ARMY TM 11-5840-352-14
AIR FORCE TO 31S9-2GSQ-160-1

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL, INCLUDING DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE REPAIR PARTS AND SPECIAL TOOLS LISTS

ELECTROMAGNETIC DETECTING-TRANSMITTING SET AN/GSQ-160

AND

SIMULATOR GROUP OA-29/GSQ-160

(FSN 5840-168-7719)

This copy is a reprint which includes current pages from Change C1. The title was changed by C1 to read as shown above.

DEPARTMENTS OF THE ARMY AND THE AIR FORCE

MARCH 1972

Change
No. 3

DEPARTMENTS OF THE ARMY
AND THE AIR FORCE
Washington, DC, *9 November 1981*

Operator's Organizational, Direct Support

and General Maintenance Manual

ELECTROMAGNETIC DETECTING-TRANSMITTING SET ANIGSQ-160

(NSN 5840-00-168-7719)

AND

SIMULATOR GROUP OH-291GSQ-160

(NSN 6625-00-482-6150)

TM 11-5840-352-14/TO 31S9-2GSQ-610-1, 7 March 1972, is changed as follows:

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Operator's, Organizational, Direct Support, and General Support Manual,
ELECTROMAGNETIC DETECTING-TRANSMITTING SET AN/GSQ-160
(NSN 5840-00-168-7719)
AND
SIMULATOR GROUP OH-29/GSQ-160
(NSN 6625-00-482-6150)

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Remove	*Insert*
i and ii	i and ii
1-1 and 1-2	1-1 and 1-2.1
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B-1 through B-13	B-1 through B-7
C-1 through C-8	None
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SAAD (10)	GENDEP (Pac) (1)
TOAD (10)	Sig Dep (Pac) (2)
LBAD (5)	Sig Sec GENDEP (Pac) (2)

NG: State AG (0); Units None
USA.R: None
For explanation of abbreviations used, see AR 310-50.

TECHNICAL MANUAL
TECHNICAL ORDER
No. 31S9-2GSQ-160-1

DEPARTMENTS OF THE ARMY
No. 11-5840-352-14

WASHINGTON, DC, 7 March 1972

Operator's, Organizational, Direct Support, and General Support Manual,

ELECTROMAGNETIC DETECTING-TRANSMITTING SET AN/GSQ-160
(NSN 5840-00-168-7719)
AND
SIMULATOR GROUP OH-29/GSQ-160
(NSN 6625-00-482-6150)

LIST OF ILLUSTRATIONS

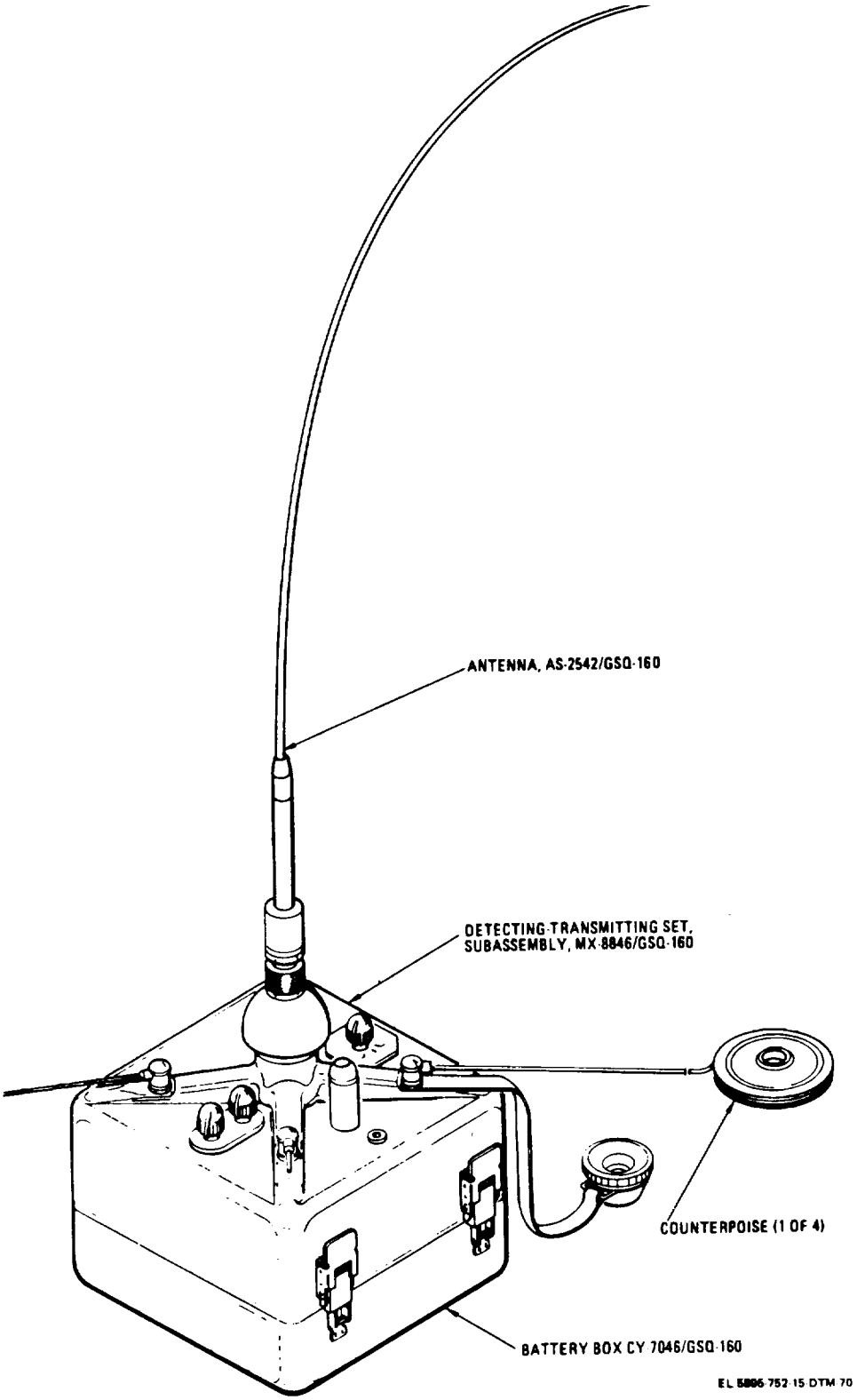


Figure 1-1. Electromagnetic Detecting - Transmitting Set AN/GSC-160.

WARNING

The battery used in this equipment contains mercury and must be handled in the following manner:

1. Do not short circuit.
2. Do not dispose of in fire.
3. Return expended batteries to Property Disposal Officer for disposal in accordance with DLSC Handbook 416Q1.

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1-1. Scope of Manual

a. This manual provides operating instructions and direct and general support maintenance instructions for Electromagnetic Detecting Transmitting Set AN/GSQ-160 in chapters 1 through 6. Shipment, storage, and destruction information is provided in chapter 7. Operation and maintenance for special test equipment is provided in chapter 9. Maintenance is to be performed in accordance with the maintenance allocation chart.

b. References are provided in appendix A. The maintenance allocation chart (MAC) appears in appendix B.

1-2. Index of Technical Publications

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.

1-3. Maintenance Forms, Records, and Reports

a. Reports of Maintenance and Unsatisfactory Equipment. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by TM 38-750, The Army Maintenance Management System.

b. Report of Packaging and Handling Deficiencies. Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in AR 735-11-2/DLAR 4140.55/NAVMATINST 4355.73/AFR 400-54/MCO 4430.3E.

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/DLAR 4500.15.

1-3.1. Reporting Errors and Recommending Improvements

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in back of this manual to: Commander, US Army Communications-Electronics Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, NJ 07703. In either case, a reply will be furnished direct to you.

1-3.2. Reporting Equipment Improvement Recommendations (EIR)

If your equipment needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Tell us why a procedure is hard to perform. Put it on SF 360 (Quality Deficiency Report). Mail it to Commander, US Army Communications-Electronics Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, NJ 07703. We'll send you a reply.

1-3.3. Destruction of Army Electronics Materiel to Prevent Enemy Use

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

1-4. Preparation for Storage or Shipment

Prior to preparing the equipment for administrative storage or shipment, perform the preventive maintenance procedures contained in paragraphs 5-3 through 5-6. Refer to paragraph 7-2 for packaging and packing requirements for the equipment.

Section II. DESCRIPTION AND DATA

1-5. Purpose and Use

a. Electromagnetic Detecting-Transmitting Set AN/GSQ-160 (fig. 1-1) is a lightweight, battery powered portable intrusion detection device designed for hand implacement and unattended operation. It consists of an active radio frequency (RF) sensing system and a data transmission module. Both are powered by the same battery. The unit radiates and receives very high frequency (VHF) energy, senses intrusion by riverine watercraft, personnel, or vehicles within a zone of response, and radiates a vhf alarm when intrusion is detected. Alarm signals are radiated

at frequencies suitable for reception on monitoring equipment such as Radio Frequency AN/USA-46A. Intruder detection ranges are shown in figure 3-1.

b. The electronics circuits and battery are contained in a sealed immersion-proof, two-section housing designed for burial below ground level. The antenna and day/night sensor are external to the upper housing and protrude above ground level. Counterpoise ground wires may be attached, extended, and buried to increase ground coupling in dry soil and to improve transmission and detection. The operational switches on top of the unit incorporate a selectable code combination unique to each AN/GSQ-160 and must be correctly set by personnel attempting recovery. Related supplemental circuits provide for nonexplosive disabling in case of unauthorized tampering, improper recovery, or termination of battery life. A recovery code tag attached to each AN/GSQ-160 specifies the correct setting of the code switches for recovery without disablement. The tag is removed prior to deployment.

c. The AN/GSQ-160 may be used singly or in networks of two or more to provide intrusion detection where electronic surveillance is desired and practical. The separation between units in a network must be selected to provide complete surveillance without interference between sensing units (para 3-2).

d. An AN/GSQ-160 may be hand-carried to a selected site and implanted by one man. The site must be within monitoring range and should offer good ground conductivity. Concealment within natural vegetation close to, but not in contact with, the unit is desirable as camouflage. For maximum performance, the antenna should be clear of foliage for 2 feet in all directions. Proper implant of case and counterpoise below the surface will leave only the antenna and the day/night sensor above ground. After implant, the operator can confirm operation with a post-implantation test device (fig. 3-5), which provides a visual indication of proper operation. The unit is then set for continuous or night-only operation and the location is marked on a map or otherwise specified. Minimum mission life is 90 days night-only operation or 45 days continuous operation. Recovery involves no special measures other than strict regard for the proper setting of the recovery code switches to preclude involuntary disable triggering.

1-6. Items Comprising an Operable Equipment

WARNING

Battery BA-1549/U contains mercury, and must be handled in the following manner:

Do not dispose of in fire.
Do not short circuit.
Return expended batteries to Property Disposal Officer for disposal in accordance with DLSC Handbook 416Q1.

The components and physical characteristics of a functionally operable Electromagnetic Detecting/Transmitting Set AN/GSQ-160 and the assigned Federal stock numbers are as follows:

Item No.	Component	Dimensions (in.) Height	Width	Depth	Weight Ob)	National stock No.
1	Detecting-Transmitting Set, Electromagnetic AN/GSQ-160.	54.0	7.5	8.0	13.5	5840-00-168-7719
2	Detecting-Transmitting Set, Subassembly MX-8846/GSQ-160.	8.5	7.5	8.0	6.7 (less data transmitter)	5840-00-168-7718
3	Antenna AS-2542/GCSQ-160	46	7/16	7/16	0.3	5895-00-181-0303
4	Counterpoise (4) (each) (spooled)	2.0	2.0	1/4	0.1	5895-00-168-7469
5	Battery BA-1549/U[a]	2.04	5.38	5.68	5.5	6135-00-459-3326
6	Data Transmittera Transmitter Encoder TC431 Code plug TC432	6.0	2.75	2.75	1.8	Not available

[a] Not supplied with AN/GSQ-160: see paragraph 1-7.
Any one of three transmitters may be used. See paragraph 1-6g.

1-7. Description of Equipment

a. Overall Description. An assembled and functionally ready AN/GSQ-160 consists of antenna AS-2542/GSQ-160, upper case Detecting-Transmitting Set Subassembly MX-8846/GSQ-160 with data transmission module installed, Battery Box CY-

7046/GSQ-160 with battery, and four counterpoise wires as shown in figure 1-1. Overall height of the assembled unit is 54 inches. The antenna and counterpoise wires are removed for transport or storage. The antenna disassembles into two sections. The strap that used as a carrying handle. The counterpoise wires, spooled for convenience prior to use, can be discarded after recovery of the unit. The upper and lower cases are secured by four latches and sealed airtight and immersion proof with conductive mesh

and a rubber gasket. It contains all power an electronics, and functions as a base for the antenna and counterpoises.

b. Battery Box CY-7046/GSQ-160. The lower case contains Battery BA-1549/U which supplies all required operating voltages. Electrical connections are made through a five-prong jack which mates with a plug on the inside of the upper case The battery is replaceable. Foam panels cemented to the interior of the case are formed to the battery for fit and shock protection. An index peg or the case mates with a detent in the battery to orient the battery jack to the upper case power plug. A tamper switch plate actuates the destruct circuit if case separation is attempted in the armed mode.

c. Detecting-Transmitting Set, Subassembly MX-8846/GSQ-160. The control switches, day/ night sensor, counterpoise posts, and antenna insulator are mounted on the top of the upper case The data transmitter and an electrical chassis are secured within the case. A shield plate covers the data transmitter. A battery power plug, a test connector, and the tamper switch protrude through the chassis base. The electrical chassis supports an interconnect circuit board which receives three functional circuit boards: the primary processor, the secondary processor, and the supplemental circuits. The sensor oscillator is in-

closed within an RF shield (metal enclosure) bolted to the electrical chassis and mates with the antenna coupler assembly housed under the dome of the antenna insulator. A wire harness and ring connector join the electrical chassis to the data transmitter.

d. Antenna AS-2542/GSQ-160. The antenna is approximately 46 inches long and insulated with olive drab epoxy paint. It consists of a 32 inch upper section threaded to a 14 inch lower section. It may be disassembled for transport. A type N connector on the base threads to a connector sealed to the domed insulator on the upper case. The antenna-to-insulator connector is immersion proof when assembled. The upper portion of the antenna is curved 6 inches off center to simulate a bending reed for camouflage purposes. Sensor signals are fed on the outer conductor at the type N connector; for these signals, the antenna functions as a base-fed monopole. Alarm transmitter signals are fed on the center conductor at the type N connector; for this signal, the antenna functions as a combined end-fed dipole and end-fed monopole.

e. Counterpoise. Each AN/GSQ-160 requires four counterpoises. A counterpoise consists of approximately 65 inches of No. 22 gage, 19-strand insulated wire. One end is attached to a spool; the other is provided with a clip for attachment to the counterpoise posts on the upper case. Counterpoises are expendable and need not be recovered.

f. Battery BA-1549/U. This component is a non-rechargeable, multiple output dry battery specifically designed for the AN/GSQ-160. Technical characteristics are provided in paragraph 1-10.

g. Data Transmitter. The data transmitter consists of three plug-in cylindrical sections stacked to comprise a cylinder approximately 6 inches long and 2.75 inches in diameter. It comprises a code plug TC432, an encoder TC432, and a transmitter. It is housed in the upper case (para 1-8c). The code plug at one end connects to the electrical chassis through a ring connector and wire harness. The transmitter segment at the other end connects to the antenna coupler through a plug and a coaxial cable. Any one of three transmitters may be used with the AN/GSQ-160. The differences are described below.

(*1) TC-560.* The TC-560 transmitter is the most desirable transmitter to use in the AN/ GSQ-160 because it does not have a commendable audio monitoring capability built in, and is therefore, the least expensive. The TC-560 transmitter has two RF connectors on the bottom and "T3" stamped on the side. There are two versions of the TC-560 transmitter, either of which may be used.

(*2) TC-516.* The TC-516 transmitter also has two versions, both of which are compatible with the AN/GSQ-160. Both have "T2" stamped on the body and three RF connectors on the bottom, only two of which are used in the AN/ GSQ-160. The version withmanufacturer's code "IBZ" has crystal access by removing the top. The version with manufacturer's code "DDJ" has a square crystal access cover on the bottom. Both versions are returnable at depot by changing crystals and realignment.

(3) TC-434. The TC-434 transmitter has three RF connectors on the bottom, RDZ stamped on the end plate, and T1 stamped on the can. Crystal access is on top through a round nylon cover. The TC-434 is returnable by changing crystals.

1-8. Additional Equipment Required

a. Operator's tools required, but not supplied,

for installation and implant checkout are specified in paragraph 3-5.

b. One Battery BA-1459;'U is required, but is not supplied, to supply power to the AN/ GSQ-160. Direct support personnel are required to install the battery in the lower case. For battery installation instructions, refer to paragraph 5-19. Dry batteries are supplied in accordance with SB 11-6.

c. One data transmitter is required, but not supplied, for each AN/GSQ-160. Refer to paragraph 1-6g. Direct support personnel are required to install the data transmitter. Refer to paragraph 5-10 for installation instructions.

d. Radio Frequency Monitor AN, 'USQ-46 or other sensor monitoring equipment, is required to monitor the vhf over which the AN./GSQ-160 transmits intrusion alarms. Specific frequencies to be monitored are determined by the crystal installed in individual data transmitter modules.

e. One post-implantation test device is required, but not supplied, for validating the detection and alarm capability of an implanted AN/GSQ-160.

1-9. Differences in Models

AN/, GSQ-160's serial numbered 534 and above do not have a tilt switch installed. Therefore, these units will not disable if tilted more than 45° from the perpendicular when armed as will AN/ GSQ-160's serial numbered 533 and below. All references in this manual to the tilt switch or tilt disable apply to AN, /GSQ-160's serial numbered 533 and below only. For differences in data transmitter modules see paragraph 1-6g.

1-10. Technical Characteristics

Input power (Battery BA-1549/U):

+4 and -4 vdc sections	Capacity, 11, 00 milliampere-hour each section load current, 10 ma each. End-of-life, 3.4 vdc + 0.2 vdc.
+30 vdc section	Capacity, 3600 milliam pere-hour. Load current, 0.8 ma. End-oflife 21 vdc + 1.0 vdc.
Sensor frequencies	Fu (upper) = 60 MHz + 0.3. F, (lower) =57.5 MHz + 0.3.
Sensor transmitter power	0.15 to 1.0 mw nominal.
False alarm rate	1 per 6 hours max.
Stabilization time	5 minutes max after power on without alarm).
Detection ranges	Within 40 to 120 feet depending upon conditions (fig. 3-1).
Data transmission fre quency	Crystal selectable vhf (162 to 174 MHz).
Data transmitter power	6 watts maximum (4 watts nominal).
Radiation pattern	Omnidirectional + 1 b.

1-11. Service Conditions

Mission life	Continuous operation, 45 days minimum. Night-only operation, 90 days minimum.
Useful life	year operation with regular battery replacement.
Storage life	5 years (batteries removed).
Temperatures:	
Storage	70°F to +120 °F and 360 btu/ft 2/hr solar radiation.
Service	+33°F to +1130F and 360 btu/ft2/hr solar radiation.
Altitude:	
Service	To 10, 000 ft.
Transport	To 50, 000 ft.
Humidity	To 95% at 90°F and 5% at 1130F.
Rain	Operable after exposure to 8-in./hr for 5 minutes and average rate of 2-in./hr.
Wind	When implanted, to 50 mph with gusts to 70 mph.
Immersion	Operable after immersion to 15 feet depth.
Fungus	All materials are nonnutritive fungus resistant.

CHAPTER 2
SERVICE UPON RECEIPT AND GROSS OPERABILITY CHECK

Section I. INTRODUCTION

2-1. General
The service upon receipt instructions included in this section pertain to direct support maintenance personnel who receive the AN, /GSQ-160 either as new equipment or from other categories. Because of the nature of the equipment, systems planning, site requirements, and installation instructions normally found in this chapter are given in chapter 3.

2-2. Scope
This chapter contains unpacking instructions and the gross operability check. Maintenance personnel must be familiar with chapters 3, 5, and 9 before proceeding with instructions given in this chapter.

CAUTION

Particular attention should be given to paragraphs 3-3 and 3-4 to avoid damage to equipment.

Section II. SERVICE UPON RECEIPT

2-3. Service Upon Receipt of Equipment
a. Unpacking. AN/GSQ-160 components are packed in corrugated cardboard cartons and palletized by the manufacturer. One carton contains Detecting-Transmitting Set Subassembly MX8846, /GSQ-160. A second carton contains Antennas AS-2542, /GSQ-160, and a third carton contains the counterpoises. An envelope contains the code list, the technical manuals, and the shipping lists.

NOTE

Data Transmitter A7 and Battery BA-1549/U are not delivered with AN/GSQ-160 shipments.

b. Unpacking Corrugated Cardboard Cartons. Unpack the cartons as follows (fig. 2-1):

(1) Inspect cartons for signs of rough handling or damage. Report damage in accordance with paragraph 1-3.

(2) If cartons are banded to pallet, cut bands and remove cartons from pallet.

(3) Open each carton.

(4) Remove vapor seal bags and place next to open cartons.

(5) Open vapor seal bags and inspect desiccant indicators for evidence of exposure to adverse moisture conditions. If desiccant indicators show equipment was exposed to excessive moisture, report in accordance with paragraph 1-3. (6) Remove components from bags for checking.

c. Checking Unpacked Equipment. Retain unpacked equipment in one place until the following inspections and checks can be completed.

(*1) Checking equipment for completeness.* Compare the shipping lists with the contents of each carton to insure that all components have been received. If shipping lists are not available, the equipment can be checked against the equip ment list in paragraph 1-6. Report all discrepancies as required by local commands and in accordance with paragraph 1-3.

(*2) Checking equipment foe damage.* Inspect the equipment for damage incurred during shipment. If the equipment was improperly packaged, or damaged, fill out and submit the DD Form 6 or DISREP (SF 361), as pertinent.

(*3) Checking equipment for modifications.* If the equipment has been used or reconditioned, see whether it has been changed by a modification work order (MWO). If the equipment has been modified, the MWO number will appear on the front panel near the nomenclature plate (fig. 5-3). Check to see whether the modified equipments are covered in the manual.

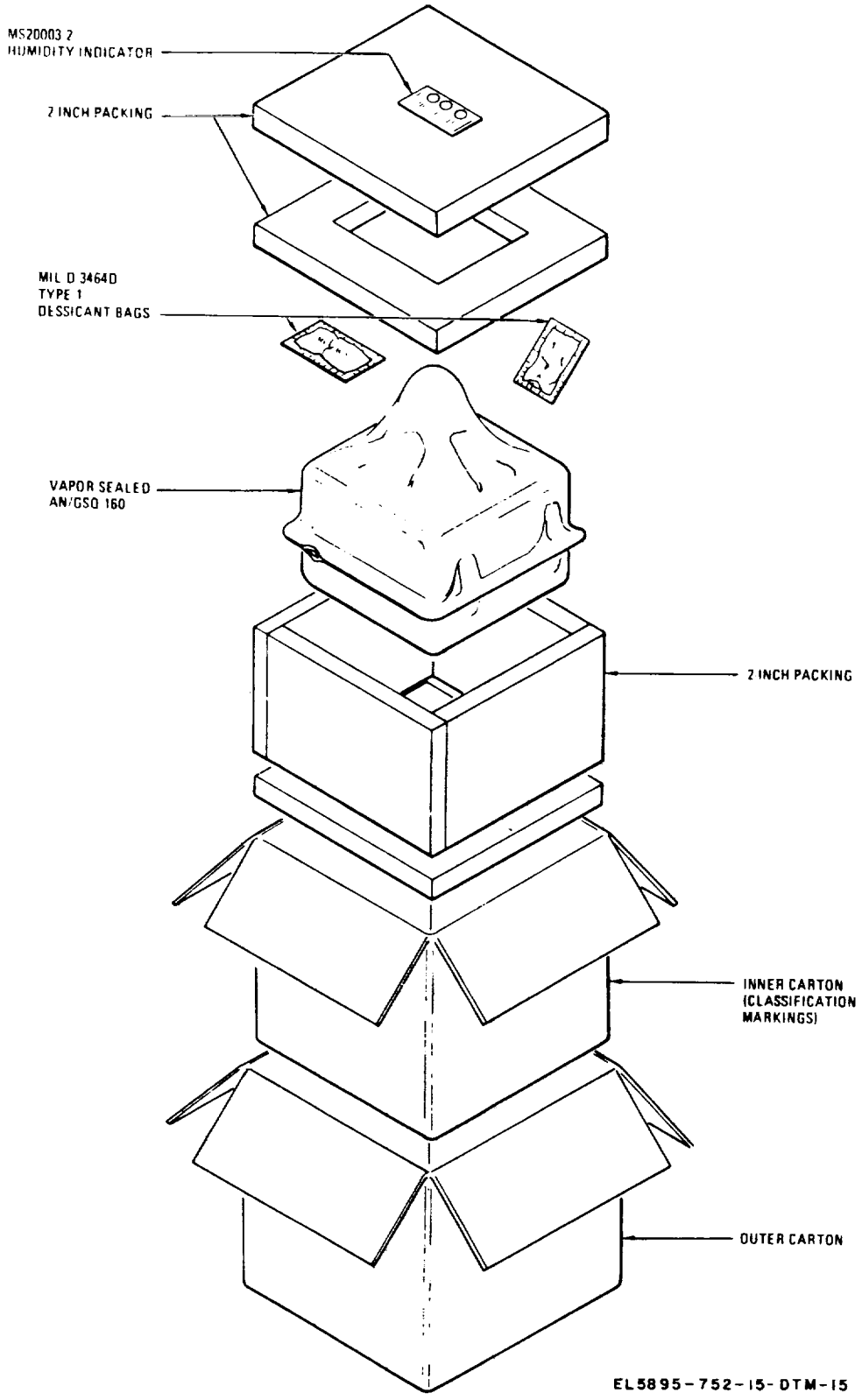


Figure 2-1. Unpacking the AN/GSQ-160.

CAUTION

A permission checkout shall be accomplished prior to complete assembly of the AN/GSQ-160 and its operational deployment. Failure to comply could result in malfunction or possible disabling.

2-4. Permission Checkout

The following procedures are mandatory for new, refurbished, or stored AN/GSQ-160 units prior to their delivery to operators for deployment. Comply with the mission order specifying channels and codes.

a. Channel Number. Verify the channel number of the crystal installed in data transmitter module A7, or install a crystal, in accordance with paragraph 5-16. Verify the channel data on the equipment tag.

b. Alarm Code. Inspect data transmitter code plug TC432 for a decal bearing the code burned into the plug. Verify the code against the equipment tag. If the decal and tag do not agree, obtain and install a coded plug and mark the tag accordingly. If the plug is not coded, accomplish the necessary coding on Code Plug Programmer PT1561 in accordance with TM 11-6625-251414-2.

c. *Transmitter Checkout.* Assemble the data transmitter module (fig. 5-3), and perform a checkout on System Test Set PT1585 in accordance with TM 11-6625-2514-14-1. *d. Recovery Code.* Verify the recovery code combination specified on the tag attached to the AN/GSQ-160 against the code combination stenciled on the inside of the case at the back of data transmitter A7 compartment.

CAUTION

Verify that the ARMING/RECOVERY switch is in the OFF/SAFE position before proceeding to avoid equipment damage or disable triggering.

e. Assembly and Battery Installation.

(1) Obtain a new battery known to be good, and install in Battery Box CY-7046/GSQ-160 in accordance with paragraph 5-9.

(2) Install validated data transmitter A7 in the MX-8846/GSQ-160 upper case subassembly in accordance with paragraph 5-10.

(3) Join and latch the two case sections.

(4) Perform the gross operational check (para 2-5) using System Test Set PT1585, and units of Simulator Group OH-29/GSQ-160 as specified. If required equipment is not available, perform a simulated deployment in accordance with paragraph 3-8, omitting the provisions for burial.

Section III GROSS OPERABILITY CHECK

2-5. Gross Operability Check

Satisfactory completion of this procedure validates the AN/GSQ-160 for operational use. Assemble the test equipment specified in paragraph 2-6, and perform the procedure in paragraph 2-7.

CAUTION

The requirements of paragraph 2-4 shall be complete before beginning this procedure. Failure to comply may damage the equipment.

2-6. Test Equipment

Equipment required for this check (fig. 2-2) is as follows. Refer to chapter 9 for test equipment particulars.

a. System Test Set PT1585.

b. Simulator, Target Standard SM-618/GSQ-160.

c. Simulator, Antenna SM-616/GSQ-160.

2-7. Test Procedure

a. Place the AN/GSQ-160 on a bench, and remove the antenna and counterpoise lugs.

b. Place Antenna Simulator SM-616/GSQ-160 over the AN/GSQ-160 antenna connector, and seat, carefully engaging the simulator legs with the counterpoise lugs and tighten securely with metal nuts. Thread the type N connector to snug fit. Place the cap provided with the SM-616/ GSQ-160 over the day/night sensor window.

c. Connect J4 of the target standard switching matrix to J4 of Antenna Simulator SM-616/GSQ-160 and thread the type N connector to snug fit.

d. Connect the multiconductor cable from the switching matrix to connector J2 on the target standard control chassis.

e. Connect power plug P1 of the target standard control chassis to a 115-volt alternating current (ac), 60-Hertz (Hz) power source.

f. Connect System Test Set PT1585 to a 115-volt ac, 60-Hz power source.

g. Place the AN/GSQ-160, with the test setup within 3 feet of System Test Set PT1585 and orient it so that radiation from Simulator, Antenna SM616/GSQ-160 strikes the antenna port in the upper right corner of the PT1585.

h. Prepare the PT1585 as follows:

(1) AC PWR to ON.

(2) BATTERY SIMULATOR to OFF.

(3) MONITOR switch to OUTPUT WATTS 5 W.

(4) T XTAL CHANNEL to the channel for the crystal of the data transmitter in the AN/GSQ-160 under test.

(5) L CODE PLUG and COMMAND to the digits appropriate to the code plug of the data transmitter in the AN/GSQ-160 under test.

(6) AUDIO to EXT.

i. Position the ARMING/RECOVERY switch on the AN/GSQ-160 under test to ON/TEST.

j. On the SM-618/GSQ-160 control chassis, position the MODE switch to MANUAL and the LOAD SELECT switch to O DB.

k. On the SM-618/GSQ-160 control chassis, position the POWER switch to ON.

l. Verify that the RANGE (FEET) lamp display on the control chassis illuminates to denote a range of 28 feet. The range is determined by adding the values represented by the illuminated lamps.

m. Verify that the LOAD lamp on the control chassis is flashing at approximately a 1-Hz rate.

n. Allow the setup to stabilize for at least 10 minutes.

NOTE

The next two steps are time-critical; read both before proceeding.

o. On the control chassis, position the LOAD SELECT switch to 12 DB and monitor the PT1585.

p. Within 50 seconds, the PT1585 shall indicate alarm reception by a flashing of the RECEIVED MESSAGE lamps corresponding to the channel and code programmed.

q. If proper alarm is observed for the 12 DB position level, position the LOAD SELECT switch on the SM-618/GSQ-160 control chassis to 0 DB and allow the setup to stabilize for at least 5 minutes before proceeding.

r. Position the control chassis LOAD SELECT switch to 10 DB and monitor the PT1585 for alarm indications.

s. There shall be no alarm for at least 50 seconds after switching to the 10 DB position.

t. If all performance is as specified, position the ARMING/RECOVERY switch on the AN/GSQ160 for use.

u. If indications are not as specified, position the ARMING/RECOVERY switch on the AN/GSQ160 to OFF/SAFE, turn power off on all test equipment, remove the AN/GSQ-160, and forward the unit to general support for checkout on the GATE.

2-8. Gross Operability Check at Platoon Level

a. General. This test procedure provides for the testing of the AN/GSQ-160 without the use of special test equipment, such as the OH-29/GSQ160.

b Equipment Required. One AN/USQ-46A.

c Test Area. The test area selected must be an open field free of any targets such as walking personnel, moving vehicles and or any other targets capable of detection by the AN/GSQ-160. The test area must also be free of any radio transmitters.

d. Test Procedure.

(1) Deploy and activate the AN/GSQ-160 as described in paragraph 3-8 (it is not necessary to bury the AN/GSQ-160 under test). Set the AN/GSQ-160 in the continuous mode of operation.

(2) After the AN/GSQ-160 is activated, withdraw to a distance of 200 feet from the unit, wait at least five minutes, and turn on the AN/USQ-46A (TM 11-5820-790-12).

NOTE

If the AN/USQ-46A indicates the identification number of the AN/GSQ-160 under test at turn on, it should not be interpreted as an indication that the AN/GSQ160 is in the proper working condition. A defective AN/GSQ-160 may produce such an alarm at turn on, and an AN/GSQ-160 that is in satisfactory operating condition may not alarm.

(3) After the proper waiting time, walk towards the AN/GSQ-160 under test at a nominal rate of speed, carrying the AN/USQ-46A to a point within 2 feet of the AN/GSQ-160.

e. Interpretation of Results

(1) If the identification number of theAN/GSQ160 under test is observed prior to the end point of the approach in *d(3)* above, the AN/GSQ-160 is operating properly.

(2 If no identification number is observed on the AN/USQ-46A during the approach, check the operation of the AN/USQ-46A and repeat steps *d(2)* and (3) above. The AN/GSQ-160 will be considered defective if it fails the test twice.

(3) Indications of the identification number on the AN/USQ-46A either before or after the approach to the unit under test will be considered as false alarms. This shall not be the basis for considering the AN/GSQ-160 as having failed unless the false alarms are continuous.

APPENDIX B
MAINTENANCE ALLOCATION

B-1. General.

This appendix provides a summary of the maintenance operations covered in the equipment literature. It authorizes categories of maintenance for specific maintenance functions on repairable items and components and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations.

B-2. Maintenance Functions.

Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

b. Test. To verify serviceability and to detect incipient failure of measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition, i.e., to clean, preserve, drain, paint, or to replenish fuel/lubricants/hydraulic fluids or compressed air supplies.

d. Adjust. Maintain within prescribed limits by bringing into proper or exact position, or by setting the operating characteristics to the specified parameters.

e. Align. To adjust specified variable elements of an item to about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipment used to precision measurement. Consists of the comparison of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Install. The act of emplacing, seating, or fixing into position an item, part, module (component or assembly) in a manner to allow the proper functioning of the equipment/system.

h. Replace. The act of substituting a serviceable like-type part, subassembly, module (component or assembly) in a manner to allow the proper functioning of an equipment/system.

i. Repair. The application of maintenance services (inspect, test, service, adjust, align, calibrate, replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module/component/assembly, end item or system.

j. Overhaul. That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (e.g., DMWR) in pertinent technical manuals. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like-new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like-new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours, miles, etc.) considered in classifying Army equipment/components.

i. Symbols. The uppercase letter placed in the appropriate column indicates the lowest level at which that particular maintenance function is to be performed.

B-3. Explanation of Format.

a. Group Number. Column 1 lists group numbers, the purpose of which is to match components, assemblies, subassemblies and modules with the next higher assembly.

b. Functional Group. Column 2 lists the next higher assembly group and the item names of components, assemblies, subassemblies and modules within the group for which maintenance is authorized.

c. Maintenance Functions. Column 3 lists the twelve maintenance functions defined in B-2 above. Each maintenance function required for an item is specified by the symbol among those listed in d below which indicates the level responsible for the required maintenance. Under this symbol is listed an appropriate work measurement time value determined as indicated in e below.

d. Use of Symbols. The following symbols are

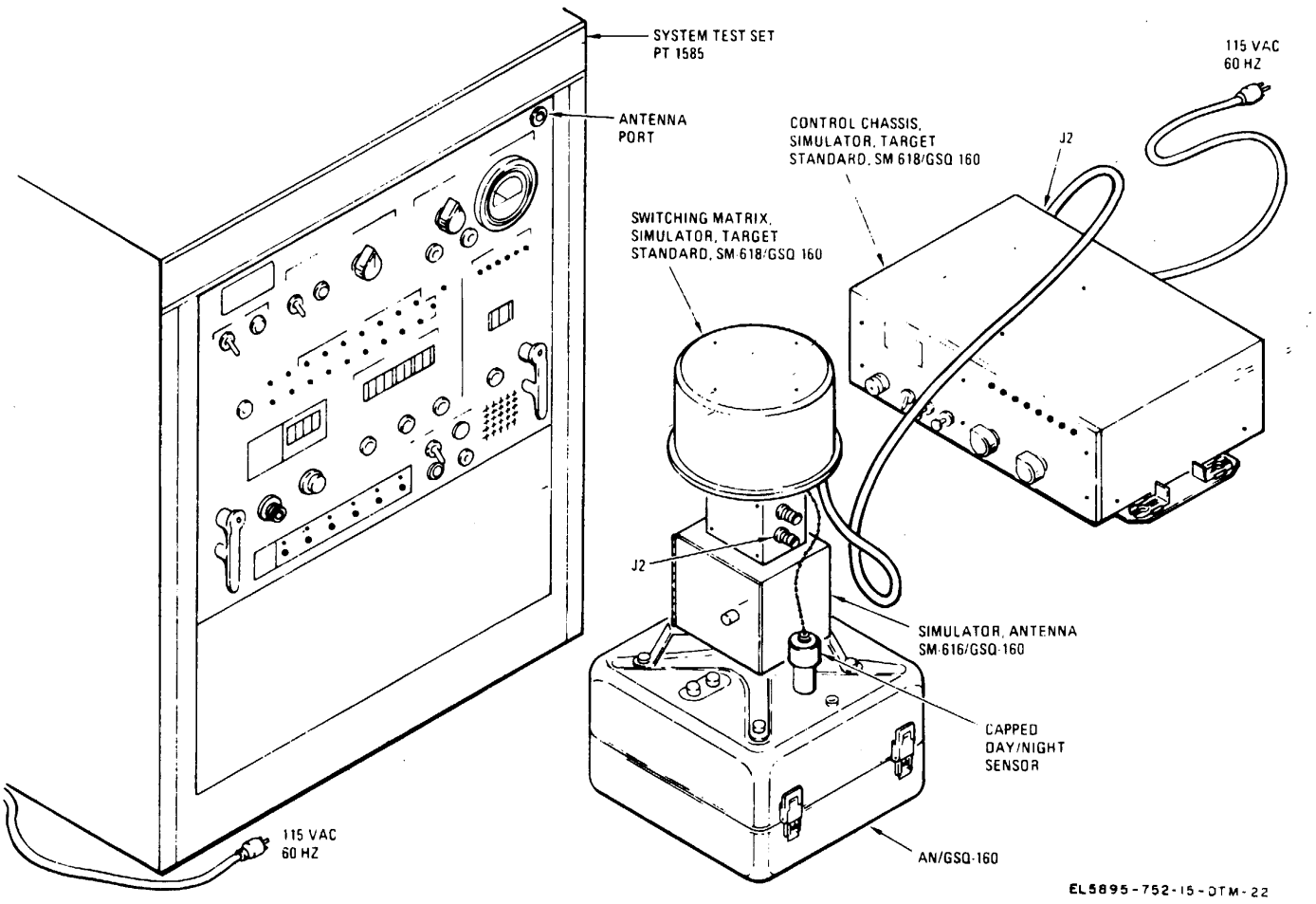


Figure 2-2. Gross operability check setup.

CHAPTER 3
OPERATING INSTRUCTIONS AND DEPLOYMENT

3-1. Deployment of AN/GSQ-1 60

The AN/GSQ-160 can be hand-carried and implanted by one man. Burial with all components except the antenna and day/night sensor below natural grade level and concealment in available natural environments such as grass and foliage are preferred. Deployment in tidal zones may be accomplished with satisfactory operation as lone as the antenna insulator is not immersed. Accidental immersion or periodic and predictable immersion by tidal water does not prevent operation when the antenna insulator is clear of water. D(not use counterpoise wires except in dry soil where conductivity is poor.

a. Site Selection. Selecting the most desirable location for deployment within the immediate area designated can materially improve operation and concealment. Refer to figure 3-1 for detection ranges.

(1) Moist loamy soil is preferred. Dry sand, gravel, and rock are least desirable and may require counterpoise installation.

(2) Open pasture, grassland, and flat terrain are preferable to dense jungle.

(3) Deployment in ravines, gullies, or depressions will reduce the detection range and alarm reception capability.

(4) Dense jungle growth will reduce the detection range.

(5) The area between the AN/GSQ-160 and the monitoring equipment should be free of large hills or structures that degrade alarm transmission.

b. Extreme Conditions. A properly deployed AN/GSQ-160 should operate over its mission life despite rainstorms, occasional immersion, gale winds, and extreme temperatures. Certain conditions, however, will reduce performance or terminate operation prematurely.

(1) Unstable soil or mud may permit the unit to sink, shorting the antenna insulator; or to tilt, triggering the transmitter disable (for units serial numbered 533 and below).

(2) High wave action along a storm shore may contaminate the insulator with dirt or debris, or may tilt the unit to trigger the transmitter disable (for units serial numbered 533 and below).

(3) Heavy salt or dirt deposits accumulating on the antenna insulator will reduce or terminate performance.

(4) Where rocky terrain prevents below grade implant, wedging the case and anchoring the counterpoise wires with large rocks will reduce shifting by wind or animals.

c. Camouflage. Simple camouflage measures will improve concealment and undisturbed operation significantly.

CAUTION

Do not attempt to improve antenna camouflage by repainting, applying body camouflage, or smearing with dirt. These measures will reduce performance.

(1) Reeds, tall grass, and clumps of shrubbery offer good camouflage but should not be closer than 2 feet to the antenna during operation.

(2) The upper section curvature of the antenna should be aligned with the prevailing inclination of tall grass or reeds.

(3) A clump of growth with a clear 2-foot center for implant offers excellent concealment.

3-2. Network Deployment

Typical intruder detection ranges for the ANI GSQ-160 are illustrated in figure 3-1. Two or more AN/GSQ-160's deployed in a network may mutually interfere if sensing signals of one unit influence another unit. The possibility of such interference depends upon the physical distance between the units and the implant conditions of the units involved (fig. 3-2). *For example,* two units

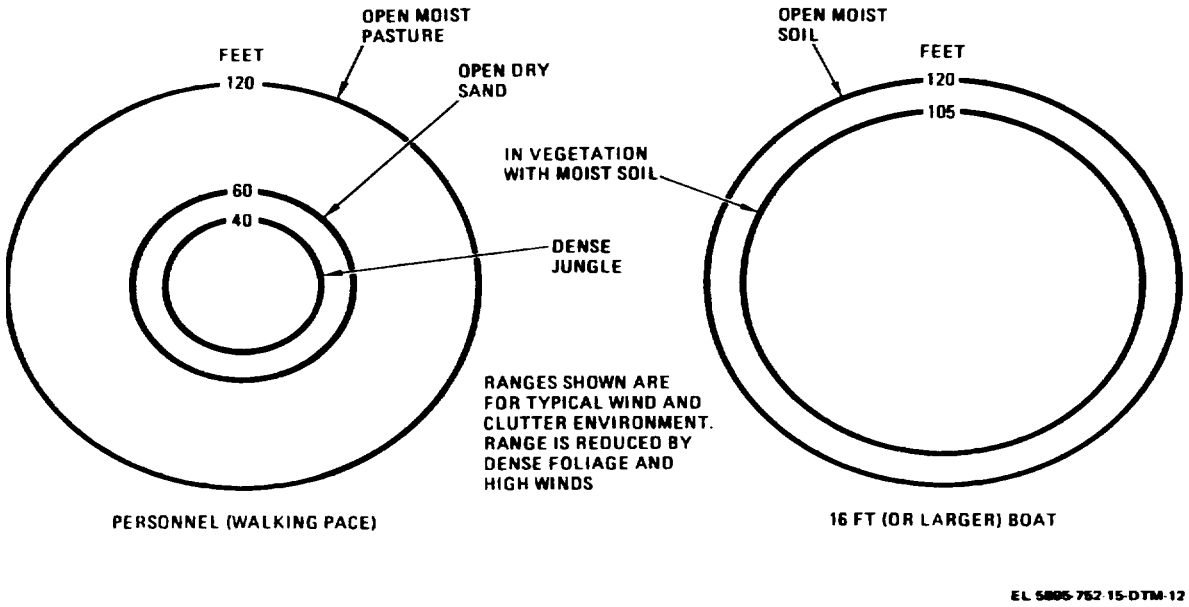
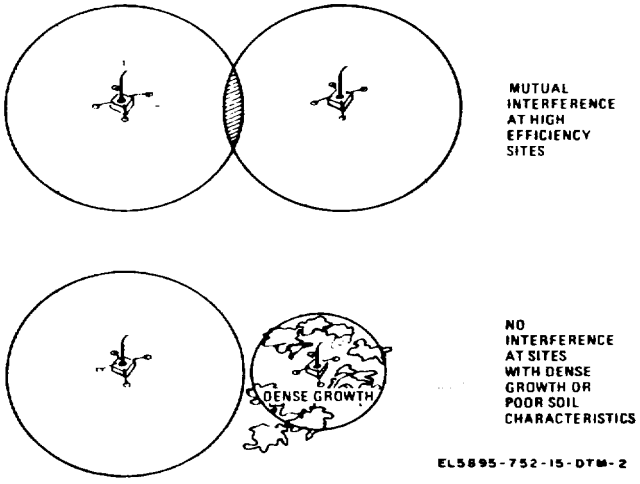


Figure 3-1. Detection ranges for AN/GSQ-160.



deployed in favorable locations (flat grassland with moist soil) might exhibit serious mutual interference when located far apart. Conversely, there may be no interference between units closely spaced in dense jungle. As a result of these considerations, commands planning network deployments must be familiar with the sites under consideration and the expected detection ranges, to optimize intruder detection coverage without mutual interference. After initial deployment, re-deployment of some units may be necessary to achieve the optimum configuration.

3-3. Controls, Indicators, and Sensors

One sensor, three switches, and the antenna protective cap on the top of the case are the only components requiring operator checks and adjustments. Refer to figure 3-3. A tabulation follows.

Control or component	Position	Function
ARMING/RECOVERY switch	OFF/SAFE	De-energizes AN/GSQ-160 for transport, handling, or storage.
	ON/TEST	AN/C S }-160 energized and operating without disable function activated.
	ARM (pull-turn to make; pull-turn to break).	AN/GSQ-160 energized and fully operational with disable function activated.
Antenna protective cap	On antenna connect,	Protection during handling and storage.
	On day/.sight sensor	For continuous AN/GSQ-160 operation.
	Beside deployed case	For night-only AN/GSQ-160 operation.

Control or component	Position	Function
Day/night sensor	Not applicable	Light sensitive element; covered for continuous operation and uncovered for night operation only.
Recovery code switches	1 thhrough 11 and SET (switch 1) A through K and SET (switch 2),	Bypass disable function to permit switching out og ARM mode and recovery when proper code combination is selected.

3-4. Transmitter Disable and Recovery Code Combinations

a. Data transmitter module A7 incorporates a voltage actuated disabling function to prevent unauthorized use of the AN/GSQ. the disabling feature is linked through the supplemental circuits to the ARMING/RECOVERY switch, a tilt switch, a tamper switch, and a battery voltage sensing circuit. the disable feature is operable any time the battery is installed and the ARMING/RECOVERY switch is in the ARM position. Under these conditions, disabling will take place if any one of the following occurs:

(1) Tilting the AN/GSQ-160 in excess of 45° ±8 from its natural vertical position (for units serial numbered 533 and below only).

(2) Separating the upper and lower case.

(3) Moving the ARMING/RECOVERY switch from the AFM position without first setting the recovery code switches to predetermined positions.

(4) Low battery voltage typical of end of life.

(5) A sharp transient acceleration in and direction sustained for more than 300 microseconds (for units serial numbered 53 and below only).

CAUTION

Never assume the battery is good. A unit in storage with low battery will disable as soon as the ARMING/RECOVERY

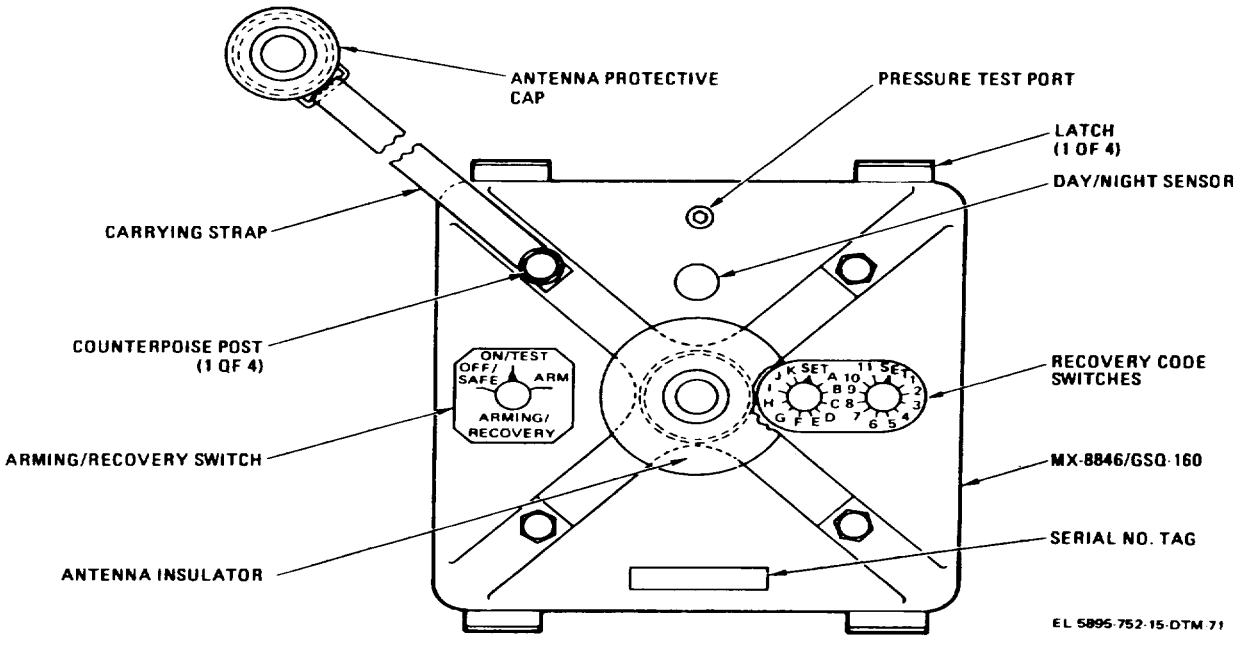


Figure 3-3. Controls and indicators, AN/GSQ-160

switch is positioned to ARM and the low voltage is sensed.

b The two recovery code switches provide the means for bypassing the disable circuits. Each is a 12-position rotary switch; one with positions A through K and SET, the second with positions 1 through 11 and SET. Each AN, 'GSQ-160 has a unique recovery code consisting of a letter and a number, B-5, C-9, etc. The codes are hard-wired into the units. Code identification is stenciled inside the case under the data transmitter. The SET positions are never used as a recovery code. Failure to select the proper code prior to switching from ARM to ON/TEST or OFF/SAFE can result in disable triggering (a above).

3-5. Tools, Equipment, and Materials Required

Deployment, operation, and recovery of an AN/GSQ-160 requires the following:

Item	Nomencature	Purpose
1	Rucksack, MIL-R-43373A, .or MIL-R-43574 (GL)	Carrying equipment.
2	Entrenching tool	Burying equipment.
3	Pliers	Loosening counterpoise capnuts.
4	Knife	Clearing foliage.
5	Terrain map	Specifying location of implant.
6	Post-implanatation test device	Post-implant test.

3. Pre-deployment Checkout

Before proceeding with the deployment, perform the following:

a. Inspect the equipment specified in paragraph 3-5 for serviceable condition.

CAUTION

Be familiar with the information on codes and controls given in paragraphs 3-3 and 3-4 before proceeding. Improper handling may disable the unit.

b. Verify that the ARMING/RECOVERY switch on the AN.'GSQ-160 is in the OFF/SAFE position and that recovery code switches are positioned to SET.

CAUTION

Moving the ARMING/RECOVERY switch from the ARM position before setting the recovery code switches to the correct code combination will disable the unit. With the ARMING/RECOVERY switch set to ARM, tilting the case more than 45° +8, or any sharp shock to the case will disable the unit (for units serial numbered 533 and below only) **or** tampering with the latches of any unit will cause it to disable.

c. Inspect the case, antenna, and counterpoises in accordance with the following:

NOTE

When disposition to the next category of maintenance is necessary, attach a tag indicating the malfunction observed to facilitate correction.

Sequence No.	Item to be inspected	Procedure	Action or paragraph reference
1	Controls	Verify that knobs are secure and set for handling: ARMING/RECOVERY to OFF/'SAFE; recovery code switches to SET.	Return units with loose controls to next category of maintenance. If unit is armed, perform recovery (para 3-9) and return unit to next category of maintenance.
2	Case.....	Inspect for dents or punctures and security of latching.	Any unit with a puncture, crack, or large dent indicative of internal damage shall be dispositioned to higher categories. Small dents and scratches inflicted during casual handling are not usually disabling. Where internal damage is suspected, do not deploy. Return the unit to

Sequence No.	Item to be inspected	Procedure	Action or paragraph reference
			direct support category for permission checkout.
3	Antenna insulator	Inspect for scratches or cracks and connector thread integrity.	The antenna insulator must be clean, and free of cracks or abrasions which may cause leakage or collect dirt, reducing efficiency. No rotation or wobble should be detected under hand stress. Remove the protective cap and inspect the interior of the connector. It must be clean, dry, and undamaged.
4	Handle and antenna cap	Check connection to case and internal threads.	If defective, return to next category of maintenance.
5	Counterpoise lugs	Check capnuts and inspect threads_ _	If defective, return to next category of maintenance.
6	Antenna.....	Inspect for connector or body damage. Check inside of connectors and verify joining of sections.	Minor scratches and handling marks will not affect performance, nor will minor bending or dents in the upper section. However, discard any lower section with dents or visible distortion; these may affect performance severely. Verify that the two sections thread together readily and that all connectors are clean, dry, and un-damaged.
7	Counterpoises	Inspect connectors; unreel and straighten twists or kinks.	Discard and replace units with defective connectors.
8	Recovery code	Verify recovery code is known	Return unit with un-authenticated code to next category of maintenance.

d. Tape or strap the two lengths of antenna together for convenient transport.

e. Replace any defective equipment or tools.

3-7. Transport

The case assembly is provided with a strap handle for hand-carrying individual units. A standard shoulder strap may be attached to the strap handle. One or two units can be carried in a rucksack. The antenna is normally hand-carried; it may be secured to the rucksack frame for transport in unobstructed areas. The counterpoise spools, tools, and post-implantation test device should be stored in the rucksack or on the operator's person to prevent loss and insure ready access.

3-8. Deployment

a. Dig a hole sufficiently deep (6 inches) and wide (8 to 9 inches) to implant the case with the top surface at or just below grade level (fig. 3-4).

b. Place the case in the hole and adjust to as near level as possible. The antenna insulator may be used as a handle.

c Connect the four counterpoise cables to the case posts only if the soil shows no evidence of natural moisture. Retain the capnuts from the posts.

d. Connect the upper and lower antenna sections. Retain the end plugs.

e. Remove the antenna mount protective cap from the insulator and place the cap on the day/ night sensor. Fold the strap handle down to the side.

f. Thread the antenna onto the antenna insulator connector.

g. Clear a 2-foot area around the antenna of branches, vines, or growth which may rub or strike the antenna. Do not remove more growth than absolutely necessary.

h. Extend the counterpoise cables, if required, out from the case in a cross arrangement (90° angles) and bury each cable approximately 2 inches deep.

i. Pack soil around the case flush with the top surface and pack firmly.

j. Proceed with the operating instructions.

k. Attach the post-implantation test device to the upper antenna (fig. 3-5) and orient for convenient flasher viewing from 10 to 16 feet away. Verify that the antenna cap covers the day 'night sensor.

l. Position the ARMING RECOVERY switch to ON, /TEST.

m. Withdraw from the deployed AN'GSQ-160 a distance of at least 10 feet, keeping the flash indicator on the post-implantation test device in view. Wait 5 minutes without moving or gesturing significantly. No flashes from the tester should be observed.

NOTE

Stabilization time for an AN/GSQ-160 is approximately 5 minutes.

n. Walk 10 feet farther away and return to the AN/'GSQ-160 while scanning for light flashes at 5to 10-second intervals from the post-implantation test device. Alternatively, an assistant can walk through the 0to 20-foot range while the immobile operator observes the flasher.

o. If flashes are not observed, repeat the steps in *k* through n above twice. If flashes are still not observed, initiate recovery (para 3-9).

p. If flashing is observed, remove and retain the post-implantation test device.

q. If night-only operation is intended, remove the cap from the day/night sensor and place or conceal beside case.

r. Position the ARMING/RECOVERY switch to ARM. This switch must be pulled to turn it into or out of the ARM position.

CAUTION

Any tilt or heavy shock of the AN/ GSQ-160 while in the ARM mode may trigger the disable function for units serial numbered 533 and below.

s. Position both recovery code switches to SET.

t. Cover the counterpoises and case with soil and vegetation, leaving the antenna insulator clean and clear. Leave at least ½ inch clearance between the bottom of the antenna insulator and the soil. Slope the soil from the insulator to the edges of the case to facilitate drainage. If the cap is off the day/night sensor for night-only opera-

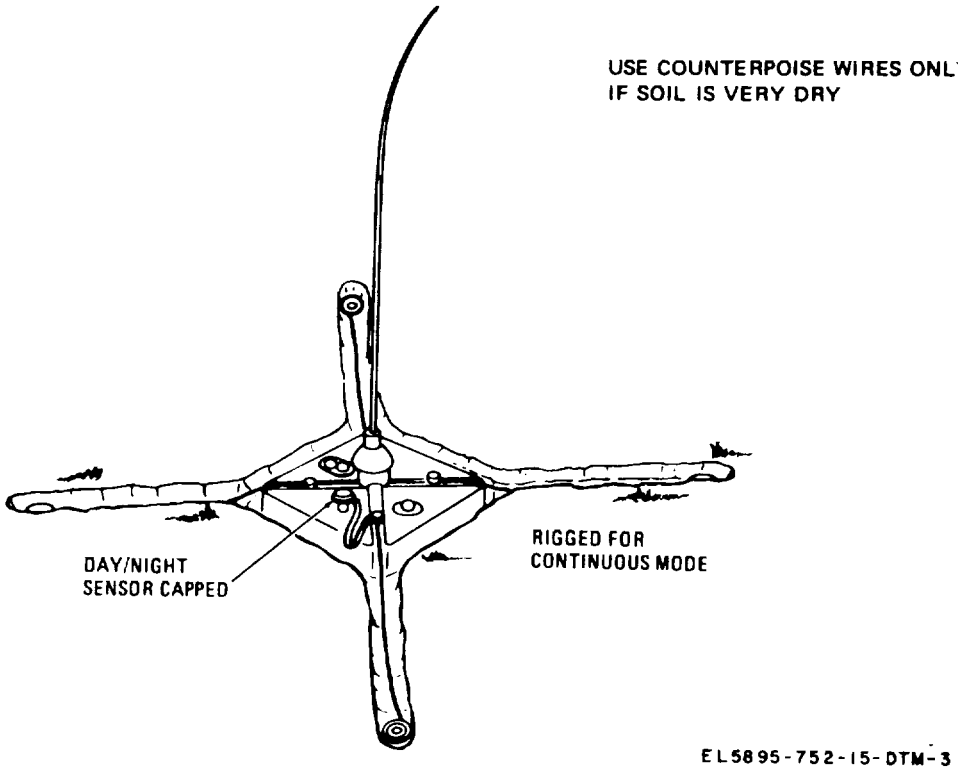


Figure 3-4. Deployment configuration before concealment.

