

**TECHNICAL MANUAL**

**OPERATOR'S MANUAL**

**RADAR TARGET SIMULATOR**

**GROUP OH-36/GPN**

**(NSN 5840-00-138-9974)**

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**HEADQUARTERS, DEPARTMENT OF THE ARMY**

**JUNE 1979**

**OPERATOR'S MANUAL  
RADAR TARGET SIMULATOR GROUP OH-36/GPN  
(NSN 5840-00-138-9974)**

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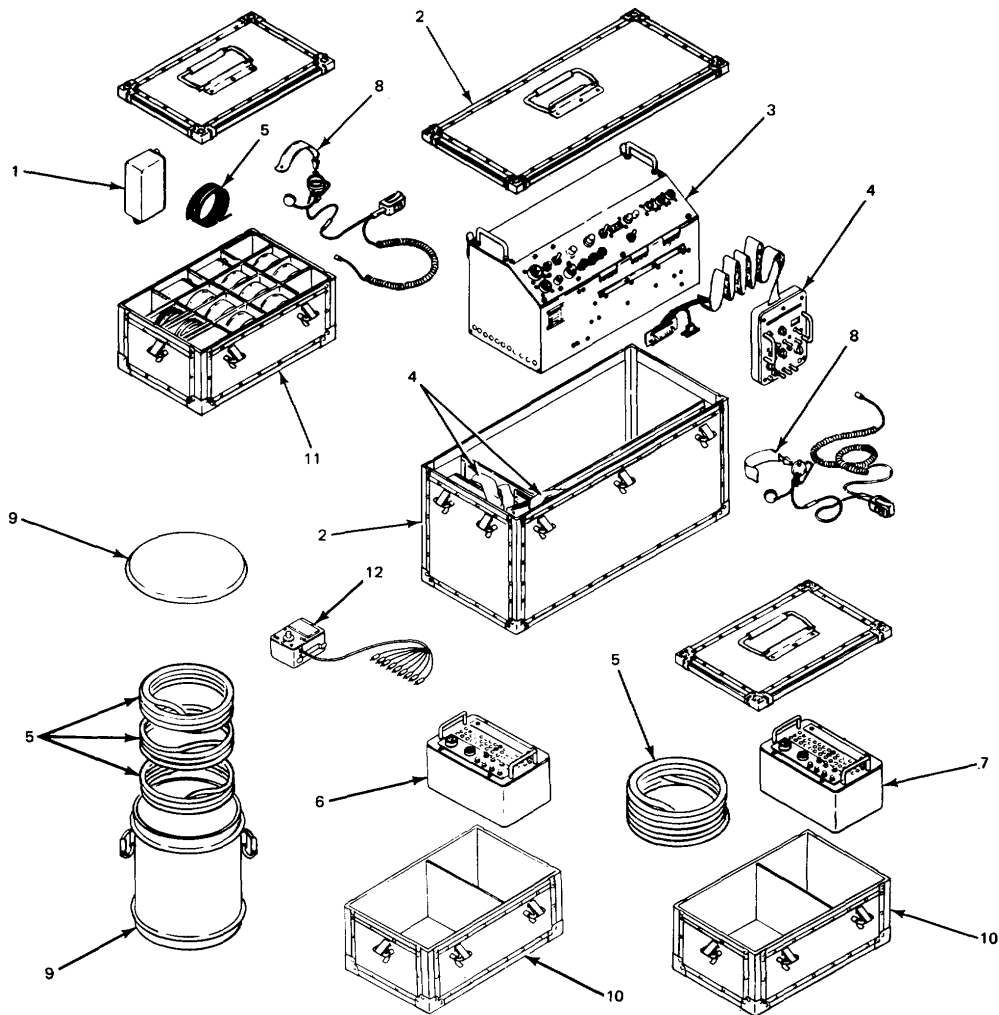
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Figure 1-1. Radar Target Simulator Group OH-36/GPN.

## CHAPTER 1

## INTRODUCTION

## Section I. GENERAL

**1-1. Scope**

This manual contains description and leading particulars required to operate Radar Target Simulator Group OH-36/GPN (target generator). The target generator is used in conjunction with an associated radar system to maintain proficiency of operators of ground control approach (GCA) radar equipment.

**1-2. Indexes of Publications**

a. DA Pam 310-4. Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

b. DA Pam 3107. Refer to DA Pam 310-7 to determine whether there are modification work orders (MWO's) pertaining to the equipment.

**1-3. Forms and Records**

a. Reports of Maintenance and Unsatisfactory Equipment. Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by TM 38-750. Navy personnel will report maintenance performed utilizing the Maintenance Data Collection Subsystem (MDCS) IAW OPNAVINST 4790.2, Vol 3 and unsatisfactory material/conditions (UR submissions) IAW OPNAVINST 4790.2, Vol 2, chapter 17.

b. Report of Packaging and Handling Deficiencies. Fill out and forward DD Form 6 (Packaging Improvement Report) as prescribed in AR 700-58/NAVSUPINST 4030.29/AFR 71-13/MCO P4030.29A, and DSAR 4145.8.

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33B/AFR 75-18/MCO P4610.19C and DLAR 4500.15.

**1-4. Reporting Equipment Improvement Recommendations (EIR)**

EIR's will be prepared using SF 368, Quality Deficiency Report. Instructions for preparing EIR's are provided in TM 38-750, the Army Maintenance Management System. EIR's should be mailed direct to Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, NJ 07703. A reply will be furnished direct to you.

**1-5. Destruction of Army Electronics Materiel**  
Demolition and destruction of Army electronics materiel equipment to prevent enemy use shall be in accordance with TM 750-244-2.

## Section II. DESCRIPTION AND DATA

1-6. Description a. Radar Target Simulator Group OH-36/GPN (target generator) (fig. 1-1) is used in conjunction with an associated radar system to maintain proficiency of operators of GCA radar equipment. The target generator simulates up to three moving targets on the associated radar indicator and the targets are maneuvered by means of target generator controls. The controls allow the GCA "pseudo pilot" to perform realistic aircraft target maneuvers in response to typical radar operator commands. In addition, the training exercise may be "frozen" at any time to permit evaluation of the radar operator's response. The following three configurations are available: (1) One junction box for use with Radar Set

AN/TPN-8/18.

(2) One junction box for use with Radar Set AN/FPN-40.

(3) Two junction boxes used in a dual mode setup for Radar Set AN/FPN-40 when one is used as a precision approach radar (PAR) and the other as an airport surveillance radar (ASR).

b. In addition to the units listed in table 2-1 the target generator consists of four transit cases and interconnecting cables that interface with the associated radar system by use of a junction box assembly. These hook-ups are necessary to accomplish the video presentation of the simulated targets in conjunction with normal radar video. The target generator is capable of operating in conjunction with the radar systems listed in table 1-1.

Table 1-1. Radar System Usage

Radar system designation	Radar system type
AN/FPN-40	ASR/PAR
ANITPN-8	ASR/PAR
AN/TPN-18	ASR/PAR

c. Table 1-2 lists the units of the target generator, giving the nomenclature and common name for each as well as the unit designation. Units listed shall hereinafter be referred to using associated common name. Table 1-3 lists the printed circuit board complement of the target generator, indicating the reference designations and nomenclature for each board. Table 1-4 lists the leading particulars of the target generator including

critical dimensions and electrical characteristics. Table 1-5 lists the cable complement supplied with the target generator and includes cable function and length. The cables supplied correspond with the junction box used for a particular radar.

**1-7. Equipment Supplied**

The equipment supplied with the target generator is listed in table 1-6

Table 1-2. Target Generator Unit Designations

Unit Designation	Nomenclature	Common Name
1A	Control module assembly	Control module
2A	Target module assembly	Target module (number 1)
3A	Target module assembly	Target module (number 2)
4A	Target module assembly	Target module (number 3)
8A		
9A		
10A		
11A		
12A	Junction box assembly	Junction box (AN/TPN-8 or ANITPN-18)
13A	Junction box assembly	Junction box (AN/FPN-40)
16A	Student communication unit	Communication unit (number 1)
17A	Student communication unit	Communication unit (number 2)
18A	Student communication unit	Communication unit (number 3)
19A	Alignment fixture assembly	Alignment fixture

Table 1-3. Target Generator Printed Circuit Board Assembly Complement

Reference Designation	Nomenclature	Remarks
1A1	BCD and rate multiplexes	
1A2	Memory and display latch	
1A3	A/D (analog-to-digital) converter	
1A4	Range and pulse generator	
1A5	Program controller	
1A6	Arithmetic logic unit (ALU)	
1A7	Extender card	
1A8	Mother board	
1A9	+ 15 Vdc, + 10 VDC, +5 Vdc power supply	
1A9A1	Power supply printed circuit board	
1PS1	+5 Vdc power supply	
2A 1	Display module	
2A2	Audio amplifier	
3A1	Display module	
3A2	Audio amplifier	
4A1	Display module	
4A2	Audio amplifier	
12A1	Signal conditioner A1	(Supplied only if unit 12 is supplied.)
12A2	Signal conditioner A2	(Supplied only if unit 12 is supplied.)
12A3	Converter	(Supplied only if unit 12 is supplied.)
13A1	Signal conditioner A 1	(Supplied only if unit 13 is supplied.)
13A2	Signal conditioner A2	(Supplied only if unit 13 is supplied.)
13A3	Converter	(Supplied only if unit 13 is supplied.)

Table 1-3. Target Generator Printed Circuit Board Assembly Compliment-Continued

Reference Designation	Nomenclature	Remarks
16A1	Audio amplifier	
17A1	Audio amplifier	
18A	Audio amplifier	

Table 1-4. Target Generator Leading Particulars  
Mechanical data

Dimensions	
Control module	15 H X 25 W X 13.25 inches D
Target modules (each)	12 H X 10 W X 4.62 inches D (including lifting handles and collapsible stand)
Communication units (each)	5 H X 2 W X 3.56 inches D (including controls)
Junction box (typical)	7 H X 10 W X 7-11/16 inches D
Weight	
Control module	70 lb
Target modules (each)	5 lb
Communication units (each)	1 lb
Junction box (typical)	5 lb
Electrical data	
Simulated target parameters	
Velocity	0 to 300 knots in 20-knot increments and 0 to 1500 knots in 100-knot increments.
Turn rate	0 to 6° per second, right or left in 1/20° per second increments.
Climb-drive rate	0 to 1500 ft per minute, up or down in 100 ft per minute increments and 0 to 3000 ft per minute, up or down in 200 ft per minute increments.
Wind speed	0 to 99 knots
Wind direction	0 to 3600
Initial position east	0 thru 255 nautical miles (nm)
Initial position west	0 thru 255 nm
Initial position north	0 thru 255 nm
Initial position south	0 thru 255 nm
Initial position altitude	0 thru 99,900 ft
Initial heading	0 to 3600
Target generator output	
Target bearing (to radar system)	0 to 360° +0.1°
Target elevation angle (to radar system)	0 to 900° 0.10
Target slant range (to radar system)	0 to 256 nm +0.05 nm
Target bearing (to target module)	0 to 360° + 0.5°
Target slant range (to target module)	0 to 256 nm +0.05 nm
Target heading (to target module)	0 to 360° +0.5°
Target altitude (to target module)	0 to 99,900 ft *50 ft
Primary power	
Power source required	117 Vac + 10%, 47 Hz to 420 Hz
Power consumption	Less than 275 watts

Table 1-5. Target Generator Cable Complement

Reference Designation	Function	Length
W1	Provides electrical connection between junction box (unit 12 or 13) connector J1 and control module connector 1J 1.	25 ft
W3	Provides electrical connection between primary power and target generator control module connector J3.	25 ft
W12	Provides electrical connection between junction box unit 12, connector 12J2 and interface connectors on Radar Set AN/TPN-8 or AN/TPN-18.	25 ft

Table 1-5. Target Generator Cable Complement-Continued

Reference Designation	Function	Length
W13	Provides electrical connection between junction box unit 13, connector 13J2 and interface connectors on Radar Set AN/FPN-40.	25 ft
W16, W17, W18	Provides electrical interconnection between control module connectors and communication units 16, 17 and 18.	35 ft
W43, W44	Provides video and trigger interconnection between junction box, unit 13 and Radar Set AN/FPN-40.	25 ft
W45, W46	Provides video and trigger interconnection between junction box unit 12, and Radar Set AN/TPN-8 or AN/TPN-18.	25 ft
W143, W144	Provides video interconnection and trigger between junction box unit 13, and Radar Set AN/FPN-40.	25 ft
W145, W146	Provides video interconnection and trigger between junction box unit 12, and Radar Set AN/TPN-8 or AN/TPN-18.	25 ft

Table 1-6. Equipment Supplied

Quantity	Nomenclature	Reference number
1	Control module	TM 11-5840-359-10
3	Target module	
1 or more (Note)	ASR/PAR junction box	
3	Communications unit	
6	Headset	
1	Primary power cable	
1	Short range cable	
3	Communications cable	
4	Transit case	
1	Alignment fixture	
2	Operator's manual	

**NOTE**

Quantity of junction boxes and cables supplied depend on specific installation requirements.

