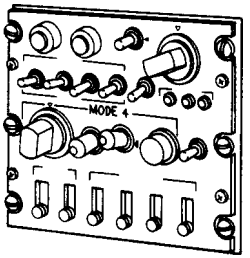
TM 11-5895-1199-12

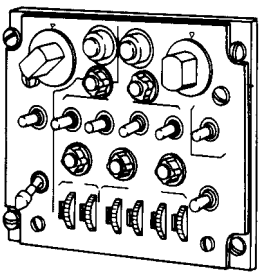
TECHNICAL MANUAL

Operator's and Organizational Maintenance

MARK XII IFF SYSTEM



AN/APX-100



AN/APX-72

Headquarters, Department of the Army

JULY 1984

Information contained in this manual will not be released to the general public.

TECHNICAL MANUAL
No. 11-5895-1199-12

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 01 July 1984

MARK XII IFF SYSTEM

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 or DA Form 2028 (Recommended Changes to Publications and Blank Forms) direct to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: DRSEL-ME-MP, Fort Monmouth, New Jersey 07703. A reply will be furnished to you.

Page

HOW TO USE THIS MANUAL

This manual is designed to help aircrew and flight line technicians perform their missions by providing easy access to concise information on the Mark XII IFF system. Topics covered will enable personnel to familiarize themselves with equipment configuration, controls, and theory of opera tion. In addition, the thumb-tabbed pages and detailed index make it easy to locate illustrated operating procedures. These procedures provide step-by-step instructions for presetting, testing, and operating the equip-ment in every mode. Special emphasis has been given to explaining the characteristics and requirements of cryptosecure Mode 4 operation. A list of references and equipment technical specifications complete the man-ual.

GENERAL INFORMATION

SCOPE

Type of manual: Operator's and Organizational maintenance manual.

Equipment and Model Numbers: Mark Xll lFF System.

Purpose of Equipment: Enables aircraft to identify itself to friendly forces automatically, utilizing cryptosecure radio transmissions.

INDEXES OF ARMY PUBLICATIONS

Refer to the latest issues of DA Pam 310-1 and (C) DA Pam 10-9(U) to determine whether there are new editions, changes, or additional publications concerning the equipment.

MAINTENANCE FORMS, RECORDS, AND REPORTS

Reports of Maintenance and Unsatisfactory Equipment

Department of the Army forms and procedures used for equipment Maintenance will be those prescribed by DA Pam 738-750 as contained in Maintenance Management Update.

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 4355.73A/AFR 400-54/ MCO 4430.3F.

MAINTENANCE FORMS, RECORDS, AND REPORTS-CONTINUED

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 4610-33C/AFR 75-18/MC P4610.19D/DLAR 4500.15.

DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE

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

REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR)

If your Mark XII IFF System needs improvement, let us know. Send us 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. Put it on an SF 368 (Quality Deficiency Report). Mail it to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: DRSEL-ME-MP, Fort Monmouth, New Jersey 07703. A reply will be sent to you.

NOMENCLATURE CROSS-REFERENCE LIST

This list contains some common names which will be used in place of official nomenclature in this manual.

NOMENCLATURE CROSS REFERENCE LIST- CONTINUED

COMMON NAME	OFFICIAL NOMENCLATURE
IFF	Mark XII IFF system
transponder	Receiver-Transmitter, Radio RT-859/APX-72 and/or Receiver-Transmitter, RT-1296, RT-1264, RT-1285, RT-1286, and RT-1157/APX-100(V).
test set	Transponder Test Set AN/APM-123(V) 1 and/or AN/APM-378.
control set	Control, Transponder Set C-6280(P)/APX and/or Control, Transponder Set C-10009, C-10532. C-10533 and C-10534/APX-100(V).
computer	KIT-1A/TSEC Reply Computer and/or KIR-1A/TSEC Interrogator Computer.
key gun	KIK-18/TSEC Key Gun
transponder tester	TS-1843( )/APX Transponder Tester

LIST OF ABBREVIATIONS

AIMS	Air Traffic Control Radar Beacon System Identification Friend or Foe/Mark XII System
SLS	Side Lobe Suppression
I/P	Identification of Position
BIT	Built-In Test equipment
VSWR	Voltage Standing Wave Ratio
SSR	Secondary Surveillance Radar

EQUIPMENT DESCRIPTION

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

AIMS was conceived to enable friendly aircraft to be identified by surface and air forces. In addition, aircrew-selectable IFF features permit special signals to be transmitted that serve to pinpoint the aircraft on a radar display, or relay emergency information.

The IFF system functions in four basic modes; Mode 1, Mode 2, Mode A, and secure Mode 4. When operating in Modes 1 or 2, IFF responds to interrogation and reply codes established by Department of Defense AIMS.

The civilian equivalent of IFF is called SSR. SSR also functions in four modes; A, B, C, and D. SSR Mode A is virtually identical to IFF Mode 3. As a result, when functioning in Mode 3/A, IFF responds to interrogation from both civilian and military facilities.

With the addition of an optional pressure altitude digitizer, IFF will transmit coded altitude data when interrogated in Mode C.

IFF utilizes an on-board cryptographic computer when operating in secure Mode 4. In this mode, IFF will transmit an encrypted reply. This reply will only be transmitted in response to a properly encrypted interrogation from a facility equipped with a similar cryptographic computer. By changing the preset computer codes daily, an enemy is prevented from simulating reply codes to deceive a ground facility.

IFF operational range is limited to line of sight and varies depending upon aircraft altitude.

A list of IFF equipment technical specifications can be found in appendix B in the back of this manual

DESCRIPTION OF MAJOR COMPONENTS

Transponder

The heart of any IFF system is the radio receiver/transmitter or transponder The transponder receives, decodes, encodes, and transmits the pulsed radio signals that carry the IFF information to and from the aircraft. All other IFF components are interconnected through the transponder, The two transponders addressed in this manual are the AN/APX-72 and the AN/APX-100.

Transponder Control Set

IFF transponders are configured in two different ways. In the first type, the transponder is designed as a single unit with all controls and indicators integrally mounted. The second type is designed for remote mounting in the aircraft avionics bay with the controls and indicators housed in a separate control set. This control set is then installed in the aircraft in an area accessible to the operator.

The AN/APX-72 is an example of the remote type of transponder as is one model of the AN/APX-100. Every AN/APX-72 installation utilizes an RT-859 transponder and a C-6280(P)/APX Transponder Control Set. The RT-1157/APX-100(V) remote transponder must be interconnected with a C-10009, C-10532, C-10533, or C-10534/APX-100(V) Transponder Control Set.

The control sets are panel-mounted and interconnected by cable with the transponders. These sets provide the operator with all controls necessary to access and enable the IFF system features. Control capabilities exist for setting codes, selecting modes and performing system self-tests. Control set indicators permit the operator to monitor system functions.

KIT-1A/TSEC Reply Computer

The onboard cryptographic equipment, utilized in the IFF systems addressed in this manual, is the KIT-1A/TSEC computer. This computer insures secure IFF operation by decrypting and authenticating encrypted interrogations and generating appropriate encrypted replies when the interrogations are judged valid.

KIT-1A/TSEC Transponder Computer - Continued

The KIT-1A/TSEC is part of the overall IFF cryptographic system designated KI-1A/TSEC. This system includes the KIR-1A/TSEC computer which is installed in interrogating facilities and the KIK-18/TSEC key gun used to load the codes in both computers.

The KIT-1A/TSEC can be installed in either the cockpit or aircraft avionics bay, depending upon space availability, and is interconnected by cable with the transponder. Prior to flight, ground personnel key the computer to load the codes which will be in effect during the anticipated flight time of the mission.

KIK-18/TSEC Key Gun

The KIK-18/TSEC Key Gun is a hand-held, manually-operated, mechanical device used to set the daily codes in KIT- and KIR-1A/TSEC computers. Although necessary for secure operation, the key gun itself is not an integral part of the IFF installation. Once the code has been set in the key, the key may be used to set any number of computers.

IFF Caution Lamp

The IFF CAUTION lamp is panel-mounted in different locations in different aircraft. The IFF CAUTION lamp will not be found on the transponder or the control set. If the IFF is configured for Mode 4 operation, the IFF CAUTION lamp will light to indicate Mode 4 operation malfunctions. These malfunctions are; computer codes zeroized, a transponder failure to reply to a valid Mode 4 interrogation, or a defective computer. The IFF CAUTION indicator will also light if the computer has not been installed.

TRANSPORTATION TESTER TS-1843/APX

The TS-1843/APX Transponder Tester is an on-board test set designed to verify the operation of the AN/APX-72 transponder before and during flight. This set is an optional piece of equipment and is not used in every AN/APX-72 installation. When installed, the transponder tester will indicate either satisfactory or unsatisfactory performance of the overall transponder system with a GO or NO-GO indication. The transponder functions tested include the receiver frequency, sensitivity, and decoding and the transmitier frequency, power, and bracket pulse coding. In addition, the test set checks the VSWR of the antenna system and monitors transponder responses to operational interrogations. The TS-1843/APX transponder tester has no Mode 4 testing capability.

Pressure Altitude Digitizer

When installed, Pressure Altitude Digitizer CPU-66/A, or equivalent, is used in Mode C operation to generate coded signals indicating aircraft altitude in hundreds of feet. These signals are transmitted when the IFF system is interrogated in Mode C. When received by a suitably equipped ground facility, these signals result in a digital readout of the aircraft altitude being displayed next to the corresponding blip on the radar screen.

Aircraft IFF Antenna

The IFF system receives interrogations and radiates replies through the same antenna(s). Antennas may be diplexed and shared with other uhf components installed in the aircraft.

DIFFERENCES BETWEEN MODELS

FEATURES	AN/APX-72	AN/APX-100
Transponder Models	RT-859-designed for remote mounting.	RT-1157-designed for remote mounting. RT-1284, RT-1285, RT-1286, and RT-1296 - designed for panel mounting.
Control Sets	C-6280(P)/APX	C-10009, C-10532, C-10533, Or C-10534 required for use with a remote RT-1157.
Antenna Configuration	One omnidirectional antenna (AT-884A/APX or equivalent).	Two omnidirectional antennas used separately or in tandem for "space diversity" operation. Transponders transmit reply through antenna receiving strongest interrogation signal.
Self-Test Capability	Optional. Requires TS-1843A/APX Transponder Tester installation. No in-flight Mode 4 test capability exists.	All models have BIT circuitry that tests IFF operation in Modes 1,2, and 3/A as well as the unencrypted portion of Mode 4 replies.

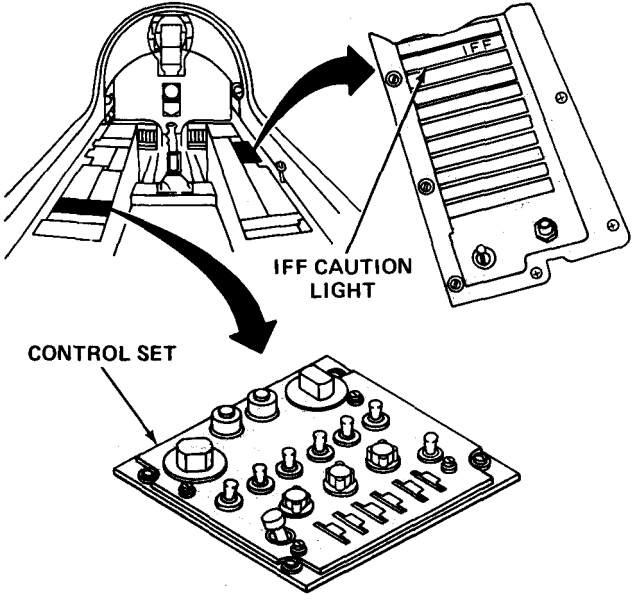
DIFFERENCES BETWEEN MODELS - CONTINUED

FEATURE	AN/APX-72	AN/APX-100
Mode 4 Monitoring Capability	Audible and/or visual indicators, that are selectable by operator, signal Mode 4 interrogations and/or replies. When both indicators are enabled, an audible indicator in operator's headset will signal each Mode 4 interrogation received. The audible indicator is a 300 to 400 Hz buzz. The REPLY light on the transponder control panel will flash to provide visual indication that a valid Mode 4 reply has been generated and transmitted.	Audible and/or visual indicators, that are selectable by operator, signal to confirm or deny the validity of each Mode 4 reply. When both indicators are enabled, the REPLY light on the Transponder control panel will flash to indicate that a valid Mode 4 reply has been generated and transmitted in response to an interrogation. Audible signal in operator's headset will indicate that IFF has received an interrogation encrypted in the code opposite to the one selected on transponder control panel. For example, IFF is set to A and interrogation is encrypted in code B.

TYPICAL AIRCRAFT INSTALLATIONS

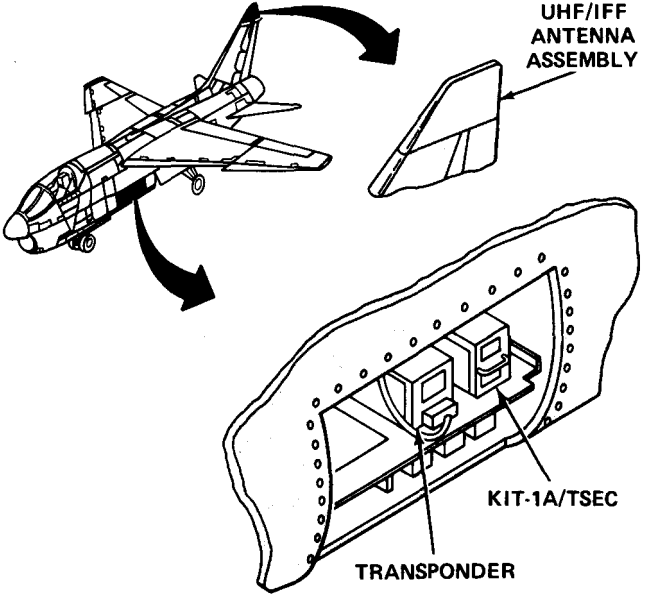
Aircraft with Compressible/Retractable Landing Gear

The accompanying illustration shows the location of the IFF controls and indicators in a typical installation in a general type of aircraft. The aircraft shown is fixed-wing and has retractable landing gear. Note that the IFF CAUTION LIGHT need not be located near the IFF control panel. In this example, it appears on the pilot's advisory panel in the right-hand console. A CODE HOLD switch is not present because that function is performed by an interlock switch built into the landing gear mechanism.