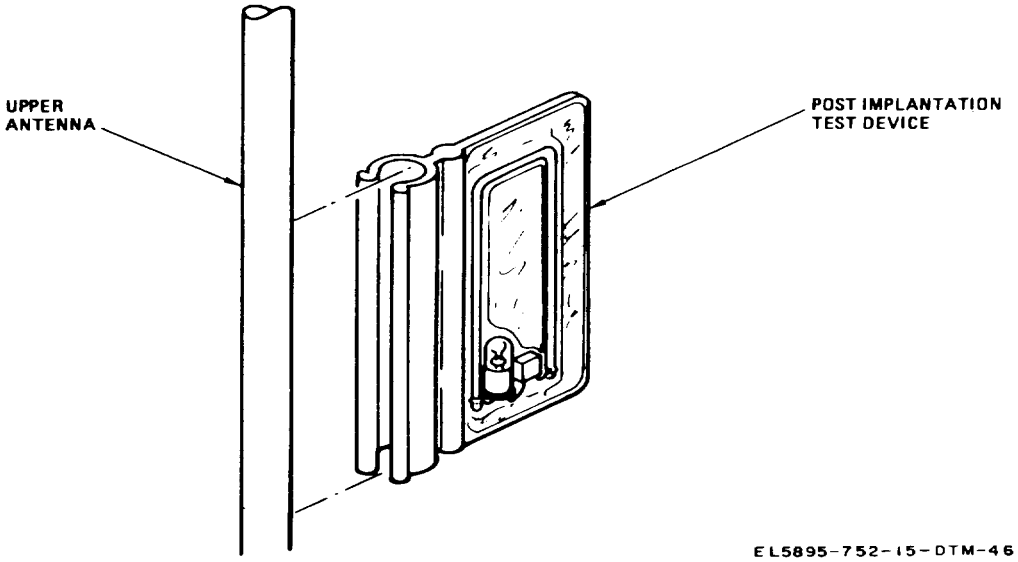
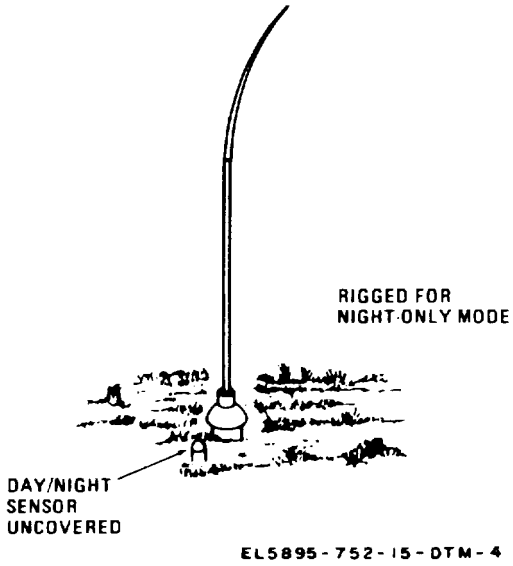


Figure 3-5. Attaching post-implantation test device.



tion, insure that the sensor is not covered (fig. 3-6).

u. Wipe the insulator clean with a cloth and camouflage the site (para 3-1c).

v. Pick up and retain, or bury, all litter and discards before leaving the area.

w. After activation, the unit is capable of continuous unattended operation for 45 full days, or 90 days with night-only operation. Recovery (para 3-9) should be scheduled prior to battery depletion to prevent transmitter disable actuation.

3-9. Recovery

Before attempting recovery, ascertain the recovery code for the unit to be retrieved. If necessary, authenticate the unit serial number against the code list retained at organizational categories. Obtain a small digging tool.

a. Carefully remove soil and vegetation from the top of the unit.

b. Set the recovery code switches to the safe combination. Where switch position marks are obscured, this may be done by turning both switch fully counterclockwise and then rotating clock wise to the code combination by counting switch positions.

CAUTION

Failure to set the recovery code switch combination before proceeding will result in disabling the unit.

c. Position the ARMING, /RECOVERY switch (pull to turn) to OFF/SAFE.

d Disconnect the counterpoise cables from the case and install capnuts, if available.

e. Clear the soil from the sides of the case and lift the case clear of the hole. The antenna insulator can be used as a handle.

f. Unscrew the antenna from the case, separate it into two sections and tape or strap the sections for transport. Install end plugs if available.

g Brush the inside of the antenna protective **c**ap clean and thread the cap onto the antenna connector. The strap can now be used as a carrying handle.

h. The counterpoise wires may be recovered and wound onto the attached spools or discarded.

3-10. Disposition of Recovered Units

AN/GSQ-160 units, including antennas and salvaged counterpoises, shall be returned to direct support categories for refurbishment if significant deployment time has been expended, disablement is suspected, or damage is evident.

CHAPTER 4

FUNCTIONING OF AN/GSQ-160

4-1. Overall Functional Operation

a. Figure FO-3 is a simplified block diagram of AN/GSQ-160 circuits. Sensor oscillator Al produces two frequencies at 57.5 and 60 Mega Hertz (MHz). RF energy at these frequencies is coupled to the antenna through diplexer circuits, part of which are in sensor oscillator A1 and part of which are in antenna coupler A5. The frequencies **a**re radiated continuously when the AN/, GSQ-160 is on, and create a close-coupled radiation field in the proximity of the antenna. When a moving tar**g**et enters the radiation field, the reflected impedance back into the oscillator circuits pulls the oscillators in frequency. The high frequency oscillator is also used as a mixer circuit, and a differential output is developed in the mixer portion of the oscillator circuit which is routed to primary processor A3 as an approximate 2.5 MHz. Leakage of the low frequency 57.5 MHz into the 60MHz oscillator circuit permits development of the difference frequency.

b. The approximate 2.5 MHz is amplified and limited in primary processor A3 prior to being applied to a Weiss-type discriminator circuit. The discriminator develops a bipolar analog output representing any changes occurring in the 2.5 MHz such as produced when a moving target is in the radiation field. The discriminated output is then applied to a bandpass filter, which limits the output to the bandwidth of desired targets (0.04 to 2.0 Hz). This mechanism excludes frequencies that might develop from undesired targets in the radiation field.

c Associated with the bandpass filter in primary processor A3 are two circuits essential to operation, the fast slew circuit and the mute circuit. The fast slew circuit functions as a current source at initial turn-on, and is used to speed up circuit functions as a current source at initial turn-on, and is used to speed up circuit settling time. The mute circuit is used to clamp the primary processor output when an alarm is developed in secondary processor A4. A mute pulse is routed to primary processor A3 and secondary processor A4 which shuts off sensitive circuits during the time when the coded data transmission is being sent. Otherwise, undesired frequency perturbations would be processed through AN/ GSQ-160 circuits during the time of coded data transmission. The mute circuit clamps the bandpass filter for 100 , sec after receipt of the mute pulse, allowing the circuit to settle in preparation for subsequent operations. The mute pulse occurs the same time that the alarm pulse occurs.

d. The input to secondary processor A4 is a 1.2 mv, /Hz signal on a +l-volt dc bias. The input high-pass filter limits any signals below 0.4 Hz, and also removes the direct current (dc) bias. The next stage is a log compression amplifier that produces a log characteristic output from the input signal. This stage normalizes the relationship between background noise and target signals. A clamp circuit associated with the log compression amplifier clamps the stage for 3.5 seconds after mute pulse occurrence. The clamp circuit further assures that no signal processing occurs during and shortly after the time of coded data transmission. Output of the log compressor is routed to the half-wave rectifiers and to the per-cycle limiter.

e. The half-wave rectifier outputs are full-wave combined to feed the bandpass filter. The per-cycle limiter develops a limiting output if a 500-millivolts (mv) rise occurs in the reference input during any half cycle of log compressor output. The effect is to eliminate long duration transients that might cause a false alarm. The bandpass filter is an operational amplifier circuit used to drive a threshold detector and pulse generator circuit. It has a delog network associated with it that expands signals by changing the log characteristic back to linear for a portion of the signal processing. As with the other sensitive circuits, a mute output is applied to the bandpass filter to drive levels below threshold to prevent immediate repeat of alarm transmissions.

f. The threshold detector and pulse generator

comprise the output stage of secondary processor A4, and produce coincident mute and alarm pulses when the threshold level is exceeded. The functions of the mute pulse have already been discussed. The alarm pulse is delivered to data transmitter A7 where it is used to initiate the coded data transmission.

g Data transmitter A7 consists of an encoder, a code plug, and a transmitter. Its output is delivered through antenna coupler A5 to the center conductor of the antenna when an alarm pulse is received. The code (transmitted to a monitor receiver) identifies the particular AN. GSQ-160 being perturbed by a moving target in the antenna field. Transmitted frequency range is 162 to 174 MHz at a nominal RF level of 4 watts.

h. The antenna is a combined end-fed dipole and end-fed monopole for the coded data frequency (162 to 174 MHz), and a base-fed monopole for the 57.5 and 60 MHz used to detect targets. During data transmission, the 57.5 and 60 MHz are on, and some interaction will exist between radiation patterns. This is the principal reason why various critical circuits within the AN GSQ-160 are muted during the time of coded data transmission.

i Supplemental circuits module A2 provides functions for the AN, GSQ-160 which are not primarily concerned with signal processing or alarm generation. The day/night circuit operates with photo sensor V1 to turn the unit on at night and off during daylight. At night, the circuit is enabled by the high impedance of photo sensor V1 to switch on + 4 and -4 volts dc for delivery to other modules and to the ± 2.8-volt dc regulator. In daylight, photo sensor impedance s low and the circuit switches the +4 and -4 volts de off, shutting down the AN GSQ-160. For continuous operation, the photo sensor window (which protrudes from the top of the upper case) is covered.

j. The disable circuit generates a pulse that destroys critical circuitry within data transmitter A7. This pulse is produced when any of the following conditions exist:

(1) The tilt switch closes because the AN/ GSQ-160 has been tilted 45° +8 from its normal vertical position (for models serial numbered 533 and below, only). Time sensing is provided by the tilt circuit, which delays circuit operation until the tilt switch has been closed for 300 sec.

(2) The tamper switch closes after the unit has been set for armed operation. This spring-loaded switch is held open as long as the upper and lower cases are together.

(3) The ARMING. RECOVERY switch is moved out of the ARM position after having been set to ARM. This action delivers a voltage to the disable circuit to produce a pulse.

(4) The voltage monitor circuit has operated from a drop in the + 30-, + 4-, or, -4-volt dc supply. Circuit operation levels are +-21 volts dc ±1, -+3.4 volts dc ±0.2, or -3.4 volts dc ±0.2.

k. When the recovery code switches are set to their proper code, the ARMING. RECOVERY switch is safe to be moved out of the ARM position. This grounds the input from this function and allows the ARMING RECOVERY switch to be placed on the OFF/SAFE or ON/TEST position to permit safe handling of the AN/GSQ-160 without the possibility of destroying data transmitter A7 circuitry. The method used to render data transmitter A7 unusable does not constitute a danger to personnel. A pulse of sufficient duration and amplitude is delivered to data transmitter A7 for burnout of some microcircuit components.

l. Battery BA-1549/U is a standard military type battery that delivers + 30, + 4, and -4 volts dc to the AN/GSQ-160 to supply all power required for 45 days of continuous operation, or 90 days of night-only operation.

4-2. Antenna AS-2542/GSQ-160

a. The data transmission portion of Antenna AS-2542. GSQ-160 has the following characteristics:

Antenna type	Combined end-fed dipole and end-fed monopole.
Frequency range	162 MHz to 174 MHz.
Vswr	2.2:1 maximum throughout operating frequency range.
Input power	6 watts maximum.
Azimuth radiation pattern	Omnidirectional + 1 db.
Elevation radiation pattern	Between 3.5° and 20°, minimum effective radiated power is not less than 7.8 db below power applied at base of antenna.

b. The sensor (57.5 and 60-MHz transmission) portion of the antenna has the following characteristics:

Antenna type	Base-fed monopole.
Frequency range	57.5 to 60 MHz.
Input power	2 milliwatts maximum.
Azimuth radiation pattern	Omnidirectional ± 1 db.

c. The antenna interfaces with the upper case through a type N coaxial connector which is sealed against water leakage at the connector/ case interface joint and at the interface with the coaxial cable. The lower section of the antenna has a corrosion-resistant steel jacket to provide stiffness. The outside diameter of this portion of the antenna is 7 16 inch. No portion of the antenna exceeds 0.5 inch in diameter, exclusive of the type N connector. Overall antenna length is approximately 46 inches.

d. The upper section of the antenna is made from corrosion-resistant steel tubing, and is tipped with an insulator faired to the diameter of the section for camouflage purposes. The antenna is curved to simulate a bending reed, with the bend being a smooth curve with the tip displaced from the vertical by 6 inches +1. The entire length of the antenna is sealed against moisture leakage, and is coated with an insulating material to prevent direct contact with insects.

e. The antenna breaks apart for stowage by a foot soldier, with the stowed length being approximately 32 inches. The antenna weighs 0.5 pound. The unit is designed for assembling in the dark without the need for tools.

4-3. Battery BA-1549/U

Paragraph 1-10 lists the pertinent characteristics of the battery. A guide lug is provided in the lower case so the battery cannot be installed incorrectly. Plug P1 of the housing subassembly, shown on interconnection diagram, figure FO-2, is rigidly installed on the subassembly and is pressed into the battery receptacle as the upper and lower cases fit together. The battery supplies +30-, +4-, and -4-volt dc power for the AN/ GSQ-160 with sufficient capacity to operate the unit continuously for 45 days. Figure 5-2 illustrates the battery.

4-4. Detecting-Transmitting Set Subassembly MX-8846/GSQ-160

a. Figures FO-2 and FO-3 are an interconnection diagram and a functional block diagram, respectively, for the AN GSQ--160. Figures FO-4 through FO-7 are schematic diagrams of the modules. Figure FO-8 contains diagrams for the plug-in integrated circuits used on the modules.

b. The MX-8846/GSQ-160 subassembly contains the following major modules/components, described in paragraphs 4-5 through 4-12.

(1) Sensor oscillator module Al.
(2) Supplemental circuits module A2.
(3) Primary processor module A3.
(4) Secondary processor module A4.
(5) Antenna coupler A5.
(6) Electrical chassis A6.
(7) Code switches, ARMING, RECOVERY switch, and day 'night sensor.

4-5. Antenna Coupler A5

a. Antenna coupler module A5 is essentially a diplexer that couples the 162 to 174-MHz coded vhf transmission, and the 57.5- and 60-MHz signals from the sensor oscillator module, to the AS-2542,/'GSQ-160. Part of the diplexer circuits are physically located in sensor oscillator Al. The design of the diplexer is such that both oscillators in sensor oscillator Al are closely coupled to the antenna. This permits reflections from a target moving in the radiation field to cause sufficient change in the antenna impedance to pull the oscillators in frequency. The change in oscillator frequencies is then processed to develop an alarm.

b. Antenna coupler A5 mounts in the space immediately below the antenna insulator, and provides the means by which a common antenna with coaxial feed can be used both for sensor oscillator and coded data transmission. The 57.5 and 60 MHz are delivered to the antenna on the outer surface of the coaxial cable shield and has the following characteristics:

Impedance	150 ohms maximum (actual value deter- mined by optimum match of sensor oscillators to antenna).
Power	2 mw maximum.

c. The coded data transmission coupled from data transmitter A7 at 162 to 174 MHz is transmitted on the coaxial cable inner conductor and inner shield surface, and has the following characteristics:

Impedance	50 ohms nominal.
Attenuation	0.8 db maximum.

d. Input specifications for antenna coupler A5 are as follows for the coded data transmission from data transmitter A7:

Frequency	162 to 174 MHz.
Power	6 watts maximum (4 watts nominal).
Impedance	50 ohms nominal.

e. Input specifications for antenna coupler A5 are as follows for the sensor oscillator outputs:

Upper frequency	60 MHz +0.3.
Lower frequency	57.5 MHz +0.3.
Power	0.15 to 1.0 mw per oscillator.

4-6. Sensor Oscillator

a. Sensor oscillator module Al provides the two frequencies transmitted by the AN/GSQ-160 to detect moving targets, and the differential frequency output used by subsequent AN/GSQ-160 circuits to produce an alarm. Two Colpitts-type oscillator circuits are used to produce the detection transmission at 57.5 MHz +0.3 and 60.0 MHz +0.3. The low frequency oscillator is the Q3 circuit, and the high frequency oscillator (which is also a mixer) is the Q1 circuit. The differential frequency output is at 2.50 MHz +0.12.

b. Oscillator outputs are routed through the diplexer portion of module Al to antenna coupler A5. The portion of the diplexer within module Al includes the L4 phase-shifting reactance, the C14 phase adjust, and the R6 sensitivity adjust. C14 is a phase adjust used to set the relative' phase of the two oscillator outputs so that both transmissions are in phase at a distance from the antenna of 8 feet +1. This adjustment, in conjunction with the effect of L4, matches the two oscillators to the antenna in such a manner that close proximity sensitivity is reduced, thus maximizing close target rejection ratio (ctrr). The object is to prevent targets or objects that are moving close to the antenna from having a much greater response than they would at more distant ranges. The use of two oscillators permits obtaining this desired characteristic. The R6 sensitivity adjust equalizes signal amplitudes and also provides isolation between oscillator outputs. Both adjustments are set at the factory.

c. The Q1 oscillator/mixer circuit operates as a mixer because there is sufficient coupling of the 57.5 MHz into the collector circuit of Q1 to cause mixing of the two frequencies (57.5 and 60 MHz), resulting in a difference frequency of 2.5 MHz being developed in the Q1 emitter circuit. High frequency components (57.5 and 60 MHz) are present too, so the output impedance of the sensor oscillator plus the input impedance of the next stage (primary processor input) are used to block these components. Characteristics for the output frequency at J2 are as follows:

Frequency	2.50 MHz +0.12.
Amplitude	5 to 200 mv rms.
Output impedance	1K maximum at 2.5 MHz.
Drift	Does not exceed 200 Hz in any 10 sec period after system warmup.

d. Sensor oscillator Al is contained within an RF shielded enclosure to reduce the possibility of electromagnetic interference with other AN/ GSQ-160 modules. The only power required is the 2.8 volts dc applied at P1. Specifications for this voltage are

Level	2.80 vdc +0.13, -0.10.
Operating current	5.0 ma maximum.
Noise	2 mv p-p maximum at 0.04 to 10 Hz.

4-7. Primary Processor A3

a. Primary processor module A3 converts variations in the 2.5 MHz from the sensor oscillator (caused by a moving target in the antenna field) into voltage variations suitable for detection by the secondary processor. The input frequency at P2 is applied to an impedance-matching network that also helps to block any high frequency components (57.5 or 60 MHz) in the input. Next the 2.5 MHz is applied to a differential amplifier circuit consisting of integrated circuit SM-A-588242 and associated components. This circuit amplifies the signal prior to limiting in the Q2-CR9 circuit. Next the signal is applied through the discriminator driver circuit (Q2Q3) to the discriminator. The signal at this point approximates a square wave. The discriminator, which uses an SM-A-588244 integrated circuit, is a Weiss-type discriminator, having associated high and low frequency inductance-capacitance (Ic) tank circuits. These circuits are factory-adjusted for the desired frequencies and consist of L5-C18-C21 (high frequency) and L6-C19-C20 (low frequency). The resulting discrimination curve for frequencies varying above and below 2.5

MHz is a bipolar analog representation varying from approximately -250 mv to +250 mv. Test points TP1 and TP2 are associated with this output as an aid in factory adjustment.

b. The bandpass filter is the output stage of the primary processor, and incorporates an SM-A-588228 integrated circuit. The bandpass filter limits the output bandwidth to those frequencies which would normally be produced by desired targets moving in the antenna field (in this case, 0.04 to 2.0 Hz). This mechanism excludes frequency variations that have been determined to be of no interest. Associated with the bandpass filter are a mute circuit and a fast slew circuit. The mute circuit is a transistor switch (Q3) which clamps the primary processor output during and shortly after receipt of the mute pulse from the secondary processor output. The mute pulse has a duration of 40 µsec, but the charging action on C5 holds the circuit on for 100 µsec, allowing the circuit to settle for the next operation. The principal reason for muting is that the alarm callup pulse from secondary processor A4 (which occurs at the same time as the mute pulse) initiates coded data transmission from data transmitter A7 through the antenna. This transmission disturbs the antenna field, resulting in possible frequency changes in the 2.5 MHz. Thus, it is necessary to short out any resulting affects in the bandpass filter to preclude the possibility of developing adverse voltage levels in the circuit. The fast slew network is also an aid in circuit operation, but is used at initial turn-on rather than during operation. The network (CR8-CR12-CR13CR18 and associated resistors) provides a current source to speed up circuit settling action. Output of the bandpass filter is a 1.2 mv/Hz signal on a + 1-volt dc bias, and is delivered to secondary processor A4 where it develops the mute and alarm pulses.

c. Characteristics of the primary processor are as follows:

(1) *Input signal.*

Frequency	2.50 MHz +0.12.
Level	5 to 200 mv rms.
Source impedance	1K maximum.

(2) *Mute input.*

Pulse width	40, sec +10.
Operate amplitude	--3.1 vdc +1.0.
Mute amplitude	+3.8 vdc +0.3.
Load impedance	25K minimum.

(3) *Output signal.*

Frequency-to-voltage conversion factor	1.20 mv/Hz ±0.2 at 2.5 MHz; 1.20 mv/Hz +0.2, -0.4 mv/Hz from 2.38 to 2.62 MHz.
Dc offset	+1.0 vdc +0.9, -0.2.
Output voltage swing	2.4 v p-p minimum.
Frequency response	3 db down at 0.04 Hz ±0.015 and 2.0 Hz ±0.5.
Output impedance	10 ohms maximum (operational amplifier output).
Load impedance	5K minimum.

(4) *Power requirements.*

	MHz At 2.5 maximum.	From 2.38 to 2.62 MHz maximum
+4 vdc	2.1 ma maximum.	3.5 ma maximum
-4 vdc	2.8 ma maximum.	3.5 ma maximum
+2.8 vdc	0.1 ma maximum.	0.1 ma maximum
-2.8 vdc	2.2 ma maximum.	2.7 ma maximum

(5) *Discriminator output test points (TP1, TP2).*

Use	Two test points for discriminator setup at factory. Test point TP2 is grounded to allow discriminator tuning independent of bandpass filter affects.

(*6*) *Primary output test point (TP3).*

Use	Same signal as output of module but at nominal ground level; connected to GATE test jack.
Frequency-to-voltage conversion factor	1.80 mv/Hz -0.3 at 2.5 MHz; 180 mv/Hz +0.3, -0.6 from 2.38 to 2.62 MHz.
Dc offset	Nominal 0.0 vdc.
Output voltage swing	4.0 v p-p minimum.
Frequency response	3 db down at 0.04 Hz ±0.015 and 2.0 Hz ±0.5.

(7) *Average input frequency test point (TP4).*

Use	Polarity indicates if frequency is above or below nominal zero point of 2.5 MHz; magnitude indicates how far. Connected to GATE test jack.
Frequency-to-voltage conversion factor	For deviations from 2.50 MHz, 9.5 ,μ/Hz.
Dc offset	0.0 vdc ±0.2 at 2.50 MHz.

4-8. Secondary Processor A4

a. Secondary processor module A4 processes primary processor A3 output to discriminate moving target signatures from background noise and to produce a-. alarm pulse and a mute pulse when a moving target is detected. The alarm pulse is used to trigger a coded data transmission from data transmitter A7; the mute pulse is used to minimize AN GSQ-160 circuit reaction to this transmission. The input signal from primary processor A3 is a 1.2 mv/Hz signal on a +i-volt dc bias voltage. The input high pass filter (C1-R3-CR1) removes the bias and limits any signals below 0.4 Hz frequency.

b. The log compression amplifier consists of integrated circuit SM-A-588244 (Z1), Q1, Q2, an amplifier in Z4 (SM-A-588228), and associated components. The circuit produces a logarithmic output characteristic of the input voltage variation. The stage normalizes the relationship between background noise and target signals. The approximate 3-mv to 2-volt input range is changed to about a 200 to 600-mv output. Associated with the log compression amplifier is a clamp circuit (Q2-Q4-Q5) which acts to clamp the log compression amplifier for approximately 3.5 seconds after mute pulse occurrence. Transistor Q4, connected across the input line, is the transistor switch portion of the clamp circuit. The output of the log compression amplifier is applied to half-wave rectifier circuits and to the per-cycle limiter.

c. The half-wave rectifiers consist of integrated circuits Z2 and Z3 (types SM-A-588244 and SM-A-588243, respectively) and associated components. They rectify positive and negative excursions of the input signal to produce a full-wave rectified signal for application to the bandpass filter. The per-cycle limiter consists of integrated circuit Z5 (SM-A-588242), Q6, Q7, and associated components. An axis-crossing detector is used to square the input signal, and this is applied to a comparator circuit which is also sampling the output of the bandpass filter. The comparator produces a limiting output for application to the bandpass filter if a 500-mv rise occurs during any half cycle of input. The effect is to limit any processing of any long-duration, one-way transients, thus reducing the possibility of false alarms.

d. The bandpass filter consists of two operational amplifiers located in Z4 (integrated circuit SM-A-588228) and associated components. The bandpass filter drives the threshold detector so that an alarm is produced for an 11.0 db +1 step increase above the average noise level. Associated with the bandpass filter is a delog network (CR15-CR16-R49) that expands the signal by changing the log characteristic back to linear for certain portions of signal processing. The effect on bandpass filter output is to change the gain characteristic so that a 6-decibel (db) step increase in signal input produces 55 percent +5 of the output produced by a 9.5-db step increase, and the filter output produced by a 10.9-db step increase is 120 percent +5 of the output produced by a 9.5-db step increase. Thus, gain at the desired detection level is accented. As with other critical circuits, the bandpass filter is muted by the mute pulse output of the secondary processor to drive the bandpass filter below threshold level to prevent immediate repeat of alarm transmissions.

e. The secondary processor output stage is the threshold detector and pulse. generator circuit, consisting of Q8, Q10, Q11, and associated components. The actual detection point is the CR27-R64 junction. The circuit produces an alarm output from Q10 and a mute output from Q11 when Q8 goes into conduction from threshold detection. Both signals are positive-going pulses. The mute pulse amplitude is 4 to +4 volts dc with 40-μsec duration. The alarm pulse amplitude is 0 to +6.3 volts dc with 40-μsec duration. The circuit input at C and D of P1 is connected to the A6J5 GATE test connector, and delivers a ground to the base of Q8 to inhibit both mute and alarm pulses for circuit checkout purposes.

f. Characteristics of the secondary processor are as follows:

(1) *Input signal.*

Frequency-to-voltage conversion factor	1.20 mv/Hz +0.2, -0.4.
Dc offset	+1.0 vdc +0.9, -0.2.
Frequency response	3 db down at 0.04 Hz ±0.0015 and 2.0 Hz ±0.5.
Load impedance	8.2K and 470 µf, nominal.

(2) *Mute output.*

Amplitude	For operate, -3.1 vdc ±1.0. For mute, +3.8 vdc ±0.3.
Pulse duration	40 µsec, ±10.
Load impedance	25K minimum.

(3) *Alarm output.*

Amplitude	0 to +6.3 vdc.
Pulse duration	40 µsec ±10.

(4) *Power requirements.*

+4 vdc	1.25 ma maximum.
-4 vdc	1.35 ma maximum.
+2.8 vdc	0.70 ma maximum.
-2.8 vdc	0.70 ma maximum.
+6.3 vdc	0.40 ma maximum during alarm output, 0.20 µa maximum average.

(5) Log compressor output test point (TP1).

Use	Connected to GATE test connector to monitor log compression amplifier output during checkout.
Operate amplitude	-1.0 to +1.0 vdc.
Mute amplitude	0.0 vdc ±0.2 (circuit is muted 3.5 µsec ±1.0 after alarm output).

(6) *Detection alarm threshold test point (TP2).*

Use	Connected to GATE test connector to monitor output of bandpass filter during checkout.
Average value	-1.8 vdc ±0.2, nominal.
Alarm level	+0.05 vdc ±0.1, nominal.
Reset	After alarm, output is driven to -0.50 vdc ±0.20 by mute pulse.

(7) *Noise memory test point (TP3).*

Use	Monitors feedback operational amplifier output in bandpass filter. Indicates average of input to secondary processor, with scale factor of-53 mv/db.
Performance check level	With 40 mv p-p square wave input to secondary processor, test point voltage should be +0.25 vdc +0.50.

(8) *Alarm inhibit test point (TP4).*

Use	Connected to GATE test connector for use in inhibiting mute and alarm pulses during checkout.
GATE output	0.0 vdc during time when secondary processor pulses are to be inhibited.

4-9. Supplemental Circuits A2

a. *General.* Supplemental circuits module A2 contains the following major circuits:

(1) A day/night circuit that operates with photo sensor V1 of the housing subassembly to turn on the AN,/GSQ-160 for night operation and off during daylight.

(2) A ±2.8-volt regulator that is turned on by the day/night circuit.

(3) A tilt circuit that processes the tilt switch output to produce a disable pulse.'

(4) A voltage monitor circuit that monitors the +4-, --4-, and +30-volt dc battery voltage for low voltage condition. A disable output results if low voltage is detected.

(5) A disable circuit that operates from either tilt, tamper, low voltage, or out-of-arm switching inputs to produce a disable pulse that destroys circuitry in data transmitter A7.

b. *Day/Night Circuit.* The day/night circuit consists of Q7, Q9, Q10, Q11, Q13, Q14, and associated components. Photo sensor V1, connected in parallel with R31 in the base circuit of Q7, has low impedance during daylight and high impedance at night. This characteristic is used with the

input voltage divider of the day/night circuit to produce day-to-night switching (turn-on) at 0.2 to 0.3 of the night-to-day switching (turnoff) level of 8 lux +8, 4 .The combination of Q7 and Q9 essentially forms a hysteresis loop the purpose of which is to provide the capability of turning on the day/night circuit at a different point than turnoff. Since Q7 is a very low current path, feedback from the Q9 emitter is used to aid circuit turn-on switching action at the desired level. For continuous operation of the AN/GSQ-160, a cover is placed over photo sensor V1. This causes the day/night circuit to be on continuously from the voltage-divider action of the input circuit. Transistor switches Q13 and Q14 route +4 and -4 volts dc to the modules of the AN/GSQ-160, and also to the +2.8-volt dc regulator.

c. Plus +2.8-Volt Dc Regulator. The +2.8-volt dc regulator circuit provides a regulated +2.8 volt dc output and a regulated -2.8-volt de output from the +4 and i-volt dc inputs from the day/night circuit. The major components of the regulator are the CR9 zener diode, two operational amplifiers supplied as part of the SM-A-588228 integrated circuit, and the Q17-Q18 output stages. Diode CR9 is an LVA56C zener that operates at a 5.6 volts dc 1 percent. The anode of CR9 is tied to -2.8 volts dc and the cathode is tied to +4 volts dc through several dropping resistors. The result is +2.8 reference input from the cathode of CR9 to the operational amplifier in the +2.8-volt dc circuit, and a 0-volt dc monitor voltage from the junction of R57-R58 for the monitor input of the operational amplifier in the -2.8-volt dc circuit. The circuits are arranged to drive the monitor inputs toward the reference inputs through feedback paths from the collectors of Q17 and Q18. The circuit is essentially a load regulator using a single Zener diode as the reference source in conjunction with a fixed point (O volt dc) obtained from a ground input used as the reference input for the -2.8-volt dc operational amplifier.

d. Tilt Circuit. The tilt circuit provides a disable input to the base of the Q6 driver stage when the AN/GSQ-160 is tipped 45° +8 from the normal vertical position for 300 µsec (for units serial numbered 533 and below, only). The S1 tilt switch provides a closure to ground when the switch is tilted, so the R-17-CR1-C6-R30 charge path is used to hold Q5 off for the required time. This action guards against intermittent short-duration grounds from the tilt switch building up a charge at C5 and eventually turning on Q5 as might happen during handling. Transistor Q4 discharges capacitor C5 at any time the ground from the tilt switch is not present. With the ground present, Q4 shuts off, permitting the buildup of charge at C5.

e. Voltage Monitor. The voltage monitor circuit consists of Q1, Q2, Q3, integrated circuit SM-A-588244, and associated components. The circuit uses the +6.3 volts dc from data transmitter A7 for reference and power. Disable output is produced when the +4 volts dc falls to +3.4 volts dc +0.2, the -4 volts de rises to -3.4 volts dc +0.2, or the +30 volts d(falls +21 volts dc +1.

f. Disable Circuit. The disable circuit produces a disable pulse of approximately +3.5 volts dc amplitude and 30,000 ergs energy from disable inputs from the tilt circuit, tamper switch, voltage monitor circuit, or the ARMING/RECOVERY S3 switch when it has been from ARM. The circuit consists of Q8, Q12, Q15, Q16, and associated components. The circuit is arranged as a one-shot multivibrator, and is driven by driver circuit Q6. As long as the ARMING/RECOVERY switch is in the ON/TEST or OFF/SAVE position, the tilt and disable circuits will not operate because no 4 volts dc is being applied through the switch. This action permits safe handling of the AN,/GSQ-160 until the ARMING/RECOVERY switch is set to ARM. Also, if the recovery code switches are set to their proper code positions, a grounding input is furnished to the input of Q12, which prevents a disable pulse when switching out of the ARM position. The disable pulse destroys microcircuit components in the data transmitter; no danger to personnel results from such action.

g. Characteristics of Supplemental Circuits Module.

(1) Power requirements.

Input	*Output*
+4.00 vdc ±0.05 at 8.7 to 9.1 ma.	+4.0 vdc output at 3.3 ma +2.8 vdc output at 5.55 ma.
-4.00 vdc ±0.05 at 7.9 to 8.3 ma.	-4.0 vdc output at 4.1 ma -2.8 vdc output at 2.9 ma.
+6.3 vdc ±0.1 at 0.8 to 1.1 ma.	None (used within module).
+30 vdc +0.0, -1.0 at 13 to 17 µa.	None (used within module).

(2) *±2.8 vdc regulator.*

Inputs	+4 vdc and -4 vdc from day/night circuit.
Outputs	+2.8 vdc +0.13, -0.11 and -2.8 vdc -0.13, +0.10 for load currents of 2.5 to 8 ma, each output.
Voltage differential	5.6 vdc +0.25, -0.20 between +2.8 and -2.8 vdc outputs.
Line regulation	15 mv maximum at each output for line variations of +3.4 to +4.16 vdc.
Noise	Less than 2 mv p-p from 0.04 to 10 Hz.

(*3) Day/night circuit.*

Switching levels	Circuit activation by input voltage representing night-to-day level of 0.2 to 0.3 of night-to-day level. Circuit deactivation by input voltage representing night-to-day level of 8 lux +8, -4 incident on the photo sensor. Input voltages +4 vdc +0.2, -0.4; -4 vdc -0.2, +0.4; +6.3 vdc ±0.2 (from common module).
Output voltages	When circuit is on, 0.02 to 0.2 vdc less than value of applied +4 and -4 vdc inputs for output currents between 2.5 and 10 ma dc. When circuit is off, 10 µa maximum.

4-10. Electrical Chassis

a. Electrical chassis module A6 contains the jacks and wiring to interconnect the modules of the AN/GSQ-160. Monitor points for various key voltages/signals are brought out to the J5 GATE test connector. The chassis also contains two switches, the S1 tilt switch and the S2 tamper switch.

b. Circuitry is straightforward and can be understood from inspection of the interconnection diagram, figure FO-2. Tilt switch S1 closes when the unit is tipped 45° +8 from the normal vertical position, routing a ground to the tilt circuit in the A2 supplemental circuits. This tilt circuit produces a disable output if the switch is closed for 300 µsec, if the circuit has been enabled by setting the AN/GSQ-160 for armed operation. Thus, the tilt switch cannot produce a disabling output unless the ARMING/RECOVERY switch on the housing subassembly is set to ARM.

c. Tamper switch S2 is spring-loaded to stay open as long as the upper and lower cases of the AN/GSQ-160 are together. When the cases are opened, the switch goes to its normally-closed position, delivering -4 volts dc to the disable circuits of supplemental circuits A2. As with the output of S1, the disable function is not operable unless the AN/GSQ-160 is armed.

4-1 1. Housing Subassembly

a. The housing subassembly contains three components of the AN/GSQ-160 electrical circuits. These are the S1 and S2 recovery code switches, the S3 ARMING/RECOVERY switch, and photo sensor V1 (also referred to as the day/night sensor).

b. The 12-position rotary recovery code switches are mounted in the upper case and are externally accessible for control. Switch S1 is labeled A through K and SET; switch S2 is labeled 1 through 11 and SET. The SET positions are never wired together. All other combinations may be wired together, for example B of S1 to 10 of S2. When the switches are set to their designated recovery positions (peculiar to unit), a ground is routed through the unit to the disable circuit of the A2 supplemental circuits. This nullifies one effect of the disable circuit and no disable output can be produced to destroy circuitry within data transmitter A7.

c. The S3 ARMING/RECOVERY switch is also mounted in the upper case and is externally accessible for control. The switch is a three-position rotary switch with OFF/SAFE, ON/TEST, and ARM positions. The OFF/SAFE position disconnects +4 and 4 and +30 volts dc operating voltages to the unit, and also to the voltage monitor circuit supplemental circuits A2. The ARM position continues all the voltage application, and also provides -4 volts dc to the tamper switch and the tilt and disable circuits of supplemental circuits A2. Once armed, the ARMING/RECOVERY switch routes +4 volts dc to the disable

circuit if the switch is moved out of the ARM position.

d. Photo sensor V1 (day/night sensor) has high impedance at night and low impedance during daylight. This characteristic is used with the input voltage divider of the day night circuit in the A2 module to accomplish switching at the desired light intensities. The sensor is mounted under a raised, sealed window in the upper case so that when the AN, GSQ-160 is emplaced, light impinges on the sensor. For constant operation, a cover is placed over the window.

4-12. Data Transmitter A7

a. Data transmitter A7 consists of a TC431 encoder, a TC432 code plug and a modularized transmitter. (Refer to para 1-6),! for different transmitter types employed.) The code plug and encoder together produce either a short code (18 bits) or long code (24 bits) for application to tile modularized transmitter. The code is used to frequency-shift key (fsk) modulate the modularized transmitter center frequency so that a coded data transmission is produced for application to the antenna. The modularized transmitter is crystal controlled at a center frequency in the range from 162 to 174 MHz, and produces a nominal 4-watt output. The crystal can be easily changer to obtain the desired center frequency.

b. The TC431 encoder functions primarily to produce either a short code (18 bits) or long code (24 bits) for modulating the TC434 transmitter. Other functions include generating regulated 5.5 volts dc for internal use and regulated +1-6.3 volts de for both internal and external use. Switching circuits apply power to the transmitter and enable code circuits when the alarm pulse is received from secondary processor A4. Also, a destruct circuit renders the code-producing circuits inoperable when a disable pulse is received from supplemental circuits A2. The encoder has an internal 4,800-pulse-per-second (pps) clock, with bit rates of 75 or 300 pps as selected by the code plug.

c. The TC431 regulator circuit furnishes +6.3 volts dc ±0.2 and a -5.5 volts dc ±0.3 from the 30-volt dc input from the AN/GSQ-160 ARMING/RECOVERY switch. Input can range from 20 to 30 volts dc, and maximum continuous current is specified as 16 ma for the -I 6.3 volts dc, 1 ma for the -5.5 volts dc. Power characteristics for the module are as follows:

Standby power	1 mw for the 1-6.3 vdc; 0.5 mw for the -5.5 vdc; 0.5 mw for the +30 vdc.
Peak power	25 mw for the +6.3 vdc; 500 mw for the +30 vdc when the transmitter is drawing 500 mw.

d. The alarm callup pulse from secondary processor A4 is applied to switching circuits within the TC431 encoder. These circuits switch the applied 130 volts dc to the modularized transmitter to turn it on, and also apply the regulated +6.3 volts dc to an AND gate chain in the encoder, which produces the characteristic code output. Alarm pulse specifications are as follows:

Polarity	Positive pulse from ground to 5.9 vdc ±0.4.
Pulse width	50 µsec to 50 µsec.
Input impedance	3K in series with P-channel MOS gate and 250K resistor in parallel with 100 pf capacitor to ground from the gate for noise rejection.

c. The split phase output of TC431 is routed to the modularized transmitter for frequency-shift keying of the carrier, and has the following characteristics:

Mark code level	5.0 to 6.3 vdc.
Space code level	0 vdc t1, -0.
Output impedance	1K for 6.3 vdc, and open to ground.

f. The long code enable from the TC432 code plug is a dc level which has the following characteristics for the duration of one complete digital frame of the encoder:

Long code enable	5.5 to 5 6.3 vdc.
Short code enable	0 vdc, ground potential, or open circuit.
Input impedance	3K in series with 250K parallel by 100 pf capacitor to ground.

g. The TC432 code plug consists of diode-resistor' pairs which program the TC431 encoder to produce the characteristic code pattern that identifies the particular AN GSQ-160 being perturbed by a moving target in the antenna field. The code is developed in the TC431 after application of the

alarm pulse. The TC432 code plug has provisions for programming a decoder and regulating a gain circuit; however, these functions are not used in the AN/GSQ-160 application.

h. The code plug provides 11 output addresses for the encoder, which enable encoder operation in a fixed manner without use of the decoder furnished for some applications. The 6.3 volts de obtained from the TC431 operates the code plug. Along with the logic outputs of the code plug, a bit rate select and long-or-short code enable is furnished to the encoder. When the bit rate select output is high (5.5 to 6.3 volts dc), bit rate is selected as 75 pps. When this output is low (open or ground), bit rate is selected as 300 pps. The long-or-short code enable sets the encoder for either a long code (24 bits) or short code (18 bits) from high (5.5 to 6.3 volts dc) or low (open or ground) output levels, respectively.

i. The modularized transmitter is a crystal-controlled vhf transmitter operating in the frequency range from 162 to 174 MHz. Modulation can be frequency modulated (fm) or fsk, and the nominal RF power output is 4 watts into a 50-ohm load for input power supply variations between +22 and +-30 volts dc. Minimum RF power output for these conditions is 2 watts. The unit can operate from supply voltages varying between 20 and 30 volts dc, with RF power output specified as not less than 1 watt for a +20-volt dc supply voltage. Input power requirement is a maximum of 13 watts or 430 milliamperes (ma).

j. The modularized transmitter can operate at any center frequency between 162 and 174 MHz, with center frequency being determined by a voltage-controlled crystal oscillator. Channel spacing is specified as 18.75 kilocycles per second (kHz).

(1) Specifications for operation are as follows:

Input format	Split phase (no dc component).
Bit rate	75 to 300 bps.
Mark deviation	+3.0 kHz (-10 percent) from carrier frequency.
Space deviation	3.0 kHz (+10 percent) from carrier frequency.
Risetime and falltimes	Risetime and falltimes for either mark or space deviations are within 0.3 µsec maximum and 0.1 µsec minimum.
Overshoot	Does not exceed 10 percent of peak mark or space deviation.
Mark input level	6 vdc +1.
Space input level	0 to 1 vdc.
Input impedance	100K.

(2) Overall characteristics of the transmitter are as follows:

Frequency range	162 to 174 MHz.
RF output	4 watts, nominal.
RF load impedance	50 ohms, nominal.
Vswr	5:1, maximum.
Spurious outputs	For frequencies of 400 MHz and below, spurious outputs are at least -40 db below the unmodulated carrier level. For frequencies above 400 MHz, spurious outputs are at least -35 db below unmodulated carrier level.
Turn-on time	5.0 µsec maximum, 0.5 µsec minimum.
Turnoff time	5.0 ,sec maximum, 0.3 µsec minimum.
Polarity protection	Polarity reversal of dc input does not cause permanent damage of unit.
Explosive disable	Provision is made for explosive destruction, but is not used.

CHAPTER 5

DIRECT SUPPORT MAINTENANCE

Section I. GENERAL

5-1. General

a. This chapter provides all data, instructions, and procedures required by direct support (DS) maintenance personnel as indicated by the maintenance plan and the maintenance allocation chart (MAC) for the AN/GSQ-160. This category of maintenance includes service upon receipt, checkout, routine preventive maintenance; fault isolation with System Test Set PT1585; inspection, mechanical refurbishment of knobs, antenna, seals, gaskets, and detachable cable assemblies; and repainting. Plug-in type printed circuit board modules shall be replaced when defective; faulty plug-in modules will be dispositioned to depot and not repaired. Circuit boards and components soldered or otherwise attached as integral parts of subassemblies shall not be removed at DS categories.

b. Maintenance personnel must be familiar with chapters 3 and 9 of this publication and with the technical manuals for the equipment specified in paragraph 5-2 before attempting maintenance operations.

CAUTION

An AN/GSQ-160 contains components susceptible to damage if improper voltages are applied or procedures for handling are not observed. The ARMING/ RECOVERY switch must be set to OFF/SAFE before attempting maintenance. If not, the recovery procedures of paragraph 3-9 must be performed to insure that all switching, disable, and antitamper features are in a safe configuration.

5-2. Tools, Test Equipment, and Materials

a. Required items are listed in the maintenance allocation chart (app. B) and the repair parts and special tools list (RPSTL) which are contained in appendix C.

b. Information on items needed is contained in the following listing:

Item	Nomenclature	Publication
1	Tool Kit, Electronic Equipment TK-105/G	SC 5180-91-CL-R07
2	Multimeter TS-352B/U	TM 11-6625-366-15
3	System Test Set PT1585	TM 11-6625-2514-1
4	Test Device, Post Implantation	
5	Simulator Group OH-29/GSQ-160	Chapter 9
6	Electronic Voltmeter ME-202/U	TM 11-6625-537-15
7	Code Plug Programmer PT1561	TM 11-6625-2514-14-2
8	Trichloroethane	Not applicable

Section II. PREVENTIVE MAINTENANCE INSTRUCTIONS

5-3. Preventive Maintenance

a. General. Preventive maintenance at direct support consists of cleaning, inspection, and refurbishment of AN/GSQ-160 units recovered from deployment, the maintenance of required storage facilities for new and refurbished AN/ GSQ-160 units, data transmitters, and batteries, and repainting and retouching. No lubrication is required.

Sequence No.	Item to be inspected	Procedure	Action or paragraph reference
1	Controls	Verifying ARMING/RECOVERY switch is set to OFF/SAFE.	If not set, set recovery code switches to specified code and position ARMING/RECOVERY switch to OFF/SAFE.
2	Exterior of AN/GSQ-160	Visual inspection	Tag punctured or dented cases and refer to higher category of maintenance.
3	Latches	Verify tension	Cases with loose or broken latches shall be tagged for higher category of maintenance.
4	Battery	Disconnect, remove, and discard	Paragraph 5-9a.
5	Lower case interior	Inspect interior for corrosion, dirt, or moisture	Clean and refurbish; para 5-4
6	Upper case	Remove data transmitter module A7	Para 5-10.
7	Upper case	Remove coverplate and electrical chassis.	Para 5-11. Clean per para 5-4 if required.
8	Circuit boards A2, A3, A4, and A5	Remove, inspect, clean, and replace	Paras 5-14 and 5-4. Discard and replace damaged or suspected boards.
9	Control knobs	Inspect and tighten	None.
10	Antenna insulator	Inspect for damage and hand torque to check mounting	If damaged, tag for higher ca
11	Antenna connector	Inspect and clean	Para 5-4. If damaged, tag for higher category of maintenance.
12	Day/night sensor window	Inspect for damage and torque to check mounting.	If damaged, tag for higher category of maintenance.
13	Test connector A6J5	Inspect and clean	If damaged, tag for higher category of maintenance.
14	Battery connector P1	Inspect and clean	Para 5-4. If damaged, tag for higher category of maintenance.
15	Gaskets	Inspect and clean mesh and sealing gaskets	Para 5-4; if damaged, tag for higher category of maintenance.
16	An/GSQ-160	Checkout	Permission checkout (para 2-4).

5-4. Cleaning

a General. Procedures for cleaning all extern and internal components and subassemblies of the AN, GSQ-160 follow. Internal cleaning should n(be performed unless the need is obvious. Trichlroethane is the only cleaning agent authorized f(electronic equipment.

WARNING

The fumes of trichloroethane are toxic. Provide thorough ventilation whenever used. DO NOT use near an open flame. Trichloroethane is not flammable, but exposure of the fumes to an open flame converts the fumes to highly toxic, dangerous gases.

WARNINGS

All components cleaned with trichloroethane shall be thoroughly dry before use or assembly. Failure to comply may result in damage to equipment or injury to personnel due to fumes.

b. Exterior. Always clean the exterior of the AN/GSQ-160 before releasing the latches to keep dirt from falling inside. A latched case with the antenna or the protective cap installed may be washed with water but must be thoroughly dried before opening to prevent drippage into the interior.

c. Controls.. Dirt or debris on the switch plates and under the switch knobs should be washed off or brushed free before attempting operation to insure legibility and proper switch functioning.

d. Antenna Insulator. Dust may be removed with a soft cloth: caked dirt or mud may be removed with water. For vegetation or insect deposits, clean with trichloroethane. Also, clean the underside of the insulator.

e. Antenna Connectors.. The interiors of the connectors may be l]blown or brushed free of loose

dirt and then cleaned by pouring a small quantity of trichloroethane into the connector and shaking it out. Dry the connector thoroughly before use or capping.

f. Day/Night Sensor. Brush or wipe the sensor window to remove dust and dirt. Remove heavy deposits with water or trichloroethane and a soft cloth.

g. Battery Box. Separate the battery and battery box for cleaning. Brush interior with a cloth moistened with trichloroethane. Blow dirt from battery connector P1 with low-pressure air. The foam pads in the case may be brushed and wiped free of surface dirt. Do not attempt to flush heavy dirt from the pads by saturation with water or cleaning agent. Heavy accumulations in the mesh electrical gasket around the rim of the case may be flushed out with a small quantity of trichloroethane poured into the flange with the case inverted; turn the case upright and rap it smartly on the bench to drain the flange. Be certain the box and new battery are completely dry before assembly and use.

h. [Upped Case. Remove data transmitter module A7 and disconnect the ring connector and output connector. Remove electrical chassis; do not disconnect. Wipe the inner surfaces of the upper case and the foam pads with a cloth moistened with trichloroethane. Clean the rotary switches *(k* below). Clean the pressure seal gasket around the rim by brushing out loose dirt and wiping with trichloroethane moistened cloth.

i. Electrical Chassis. Remove the circuit boards for sensor oscillator Al, supplemental circuits A2, primary processor A3, and secondary processor A4 and clean in accordance with j below. Interconnect board A6 then may be cleaned with a brush moistened with trichloroethane. Avoid saturating the assembly and the attached wires and harnesses.

j. Circuit Boards and Contacts. The shield cover on sensor oscillator Al is sealed to the board; do not remove; do not allow trichloroethane to flood the seal or the holes in the cover that are used for factory adjustments. Circuit boards may be cleaned with a brush moistened with trichloroethane. Avoid saturating; thorough drying is mandatory. Do not attempt to clean the contact pins on circuit boards unless deposits or corrosion are conspicuous. Clean the pins with fine crocus cloth; be careful to avoid bending or changing the shape or diameter of the pins.

k. Switches. All switches in the AN/GSQ-160 are sealed. Do not attempt to disassemble for cleaning or service. Brush dust or dirt from between the contact solder lugs and from the bodies of the switches.

CAUTION

The three segments comprising data transmitter module A7 and its ring connector P1 use small diameter, precision-fit pin contacts. Do not attempt to clean or adjust. When dirty or faulty connections are suspected, replace the entire connector or segment.

l. Connectors and Plugs. Circuit board connectors and the female sections of harness plugs should be brushed clean whenever possible. For extreme cases, flush with a small quantity of trichloroethane, drain thoroughly, and blow dry with low-pressure air.

5-5. Ready Storage

a. General. Requirements for the storage of AN/GSQ-160 units, Batteries BA-1549/U, or data transmitter modules A7 are not severe. Observing the precautions outlined below will minimize casual damage and insure that components are available for speedy deployment.

b. Battery BA-1549/'U. Used or suspected batteries shall never be stored or otherwise retained. Batteries shall be stored in cool, dry locations with good ventilation and protection against moisture and storm damage. Storage in the original cartons on open shelving well off the ground is preferred. If the original cartons were not retained, place tape over the pin sockets of connector P1 before placing the battery in storage. Batteries in storage for extended periods shall not be installed in AN/GSQ-160 units for deployment without permission checkout (paras 5-7 and 2-4). Batteries shall not be stored in AN/GSQ-160 cases unless immediate premission checkout and deployment is contemplated.

c. Case, Antenna, and Counterpoises. These units should be stored in operational groups or sets. Avoid subjecting units to extreme heat, severe environmental conditions, or casual accidental damage. Antenna AS-2542/'GSQ-160 should be separated into upper and lower elements with protective caps installed on the connectors. The two elements may be taped together for ease in handling and storage. Detecting-Transmitting Set

Subassembly MX-8846 GSQ-160 should be securely latched to Battery Box CY-7046/GSQ-160, have the counterpoise post lugs securely attached, and the antenna protective cap in place. A tag shall be attached specifying the recovery code, the transmitter code, and the transmitter channel. The counterpoises (four for each AN GSQ-160) should be in a small bag attached to the case.

d. Date Transmitter A7. Store these units in cool, dry locations that offer good protection against temperature and environmental extremes. Whenever possible, store these units in the padded cartons in which they were received and take measures to preclude physical damage to cartons or contents. If the cartons were not retained or are damaged, find a suitable equivalent or store the modules by installing them in the compartments of the AN/GSQ-160 units where they are operationally housed. When this is done, the tag on the unit should be clearly marked to specify the inclusion of the module.

5-6. Repainting and Retouching

NOTE

Instructions for painting are contained in TB 746-10.

CAUTION

Do not prime or paint gaskets, seals, the antenna insulator, threaded connectors, the antenna connector, or the clear spot on the day/night sensor window. Failure to comply will impair the performance of the AN/GSQ-160.

a. Scratched or damaged areas shall be smoothed and cleaned with fine sandpaper.

b. Prime the area to be painted with one coat of epoxy-polyamide primer, MIL-P-23377. Allow to dry.

c. Paint primed area with two coats of epoxy-polyamide coating per MIL-C-22750, Class **2:** Color; Olive-Drab Green, No. 34087 per Federal Standard FED-STD-595.

d. Camouflage colors other than that specified in c above may be employed if they comply with MIL-C-22750 and FED-STD-595.

Section III. CHECKOUT AND TROUBLESHOOTING

5-7. Battery BA-1 549/U Checkout

Batteries held in long-term storage, and for which GATE checkout is not desirable, may be checked as follows. Battery checkout is mandatory prior to installation in AN GSQ-160. Batteries with out puts less than specified shall be discarded.

a. Collect a 400-ohm resistor across the test leads of Mutilmeter TS-352B U and measure between the X 4 volts dc and COM pins, and between the -4 volts (Ic and COM pins, on Battery BA-1549 U. Both indications shall be at least 3.9 volts dc.

b. Connect a 3.7K-ohm resistor across the leads of Multimeter TS -,3)2B U and measure between the t 30 volts de pin and COM on Battery BA-1;)49 U. The indication shall be at least ’29 volts dc.

5-8. Troubleshooting

a. Troubleshooting at direct support shall be confined to radar repairman checks that confirm operator reported malfunctions and correct faults by data transmitter module A7 removal and replacement, and authenticate codes and frequency channels. Troubleshooting and malfunction correction shall be accomplished using System Test Set PT1585 and components of Simulator Group OH-29/GSQ-160. Procedures shall be as follow s:

b. Inspect and refurbish (para 5-3).

c. Premission checkout (para 2-4).

d. Remove and replace defective plug-in modules detected during premission checkout (para 2-4).

e. Disposition units not repairable by plug-in module replacement to category of maintenance.

Section IV. REMOVAL AND REPLACEMENT

CAUTION

Position the recovery code s-witches to the recovery code combination and the ARMING ’RECOVERY switch to OFF/ SAFE before attempting any removal and replacement.

5-9. Battery BA-15491U

WARNING

Battery BA-1549/U contains mercury and must be handled in the following manner:

Do not dispose of in fire.

Do not short circuit.

Return expended batteries to Property Disposal Officer for disposal in accordance with DLSC Handbook 416Q1.

a. Open the four latches that secure the upper MX-8846/GSQ-160 to Battery Box CU-7046/GSQ-160 and separate the cases (fig. 4-1).

b. Lift battery from Battery Box CX-7046/GSQ-160 (fig. 4-2).

c. Align replacement battery detent with the lower case index pin to insure proper installation and insert replacement battery into lower case.

d. Insure that battery connector P1 in upper case is mated with battery connector in lower case.

e. Align upper case with lower case and fasten four latches.

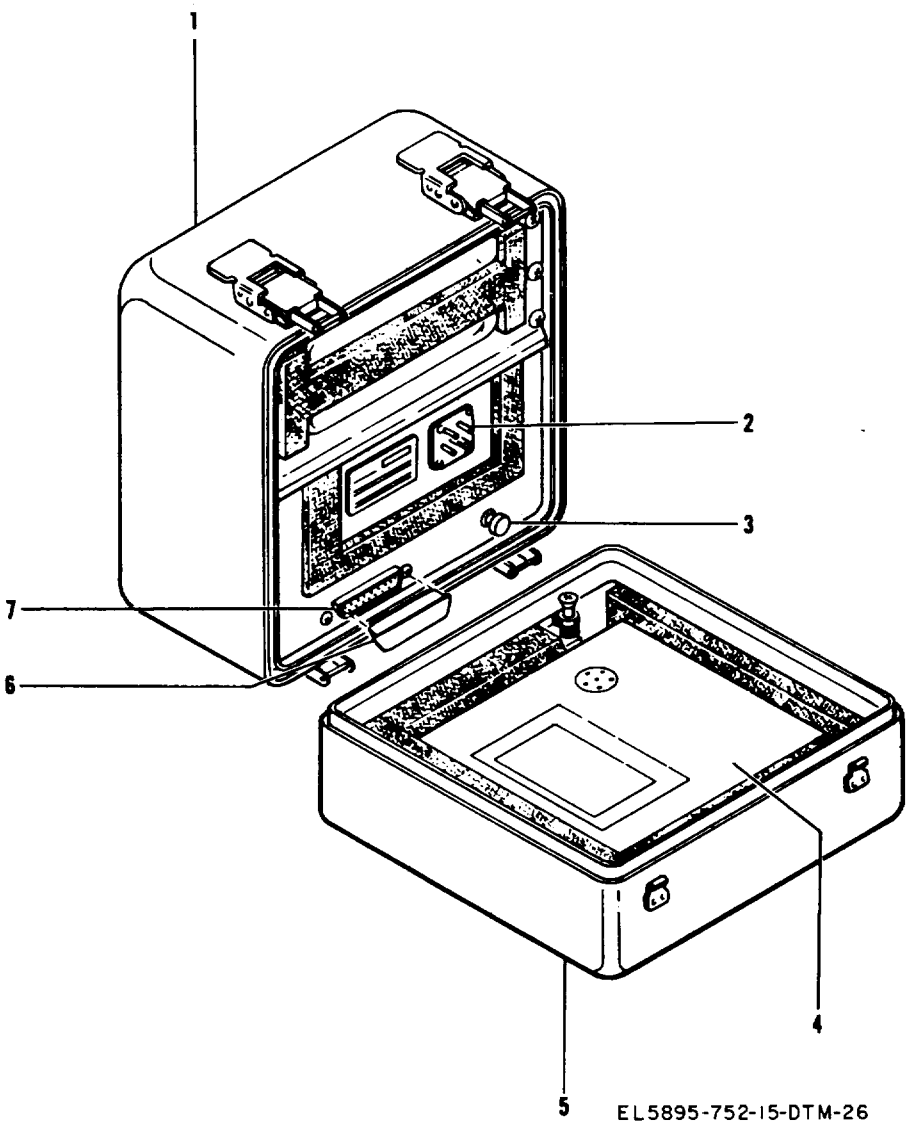


Figure 5-1. Separation of An/GSQ-160 housing.