**1-8. Physical Description**

a. Target (Generator. The target generator is a self-contained portable training device which consists of the following assemblies.

(1) One control module assembly which serves as the central processing unit for the target generator.

(2) Three target module assemblies which initiate target generator operation, provide a communications terminal for the instructor (pseudo pilot), and serve as the main operating station for pseudo pilot control of the simulated target aircraft.

(3) Three student communication stations. each providing closed loop communications capability between the radar operator (trainee) and the instructor.

(4) One or more self-contained junction box assemblies which provide the necessary interface between the associated radar system(s) and the target generator.

(5) Six headsets for two-way communications; three for use by the pseudo-pilot at the three target module assemblies.

(6) Various interconnecting cable assemblies.

(7) Four or more lightweight splashproof transit cases; one used to store and transport the control module assembly and three target module assemblies, one or more used to store and transport the junction box assembly (or assemblies), and associated cables, one used to transport the student communication assemblies associated cables, and one for short range cable W1.

b. Control Module Unit I (fig. 1-2). This assembly houses the data processing circuitry, power supplies and some of the target generator controls. Physically, the control module assembly consists of the following subassemblies.

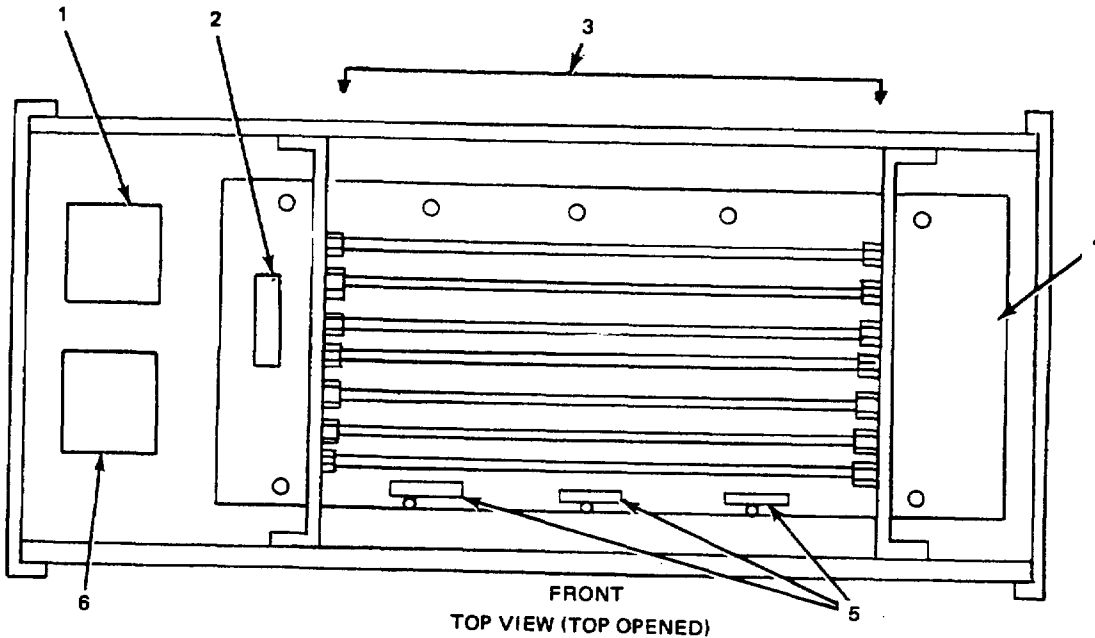
(1) The case subassembly is constructed to form an enclosure for the internal components. These components include a main circuit card assembly (mother board). seven mating printed circuit card assemblies and two power supply assemblies. Each printed circuit card is fitted with an extractor for removal. Additional mother board connectors receive the plugs from the control module top panel cable assembly and the three target module cables. This allows removal of the mother board. The top edge of the front of the control module assembly case is notched to permit passage



of the three target module assembly ribbon cables when the top panel is closed. Air circulation for cooling is provided through openings in the front and rear of the case.

(2) The top panel subassembly contains some of the controls and indicators for operation of the target generator. The controls and indicators are listed in table 1-7 and shown in figure 1-3. The panel presents the operator (instructor) with an eye level view of the controls and indicators installed on the front

section. The top is swung open by unfastening the screwdriver latches and lifting the top of the rear on its hinge. When the top is opened all components on the rear are accessible. Target module assembly cable insertion is done using handles on the sides which permit opening of the panel. All panel mounted components, connectors J1 and J2 are wired into a single cable assembly which terminates internally in a single printed circuit card connector. This connector plugs into the mother board.



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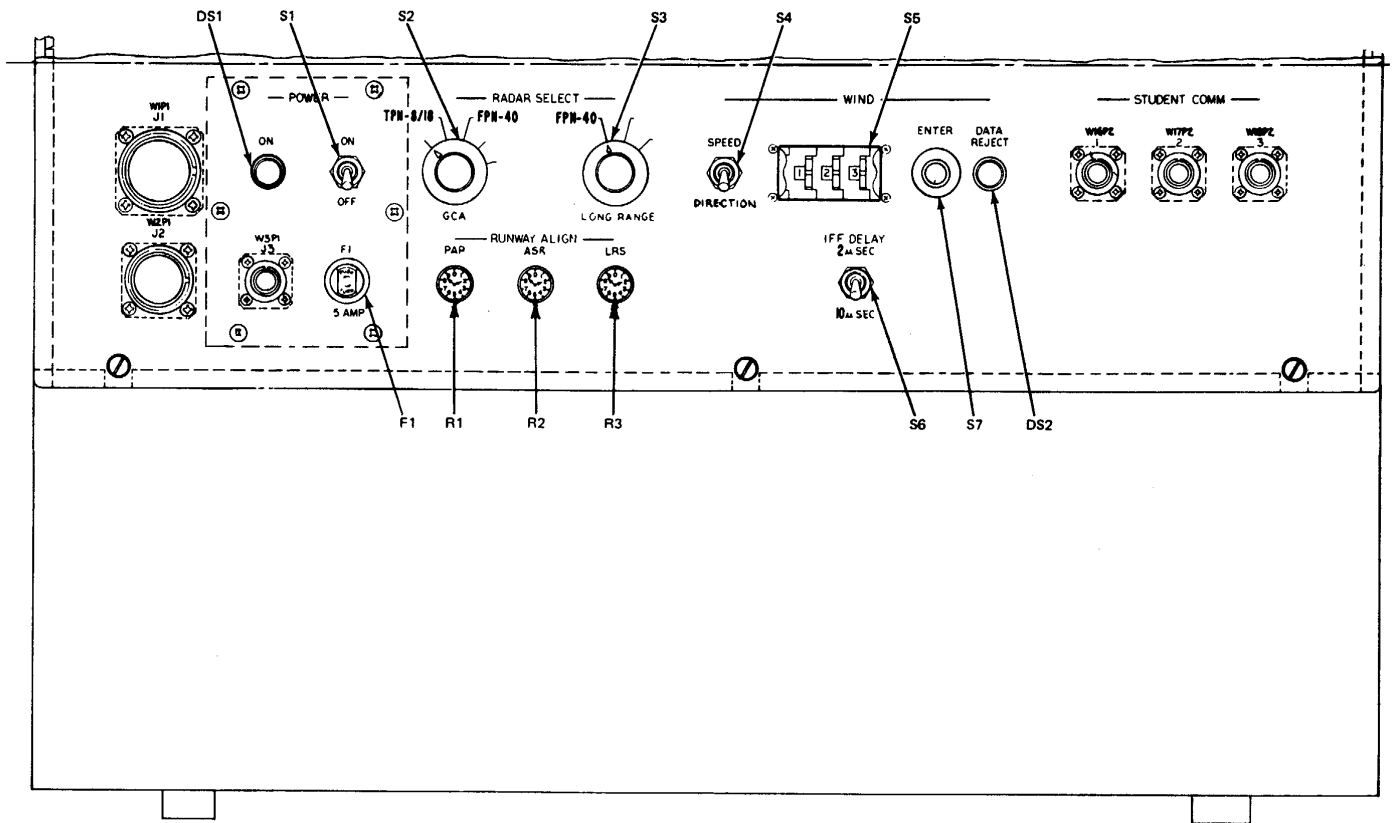
- 1. POWER SUPPLY ASSEMBLY
- 2. PRINTED CIRCUIT CARD CONNECTOR (MATES WITH CABLE FROM PANEL CONNECTORS AND COMPONENTS)
- 3. PRINTED CIRCUIT CARD ASSEMBLIES
- 4. MOTHERBOARD
- 5. TARGET MODULE CABLE CONNECTORS
- 6. +5 VDC POWER SUPPLY ASSEMBLY

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Figure 1-2. Control unit Module unit 1.

Table 1-7. Control Module Assembly, Unit 1, Controls and Indicators

Control or indicator	Function
POWER ON indicator DS1	Illuminates when POWER ON-OFF switch is set to ON and primary power is applied.
POWER ON-OFF switch S1	When set to ON position applies primary power to target simulator. In OFF position, removes primary power.
RADAR SELECT GCA switch S2	When set to associated host radar position (AN/TPN-8/18 or AN/FPN-40) causes target generator to utilize applicable azimuth and elevation antenna data and search antenna position synchro frequency.
RADAR SELECT LONG RANGE switch S3	When set to associated host radar position causes target generator to utilize applicable azimuth and elevation antenna data and antenna position synchro frequency.
WIND SPEED-DIRECTION switch S4	When set to SPEED, WIND thumbwheel parameter is entered as wind velocity when ENTER pushbutton is depressed. When set to DIRECTION WIND thumbwheel parameter is entered as wind direction when ENTER pushbutton is depressed.
WIND THUMBWHEEL switch S5	Operated to desired wind speed or direction value as selected by WIND SPEED-DIRECTION switch.
WIND ENTER pushbutton switch S7	When depressed, enters the wind speed or direction data selected by WIND SPEED-DIRECTION switch.
WIND DATA REJECT indicator DS2	Lights when WIND ENTER pushbutton is pressed to indicate wind data selected with WIND thumbwheels exceeded the following:
Wind Speed: 099 knots Wind Direction: 359 degrees IFF DELAY switch S6	When set to 2 usec causes IFF response displayed on host search radar to be displaced by a distance equivalent to 2 usec (approximately 1/8 nautical mile) from the simulated target. When set to 10 usec causes IFF response displayed on host search radar to be displaced by a distance equivalent to 10 usec (approximately 0.8 nautical mile) from the simulated target. IFF response is activated for each target by the IFF RESPONSE
ON-OFF switch on each target module (table 1-8).	Adjusted to align target generator PAR antenna angle data with runway.
RUNWAY ALIGN PAR potentiometer R1	Adjusted to align target generator ASR azimuth antenna synchro angle bearing with north.
RUNWAY ALIGN ASR potentiometer R2	Adjust to align target generator LRS radar antenna synchro angle bearing with north, when FPN-40 dual mode is used.
RUNWAY ALIGN LRS potentiometer R3	Illuminates to indicate that fuse F1 is defective.
Blown fuse indicator F1	



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Figure 1-3. Control module assembly, controls and indicators.

c. Target Module, Units 2, 3 and 4 (fig. 1-4).

(1) This unit contains most of the controls for target generator operation which define the initial position of the target and its flight pattern. The controls and indicators are listed in table 1-8 and shown in figure 1-4. The target module contains a digital display of simulated target parameters and provides an intercommunications terminal for the pseudo pilot (instructor). The digital readout display section consists of a 13-digit display. The 13-digits are grouped into four individual readouts; RANGE NM, 4 digits, BEARING DEG, HEADING DEG

and ALTITUDE FT X100, 3 digits each.

