

LESSON 5. FIELD MAINTENANCE SHOPS 1, 2, AND 3, AND EMERGENCY CONTACT UNIT

MMS Subcourse No 151 Nike Missile and Test Equipment

Lesson Objective To give you a general knowledge of the purpose, capabilities, physical description, and basic function of the test consoles comprising shops 1, 2, and 3, to include console layout, types of test modules used during operation of the shops, and maintenance problem areas.

Credit Hours Four

TEXT

1. INTRODUCTION.

a. **General.** The test equipment used to support the Nike Hercules and improved Nike Hercules battery is identified by two major areas of use. One group is the missile test equipment which is used to test, troubleshoot, and repair the missile and launching equipment. This equipment was covered in lesson 4. The other group which is used to test, troubleshoot, and repair assemblies from equipment in the radar course directing central (RCDC) will be discussed in this lesson. The equipment in both groups is used by direct support, general support, and depot maintenance personnel to keep the Nike batteries in a combat ready status. Efficient use of this test equipment is extremely important in keeping the Nike battery prepared to engage hostile forces.

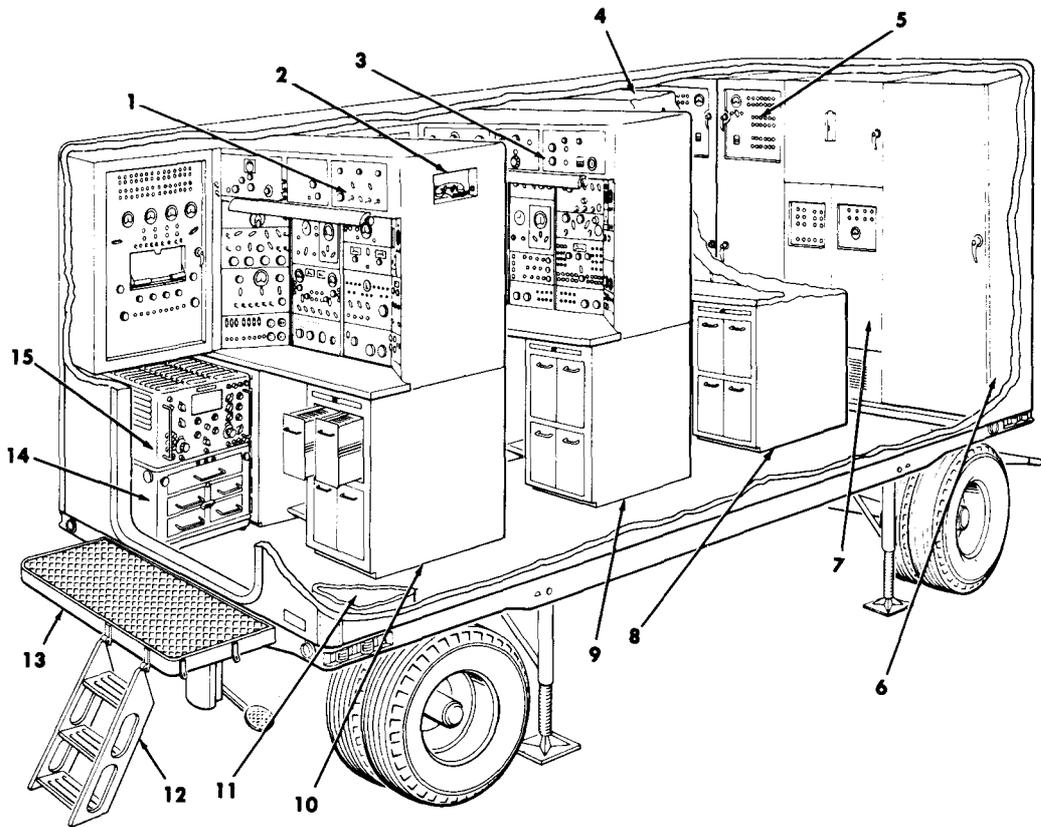
b. **Electronic shops 1, 2, and 3.** Part of the support maintenance test equipment, also referred to as field maintenance test equipment, is housed in three

van-type trailers designated as electronic shop 1, electronic shop 2, and electronic shop 3. These shops contain console mounted test equipment and accessories. At permanent support or depot maintenance installations, these consoles may be removed from the vans and placed in a shop building to facilitate better work flow and production control. The consoles in each shop are referred to as test positions. Positions 1, 2, and 3 are in shop 1; positions 4 and 5 are in shop 2; and positions 6 and 7 are in shop 3. Test equipment mounted in various panels of each position is classified into three categories as follows:

(1) Government issue items, such as multimeters and vacuum tube voltmeters.

(2) Contract purchase items (commercial test equipment), such as signal generators and frequency counters.

(3) Special engineer design circuits or actual circuits found in the RCDC equipment.



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|---|---|----|---|
| 1 | Servo test set AN/MPM-48A—position 3 | 9 | Electrical test and maintenance table 2 |
| 2 | Telephone handset | 10 | Electrical test and maintenance table 3 |
| 3 | Servo test set AN/MPM-47—position 2 | 11 | Utility cabinet |
| 4 | Computer test set AN/MPM-45—position 1 | 12 | Access ladder |
| 5 | Power supply set AN/MSQ-31 | 13 | Rear platform |
| 6 | Storage cabinet | 14 | Oscilloscope dolly |
| 7 | Personnel heater | 15 | Oscilloscope |
| 8 | Electrical test and maintenance table 1 | | |

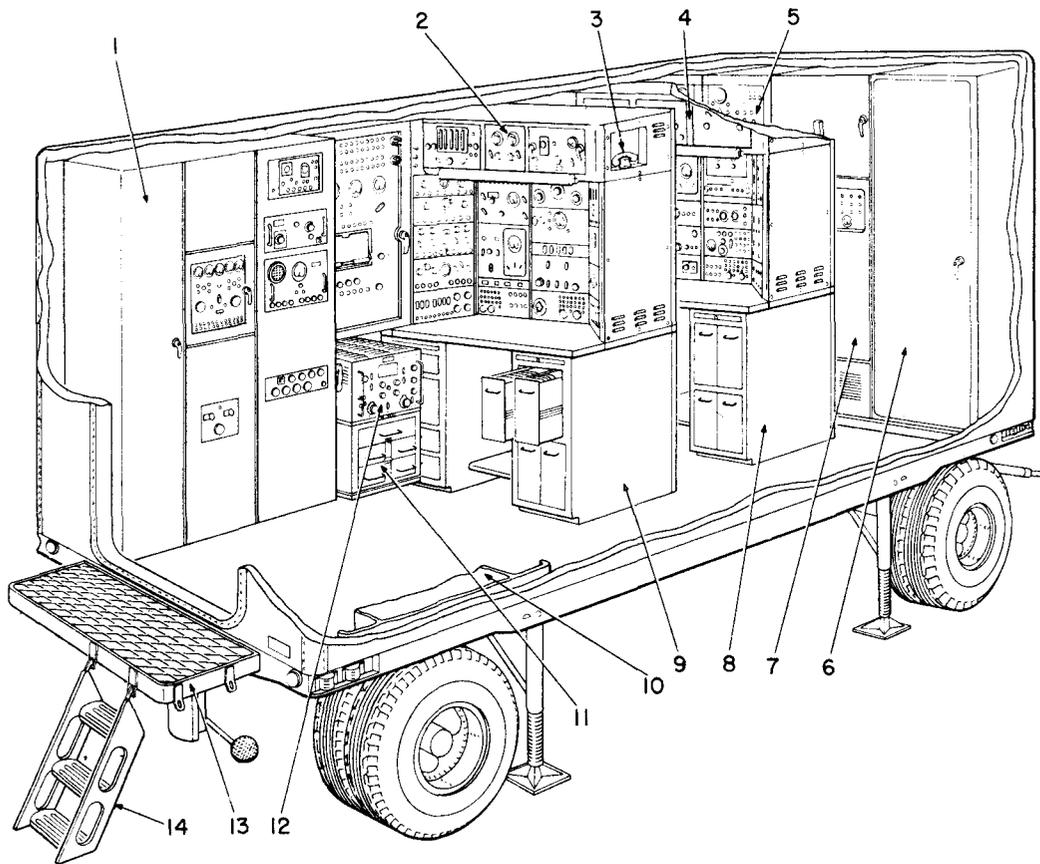
Figure 1. Electronic shop 1 - cutaway view.

c. **Emergency contact unit.** The other support maintenance test equipment, consisting of unmounted test equipment, is housed in an M109 shop van. This van is referred to as the emergency contact unit (ECU). The ECU is used for on-site testing of HIPAR assemblies which are NOT easily movable to electronic shops 1, 2, and 3. Shop 3 will be covered in a separate paragraph from shops 1 and 2 because shop 3 employs a different scheme of operation.

2. DESCRIPTION OF SHOP 1 AND SHOP 2.

a. **General.** The major assemblies of electronic shop 1 (fig 1) are the computer test set AN/MPM-45

(position 1), servo test set AN/MPM-47 (position 2), servo test set AN/MPM-48A (position 3), and the power supply set AN/MSQ-31. The major assemblies of electronic shop 2 (fig 2) are the radar test set AN/MPM-43 (position 4), electrical power test set AN/MPM-42 and radar test set AN/MPM-37A (position 5), and power supply group OS-1065/MPM-34. Each test set is used to test assemblies having common or closely related functions and to determine the quality of operation and acceptability of the assembly. The power supply sets in both shops supply DC voltages, preknock and sync pulses, and distribute AC voltages to the test sets. Each test set is independently operated and contains facilities for controlling the magnitude of input power from the power supply sets.



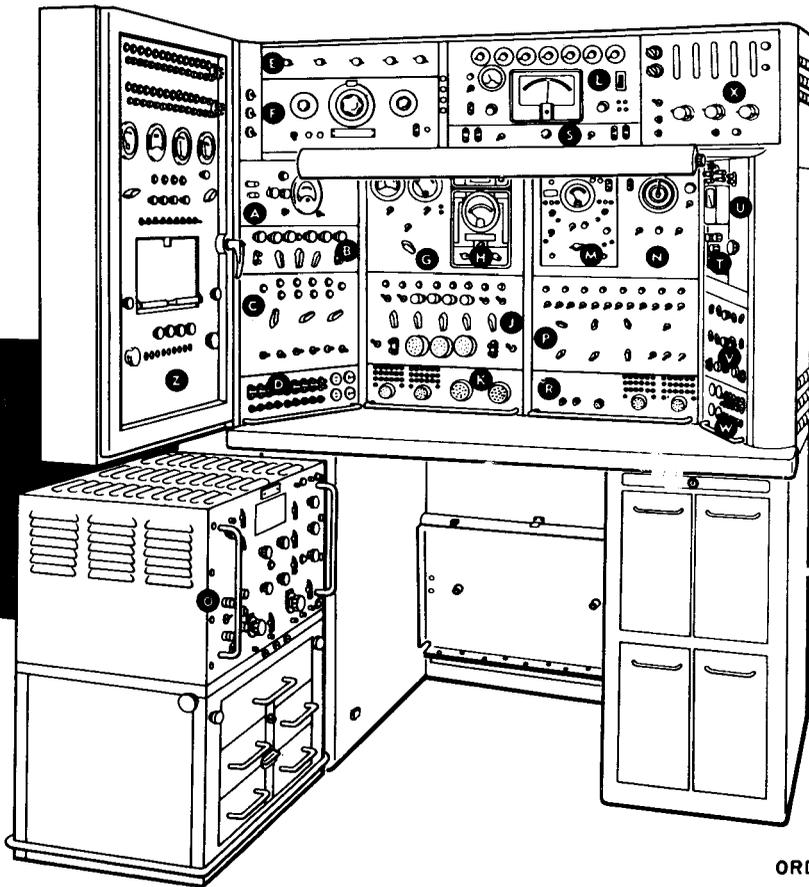
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| 1 Radar test set AN/MPM-37A—position 5 | 8 Electrical test and maintenance table 4 |
| 2 Electrical power test set AN/MPM-42—position 5 | 9 Electrical test and maintenance table 5 |
| 3 Telephone handset | 10 Storage cabinet |
| 4 Radar test set AN/MPM-43—position 4 | 11 Oscilloscope dolly |
| 5 Power supply group OA-1065/MPM-34 | 12 Oscilloscope |
| 6 Storage cabinet | 13 Rear platform |
| 7 Personnel heater | 14 Access ladder |

Figure 2. Electronic shop 2 - cutaway view.

b. **Computer test set AN/MPM-45** (fig 3). Position 1 provides test equipment for testing computer assemblies and for testing voltage regulators, amplifiers, relays, converters, reference generators, brush recorders, and oscillators of the guided missile system radar-signal simulator station AN/MPQ-36. The computer test set, as well as other test sets in shops 1 and 2, is mounted on top of an electrical test and maintenance table. The electrical test and maintenance table at each position contains storage space for manuals, patch cards, miscellaneous test equipment, and cables used at that

position. The major difference between each console is the type test equipment mounted in the electrical equipment cabinet panels. This provides capability for testing different units at each console.

