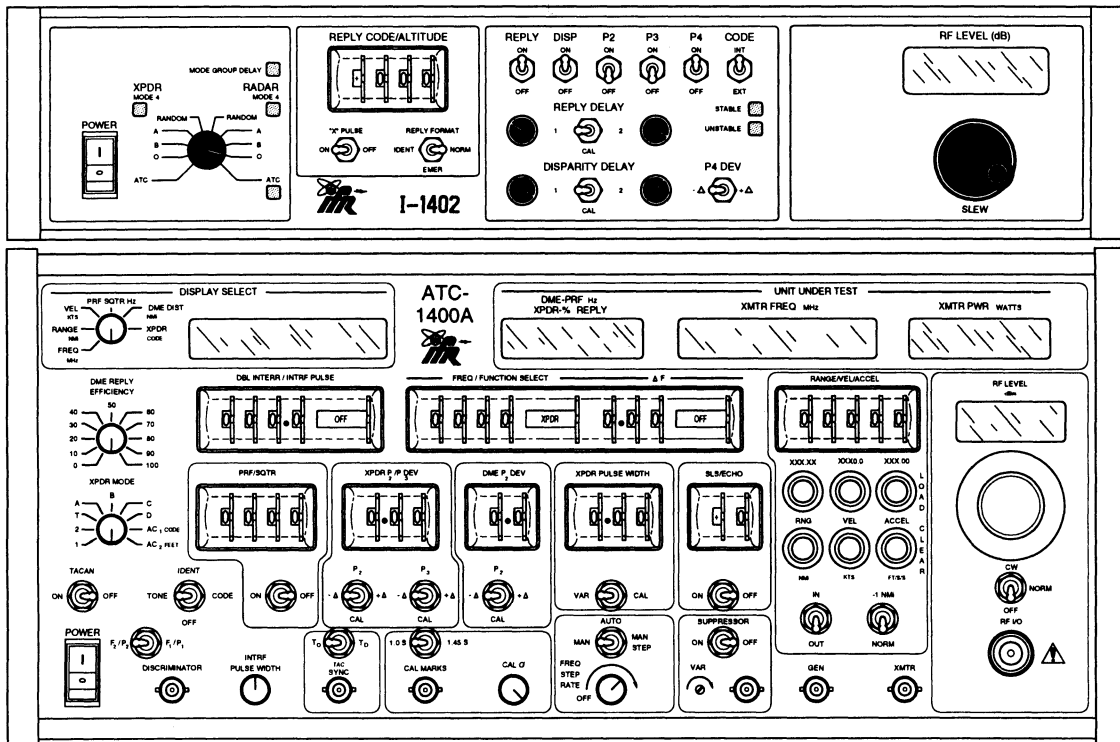




OPERATION MANUAL

MODE 4 TEST SYSTEM



10200 West York Street / Wichita, Kansas 67215 U.S.A. / (316) 522-4981 / FAX (316) 524-2623

1002-6704-200
SAFE1



OPERATION MANUAL
MODE 4 TEST SYSTEM

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OPERATION MANUAL MODE 4 TEST SYSTEM

Cable Statement:

For continued EMC compliance, double shielded and properly terminated external interface cables must be used with this equipment when interfacing with the TEST, IFR BUS and/or AUX BUS Connectors.

Test System Statement:

For continued EMC compliance, the Mode 4 Test System requires an I-1402-2 Test Auxiliary correctly mated with an ATC-1400A-1 or ATC-1400A-2.

For continued Safety compliance, the Mode 4 Test System requires an I-1402-2 Test Auxiliary correctly mated with an ATC-1400A-2.

Nomenclature Statements:

The I-1402-2 Test Auxiliary is the official nomenclature for the EMC and Safety compliant I-1402 Test Auxiliary. In this manual the I-1402, I-1402 Test Auxiliary or Test Auxiliary refers to the I-1402-2 Test Auxiliary. The generic terms unit and Test Set also refer to the I-1402-2 Test Auxiliary.

The ATC-1400A-1 Transponder/DME Test Set is the official nomenclature for the EMC Compliant ATC-1400A Transponder/DME Test Set. The ATC-1400A-2 Transponder/DME Test Set is the official nomenclature for the EMC and Safety compliant ATC-1400A Transponder/DME Test Set. In this manual the ATC-1400A, ATC-1400A Transponder/DME Test Set or ATC-1400A Test Set refers to the ATC-1400A-1 or ATC-1400A-2 Transponder/DME Test Set.



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OPERATION MANUAL MODE 4 TEST SYSTEM

SAFETY FIRST: TO ALL OPERATIONS PERSONNEL

REFER ALL SERVICING OF UNIT TO QUALIFIED TECHNICAL PERSONNEL. this unit contains no operator serviceable parts.

CASE, COVER OR PANEL REMOVAL

Removing protective covers, casings or panels from this Test Set exposes the operator to electrical hazards that can result in electrical shock or equipment damage. Do not operate this Test Set with the case, cover or panels removed.

SAFETY IDENTIFICATION IN TECHNICAL MANUAL

This manual uses the following terms to draw attention to possible safety hazards, that may exist when operating this equipment.

CAUTION: THIS TERM IDENTIFIES CONDITIONS OR ACTIVITIES THAT, IF IGNORED, CAN RESULT IN EQUIPMENT OR PROPERTY DAMAGE (E.G., FIRE).

WARNING: THIS TERM IDENTIFIES CONDITIONS OR ACTIVITIES THAT, IF IGNORED, CAN RESULT IN PERSONAL INJURY OR DEATH.

SAFETY SYMBOLS IN MANUALS AND ON UNITS



CAUTION: Refer to accompanying documents.



AC OR DC TERMINAL: Terminal that may supply or be supplied with ac or dc voltage.



DC TERMINAL: Terminal that may supply or be supplied with dc voltage.



AC TERMINAL: Terminal that may supply or be supplied with ac or alternating voltage.



SWITCH OFF: AC line power to the device is OFF.



SWITCH ON: AC line power to the device is ON.

EQUIPMENT GROUNDING PRECAUTION

Improper grounding of equipment can result in electrical shock.

USE OF PROBES

Check the specifications for the maximum voltage, current and power ratings of any connector on the Test Set before connecting it with a probe from a terminal device. Be sure the terminal device performs within these specifications before using it for measurement, to prevent electrical shock or damage to the equipment.

POWER CORDS

Power cords must not be frayed, broken nor expose bare wiring when operating this equipment.

USE RECOMMENDED FUSES ONLY

Use only fuses specifically recommended for the equipment at the specified current and voltage ratings.

INTERNAL BATTERY

This unit contains a Lithium Battery, serviceable only by a qualified technician.

CAUTION: SIGNAL GENERATORS CAN BE A SOURCE OF ELECTROMAGNETIC INTERFERENCE (EMI) TO COMMUNICATION RECEIVERS. SOME TRANSMITTED SIGNALS CAN CAUSE DISRUPTION AND INTERFERENCE TO COMMUNICATION SERVICES OUT TO A DISTANCE OF SEVERAL MILES. USERS OF THIS EQUIPMENT SHOULD SCRUTINIZE ANY OPERATION THAT RESULTS IN RADIATION OF A SIGNAL (DIRECTLY OR INDIRECTLY) AND SHOULD TAKE NECESSARY PRECAUTIONS TO AVOID POTENTIAL COMMUNICATION INTERFERENCE PROBLEMS.



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OPERATION MANUAL MODE 4 TEST SYSTEM

INTRODUCTION - MODE 4 TEST SYSTEM

This manual contains the information necessary to install and operate the Mode 4 Test System. It is designed to be used in conjunction with the ATC-1400A Operation Manual. The I-1402 Test Auxiliary, when interfaced with the ATC-1400A Transponder/DME Test Set, forms the Mode 4 Test System. The additional GPIB commands required for both ATC and Mode 4 testing, are listed in Section 1-2-4 of this manual.

It is strongly recommended that personnel be thoroughly familiar with the contents of this manual, along with contents of the ATC-1400A Operation Manual, before attempting to operate this equipment.

ORGANIZATION

This manual is divided into the following Chapters and Sections:

CHAPTER 1 - OPERATION

Section 1 - DESCRIPTION (physical description of the I-1402)

Section 2 - OPERATION (installation; description of controls, connectors and indicators; general operating procedures and remote operation)

Section 3 - SPECIFICATIONS

Section 4 - SHIPPING

Section 5 - STORAGE



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SECTION 1 - DESCRIPTION

1. GENERAL DESCRIPTION AND CAPABILITIES

1.1 DESCRIPTION

The I-1402 Test Auxiliary provides additional pulse code modulation when interfaced with the ATC-1400A Transponder/DME Test Set, for the purpose of testing both ATC and Mode 4 Transponders, as well as Radar Interrogators in ATC modes A, C and 4. The Mode 4 Test System can be operated manually using front panel controls and switches, or remotely by ATE (Automatic Test Equipment) control through the GPIB (General Purpose Interface Bus).

All necessary test signals and their variations are generated within the I-1402 and ATC-1400A Test Sets. Only an oscilloscope is required as peripheral equipment.

1.2 FUNCTIONAL CAPABILITIES

The I-1402 Test Auxiliary monitors all inputs in a round robin fashion, including the IFR BUS input; processes this information, and sends output to all devices, including the IFR BUS output.

A vernier control provides 0.1 dB steps in all modes. An encoder with octal thumbwheels provides reply pulses to drive a modulator.

The I-1402 Test Auxiliary, when interfaced with the ATC-1400A Transponder/DME Test Set, performs the following test functions:

- XPDR ATC Test Function
- XPDR Mode 4 Test Function (Internal)
(For use without encryption devices)
- XPDR Mode 4 Test Function (External)
(For use with KIR Encryption Device for Test Set and KIT Encryption Device for Transponder UUT)
- Radar ATC Test Function
- Radar Mode 4 Test Function (Internal)
(For use without encryption devices)
- Radar Mode 4 Test Function (External)
(For use with KIT Encryption Device for Test Set and KIR Encryption Device for Radar UUT)



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SECTION 2 - OPERATION

1. INSTALLATION

1.1 GENERAL

The Mode 4 Test System is a bench test set requiring continuous ac power to operate. Installation of the Mode 4 Test System includes connecting the I-1402 Test Auxiliary with the ATC-1400A Transponder/DME Test Set, powering up the system and accomplishing an installation calibration.

1.2 SAFETY PRECAUTIONS

The following safety precautions must be observed during installation and operation. IFR Systems, Inc. assumes no liability for failure to comply with any safety precaution outlined in this manual.

1.2.1 Complying with Instructions

Installation/operating personnel should not attempt to install or operate the Mode 4 Test System without reading and complying with instructions contained in this manual. All procedures contained in this manual must be performed in exact sequence and manner described.

1.2.2 Grounding Equipment and Power Cord

WARNING: ALL EQUIPMENT CHASSIS CABINETS MUST BE CONNECTED TO AN ELECTRICAL GROUND TO MINIMIZE SHOCK HAZARD.

WARNING: DO NOT USE A THREE-PRONG TO TWO-PRONG ADAPTER PLUG. DOING SO CREATES A SHOCK HAZARD BETWEEN THE CHASSIS AND ELECTRICAL GROUND.

The power cord, equipped with standard three-prong plug, must be connected to a properly grounded three-prong receptacle. It is the customer's responsibility to:

- Have a qualified electrician check receptacle(s) for proper grounding.
- Replace any standard two-prong receptacle(s) with properly grounded three-prong receptacle(s).

1.2.3 Operating Safety

Due to potential for electrical shock within test equipment, Test Set covers should not be removed. Component replacement and internal adjustments must be performed only by qualified service personnel.

1.2.4 CAUTION and WARNING Labels

Exercise extreme care when performing operations preceded by a CAUTION or WARNING label. CAUTION labels appear where possibility of damage to equipment exists. WARNING labels denote conditions where bodily injury or death may result.



1.3 POWER REQUIREMENTS

The Mode 4 Test System operates over a voltage range of 100 to 120 VAC at 60 Hz or 220 to 240 VAC at 50 Hz. No internal wiring changes are required before applying ac power to the Test Auxiliary. The VOLTAGE SELECT Switch setting on I-1402 rear panel must match the input line voltage. Instantaneous surge current at power up is ≤ 50 A. The specified fuse ratings are listed in 1-2-1, Table 1.

CAUTION: FOR CONTINUOUS PROTECTION AGAINST FIRE, REPLACE ONLY WITH FUSE OF THE SPECIFIED VOLTAGE AND CURRENT RATINGS.

INPUT VOLTAGE	F1 AND F3 AC IN FUSES	F2 AND F4 LINE SUPPLY FUSES
100 to 120 VAC	3.0 A, 250 V Fast Blo (IFR PN: 5106-0300-600) (Bussman AGC3)	1.0 A, 250 V Fast Blo (Type F) (IFR PN: 5106-4501-000) (Bussman AGC1)
220 to 240 VAC	3.0 A, 250 V Fast Blo (IFR PN: 5106-0300-600) (Bussman AGC3)	0.5 A, 250 V Fast Blo (Type F) (IFR PN: 5106-0000-016) (Bussman AGC1/2)

Specified Fuse Ratings
Table 1

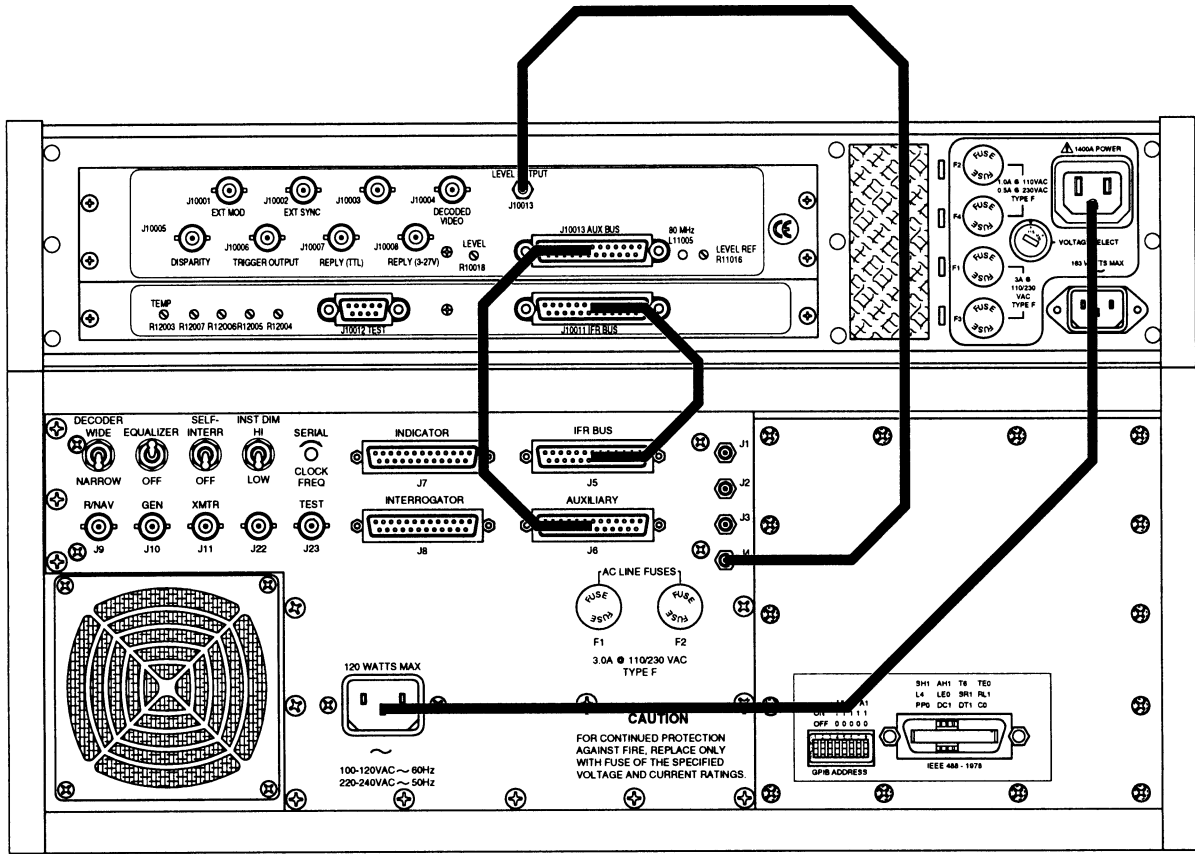
1.4 INSTALLATION PROCEDURE

Refer to 1-2-1, Figure 1.