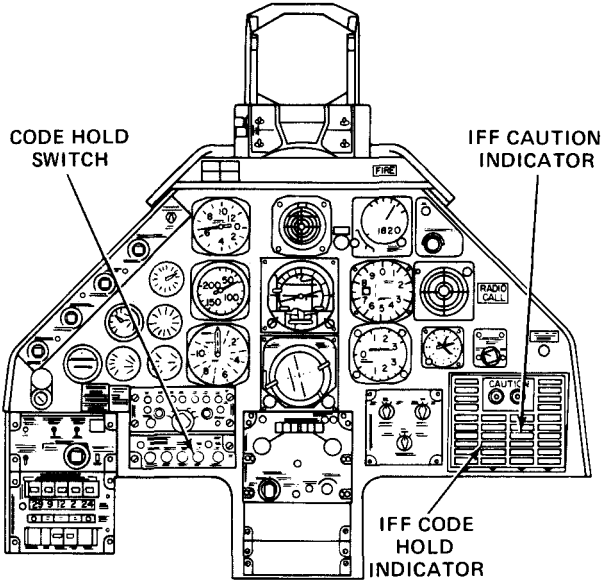
Aircraft with Compressible/Retractable Landing Gear - Continued

The IFF transponder and computer are secured in their respective mounts within the aircraft avionics bay and are remotely controlled. The optional transponder tester, if installed, would be situated in the same area and interconnected between the transponder and antenna. The per titular type of vertical stabilizer, fin-cap antenna depicted in this illustration enables reception and transmission of UHF signals from sources other than the IFF. This configuration utilizes a UHF/IFF diplexer to split signals from different sources going to and coming from the antenna.



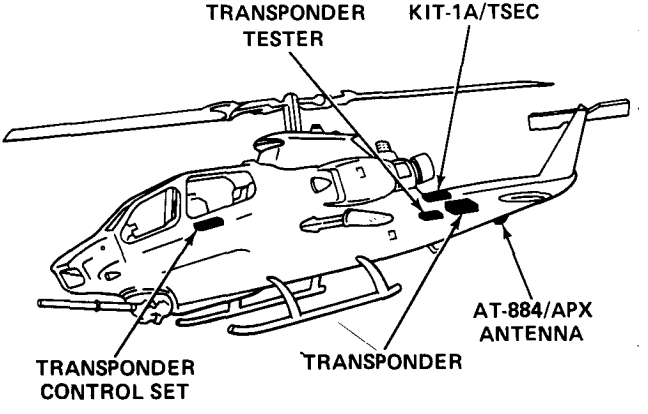
Aircraft with Fixed/Rigid landing gear

Note the location of the CODE HOLD switch and CODE HOLD indicator in the accompanying illustration. These controls are required in every IFF system installed in an aircraft with fixed/rigid landing gear. Although the function of these controls is always the same, the placarding on the switch and indicator will differ in different aircraft. The IFF CODE HOLD indicator must not be confused with the IFF CAUTION indicator, which appears in every IFF installation regardless of aircraft type. See Operating Procedures – Mode 4, page 45, for an explanation of the function of both of these indicators and the CODE HOLD switch.



Aircraft with Fixed/Rigid Landing Gear-Continued

The accompanying illustration shows an overall view of an IFF installation in a rotary-wing aircraft. The transponder control set is mounted in the pilot's right-hand console. The AT-884/APX antenna shown in use with this configuration is located on the underside of the aircraft and is interconnected with the transponder through the optional transponder tester.



TRANSPONDER:

Range	Line of Sight
Power requirements	28 vdc, 70 watts (maximum) or 28 vdc, 8.4 watts and 115 vac, 95 VA (maximum), 360-440 Hz
Operating temperature	-65 to 230°F (-54 to + 95°C)
Warmup time	1 minute maximum (normal conditions), 2 minute maximum (extreme service conditions)
Type of signal received and transmitted	Pulsed radio frequency
Frequency:	
Receiver	1030 MHz ± 0.5 MHz
Transmitter	1090 MHz± 0.5 MHz
Peak power output	500 W± 3db

Detailed equipment specifications can be found in appendix B in the back of this manual.

SECURITY REQUIREMENTS

Unkeyed KI-1A equipment must be provided with the same protection as that given to the aircraft or vehicle in which the equipment is installed to prevent damage, sabotage, or tampering. The security precautions surrounding the type of ground facilities and aircraft in which this equipment is installed will normally be sufficient to safeguard the computers as well. The KIT-1A/TSEC should not be removed from aircraft as a routine security measure. Aside from causing loss of operational readiness, excessive removal and reinstallation will cause the equipment to require increased maintenance.

Keyed computers must be kept under the continuous control of US personnel or personnel of an allied country to which the KI-1A has been officially released. When keyed computers are deployed on standby status, as with aircraft on alert, guards must be posted. Personnel assigned to guard keyed computers do not need a security clearance.

During limited maintenance or temporary storage, measures must be taken to limit KI-1A equipment and documentation access to authorized personnel only. All classified keying material, COMSEC documents, and keyed code keys must be stored in a safe-type container when not in use. This container must be equipped with a three-position, dial-type, changeable combination lock.

In an emergency situation, when capture or loss appears imminent, all formal authorization access requirements will be waived. The primary concern of personnel having custody of, or responsibility for, KI-1A material, must be the destruction of the current and future key settings. Obviously, the highest priority in this regard would be the destruction of the key setting tables or extracts that contain future codes. The destruction of current and future key settings would also include the zeroizing of all key guns. See Zeroizing the KIK-18 Key Gun, page 70. The next priority would be the zeroizing of all computers. See Mode 4 Code Zeroizing, page 48. Circumstances permitting, all other KI-1A-related material and equipment including maintenance documents and spare parts must be destroyed or rendered unusable.

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

PRINCIPLES OF OPERATION

SYSTEM PRINCIPLES

The Mark XII IFF system provides US forces with the capability to transmit interrogations and replies in a cryptosecure mode. These transmissions take the form of high-speed, pulsed, rf signals which are exchanged with the purpose of identifying and locating friendly forces. To accomplish this mission, IFF utilizes transponders, interrogators, altitude computers, servoaltimeters, controls, and other associated equipment. When operating in the secure mode, Mode 4, these components are augmented by KI-1A/TSEC cryptographic equipment.

Operation of this system in the field involves the transmission of interrogation signals from ground facilities, weapons platforms, or aircraft. These signals, when received by IFF-equipped aircraft, trigger an automatic reply transmission, These transmissions are sent and received in four different modes; Mode 1, Mode 2, Mode 3/A, and Mode 4.

Mode 1 is known as the General Identification Signal. Switch settings permit the selection of any one of 32 reply codes.

Mode 2 is an individual identification mode. The Mode 2 code is preset before flight and is usually not aircrew-selectable. There are 4,096 codes available for use as Mode 2 identification numbers.

Mode 3/A combines military IFF Mode 3 with civilian SSR Mode A. There are 4,096 aircrew-selectable reply codes.

Mode 4 is the secure mode. Operation in Mode 4 requires the installation of KI-1A/TSEC equipment. The cryptographic codes in effect for the anticipated flight time must be preset in the computer by the ground crew. Mode 4 may be enabled or switched off by the aircrew in accordance with operational requirements.

Mode C becomes functional with the installation of the associated altimetry components. When interrogated, the IFF codes will convey the aircraft's altitude as well as its identification code.

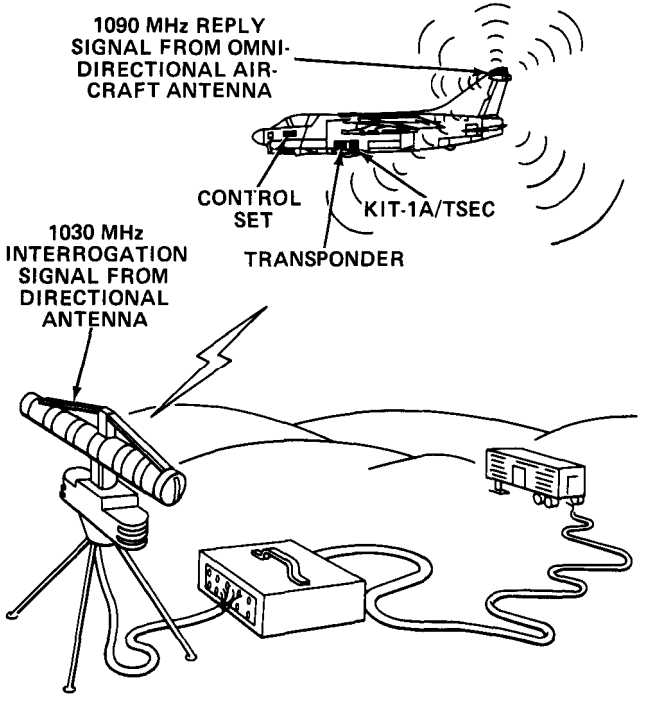
In addition to these five basic modes of operation, the IFF can transmit a simultaneous Identification of Position signal and/or Emergency signal. These signals are selected individually and are enabled by the operator.

A typical interrogator subsystem installed at a ground facility would be made up of a receiver-transmitter, synchronizer, data processor, displays, controls, antennas, and a KIR-1A/TSEC interrogation computer.

A typical transponder subsystem in an IFF-equipped aircraft would be made up of a transponder, controls, associated mounts, an antenna system, and a KIT-1A/TSEC computer. Optionally, the system could also include a transponder tester and altimetry subsystem.

Interrogations are encoded by the ground facility IFF and transmitted on 1030 MHz. The transmitted pulse code format will vary depending upon the selected Interrogation mode. The aircraft must respond in the same

mode in which it is interrogated. Interrogation signals received in Modes 1, 2, 3/A, and C are decoded by the aircraft transponder. The appropriate replies are then generated within the transponder and transmitted. Mode 4 interrogations and replies are decrypted and encrypted by the KIT-1A/TSEC and forwarded to the aircraft transponder for transmission.



All IFF reply codes in every mode are transmitted on 1090 MHz. Aircraft equipped with space diversity transponders will transmit the reply from the antenna which received the strongest interrogation signal.

Direction finding capabilities existing at some ground facilities enable the operator to approximate the azimuth to the aircraft.

COMPONENT PRINCIPLES

Transponder

As described in the paragraph on System Principles, IFF system operation is dependent upon the transmission and reception of pulsed rf signals. The transponder is the component responsible for both receiving and decoding interrogations and encoding and transmitting replies. Although Mode 4 signals must be decrypted and encrypted by the cryptographic equipment, they are routed through the transponder.

With the AN/APX-72 transponder, an interrogation signal is received by the antenna and transponder receiver section and is forwarded to the decoder circuit for processing. The AN/APX-100 transponder utilizes two antennas and a diversity processor circuit. This configuration enables the AN/APX-100 to compare the strength of the incoming signals to determine which of the two antennas is oriented most favorably in relation to the interrogating station. When this is determined, the diversity processor forwards a command to the rf distribution subassembly. After the reply is prepared, the rf distribution subassembly will direct the transmission to

Transponder-Continued

the antenna selected beforehand by the diversity processor. This selection is accomplished at the same time the interrogation signal is being sent to the decoder.

In the decoder section, the signal is checked to determine its mode and to verify that the code is valid. The recognition of the interrogation mode is provided for by the different lengths of the associated pulse trains and the spacing of the individual pulses. Interrogation signals for Modes,1,2, 3/A, C, and Test vary in duration from 4 µs to 22 µs. Each mode has a specific, assigned signal length. Mode 4 interrogations are not of uniform length because of cryptographic requirements. All interrogation pulse trains may contain a side-lobe suppression pulse. When used, this SLS pulse will always appear in the same position in the pulse train. The SLS pulse is transmitted from an omnidirectional antenna at the interrogating station at a lower amplitude than the remainder of the pulse train. When received, the transponder compares the amplitude of this pulse to the rest of the signal. If the amplitude is approximately equal, the transponder recognizes that the signal being received is a side-lobe transmission from the main antenna. The transponder will not reply to detected side-lobe transmissions when SLS is operative. Once the decoder circuit has determined that a valid interrogation has been received, and that the aircraft is within the main-lobe transmission from the surface facility, the transponder is prepared to generate and transmit the appropriate reply.

Transponder-Continued

Mode 1, 2, and 3/A reply signals are generated by the encoder circuit of the transponder. If the IFF has a pressure altitude digitizer, the digitizer will generate the necessary information to enable the transponder to formulate a reply in Mode C.

When the IFF has been interrogated in Mode 4, the signals are relayed through the transponder to the KIT-1A/TSEC computer. All Mode 4 reply pulse trains are under the control of the KIT-1A/TSEC.

At the discretion of the operator, all the reply signals, with the exception of Mode 4, can be expanded to convey additional information. When the Emergency feature is activated, all modes are enabled regardless of transponder settings. The preset Mode 1 and 2 reply code numbers are transmitted followed by three sets of empty framing pulses. Framing pulses are the first and last pulses in every 20 µs pulse train. Mode 3/A automatically transmits a pulse train denoting 7700, the emergency code, followed by the same pattern of three empty framing pulses. No pulses are added to the Mode 4 reply when the Emergency feature is enabled.

When the operator chooses, the transponder can be set to transmit an Identification of Position signal. This I/P signal takes the form of an additional pulse inserted after every Mode 2 or 3/A reply. If the transponder is operating in Mode 1, activation of the I/P feature causes the Mode 1 reply can be transmitted twice in succession. I/P is useful for enabling ground facility personnel to distinguish between aircraft that are transmitting otherwise identical transponder codes.

Transponder-Continued

In every Mode 1, 2, 3/A, and Test reply pulse train, space is reserved for the insertion of an X-pulse. This feature is not aircrew-selectable and must be enabled by ground crew technicians before flight. The purpose of the X-pulse is to identify special vehicles such as pilotless aircraft.

After the pulse train has been generated and modified, as was just described, it is forwarded to the transmitter section of the transponder. The signal is then radiated from a single omnidirectional uhf antenna. The antenna used is, either the single unit utilized by the AN/APX-72 or the one selected from the pair of antennas available to the AN/APX-100.

The transponder cannot process new interrogation signals while transmitting a reply.

The AN/APX-100 is equipped with built-in test circuitry. This BIT circuitry monitors each encoded reply signal and compares it with the corresponding interrogation signal. If the reply signal is incorrect in either content or mode, the TEST/MON NO-GO lamp will light. The BIT circuitry is also capable of generating its own interrogation signals. When selected by the operator, this feature enables the AN/APX-100 to perform a self-test resulting in a visual GO/NO-GO indication.

Transponder Control Set

The AN/APX-72 and one model of the AN/APX-100 are designed for remote operation. This type of operation requires the installation of a transponder control set. The control set applies power to the IFF and houses all of the necessary controls and indicators with the exception of the CODE HOLD switch, the IFF CODE HOLD indicator, the IFF CAUTION indicater, and the Mode 2 code setting switches.