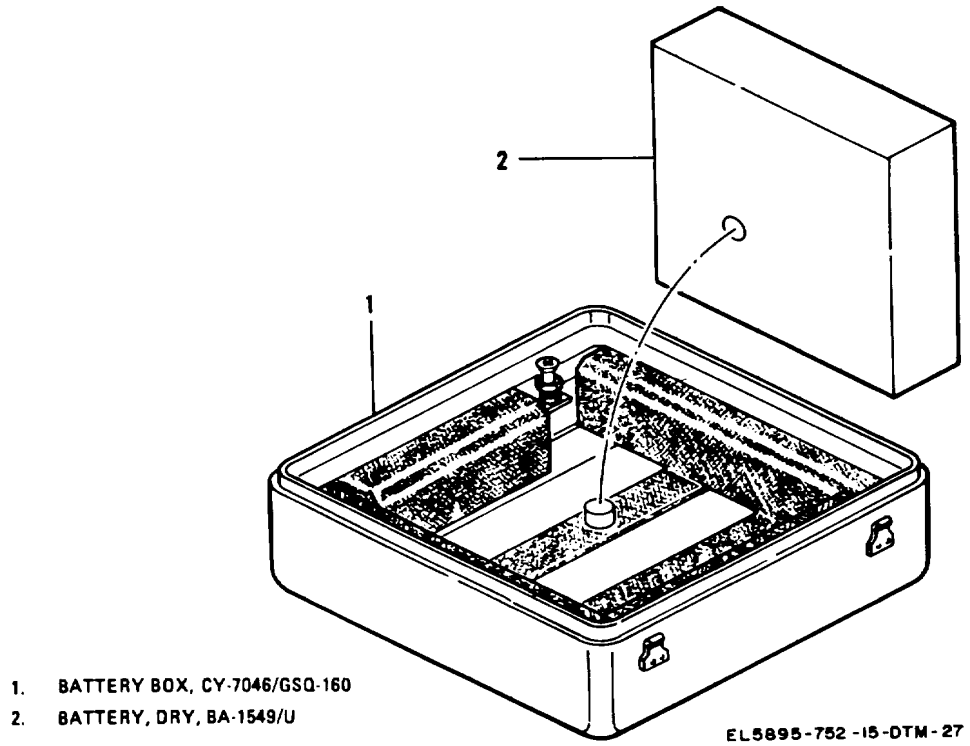


Figure 5-2. Battery location

5-10. Data Transmitter A7
(fig. 5-3)

To remove and replace data transmitter A7, proceed as follows:

a. Open the four latches that secure upper case and lower case.

b. In upper case, remove six machine screws and washers (3, 4, fig. 5-3) that secure cover SM-C-588351 (5) and remove the cover.

c. Lift data transmitter A7 (6, 7, 8) free of upper case by using the mylar belt (8B).

d. Disconnect plug A6P1 (2) from jack A7J1 on data transmitter code plug TC432 (6).

e. Disconnect plug A5P2 from jack A7J2 on TC434 (8), and remove the mylar belt (8B).

f. Record burned-in code and the frequency from the replacement data transmitter A7 on appropriate tag to accompany this AN/GSQ-160.

g. Be sure that mylar insert (8A) is in place, and position mylar belt (8B) at the center of data transmitter A7 (6, 7, 8).

h. Connect plug A6P1 to jack A7J1.

i. Connect A5P2 to jack A7J2.

j. Install replacement data transmitter A7 in upper case.

k. Replace cover SM-C-588351 and secure with six machine screws and washers.

l. Insure that battery connector P1 in upper case is mated with battery connector in lower case.

m. Align upper case with lower case and fasten four latches.

5-11. Electrical Chassis

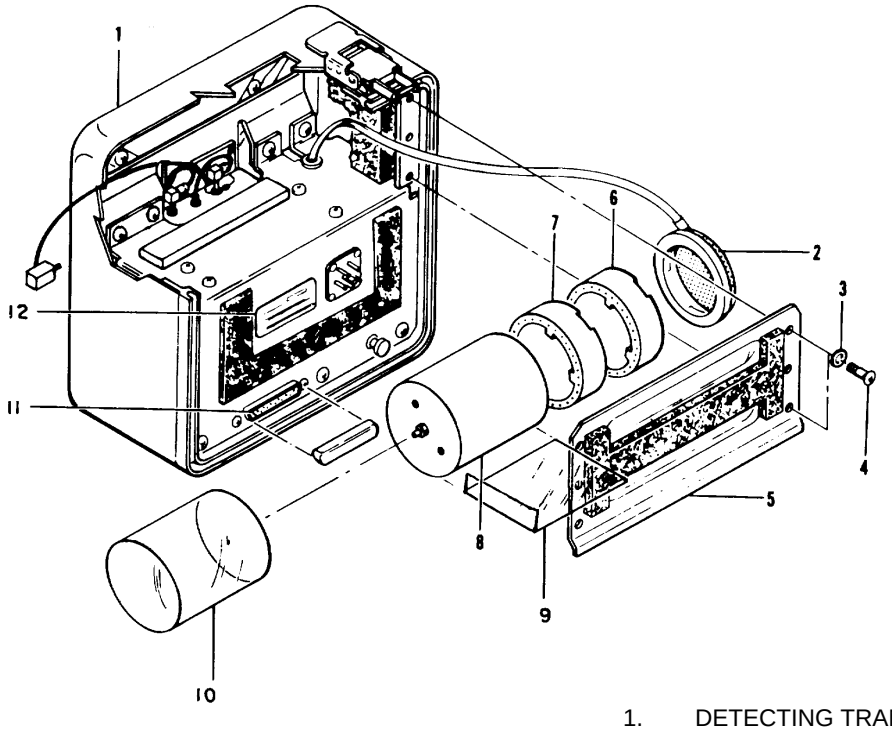
This chassis must be removed to gain access to the plug-in circuit cards. Proceed as follows:

a. Unlatch case and remove battery in accordance with paragraph 5-9.

b. Remove data transmitter A7 (para 5-10).

c. Disconnect sensor oscillator Al leads at A1J2 (A3P2), A1J1 (A5P1), and A1P1 (A6J1) (5, fig. 5-4).

*US GOVERNMENT PRINTING OFFICE 1981-564-016/124



1. DETECTING TRANSMITTING SET SUBASSEMBLY MX-BB46/GSO 160, SM-D-588230
2. CONNECTOR TA386, A6P1 1A7J1)
3. WASHER. FLAT, (6),. MS15795 805
4. SCREW, MACHINE, (6). MS51957 28
5. COVER, DATA TRANSMITTING UNIT COMPARTMENT, SM C 588351
6. CODE PLUG TC432 (A7J1)
7. ENCODER TC431
8. TRANSMITTER TC434, TC516 OR TC560
9. MYLAR INSERT
10. MYLAR BELT
11. GATE TEST CONNECTOR, A6J5. PLUG. ELECTRICAL, SM D 588260
12. NAMEPLATE, EQUIPMENT

EL5895-752-15-OT28

Figure 5-3. Removing data transmitter A7.

d. Remove seven machine screws and washers (6, 7) that secure electrical chassis to upper case.

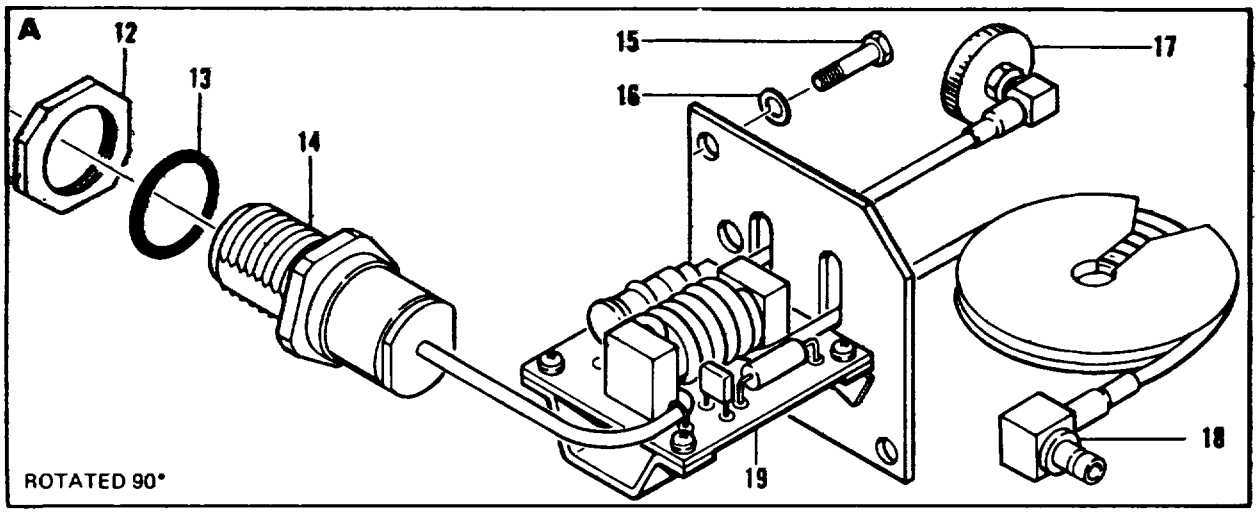
e. Swing electrical chassis out of upper case using wire harness as pivot (fig. 5-4).

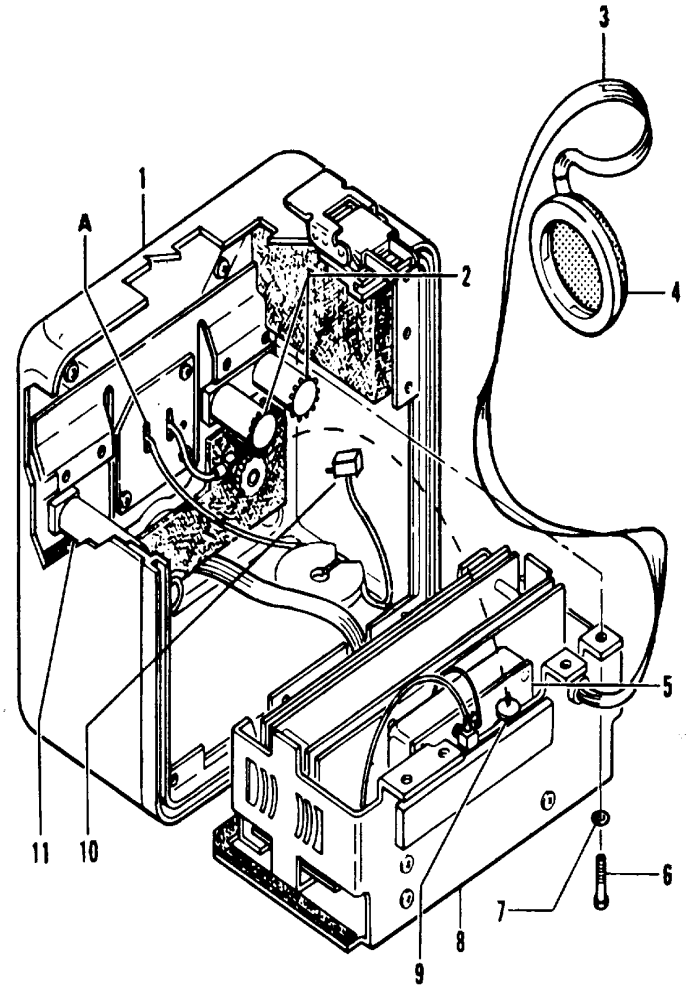
f. Reverse the above procedure to assemble after completing other required maintenance.

5-12. Antenna Coupler A5

To remove and replace antenna coupler A5, proceed as follows:

a. Perform procedures in paragraph 5-11*a* through *e*.





1. DETECTING TRANSMITTING SET, SUB-ASSEMBLY MX-8846/GSQ-160, SM-D-588230
2. RECOVERY CODE SWITCHES S1 AND S2
3. CABLE ASSEMBLY, SM-C-588324
4. CONNECTOR TA386 A6P1 (A7J1)
5. OSCILLATOR, RADIO FREQUENCY SENSOR A1, SM-0-588221
6. SCREW, MACHINE (7),MS51957-28
7. WASHER, FLAT, MS15795-805
8. CHASSIS, ELECTRICAL, SM-B-588205
9. ASP (A1J1) SENSOR OUTPUT
10. A5P2 (A7J2) TRANSMITTER OUTPUT (A7J2)
11. ARMING/RECOVERY SWITCH S3
12. NUT, NEX, ANTENNA CONNECTOR
13. SEAL, ANTENNA CONNECTOR
14. CONNECTOR, ANTENNA, A5J1
15. SCREW, MACHINE (3), MS51957-14
16. WASHER, FLAT (3), MS15795-803
17. ASP (A1J1) SENSOR OUTPUT
18. A5P2 (A7J2) TRANSMITTER OUTPUT
19 COUPLER, ANTENNA, AS, SM-0-588222

EL S95752-15 DTM-29

Figure 5-4. Removing electrical chassis and antenna coupler A5.

b. Lift data transmitter A7 (6, 7, 8, fig. 5-3) free of upper case using mylar belt (8B).

c. Disconnect plug A6P1 from jack A7J1 (fig. 5-3).

d. Disconnect plug A5P2 from jack A7J2 (fig.

e. Remove antenna mount protective cap.

f. Remove retaining nut and seal (12, 13) from antenna mount threaded shaft (fig. 5-4).

g. Remove three machine screws and washers (15, 16) from antenna coupler mounting plate.

h. Pull antenna coupler A5 out of antenna tube from inside upper case.

i. Mount replacement antenna coupler A5 with three machine screws.

j. Replace retaining nut and seal on antenna mount threaded shaft. Torque firmly to insulator (125 125 inch-pound).

k. Be sure that mylar insert (8A, fig. 5-3) is in place, and position mylar belt (8B) at the center of data transmitter A7 (6, 7, 8).

l. Connect plug A5P2 to jack A7J2.

m. Connect plug A6P1 to jack A7J1.

n. Install data transmitter A7 in upper case.

o. Install electrical chassis (reverse order, para-11).

5-13. Sensor Oscillator A1

To remove and replace sensor oscillator A1, proceed as follows:

a. Remove data transmitter A7 and electrical chassis in accordance with paragraphs 5-10 and 5-11.

b. Remove four machine screws (10, fig. 5-5), four lockwashers (11), four flat washers (12), and two nut plates (15) that secure sensor oscillator Al (16) to electrical chassis A6 and lift sensor oscillator A1 free.

c. Disconnect plug A1P1 from jack A6J1.

d. Disconnect plug A3P2 from jack A1J2.

e. On replacement sensor oscillator A1, connect plug A1P1 to jack A6J1 and plug A3P2 to jack A1J2.

f. Mount sensor oscillator Al to electrical chassis X6 using four machine screws, four flat washers, four lockwashers, and two nut plates (fig. 5-5).

g. Swing electrical chassis A6 back into upper case.

h. Mount electrical chassis A6 to upper case using seven machine screws (fig. 5-4).

i. Connect plug A5P1 to jack A1J1.

j. Be sure that mylar insert (SA, fig. 5-3) is in place, and position mylar belt (83) at the center of data transmitter A7 (6, 7, 8).

k. Install data transmitter A7; replace cover SM-C-588351 and secure with six machine screws and washers (fig. 5-3).

l. Insure that battery connector P1 in upper case is mated *with battery connector in lower case.

m. Align upper case with battery box and fasten four latches.

5-14. Circuit Boards A2, A3, and A4

To remove and replace circuit boards A2, A3, or A4, proceed as follows:

a. Perform procedures in paragraph 5-11a through e.

b. Remove circuit board from socket with finger tips, pulling board straight out (fig. 5-5).

c. To install, insert circuit board in guides, align pins with connector and press in until board is seated in place.

d. Reinstall electrical chassis (reverse order, para 5-*lla* through *e).*

5-15. Webbing Handle Strap Assembly

To remove and replace the webbing handle strap assembly, proceed as follows:

a. Remove retaining cap from counterpoise lug with the webbing handle strap assembly attached (fig. 3-3).

b. Remove nut and lockwasher from counter-poise lug.

c. Lift webbing handle strap assembly free of counterpoise lug and discard.

d. Install replacement webbing handle strap assembly and secure with lockwasher and nut.

e. Replace retaining cap on counterpoise lug.

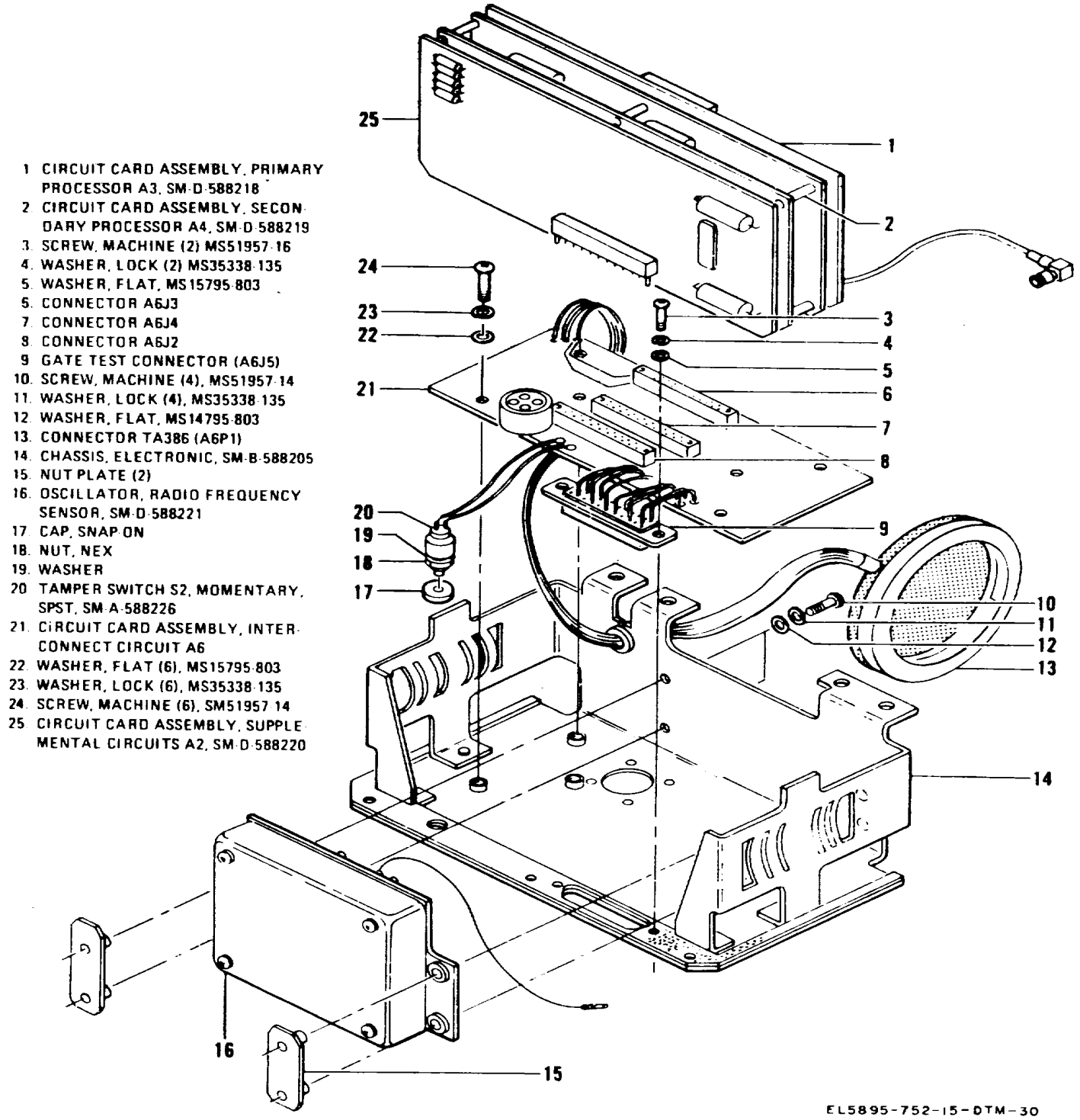


Figure 5-5. Disassembly of electrical chassis.

f. Thread protective cap onto antenna connector.

5-16. Data Transmitter A7 Crystal Changing

NOTE

Only transmitter module TC434 is returnable by crystal substitution without realignment.

a. Remove data transmitter A7 from the MX-8846./GSQ-160 in accordance with instructions in paragraph 5-10.

b. Separate transmitter module from the data transmitter stack and set code plug module TC431 and encoder plug module TC431 aside (fig. 5-3).

c. Inspect each end of transmitter module to locate the crystal compartment.

NOTE

In some models of TC434, the crystal is located under a white nylon plug, see also paragraph 1-6g, located on the ring connector end of the module. In others, the crystal is located under a square plate secured with four screws and located on the transmitter output end of the module.

d. Remove the white nylon plug, or the square plate, covering the crystal compartment.

e. Use tweezers carefully to pull the crystal can from the pin connections. Store crystal in secure place.

f. Obtain a new crystal bearing the channel number desired and insert it in the crystal compartment. Be careful to avoid damaging either the crystal or the module.

g. Record the channel number of the crystal installed on the tag accompanying the AN/GSQ-160 being worked.

h. Replace the plug or the plate as appropriate. Be sure that mylar insert (8A, fig. 5-3) is in place, and position mylar belt (SB) at the center of data transmitter A7 (6, 7, 8).

i. Reinstall data transmitter A7 in the MX-8846/GSQ-160.

CHAPTER 6

GENERAL SUPPORT MAINTENANCE

Section I. MAINTENANCE REQUIREMENTS AND PROCEDURES

6-1. Scope of Maintenance

General support maintenance and repair functions include troubleshooting, removal, and replacement of hard-wired components, switching and continuity checks, and complete assembly and disassembly up to, but not including, major overhaul and rebuilding of AN/GSQ-160 units. Defective printed circuit board modules shall not be repaired but shall be disposed of in accordance with current directives.

6-2. Tools, Test Equipment, and Materials

a. Required items are listed in the maintenance allocation chart (MAC) and the repair parts and special tools list (RPSTL) which are contained in the appendixes to this manual.

b. Information on items needed is contained in the following listing:

Item	Nomenclature	Publication
1	Tool Kit, Electronic Equipment TK-105G	SC 5180-91-CL-R07
2	Multimeter TS-352B/U	TM 11-6625-366-15
3	GATE Test Set, Alarm, Anti-Intrusion AN/GSM-220(U)	Hewlett-Packard, HPS 9203B
4	System Test Set PT1585	TM 11-6625-2514-14-1
5	Test device, post implantation.	
6	Simulator Group OH-29/GSQ-160 b	Chapter 9
7	Differential Voltmeter ME-202/U	TM 11-6625-537-15
8	Code Plug Programmer PT1561	TM 11-6625-2514-14-2
9	Trichloroethane	Not applicable

[a] Requires program tape to operate.
[b] Simulator Group OH-29/GSQ-160 is discussed in chapter 9 and is used in conjunction with GATE Test Set Alarm, Anti-Intrusion AN/GSM-220(U) and System Test Set PT156865.

CAUTION

Maintenance personnel shall be thoroughly familiar with the control and operating information given in chapter 2 before proceeding. Failure to comply with the switching instructions may result in actuating the transmitter destruct.

6-3. General Inspection Procedures

An AN/GSQ-160 unit returned from field use for maintenance will usually be shipped with antenna and counterpoises removed. Two tags should be attached; the recovery code tag and a tag identifying the probable malfunction or cause of failure. Before undertaking maintenance, inspect both tagged and untagged units as follows:

Sequence No.	Item to be inspected	Procedure	Action or paragraph reference
1	Controls	Verify that ARMING/RECOVERY switch is set to OFF/SAFE	If not set, set recovery code switches to specified code and position ARMING/RECOVERY switch to OFF/SAFE.

Sequence No.	Item to be inspected	Procedure	Action or paragraph reference
2	Exterior	Visual inspection	Scrap punctured or badly dented cases.
3	Latches	Verify tension	Cases with loose or broken latches shall be stripped and scrapped.
4	Exterior	Cleaning	Para 5-4.
5	Battery	Disconnect, remove, and discard	Paras 5-9.
6	Lower case	Inspect interior for corrosion, dirt or moisture.	Clean and refurbish as necessary (para 5-4).
7	Upper case	Remove data transmitter module A7-	Unclip, disconnect, and remove; verify code and frequency (para 5-10).
8	Upper case	Remove coverplate and electrical subassembly. Inspect inside of case for dirt, moisture, or damage.	Clean as required (para 54).
9	Electrical	Inspect and clean as required	Replace nonrepairable subassembly.
10	Circuit boards	Remove, inspect, clean if required, and replace.	Discard and replace damage or suspect boards (para 5-4).
11	Controls	Verify rotary action and visually inspect for damage to knobs or seals.	Check suspected switches (para 6-13).
12	Antenna insulator	Inspect for damage for hand torque to check mounting.	Replace as required (para 6-25).
13	Antenna connector	Inspect for damage, dirt, or moisture	Clean; replace if required (para 5-4).
14	Day/night sensor	Inspect for damage and check 1/8-in. clear spot	Replace as required (para 6-23 and
15	Battery power connector P1	Inspect and clean as required	Clean replace if suspected (para 6-16).
16	Gate test connector	Inspect for damage, dirt, or moisture	Clean; replace if suspected (para 6-19).
17	Sensor coaxial cable to antenna coupler A5	Check cable for damage; connector for fit and dirt.	Clean as required, Replace if suspected.
18	Transmitter coaxial cable between A7J2 and antenna coupler A5	Check cable and connector for damage or dirt.	Clean as required. Replace if suspected.
19	A7 ring connector and harness	Check harness and connector for damage or dirt.	Clean as required. Replace if suspected
20	Circuit board contacts	Inspect for damage or corrosion	Clean in accordance with para 5-4. Replace boards with damaged contacts.
21	Tamper switch S2	Verify freedom of action check continuity.	(Para 6-13).
22	Tilt switch S1[a]	Check continuity for three axes of tilt.	Para 6-13.
23	Gaskets	Inspect mesh and sealing gaskets (edge-sealing) on upper and lower case.	Replace damaged gaskets.
24	AN/GSQ 160	Assemble upper case; install good battery in lower case; join and latch cases.	Proceed to para 6-4, then complete step 25 below.
25	Seals	Perform seal checkout	Para 6-26.

[a] Tilt switch is installed in model serial numbered 533 and below only.

Section II. CHECKOUT AND TROUBLESHOOTING WITH GATE

6-4. Checkout With GATE

a. Upon completion of the general inspection procedures (para 6-3), proceed with the GATE checkouts as specified in paragraphs 6-5 through 6-9.

(1) GATE checkout provides a fast and accurate means of isolating malfunctioning plug-in modules; however the GATE may not distinguish between a malfunctioning module and a defective cable or
connector to or from that module.

(2) GATE checkout may not distinguish between a defective switch and a defective module in the same signal patch.

b. When a GATE-indicated malfunction persists despite replacement of the apparently malfunctioning module, refer to the manual troubleshooting procedures of paragraph 6-13.

c. AN/GSQ-160 tests can be divided into two categories: manual and automatic. Manual tests include the gross test performed in conjunction with the System Test Set PT1585 (para 2-4). Automatic test of the AN/GSQ-160 is performed using GATE, and may be divided into three categories according to reporting levels-

(1) Short form (also referred to as *flash or go/no-go).*
(2) Intermediate form.
(3) Long form.

d. Modes are selected by manipulating register (toggle) switches on the GATE. The principal difference between modes is the quantity of data printed out by the GATE. In the short form (flash) mode, go 'no-go printouts are obtained for individual tests. In the intermediate form mode, the go-no-go indication, the limits of the no-go parameter, and the measured parameter value are printed out for individual tests. In the long form mode, the go 'no-go indication, all measured parameter values, and the limits of all parameters are printed out for individual tests.

6-5. Test Setup

(fig. FO-12)

a. Interconnection of the GATE and the AN,/ GSQ-160 is illustrated in FO-12. Three different test interconnection arrangements are actually shown on the figure. These arrangements include the test setup to isolate faults to the module level, antenna coupler test setup, and sensor oscillator module analysis test setup. Additionally, jacks are provided for module analysis tests of the primary processor, secondary processor, and supplemental circuits by appropriate insertion of the modules into J13, J19, or J22 of interface unit MX-8924,' GSQ-160. Although the MX-8924/GSQ-160 has the capability for module analysis tests, only the basic fault isolation to module level tests, antenna test, and antenna coupler test (also a fault isolation to module level test) are currently programmed as part of automatic test of the AN,/GSQ-160.

b. When the upper and lower cases have been properly connected and positioned on top of the MX-8924/GSQ-160, raise the spring-loaded clamp and rotate it a half-turn to clamp both bases firmly to the MX-8924/GSQ-160.

c. For the antenna coupler test, remove all modules except antenna coupler A5 from the upper case of the AN/GSQ-160, and connect P17 and P18 of the MX-8924/GSQ-160 to A5P2 and ASP, respectively, of antenna coupler A5. Install the case on the MIX-8924/GSQ-160, and make the normal connection between A5J1 on top of the upper case and the J1 connector on the bottom of Antenna Simulator SM-616,/GSQ-160.

d. For the antenna test, mount the AS-2542/ GSQ-160 on the J6 test jack of the MX-8924/ GSQ-160.

e. Fault analysis test of sensor oscillator Al is performed by installing the module on the standoffs provided on top of the MX-8924/GSQ-160, and making the following connection: A1P1 to J16 (2.8 volts) of the MX-8924/GSQ-160; A1J2 to P16 (2.5 MHz) of the MX-8924/GSQ-160; and using special cable SM-C-588518 to interconnect A1J1 to J1 of Antenna Simulator SMA-617/GSQ-160. After making the connections indicated on figure FO-12, connect P2 of Target Standard Simulator SM-618/GSQ-160 (switching matrix) to J2 of Target Standard Simulator SM-618/GSQ-160 (control unit).

6-6. Fault Isolation Test Descriptions

a. General. Automatic test of the AN/GSQ-160 with GATE is designed to isolate faults to malfunctioning modules. Test reporting can be short form, intermediate form, or long form. A printout at test start gives the operator the information required to select the desired form from the GATE. Each test performed on the AN/GSQ-160 is summarized in b through m below. If a no-go condition results from an individual test, an offline (manual) operation such as replacing the defective module will be required. Also, as the test progresses, some switch manipulations on GATE may be required. Where such manual operations are necessary, a printout on the GATE teletypewriter will instruct the operator to perform the manual operations. After a defective module has been identified and replaced, the program returns to program start. At this time, the desired program-skip function is selected to bypass tests already completed and to go directly to the test (or series of tests) required. The necessary instructions for the operator to perform this action (program skip) are provided by a GATE printout the

same way as the other manual instructions. The GATE controls test operations by routing 0 and 28 volts dc levels from a GATE power supply to control circuits, and/or by automatic relay control.

b. Lower Case Loaded Battery Voltages. This test establishes that the voltages provided by the BA-1549,/U under loaded conditions are within specifications. Loads for the +4 and -4 volts dc from the battery are supplied by the AN/ GSQ-160. Load for the $+^{30}$ volts dc from the battery is supplied by Simulator Group OH-29/ GSQ-160 as programmed by GATE. The voltages are measured by the GATE digital voltmeter.

c. Upper Case Loaded Voltages and Regulator Output Measurements. This test establishes that the d and -4-volt dc voltages switched through the day/night circuit of the supplemental circuits module, and the -and -2.8-volt dc voltages produced from the regulator circuit of the supplemental circuits module, are within specifications with loading provided by the AN/,GSQ-160. To enable the day 'night switch, the cover provided for the AN. GSQ-160 photo sensor must be in place over the sensor. The voltages are measured by the GATE digital voltmeter.

d. Supplemental Circuits Day/Night and Disable Functions. This test establishes that the functions of the supplemental circuits module not tested in the previous test are satisfactory. The test includes three general parts. First, the photo sensor is exposed to ambient light, and a test is made that the regulator circuit is not supplying an output. Second, various conditions are manually applied to AN/GSQ-160 switches, and tests for disable and no-disable outputs are made. Third, end-of-battery life conditions are simulated and a check made for proper disable outputs for each condition tested. The tests are performed using a combination of GATE programming and operator manual manipulation of switches. The GATE digital voltmeter is used to evaluate circuit outputs.

e. Sensor Oscillator Frequency Measurement. This test establishes that the three frequency outputs of sensor oscillator module Al are within their limits. These frequencies are the 57.5- and 60-MHz sensor frequencies, and the 2.5-MHz difference frequency. The sensor frequencies are measured using the GATE counter. The difference frequency is obtained by subtracting the two sensor frequencies. If a no-go is obtained from the test, the sensor oscillator is replaced and the test is repeated. A second no-go requires that antenna coupler A5 be tested.

f. Frequency Deviation (CTRR) Test. This test establishes that the Close Target Rejection Ratio (CTRR) of the AN/GSQ-160 is within acceptable limits. The test is performed at simulated ranges of 21/2, 41/4, and 63/4 feet. At each increment, the lower sensor oscillator frequency is measured at loaded and unloaded conditions.

g. Primary Processor Sensitivity Test. This test establishes that primary processor module A3 has an output that is within acceptable limits for a measured difference frequency deviation of the two oscillators in sensor oscillator module Al. Frequency measurements are made using the GATE counter. The dc output of primary processor A3 is measured using the GATE digital voltmeter. From the measurements made, a calculation is used to determine sensitivity.

h. Sensor Oscillator Plus Primary Processor Noise Test. This test establishes that the additive noise of sensor oscillator Al and primary processor A3 is within the specified level. During the test, the TP3 output of the primary processor is monitored with the GATE digital voltmeter and a quantity of samples is obtained while the AN/ GSQ-160 antenna output is terminated. From the measurements, the GATE computes the mean value, and then calculates the standard deviation from the mean. Then the standard deviation is checked to make sure it is less than 9 mv root mean square (rms).

i. Differential Frequency Deviation Sensitivity Test. This test establishes that the differential frequency deviation sensitivity (DFDS) of the AN/GSQ-160 is within specified limits at a simulated range of 28 feet. The test is performed by measuring the primary processor output voltage with the sensor oscillator frequencies unloaded, then measuring the output voltage with the sensor oscillator frequencies loaded. The GATE digital voltmeter is used to make measurements. Then the GATE computes the difference voltage and the DFDS.

j. Secondary Processor Alarm Threshold Test. This test evaluates secondary processor A4 alarm outputs and threshold level. The first part of the test establishes that secondary processor A4 does not generate an alarm when a 10-db differential input is applied to the module, but will generate

an alarm when a 12-db differential input is applied. Then the alarm output is checked for being within alarm condition limits. Voltage measurements are made with the GATE digital . After the alarm evaluations, the per-cycle limiter circuit performance is checked by evaluating the voltage level at TP2 of the secondary processor module. The GATE then computes the difference voltage and checks that the result is within limits.

k. Per Cycle Limit Test. This test establishes the secondary processor integration response to a step function input stimuli. the SM-618/SQ-160 set for a specific range, the unloaded integrator output voltage is measured; a load is then applied and, after a short interval, the integrator output is measured again The difference is then computed and compared to specified limits.

l. Antenna Test. This test is a gross test of antenna performance, and establishes that the percentage of reflected power from the antenna is within acceptable limits. The antenna is exercised by connecting it to a jack on the interface test equipment, and then applying a frequency of 168 MHz from the GATE frequency synthesizer. The GATE measures the value of reflected voltage, **a**nd checks that this value is within limits.

m. Antenna Coupler Test. The antenna coupler test is used to evaluate performance of antenna coupler A5 if sensor oscillator Al has failed, and after replacement, the test is failed again. The antenna coupler is tested by removing all other modules from the AN 'GSQ-160 upper case, interconnecting the antenna coupler with the MX-8924 "GSQ-160, and terminating the antenna coupler with the SM-616 'GSQ-160 simulator and SM-618 'GSQ-160 switching matrix in the normal way. The antenna coupler is then exercised at different frequencies from the GATE frequency synthesizer. The GATE measures the values of reflected power for each frequency, and determines that the reflected power is within acceptable limits for each case.

6-7. Module Level Fault Isolation Test Procedures

a. Test Equipment Required).

(1) Gate Test Set, Alarm, Anti-Intrusion AN/GSM-220(U).

(2) Cable Assembly, Special Purpose, Electrical, Branched CX-12591/SQ-160.

(3) Cable Assembly, Special Purpose, Electrical, Branched CX-12593/GSQ-160.

(4) Interface Unit, Electronic Circuit, Plug-In MX-8924/GSQ-160.

(5) Antenna Simulator SM-616/GSQ-160.

(6) Target Standard Simulator SM-618/ GSQ-160.

(7) SM-C-588516 cable assembly (coaxial, 5 feet).

b. Test Connections and Conditions.

(1) Make connections as shown in figure FO-12.

(2) Plug P1 of SM-618/GSQ-160 into 115-volt ac, 60-Hz power source.

(3) Position AN/GSQ-160 upper and lower cases on top of MX-8924, GSQ-160; raise clamp on MX-8924/GSQ-160, rotate a half-turn, and clamp cases to MX-8924/GSQ-160.

(4) Arrange Antenna Simulator SM-616/ GSQ-160 and switching matrix of SM-618/ GSQ-160, on top of upper case as shown in figure FO-12.

c. Procedure..

Step No.	Equipment	Procedure
1	On AN. GSM1/220(U) set controls as follows:	
	2116B computer	Momentarily press POWER switch.
	Photoreader	Set power switch to OFF.
	Teletypewriter	Set ON LINE OFF LOC switch to ON LINE.
	5110B synthesizer driver	Set FREQ STD switch to TNT, RANGE SEL1 switch to 1 MHZ, OPERATE/STANDBY switch to OPERATE
	5105A frequency synthesizer	Set meter select switch to ALC, FREQ SEL to REMOTE, pushbuttons for all O's LOCK-OPERATE to OPERATE, search switch to LOCAL, output level to 0 DBM, and power switch to ON.
	2402A digital voltmeter	Open access door, and set INPUT to REAR, MEASURING RATE to HOLD, ENCODE RANGE to AUTO, FUNCTION to EXT. FREQ switch is not applicable.
	333A distortion analyzer	Not applicable.

Step No.	Equipment	Procedure
	432A power meter	Not applicable.
	5360A computing counter	Set CYCLE RATE to HOLD, DIGITS DISPLAYED to AUTO, MEASUREMENT TIME to 100 MS, RANGE to 1S, EXT to RECESSED, and MAX/ FAST, NORM to MAX
	536A input module	Set AC DC to DC, FUNCTION to FREQ, INPUT to CHANNEL B, LEVELS A & B to PRESET, and MULTIPLER to X1
	5379A time interval	Not applicable.
	5210A frequency meter	Not applicable.
	355D programmable attenuator	Set power switch to ON.
	Wavetek 157 S134 oscillator	Not applicable.
	6206B power supply (left side)	Set power switch to ON, range to 30 vdc, and voltage to 2.8 vdc.
	6130B power supply (lower)	Set power switch to ON, voltage to 50 vdc, and current to 1.2 amperes.
	6130B power supply (upper)	Set power switch to ON, voltage to 50 vdc, and current to 1.2 amperes.
	2759B synthesizer programmer	Set power switch to ON.
	9300M high frequency interface unit	Set power switch to ON.
	9400B modular switch	Set power switch to ON.
2	SM 618/GSQ-160	Set ON/OFF to ON, MODE to GATE, and LOAD select to NORMAL.
3	AN/GSQ-160	Set mode switch to ON/TEST, set in proper recovery code, place cover over day 'night sensor
4	AN/GSM-220,/U( )	a. Load basic binary loader and configured basic program without punch. b. Insert AN, GSQ-160 test program tape on tape reader c. Press PTA key on teletypewriter. When READY is typed out, press RUN and RETURN keys. Automatic test begins. All further instructions and the performance indications are printed out on the teletypewriter

6-8. Antenna Coupler Test

a. Test Equipment Required.

(1) GATE Test Set, Alarm, Anti-Intrusion AN/GSM-220 (U).

(2) Cable Assembly, Special Purpose, Electrical, Branched CX-12591/GSQ-160.

(3) Cable Assembly, Special Purpose, Electrical Branched CX-12593/GSQ-160.

(4) Interface Unit MX-8924/GSQ-160.

(5) Antenna Simulator SM-616/GSQ-160.

(6) Target Standard Simulator SM-618/GSQ-160.

(7) SM-C-588516 cable assembly (coaxial, feet).

b. Test Connection and Conditions.

(1) Remove all modules from AN/GSQ-160 upper case except for antenna coupler module A5.

(2) Make connections as shown in figure FO-12.

(3) Plug P1 of SM-618/GSQ-160 into 115-volt ac, 60-Hz power source.

(4) Position AN/GSQ-160 upper case on top of MX-8924**/**GSQ-160; raise clamp on MX-8924/GSQ-160, rotate a half-turn, and clamp case to MX-8924/GSQ-160.

(5) Arrange Antenna Simulator SM-616/GSQ-160 and switching matrix of SM-618/GSQ-160 on top of upper case as shown in figure FO-12.

c. Procedure. Perform same procedure as given in paragraph 6-7c.

6-9. Antenna Test

a. Test Equipment Required.

(1) GATE Test Set, Alarm, Anti-Intrusion AN/GSM-220(U).

(2) Cable Assembly, Special Purpose, Electrical, Branched CX-12591/GSQ-160.

(3) Cable Assembly, Special Purpose, Electrical, Branched CX-12593/GSQ-160.

(4) Interface Unit, Electronic Circuit, Plug-In MX-8924/GSQ-160.

b. Test Connections and Conditions.

(1) Connect the CX-12591/GSQ-160 and CX-12593,/ GSQ-160 as shown in figure FO-12.

(2) Install Antenna AS-2542/GSQ-160 on J6 of MX-8924/GSQ-160.

c. Procedure. Perform same procedure as given in paragraph 6-7c.

Section III. MANUAL TROUBLESHOOTING

6-10. General

The instructions in paragraphs 6-11, 6-12, and 6-13 specify the bench checkout procedures for wired and mounted components in the AN/GSQ-160 in cases where a malfunction is noted during the inspection routines of paragraph 6-3, or where plug-in module replacement based on GATE checkout does not correct the no-go condition. An interconnection diagram is provided as figure FO-2.

CAUTION

Before proceeding, position the recovery code switches to the specified recovery code combination and position the ARMING/RECOVERY switch to OFF/ SAFE.

NOTE

Refer to chapter 5, section IV for removal and replacement instructions.

6-11. Preparation for Bench Checkout

Unlatch the case. Disconnect and remove Battery BA-1549/U. Disconnect and remove data transmitter module A7. Remove the plug-in modules for supplemental circuits A2, primary processor A3, and secondary processor A4. Disconnect the three cables to sensor oscillator A1 at A1J1, A1J2, and A1P1. Prepare Multimeter TS-352B/U for resistance measurements.

CAUTION

Do not force multimeter probes into connector spring pins. Loss of tension and open circuits may result.

6-12. Wiring and Harnesses

Breaks or damage to printed circuit paths or wire leads are rare. However, repeated flexing may cause damage at the connections between wires and connector pins. Where this is suspected, make plug-to-plug continuity checks of the harnesses with an ohmmeter (fig. FO-2) and resolder or replace defective wiring.

a. A6J5 to A6J4, A6P1, A6J3, and A6J2.

b. Signal cable between A1A3P2 and primary processor A3 (on A3).

c. The vhf cable between A1A5P1 and antenna coupler A5 (on A5).

d. The transmission cable between A7A5P2 and antenna coupler A5 (on A5).

e. The +28 vdc cable between A1P1 and sensor oscillator A1 (on A1).

f. From A6P1 (data transmitter ring connector) to A6J4, A6, and A6J2.

g. A6J2 to tamper switch S2 terminals.

h. A6J2 to day/night sensor V1 terminals.

i. Rotor arms of ARMING/RECOVERY switch S3 to A6 termination's.

j. Stator arms of ARMING/RECOVERY switch S3 to termination's on A6.

k. Battery plug P1 to termination's on A6.

6-13. Upper Case Switches

Operation of the five switches in the upper case of the AN/GSQ-160 may be checked with an ohmmeter. Prepare the unit for bench checkout as specified in paragraph 6-11. Refer to figure FO-2 and proceed as directed in table 6-1. The steps need not be accomplished in the sequence given.

Table 6-1. Switch Function Tests and Corrective Actions

Item No.	Component	Procedure	Test results	Corrective action or paragraph reference
1	ARMING,/RECOVERY switch S3A-C1.	Connect ohmmeter between A6J2 and +4 vdc pin on battery connector P1. Position S3 to:		
		OFF/SAFE	Open	Replace S3 (para 6-22).
		ON/TEST	Short.	
		ARM	Short.	
2	ARMING/RECOVERY switch S3A-C2.	Connect ohmmeter between A6J2 R and +4 vdc pin on battery connector P1. Position S3 to:		
		OFF/SAFE	Short	Replace S3 (para 6-22).
		ON/TEST	Short.	
		ARM	Open.	

Item No.	Component	Procedure	Test results	Corrective action or paragraph reference
3	ARMING/RECOVERY switch S3A-C3.	Connect ohmmeter between A6J2 K nector P1 and position to:		
		OFF, SAFE	Open	Replace S3 (para 6-22).
		ON, TEST	Short	
		ARM	Short	
4	ARMING/RECOVERY switch S3A-C4.	Connect ohmmeter between A6J2-Q and -4 vdc pin battery connector P1. Position S3 to:		
		OFF/SAFE	Open	
		ON/TEST	Open.	
		ARM	Short.	Replace S3 (para 6-22).
5	ARMING/RECOVER,Y	Connect ohmmeter between A6J2-W and A6J2N. Position S3 to:		
		OFF/SAFE	Open	Replace S3 (para 6-22).
		ON/TEST	Open.	
		ARM	Short	
6	Recovery code switches S1 and S2	Connect ohmmeter between A6J2-T and COM pin on battery connector P1. Position S1 and S2 to:		
		Recovery code	Short	Check for bad code tag, defective jumper, or defective switch contacts (para 6-22).
		All other combinations	Open	
7	Tamper switch A62	Connect ohmmeter between A6J2-Q and A6J2-G and:		
		Depress S2	Open	Replace S2 (para 6-22).
		Release S2	Short.	
Note. Step 8 below refers to units serial numbered 533 and below. Units aerial numbered 534 and above do not use tilt switch.				
8	Tilt switch A6S1	Connect ohmmeter between COM pin on battery connector P1 and A6J2-U. Position case to:		
		Normal vertical	Open	If shorted in normal vertical, or not shorted for 45 ±8 tilt (any axis), replace A6S1 (para 6-18).
		Tilt one side to 45° ±8	Short.	
		Tilt adjacent side to 45° ±8	Short.	
		Tilt one corner to 45° ±8	Short.	
9	Day/night sensor VI	Connect ohmmeter between A6J2-I and A6J2-0 and arrange for bright light on sensor window and--		
		Cap sensor window	High (37 or more megohms).	If resistance change is not approximately as specified, replace sensor VI (para 6-23).
		Uncap sensor window	Low (approximately 0.5 megohms).	

Section IV. DISSEMBLY AND REASSEMBLY

6-14. General

a. Chapter 5 provides removal and replacement instructions for the battery, data transmitter module A7, the electrical chassis, and plug-in modules Al through A5. This section provides disassembly and reassembly instructions down to the lowest component level of the AN, GSQ-160 authorized for general support by the maintenance allocation chart and the spares provisioning. Soldering procedures and related tools and materials are required. The repair parts and special tools list is provided as appendix C. *b.* Personnel performing the maintenance outlined in this section shall comply with the requirements for the use of tools, and procedures for maintenance, repair, and inspection set forth in the publications listed in appendix A.

c. The procedures which follow provide for removal or disassembly. Unless otherwise stated, installation and assembly is accomplished by performing the instructions in reverse order. It is assumed that the disassembly instructions of chapter 5 have been completed.

6-15. Interconnection Board A6

NOTE

Board A6 may be partially dismounted as follows to replace tilt switch S1 (installed on models serial numbered 533 and below only), connectors A6J2, J3, and J4, data transmitter A7 ring connector P1 assembly, or battery power plug P1:

a. Remove the electrical chassis (para 5-11).

b. Free the grommet that holds the ring connector harness to the chassis.

c. Remove four screws and washers (22, 23, 24, fig. 5-5) that secure the board to the chassis.

d. Tilt the board up to gain access to the under-side or to battery power plug P1.

e. Replace components as required and reinstall. Refer to additional instructions in this section for component replacement.

6-16. Battery Power Plug P1

a. Partially dismount interconnection board A6 as specified in paragraph 6-15.

b. Unsolder five leads from A6 to connector P1
at connector P1; note and mark the location of
each wire (fig. 6-2).

c. Record pin orientation and position of flats on center pin of plug P1.

d. Drill out four rivets that secure P1 to chassis, discard defective plug P1.

e. Align new plug P1 to position recorded in *c* above and attach ,with new rivets.

f. Solder leads from A6 to plug P1 as marked; verify the connections against figures 6-1 and 6-2.

g. Arrange power leads to avoid interference or binding and reinstall circuit board A6.

6-17. Tamper Switch 52

a. Unsolder two leads from board A6 to switch S2 terminals at switch (fig. 6-1).

b. Remove snap-off button on shaft of switch S2.

c. Remove hexagonal nut that secures switch to
chassis and lift switch free.

d. Install new switch with solder contacts oriented to accept existing leads. Torque hexagonal nut firmly to secure switch to chassis and attach snap-off cap to shaft. Poor assembly will affect the tamper function and related disable provisions.

6-18. Tilt Switch S1

NOTE

The following procedures apply to units serial numbered 533 and below only.

a. Partially dismount interconnection board A6 as specified in paragraph 6-15.

b. Switch S1 is soldered directly to the circuit on the board by two electrical pins. Heat one connection and then the other while maintaining tension on the switch body to progressively rock the connections loose and free the switch (fig. 5-1).

c. Clean the mounting holes and immediate area of excess solder.

d. Align the electrical pins on the new switch with the holes in the board, and press firmly in place while soldering the pins to the board. The flat on the base of the switch must be firmly against the board to insure proper operation and angular response.

e. Reinstall board A6.

6-19. GATE Test Connector A6J5

a. Remove and retain the connector dust cover (6, fig. 5-1).

b. Unsolder jumpers between pins 16 and 19, 19 and 21, and 21 and 23 on connector A6J5.

c. At the pins of J5, unsolder the wires between J5 and board A6. Mark each wire with the number of the pin from which it *as removed (fig. 6-1).

d. Remove two screws and washers (3, 4, 5, fig. 5-5) that secure the connector to the chassis and discard the connector. Retain the hardware.

e. Install new connector J5 (SM--D-588260) with hardware retained in d above.

f. Connect and solder the leads from A6 to connector J5 as marked. Verify the pin location of each lead before soldering against the assembly drawing (fig. 6-1).

6-20. Data Transmitter A7 Ring Connector P1 Assembly

NOTE

This assembly is spared as a complete unit including wiring and chassis grommet. Do not attempt to remove and replace only the plug.

a. Partially dismount interconnection board A6 as specified in paragraph 6--15.

b. Free the harness grommet from the chassis (fig. 5-5).

c. Unsolderl the five leads at the circuit board and discard the assembly (fig. 6-1).

d. Remove excess solder and clean the board.

e. Insert the leads of the new harness into the proper holes on the circuit board. Verify the location of each lead against the wiring diagram (figs. 6-1 and 6-2) before soldering.

f. Press the harness grommet into the chassis slot (fig. 5-5).

g. Reinstall interconnection board A6.

6-21. Circuit Board Connectors A6J2, J3, and J4

NOTE

Connectors J2, J3, and .J4 are retained on board A6 by rivets and pin soldering; do not attempt removal unless absolutely necessary to salvage the board.

a. Partially dismount interconnection board A6 as specified in paragraph 6-15.

b. Drill out two rivets at each end of connector (fig. 6-1).

c. Beginning at one end of the connector, apply heat to the first solder connection while placing tension on the connector to pull it away from the board. The board may be bent very slightly to facilitate the initial separation.

d. Insert a thin woo(den stick or wedge between the connector and the board and work down the remaining connections, progressively wedging the connector free of the board.

CAUTION

Be extremely careful when bending the board and wedging the connector out to avoid damage to the printed circuit tracks.

e. Discard the defective connector, clear the solder holes on the board, and clean the immediate area.

f. Verify the pin orientation (fig. 6--1) and position the new connector with the pins through the board holes and be sure the base of the connector is firmly against the board. Be careful to insure the connector is neither tilted nor cocked; either will cause difficulty in inserting the applicable circuit board plug-in during chassis assembly. Insert and expand rivets and solder all connections.

g. Reassemble interconnection board A6.

6-22. Recovery Code Switches S1, S2, and Arming/Recovery Switch S3

NOTE

The mechanical remove, replace requirements for S1, S2, and S3 are identical. Electrical connections are shown in figure 6-2.

a. To gain access to the switches, remove data transmitter module A7 and the electrical chassis from the upper case (paras 5-10 and 5-11).

b. Loosen two setscrews (2, fig. 6-3) and remove control knob (1).

c. Carefully peel foam cushion pad from underside of case top to free electrical wiring to the switch. Retain the pad.

d. Use socket wrench to remove seal boot (4). Discard seal boot.

e. Withdraw switch from case and place on bench in holder or vise to facilitate disconnection.

f. Mark each wire to identify its switch termination and unsolder all wires. Discard the switch.

CAUTION

Location of the jumper between recovery switches S1 and S2 determines the recovery code. Failure to correctly replace this jumper will cause data transmitter disable during operation.

g. Connect all wires to the new switch, noting carefully the termination of each. Verify terminal-

tions against the wiring diagram (fig. 6-2) and the interconnection drawing (fig. 6-1) before soldering. Do not overlook the recovery code jumper between S1 and S2: verify jumper connections against recovery code tag.

h. Remove all attaching hardware on the switch mounting shaft, orient the switch body precisely with the case, and thread a new seal boot, M5423109-03 (4, fig. 6-3) onto the shaft to secure the switch to the case.

i. Hold the switch body while tightening the seal boot moderately with a socket wrench.

j. Place the knob on the shaft and verify that the knob indicator aligns exactly with the position marks on the placard plate for all positions of the switch.

k. If knob indicator and placard marks do not align, remove knob, loosen seal boot, and realign switch.

l. When knob indicator and placard marks align, remove knob and tighten seal boot securely with socket wrench. Recheck alignment.

CAUTION

The seal boot provides a waterproof seal to both the case and the rotor of the switch. It must be sufficiently tight to insure waterproof integrity without binding the rotor shaft or rupturing the seal material.

m. The knob aligns to the shaft with a flat insert. Install the knob and tighten the setscrews securely.

n. Arrange the wire harnesses between case and chassis as they were found, and reinstall the foam cushion pad. Cement in place with a light film of Adhesive, Specification MMM-A-001058.

6-23. Day/Night Sensor VI

a. To gain access to the day/night sensor, re- move data transmitter module A7 and the electrical chassis from the upper case (paras 5-10 and 5-11).

b. Carefully peel the foam cushion pad (3, fig. 6-4) from the underside of the case to free the electrical wiring to the sensor and permit access to the sensor tube. Retain the pad.

c. Extract the slotted-sleeve sensor retainer (7, fig. 6-4) from the sensor tubs carefully to avoid stressing the sensor leads.

d. Pull evenly on the sensor leads to draw the photosensitive semiconductor cell (5) out of the tube. The sleeve bushing (4) may remain in the tube or come out with the cell; retain the bushing.

e. Strip the sleeve insulation from the cell leads to expose the solder connection between the cell terminals and the leads.

f. Cut two pieces of sleeve insulation, MIL-I-230535, the same length as those removed and slip these over the two wires. Be sure the wires remain inside the slotted-sleeve sensor retainer.

g. Solder the cell terminals to the leads using long-nose pliers as a heat sink between the cell and the solder points.

h. Pull the sleeve insulation over the solder joints until it butts against the cell and heat moderately to shrink-fit.

i. If the sleeve bushing was withdrawn from the sensor tube, place it over the cell cap and insert both into the tube, bushing first.

j. Use a wooden or plastic tool to gently push the cell into the tube until the cell and bushing butt against the sensor window.

k. Insert the slotted sleeve into the tube and press it in until the flange bottoms on the base of the tube. If it will not, the (cell and bushing are not properly seated; extract and correct.

l. Position the sensor leads as they were found and cement the foam cushion pad in place using Adhesive, MMM-A-001058.

6-24. Day/Night Sensor Window

NOTE

The sensor window is attached to the inside of the sensor tube with a waterproof adhesive. Do not attempt to remove and replace the window unless it is cracked, leaking, or no longer transmits adequate light. The window should be opaque except for a 1/8-inch clear spot top center.

a. Perform procedures in paragraph 6-23*a* through *d.* Remove bushing (4, fig. 6-4).

CAUTION

All measures taken to remove the win-

dow must not involve force or tools which may bend, twist, or distort the tube.

b. Insert a dowel rod or long punch into the neck of the sensor tube and tap with a hammer to break the seal and drive the window out of the tube. Failing this, file a flat on the top of the window, drill progressively larger holes, and file the window out of the tube.

c. Clean and smooth the inside of the tube to facilitate component replacement and the cementing of the new window to bare metal.

d. Apply a light coat of Adhesive, Specification MMM-A-187, to the mounting flange of the new window (SM-D-588313) and a film of adhesive to the inner edge of the tube throat. Seat the window firmly in the throat of the tube and wipe off excess adhesive.

e. Inspect the inside of the tube to insure adhesive has not formed a bead, preventing proper seating of the cell and sleeve to the base of the window. Remove any bead formed; be careful not to smear adhesive on the central area of the window.

f. Allow the assembly to dry for 4 hours.

g. Clean interior of upper case.

h. Perform procedures in 6-23*i* through *l*.

i. Perform seal checkout (para 6-26).

6-25. Antenna Insulator

NOTE

The antenna insulator is a solid color-impregnated plastic casting cemented to the exterior of the antenna tube. Do not attempt to remove and replace unless damage is severe or there is leakage at the insulator-to-tube seal.

a. Disassemble the upper case and remove antenna coupler A5 in accordance with paragraph 5-12.

b. Plug the base of the antenna tube with paper or cloth to block the entry of chips or debris into the case.

c. Saw a slot down the center of the insulator through the antenna connector hole. Take care not to notch the top of the antenna tube.

d. Insert a wedge into the antenna connector hole and tap with a hammer to split the insulator and pry it off the antenna tube. Be careful to avoid damaging the tube or depressing the top of the case.

e. Clean all residual adhesive and burrs off the exterior of the tube from which the insulator was removed.

f. Apply a light film of Adhesive, Specification MMM-A-187, to the inside mounting lip of the new insulator (SM-D588312) and to the exterior mounting surface of the tube.

g. Place the insulator on the tube and press down firmly, insuring that the insulator seats fully on the throat of the tube. Remove excess adhesive on interior and exterior surfaces.

h. Allow unit to dry 4 hours and reassemble.

i. Paint exterior of the tube near insulator if any metal is exposed (para 5-6).

j. Perform seal checkout in accordance with paragraph 6-26.

6-26. Seal Checkout

The AN/GSQ-160 must be fully assembled, except for the antenna and counterpoises, and securely latched. Remove the antenna protective cap from the antenna connector and the knobs from switches S1, S2, and S3.

a. With an Allen wrench, remove the pipe plug (AN932-S2) from the pressure test port on the top of the case (fig. 3-3).

b. Connect a controlled source of dry air and a pressure gage to the port as shown in figure 6-5.

c. Pressurize the case to 3 pounds per square inch gage.

d. Apply a foaming soap or detergent and water solution to the seals of the case and controls and interfaces as follows:

(1) Interior and exterior of antenna connector.

(2) Juncture of antenna insulator and case tube.