STEP	PROCEDURE
1.	Place the ATC-1400A on the bench.
2.	Place the I-1402 on top of the ATC-1400A.
3.	Connect two 25-Pin D style ribbon cables: <ul style="list-style-type: none"> ● One to the I-1402 IFR BUS Connector (J10011) and ATC-1400A IFR BUS Connector (J5). ● One to the I-1402 AUX BUS Connector (J10010) and ATC-1400A AUXILIARY Connector (J6).
4.	Connect SMB-to-SMB coaxial cable to the I-1402 RF LVL Connector (J10013) and ATC-1400A RF LEVEL INPUT Connector (J4).
5.	Connect ac power cable to the I-1402 1400A POWER Connector and ATC-1400A AC INPUT Connector.
6.	Perform Power-up Procedure according to 1.5 of 1-2-1.
7.	Calibrate the Mode 4 Test System according to the Installation Calibration procedure (1.6 in 1-2-1). Perform the Installation Calibration procedure any time the I-1402 or ATC-1400A is replaced.



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I-1402 to ATC-1400A Interconnections
Figure 1

The Mode 4 Test System can be installed in either bench-top or rack-mount fashion. All IFR Systems, Inc., test sets are normally shipped from the factory with plastic feet installed for bench-top installation. Installation kits are listed in 1-2-1, Table 2.

CAUTION: AVOID RESTRICTION OF AIR FLOW TO INTAKE VENT. WHEN OPERATING IN THE NORMAL HORIZONTAL POSITION, MAINTAIN AT LEAST TWO INCHES (FIVE CENTIMETERS) OF CLEARANCE BETWEEN THE FAN SIDE OF THE EQUIPMENT AND OBJECTS OR WALLS. IF OPERATING IN A RACK, MAXIMUM AMBIENT TEMPERATURE MUST BE AT OR BELOW 40° C.

KIT	INSTRUMENT	IFR SYSTEMS PART NUMBER
Rack-Mount	ATC-1400A I-1402	7001-7636-800 7001-6740-800
Bench-Top/ Stack-Mount	ATC-1400A I-1402	7005-6743-000 One kit required per Mode 4 Test System

Installation Kits
Table 2



1.5 POWER-UP PROCEDURE

The Mode 4 Test System is configured for one-touch power control. When the ATC-1400A POWER Switch is **ON (I)**, the I-1402 POWER Switch controls power to the I-1402 Test Auxiliary and ATC-1400A Transponder/DME Test Set.

STEP	PROCEDURE
1.	After performing Installation Procedure according to 1.4 in 1-2-1, connect ac power cable to I-1402 AC IN Connector and standard 3-pin grounded power receptacle.
2.	Press ATC-1400A POWER Switch ON (I) .
3.	Press I-1402 POWER Switch ON (I) to energize Test Auxiliary and ATC-1400A.
4.	Verify ATC-1400A Displays illuminate.
5.	Verify I-1402 RF LEVEL (dB) Display illuminates.

1.6 INSTALLATION CALIBRATION

The Mode 4 Test System Installation Calibration requires a calibrated I-1402 connected to a calibrated ATC-1400A according to 1.4 in 1-2-1.

TEST EQUIPMENT: 1 RF Power Meter

STEP	PROCEDURE														
1.	Connect I-1402 to ATC-1400A according to 1.4 in 1-2-1.														
2.	Apply power to Mode 4 Test System according to 1.5 in 1-2-1.														
3.	Set I-1402 as follows:														
	<table border="1"> <thead> <tr> <th>CONTROL</th> <th>SETTING</th> </tr> </thead> <tbody> <tr> <td>REPLY CODE/ALTITUDE Thumbwheels</td> <td>0000</td> </tr> <tr> <td>REPLY ON/OFF Switch</td> <td>ON</td> </tr> <tr> <td>REPLY DELAY Switch</td> <td>CAL</td> </tr> <tr> <td>REPLY FORMAT Switch</td> <td>NORMAL</td> </tr> <tr> <td>"X" PULSE Switch</td> <td>OFF</td> </tr> <tr> <td>MODE SELECT Control</td> <td>XPDR ATC</td> </tr> </tbody> </table>	CONTROL	SETTING	REPLY CODE/ALTITUDE Thumbwheels	0000	REPLY ON/OFF Switch	ON	REPLY DELAY Switch	CAL	REPLY FORMAT Switch	NORMAL	"X" PULSE Switch	OFF	MODE SELECT Control	XPDR ATC
CONTROL	SETTING														
REPLY CODE/ALTITUDE Thumbwheels	0000														
REPLY ON/OFF Switch	ON														
REPLY DELAY Switch	CAL														
REPLY FORMAT Switch	NORMAL														
"X" PULSE Switch	OFF														
MODE SELECT Control	XPDR ATC														

STEP	PROCEDURE																										
4.	Set ATC-1400A as follows:																										
	<table border="1"> <thead> <tr> <th>CONTROL</th> <th>SETTING</th> </tr> </thead> <tbody> <tr> <td>CW/NORM/OFF Switch</td> <td>NORM</td> </tr> <tr> <td>SLS/ECHO ON/OFF Switch</td> <td>OFF</td> </tr> <tr> <td>XPDR DEV P₃/CAL Switch</td> <td>CAL</td> </tr> <tr> <td>XPDR DEV P₂/CAL Switch</td> <td>CAL</td> </tr> <tr> <td>To/TAC/Td Switch</td> <td>To</td> </tr> <tr> <td>PRF/SQTR ON/OFF Switch</td> <td>ON</td> </tr> <tr> <td>XPDR MODE Control</td> <td>A</td> </tr> <tr> <td>DISPLAY SELECT Control</td> <td>PRF/SQTR Hz</td> </tr> <tr> <td>PRF/SQUITTER Thumbwheels</td> <td>1000</td> </tr> <tr> <td>DBL INTERR/INTRF Thumbwheels</td> <td>000.0 OFF</td> </tr> <tr> <td>FREQ/FUNCTION SELECT Thumbwheels</td> <td>1030 XPDR</td> </tr> <tr> <td>RANGE/VEL/ACCEL Thumbwheels</td> <td>0000</td> </tr> </tbody> </table>	CONTROL	SETTING	CW/NORM/OFF Switch	NORM	SLS/ECHO ON/OFF Switch	OFF	XPDR DEV P ₃ /CAL Switch	CAL	XPDR DEV P ₂ /CAL Switch	CAL	To/TAC/Td Switch	To	PRF/SQTR ON/OFF Switch	ON	XPDR MODE Control	A	DISPLAY SELECT Control	PRF/SQTR Hz	PRF/SQUITTER Thumbwheels	1000	DBL INTERR/INTRF Thumbwheels	000.0 OFF	FREQ/FUNCTION SELECT Thumbwheels	1030 XPDR	RANGE/VEL/ACCEL Thumbwheels	0000
CONTROL	SETTING																										
CW/NORM/OFF Switch	NORM																										
SLS/ECHO ON/OFF Switch	OFF																										
XPDR DEV P ₃ /CAL Switch	CAL																										
XPDR DEV P ₂ /CAL Switch	CAL																										
To/TAC/Td Switch	To																										
PRF/SQTR ON/OFF Switch	ON																										
XPDR MODE Control	A																										
DISPLAY SELECT Control	PRF/SQTR Hz																										
PRF/SQUITTER Thumbwheels	1000																										
DBL INTERR/INTRF Thumbwheels	000.0 OFF																										
FREQ/FUNCTION SELECT Thumbwheels	1030 XPDR																										
RANGE/VEL/ACCEL Thumbwheels	0000																										
5.	Set ATC-1400A RF LEVEL Control to read -10 dBm on RF LEVEL -dBm Display.																										
6.	Set ATC-1400A CW/NORM/OFF Switch to CW .																										
7.	Connect RF Power Meter to ATC-1400A RF I/O Connector.																										
8.	Disconnect coaxial cable from I-1402 LEVEL OUTPUT Connector (J10013).																										
9.	Verify RF level on Power Meter is -10 dBm (±2.0 dB). Note RF level for reference.																										
10.	Reconnect coaxial cable to I-1402 LEVEL OUTPUT Connector (J10013).																										
11.	Set I-1402 SLEW Control to read 0.0 dB on RF LEVEL (dB) Display.																										
12.	Adjust I-1402 LEVEL REF Adjust (R11016) until RF Power Meter indicates reference level in Step 9.																										
13.	Set I-1402 SLEW Control to read +3.0 dB on RF LEVEL (dB) Display.																										
14.	Adjust I-1402 LEVEL Adjust (R10018) until RF Power Meter indicates reference level in Step 9 plus 3.0 dB.																										



STEP	PROCEDURE
15.	Adjust I-1402 SLEW Control in 0.1 dB steps from +3.0 dB to -3.0 dB. Verify each corresponding setting is within 0.05 dB of relative reference level.
16.	Set I-1402 SLEW Control to read 0.0 dB on RF LEVEL (dB) Display.
17.	Disconnect coaxial cable from I-1402 LEVEL OUTPUT Connector (J10013).
18.	Verify change in dB displayed on I-1402 RF LEVEL (dB) Display is <0.05 dB.
19.	Reconnect coaxial cable to I-1402 LEVEL OUTPUT Connector (J10013).
20.	Disconnect RF Power Meter from ATC-1400A RF I/O Connector.
21.	Set ATC-1400A CW/NORM/OFF Switch to NORM .

1.7 EXTERNAL CLEANING

The following procedure contains routine instructions for cleaning the outside of the Test Set.

CAUTION: DISCONNECT POWER FROM TEST SET TO AVOID POSSIBLE DAMAGE TO ELECTRONIC CIRCUITS.

STEP	PROCEDURE
1.	Clean front panel, switches and display face with soft lint-free cloth. If dirt is difficult to remove, dampen cloth with water and a mild liquid detergent.
2.	Remove grease, fungus and ground-in dirt from surfaces with soft lint-free cloth dampened (not soaked) with isopropyl alcohol.
3.	Remove dust and dirt from connectors with soft-bristled brush.
4.	Cover connectors, not in use, with suitable dust cover to prevent tarnishing of connector contacts.
5.	Clean cables with soft lint-free cloth.
6.	Paint exposed metal surface to avoid corrosion.



OPERATION MANUAL
MODE 4 TEST SYSTEM

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OPERATION MANUAL
MODE 4 TEST SYSTEM

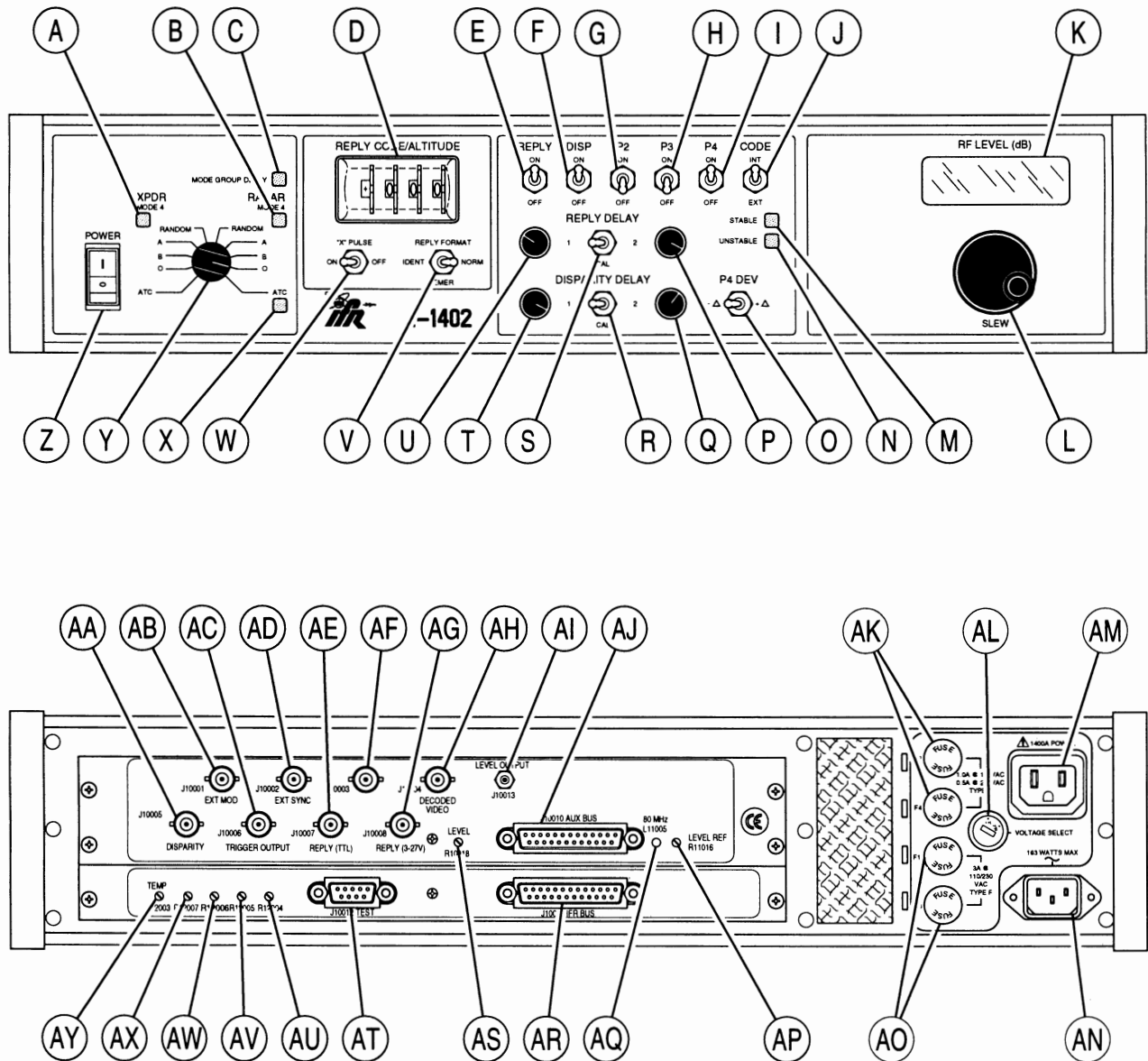
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2. CONTROLS, CONNECTORS, AND INDICATORS

See 1-2-2, Figure 2 to locate all I-1402 controls, connectors and indicators. See 1-2-2, Figure 4 to locate all ATC-1400A controls connectors and indicators.

2.1 I-1402 FRONT AND REAR PANELS



6707002

I-1402 Front and Rear Panels
Figure 2



I-1402 Controls, Connectors and Indicators Location List:

1400A POWER Connector.....	AM	RADAR ATC Indicator.....	X
80 MHz Adjust (L11005)	AQ	RADAR MODE 4 Indicator	B
AC IN Connector	AN	REPLY (3-27 V) Connector (J10008).	AG
AUX BUS Connector (J10010)	AJ	REPLY CODE/ALTITUDE	
CODE INT/EXT Switch	J	Thumbwheels.....	D
DECODED VIDEO Connector		REPLY DELAY 1 Control.....	U
(J10004).....	AH	REPLY DELAY 2 Control.....	P
DISP ON/OFF Switch	F	REPLY DELAY Switch.....	S
DISPARITY Connector (J10005)	AA	REPLY FORMAT Switch.....	V
DISPARITY DELAY 1 Control	T	REPLY ON/OFF Switch	E
DISPARITY DELAY 2 Control	Q	REPLY (TTL) Connector (J10007)	AE
DISPARITY DELAY Switch.....	R	Reserved for future use (J10003)	AF
EXT MOD Connector (J10001).....	AB	RF LEVEL (dB) Display	K
EXT SYNC Connector (J10002)	AD	SLEW Control.....	L
F1 and F3 Fuses	AO	SPARE 1 (R12007).....	AX
F2 and F4 Fuses	AK	SPARE 2 (R12006).....	AW
IFR BUS Connector (J10011)	AR	SPARE 3 (R12005).....	AV
LEVEL Adjust (R10018)	AS	SPARE 4 (R12004).....	AU
LEVEL OUTPUT Connector (J10013).	AI	STABLE Indicator.....	M
LEVEL REF Adjust (R11016).....	AP	TEMPERATURE Adjust (R12003)	AY
MODE GROUP DELAY Indicator	C	TEST Connector (J10012)	AT
MODE SELECT Control	Y	TRIGGER OUTPUT Connector	
P2 ON/OFF Switch.....	G	(J10006)	AC
P3 ON/OFF Switch.....	H	UNSTABLE Indicator	N
P4 DEV Switch.....	O	VOLTAGE SELECT Switch	AL
P4 ON/OFF Switch.....	I	"X" PULSE Switch.....	W
POWER Switch.....	Z	XPDR MODE 4 Indicator	A