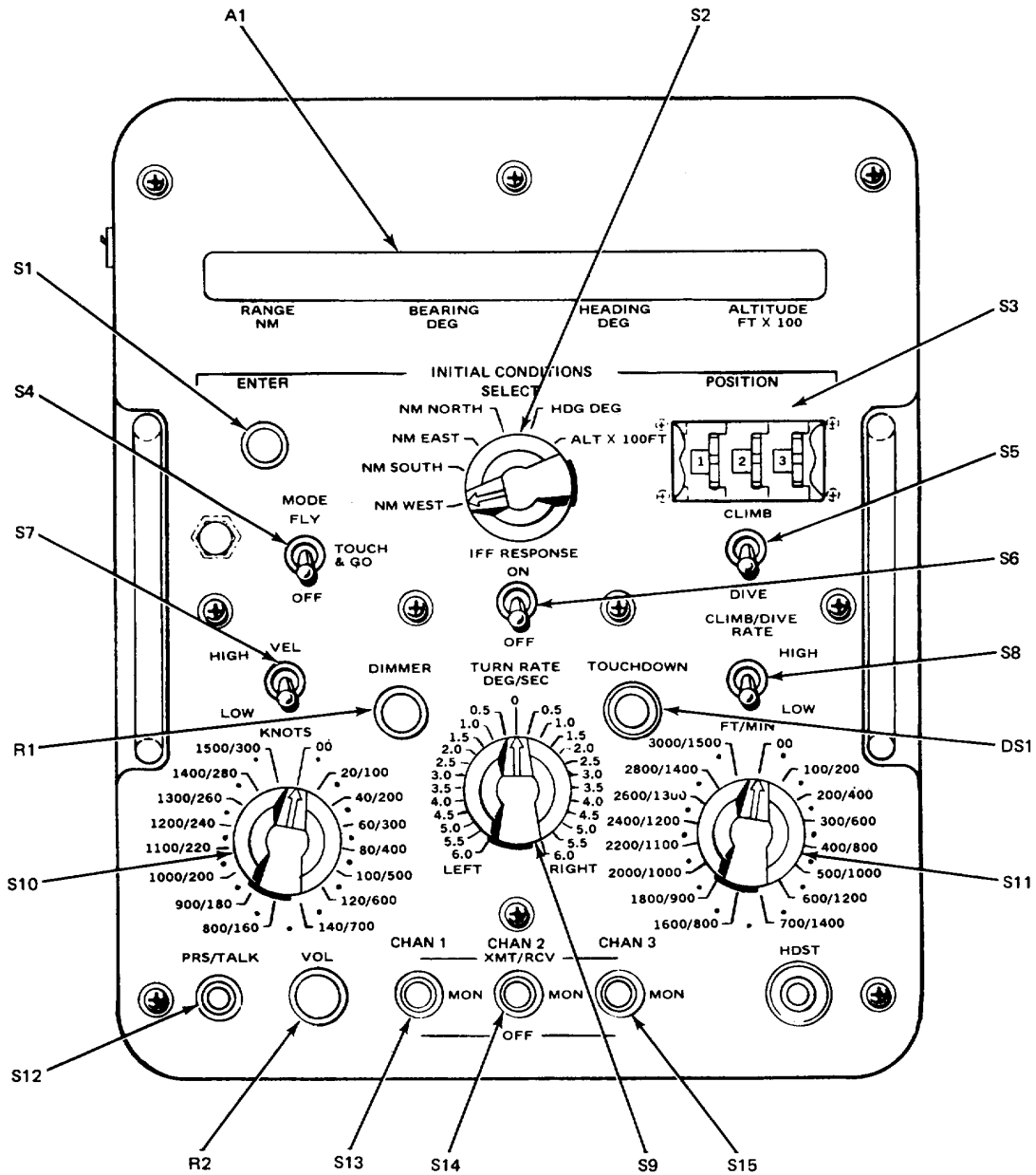
(2) The target module assembly consists of a cover and stand assembly and an edge-lit panel assembly. The top edge of the rear of the case has a notched opening to allow passage of the target module assembly cable with the edge-lit panel installed. The collapsible stand assembly consists of slotted angle base brackets which support a collapsible steel frame. When extended, the stand raises the rear of the target module assembly for a comfortable eye-level view of the controls and displays.

Table 1-8. Target Module, Controls and Indicators

Controls and indicators	Function
RANGE, BEARING, HEADING, ALTITUDE digital readout display A1	Provides digital display of the following simulated target parameters: RANGE NM - 000.0 thru 256.0 nautical miles BEARING DEG - 000 thru 360 degrees HEADING DEG - 000 thru 360 degrees ALTITUDE FT x 100 - 000 thru 999
INITIAL CONDITIONS SELECT switch S2	When set to NM WEST, NM SOUTH, NM EAST or NM NORTH, POSITION thumbwheel parameter is entered as range (distance) data, when ENTER pushbutton is depressed. When set to HDG DEG, POSITION thumbwheel parameter is entered as heading data, when ENTER pushbutton is depressed. When set to ALT x 100 FT, POSITION thumbwheel parameter is entered as altitude, when ENTER pushbutton is depressed.
INITIAL CONDITIONS POSITION thumbwheel S3	Operated to desired distance (nautical miles: north, east, south or West), heading or altitude value as selected by INITIAL CONDITIONS SELECT switch.
INITIAL CONDITIONS ENTER pushbutton switch S1	When depressed allows entry of distance, heading or altitude data selected by INITIAL CONDITIONS SELECT switch and POSITION thumbwheel.
CLIMB-DIVE switch S5	When set to CLIMB causes the feet per minute rate selected by CLIMB-DIVE RATE FT/MIN selector switch to be entered as rate of climb data. When set to DIVE causes the feet per minute rate selected by CLIMB-DIVE RATE FT/MIN selector switch to be entered as dive (rate of descent) data.
CLIMB/DIVE RATE HIGH-LOW switch S8	Selects either high or low range of climb or dive data as selected by CLIMB/DIVE RATE FT/MIN selector switch to be entered.
CLIMB/DIVE RATE FT/MIN selector switch S1 CLIMB/DIVE RATE HIGH-LOW switch, of simulated	Operated to desired climb or dive rate, as selected by target. Low climb or dive rates are between 0 and 1,500 ft per minute in 100 ft increments. High climb or dive rates are between 0 and 3,000 ft per minute in 200 ft increments.
TOUCHDOWN indicator DS1 CHAN 1, CHAN 2 and CHAN 3 switches S13, S14, and S15	Illuminates to indicate simulated target altitude is zero. When set to XMT/RCV allows two-way voice communication between manned target module and communication unit.
TURN RATE DEG/SEC selector switch S9	When set to MON allows person stationed at target module to monitor voice communications between target modules and communication units. Operated to desired simulated target turn rate. Both left and right turns are selectable at a 0° to 60 per second rate, in 0.5° per second increments.
IFF RESPONSE switch S6 simulated target on radar indicator crt. DIMMER potentiometer R1	When set to ON causes IFF video to be painted behind Controls intensity of target module panel illumination.

Table 1-8. Target Module. Controls and Indicators-Continued

Controls and indicators	Function
VOL control potentiometer R2	Controls audio input level to headset connected to HDST connector,
PRS/TALK pushbutton switch S12	When depressed, allows audio from headset microphone to be transmitted to selected Communication Unit.
VEL KNOTS selector switch S10	Operated to desired simulated target velocity. High and low velocities are selectable between the rates 00 to 300 knots in 20-knot increments (low) and 00 to 1500 knots in 100-knot increments (high).
VEL HIGH-LOW switch S7	Selects the high or low range of velocity selected by VEL KNOTS selector switch.
MODE FLY-TOUCH & GO-OFF select switch S4	When set to FLY allows the target generator to produce a simulated target which maneuvers in response to set-in parameters. In this mode when simulated target altitude reaches zero, target maneuvers stop. When set to TOUCH & GO allows target generator to simulate a target as in FLY mode; however, after touchdown is experienced the simulated target continues flight. When set to OFF position causes simulated target to stop maneuvers and is displayed as a stationary target.



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Figure 1-4. Target Module units 2, 3, and 4, controls and indicators.

d. Student Communication Station, Units 16, 17 and 18 (fig. 1-5).

(1) Three radar operator communication stations are mounted conveniently on the indicator console to which the target generator is connected. Each provides a realistic closed loop com

munications links between the radar operator (student) and the instructor (pseudo pilot) operating the target generator. A single printed circuit card, containing an audio amplifier network and a microphone preamplifier for each radar headset, is mounted on brackets on the back of the front panel.

A foot switch may be connected for foot controlled press-to-talk transmission.

(2) HDST-FT SW switch permits selection of hand controlled or foot controlled press-to-talk transmission. Two jacks (INSTR HDST and STU DT HDST) are provided to accommodate the

instructor's and student's headsets. Volume at the headset is controlled by the VOL control. The unit consists of a housing assembly and a front panel and can be mounted on the radar indicator console. The controls and indicators are listed in table 1-9 and shown in figure 1-5.

Table 1-9. Student Communication Station, Controls and Indicators

Controls and indicators	Function
VOL control R1	Controls audio input level to headset connected to INSTR and STU DT HDST connector.
HDST-FT SW switch S1	In HDST position allows student to listen. In FT SW position allows student to talk by connecting a foot activated switch.
Connector J1	Connects station to control module.
Receptacle J2	Allows students headsets to be connected to intercom system.
Receptacle J3	Allows instructors headset to be connected to intercom system.
Foot switch connector J4	Provides connection to foot operated press-to-talk switch.

e. Junction Box Assembly, Units 12 and 13 (fig.1-6). The junction boxes provides interface between the radar and the target generator. Fifty-one front panel test points (A1-A17), (B1-B17) and (C1-C17) are provided to monitor signals on lines connecting the target generator to the radar. A cover plate may be opened by loosening two fasteners to gain access to signal conditioner adjustment controls and internal test points. The junction boxes perform the following signal conditioning functions:

(1) Convert the radar pretrigger pulse from the voltage level used in the radar to the logic levels used in the target generator.

(2) Delay the radar pretrigger the amount of time between radar pretrigger and radar main bang with an adjustable delay.

(3) Provide synchro signal conditioning prior to

conversion to digital signal for use in the control module.

(4) Accept the target generator video triggers from the control module and forms a video pulse of the proper pulse width.

(5) Change the video pulse width from wide to narrow according to the pulse width selected signal from the radar.

(6) Amplify the video pulses and apply them to the indicator video input.

**NOTE**

Some of the precision radar junction boxes also provide signal conditioning circuits to accept discrete control signals that choose the video, ASR or PAR to be applied to the video lines.

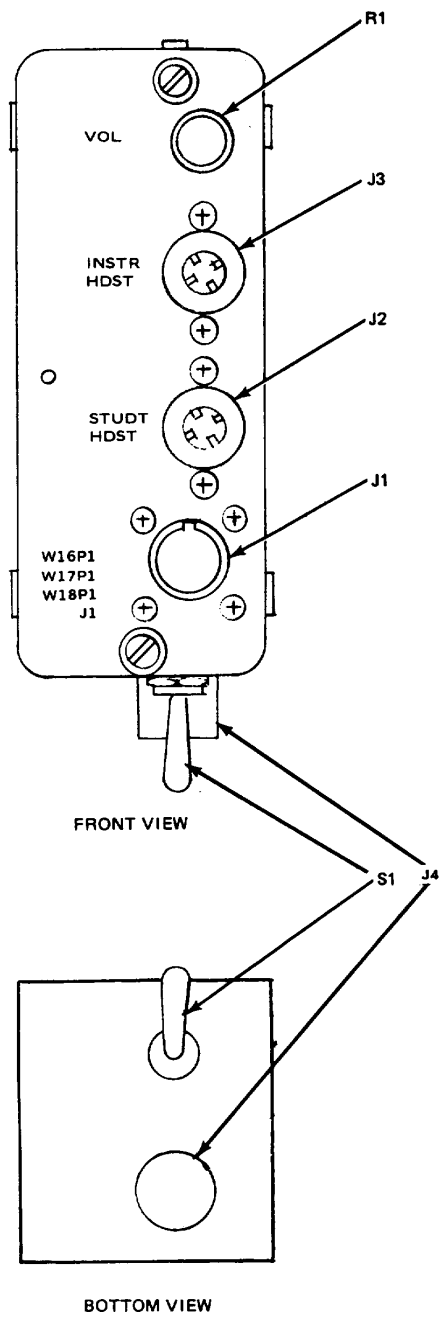


Figure 1-5. Student communication station, units 16, 17 and 18 controls and indicators.