(3) Around the shafts of switches S1, S2, and S3.

(4) Juncture of day/night sensor window and case.

(5) The seal between the upper and lower case (apply solution under the latches).

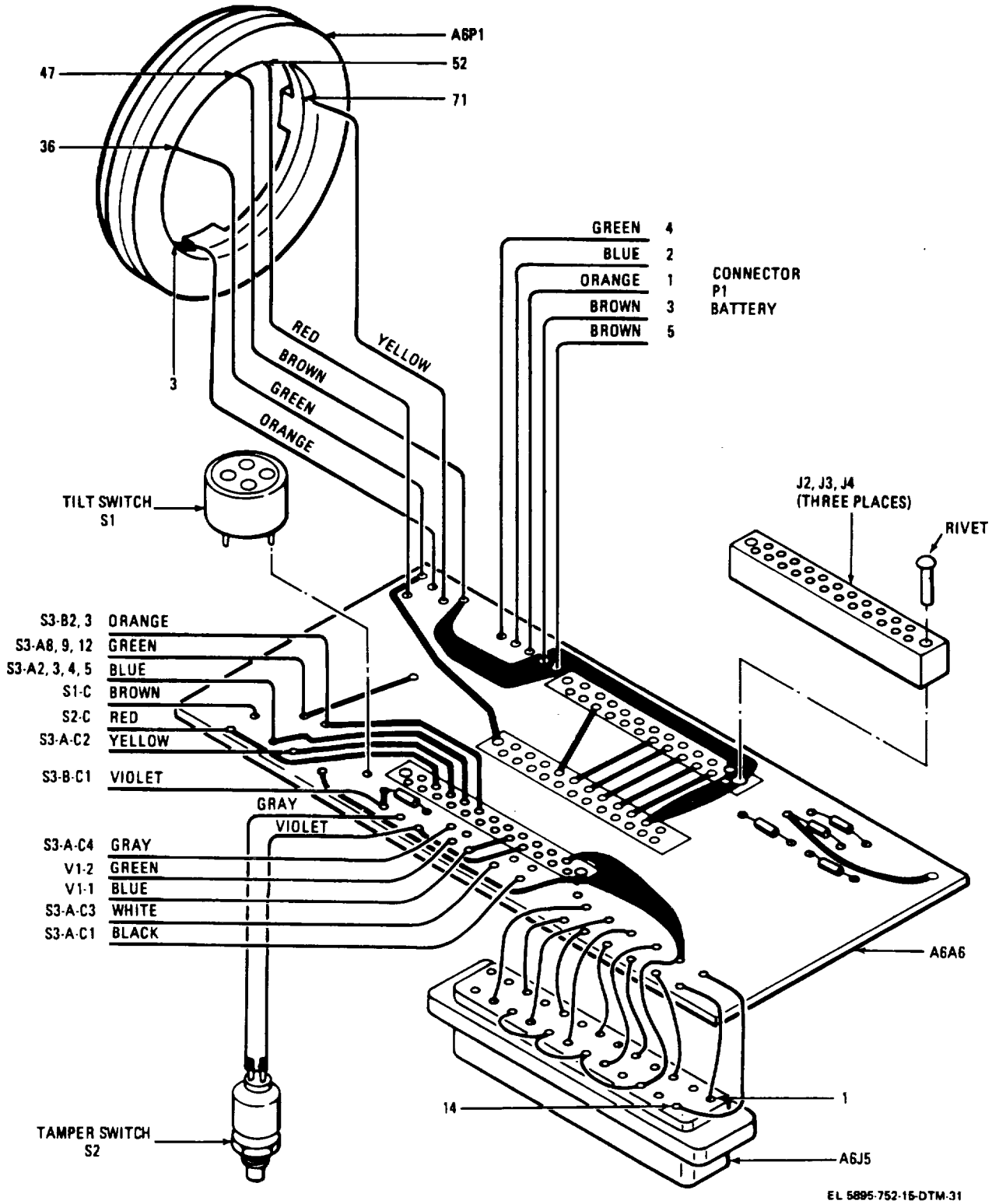


Figure 6-1. Disassembly of A6A6 harness.

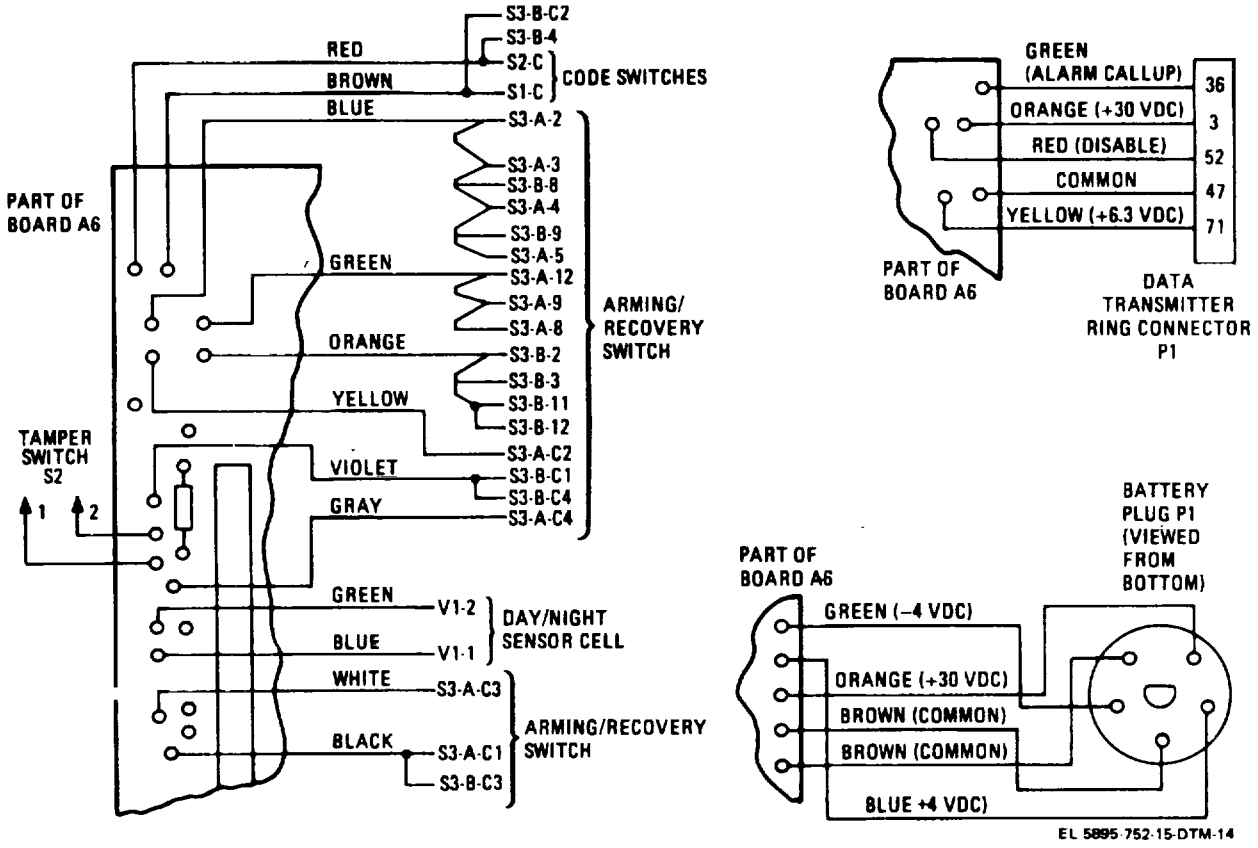


Figure 6-2. Interconnection of A6A6 harness.

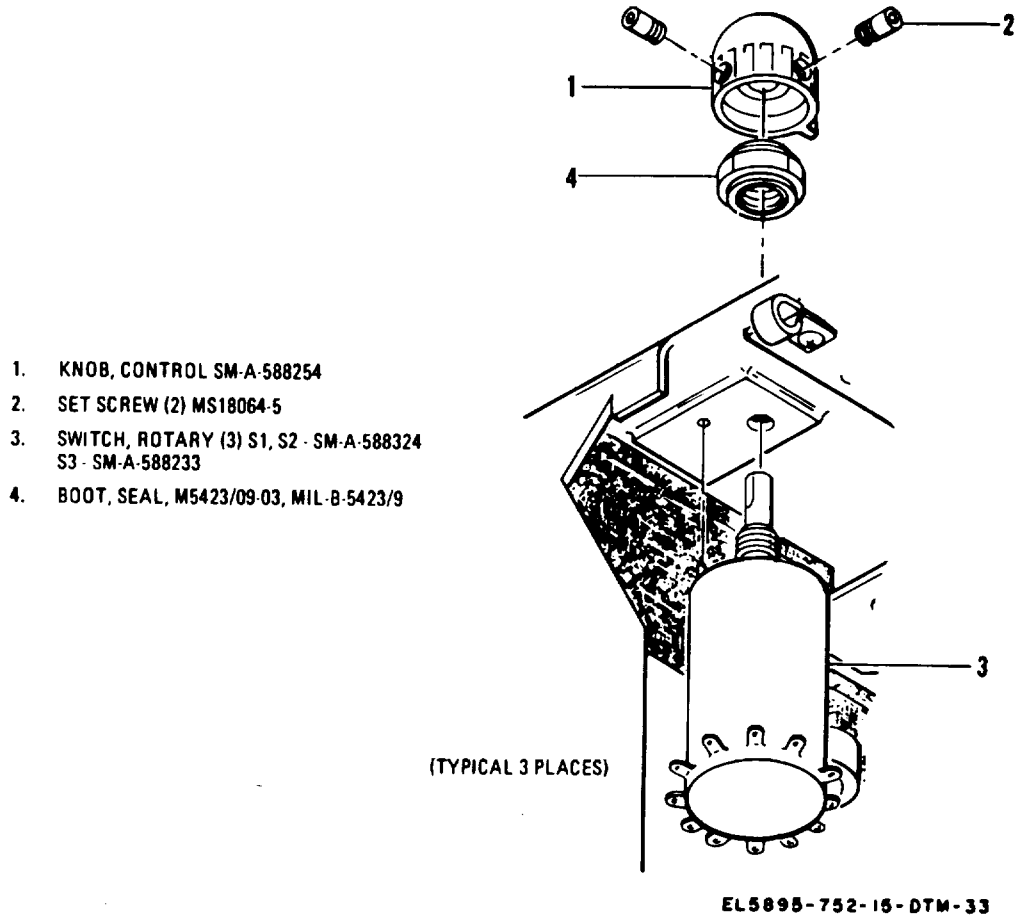


Figure 6-3. Disassembly of day/night sensor.

1. WINDOW, LIGHT SENSOR SM-C-588313
2. PART OF DETECTING-TRANSMITTING SET, SUBASSEMBLY, MX-8846/GSQ-160 SM-D-588230
3. PAD, CUSHIONING SM-C-588320
4. BUSHING, SLEEVE, INSULATOR SM-C-588347
5. SEMICONDUCTOR, PHOTO CONDUCTOR, (SENSOR VI), SM-A-588253
6. SLEEVE, INSULATION MIL-I-23053-5
7. RETAINER, SENSOR, DAY/NIGHT SM-C-588350

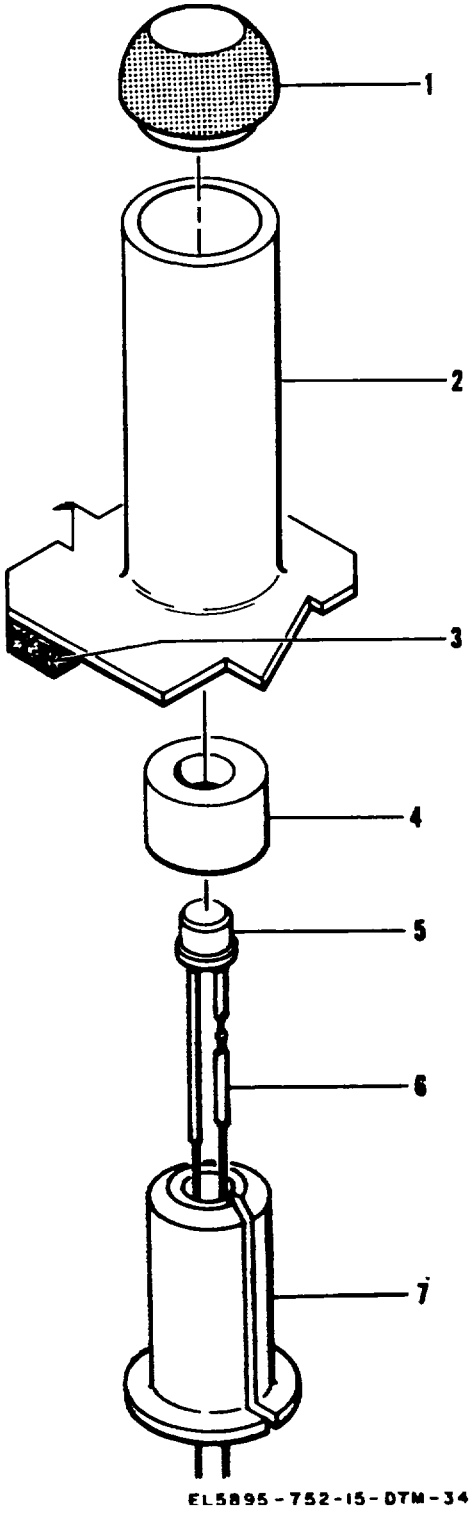


Figure 6-4. Disassembly of day/night sensor.

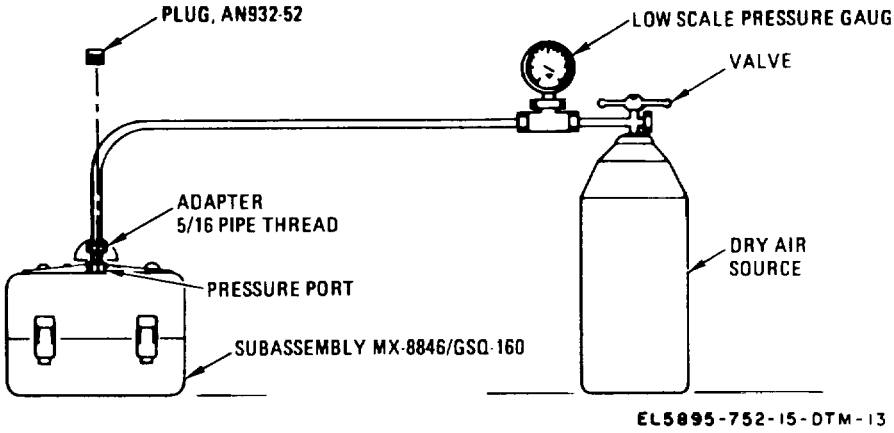


Figure 6-5. Test setup for seal checkout.

(6) Around the base of each counterpoise post.

e. Inspect carefully for the formation of bubbles indicating leaks. Repeat the application of soap solution until certain that no leaks are evident.

f. Disconnect the source of dry air and bleed pressure off slowly to permit pressure equalization without depressurization condensate forming in the case.

g. Disconnect the test setup, apply a thin film of sealant to the threads of the pipe plug, and thread the plug into the pressure port.

h. Reinstall the switch knobs.

i. Wash the exterior of the case and dry thoroughly.

CHAPTER 7
SHIPMENT AND STORAGE

7-1. General

The equipment should be disassembled for shipment and storage only to the extent to permit the re-use of the original packaging material and methods (para 2-3). Procedures for repacking the equipment are given in paragraph 7-2 below.

7-2. Repacking for Shipment and Administrative Storage

CAUTION

Verify that the ARMING/RECOVERY switch is set to OFF/SAFE before proceeding. If not, perform the recovery switching procedures (para 3-9).

a. Remove the antenna and counterpoise if attached.

b. Separate the two antenna sections.

c. Perform cleaning procedures (para 5-4).

d. Thread the antenna cap onto the antenna insulator and press plastic protector caps onto the connector ends of the antenna sections. If caps are not available, use tape to protect the threads and connectors. Tape the antenna sections together and pack in original carton.

e. Unlatch the case and remove the battery (para 5-9).

f. Place tape over the battery connector and wrap battery in original vapor seal and place in carton. (Do not retain a used battery.)

g. Disconnect and remove data transmitter A7 (para 5-10). Pack data transmitter A7 in the case with paper to restrain the ring connector, and replace the cover.

h. Remove the crystal from data transmitter A7 in accordance with paragraph 5-16. Pack and forward the crystal to authorized commands in accordance with current directives.

i. Pack data transmitter A7 in its original vapor seal and place in carton together with a tag identifying the code burned into the code plug.

j. Latch the case, attach the recovery code tag, and wrap in original vapor seal and place in carton. Use original packing if available. Place a copy of the technical manual in the carton with the unit.

k. Seal all cartons and mark to identify the contents.

CHAPTER 8
DEPOT OVERHAUL STANDARDS

8-1. General

Depot overhaul standards consist of the GATE checkout.

8-2. Reference

Refer to paragraph 6-4 for GATE checkout.

CHAPTER 9
SPECIAL TEST EQUIPMENT

Section I. GENERAL DESCRIPTION

9-1. General

The special test equipment for the AN/GSQ-160 is comprised of four equipment units and five cable assemblies contained in a transit case and designated Simulator Group OH-29/GSQ-160. This equipment is designed to interface the AN/GSQ-160, or sub-assemblies of the AN/GSQ-160, to System Test Set PT1585 or GATE Test Set, Alarm, Anti-Intrusion AN/GSM-220(U) for manual and automatic checkout and troubleshooting. Simulator Group OH-29/GSQ-160 includes the test equipment required for the gross operability check (para 2-5) and the units required to interface with GATE for six test configurations on the AN/GSQ-160 equipment. Complete functional and maintenance data for the OH-29/GSQ-160 is provided in this chapter. Test setups are detailed in chapters 5 and 6.

9-2. Simulator Group OH-29/GSQ-160

a. Components. Simulator Group OH-29/GSQ-160 consists of eight assemblies contained in a two-piece transit case (fig. 9-1).

Item	*Component*
1	Simulator, Target Standard SM-618/GSQ-160, consisting of: Control unit Switching matrix
2	Simulator, Antenna SM-616/GSQ-160
3	Simulator, Antenna SM-617/GSQ-160
4	Cable Assembly, Special Purpose, Electrical, Branched CX-12591/GSQ-160.
5	Cable Assembly, Special Purpose, Electrical, Branched CX-12593/GSQ-160.
6	Interface Unit, Electronic Circuit, Plug-In, MX-8924/GSQ-160.
7	W5 cable assembly, SM-C-588516
8	W6 cable assembly, SM-C-588517
9	W7 cable assembly, SM-C-588518

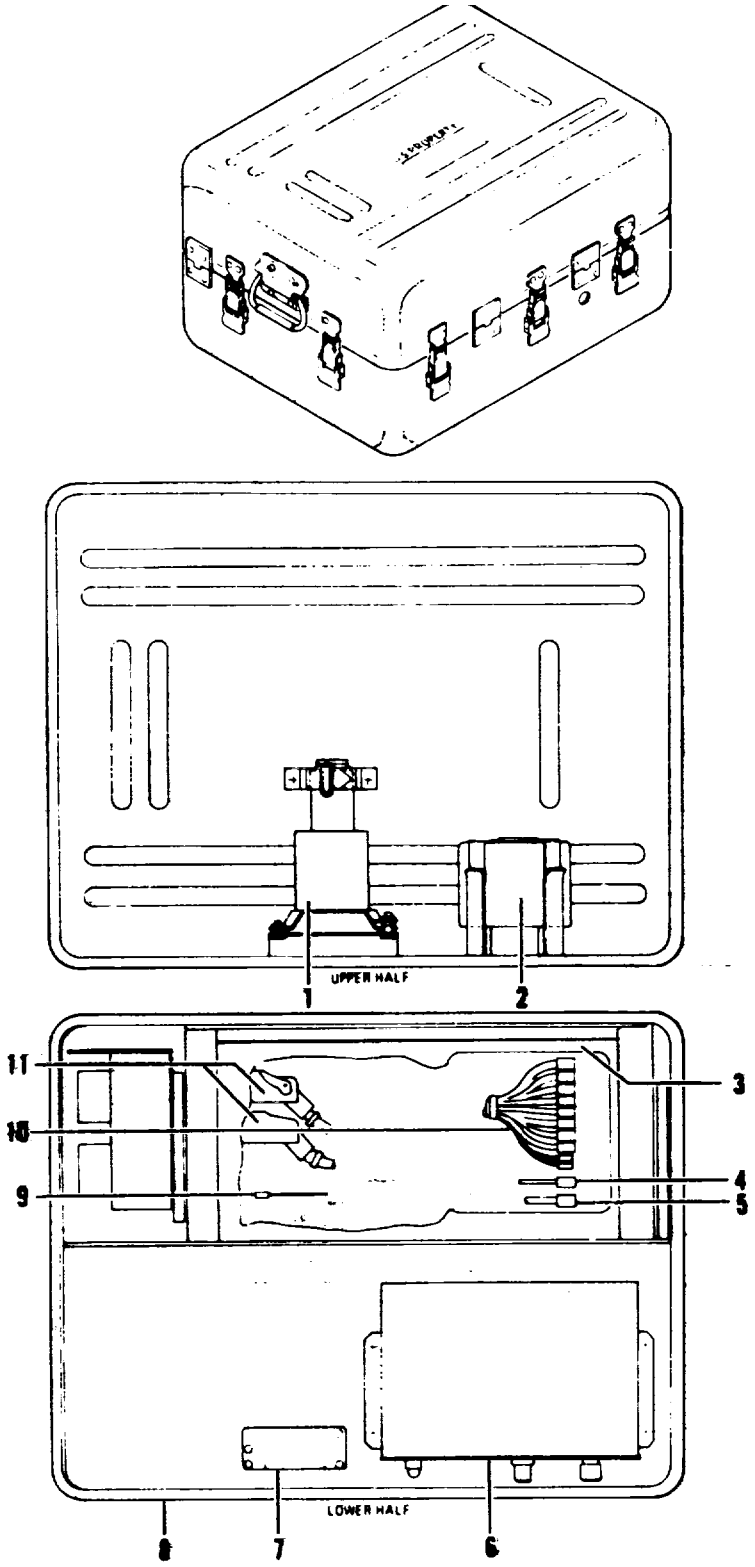
b. Housing. The transit case of the OH-29/GSQ-160 performs several functions. It serves as a portable storage case for the cables and subassemblies of the simulator group. The lower half functions as the electronic chassis for the MX-8924/GSQ-160. It also functions as a fixture for mounting and interconnecting AN/GSQ-160 units under test and interfacing the units under test with manual and automatic test equipment in several configurations (ch. 5).

c. Modes of Operation. Subassemblies of Simulator Group OH-29/GSQ-160 are used in both manual and automatic test modes. The manual mode of operation enables a gross operability check of the AN/GSQ-160, including the alarm capability. The equipment required consists of System Test Set PT1585, Antenna Simulator SM-616,/GSQ-160 and the Target Standard Simulator SM-618/GSQ-160. For the gross test, the AN/GSQ-160 is exercised at a manually selected fixed range while being monitored by the PT1585. The automatic mode enables checkout and troubleshooting of the AN/GSQ-160 and its subassemblies, using the AN/GSM-220(U). The GATE computer controls equipment operation and provides test stimuli, operator instructions, and test results.

9-3. Target Standard Simulator SM-618/GSQ-160

a. This simulator consists of switching matrix and control unit (fig. 93). The switching matrix is a relay and coaxial cable assemblage attaching directly to the antenna simulators; a control cable connects the switching matrix with the control unit. The control unit houses conditioning and logic circuits, together with controls and indicators, in a covered chassis suitable for rack mounting. Power and signal cables connect at the rear of the unit. Control unit is the only unit of Simu- lator Group OH-29/GSQ-160 provided with controls and indicators.

b. The front panel of the control unit is shown in figure 93; control and indicator functions are-



1. SM-616/GSQ-160 ANTENNA SIMULATOR
2. SM-618/GSQ-160 TARGET STANDARD SIMULATOR (SWITCHING MATRIX)
3. HINGED ACCESS DOOR (LIFT UP TO REMOVE CABLES)
4. SM-C-588516 CABLE ASSEMBLY (FOR USE BETWEEN MX-8924 AND SM-616; W5, 5 FT)
5. SM-C-588518 CABLE ASSEMBLY (FOR USE BETWEEN SM-617 AND SENSOR OSCILLATOR MODULE; W7, 2.5 IN.)
6. SM-618/GSQ-160 TARGET STANDARD SIMULATOR (CONTROL UNIT)
7. SM-617/GSQ-160 ANTENNA SIMULATOR
8. MX-8924/GSQ-160 INTERFACE UNIT, ELECTRICAL CIRCUIT, PLUG-IN
9. SM-C-588517 CABLE ASSEMBLY (FOR USE BETWEEN MX-8924 AND SM-617; W6, 5 FT)
10. CX-12593/GSQ-160 CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL, BRANCHED (RF)
11. CX-12591/GSQ-160 CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL, BRANCHED

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Figure 9-1. Simulator Group OH-29/GSQ-160.

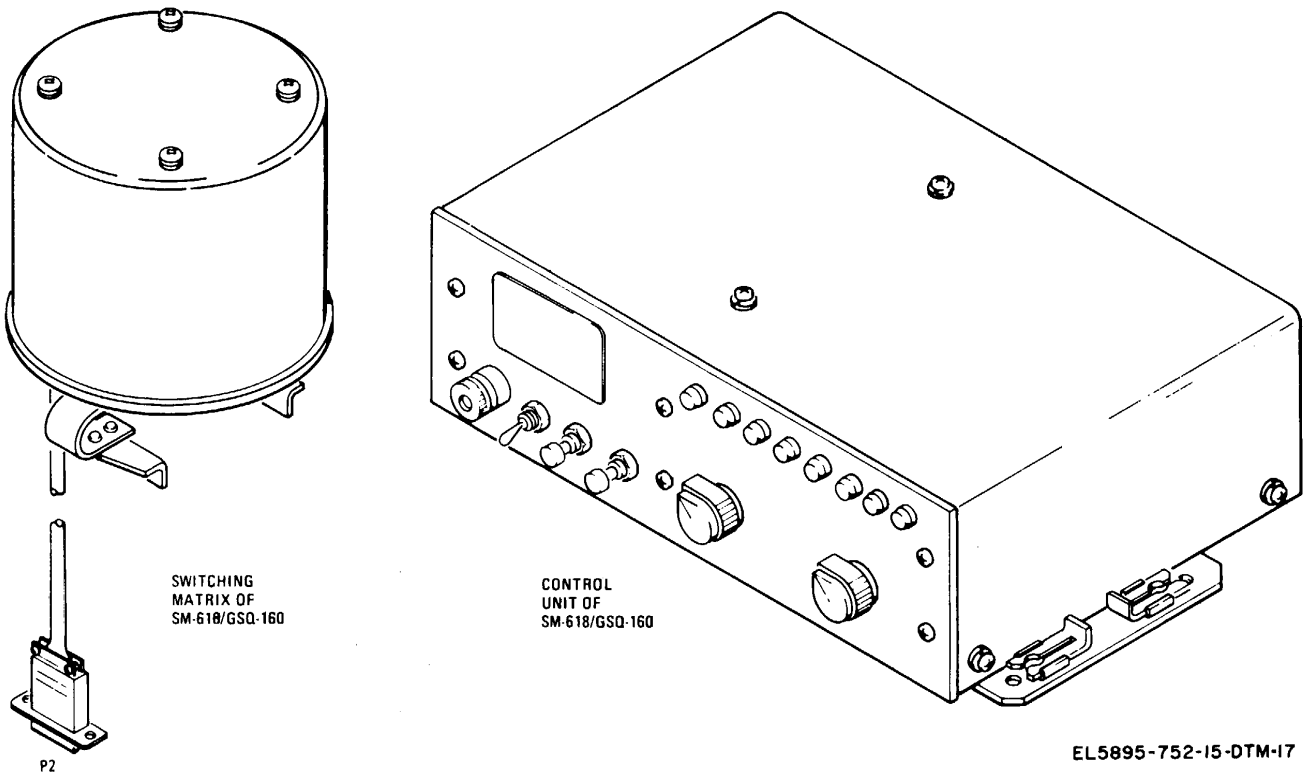


Figure 9-2. Target Standard Simulator SM-618/GSQ-160.

Key No.	Nomenclature	Function
1	POWER ON/OFF switch	Energized internal power supply.
2	RANGE (FEET) 16 Indicator lamp	Readout of simulated range.
3	RANGE (FEET) 8 Indicator lamp	Readout of simulated range.
4	RANGE (FEET) 4 Indicator lamp	Readout of simulated range.
5	RANGE (FEET) 2 Indicator lamp	Readout of simulated range.
6	RANGE (FEET) 1 Indicator lamp	Readout of simulated range.
7	RANGE (FEET) 1/2 Indicator lamp	Readout of simulated range.
8	RANGE (FEET) 1/4 Indicator lamp	Readout of simulated range.
9	LOAD Indicator lamp	Lights to indicate load is switching.
10	LOAD SELECT control:	
	NORMAL	Provides maximum stimulus level available from SM-618/GSQ-160.
	0 DB 10 DB 12 DB	Three different resistive loads are switched in to correspond to the control position selected.
11	MODE control MANUAL	Causes SM--618/GSQ-160 to jump to a preset range and begin to cycle the load at a 1-Hz rate as determined by the internal clock. The internal clock is also energized in CYCLE mode.
	CYCLE	Causes SM-618/GSQ-160 to cycle from minimum to maximum range when RESET and START pushbuttons are pressed. Internal clock is used.
	GATE	Causes SM-618/CSQ-160 to remove the stimulus that causes the jump to a preset range, allows the input of an external clock, and enables response to remote commands through rear panel connectors.
12	START pushbutton	Allows the clock pulses to begin cycling the load and range increment relays when pressed.
13	RESET pushbutton	Resets all flip-flops to the residual range condition.

9-4. Antenna Simulator SM-616/GSQ-160

a. Antenna Simulator SM-616/GSQ-160 is one of two antenna simulators used in AN/GSQ-160 checkout, calibration, and troubleshooting. It consists of an RF shield and adapter SM-D-588431, and an electronic subassembly with RF connectors SM-D-588430, mounted above the adapter (fig. 9-4).

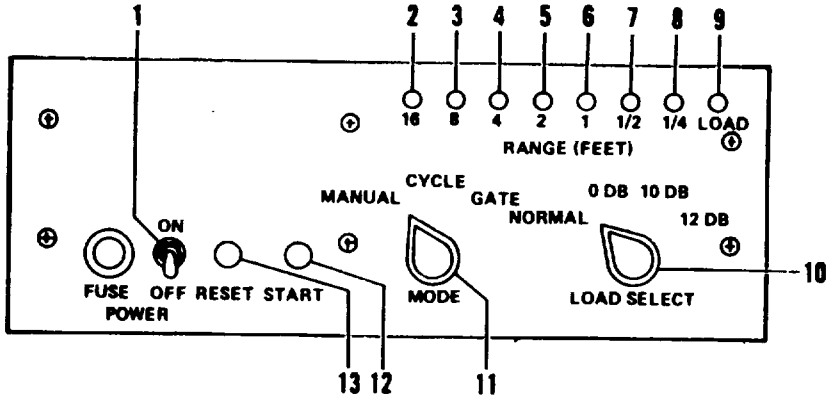
b. This simulator replaces an antenna on a complete AN/GSQ-160 to properly terminate antenna coupler A5 and to provide signal monitoring connections when exercising the AN/GSQ-160 to verify proper operation. Antenna Simulator SM-616/GSQ-160 is used with Target Standard Simulator SM-618/GSQ-160 and System Test Set PT1585 for the gross operability check (para 2-5). It is also used with the target standard simulator and the GATE equipment during automatic checkout of a complete AN/GSQ-160 (fig. FO-12).

c. Adapter SM-D588431 provides mechanical support for the electronic subassembly, RF bonding to the AN/GSQ-160 under test, and RF shielding. The aluminum adapter mounts to the AN/GSQ-160 with four brackets that mate to the four counterpoise posts. The shielding reduces RF leakage to at least -50 dbm so that two or more AN/GSQ-160 units may be under test in a small area without mutual interference. One side of the adapter is a hinged door providing access to the connection between AN/GSQ-160 antenna connector A5J1 and jack J1 on the simulator electronic subassembly.

d. Electronic subassembly SM-D-588430 comprises an electronic circuit board housed in a rectangular box secured to the top of the adapter. It consists of a complex impedance, a simulated di- plexer, two output attenuators, three output connectors, and one input connector.

9-5. Antenna Simulator SM-617/GSQ-160

Antenna Simulator SM-617/GSQ-160 can be used with Target Standard Simulator SM-618/GSQ-160 and Electronic Circuit Plug-In Interface Unit MX-8924/GSQ-160 to align and test sensor oscillator A1 circuit boards (fig. FO-12). This simulator consists of a rectangular box that houses an electronic components circuit board, one input connector port, and two output connector ports. The input port is a miniature connector for a special cable to the sensor oscillator A1 under test. One output port is a type N connector for mating with the switching matrix of the target standard simulator; the other output port is a type BNC connector for frequency measurement. Both output ports have output impedances of 50 ohms. The box provides sufficient



1. POWER ON/OFF SWITCH S1
2. RANGE (FEET) 16 INDICATOR LAMP DS5
3. RANGE (FEET) 8 INDICATOR LAMP DS4
4. RANGE (FEET) 4 INDICATOR LAMP DS3
5. RANGE (FEET) 2 INDICATOR LAMP DS2
6. RANGE (FEET) 1 INDICATOR LAMP DS1
7. RANGE (FEET) ½ INDICATOR LAMP DS7
8. RANGE (FEET) ¼ INDICATOR LAMP DS8
9. LOAD INDICATOR LAMP DS6
10. LOAD SELECT CONTROL S3
11. MODE CONTROL S4
12. START PUSHBUTTON S5
13. RESET PUSHBUTTON S2

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Figure 9-3. Control Unit of SM-618/GSQ-160 control s and indicators.

1. SIMULATOR COVER; HELD BY FOUR MACHINE SCREWS (REMOVE COVER TO REACH ALL ADJUSTMENTS)
2. CONNECTOR J4 TARGET SIMULATION PORT; MATES WITH SWITCHING MATRIX OF TARGET STANDARD SIMULATOR
3. CONNECTOR J3; FREQUENCY MEASUREMENT PORT: FROM SENSOR OSCILLATOR A1 OUTPUT
4. CONNECTOR J2 ANTENNA TRANSMISSION RADIATION PORT; FROM DATA TRANSMITTER A7 OUTPUT
5. HINGED DOOR FOR ACCESS TO AN/GSQ-160 ANTENNA MOUNT MATING WITH CONNECTOR J1
6. ANTENNA SIMULATOR ADAPTER SM-D-588431
7. CONNECTOR J1 ANTENNA PORT; MATES WITH AN/GSQ-160 ANTENNA MOUNT
8. ANTENNA SIMULATOR SUBASSEMBLY SM-D-588430
9. DAY/NIGHT SENSOR CAP

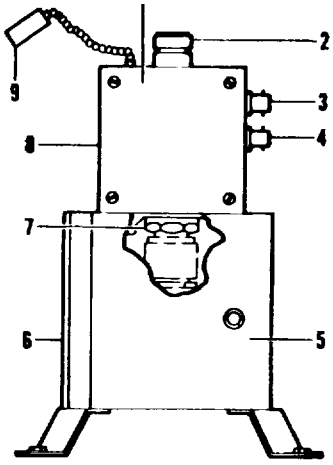

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Figure 9-4. Antenna Simulator SM-616/GSQ-160.

shielding to permit the operation of two or more sensor oscillator A1 units in a small area without mutual interference. Removal of four screws and the cover permits access to all adjustable components.

9-6. Special Purpose Branched Electrical Cable Assembly CX-12591/GSQ-160

a. The CX-12591/GSQ-160 branches at both ends to join connectors J1 and J2 on the GATE interconnect panel to connectors J1 and J2 on the MX-8924/GSQ-160.

b. The cable assembly is approximately 60 inches long, excluding connectors (fig. 9-6). Each of the four connectors (P1 through P4) has four electrical plug inserts identified as D, C, B, and A from left to right when looking into the face of the connector. Connector

1. CONNECTOR J3 MATES WITH SWITCHING MATRIX OF TARGET STANDARD SIMULATOR
2. MOUNTING BRACKET
3. CONNECTOR J1 SELECTRO MINIATURE PORT MATES WITH SPECIAL CABLE FOR CONNECTION TO SENSOR OSCILLATOR UNDER TEST
4. ANTENNA SIMULATOR CASE
5. CONNECTOR J2 FOR FREQUENCY MEASUREMENTS
6. SIMULATOR COVER HELD BY FOUR MACHINE SCREWS (REMOVE COVER TO REACH ALL ADJUSTMENTS)

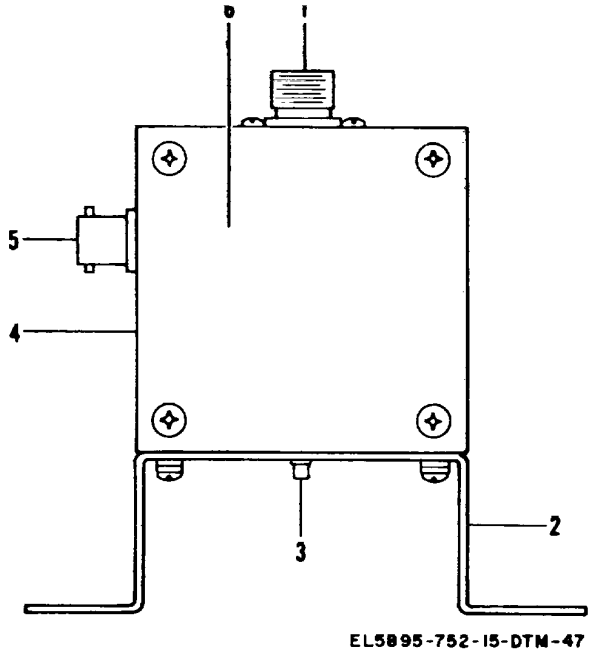


Figure 9-5. Antenna Simulator SM-617/GSQ-160.

P1 pins are wired to the corresponding pins on connector P3 and connector P2 pins are wired to connector P4 pins. A1 16 plug inserts are identical 41-pin units. Not all pins are used. On the A, B, and C inserts, 32 pins are wired for use; on the D inserts, only 26 pins are wired.

c. A keyway in the top of each connector mates with a key in the proper jack. To operate the connector, the locking lever is pivoted backward to the open position and the plug is placed over the jack and gently lowered on to the mating lugs. If the plug does not fit easily over the mating lugs, the key is not matched with the keyway and the connectors are mismatched. Once the plug is in position, the locking lever is pivoted forward to engage pins and sockets.

9-7. Special Purpose Branched Electrical Cable Assembly CX-12593/GSQ-160

a. The CX-12593./GSQ-160 comprises 10 conductors with terminations designated P1 through P20. Eight of these are coaxial cables for connecting between J1 through J8 on the GATE 9300M high frequency interface unit and various coaxial connector jacks on the MX-8924/GSQ-160. The remaining two are control cables connecting between L1 and L2 on the GATE time interval plug-in unit and J3 and J4 the MX-8924/GSQ-160.

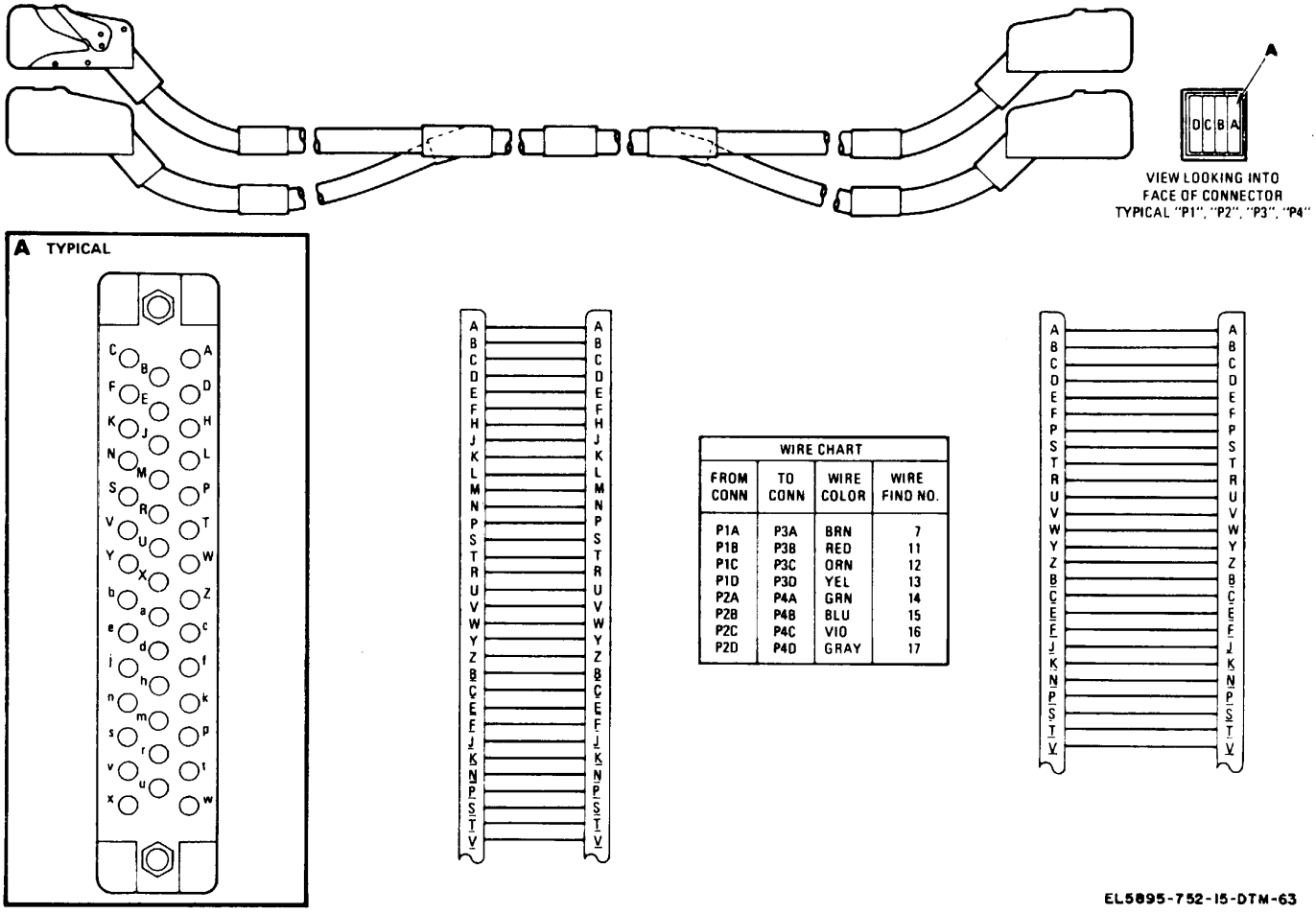
b. The CX-12593/GSQ-160 is approximately 60 inches long including the connectors. The 16 BNC connector plugs mate with corresponding BNC jacks as shown in figure 9-7. The two control cables with pin jacks are used for automatic control of the triggering levels of the MX-8924/GSQ-160.

9-8. Electronic Circuit Plug-In Interface Unit MX-8924/GS-1 60

a. The MX-8924/GSQ-160 provides mechanical support for the AN/GSQ-160 units and modules during test, interconnects the other units of the Simulator Group OH-29/GSQ-160 in the several test configura-tions, and interfaces with the AN/GSM-220(U) test equipment.

b. The MX-8924/GSQ-160 (fig. 9-8) is teamed with the AN/GSM-220(U) for automatic check- out, for which it provides six test setup configurations:

(1) Checkout of upper case subassembly MX-8846/GSQ-160 in conjunction with Target Standard Simulator SM-618/GSQ-160 and antenna simulator SM-616/GSQ-160 through connectors P15, P14, J24, and J9.



WIRE CHART			
FROM CONN	TO CONN	WIRE COLOR	WIRE FIND NO.
P1A	P3A	BRN	7
P1B	P3B	RED	11
P1C	P3C	ORN	12
P1D	P3D	YEL	13
P2A	P4A	GRN	14
P2B	P4B	BLU	15
P2C	P4C	VIO	16
P2D	P4D	GRAY	17

Figure 9-6. Special Purpose Branched Electrical Cable Assembly CX-12591/GSQ-160.

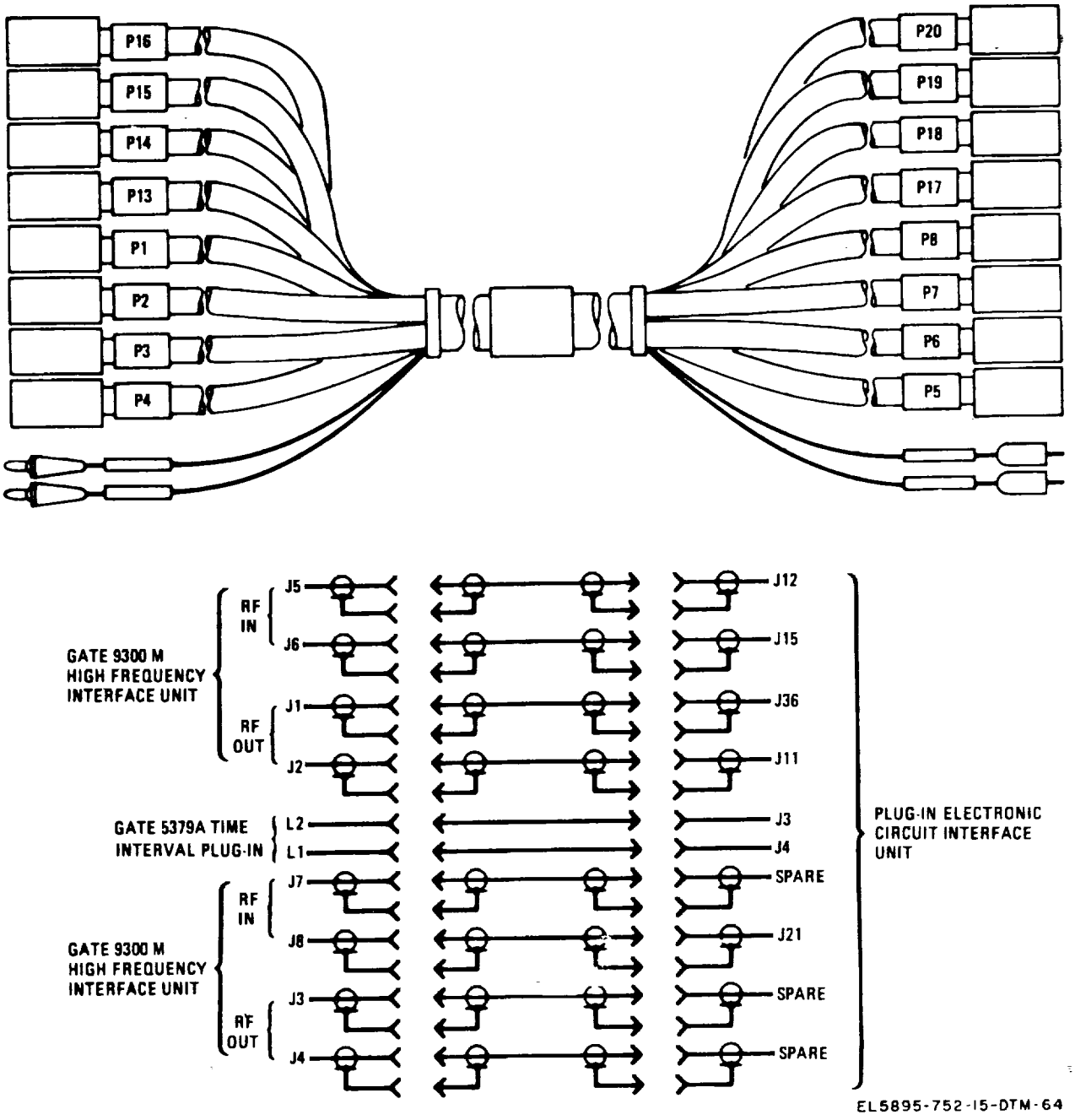


Figure 9-7. Special Purpose Branched Electrical Cable Assembly CX-12593/GSQ-160.

(2) Checkout of antenna coupler A5 through connectors P17 and P18.

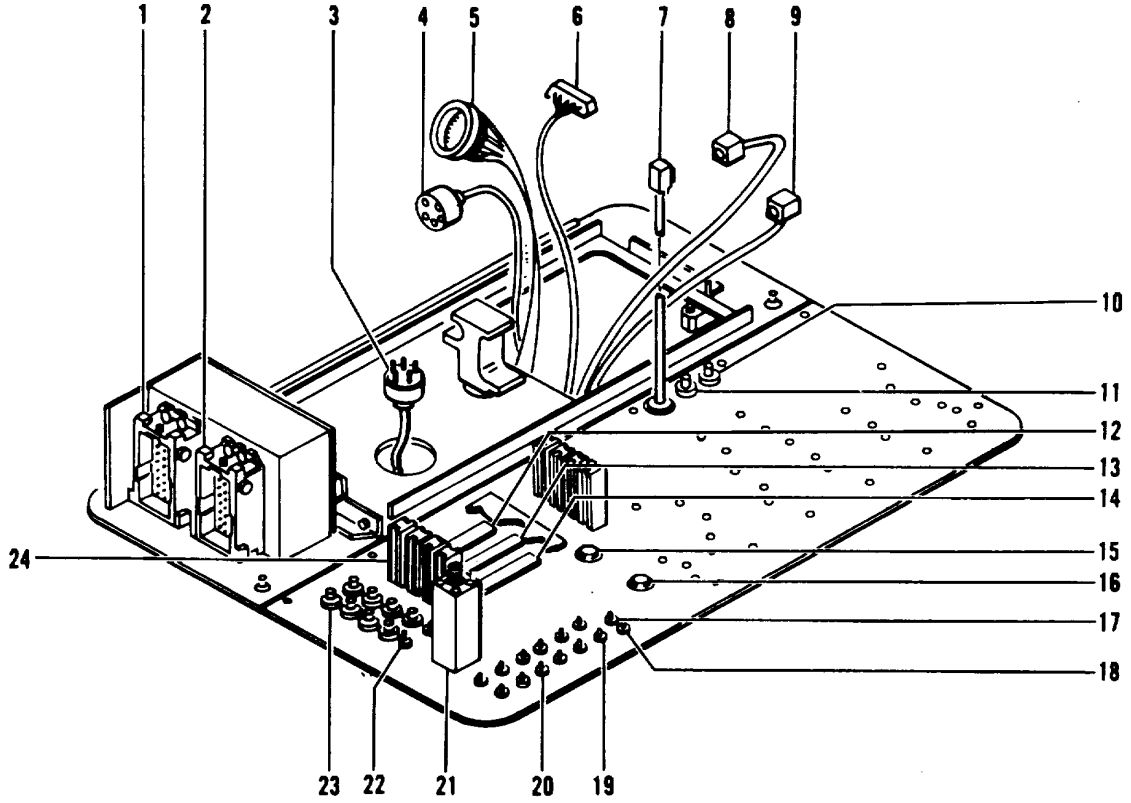
(3) Checkout of sensor oscillator module A1 in conjunction with Target Standard Simulator SM-618/GSQ-160 and Antenna Simulator SM-617,/GSQ-160 through connectors J14, J16, and J8.

(4) Checkout of Antenna AS-2542/GSQ-160 through connector J6.

(5) Checkout of AN/GSQ-160 circuit boards A2, A3, and A4 through circuit board connectors J13, J19, and J22.

(6) Checkout of Battery BA-1549/U through connector P13.

c. The interfaces between the MX-8924-GSQ-160 and the AN/GSM-220(U) are comprised of the signal cabling between the GATE interconnect panel



1., 2. CONNECTOR J1, J2
CONNECTOR, RECEPTACLE, SM-C-588363
SHIELD, ELECTRICAL, SM-A-588364
CONTACT, ELECTRICAL, SM-A-588366

3. CONNECTOR, RECEPTACLE, P13, SM-C-588386
COVER, CONNECTOR, SM-C.588508

4. CONNECTOR, RECEPTACLE, P14, SM-A-588358
COVER, CON,NECTOR, SM-C 588509

5. CONNECTOR, J24, TA383

6. CONNECTOR, P15, M24308/1-3
SHIELD, CONNECTOR, SM-A-588502 002

7 CONNECTOR, P1, M24308/3-3
SHIELD, CONNECTOR, SM-A-588502-003

8. CONNECTOR, P17, SM-A-588526
LUG, TERMINAL, MS35436-6

9. CONNECTOR, RECEPTACLE, P18, SM A-588225
LUG, TERMINAL, MS35431-3

10., 11. CONNECTOR, J8, J9, M39012/21-0001
LUG, TERMINAL, MS35456-9

12. J19
13. J22 } WIRING BOARD, PRINTED, TB2, SM-C-588467 CONNECTORS (3) M55302 2-04
14 J13

15 GROMMET, MS35431-7
CONTACT, ELECTRICAL, J16, SM-A-588236

16. GROMMET, MS35489-35489-35 (J14)

17., 18 POST, ELECTRICAL, J34, J35, SM-C-588452

19. CONNECTORS J28, J23, J26, J30, J33, J32, J28, J25, J29, J24, M3924/10-02

20 CONNECTOR, J27, M39024/10-03

21. STAND, ANTENNA, SM-C588493
CONNECTOR, J6, M39012/4-0002

22 CONNECTORS J3, J4, M39024/10-02

23 CONNECTORS, 3 SPARES, J12, J21, J11, J15, J36 M39012/21-0001

24 CARD GUIDE (8), SM-A-588480

EL5895-752-15-DTM-67

Figure 9-8. Plug-In Electronic Circuit Interface Unit MX-8924/GSQ-160.

connectors J1 and J2 and J1 and J2 on the interface unit; signals between the GATE high frequency interface unit connectors J1 through J8 and interface unit connectors J11, J12, J15, J21, J36 and three spares; between GATE time interval plug-in connectors L1 and L2 and interface unit connectors J3 and J4 (figs. 9-6 and 9-7).

d. The MX-8924/GSQ-160 requires dc voltages to power the AN/GSQ-160 subassemblies under test and

to energize signal conditioning circuits within the unit. All required dc voltage inputs are supplied by the AN/GSM-220(U) through the GATE interconnect panel or by the Battery BA-1549/U. The signal conditioning circuits within the MX-8924/GSQ-160 consist of a ±2.8- volt regulator, a signal amplifier, filters, a standard primary processor, a peak detector, and a voltage standing wave ratio (vswr) detector. All these components are located beneath the top plate of the MX-8924,/GSQ-160.

Section II. FUNCTIONING

9-9. SM-618/GSQ-160

a. The control unit and switching matrix of Target Standard Simulator SM-618/GSQ-160 operate with the Antenna Simulator SM-616/GSQ-160 or SM-617/GSQ-160 to verify the AN,/GSQ-160 primary processor output as a function of the RF difference frequency and the target range, to simulate targets at varying ranges for use in aligning sensor oscillator A1, to enable adjustment of the antenna coupling to optimize close target rejection, and to check a complete AN/GSQ-160.

b. The switching matrix (fig. 9-9) consists of seven semirigid coaxial cable lengths associated with relays K1 through K7, a 50-ohm termination associated with relay K8, and the network associated with relays K9 and K10 which simulate the standard reflections of 0, 10 and 12 db used to evaluate AN/GSQ-160 threshold detection performance. The electrical lengths of the semirigid coaxial cables represent simulated range distances from 3 inches to 16 feet each. They are selected in various combinations by outputs of the 7-stage binary counter in the control unit to program range increments varying from residual (18 inches) to 31.75 feet (plus residual) in 3-inch increments. The residual length of approximately 18 inches represents the cumulative electrical length through the shunt paths across the relays and relay interconnections. A 5-db attenuator at the input port of the switching matrix isolates any mismatching that may develop at the type N connector mating to the antenna simulator.

c. The control unit provides the logic for automatic operation controlled by GATE or manual operation from the front panel switches. Figure 9-10 is a simplified block diagram of the control unit and its connection to the switching matrix. Either an external or internal clock can be used to drive the divide-by-4 counter consisting of two flip-flops connected in series. The output of the divide-by-4 counter is gated to the 7-stage binary counter and K8 in the switching matrix through a switching relay. The internal clock operates at 4 pps so the normal signal input to the binary counter and switching matrix will be either 1 pps or off.

d. The control unit provides for three operating modes. In the manual mode, the internal clock is used, the logic jumps to a preset range, and the load oscillates at a 1-pps rate. This is the mode used for gross operability checks. In the cycle mode, the unit cycles from minimum to maximum range when the START pushbutton is pressed. In the GATE mode, the unit responds to the external clock and remote commands from the GATE equipment.

e. Typically, operation begins with relays K1 through K7 deenergized and the range simulation at the residual. Relay K8 is programmed to switch between the 50-ohm termination and the open circuit mismatch through deenergized relays K9 and K10.

9-10. Antenna Simulator SM-616/GSQ-160

a. A schematic diagram for the antenna simulator is given as figure 9-11. This simulator is used in the manual gross operability check and in the automatic GATE checks. It is used as a compatible termination to the output of antenna coupler module A5 of the AN/GSQ-160.

b. Input to the simulator from the AN/GSQ-160 is through type N connector J1. Two RF paths are provided by connector J1 to conform to the design of the AN/GSQ-160. The center conductor with shield is used for data transmitter A7 output and is routed through L1 to J2. Coil L1 is a five-turn coil made by winding coaxial cable on an air core form. The attenuation to connector J2, data transmitter A7 output, is less than 1 db at data transmitter A7 frequency. Capacitors C1 and C2 and inductor L1 make up a band rejection filter for sensor oscillator A1 and are connected to the outer conductor of both the connector and the coaxial cable. The connection technique permits grounding of the coaxial shield at data transmitter A7 without shorting sensor

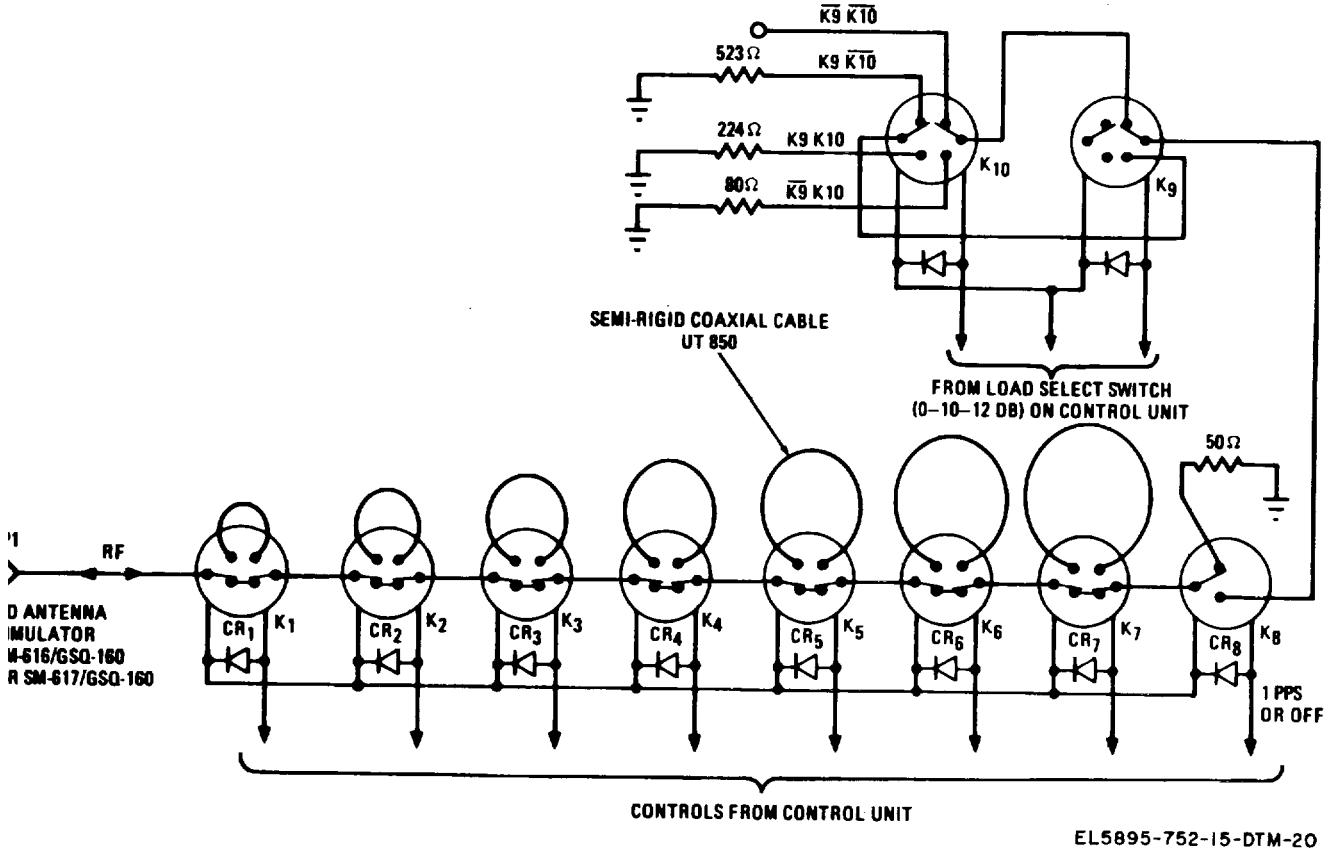


Figure 9-9. Switching matrix simplified logic diagram.