The control set enables the operator to select the mode and category of operation and to observe the indicators. The operator may also change the code settings for Mode 1 and 3/A, and select or zeroize the codes preset in the computer.

Switches and indicators are provided on the control set which permit the operator to perform an equipment self-test on systems equipped with BIT or a separately installed transponder tester.

Although the control set interfaces with the transponder, the computer, and the BIT equipment, it generates no signals of its own. There are no electron tubes, semiconductor devices, resistors, capacitors, or inductors used in the control unit.

Transponder Tester

The TS-1843( )/APX transponder tester is optionally installed with the AN/APX-72. When installed, this component provides in-flight test capability for IFF Modes 1,2, 3/A, and C. This transponder tester has no Mode 4 test capability.

The transponder tester monitors operational replies generated by the transponder and compares them to the original interrogations for accuracy. The frequency and sensitivity of the transponder receiver section, and the frequency and power of the transmitter section are also constantly monitored along with the antenna VSWR.

When functioning in the test setting, the transponder tester initiates interrogations in each mode as selected by the operator, The corresponding replies generated by the transponder are compared with the simulated interrogations. If the tester verifies that the reply is correct and system performance is within tolerance, the TEST indicator on the transponder control panel will light.

Pressure Altitude Digitizer

The AAU-32/A Altimeter, or equivalent, when installed, enables the IFF to transmit altitude data in Mode C.

This pressure altitude digitizer is a self-contained unit made up of two component parts. The first part is an aneroid altimeter that provides the pilot with a digital readout of the aircraft altitude. The second part is an encoder that converts the altitude reading into a digital code. This code is

then sent to the transponder and transmitted in response to Mode C interrotations.

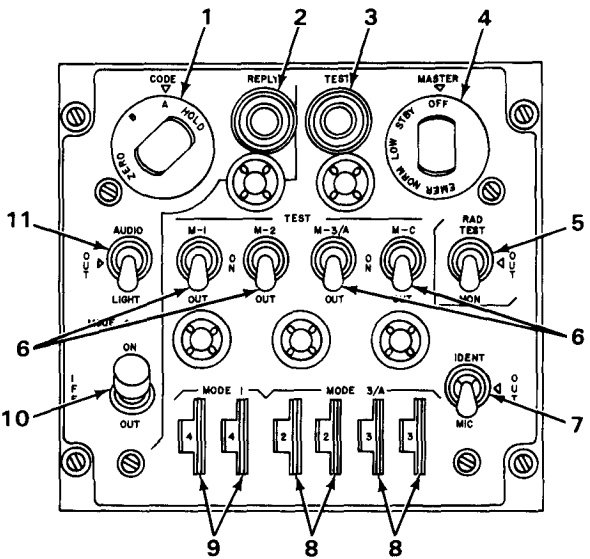
The encoding capability of the altimeter is achieved through the use of light emitting diodes and photo-transistor detectors. These components are separated by perforated code disks which are rotated in synchronization with the altimeter's digital display drums. The resulting light patterns are converted to electrical impulses to generate the digital code.

In the event of a power failure affecting the encoder, a CODE OFF indicator will appear in a window on the face of the altimeter. This indicator alerts the operator that the IFF is no longer transmitting altitude readings. The altimeter portion of the pressure altitude digitizer does not rely on electrical power for operation. Altitude readouts available to the pilot will continue uninterrupted.

DESCRIPTION OF CONTROLS AND INDICATORS

AN/APX-72 CONTROLS AND INDICATORS

Control Set C-6280(P)/APX



1 Code Control. Permits selection of operational code A or B and enables operator to retain or zeroize code settings in the KIT-1A/TSEC.

2 REPLY Indicator. When enabled by AUDIO/LIGHT switch, indicator lights to signal a valid Mode 4 reply.

3 TEST Indicator. Lights when transponder responds properly to on-board transponder tester interrogation in Modes 1,2, 3/A, or C.

4 MASTER Control. Applies power to transponder and permits selection of transponder sensitivity setting. Control also enables automatic emergency transmissions in Modes 1, 2, and 3/A.

5 RAD TEST/MON Switch. Enables monitor function of on-board test equipment or configures transponder for a radiated test with external IFF test set.

6 TEST/ON/OUT Switches. Four individual switches designated M-1, M-2, M-3/A, and M-C configure transponder to reply to, or reject external operational interrogations or interrogations from on-board transponder tester. Selecting OUT position on any switch disables corresponding mode.

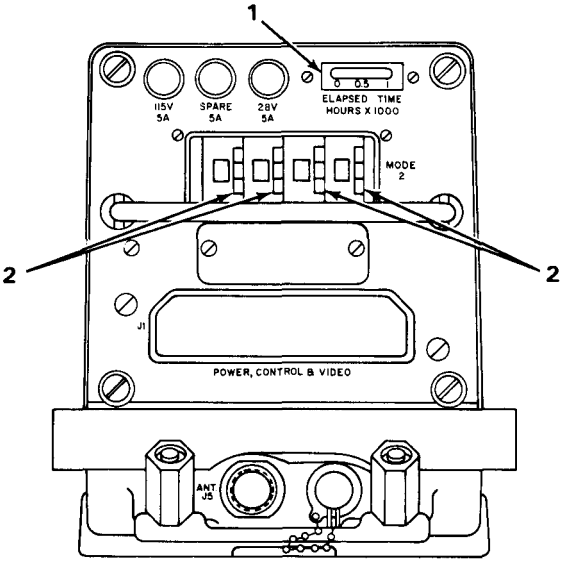
7 IDENT/MIC Switch. Enables transmission of I/P signal.

8 MODE 3/A Code Select Switches. Selects and indicates the Mode 3/A four-digit reply code number.

9 MODE 1 Code Select Switches. Selects and indicates the Mode 1 two-digit reply code number.

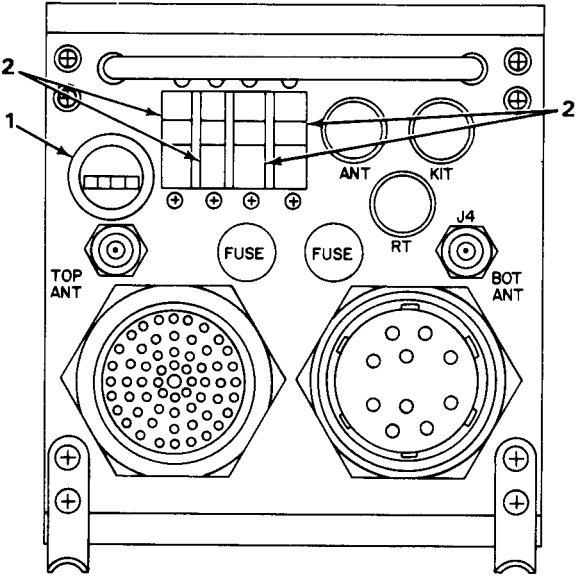
0 MODE 4 Switch. Configures transponder to reply to, or reject Mode 4 interrogations.

1 AUDIO/LIGHT Switch. Enables and disables visual or visual and audible indicators that accompany each valid Mode 4 interrogation and reply.



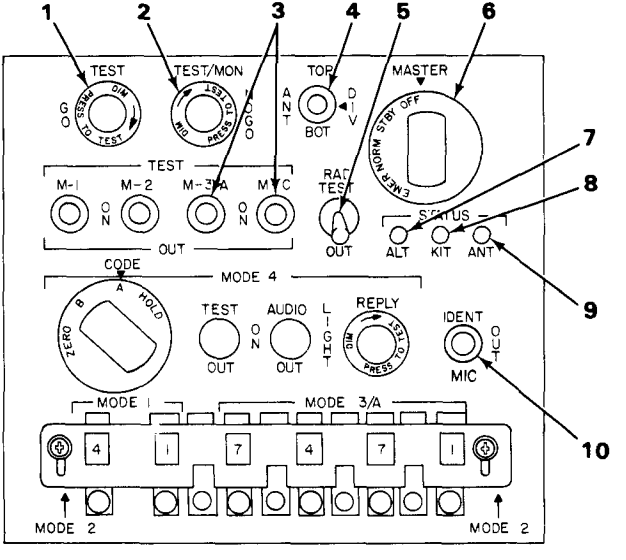
1 ELAPSED TIME Meter. Displays cumulative operational time-in-service of transponder.

2 MODE 2 Code Select Switches. Select and indicate the Mode 2 four-digit reply code number.



ELAPSED TIME Meter. Displays cumulative operational time-in-service of transponder.

MODE 2 Code Select Switches. Select and indicate the Mode 2 four-digit reply code number.



1 TEST GO Indicator. Lights to indicate successful BIT test.

2 TEST/MON NO-GO Indicator. Lights to indicate transponder malfunction.

3 TEST/ON/OUT Switches. Four individual switches designated M-1, M-2, M-3/A, and M-C configure transponder to reply to, or reject, external operational interrogations or internal test interrogations.

4 ANT DIV Switch. Enables operator to select antenna(s) used by IFF; either top only, bottom only, or both, for space diversity operation.

5 RAD TEST/OUT Switch. Enables transponder to respond to interrogations in radiated test with external IFF test set.

6 MASTER Control. Applies power to transponder and permits selection of transponder sensitivity setting. Control also enables automatic emergency transmissions in Modes 1, 2, and 3/A.

7 STATUS ALT Indicator. Indicates that a failure is due to altitude digitizer.

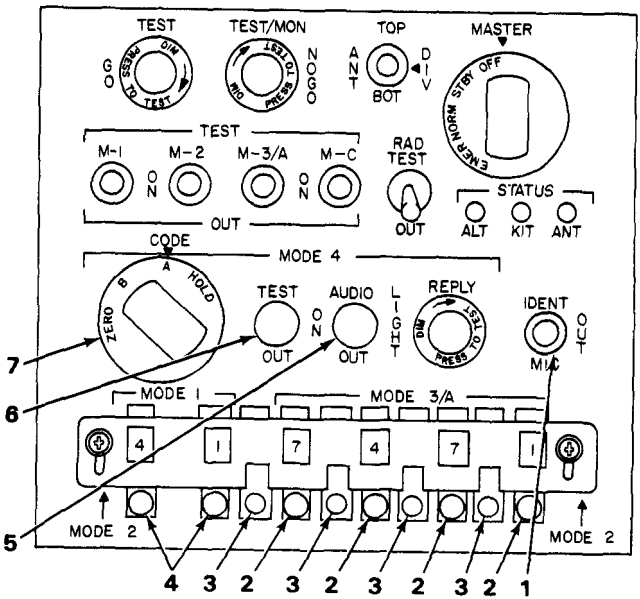
8 STATUS KIT Indicator. Indicates that a failure is due to computer system.

9 STATUS ANT Indicator. Indicates that a failure is due to high VSWR in antenna.

10 REPLY Indicator. When enabled by AUDIO/LIGHT switch, indicator lights to signal a valid Mode 4 reply.

AN/APX-100 CONTROLS AND INDICATORS – CONTINUED

RT-1284, RT-1285, RT-1286 and RT-1296/APX-100(V)– Continued



1 IDENT/MIC Switch. Enables transmission of I/P signal

2 MODE 3/A Code Select Switches. Select and indicate the Mode 3/A four-digit reply code number.

3 MODE 2 Code Select Switches. Select and indicate the Mode 2 four-digit reply code number.

4 MODE 1 Code Select Switches. Select and indicate the Mode 1 two-digit reply code number.

5 AUDIO/LIGHT Switch. Enables and disables visual or visual and audible Mode 4 indicators. Visual indicator signals valid replies. Audible indicator signals that interrogation and reply computers are set to opposite codes.

6 MODE 4 TEST/ON/OUT Switch. Configures transponder to reply to or to reject external, operational, Mode 4 interrogations. In TEST position, enables transponder to respond to Mode 4 BIT interrogations.

7 CODE Control. Permits selection of operational code A or B and enables operator to retain or zeroize code settings in the external computer.

C-10009, C-10532, C-10533, AND C-10534 CONTROLS AND INDICATORS

Controls and indicators on the various AN/APX-100 transponder control set configurations are identical to those on the panel mounted transponders with one exception. There are no Mode 2 code select switches on the control sets. These controls are located on the RT-1157 transponder. With this exception, all controls and indicators are located in the same place on the panel, placarded the same, and perform the same function.

OPERATING INSTRUCTIONS

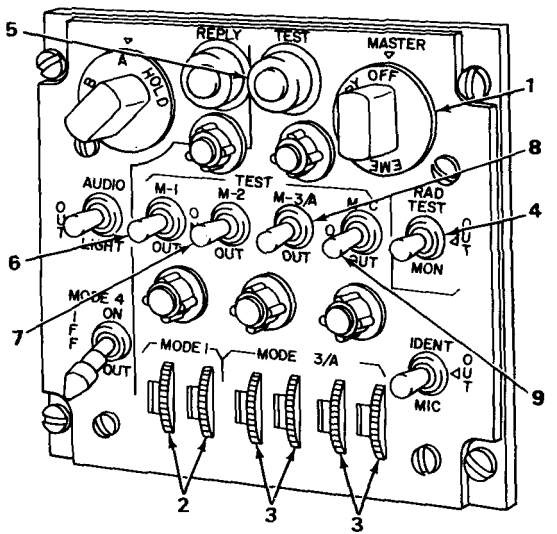
SELF-TESTS

AN/APX-72

This procedure provides instructions for performing a self-test on an AN/APX-721FF utilizing an optionally installed transponder tester. This test is intended to verify the operational readiness of the IFF and is valid for Modes 1,2, 3/A, and C only.

NOTE

All toggle switches should be in OUT position before beginning test.



1. Set MASTER switch (1) to STBY position.

NOTE

Wait approximately two minutes to allow for warmup before proceeding to step 2.

2. Set code select wheels (2) and (3) to indicate appropriate Mode 1 and Mode 3/A reply code numbers.

3. Set MASTER switch (1) to NORM position.

4. Set RAD TEST/OUT/MON switch (4) to MON position.

5. Press TEST indicator (5) and check that lamp lights.

NOTE

TEST indicator lamp (5) lights to indicate satisfactory transponder performance in steps 6 through 9.