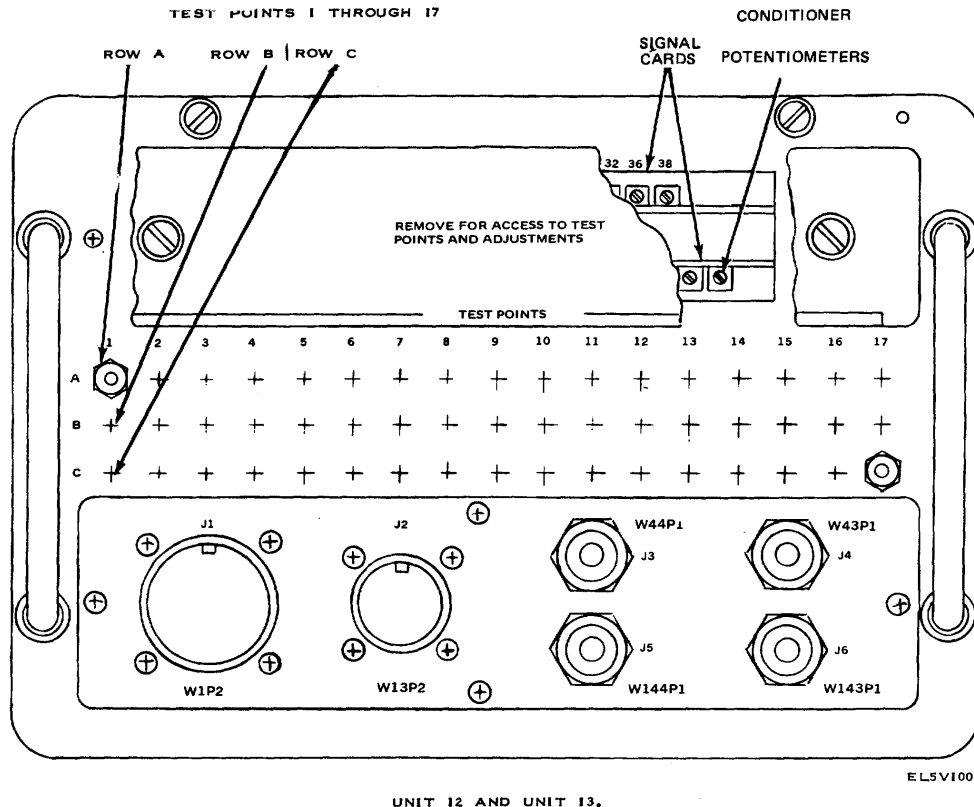


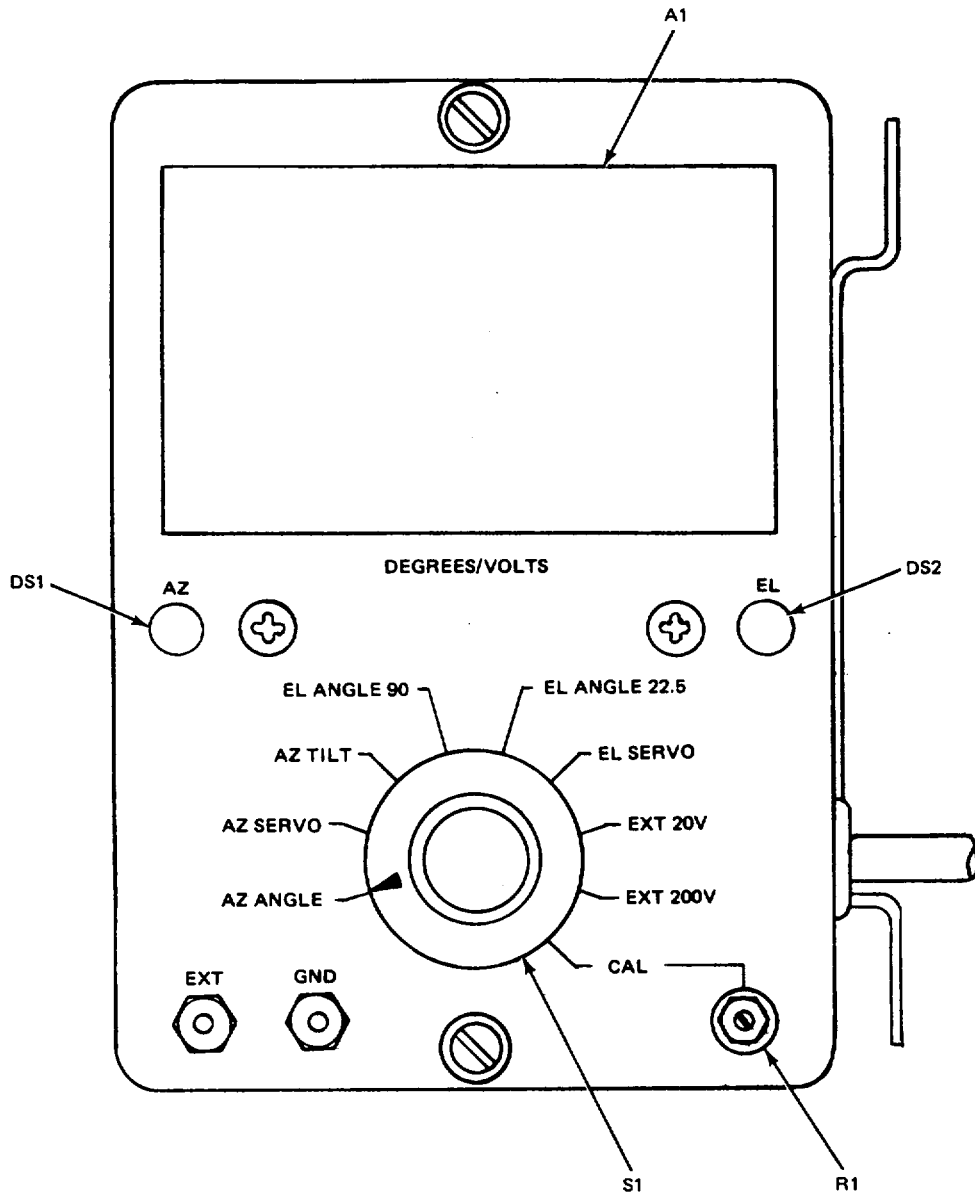
Figure 1-6. Junction box assembly, units 12 and 13.

f Alignment Fixture, Unit 19 (fig. 1-7). The alignment fixture is used for the alignment of the junction box with the radar. Ten jacks at the end of a two-foot alignment fixture harness plug into

marked jack receptacles on the front of the junction box. The controls and indicators are listed in table 1-10 and shown in figure 1-7.

Table 1-10. Alignment Fixture, Controls and Indicators

Control or indicator	Function
Function switch Si	Selects calibration and alignment mode of operation by placing meter into the selected circuit.
CAL potentiometer Ri	Adjusts voltage applied to the meter for calibration.
AZ indicator DSI	When illuminated indicates that PAR azimuth antenna position may be calibrated.
EL indicator DS2	When illuminated indicates that PAR elevation antenna position may be calibrated.
Meter display AI	Indicates degrees when function switch is in AZ ANGLE, AZ SERVO, AZ TILT, EL ANGLE 90, EL ANGLE 22.5 or EL SERVO position. Indicates volts when function switch is set to EXT 20V or EXT 200V. With the function switch in CAL position, CAL potentiometer R1 is adjusted for meter reading of 1000.



EL5V1007

Figure 1-7. Alignment fixture, controls and indicators.

## CHAPTER 2

OPERATING INSTRUCTIONS

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**Section I. PREPARATION FOR OPERATION****2-1. General**

This section contains procedures for preparing the target generator for operation. It includes instructions for a preliminary inspection, warmup, and operational checks.

**NOTE**

The following procedure requires the use of two persons, one at the control and target modules and the other at the radar indicator console.

**2-2. Preliminary Inspection**

Perform procedure in a through e below before energizing the equipment.

a. Ensure primary power is applied to control module connector J3 through cable W3.

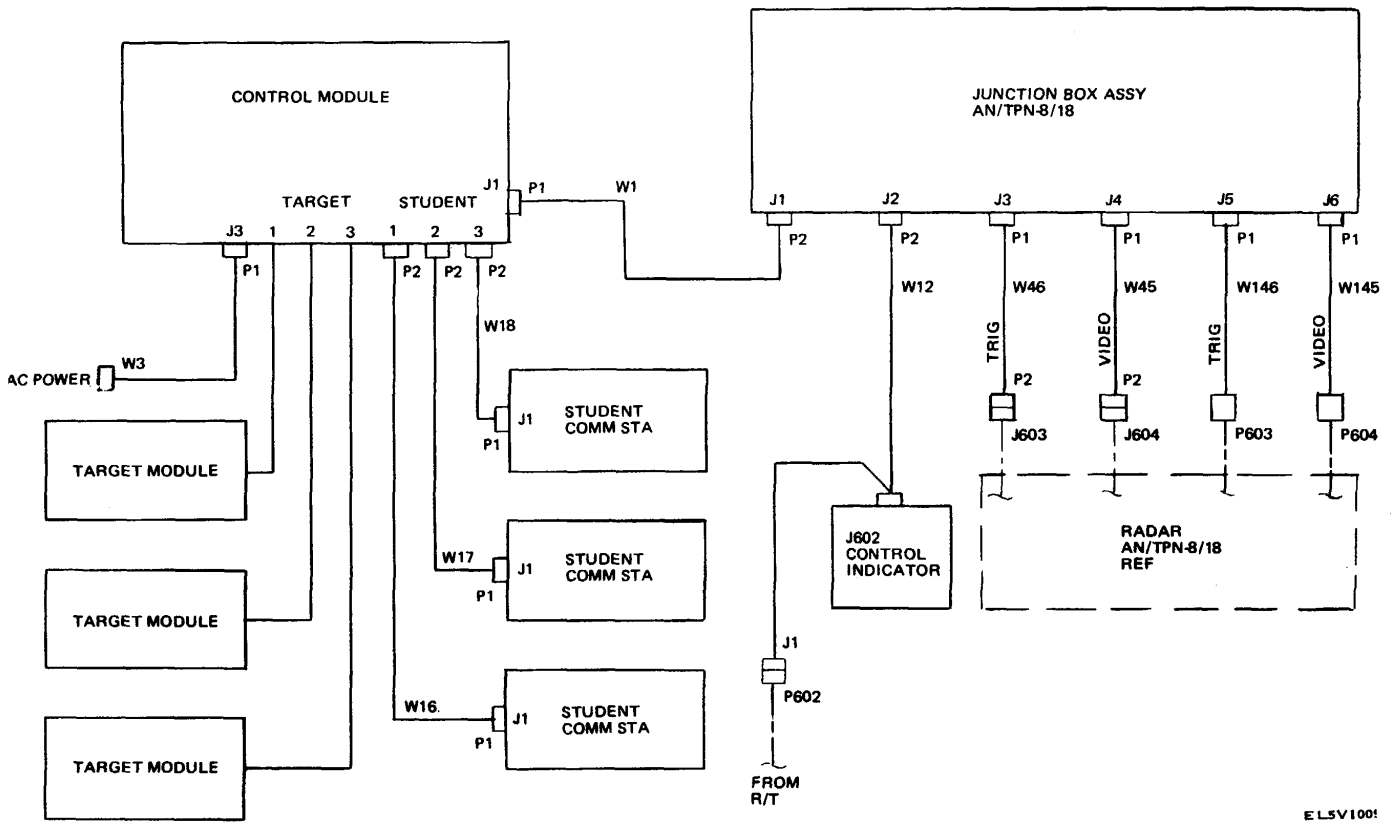
b. Plug in six headsets; three into the HDST positions on the three target module; three into the STUdT HDST position at the three student (radar operator) communication stations.

c. If required, plug in a foot switch cable at connector J4 of each student communication station.

d. Check interconnection of components. Refer to figure 2-1 or 2-2.

e. Set the control module and target module switches and controls listed in table 2-1 to the positions indicated.

*Figure 2-1. Interconnection diagram with Radar Set AN/F'PN-40.  
(Located in back of manual)*



E L5V1001

Figure 2-2. Interconnection diagram with Radar Sets AN/TPN-8orA N/TPN-18

Table 2-1. Preliminary Switch and Control Settings

Switches or controls	Location	Position or setting
POWER switch	Control module (fig. 1-3)	OFF
MODE switch	Target module (fig. 1-4)	OFF
RADAR SELECT	Control module	Select host radar (AN/I'PN-8/18 or AN/FPN-40)
CHAN 1, CHAN 2 and CHAN 3 switches	Target module	All channels - OFF
VOL control	Target module	Max cw
VOL control	Student communication station fig. 1-5)	Max cw
HDST/FTSW switch	Student communication station	HDST
DIMMER control	Target module	Max cw
KNOTS switch	Target module	00
TURN RATE DEG/SEC switch	Target module	0
IFF RESPONSE switch	Target module	OFF
CLIMB/DIVE RATE FT/M IN switch	Target module	00

**2-3. Warmup**

a. Energize Equipment. Set control module POWER ON-OFF switch to ON. Check to see that POWER ON indicator illuminates. Return POWER switch to OFF.

**NOTE**

The following performance checks must be accomplished with the target generator interconnected to its associated host radar(s).

b. Power Turn-On Check.

(1) Ensure each target module (fig. 1-4) MODE switch is set to OFF.

(2) Set control module (fig. 1-3) POWER switch to ON. Check to see that POWER ON indicator illuminates.

(3) Rotate each target module DIMMER control counterclockwise and note that front panel lettering is at minimum intensity.

(4) Rotate each target module DIMMER control clockwise and note that front panel lettering brightness is at maximum intensity. Set each DIMMER control to desired intensity level.

**2-4. Operation Check**

**NOTE**

The following procedure requires the use of two persons, one stationed at the control and target modules (pseudo pilot) and the other stationed at the radar indicator console operating station (radar operator (student)).

a. Communications Check.

(1) On target module 1, set CHAN 1 switch to XMT/RCV and CHAN 2 and CHAN 3 switches to OFF.

(2) On target module 1, depress PRS/TALK pushbutton and establish voice communications with radar operator No. 1 communications unit. During communications, rotate target module VOL control and note audio level change. Have radar operator rotate VOL control on student com-

munications station. The student should note audio level change.

(3) Set CHAN 1 switch to OFF and CHAN 2 switch to XMT/RCV. Repeat step (2), establishing voice communications with radar operator No. 2 student communications unit.

(4) Set CHAN 2 switch to OFF and CHAN 3 switch to XMT/RCV. Repeat step (2), establishing voice communications with radar operator No. 3 student communications unit.

(5) Set CHAN 1, CHAN 2, and CHAN 3 switches to MON. Check that an adequate level of audio communications from each of the radar operator's student communication units can be monitored.