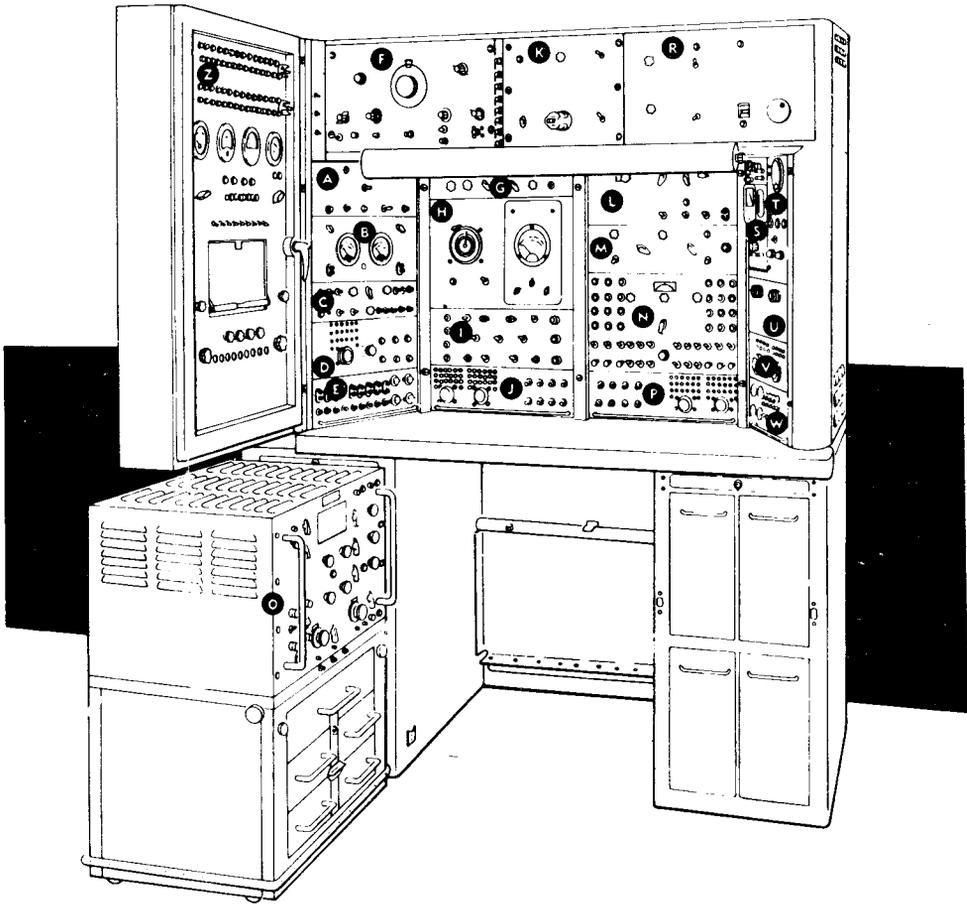
c. **Servo test set AN/MPM-47** (fig 4). Position 2 contains facilities for testing range, azimuth, and elevation indicators; acquisition and track range amplifier-control groups from the LOPAR and tracking radars; amplifiers, generators, converters, servomotors and the CRT scanners of the AN/MPQ-36 simulator.



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|---|---|---|-------------------------------------|
| A | Electronic voltmeter | N | Continuity and insulation test set |
| B | Electrical test panel | O | Oscilloscope |
| C | Relay test set | P | Electrical test panel |
| D | Electrical test panel SB-517B/MPM | R | Test connection jack assembly |
| E | Zero set amplifier test set | S | Test connection generator panel |
| F | Audio oscillator TS-312/FSM-1 | T | Electronic voltmeter |
| G | Electrical test panel | U | Control panel |
| H | Multimeter TS-352/U | V | Servo modulator test set |
| J | Zero set, varistor, and dc amplifier test panel | W | Electrical test panel SB-518B/MPM |
| K | Test connection jack assembly | X | Electronic counter |
| L | Resistance bridge | Z | Power distribution panel SB-690/MPM |
| M | Megohmmeter | | |

Figure 3. Computer test set AN/MPM-45.



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|---|----------------------------------|---|--------------------------------------|
| A | Pulse generator | M | Electrical test panel |
| B | Electrical test panel | N | Indicator test set |
| C | Sweep generator amplifier | O | Oscilloscope |
| D | Jack assembly | P | Jack assembly |
| E | Electrical test panel | R | Range calibrator set |
| F | Pulse generator | S | Electronic voltmeter |
| G | Pulse generator | T | Indicator high voltage control panel |
| H | Multimeter stop timer | U | Electrical dummy load |
| I | Range servo test set | V | Jack assembly |
| J | Jack assembly | W | Electrical test panel |
| K | Control panel | Z | Power distribution panel |
| L | 4-KC signal generator dummy load | | |

Figure 4. Servo test set AN/MPM-47.

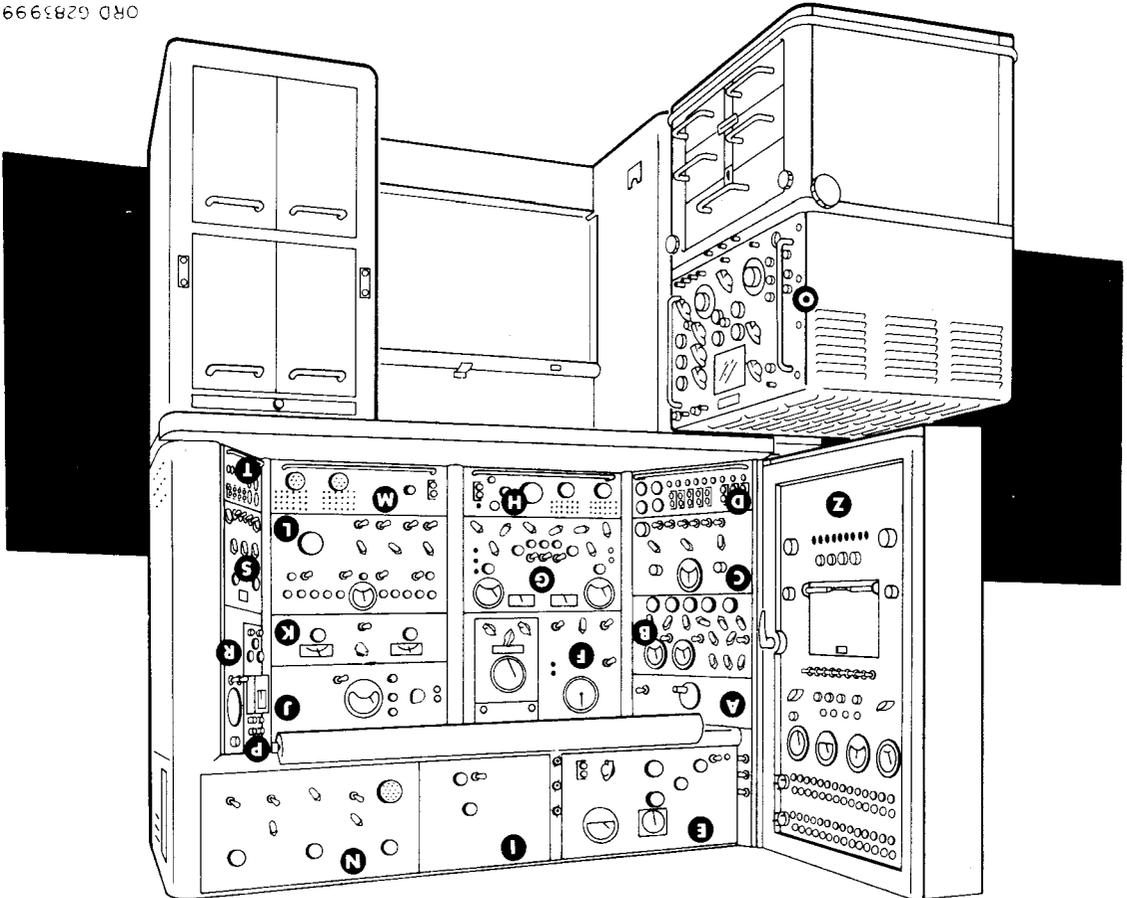
d. Servo test set AN/MPM-48A (fig 5). Position 3 contains facilities for testing servos, amplifiers, and communication assemblies of the Nike Hercules system. Facilities are also provided for testing scoring panels, target coordinate generators, and power supplies.

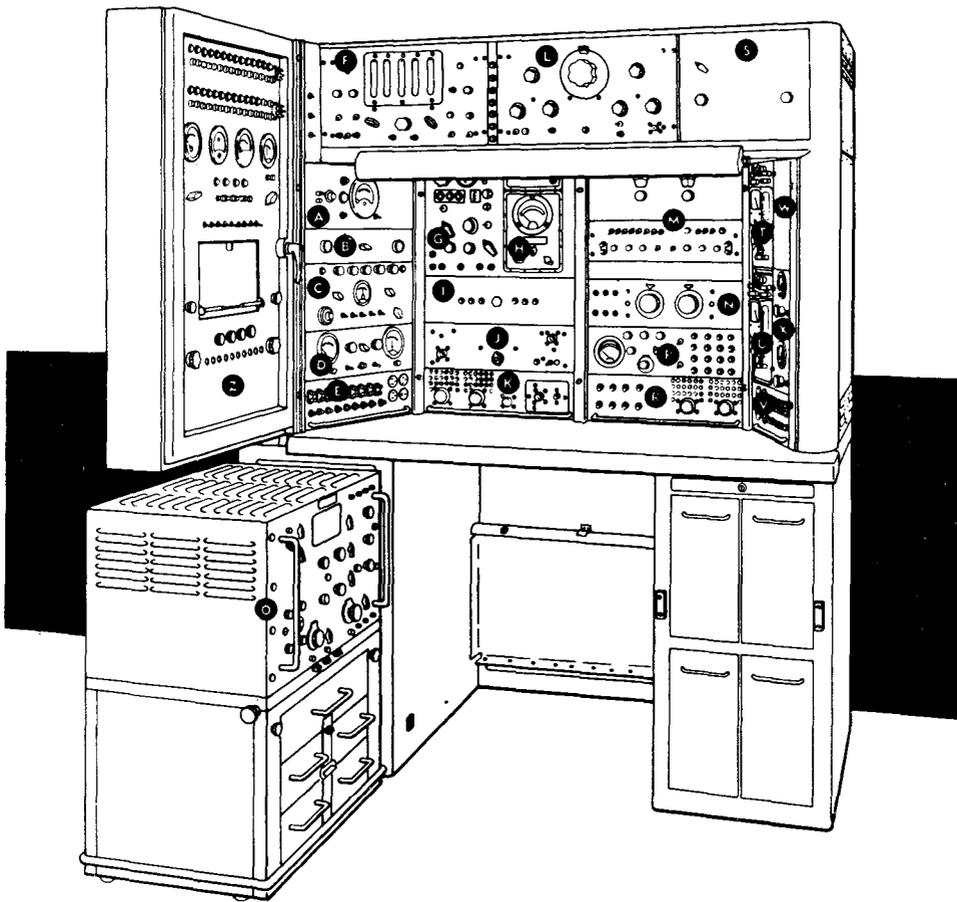
e. Radar test set AN/MPM-43 (fig 6). Position 4 provides facilities for testing IF and video amplifiers and components of the command coder set. It also contains facilities for testing units of the guided missile radar-signal simulator stations.

Figure 5. Servo test set AN/MPM-48A.