6. Hold M-1 switch (6) in TEST position. Observe TEST indicator lamp.

7. Hold M-2 switch (7) in TEST position. Observe TEST indicator lamp.

8. Hold M-3/A switch (8) in TEST position. Observe TEST indicator lamp.

9. Hold M-C switch (9) in TEST position. Observe TEST indicator lamp.

10. Set RAD TEST/OUT/MON switch (4) to OUT position.

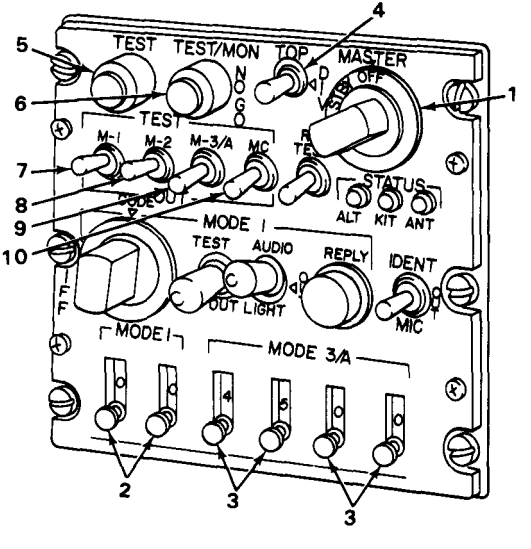
SELF-TESTS - CONTINUED

AN/APX-100

This procedure utilizes BIT to perform a self-test on AN/APX-100 IFF. Because BIT cannot test the KIT-1A/TSEC, this test will only verify the operational readiness of the IFF in Modes 1, 2, 3/A, and C.

NOTE

All toggle switches should be in OUT position before beginning test.



1. Set MASTER switch (1) to STBY position.

NOTE

Wait approximately two minutes for IFF to warm up before proceeding to step 2.

2. Set mode select switches (2) and (3) to indicate appropriate Mode 1 and Mode 3/A reply code numbers. Press and release buttons until correct numbers appear in corresponding windows.

3. Place ANT switch (4) in BOT position.

4. Set MASTER switch (1) to NORM position.

5. Press TEST GO indicator (5) and check that lamp lights.

6. Press TEST/MON NO-GO indicator (6) and check that lamp lights.

NOTE

TEST GO indicator lights to indicate satisfactory transponder performance in steps 7 through 10. TEST/MON NO-GO indicator lights to indicate incorrect response to BIT interrogation.

7. Hold M-1 switch (7) in TEST position. Observe indicator lamps.

8. Hold M-2 switch (8) in TEST position. Observe indicator lamps.

SELF-TESTS – CONTINUED

AN/APX-100-Continued

9. Hold M-3/A switch (9) in TEST position. Observe indicator lamps.

10. Hold M-C switch (10) in TEST position. Observe indicator lamps.

11. Set ANT switch (4) to TOP position.

12. Repeat steps 7 through 10.

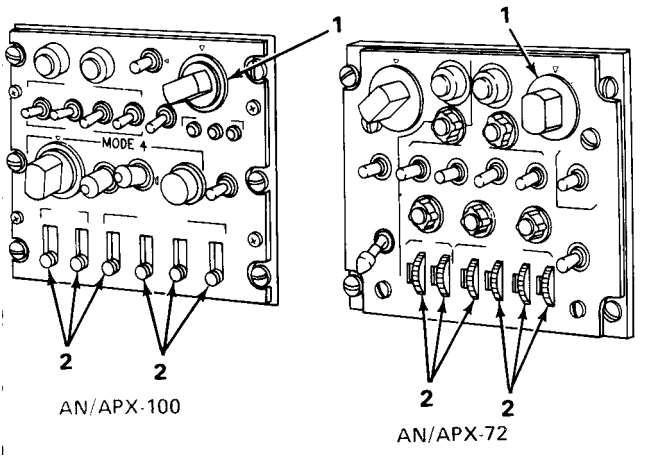
13. Set ANT switch (4) to DIV position.

14. Repeat steps 7 through 10.

OPERATING PROCEDURES - MODES 1, 2, 3/A, AND C

Although the layout of the controls on the panel differs between the AN/APX-72 and the various models of the AN/APX-100, the functions of the individual controls are identical and operating procedures for both transponders are basically the same. The following procedure is applicable for either IFF system. Exceptions, where they exist, will be noted.

Before beginning a mission, the appropriate four-digit Mode 2 reply code number must be preset in the system transponder. In addition, the self-test procedures described previously should be performed in order to verify equipment readiness.



NOTE

Check that all toggle switches are in the OUT position before energizing IFF.

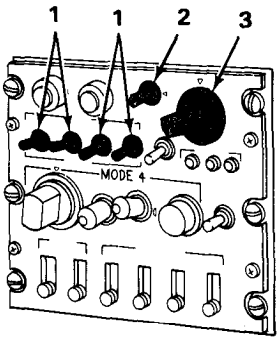
1. Set MASTER switch (1) to STBY position.

NOTE

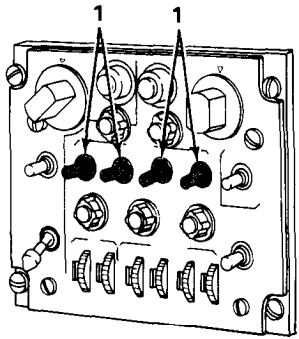
Wait approximately two minutes for IFF to warm up before proceeding to step 2.

2. Set mode select switches (2) to indicate appropriate Mode 1 and Mode 3/A reply code numbers.

OPERATING PROCEDURES – MODES 1,2, 3/A, AND C-CONTINUED



AN/AFX-100



AN/APX-72

NOTE

Selection of mode(s) is determined by operational requirements.

3. Enable Mode 1, 2, 3/A, and/or C by setting corresponding switch(es) (1) to ON position.

NOTE

ANT switch (2) on AN/APX-100 enables operator to select top, bottom, or both antennas. This switch should normally be set to DIV position, however, the effects of enemy jamming can sometimes be lessened by selective use of the two antennas.

OPERATING PROCEDURES - MODES 1, 2, 3/A, AND C - CONTINUED

4. On AN/APX-100, set ANT switch (2) to DIV position.

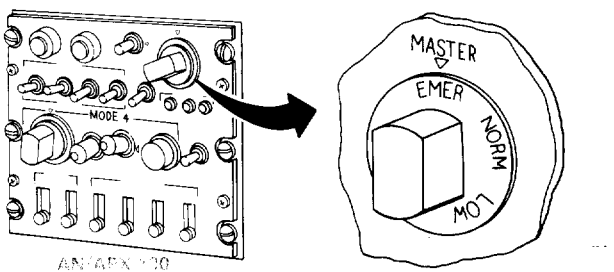
NOTE

MASTER control has two positions, LOW and NORM, which permit operator to vary sensitivity of transponder receiver. Enemy jamming originating at a distant station can be lessened by operating IFF on LOW setting.

5. Set MASTER control (3) to NORM position.

EMERGENCY OPERATION

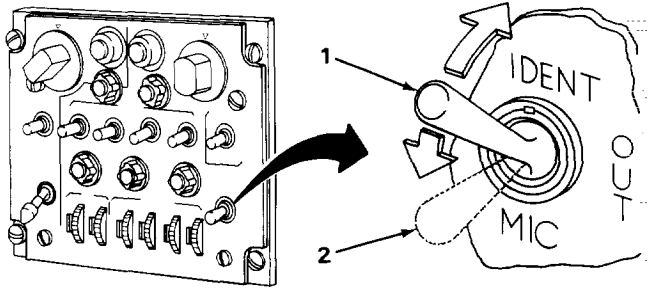
The IFF Emergency signal feature can be activated either manually, as described in this paragraph, or by the pilot ejecting from the aircraft. Either way, once activated, all modes are enabled and the reply codes for Modes 1, 2, and 3/A are modified to indicate an in-flight emergency.



To enable the IFF Emergency feature, grasp the MASTER control knob, pull outward, and turn knob to EMER position.

IDENTIFICATION OF POSITION

The IFF Identification of Position feature permits the operator to transmit position identifying signals to all interrogating stations in Modes 1,2, and 3/A. These modes will be enabled regardless of switch positions when I/P is activated. The I/P signals are special pulses added to the standard reply codes. The modified codes are transmitted for a duration of from 15 to 30 seconds each time the operator triggers the I/P. The operator may choose to trigger the l/P in either of two ways; by using the IDENT/MIC switch on the control panel or, by using the aircraft microphone button.



NOTE

To trigger the I/P from the IFF control panel, do step 1. To trigger I/P from microphone, do step 2.

1. Momentarily place IDENT/MIC switch in IDENT position (1) and release.

2. Set IDENT/MIC switch in MIC position (2). l/P signal will be triggered each time aircraft microphone button is pressed.

Mode 4 IFF operations require the installation of a properly keyed KIT-1A/TSEC computer. The procedures necessary for keying and installing the computer are covered in Keying Cryptographic Equipment, page 64 in this manual.

Successful utilization of IFF in Mode 4 requires that the operator understand how the computer interfaces with the rest of the system. Included in this system are certain Mode 4-related controls and indicators whose functions and locations have been discussed elsewhere in this manual. These controls and indicators permit the operator to enable Mode 4 operation, select codes, retain the code when the aircraft is powered down, and zeroize the computer to erase the codes when desired. Various other indicators monitor the status of the system in operation.

The Mode 4 operating procedures which follow are broken down into three separate sections; in-flight procedures, zeroizing the computer, and engaging the code hold mechanism while the aircraft is on the ground.

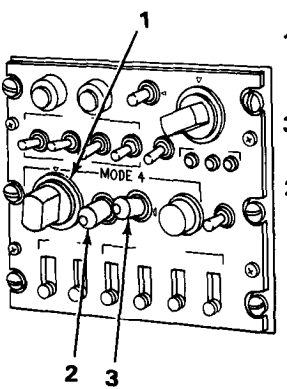
Mode 4 In-Flight Procedures

Once the equipment and controls are configured properly, the in-flight operation of the IFF in Mode 4 is identical to its operation in other modes and no other actions are required on the part of the operator. Interrogations are received and authenticated automatically. The proper replies are formulated, encrypted using the preselected daily code, and transmitted.

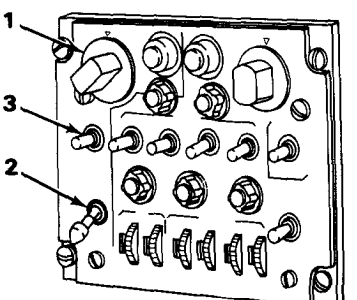
Mode 4 In-Flight Procedures - Continued

Before beginning a mission that will require Mode 4 IFF capabilities, the system must be tested to ensure operational readiness in all modes. On AN/APX-100 systems and optionally equipped AN/APX-72 systems, it is possible to perform a self-test using BIT. See Self-Tests, pages 36 through 40. In addition, a preflight test can be performed that will test every area of Mode 4 operation using an external test set. See Operational Preflight Tests, beginning on page 54.

This preflight test will not only check the transponder but will also verify that the computer has been keyed properly. The computer must be handled in accordance with Keying Cryptographic Equipment, page 64 and Mode 4 Code Zeroizing, page 48.



AN/APX-100



AN/APX-72

Mode 4 In-Flight Procedures-Continued

NOTE

These procedures begin with the IFF already energized and warmed up. See Operating Procedures - Modes 1, 2, 3/A, and C, page 40.

1. Set CODE switch (1) to position A or B as required.

NOTE

The MODE 4 ON-OUT toggle switch is designed to prevent it being placed in the OUT position by accident. To disable Mode 4, toggle handle must be pulled outward and then lowered to OUT position.

2. Check that MODE 4 ON-OUT switch (2) is set to the ON position.

NOTE

Mode 4 monitoring capabilities enabled by the AUDIO/OUT/LIGHT switch differ between IFF models. See Differences Between Models, page 9.

3. Set AUDIO/OUT/LIGHT switch (3) for desired indication.

Mode 4 In-Flight Procedures- Continued

CAUTION

IFF CAUTION lamp will light if reply is not transmitted in response to a valid Mode 4 interrogation. This can be caused by a defect in the computer or transponder, by the code zeroizing, or if an improper code is in the computer. The lamp will flicker if replies are not being transmitted at an established minimum rate.

4. If mission is interrupted for refueling, etc, computer must be put on hold to preserve the code setting. See Code Holding, page 51.

Mode 4 Code Zeroizing

The two codes entered in the KIT-1A/TSEC computer can be zeroized inadvertently or deliberately in any one of three ways. These ways include; turning off aircraft power, opening the door on the computer, or utilizing the CODE switch on the IFF control panel. Each of these actions will cause the computer to zeroize and both daily codes will be lost.

There are two methods by which the codes are retained or kept on hold in the computer. The first method is a mechanical hold. Once the codes are keyed into the computer (see Keying the Cryptographic Equipment, page 64), and the access door on the computer is closed, the mechanical hold is engaged. This mechanical hold will remain in effect until 15 seconds after power is applied. At that time, the computer will automatically convert to the second hold method, electrical hold.

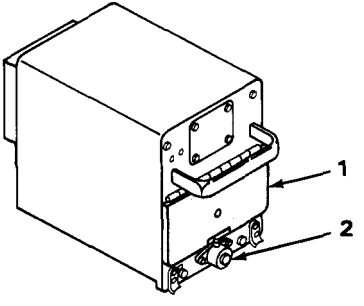
The electrical hold will retain the code for as long as power is applied. If the power is turned off or interrupted for more than five seconds, the computer will zeroize and the code settings will be lost. Obviously, turning off the IFF circuit breaker or powering-down the aircraft will zeroize the computer. However, the temporary reduction in system power that occurs when the aircraft engine(s) are started could also be enough to zeroize the computer.

In order to prevent the computer from being accidentally zeroized during aircraft startup, the computer must be kept in a mechanical old condition. To ensure this, the IFF MASTER switch must be in the OFF position when the computer is keyed and until after startup (see Keying the Cryptographic Equipment, page 64). The computer will remain on mechanical hold and the code settings will be secure. After aircraft startup, the IFF MASTER switch maybe set to STBY, At that time the computer will automatically convert to an electrical hold **condition which will remain in effect for the duration of the mission (see Mode 4 in-Fiight Procedures, page 45).**

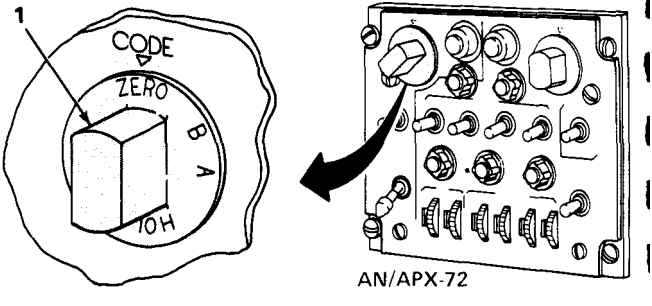
When aircraft power must be interrupted for refueling, etc, the computer can be returned to a mechanical hold condition before powering-down in order to preserve the code (see Code Holding, page 51).

The computer will also zeroize, regardless of hold condition, if the access door on the front panel is opened.

Mode 4 Code Zeroizing - Continued



Once the computer has been keyed and the access door (1) closed, any attempt to open latch (2) will cause it to zeroize.