(6) Repeat (1) through (5) above using target modules 2 and 3.

b. Initial and Digital Readout Display Test.

(1) On each target module, operate POSITION thumbwheels to 001.

(2) On each target module rotate SELECT switch clockwise to each of its positions, starting with NM EAST and depress ENTER pushbutton for each position of the SELECT switch. Check to see that each target module digital readout display indicates the following:

- (a) RANGE NM: 001.4
- (b) BEARING DEG: 045
- (c) HEADING DEG: 001
- (d) ALTITUDE FT X 100:001

(3) On each target module, set SELECT switch to NM SOUTH, and depress ENTER pushbutton. Check to see that each target module digital readout display indicates the following:

- (a) RANGE NM: 001.4
- (b) BEARING DEG: 135
- (c) HEADING DEG: 001
- (d) ALTITUDE FT X 100:001

(4) On each target module, set SELECT switch to NM WEST and depress ENTER pushbutton. Check to see that each target module digital readout display indicates the following:

- (a) RANGE NM: 001.4
- (b) BEARING DEG: 225
- (c) HEADING DEG: 001
- (d) ALTITUDE FT X 100: 001

- (c) HEADING DEG: 001
- (d) ALTITUDE FT X 100:001

(5) On each target module, set SELECT switch to NM NORTH and depress ENTER pushbutton. Check to see that each target module digital readout display indicates the following:

- (a) RANGE NM: 001.4
- (b) BEARING DEG: 315

(6) On each target module, set SELECT switch to ALT X 100 FT and POSITION thumbwheels to each of the settings listed in table 2-2. For each altitude setting depress ENTER pushbutton and check to see that each target module ALTITUDE FT X 100 digital readout display agrees with the listing in table 2-2.

Table 2-2. Target Altitude Positioning Test

POSITION thumbwheel setting	Target module ALTITUDE FT X 100 display	POSITION thumbwheel setting	Target module ALTITUDE FT X 100 display
987	987	321	321
876	876	210	210
765	765	109	109
654	654	098	098
543	543		
432	432		

(7) Set target module 1 SELECT switch to NM NORTH and POSITION thumbwheel to 220. Depress ENTER pushbutton.

(8) Set target module 1 SELECT switch to NM EAST and POSITION thumbwheel to 001. Depress ENTER pushbutton. Check to see that digital readout display RANGE NM indicates between 219.3 and 220.8 and BEARING DEG indicates 000.

(9) On target module 1 repeat the procedure given in (7) and (8) above twice for two other randomly selected thumbwheel settings in each of the

four test groups in table 2-3 and observe that digital readout displays of RANGE NM and BEARING DEG agree with the listing in table 2-3.

(10) Repeat (7), (8) and (9) above for target modules 2 and 3.

(11) Set control module (fig. 1-3) WIND SPEED-DIRECTION switch to SPEED and WIND thumbwheels to 000. Depress WIND ENTER pushbutton and note that WIND DATA REJECT indicator does not illuminate.

Table 2-3. Target Bearing Positioning Test

Target module POSITION		Digital readout display		
thumbwheel setting		RANGE NM		BEARING DEG
NM NORTH	NM EAST	Min	Max	
128	220	253.6	255.4	060
128	128	180.0	181.6	045
016	128	128.5	129.5	083
064	016	065.8	066.2	014
008	064	064.3	064.7	083
032	016	035.7	035.9	027
001	032	031.9	032.1	088
016	002	016.1	016.2	007
004	016	016.4	016.5	076

Target module POSITION		Digital readout display		
thumbwheel setting		RANGE NM		BEARING DEG
NM NORTH	NM EAST	Min	Max	
016	220	219.8	221.3	094
016	128	128.5	129.5	097
016	064	065.8	066.2	104
016	032	035.7	035.9	117
016	016	022.6	022.7	135
032	016	035.7	035.9	153
064	016	065.8	066.2	166
128	016	128.5	129.5	173
220	016	219.8	221.3	176

Target module POSITION		Digital readout display		
thumbwheel setting		RANGE NM		BEARING DEG
NM NORTH	NM EAST	Min	Max	
008	220	219.4	220.9	272
008	128	127.8	128.7	274
008	064	064.3	064.7	277
008	032	032.9	033.1	284
008	016	017.8	017.9	297
008	008	011.3	011.4	315
016	008	017.8	017.9	333
032	008	032.9	033.1	346
064	008	064.3	064.7	353
128	008	127.8	128.7	356
220	008	219.4	220.9	358

Target module POSITION		Digital readout display		
thumbwheel setting		RANGE NM		BEARING DEG
NM NORTH	NM EAST	Min	Max	
220	016	219.8	221.3	184
128	016	128.5	129.5	187
064	016	065.8	066.2	194
032	016	035.7	035.9	207
016	016	022.6	022.7	225
016	032	035.7	035.9	243
016	064	065.8	066.2	256
016	128	128.5	129.5	263
016	220	219.8	221.3	266

c. Heading and Turn Rate Test.

NOTE

Operate only target module 1 switches while performing (1) through (10) below.

(1) On target module set SELECT switch to NM EAST and POSITION thumbwheels to 000. Depress ENTER pushbutton.

(2) Set SELECT switch to NM NORTH and POSITION thumbwheels to 004. Depress ENTER pushbutton.

(3) Set SELECT switch to HDG DEG and POSITION thumbwheels to 090. Depress ENTER pushbutton.

(4) Set SELECT switch to ALT X 100 FT and POSITION thumbwheels to 001. Depress ENTER pushbutton. Observe that digital readout display indicates as follows:

- (a) RANGE NM: 004.0
- (b) BEARING DEG: 000
- (c) HEADING DEG: 090
- (d) ALTITUDE FTX 100:001
- (5) Set target module switches as follows:
  - (a) VEL HIGH-LOW to HIGH
  - (b) CLIMB-DIVE to CLIMB
  - (c) CLIMB/DIVE RATE HIGHLOW to

LOW

- (d) CLIMB/DIVE RATE FT/MIN to 00
- (e) VEL KNOTS to 1500/300
- (f) TURN RATE DEG/SEC to RIGHT 6.0

(6) Simultaneously set target module 1 MODE FLY-TOUCH & GO-OFF switch to FLY and start stopwatch. Observe that digital readout BEARING DEG display increases from 000 through 360degrees to 000 and HEADING DEG display increases from 090 through 360 and back to 090 degrees in 60 ± 2 seconds. When this condition occurs set MODE switch to OFF.

(7) Repeat (1) and (2) above to reinitialize target position.

(8) Set target module SELECT switch to HDG DEG and POSITION thumbwheels to 270. Depress ENTER pushbutton. Observe that digital readout display indicates as follows:

- (a) RANGE NM: 004.0
- (b) BEARING DEG: 000
- (c) HEADING DEG: 270
- (d) ALTITUDE FT X 100:001

(9) Set target module TURN RATE DEG/SEC switch to LEFT 6.0.

(10) Simultaneously set target module MODE FLY-TOUCH & GO-OFF switch to FLY and start stopwatch. Observe that digital readout BEARING DEG display decreases from 000 through 360 degrees to 000 and HEADING DEG display decreases from 270 through 000 and back to 270 degrees in 60 ± 2 seconds.

(11) Set MODE switch to OFF.

(12) Repeat (1) through (11) above for target modules 2 and 3.

d. PAR Target Simulation Test.

(1) On each target module perform the following:

(a) Set MODE FLY-TOUCH & GO-OFF switch to OFF.

(b) Using the three target modules fly three targets on course at a range of 8 miles as given in 1 through 6 below.

1. Set POSITION thumbwheels to 000 and SELECT switches to NM WEST. Depress ENTER pushbutton.

2. Set SELECT thumbwheels sequentially to NM SOUTH, NM EAST and NM NORTH and at each setting depress ENTER pushbutton.

3. Set SELECT switches to HDG DEG and set POSITION thumbwheels to the runway reciprocal heading (runway heading + 180°). Depress ENTER push-buttons.

4. Set MODE FLY-TOUCH / GO-OFF switches to FLY until targets are at 8 miles (RANGE NM 008.0 on target module digital

displays) and then return MODE switches to OFF.

5. Set SELECT switches to ALT X 100 FT and enter a target altitude which will place the targets on the slide path.

6. Verify that radar scope presentation displays the simulated targets on course and on slide path.

e. ASR Target Simulation Test.

(1) On control module set RADAR SELECT GCA switch to applicable ASR host radar position.

(2) On each target module perform the following:

(a) Set MODE FLY-TOUCH & GO-OFF switches to OFF.

(b) Set SELECT switches to NM EAST and POSITION thumbwheels to 000. Depress ENTER pushbuttons.

(c) Set SELECT switches to NM NORTH and POSITION thumbwheels to 010. Depress ENTER pushbuttons.

(d) Set SELECT switches to ALT X 100 FT and POSITION thumbwheels to 123. Depress ENTER pushbutton. Check to see that radar indicator crt presentation displays the simulated target at the following fixed location:

- 1. Range: 10.2 nm
- 2. Heading: 0°

(3) Using the POSITION thumbwheel and ENTER pushbutton on target module 1, increase the altitude in 100-ft increments to the point at which the target begins to fade on the radar scope.



(4) Determine if the target fades on the peripheral field of the radar azimuth antenna vertical beam using the formula:

$Q = \text{antenna vertical beam width} + \text{antenna tilt angle}$ . Refer to table 2-4 for antenna beam-widths.

(5) Reset target altitude to initial position of (2)(d) above.

(6) Using the radar indicator cursor, check the antenna azimuth beamwidth simulated by the target generator by measuring the target angular width on the radar scope. Target angular width should be 1.0° to 3.00 for all radars.

(7) Repeat (3) through (6) above for target modules 2 and 3.

Table 2-4. ASR Vertical Antenna Beamwidths

Radar type	Vertical beamwidth
AN/FPN-40	15° ±3°
AN/TPN-8	15° ±3°
AN/TPN-18	15° ±3°

## Section II. OPERATION

### 2-5. Scope of Operation

This section contains instructions for preoperational, operational and postoperational procedures.

### 2-6. Preoperation Procedures

a. Set target module MODE FLY-TOUCH & GO-OFF switch to OFF.

b. Set control module POWER switch to the ON position. Note that POWER ON indicator is illuminated.

c. Rotate each target module DIMMER control to desired edge-lit panel intensity level.

d. At target module 1 set CHAN 1 switch to XMT/RCV and CHAN 2 and CHAN 3 switches to either MON or OFF. Depress PRS/TALK push-button and establish voice communications with students at communication stations. Set VOL control for suitable listening level.

e. At target module 2 set CHAN 2 switch to XMT/RCV and CHAN 1 and CHAN 3 switches to either MON or OFF. Depress PRS/TALK push-button and establish voice communications with students at communication stations. Set Channel 2 VOL control for suitable listening level.

f. At target module 3 set CHAN 3 switch to XMT/RCV and CHAN 2 and CHAN 3 switches to either MON or OFF. Depress PRS/TALK push-button and establish voice communication with students at communications stations. Set Channel 3 VOL control for suitable listening level.

g. Set control module RADAR SELECT switches to the host radar TPN-8/18 or FPN-40 position.

h. Establish communications with student and brief the student on the upcoming training exercise. At completion of briefing, set target module(s)

MODE switch to FLY or TOUCH & GO. Verify that the simulated target(s) are displayed and moving across the associated radar indicator crt. As time progresses, the pseudo-pilot performs all maneuvers directed by the student controller by operation of target module switches. At any time during the training exercise, any simulated target can be stopped at its current position by setting the associated target module MODE switch to OFF.

i. If target module MODE switch was set to FLY position the TOUCHDOWN indicator illuminates when the simulated target is at zero altitude (ALTITUDE FT X 100 indicates 000). When this condition occurs, the training exercise is terminated.

j. If target module MODE switch was set to TOUCH & GO, the TOUCHDOWN indicator illuminates when the simulated target is at zero altitude (ALTITUDE FT X 100 display indicates 000). However, the training exercise continues until the associated MODE switch is set to OFF.

### 2-7. Operation Procedures

a. Control Module Assembly. Insert wind speed (000-099 knots) and direction (000-359°) into the target simulation section by means of the WIND thumbwheel settings and WIND ENTER push-button on the control module.

#### NOTE

Wind speed and direction values are provided by the instructor as part of the training exercise.

(1) To enter wind speed proceed as follows:

(a) Place WIND SPEED-DIRECTION switch in SPEED position.

(b) Using WIND thumbwheels insert wind speed value selected (000-099 knots) for the problem.

(c) Depress WIND ENTER pushbutton and note that WIND DATA IEJECT light does not illuminate.

(2) To enter wind direction proceed as follows:

(a) Place WIND SPEED-DIRECTION switch in DIRECTION position.

(b) Using WIND thumbwheels insert wind direction value (degrees) selected (000-359) for the problem.

(c) Depress WIND ENTER pushbutton and note that WIND DATA REJECT light does not illuminate.

b. Airport Surveillance Radar (ASR) Operation

NOTE

To simulate a target which is to be displayed on ASR radars, proceed as follows:

(1) Set control module WIND SPEED-DIRECTION switch to SPEED and set WIND thumbwheels to 000. Depress WIND ENTER pushbutton and observe that WIND DATA REJECT indicator does not illuminate.