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| <ul style="list-style-type: none"> K Synchro test set L Servo test set M Jack assembly N Servo test set group O Oscilloscope LA-239C P Electronic voltmeter R Dynamic loudspeaker S Servo test set T Electrical test panel Z Power distribution panel | <ul style="list-style-type: none"> A Electrical test panel B Power distribution panel C Servo test set D Electrical test panel E Test set oscillator F Multimeter stop timer G Servo test control panel H Jack assembly I Audio frequency amplifier J AC electronic voltmeter |
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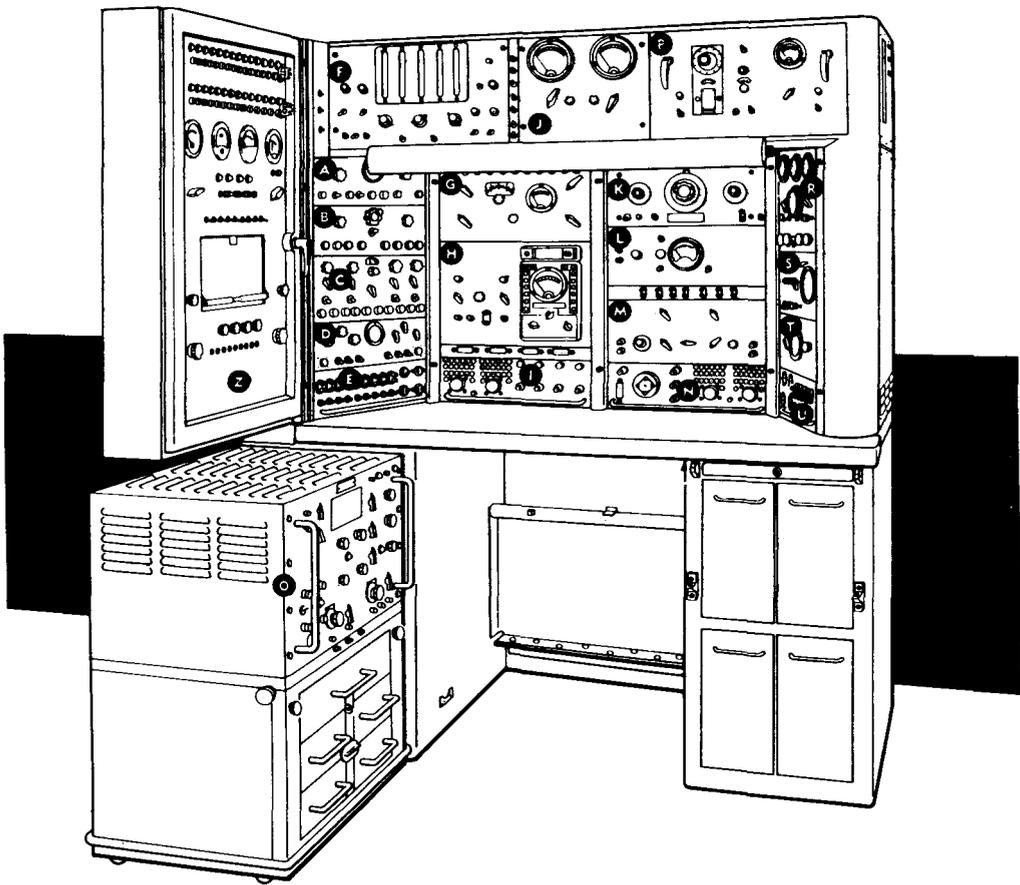
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|---|-----------------------------------|---|--|
| A | Electronic voltmeter | M | Sweep generator |
| B | Control panel | N | Attenuator |
| C | Electrical test panel | O | Oscilloscope LA-239C |
| D | Modulator test set | P | IF components test set |
| E | Electrical test panel SB-517B/MPM | R | Test connection jack assembly |
| F | Electronic counter | S | Signal generator assembly |
| G | Control panel | T | Electronic voltmeter (GR 1800B) |
| H | Multimeter TS-352/U | U | Electronic voltmeter (GR 1800B) |
| I | Phase comparison test set | V | Electrical test panel SB-518B/MPM |
| J | Wide band amplifier | X | Dual differential electronic voltmeter |
| K | Electrical test panel | Z | Power distribution panel SB-690/MPM |
| L | Pulse generator (HP 212AR) | | |

Figure 6. Radar test set AN/MPM-43.



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|---|-------------------------------------|---|--|
| A | Test set subassembly | L | Electronic voltmeter and test connection jack assembly |
| B | Electrical test panel | M | RF test set test set |
| C | Pulse generator | N | Electrical test panel |
| D | Electrical test panel | O | Oscilloscope |
| E | Electrical test panel SB-517B/MPM | P | RF test set |
| F | Electronic counter | R | Power supply test set |
| G | Control panel test set | S | Interval timer test set |
| H | Multimeter—load and pulse simulator | T | Control panel |
| I | Test connection jack assembly | U | Electrical test panel SB-518B/MPM |
| J | RF power meter | Z | Power distribution panel SB-690/MPM |
| K | Audio oscillator TS-312/FSM-1 | | |

Figure 7. Electrical power test set AN/MPM-42.

f. Electrical power test set AN/MPM-42 (fig 7).

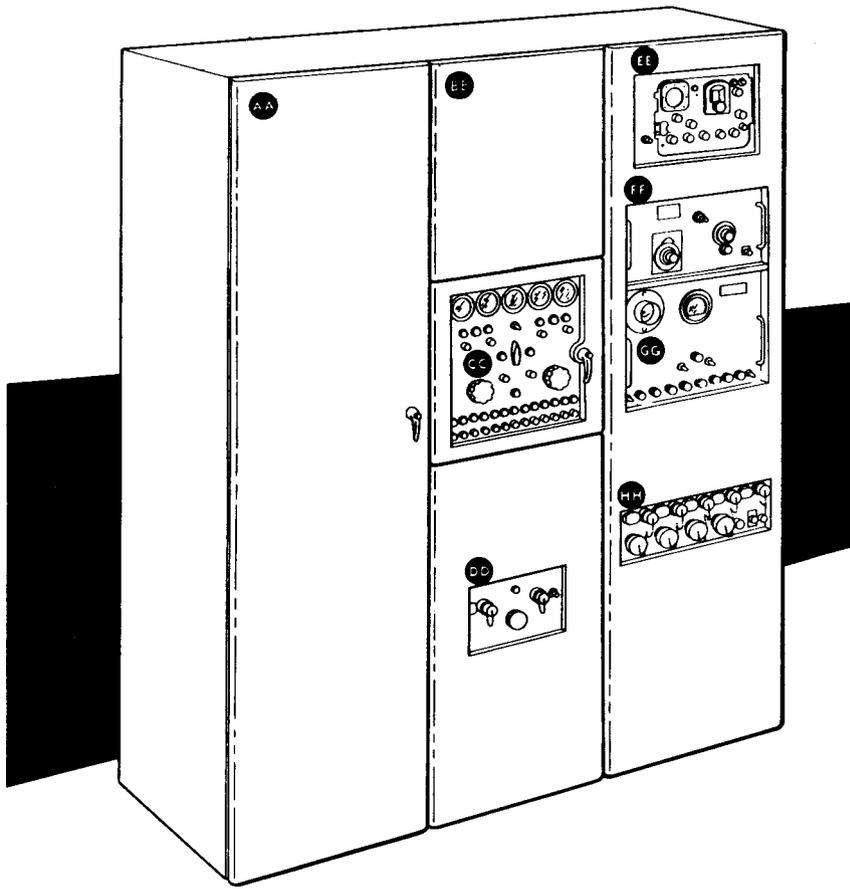
The electrical power test set provides facilities for testing low voltage power supplies and regulators, high voltage supplies, delay timers, servos, servomotors, amplifier assemblies, and miscellaneous control panels.

g. Radar test set AN/MPM-37A (fig 8).

This part of position 5 is used with the electrical power test set AN/MPM-42 to test Nike track radar high voltage power supplies, modulators, and RF units. It permits testing of a complete RF system, which is too large to bring into the shop, by providing connections through the trailer wall to the RF system located outside.

h. Storage.

In addition to the consoles, shops 1 and 2 contain a storage cabinet, a personnel heater, and a utility cabinet (6, 7, and 11, fig 1, respectively for shop 1). Additional storage facilities are provided in each electrical test and maintenance table. The electrical test and maintenance table at each position as well as other storage places use an alphanumeric system of location as shown in figure 9. The vertical bays have alphabetical designations while the horizontal bays have numerical designations. There is also storage space in the rear of each electrical test and maintenance table. Each position is laid out in the same manner to facilitate rapid location of any test equipment or accessory needed by



- AA Trigger amplifier AM-1104A/M
Radar modulator MD-243A/M
Power supply PP-1191/M
Power supply PP-1162/MS
- BB Trigger amplifier AM-1104A/M
Radar modulator MD-243A/M
- CC Control panel

- DD Electrical dummy load
- EE Spectrum analyzer TS-148/UP
- FF Spectrum analyzer
- GG Spectrum analyzer
- HH Test connection jack assembly
- JJ¹ Test connection jack assembly

¹This assembly is not illustrated. It is located on the rear of radar test set AN/MPM-37 and protrudes through the outside wall of electronic shop van trailer XM383.

Figure 8. Radar test set AN/MPM-37A.

the technician to perform a particular test.

i. Miscellaneous test equipment.

(1) General. The miscellaneous test equipment used in shops 1 and 2 consists of unmounted test equipment; cables and test lead sets 1, 2, 3, 4, and 5; adapters and fixture sets 1, 2, 3, 4, and 5; and electrical contact assembly sets 1, 2, 3, 4, and 5. Shop 1 and shop 2 miscellaneous test equipment is discussed in (2) through (5) below.

(2) Unmounted test equipment (fig 10). The unmounted test equipment supplements the

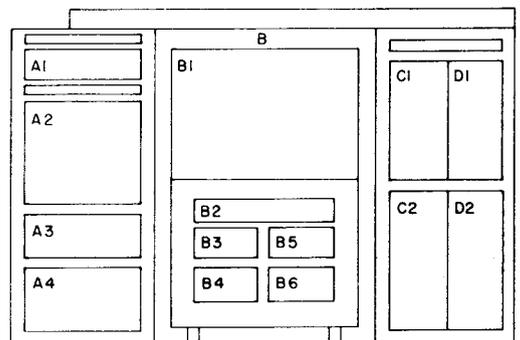
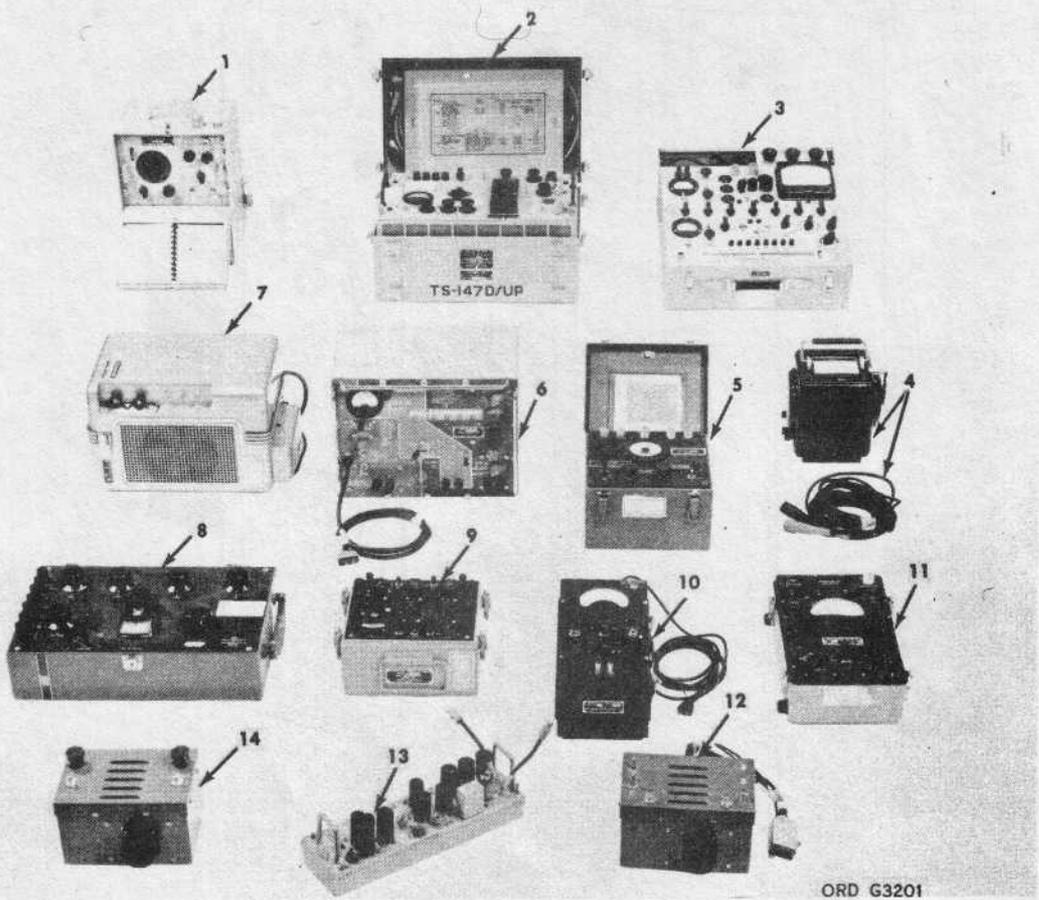


Figure 9. Electrical test and maintenance table and oscilloscopy dolly - typical for position 1, 2, 3, 4, and 5.