ITEM	DESCRIPTION	ITEM	DESCRIPTION
A.	<p>XPDR MODE 4 Indicator</p> <p>Illuminates to indicate XPDR Mode 4 Test Function is selected on MODE SELECT Control.</p>	F.	<p>DISP ON/OFF Switch</p> <p>ON enables Disparity, ISLS, or GTC Pulse; depending on test function and DISPARITY DELAY Switch position. See 1-2-2, Table 4.</p> <p>OFF disables any pulse controlled by DISPARITY DELAY Switch.</p>
B.	<p>RADAR MODE 4 Indicator</p> <p>Illuminates to indicate RADAR Mode 4 Test Function is selected on MODE SELECT Control.</p>	G.	<p>P2 ON/OFF Switch</p> <p>ON enables a nominal 0.5 μs P₂ pulse in Mode 4 interrogation preamble. Pulse position is variable from nominal (2 μs following P₁) \pm1.95 μs in 0.05 μs steps using the ATC-1400A XPDR DEV P₂/CAL Switch and XPDR P₂/P₃ DEV Thumbwheels.</p> <p>OFF disables P₂ pulse.</p>
C.	<p>MODE GROUP DELAY Indicator</p> <p>Indicates the ATC-1400A DBL INTERR/INTRF Thumbwheels are set to DOUBLE Interrogation at the same time the ATC-1400A SUPPRESSOR ON/OFF Switch is ON. When this happens, the first interrogation is omitted. Delay between the mutual suppression pulse and second interrogation is controlled by the DBL INTERR/INTRF PULSE Thumbwheels.</p>	H.	<p>P3 ON/OFF Switch</p> <p>ON enables a nominal 0.5 μs P₃ pulse in Mode 4 interrogation preamble. Pulse position is variable from nominal (4 μs following P₁) \pm1.95 μs in 0.05 μs steps using the ATC-1400A XPDR DEV P₃/CAL Switch and XPDR P₂/P₃ DEV Thumbwheels.</p> <p>OFF disables P₃ pulse.</p>
D.	<p>REPLY CODE/ALTITUDE Thumbwheels</p> <p>Selects one of 4096 reply IDENT codes, from 0000 to 7777 (octal) for modes 1, 2, or 3/A; or altitude from -0010 (represented as 9010) to 1267 (decimal), in hundreds of feet (30.48 meters/100 ft), for Mode C.</p> <p>NOTE: All 12 bits of the reply code are active regardless of the XPDR mode selected. Mode 1 only uses digits A and B (first six bits). Digits C and D (last six bits), the two least significant digits on the thumbwheel switch, should be set to zero, (e.g., select 1100 to 7700).</p>	I.	<p>P4 ON/OFF Switch</p> <p>ON enables a nominal 0.5 μs P₄ pulse in Mode 4 interrogation preamble. Pulse position is variable from nominal (6 μs following P₁) \pm1.95 μs in 0.05 μs steps using the I-1402 P₄ DEV Switch and ATC-1400A XPDR P₂/P₃ DEV Thumbwheels.</p> <p>OFF disables P₄ pulse.</p>
E.	<p>REPLY ON/OFF Switch</p> <p>ON enables all Reply Pulses, not otherwise controlled, to be sent to the UUT.</p> <p>OFF inhibits all Reply Pulses within the I-1402.</p>		



ITEM DESCRIPTION

J. CODE INT/EXT Switch

Selects Interrogation word (P₆ through P₃₇) as follows:

- **INT**, used in Mode 4 (Internal) Test Functions, generates interrogation word format O, A, B, or Random depending on MODE SELECT Control position. See Appendix B for formats.
- **EXT**, used in Mode 4 (External) Test Functions, allows an optional external encryption device to generate the interrogation word format.

K. RF LEVEL (dB) Display

Displays value of vernier RF level in 0.1 dB steps, as selected by the SLEW Control or remote control (GPIB). The Mode 4 Test System adds the displayed level to the ATC-1400A RF level generator output displayed on the ATC-1400A RF LEVEL -dBm Display.

L. SLEW Control

Adjusts vernier RF level ± 3.0 dB, as displayed on RF LEVEL (dB) Display.

M. STABLE Indicator (LED)

Illuminates when pulse repetition jitter, as measured from pre-trigger to decode video, is less than 0.45 μ s.

N. UNSTABLE Indicator (LED)

Illuminates when pulse repetition jitter, as measured from pre-trigger to decode video, is greater than 0.65 μ s.

NOTE: When pulse jitter is between 0.45 μ s and 0.65 μ s, either the STABLE Indicator or UNSTABLE Indicator may be illuminated.

ITEM DESCRIPTION

O. P4 DEV Switch

- **- Δ** advances position of P₄ Pulse by value selected on ATC-1400A P₂/P₃ DEV Thumbwheels, in microseconds.
- **CAL** sets P₄ Pulse to the nominal position (6 μ s from leading edge of P₁). ATC-1400A P₂/P₃ DEV Thumbwheels have no effect on deviating P₄ pulse.
- **+ Δ** delays position of P₄ Pulse by value selected on ATC-1400A P₂/P₃ Thumbwheels, in microseconds.

P. REPLY DELAY 2 Control

Varies position of Reply Pulses when position 2 is selected on the REPLY DELAY Switch. See 1-2-2, Table 3.

TEST FUNCTION	CAL	DELAYS 1 AND 2
XPDR ATC	3 μ s	0 to 12 μ s
XPDR Mode 4	A: 200 μ s B: 260 μ s O: 230 μ s RANDOM: 200 to 260 μ s	180 to 280 μ s
RADAR ATC	3 μ s + range delay	1.0 to 12 μ s
RADAR Mode 4	A: 202 μ s B: 262 μ s O: 232 μ s RANDOM: 202 to 262 μ s	180 to 280 μ s
All ATC reply delays are measured from the nominal P ₄ position. All Mode 4 reply delays are measured from the nominal P ₃ position. RANDOM varies in quasi-random fashion.		

Reply Delay Control
Table 3



ITEM DESCRIPTION

Q. DISPARITY DELAY 2 Control

Varies position of Disparity or GTC Trigger Pulse, depending on test function, when position 2 is selected on DISPARITY DELAY Switch. See 1-2-2, Table 4.

TEST FUNCTION	CAL	DELAY 1	DELAY 2
XPDR ATC	Not Used		
XPDR Mode 4	198 μ s after P ₄	180 to 280 μ s	180 to 280 μ s
RADAR ATC	Not Used		
RADAR Mode 4	(ISLS) 5.9 μ s after P ₁	(ISLS) -6.1 to 17.9 μ s after P ₁	(GTC) 360 to 384 μ s after EXT SYNC Pulse

Disparity Delay Control
Table 4

R. DISPARITY DELAY Switch

1 allows the DISPARITY DELAY 1 Control to vary position of the Disparity or ISLS Pulse according to 1-2-2, Table 4.

CAL sets the Disparity, ISLS or GTC Pulse to the calibrated position indicated in 1-2-2, Table 4.

2 allows the DISPARITY DELAY 2 Control to vary position of the Disparity or GTC Pulse according to 1-2-2, Table 4.

S. REPLY DELAY Switch

1 allows the REPLY DELAY 1 Control to vary position of the Reply Pulses according to 1-2-2, Table 3.

CAL sets Reply Pulses to the calibrated position, as selected by test function and word format on the MODE SELECT Control. See 1-2-2, Table 3 for calibrated positions.

2 allows the REPLY DELAY 2 Control to vary position of the Reply Pulses according to 1-2-2, Table 3.

ITEM DESCRIPTION

T. DISPARITY DELAY 1 Control

Varies position of Disparity, ISLS or GTC Pulse (depending on test function) when position 1 is selected on DISPARITY DELAY Switch. See 1-2-2, Table 4.

U. REPLY DELAY 1 Control

Varies position of Reply Pulses when position 1 is selected on REPLY DELAY Switch. See 1-2-2, Table 3.

V. REPLY FORMAT Switch

XPDR ATC

- **NORM** selects normal reply format for Modes 1, 2, 3/A, T, B, C, D, AC₁, and AC₂ as selected by ATC-1400A XPDR MODE Control. See 1-2-2, Figure 3 for the reply format description.

- **EMER** selects emergency reply format for Modes 1, 2, 3/A, T, B, D, and AC₁ as selected by ATC-1400A XPDR MODE Control. See 1-2-2, Figure 3 for the reply format description.

NOTE: I-1402 REPLY CODE/ALTITUDE Thumbwheels should be set to 7700 when using Emergency Reply Format.

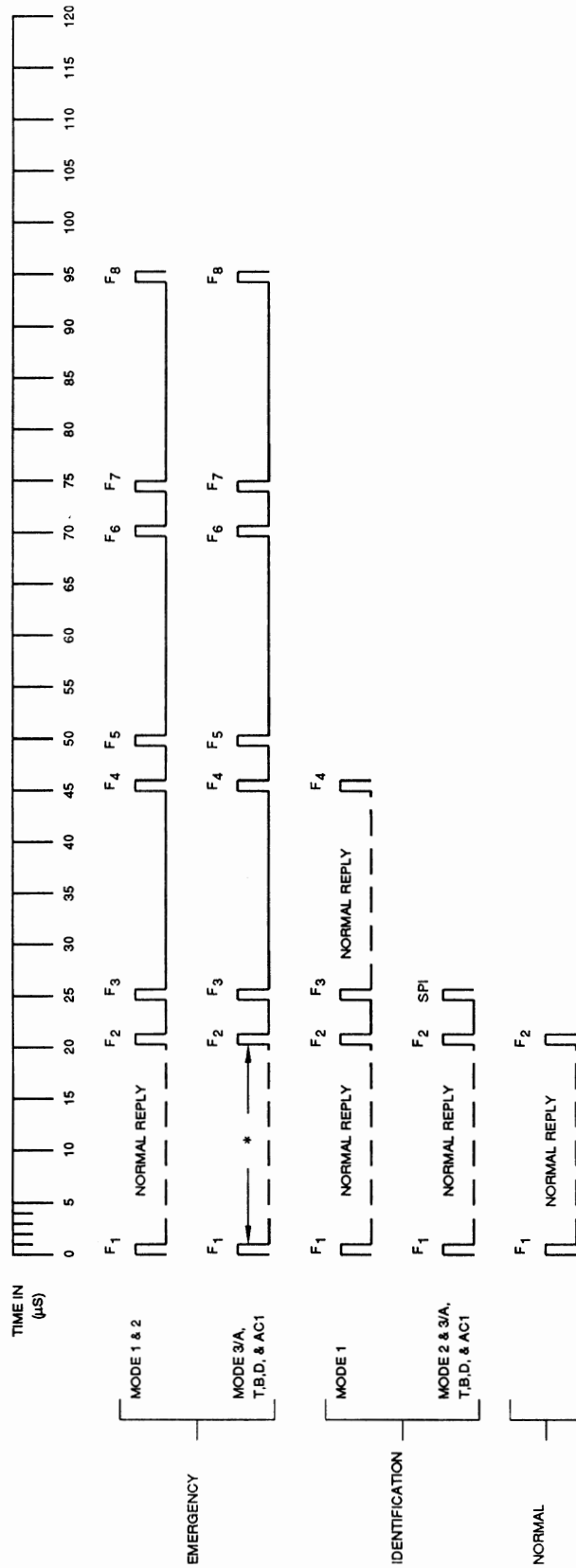
- **IDENT** selects identification reply format for Modes 1, 2, 3/A, T, B, D, and AC₁ as selected by ATC-1400A XPDR MODE Control. See 1-2-2, Figure 3 for the reply format description.

RADAR ATC

- **NORM** disables SPI Pulse.

- **EMER** enables SPI Pulse and generates the 7700 code, overriding the I-1402 REPLY CODE/ALTITUDE Thumbwheels.

- **IDENT** enables SPI Pulse with the I-1402 REPLY CODE/ALTITUDE Thumbwheels selected reply code. See 1-2-3, Figure 13.




Reply Code Format Timing Chart
Figure 3

* THE OPERATOR SHOULD SELECT 7700 FOR EMERGENCY REPLY.



ITEM DESCRIPTION

- W. "X" PULSE Switch**
The added X Pulse simulates an unmanned aircraft signal.
ON enables X pulse in the IDENT reply code. See 1-2-3, Figures 6 and 13 for the X Pulse position.
OFF disables X Pulse.
- X. RADAR ATC Indicator**
Illuminates to indicate RADAR ATC Test Function is selected on MODE SELECT Control.
- Y. MODE SELECT Control**
Selects Test Function mode, and in Mode 4, interrogation word format (A, B, 0, or RANDOM).
- Z. POWER Switch** | or 
Connects (I) or disconnects (O) external ac power to I-1402 and 1400A POWER Connector.
- AA. DISPARITY Connector (J10005)**
Output to UUT Disparity Input, providing Disparity, ISLS, or GTC trigger in lieu of an encryption device.
- AB. EXT MOD Connector (J10001)**
Signal received from the optional encryption device, at this connector, is used to modulate the ATC-1400A RF generator. Signal definitions are shown in 1-2-3, Figures 11 and 17.
- AC. TRIGGER OUTPUT Connector (J10006)**
Output provides a particular trigger pulse. See 1-2-2, Table 5.
- AD. EXT SYNC Connector (J10002)**
Receives input from Radar UUT to initiate interrogation and used in lieu of an encryption device. Signal definition is shown in 1-2-3, Figure 15.


ITEM DESCRIPTION

TEST FUNCTION	TRIGGER PULSE
XPDR ATC	Not Used
XPDR Mode 4 (Internal)	Oscilloscope Trigger 194 μ s after P ₄
XPDR Mode 4 (External)	Pre-Trigger sent to KIR to start Mode 4 interrogation process
RADAR ATC	Trigger coincides with end of range delay after P ₃
RADAR Mode 4 (Internal)	Time-Decoded Video to UUT, simulating a KIR
RADAR Mode 4 (External)	Enable Trigger to KIT

Trigger Pulse Output
Table 5

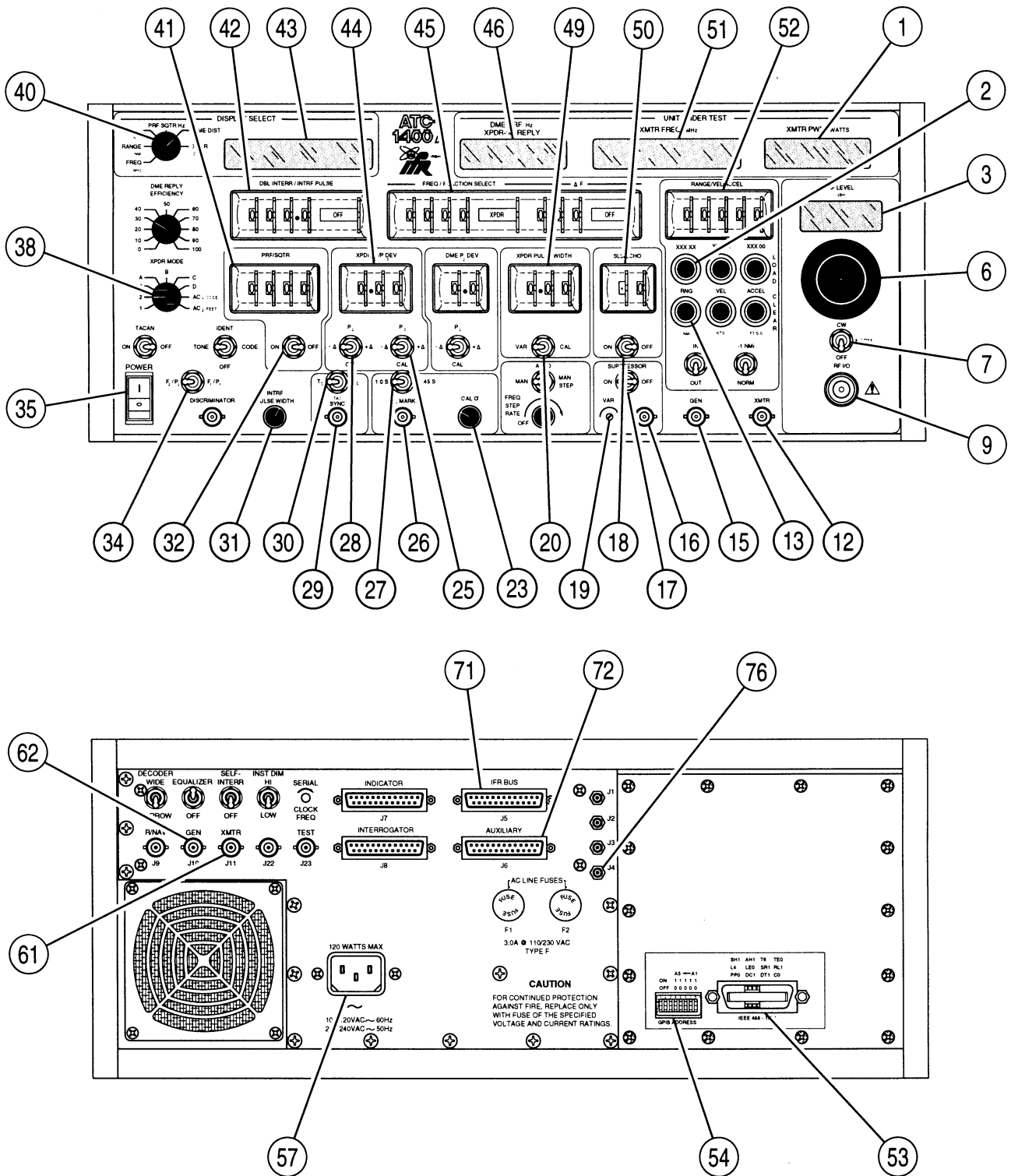
- AE. REPLY (TTL) Connector (J10007)**
Provides external pulse modulation to UUT for simulating an encryption device in Mode 4 or for use with ATCRBS transponders requiring external encoding. See 1-2-3; Figures 6, 9 and 15 for signal definition.
- AF. Reserved for future use (J10003)**
- AG. REPLY (3-27 V) Connector (J10008)**
Provides external pulse modulation to UUT for simulating an encryption device in Mode 4 or for use with ATCRBS transponders requiring external encoding.
- AH. DECODED VIDEO Connector (J10004)**
Receives signal from optional encryption device to determine reply jitter for I-1402 STABLE Indicator or UNSTABLE Indicator. See 1-2-3, Figure 11 for signal definition.
- AI. LEVEL OUTPUT Connector (J10013)**
Provides vernier RF level output, controlled by I-1402 SLEW Control and sent to ATC-1400A RF LEVEL INPUT Connector (J4).