(2) Set control module WIND SPEED-DIRECTION switch to DIRECTION and set WIND thumbwheel to 090. Depress WIND ENTER pushbutton and observe that WIND DATA REJECT indicator does not illuminate.

NOTE

Select and use one target module for the remainder of this procedure.

(3) Set target module INITIAL CONDITIONS SELECT switch to NM NORTH and set POSITION THUMBWHEELS to 026. Press ENTER pushbutton.

(4) Set target module SELECT switch to NM EAST and set POSITION thumbwheels to 015. Press ENTER pushbutton and observe that BEARING DEG displays 030 on digital readout.

(5) Set target module SELECT switch to HDG DEG. Operate POSITION thumbwheels to bearing of site runway heading or 270. Press ENTER push-button and observe that HEADING DEG digital readout displays previously entered site runway heading or 270.

(6) Set target module SELECT switch to ALT x 100 FT. Operate POSITION thumbwheels to 050. Press ENTER pushbutton and observe that ALTITUDE FT x 100 digital readout displays 050 and RANGE NM displays 030.0.

(7) Verify that the ASR radar indicator crt

presentation includes the simulated target at approximately the following fixed location:

Range: 30 nm

Bearing: 30°

NOTE

Target module altitude is altitude above ground level and displayed range is from radar receiver-transmitter and not touchdown.

(8) Set target module controls as follows:

(a) CLIMB-DIVE to CLIMB.

(b) CLIMB/DIVE RATE HIGH-LOW to LOW.

(c) CLIMB/DIVE RATE FT/MIN to 00.

(d) TURN RATE DEG/SEC to 0.

(e) VEL HIGH-LOW to LOW.

(f) KNOTS to 1500&300.

(g) IFF RESPONSE ON-OFF to OFF.

NOTE

A stopwatch is required to verify the results of the following steps.

(9) Simultaneously set target module MODE FLY-TOUCH & GO-OFF switch to FLY and start stopwatch. Observe that RANGE NM, and BEARING DEG digital readout displays change and HEADING DEG and ALTITUDE FT x 100 digital readout displays remain fixed. Verify that the simulated target is now tracking across the radar scope at the parameters set in the displayed on the target module.

(10) Set control module IFF DELAY switch to 2 A sec. Set target module IFF RESPONSE switch to ON. Verify that IFF identification marker appears (same form as target video) behind the simulated target.

(11) Set control module IFF DELAY 2 AS SEC-10 ' SEC switch to 10 4 sec and verify that IFF identification marker appears, although further displaced, behind the simulated target. Set target module IFF RESPONSE switch to OFF.

(12) After 3 + 1/4 minutes of operation target module RANGE NM and BEARING DEG should display 026.0 and 000 respectively. When this condition occurs, set MODE switch to OFF and stop the stopwatch. Verify that the simulated target appears on GCA radar indicator crt at a fixed location.

c. Precision Approach Radar (PAR) Operation.

NOTE

Operate the host radar set in the FINAL APPROACH, PREC or NORMAL mode of operation.

(1) Set target module MODE FLY-TOUCH & GO-OFF switch to OFF.

(2) Set control module WIND SPEED-DIRECTION switch to SPEED and set WIND thum-

thumbwheels to 000. Depress WIND ENTER push-button and observe that WIND DATA REJECT indicator does not illuminate.

(3) Set target module INITIAL CONDITIONS SELECT switch to NM NORTH and set POSITION thumbwheels to 000. Depress ENTER pushbutton.

(4) Set target module SELECT switch to NM EAST and set POSITION thumbwheels to 000. Depress ENTER pushbutton and observe that BEARING DEG displays 045 on digital readout.

(5) Set target module SELECT switch to HDG DEG and set POSITION thumbwheels to HEADING number that the target would be required to have to fly out along the runway centerline. Depress ENTER pushbutton and observe that HEADING DEG digital readout displays previously entered heading.

(6) Set target module SELECT switch to ALT x 100 FT and set POSITION thumbwheels to the altitude (in 100's of feet) above the ground that target would be required to have at range of seven miles to be on glide path. Depress ENTER push-button and observe that ALTITUDE FT x 100 digital readout displays previously entered altitude.

NOTE

Target module altitude is altitude above ground level and displayed range is from radar and not touchdown.

(7) Set target module switches as follows:

- (a) CLIMB-DIVE to CLIMB
- (b) CLIMB/DIVE RATE HIGH-LOW to LOW.
- (c) CLIMB/DIVE RATE FT/MIN to 00.
- (d) TURN RATE DEG/SEC to 0.
- (e) VEL HIGH-LOW to HIGH.
- (f) VEL KNOTS to 1500/300.
- (g) IFF RESPONSE ON-OFF to OFF.

NOTE

A stopwatch is required to verify the results in (8) and (9) below.

(8) Simultaneously set target module MODE FLY-TOUCH & GO-OFF switch to FLY and start stopwatch. Observe that RANGE NM display increases, and BEARING DEG digital readout display becomes equal to HEADING display value, and HEADING DEG and ALTITUDE FT x 100 digital readout displays remain fixed. Verify that the simulated target is now tracking across the radar indicator crt at the parameters set in and displayed on the target module.

(9) After  $17 \pm 2$  seconds of operation target module RANGE NM should display 007.0 and BEARING DEG should display 007 and same number in heading. When target range is 7.0 miles set

MODE switch to OFF and stop the stopwatch. Verify that the simulated target appears on the radar indicator crt and on a coarse 7.0 miles from the radar.

(10) Tilt azimuth antenna up and note where the antenna is in angular position when the target is no longer displayed.

(11) Tilt azimuth antenna down until the target is no longer displayed. Observe that required angular movement is approximately 15 degrees.

(12) Tilt the azimuth antenna back onto the target.

(13) Servo the elevation antenna to the left of a point where the target first begins to disappear.

(14) Servo the elevation antenna to the right. Observe that the required antenna angular movement is approximately equidistant to the right and to the left.

(15) Servo the elevation antenna back to the target.

d. Control Module and Target Generator Operation.

(1) Set target module MODE FLY-TOUCH & GO-OFF switches to OFF.

(2) Set control module POWER switch to ON. Note that POWER ON indicator illuminates.

(3) Rotate each target module DIMMER control to desired edge-lit panel intensity level.

(4) At target module 1 set CHAN 1 switch to XMT/RCV and CHAN 2 and CHAN 3 switches to either MON or OFF.

(5) At target module 2 set CHAN 2 switch to XMT/RCV and CHAN 1 and CHAN 3 switches to either MON or OFF.

(6) At target module 3 set CHAN 3 switch to XMT/RCV and CHAN 2 and CHAN 3 switches to either MON or OFF.

(7) Set control module RADAR SELECT GCA and LONG RANGE switches to applicable radar positions.

(8) Set Control Module WIND SPEED-DIRECTION switch to SPEED. Operate WIND thumbwheels for desired wind speed value. Depress WIND ENTER pushbutton and observe that WIND DATA REJECT indicator does not illuminate.

(9) Set control module WIND SPEED-DIRECTION switch to DIRECTION. Operate WIND thumbwheels to desired wind direction value. Depress WIND ENTER pushbutton and observe that WIND DATA REJECT indicator does not illuminate.

(10) Fly target module 1 target to the desired target range and bearing using the procedure described in paragraph 2-4d. If it is desired to calculate the switch settings to place a target at a

specific range and bearing, refer to figure 2-3 for formulas, example problems and instructions for calculation of any desired initial condition. Calculate a target initial range and bearing and perform (a) and (b) below.

(a) Set target module 1 INITIAL CONDITION SELECT switch to first nautical miles direction. Set POSITION thumbwheel to associated distance. Depress ENTER pushbutton.

(b) Set target module 1 INITIAL CONDITION SELECT switch to second nautical miles direction. Set POSITION thumbwheel to associated distance. Depress ENTER pushbutton. Observe that digital display readout indicates desired RANGE NM and BEARING DEG indications.

(11)Set target module 1 INITIAL CONDITION SELECT switch to HDG DEG. Set POSITION thumbwheel to desired simulated target bearing angle. Depress ENTER pushbutton. Observe that digital display readout indicates desired target HEADING DEG indication.

(12)Set target module 1 INITIAL CONDITION SELECT switch to ALT X 100 FT. Set POSITION thumbwheel to desired simulated target altitude. Depress ENTER pushbutton. Observe that display readout indicates desired ALTITUDE FT X 100 indication.

(13)Set the following target module 1 switches to positions as required for start of simulated target training exercise:

- (a) IFF RESPONSE ON-OFF
- (b) CLIMB-DIVE
- (c) CLIMB/DIVE RATE HIGH-LOW
- (d) CLIMB/DIVE RATE FT/MIN
- (e) TURN RATE DEG/SEC

(f) VEL HIGH-LOW

(g) VEL KNOTS

(14)Repeat (10) through (13) above for remaining target modules.

(15)Establish communications with student and brief him on the simulated target training exercises. At completion of briefing, set target module(s) MODE switch to FLY or TOUCH & GO. Verify that the simulated target(s) are displayed and moving on the associated radar indicator crt. As time progresses, the pseudo-pilot performs all maneuvers requested by the radar operator (student controller) by operation of target module switches initially set in (13) above. At any time during the training exercise, any simulated target can be stopped at its current position by setting its associated Target Module MODE switch to OFF.

(16)If target module MODE switch was set to FLY, the TOUCHDOWN indicator illuminates when the simulated target is at zero altitude (digital display readout indicates zero feet). When this condition occurs, the training exercise is terminated.

(17)If target module MODE switch was set to TOUCH & GO, the TOUCHDOWN indicator illuminates when the simulated target is at zero altitude (ALTITUDE X 100 FT display indicates 000). However, the training exercise continues until the associated MODE switch is set to OFF.

(18)Set control module POWER switch to OFF when all training exercises are complete. **2-8. Postoperational Procedures** The only action required to shutdown the target generator is to set control module POWER switch to OFF.

Table 2-5. Typical Simulated Target Ranges (NM) and Bearing Angles for Quadrant I (Fig. 2-3)

Desired simulated target range (nm)		Desired simulated target bearing	Target module POSITION thumbwheel setting	
Min	Max		Nm North	Nm East
219.3	220.8	0°	220	001
253.6	255.4	60°	128	220
180.0	181.6	45°	128	128
128.5	129.5	83°	016	128
65.8	66.2	14°	064	016
64.3	64.7	83°	008	064
35.7	35.9	27°	032	016
31.9	32.1	88°	001	032
16.1	16.2	7°	016	002
16.4	16.5	76°	004	016

Table 2-6. Typical Simulated Target Ranges (NM) and Bearing Angles for Quadrant II (Fig. 2-3)

Desired simulated target range (nm)		Desired simulated target bearing	Target module POSITION thumbwheel setting	
Min	Max		Nm North	Nm East
219.8	221.3	94°	016	220
128.5	129.5	97°	016	128
65.8	66.2	104°	016	064
35.7	35.9	117°	016	032
22.6	22.7	135°	016	016
35.7	35.9	153°	032	016
65.8	66.2	166°	064	016
128.5	129.5	173°	128	016
219.8	221.3	176°	220	016

Table 2-7. Typical Simulated Target Ranges INMJ and Bearing Angles for Quadrant III (Fig. 2-31)

Desired simulated target range (nm)		Desired simulated target bearing	Target module POSITION thumbwheel setting	
Min	Max		Nm North	Nm East
219.8	221.3	184°	220	016
128.5	129.5	187°	128	016
65.8	66.2	194°	064	016
35.7	35.9	207°	032	016
22.6	22.7	225°	016	016
35.7	35.9	243°	016	032
65.8	66.2	25°	016	064
128.5	129.5	263°	016	128
219.8	221.3	266°	016	220

Table 2-8. Typical Simulated Target Ranges (NM) and Bearing Angles for Quadrant IV(Fig. 2-3)

Desired simulated target range (nm)		Desired simulated target bearing	Target module POSITION thumbwheel setting	
Min	Max		Nm North	Nm East
219.4	220.9	272°	008	220
127.8	128.7	274°	008	128
64.3	64.7	277°	008	064
32.9	33.1	284°	008	032
17.8	17.9	297°	008	016
11.3	11.4	315°	008	008
17.8	17.9	333°	016	008
32.9	33.1	346°	032	008
64.3	64.7	353°	064	008
177.8	128.7	356°	128	008
219.4	220.9	358°	220	008

Figure 2-3. Simulated target range and bearing angle formulas and example problems. (Located in back of manual)

## CHAPTER 3 OPERATOR'S MAINTENANCE

### NOTE

Preventive maintenance for commanders is contained in DA Pam 750-1.

### 3-1. Scope of Maintenance

The maintenance duties of the operator are to perform a prescribed sequence of preventive maintenance checks and services. The preventive maintenance procedures are the systematic care, servicing, and inspection of equipment to prevent the occurrence of trouble and to reduce down time by detecting and correcting the onset of trouble. These checks and services are to maintain Army electronic equipment in a combat serviceable and mission ready condition.