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| <ul style="list-style-type: none"> 1 Frequency meter TS-323/UR 2 Radar test set TS-147D/UP 3 Tube tester 4 Insulation resistance tester ZM-21A/U and cable 5 Frequency-power meter ME-51/UP 6 Analyzer ZM-3/U 7 Test recorder | <ul style="list-style-type: none"> 8 Null voltage test set 9 Resistance bridge ZM-4B/U 10 Electronic multimeter ME-6/U 11 Multimeter TS-352/U 12 Pulse generator 13 Receiver control 14 Receiver-gate generator |
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Figure 10. Unmounted test equipment.

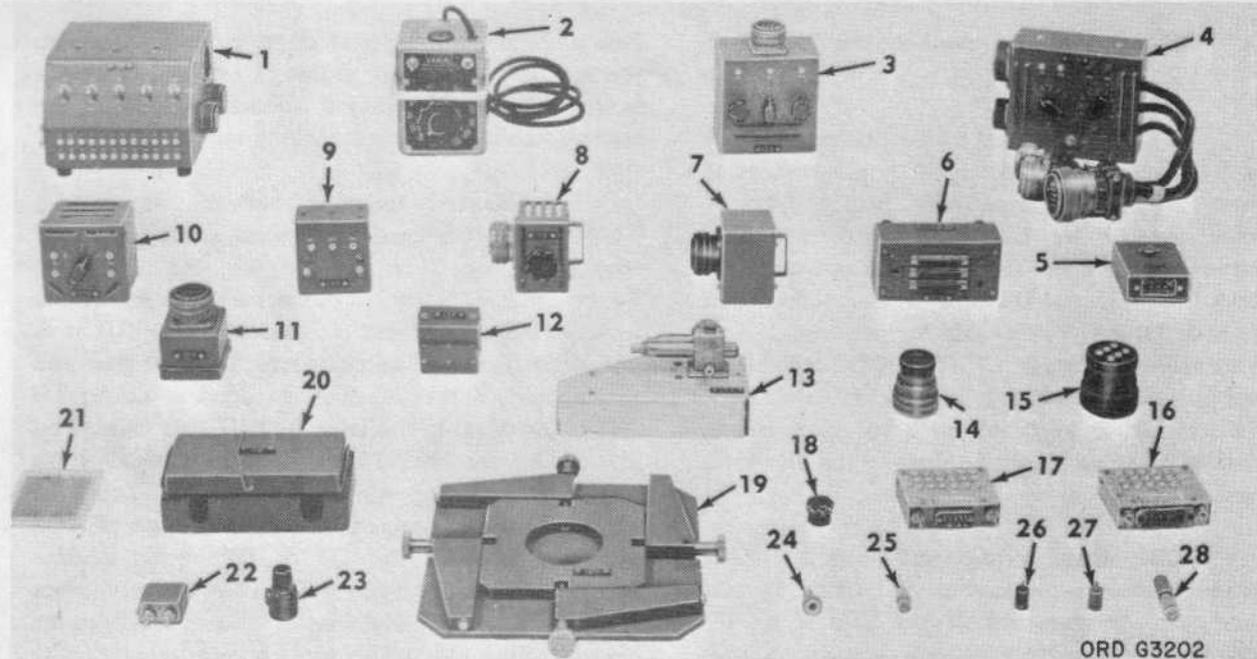
mounted test equipment in performing tests on assemblies. The pulse generator and receiver-gate generator (12 and 14, fig 10) are stored in storage location A2 of the electrical test and maintenance table at position 1. The electronic multimeter and multimeter TS-352/U (10 and 11, fig 10) are stored in rear of the electrical test and maintenance table 1 at storage location A1. The remaining unmounted test equipment in figure 10 is stored in the storage cabinet (6, fig 1).

(3) Cables and test leads sets 1, 2, 3, 4, and 5. Table I gives you an example of how the cables are listed in technical manuals. This table is typical and reflects information found in technical manuals stored in the electrical test and maintenance tables of shops 1 and 2. It shows the part number of each cable and, by

reference to illustrations, shows the storage location of each cable. The 100-, 200-, 300-, 400-, and 500-series

TABLE I. CABLES

ITEM	PART NO	STORAGE LOCATION REFERENCE
Cable 101	8157650	2 in A1, 2 in B1, rear of 9, fig 1
Cable 102	8157651	C1, rear of 9, fig 1
Cable 103	8150933	D1, rear of 9, fig 1
Cable 104	8150934	D1, rear of 9, fig 1
Cable 201	8151081	A1 and B1, rear of 9, fig 1
Cable 202	8151082	C1, rear of 10, fig 1
Cable 235	9140631	A4, 9, fig 1
Cable 301	8151221	2 in B1, 11, fig 1
Cable 302	8151222	B1, 11, fig 1
Cable 303	8151223	B1, 11, fig 1



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1 TA-136	9 TA-130	15 TA-113	20 TA-116	TA-122
2 TA-135	10 TA-125	TA-114	21 TA-138	TA-123
3 TA-128	11 TA-126	TA-124	22 TA-101	23 TA-132
4 TA-129	TA-127	16 TA-107	TA-102	24 TA-119
5 TA-141	12 TA-137	17 TA-111	TA-109	25 TA-121
6 TA-106	13 TA-133	18 TA-108	TA-110	26 TA-103
7 TA-115	14 TA-112	19 TA-120	TA-117	27 TA-105
8 TA-118				28 TA-134

Figure 11. 100-series test adapters.

cables are used in various combinations to perform tests at positions 1, 2, 3, 4, and 5, respectively. It can be seen from the accompanying table that each cable is stored in a location which makes it easily accessible to the technician working at the individual consoles.

components are not shown but are stored in a location easily accessible to the technician working at the respective consoles.

(4) Adapters and fixtures sets 1, 2, 3, 4, and 5. An example of the test adapters used to perform tests in electronic shop 1 is given in table II. The part number for each item and a reference to illustrations showing physical appearance and storage location of each item are included in the table. The 100-, 200-, and 300-series test adapters are used in various combinations to perform tests at positions 1, 2, and 3, respectively. The 400- and 500-series test adapters are used in shop 2, at positions 4 and 5, respectively. The functional use of each item is given in the description column of the table. The 100-series test adapters are shown in figure 11. The only improved Nike-Hercules test adapter appearing in the 100-series components is TA-C139 and is indicated by the INH suffix. The 200-, 300-, 400-, and 500-series

TABLE II. TEST ADAPTERS

ITEM	PART NO	FIG REF PHYSICAL APPEARANCE	STORAGE LOCATION	DESCRIPTION
TA-101	8156115	22, fig 7	E7, rear of 9, fig 1	2.2-megohm standard re- sistor adapter
TA-102	8156116	22, fig 7	E7, rear of 9, fig 1	10-megohm standard re- sistor adapter
TA-103	8157653	26, fig 7	2 in E7, rear of 9, fig 1	Tip jack adapter
TA-C139 (INH)	9980829	(not shown)	F8, rear of 9, fig 1	Adapter

j. **Electrical contact assembly sets 1, 2, 3, 4, and 5.**

(1) The electrical contact assembly sets 1, 2, and 3 (patch cards) of electronic shop 1 are used at positions 1, 2, and 3, respectively. Sets 4 and 5 of electronic shop 2 are used at positions 4 and 5, respectively. Patch cards for position 1 are stored in drawers C1, C2, D1, and D2 (fig 1) of electrical test and maintenance table 1. Patch cards for positions 2, 3, 4, and 5 are stored in drawers C1, D1, and D2 of electrical test and maintenance tables 2, 3, 4, and 5, respectively. Each patch card is applicable to a particular test as specified in technical bulletins covering the test being performed.

(2) A patch card consists of three phenolic blocks mounted on a common metallic frame. Metallic contact studs are mounted in perforations on the phenolic block. The contact studs are cross-connected as required on the rear of the patch card. When the patch card is placed in the patching panel (located on panel Z at each position), the door of the patching panel is closed and patch card contact studs make contact with similar studs on the patching panel. This establishes connections only for those circuits of the test set required for testing a particular assembly. Patch cards are slotted on each side to prevent incorrect insertion. Each patching panel contains a lever operated interlock switch which, when closed, provides ground to relays so that the test set can be energized to ON, provided a patch card is inserted and the door interlocks are closed.

3. OPERATION AND USE OF SHOPS 1 AND 2.

a. **General.** When a chassis, assembly, or subassembly (referred to as units under test (UUT)), arrives at a Nike direct or general support unit, it has a DA Form 2407 (maintenance request) attached to it. The job order clerk assigns the chassis a control number to identify it with the 2407. The chassis is passed on to an inspection section where it is given a visual inspection to determine if any components are missing or broken,

then an inspection tag is attached to the chassis. The position used to test the chassis is determined from a master technical bulletin and the chassis is sent to the appropriate shop position for testing and repair.

b. **Master technical bulletin.** Master TB 9-4900-250-35/1 is used to determine which position of shop 1, 2, or 3 is used to test the UUT. TB 9-4900-250-35/2 is used to determine which missile and launcher test equipment is used to test UUT's or assemblies from the launching area. Table III gives you an example of the information found in master TB 9-4900-250-35/1. In this table the UUT's are indexed by part number sequence. The part number stamped on the chassis to be tested will identify the UUT, and the position column of table III identifies the console used to test the UUT. The TM or TB number column identifies the manual or bulletin to be used when performing the test. The chapter column identifies the chapter of the TM or TB which concerns the particular UUT. The date and latest change number of the TM or TB is also given in the master TB.

c. **Use of technical manuals.** At the appropriate position the correct TM or TB is selected for testing the UUT. Each chapter in the TM or TB contains the following information.

(1) Purpose of the test. This section explains what the test checks.

(2) Test equipment. This section lists the panels of the console, miscellaneous test equipment, cables, adapters, and patch cards which the technician will need to perform the test. From this information all the test equipment and accessories can be selected from their storage locations.

(3) Preparation for test. This section contains information on how to condition the console for making the test and how to connect the UUT to the console. It also tells which patch card to insert in the patching panel. From this information the technician

TABLE III. MASTER TECHNICAL BULLETIN

PART NO	SPEC NO	POSITION	TM OR TB NO	CHAP	DATE	CHANGE NO
9140712	GS-58611	2	TM 9-1400-250-34/2/2	21	16 Sep 64	C1
9140745	GS-57536	2	TM 9-1400-250-35/2/3	4	15 Sep 64	
9140754	GS-56957	5	TM 9-1400-250-34/5/4	5	28 Oct 64	
9140767	GS-18353	3	TM 9-1400-250-34/3/2	9	28 Apr 64	

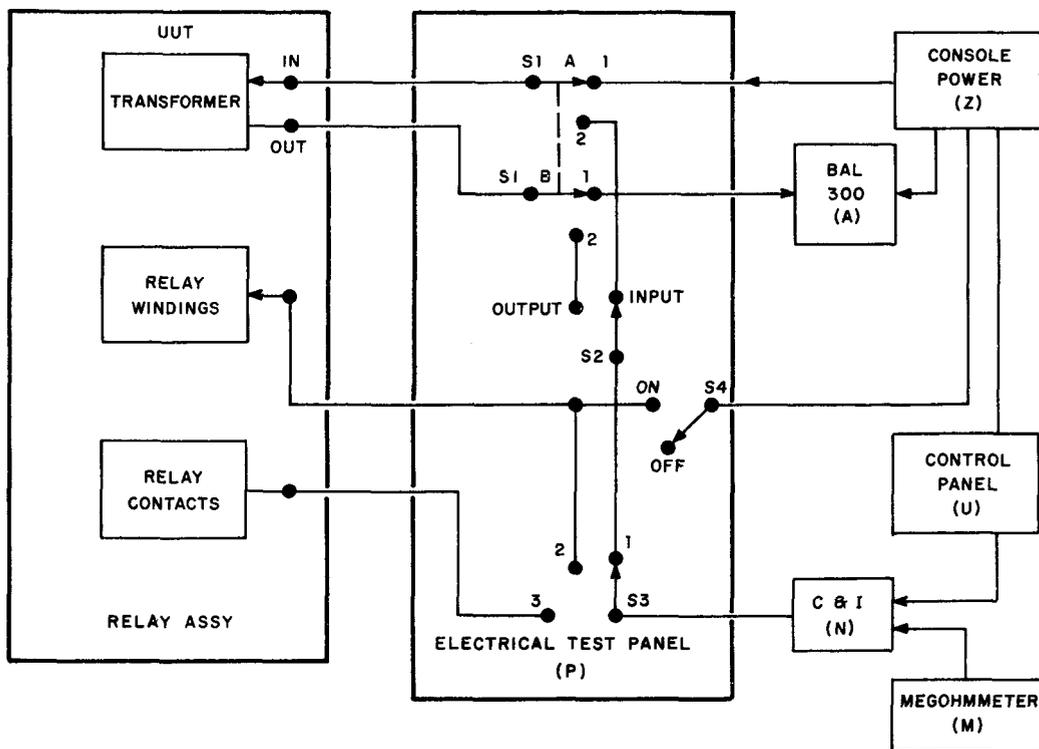


Figure 12. Typical test layout.

sets switches, potentiometers, and other controls to the designated position and connects the UUT to the correct console panels. The technician then places the correct patch card in the patching panel and closes the door to the patching panel.