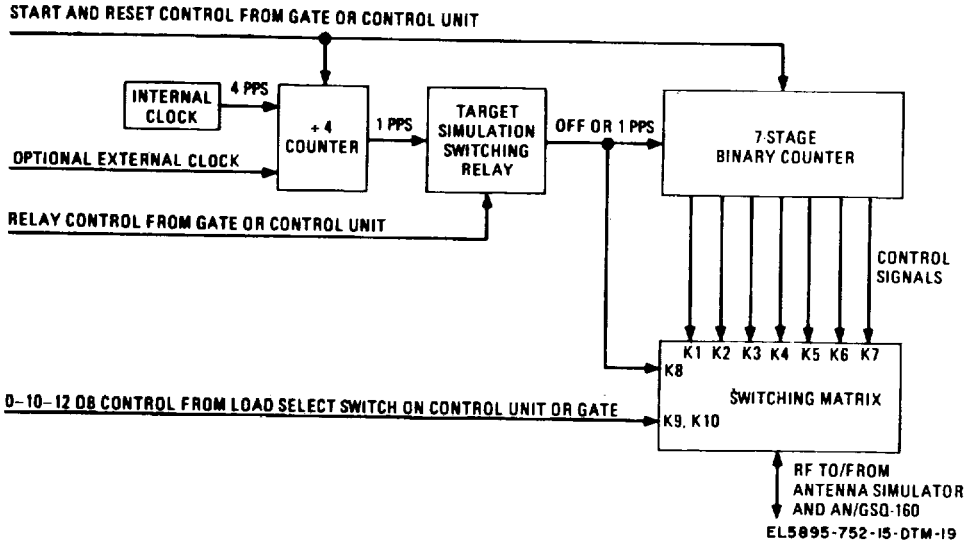


Figure 9-10. Control unit block diagram.

oscillator A1 frequencies. The sensor oscillator circuit is between the outer conductor and case ground. Complex impedance, made up of variable inductance L2, variable capacitor C3, and variable resistor R4 is adjustable to match the antenna impedance and phase curves required.

c. An increase in L2 inductance with a decrease in capacitor C3 tends to increase the slope of the curve; resistor R4 is used to set the Z-magnitude

at resonance. Variable resistor R8 is used to compensate for input signal level changes to the bridged-T pad consisting of resistors R3, R5, R6, and R9, and to the L-pad consisting of resistors R3, R5, R6, and R9, and to the L-pad consisting of resistors R1 and R2 when changes to variable resistor R4 have been made. Attenuation to the two pads is thus maintained at 6.5 db. Attenuation of the L-pad connected to J3, used for frequency measurements, is 13.5 db into 50 ohms. The total attenuation between J1 and J3 is 20 db. The bridged-T pad reduces the signal by 3.5 db prior to the output pi attenuator connected to J4 that consists of resistors R7, R10, and R11. The total attenuation between J1 and J4 is --20 db into 50 ohms. The characteristic impedance at J4 is maintained through R7, R10, and R11 (pi attenuator) by control of the circuit board component layout.

d. Functional particulars for the connectors on the SM-616,/GSQ-160 are-

Connector	Function	Characteristics
J1	Input port for interface with AN/GSQ-160 during simulation of antenna in an average field with data transmitter A7 connected and in the OFF mode.	*Frequency:* (f_L±500 KHz)+(f_H ±500 KHz). *Power:* 1 milliwatt maximum per oscillator. *Impedance:* Between 49 and 55 ohms between 23° and 27° for f_L; between 69 and 75 ohms between 41° and 45° for f_H. Connector type: Selectro (male), type N.
J2	Provides an output relative to the RF output power level of data transmitter A7.	*Frequency*=vhf specific frequency determined by crystal in data transmitter A7. *Impedance:* 50 ohms. *Connector type:* BNC. A*ttenuation:* 1 db (nominal).
J3	Frequency measurement port for sensor oscillator A1 output. The frequency measurement port is isolated from the input port.	*Frequency:* (f_L500 KHz)+(f_H±500 KHz). *Impedance:* 50 ohms. C*onnector type:* BNC. *Attenuation:* Between 19 and 21 db.
J4	Target simulation port for interface with the switching Matrix of Target Standard Simulator SM-618/GSQ-160	*Frequency:* (f_L±500 KHz)+(f_H±500 KHz). *Impedance:* 50 ohms (nominal). *Connector type:* N (receptacle). *VSWR:* 1.1:1 *Differential phase delay:* ±1°.

9-11. Antenna Simulator SM-617/GSQ-160

a. The SM-617/GSQ-160, is used only for output loading of the AN/GSQ-160 sensor oscillator module A1 module A1 during checkout and adjustment. A schematic diagram is given in figure 9-12.

b. This simulator consists of a complex input impedance, a simulated diplexer, two output attenuators, and three connectors. Input is through a miniature connector to a trap consisting of tuning capacitor C4 and inductor L3. Tuning capacitor C1, capacitor C2, and inductor L1 make up a band-rejection filter for the sensor oscillators. The complex impedance, made up of variable inductor L2, tuning capacitor C3, and variable resistor R4, is adjustable to match the antenna impedance and phase curves required. An increase in L2 inductance with a decrease in C3 capacitance tends to increase the slope of the curve; variable resistor R4 is used to set the Z-magnitude at resonance. Variable resistor R8 is used to compensate for input signal level changes to the bridged-T pad and the L-pad when changes to variable resistor R4 have been made. The bridged-T pad consists of resistors R3, R5, R6, and R9; the L-pad consists of resistors R1 and R2. Attenuation to these two pads is thus maintained at 6.5 db. Attenuation of the L-pad into J2 for use in frequency measurement is 13.5 db into 50 ohms. The total attenuation between J1 and J2 is 20 db. The bridged-T pad reduces the signal by 3.5 db prior to the output pi attenuator connected to the J3 port. The pi attenuator consists of resistors R7, R10, and R11. The total attenuation between J1 and J3 is 20 db into 50 ohms. The characteristic impedance at J3 is maintained through pi attenuator resistors R7, R10, and R11 by controlling the layout of components on the printed cir-cuit board.

9-12. Electronic Circuit, Plug-in MX-8924/GSQ-160 Interface Unit

Many of the response and stimuli signals passed between the AN/GSQ-160 under test and GATE are routed through the MX-8924/GSQ-160 without any additional signal conditioning. These signal paths are readily traced on the schematic diagram (fig. FO-11).

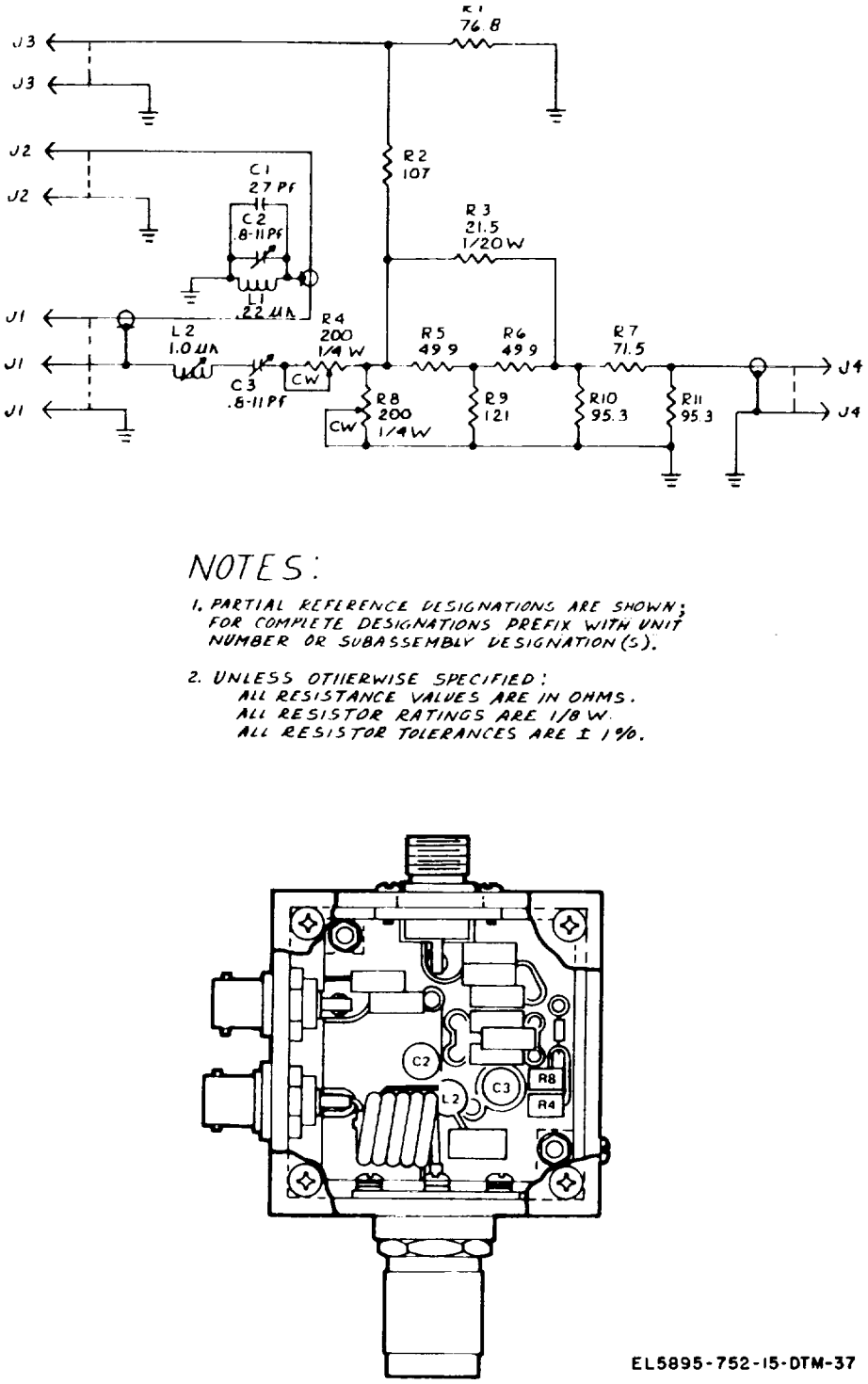
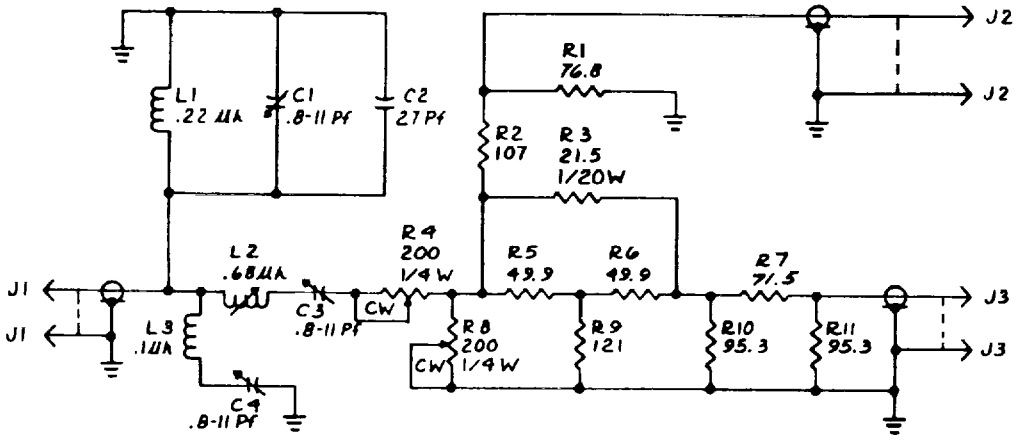


Figure 9-11. Antenna Simulator SM-616/GSQ-160, schematic diagram and parts location.

In other cases, signal conditioning is required for interface compatibility.

a. RF Signal Conditioning. The RF signal conditioning function involves the amplification and filtering of the AN/GSQ-160 sensor oscillator A1 output signal during testing. The output of sensor oscillator A1 is a composite signal containing both a high frequency (f_h) and a low frequency (f_l). Filter A3 (fig. FO-11) in the MX-8924/GSQ-160 separates the two frequencies for measurement.



NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER OR SUBASSEMBLY DESIGNATION'S.

2. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTANCE VALUES ARE IN OHMS.
   ALL RESISTOR RATINGS ARE 1/8 W.
   ALL RESISTOR TOLERANCES ARE ±.25%.

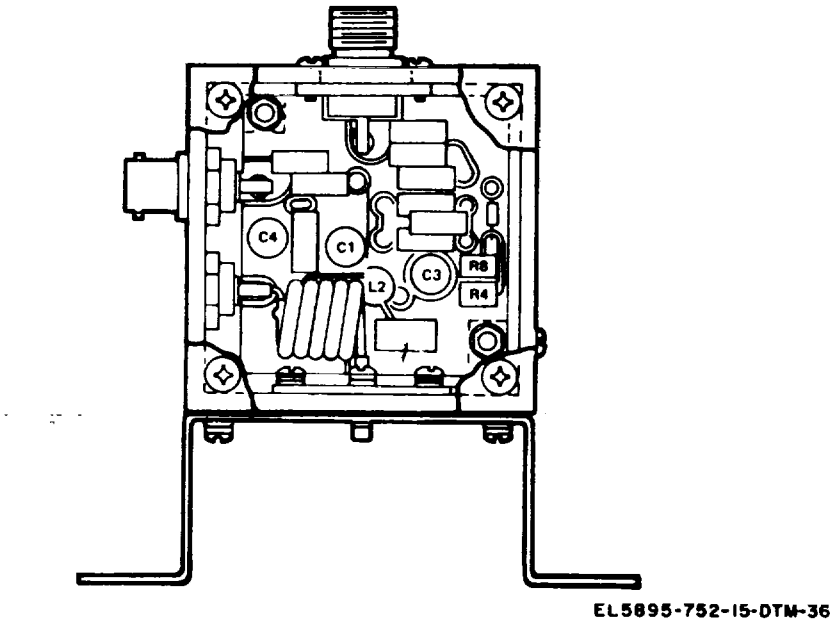


Figure 9-12. Antenna Simulator SM-617/GSQ-160, schematic diagram and parts location.

Filter A3 is voltage controlled to enable automatic testing. When 0 volt is applied to the control input from a GATE power supply F_1 is routed to the GATE for measurement. When +28 volts are applied to the control input, f_h is routed to the GATE for measurement. RF amplifier A1 in the loop amplifies the RF signal to a level sufficient to trigger the counter within the GATE. The gain of RF amplifier A1 is 17 db minimum and dc power is supplied from the GATE equipment.

b. Vswr Measurement. Vswr detector A2 (fig. FO-11) is a bridge that compares an unknown impedance with a standard termination having a vswr of 1:1. Vswr detector A2 receives an RF input from a frequency synthesizer within the GATE. The output of A2 is a negative dc voltage with a magnitude proportional to the vswr of the unknown load. Reference Z1 represents the standard 1:1 vswr termination while the unknown impedance is routed through relays K18 and K17 to input Z2. Detector A2 is also used to measure the vswr of the data transmitter A7 connector port and the sensor oscillator connector port of the AN/GSQ-160 antenna coupler A5 and Antenna AS-2542/GSQ-160.

c. Disable Pulse Load. Because data transmitter module A7 of the AN/GSQ-160 is not connected during automatic testing, the MX-8924/GSQ-160 supplies a load for the disable pulse that simulates the load normally presented by data transmitter A7. The parallel combination of resistors R2 and R3 from disable pin 52 on connector J24 is used for testing on a complete AN/GSQ-160. During module level testing, the parallel combination of resistors R9 and R12 from disable high (pin V) on connector J13 are used (fig. FO-11).

d. Regulator Loading. During module level testing, the ±2.8-volt dc regulator (located in AN/GSQ-160 supplemental circuits module A2) is tested under loaded conditions. The simulated loading is controlled by relays K6 and K19 in the MX-8924/GSQ-160 (fig. FO-11).

e. Day Night Simulation. During module level testing, fixed resistors R21 and R22 in the MX-8924/GSQ-160 simulate the on or off impedance of photo sensor V1. The two resistors are controlled by two address relays in the GATE. Closing GATE relay address No. 0 simulates a day condition; closing GATE relay address No. 1 simulates a night condition. Signals are routed through MX-8924/GSQ-160 connector J1, pins AT and AV (fig. FO-11).

f. Disable Condition Simulation. The MX-8924 /GSQ-160 simulates various combinations of disable conditions with relay logic involving relays K7, K8, K9, K10, K15, and K16 (fig. FO-11). Relays K15 and K16 are used to switch between a fixed +4 volts, -4 volts, or +30 volts supply voltage and a source of variable supply voltages that simulate a low voltage disable condition. The remaining relays simulate functions as follows:

Relay designator	Relay state	Function performed
K7	Energized	ON-TEST/ARM
	Deenergized	OFF
K8	Energized	ON-TEST/ARM
	Deenergized	OFF
K9	Energized	ARM
	Deenergized	ON-TEST
K10	Energized	Improper code/no tamper
	Deenergized	Proper code/tamper
K11	Energized	Tilt
	Deenergized	No tilt

g. Standard Primary Processing. Standard primary processor A4 in the MX-8924/GSQ-160 is identical with primary processor A3 in the AN/GSQ-160. Primary processor A4 is used to measure the noise of the AN/GSQ-160 sensor oscillator A1 under test. To perform this test, sensor oscillator A1 is connected to the input of standard primary processor A4 and the output of A4 is measured. The sensor oscillator A1 under test is then removed from the setup. The output of standard primary processor A4 is again measured. The difference between the two standard primary processor A4 output measurements can then be correlated to the noise level of the AN/GSQ-160 sensor oscillator A1 under test.

h. Peak Detector,/Regulator. The peak detector and ±2.8-volt regulator are located on circuit board A5 in the MX-8924/GSQ-160. The ±2.8-volt regulator receives ±4-volt and -4-volt inputs from the AN/GSQ-160 Battery BA-1549/U in Battery Box CY-7046/GSQ-160 and derives the +4-volt, -4-volt, ±2.8-volt outputs to power the various modules when under test. Using Bat- tery BA-1549/U power and the regulator in the MX-8924/GSQ-160 frees the power supplies in the

GATE for other functions. The peak detector is used to hold the peak level of short duration signals so they can be measured with the digital voltmeter in the GATE. In addition to the ±4-volt dc supplied to the peak detector circuits from Battery BA-1549/U through the 2.8-volt regulator, the peak detector receives +28 volts dc from a GATE power supply. Relays K12 and K13 (fig. FO-11) provide input signal switching for the peak detector so that the proper signal can be routed to the peak detector input. The hold time of the peak detector is sufficient to enable measurements with less than 5 percent amplitude decay 10 seconds after the input pulse is removed. Signals routed to the peak detector input are-

Signal	*Source*
Alarm	From MX-8846/GSQ-160 upper case
Disable	From MX 8846/GSQ-160 upper case
Alarm	From module under test
Disable	From module under test
Mute	From module under test
Primary processor output.	From module under test

i. Power Consumption. The MX-8924/GSQ-160 measures the +4-volt, -4-volt, and +30-volt power consumption of an AN,/GSQ-160. Energizing relays K1 and K5 (fig. FO-11) places resistors R1, R5, and R6 in series with the AN/GSQ-160 Battery BA-1549/U and upper case MX-8846/GSQ-160. The voltage across the resistors is then measured with the digital voltmeter in the GATE to provide a figure related to full-load power consumption.

Section III. DIRECT SUPPORT MAINTENANCE

9-13. General

a. Maintenance Categories. This section pro- vides maintenance information for Simulator Group OH-29/GSQ-160 required by direct support maintenance personnel. Because the equipment is intended for use in support of the AN/ GSQ-160 at higher maintenance categories as well, the information provided is equally applicable at direct support, general support, and depot maintenance locations.

b. Scope of Maintenance. The maintenance duties assigned to operators of Simulator Group OH-29/GSQ-160 include all the items covered in this section. These include-

(1) Service upon receipt of equipment (para 9-15).

(2) Preventive maintenance checks and services (para 9-16).

(3) Cleaning (para 9-17).

(4) Troubleshooting (para 9-18).

(5) Removal and replacement, disassembly and reassembly (para 9-22).

9-14. Tools, Test Equipment, and Materials Required

Required items are listed in the maintenance allocation chart and repair parts and special tools list. A summary of this information is as follows:

Item No.	Nomenclature	Federal stock number	Publication
1	Oscillograph RO-189/G with model 880/A pre-amplifier.	6625-892-4547	TM 11-6625-801-15
2	GATE Test Set, Alarm, Anti-Intrusion AN/GSQ-220(U).	6350-133-7595	General purpose automatic test equipment system (GATE), Hewlitt-Packard model 9203B.

9-15. Service Upon Receipt of Equipment

a. Unpacking. All components of Simulator Group OH-29/GSQ-160 are housed in the suitcase package and packed in a single commercial carton. No special unpacking precautions are required other than reasonable care to avoid damage to the equipment when opening the carton. Inspect the carton for signs of rough handling or damage. Report damage in accordance with paragraph 1-3. A shipping list and applicable technical manual should be included in the carton.

b. Checking Unpacked Equipment. Compare the contents of the carton with the shipping list to insure that all components have been received. After removing the suitcase from the carton, open the transit case and check the equipment stored within it (fig. 9-1) against the equipment list in paragraph 9-2. Report all discrepancies as required by local commands and in

accordance with paragraph 13.

NOTE

Shortage of a minor assembly or part that does not affect proper functioning of the equipment should not prevent the use of the equipment.

c. Checking Equipment for Damage. Inspect the equipment for damage incurred during shipment. If the equipment was improperly packaged, or damaged, report the difficulty on DD Form 6 or DISREP (SF 361) as pertinent.

d. Checking Equipment for Modifications. If the equipment has been used or reconditioned, see whether it has been changed by a modification work order. If the equipment has been modified, the MWO number will appear on the front panel near the nomenclature plate. Check to see whether the modified equipments are covered in the manual.

NOTE

This manual does not include modification work orders (MWO) for the equipment.

e. Inspection Prior to Use. Visually inspect all cables and components of Simulator Group OH-29/GSQ-160 for obvious indications of damage. Perform the routine preventive maintenance and inspection procedures specified in paragraph 9-16.

f. Checkout of Equipment. Obtain a complete AN/GSQ-160 and AN/GSM-220(U) known to be in good operating condition. Prepare the test setup and perform the checkout procedures specified in paragraph 9-18. If operation is not satisfactory, perform troubleshooting (para 9-18). If troubleshooting discloses a need for calibration of the SM-616/GSQ-160 or SM-617/GSQ-160 simulators, or depot maintenance on other components of the OH-20,/GSQ-160, attempt to obtain a replacement for the defective component before initiating disposition of a complete OH-29/GSQ-160 to higher category of maintenance.

9-16. Preventive Maintenance Checks and Services

a. Responsibility and Intervals. Personnel responsible for the operation and maintenance of Simulator Group OH-29/GSQ-160 at organizational categories shall perform the preventive maintenance procedures specified below at monthly intervals and shall insure that Antenna Simulators SM-616/GSQ-160 and SM-617/GSQ-160 are returned to depot facilities for calibration every 6 months. Simulators in need of calibration should be exchanged for simulators with valid calibrations to insure continued operability of the OH-29/GSQ-160 equipment at user activities.

b. Monthly Checks and Services.

Sequence	Item	Procedure	Reference
1	Handles and latches	Inspect handles, latches, and hinges for looseness. Replace or tighten as necessary.	
2	Cables	Inspect cords and cables for chafed, cracked, or frayed insulation. Replace cords and cables that are broken, stripped, or excessively worn.	
3	Connectors and test jacks	Verify that mountings are secure and electrical contacts are not bent or broken.	
4	On MX-8924/GSQ-160:		
	Clamp	Check spring tension and proper rotation.	
	Tilt bracket	Raise tilt plate to insure free action and check holding action of locking arm at all positions.	
	Control unit clips	Verify that clips securing control unit to test panel are fully inserted and secure.	
	Test panel	Raise test panel and inspect interior connections and components for visual indications of damage.	
	Connectors	Tighten all interior coaxial and threaded connectors on modular components.	
	Circuit cards A4 and A5	Insure that A4 and A5 are securely seated in connectors.	
	Test panel	Reinstall attaching hardware.	
5	Control unit of SM-618/GSQ-160:		
	Connectors J1 and J2	Inspect for pin damage. Replace as required.	
	Panel lamps	Inspect for broken bulbs or loose mountings, Replace as necessary.	

Sequence	Item	Procedure	Reference
	Fuse F1	Remove and visually inspect. Replace as necessary.	
	Panel switches	Tighten mounting nuts and knobs as required. Check rotation and snap action as appropriate.	
6	SNM-616/CSQ-160 and SM-617/GSQ-160.	Tighten cover screws. Inspect connectors for dirt or damage. Clean as required. Replace units with damage or with expired calibration periods.	
7	Switching matrix of SM-618/GSQ- 160.	Inspect cable, connector, and mounting bracket. Replace defective unit.	
8	OH-29/GSQ-160	Inspect all components for dirt and debris and clean as required.	Para 9-17.
		Perform check out procedures	Para 9-18.

9-17. Cleaning

The case and components of Simulator Group OH-29/GSQ-160 should be cleaned only when inspection discloses an obvious need. Trichloroethane is the only cleaning agent authorized for electronic equipment.

WARNING

1. The fumes of trichloroethane are toxic. Provide thorough ventilation whenever used. DO NOT use near an open flame. Trichloroethane is not flammable, but exposure of the fumes to an open flame converts the fumes to highly toxic, dangerous gases.
2. All components cleaned with trichloroethane shall be thoroughly dry before use or assembly. Failure to comply may result in damage to equipment or personnel injury due to fumes.

a. Remove dust from the exterior surfaces and interior compartments of the equipment with a portable vacuum cleaner fitted with a small brush nozzle. Be careful to avoid damaging electronic components. Use a small hand brush to remove dust from narrow spaces between components.

b. Remove film from the panels and cases of the equipment by using a clean lint free cloth moistened with trichloroethane.

c. Clean coaxial and pin connectors or cables with the portable vacuum cleaner or a small brush. Heavy accumulations may be removed with a brush moistened with trichloroethane. Dry thoroughly before storing or using.

d. Clean circuit boards with a brush moistened with trichloroethane. Avoid saturating; thorough drying is mandatory. Do not attempt to clean the contact pins on circuit boards unless there are conspicuous deposits or corrosion. Clean the pins with fine crocus cloth; be careful to avoid bending or changing the shape or diameter of the pins.

9-18. Troubleshooting and Checkout of OH-29/GSQ-160

The following checkout of OH-29/GSQ-160 equipment should be performed on a periodic basis to evaluate the operability of the equipment. The only additional equipment required to perform the test is a strip-chart recorder and an AN/GSQ-160 that is known to be good.

a. Equipment Required.

(1) Interface Unit, Electronic Circuit, Plug-In MX-8924/GSQ-160.

(2) Target Standard Simulator SM-618/GSQ-160.

(3) Antenna Simulator SM-616/GSQ-160.

(4) AN/GSQ-160.

(5) Oscillograph RO-189/G with 8801A pre-amplifier or equivalents.

(6) Two test cables to interconnect MX-8924/GSQ-160 with recorder.

b. Test Connections and Conditions.

(1) Use an AN/GSQ-160 that is known to be in good operating condition. Make sure data transmitter A7 is left within the upper case connected for operation, and the mode select switch on the upper case is set to OFF/SAFE.

(2) Make connections as shown in figure 9-13.

(3) Plug P1 of SM-618/GSQ-160 into 115-volt ac, 60-Hz power source.

(4) Position AN/GSQ-160 upper case on top of MX-8924/GSQ-160, raise clamp on MX-8924/GSQ-160, rotate a quarter turn, and clamp case to MX-8924/GSQ-160.

(5) Arrange Antenna Simulator SM-616/GSQ-160 and switching matrix of SM-618/GSQ-160, on

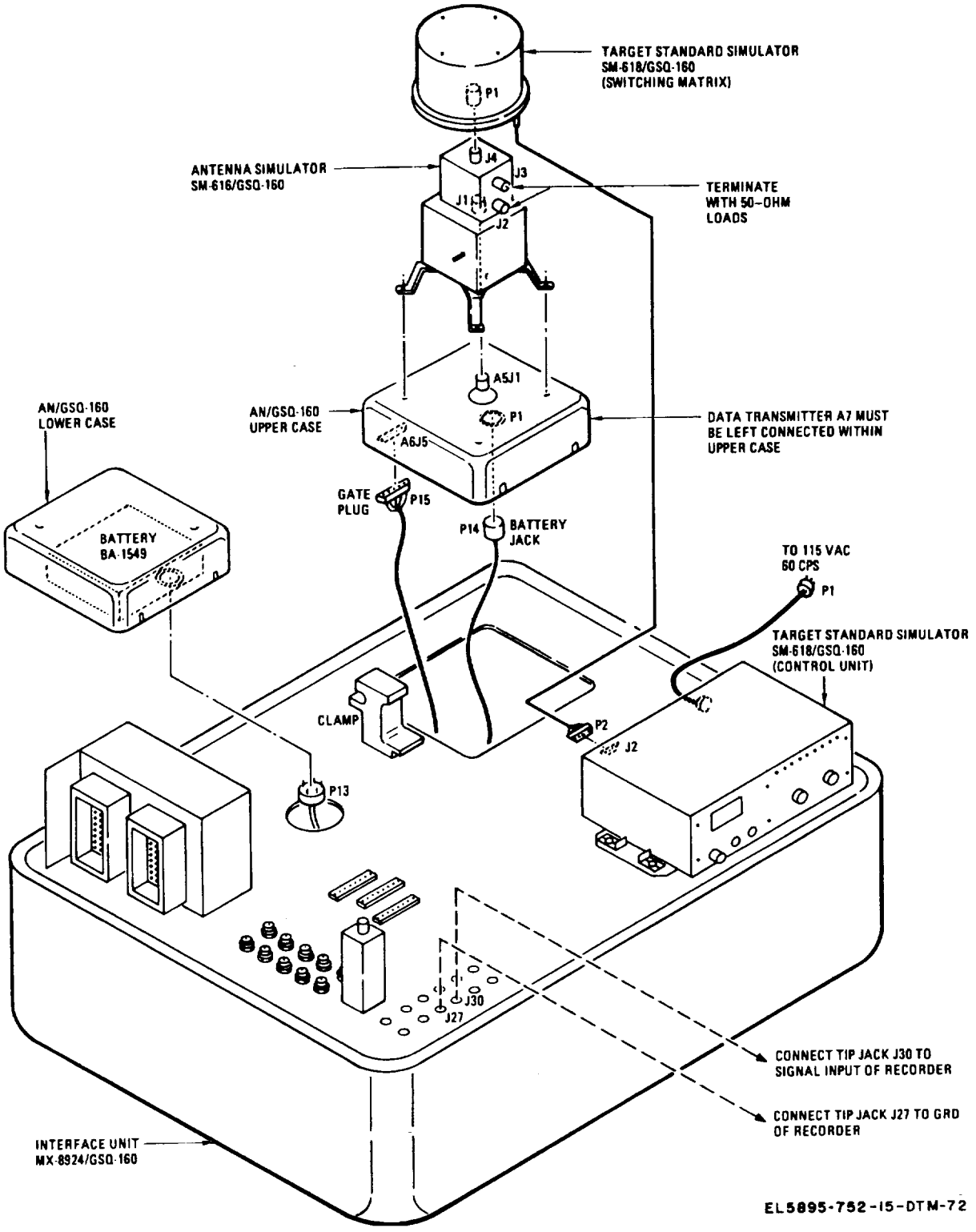


Figure 9-13. Operational checkout, test setup.

top of upper case as shown in figure 9-13. To insure no coupling of any external signals, J2 and J3 of SM-616/GSQ-160 can be terminated in 50-ohm loads.

c. Procedure.

(1) On the AN/GSQ-160, set the mode select switch to ON/TEST.

(2) On the control unit of the SM-618/GSQ-160, set the ON/OFF switch to OFF, the MODE switch to CYCLE, and the LOAD SELECT switch to NORMAL..

(3) Set up the oscillograph for a deflection sensitivity of 0.2 volts/cm, and prepare the oscillograph for operation at a chart speed of 2.5 millimeters/sec.

(4) After the AN/GSQ-160 has warmed up for 5 minutes, set the ON/OFF switch of the SM-618/GSQ-160 control unit to ON. Then press the RESET switch

Malfunction	Probable cause	Corrective action
1. Control unit ..... source.	No input power	Plug P1 of unit into 11, vac power
	Bad fuse.....	Replace fuse F1.
	Faulty LOAD lamp or circuit failure	For quick isolation of fault, proceed to step 2.
2. Switching matrix	Circuit failure	Remove P2 of switching matrix from J2 of control unit. If malfunction is corrected, switching matrix is probably bad and should be replaced. If malfunction is not corrected, replace control unit.

and note that the LOAD lamp cycles on and off at an approximate 1-Hz rate. If not, troubleshoot the equipment as follows:

(5) Press START switch on SM-618/GSQ-160 control unit. Observe that RANGE (FEET) lamps light and extinguish in a sequence which indicates a linear increase in range. *For example,* for each two cycles of the 1/4 foot lamp, the 1/2 foot lamp should cycle one time, etc. If not, troubleshoot as follows:

Malfunction	Probable cause	Corrective action
1. Control unit	Faulty RANGE (FEET) lamps or circuit failure.	For quick isolation of fault, proceed to step 2.
2. Switching matrix	Circuit failure	Remove P2 of switching matrix from J2 of control unit. If malfunction is corrected, switching matrix is probably bad and should be replaced. If malfunction is not corrected, replace control unit.

(6) Repeat previous step by pressing RESET and then START switch on control unit. However, this time obtain recording on oscillograph similar to that shown on A, figure 9-14. Analyze the recording obtained. The curve traced by end points of pulses must be smooth with no major discontinuities between pulses, and no pulses can be missing. If not, troubleshoot as follows:

NOTE

The recording is obtained by monitoring AN/GSQ-160 primary processor output as the switching matrix cycles from 0 to 31.75-foot range with the line being terminated in matched terminations and mismatch alternately. Each recording will be typical of the AN/GSQ-160 involved; therefore, an AN/GSQ-160 of known performance should be retained for this checkout procedure. Otherwise, unit-to-unit variation might show the peaks and nulls at different ranges, or amplitude variation. Difference in range of the nulls would appear as variations of the zero amplitude points, moving to different locations on the abscissa.

Malfunction	Probable cause	Corrective action
1. No pulses	Oscillograph interconnection or adjustment.	Check wiring between oscillograph and MX-8924/GSQ-160. Check oscillograph setup instructions.
	Antenna Simulator SM-616/GSQ-160 faulty or mistuned sufficiently to cause AN/GSQ-160 oscillators to pull outside dynamic range of primary processor.	Replace SM-616/GSQ -160.
2. Pulses present but have very low amplitude.	Oscillograph adjustment	Check oscillograph setup instructions.
	Tuning or component change in SM-616/GSQ-160.	Replace SM -616--GSQ--160.
3. Major discontinuities in curve traced by end points of pulses.	Relay failure in switching matrix	Replace switching matrix of SM-618/GSQ-160.
	Control unit not sending proper control signals to relays of switching matrix.	Replace control unit of SM-618/GSQ-160.
4. Missing pulses	Control unit not consistently sending control signals to switching matrix relays, or internal clock not functioning properly. Erratic relay switching in switching matrix.	Replace control unit.
		Replace switching matrix.
5. Triangular instead of sinusoidal waveforms.	Mismatch in SM-616/GSQ-160 or switching matrix of SM-618/GSQ-160.	Replace either of the units and observe results, obtained from re-run of recording. If fault is still present, change the other unit and observe results obtained from next re-run of recording.

(7) On control unit of SM-618/GSQ-160, set LOAD SELECT switch to 0 DB, then press RESET and START switches, and obtain recording on oscillograph similar to that shown on B, figure 9-14. Set LOAD SELECT switch to 10 DB, press RESET and START switches, and obtain recording similar to that shown on C, figure 9-14. Finally, set LOAD SELECT switch to 12 DB, press RESET and START switches, and obtain recording similar to that shown on D, figure 9-14. Allow at least 30-second settling time between runs. Analyze the recordings obtained to check to see that the figure 9-14 recording is similar to the A, figure 9-14 recording except that the pulse peaks will be reduced at the range of 28 feet by an approximate factor of 5. Also check to see that the figure 9-14 recording is similar to the B, figure 9-14 recording, except that the pulse peaks will be increased at the range of 28 feet by an approximate factor of 3.1 (10 db), and that the D, figure 9-14 recording is similar to the figure B, 9-14 recording except that the pulse peaks will be increased at the range of 28 feet by an approximate factor of 4 (12 db). If not, troubleshoot as follows:

NOTE

B, figure 9-14 is obtained in the same way as the previous test, but the switching matrix is switching between a matched condition and an arbitrary reference level defined as 0 db. In operation, the AN/GSQ-160 makes alarm decisions based on the presence or absence of a target yielding either a 12 or 10-db increase (respectively) differential deviation over the reference, at the primary processor input. To test this function, the AN/GSQ-160 is allowed to settle at a specific range at the 0 db (reference) level. After this, the stimulus level is switched to 10 db for a *no-alarm* condition, and to a 12-db level for an *alarm* condition. B, C, and D, figure 9-14 illustrate these changes in level, but the only relation designed to be consistent is the amount of differential deflection between 0-, 10-, and 12-db levels at a specific range, in this case, 28 feet.

Malfunction	Probable cause	Corrective action
1. No pulses (B, fig. 9-14)	Oscillograph gain level too low	Check to see that oscillograph gain setting is 0.2 v/cm.
	Switching matrix not operating with 0-db load.	Replace switching matrix.
2. Pulses (C, fig. 9-14) not 10 db higher than pulses of B, fig. 9-14 at 28-foot range.	Switching matrix not switching in 10-db load or load has changed value.	Replace switching matrix.
3. Pulses (D, fig. 9-14) not 12 db higher than pulses of B, fig. 9-14 at 28-foot range.	Switching matrix not switching in 12 db load or load has changed value.	Replace switching matrix.

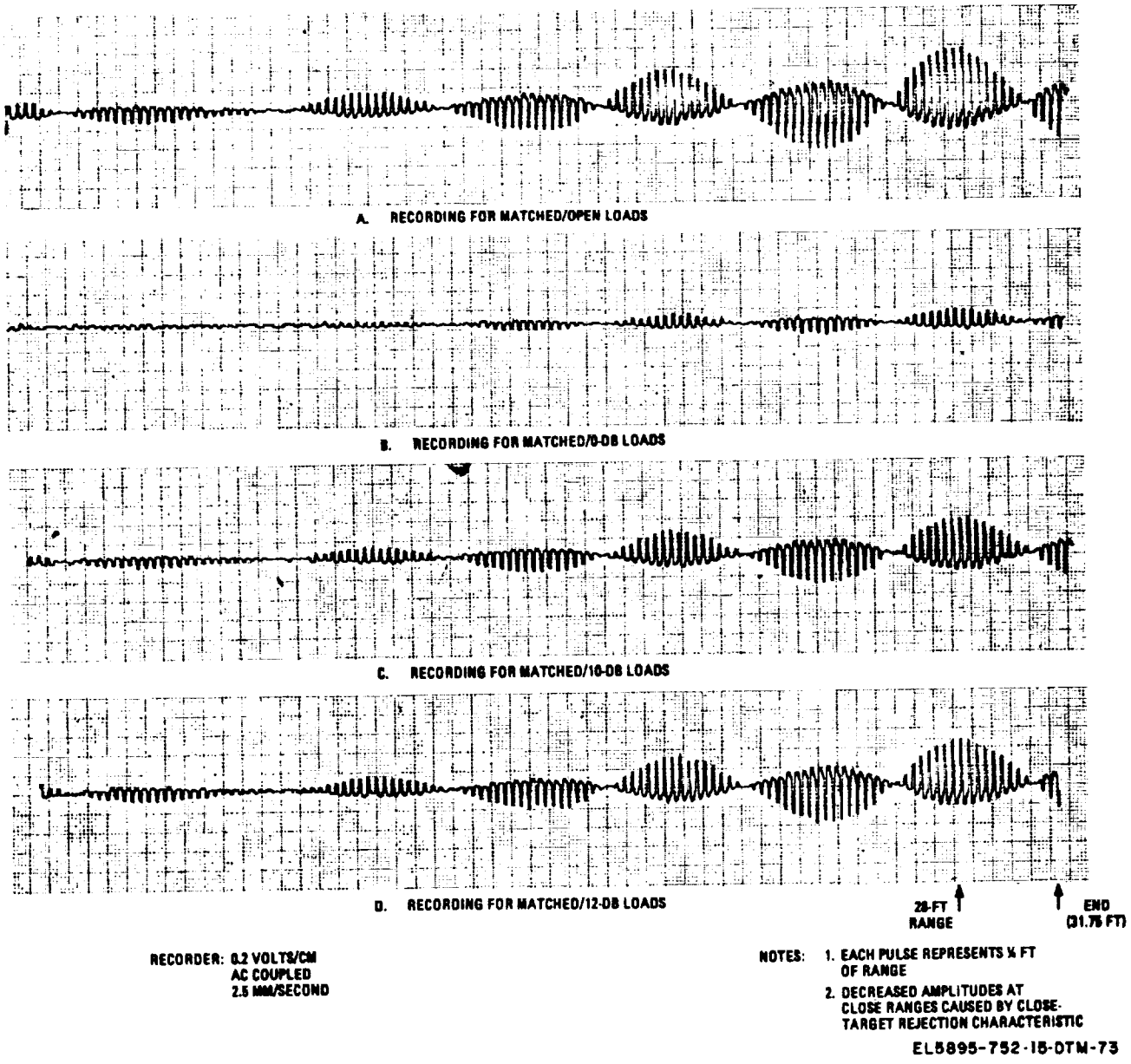


Figure 9-14. Typical checkout recording.

(8) If a malfunction of the SM-618/ GSQ-160 control unit has been isolated in any of the preceding steps, replace the complete unit as indicated in the procedural steps. At a later time, the trouble can be further isolated using the troubleshooting procedure given in paragraph 9-16. The SM-616/GSQ-160 and the switching matrix of the SM-618/GSQ-160 should be replaced as entire units when found to be faulty. No further trouble isolation is recommended. If the checkout procedure cannot be performed as indicated, then the MX-8924/GSQ-160 may be faulty, and the troubleshooting procedure given in paragraph 9-20 should be performed.

9-19. Troubleshooting Control Unit of SM-618/GSQ-160

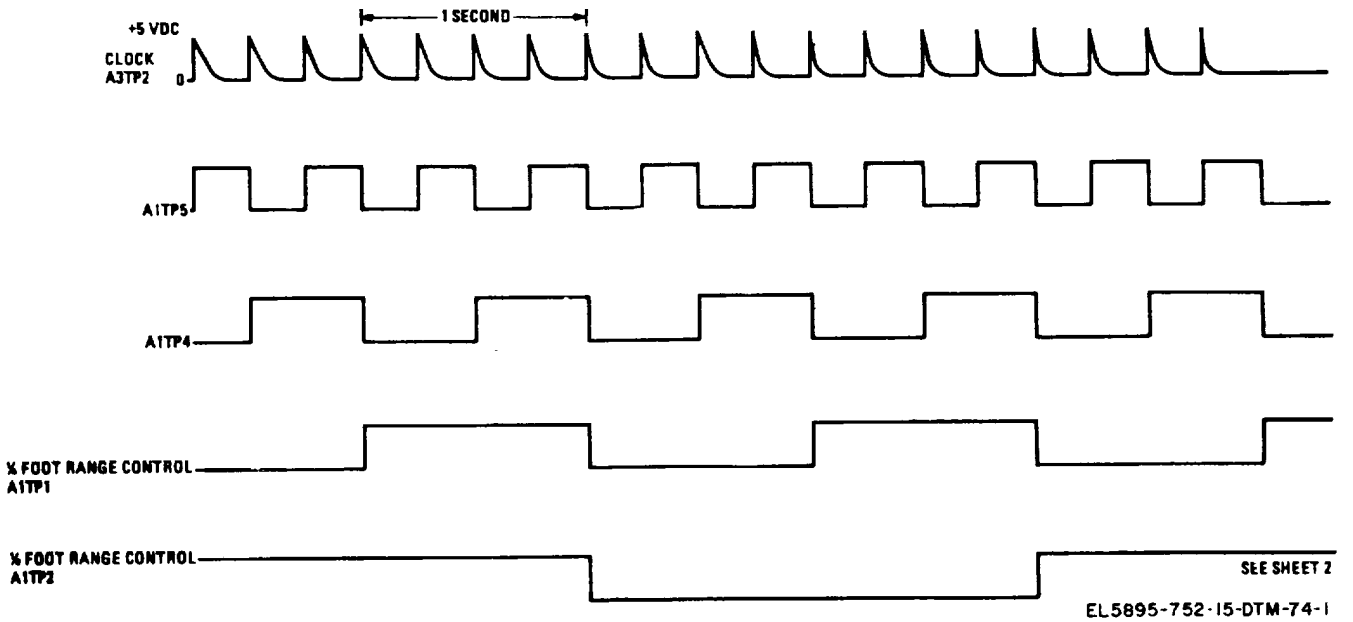
a. Plug P1 of the control unit into a 115-volt ac, 60-Hz power source. Set the ON/OFF switch to ON, the MODE switch to CYCLE, and press the RESET switch. At this time, all the RANGE (FEET) lamps should be off, but the LOAD lamp should be cycling on and off at an appropriate 1-Hz rate. If this does not occur, check fuse F1 before proceeding to next step.

b. Press the START switch. At this time, the RANGE (FEET) lamps should begin to light in an ascending order as described in paragraph 9-18 until all are lighted, indicating the maximum range of 31.75 feet. Then all the lamps should extinguish and remain off until the RESET and START switches are pressed again. If this does not occur, open the unit and connect the strip- chart recorder to the test points indicated on the timing diagram (fig. 9-15). Operate the RESET and START switches and obtain waveforms similar to those shown on the timing diagram. If more convenient, selected waveforms may be checked at connector J2 as follows. However, the 0- to +5- volt dc levels at the test points are inverted to +28 volts dc to 0 levels at the J2 pin. Figure 9-16 shows test point locations.

Test point 0 10 +5)	*Pint of J2 (+28 to 0)*
A1TP1	1
A1TP2	2
A2TP1	3
A2TP2	4
A2TP3	5
A2TP4	6
A2TP5	7
A1TP4	8

c. After obtaining the waveforms, analyze them as a troubleshooting aid *(for example,* no waveform at a test point would indicate that the associated module should be replaced) and proceed to troubleshoot as follows:

Malfunction	Probable cause	Corrective action
1. No waveforms and no lamps are lighted.	Bad fuse.....	Replace fuse F
	Bad power switch.....	Replace switch S1.
	Malfunction in power supply	Check for 115 vac (high) on pin 7 of power supply PSI, 115 vac (low) on pin 8, ground on pins 3 and 5. PS1 output at pin 6 should be +24 vdc. If not, replace PSI.
	Malfunction in +5 vdc circuit	Check A3TP1 for + 5 vdc level. If not present, replace module A4.
	Bad START or RESET switch.....	Check to see that AlTP3 is at +5 vdc when START switch is operated, and goes to 0 vdc after range has incremented to 31.5 feet or when RESET switch is pressed. If not, check and replace RESET S2 and START S5 switches as necessary.
	Bad MODE switch.....	Make continuity checks on MODE switch S4 and replace if necessary.
2. No waveform at A3TP2, or bad waveform.	Malfunction in A3 or A4.....	Replace module A3, then A4 if trouble is not corrected.
3. No waveform at A1TP5, or bad waveform.	Malfunction in A1	Replace module Al.
4. No waveform at A1TP4, or bad waveform.	Malfunction in A1	Replace module Al.
5. Waveform at AlTP4 but LOAD lamp not lighting.	Bad LOAD lamp.....	Replace LOAD lamp DS6. If trouble is not corrected, replace module A3.
6. No waveform at AlTP1, or bad waveform.	Malfunction in A1	Replace module A1



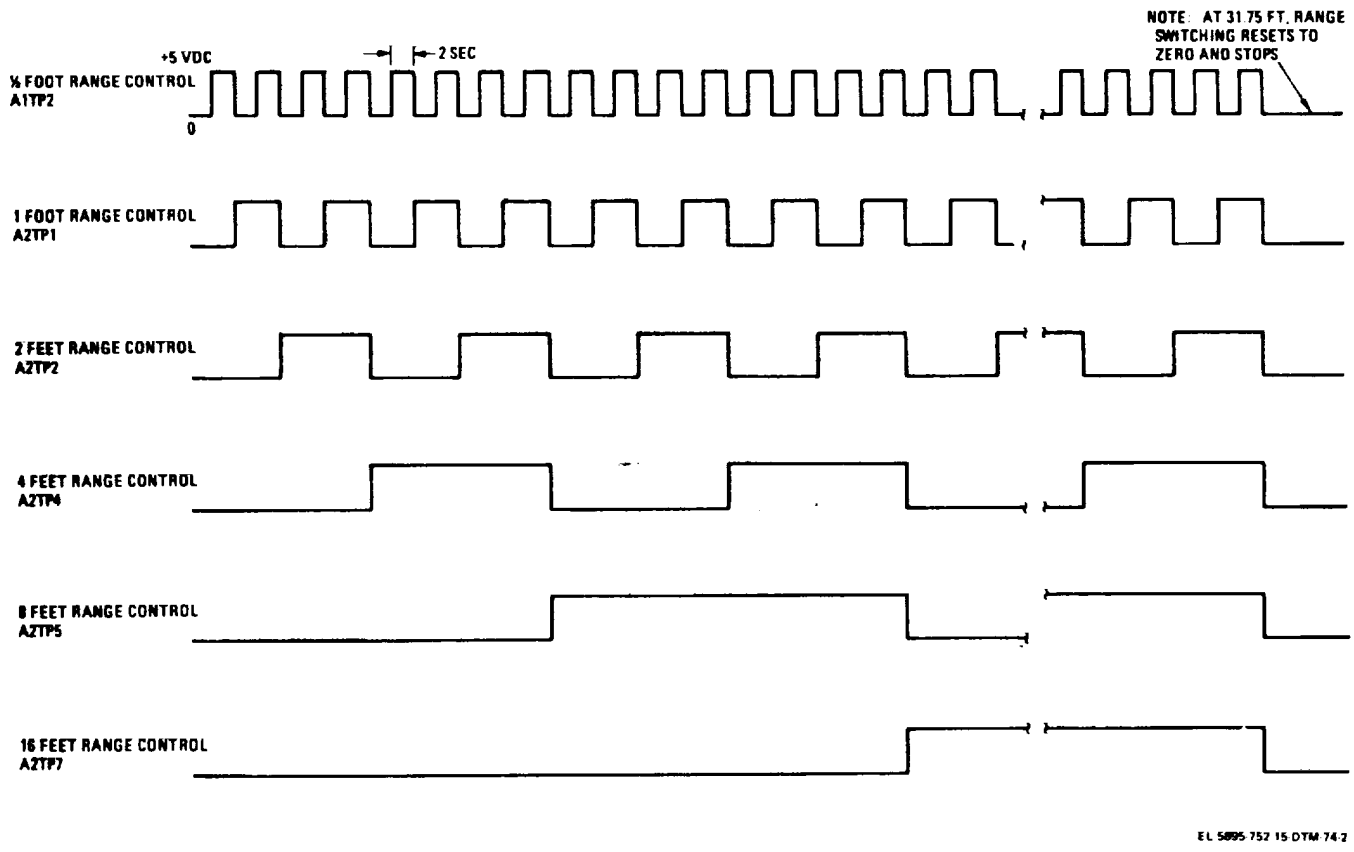


Figure 9-15. Control unit timing diagram (part 2 of 2)

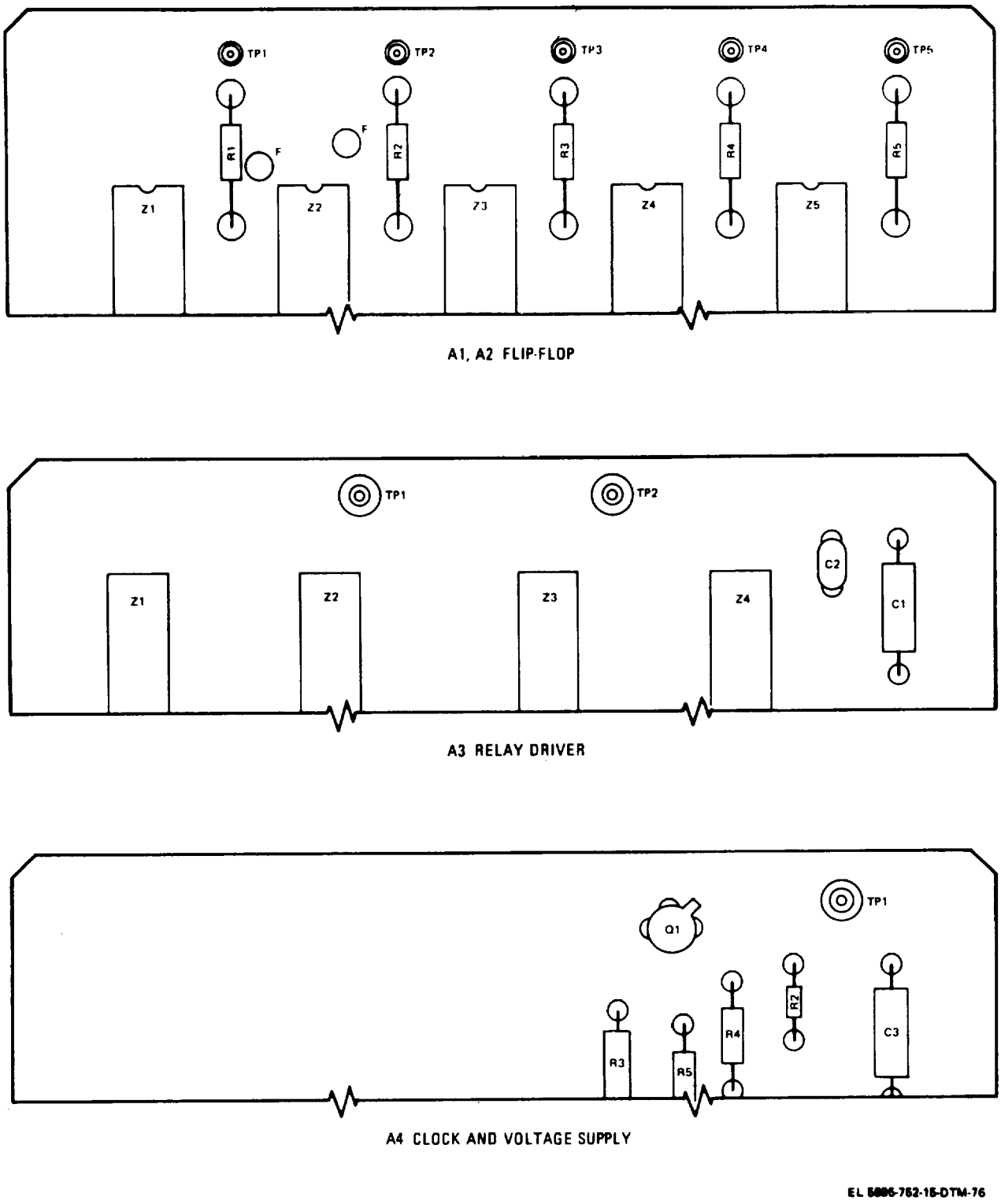


Figure 9-16. Control unit test points.

Malfunction	Probable cause	Corrective action
7. Waveform at A1TPI but 14 lamp not lighting.	Bad 14 lamp	Replace 14 lamp DS8. If trouble is not corrected, replace module A3.
8. No waveform at A1TP2, or bad waveform.	Malfunction in A1	Replace module Al.
9. Waveform at A1TP2 but l lamp not lighting.	Bad ½ lamp	Replace 12 lamp DS7. If trouble is not corrected, replace module A3.
10. No waveform at A2TP1, or bad waveform.	Malfunction in A2	Replace module A2.
11. Waveform at A2TPI but 1 lamp not lighting.	Bad 1 lamp	Replace 1 lamp DS1. If trouble is not corrected, replace module A3.
12. No waveform at A2TP2, or bad waveform.	Malfunction in A2	Replace module A2.
13. Waveform at A2TP2, but 2 lamp not lighting.	Bad 2 lamp	Replace 2 lamp DS2. If trouble is not corrected, replace module A3
14. No waveform at A2TP3, or bad waveform.	Malfunction in A2	Replace module A2.
15. Waveform at A2TP3 but 4 lamp not lighting.	Bad 4 lamp	Replace 4 lamp DS3. If trouble is not corrected, replace module A3.
16. No waveform at A2TP4, or bad waveform.	Malfunction in A2	Replace module A2.
17. Waveform at A2TP4, but 8 lamp not lighting	Bad 8 lamp	Replace 8 lamp DS4. If trouble is not corrected, replace module A3.
18. No waveform at A2TP5, or bad waveform.	Malfunction in A2	Replace module A2.
19. Waveform at A2TP5, but 16 lamp not lighting.	Bad 16 lamp	Replace 16 lamp DS5. If trouble is not corrected, replace module A3.

9-20. Troubleshooting MX-8924/GSQ-160

a. Troubleshooting the MX-8924/GSQ-160 at direct support is confined to fault isolation to, and removal and replacement of, those modules and components of the unit which can be replaced with minimum effort and tools. These items include-

(1) RF amplifier A1.
(2) Vswr detector A2.
(3) Bandpass filter (voltage-controlled) A3.
(4) Standard primary processor A4.
(5) +2.8-volt dc regulator and peak detector A5.
(6) Coaxial relays.

b. The test equipment in the GATE is the only equipment required for fault Isolation. However, the test equipment is operated manually (controlled by front panel switches rather than by using the GATE computer), and all signals are routed to and from the test equipment through front panel jacks. The trouble symptoms listed in the troubleshooting chart would probably be noted during automatic test of the AN/GSQ-160 by GATE.

c. Troubleshooting Chart.