AN/APX-72

To zeroize computer, grasp CODE switch knob (1), pull out slightly, and set to ZERO position.

Code Holding

NOTE

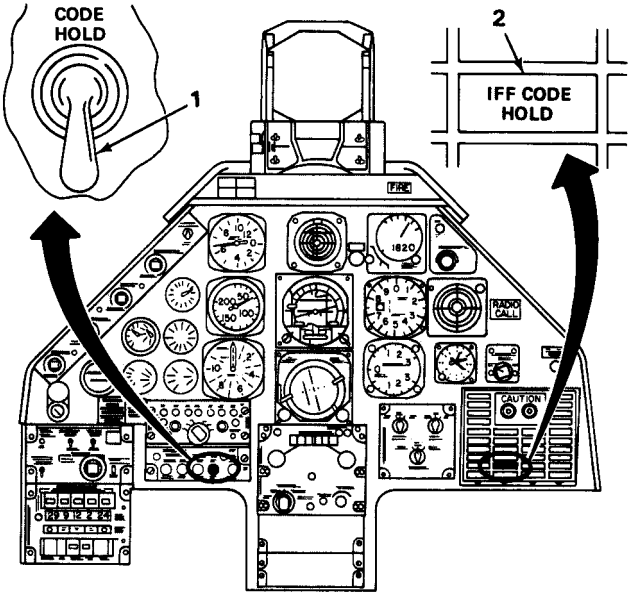
The ZERO switch position is normally used only at the end of a mission or during emergencies that require code to be zeroized quickly.

It is frequently necessay to power-down the aircraft during a mission for reasons such as refueling. To preserve the IFF code, the computer must be taken off electrical hold and put on mechanical hold. For aircraft with compressible landing gear struts, this must be done when the aircraft is on the ground and before electrical power is removed. For aircraft with fixed/rigid landing gear, it must be done with the CODE HOLD switch in the HOLD position and before electrical power is removed. When power is reapplied to the IFF, the computer will revert to electrical hold and the aircraft will be ready to resume the mission. Performing the following code hold procedure will make it unnecessary to rekey the computer in order to replace zeroized codes.

The illustration that accompanies step 1 of this procedure shows a typical control panel in an aircraft equipped with fixed landing gear. The IFF controls and indicators addressed in this procedure will be found in different ocations in other aircraft. It is also possible that the placarding on these controls will be slightly different from one aircraft to another.

The aircraft CODE HOLD switch enables the code hold circuit. Its primary function is to prevent the operator from accidentally putting the computer into hold status while in flight. This same function is performed by the landing gear interlock switch on retractable landing gear aircraft. When either type of switch is disabled either manually or automatically at takeoff, the computer cannot be put on hold.

Code Holding - Continued



NOTE

On aircraft with fixed landing gear, locate CODE HOLD switch and IFF CODE HOLD indicator on aircraft control panel and begin procedure in step 1.

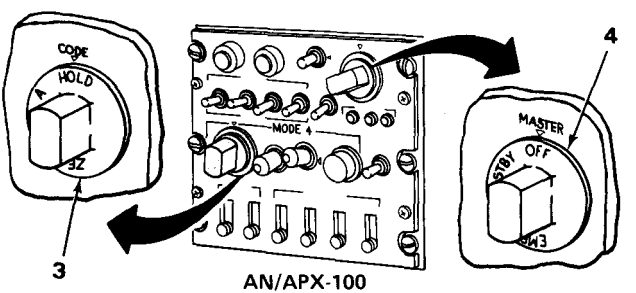
Code Holding - Continued

NOTE - Continued

On aircraft with telescoping or retractable landing gear, wait until aircraft weight is resting on gear, then do steps 3, 4, and 5.

1. Set the CODE HOLD switch (1) to the on position.

2. Check that IFF CODE HOLD indicator lamp (2) is lit, signaling that the code hold circuitry is enabled.



AN/APX-100

3. Momentarily set CODE switch (3) to HOLD position, then release.

4. Set CODE switch (3) to code A or B, as applicable.

5. Set MASTER switch (4) to OFF position.

CAUTION

CODE HOLD switch must be reset to OFF position before takeoff.

ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

Preventive maintenance checks and services for the separate IFF components are found in the individual equipment technical manuals. See appendix A in the back of this manual for a list of the appropriate TMs and then refer to them for the required PMCS.

The operational preflight checks which appear in this manual should be used by the Technician to ensure that the equipment is maintained in a state of readiness.

OPERATIONAL PREFLIGHT CHECKS

INTRODUCTION

The IFF operational preflight procedures which follow are presented in the form of two separate tables. The first table details testing the AN/APX-72 or AN/APX-100 IFF with TransponderTest Set AN/APM-123(V)1.The second table tests the same equipment with Transponder Test Set AN/APM-378. Both tables provide instructions enabling the technician to perform radiated tests of the IFF in Modes 1, 2, 3/A, and 4.

The individual transponder technical manuals, listed in appendix A in the back of this manual, contain procedures for performing nonradiated tests with the same test equipment. The only significant difference between radiated and nonradiated testing is the way in which the rf output of the IFF reaches the test set. In nonradiated tests, the rf signal bypasses the aircraft antenna system and is thereby prevented from being transmitted.

This type of nonradiated test is to be used to check the IFF Emergency signaling feature which must not be enabled as part of a radiated test. In addition, the ability to bypass the aircraft antenna system provided by this type of test can be valuable in isolating system failures caused by that component.

To use the tables, select the one that corresponds to the test equipment that will be used. The procedure steps are consecutively numbered and the necessary Notes, Cautions, and Warnings are inserted in the body of the table near the associated step. The first column on the left directs the technician to a specific component; the transponder, test set, etc. The second and third columns identify the individual component controls and specify the correct setting for each. Tasks that require narrative explanabon are described under ACTION in the fourth column. Finally, the indications that will be generated by properly functioning equipment appear in the RESULTS column.

The actual test tables are preceded by information designed to familiarize you with the controls and indicators found on both test sets. Procedures for setting the key gun and keying the cryptographic equipment have also been included in this section of the manual.

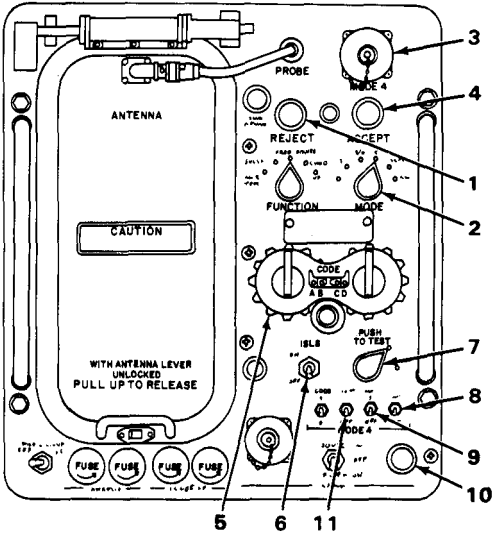
If an IFF being tested has BIT installed,Modes 1, 2,and 3/A may be tested using that capability. The technician will then refer to the appropriate table to test Mode 4 operations. If operational requirements necessitate setting

INTRODUCTION - CONTINUED

up a transponder test set to check Mode 4 capabilities, the remaining IFF modes should be checked at the same time. In this way, the complete operational readiness of the IFF, including antenna, is verified in all modes.

TEST SET CONTROLS AND INDICATORS

AN/APM-123



TEST SET CONT

1 REJECT Indicator. Lights red to indicate transponder has failed to respond properly to test.

2 MODE Switch. Selects transponder mode being tested by tes set.

3 MODE 4 Receptacle. Provides connection point for KIR-1A/TSEC.

4 ACCEPT Indicator. Lights white to indicate transponder test response is satisfactory.

5 CODE AB-CD Code Dials. Code selector switches enable operator to input two- and four-digit reply codes to test set.

6 ISLS Switch. Enables test of side lobe suppression feature.

7 PUSH TO TEST Switch. Enables test when depressed. LOCK position locks switch in test position.

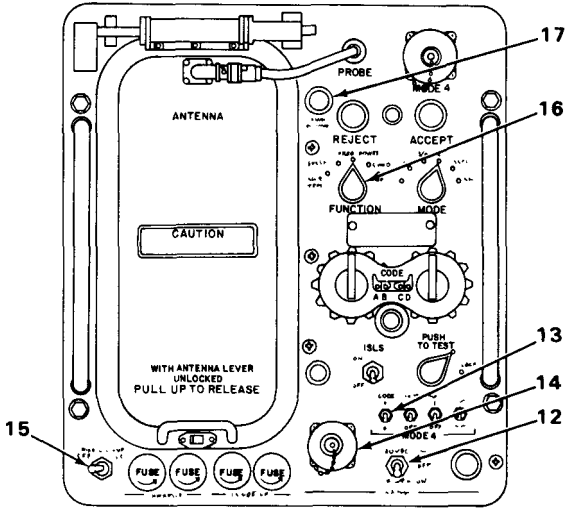
8 DIR/RAD Switch. Selects direct connection or radiated test conditions.

9 VER BIT 2 Switch. Controls verification bits of computer being tested.

10 POWER Indicator. Lights red when power is applied to test set.

11 VER BIT 1 Switch. Controls verification bits of computer being tested.

AN/APM-123-Continued



12 28VDC/OFF/115 VAC POWER Switch. Selects ac or dc power input and applies power to test set.

13 CODE A/B Switch. Selects codes being used during Mode 4 test.

14 Power Receptacle. Provides connection point for power input

15 PANEL LIGHT Switch. Applies power to panel illumination lamps.

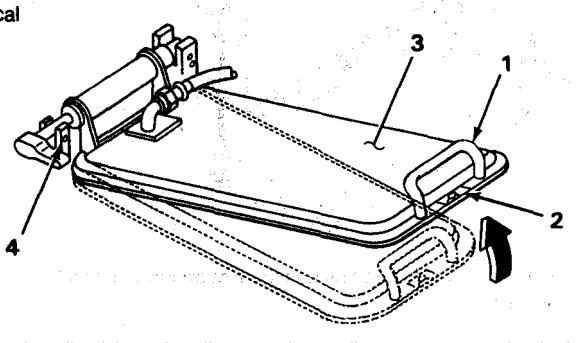
16 FUNCTION Switch. Selects aspect of transponder operation being tested and enables SELF-TEST feature of test set.

17 CODE ZEFOIZE Indicator. Lights to indicate that lFF under test cannot reply to encrypted interrogation.

AN/APM-123 Antenna Positioning

The test set antenna must be polarized to match the IFF antenna(s). Ordinarily, the IFF antenna(s)are mounted vertically. If mounted on movable portions of the aircraft, such as wheel flaps, the antenna(s) maybe horizontal when the aircraft is on the ground.

The following procedure shows how to position the test set antenna vertically or horizontally as required.

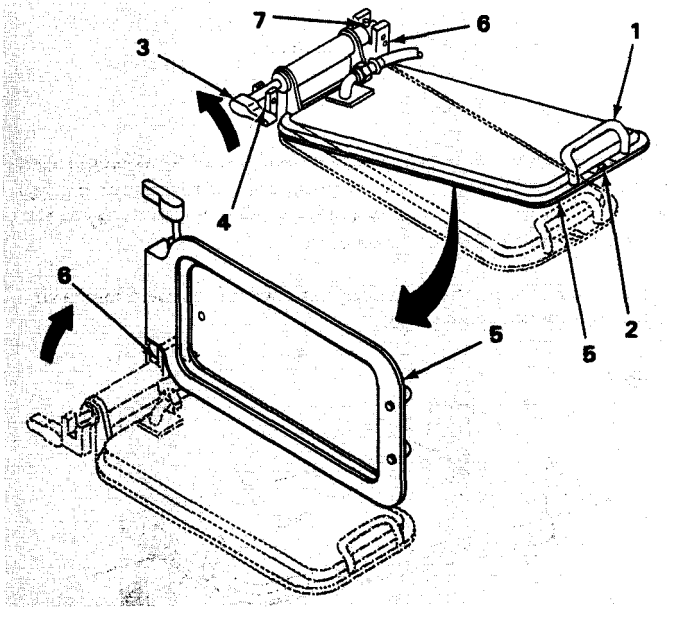


1. Grasp handle (1) and pull upwards to disengage snap latch (2).

2. Pivot antenna (3) upright until detent locking pin (4) snaps into place securing antenna in vertical position.

AN/APM-123 Antenna Positioning - Continued

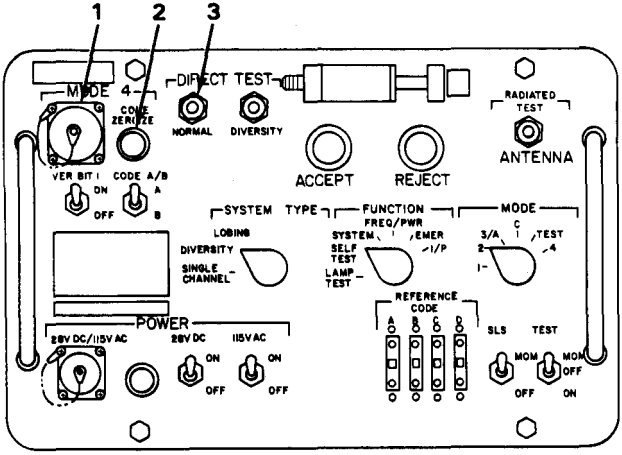
Horizontal



1. Grasp handle (1) and pull upward just enough to disengage snap latch (2).

2. Turn lever (3) to the left to disengage hinge detent pin (4).

3. Pivot antenna (5) upright from hinge (6) until detent pin (7) snaps into place securing antenna.

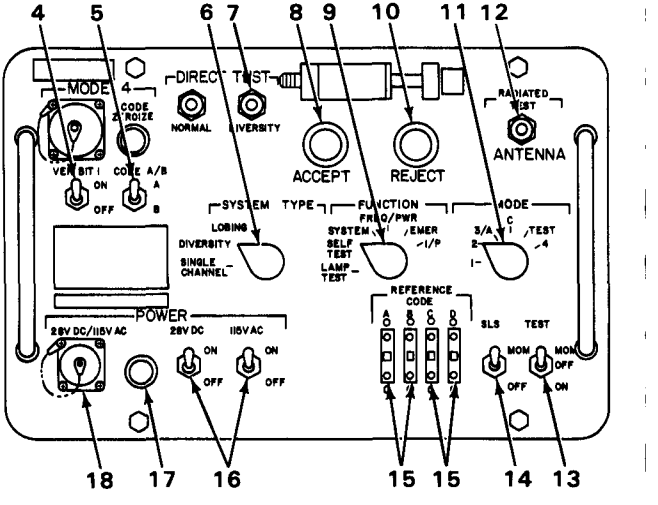


1 MODE 4 Receptacle. Provides connection point for KIR-1A/TSEC.

2 CODE ZEROIZE Indicator. Lights to indicate that IFF under test cannot reply to encrypted interrogation.

3 DIRECT TEST NORMAL Jack. Provides connection point for rf cable from single antenna-equipped transponder when conducting nonradiated tests.