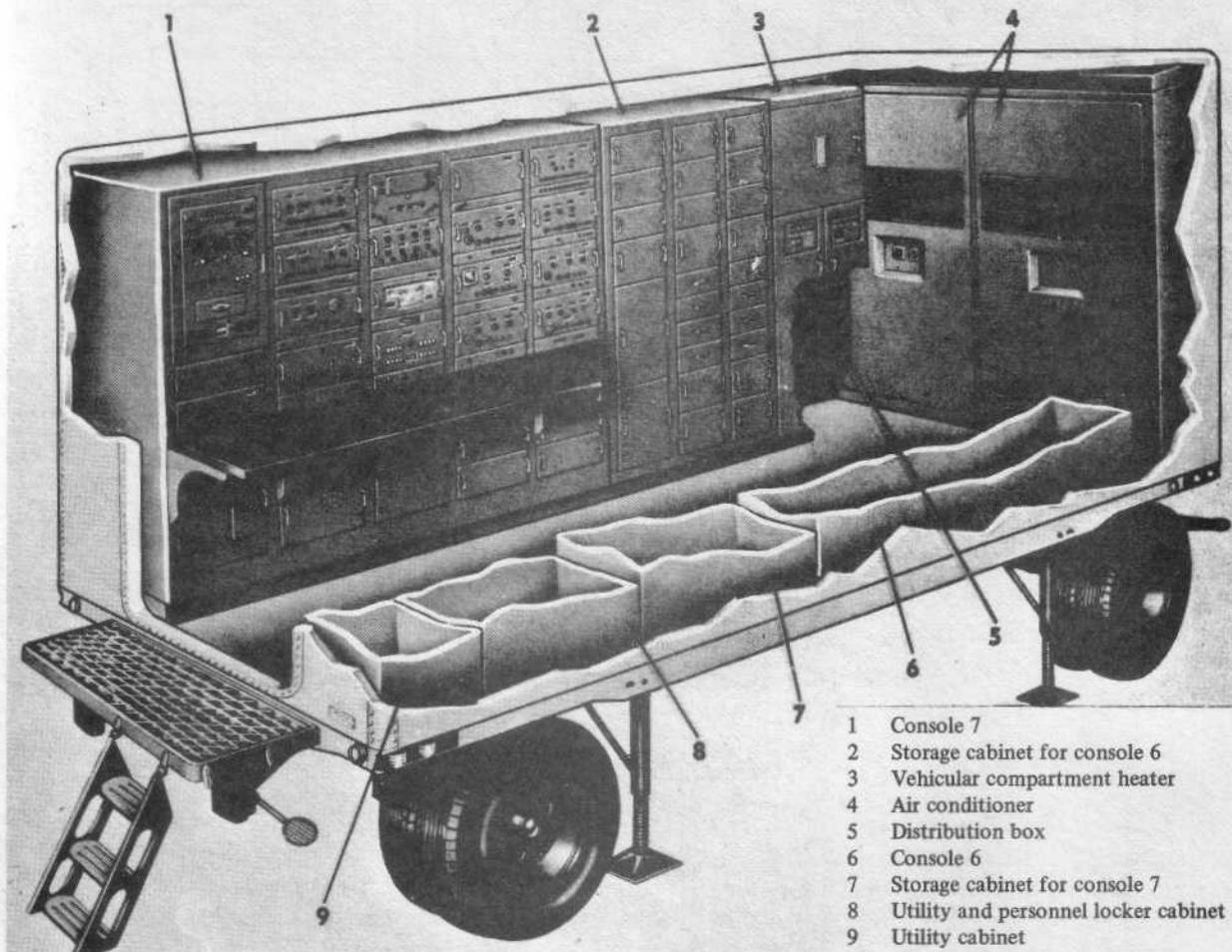
(4) Acceptance test. This section gives a step by step procedure for testing the UUT. Signals, biases, and other voltages which the UUT receives from the console are adjusted by the technician to those values which the UUT is supposed to receive when it is a component in the Nike Hercules or improved Hercules system. In addition to describing these voltages, this section contains pictures of waveshapes to be observed and adjustments to be made on the UUT. Any time the UUT fails to comply with the normal indications listed in this section, the step numbers it failed are recorded on the inspection tag attached to the UUT. The step number of the acceptance test which the UUT failed will localize the problem. When all the steps of this test are performed and the actual indications are the same as those described in this section, the UUT passes.

(5) Maintenance. This section gives a detailed schematic and verbal analysis of how the UUT is supposed to function. It also contains a test layout that shows connections between the UUT and console. By

using the step number failed, detail schematic of the UUT, and verbal description of how the UUT is supposed to function, the technician proceeds to locate the faulty component. When located, the faulty component is replaced and the acceptance test is continued until it is completed. When the UUT passes the acceptance test, it is returned to supply channels or to the Nike battery. A block diagram for a typical test layout and the test performed at position 1 is illustrated in figure 12. The panels on shop 1 used for this particular test are A, M, N, P, U, and Z. The test and checks are performed through electrical test panel (P) by switching in the following manner:

(a) Voltage check. When S1-A and S1-B (which are ganged together) are in position 1, S1-A supplies power from the console to the transformer in the UUT and S1-B connects the output of the transformer to the BAL 300 (electronic voltmeter) on panel A of the console for an output voltage reading.

(b) Continuity and insulation check. This check is performed by placing S3 to position 1 and S2 to the input position (as shown in fig 12). Continuity of the transformer input winding is then checked by



- 1 Console 7
- 2 Storage cabinet for console 6
- 3 Vehicular compartment heater
- 4 Air conditioner
- 5 Distribution box
- 6 Console 6
- 7 Storage cabinet for console 7
- 8 Utility and personnel locker cabinet
- 9 Utility cabinet

Figure 13. Trailer mounted electronic shop 3 - cutaway view.

placing S1-A and B to position 2 and reading the resistance on panel (M). Continuity and insulation of the transformer output winding is checked by placing S2 to the output position and reading the resistance on panel (M). Connection of panel (M) and (N) are controlled at panel (N).

(c) Relay check. Continuity of the relay windings is checked by placing S3 to position 2 and reading the resistance on panel (M). The open circuit resistance of the relay contacts is checked by placing S3 to position 3. Both positions of S3 connect the relay to panel (N). When S3 is in position 3, S4 can be placed ON to energize the relay and the closed circuit resistance of the relay contacts is read on panel (M).

4. DESCRIPTION OF SHOP 3.

a. General. The addition of shop 3 (fig 13) to the Nike field maintenance test equipment (FMTE) was necessary when TTR, HIPAR, and AN/MPQ-T1 were

added to the basic Nike Hercules system. The conversion of a Nike Hercules FMTE system to an improved Nike Hercules FMTE system consisted of adding electronic shop 3 to the basic system and modifying electronic shops 1 and 2. The modifications to these electronic shops consisted of equalizing the workload on some of the consoles by transferring certain units under test from these consoles to the new electronic shop 3. In addition, some of the improved Nike Hercules system chassis are checked in electronic shops 1 and 2, but most of these units were assigned to consoles which had light workloads. Shops 1 and 2 had to be modified to receive the newly assigned UUT's. The modifications consisted primarily of removing the technical bulletins, test adapters, and patch cards of the units under test which were transferred to electronic shop 3. At the same time new technical bulletins, patch cards, and test adapters were added for the newly assigned UUT. One hundred and ninety-five units have been assigned to electronic shop 3. Eighteen of the 195 units are Nike Ajax/Hercules units which reduced the traffic on

consoles in electronic shops 1 and 2. Twenty-five improved Nike Hercules units, excluding HIPAR, were assigned to consoles 1, 2, 3, and 5 in electronic shops 1 and 2. These units are modified units of the basic Nike Ajax/Hercules systems and therefore may be checked on these consoles without any wiring changes being made in the consoles. The 18 units transferred to electronic shop 3 consist primarily of large turnover units such as IF amplifiers, AFC units, synchronizers, and IF-to-video detectors. This assignment is tentative and subject to change as a result of system changes. The layout of the equipment in electronic shop 3 is shown in figure 13. Two separate and independent test consoles with associated storage cabinets are provided. The test consoles are basically identical; the storage cabinets are similar, varying only in storage details. The two consoles are designated consoles 6 and 7. Console 6 is located on the curbside of the trailer while console 7 is located on the roadside of the trailer. The test consoles and storage cabinets are designed to permit ready installation at permanent locations. Each console in electronic shop 3 contains a limited number of test equipment panels which allows it to test a specific category of units. As test requirements change, dictating a different or modified test equipment lineup or perhaps even a complete change in the testing capability of an individual console, these plug-in test equipment panels may be replaced by a different group of panels. The unused panels may then be mounted in the storage cabinets which are specifically designed to accept them. This capability of ready console conversion, coupled with the facility of storage of alternate test equipment panels, provides the flexibility necessary for modifications.

b. Console 6.

NOTE: Information in (1), (2), (3), (4), and (7) below applies to console 7 (fig 15) as well as console 6.

(1) General. Console 6 (fig 14) in electronic shop 3 is composed of rectangular modules, 7 inches high by 19 inches wide. The modules are mounted in five bays, 60 inches high by 19 inches wide. The vertical bays are designated A through E (left to right facing the console). In the individual bays, each slot is assigned a number beginning with 1 at the top and proceeding downward. This also applies to the small cable connection areas, or reentry strips, which occupy space between modules. The identification (for the purpose of locating any exposed console area) is given by a letter followed by a number. This identification is placed on the console frame to the right side of the space and any module placed within that space assumes

the designated area identification. For example, the third area from the top in the third bay from the left is called C3. When the console operator is instructed to perform some type of operation at panel C3, he will be able to find that location immediately by observing the front of the console. The associated ordnance number is also displayed on the front panel of each module. A small removable plate bearing the ordnance number is mounted on the upper right-hand portion of the module. When the ordnance number is caused to change, the plate mounting is loosened behind the panel, and the plate is replaced with one bearing the new ordnance number.

(2) Location of the connected UUT and test accessories. The connectors for the interconnection of the UUT and the console are located just above the workbench on the electrical test panel located in area A4. The operator is normally positioned in front of area C with the UUT in front of area B7. This position leaves the work surface directly in front and to the right free for use by the operator. The test consoles are so arranged that the outer bays and center bays below the work surface contain those items of test equipment seldom used. The center three bays above the work surface contain those items normally used by the operator. Thus the operator has within easy reach and ready vision all the equipment normally used during a test procedure.

(3) Location of the patch panel. The electrical power distribution panel is located in area A1 (fig 14) and contains the circuitry for energizing the console. No attempt was made toward programming the operation of this panel. This unit also contains the test connection patching panel which is in area A3. The patching panel is the same multicontact switch assembly used on shop 1 and 2 consoles. The insertion of the individual prewired patch card associated with each unit under test provides the proper interconnections of the UUT to the test console. The patching switch is used in electronic shop 3 because it is still the most reliable and economical device available for accomplishing a large scale switching operation. The remaining units within the consoles of electronic shop 3 may be divided into four functional groups: the console programming equipment, display and measuring equipment, special purpose test equipment and power supplies. The location of these units is discussed in (4) through (7) below.