- a. Routine services (para 3-3).
- b. Preventive maintenance checks and services (para 3-5).
- c. Operator's weekly checks (para 3-6).
- d. Cleaning (para 3-7).
- e. Troubleshooting (para 3-8).
- f. Repairs and adjustments (para 3-9).
- g. Performance tests (para 3-10).

### 3-2. Tools, Materials, and Equipment Required for Maintenance

No tools or equipment are required for operator's maintenance. The following cleaning materials will be useful to the operator.

- a. Lint-free cloths.
- b. Dishwashing compound or detergent.
- c. Trichloroethane.

### 3-3. Routine Services

Routine services are a collection of checks and observations performed by the operator at all times. Routine services are not listed in the preventive maintenance checks and services (table 3-1), in order to separate the nonoperational from the operational services.

- a. Routines. The operator should perform the following routines as necessary.
  - (1) Cleaning.
  - (2) Dusting.
  - (3) Washing.
  - (4) Check for cut or frayed cables. n

(5) Check for dented, bent, or broken components.

(6) Check to see that items not in use are properly stowed.

(7) Check for rusting.

(8) Check controls for smooth operation.

(9) Check for loose nuts, bolts and connectors.

(10) Check to see that all nameplates are clean and legible.

(11) Check to see that cables are securely connected.

(12) Check for completeness of equipment.

b. Items Requiring Routine Services.

(1) Transit cases.

(2) Control module assembly.

(3) Target module assemblies.

(4) Junction box assembly.

(5) Communications units.

(6) Alignment fixture assembly.

(7) Headphones.

### 3-4. Preventive Maintenance Checks and Services Periods

Complete preventive maintenance is the performance of routine services (para 3-3) and preventive maintenance checks and services (PMCS) (para 3-5), to ensure that the equipment is available and ready for use. The equipment should be checked and serviced just before a training exercise and as soon as possible after completion of the training exercise.

### 3-5. Preventive Maintenance Checks and Services (PMCS)

a. PMCS procedures, covering operational services of the target simulator are given in table 3-1. The PMCS are normally performed by the operator.

b. Before starting PMCS, check to see that all cables and accessories are in usable condition, and major assemblies fit properly.

c. If a PMCS procedure does not meet the readiness/availability requirements, refer to the operator's troubleshooting chart (para 3-8) or to repair and adjustments (para 3-9).

Table 3-1. Operator's Preventive Maintenance Checks and Services

**NOTE**

Within the designated interval, these checks are to be performed in the order listed. The designated intervals are as follows.

B-Before

D-During

A-After

Item No.	Interval			Item to be inspected/adjusted as necessary	Procedures Check and have repaired or available if	For readiness reporting equipment is not ready/
	B	D	W			
1	*		*	Control module assembly (fig. 1-3)	<p><b>NOTE</b></p> <p>Limited operation is possible with two target modules, two student communications station or their associated cables missing or faulty. Place POWER ON-OFF switch to ON. POWER indicator DS1 lights. If indicator DS 1 does not light, verify fuse indicator is not lighted. If not, check for ac power by observing edge lighting of target module (Item No. 4 below). If edge lighting is present on target module, operation can continue. Report condition to higher maintenance category.</p>	Fuse indicator (blown fuse) is lighted.
2	*			Control module assembly	<p><b>NOTE</b></p> <p>RADAR SELECT SWITCH should be in host radar position. Place WIND SPEED-DIRECTION switch in SPEED position, WIND thumbwheel switches to 199 and press WIND ENTER switch. DATA REJECT indicator DS2 should light. Place wind thumbwheel switch to a number less than 099 and press WIND ENTER switch. DATA REJECT indicator DS2 does not light.</p>	DATA REJECT indicator does not light with 199 windspeed entry or lights when less the 099 (99 knots) is entered.
3	*			Control module assembly	<p>Place WIND SPEED-DIRECTION switch in DIRECTION position, WIND thumbwheel switches to 459 and press WIND ENTER switch. DATA REJECT indicator should light. Place WIND thumbwheel switches to a number less than 359 and press WIND ENTER switch. DATA REJECT indicator DS2 does not light.</p>	DATA REJECT indicator does not light with 459 (degree) entry or lights with 359 (degree) entry. Higher category of maintenance is required.
4	*	*		Target Module assembly (fig.-1-4)	<p><b>NOTE</b></p> <p>Check each of the three target modules. Operate the DIMMER control RI cw and ccw. Target module panel lighting intensity should vary accordingly. varied with adjustment of</p>	Target module panel lighting intensity absent or cannot be
5	*	*		Target module assembly.	Operate rotary and POSITION thumbwheel switches to all positions. All switches must operate smoothly. in all positions.	DIMMER control R 1. Any rotary or thumbwheel switch binds or cannot be set
6	*	*		Target module assembly.	Perform communications check given in paragraph 2-4a. Two persons are required.	Communications cannot be established on any of the three channels. Limited operation can take place with one or two
7	*		*	Target module assembly.	Perform initial and digital readout display test given in paragraph 2-4b.	channels inoperable. Digital readouts are not as specified on all of the three target modules. Limited operation can take place with one or two target modules inoperable.

Table 3-1. Operator's Preventive Maintenance Checks and Services

**NOTE**

Within the designated interval, these checks are to be performed in the order listed. The designated intervals are as follows.

B-Before

D-During

A-After

Item No.	Interval			Item to be inspectedadjusted as necessary	Procedures Check and have repaired or available if	For readiness reporting equipment is not ready/
	B	D	W			
8	*			Target module assembly.	Perform heading and turn rate test given in paragraph 2-4c.	Same as 7 above.
9	*			Target module assembly.	Perform PAR target simulation test given in paragraph 2-4d. If unable to display simulated target or course/line and glidepath realignment of junction box may be required.	Unable to display simulated target on course/line and glidepath. A higher category of maintenance required.
10	*			Target module assembly	Perform ASR target simulation test given in paragraph 2-4e. If unable to obtain proper simulated target video return amplitude with radar azimuth antenna elevation position realignment of junction box may be required. A higher category of maintenance required.	Unable to obtain required simulated target video return amplitude with radar azimuth antenna varied elevation

**3-6. Operator's Weekly Checks**

Check for completeness of the target generator by referring to the items listed in tables 1-2 and 1-5. Be sure that all the items relating to the requirement of the host radar are complete and accounted for.

**3-7. Cleaning**

The exterior surfaces of the components of the target generator should be kept clean and free of dirt, grease, and fungus. When necessary, clean the surfaces as follows:

- a. Dust and Loose Dirt. Remove dust and loose dirt by wiping with a clean, soft cloth.
- b. Grease, Fungus, and Ground-In Dirt. Remove grease, fungus, and ground-in dirt as follows:

**WARNING**

The fumes of TRICHLOROETHANE are toxic. Provide thorough ventilation whenever it is used; avoid prolonged or repeated breathing of vapor. Do not use near an open flame or hot surface; trichloroethane is nonflammable but heat converts the fumes to a highly toxic phosgene gas the inhalation of which could result in serious injury or death. Prolonged or repeated skin contact with trichloroethane can cause skin inflammation. When necessary, use gloves, sleeves and aprons which the solvent cannot penetrate.

(1) Dampen cloth (do not soak) with cleaning compound (NSN 6850-00-597-9765).

(2) Wipe off grease, fungus, or ground-in dirt with a cloth.

(3) Wipe the component dry with a clean cloth.

c. Plugs and Jacks. Remove dirt from plugs and jacks with a brush.

d. Meters, Counters, Switches, and Control Knobs. Clean switches, control knobs, and glass windows of meters and counters as follows:

**CAUTION**

Do not press on glass windows of alignment fixture meter and target module counters.

(1) Dampen a cloth with water. (Use dish-washing compound or detergent or mild soap, if available).

(2) Gently wipe dirt off all windows, switches, and control knobs with damp cloth.

(3) Clean with a clean cloth.

**3-8. Operator's Troubleshooting Chart**

Operator's troubleshooting is based on performing the preventive maintenance checks and services (para 3-5) until an abnormal condition or result is observed. Refer to the trouble symptom in the troubleshooting chart below. If the corrective measures do not apply or do not remedy the trouble, higher category of maintenance is required.



Table 3-2. Troubleshooting Chart

Item No	Trouble Symptom	Probable Trouble	Check and Corrective Measures
1	POWER indicator DS1 does not light when POWER ON-OFF switch is placed to ON	<ul style="list-style-type: none"> <li>a Faulty indicator lamp required.</li> <li>b Open fuse FI indicated by blown fuse indicator.</li> </ul>	<ul style="list-style-type: none"> <li>a Higher category of maintenance</li> <li>b Same as a above.</li> </ul>
2	DATA REJECT indicator DS2 does not light with 199 wind speed entry or lights when less than 099 is entered.	Faulty control module required.	Higher category of maintenance required.
3	DATA REJECT indicator DS2 does not light with 459 DIRECTION entry or lights with 359 entry.	Faulty control module	Higher category of maintenance required.
4	Target module panel lighting intensity absent or cannot be varied with adjustment of DIMMER Control R1	<ul style="list-style-type: none"> <li>a Faulty control module</li> <li>b Faulty target module or cable</li> </ul>	<ul style="list-style-type: none"> <li>a Verify edge lighting is absent on all target modules A higher category of maintenance required.</li> <li>b Verify edge lighting satisfactory on at least one target module A higher category of maintenance required.</li> </ul>
5	Rotary or thumbwheel switches inoperable	Faulty target module	A higher category of maintenance required.
6	Communications cannot be established channels maintenance required.	<ul style="list-style-type: none"> <li>a Faulty control module</li> <li>b Faulty target module or cable</li> <li>c Faulty communications station or cable</li> </ul>	<ul style="list-style-type: none"> <li>a Verify communications lost on all A higher category of</li> <li>b Verify communications can take place on at least one channel A higher category of maintenance required.</li> <li>c Verify faulty communication station and cable A higher category of maintenance required.</li> </ul>
7 and 8	Digital readouts on target module incorrect on substituted modules	<ul style="list-style-type: none"> <li>a Faulty controls module</li> <li>b Faulty target module</li> </ul>	<ul style="list-style-type: none"> <li>a Substitute another target module and verify similar error exists A higher category of maintenance required.</li> <li>b As in a above verify substituted target module has correct digital readout A higher category of maintenance required.</li> </ul>
9	Unable to display simulated target on course line and glidepath	<ul style="list-style-type: none"> <li>a Faulty or misaligned junction box</li> <li>b Faulty control module</li> <li>c Faulty target module</li> </ul>	<ul style="list-style-type: none"> <li>a Verify target is present but not on course line and glidepath A higher category of maintenance required.</li> <li>b Verify target is absent or erratic. A higher category of maintenance required.</li> <li>c Substitute another target module and verify target is on course line and glidepath A higher category of maintenance required.</li> </ul>
10	Simulated target video amplitude does not change with radar azimuth antenna varied in elevation position	<ul style="list-style-type: none"> <li>a Faulty or misaligned junction box</li> <li>b Radar antenna position data input to junction box absent or incorrect</li> <li>c Faulty control module</li> </ul>	<ul style="list-style-type: none"> <li>a Verify target is present and in proper location on radar indicator crt A higher category of maintenance required.</li> <li>b Verify target course line in item 9 above is satisfactory A higher category of maintenance required.</li> <li>c Same as b above.</li> </ul>

**APPENDIX A  
REFERENCES**

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DA Pam 310-4	Index of Technical Publications: Technical Manuals, Technical Bulletins, Supply Manuals (Types 7, 8, and 9), Supply Bulletins, and Lubrication Orders.
DA Pam 310-7	Index of Modification Work Orders (MWO's).
TM 11-5840-281-12	Operator's and Organizational Maintenance Manual: Radar Set AN/TPN-18.
TM 11-5840-293-12	Operator's and Organizational Maintenance Manual: Radar Set AN/FPN-40 (With IFF capability).
TM 38-750	The Army Maintenance Management Systems (TAMMS).
TM 750-244-2	Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command).

**APPENDIX B  
COMPONENTS OF END ITEM LIST**

**Section I. INTRODUCTION**

**B-1. Scope**

This appendix lists integral components of and basic issue items for the OH-36/GPN to help you inventory items required for safe and efficient operation.

**B-2. General**

This Components of End Item List is divided into the following sections:

a. Section II. Integral Components of the End Item. These items, when assembled, comprise the OH-36/GPN and must accompany it whenever it is transferred or turned in. The illustrations will help you identify these items.

b. Section III. Basic Issue Items. Not applicable.