Item No.	Trouble symptom	Probable trouble, checks, and corrective action
1	Either F,1 or Fl. (upper and lower oscillator frequencies) but not both, present and has sufficient amplitude to trigger the 5360A counter within the GATE.	Faulty bandpass filter A3. Remove and replace A3.
2	Neither F,, nor Fl triggers the 5360A counter within the GATE.	Faulty coaxial relay K4, amplifier Al, or bandpass filter A3. Isolate the trouble as follows: a. Set GATE 5105A frequency snythesizer and 5110 synthesizer drive controls as follows: OUTPUT LEVEL, to 0 dbm SEARCH CONTROL to LOCAL Meter switch to ALC FREQUENCY SELECTION to LOCAL KEYBOARD

Item No.	Trouble symptom	Probable trouble, checks, and corrective action
		LOCK/OPERATE to OPERATE FREQUENCY STANDARD to TNT. Operate keyboard buttons to select 60 MHz b. Set GATE 5360A counter controls as follows: CYCLE RATE to HOLD MAX/FAST/NORM to NORM DIGITS DISPLAYED to AUTO MEASUREMENT TIME to 10 ms Module select to MODULE c. Set 5365A input module (associated with counter) controls as follows: FUNCTION select to FREQ INPUT to B LEVEL B to PRESET SENSITIVITY MULTIPLIER to X1 *d*. Manually adjust GATE power supply No. 4 for +28 vdc output. e. Disconnect BNC connector (W2-P1) from common of K4 and use BNC test cable to connect common of K4 to B input of 5360A counter (fig. 9-17). Connect 5105A synthesizer output to J9 of MX-8924/GSQ-160. Connect +28 vdc from GATE power supply No. 4 to J1 A-B and common to J1-A-E of MX-8924/GSQ-160. If counter does not trigger, coaxial relay K4 is faulty and should be replaced. If counter does trigger, K4 is functioning properly and the fault is probably in Al or A3. Before proceeding, remove test connections and replace MX-8924/GSQ-160 connector on common of K4. *f*. Remove W4 P2 connector from IN of A3 bandpass filter, and connect test cable from 5105 synthesizer output to IN of A3. Connect J12 of MX-8924/ GSQ-160 to B-input of 5360A counter. Select 57.5-MHz output on 5105A keyboard. If counter does not trigger, bandpass filter A3 is faulty and should be replaced. If counter does trigger and reads 57.5 MHz, the low frequency circuit of A3 is functioning properly. To check the high frequency circuit, perform next step. g. Connect +28 vdc and common from GATE power supply No. 4 to J1-A-J and J1-A-E respectively. Select 60-MHz output on 5105Akeyboard.If counter does not trigger, bandpass filter A3 is faulty and should be replaced. If counter does trigger and reads 60 MHz, bandpass filter A3 is operating properly. RF amplifier Al is probably at fault. Remove and replace Al and reconnect all cables in MX-8924/GSQ-160.
3	Incorrect or no dc voltage present at the Vswr detector A2 output.	Faulty coaxial relay K17, coaxial relay K18, or Vswr detector A2. Isolate trouble as follows: a. Set the front panel controls on the GATE 2402A digital voltmeter as follows: INPUT control to FRONT MEASURING RATE to HOLD RANGE switch to AUTO FUNCTION switch to OHMS *b*. GATE power supply No. 4 is set for +28 vdc output (item No. 2 above). c. Remove BNC connector (W1 P1) from common of K18. Connect 2402A voltmeter between common of K18 and P18 of MX-8924/GSQ-160. Verify resistance is less than 2 ohms. Apply +28 vdc and common from power supply No. 4 to J2-A-W and J2 A-Y, respectively. Verify that resistance is greater than 10 megohms. If both conditions are not met, remove and replace coaxial relay K18. If conditions are met,-K18 is functioning properly and the fault is probably in K17 or A2. Before proceeding, reconnect W1-P1 to common of K18 after disconnecting voltmeter. *d*. Remove BNC connector (W3-P2) from adapter CP1 that mates with A2. Remove BNC connector (WI-P2) from NC jack of K17. Connect 2402A volt- meter between NC jack and W3-P2. Verify that resistance is less than 2 ohms. Apply +28 vdc and common from power supply No. 4 to J1-B-J and J1-B-M respectively. Verify that resistance is greater than 10 megohms. If both conditions are not met, remove and replace coaxial relay K17. If conditions are met, K17 is functioning properly and the A2 vswr detector is probably at fault. Before proceeding, remove all test connections and reconnect cables removed for K17 check. e. On the 2402A voltmeter, set the function switch to DC. Connect the volt- meter leads between J1 A Z (the A2 output) and J1-A-B (ground). Connect the switching matrix of SM-618,'GSQ 160 directly to J6 of MX-8924/GSQ- 160. This action terminates J6 in a 50-ohm load. Connect +28 vdc and com-

Item No.	Trouble symptom	Probable trouble, checks, and corrective action
		mon from power supply No. 4 to J2 A W and J2-A- Y, respectively. Record the digital voltmeter reading. Disconnect the switching matrix from J6 and again record the digital voltmeter reading. **If** the reading does not increase (become more negative), the A2 vswr detector is faulty. Remove and replaceA2.
4	During tests to isolate troubles to the module level, the sensor oscillator noise test is performed. The results of this test are repeatedly out of specification or there is no output from the A4 standard primary processor.	Faulty coaxial relay K3 or the A4 standard primary processor. Isolate the trouble as follows: a Set the GATE 2402A digital voltmeter to read ohms as detailed in item No. 3a. Connect voltmeter leads between P16 and J15 of MX 8924, GSQ 160 and verify that resistance is less than 2 ohms. Connect +28 vdc and common from GATE power supply No. 4 to J1 B -W and J1 B Y, respectively. Verify that resistance is greater than 10 megohms. If both conditions are not met, remove and replace coaxial relay K3. If conditions are met, K3 is functioning properly and standard primary processor A3 is probably at fault. Before proceeding, remove voltmeter leads from P16 and J15 and set voltmeter function switch to DC. b. Make sure that a good Battery BA 15)t9, U is connected to P13 of MX 8924/ GSQ- 160. Then remove the standard primary processor A4 from J18 of the MX-8924, GSQ 160. Check the following input voltages at J18 usingthe2402A voltmeter: *J18pin* — *Required voltage* T..... +4 (4 0.2, -0.6) vdc P..... - 4 (f 0.6, - 0.2) vdc V..... -2.8 (4 0.04) vdc R ..... +2.8 (+0.04) vdc W ..... Common *c.* If any of the voltages checked at J18 are out of specification, the A5+2.8 vdc regulator and peak detector is probably malfunctioning. Remove and replace AS, then repeat b above. If the problem is still present, Battery BA-1549,'U should be changed before proceeding. *d.* If the J18 voltages are within specifications, reinstall A4 in J18. Disconnect P10 from the common connector of coaxial relay K3 and connect common of K3 to the 5105A frequency synthesizer output. Set up the 5105A as detailed in item No. 2a except select 2.5 Mltz on the keyboard and also S in the 100-Hz column on the keyboard. With the voltmeter set to read DC volts, connect the voltmeter leads to J1 B -K (primary processor output) and J1-B-J (common). Connect 4 28 vde and common from GATE power supply No. 4 to J1 B-W and J1 B Y, respectively. On the 5105A synthesizer, rotate the SEARCH OSCILLATOR control from full ccw to full cw several times while checking to see that the voltmeter reads approximately 1.2+0.5 vdc as the control is varied, If the voltmeter reading is seriously out of specification, the standard primary processor is malfunctioning. Remove and replace standard primary processor A4. Check new A4. Disconnect test equipment and reconnect cables of MX 89)24,GSQ 160.
5	Several tests fail repeatedly during automatic test of AN/GSQ 160	The A5:+2.8 vdc regulator and peak detector is probably malfunctioning. Use the GATE 2402A voltmeter set to measure DC volts to perform the test given in item No. 4*b,* If any of the voltage readings are out of specification, remove and replace A.5.
6	Peak detector output is incorrect or missing.	Faulty relay Kl2, relay K13, or peak detector circuit in A5. Isolate the trouble as follows: a. Make sure that a good Battery BA-154. U is connected to P13 of MX-8924/ GSQ-160. Set the GATE 2402A voltmeter to read DC volts and connect voltmeter leads to TP11 (peak detector output) and TP12 (common) of MX-8924,/GSQ 160. Connect +28 vdc and common from GATE power supply No. 4 to J2 -C W and J2 -C -Y, respectively. Set GA'IE power supply No. 3 for +5 vdc and connect the common output to J1 A S. Momentarily apply the +5 vdc from power supply No. 3 to relay pin K13 A2. Wait 10 seconds after removing the +5 vdc from K13 A2 and verify that the voltmeter reading is +5 (+0.25) vde. If the reading obtained is out of specification, the peak de tector circuit in A5 is probably faulty. Remove and replace module A5 and perform the check again. If the trouble is still present, relay K12 or K13 is probably at fault. Remove all test connections before proceeding to next step.

Item No.	Trouble symptom	Probable trouble, checks, and corrective action
		b. If the previous step has been performed and the malfunction is still present, remove and replace relay K12 and check results. If malfunction is still present, remove and replace and relay K13. Note that removal and replacement of relays K12 and K13 involve numerous soldering operations, and probably should be performed only at general or depot maintenance categories.

9-21. Troubleshooting Cable Assemblies

Troubleshooting the CX-12591/GSQ-160 cables is limited to visual inspection for obvious defects and continuity checks. Continuity checks can be performed in accordance with the wiring given on figures 9-6 and 9-7. If such checks disclose an open circuit condition, replace the entire cable assembly. Coaxial cables associated with Simulator Group OH-29/GSQ-160 can be checked the similar way.

9-22. Removal and Replacement, Disassembly and Reassembly.

a. Target Standard Simulator SM-618/ GSQ-160. The switching matrix portion of the SM-618/GSQ-160 is replaced as a unit when defective and thus has no applicable disassembly and reassembly procedures. Disassembly and reassembly of the control unit portion of the target standard simulator is as follows:

(1) On control unit, remove two each machine screws, lockwashers, and flat washers (1, fig.9-19) from top of cover.

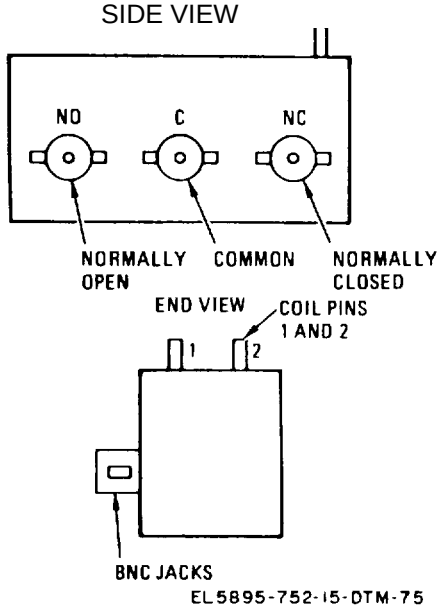


Figure 9-17. Coaxial relay connector an pin identification

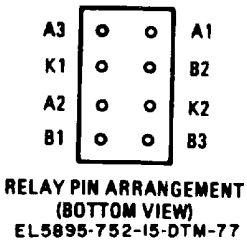


Figure 9-18. Relays K12, K13 pin identification

(2) On control unit, remove four machine screws, lockwashers, and flat washers (two sets from each side) from sides of cover and lift cover (2) free of control unit.

(3) Remove circuit boards A1, A2, A3, and A4 as required (3, 4, 5, 6, fig. 9-19).

(4) Remove six machine screws, lockwashers, and flat washers (two on the front panel, two on the rear panel, and two on the bottom) that secure the connector mounting bracket SM-D-588372 and lift connector mounting bracket out of control unit (20, fig. 9-20).

(5) Remove four machine screws, four lockwashers, and four nuts (9 and 10, fig. 9-20) and remove power supply mounting bracket (17) together with power supply PS1 (15).

(6) Remove four each machine screws, lock-washers, flat washers, and spacers (18) on power supply mounting bracket that mates with power supply PSI and separate power supply PSI (15).

(7) Remove two machine screws, lockwashers, and flat washers (16) that secure socket (19) to power supply mounting bracket and separate socket from bracket.

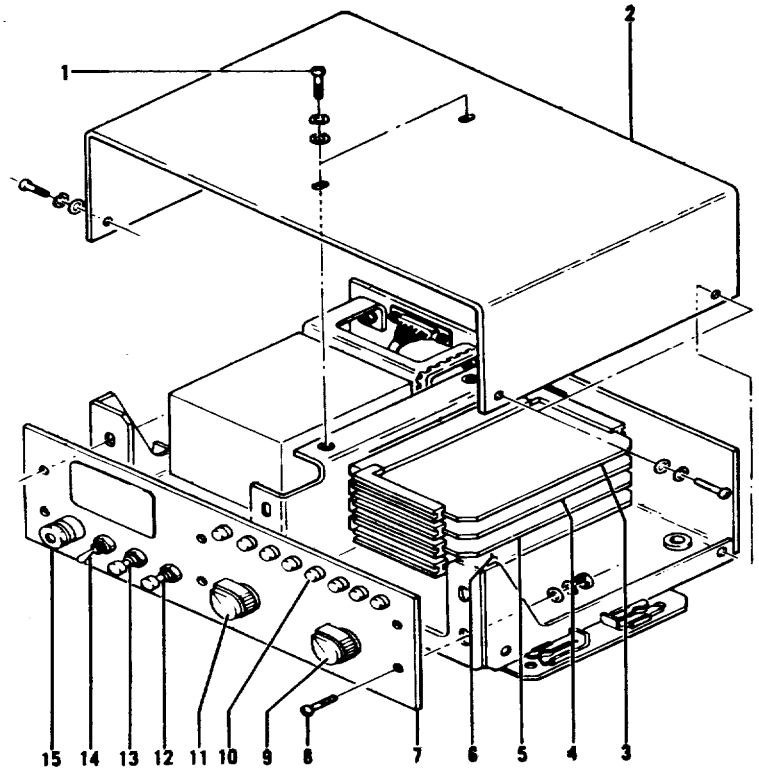
(8) Reassemble control unit in reverse order of disassembly.

b. Interface Unit, Electronic Circuit, Plug-In MX-8924/GSQ-1 60.

(*1) Preparation for disassembly.* Prepare the unit for disassembly and subsequent reassembly as follows:

(a) Disconnect all external connections to jacks and plugs.

(b) Remove the target standard simulator



1. SCREW, PAN HEAD, MS51957-15 (6 PLACES)
   WASHER, LOCK, MS35338-135
   WASHER, FLAT, MS 15795-803
2. COVER, SENSOR EXERCIZER, SM.0-586396
3., 4 CIRCUIT CARD ASSEMBLY, A1, A2, SM-0-586369
5. CIRCUIT CARD ASSEMBLY, A3, SM-0-588371
6. CIRCUIT CARD ASSEMBLY, A4, SM-0D.588370
7. PANEL, CONTROL UNIT, SM D.S81397
8. SCREW, PAN HEAD, MS51957-15 (6 PLACES)
   WASHER, LOCK, MS35338135
   WASHER, FLAT, MS15795-803
   NUT, MS35649-244
9. SWITCH ROTARY, S3, M3786-4-0014
   KNOB CONTROL, MS91528-1K1B
10. LAMP, INCANDESCENT, SM-A-588293
    LARPHOLDER, MS90308-9
11 SWITCH, ROTARY, S4 M3786-4-0035
12. SWITCH, PUSH, S5, SM-A-588410-002
13. SWITCH, PUSH, S2, SM-A-588410-001
14 SWITCH, TOGGLE, S1, MS75028-22
15. FUSEHOLDER, XF1, FHN26G2
    FUSE, CARTRIDGE, F1, F02125V1-1-2A

EL5895-752-15-DTM-66

Figure 9-19. Control unit disassembly.

and any part of AN GSQ-160 that is under test and mounted to the MX-8924/GSQ-160.

(c) Remove two machine screws, two lockwashers, and two flat washers (one set from each front corner) from the front top corners of the MX-8924/GSQ-160.

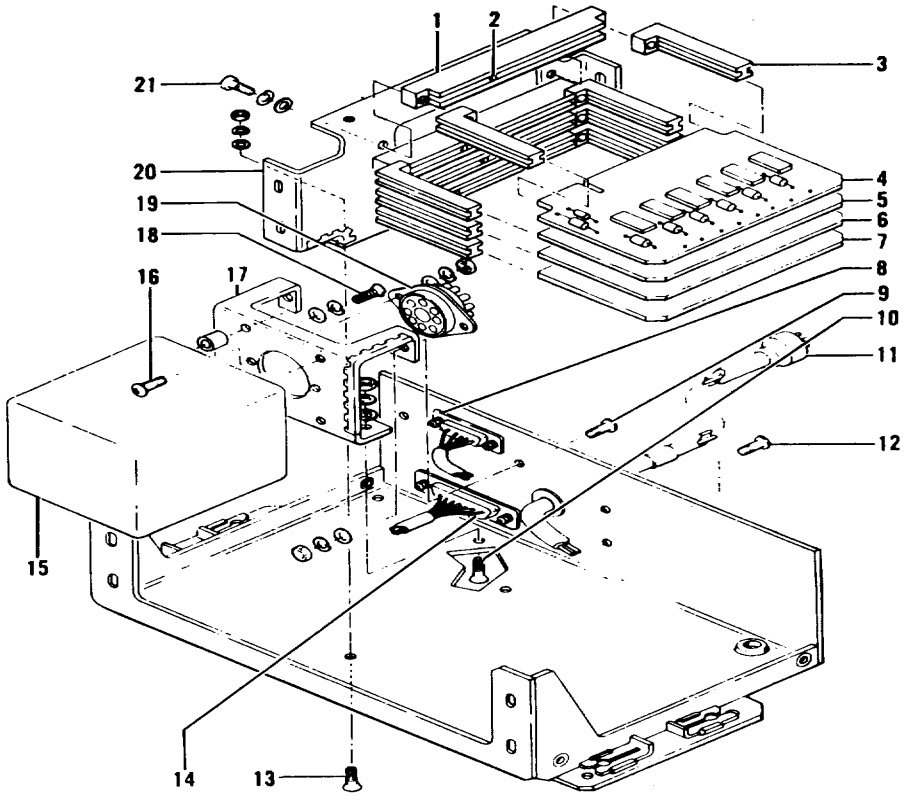
(d) Raise hinged top panel to gain access to parts and subassemblies as shown in figure 9-21.

.

(*2) Coaxial relays.* Remove coaxial relay K3, K4, K17, or K18 as follows:

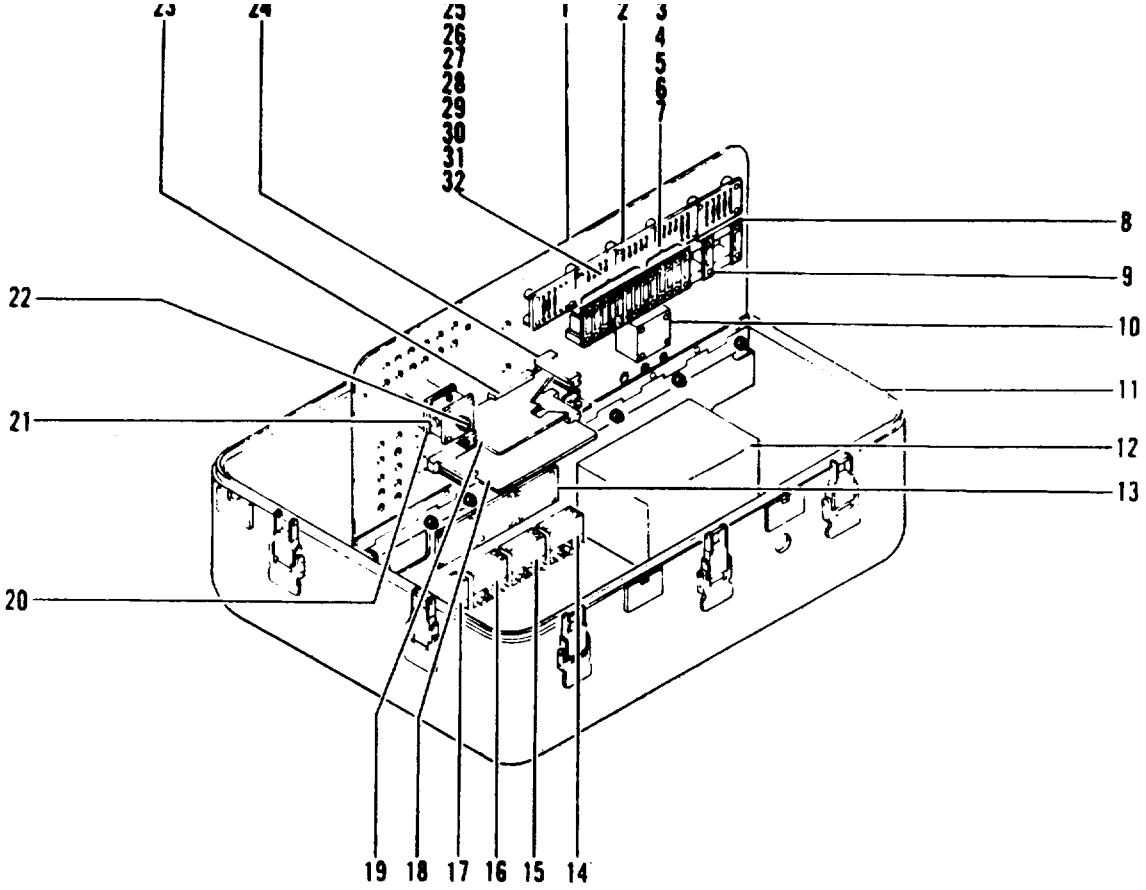
*(*a) With hinged top panel raised, locate coaxial relays K3, K4, K17, and K18 on rear vertical panel inside lower case (14, 15, 16 and 17, fig. 9-21).

*(*b) At relay to be removed, remove four machine screws, four flat washers, and four lockwashers (one set from each corner of relay).



1. CONNECTOR, M21097-1-163 (4 PLACES)
2. KEY, POLARIZING, SM-A 588255 (6 PLACES)
3. GUIDE, CIRCUIT BOARD, SM-A 588296 (8 PLACES)
4.,5 CIRCUIT CARD ASSEMBLY, Al, A2, SM-D 588369
6. CIRCUIT CARD ASSEMBLY, A3, SM D-588371
7. CIRCUIT CARD ASSEMBLY, A4, SM D-588370
8. CONNECTOR J2, M24308-1-2
   SCREW, PAN HEAD MS51957-15
   WASHER, LOCK, MS35338-135
   WASHER, FLAT, MS 15795-803
   NUT, MS35649-244
9.,10 SCREW, PAN HEAD, MS51957-15
   WASHER, FLAT, MS15795-807
   WASHER, LOCK, MS35338-137
   NUT, MS35649-284
11. CABLE ASSEMBLY P1, SM-A-588293
   BUSHING, STRA1N RELIEF, SM A 588297
12,13 SCREW, PAN HEAD, MS51957-15
   WASHER, FLAT, MS15795 803
   WASHER, LOCK, MS35338 135
   NUT, MS35649-244
14 CONNECTOR, J1 M24308-1-3
   SCREW, PAN HEAD, MS51957-15
   WASHER, LOCK, MS35338-135
   WASHER, FLAT, MS15795-803
   NUT, MS35649-244
15 POWER SUPPLY PSI, SM-A-588262
16 SCREW, PAN HEAD, MS51957-30
   WASHER, LOCK, MS35338 136
   WASHER, FLAT, MS15795-805
17 BRACKET, POWER SUPPLY, SM-C-588395
18. SCREW, PAN HEAD, MS51957 45
   WASHER, LOCK, MS35338-137
   WASHER, FLAT, MS15795-807
   SPACER, NAS43003-16
19. SOCKET, XPS1, M12883-01-04
20. BRACKET, CONNECTOR MOUNTING, SM-0-588372
21. SCREW, PAN HEAD, MS51957-18
   WASHER, LOCK, MS35338 135
   WASHER, FLAT, MS15795-803

Figure 9-20. Power supply and connector mounting bracket disassembly.



1. COVER, TEST PANEL. SM D588482
2. TERMINAL BOARD TB1. SM A 588359
3 RELAY K11

4 RELAY K12
5. RELAY K13,
6 RELAY K14, } M5757110011. PLATE SM C 588463.
7. RELAY K15. } AND DIODE IN4148AN
8 RELAY K19
9. RELAY K16

10 RF AMPLIFIER AI, SM A 588361
11 LOWER CASE
12 FILTER. BANDPASS. A3. SM A 588360
13 TERMINAL BOARD, SM C 588510

14. RELAY. COAXIAL. K18. SM A 588294
15 RELAY. COAXIAL, K 17. SM A 588294
16 RELAY, COAXIAL, K4. SM A 588294
17. RELAY. COAXIAL, K3. SMA-588294
18. CIRCUIT CARD. 2 8 VOLT REGULATOR AND PEAK DETECTOR, A5, SM 0 588465
19 CIRCUIT CARD, STANDARD PRIMARY PROCESSOR, A4, SM D 588218
20 VSWR ODETECTOR. A2. SM A 588406
SPACERS (41. NAS43000 32

21. TERMINATION, IMPEDANCE MATCHING, SM A 588407
22 ADAPTER, COAXIAL. CPI. TYPE UG 201 A,U
23 CONNECTOR, CIRCUIT BOARD. (2) M5530212 04
24. CARD GUIDE (4). SM A 588480
25 RELAY K1'
26. RELAY K2
27 RELAY K5
28 RELAY K6. } M5757/011, PLATE, SM C 588463. AND DIODE IN4148JAN
29. RELAY K7
30 RELAY K8
31. RELAY K9
32. RELAY K10

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Figure 9-21. MX-8924/GSQ-160 disassembly

(c) Disconnect coaxial jack and plug connections to coaxial relay to be removed and lift relay free from lower case.

(d) Replace coaxial relays in reverse order of removal.

(*3) Relays.* Remove relays K1, K2, K5 through K16 or K19 as follows:

(a) With hinged top panel raised, located relays mounted on bottom side of top panel directly below terminal board TB1 (fig. 9-21).

(b) At relay to be removed, remove two nuts, two flat washers, two spacers, two lockwashers, and two screws that secure the relay to the relay mounting plate.

(c) Disconnect and inspect IN4148 diode across relay coil.

(d) Replace relays in reverse order of removal. Replace IN4148 diode in position across coil of relay (use new diode if necessary).

(*4) RF amplifier Al.* Remove RF amplifier A1 as follows:

(a) With hinged top panel raised, locate RF amplifier Al mounted to bottom side of top panel directly below relays (10, fig. 9-21).

(b) Remove four nuts, four lockwashers, four flat washers, and four screws (one set from each corner) from RF amplifier Al and lift free of top panel.

(c) Disconnect coaxial cable W2 plug P2 and coaxial cable W4 plug P1 and remove RF amplifier Al.

(d) Replace RF amplifier A1 in the reverse order of removal.

(5) Bandpass filter A3. Remove bandpass filter A3 as follows:

(a) With hinged top panel raised, locate bandpass filter A3 (12, fig. 9-21) on rear vertical panel inside lower case next to coaxial relay K18.

(b) Remove four nuts, four flat washers, and four lockwashers and lift A3 away from panel.

(c) Disconnect (+) lead from connector J1 pins J1-A-J and J1-A-L.

(d) Disconnect (-) lead from chassis ground.

(e) Disconnect coaxial cable W4 plug P2 from input to A3.

(f) Disconnect coaxial plug P9 from output of A3 and lift filter out of lower case.

(g) Replace bandpass filter A3 in the reverse order of removal.

(*6) Circuit boards.* Standard primary processor A4 circuit board (19, fig. 9-21) and the +2.8-volt dc regulator and peak detector A5 circuit board (18, fig. 9-21) mount in the card guide and are lifted out. No special removal and replacement procedures apply.

Section IV. GENERAL AND DEPOT MA1NTENANCE

9-23. General

a. This section provides all data, instructions, and procedures required by general and depot support maintenance personnel, as indicated by the maintenance allocation chart, for Simulator Group OH-29/GSQ-160. The direct support maintenance information in section III of this chapter is also applicable. This section includes voltage and resistance measurements, troubleshooting procedures, and detailed alignment procedures as required for the individual units of the OH-29/ GSQ-160 and provides for the isolation and replacement of defective components to the piece part level authorized by the repair parts and special tools list (app. C).

b. Equipments covered in this section consist of-

(1) Target Standard Simulator SM-618/ GSQ-160 (para 9-25).

(2) Antenna Simulator SM-616/GSQ-160 (para 9-26).

(3) Antenna Simulator SM-617/'GSQ-160 (para 9-27).

(4) MX-8924/GSQ-160 Interface Unit, Electronic Circuit, Plug-In, (para 9-28).

9-24. Tools, Test Equipment, and Materials Required

Required items are listed in the maintenance allocation chart and the repair parts and special tools list are in the appendixes to this manual. The following lists the items required for maintenance of the components of Simulator Group OH-29/ GSQ-160.

Item	Nomenclature	Federal stock number	Technical manual or publication
1	Counter, Electronic AN/USM-207	6625-911-6368	TB 9-6625-1183-50
2	Vector impedance meter, HP 4815A.		
3	Generator, Signal AN-USM-44A	6625-669 4031	TM 11-6625-508-10
4	Vector voltmeter, HP8405.		
5	Tee connector, HP22536.		
6	Multimeter TS 352BU	6625-242-5023	TM 11-6625-366-15
7	Cable, RG-9,/U (2 to 5 ft).		
8	Time domain reflectometer, HP1415A.		
9	Spectrum analyzer, HP140S.		
10	Strip chart recorder, HP7701B.		
10	Strip chart recorder, HP7701B. Preamplifier, HP8801A.		
11	Voltmeter, Electronic ME-202/U	6350-133-7595	
12	GATE Test Set, Alarm, Anti-Intrusion AN/GSM-220(U).		

9-25. Target Standard Simulator SM-61 8/GSQ-160

A performance test on the SM-618/GSQ-160 should be performed periodically to verify operating characteristics. There are no adjustments on either the switching matrix or the control unit of the SM-618/GSQ-160; therefore, serious degradation of performance would result in removal and replacement of major hardware items. Replace the entire switching matrix if a fault is discovered. If a fault is discovered in the control unit, modules, switches, lamps, and/or wiring may be replaced. When the units are in continuous use, test intervals should not exceed 90 days.

a. Performance Test.

(1) Connect a length of RG-9,/U (2 to 5 feet) to time domain reflectometer (such as HP Model 1415A with associated spectrum analyzer HP-140S).

(2) Set reflectometer REFL. COEFFICIENT control to 0.01 SEC/'CM to 20, and MAGNIFIER to 20.

(3) Using reflectometer VERB POSITION control, locate the RG-9/U reflection on the oscilloscope.

(4) Locate the termination of the RG-9/U at the dot near the center of the reflectometer scope.

(5) Connect the RG-9, U to P1 of the switching matrix. Connect P2 of switching matrix to J2 of control unit. Connect P1 of control unit to 115- volt ac, 60-Hz power source.

(6) Set ON/OFF switch of control unit to OFF position, and observe oscilloscope on spectrum analyzer. Residual coaxial length should remain and be between 17 and 19 inches as determined by rotating the MAGNIFIER DELAY until residual termination discontinuity is located at the dot near the center of the oscilloscope. Note the difference in readings on the MAGNIFIER DELAY control.

(7) Set MODE control on control unit to CYCLE. Set ON/OFF switch to ON.

(8) Press RESET switch on control unit. Residual length display on oscilloscope should be momentarily increased for 250 milliseconds at a 1-Hz rate.

(9) Press START switch on control unit. Coaxial length display on reflectometer scope should increase from residual by 3-inch increments at a 1-Hz rate. On oscilloscope, no discontinuity (reflection) greater than 0.015 should be noted. Increase in range must be accompanied by proper sequential lighting of the RANGE (FEET) indicator lamps on the control unit. Increase in length must be linear to 31.75 feet.

(10) Set MODE switch on control unit to MANUAL. Press RESET switch.

(11) Press START switch on control unit and observe oscilloscope. Verify range on scope presentation is between 27.5 and 28.5 feet.

(12) Press RESET switch on control unit and set ON/OFF switch to OFF.

(13) Disconnect test equipment.

(14) If the test given in the previous steps can be performed satisfactorily, the SM-618/GSQ-160 is operating normally. If the test cannot be performed, fault isolation can be performed by inserting a new switching matrix or control unit into the test setup and performing the test again. The control unit (if faulty) can be further checked using the procedures given in b through e below.

b. Voltage and Waveform Checks.

(1) On control unit, remove two machine

screws, lockwashers, and flat washers from top of cover.

(2) On control unit, remove four machine screws, lockwashers, and flat washers (two sets from each side) from sides of cover and lift cover free of control unit.

(3) Connect P2 of switching matrix to J2 at rear of the control unit.

(4) Connect P1 of control unit to 115-volt ac,60-Hz power source.

(5) Set ON/OFF switch of control unit to ON. For the following checks, the MODE switch is set to CYCLE. Press RESET and START switches to obtain waveforms at indicated jacks. Use a strip chart recorder to view waveforms. Use Multimeter TS-352B/U to check voltages. Refer to figure 9-16.

Test point	Proper indication	Possible fault if bad indication
A4TP1	+27 vdc (+3).....	F1, SI, PSI
A3TP1	+5 vdc (+0.5).....	A4
A3TP2	4 pps, 0 to +4 dc (±1)	A4, S4
A1TP3	0 vdc when RESET operated +4 vdc +I when START operated.....	A1, S5, S2
A1TP5	O.5 sec Hz (±10%) square wave 0 to +4 vdc (±1)	A1
A1TP4	1 sec Hz (±10%**)** square wave 0 to +4 vdc (±1).....	A1
A1TP1	2 sec Hz (±10,) square wave 0 to +4 vdc (±1)	A1
A1TP2	4 see Hz (±10%) square wave 0 to +4 vdc (±1).....	A1
A2TP1	8 se*c,* Hz (±10%) square wave 0 to +4 vdc (±1).....	A2
A2TF2	16 see Hz (±10%) squire wave 0 to +4 vdc (±1).....	A2
A2TP3	32 see Hz (+10%) square wave 0 to +4 vdc (±1).....	A2
A2TP4	64 sec Hz (±10%)square wave 0 to +4 vdc (±1).....	A2
A2TP5	128 sec Hz (±10%) square wave 0 to +4 vdc (±1).....	A2

c. External Input Checks. The following test signals apply to the indicated pins of J1.

SM-618, GSQ-160 equipment is connected as detailed in b above. Use any convenient source of +5 volts dc.

Test signal	At J1-	Name	Test point	Normal indication	Possible fault if bad indication
Ground.....	-1	Start	A1TP3	+4 vdc ±1	A1, wiring
Ground.....	-3	Reset.....	A1TP3	Ovdc	A1, A3, wiring
Ground.....	-11	Remote select 1 ft	DS1	Lights	A3, DS1, wiring
Ground.....	-12	Remote select 2 ft	DS2	Lights	A3, DS2, wiring
Ground.....	-13	Remote select 4 ft	DS3	Lights	A3, DS3, wiring
Ground.....	-14	Remote select 8 ft	DS4	Lights	A3, DS4, wiring
Ground.....	-15	Remote select 16 ft	DS5	Lights	A3, DS5, wiring
Momentary + 5 vdc	-18	Remote clock A.....	A1TP4	Level change	A1, wiring
Momentary +5 vdc	-19	Remote clock B.....	A.1TP4	Level change	A1, wiring
Ground.....	-20	Remote select 1/4 ft.....	DS8	Lights	A3, DS8, wiring
Ground.....	-21	Remote select 1/2 ft	DS7	Lights	A3, DS7, wiring

d. Manual Operation Check..

(1) With the SM-618/GSQ-160 set up as given in b above, set the MODE switch to MANUAL. This causes the control unit to switch between loads at a range of 28 feet. Observe that DS6 (LOAD) lamp flashes on and off at a 1-Hz rate. DS5 (16) and DS4 (8) lamps, and any combination of DS3, DS2, DS1, DS7, and DS8, will light depending on range.

(2) If the operation described in (1) above cannot be obtained, the S4 MODE switch is probably faulty, since the other circuit components have been checked in procedures b and c above. If the DS6 LOAD lamp does not light, module A3 or the DS6 LOAD lamp may be faulty.

c. Continuity Checks. Check continuity between the following points at the indicated control settings. Deenergize SM-618/'GSQ-160 before making checks.

From	To	Control setting	Possible fault if no continuity obtained
J1-25	Chassis ground	None	Wiring
J1-16	J2 10	LOAD SELECT to NORMAL	S3, wiring
J1-17	J2 9	LOAD SELECT to NORMAL	S3:, wiring
J1-16	Chassis ground	LOAD SELECT to 0 DB	S3, wiring
J1-16	Chassis ground	LOAD SELI,ECT to 10 DB	S3, wiring
J1-17	Chassis ground	LOAD SELECT to 10 D	S3, wiring
J1-17	Chassis ground	LOAD SELECT to 12DB	S3, wiring
J1-1	Chassis ground	.Push START	S3, wiring
J1-2	A3TP2	MODE to GATE	S4, wiring

9-26. Antenna Simulator SM-616/GSQ-160

A performance test on the SM-616/GSQ-160 should b)e performed periodically to verify operating characteristics. The test detailed in a, *b,* and c below verifies impedance and attenuation at connectors JI through J4. Test intervals should not exceed 90 days when the units are in continuous use.

a. Adjustments.. With the removal of one cover (fig. 9 11), adjustment of all variable components is possible. The components are-

(1) Tuning capacitor C2.
(2) Tuning capacitor C3.
(3) Variable inductance L2.
(4) Variable resistor R4.
(5) Variable resistor R8.

b. Test Setup. The test setup is shown in figure 9-22. Unused ports (connectors) in each setup should be terminated with 50-ohm terminations, except for the J1 center conductor. The.J1 input port on the antenna simulator is a special fitting with the outer conductor not, connected to case ground.

c. Procedure.

(1) Connect the vector impedance meter probe to outer conductor of .J1 is shown in A, figure 9-22. Connect probe shield to case ground of antenna simulator. Terminate J3 and J4 with 50-ohm terminations. Connect Counter, Electronic AN/USM-207 to RF OUTPUT jack of the vector impedance meter.

(2) Turn on test equipment and allow 10-minute warmup period.

Frequency (MHz)	Impedance (ohms,)	Phase angle (degree)	Vswr-
57	49±6	+22°± 4°	
57.5	52±3	+25°±2°	1.1:1
58	55±6	+30°±4°	
Max difference of above (calculate)	20±3	18°±1°	
59.5	68±6	+41°±4°	
60	72±3	+43°±2°	1.1:1
60.5	76±6	46°±4°	
Max difference of above (calculate)	20±3	18±1°	

[a] Use Smith chart and readings obtained to determine that equivalent vswr is not more than 1.1:1.

(3) Not used.

(4) Remove four machine screws and remove cover from antenna simulator to obtain access to adjustments (fig. 9-11).

(5) Set the vector impedance meter to 57.5 MHz ±1 kHz. Adjust C3, L2, and R4 for desired indications as shown in chart.

(6) Set the vector impedance meter to 60 MHz ±1 kHz. Check the values of impedance and phase angle as shown in chart. The values can be increased by adjusting L2 ccw, and C3 ccw (increased inductance and decreased capacitance). Conversely, the values can be decreased by adjusting L2 cw and C3 cw (decreased inductance and increased capacitance). Make adjustment as necessary.

(7) Return the vector impedance meter to 57.5 MHz ±1 kHz, and recheck values of impedance and phase angle. If adjustment is necessary, use C3 and R4 to attain proper readings.

(8) Set the vector impedance meter again to 60 MHz ±1 kHz. Use L2 and C3 as in (6) above to adjust for proper readings if both impedance and phase angle are high, or both are low. If impedance is high and phase angle is low, tune C2 ccw to set impedance and phase angle on same side of desired values. Then use L2 and C3 to move both toward proper values.

(9) After adjustment is complete, recheck all frequencies given in chart and record values obtained. Readjust as required to obtain closest values near the center of the tolerances given. For convenience, the following adjustment guide can be used:

Frequency	Adjust	Impedance magnitude	Phase direction
57.5 MHz	R4 ccw	Decrease	Positive
57.5 MHz	C3 cow	Decrease	Negative
60 MHz	C2 ccw	Decrease	Positive
60 MHz	C2 ccw, L2 ccw	Increase	Positive
60 MHz	C2 cw, L2 cw	Decrease	Negative

(10) After all adjustments are completed, remove the vector impedance meter from J1.
(11) Connect vector voltmeter probes to J1 outer conductor and to the input port at the HP1153G special tee connector as shown in B, figure 9)-22. Make other connections as shown in the figure.
(12) Set Signal Generator AN/USM-44A frequency to 58.75 MHz.
(13) Set the signal generator CW signal level for an indication of 1 milliwatt in both channels7 of the vector voltmeter.
(14) Adjust the phase reference of the vector voltmeter to 0- on the 6- range.
(15) Connect probe B to J4 of antenna simulator. Note and record the signal level indication of channel B in (lb values below the channel A indication. Note and record the phase angle displayed by the vector voltmeter. If channel B signal level is not within specification (-20 ±0.1 db), adjust variable resistor R8 as required. If variable resistor R8 must be adjusted repeat (3) through (14) above and the instructions in this subparagraph.
(16) Remove the signal generator and vector voltmeter from test setup.
(17) Connect vector impedance meter to J4 of antenna simulator.
(18) Tune the vector impedance meter to 58.75 MHz. Note and record impedance and phase angle values. Convert values to equivalent vswr using Smith chart. Value of vswr must be not more than 1.1:1.
(19) Remove vector impedance meter from test setup.
(20) connect vector voltmeter probe A to J1 outer conductor (B, fig. 9-22) at the HP11536 tee connector which is common to the signal generator output.
(21) Tune the signal generator frequency to 58.75 MHz. Adjust cw level for an indication of 1 milliwatt on A channel of the vector voltmeter.
(22) Connect the vector voltmeter probe B to connector J3 on antenna simulator. Note and record the signal level in terms of db values below channel A indication recorded in (18) above. Channel B signal level must be within specified limits of -20 db (±1 db). If indication is not within limits, repeat (3) through (16) above. Note and record the final value of attenuation for connector J3.
(23) Change the vector voltmeter probe B from J3 to J4.
(24) Tune the signal generator frequency to 168 MHz. Adjust the cw level for an indication of 1 milliwatt on both channels of vector voltmeter. Adjust the phase reference of the vector voltmeter to 0° on the 6° range.
(25) Note and record the channel B signal level in terms of db values below channel A indication. Channel B signal level must be within the specified limit of -1 db maximum. If indication is not within the limit, replacement of the antenna simulator is required.
(26) Remove all test equipment from antenna simulator. If necessary, replace cover (fig. 9-11) and secure with four machine screws.

9-27. Antenna Simulator SM-617/GSQ-160

A performance test on the SM-617/GSQ-160

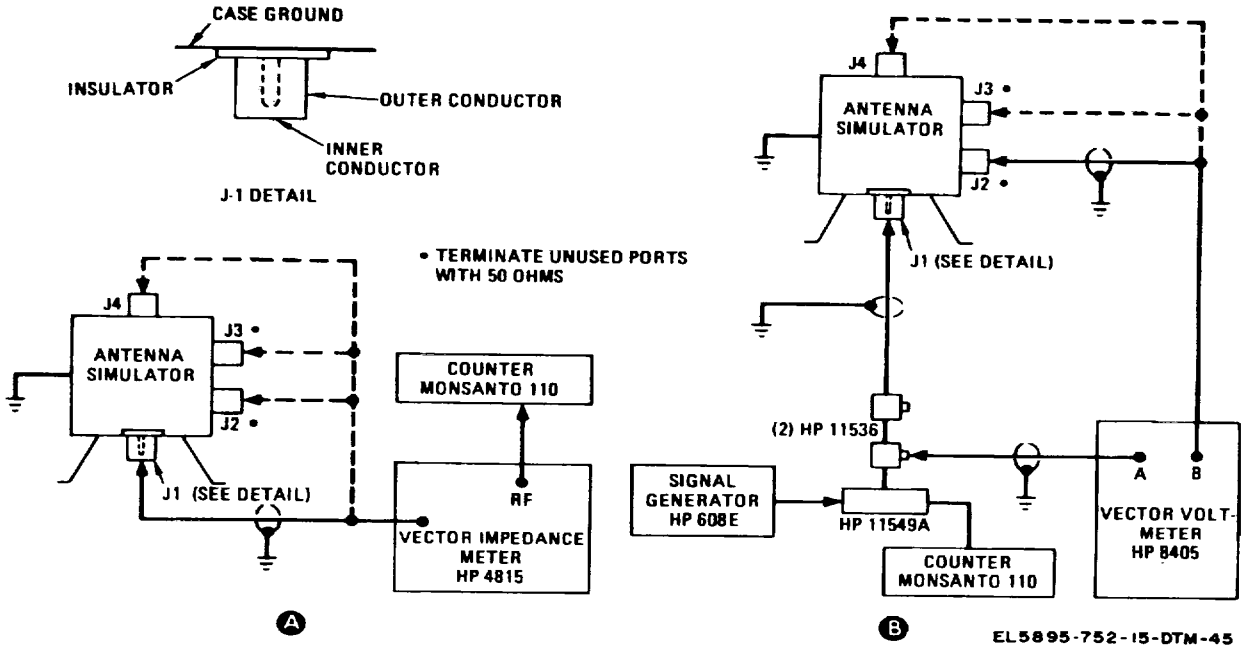

Figure 9-22. SM-616/GSQ-160, test setup

should be performed periodically to verify operating characteristics. This test is detailed in a, b, and c below, and verifies impedance and attenuation at connectors J1, J2, and J3. Test intervals should not exceed 90 days when the units are in continuous use.

a. Adjustments. With the removal of one cover (fig. 9-12), adjustment of all variable components is possible. These components are-

(1) Tuning capacitor C1.
(2) Tuning capacitor C3.
(3) Tuning capacitor C4.
(4) Variable inductor L2.
(5) Variable resistor R4.
(6) Variable resistor R8.

b. Test Setup. The test setup is shown in figure 9-23. Unused ports (connectors) in each setup should be terminated with 50-ohm terminations.

c. Procedure.

(1) Connect vector voltmeter as shown in A, figure 9-23 with both probes connected to the HP11536 tee connectors, but do not complete connection of signal line to antenna simulator connector J1. Make other connections as shown in the figure.

(2) Turn on test equipment and allow 10-minute warmup period.

(3) Remove four machine screws and remove cover (fig. 9-12) from antenna simulator.

(4) Tune the vector voltmeter and the Signal Generator AN/USM-44A to 168 MHz. Adjust cw signal level for an indication of 1 milliwatt (0 dbm) on the B channel of the vector voltmeter.

(5) Connect tee connector fitting to J1 of an- tenna simulator.

(6) Connect probe B of HP8405 to J2 of antenna simulator. Note and record the signal level indication on channel B of the vector voltmeter. Adjust C4 of antenna simulator for minimum level.

(7) Connect the vector impedance meter to J1 as shown in B, figure 9-23. Connect probe shield from the vector impedance meter to antenna simulator case. Terminate connectors J2 and J3 with 50-ohm terminations. Allow time for the vector impedance meter to stabilize.

(8) Tune the vector impedance meter to each of the frequencies listed below. Note and record the values of phase angle and impedance indicated on the vector impedance meter for each frequency selected. If recorded data show excessive deviation from nominal values shown, perform small adjustments of variable components as indicated in (9) through (12) below to obtain the closest phase and impedance values for the frequencies shown in the chart.

Frequency (MHz)	Impedance (ohms,)	Phase angle (degree)	Vswr-
57	66±4	-25°± 4°	
57.5	59±3	-22°±2°	1.1:1
58	53±4	-18°±4°	
Max difference of above (calculate)	22±3	27°±2°	
59.5	40±4	-3°±4°	
60	37±2	+5°±2°	1.1:1
60.5	36±4	+12°±4°	
Max difference of above (calculate)	22±3	27±2°	

[a] Use Smith chart and readings obtained to determine that equivalent vswr is not more than 1.1:1.

(9) Set the vector impedance meter to 57.5 MHz ±1 kHz. Adjust C3, 1,2, and R4 for desired indications as shown in chart ((6) above).

(10) Set the vector impedance meter to bO MHz ±1 kHz. Check the values of impedance and phase angle as shown in the chart. The values can be increased by adjusting L2 and C3 ccw (in- creased inductance and decreased capacitance). Conversely, the values can be decreased by adjusting L2 and C3 cw (decreased inductance and increased capacitance). Make adjustment as necessary.

(11) Return the vector impedance meter to 57.5 MHz ±1 kHz, and recheck values of impedance and phase angle. If adjustment is necessary, use C3 and R4 to attain proper readings. Small adjustments of C 4 may be necessary to obtain best data.

(12) Set the vector impedance meter again to 60 MHz ±1 kHz. Use L2 and C3 as in (10) above to adjust for proper readings if both impedance and phase angle are high, or both are low. If impedance is high and phase angle is low, tune C2 ccw to set impedance and phase angle on same side of desired values. Then use L2 and C3 to move both toward proper values.

(13) After adjustment is complete, recheck all frequencies given in chart and record values obtained. Readjust as required to obtain best fit of values near the center of the tolerances given. Use the following adjustment guide:

Frequency	Adjust	Impedance magnitude	Phase direction
57.5 MHz	R4 ccw	Decrease	Positive
57.5 MHz	C3 cow	Decrease	Negative
60 MHz	C2 ccw	Decrease	Positive
60 MHz	C2 ccw, L2 ccw	Increase	Positive
60 MHz	C2 cw, L2 cw	Decrease	Negative

(14) After all adjustments are completed, remove the vector impedance meter from connector J1.

(15) Connect vector voltmeter probes to connector J1 conductor and the input port of the tee connector as shown in A, figure 9-23. Make other connections as shown in the figure.

(16) Set signal generator frequency to 58.75 MHz.

(17) Set the signal generator CW signal level for an indication of 1 milliwatt in both channels of the vector voltmeter. Adjust the phase reference of the HP8405 to 0° on the 6° range.

(18) Connect probe B to connector J2 on antenna simulator. Note and record the signal level indication of channel B in db values below the channel A indication. Note and record the phase angle displayed by the vector voltmeter. If channel B signal level is not within specification (-20 db +0.1), adjust variable resistor R8 as required to bring signal level within specification. If variable resistor R8 must be adjusted, repeat (8) through (13) above.

(19) Remove the signal generator and vector voltmeter from test setup.

(20) (Connect vector impedance meter to J3 of antenna simulator (B, fig. 9-23).

(21) Tune the vector impedance meter to frequency of 58.75 MHz. Note and record impedance and phase angle values. Convert values to equivalent vswr using Smith chart. Vswr value must be not more than 1.1 :1.

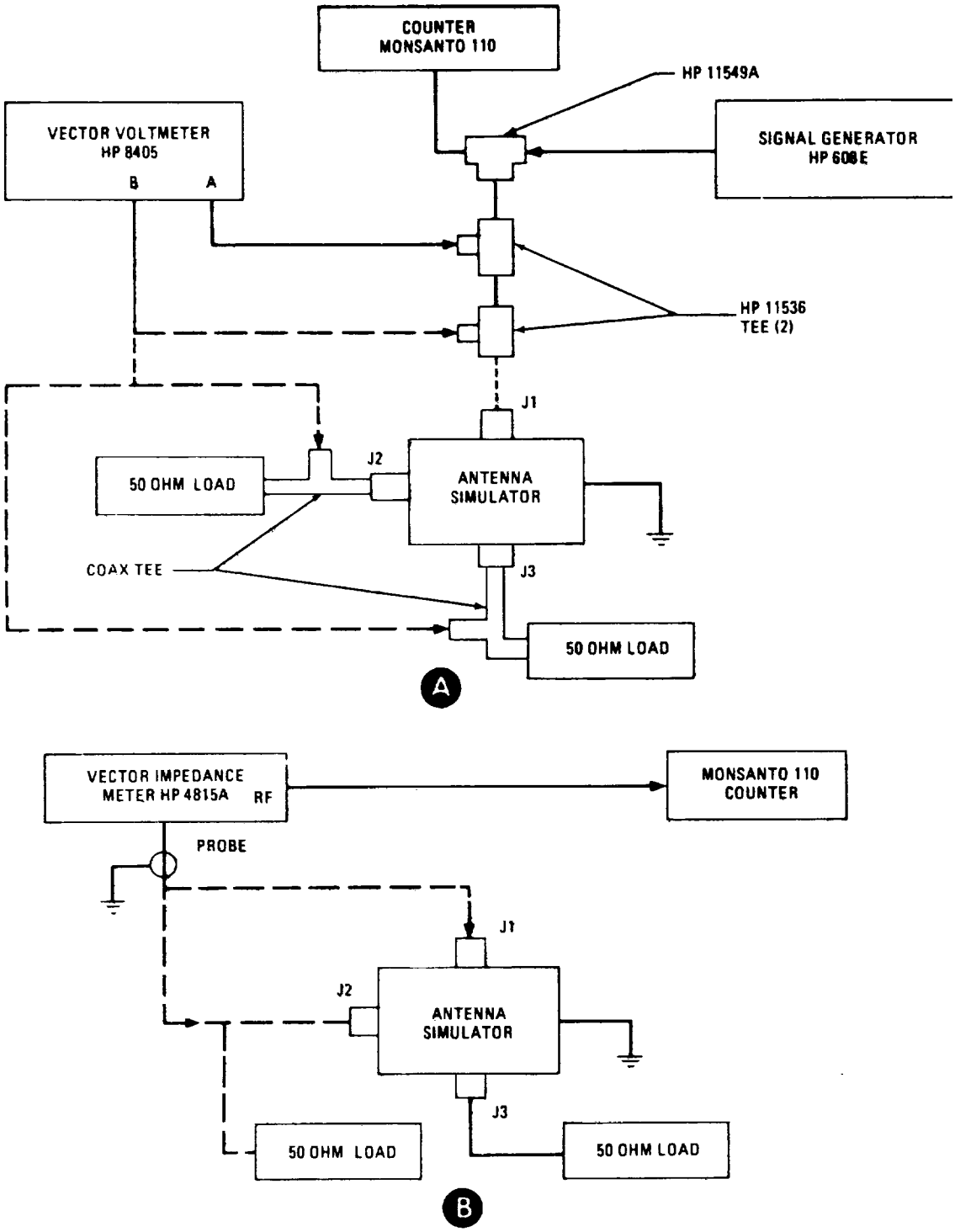

Figure 9-23. SM-617/GSQ-160 test setup

(22) Remove vector impedance meter from test setup.

(23) Connect vector voltmeter probe A to connector J1 at the HP11536 tee connector which is common to the signal generator as shown in A, figure 9-23.

(24) Tune the signal generator frequency to 58.75 MHz. Adjust the signal generator CW level for an indication of 1 milliwatt on the vector voltmeter channel A.

(25) Connect the vector voltmeter probe B to J2 of antenna simulator.

(26) Note and record the signal level in terms of db values below channel A indication. Channel B signal level must be within specified limits of -20 db -1. If indication is not within limits, replacement of the antenna simulator is indicated.

(27) Remove all test equipment from antenna simulator.

(28) If necessary, replace cover (fig. 9-12) and secure with four machine screws.

9-28. Interface Unit, Electronic Circuit, Plug-in MX-8924/GSQ-160

a. Regulator Test. Apply +4 and 4 volts dc to the A5 +2.8-volt dc regulator and peak detector within the MX-8924/GSQ-160 as shown in figure 9-24. Use the 6206B power supplies in the GATE to obtain the +4 and 4 volts dc required.

(1) After connecting power supplies to P13 and load resistors to J19-R, -V, as shown in figure 9-24, set output of power supply No. 1 to -4.2 volts dc, and output of power supply No. 2 to +4.0 volts dc. Connect the ME-202/U leads to J19-V (-2.8 vdc output) and J19-W (common), and check to see that the voltage reading is -2.8 volts dc (+0.04). Change the output of power supply No. 1 to -3.4 volts dc, and check to see that the output at J19-V is still --2.8 volts dc (+0.04). After check is complete, set output of power sup- ply No. 1 to 4 volts dc.

(2) Set output of power supply No. 2 to +4.2 volts dc. Connect voltmeter leads to J19-R (+2.8 vdc output) and J19-W (common), and check to see that the voltage reading is +2.8 volts dc (+0.04). Change the output of power supply No. 2 to +3.4 volts dc, and check to see that the output at J19-R is still +2.8 volts dc (+0.04).

(3) If the readings specified in (1) and (2) above cannot be obtained, module A5 is defective. Remove and replace A5, and perform the test again. When test is complete, disconnect all test equipment.

b. Peak Detector Circuit Test. Power for this test is most easily obtained by plugging Battery BA-1549/U known to be good into P13 of the MX-8924/GSQ-160. Otherwise, the +4, 4, and +30 volts dc must be supplied from an external source. Connect ME-202/U set to read +5 volts dc to TP11 (peak detector output) and TP12 (common).

(1) Use GATE power supply 6206B set to an output of +5 volts dc, and connect common output to J1-A-S. Prepare to momentarily apply +5 volts dc output to the points listed below, while the relays in the detector circuit are energized by applying +28 volts dc to the points listed. The test is performed by energizing the relays as indicated, momentarily applying the +5 volts dc to the point indicated, and then waiting 10 seconds to verify that the voltmeter reading is +5 volts dc +0.25. The +28-volt dc source can be jumpered out of P14 (+30 volts dc) if the BA-1549/U is

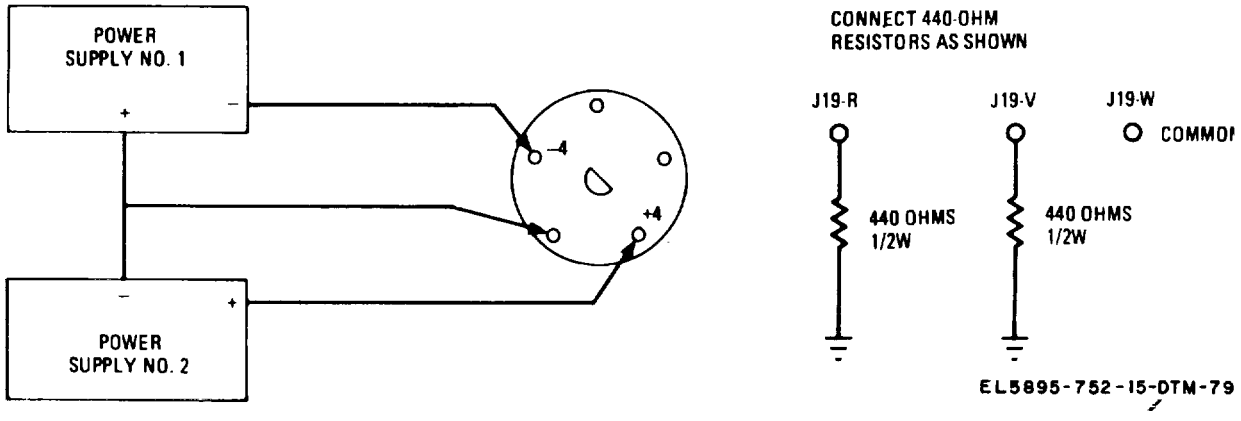

Figure 9-24. Regulator test setup

used, or may be obtained from an external source can be momentarily grounded to insure that the such as a power supply. Between each test, TP11 can be momentarily grounded to insure that the detector circuit is reset to zero.