AN/APM-378 - Continued



4 VER BIT 1 Switch. Controls verification bits of computer being tested.

5 CODE A/B Switch. Selects codes being used during Mode 4 test.

6 SYSTEM TYPE Switch. Configures test set to function with IFF systems that have different operational capabilities.

7 DIRECT TEST DIVERSITY Jack. Provides connection point for rf cable from space diversity transponders when conducting non-radiated tests.

8 ACCEPT Indicator. Lights to indicate transponder test response is satisfactory.

9 FUNCTION Switch. Selects aspect of transponder operation being tested and enables SELF-TEST feature of test set.

10 REJECT Indicator. Lights to indicate transponder has failed to respond properly to test.

11 MODE Switch. Selects transponder mode being tested by test set.

12 RADIATED TEST ANTENNA Jack. Provides connection point for test set antenna used during radiated tests.

13 TEST Switch. Enables test when set to MOM position. The ON position locks switch in test function.

14 SLS Switch. Enables test of side lobe suppression feature.

15 REFERENCE CODE Switches. Code selector buttons enable operator to input two- and four-digit reply codes to test set.

16 28 VDC/115 VAC Power Switches. Apply ac or dc input power, as applicable, to the test set.

17 POWER Indicator. Lights when power is applied to the test set.

18 28 VDC/115 VAC Receptacle. Provides connection point for ac or dc input power cable.

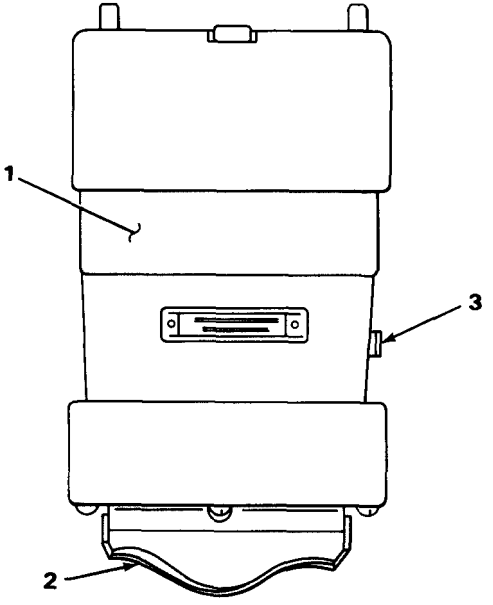
KEYING THE CRYPTOGRAPHIC EQUIPMENT

AIMS relies on the KI-1A/TSEC cryptographic equipment system for secure operation. The K1-1A system is made up of the KIR-1A interrogation computer, the KIT-1A reply computer, and the KIK-18 key gun. The key gun is used to mechanically preset the two daily codes in the computers. This process of loading the codes in the computer is called keying and can be done with power applied or with power off. Keying the computer with power off is referred to as cold loading. If power is removed from a keyed computer, the computer will zeroize and the code will be lost (see Mode 4 Code Zeroizing, page 48 to 50). For this reason, cold loading is recommended because the computer will retain the code on mechanical hold until power is applied to the IFF.

The code settings are made available in the form of key setting tables that dictate how the keying variables are to be set for a specific time period. The technician sets the physical positions of the key gun mechanism according to the entries on the tables. When the key gun is inserted into the computer, these variables are transferred to the computer. This action keys the computer with codes A and B simultaneously. The key gun can be used to key as many computers as required. When the technician has finished keying the computer(s), the key gun must be zeroized mechanically and the codes erased.

See Security Requirements, page 16, for guidelines in safeguarding KI-1A cryptographic equipment and documentation.

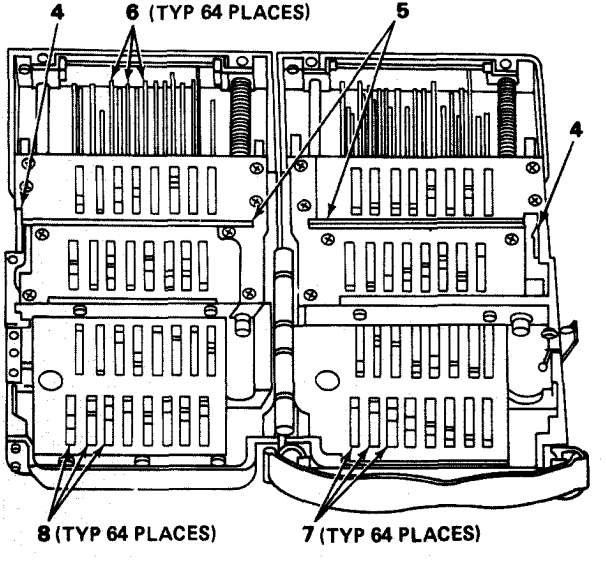
Setting the KIK-18 Key Gun



1. Place key gun (1) on flat surface with carry strap (2) nearest technician.

2. Press latch (3) and open key gun to expose key pin mechanism.

Setting the KIK-18 Key Gun - Continued



3. Push two cam levers (4) to slot position farthest from technician Key pin locking plates (5) will lift. This unlocks the pins.

CAUTION

A nonmetallic tool, NSN 5120-00-293-2081, or equivalent, should be used to set the key pins. Do not use the point of a lead pencil or any other object that will break off and damage the key gun.

Setting the KIK-18 Key Gun-Continued

NOTE

There are a total of 64 key pins (6) and each pin has 17 possible settings. The pin tab slots (7) are numbered 1 through 64. The vertical row of letters to the left of each slot are the alpha-designated pin setting positions.

4. Refer to the key list and aline each of the 64 key pin tabs (8) with the letter designating the position specified.

CAUTION

The cam levers (4) cannot be put in the locking position if any of the associated key pin tabs are positioned between two settings. Do not force the cam levers or the key gun will be damaged.

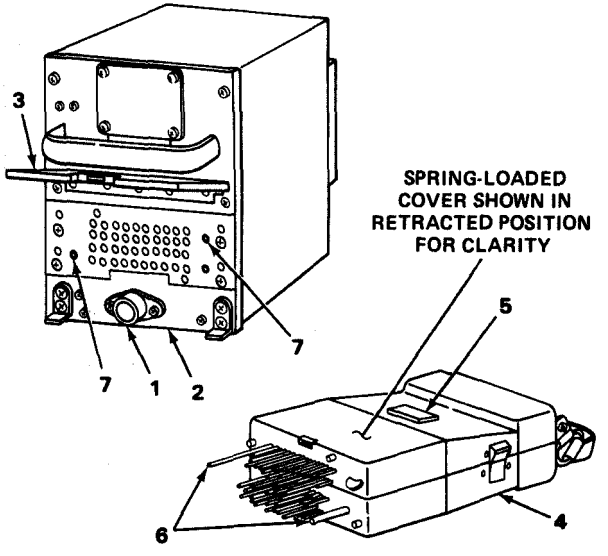
5. Pull both cam levers (4) back and down to lock key pins in position.

NOTE

A second technician must check key pin settings before key gun is closed. If a second technician is not available, original technician must check and verify settings.

6. Close key gun gently and lock latch (3).

Keying the Computer

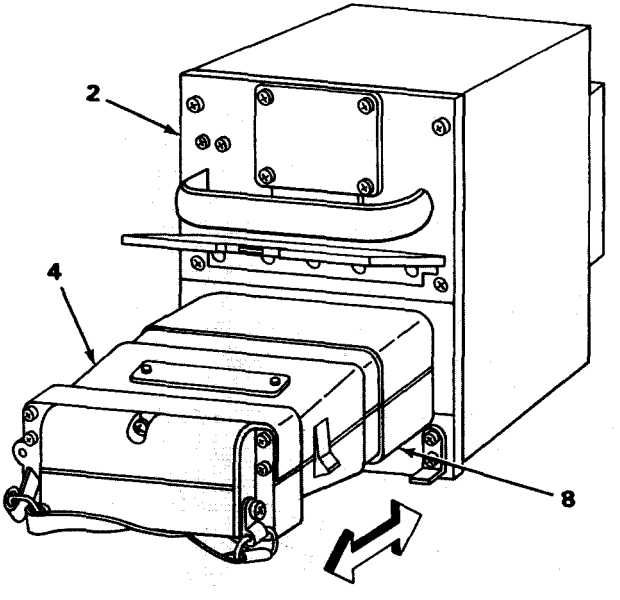


1. Press latch button (1) on computer (2) to open code access door (3).

NOTE

The computer should be keyed with power to IFF turned off.

2. Hold key gun (4) with data plate (5) facing up and aline guide pins (6) with holes (7) in computer.



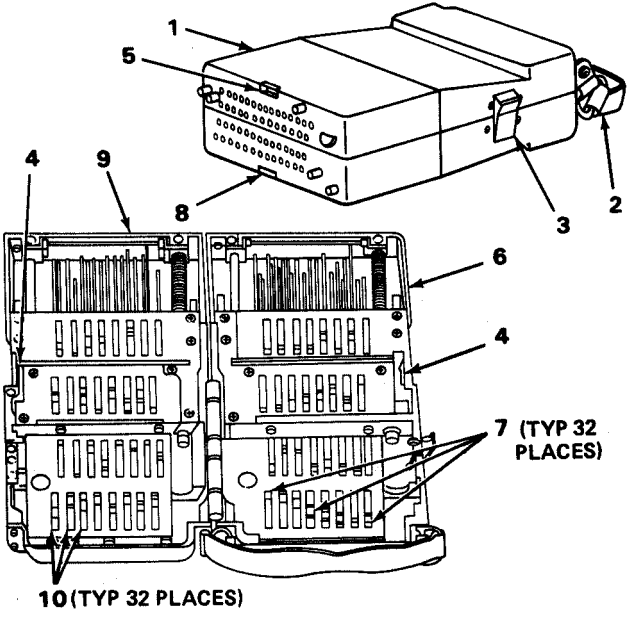
3. Push key gun (4) against computer (2) until spring-loaded cover (8) is fully retracted.

NOTE

Computer code access door (3) must be closed firmly in one quick, uninterrupted motion to avoid zeroizing the computer.

4. Remove key gun (4) from computer (2) and close access door (3).

Zeroizing the KIK-18 Key Gun



1. Place key gun (1) on flat surface with carry strap (2) nearest technician.

2. Press latch (3) and open key gun to expose key pin mechanism.

3. Push two cam levers (4) to slot position farthest from technician to unlock key pins.

Zeroizing the KIK-18 Key Gun-Continued

4. Press shutter pushbutton (5) on right-hand side of key gun and slide associated cover half (6) toward the hand grip as far as it will go.

5. When each key pin tab (7) on the right-hand side of the key gun is alined with the letter U next to its respective slot, return right-hand cover half (6) to the extended position.

6. Press shutter pushbutton (8) on left-hand side of key gun and slide associated cover half (9) toward the hand grip as far as it will go.

7. When each key pin tab (10) on the left-hand side of the key gun is alined with the letter U next to its respective slot, return left-hand cover half (9) to the extended position.

CAUTION

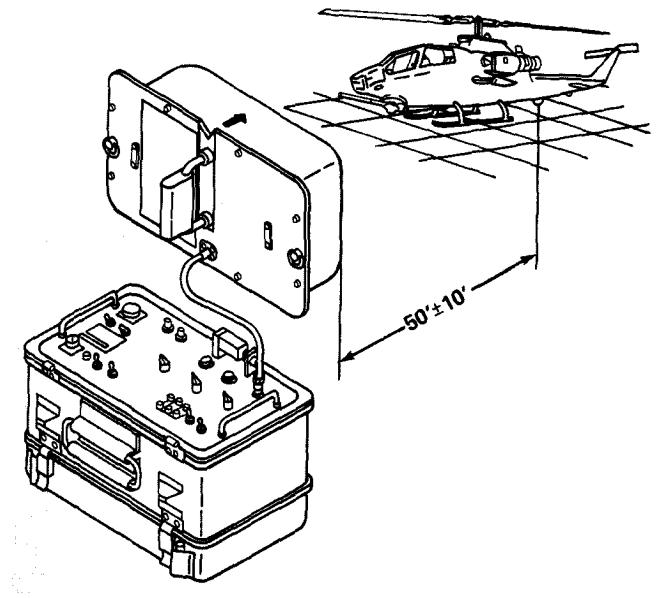
The cam levers (4) cannot be put in the locking position if any of the associated key pin tabs are positioned between two settings. Do not force the cam levers or the key gun will be damaged.

8. Pull both cam levers (4) back and down to lock key pins in position.

9. Close key gun gently and lock latch (3).

TEST TABLES

The radiated test procedures outlined in the test tables require that the test set be positioned approximately 50 feet (15.25 meters) from the aircraft IFF antenna(s). The accompanying illustration shows an AN/APM-378, equipped with a hand-held diversity antenna, setup for radiated testing. Observe that the test set has been elevated from the ground and the arrow painted on the antenna is aimed at the aircraft. When siting the test set, do not locate it where there are any obstructions between the test set antenna and the aircraft antenna(s).



COMPONENT	CONTROL	SETTING	ACTION	RESULT
1. AN/APM-123 Test Set	• • •	• • •	Locate the test set approximately 50 feet from the aircraft IFF antenna(s).	• • •
WARNING:	Unscrew the relief valve on the AN/APM-123 two turns to release internal pressure. Failure to depressurize the unit may allow the cover to spring upwards when opened, injuring personnel.			
2. AN/APM-123 Test Set	• • •	• • •	Unlatch and remove cover. Raise test set above ground level by latching the case to the inverted cover. Configure test set antenna to match aircraft antenna(s) so both are either horizontal or vertical. See page 59.	• • •

RADIATED TEST AN/APM-123 – CONTINUED

COMPONENT	CONTROL	SETTING	ACTION	RESULT
2. Continued			Position test set so arrow on antenna points toward aircraft antenna.	
3. AN/APM-123 Test Set	POWER	OFF		
	MODE	Any mode except 4		
	ISLS	OFF		
	FUNCTION	SELF-TEST		
	AB-CD code	0000	• • •	• • •
	VER BIT 1	OFF		
	VER BIT 2	OFF		

CAUTION:	**Type of power source (ac or dc) used for AN/APM-123 is determined by power requirements of associated KIR-1A/TSEC being used for Mode 4 tests. Computer power supply Z-ACA/1 requires ac power and Z-ACB/1 utilizes dc power.** **When connecting dc cable to battery, make certain clip with red insulator is attached to positive(+) terminal.**			
4. AN/APM-123 Test Set	• • •	• • •	Connect test set to power source using appropriate, supplied cable; CX-8330 for ac power, CX-8331 for dc power.	• • •
5. AN/APM-123 Test Set	Power Switch	28 VDC or 115 VAC	• • •	Power indicator lights.
NOTE:	**If the ACCEPT indicator fails to light in steps 6 and 7, the AN/APM-123 requires higher level maintenance.**			
6. AN/APM-123 Test Set	PRESS TO TEST	LOCK	Push in and rotate PRESS TO TEST switch to LOCK position.	ACCEPT indicator lights.