ITEM	DESCRIPTION	ITEM	DESCRIPTION
AJ.	AUX BUS Connector (J10010) 25-pin female connector used to interconnect logic and timing signals between the I-1402 and ATC-1400A AUXILIARY Connector (J6). See Appendix A for pin assignments.	AO.	F1 and F3 Fuses Fuses input power to the I-1402 and 1400A POWER Connector. Refer to 1.3 of 1-2-1 for correct fuse size and type.
AK.	F2 and F4 Fuses Fuses power to the I-1402 VOLTAGE SELECT Switch. Refer to 1.3 of 1-2-1 for correct fuse size and type.	AP.	LEVEL REF Adjust (R11016) Sets 0.0 dB reference level for vernier RF control.
AL.	VOLTAGE SELECT Switch Selects the line voltage applied to the I-1402: 115 for 100 to 120 VAC or 230 for 220 to 240 VAC.	AQ.	80 MHz Adjust (L11005)
AM.	1400A POWER Connector  CAUTION: FOR CONNECTION TO ATC-1400A ONLY. Provides ac power to the ATC-1400A.	AR.	IFR BUS Connector (J10011) 25-pin female connector used to provide communication between the I-1402 and ATC-1400A IFR BUS Connector (J5). See Appendix A for pin assignments.
AN.	AC IN Connector Provides the input for 115 or 230 VAC single phase power to the I-1402. The I-1402 VOLTAGE SELECT Switch must be set to correct position before applying power.	AS.	LEVEL Adjust (R10018) Sets +3.0 dB level for vernier RF control.
		AT.	TEST Connector (J10012)
		AU.	SPARE 4 (R12004)
		AV.	SPARE 3 (R12005)
		AW.	SPARE 2 (R12006)
		AX.	SPARE 1 (R12007)
		AY.	TEMPERATURE Adjust (R12003)



2.2 ATC-1400A FRONT AND REAR PANELS



ATC-1400A Front and Rear Panels
Figure 4

6707003




ATC-1400A Controls, Connectors and Indicators Location List:

1.0 μ s/1.45 μ s Switch.....	27	PRF/SQTR Thumbwheels	41
AC INPUT Connector	57	RANGE/VEL/ACCEL Thumbwheels ...	52
AUXILIARY Connector (J6)	72	RF I/O Connector (J15).....	9
CAL MARKS Connector (J19)	26	RF LEVEL -dBm Display.....	3
CAL \emptyset Control.....	23	RF LEVEL Control	6
CLEAR RNG Pushbutton Switch.....	13	RF LEVEL INPUT Connector (J4)	76
CW/NORM/OFF Switch.....	7	SLS/ECHO ON/OFF Switch.....	18
DBL INTERR/INTRF PULSE Thumbwheels	42	SLS/ECHO Thumbwheels	50
DISPLAY SELECT Control	40	SUPPRESSOR ON/OFF Switch	17
DISPLAY SELECT Readout.....	43	SUPPRESSOR OUTPUT Connector (J18)	16
DME-PRF Hz/XPDR-%REPLY Display.....	46	SUPPRESSOR VAR Adjustment	19
F ₂ /P ₂ F ₁ /P ₁ Switch	34	SYNC Connector (J20).....	29
FREQ/FUNCTION SELECT Thumbwheels	45	To/TAC/T _D Switch.....	30
GEN Connector (J10)	62	XMTR Connector (J11).....	61
GEN Connector (J17)	15	XMTR Connector (J16).....	12
GPIB ADDRESS/OPTION Dip Switches	54	XMTR FREQ MHz Display	51
GPIB Connector (J14)	53	XMTR PWR WATTS Display	1
IFR BUS Connector (J5)	71	XPDR DEV P ₂ /CAL Switch.....	28
INTRF PULSE WIDTH Control	31	XPDR DEV P ₃ /CAL Switch.....	25
LOAD RNG Pushbutton Switch	2	XPDR MODE Control	38
POWER Switch.....	35	XPDR P ₂ /P ₃ DEV Thumbwheels	44
PRF/SQTR ON/OFF Switch.....	32	XPDR PULSE WIDTH Thumbwheels..	49
		XPDR PULSE WIDTH VAR/CAL Switch	20



Descriptions listed below supersede descriptions listed in the ATC-1400A Operation Manual. See 1-2-2, Figure 4.

ITEM	DESCRIPTION
1. XMTR PWR WATTS Display	Provides a continuous visual display of peak pulse power of the UUT.
2. LOAD RNG Pushbutton Switch	Programs a fixed range distance as selected on the ATC-1400A RANGE/VEL/ACCEL Thumbwheels. NOTE: Maximum range used in the Mode 4 Test System Test Functions is 200 nautical miles.
3. RF LEVEL -dBm Display	Displays the programmed peak RF power of the generator in dB below 1 mW.
6. RF LEVEL Control	Adjusts RF generator level (Interrogation Transmission in XPDR Test Functions and Reply Transmission in RADAR Test Functions).
7. CW/NORM/OFF Switch	Controls the signal through the ATC-1400A RF I/O Connector as follows: CW supplies continuous wave signal (RF with no modulation) at frequency set by ATC-1400A FREQ/FUNCTION SELECT Thumbwheels. The CW setting is used to test the Mode 4 Test System. NORM supplies the modulated RF signal and is the normal setting for Mode 4 Test System operation. OFF disables output.

ITEM	DESCRIPTION
9. RF I/O Connector (J15) 	CAUTION: MAXIMUM INPUT TO THE RF I/O CONNECTOR MUST NOT EXCEED 5 kW PEAK OR 10 W AVERAGE. Connects all interrogation and reply RF pulses to the Antenna Connector of UUT.
12. XMTR Connector (J16)	Provides detected RF pulses transmitted by UUT.
13. CLEAR RNG Pushbutton Switch	Clears previously selected range information.
15. GEN Connector (J17)	Provides detected RF output pulses from generator, to enable viewing transponder interrogations and interference pulses.
16. SUPPRESSOR OUTPUT Connector (J18)	Provides mutual suppression pulses.
17. SUPPRESSOR ON/OFF Switch	Enables or disables mutual suppression pulses. NOTE: When the ATC-1400A DBL INTERR/INTRF PULSE Thumbwheels have DOUBLE selected, an active suppression pulse eliminates the first interrogation of the double interrogation. The DBL INTERR/INTRF PULSE Thumbwheels determine the delay from the suppression pulse to second interrogation.



ITEM DESCRIPTION

18. SLS/ECHO ON/OFF Switch
ON enables the P₂ (ATCRBS) or P₅ (Mode 4) Side-Lobe Suppression (SLS) pulse for XPDR Test Functions or enables echo replies for Radar Test Functions. The ATC-1400A SLS/ECHO Thumbwheels control only the amplitude of the SLS pulse when the SLS/ECHO ON/OFF Switch is **ON**.

NOTE: Interrogation and SLS pulses are inhibited when ATC-1400A DBL INTERR/INTRF PULSE Thumbwheels are set to **INTERF+** or **INTERF-**.

OFF disables SLS or echo reply pulses and allows the ATC-1400A SLS/ECHO Thumbwheels to control other pulse amplitudes if selected.

19. SUPPRESSOR VAR Adjustment
Adjusts voltage level of mutual suppression pulse from +3 to +27 V.

20. XPDR PULSE WIDTH VAR/CAL Switch
VAR selects a variable pulse width set by the ATC-1400A XPDR PULSE WIDTH Thumbwheels.
CAL selects the nominal pulse width depending on test function. See 1-2-2, Table 6.

TEST FUNCTION	PULSES AFFECTED	NOMINAL WIDTH
XPDR ATC	P ₁ , P ₂	0.8 μs
XPDR Mode 4	P ₁ , P ₂ , P ₃ , P ₄	0.5 μs
RADAR ATC	F ₂	0.45 μs
RADAR Mode 4	P ₁ , P ₂ , P ₃ , P ₄	0.5 μs

Pulse Width Control
Table 6

23. CAL Ø Control
Adjusts the phase of calibration (timing) pulses.

ITEM DESCRIPTION

25. XPDR DEV P₃/CAL Switch
-Δ advances position of P₃ pulse from nominal, by value selected on ATC-1400A XPDR P₂/P₃ DEV Thumbwheels, in μs.

CAL sets P₃ pulse to nominal position. ATC-1400A XPDR P₂/P₃ DEV Thumbwheels do not deviate P₃ pulse.

+Δ delays position of P₃ pulse from nominal, by value selected on ATC-1400A XPDR P₂/P₃ DEV Thumbwheels, in μs.


26. CAL MARKS Connector (J19)
Provides an output for the calibration pulses set by the ATC-1400A 1.0 μs/1.45 μs Switch and aligned by the CAL Ø Control.

27. 1.0 μs/1.45 μs Switch
Sets calibration pulses through the ATC-1400A CAL MARKS Connector. The 1.45 μs setting is used to verify ATC reply pulses.

28. XPDR DEV P₂/CAL Switch
-Δ advances position of the P₂ pulse from nominal, by the XPDR P₂/P₃ DEV Thumbwheels value, in μs.
CAL sets P₂ pulse to nominal position. ATC-1400A XPDR P₂/P₃ DEV Thumbwheels do not deviate P₂ pulse.
+Δ delays position of the P₂ pulse from nominal, by the XPDR P₂/P₃ DEV Thumbwheels value, in μs.

29. SYNC Connector (J20)
Provides active low oscilloscope sync pulse set by T₀/TAC/T_D Switch.



ITEM	DESCRIPTION	ITEM	DESCRIPTION
30.	<p>To/TAC/Td Switch</p> <p>Controls sync pulse positions through the ATC-1400A SYNC Connector.</p> <p>To positions sync pulse for viewing interrogation or ATC reply pulses on oscilloscope.</p> <p>TAC not used by Mode 4 Test System.</p> <p>Td positions sync pulse for viewing second interrogations or Mode 4 replies on oscilloscope.</p>	40.	<p>DISPLAY SELECT Control</p> <p>Sets the DISPLAY SELECT Readout. Only three positions are valid for Mode 4 Test System operation.</p> <p>FREQ MHz displays Mode 4 Test System transmit frequency in MHz as set by ATC-1400A FREQ/FUNCTION SELECT Thumbwheels.</p> <p>PRF/SQTR Hz displays the PRF as set by the ATC-1400A PRF/SQTR Thumbwheels.</p> <p>XPDR CODE displays the octal form of identification code received in Mode A replies or altitude in Mode C replies (XPDR ATC Test Function).</p>
31.	<p>INTRF PULSE WIDTH Control</p> <p>Adjusts width of interference pulse from 0.2 to 5 μs.</p>	41.	<p>PRF/SQTR Thumbwheels</p> <p>Selects the interrogation rate in Hz. When double interrogation rate is selected, interrogation rate is twice the thumbwheel value. When ATC-1400A XPDR MODE Control is set to AC₁ or AC₂, the rate of A or C interrogations is half the thumbwheel value.</p>
32.	<p>PRF/SQTR ON/OFF Switch</p> <p>Enables or disables interrogation transmissions through the ATC-1400A RF I/O Connector. The ATC-1400A DISPLAY SELECT Readout indicates OFF when the PRF/SQTR ON/OFF Switch is set to OFF.</p>	42.	<p>DBL/INTERR/INTRF Thumbwheels</p> <p>Selects either a double interrogation or an interference pulse. Numbers, in microseconds, represent the distance from the leading edge of P₁ in the regular interrogation to the interference pulse or P₁ in the extra interrogation, depending on the function selected. This feature overrides normal transponder mode of operation.</p> <p>NOTE: I-1402 MODE GROUP DELAY Indicator illuminates whenever double interrogation and suppressor are selected simultaneously.</p>
34.	<p>F₂/P₂ F₁/P₁ Switch</p> <p>Measures UUT frequency and power of F₁ or F₂ reply pulse. For Mode 4 test functions, normal setting is F₁/P₁.</p>	43.	<p>DISPLAY SELECT Readout</p> <p>Displays information selected on ATC-1400A DISPLAY SELECT Control.</p>
35.	<p>POWER Switch or </p> <p>Connects (I) or disconnects (O) external ac power to the ATC-1400A.</p>		
38.	<p>XPDR MODE Control</p> <p>Selects nominal P₃ pulse position for XPDR ATC interrogation modes and determines start time for range delay by referencing to P₃ spacing for RADAR ATC interrogation modes.</p> <p>NOTE: In RADAR ATC Test Function, the XPDR MODE Control should be set to the same mode position as the Radar UUT.</p>		



ITEM DESCRIPTION

44. XPDR P₂/P₃ DEV Thumbwheels
Deviates pulses, as shown in 1-2-2, Table 7, from nominal position by value selected on the thumbwheel switches, in μ s.

TEST FUNCTION	PULSE/(CONTROL SWITCH)
XPDR ATC	P ₂ /(28), P ₃ /(25)
XPDR Mode 4	P ₂ /(28), P ₃ /(25), P ₄ /(E)
RADAR ATC	F ₂ /(28)
RADAR Mode 4	P ₂ /(28), P ₃ /(25), P ₄ /(E)

Pulse Deviation Control
Table 7

45. FREQ/FUNCTION SELECT Thumbwheels
Selects the Mode 4 Test System transmitting frequency and must be set to **XPDR** for normal operation. **1030** MHz is nominal for interrogator transmissions (XPDR Test Functions) and **1090** MHz is nominal for transponder transmissions (RADAR Test Functions).
46. DME-PRF Hz XPDR - % REPLY Display
Continuously displays ratio of transponder replies to Mode 4 Test System interrogations.
49. XPDR PULSE WIDTH Thumbwheels
Selects, in microseconds, pulse width of pulses shown in Table 6 when ATC-1400A XPDR PULSE WIDTH VAR/CAL Switch is set to **VAR**.
50. SLS/ECHO Thumbwheels
Selects amplitude of side-lobe suppression pulses (P₂ for XPDR ATC and P₅ for XPDR Mode 4), interference pulses for XPDR Test Functions and echo replies for Radar Test Functions.

ITEM DESCRIPTION

51. XMTR FREQ MHz Display
Continuously displays average frequency of UUT RF pulses as measured between 50% amplitude points.
52. RANGE/VEL/ACCEL Thumbwheels
Simulates range in nautical miles.
NOTE: The maximum range used in Mode 4 Test System Test Functions is 200 nautical miles.
53. GPIB Connector (J14)
24-pin female connector conforming to IEEE standard 488-1978 provides interface of general purpose programmable instrumentation.
54. GPIB ADDRESS/OPTION Dip Switches
Eight segment DIP switch sets IEEE-488 bus address for remote control mode of operation.
57. AC INPUT Connector
Connects ac power from I-1402 to ATC-1400A.
61. XMTR Connector (J11)
Video output of RF pulses from the UUT (reply pulses in XPDR Test Functions and interrogation pulses in RADAR Test Functions) are at this connector. In Mode 4 External Test Functions, this connector is used to transmit pulses to encryption devices (KIR in XPDR Test and KIT in RADAR Test).
62. GEN Connector (J10)
Provides the TTL-compatible signal to modulate ATC-1400A generator output.
71. IFR BUS Connector (J5)
25-pin female connector exchanges microprocessing data between the ATC-1400A and I-1402 (J10011).



