hz	J1-7 J1-2	SMS	SINE WAVE J.Vp-p ±.1v	J1-9 J1-2	
2180				Counter	Freq 66.666Hz ±.5K	J1-9 J1-2	
2190				SMS	DISTORTION less than .05		

*ref. Chapter 13

FIGURE 1. Tabular test plan sample

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10.3.7 Chapter 7, Label Definition. Provide a tabular list, in alphabetical order, of all user-defined ATL labels. Include type (integer, decimal, array) and a brief description of the function of each. This description should clearly indicate what the label is used for and in what section of the test program it appears. A separate list shall be provided for all programs which are "linked to".

10.3.8 Chapter 8, All-Results Printout. A copy of an All-Results printout (reference TSEC/ST-51 Analog/Digital Automatic Test System operator's manual, All-Results Mode) from a "Good Board" shall be included in the Test Program Manual in Chapter 8. The All-Result printout shall be output by the contractor during Government verification of the Automatic Test Program. This Chapter is included in the Test Program Manual to provide an example of typical measured values for a "Good Board".

10.3.9 Chapter 9, Program Printout. This printout shall be the latest revision of the program and shall begin with the statement 0001 and end with statement 9999. This chapter shall include all source files and programs which are "linked to" by the main program. The format of this program will be specified by the Government.

10.3.10 Chapter 10, Internal Node Information. Provide internal node information which is produced during generation of diagnostics for Automated Test Programs, as follows:

a. For UUT diagnostics which are developed using Computer Aided Design (CAD) techniques, include timing diagrams and/or signal diagrams which are normal outputs of CAD. Include a definition of signals at all inputs, outputs, and internal nodes of the UUT and their interrelationship. Fake modules or nodes which are added to the computer coding shall be identified as a preface to this section. The requirement for timing diagrams and/or signal diagrams for CAD programs shall apply for digital, hybrid and analog UUTs.

b. For digital-board diagnostics which are developed using manual generation techniques, include the timing diagrams and explanations of the diagnostics. Include a definition of signals at all inputs, outputs, and internal nodes of the UUT and their interrelationship.

c. For analog-board diagnostics which are developed using manual generation techniques, include a definition and explanation of the analog signals for one unique set of input parameters for every node. Do not include every set of input parameters, just one set. Nodes shall be referenced, where possible, using a unique reference designator point. If this is not possible, the node can be referenced by two components which form the node.

d. For diagnostics which are developed using an automated probing algorithm or any similar techniques, include a printout of the files used to generate the diagnostics. Final selection of files to be included is subject to Government approval.

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10. PREPARATION INSTRUCTIONS (Continued)

An example of such files would be the data base, input language, and statistical data files for the ST-51 automatic probing algorithm.

10.3.11 Chapter 11, UUT Schematic Including Manual Probe Point Information. Provide a single sheet (foldout if necessary) schematic of the UUT. This shall be an engineering drawing, reproduced from the schematic used in the engineering drawing package and shall include all manual programmer-added ATE test points. These probe points shall be labeled using P1 through P99 encircled and extended with a leader line to the point being probed. Provide a note on the drawing to indicate that these alphanumeric characters refer to ATE test points. If number of probe points exceeds 99, the Government shall be notified immediately to find an alternate method for indicating test points. If all electrical nodes are probe points, then probe points shall not be added to the schematic.

In addition, the second page of this chapter shall contain a list of all alphanumeric characters corresponding to probe points and their associated module and pin number or device name, whichever is of more use to the operator.

10.3.12 Chapter 12, UUT Assembly Drawing Including Manual Probe Point Information. Provide a single sheet (foldout if necessary) assembly drawing of the UUT. This shall be an engineering drawing, reproduced from the assembly drawing used in the engineering drawing package and shall include all programmer-added ATE test points. These probe points shall be labeled using P1 through P99 encircled and extended with a leader line to the point being probed. Provide a note on the drawing to indicate that these alphanumeric characters refer to ATE test points. These alphanumeric characters shall be identical with those used on the UUT schematic (see Chapter 11). If the number of probe points exceeds 99, the Government shall be notified immediately to find an alternate method for indicating test points. Probe point designators shall start in the lower left hand corner, proceed in ascending order and in a clockwise direction.

10.3.13 Chapter 13, Channel-to-Pin Assignment. Provide a list of tester channels and the corresponding pin on the UUT. If a tester channel is not used, the list should indicate this by labeling that channel as not connected. If a tester channel is not connected directly to the UUT, but goes through some circuitry in the Test Head Adapter or Matrix, the list shall reflect that hardware connection. In all cases, every tester channel shall be accounted for. Channel 160 shall be labeled as "autoprober" if applicable. In addition, each tester channel shall be labeled as to its functions for the UUT (stimulus and/or measurement). Channels corresponding to the programmable power supplies should also be labeled with all values in volts that the power supply is required to apply. Channels corresponding to the UUT clocks should be labeled with the clock phase they are generating. If the channel-to-pin list should change during the testing of a board (e.g., more than one matrix used), a second list shall be provided.

10.3.14 Chapter 14, Interconnection Schematic. Develop an interconnection schematic which shows the electrical paths and components between the tester

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10. PREPARATION INSTRUCTIONS (Continued)

and the UUT connector pins. The schematic shall be a composite of the electrical connections and components of the matrix card and the test head adapter. It shall be drawn so that the tester channels are in a column on the left hand side of the schematic and the UUT connector pins are on the right hand side of the schematic. Components shall be labeled with reference designator, electrical value, tolerance, pin location, etc. When electrical connections consist of only one-to-one wiring between tester channels and UUT connector pins, then a short form method by using TO and FROM notations shall be used to reduce congestion. Interconnections shall be shown in their connected form using a single sheet (foldout if necessary). Multiple sheets are acceptable if all of the interconnections cannot be conveniently shown in a single sheet.

10.4 Security Classification. The security classification of material contained in the manual shall be indicated as follows:

a. The symbols (U), (C), and (S) shall be used to indicate classifications of UNCLASSIFIED, CONFIDENTIAL, and SECRET, respectively. Unclassified manuals shall be marked FOR OFFICIAL USE ONLY (FOUO).

b. The classification of each main paragraph and each subparagraph shall be indicated by the appropriate symbol preceding the heading.

For example: 1-2(U) FUNCTIONAL DESCRIPTION.

c. The classification of each table and illustration shall be indicated by a double symbol following the title.

For example: Figure 1-2. System Block Diagram (U) (C). The first symbol shall indicate the classification of the title alone; the second symbol shall indicate the classification of the contents of the table or illustration.

d. The classification of each Chapter and Section heading shall be indicated by a double symbol following the heading.

For example: Chapter 1 - SUPPORT DOCUMENTATION (U). This symbol shall indicate the classification of the heading alone.

10.5 Engineering Drawings. If engineering drawings (schematics, etc.) being procured on the same contract fulfill the basic requirements, they shall be used in the manual.

10.6 Preparation of Illustration. Illustrations shall be prepared in accordance with NSA DS-56 Paragraph 2.6.8, Data Standard for the preparation of COMSEC Technical Manuals.