RADIATED TEST AN/APM-123 – CONTINUED

COMPONENT	CONTROL	SETTING	ACTION	RESULT
7. AN/APM-123 Test Set	ISLS	ON	• • •	ACCEPT indicator remains lit.
8. AN/APM-123 Test Set	PRESS TO TEST	• • •	Push in on PRESS TO TEST switch and release from LOCK position.	ACCEPT indicator switches off.
9. AN/APM-123/ KIR-1A/TSEC	• • •	• • •	Connect zeroized computer to test set MODE 4 receptacle using cable CX-12216.	Test set ZEROIZE indicator lights.
10. AN/APM-123/ KIR-1A/TSEC	• • •	• • •	Key computer. See keying the Cryptographic Equipment, page 64.	Test set ZEROIZE indicator switches off.

NOTE: Mode and code settings on test set must duplicate settings on transponder controls during test procedures. Do not perform any tests with the Mode 3/A code selector switches set to 7400, 7600, or 7700. Do not set transponder MASTER control to EMER position.

11. *Aircraft*			Connect headset to aircraft intercom system.	
12. *Transponder*	MASTER	STBY *for one* minute – then NORM		
	IDENT-MIC	OUT		
	M-1	ON	• • •	• • •
	M-2	OUT		
	M-3/A	OUT		
	M-C	OUT		
	MODE 4	OUT		
NOTE:	When testing AN/APX-100 transponder, set ANT switch on transponder control panel to DIV position.			
13. AN/APM-123 Test Set	FUNCTION	SYSTEM	• • •	• • •

RADIATED TEST AN/APM-123 – CONTINUED

COMPONENT	CONTROL	SETTING	ACTION	RESULT
14. AN/APM-123 Test Set	MODE CODE AB	1 Match transponder code.	Press the PRESS TO TEST switch.	ACCEPT indicator lights. If REJECT indicator lights, proceed to step 19.
15. Transponder	M-1 M-2	OUT ON	• • •	
16. AN/APM-123 Test Set	MODE CODE ABCD	2 Match transponder code.	Press the PRESS TO TEST switch.	ACCEPT indicator lights. If REJECT indicator lights, proceed to step 19.
17. Transponder	M-2 M-3/A	OUT ON	• • •	

18. AN/APM-123 Test Set	MODE CODE ABCD	3/A Match transponder code.	Press the PRESS TO TEST switch.	ACCEPT indicator lights. If REJECT indicator lights, proceed to step 19.
NOTE:	If ACCEPT indicator lights in step 14, 16, and 18, operation in Modes 1, 2, and 3/A is satisfactory. Proceed to step 21 to test Mode 4 capabilities.			
19. AN/APM-123 Test Set	PRESS TO TEST FUNCTION	LOCK FREQ-POWER	• • •	If ACCEPT indicator lamp lights, the transponder power output or coder operation is abnormal or the antenna system is defective.
CAUTION:	Do not move the test set closer than within 30 feet of the aircraft's antenna(s) in the following step.			

RADIATED TEST AN/APM-123 – CONTINUED

COMPONENT	CONTROL	SETTING	ACTION	RESULT
20. AN/APM-123 Test Set	FUNCTION	SYSTEM	Move the test set 10 feet closer to the aircraft IFF antenna and repeat steps 14 through 18.	If REJECT indicator lights, the transponder encoder is defective. Refer unit to higher level of maintenance. If ACCEPT indicator lights, refer to corresponding transponder TM for nonradiated test procedures. If results of nonradiated tests are satisfactory, aircraft

				antenna system is defective. Refer antenna system to higher level of maintenance.
21. Transponder	M-3/A AUDIO/OUT/LIGHT CODE	OUT AUDIO A	• • •	• • •
22. AN/APM-123 Test Set	MODE 4 DIR/RAD MODE CODE A/B	RAD 4 A	• • •	No tone will be heard in headset. IFF CAUTION indicator on instrument panel lights.

RADIATED TEST AN/APM-123 – CONTINUED

COMPONENT	CONTROL	SETTING	ACTION	RESULT
23. KIT-1A/TSEC	• • •	• • •	Using KIK-18/TSEC, key KIT-1A/TSEC computer and close access door.	Test set . REJECT indicator lights. No tone will be heard in headset. IFF CAUTION indicator on instrument panel lights.
24. AN/APM-123 Test Set	PRESS TO TEST	• • •	Release PRESS TO TEST switch from LOCK position.	• • •
25. Transponder	MODE 4	ON	• • •	• • •
26. AN/APM-123 Test Set	• • •	• • •	Press the PRESS TO TEST switch.	REJECT indicator will light briefly followed by ACCEPT indicator.

NOTE:	If REJECT indicator does not light briefly, the test set power supply is faulty and ACCEPT indication may not be valid. If ACCEPT indicator does not light but the transponder REPLY indicator does light, the AN/APM-123 test set is defective.			
	• • •	• • •	• • •	REPLY indicator lights. Tone is heard in headset. IFF CAUTION indicator remains unlit.
27. Transponder	AUDIO/OUT/ LIGHT	LIGHT	Repeat step 26.	Results are identical to step 26 except no tone is heard in headset.
28. AN/APM-123 Test Set	CODE A/B	B	Press the PRESS TO TEST switch.	REJECT indicator lights.
29. AN/APM-123 Test Set	CODE A/B	A	• • •	• • •

RADIATED TEST AN/APM-123 – CONTINUED

COMPONENT	CONTROL	SETTING	ACTION	RESULT
29. Continued	VER BIT/1	1	Press the PRESS TO TEST switch.	ACCEPT indicator lights.
30. AN/APM-123 Test Set	VER BIT/1 VER BIT/2	OFF 2	Press the PRESS TO TEST switch.	REJECT indicator lights.
31. AN/APM-123 Test Set	VER BIT/2 ISLS	OFF ON	Press the PRESS TO TEST switch.	REJECT indicator lights.
32. AN/APM-123 Test Set	ISLS	OFF	• • •	• • •

NOTE: The IFF CODE HOLD switch and IFF CODE HOLD light are located in various places in different fixed landing gear aircraft. Check that CODE HOLD switch is set to the ON position and CODE HOLD indicator is lit. On retractable landing gear aircraft, check that Landing Gear Interlock Switch is activated.

33. Transponder	CODE	HOLD	Place CODE switch in HOLD position briefly and then release. Wait 15 seconds.	• • •
34. Transponder	MASTER	OFF	Wait 15 seconds.	• • •
35. Transponder	MASTER	STBY	Wait 30 seconds for equipment warmup.	• • •
36. Transponder	MASTER	NORMAL	• • •	• • •
NOTE: On aircraft with fixed landing gear, set CODE HOLD switch to OFF position. To insure that KIT-1A/TSEC will zeroize when power is removed, the CODE HOLD switch must always be in the OFF position unless test or flight procedures require that IFF be in a CODE HOLD status.				
37. AN/APM-123 Test Set	PRESS TO TEST	• • •	Press the PRESS TO TEST switch.	ACCEPT indicator lights.
38. Transponder	CODE AUDIO/OUT/ LIGHT	ZERO AUDIO	• • •	• • •

RADIATED TEST AN/APM-123 – CONTINUED

COMPONENT	CONTROL	SETTING	ACTION	RESULT
39. AN/APM-123 Test Set	PRESS TO TEST	LOCK	• • •	REJECT indicator lights. Tone is heard in headset. IFF CAUTION indicator will light on instrument panel.
NOTE: Step 40 will only be performed if the aircraft is to go on operational status.				
40. KIT-1A/TSEC	• • •	• • •	Using KIK-18/TSEC, key KIT-1A/TSEC computer and close access door, see page 68.	• • •
41. AN/APM-123 Test Set	PRESS TO TEST		Release PRESS TO TEST switch from LOCK position.	Power indicator switches off.

	POWER switch	OFF		
42. KIR-1A/TSEC	• • •	• • •	Press latch to open access door.	Computer zeroizes.

RADIATED TEST AN/APM-378

COMPONENT	CONTROL	SETTING	ACTION	RESULT
1. AN/APM-378 Test Set	• • •	• • •	Locate the test set approximately 50 feet from the aircraft IFF antenna(s).	• • •
WARNING: Unscrew the relief valve on the AN/APM-378 two turns to release internal pressure. Failure to depressurize the unit may allow the cover to spring upwards when opened, injuring personnel.				
2. AN/APM-378 Test Set	• • •	• • •	Unlatch and remove cover. Raise test set above ground level by latching the case to the inverted cover.	• • •

RADIATED TEST AN/APM-378 – CONTINUED

COMPONENT	CONTROL	SETTING	ACTION	RESULT
2. Continued			Connect test set antenna to RADIATED TEST ANTENNA receptacle on test set with cable provided.	
NOTE: When testing an AN/APX-72-equipped IFF, set SYSTEM TYPE switch on AN/APM-378 to SINGLE CHANNEL position. When using a diversity antenna to test an AN/APX-100-equipped IFF, set SYSTEM TYPE switch on AN/APM-378 to DIVERSITY position. When a diversity antenna is not available, SYSTEM TYPE switch must be set to SINGLE CHANNEL position.				
3. AN/APM-378 Test Set	• • •	• • •	Position the test set antenna by pointing the arrow painted on the antenna at the aircraft IFF Antenna(s). Connect KIR-1A/TSEC to MODE 4 receptacle on test set using cable provided with test set.	• • •

CAUTION: Type of power source (ac or dc) used for AN/APM-378 is determined by power requirements of associated KIR-1A/TSEC being used for MODE 4 tests. Computer power supply Z-ACA/1 requires ac power and Z-ACB/1 utilizes dc power. When connecting dc cable to battery, make certain clip with red insulator is attached to positive (+) terminal.				
4. AN/APM-378 Test Set	• • •	• • •	Connect test set to power source using appropriate cable supplied.	• • •
5. AN/APM-378 Test Set	POWER	ON	Set appropriate POWER switch to ON position.	POWER indicator lights. ZEROIZE indicator lights.
6. AN/APM-378/ KIR-1A/TSEC	• • •	• • •	Key computer. See keying the Cryptographic Equipment, page 64.	Test set ZEROIZE indicator switches off.
7. AN/APM-378 Test Set	FUNCTION	LAMP TEST	• • •	REJECT, ACCEPT, and CODE ZEROIZE indicators light.

RADIATED TEST AN/APM-378 – CONTINUED

COMPONENT	CONTROL	SETTING	ACTION	RESULT
8. AN/APM-378 Test Set	FUNCTION	SELF TEST	Hold TEST switch in MOM position.	ACCEPT indicator lights.
9. AN/APM-378 Test Set	FUNCTION MODE REFERENCE CODE	SYSTEM Match transponder Match transponder	• • •	• • •
NOTE: Mode and code settings on AN/APM-378 test set must duplicate settings on transponder controls during test procedures. Do not perform any tests with the Mode 3/A code selector switches set to 7400, 7600, or 7700. Do not set MASTER control to EMER position.				
10. AN/APM-378 Test Set	TEST	MOM	Hold TEST switch in MOM position.	ACCEPT indicator lights.
11. AN/APM-378 Test Set	SLS	MOM	Hold SLS switch in MOM position.	ACCEPT indicator lights.

12. Transponder	MASTER	STBY for one minute, then NORM		
	MODE 1 code selector	00		
	MODE 2 code selector	0000		
	MODE 3/A code selector	0000	• • •	• • •
	M-1	ON		
	M-2	ON		
	M-3/A	ON		
	M-C	ON		
	Mode 4	OUT		
	IDENT/OUT/ MIC	OUT		

NOTE: When testing the AN/APX-100 transponder, set ANT switch to the DIV position.

RADIATED TEST AN/APM-378 – CONTINUED

COMPONENT	CONTROL	SETTING	ACTION	RESULT
13. AN/APM-378 Test Set	REFERENCE CODE MODE TEST	0000 1 ON	• • •	ACCEPT indicator lights.
14. AN/APM-378 Test Set	MODE	2	• • •	ACCEPT indicator lights.
15. AN/APM-378 Test Set	MODE	3/A	• • •	ACCEPT indicator lights.
NOTE: When the FUNCTION switch on the AN/APM-378 test set is in the FREQ/PWR position, the REFERENCE CODE switches are disabled.				
16. AN/APM-378 Test Set	FUNCTION MODE	FREQ/PWR 1	• • •	ACCEPT indicator lights.
17. AN/APM-378 Test Set	MODE	2	• • •	ACCEPT indicator lights.

18. AN/APM-378 Test Set	MODE	3/A	• • •	ACCEPT indicator lights.
19. AN/APM-378 Test Set	MODE	C	• • •	ACCEPT indicator lights.
20. AN/APM-378 Test Set	SLS MODE	MOM 1	Hold SLS switch in MOM position.	ACCEPT indicator lights.
21. AN/APM-378 Test Set	SLS MODE 2	MOM 2	Hold SLS switch in MOM position.	ACCEPT indicator lights.
22. AN/APM-378 Test Set	SLS MODE	MOM 3/A	Hold SLS switch in MOM position.	ACCEPT indicator lights.
23. AN/APM-378 Test Set	SLS MODE	MOM C	Hold SLS switch in MOM position.	ACCEPT indicator lights.

RADIATED TEST AN/APM-378 – CONTINUED

COMPONENT	CONTROL	SETTING	ACTION	RESULT
NOTE: Avoid setting any of the emergency codes while changing code settings in the following steps.				
24. Transponder	MODE 1 code selectors	73	• • •	• • •
25. AN/APM-378 Test Set	REFERENCE CODE MODE FUNCTION	7300 1 SYSTEM	• • •	ACCEPT indicator lights.
26. Transponder	MODE 2 code selectors MODE 3/A code selectors	7777 7777	• • •	• • •

27. AN/APM-378 Test Set	REFERENCE CODE MODE	7777 2	• • •	ACCEPT indicator lights.
28. AN/APM-378 Test Set	MODE	3/A	• • •	ACCEPT indicator lights.
29. AN/APM-378 Test Set	SLS	MOM	Hold SLS switch in MOM position.	ACCEPT indicator lights.
30. AN/APM-378 Test Set	MODE SLS	2 MOM	Hold SLS switch in MOM position.	ACCEPT indicator lights.
31. AN/APM-378 Test Set	MODE	TEST	• • •	• • •
32. Transponder	RAD TEST/ OUT	OUT	• • •	REJECT indicator lights.
33. Transponder	RAD TEST/ OUT	RAD TEST	Hold RAD TEST/OUT switch in RAD position.	ACCEPT indicator lights.