ITEM	DESCRIPTION
72.	<p>AUXILIARY Connector (J6)</p> <p>25-pin female connector exchanges signal, video, and timing data between the ATC-1400A and I-1402 (J10010).</p>
76.	<p>RF LEVEL INPUT Connector (J4)</p> <p>Used for additional ± 3 dB level control of RF Output from I-1402 LEVEL OUTPUT Connector (J10013).</p>



3. GENERAL OPERATING PROCEDURES

There are many variable controls on both the I-1402 and ATC-1400A test units. An understanding of how these controls affect test functions and how both units interact to carry out these test functions is important. This section provides a general description of controls, connectors, and indicators used in Mode 4 Test System functions. A brief overview of how the units interact is included in this paragraph. Changing I-1402 controls affecting ATC-1400A output is accomplished as the I-1402 sends commands to the ATC-1400A. The I-1402 monitors ATC-1400A control settings and reacts accordingly to any changes. In XPDR ATC, the ATC-1400A produces interrogation pulses and the I-1402 produces simulated reply video used to test XPDR UUT encoder inputs. In all other modes, the I-1402 controls all pulse functions, except interference pulses, through the Auxiliary Bus.

NOTE: The procedures contained within this section are general procedures, identifying the controls, connectors and indicators used for the individual test functions. Specific UUT Test Procedures are addressed in the UUT Manuals.

LOCAL CONTROL (FRONT PANEL) OPERATION

The Mode 4 Test System has six distinct functions of operation listed as follows:

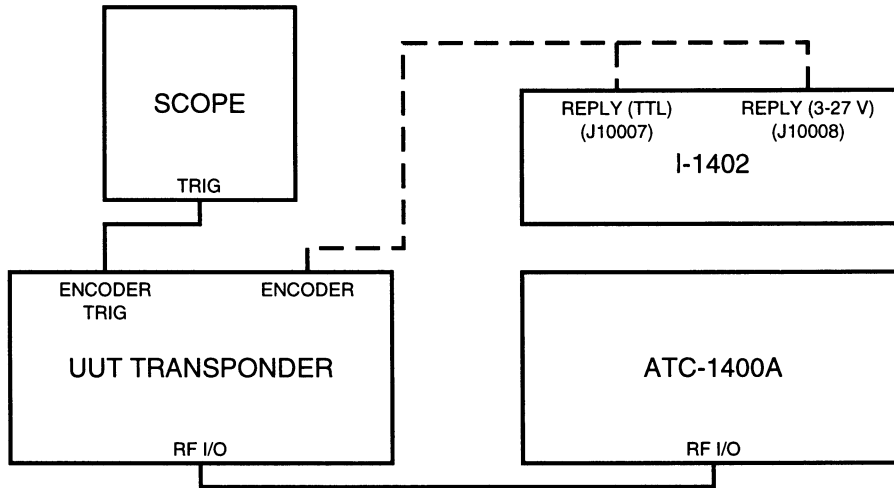
Paragraph	Test Function	Page
3.1	XPDR ATC-----	1
3.2	XPDR Mode 4 (Internal) (w/o encryption devices)--	4
3.3	XPDR Mode 4 (External) (w/ encryption devices) ---	7
3.4	RADAR ATC-----	10
3.5	RADAR Mode 4 (Internal) (w/o encryption devices)--	13
3.6	RADAR Mode 4 (External) (w/ encryption devices) ---	16

3.1 XPDR ATC TEST FUNCTION

The XPDR ATC Test Function verifies the accuracy of transponders in transmitting altitude and identification codes. The I-1402 Test Auxiliary provides this input information.

3.1.1 Setup and Controls

STEP	PROCEDURE
1.	Set up Mode 4 Test System according to XPDR ATC Test Hook-Up Diagram (1-2-3, Figure 5).
2.	Set the ATC-1400A FREQ/FUNCTION SELECT Thumbwheels to XPDR at 1030 MHz .
3.	Set I-1402 Mode SELECT Control to XPDR ATC (fully counterclockwise).
4.	Set ATC-1400A XPDR MODE Control to desired interrogation mode.
5.	Set ATC-1400A DISPLAY SELECT Control to XPDR CODE .
6.	Vary test parameters as follows: <ul style="list-style-type: none"> ● Use ATC-1400A FREQ/FUNCTION SELECT Thumbwheels to set RF. ● Set RF level using I-1402 SLEW Control with RF LEVEL (dB) Display and ATC-1400A RF LEVEL Control with RF LEVEL -dBm Display. ● Set interrogation pulse repetition frequency (PRF) with ATC-1400A PRF/SQTR Thumbwheels. ● Set interrogation pulse width with ATC-1400A PULSE WIDTH VAR/CAL Switch and XPDR PULSE WIDTH Thumbwheels. ● Deviate interrogation pulse position with the ATC-1400A XPDR DEV P₃/CAL Switch, XPDR DEV P₂/CAL Switch and XPDR P₂/P₃ DEV Thumbwheels.



06703001

XPDR ATC Test Hook-Up Diagram
Figure 5

STEP	PROCEDURE
●	Use ATC-1400A SLS/ECHO ON/OFF Switch with SLS/ECHO Thumbwheels to control Side-Lobe Suppression (SLS).
●	Use ATC-1400A SUPPRESSOR ON/OFF Switch, SUPPRESSOR OUTPUT Connector and SUPPRESSOR VAR Adjustment for Mutual Suppression.
●	Use ATC-1400A DBL INTERR/INTRF PULSE Thumbwheels and INTRF PULSE WIDTH Control to provide double interrogations and interference pulses.
●	Vary reply format and content using the I-1402 REPLY ON/OFF Switch, REPLY CODE/ALTITUDE Thumbwheels, REPLY FORMAT Switch and "X" PULSE Switch.
●	Control reply delay with the I-1402 REPLY DELAY Switch, REPLY DELAY 1 Control and REPLY DELAY 2 Control.
7.	Verify percent reply on ATC-1400A DME-PRF Hz/XPDR-%REPLY Display.
8.	Verify UUT frequency on ATC-1400A XMTR FREQ MHz Display.
9.	Verify UUT power on the ATC-1400A XMTR PWR WATTS Display.

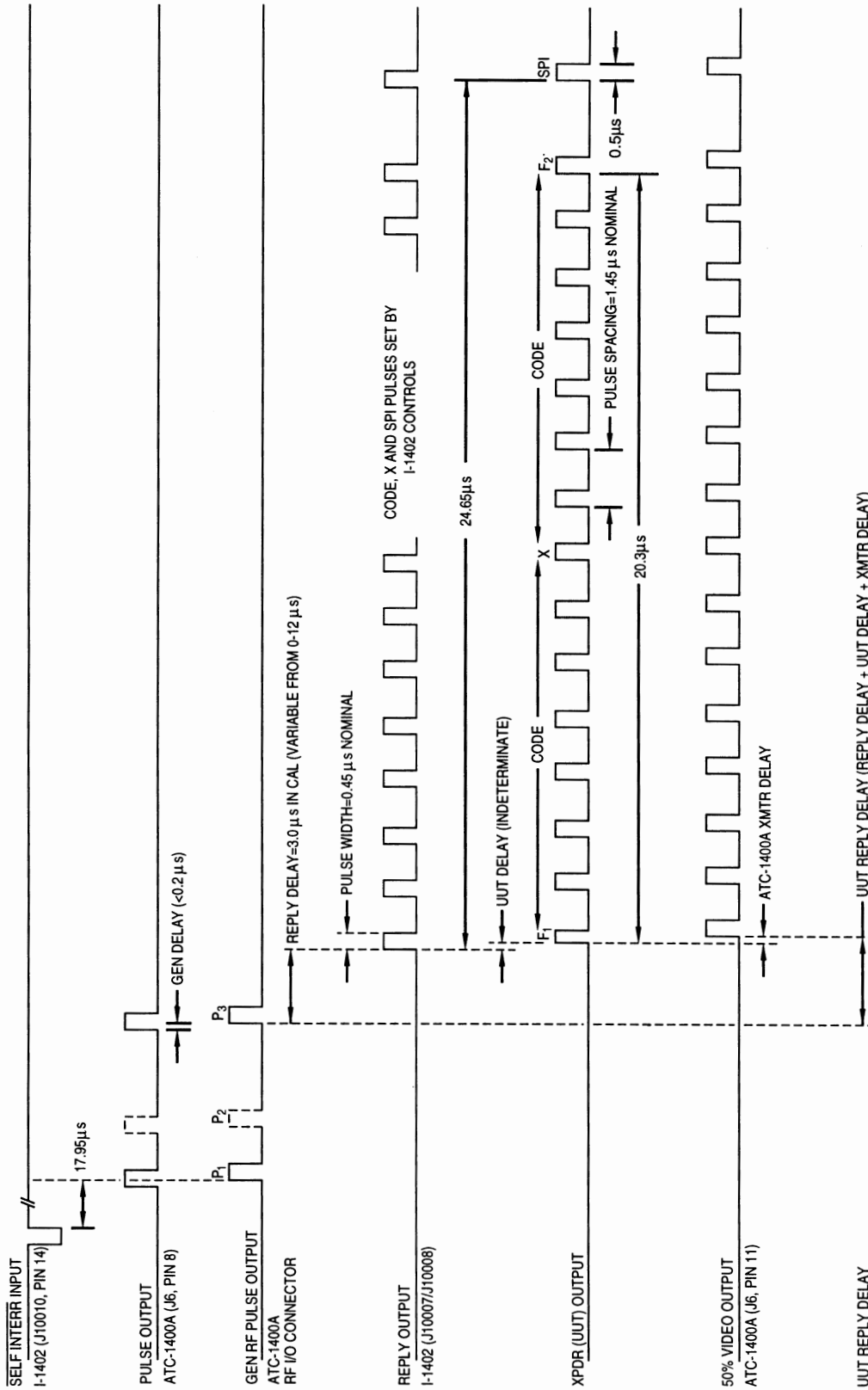
3.1.2 General Test Sequence

Refer to 1-2-3, Figure 6.

STEP	ACTION/TEST
1.	The ATC-1400A initiates interrogation process by sending SELF INTERR Input sync pulse to the I-1402.
2.	The ATC-1400A sends operator controlled ATCRBS interrogation (Pulse Output TTL signal) to I-1402 Test Auxiliary (J10010, Pin 8) as a timing reference for generating the reply code.
3.	The ATC-1400A sends ATCRBS interrogation (GEN RF Pulse Output signal) to UUT Transponder.
4.	The I-1402 sends operator controlled Reply Output with altitude or identification code to transponders requiring externally encoded input.
5.	After an indeterminate delay, the UUT Transponder sends the XPDR (UUT) Output reply back to the Mode 4 Test System. Detected Video can be seen with an Oscilloscope connected to the ATC-1400A XMTR Connector (J16).
6.	The Mode 4 Test System measures UUT Reply Delay using a GPIB command (AX2=UUTD?).



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XPDR ATC Test Function Timing Chart
Figure 6

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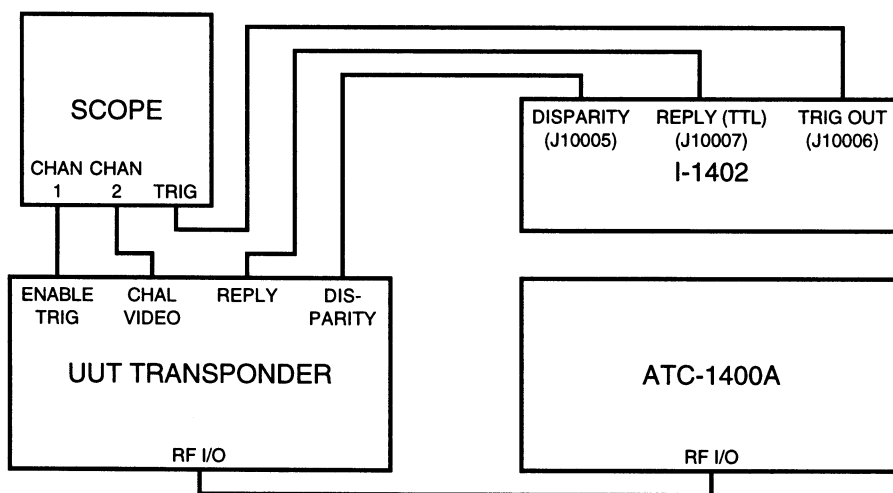
3.2 XPDR MODE 4 (INTERNAL) TEST FUNCTION

The XPDR Mode 4 (Internal) Test Function verifies the ability of transponders to correctly transmit Mode 4 reply pulses. The I-1402 Test Auxiliary supplies data, simulating encrypted interrogations and decoded replies. controlling several variables (SLS, disparity delay, pulse widths, pulse spacings, interrogation frequency, interference, RF level), the test ensures the UUT reply pulses remain consistently correct.

3.2.1 Setup and Controls

STEP	PROCEDURE
1.	Set up Mode 4 Test System according to XPDR Mode 4 (Internal) Test Hook-Up Diagram (1-2-3, Figure 7).
2.	Set the ATC-1400A FREQ/FUNCTION SELECT Thumbwheels to XPDR at 1030 MHz.
3.	Set I-1402 Mode SELECT Control to desired XPDR MODE 4 position, selecting interrogation word format A , B , 0 , or RANDOM .
4.	Verify I-1402 XPDR MODE 4 Indicator illuminates.
5.	Set I-1402 CODE INT/EXT Switch to INT .

STEP	PROCEDURE
6.	Vary test parameters as follows: <ul style="list-style-type: none"> ● Use ATC-1400A FREQ/FUNCTION SELECT Thumbwheels to set RF. ● Set RF level using I-1402 SLEW Control with RF LEVEL (dB) Display and ATC-1400A RF LEVEL Control with RF LEVEL -dBm Display. ● Set interrogation pulse repetition frequency (PRF) with ATC-1400A PRF/SQTR Thumbwheels. ● Set interrogation pulse width using ATC-1400A PULSE WIDTH VAR/CAL Switch and XPDR PULSE WIDTH Thumbwheels. ● Deviate interrogation pulses using the I-1402 P4 DEV Switch, P2 ON/OFF Switch, P3 ON/OFF Switch and P4 ON/OFF Switch. Also use ATC-1400A XPDR DEV P3/CAL Switch, XPDR DEV P2/CAL Switch and XPDR P2/P3 DEV Thumbwheels. ● Use ATC-1400A SLS/ECHO ON/OFF Switch with SLS/ECHO Thumbwheels to control SLS.

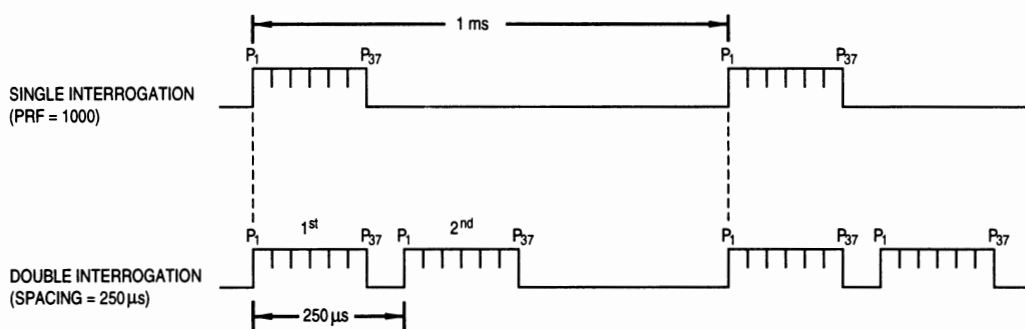


XPDR Mode 4 (Internal) Test Hook-Up Diagram
Figure 7

06703002



STEP	PROCEDURE	STEP	PROCEDURE
	<ul style="list-style-type: none"> ● Use ATC-1400A DBL INTERR/INTRF PULSE Thumbwheels and INTRF PULSE WIDTH Control to provide double interrogations and interference pulses. See 1-2-3, Figures 8 and 9. ● Control Disparity output using the I-1402 DISP ON/OFF Switch, DISPARITY DELAY Switch, DISPARITY DELAY 1 Control and DISPARITY DELAY 2 Control. 		<ul style="list-style-type: none"> ● Control reply delay with the I-1402 REPLY DELAY Switch, REPLY DELAY 1 Control and REPLY DELAY 2 Control.
		7.	Verify percent reply on ATC-1400A DME-PRF Hz/XPDR-%REPLY Display.
		8.	Verify UUT frequency on ATC-1400A XMTR FREQ MHz Display.
		9.	Verify UUT power on the ATC-1400A XMTR PWR WATTS Display.