(4) Location of the console programming equipment (CPE). A card reader and an associated remote switching control, which comprise the console

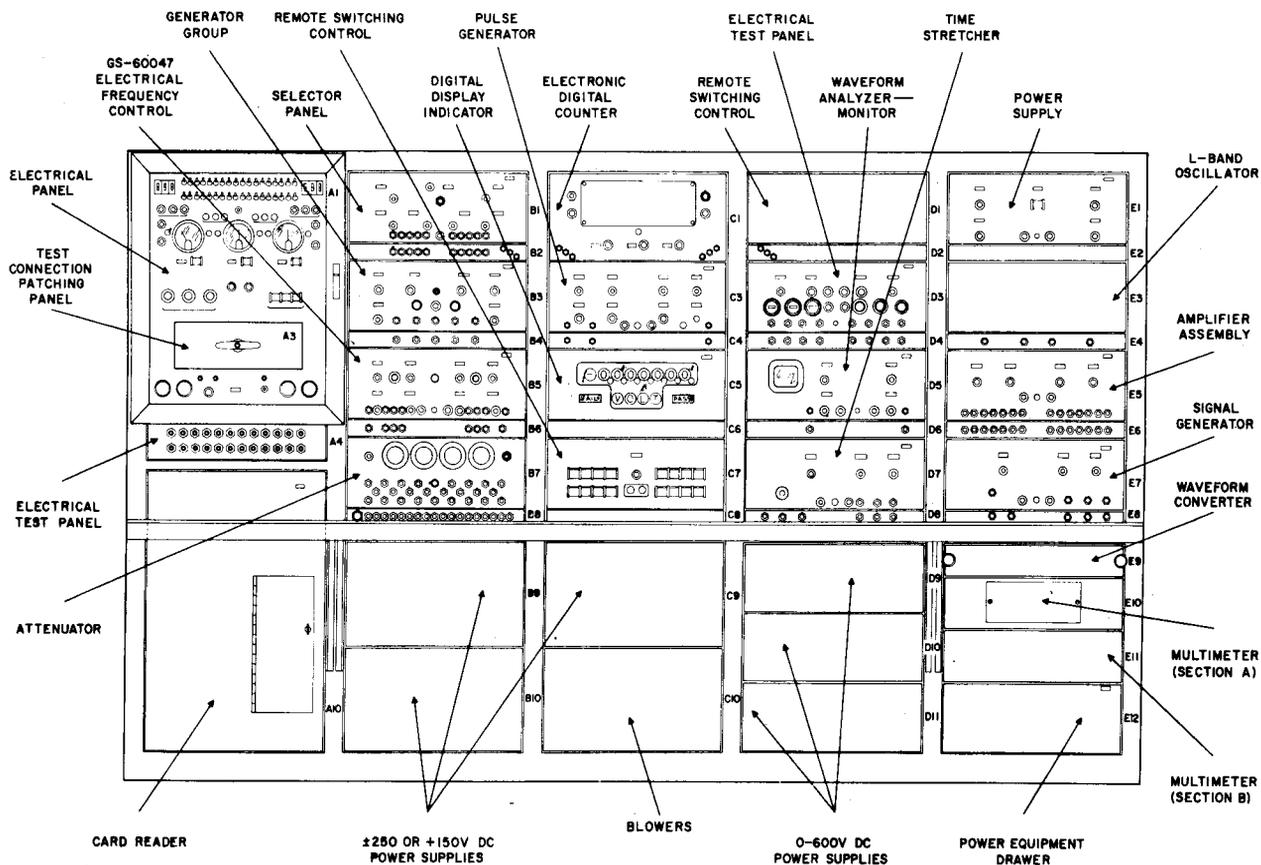


Figure 14. Console 6 - location diagram.

programming equipment, are located in areas A10 and C7, respectively. The card reader may be pulled forward on drawer slides to facilitate maintenance procedures. The remote switching control is centrally located within the console where it is easily accessible to the console operator.

(5) Location of the display and measuring equipment (DAME). The units within the display and measuring equipment are located in various places in the consoles. The digital display indicator, the waveform analyzer monitor, and the time stretcher are centrally located within the console in areas C5, D5, and D7, respectively. Thus the console operator has within easy reach and ready vision all the test and monitoring equipment normally needed during any test procedure. An electronic digital counter is located in area C1 and a multimeter, consisting of three sections, is located in areas E9 through E11 of the console. The outputs of the electronic digital counter and the multimeter are displayed on the digital display indicator; therefore, these units do not have to be centrally located.

(6) Location of the special purpose test equipment (SPT). The special purpose test equipment is located in areas B1 through B8, C3, D1, D3, and E1 through E8. These panels are specifically designed to test a particular category of units. For console 6 these units are designed to check IF amplifiers, AFC units, and video detectors. The panels have been standardized in layout, dimension, connectors, and mounting facilities. As additional special test equipment items are required for checking units of the improved Nike Hercules, they may be readily interchanged with those initially provided. They may be stored in the storage cabinets when not in use and, as required, interchanged with units in the console. The small connector panels or reentry strips between the large panels facilitate interconnecting coaxial type signal leads to the signal switching system. These panels also provide direct access to input and output signals which may be required during maintenance and repair operations on a faulty UUT.

(7) Location of power supplies. The DC

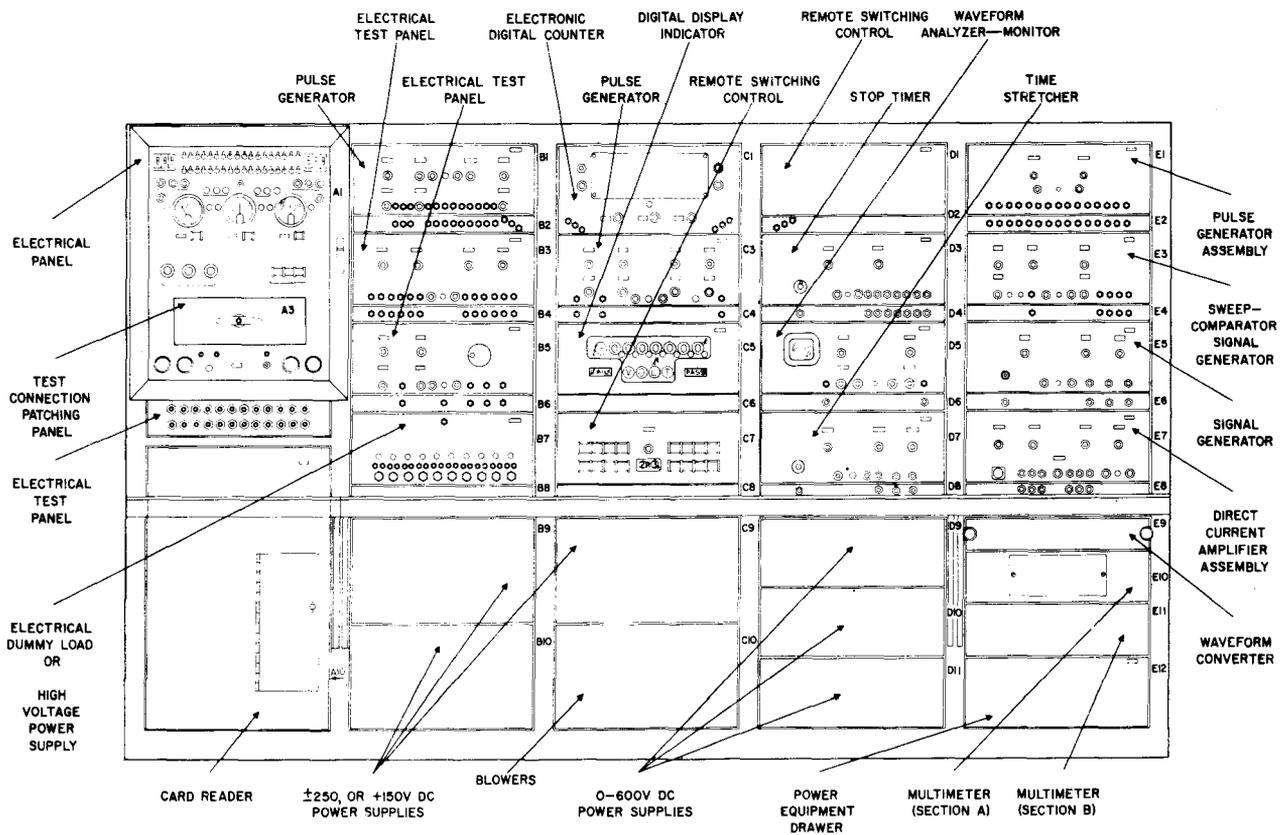


Figure 15. Console 7 - location diagram.

power supplies and voltage regulators are located in areas B9, B10, C9, D9 through D11, and E12. The power supplies are located below the workbench and are not accessible to the operator for maintenance purposes. Also below the workbench and located in area C10 are the blowers which provide cooling and ventilation of the units within the console.

c. Console 7.

(1) As depicted in figure 15, the console programming equipment, the display and measuring equipment, and the power supply areas are identical on consoles 6 and 7. The difference in console panels occurs in the special purpose test equipment areas of the B bay, E bay, and areas D1 and D2. These special test equipment panels are used to check video amplifiers, DC amplifiers, pulse generators, relay assemblies, and power supplies. The overall operation of console 7 is identical to the operation of console 6 except for the special purpose test equipment.

(2) All of the panels within the test consoles of electronic shop 3 are constructed to utilize a new concept in the layout of equipment. Each major

panel has one or more subassemblies called minispecs. A minispec is a module which contains usually one complete circuit such as an IF amplifier, a pulse generator, or a DC amplifier. A minispec subassembly is 1-1/2 inches wide by 8-1/2 inches long by 3-1/2 inches high. Up to five tube stages may be mounted on this subassembly depending on the complexity of the circuit. In special circuits a double minispec, which is twice the width of a single minispec, is used in order to get a complex circuit on a subassembly. All the minispecs within a panel may function together to produce an output signal, as in the pulse generator, or they may perform separate and independent functions as in the amplifier assembly. The individual minispec contains numerous test points making it possible to check nearly every point within the circuit. For troubleshooting purposes, the minispec is raised from the surrounding units and locked in this position for easier accessibility. The minispec is less difficult to replace than a subassembly of a panel, thus making maintenance and repair easier.

5. FUNCTION OF SHOP 3 CONSOLES (FIG 16).

a. **General.** In order to simplify test procedures

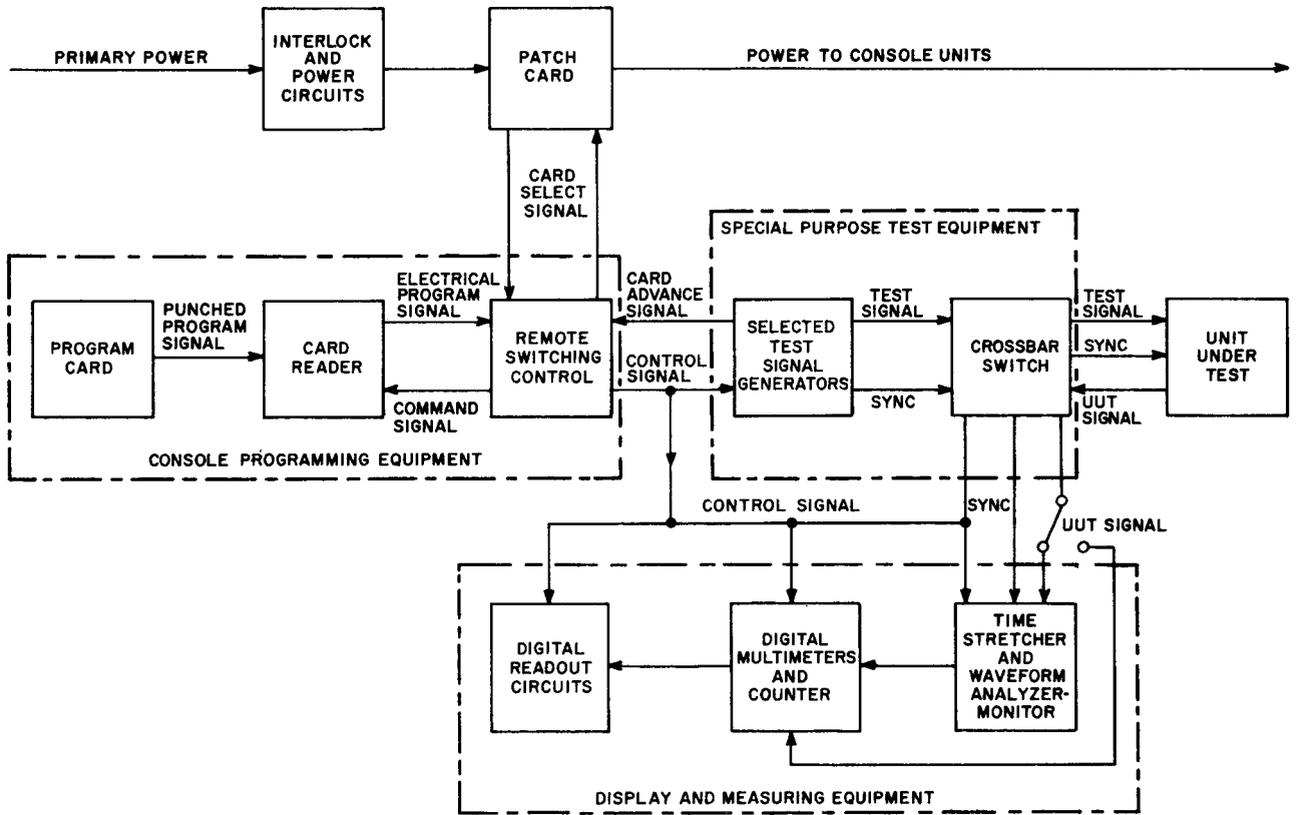


Figure 16. Electronic shop 3 - block diagram.

and have a maximum testing rate of UUT's on a pass-fail basis, a certain degree of automatic console operation is desired. The automation of the setup controls and subsequent positioning or repositioning of controls during the control of a test procedure provides the greatest return in terms of test time saved at a reasonable cost and equipment complexity. With these features in mind, the consoles in electronic shop 3 have been designed to operate semiautomatically. However, facilities are provided for the consoles to be completely manually operated by the console operator for manual repair and maintenance of defective units. The test consoles contain test equipment panels including a number of selector switches that provide the proper output signals and adjust the output measuring equipment to the proper range and characteristics. These switches are rotary type with an actuating solenoid positioning device to position each switch. The console programming equipment functions to position these rotary selector switches to the proper positions in the correct sequence. In addition, the selector switches may be manually operated if required. The functional units within the consoles of electronic shop 3, i.e., the interlocks and power circuits, the console programming equipment, the special purpose test equipment, and the

display and measuring equipment, are discussed in paragraphs b thru e below.

b. Interlock and power circuits. These circuits (fig 16) provide the necessary protection and power for operating the console. The patch card for each UUT provides the power interconnections to program the three variable power supplies (0 to 600 volts) and to verify selection of the correct program card. The patch card establishes continuity with verification circuits in the remote switching control. The verification circuit determines that the correct program card for performing test on the UUT is selected by the card reader.

c. Console programming equipment.