Momentarily apply ±5 vdc	Apply ± vdc t pin (return to chassis grd	Relay path	After 10 sec, measure at TP11 (vdc))
J2-C-Z	J2 A W 2 W	K12 B2 B1, K13 A2-A1	+5 (±0.25)
J2-C-c		K13B NC	+5 (±0.25)
J1-D-Z	J2 B W	K13 B2 B1	+5 (±0.25)
J1-B-f	J2 A W	K12 A2 A1, J13A NC	+5 (±0.25)
J1-A-k	J2 B W	K12B NC, K13 A2 A1	+5 (±0.25)
J1-D-p		K12A NC, K13A, NC	+5 (±0.25)

(2) If the readings specified in (1) above cannot be obtained, either the peak detector circuit of module A5 or the associated relays in the signal path are defective. Analyze test results to determine the probably fault, then remove and replace module A5 or the suspected relay. Perform test again. When test is complete, disconnect all test equipment.

c. RF Amplifier and Bandpass Filter Test

Power for this test is most easily obtained by plugging a Battery BA-1549/U that is known to be good into P13 of the MX-8924/GSQ-160. Otherwise, + 30 volts dc must be supplied from an external source to J2-C-W to provide power for RF amplifier A1. If the external source is used, connect common to J1-A-E. Additionally, a source of + 28 volts dc is required to select the proper filter in bandpass filter A3 during a portion of the test. This + 28 volts dc can be jumpered out of P14 (+30 volts dc) if Battery BA-1549/U is used, or may be obtained from an external source such as a power supply.

(1) Connect an RF power meter (from GATE) to J12 of MX-8924/GSQ-160. Connect a frequency synthesizer (from GATE) to J8 of MX-8924/GSQ-160. Apply the following frequencies in the order given at 0 dbm level. Verify that the output level at J12 is within the value specified for each input frequency.

Input frequency at J8 (MHz) Output level at J12 (dbm)

57 5	14 minimum
57.350	13 maximum
57 650	13 maximum
57 200	8 maximum
57 800	8 maximum
56 300	6 maximum
58 700	--6 maximum
55 100	--26 maximum
59 900	--26 maximum

(2) Using the same test setup, apply +28 volts dc to J1-A-J and the return to J1-A-E. This action switches in high frequency filter in bandpass filter module A3. Apply the following frequencies in the order given at 0 dbm level. Verify that the output level at J12 is within the value specified for each input frequency.

Input frequency at J8 (MHz) Output level at J12 (dbm)

60	14 minimum
59.850	13 maximum
60 150	13 maximum
59 700	8 maximum
60 300	8 maximum
58 800	--6 maximum
61 200	--6 maximum
57-600	--26 maximum
64.400	--26.maximum

(3) If the readings specified in (1) and (2) above cannot be obtained, either RF amplifier Al or bandpass filter A3 is probably at fault. Note also that the K4 normally closed contacts are in the signal path, and if no output is obtained, this relay may be at fault. Analyze test results to determine the probable fault, then remove and replace the suspected module or the relay. Perform test again. When test is complete, disconnect all test equipment.

d. Resistance Checks.

(1) Use a precision ohmmeter connected between the following points to check the resistance of the indicated resistors. The test function associated with the resistors is listed as an aid in fault analysis. If the resistance value is not obtained, remove and replace the resistor. Figure 9-25 shows resistor location.

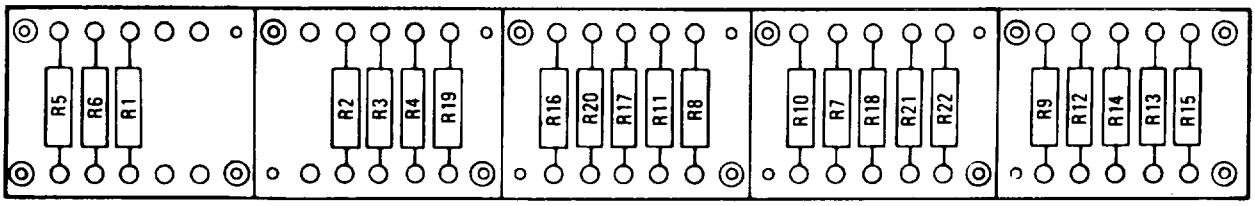

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Figure 9-25. TB1 resistor locations.

From-	To-	Resistance (ohms)	Resist	Test function
J1-A-T	J13-0	82K+4K	R21	Light sensor control No. 1
J1-A-U	J13-0	560+28K	R22	Light sensor control No. 2
J1-A-t	J1-C-e	3+0.5	R5	+4 vdc
J1-A-k	Chassis grd	6+0.3	R2-R3	Disable pulse
J1-B-t	J1-B-c	3+0.5	R6	-4 vdc
J1-C-t	J1-C-n	3+0.5	R1	+30 vdc
J2-C-Z	Chassis grd	6+0.3	R9-R12	Disable pulse

(2) In a similar manner, check the following resistances. In this case, however, apply +28 volts dc to the indicated pins to operate relay contacts. If the proper results are not obtained, either the relay or resistor may be at fault.

From-	To-	Apply +28 vdc to pns (return to chaais grd)	Relay path	Resistance (ohms)	Resistor	Test function
J1-C-f	Chassis grd		K6 B2-B3	698±35	R8-R11-R17-R20	+2.8vdc
		J1-C-W	K6 B2-B1	349±18	R17-R20	+2.8 vdc
J1-C-n	Chassis grd		K11 A2-A3	10 meg minimum		+30 vdc open circuit
		J1-B-L	K11 A2-A1	3±0.5	R4	+30 vdc load
J1-D-c	Chassis grd		K6 A2-A3	698±35	R7-R10-R16-R19	-2.8 vdc
		J1-C-W	K6 A2-A1	349±18	R16-R19	+4 vdc day/night switch
		J1-C-W	K19 A2-A1	400±20	R13-R15	+4 vdc day/night switch
J1-D-t	Chassis grd		K19 B2-B3	1600±80	R14-R18	-4 vdc day/night switch
		J1-C-W	K19 B2-B1	400±20	R13-R15	-4 vdc day/night switch

e. Relay Checks. The following checks on relay operation can be made by connecting an ohmmeter between the indicated points and checking for the indicated resistance. Apply +28 volts dc to the indicated pins to operate relay contacts. If the proper results are not obtained, remove and replace the relay. NLT means not less than; NMT means not more than; NO means normally-open; NC means normally-closed.

From-	To-	Apply +28 vdc to pin: (return to chassis grd)	Resistance	Relay path
J1-C-k	P13-(+30V)		NLT' 10 megohms	K5A NO
		J1-A-W	NMT 2 ohms	K5 A2-A1
J1-C-L	J13-N		NMT 2 ohms	K15 A2-A3
		J2-D-W	NLT 10 megohms	K15A NC
J1-C-L	J13-P		NLT 10 megohms	K15B NO
		J2-D-W	NMT 2 ohms	K15 B2-B1
J1-C-L	P14-(+4V)		NLT 10 megohms	K2B NO
		J1-C-W	NMT 2 ohms	K2 B2-B1
J1-C-L	P14-(+30V)		NLT 10 megohms	K16B NO
		J1-D-W	NMT 2 ohms	16 B2-B1

From-	To--	Apply ±28 vdc to pin: (return to chassis grd)	Resistance	Relay path
J1-D--D	P14 (-4V)		NLT 10 megohms	K16A NO
		J1-D-W	NMT 2 ohms	K16 A2-A1
J1-B-c	P13 (-4V)		NMT 2 ohms	K1 B2-B3
		J1-A-W	3.0±0.5 ohms	K1B NC
J1 B e	P13 (-4V)		3.0±0.5 ohms	K1B
		J1-A-W	NMT 2 ohms	K1 B2-B1
J1-C-c	P13 (t4V)		3.±0.5 ohms	K1A NO
		J1-A-W	NMT 2 ohms	K1 A2-A1
J1-C-e	P13 (+4V)		NMT 2 ohms	K1 A2-A3
		J1-A-W	3.0±0.5 ohms	K1A NC
J1-C-e	P14-(+4V)		NMT 2 ohms	K2 B2-BC
		J1-C-W	NLT 10 megohms	K2B NC
J13-C	J13 P		NLT 10 megohms	K7B NO
		J1-B-W	NMT 2 ohms	K7 B2-B1
J13-G	13 Q		NMT 2 ohms	K10 B2-B3
		J1-A-D	NLT 10 megohms	K1OB NC
J13-K	J1 D-D		NLT 10 megohms	K7A NO
		J1-B-W	NMT 2 ohms	K7 A2-A1
J13-N	P13 (+130V)		NLT 10 megohms	K5A, NO, K5 A2-A3
		J2-D-W	NLT 2 ohms	K15 A2-A1, K5 A2-A3
		J2-D-W, J1-A-W	NLT 10 megohms	K15 A2-AI, K5A NC
J13-N	J13 W		NMT 2 ohms	K8 A2-A3
		J1-B-W	NLT 10 megohms	K8A NC
J13-N	P14-(+30V)		NLT 10 megohms	K15 A2-A3, K16B NO
		J2-D-W	NMT 2 ohms	K15 A2-A3, K16 B2-B1
		J2-D-W, J1-D-W	NLT 10 megohms	K15A NC, K16 B2-B1
J13-Q	J1D d		NLT 10 megohms	K9A NO, K8B NO
		J1-C-W	NLT 10 megohms	K9 A2-A1, K8B NO
		J1-B-W	NLT 10 megohms	K9A NO, K8 B2-B1
		J1-C-W, J1-B-W	NMT 2 ohms	K9 A2-A1, K8 B2-B1
J13-P	J18 T		NMT 2 ohms	K15 B2-B3
		J2-D-W	NLT 10 megohms	K15B NC
J13-R	J13-P (K7B and K9B con tacts are in parallel).		NMT 2 ohms	K7 B2-B3, K9 B2-B3
		J1-C-W	NMT 2 ohms	K7 B2-B3
		J1-B-W	NMT 2 ohms	K9 B2-B3
		J1-C-W, J1-B-W	NLT 10 megohms	K7B NC, K9B, NC
J13-T	chassis grd		NMT 2 ohms	K10 A2-A3
		J1-A-B	NLT 10 megohms	K1OA NC
J13-U	chassis grd		NLT 10 megohms	KI1B NO
		J1-C-W	NMT 2 ohms	K2 A2-A1
J19-P	P14(- 4V)		NMT 2 ohms	K16 A2-A3, K14 B2-B3
		J1-A-W	NLT 10 megohms	K16 A2-A3, K14B NC
J19-T	P14(+4V)		NMT 2 ohms	K2 B2-B3, K14 A2-A3
		J1-A-W	NLT 10 megohms	K2 B2-B3, K14A NC
P16	J17	J-B-W	NMT 2 ohms	K3 COM-NO
P16	J15		NMT 2 ohms	K3 NC
		J1-B-W	NLT 10 megohms	K3 open
J9	W2-P2		NLT 10 megohms	K4 NO
		J1-A-D	NMT 2 ohms	K5 COM-NO
J8	W2-P2		NMT 2 ohms	K4 NC
		J1-A-D	NLT 10 megohms	K4 open
P17	CP1		NLT 10 megohms	K17 NO
		J1-B-L	NMT 2 ohms	K17 COM-NO
P18	CP11		NMT 2 ohms	K17 NC, K18 NC
		J1-B-L	NLT 10 megohms	K17 open, K18 NC
		J2-A-W	NLT 10 megohms	K17 NC, K18 open
J6	CP1		NLT 10 megohms	K18S NO, K17 NC
		J2-A-W	NMT 2 ohms	K18 COM NO, K17 NC
		J1-B-L, J2-A-W	NLT 10 megohms	K18 COM-NO, K17 open

f. Continuity Check.

(1) Continuity checks on the unit can be performed by connecting an ohmmeter between the following pin and chassis ground. Verify that the resistance reading obtained is less than 2 ohms for each check. If the result is not obtained, analyze the schematic diagram (fig. FO-11) to isolate the fault.

J1-A E	J1-D R	J2-A R	J13 B
J1-A-K	J1-D-V	J2-A V	J19 W
J1-A-M	J1-D-Y	J2-A Y	P13 Com
J1-A S	J1-A-e	J2-B R	P13 (30V)
J1-A Y	J1-A-j	J2-B V	J22 V
J1-B M	J1-A-n	12-B Y	P14 Com
J1-B P	J1-A s	J2-C R	
J1-B R	J1-A v	J2-C.V	J24 47
J1-B V	J1-B-b	J2-C Y	P1 25
J1-B-Y	J1-B-j	J2-D R	J18 W
J1-C E	J1-B-n	J2-D V	P15 16
J1-C F	J1-B-s	J2-D Y	J27
J3-C M	J1-B-v	J2-A b	
J1-C N	J1-C-j	J2-A e	
J1-C r	J1-C-s	J2-A J	
J1-C-V	J1 C-v	J2-B b	
J1-C-Y	J1-D-b	J2-B e	
J1-D E	J1-D-e	J2-C b	
J1-D F	J1-D-j	J2-C e	
	J1-D-n	J2-D b	
	J1-D-s	J2-D e	
	J1-D-v	J2-A E	
		J2-A F	
		J2-A M	
		J2-A N	

(2) Use all ohmmeter connected between the following pins to verify that the resistance between the pins is less than 2 ohms. If the result is not obtained, inspect the schematic diagram (fig. FO-11) for analysis of the fault before making a wiring correction.

From	*To*
J1-A-B	J1-A-D
J1-A-H	J22-J
J1-A-L	J1-A J
J1-A-P	J24-71
J1-A-P	J22-L
J1-A-P	J13-M
J1-A-R	J1-A-V
J1-A-R	J13-I
J1-B-L	J1-B-J
J1-B-T	P1-20
J1-B-U	P15-9
J1-B-U	J22-D
J1-B-Z	J19-H
J1-C-B	J19-B
J1-C-B	J1-C-D)
J1-C-B	J1-B-S
J1 C T	P1-16
J1-C-U	P1-17
J1-D-B	J1-D-D
J1-D-E	J1-D-F
J1-D-T	P1-e
J1-D-U	P1-21
J1-D-Z	J22-B
J1-D-Z	J21
J1-A-c	J22-**11**
J1-A-f	J22-W
J1-A-p	P15-14
J1-A-p	J29
J1-A-t	J-C-c
J1-A-k	J24-52
J1-B-f	J22-A
J1-B-K	J18-F
J1-C-p	P15-24
J1-C-p	J35
J1-C-t	J1-C-k
J1-D-e	J13-D
J1-D-f	J13-F
J1-D-t	J13-J
J1-D-k	P15-11
J1-D-k	J33
J1-D-p	P15-20
J1-D-p	J28
J2-A D	J3
J2-A D	J2-A-B
J1-B-p	P15-5
J1-B-P	J31
J1-B-t	J1-B-e
J1-C--f	J13-H
J2-A-L	J2-A-J
J2-A-L	J4
J2-A-T	P1-11
J2-A-U	P1-12
J2-A-Z	P15-7
J2-A-Z	J26
J2-B-T	P1-13
J2-B-U	P1-14
J2-B-Z	P15-22
J2-B-Z	J34
J2-C-T	P1-15
J2-C-U	P1 18
J2-C-Z	J13-V
J2-D-T	J1 19
J2-D-U	J2-B-c
J2-D-U	J23
J2-A-f	P15-1
J2-A-f	J25
J2-C-c	J19-F
J2-D-c	J30
J2-D-c	P15-18
J2 A-c	J32
J2-A-c	P15-3
J19-P	J22-N
J19-P	J18-P
J19-R	J16
J19-R	J18-R
J19-R	J22-P
J19-T	J22-R
J19-T	J18-T
J19-V	J22-T
J19 V	J18-V
J36	J37

(3) As a final check, use an ohmmeter to test the continuity of shield and center conductor on all supplied coaxial cables. The resistance reading obtained should be less than 2 ohms.

g. Isolation Checks. Isolation checks can be performed on the unit by connecting an ohmmeter between the following points. Verify that the resistance reading obtained is more than 10 megohms for each check. If the result is not obtained analyze the schematic diagram (fig. FO-11) to isolate the fault before making a wiring correction.

h. Cable Checks. As a final check, use an ohmmeter to test that the isolation between center conductor and shield of all coaxial cables supplied is more than 10 megohms.

From	To	Disconnect at-
J1-A-Z	J1-A-B	P8 of A2 VSWR detector
J6	Shield	
J8	Shield	P2 of Al RF amplifier
J9	Shield	
J11	Shield	P7 of A2 VSWR detector
J12	Shield	P9 of A3 bandpass filter
J15	Shield	
P5	Shield	CP1 of A2 VSWR detector
P7	Shield	
P12 (primary processor).	Shield	
J36	Shield	

APPENDIX A

REFERENCES

Following is a list of applicable publications available to the operator and direct, general support, and depot maintenance repairman of AN/GSQ-160:

AR 700-58	Report of Damaged or Improper Shipment.
DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (Types 7, 8, and 9), Supply Bulletins, and Lublication Orders.
DA Pam 310-7	U. S. Army Index of Modification Work Orders.
SB 11-6	Dry Battery Supply Data.
SC 5180-91-CIRO7	Tool Kit, Electronic Equipment TK-105/G.
TB SIG 355-1	Depot Inspection Standard for Repaired Signal Equipment.
TB SIG 355-2	Depot Inspection Standard for Refinishing Repair Signal Equipment.
TB SIG 355-3	Depot Inspection Standard for Moisture and Fungus Resistant Treatment.
TB 746-10	Field Instructions for Painting and Preserving Electronics Command Equipment.
TM 11-6625-366-15	Organizational, DS, GS and Depot Maintenance Manual: Multimeter TS-352B/U.
TM 11-6625-508-10	Operator's Manual: Signal Generators AN/'USM-44 and AN/USM-44A.
TM 11-6625-508-25	Organizational, Field and Depot Maintenance Manual: Signal Generators AN/USM-44 and AN/USM-44A.
TM 11-6625-537-15	Operator, Organizational, Field and Depot Maintenance Manual: Differential Voltmeter ME-202/U.
TM 11-6625-801-15	Operator, Organizational, DS, GS and Depot Maintenance Manual: Oscillograph RO-189/G.
TM 11-6625-2514-1	System Test Set PT1585.
TM 11-6625-2514-2	Code Plug Programmer PT1561.
TM 38-750	The Army Maintenance Management Systems (TAMMS).
TM 740-90-1	Administrative Storage of Equipment.
TO 313-64	Solder and Soldering.

APPENDIX B
MA1NTENANCE ALLOCATION

Section I. INTRODUCTION

B-1. General

This appendix provides a summary of the maintenance operations for the AN/GSQ-160 and OH-29/ GSQ-160. It authorizes categories of maintenance for specific maintenance functions on repairable items and components and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations.

B-2. Maintenance Function

Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

b. Test. To verify serviceability and to detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition, i.e., to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

d. Adjust. To maintain, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to the specified parameters.

e. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Install. The act of emplacing, seating, or fixing into position an item, part, module (component or assembly) in a manner to allow the proper functioning of the equipment or system.

h. Replace. The act of substituting a serviceable like type part, subassembly, or module (component or assembly) for an unserviceable counterpart.

i. Repair. The application of maintenance services (inspect, test, service, adjust, align, calibrate, replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

j. Overhaul. That maintenance effort (service/ action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours, miles, etc.) considered in classifying Army equipments/components.

B-3. Column Entries

a. Column 1, Group Number. Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2, Component/Assembly. Column 2 contains the noun names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Functions. Column 3 lists the functions to be performed on the item listed in column 2. When items are listed without maintenance functions, it is solely for purpose of having the group numbers in the MAC and RPSTL coincide.

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a "worktime" figure in the appropriate subcolumn(s), the lowest level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate "worktime"

figures will be shown for each category. The number of task-hours specified by the "worktime" figure represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. Subcolumns of column 4 are as follows:

C- Operator/Crew
0 - Organizational
F - Direct Support
H - General Support
D- Depot

e. Column 5, Tools and Equipment. Column 5 specifies by code, those common tool sets (not individual tools) and special tools, test, and support equipment required to perform the designated function.

f Column 6, Remarks. Column 6 contains an alphabetic code which leads to the remark in section VI. Remarks, which is pertinent to the item
opposite the particular code.

B-4. Tool and Test Equipment Require- ments (sec III and V)

a. Tool or Test Equipment Reference Code. The numbers in this column coincide with the numbers used in the tools and equipment column of the MAC. The numbers indicate the applicable tool or test equipment for the maintenance functions.

b. Maintenance Category. The codes in this column indicate the maintenance category allocated the tool or test equipment.

c. Nomenclature. This column lists the noun name and nomenclature of the tools and test equipment required to perform the maintenance functions.

d. National/NATO Stock Number. This column lists the National/NATO stock number of the specific tool or test equipment.

e. Tool Number. This column lists the manufacturer's part number of the tool followed by the Federal Supply Code for manufacturers (5-digit) in parentheses.

B-5. Remarks (sec VI)

a. Reference Code. This code refers to the appropriate item in section II or IV, column 6.

b. Remarks. This column provides the required explanatory information necessary to clarify items appearing in (sec II and IV).

SECTION II MA1NTENANE ALLOCATION CHART
FOR
DETECTING-TRANSMITTING SET, ELECTROMAGNETIC AN/GSQ-160

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MA1NTENANCE FUNCTION	(4) MA1NTENANCE LEVEL C	O	F	H	D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
00	DECTING-TRANSMITTING SET, ELECTROMAGNETIC A/MQ-160	Inspect	0.1						A
		Test	0.5					1,3,4,7,8	
		Test			1.0			3 5 thru 8	
		Replace			0.3			2	B
		Repair				1.5		2,3 5 thru 8	
		Overhaul					32.0	2,3 5thnu 8	
01	DETECTING-TRANSMITTING SET, SUBASSEMBLY MX-8846/GSQ-160	Repair			1.3			2,3 5 Thru 8	B
		Repair				2.5		2,3 5thru 8	
		Repair					16.0	2,3 5 thru 8	
0101	DATA TRANSMITTER A7 CONSISTING OF KY-678/GSQ (TC-431) and KY-677/GSQ (TC-432) and either T-1143/gSQ (TC-516) or T-1233/GSQ (TC-560)	Test	0.5					3,7,8	
		Install			0.3			2	
		Repair			1.3			2,3,7,8	B,C
0102	OSCILIATOR, RF, RF SENSOR A1	Test			1.0			6,7	
		Replace			1.0			2	
		Repair					8.0	2,6,7	
0103	CIRCUIT CARD,SUPPLEMENTAL PROCESSOR A2	Test			1.0			6,7	
		Replace			1.0			2	
		Repair					8.0	2,6,7	
0104	CIRCUIT CARD, PRIMARY PROCESSOR A3	Test			1.0			6,7	
		Replace			1.0			2	
		Repair					8.0	2,6,7	
0105	CIRCUIT CARD, SECONDARY PROCESSOR A4	Test			1.0			6,7	
		Replace			1.0			2	
		Repair					8.0	2,6,7	
0106	ANTENNA COUPLER A5	Test				1.0		6,7	
		Replace			1.0			2	
		Repair					8.0	2,6,7	
0107	IINTERCONNECTION BOARD A6	Repair				6.0		2,5,6,7	
02	BATTERY BA-1549/U	Test			0.1			5	
		Install			0.1				
03	ANRENNA AS-2542/GSQ-160	Test				0.5		6,7	
		Replace			0.1				
	COUNTERPOISE	Replace			0.1				
	BATTERY BOX	Replace			0.1				D

SECTION III TOOL AND TEST EQUIPMENT REQUIREMENTS FOR DETECTING-TRANSMITTING SET, ELECTROMAGNETIC AN/GSQ-160

TOOL OR TEST EQUIPMENT REF CODE	MA1NTENANCE CATEGORY	NOMENCLATURE	NATIONAL/ NATO STOCK NUMBER	TOOL NUMBER
1	0	TOOL KIT TK-101	518o-00-o64-5178	
2	F,H,D	TOOL KIT TK-105	5180-00-610-8177	
3	C,F,R,D	TEST SET, SENSORS REPEATER SET, RADIO TS-3470/USM (PT-1585)		
4	c	R F IMIITOR SET AN/USQ-46A	5820-O-1 68-8382	
5	F,H,D	MULTIMETER AN/ISM-223	6625-00-999-7465	
6	F,H,D	TEST SET, ALARM, ANTI-IIINTRUSION, AN/GSM-220(V)	6350-00-133-7595	
7	F,H,D	SIMULATOR GROUP OH-29/OSQ-160		
8	C,F,F,D	PROOGRA.ER-INDICATOR CODE C-9074/GSQ (PT-1561)	6625-00-169-1683	

SECTION IV MAINTENANCE ALLOCATION CHART

FOR

SIMULATOR GROUP OH-29/GSQ-160

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY C	O	F	H	D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
00	SIMULATOR GROUP OH-29/GSQ-160	Inspect			0.5				A
		Repair			2.5			6,912, 13	E
		Overhaul					40.0	1 thru 13	
01	TARGET SANDARD SIMULATOR SM-618/GSQ-160	Test			0.5			6,9	F
		Repair			1.5			6,9,13	
		Repair					18.0	1 thru II13	
0101	CONTROL UNIT	Test			0.5			6,9	
		Replace			0.2			13	
		Repair			1.5			6,9,13	
		Repair					16.0	1 thru 13	
010101	CIRCUIT CARD ASSEMBLY.A1	Test			0.5			6,9	
		Replace			0.3			13	
		Repair					8.0	6,9,10, 12,13	
010102	CIRCUIT CARD ASSEMBLY A2	Test						6,9	
		Replace						13	
		Repair						6,9,10, 12, 13	
010103	CIRCUIT CARD ASSEMBLY A3	Test			0.5			6,9	
		Replace			0.3			13	
		Repair						6,9,10, 12,13	
010104	CIRCUIT CARD ASSEMBLY A4	Test			0.5			6,9	
		Replace			0.3			13	
		Repair					8.0	6 9,10, 12,.13	
0102	SWITCH MATRIX	Test			0.5				
		Replace			0.3				
02	ANTENNA SIMULATOR SM-617/GSQ-160	Repair					6.5	1 thru 5 ; 13	
		Adjust					3.0	1 thru 5 13	
03	ANTENNA SIMULATOR SM-616/GSQ-160	Test			0.5			6,9	F
		Replace			0.1				
		Repair					6.5	1 thru 5 13	
		Adjust 13					3.0	1 thru 5	
04	ELECTRONIC CIRCUIT PLUG-IN INTERFACE UNIT MX-8924/GSQ-160	Test			1.0			6,11,12	F
		Repair					8.0	6,11,12, 13	
05	CABLE ASSEMBLY CX-12593/GSQ-160	Test			0.8			6	
		Replace			0.1				
		Repair					2.0	6,13	
06	CABLE ASSEMBLY CX-12591/GSQ-160	Test			0.8			6	
		Replace			0.1				
		Repair					2.0	6,13	

SECTION V TOOL AND TEST EQUIPMENT REQUIREMENTS FOR SIMULATOR GROPU OH-29/GSQ-160

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/ NATO STOCK NUMBER	TOOL NUMBER
1	H,D	COUNTER, ELECTRONIC DIGITAL READOUT AN/USM-207	6625-00-044-3228	
2	H,D	METER, VECTOR IMPEDANCE TS-3351/U	6625-00-469-2261	
3	H,D	GENERATOR, SIGNAL AN/USM-44A	6625-00-539-9685	
4	H,D	VOLTMETER, ELECTRONIC ME-202/U	6625-00-709-0288	
5	H,D	ACCESSORY KIT HP 11570	6625-00-197-8443	
6	F,H,D	MULTIMETER AN/USM-223	6625-00-999-7465	
7	H,D	TIME DOMAIN REFLECTOMETER HP 1415A	6625-00-988-2579	
8	H,D	SPECTRUM .ANALYZER AN/UPM-84A	6625-00-411-3072	
9	F,H,D	OSCILLOGRAPH RO-1 89/G	6625-00-892-4547	
10	H,D	PREAMPLIFIER HP 8801A	6625-00-111-3966	
11	F,H,D	TEST SET, ALARM, ANTI-INTRUSION AN/SGM-220	6350-00-133-7595	
1’2	F,H,D	TOOL KIT, ELECTRONIC EQUIPMENT TK-105G	5180-00-610-8177	

SECTION VI. REMARKS

REFERENCE CODE	REMARKS
A	VISUAL INSIECTION.
B	REPAIR BY REPACING BATTERY, COMMON MODULES,, AND CASE COMPOENTS.
C	INCLUDES CHANGING CRYSTAL IN DATA TRANSMITTER A7.
D	INCLUDES BATTERY REPACEMENT.
E	REPAIR BY REPLACING SWITCHING MATRIX ANDCONTROL UNIT.
F	INCLUDES PERFORMANCE TESTING AT GS OR DEPOT LEVEL..

APPENDIX C

DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE REPAIR PARTS

Section I. INTRODUCTION

C-1. Scope

This manual lists repair parts required for the performance of direct support, general support, and depot maintenance of the AN/GSQ-160.

NOTE

1.No special tools or test equipment are required.

2.No parts authorized for stockage at organizational maintenance.

C-2. General

This repair parts list is divided into the following sections:

a. Repair Parts for Direct Support, General Support, and ,Depot Maintenance-Section II.A **list of repair parts authorized for the performance of maintenance at the direct support, general sup- port, and depot level.**

b. .Index-Federal Stock Number Cross-Refer ence to Figure and Item Number or Reference Designation-Section III.**A list of Federal stock numbers in ascending numerical sequence, cross-referenced to the illustration figure number and item number or reference designation.**

c. .Index-Reference Designation Cross-Refer ence to Page Number-Section? IV.**A list of reference designations cross-referenced to page numbers.**

C-3. Explanation of Columns

The following provides an explanation of columns in the tabular lists:

a. .Source, Maintenance, and Recoverability Codes (SMR).

(1)) Source codes indicate the selection status and source for the list item. Source codes are-

Code	*Explanation*
P	**- Repair parts which are stocked in or supplied from the GSA/DSA, or Army supply system and authorized for use at indicated maintenance categories.**
P*2*	**—Repair parts which are procured and stocked for insurance purposes because the combat or military essentiality of the end item dictates that a minimum quantity be available in the supply system.**
P*9*	**—-Assigned to items which are NSA design controlled: unique repair parts, special tools, test, measuring and diagnostic equipment, which are stocked and supplied by the Army COMSEC logistic system, and which are not subject to the provisions of AR 380-41.**
P10	**—Assigned to items which are NSA design controlled: special tools, test, measuring and diagnostic equipment for COMSEC support, which are account- able under the provisions of AR 380-41, and which are stocked and supplied by the Army COMSEC logistic system.**
M	**—Repair parts which are not procured or stocked, but are to be manufactured at indicated maintenance levels.**
A	**—Assemblies which are not procured or stocked as such, but are made up of two or more units.Such component units carry individual stock numbers and descriptions, are procured and stocked separately and can be assembled to form the required assembly at indicated maintenance categories.**
X	**—Parts and assemblies which are not pro- cured or stocked and the mortality of which normally is below that of the applicable end item or component. The failure of such part or assembly should result in retirement of the end item from the supply system.**
X1	**—Repair parts which are not procured or**

Code	Explanation
	stocked. The requirement for such items will be filled by use of the next higher assembly or component.
X2	—Repair parts which are not stocked. The indicated maintenance category requiring such repair parts will attempt to obtain same through cannibalization. Where such repair parts are not obtainable through cannibalization, requirements will be requisitioned, with accompanying justification, through normal supply channels.
G	—Major assemblies that are procured with PEMA funds for initial issue only as exchange assemblies at DSU and GSU level. These assemblies will not be stocked above DS and GS level or re- turned to depot supply level.

(2) Maintenance codes indicate the lowest category of maintenance authorized to install the listed item. The maintenance level codes are-

Code	Explanation
C	.....Operator/crew.
0	.....Organizational maintenance.
F	.....Direct support maintenance.
H	.....General support maintenance.
D	.....Depot maintenance.

(3) Recoverability codes indicate whether unserviceable items should be returned for recovery or salvage. Items not coded are expendable. Recoverability codes are-

Code	Explanation
R —	Repair parts and assemblies that are economically repairable at DSU and GSU activities and are normally furnished by supply on an exchange basis.
S —	Repair parts and assemblies which are economically repairable at DSU and GSU activities and which normally are furnished by supply on an exchange basis. When items are determined by GSU to be uneconomically repairable, they will be evacuated to a depot for evaluation and analysis before final disposition.
T —	High-dollar value recoverable repair parts which are subject to special handling and are issued on an exchange basis. Such repair parts normally are re- paired or overhauled at depot mainte- nance activities.
U —	Repair parts specifically selected for salvage by reclamation units because of precious metal content, critical materials, or high-dollar value reusable casings or castings.

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

c.Description. Indicates the Federal item name and any additional description of the item required. The index number has been included as part of the description to aid in the location of "same as" item. A part number or other refer- ence number is followed by the applicable five- digit Federal supply code for manufacturers in parentheses.

*d. Umit of Measure (U/M).*A two-character alphabetical abbreviation indicating the amount or quantity of the item upon which the allowances are based, e.g., ft, ea, pr, etc.

e. Quantity Incorporated in Unit. Indicates the quantity of the item used in the AN/GSQ-160. Subsequent appearances of the same item in the same assembly are indicated by the letters "REF."

*f. Allowances (15-Day Organizational Maintenance, 30-Day DS/GS Maintenance, I Year per Equipment(Contingency), and Depot Maintenance).*Items authorized for requisition as required are identified by an asterisk in the allowance column.

g. Illustrations.

(1) Figure number. Indicates the figure number in which the item is shown.

(2) Item number or reference designation. Indicates the reference designation used to identify the item in the illustration.

C-4. Dry Batteries

Dry batteries shown are used with the equipment but are not considered part of the equipment. They will not be preshipped automatically but are to be requisitioned in quantities necessary for the particular organization, in accordance with SB 11-6.

C-5. Special Information

a. Electromagnetic Detecting-Transmitting Set AN,'GSQ-160 is stored and issued less Battery r, BA-1549.'U, Code Setter KY-677/GSQ, Encoder KY-678/GSQ, and Transmitter T-1233(V)/GSQ or Transmitter T-1143 (P)/GSQ.

b. The following components are required in order to assemble a complete AN/GSQ-160 before operational employment:

(1) One each Battery BA-1549/U, FSN 6135-459-3326.

(2) One each Code Setter (TC-432) KY-677/GSQ, FSN 5820-493-9317.

(3) One each Encoder (TC-431) KY-678/ GSQ, FSN 5820-484-8651.

(4) One each Transmitter, Radio T-1233 (V) /GSQ (TC-560) or Transmitter, Radio T-1143 (P)/GSQ (TC-516 or TC-434).The T-1233(V)/ GSQ (TC-560) is preferred and should be requisitioned.

(a) Appropriate operating channels for the T-1233(V)/GSQ are as follows:

Transmitter Radio T-1233(V)/GSQ-(TC-560)
List of Channels

0184	0262	0598	0886
0250	0382	0616	0996
0310	0442	0736	1166
0364	0502	0778	1186
0424	0562	0796	1306
0550	0604	0856	1486
0610	0622	0916	1606
0670	0664	0976	
0724	0730	1096	
0802	0742	1138	
1030	0782	1156	
1084	0844	1216	
1090	0964	1276	
1150	1024	1318	
1204	1384	1336	
1264	1504	1396	
1324	1564	1456	
1390	0556	1516	
1450	0676	1576	
1624	0526	1636	
1744	0958	1696	
0130	1036	1756	
0142	0816	1816	
0202	0826	1876	
0244	0496	0866	

(b) If the T-1233(V)/GSQ(TC-560) is not available,requisitiontheT-1143(P)/GSQ (TC-516 or TC-434) with FSNs and operating channels as follows:

Transmitter, Radio; T-1143(P)/GSQ (02859)

*C*hannel *No.*	*FSN 5820-*
0016	459-3768
0058	459-3786
0076	459-3798
0124	480-5689
0130	459-3815
0136	459-3820
0142	459-3825
0184	459-3840
0190	459-3854
0196	459-3868
0202	459-3874
0238	459-3879
0244	459-3886
0250	459-3891
0256	459-3898
0262	459-3904
0304	459-3916
0310	4593924
0316	459-3931
0322	459-3937
0364	459-3942
0370	459-3943
0376	459-3944
0382	459-3945
0418	459-3769
0424	459-3788
0430	459-3799
0436	459-3809
0442	459-3816
0484	459-3821
0490	459-3826
0496	459-3841
0502	459-3856
0544	459-3869
0550	459-3875
0556	-459-3880
0562	459-3887
0598	459-3892
0604	459-3899
0610	459-3905
0616	459-3917
0622	459-3925
0664	459-3992
0670	480-5718
0676	459-3947
0682	459-3949
0724	459-3952
0730	459-3953
0736	459-3770
0742	459-3789
0778	459-3802
0784	459-3810
0790	459-3817
0796	459-3822
0802	459-3827
0844	459-3848
0850	459-3858
0856	459-3870
0862	459-3876
0904	459-3881
0910	459-3888
0916	459-3893
0922	459-3900
0958	459-3906
0964	459-3918
0970	459-3926
0976	459-3934
0982	459-3938
1024	459-3954
1030	459-3959
1036	459-3960
1042	459-3966
1084	459-3771
1090	459-3792
1096	459-3803

Channel No.	*FSN 5820-*
1102	459-3812
1138	459-3818
1144	459-3823
1150	459-3834
1156	459-3851
1162	459-3860
1204	459-3871
1210	459-3877
1216	459-3883
1222	459-3889
1264	459-3896
1270	459-3901
1276	459-3911
1282	459-3921
1318	459-3927
1324	459-3935
1330	459-3939
1336	459-3969
1342	459-3971
1384	459-3973
1390	480-5691
1396	459-3775
1402	459-3793
1444	459-3805
1450	480-5690
1456	459-3819
1462	459-3824
1504	459-3835
1510	459-3852
1516	459-3864
1522	459-3873
1564	459-3878
1570	459-3884
1576	459-3890
1582	459-3897
1624	459-3902
1630	459-3912
1636	459-3923
1642	459-3930
1684	459-3936
1690	459-3941
1696	459-3970
1702	459-3972
1744	459-3974
1750	459-3976
1756	459-3779
1762	459-3797
1816	459-3808
1876	459-3814

Transmitter, Radio: T-1143(P)/GSQ (07618)
Model TC-516

Channel No.	*FSN 5820-*
0016	459-3405
0058	459-3406
0076	459-3407
0124	459-3409
0130	459-3410
0136	459-3429
0142	459-3411
0184	459-3412
0190	459-3413
0196	459-3414
0202	459-3415
0238	459-3416
0244	459-3417
0250	459-3418
0256	459-3419
0262	459-3420
0304	459-3422
0310	459-3421
0316	459-3424
0322	459-3423
0364	459-3425
0370	459-3427
0376	457-3426
0382	459-3428
0418	459-3574
0424	459-3430
0430	459-3431
0436	459-3432
0442	459-3434
0484	459-3435
0490	459-3437
0496	459-3438
0502	459-3439
0544	459-3441
0550	459-3442
0556	459-3443
0562	459-3446
0598	459-3444
0604	459-3447
0610	459-3449
0616	459-3450
0622	459-3451
0664	459-3452
0670	459-3453
0676	459-3454
0682	459-3455
0724	459-3458
0730	459-3456
0736	459-3459
0742	459-3465
0778	459-3470
0784	459-3485
0790	459-3489
0796	459-3500
0802	459-3502
0844	459-3506
0850	459-3508
0856	459-3516
0862	459-3519
0904	459-3522
0910	459-3525
0916	459-3529
0922	459-3533
0958	459-3536
0964	459-3541
0970	459-3544
0976	459-3547
0982	459-3552
1024	459-3557
1030	459-3559
1036	4593563
1042	459-3570
1084	459-3460
1090	459-3464
1096	459-3478
1102	459-3486
1138	459-3496
1144	459-3497
1150	459-3503

Channel No.	*FSN 58s0-*
1156	459-3507
1162	459-3510
1204	459-3517
1210	459-3520
1216	459-3523
1222	459-3527
1264	459-3531
1270	459-3535
1276	459-3539
1282	459-3542
1318	459-3545
1324	459-3550
1330	459-3554
1336	459-3558
1342	459-3561
1384	459-3566
1390	459-3572
1396	459-3461
1402	459-3466
1444	459-3484
1450	459-3487
1456	459-3491
1462	459-3501
1504	459-3504
1510	459-3509
1516	459-3511
1522	459-3518
1564	459-3521
1570	459-3524
1576	459-3530
1582	459-3532
1624	459-3537
1630	459-3540
1636	459-3543
1642	459-3546
1684	459-3551
1690	459-3555
1696	459-3560
1702	459-3562
1744	459-3568
1750	459-3573
1756	459-3463
1762	459-3475
1816	459-3483
1876	459-3490

Transmitter, Radio; T-114,3(P)/GSQ (9141 7)
Model TC-434

Channel No.	*FSN 5820-*
0016	459-3575
0058	459-3581
0076	459-3592
0124	459-3600
0130	459-3607
0136	459-3611
0142	459-3619
0142	459-3633
0184	459-3633
0190	459-3641
0196	459-3647
0202	459-3658
0238	459-3665
0244	4459-3675
0250	459-3683
0256	459-3691
0262	459-3701
0304	459-3709
03104	59-3713
0316	459-3721
0322	459-3729
0364	459-3739
0370	459-3748
0376	459-3752
0382	459-3758
0418	459-3766
0424	459-3585
0430	459-3591
0436	459-3601
0442	459-3608
0484	459-3613
0490	458-3625
0496	459-3637
0502	459-3643
0544	459-3650
0550	459-3657
0556	459-3666
0562	459-3676
0598	459-3684
0604	459-3692
0610	459-3703
0616	459-3710
0622	459-3715
0664	459-3720
0670	459-3730
0676	459-3741
0682	459-3747
0724	459-3753
0730	459-3762
0736	459-3576
0742	459-3586
0778	459-3593
0784	459-3602
0790	459-3609
0796	459-3614
0802	459-3626
0844	459-3638
0850	459-3644
0856	459-3649
0862	459-3662
0904	459-3667
0910	459-3678
0916	459-3685
0922	459-3693
0958	459-3704
0964	459-3711
0970	459-3716
0976	459-3726
0982	459-3731
1024	459-3743
1030	459-3749
1036	459-3756
1042	459-3764
1084	459-3577
1090	459-3587
1096	459-3595
1102	459-3603
1138	459-3610
1144	459-3617
1150	459-3630
1156	459-3639
1162	459-3646
1204	459-3656
1210	459-3663

Channel No.	*FSN 5820-*
1216	4593672
1222	459-3680
1264	459-3686
1270	459-3697
1276	459-3707
1282	459-3712
1318	459-3717
1324	459-3727
1330	459-3733
1336	459-3745
1342	459-3750
1384	459-3767
1390	459-3763
1396	459-3578
1402	459-3588
1444	459-3598
1450	459-3604
1456	459-3612
1462	459-3618
1504	459-3632
1510	459-3640
1516	459-3648
1522	459-3651
1564	459-3664
1570	459-3674
1576	459-3682
1582	459-3687
1624	459-3698
1630	459-3708
1636	459-3714
1642	459-3718
1684	459-3728
1690	459-3738
1696	459-3746
1702	459-3751
1744	459-3757
1750	459-3765
1756	459-3580
1762	459-3589
1816	459-3766
1876	459-3605

C-6. Location of Repair Parts

a. **This appendix contains two cross-reference indexes (secs.III and IV) to be used to locate a repair part when either the Federal stock number, reference number (manufacturer's part number) or reference designation is known. The first column in each index is prepared in numerical and,/or alphanumerical sequence in ascending order. Where a Federal stock number is listed, refer to section III.**

b. **When the Federal stock number or refer- ence designation is known, follow the procedures given in (1) and (2) below.**

(1) Refer to section III and note the applicable figure and reference designation.

(2) When the reference designation is determined, refer to the reference designation index (sec.IV).The reference designations are listed in alphanumerical ascending order and are cross-referenced to the page number on which they appear in the repair parts list (sec.II).Refer to the page number noted in the index and locate the reference designation in the repair parts list (col.lb).If the description column indicates that it is a "SAME AS" item, locate the first appearance of the item by the index number (sequence number) reference.

C-7. Federal Supply Codes for Manufacturers

Code	*Manufacturer*
02859	I.T.T. Aerospace/Optical.
07618	Dorsett Electronics.
12436	General Dynamics Corp.
80063	Army Electronics Command.
91417	Radition, Inc.

SECTION II. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION / REF. NUMBER & MFR CODE / USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE (A) 1-20	(B) 21-50	(C) 51-100	(7) 30 DAY DS MAINT ALLOWANCE (A) 1-20	(B) 21-50	(C) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (A) FIG. NO.	(B) ITEM NO. OR REFERENCE DESIGNATION
		AOO1 DETECTING-TRANSMITTING SET, ELECTROMAGNETIC AN/GSQ-160 (This item is nonexpendable)												
P-F	5985-168-7469	AO02 CCOUNTERPOISE, ANTENNA ASSEMBLY: 588223-001 (12436)	EA	4	*	*	*	*	*	*	*	*	1-1	
P-F	5965-168-7470	A003 CAP, PROTECTIVE, COUNTERPOISE: 588314-001 (12436)	EA	4	*	*	*	*	*	*	*	*	1-1	
P-F-S	5985-181-*O*303	A004 ANTENNA AS-2542/GSQ-160: 588326-001 (12436)	EA	1	*	*	*	*	*	*	*	*	1-1	
P-F	6135-459-3326	A005 BATTERY BA-1549/U: BA-1549/U (80063)	EA	1	*	*	*	*	*	*	*	*	5-1	4
P-H	5840-168-7411	A006 COVER, DATA TRANSMITTING UNIT: 588351-001 (12436)	EA	1				*	*	*	*	*	5-3	5
P-H-S	5985-168-746B	A007 COUPLE, ANTENNA: 588222-001 (12436)	EA	1				*	*	*	*	*	5-4	19
P-H	5840-168-7412	AOO OSCILLLATOR, RF SENSOR: 58221-001 (12436)	EA	1				*	*	*	*	*	5-5	16
P-H-F	5840-168-7413	A009 PRIMARY PROCESSOR ASSEMBLY: 588218-001 (12436)	EA	1				*	*	*	*	*	5-5	1
P-H-S	5840-168-7414	A010 SECONDARY PROCESSOR ASSEMBLY: 588219-001 (12436)	EA	1				*	*	*	*	*	5-5	2
P-H-S	5840-168-7415	A011 SUPPLEMENTAL CARD ASSEMBLY 588220-001 (12436)	EA	1				*	*	*	*	*	5-5	25
P-H	5935-168-4436	A012 CONNECTOR, PLUG, BATTERY: 588386-001 (12436)	EA	1				*	*	*	*	*	9-8	1
P-F	5840-168-7410	A013 STRAP, WEBBING, HANDLE: 588319-001 (12436)	EA	1	*	*	*	*	*	*	*	*	3-3	
P-H	5961-168-7471	A014 SEMICONDUCTOR, PHOTO CONDUCTION: 588253-001 (12436)	EA	1				*	*	*	*	*	6-4	5
P-H	5840-168-7409	A015 RETAINER, SENSOR, DAYLIGHT: 588350-001 (12436)	EA	1				*	*	*	*	*	6-4	7
P-H	3120-182-8496	A016 BUSHING, SLEEVE INSULATOR: 588347-001 (12436)	EA	1				*	*	*	*	*	6-4	4
P-H	5840-168-7408	A017 PAD, CUSHING: 588320-1 (12436)	EA	1				*	*	*	*	*	6-4	2
P-H	5355-168-3125	AO18 KNOB, CONTROL: 588254-001 (12436)	EA	3				*	*	*	*	*	6-3	1
P-H	5930-892-9026	AO19 BOOT, SEAL: MS5423/09-03 (81349)	EA	3				*	*	*	*	*	6-3	4
P-H	5820-168-7407	A020 WINDOW, LIGHT, SENSOR: 588313-001 (12436)	EA	1				*	*	*	*	*	6-4	1
P-H	5970-168-7462	A021 INSULATOR, STAND-OFF, ANTENNA: 588312-001 (12436)	EA	1				*	*	*	*	*	1-1	
P-H	5930-168-4439	A022 SWITCH, ROTARY (ARMING): 588233-001 (12436)	EA	1				*	*	*	*	*	6-3	3
P-H	5930-168-4441	A023 SWITCH, ROTARY (CODING): 588234-001 (12436)	EA	2				*	*	*	*	*	3-3	
P-D	5935-177-2126	A024 CONNECTOR, RECEPTACLE, ELECTRICAL: M55302/2-o4 (81349)	EA	3							*	*	5-21	23

SECTION II. REPAIR PARTS FOR DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE (CONTINUED)

(1) SMR CODE	(2) FEDERAL STOCK NUMBER	(3) DESCRIPTION / REF. NUMBER & MFR CODE / USABLE ON CODE	(4) UNIT OF MEAS	(5) QTY INC IN UNIT	(6) 30 DAY DS MAINT ALLOWANCE (A) 1-20	(B) 21-50	(C) 51-100	(7) 30 DAY DS MAINT ALLOWANCE (A) 1-20	(B) 21-50	(C) 51-100	(8) 1-YR ALW PER 100 EQUIP CNTGY	(9) DEPOT MAINT ALW PER 100 EQUIP	(10) ILLUSTRATION (A) FIG. NO.	(B) ITEM NO. OR REFERENCE DESIGNATION
P-H	5930-168-4442	A025 SWITCH, MOMENTARY (SPST): 588226-001 (12436)	EA	1				*	*	*	*	*	5 -1	3
P-D	5995-168-3779	A026 CABLE ASSEMBLY (8"LG): 588324-001 (12436)	EA	1							*	*	05-4	3
P-H	5930-16P-4440	AG027 SWITCH, ANGLE, SENSOR: 588238-001 (12436)	EA	1				*	*	*	*	*	6-1	
P-D	5935-168-4437	AG028 CONNECTOR, PLUG, ELECTRICAL: 588260-00 (12436)	EA	1							*	*	5-1	7
P-F	5820-493-9317	A029 CODE SETTER (TC-432) KY-677/GSQ: (SEECOVER NOTES FOR ADDITIONAL DATA)	EA	1									5-3	6
P-F	5820-484-8651	A030 ENCODER (TC-431) KT-677/GSQ: (SEE COVER NOTES FOR ADDITIONAL DATA)	EA	1									5-3	7
P-F		A031 TRANSMITTER T-1143(P)/GSQ: (SEE COVER NOTES FOR ADDITIONAL DATA)	EA	1									5-3	8
		A032 TRANSMITTER T-1233( )/GSQ: (SEE COVER RNOTES FOR ADDITIONAL DATA) SIMULATOR GROUP, OH--29,/GSQ-160												
P-F-S		A033 CONTROL UNIT ASSEMBLY: 588424-001 (12436)	EA	1	*	*	*	*	*	*	*	*	9-2	
P-F-S	6625-415-6360	A034 SIMULATOR, ANTENNA SM-616/GSQ-160: 588207-001 (12436)	EA	1	*	*	*	*	*	*	*	*	9-2	
P-H-S	6625-415-6359	A035 SIMULATOR, ANTENNA SM-617/GSQ-160: 588208-001 (12436)	EA	1				*	*	*	*	*	9-1	
P-H-S	6625-415-6347	A036 CABLE ASSEMBLY, SPECLAL PURPOSE CX-12593/GSQ-160: 588211-001 (121436)	EA	1					*	*	*	*	9-7	
P-H-S	6625-415-6346	A037 CABLE ASSEMBLY, SPECIAL PURPCSE CX-12591/OSQ-160: 588212-001 (12436)	EA	1				*	*	*	*	*	9-6	
P-F-S		A038 SWITCH ASSEMBLY, MATRIX: 586368-001 (12436)	EA	1	*	*	*	*	*	*	*	*	9-2	
P-D	6135-165-3719	A039 BATTERY, CY-7046/GSQ-160: 588455-001 (12436)	EA	1							*	*	5-2	1

SECTION III. INDEX - FEDERAL STOKS NUMBER CROSS REFEREE TO FIGURE AND ITEM NUMBER OR REFERENCE DESIGNATION

FEDERAL STOCK NUMBER	FIGURE NUMBER	ITEM NUMBER OR REF. DESIGNATION	FEDERAL STOCK NUMBER	FIGURE NUMBER	ITEM NUMBER OR REF. DESIGNATION
3120-182-8496	6-4	4			
5355-168-3125	6-3	1			
5820-168-7407	6-4	1			
5820-484-8651	5-3	7			
5820-493-9317	5-3	6			
5840-168-7408	6-4	2			
5840-168-7409	6-4	7			
5840-168-7411	5-3	5			
5840-168-7412	5-5	16			
5840-168-7413	5-5	1			
5840-168-7414	5-5	2			
5840-168-7415	5-5	25			
5930-168-4439	6-3	3			
5930-168-4442	5-1	3			
5930-892-9026	6-3	4			
5935-168-4436	9-8	3			
5935-168-4437	5-1	7			
5935-177-2126	9-21	23			
5961-168-7471	6-4	5			
5985-168-7468	5-4	19			
5995-168-3779	5-4	3			
6135-165-3719	5-2	1			
6135-459-3326	5-1	4			

SECTION VI. INDEX-REFERENCE DESIGNATION

CROSS REFERENCE TO PAGE NUMBER

REFERENCE DESIGNATION	PAGE NUMBER	REFERENCE DESIGNATION	PAGE NUMBER	REFERENCE DESIGNATION	PAGE NUMBER
1	C-5				
2	C-5				
3	C-5				
4	C-5				
5	c-5				
6	C-6				
7	C-5				
16	C-5				
19	C-5				
23	C-5				
25	C-5				

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Sig Sec, Gen Dep (Pac) (8)
Sig FLDMS (Pac) (2)

ARNG & USAR: None.
For explanation of abbreviations used, see AR 310-50.

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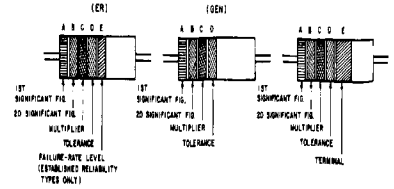


COLOR CODE MARKING FOR COMPOSITION TYPE RESISTORS.

COLOR-CODE MARKING FOR FILM-TYPE RESISTORS.

TABLE I
COLOR CODE FOR COMPOSITION TYPE AND FILM TYPE RESISTORS.

BAND A		BAND B		BAND C		BAND D		BAND E	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)	COLOR	FAILURE RATE LEVEL
BLACK	0	BLACK	0	BLACK	1			BROWN	M=1.0
BROWN	1	BROWN	1	BROWN	10			RED	P=0.1
RED	2	RED	2	RED	100			ORANGE	R=0.01
ORANGE	3	ORANGE	3	ORANGE	1,000			YELLOW	S=0.001
YELLOW	4	YELLOW	4	YELLOW	10,000	SILVER	±10 (COMP. TYPE ONLY)	WHITE	SOLDERABLE
GREEN	5	GREEN	5	GREEN	100,000	GOLD	±5		
BLUE	6	BLUE	6	BLUE	1,000,000	RED	± 2 (NOT APPLICABLE TO ESTAB. RELIABILITY)		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7						
GRAY	8	GRAY	8	SILVER	0.01				
WHITE	9	WHITE	9	GOLD	0.1				

BAND A — THE FIRST SIGNIFICANT FIGURE OF THE RESISTANCE VALUE (BANDS A THRU D SHALL BE OF EQUAL WIDTH.)

BAND B — THE SECOND SIGNIFICANT FIGURE OF THE RESISTANCE VALUE.

BAND C — THE MULTIPLIER (THE MULTIPLIER IS THE FACTOR BY WHICH THE TWO SIGNIFICANT FIGURES ARE MULTIPLIED TO YIELD THE NOMINAL RESISTANCE VALUE.)

BAND D — THE RESISTANCE TOLERANCE.

BAND E — WHEN USED ON COMPOSITION RESISTORS, BAND E INDICATES ESTABLISHED RELIABILITY FAILURE-RATE LEVEL (PERCENT FAILURE PER 1,000 HOURS) ON FILM RESISTORS, THIS BAND SHALL BE APPROXIMATELY 1-1/2 TIMES THE WIDTH OF OTHER BANDS AND INDICATES TYPE OF TERMINAL.

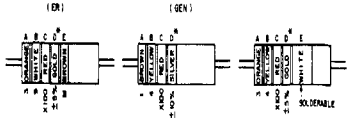
RESISTANCES IDENTIFIED BY NUMBERS AND LETTERS (THESE ARE NOT COLOR CODED)

SOME RESISTORS ARE IDENTIFIED BY THREE OR FOUR UNIT ALPHA NUMERIC DESIGNATORS. THE LETTER R IS USED IN PLACE OF A DECIMAL POINT WHEN FRACTIONAL VALUES OF AN OHM ARE EXPRESSED. FOR EXAMPLE:

2R7 = 2.7 OHMS 10R0 = 10.0 OHMS

FOR WIRE-WOUND-TYPE RESISTORS COLOR CODING IS NOT USED. IDENTIFICATION MARKING IS SPECIFIED IN EACH OF THE APPLICABLE SPECIFICATIONS.

EXAMPLES OF COLOR CODING



NOMINAL RESISTANCE 3,900 OHMS
RESISTANCE TOLERANCE ±5%
FAILURE RATE LEVEL M

NOMINAL RESISTANCE 1,400 OHMS
RESISTANCE TOLERANCE ±1%

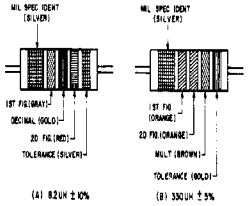
NOMINAL RESISTANCE 3,400 OHMS
RESISTANCE TOLERANCE ±1%
TERMINAL SOLDERABLE

COMPOSITION-TYPE RESISTORS

FILM-TYPE RESISTORS

* IF BAND D IS OMITTED, THE RESISTOR TOLERANCE IS ± 20% AND THE RESISTOR IS NOT MIL-STD

A. COLOR CODE MARKING FOR MILITARY STANDARD RESISTORS.



(A) 8.2 UH ± 10%

(B) 330 UH ± 5%

COLOR CODING FOR TUBULAR ENCAPSULATED R.F. CHOKES. AT A, AN EXAMPLE OF THE CODING FOR AN 8.2UH CHOKE IS GIVEN. AT B, THE COLOR BANDS FOR A 330 UH INDUCTOR ARE ILLUSTRATED.

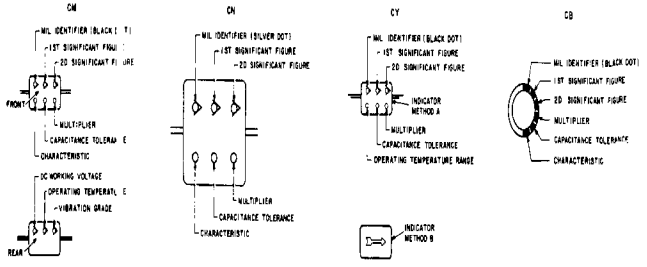
TABLE 2
COLOR CODING FOR TUBULAR ENCAPSULATED R.F. CHOKES.

COLOR	SIGNIFICANT FIGURE	MULTIPLIER	INDUCTANCE TOLERANCE (PERCENT)
BLACK	0	1	
BROWN	1	10	1
RED	2	100	2
ORANGE	3	1,000	3
YELLOW	4		
GREEN	5		
BLUE	6		
VIOLET	7		
GRAY	8		
WHITE	9		
NONE			20
SILVER			10
GOLD	DECIMAL POINT		5

MULTIPLIER IS THE FACTOR BY WHICH THE TWO COLOR FIGURES ARE MULTIPLIED TO OBTAIN THE INDUCTANCE VALUE OF THE CHOKE COIL.

B. COLOR CODE MARKING FOR MILITARY STANDARD INDUCTORS.

CAPACITORS, FIXED, VARIOUS-DIELECTRICS, STYLES CM, CN, CY, AND CB.