RADIATED TEST AN/APM-378 – CONTINUED

COMPONENT	CONTROL	SETTING	ACTION	RESULT
34. Transponder	MODE 1 code selectors	00	• • •	• • •
	MODE 2 code selectors	0000		
	MODE 3/A code selectors	0000		
35. AN/APM-378 Test Set	REFERENCE CODE	0000	• • •	• • •
36. Transponder	M-1	ON	• • •	• • •
	M-2	ON		
	M-3/A	ON		
	M-C	ON		
37. AN/APM-378 Test Set	FUNCTION	I/P	• • •	• • •
	MODE	1		

38. Transponder	IDENT/OUT/ MIC	IDENT	Hold IDENT/OUT/MIC switch in IDENT position.	ACCEPT indicator lights for 15 to 30 seconds.
39. AN/APM-378 Test Set	MODE	2	• • •	• • •
40. Transponder	IDENT/OUT/ MIC	IDENT	Hold IDENT/OUT/MIC switch in IDENT position.	ACCEPT indicator lights for 15 to 30 seconds.
41. AN/APM-378 Test Set	MODE	3/A	• • •	• • •
42. Transponder	IDENT/OUT/ MIC	IDENT	Hold IDENT/OUT/MIC switch in IDENT position.	ACCEPT indicator lights for 15 to 30 seconds.
43. AN/APM-378 Test Set	FUNCTION MODE	SYSTEM 4	• • •	• • •

RADIATED TEST AN/APM-378 – CONTINUED

COMPONENT	CONTROL	SETTING	ACTION	RESULT
44. KIT-1A/TSEC	• • •	• • •	Using KIK-18/TSEC, key KIT-1A/TSEC computer and close access door.	Test set REJECT indicator lights. No tone will be heard in headset. IFF CAUTION indicator on instrument panel lights.
45. Transponder	MODE 4 CODE	ON A or B	• • •	• • •
46. AN/APM-378 Test Set	CODE A/B	A or B	Set CODE A/B switch to correspond with setting of CODE switch on transponder.	ACCEPT indicator lights.

	VER BIT 1 TEST	OFF MOM	Hold TEST switch in MOM position.	
NOTE:	**When testing an AN/APX-100-equipped IFF, do the remaining steps in sequence. When testing an AN/APX-72-equipped IFF, omit steps 47, 48, and 49 and proceed directly to step 50.**			
47. Aircraft	• • •	• • •	Connect headset to aircraft intercom system.	• • •
48. AN/APM-378 Test Set	CODE A/B	A or B	Set CODE A/B switch to code setting opposite from transponder CODE switch setting. Hold TEST switch in MOM position.	REJECT indicator lights. Tone is heard in headset.
49. AN/APM-378 Test Set	CODE A/B	A or B	Set CODE A/B switch to correspond with setting of CODE switch on transponder.	• • •
50. AN/APM-378 Test Set	VER BIT 1	ON	• • •	• • •

RADIATED TEST AN/APM-378 – CONTINUED

COMPONENT	CONTROL	SETTING	ACTION	RESULT
51. Transponder	RAD TEST/ OUT	RAD TEST	Hold RAD TEST/OUT switch in RAD TEST position.	• • •
52. AN/APM-378 Test Set	TEST	MOM	Hold TEST switch in MOM position.	ACCEPT indicator lights.
53. AN/APM-378 Test Set	POWER	OFF	• • •	POWER indicator lamp switches off.
54. KIR-1A/TSEC and KIT-1A/TSEC	• • •	• • •	Press latch and open access door on each computer.	Both computers zeroize.

APPENDIX A - REFERENCES

SCOPE

The following is a list of pamphlets, forms, service bulletins, and technical manuals referenced in or related to this manual.

PAMPHLETS

Consolidated Index of Army Publication . . . . . DA PAM 310-1

(C)Index of COMSEC Publications . . . . . DA PAM 310-9(U)

The Army Maintenance Management System (TAMMS) DAPAM738-750

FORMS

Recommended Changes to Publications and Blank Forms . . . . . DA FORM2028

Discrepancy in Shipment Report (DISREP) SF-361

Report of Discrepancy (ROD) SF-364

Quality Deficiency Report SF-368

SERVICE BULLETINS

Field Instructions for Painting and Preserving Electronics Command Equipment TB746-10

TECHNICAL MANUALS

(C) Operating Instructions for KI-1A/TSEC (U) KAC-75D/TSEC

TECHNICAL MANUALS - CONTINUED

(C) Maintenance Manual for KIT-1A/TSEC (U) KAM-224A/TSEC

(C) Limited Maintenance Manual for KIR-1A/TSEC and KIT-1A/TSEC (U) KAM-225D/TSEC

Operator's, Organizational, Direct Support, and General Support Maintenance Manual (including Repair Parts and Special Tools List) for Transponder Set, Test Set, AN/APM-378 (NSN 4920-00-134-1533) . . . . . TM 11-4920-296-14&P

Organizational, Field, Intermediate, Direct Support, General Support, and Depot Maintenance with Illustrated Parts Breakdown for Control, Transponder Set, C-6280 (P)/APX, C-6280A(P)/APX, C-6717/APX and C-7483/APX . . . . . TM 11-5841-268-25

Organizational Maintenance Manual for Receiver-Transmitters, Radio, RT-859/APX-72 (NSN 5895-00-089-7179) and RT-859A/APX-72 (5895-00-160-2198) and Mountings, MT-3809/APX-72 (5895-00-063-9498) and MT-3948/APX-72 (5895-00-089-9202) . . . . . TM 11-5895-490-20

Operator's and Organizational Maintenance Manual: Transponder Set, AN/APX-100(V) . . . . . TM 11-5895-1037-12

Operator and Organizational Maintenance Manual,Test Sets,TransponderAN/APM-123(V)l (FSN 6625-948-0071), AN/APM-123(V)2 (6625-948-0077) and AN/APM-123(V)3 (6625-948-0076) TM11-6625-667-12

Organizational Intermediate and Depot Maintenance Instructions with Illustrated Parts Breakdown, Test Set, Transponder SetTS-1843B/APX TM11-6625-1646-24-1

Orgánlzatlonal/intermediate Maintenance with Depot Overhaul Instructions and Illustrated Parts Breakdown. Transponder Set Test Set TS-1843A/APX TM11-6625-1646-25

Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command) TM750-244-2

NOTES

APPENDIX B - EQUIPMENT TECHNICAL SPECIFICATIONS

RECEIVER – TRANSMITTER, RADIO RT-859/APX-72

Number of modules	26
Number of silicon diodes	311
Number of Transistors	196
Range	Line-of-sight
Response	Limited by interrogation rate and internal limiting action.
Power requirements	28 vdc, 70 watts maximum or 28 vdc, 8.4 watts and 115 vac, 95 va maximum, 360-440 Hz.
Power source	28 vdc source or 28 vdc and 115 vac source.
Operating temperature range	-65 to 203°F (-54 to + 95°C)
Warmup time	One minute maximum, standard conditions. Two minute maximum extreme service conditions.
Pressurization	5 psig at sea level (can operate unpressurized to 30,000 feet (9150 meters)).

Receiver

Type of signal received	Pulsed radio frequency.
Frequency	1030 ± 0.5 MHZ.
Bandwidth	Minimum 7 MHz at 6 db point. Maximum ± 25 MHz at 60 db point.
Frequency stability	± 1.5 MHz maximum for a period of at least 500 hours.
Sensitivity:	
Normal triggering level	Between 69 and 77 db below 1 mW.

Receiver - Continued

Sensitivity:	
Normal triggering level	Between 69 and 77 db below 1 mW.
Low triggering level	Between 52 and 67 db below 1 mW.
Random triggering rate	Maximum of five replies per second averaged over a one minute period.
Triggering bandwidth	± 2.5 MHz at 3 db points.

Transmitter

Type of signal transmitted	Pulsed radio frequency.
Frequency	1090 ± 0.5 MHZ.
Frequency stability	± 3 MHz maximum drift.
Peak power output	500 W ± 3 db.
Duty cycle	1.1 percent maximum.
Delay	3.5 ± 5 µs between the leading edge of the second interrogation pulse to the leading edge of the first reply pulse.
Spurious responses	Maximum of 60 db down from the amplitude of transmitted pulse.

AN/APX-100(V) RECEIVER - TRANSMITTERS

Input power, dc	MIL-STD-704, 28 vdc Category B (21 to 29 volts) 32 watts (nominal) 50 watts (maximum).

AN/APX-100(V) RECEIVER - TRANSMITTERS -CONTINUED

Input power ac	None, except to provide ac power as required for computer.

Receivers:

Center frequency	1030 ± 0.5 MHz
Bandwidth (6 db)	7-10 MHz
Sensitivity	-77 ± 3 dbm
Channel difference	1.0 db maximum

Transmitter:

Frequency	1090 ± 0.5 MHz
Peak power	500W±3db
Duty cycle	1.1%maximum
Spurious	60 db minimum down from main pulse.

RECEIVER -TRANSMITTERS RT-1284, RT-1285, RT-1286, AND RT-1296/APX-100(V)

Physical Dimensions:

Weight	8.5 lb (3.85 kg)
Height	5.25 in. (13.33 cm)
Width	5.75 in. (14.6 cm)
Length (overall)	8.25 in. (20.95 cm)

RECEIVER-TRANSMITTERS RT-1284, RT-1285, RT-1286, AND RT-1296/APX-100(V)- CONTINUED

Receiver-transmitter RT-1157/APX-100(V)

Weight	10.0 lb (4.5 kg)
Height	5.37 in. (13.63 cm)
Width	5.37 in. (13.63 cm)
Length (overall)	10.25 in. (26,03 cm)

Mounting **Base, Electrical Equipment MT-4811/APX-100(v)**

Weight	1 lb (.45 kg)
Height	1.25 in. (3.1 7 cm)
Width	6 in. (15.24 cm)
Length (overall)	10.625 in. (26.98 cm)

TRANSPONDER SET TEST SET AN/APM-378

Physical Dimensions:

Weight	29 lb(13.16 kg)
Height	12 in. (30.48 cm)
Width	10.38 in. (26.36 cm)
Length	14.13 in. (35.89 cm)
Volume	1.4 cu ft (.45 cu meters)
Power requirements	115 vat, 60 or 400 Hz at 0.4A 28 vdc at 1.0A
Environmental limitations	-40 to 166.1 “F (-40 to +71 “C) (operating) -79 to 185°F (-62 to + 85°C) (storage)

Test set functions	Lamp Test, Self-Test, System, Frequency/ Power, Emergency and I/P.
Transponder modes checked by test set	Mode 1,2, 3/A, C, (with or without SP1 pulse), Test, and 4. (KIR-1 A interrogator computer required for Mode 4 test).
Input pulse signals required by test set (Mode 4 only)	Mode 4 Video Interrogation Word, SLS Pulse, GTC Pulse. and TDV Pulse.
Output pulse signals produced by test set	Mode 4 Pretrigger and Reply video.

Transmitter:

output	1030 ± 0.2 MHz, -6 dbm ± 1 db
Stability	± 3db
Duty cycle	1 %

Receiver:

	7.0 ± 1 MHz (-3 db points)
	-6 dbm ± 1 db
Sensitivity stability	± 3 db

Antenna:

Horizontal beamwidth	40° to 80° (3 db points)
Vertical beamwidth	5° to + 500(amplitude variation less than 6 db)

Interrogation rate 257 ± 5 Hz

Interrogation pulses:

Mode	Pulse Width	Spacing
1	**0.7–0.9** µs	**3 ± 0.2** µs
2	**0.7–0.9 µs**	**5 ± 0.2µs**
3/A	0.7–0.9µs	8 ± 0.2 µs
c	**0.7–0.9** µs	**21 ± 0.2** µs
TEST	0.7–0.9 µs	6.5 ± 0.2 µs
4	**0.7-0.9** µs	Mode 4 spacing

Raply Pulses - Analysis Capability:

Pulse spacing (from correct nominal)	± 0.15 µs– ACCEPT ± 0.3— REJECT
Mode 3 SPI	(With or without F3 pulse)
Side lobe suppression	SLS control pulse alternates between O and 11 ± 1.5 db below level of interrogation pulses.
Control pulse spacing	2 ± 0.15 µs from P1 pulse, for any mode.
Mode 4	8 ± 1.5 µs after the first pulse. ACCEPT indication for correct replies to greater than 80% or 40% of interrogations.

TRANSPONDER SET TEST SET AN/APM-378 -CONTINUED

SIF and I/P:

I / P	**Mode C, with or without SIF pulse.**
I/P	**Mode 1,2, 3/A, TEST (SIF Modes).**

Emergency/Frequency/Power Checks:

Frequency	**1090 ± 3 MHz, ACCEPT 1086 MHz and less or 1094 MHz and more, REJECT.**
Power	**-6 dbm ±1 db, ACCEPT.**
Self-test	**Checks test set circuits for all modes of operation.**

KI-1A CRYPTOGRAPHIC EQUIPMENT

Physical Dimensions:

KIK-18	
Weight	**12.6 lb (5.72 kg)**
Height	**6.75 in. (17.14 cm)**
Width	**4.50 in. (11 .43 cm)**
Length	**8.87 in. (22.52 cm)**

KIR-1A(including power supply)

Height	**6.75 in. (17.14 cm)**
Width	**5. in. (11 .2 cm)**
Length	**10.06 in. (25.55 cm)**

Physical Dimensions - Continued:

KIT-1A (including power supply)

Weight	10.8 lb (4.9 kg)
Height	6.75 in. (17.14 cm)
Width	5. in. (11.2 cm)
Length	10.06 in. (25.55 cm)

Computer Power Requirements:

AC power supply	103.5 to 126.5 vac, 47-440 Hz, 35 **Watts** maximum.
DC power supply	21 to 30 vdc, 35 watts maximum.

INDEX

Page

A

I - CONTINUED

Page

K

L

M

N

O

P

Page

P - CONTINUED

R

S

T

X

Z

By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Major General, United States Army
The Adjutant General

DISTRIBUTION:

To be distributed in accordance with DA form 12-43, Operational Maintenance requirements for TSEC/K1-1A-242; and DA Form 12-36B, Operational Crew Maintenance requirements for AN/APX-100.

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