**B-3. Explanation of Columns**

a. Illustration. This column is divided as follows:  
 (1) Figure number. Indicates the figure number of the illustration on which the item is shown.  
 (2) Item number. The number used to identify item called out in the illustration.

b. National Stock Number. Indicates the National stock number assigned to the item and which will be used for requisitioning.

c. Description. Indicates the Federal item name and, if required, a minimum description to identify the item. The part number indicates the primary

number used by the manufacturer, which controls the design and characteristics of the item by means of its engineering drawings, specifications, standards, and inspection requirements to identify an item or range of items. Following the part number, the Federal Supply Code for Manufacturers (FSCM) is shown in parentheses.

d. Location. The physical location of each item listed is given in this column. The lists are designed to inventory all items in one area of the major item before moving on to an adjacent area.

e. Usable on Code. "USABLE ON" codes are included to help to identify which component items are used on the different models. Identification of the codes used in these lists are:

Code	Used on
A	AN/TPN-18
B	AN/FPN-40

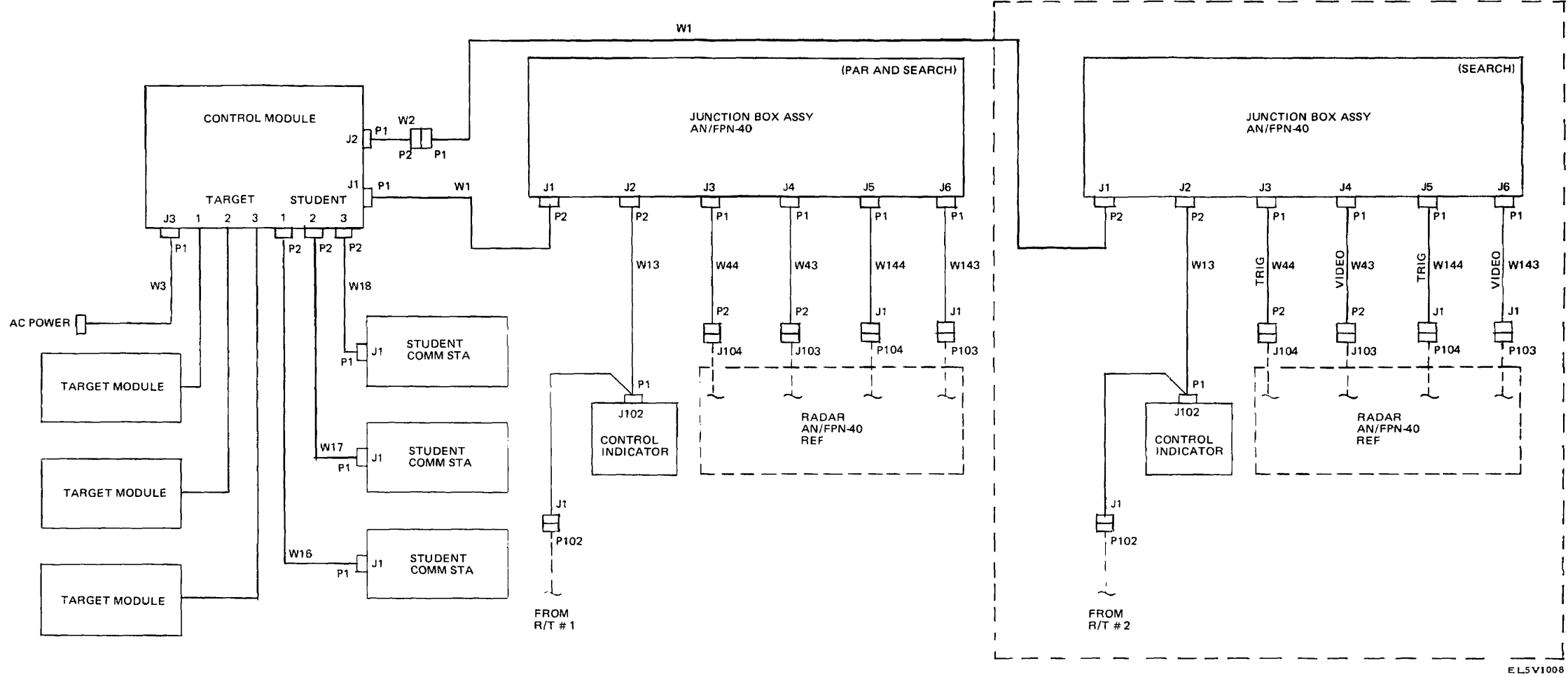
f. Quantity Required (Qty Reqd). This column lists the quantity of each item required for a complete major item.

g. Quantity. This column is left blank for use during an inventory. Under the Rcvd column, list the quantity you actually receive on your major item. The Date columns are for your use when you inventory the major item.

SECTION II INTEGRAL COMPONENTS OF END ITEM

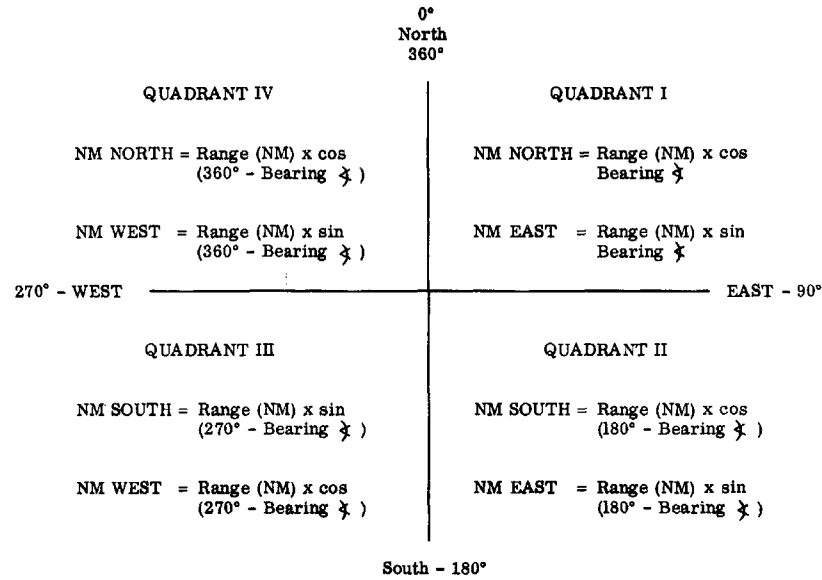
(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION		(4) LOCATION	(5) USUABLE ON CODE	(6) QTY REQD	(7) QUANTITY	
(A) FIG.	(B) ITEM		PART NUMBER	CAGE				RCVD	DATE
1-1	3	58400-01-017-7044	CONTROL MODULE ASSSMBLY			A,B	1		
1-3			535085360010-2	(23759)					
1-1	4	5840-01-01 7-696E	TARGET MODULE ASS--BLY			A,B	3		
1-4			535085S60011-1	(23259)					
1-1	1	5840-01-008-4110	STUDENT COMMUNICATIONS ASSMBLY			A,B	3		
1-5			535085360009-2	(23259)					
1-1	8		HEADS-T-MICROPDN3			A,B	6		
			155641744	(97101 )					
1-1	6	5840-00-138-9976	JUNCTION BOX ASSEMBLY			A	1		
			535085E62005-1	(23259)					
1-1	12		ALIGNMENT FIXTURE ASSSBL			A,B	1		
1-7			535085R60026-1	(23259)					
1-1	5		CABLE ASSEMBLY W1			A,B	1		
			535085564R02-1	(23259)					
1-1	5		CABLE ASSEMBLY 43			A,B	1		
			53508564041 -1						
1-1	5		CABLE ASSSMBLY W13		(23259)	B	1		
			535085641 07-2						
1-1	5		CABLE ASSEMBLY WLL2		(23259)	A	1		
			535085E64109-3						
1-1	5		CABLE ASSSMBLY W43		(23259)	B	1		
			535085364114-23						
1-1	5		CABLE ASSEMBLY ,*44		(23259)	B	1		
			5350856411 14-24						
1-1	5		CABLE ASSSMBLY WL*5		(23259)	A	1		
			535085S64114-25						
1-1	5		CABLE ASSEMBLY W46		(23259)	A	1		
			535085E6411 4-26						
1-1	5		CABLE ASSEMBLY X16		(23259)	A,B	1		
			535085364 115-1						
1-1	5		CABLE ASSEMBLY N17		(23259)	A,B	1		
			535085064 115-2						
1-1	5		CABLE ASSMBLY W18		(23259)	A,B	1		
			535085S641 15-3						
1-1	5		CABLE ASSEMBLY 1D43		(23259)	B	1		
			535085E64117-13						
1-1	5		CABLE ASSE3BLY X2144		(23P;9)	B	1		
			535085S641 17-14						
1-1	5		CABLE ASSSMBLY W145		(23259)	A	1		
			535085S641 17-15						
1-1	5		CABLE ASSE3BLY .4146		(23259)	A	1		
			535085564 117-16						
1-1	5		CABLE ASSEMBLY W2		(23259)	B	1		
			5350850641 18-1						
1-1			TRANSIT CASE		(23259)	A,B	1		
			535085E60020-2						
1-1			TRANSIT CASE		(23259)	A,B	1		
			535085560018-2						
1-1			TRANSIT CASE		(23259)	A,B	1		
			535085360018-4						
1-1			T-RANSIT CASS		(23259)	A,B	1		
			535085E60023-7						

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Figure 2-1. Interconnection diagram with Radar AN/FPN-40.



**QUADRANT I EXAMPLE:**

Desired initial target range: 220 NM

Desired initial target bearing: 4°

$$\text{NM North} = \text{Range (NM)} \times \text{Cos bearing angle}$$

$$= 220 \text{ NM} \times \text{Cos } 4^\circ$$

$$219.6 \text{ NM North} = 220 \text{ NM} \times 0.998$$

Therefore enter 220 into target module position thumbwheel

$$\text{NM East} = \text{Range (NM)} \times \text{sin bearing angle}$$

$$= 220 \text{ NM} \times \text{sin } 4^\circ$$

$$15.4 \text{ NM East} = 220 \text{ NM} \times 0.070$$

Therefore enter 016 into target module position thumbwheel

**QUADRANT II EXAMPLE:**

Desired initial target range: 65 NM

Desired initial target bearing: 104°

$$\text{NM South} = \text{Range (NM)} \times \text{Cos (180° - bearing angle)}$$

$$= 65 \text{ NM} \times \text{cos (180° - 104°)}$$

$$= 65 \text{ NM} \times \text{cos } 76^\circ$$

$$15.7 \text{ NM South} = 65 \text{ NM} \times 0.242$$

Therefore enter 016 into target module position thumbwheel

$$\text{NM East} = \text{Range (NM)} \times \text{Sin (180° - bearing angle)}$$

$$= 65 \text{ NM} \times \text{sin (180° - 104°)}$$

$$= 65 \text{ NM} \times \text{sin } 76^\circ$$

$$63.1 \text{ NM East} = 65 \text{ NM} \times 0.970$$

Therefore enter 064 into target module position thumbwheel

**QUADRANT III EXAMPLE:**

Desired initial target range: 129 NM

Desired initial target bearing: 263°

$$\text{NM South} = \text{Range (NM)} \times \text{sin (270° - bearing angle)}$$

$$= 129 \text{ NM} \times \text{sin (270° - 263°)}$$

$$= 129 \text{ NM} \times \text{sin } 7^\circ$$

$$15.7 \text{ NM South} = 129 \text{ NM} \times 0.122$$

Therefore enter 016 into target module position thumbwheel

$$\text{NM West} = \text{Range (NM)} \times \text{cos (270° - bearing angle)}$$

$$= 129 \text{ NM} \times \text{cos (270° - 263°)}$$

$$= 129 \text{ NM} \times \text{cos } 7^\circ$$

$$128.0 \text{ NM West} = 129 \text{ NM} \times 0.993$$

Therefore enter 128 into target module position thumbwheel

**QUADRANT IV EXAMPLE:**

Desired initial target range: 128 NM

Desired initial target bearing: 274°

$$\text{NM North} = \text{Range (NM)} \times \text{cos (360° - bearing angle)}$$

$$= 128 \text{ NM} \times \text{cos (360° - 274°)}$$

$$= 128 \text{ NM} \times \text{cos } 86^\circ$$

$$8.9 \text{ NM North} = 128 \text{ NM} \times 0.070$$

Therefore enter 009 into target module position thumbwheel

$$\text{NM West} = \text{Range (NM)} \times \text{sin (360° - bearing angle)}$$

$$= 128 \text{ NM} \times \text{sin (360° - 272°)}$$

$$= 128 \text{ NM} \times \text{sin } 86^\circ$$

$$127.7 = 128 \text{ NM} \times 0.998$$

Therefore enter 128 into target module position thumbwheel

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Figure 2-3. Simulated target range and bearing angle formulas and example problems.

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Fort Gillem (10)  
Fort Huachuca (10)  
Fort Carson (5)  
Ft Monmouth (HISA) (26)  
Ft Richardson (CERCOM) (2)  
Army Dep (1) except  
LBAD (14)  
SAAD (30)  
TOAD (14)  
SHAD (3)  
USA Dep (1)  
Sig Sec USA Dep (1)  
Units org under fol TOE:  
29-207 (2)  
29-610 (2)

NG: None

USAR: None

For explanation of abbreviations used, see AR 310-50.

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS



THEN... JOT DOWN THE DOPE ABOUT IT ON THIS FORM, CAREFULLY TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL!

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