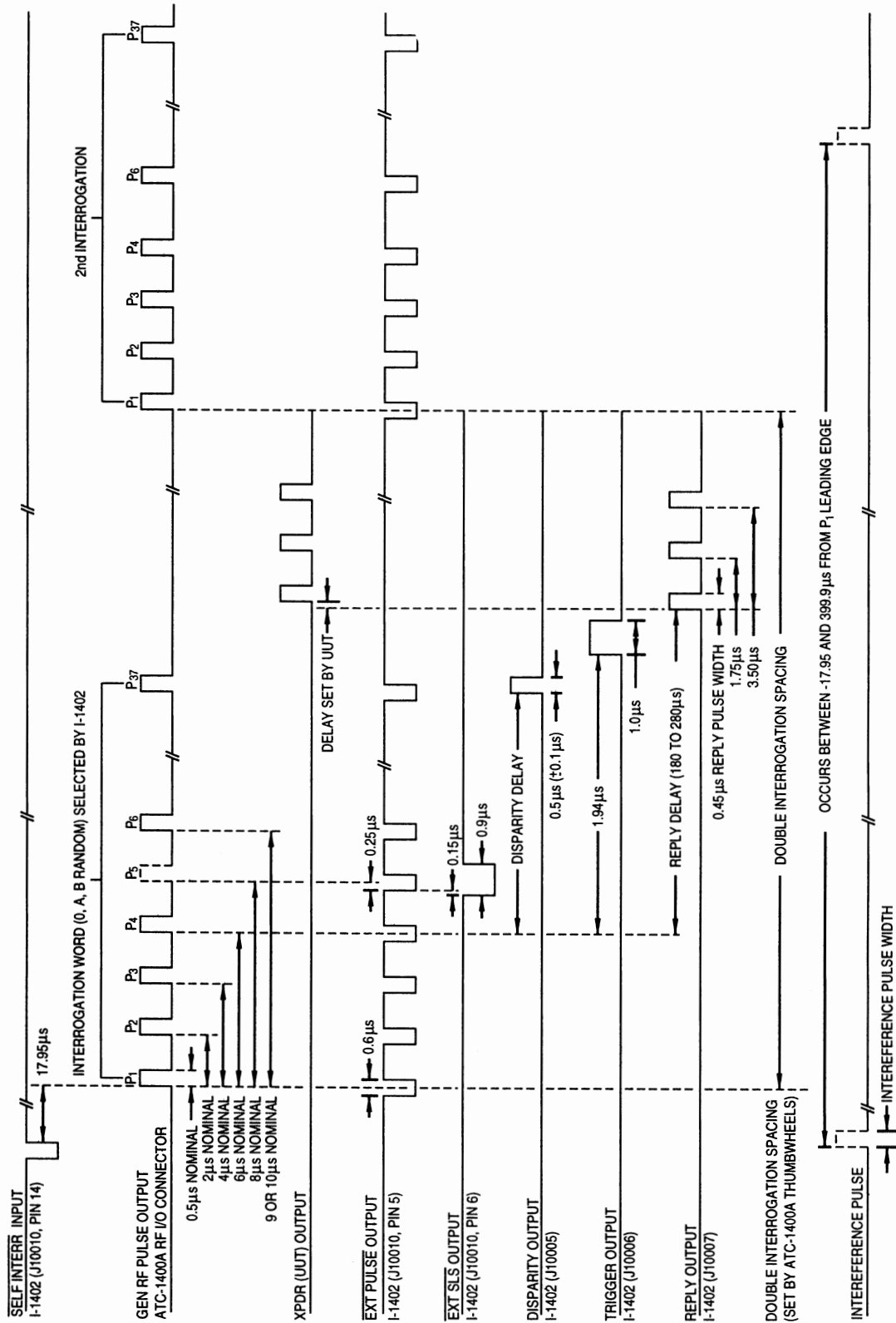
06702005

Double Interrogation Example
Figure 8

3.2.2 General Test Sequence

Refer to 1-2-3, Figure 9.

STEP	ACTION/TEST	STEP	ACTION/TEST
1.	The ATC-1400A initiates interrogation process by sending <u>SELF INTERR</u> Input sync pulse to the I-1402.	4.	The UUT Transponder sends the Enable Trigger followed by Challenge Video (should be same as GEN RF Pulse Output) to Oscilloscope.
2.	The Mode 4 Test System sends interrogations to the UUT through the ATC-1400A RF I/O Connector (GEN RF Pulse Output). <ul style="list-style-type: none"> ● The I-1402 controls P₁ through P₄ and adds selected word (P₆-P₃₇) with <u>EXT PULSE</u> Output. (P₁ to P₆ is 9 μs for word format 0 or 10 μs for word formats A or B.) ● If activated on the ATC-1400A, the I-1402 enables the <u>EXT SLS</u> Output to set P₅. 	5.	The I-1402 simulating a KIT encryption device, sends the Disparity or Reply Output to the UUT Transponder. <ul style="list-style-type: none"> ● Disparity Delay varies from 0 to 280 μs, depending on I-1402 disparity delay settings. ● Reply Delay varies from 180 to 280 μs, depending on word format and I-1402 reply delay settings.
3.	The I-1402 sends the Trigger Output to the Oscilloscope.	6.	The UUT Transponder sends reply, XPDR (UUT) Output, to Mode 4 Test System. Detected Video can be seen with an Oscilloscope connected to the ATC-1400A XMTR Connector (J16).



06702004

XPDR Mode 4 (Internal) Test Function Timing Chart
Figure 9

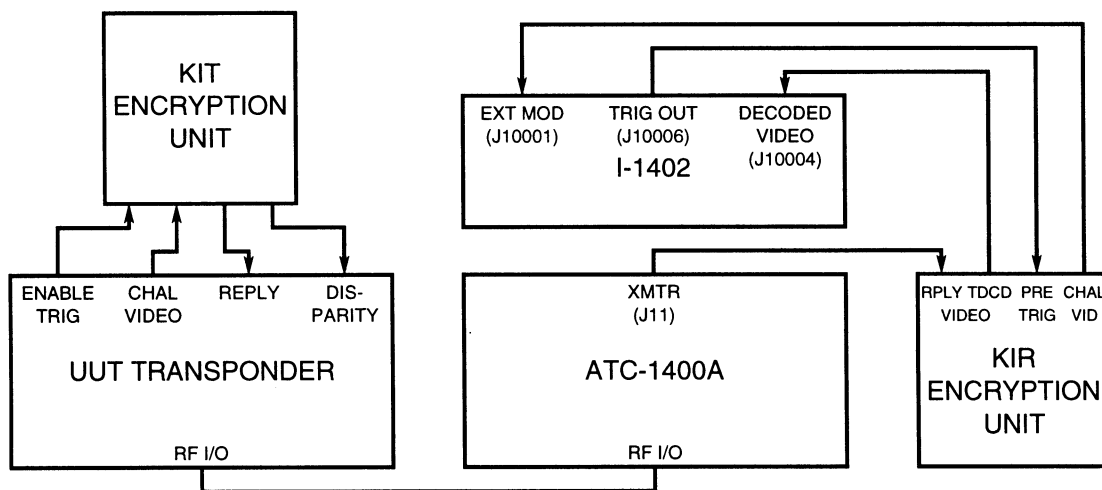


3.3 XPDR MODE 4 (EXTERNAL) TEST FUNCTION

The XPDR Mode 4 (External) Test Function verifies the ability of transponders to receive IFF interrogations and transmit consistent replies. This test utilizes two encryption devices. The UUT Transponder uses a KIT encryption device to decode interrogations and encrypt replies. The Mode 4 Test System uses a KIR encryption device for encrypting interrogations and decoding replies.

3.3.1 Setup and Controls

STEP	PROCEDURE
1.	Set up Mode 4 Test System according to XPDR Mode 4 (External) Test Hook-Up Diagram (1-2-3, Figure 10).
2.	Set the ATC-1400A FREQ/FUNCTION SELECT Thumbwheels to XPDR at 1030 MHz .
3.	Set I-1402 Mode SELECT Control to desired XPDR MODE 4 position, selecting interrogation word format A , B , 0 , or RANDOM .
4.	Verify I-1402 XPDR MODE 4 Indicator illuminates.
5.	Set I-1402 CODE INT/EXT Switch to EXT .
6.	When Mode 4 Test System receives Time-Decoded Video Input (see 1-2-3, Figure 11) from KIR encryption device, verify I-1402 STABLE Indicator or UNSTABLE Indicator illuminates, checking jitter stability.



06703003

XPDR Mode 4 (External) Test Hook-Up Diagram
Figure 10



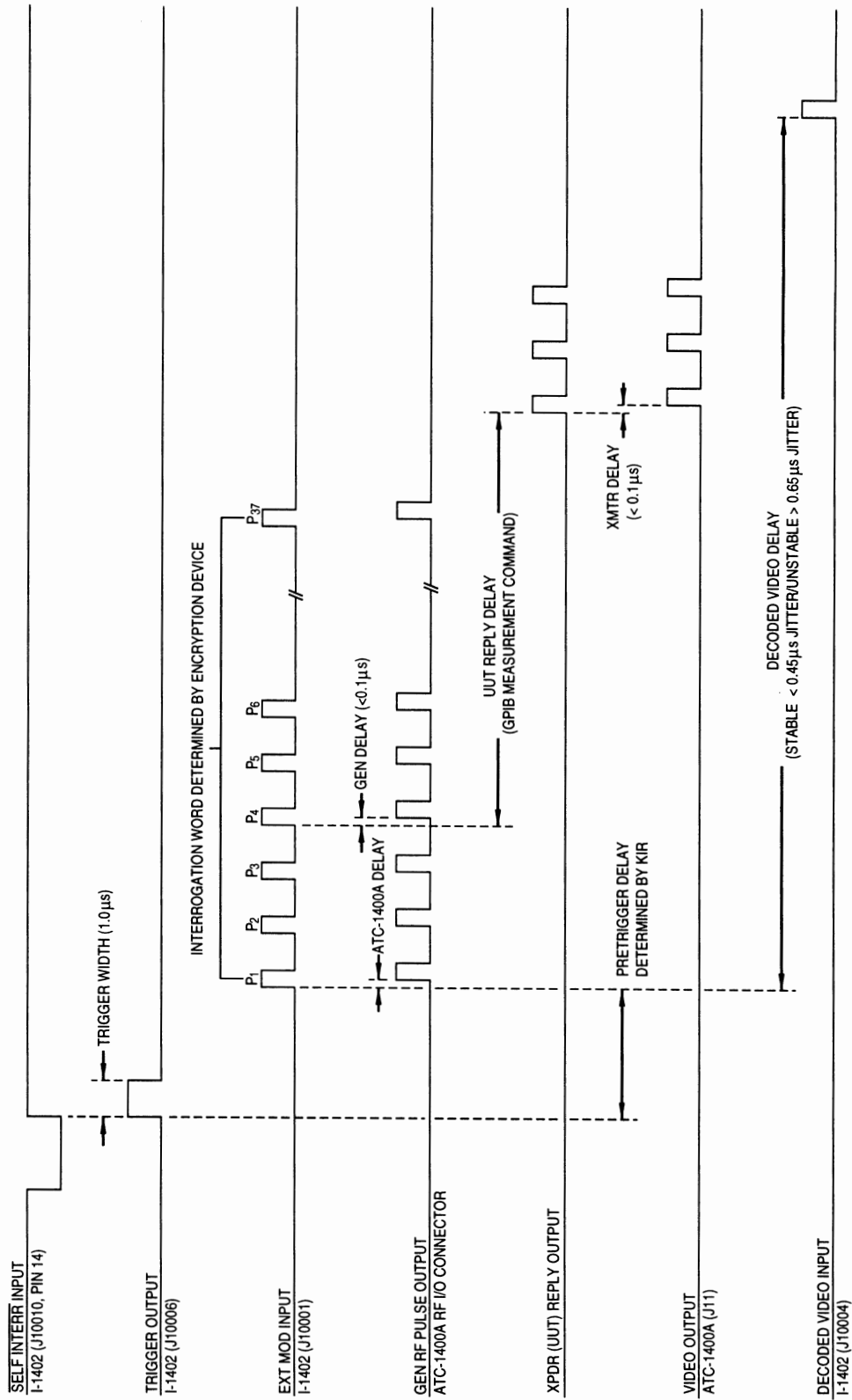
3.3.2 General Test Sequence

Refer to 1-2-3, Figure 11.

STEP	ACTION/TEST
1.	The ATC-1400A initiates <u>interrogation</u> process by sending <u>SELF INTERR</u> Input sync pulse to the I-1402.
2.	The I-1402 triggers the KIR encryption device with the Trigger Output (uses ATC-1400A generated PRF with P ₁ , P ₂ , P ₃ and P ₄ disabled).
3.	The KIR encryption device sends interrogation, Challenge Video, to Mode 4 Test System as EXT MOD Input.
4.	The ATC-1400A sends the interrogation to the UUT Transponder as GEN RF Pulse Output.
5.	The UUT Transponder sends the Enable Trigger to KIT encryption device, to set KIT for receiving interrogation.
6.	The UUT Transponder sends interrogation (GEN RF Pulse Output), Challenge Video, to KIT encryption device.
7.	If interrogation is accepted, the KIT encryption device sends reply to UUT Transponder. If interrogation is not accepted, the KIT encryption device sends Disparity Pulse to UUT Transponder.
8.	The UUT Transponder sends reply, XPDR (UUT) Reply Output, (or Disparity) to Mode 4 Test System. The Mode 4 Test System measures UUT Reply Delay using a GPIB command (AX2=UUTD?).
9.	The ATC-1400A sends the reply, Video Output to the KIR encryption device.
10.	The KIR encryption device sends time-decoded video, Decoded Video Input, to the Mode 4 Test System.



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XPDR Mode 4 (External) Test Function Timing Chart
Figure 11



3.4 RADAR ATC TEST FUNCTION

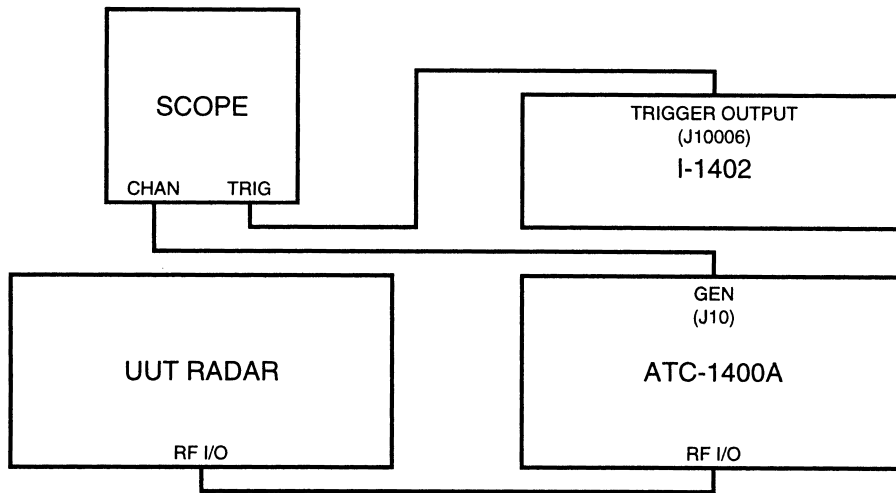
The RADAR ATC Test Function verifies the ability of radars to correctly interpret replies to Mode 3/A and Mode C interrogations. The I-1402 Test Auxiliary provides variable altitude and IDENT codes and the ATC-1400A varies range and simulates echo replies.

3.4.1 Setup and Controls

STEP	PROCEDURE
1.	Set up Mode 4 Test System according to RADAR ATC Test Hook-up Diagram (1-2-3, Figure 12).
2.	Set the ATC-1400A FREQ/FUNCTION SELECT Thumbwheels to XPDR at 1090 MHz.
3.	Set I-1402 Mode SELECT Control to RADAR ATC (fully clockwise).
4.	Verify I-1402 RADAR ATC Indicator illuminates.
5.	Set ATC-1400A XPDR MODE Control to correct interrogation mode (same as UUT Radar).

NOTE: The Mode 4 Test System does not interpret interrogation pulse spacing to determine what to reply. Instead, interrogation is referenced internally, triggered off P₁ from UUT and controlled by **XPDR MODE** Control. Therefore, the **XPDR MODE** Control must be in the same mode as the UUT to get accurate readings.

STEP	PROCEDURE
6.	Vary test parameters as follows: <ul style="list-style-type: none"> ● Use ATC-1400A FREQ/FUNCTION SELECT Thumbwheels to set RF. ● Set RF level using I-1402 SLEW Control with RF LEVEL (dB) Display and ATC-1400A RF LEVEL Control with RF LEVEL -dBm Display. ● Simulate range by pressing ATC-1400A CLEAR RNG Pushbutton Switch, adjusting RANGE/VEL/ACCEL Thumbwheels to desired range in nautical miles and pressing LOAD RNG Pushbutton Switch. ● Control reply delay with the I-1402 REPLY DELAY Switch, REPLY DELAY 1 Control and REPLY DELAY 2 Control. ● Set reply format and content using the I-1402 REPLY ON/OFF Switch, REPLY CODE/ALTITUDE Thumbwheels, REPLY FORMAT Switch and "X" PULSE Switch. ● Adjust F₂ reply pulse width using the ATC-1400A PULSE WIDTH VAR/CAL Switch and XPDR PULSE WIDTH Thumbwheels. ● Deviate F₂ reply pulse using the ATC-1400A XPDR DEV P₂/CAL Switch and XPDR P₂/P₃ DEV Thumbwheels. ● Control echo replies using the ATC-1400A SLS/ECHO ON/OFF Switch and SLS/ECHO Thumbwheels.