(1) To accomplish its required function, the console programming equipment has the capability of addressing a particular panel and positioning a selected switch to any one of a number of discrete positions. The console programming equipment then proceeds to position additional switches in the same panel or other panels in the proper sequence until a complete test procedure has been accomplished. To make effective use of the console programming

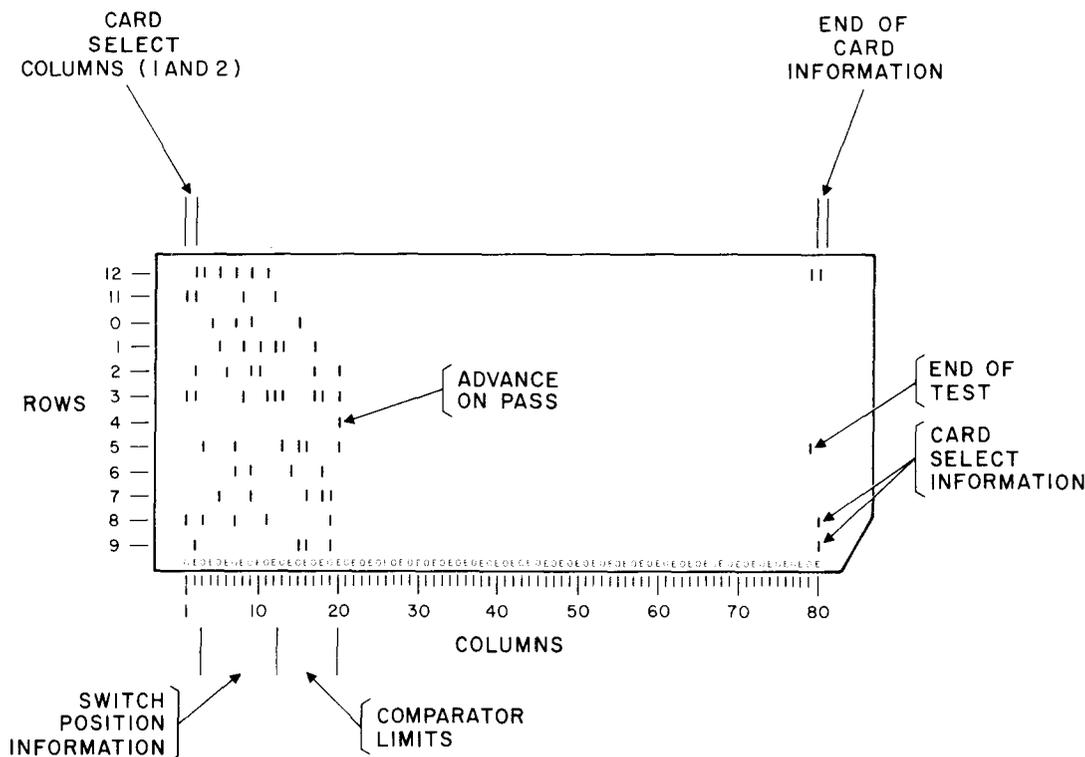


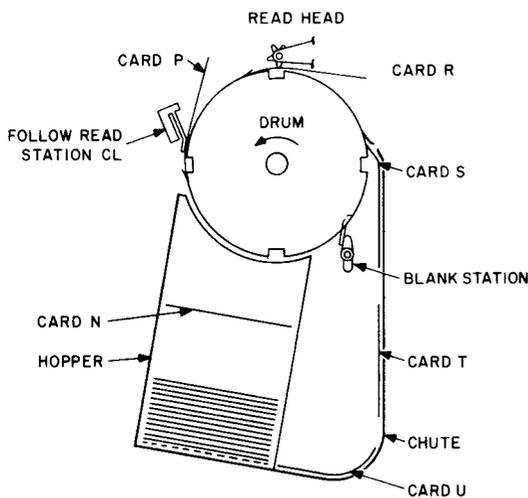
Figure 17. Standard program card.

equipment, as many test equipment controls as possible must be operable in discrete increments. As shown in figure 16, the console programming equipment consists of a program card, card reader, and a remote switching control panel.

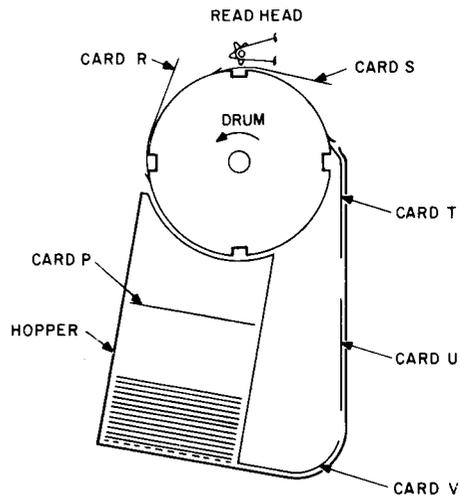
(2) All test condition information for semiautomatic console operation is placed on the program card (fig 17) by holes punched in the card. This card is a standard punched card, 3-1/4 by 7-3/8 inches, containing 12 rows and 80 columns. The four classes of information contained on this card are: card select, switch position, comparator limit, and end of card. The card select information is always punched in columns 1 and 2 and is used to find the correct card for a particular UUT. The switch position information is punched in columns 3 and 4. This information is used to select a particular panel, switch, and switch position for the test to be performed. The next eight columns are used to program the comparator limit information which establishes the upper and lower limits of the parameter to be tested. Programming of the switches and the limits completes one test condition. As many test conditions as necessary to check the UUT may be programmed in the same manner. The final information punched on a card is the end of card information. This information is punched either in the last two columns of the card,

columns 79 and 80, or at the end of a particular test if the test ends before all columns of the card are used. If all test conditions have been completed, the end of card punches will provide an end of test signal which will be displayed by a front panel indicator on the remote switching control. If another card is required to complete the test, the end of card punches will contain card select information which is used to select the next card required to continue the test.

(3) The program cards are stored in the hopper of the card reader (fig 18). Single cards are automatically picked from the bottom of the deck with a picker knife and pushed into feed rollers. Four sets of clutched rollers transfer cards up the chute to the rotating drum. The card is clamped onto the drum and rotated to the read station. At the read station 12 star wheels are in a position to drop into the holes in the card. Microswitches on the star wheel arms generate program signals when the wheel drops into the punched holes. After the card is read it is rotated to the follow read station and dropped back into the hopper. The program signals from the card reader (fig 16) are applied to the remote switching control which contains logic relay circuits to convert all signals from the card reader into commands to be applied to the desired panel within the console. It is the remote switching control which



ORIGINAL POSITION OF CARDS RE-READ



FINAL POSITION OF CARDS RE-READ

Figure 18. Card reader.

actually addresses the selected console panel, selects a particular switch on the selected panel, and then rotates it to the correct position. Control signals are applied between the remote switching control and nearly every panel within the console. In order for the card reader to select the correct series of program cards for a particular test, card select signals are coupled between the remote switching control and the patch card. The card reader searches for the first program card until the output signals from the card reader energizes a particular combination of logic relays whose contacts complete a patch through the patch card and energizes a card selected relay in the remote switching control. When the first program card of a test series has been selected, a **CARD SELECTED** visual indication is given to the console operator indicating that the check of the UUT may progress.

d. Special purpose test equipment. This special purpose test equipment consists of specifically designed panels which test a particular category of units such as IF amplifiers, AFC units, pulse generators, and DC control units. It is these special test equipment panels which make the two consoles in electronic shop 3 differ. The console programming equipment addresses the panels required for checking the UUT and establishes the proper test signal output which is to be applied to the UUT. The special purpose test equipment consists of synchronizer units, IF and RF signal generators, pulse generators, DC amplifiers, and associated control circuits. The special purpose test equipment has been broadly designed so that it is capable of generating all signals for the improved Nike Hercules system including TRR, HIPAR, and the AN/MPQ-T1 simulator, as well as

providing a margin for future growth as required when the improved Nike system is modified. Test signals between the UUT and the special purpose test equipment are applied through a crossbar switch. The crossbar switch is positioned by signals from the remote switching control to set up a path for signals between the UUT and the console equipment. The crossbar switch permits establishment of alternate signal paths, which are required for different test conditions and it also eliminates external cabling between the UUT and the console test panels.

e. Display and measuring equipment.

(1) **General.** The signals from the UUT are applied through the crossbar switch to the display and measuring equipment (DAME). The DAME system consists of a timer stretcher, a waveform analyzer-monitor, a digital counter, a digital multimeter, and a digital readout circuit.

(2) **Time stretcher and waveform analyzer-monitor.** The time stretcher and waveform analyzer-monitor are used to interpret pulsed signal information. These two units permit pulse characteristics such as pulse duration, amplitude, rise time, and fall time to be measured. The time stretcher converts the pulsed signals to an increased time base so that accurate measurements of the pulse characteristics may be made. For example, a 1-microsecond pulse can be stretched to a pulse duration of 1 second, an increase of one million in time base. The waveform analyzer-monitor actually performs the measurement of the pulse characteristics and applies the measured information to either the digital multimeter or

counter, depending on the characteristics being measured. The time stretcher and waveform analyzer-monitor have the advantage of greater frequency coverage, programmable operation, and simple pushbutton control when manually operated. In addition, the numerical readout of measured parameters requires no interpretation of the results on the part of the operator. These panels provide equipment which requires a minimum of decisionmaking on the part of the operator.

(3) Digital multimeter and digital counter.

The digital multimeter and the digital counter are the only two measuring instruments within the consoles of electronic shop 3. These instruments are controlled by the console programming equipment in the semiautomatic mode of console operation but they may be manually controlled if necessary. The signal inputs to these measuring units are from the waveform analyzer-monitor when pulsed signals are being measured or from the crossbar switch and sometimes the patch card if continuous wave signals such as AC voltages, DC voltages, resistances, or ratios are being measured. The digital multimeter and digital counter are commercial instruments modified for application in this system. The output from the digital multimeter or digital counter, depending on the measurement being made, is applied to the digital readout circuits.

(4) Digital readout circuits. The digital readout circuits display, in numerical form, all the measured quantities of both the test console and the UUT, as shown in figures 14 and 15. In addition to the numerical value of the measured quantity, the characteristic of this quantity is displayed such as volts, ohms, microseconds, etc. The numerical readout value of the signal from the UUT is also compared in these circuits with limits from the console programming equipment which are established by punches in the program card. A visual PASS or FAIL signal is given to the console operator depending on whether or not the signal from the UUT is within programmed limits. A PASS signal permits the semiautomatic console operation to continue, but a FAIL signal or the absence of a PASS signal stops the console programming equipment. If a FAIL condition occurs, the operator can perform troubleshooting procedures while observing the digital readout display. Once the trouble is cleared and a PASS signal is obtained the operator may then place the console programming equipment back into semiautomatic operation.

6. OPERATION AND USE OF SHOP 3. The general pattern of testing UUT's in shop 3 is similar to shops 1 and 2. However, since switch positions and most cable

connections are made automatically, the operator's main function is to connect the UUT to the console, press buttons, and observe indications on the readout equipment as instructed by technical manuals. The technical manuals covering the UUT's tested in shop 3 are selected by using the master technical bulletin and they contain the same type data as shop 1 and 2 technical manuals; i.e., purpose of test, preparation for test, acceptance test, and troubleshooting aids. The purpose of the test and preparation for test are the same as shops 1 and 2, while the acceptance test gives the number of each test condition, refers to a location by area number, and gives the operation to be performed or observations to be made in that area. The acceptance test also gives the purpose of the test condition. While the acceptance test is being performed, the test equipment is in semiautomatic operation. If the UUT fails the acceptance test, the repairman performs the troubleshooting aids listed in the TM. While performing the troubleshooting aids the test equipment is operated manually. Data given in the troubleshooting aids allow the operator to set each switch and control. If the switches on the console are in the position prescribed by the TM, the trouble is in the UUT. If not, the trouble is in the console.