MICA-DIELECTRIC

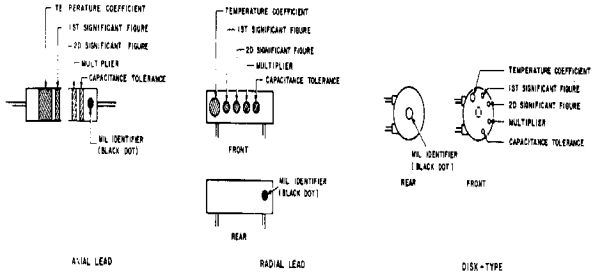
PAPER-DIELECTRIC

GLASS-DIELECTRIC, GLASS CASE

MICA, BUTTON TYPE

TABLE 3 — FOR USE WITH STYLES CM, CN, CY AND CB

COLOR	MIL ID	1ST SIG FIG	2D SIG FIG	MULTIPLIER	CAPACITANCE TOLERANCE			CHARACTERISTIC			DC WORKING VOLTAGE	OPERATING TEMP RANGE	VIBRATION GRADE
					CM	CN	CY	CB	CM	CN	CB	CM	CY, CN	CM
BLACK	CM, CY, CB	0	0	1			±20%	±20%	A				-55°_{10} to $+70^{\circ}$C	10-55Hz
BROWN		1	1	10					B	E	E			
RED		2	2	100	±2%		±1%	±2%	C				-55°_{10} to $+85^{\circ}$C	
ORANGE		3	3	1,000	±30%				D		D	300		
YELLOW		4	4	10,000					E				-55°_{10} to $+125^{\circ}$C	10-2,000Hz
GREEN		5	5		±5%				F			500		
BLUE		6	6										-55°_{10} to $+150^{\circ}$C	
PURPLE (VIOLET)		7	7											
GREY		8	8											
WHITE		9	9											
GOLD				0.1		±5%	±5%							
SILVER	CN				±10%	±10%	±10%	±10%						



AXIAL LEAD

RADIAL LEAD

DISK-TYPE

TABLE 4 — TEMPERATURE COMPENSATING, STYLE CC.

COLOR	TEMPERATURE COEFFICIENT[4]	1ST SIG FIG	2D SIG FIG	MULTIPLIER	CAPACITANCE TOLERANCE		MIL ID
					CAPACITANCES OVER 10 UUF	CAPACITANCES 10 UUF OR LESS	
BLACK	0	0	0	1		±2.0 UUF	CC
BROWN	−30	1	1	10	±1%		
RED	−80	2	2	100	±2%	±0.25 UUF	
ORANGE	−150	3	3	1,000			
YELLOW	−220	4	4				
GREEN	−330	5	5		±5%	±0.5 UUF	
BLUE	−470	6	6				
PURPLE (VIOLET)	−750	7	7				
GREY		8	8	0.01			
WHITE		9	9	0.1	±10%		
GOLD	+100					±1.0 UUF	
SILVER							

1. THE MULTIPLIER IS THE NUMBER BY WHICH THE TWO SIGNIFICANT (SIG) FIGURES ARE MULTIPLIED TO OBTAIN THE CAPACITANCE IN UUF.

2. LETTERS INDICATE THE CHARACTERISTICS DESIGNATED IN APPLICABLE SPECIFICATIONS- MIL-C-5, MIL-C-25D, MIL-C-11272B, AND MIL-C-10950C RESPECTIVELY.

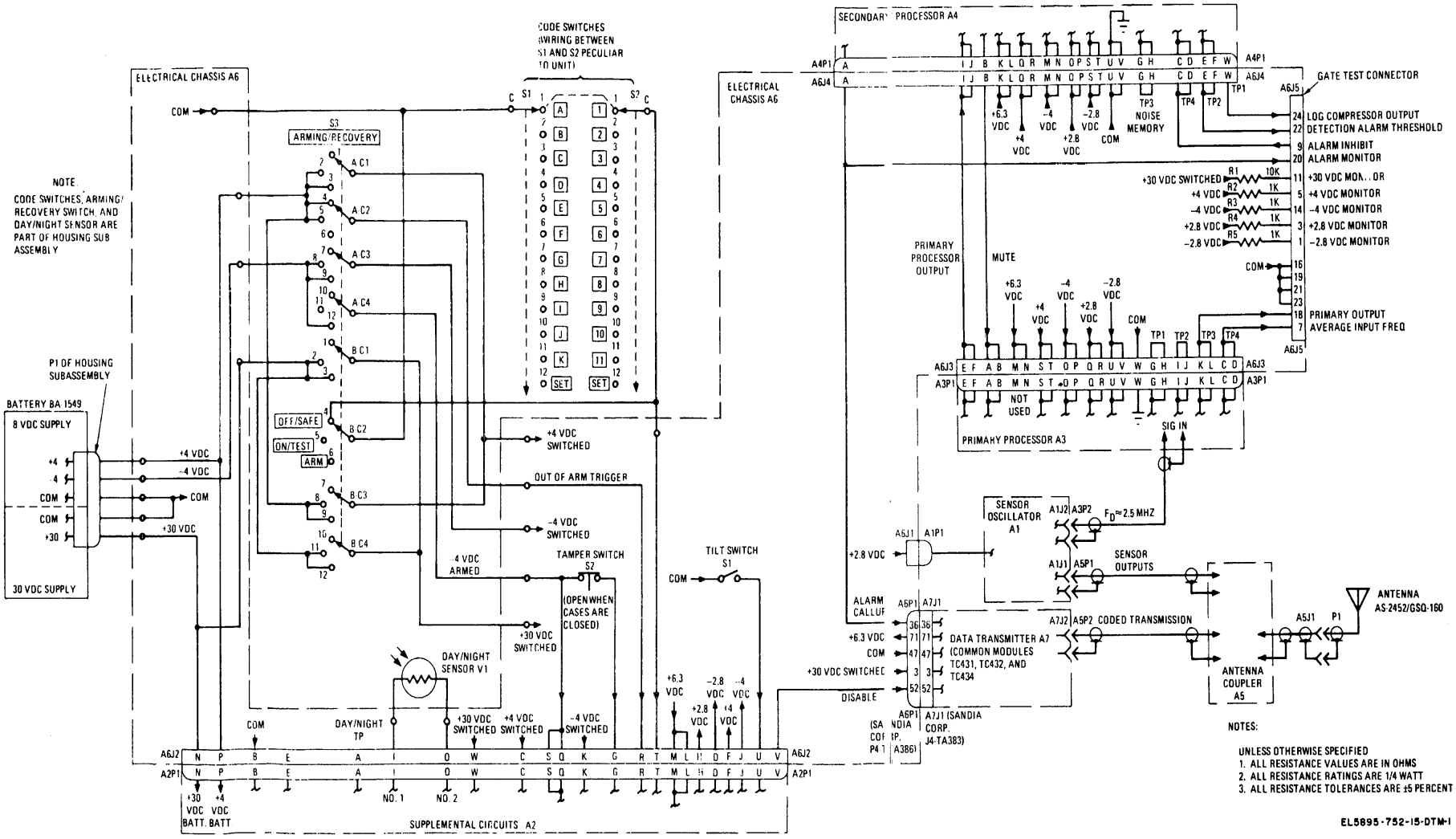
3. LETTERS INDICATE THE TEMPERATURE RANGE AND VOLTAGE-TEMPERATURE LIMITS DESIGNATED IN MIL-C-11015D.

4. TEMPERATURE COEFFICIENT IN PARTS PER MILLION PER DEGREE CENTIGRADE.

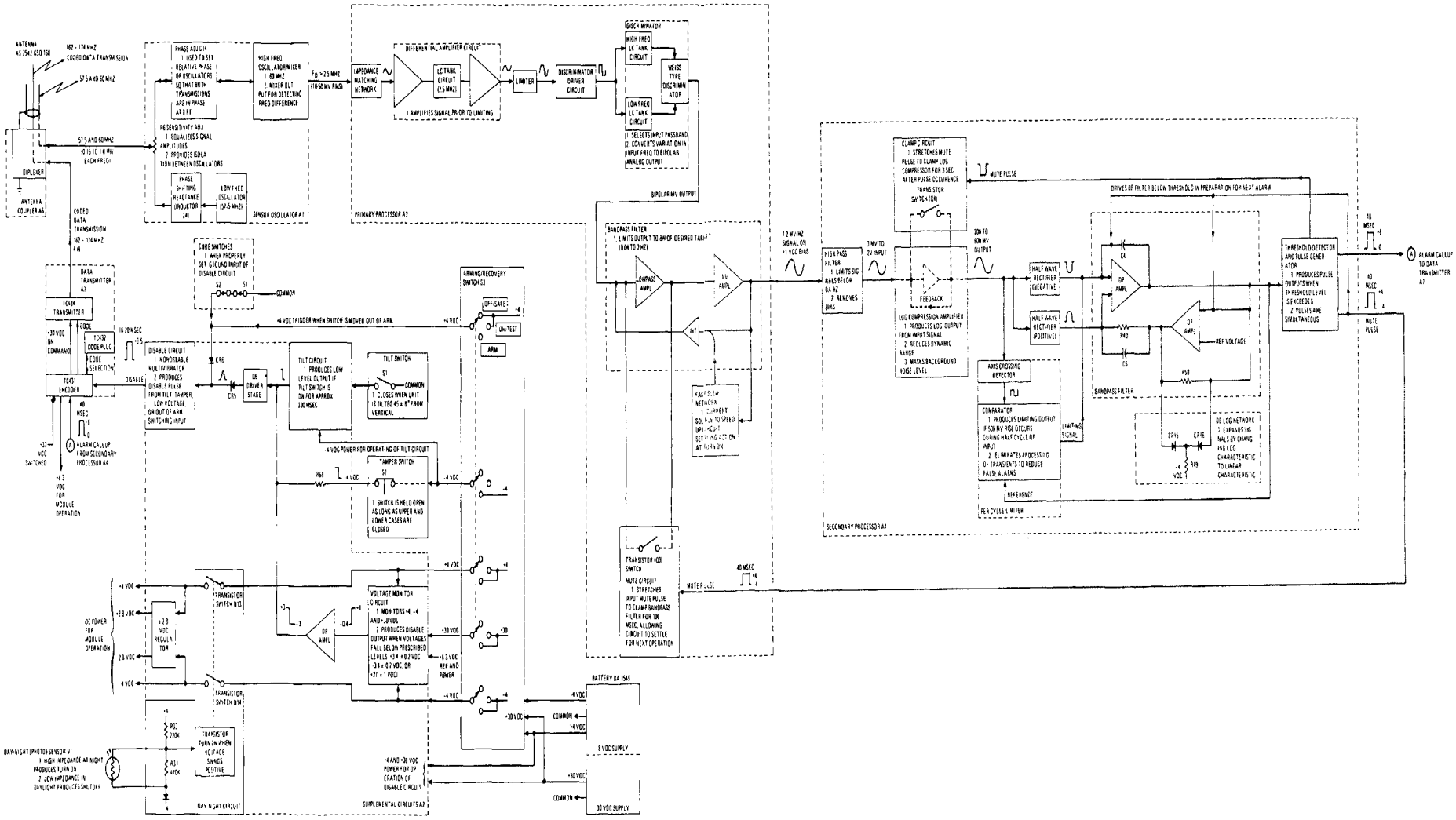
C. COLOR CODE MARKING FOR MILITARY STANDARD CAPACITORS.

ESC-FM (794-71

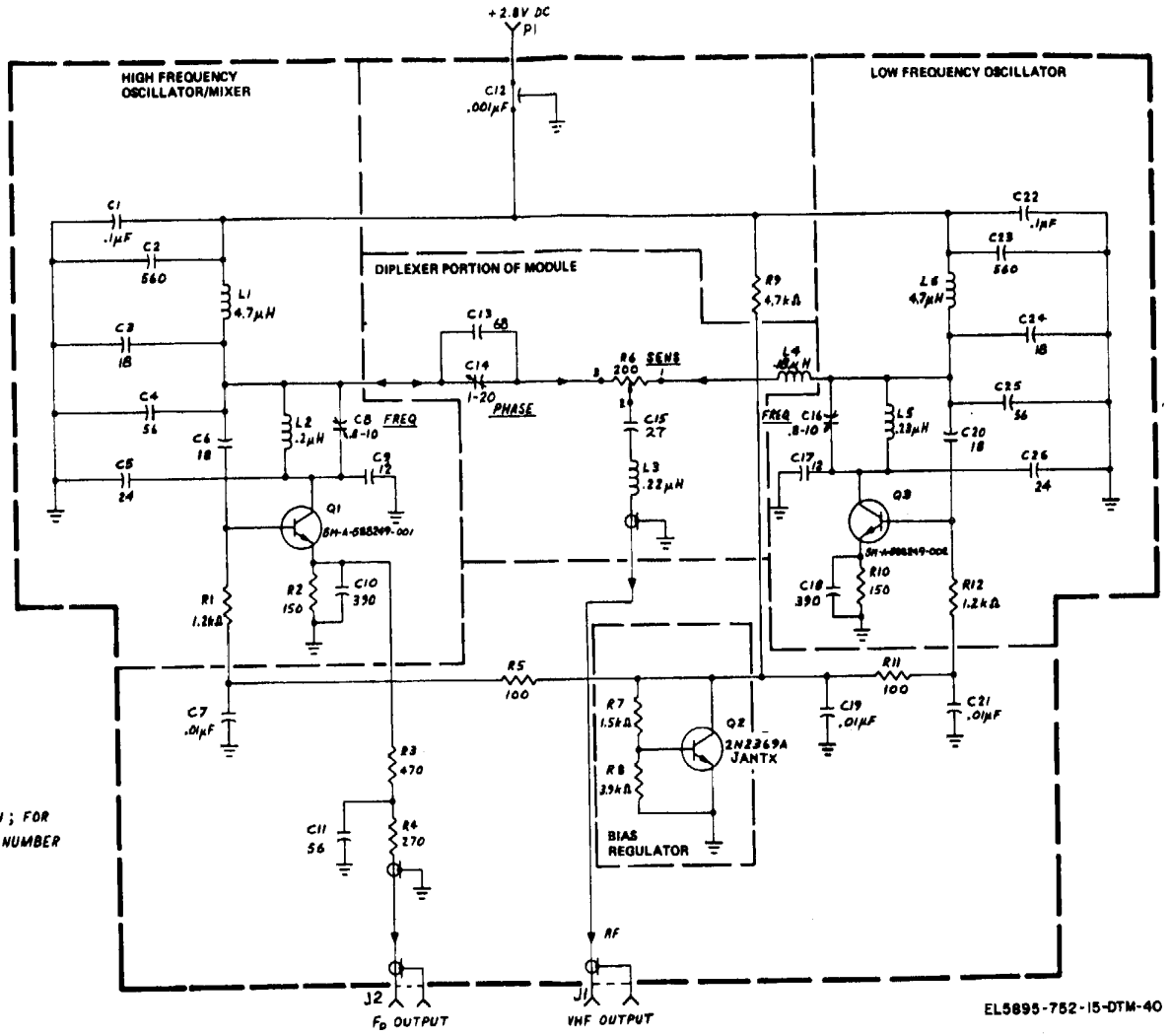
FO-1 MIL-STD color code markings



FO-2. Interconnection diagram for AN/GSQ-160.



FO-3. functional block diagram for AN.GSQ-160/

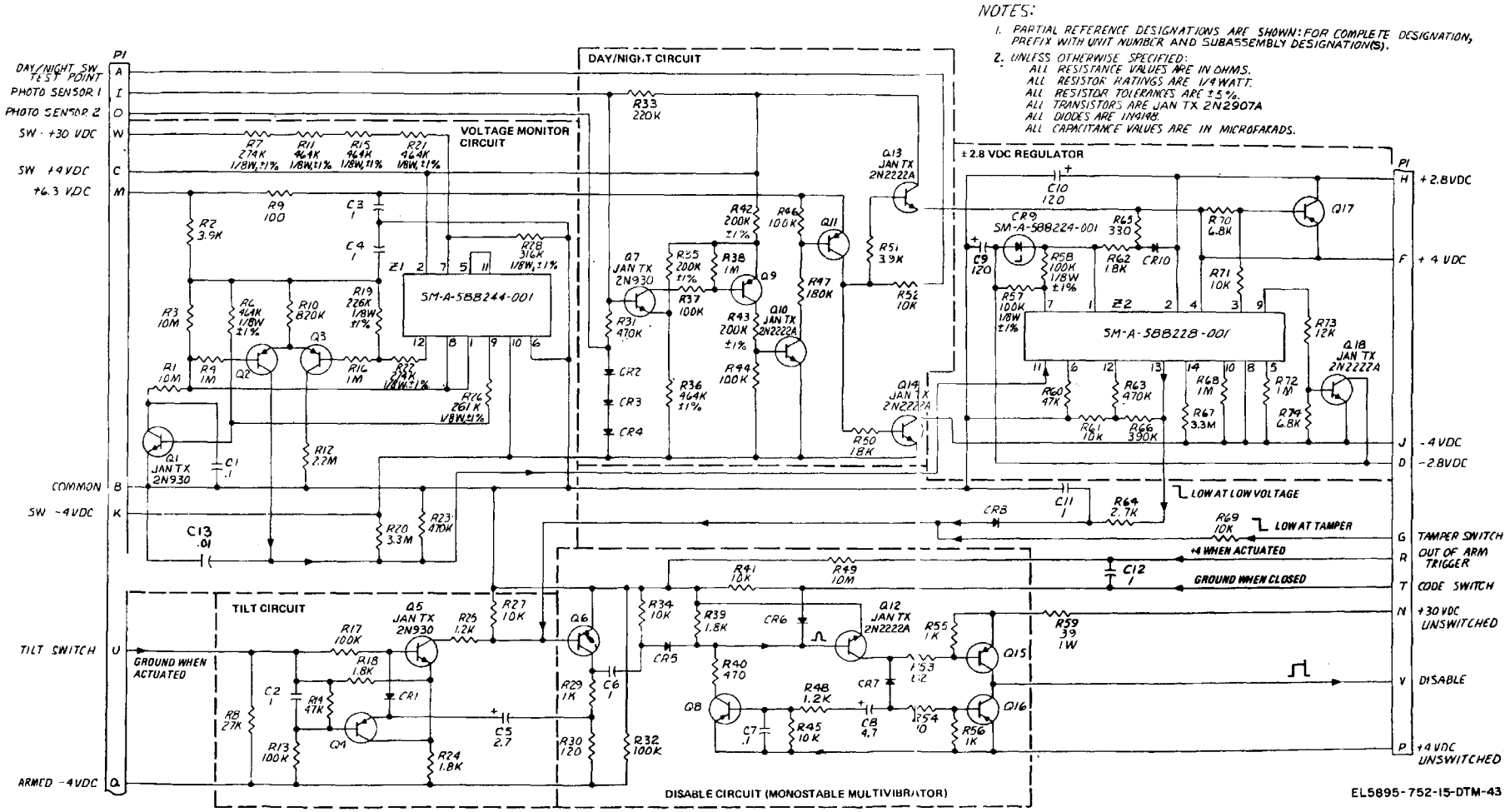


NOTES:

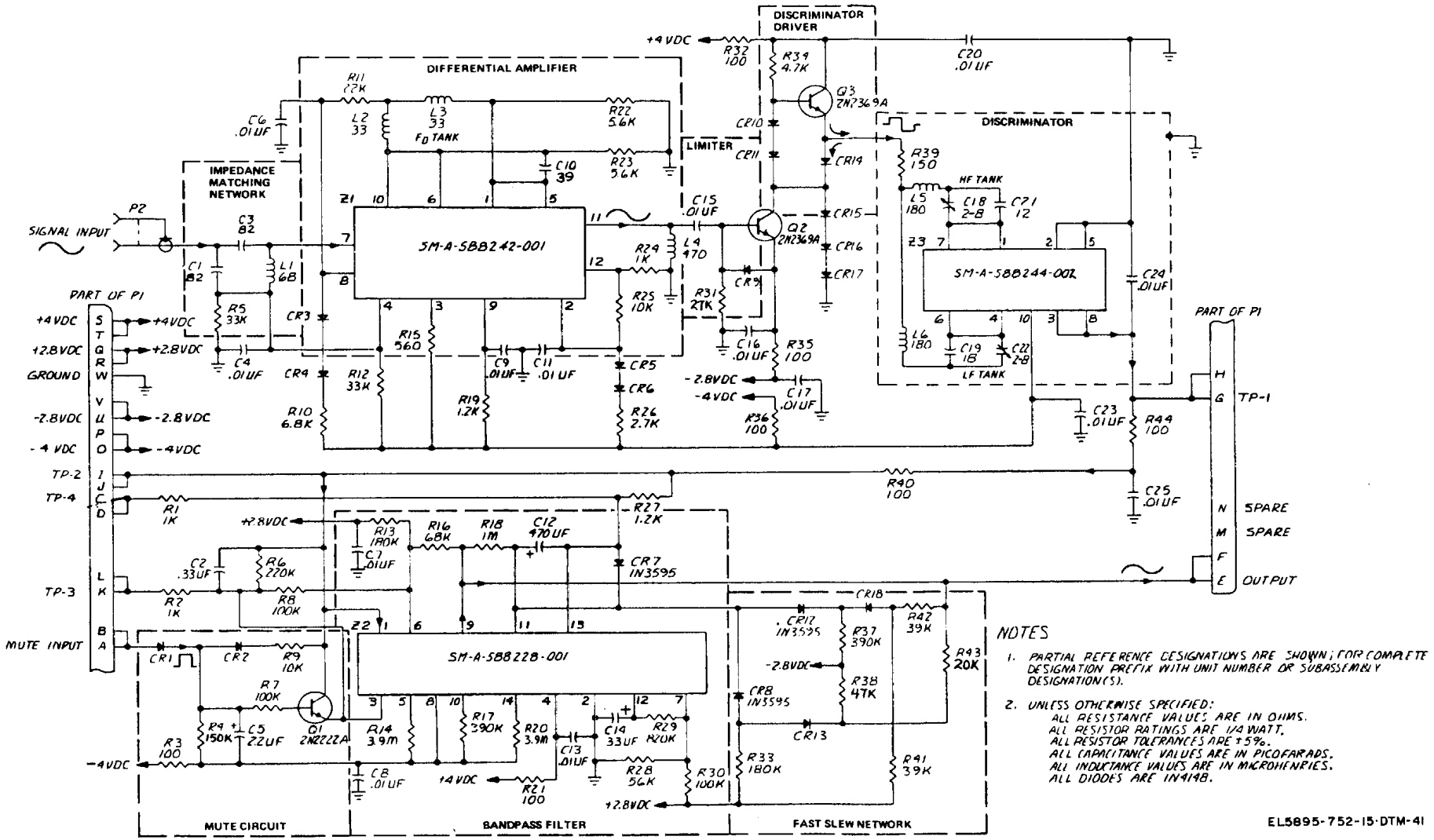
1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATIONS, PREFIX WITH UNIT NUMBER AND/OR SUBASSEMBLY DESIGNATION(S).

2. UNLESS OTHERWISE SPECIFIED:
   ALL CAPACITANCE VALUES ARE IN PICOFARADS.
   ALL RESISTANCE VALUES ARE IN OHMS.
   ALL RESISTOR RATINGS ARE ¼ W.
   ALL RESISTANCE TOLERANCE ARE ±5%.
   ALL TRANSISTORS ARE JANTX2N2369A.

FO-4. Sensor oscillator module A1, schematic diagram.



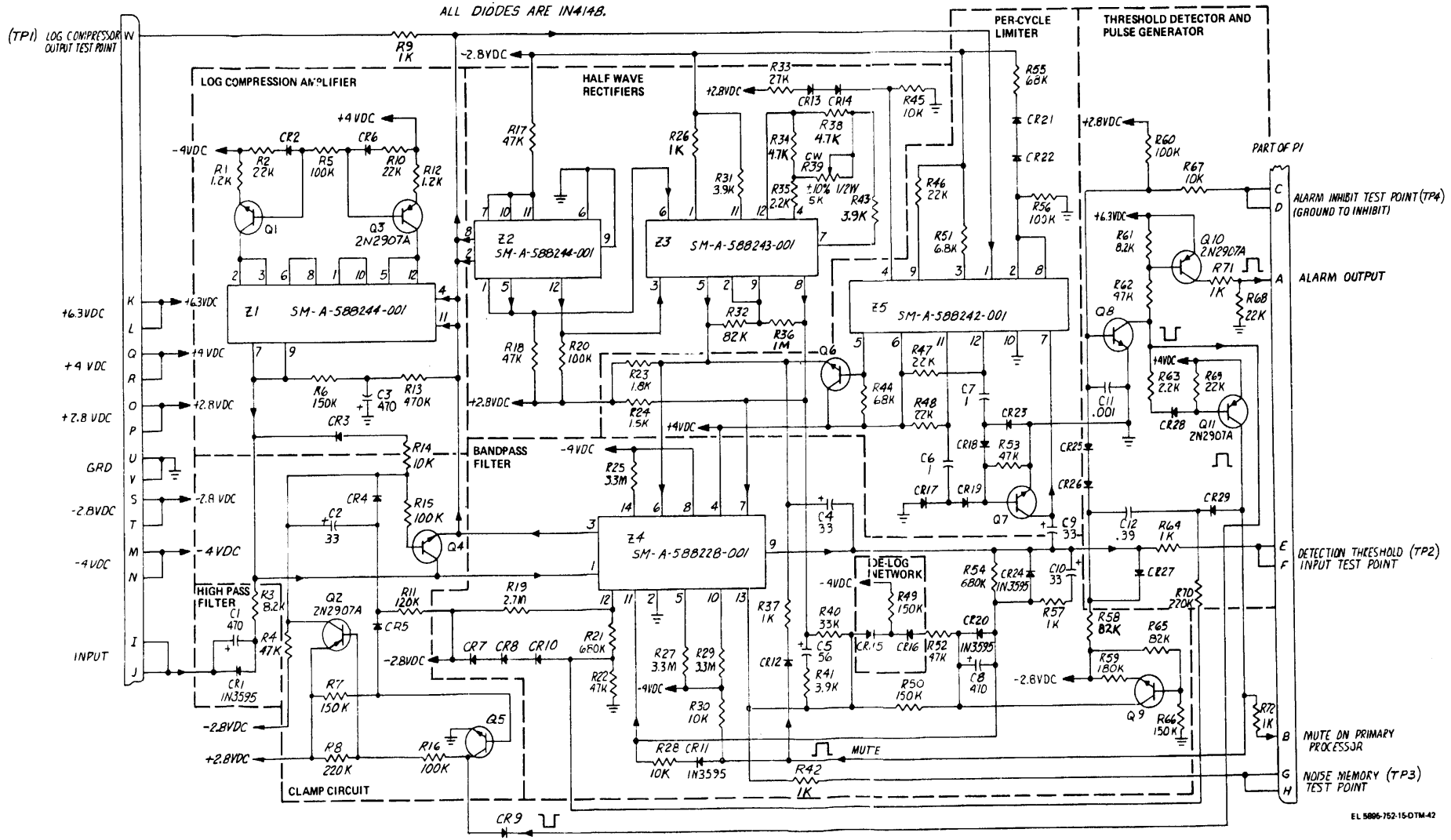
FO-5. Supplemental circuits module A2, schematic diagram.



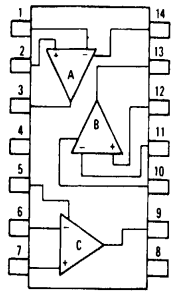
FO-6. Primary module A3, schematic diagram.

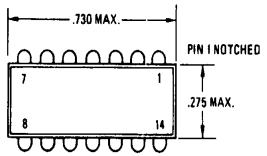
NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN: FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER OR SUBASSEMBLY DESIGNATION(S).
2. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTANCE VALUES ARE IN OHMS.
   ALL RESISTOR RATINGS ARE 1/4W, AND ALL RESISTOR TOLERANCES ARE ±5%.
   ALL TRANSISTORS ARE 2N2222A.
   ALL CAPACITANCE VALUES ARE IN MICROFARADS.
   ALL DIODES ARE IN4148.



FO-7. Secondary processor module A4, schematic diagram

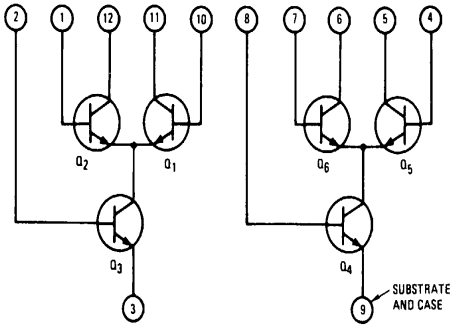


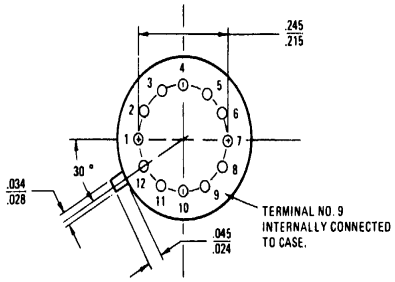


INTEGRATED CIRCUIT, TRIPLE OPERATIONAL AMPLIFIER
IDENTIFICATION NUMBER: SM-A-588228-001
GENERIC IDENTIFICATION NUMBER: SOLITRON UC4253 OR VARADYNE VH1590
APPLICATION: GENERAL PURPOSE AMPLIFICATION REQUIRING ONLY MICRO-WATTS OF STANDBY POWER

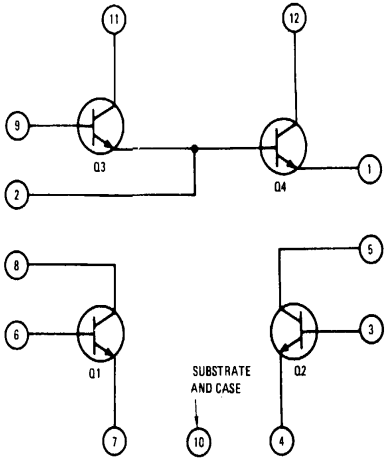
TABULATION BELOW INDICATES INTERNAL FUNCTION TO TERMINAL NUMBER.

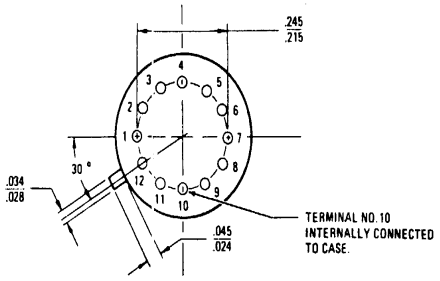
1	=	INV. (A)	8	=	V– (ALL)
2	=	N–I (A)	9	=	OUT (C)
3	=	OUT (A)	10	=	I_Q SET (B)
4	=	V+ (ALL)	11	=	INV. (B)
5	=	I_Q SET (C)	12	=	N–I (B)
6	=	INV. (C)	13	=	OUT (B)
7	=	N–I (C)	14	=	I_Q SET (A)



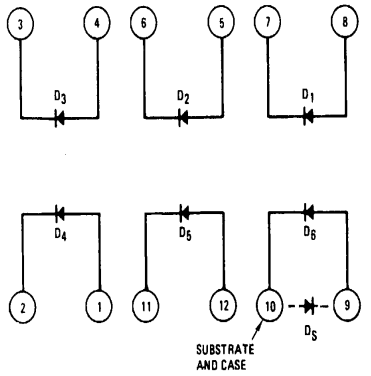


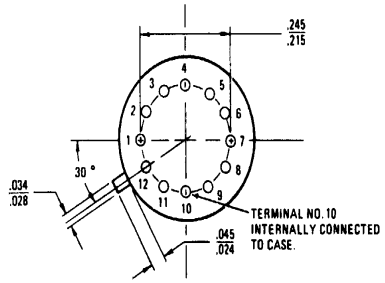
INTEGRATED CIRCUIT, DUAL DIFFERENTIAL AMPLIFIERS
IDENTIFICATION NUMBER: SM-A-588242-001
GENERIC IDENTIFICATION NUMBER: RCA OR VARADYNE CA3026
APPLICATION: LIMITING AND DIFFERENTIAL APPLICATIONS





INTEGRATED CIRCUIT, THAN SISTOR ARRAY
IDENTIFICATION NUMBER: SM-A-588243-001
GENERIC IDENTIFICATION NUMBER: RCA OR VARADYNE CA3018A
APPLICATION: DIFFERENTIAL AMPLIFIER IN FULL WAVE RECTIFICATION SYSTEM

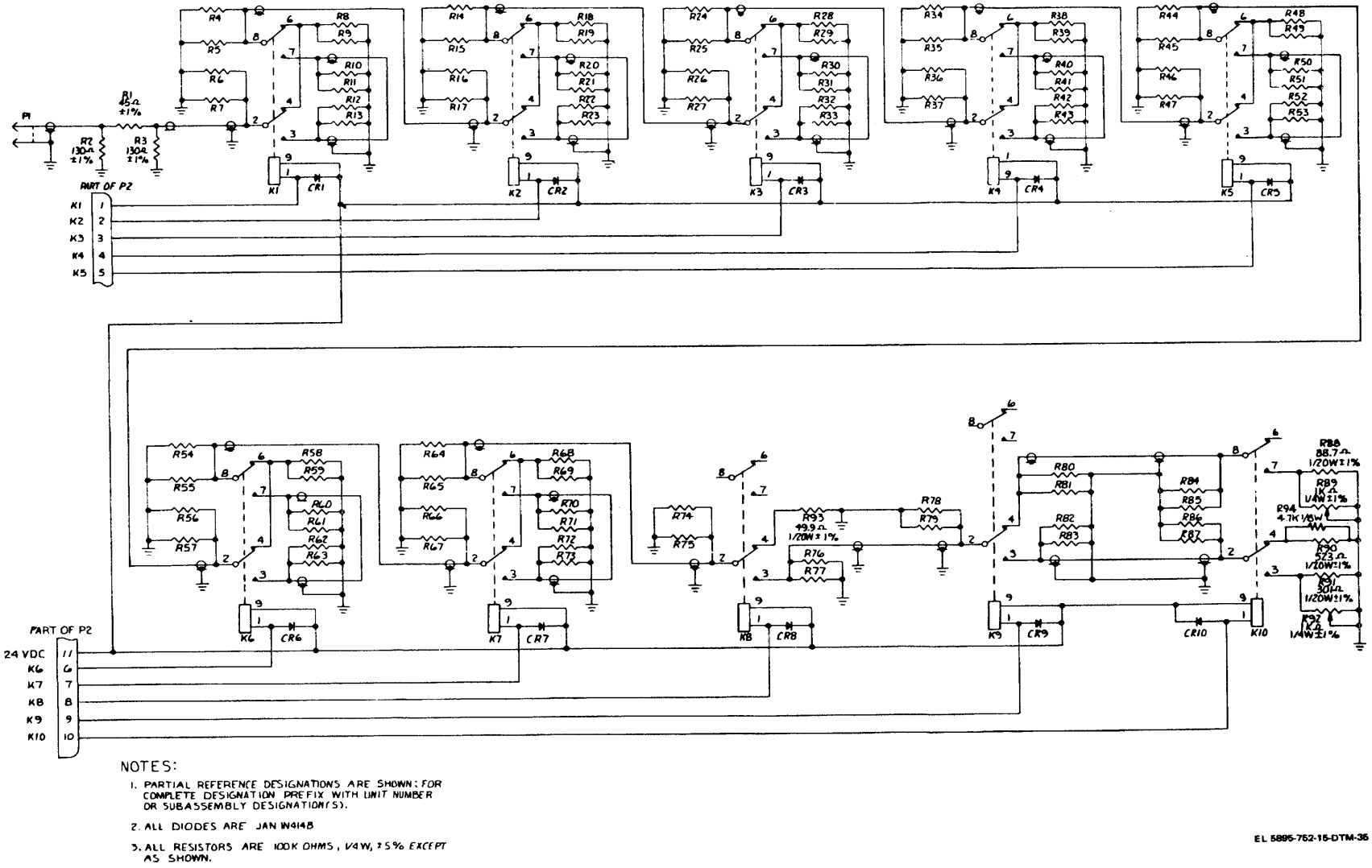




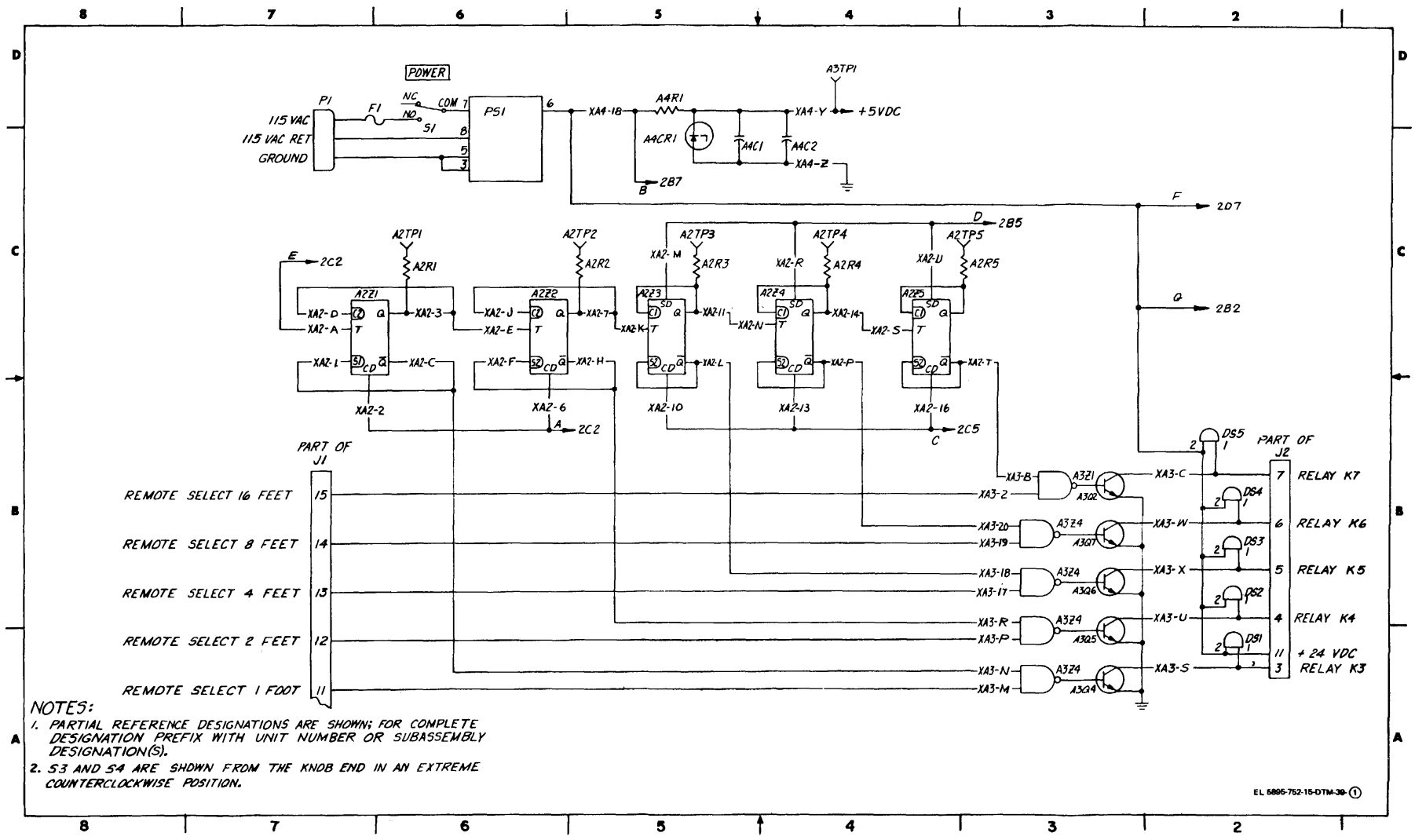
INTEGRATED CIRCUIT, DIODE ARRAY
IDENTIFICATION NUMBER: SM-A-588244-001
GENERIC IDENTIFICATION NUMBER: RCA OR VARADYNE CA3039
APPLICATION: LOGARITHMIC COMPRESSOR AND AN RF DETECTOR IN A DISCRIMINATOR

EL 5895-752-15 DTM-8

FO-8. Micromodules for AN/GSQ-160 circuits, schematic diagrams



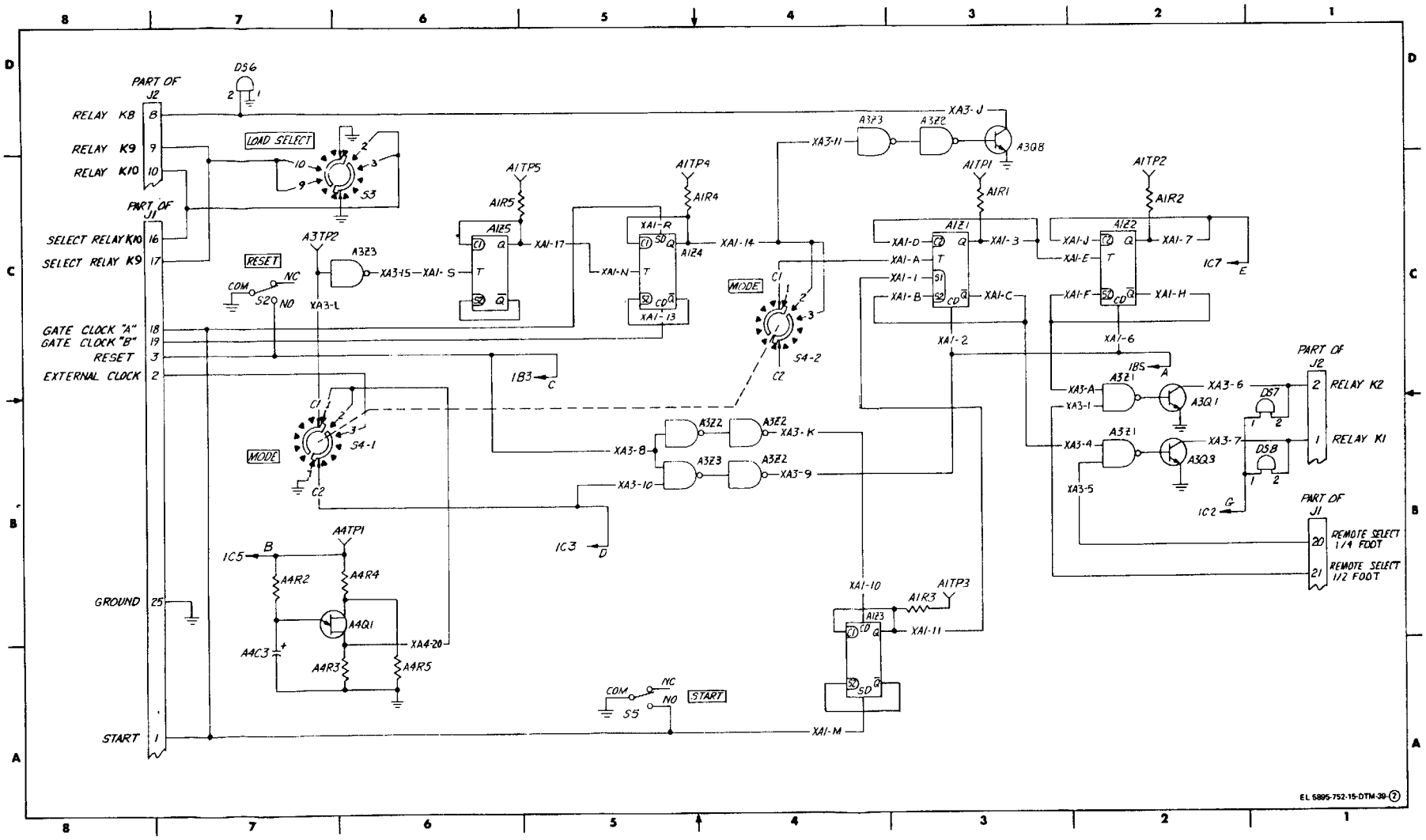
FO-9. Switching matrix of SM-618/GSQ-160, schematic diagram.



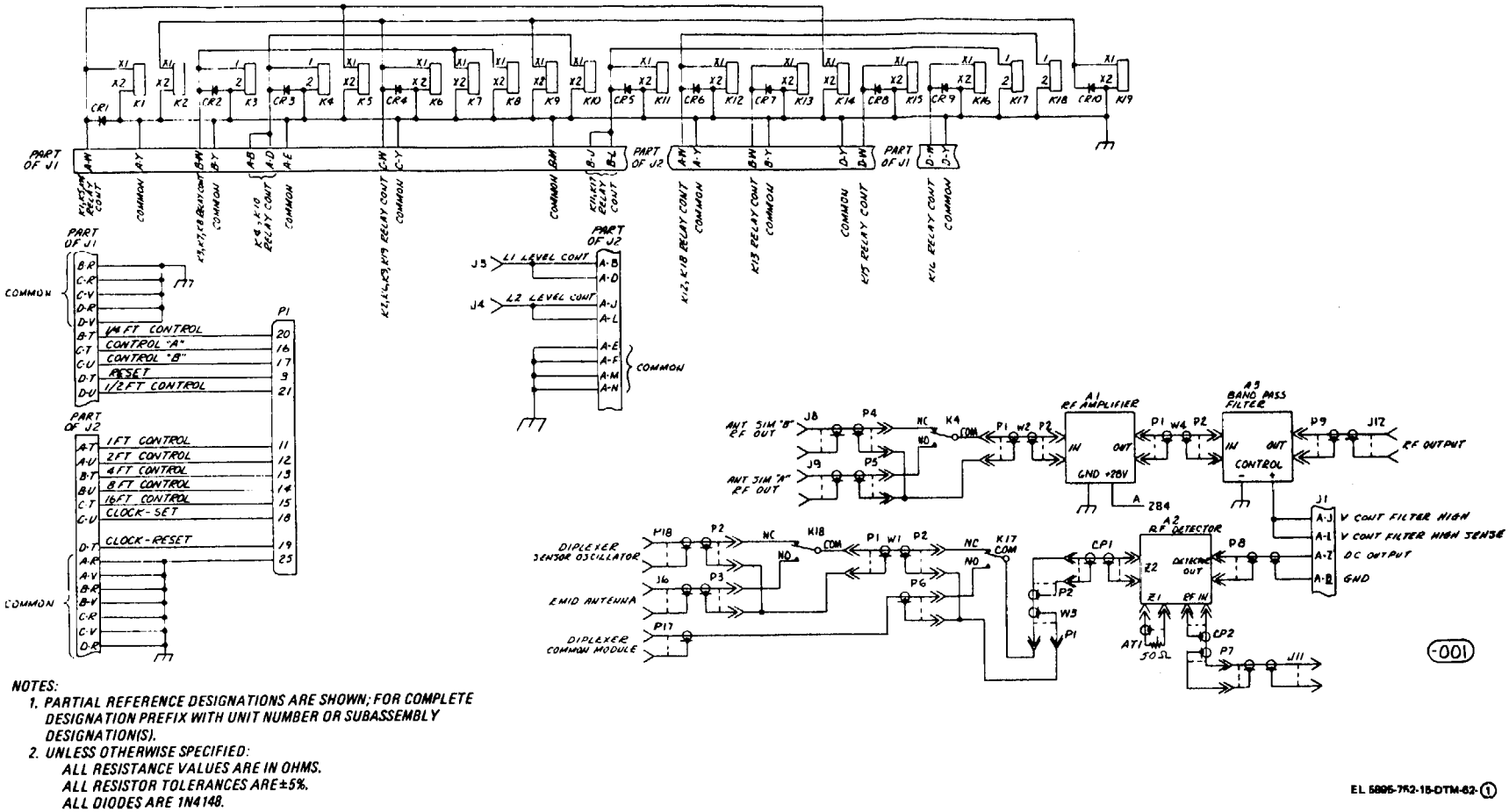
NOTES:
1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER OR SUBASSEMBLY DESIGNATION(S).
2. S3 AND S4 ARE SHOWN FROM THE KNOB END IN AN EXTREME COUNTERCLOCKWISE POSITION.

EL 5805-752-15-DTM-39-①

FO-10①. Control unit of SM-618/GSQ, schematic diagram (sheet 1 of 2).



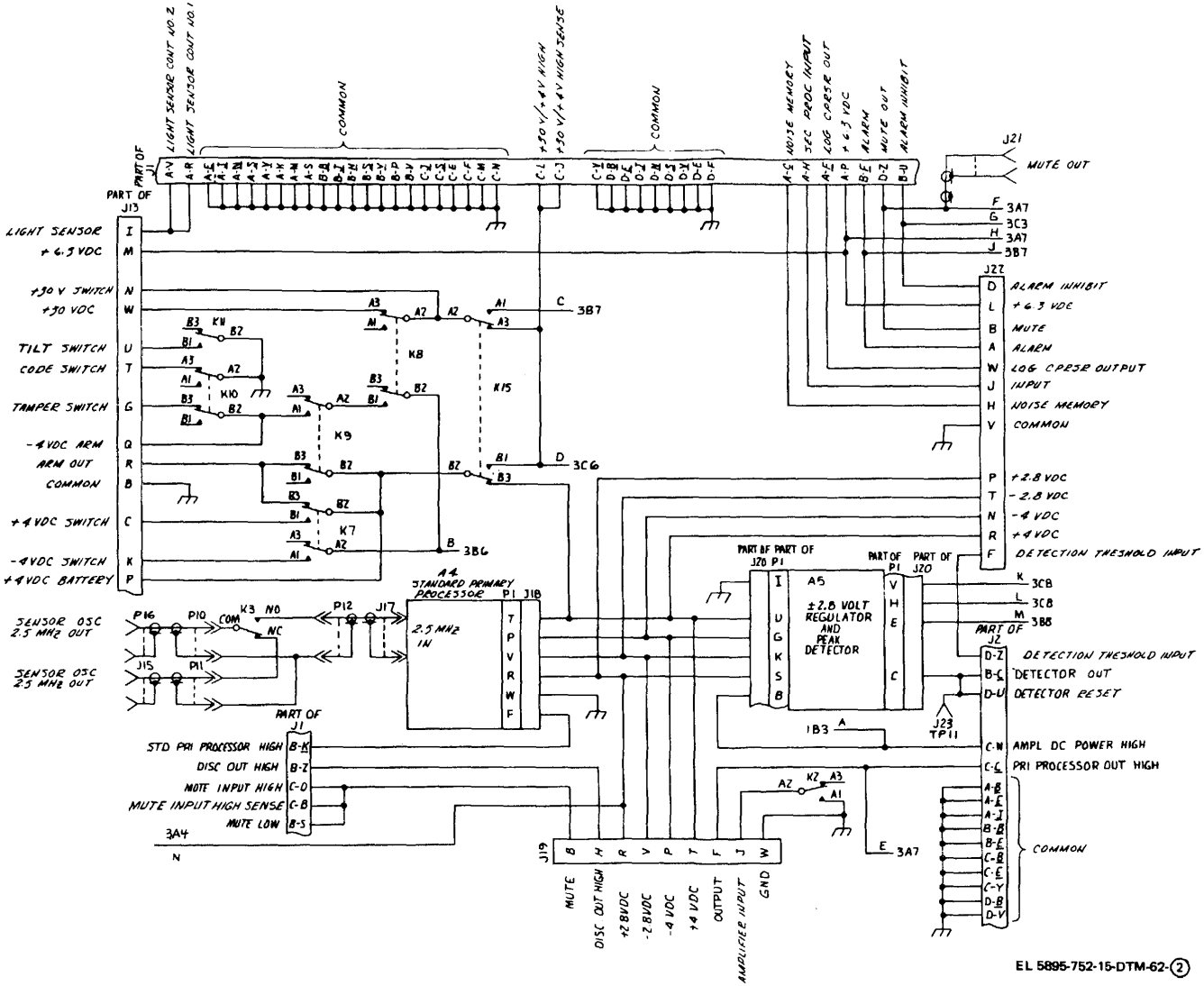
FO-10②. Control Unit of SM-618/GsQ-160, schematic diagram (sheet 2 of 2).



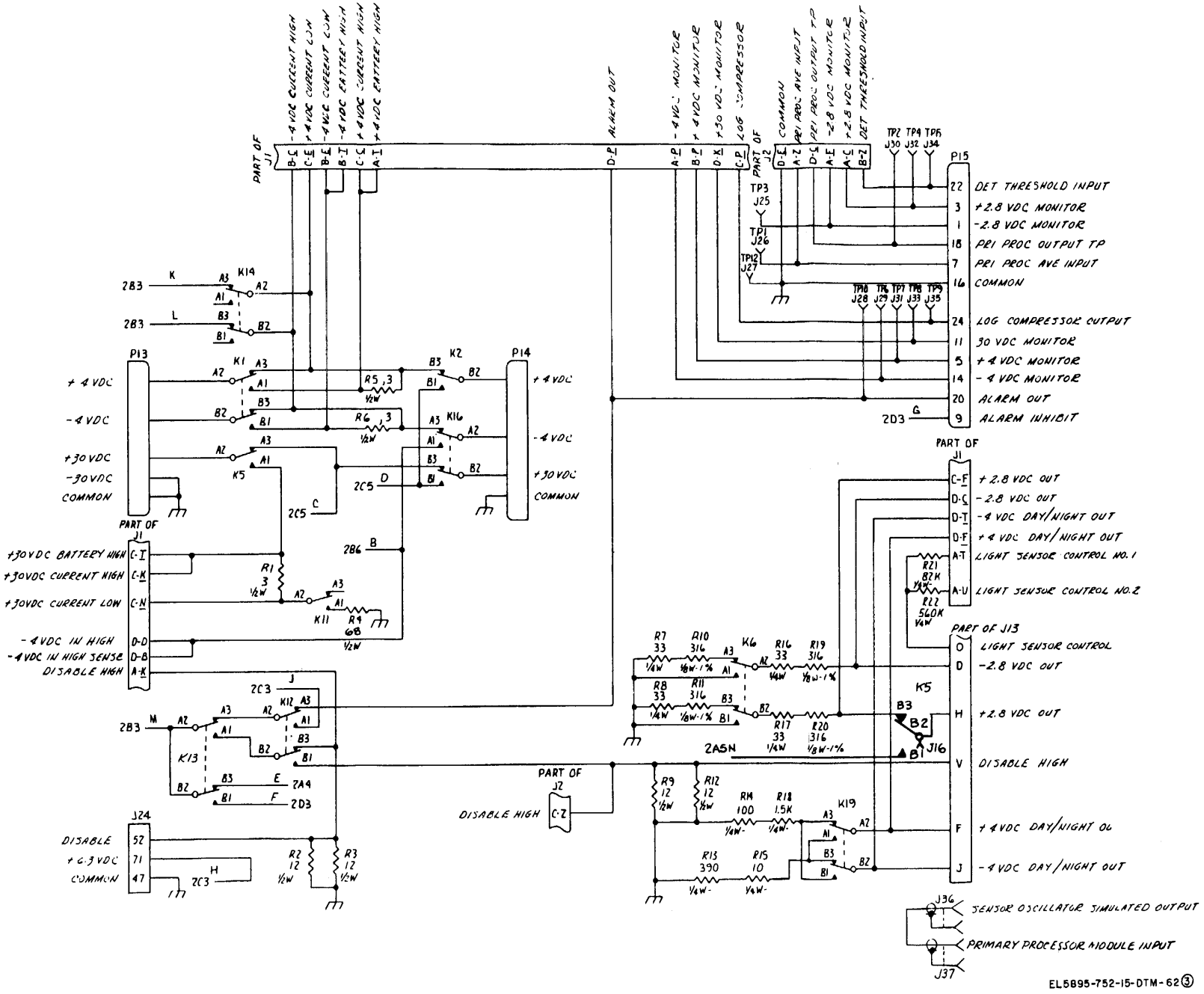
NOTES:
1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH UNIT NUMBER OR SUBASSEMBLY DESIGNATION(S).
2. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTANCE VALUES ARE IN OHMS.
   ALL RESISTOR TOLERANCES ARE ±5%.
   ALL DIODES ARE 1N4148.

EL 5895-7R2-15-DTM-62-①

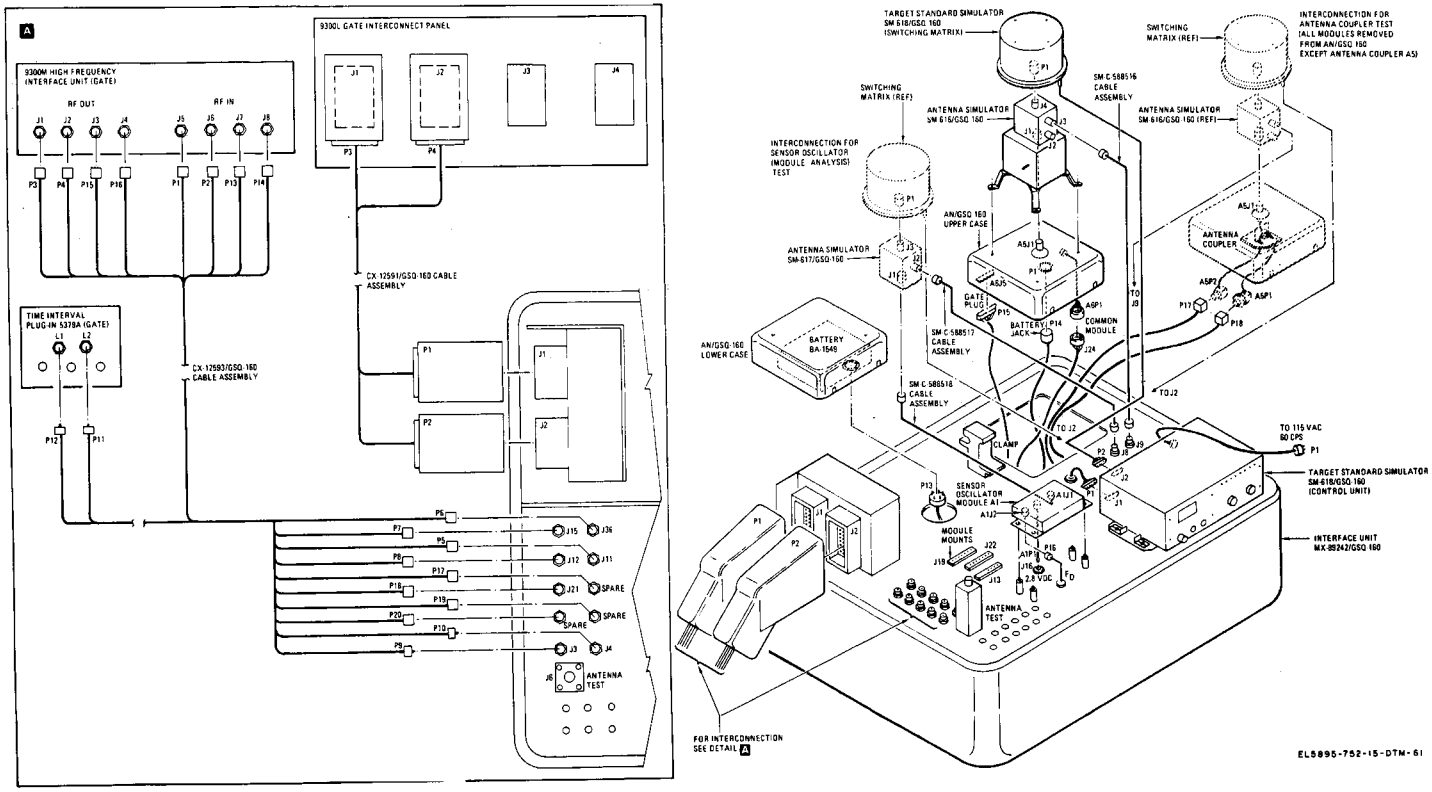
FO-11①. Interface unit MX-8924/GSQ-160, schematic diagram (Sheet 1 of 3).



FO-11②. Interface unit MX-8924/GSQ-160, schematic diagram (sheet 2 of 3).



FO-11③. Interface unit MX-8924/GSQ-160m schematic diagram (sheet 3 of 3).



FO-12. Test setup for GATE checkout of AN/GSQ-160.

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