06703004

RADAR ATC Test Hook-Up Diagram
Figure 12

3.4.2 General Test Sequence

Refer to 1-2-3, Figure 13.

STEP	ACTION/TEST
1.	The UUT Radar sends the interrogation, Radar (UUT) Output, to the ATC-1400A.
2.	The ATC-1400A sends the interrogation, 50% Video Output, to the I-1402.
3.	The I-1402 sends the Trigger Output pulse to Oscilloscope for accurate range delay to compare with the UUT Radar.
4.	After the controlled range and replay delays, the I-1402 sends the <u>EXT PULSE</u> Output to the ATC-1400A to control the reply format and content.
5.	The ATC-1400A sends the reply, GEN RF Output, to the UUT Radar.

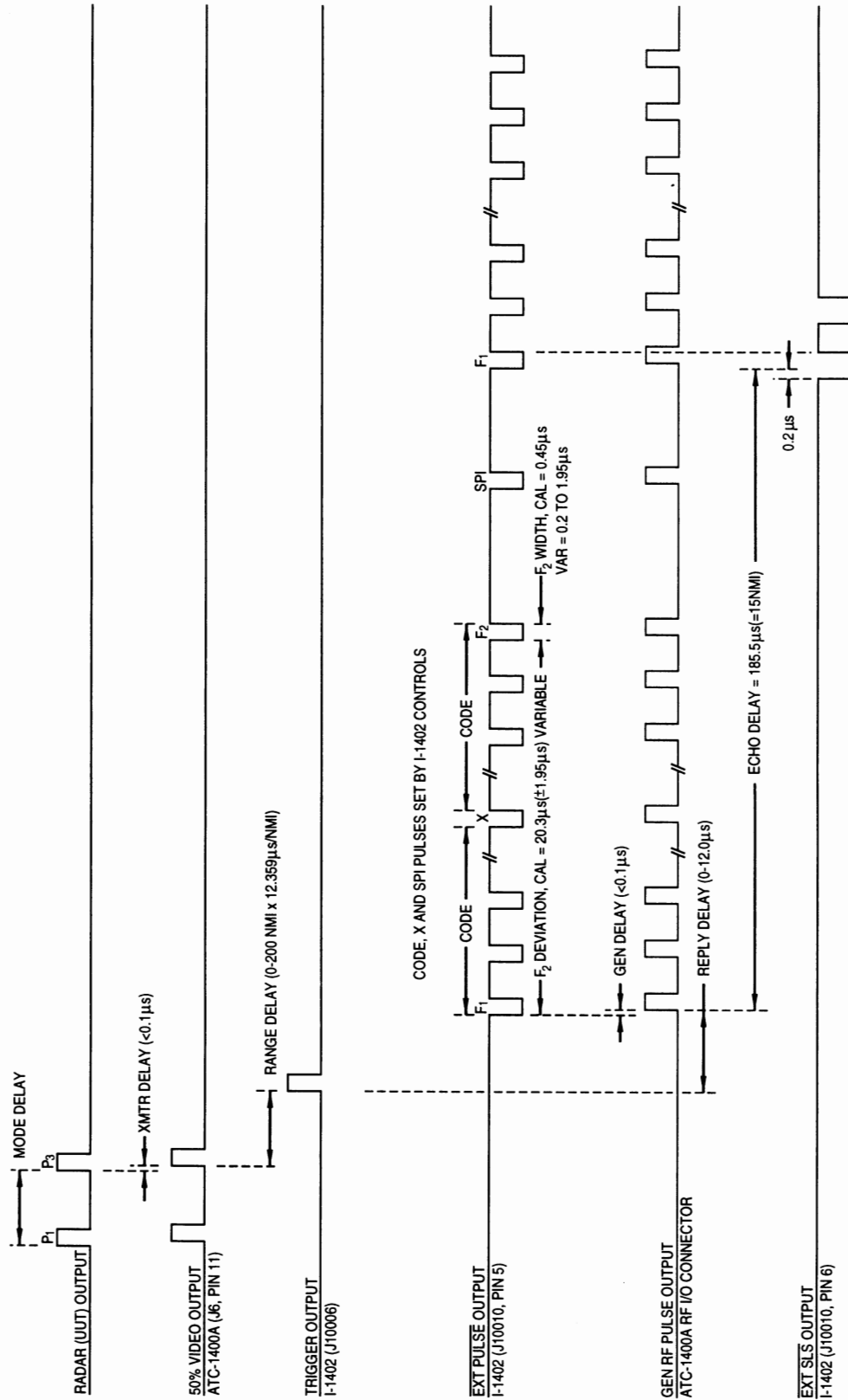
The GEN RF Output video can be seen with an Oscilloscope connected to the ATC-1400A GEN Connector (J17).

STEP	ACTION/TEST
6.	If echo replies are activated, the I-1402 enables the <u>EXT SLS</u> Output to provide level control for the echo pulses (one SLS enable pulse for each echo pulse).

The EXT PULSE Output controls and the GEN RF Output provides the echo reply pulses at the fixed echo delay from P₃ (range delay plus reply delay plus 15 nautical miles [185.4 μs]).



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RADAR ATC Test Function Timing Chart
Figure 13

06702007



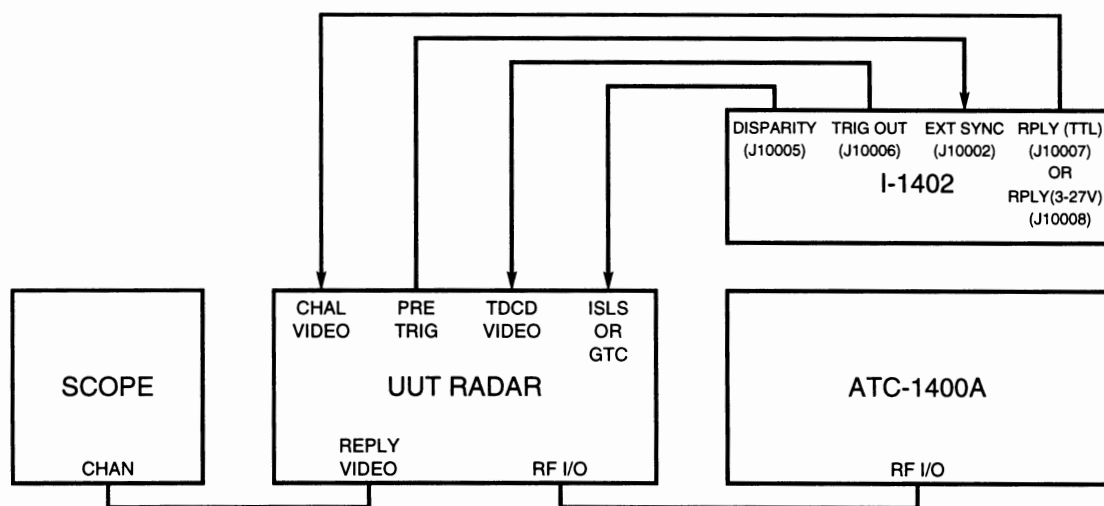
3.5 RADAR MODE 4 (INTERNAL) TEST FUNCTION

The RADAR Mode 4 (Internal) Test Function verifies the ability of radars to transmit IFF interrogations and correctly respond to replies. The I-1402 Test Auxiliary provides input data, simulating encrypted interrogations and decoded replies.

3.5.1 Setup and Controls

- | STEP | PROCEDURE |
|------|--|
| 1. | Set up Mode 4 Test System according to RADAR Mode 4 (Internal) Test Hook-Up Diagram (1-2-3, Figure 14). |
| 2. | Set the ATC-1400A FREQ/FUNCTION SELECT Thumbwheels to XPDR at 1090 MHz. |
| 3. | Set I-1402 Mode SELECT Control to desired RADAR MODE 4 position, selecting interrogation word format A , B , 0 , or RANDOM . |
| 4. | Verify I-1402 RADAR MODE 4 Indicator illuminates. |
| 5. | Set I-1402 CODE INT/EXT Switch to INT . |
| 6. | Vary parameters as follows: <ul style="list-style-type: none"> ● Use ATC-1400A FREQ/FUNCTION SELECT Thumbwheels to set RF. |

- | STEP | PROCEDURE |
|------|--|
| ● | Set RF level using I-1402 SLEW Control with RF LEVEL (dB) Display and ATC-1400A RF LEVEL Control with RF LEVEL -dBm Display. |
| ● | Simulate range by pressing ATC-1400A CLEAR RNG Pushbutton Switch, adjusting RANGE/VEL/ACCEL Thumbwheels to desired range in nautical miles and pressing LOAD RNG Pushbutton Switch. |
| ● | Control reply delay with the I-1402 REPLY DELAY Switch, REPLY DELAY 1 Control and REPLY DELAY 2 Control. |
| ● | Control Disparity, SLS/GTC Output, using the I-1402 DISP ON/OFF Switch, DISPARITY DELAY Switch, DISPARITY DELAY 1 Control and DISPARITY DELAY 2 Control. |
| ● | Control echo replies using the ATC-1400A SLS/ECHO ON/OFF Switch and SLS/ECHO Thumbwheels. |



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RADAR Mode 4 (Internal) Test Hook-Up Diagram
Figure 14

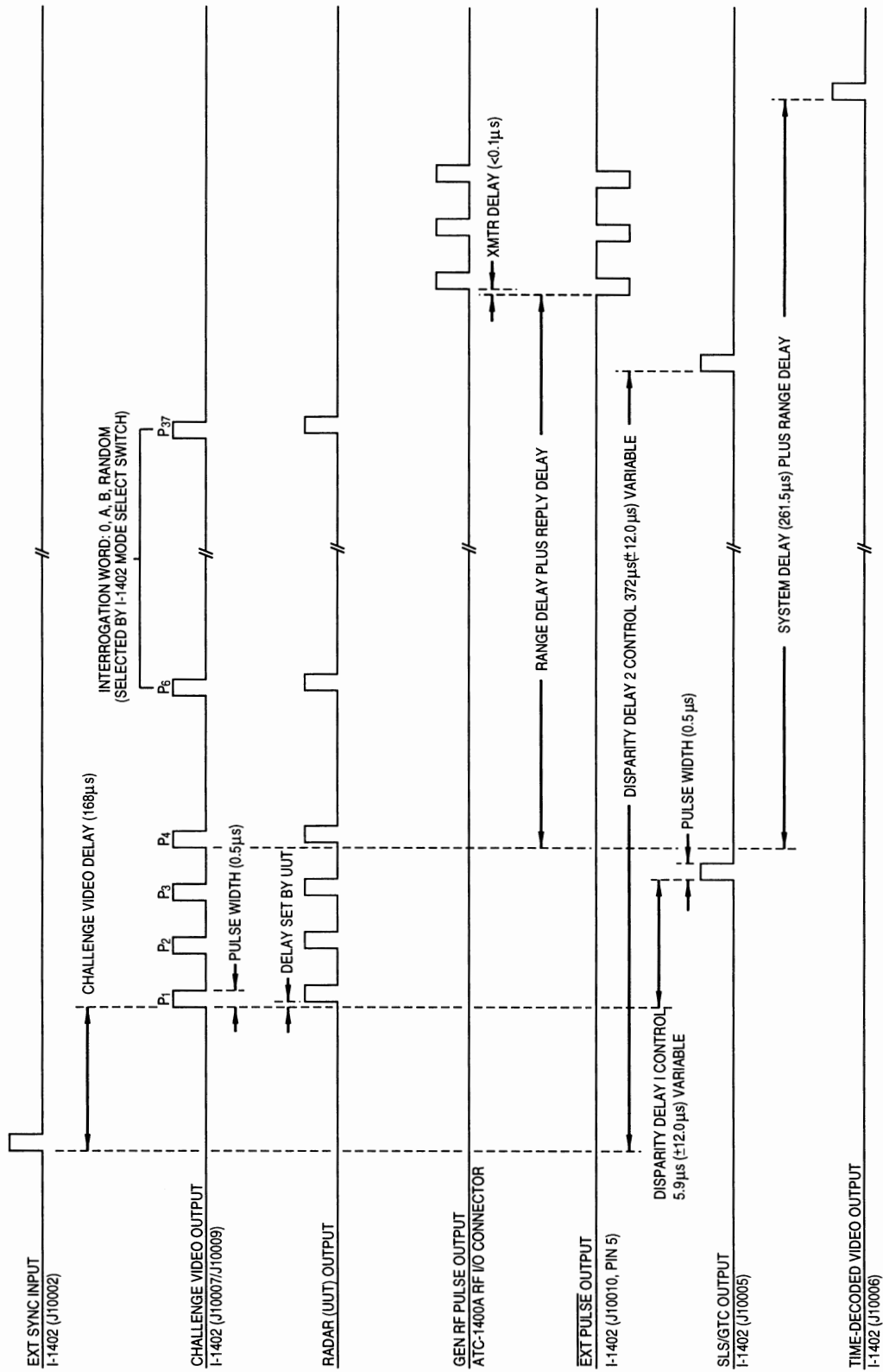


3.5.2 General Test Sequence

Refer to 1-2-3, Figure 15.

STEP	ACTION/TEST
1.	The UUT Radar sends a Pre-Trigger to the I-1402, simulating a KIR encryption device.
2.	The I-1402 sends the interrogation, Challenge Video Output, to the UUT Radar.
3.	The UUT Radar interrogates Mode 4 Test System, Radar (UUT) Output.
4.	The Mode 4 Test System sends a reply back to the UUT Radar. <ul style="list-style-type: none">● The I-1402 sends the $\overline{\text{EXT PULSE}}$ Output to control the reply content.● The ATC-1400A sends the reply to the UUT Radar, GEN RF Pulse Output.
5.	The UUT Radar sends the Reply Video to the Oscilloscope for viewing and to simulate sending to the KIR encryption device.
6.	The I-1402, simulating the KIR encryption device, sends the Time-Decoded Video Output to the UUT Radar at a fixed 261.5 μs plus range delay (for the PPI Display).

Multiply the nautical mile ATC-1400A RANGE/VEL/ACCEL Thumbwheels setting by 12.359 to obtain the range delay in μs .



RADAR Mode 4 (Internal) Test Function Timing Chart
Figure 15

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3.6 RADAR MODE 4 (EXTERNAL) TEST FUNCTION

The RADAR Mode 4 (External) Test Function confirms the ability of radars to transmit IFF interrogations and receive the replies. This test utilizes two encryption devices. The UUT Radar uses a KIR encryption device for encrypting interrogations and decoding replies. The Mode 4 Test System uses a KIT encryption device for decoding interrogations and encrypting replies.

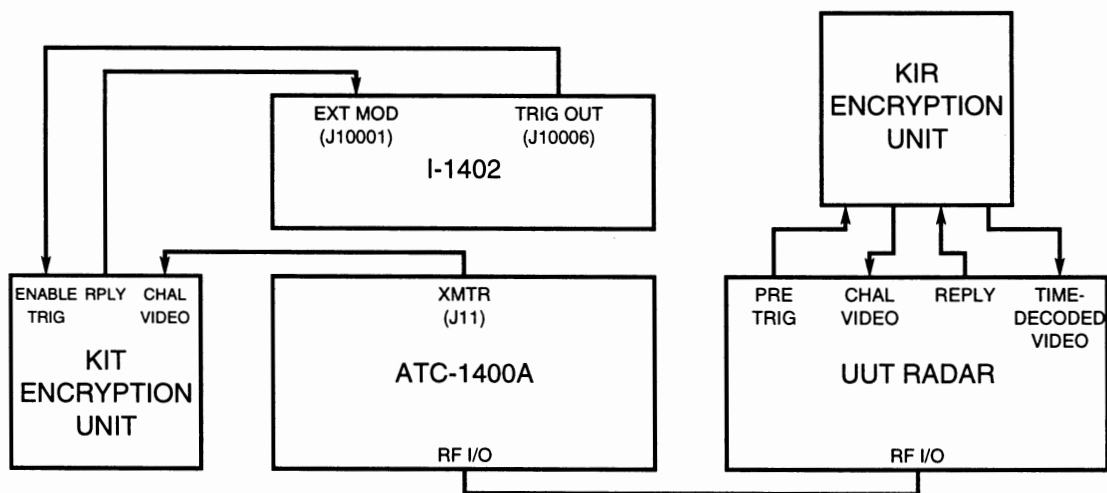
3.6.1 Setup and Controls

STEP	PROCEDURE
1.	Set up Mode 4 Test System according to RADAR Mode 4 (External) Test Hook-Up Diagram (1-2-3, Figure 16).
2.	Set the ATC-1400A FREQ/FUNCTION SELECT Thumbwheels to XPDR at 1090 MHz.
3.	Set I-1402 Mode SELECT Control to any RADAR MODE 4 position.
4.	Verify I-1402 RADAR MODE 4 Indicator illuminates.
4.	Set I-1402 CODE INT/EXT Switch to EXT .