7. EMERGENCY CONTACT UNIT (FIG 19). The support maintenance test equipment used to test some HIPAR assemblies is housed in the emergency contact unit (ECU). This test equipment is normally used by maintenance contact teams which are dispatched from a direct support maintenance shop to the Nike site. The men dispatched with the ECU should be well qualified technicians holding a 23U MOS. The ECU contains test equipment necessary to analyze and evaluate the HIPAR system performance. Many of the test equipment items stored in the ECU are of the commercial type including a differential voltmeter, a tube tester, an oscilloscope, a vacuum tube voltmeter, and a multimeter. Many other ECU test equipment items are made especially for the HIPAR, such as the precision slotted waveguide, a slide screw tuner, a slotted line probe, and a coaxial waveguide adapter.

8. CALIBRATION. Most items of test and measuring equipment in shops 1, 2, 3, and the ECU require calibration every 90 days. However, some of this equipment requires calibration at 180-day intervals. Many of the items of test equipment can be calibrated only by authorized calibration teams while other items can be maintenance calibrated by direct support, general support, or depot maintenance personnel. Information on calibration requirements for test equipment in the improved Nike Hercules system as well as other items of

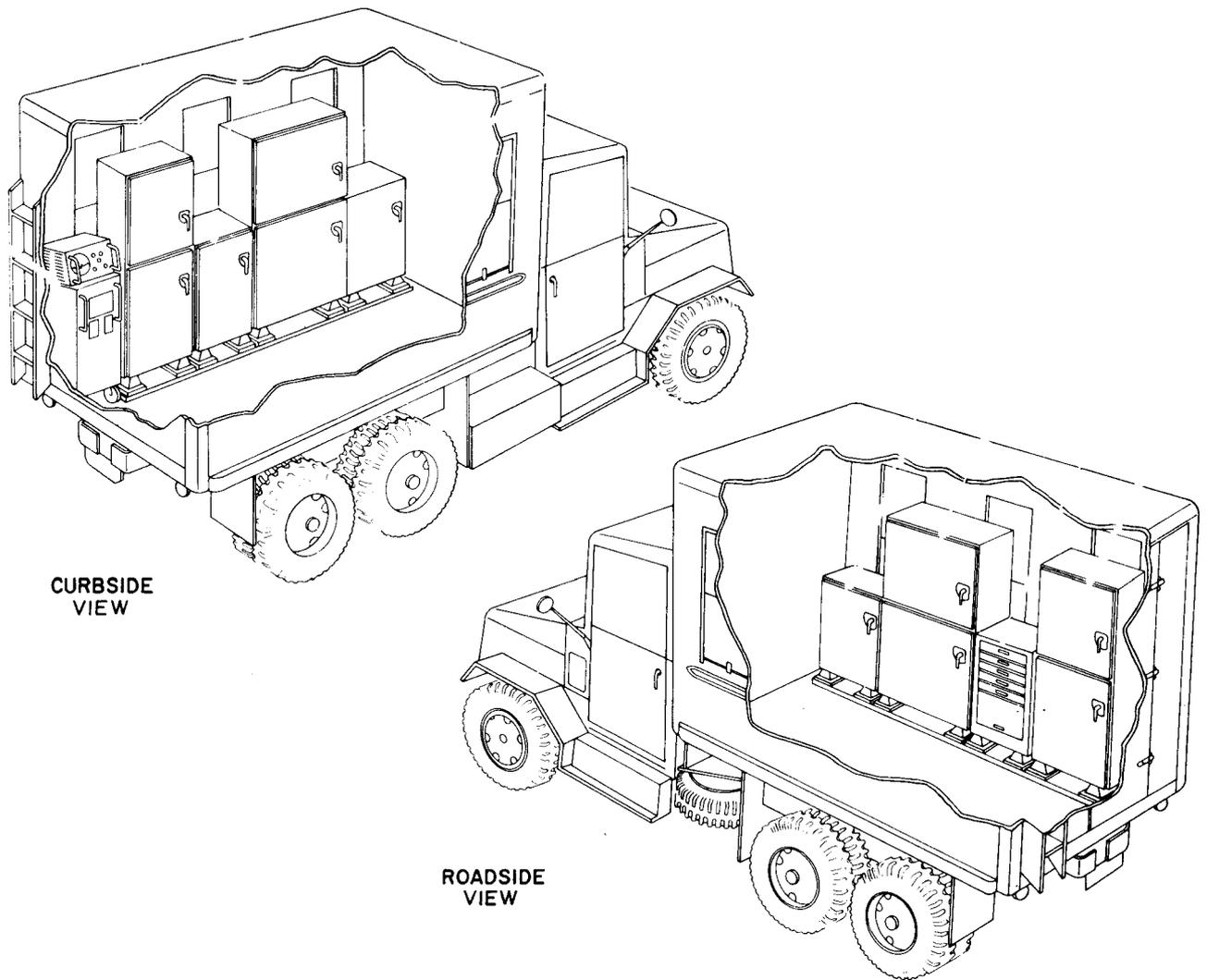


Figure 19. Emergency contact unit.

Army materiel can be found in TB 750-236.

9. MAINTENANCE. The Army's philosophy of constant equipment improvement insures excellent return for the money spent on missile systems in terms of missile effectiveness. As the Nike system is modified, the field maintenance test equipment must also be modified to accommodate these system changes. As the modifications are made to the test equipment, check procedures will change requiring changes to be posted in the technical manuals. If the modifications and changes to TM's are kept current, the shops will retain their capability as effective support maintenance equipment. The Nike system has been deployed sufficiently long for most basic maintenance problems to be solved. However, the card reader in shop 3 is an area where some difficulty exists. The cards tend to "swell" if stored

where the humidity is excessively high. Most of the card reader problems are solved by "keeping your cards dry" and by having a well trained operator who keeps the card reader in proper adjustment.

10. SUMMARY. This lesson has presented field maintenance shops 1, 2, and 3 which are used primarily to test, troubleshoot, and repair assemblies and subassemblies from the RCDC and the emergency contact unit which is used to analyze HIPAR system performance and repair assemblies at the Artillery battery location. There are five positions or consoles in shop 1 and 2, and two consoles in shop 3. The consoles in shops 1 and 2 are manually operated while those in shop 3 are semiautomatic for performing test and manually operated for repair and maintenance of defective units. Each shop uses the alphanumeric system

for locating stored test adapters and accessories used in performing test and maintenance on assemblies. Each console is capable of being used to test different assemblies or UUT's and master TB 9-4900-250-35/1 is used to route the UUT to the correct console. When the UUT arrives at the correct console the operator also uses

the master TB to determine which manual, stored at the console, should be used to perform maintenance on the UUT. When the UUT is repaired it is returned to supply channels or returned to the Nike Artillery battery from which it came.

MMS SUBCOURSE NUMBER 151, NIKE MISSILE AND TEST EQUIPMENT

EXERCISES FOR LESSON 5

- After performing a voltage check on a relay assembly, at what panel in shop 1 is switching accomplished to change to a relay check?
 - A
 - M
 - P
 - Z
- Which is the first step in determining the location of a malfunction in a faulty chassis?
 - Route to the proper console
 - Connect the UUT to the console
 - Visually inspect the UUT
 - Measure the UUT parameters
- At what location in the electrical test and maintenance table of position 1 is the receiver-gate generator stored?
 - A1
 - A2
 - B1
 - B2
- Which test set is located at position 3 of electronic shop 1?
 - Servo test set AN/MPM-48A
 - Computer test set AN/MPM-45
 - Electrical power test set AN/MPM-42
 - Radar test set AN/MPM-37A
- Which electronic shop position is used to test computer assemblies?
 - 1
 - 2
 - 4
 - 5
- In what portion of shop 3 are the programmed comparator limits compared with the measured parameters from the UUT's?
 - Digital readout circuits
 - Digital multimeter and counter
 - Time stretcher
 - Waveform analyzer-monitor
- Which gives information concerning calibration requirements for test equipment associated with the improved Nike Hercules system?
 - TB 9-4900-250-35/1
 - TM 9-1400-250-34/2/2
 - TB 750-236
 - TB 9-131-2
- Which consoles are located in electronic shop 3?
 - 6 and 7
 - 4 and 5
 - 2 and 3
 - 1, 2, and 3
- Which is NOT a functional group of the equipment mounted in shop 3?
 - GFE
 - DAME
 - SPTE
 - CPE
- Which is one of the primary considerations for retaining the use of patch cards in electronic shop 3?
 - Simple
 - Economical
 - Automatic
 - Fault free

11. In the absence of a pass indication on console 7, what action should be taken on part of the operator?
 - A. Perform troubleshooting procedures
 - B. Tag the UUT with the step failed
 - C. Place the CPE into semiautomatic operation
 - D. Perform the acceptance test
12. What is a function of the console programming equipment in electronic shop 3?
 - A. Select and position switches
 - B. Test the UUT
 - C. Establish comparator limits
 - D. Verify program card selection
13. A chassis with part number 9140754 arrives at a Nike direct support unit. To which electronic shop position should this chassis be sent to receive proper testing?
 - A. 1
 - B. 3
 - C. 4
 - D. 5
14. What chapter of TM 9-1400-250-34/3/2 should be used by the technician to make an acceptance test on part number 9140767?
 - A. 21
 - B. 9
 - C. 5
 - D. 4
15. What was the primary purpose of automating the operation of electronic shop 3?
 - A. Increase test accuracy
 - B. Decrease test time
 - C. Increase reliability
 - D. Decrease equipment cost
16. What is the maximum number of tube stages mounted on a minispec?
 - A. 2
 - B. 3
 - C. 4
 - D. 5
17. In which area are the connectors for interconnections between the UUT and console 6 located?
 - A. A1
 - B. A2
 - C. A3
 - D. A4
18. A UUT being tested at console 6 does NOT meet the comparator limits established by the program. If the operator successfully performs all the prescribed troubleshooting aids and finds all switches in the correct position, to what location is the malfunction isolated?
 - A. Console
 - B. UUT
 - C. Interconnecting cables
 - D. Crossbar switch
19. Which class of information is NOT contained on the program cards for electronic shop 3?
 - A. Switch position
 - B. Card select
 - C. End of card
 - D. UUT pass or fail
20. What is one maintenance problem associated with electronic shop 3?
 - A. Patch cards
 - B. Crossbar switch
 - C. Time interval test
 - D. Card reader adjustments
21. The electrical program signals are generated by the card reader in shop 3 when the
 - A. picker knife puts the card into the feed rollers.
 - B. card is clamped onto the drum.
 - C. star wheels drop into the punched holes.
 - D. microswitches drop into the punched holes.
22. Personnel holding which MOS should be dispatched to the HIPAR with the ECU?
 - A. 23N
 - B. 23U
 - C. 22L
 - D. 22G

23. Which establishes continuity with the verification circuits in the remote switching control at console 6?
- A. Program card
 - B. Patch cards
 - C. Card reader
 - D. Console programming equipment
24. In which alpha designated drawers of the electrical test and maintenance tables are the patch cards located?
- A. A1, A2 and B1, B2
 - B. A1, A2 and C1, C2
 - C. B1, B2 and C1, C2
 - D. C1, C2 and D1, D2
25. Which is tested at position 2 of electronic shop 1?
- A. Relays
 - B. Voltage regulators
 - C. CRT indicators
 - D. Communication assemblies
26. Which shop position is used to test a complete RF system?
- A. AN/MPM-43
 - B. AN/MPM-37A
 - C. AN/MPM-48A
 - D. AN/MPM-47
27. What was added to the field maintenance test equipment to change it to an improved field maintenance system?
- A. Emergency contact unit
 - B. Electronic shop 1
 - C. Electronic shop 2
 - D. Electronic shop 3
28. What information is contained in the last two columns of a punched card of electronic shop 3 if the test is incomplete?
- A. Card select
 - B. Switch position
 - C. Comparator limits
 - D. End of test
29. Which is used to determine the position at which a UUT is tested?
- A. DA Form 2407
 - B. TM 9-1400-250-34/2/2
 - C. TB 9-4900-250-35/1
 - D. Chassis control number
30. What instructions are given by the acceptance test portion of the chapter in TM 9-1400-250-34/2/2 pertaining to part number 9140712?
- A. Purpose of the test
 - B. Procedures for connecting the UUT
 - C. Waveshapes to be observed
 - D. Test layouts to be used