3.6.2 General Test Sequence

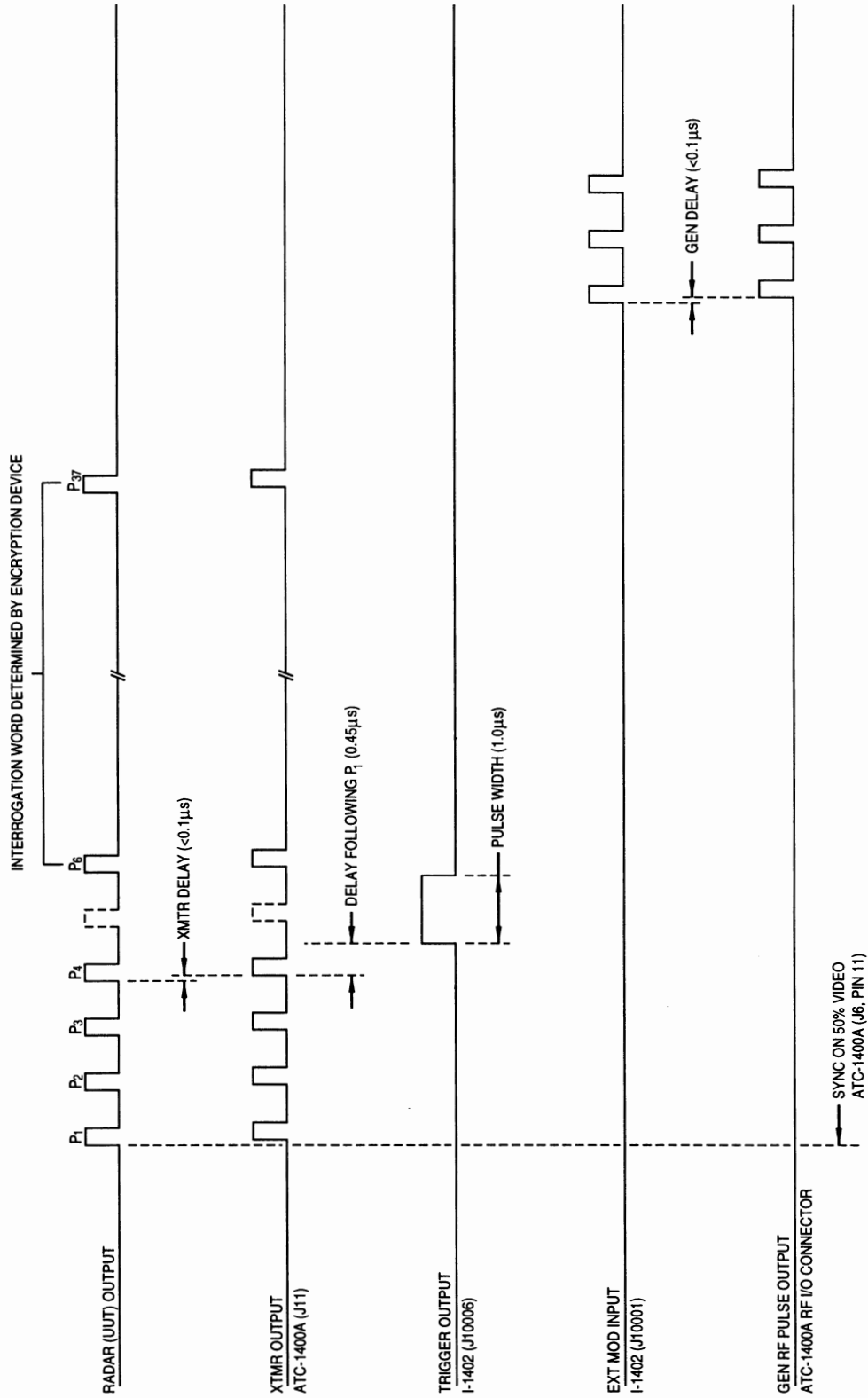
Refer to 1-2-3, Figure 17.

STEP	ACTION/TEST
1.	The UUT Radar triggers the KIR encryption device with Pre-Trigger.
2.	The KIR sends interrogation, Challenge Video, to UUT Radar.
3.	The UUT Radar sends interrogation, Radar (UUT) Output, to the Mode 4 Test System.
The interrogation video can be seen with an Oscilloscope connected to the ATC-1400A XMTR Connector (J16).	
4.	The I-1402 sends an enable Trigger Output to the KIT encryption device.
5.	The ATC-1400A sends the interrogation, XMTR Output, to the KIT encryption device.
6.	The KIT encryption device sends the reply, EXT MOD Input to the I-1402.
7.	The ATC-1400A sends the reply, GEN RF Pulse Output, to the UUT Radar.
8.	The UUT Radar sends the reply to the KIR encryption device.
9.	The KIR encryption device decodes and verifies the reply and sends Time-Decoded Video to UUT Radar.



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RADAR Mode 4 (External) Test Hook-Up Diagram
Figure 16



RADAR Mode 4 (External) Test Function Timing Chart
Figure 17

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4. REMOTE OPERATION

This section contains operating instructions for remotely controlling the operation of the Mode 4 Test System.

4.1 REMOTE CONTROL THROUGH GPIB

The ATC-1400A provides the parallel communication interface to the external controller through the GPIB Connector (J14). The General Purpose Interface Bus (GPIB) conforms to IEEE Standard 488-1978. All communication with the Mode 4 Test System over the GPIB is implemented with ASCII encoded character strings.

Refer to the ATC-1400A Operation Manual for an explanation of remote communication with the ATC-1400A and an Auxiliary Unit (I-1402).

4.2 COMMANDS

The GPIB commands contained in 1-2-4, Table 8 apply to all I-1402 Test Auxiliaries when interfaced with the ATC-1400A, and should be used in conjunction with the commands listed in the ATC-1400A Operation Manual.

4.2.1 Delimiters

Delimiters separate or classify commands. I-1402 GPIB operation use the following delimiters:

- = represents a *set value* to operation.
- ? represents a *get value* operation.
- . represents an *enable* operation.
- : separates commands on same line.

Commands may be grouped together on the same line using the : as a separator. The ? and . delimiters are also separators for commands that normally use these.

4.2.2 Table and Command Text

The I-1402 GPIB Command List in 1-2-4, Table 8 defines the ASCII commands used to control the I-1402 during GPIB operation. The Mode 4 Test System also has the capability of transmitting user defined word formats, programmable only through GPIB remote operation. The I-1402 GPIB Controlled Word Format Commands are found in 1-2-4, Table 9.

Command lines sent to the Mode 4 Test System specifically to the I-1402 must be preceded with the qualifier **AX2=** as in: AX2=[COMMAND 1]: [COMMAND 2]: ... [COMMAND n].

All commands and data entries must be numeric, one of the assigned delimiters, or an alphabetic character.

Items listed under the Range column reflect data entered into or retrieved from the I-1402. Data enclosed in parentheses indicates data retrieved from the I-1402. Data not enclosed in parentheses indicates data sent to the I-1402. Data sent to the I-1402 immediately follows the = delimiter in the GPIB command.



4.2.3 Command List

COMMAND	RANGE	DEFINITION
AX2=RLCD=	-10 to 1267 (Decimal) in Mode C or 0000 to 7777 (Octal) in all other modes	Sets an altitude from -10 to 1267 in hundreds of feet for Mode C or sets Reply Code with four octal digits.
AX2=RLCD?	(-10 to 1267) in Mode C or (0000 to 7777) in other modes	Returns Altitude or Reply Code.
AX2=PULS=	ON or OFF	Sets X Pulse ON or OFF.
AX2=PULS?	(ON or OFF)	Returns X Pulse status.
AX2=RLFM=	IDENT, NORM or EMER	Sets reply to Identification, Normal or Emergency format.
AX2=RLFM?	(IDENT, NORM or EMER)	Returns reply format status.
AX2=RPLY=	ON or OFF	Enables or disables Reply Pulses.
AX2=RPLY?	(ON or OFF)	Returns Reply status.
AX2=RLDL=	CAL, DELAY1 or DELAY2	Selects Reply Delay: calibrated, REPLY DELAY 1 Control or REPLY DELAY 2 Control.
AX2=RLDL?	(CAL, DELAY1 or DELAY2)	Returns Reply Delay status.
AX2=RLD1=	180 to 450 μ s in Mode 4 (0.1 μ s steps) or 0 to 12 μ s in ATC (50 ns steps)	Sets Reply Delay for REPLY DELAY 1 Control (only for remote operation).
AX2=RLD1?	(180 to 450 μ s in Mode 4 or 0 to 12 μ s in ATC)	Returns Reply Delay for REPLY DELAY 1 Control.
AX2=RLD2=	180 to 450 μ s in Mode 4 (0.1 μ s steps) or 0 to 12 μ s in ATC (50 ns steps)	Sets Reply Delay for REPLY DELAY 2 Control (only for remote operation).
AX2=RLD2?	(180 to 450 μ s in Mode 4 or 0 to 12 μ s in ATC)	Returns Reply Delay for REPLY DELAY 2 Control.
AX2=DISP=	ON or OFF	Enables or disables Disparity Pulse.
AX2=DISP?	(ON or OFF)	Returns Disparity status.
AX2=DSDL=	CAL, DELAY1 or DELAY2	Selects Disparity Delay: calibrated, DISPARITY DELAY 1 Control or DISPARITY DELAY 2 Control.
AX2=DSDL?	(CAL, DELAY1 or DELAY2)	Returns Disparity Delay status.
AX2=DSD1=	0 to 100 μ s in XPDR-M4 (0.1 μ s steps) or -6.1 to +17.9 μ s in RADAR-M4 (0.1 μ s steps)	Sets Disparity Delay for DISPARITY DELAY 1 Control based on test mode.
AX2=DSD1?	(0 to 100 μ s in XPDR-M4 or -6.1 to +17.9 μ s in RADAR-M4)	Returns Disparity Delay for DISPARITY DELAY 1 Control.
AX2=DSD2=	180 to 280 μ s in XPDR-M4 (0.1 μ s steps) or 360 to 384 μ s in RADAR-M4 (0.1 μ s steps)	Sets Disparity Delay for DISPARITY DELAY 2 Control based on test mode.
AX2=DSD2?	(180 to 280 μ s in XPDR-M4 or 360 to 384 μ s in RADAR-M4)	Returns Disparity Delay for DISPARITY DELAY 2 Control.
AX2=P2=	ON or OFF	Set P ₂ pulse ON or OFF.
AX2=P2?	(ON or OFF)	Returns P ₂ pulse status.
AX2=P3=	ON or OFF	Sets P ₃ pulse ON or OFF.
AX2=P3?	(ON or OFF)	Returns P ₃ pulse status.
AX2=P4=	ON or OFF	Sets P ₄ pulse ON or OFF.
AX2=P4?	(ON or OFF)	Returns P ₄ pulse status.

I-1402 GPIB Command List
Table 8



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MODE 4 TEST SYSTEM

COMMAND	RANGE	DEFINITION
AX2=CODE=	INT or EXT	Selects Code Source as internal (no encryption device) or external (encryption device present).
AX2=CODE?	(INT or EXT)	Returns Code Source status.
AX2=P4D=	CAL, - or +	Selects P ₄ pulse deviation.
AX2=P4D?	(CAL, - or +)	Returns P ₄ pulse deviation status.
AX2=RFLV=	-3.0 to +3.0 dB (0.1 dB steps)	Sets RF Vernier level.
AX2=RFLV?	(-3.0 to +3.0 dB)	Returns RF Vernier Level status.
AX2=MODE=	XATC, XM4-RANDOM, XM4-A, XM4-B, XM4-Ø, RATC, RM4-RANDOM, RM4-A, RM4-B or RM4-Ø	Selects Test Mode: XPDR ATC, XPDR Mode 4 with Random word format, XPDR Mode 4 with A word format, XPDR Mode 4 with B word format, XPDR Mode 4 with 0 word format, RADAR ATC, RADAR Mode 4 with Random word format, RADAR Mode 4 with A word format, RADAR Mode 4 with B word format or RADAR Mode 4 with 0 word format. See also 1-2-4, Table 9.
AX2=MODE?	(XATC, XM4-RANDOM, XM4-A, XM4-B, XM4-Ø, RATC, RM4-RANDOM, RM4-A, RM4-B or RM4-Ø)	Returns Test Mode status.
AX2=STAB?	(<0.45 µs to >0.65 µs or OVER)	Returns stability time (Decoded Video Pulse jitter).
AX2=UUTD?	(0.2 to 199.9 µs or OVER)	Returns UUT Reply Delay status.

I-1402 GPIB Command List
Table 8 (Cont)

COMMAND	RANGE	DEFINITION
AX2=MODE=XM4-VAR.		Selects XPDR Mode 4 Test Mode with GPIB controlled word format using even and odd data field settings. Command must be used again any time settings for the odd and/or even data fields change.
AX2=MODE=XM4-VAR-INT.	(default)	Selects ATC-1400A SELF-INTERR as trigger for XM4-VAR operation.
AX2=MODE=XM4-VAR-EXT.		Selects external trigger through I-1402 EXT SYNC Connector (J10002) for XM4-VAR operation.
AX2=ODD=	00000000 (default) to FFFFFFFF in hexadecimal numerical format	Sets 32-bit odd data field with each bit representing every other 1 µs pulse position in the word format starting with 9 µs from P ₁ .
AX2=ODD?	00000000 to FFFFFFFF	Returns 32-bit odd data field setting.
AX2=EVEN=	00000000 (default) to FFFFFFFF in hexadecimal numerical format	Sets 32-bit even data field with each bit representing every other 1 µs pulse position in the word format starting with 10 µs from P ₁ .
AX2=EVEN?	00000000 to FFFFFFFF	Returns 32-bit even data field setting.

I-1402 GPIB Controlled Word Format Commands
Table 9



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MODE 4 TEST SYSTEM

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SECTION 3 - SPECIFICATIONS

1. MODE 4 TEST SYSTEM SPECIFICATIONS

NOTE: These specifications supersede ATC-1400A Specifications when the ATC-1400A is connected with the I-1402. Refer to the ATC-1400A Operation Manual for Specifications not outlined in this section.

1.1 RF LEVEL VERNIER

Range:	±3.0 dB
Step:	0.1 dB
Accuracy:	±0.05 dB or ±10%

1.2 XPDR ATC

GEN CODE DELAY (P₃ to F₁)

CAL Position:	3.0 μs (±50 ns)
Variable (I-1402 REPLY DELAY 1 and 2 Controls):	0 to 12 μs (modes 1, 2, T, A, B, C, D)

REPLY CODE/ALTITUDE CODE OUTPUT (J10007/J10008)

Pulse Spacing:	1.45 μs (±10 ns)
Pulse Width:	
(J10007):	0.45 μs (±10 ns)
(J10008):	0.45 μs (±100 ns)
F ₁ to F ₂ Spacing:	20.3 μs (±10 ns)
F ₁ to SPI Spacing:	24.65 μs (±10 ns)
Pulse Jitter (using ATC-1400A 20 MHz clock and TO SYNC):	<5 ns
Level:	
(J10007):	>3.0 V into 90 Ω
(J10008):	Nominal 4.5 V, internally adjustable from +3 to +27 V into 1 kΩ

SPI PULSE

Width:	
(J10007):	0.5 μs (±10 ns)
(J10008):	0.5 μs (±100 ns)
Position:	24.65 μs (±10 ns)

CODE FORMATS: Refer to Appendix D.



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MODE 4 TEST SYSTEM

IDENT PATTERN

Mode 1: Double reply
Modes 2, A, T, B, D, AC₁: Single reply

EMER PATTERN

All modes except C and AC₂: 4 replies (F₁-F₈)

Mode Group Delay (Modes 1, 2, T, A, B, C, D)

ATC-1400A DBL INTERR/INTRF
PULSE Thumbwheels set to
DOUBLE and SUPPRESSOR
ON/OFF Switch ON:

MODE GROUP DELAY Indicator ON

Delay (P₁ rising edge to suppressor pulse rising edge):

Minimum (Thumbwheels = 0): 20.5 μ s

Adjustable (Thumbwheels varied): 20.5 to 399.9 μ s

UUT REPLY DELAY (GPIB Only)

Range (P₃ rising edge to F₁
rising edge): 0.2 to 199.9 μ s

Resolution: 25 ns

Accuracy: \pm 50 ns

1.3 XPDR MODE 4

GEN PULSES P₁ THROUGH P₃₇

Pulse Width: 0.5 μ s (\pm 10 ns)

Deviation (P₁ through P₄): 0.2 to 1.90 μ s

Pulse Spacing:

P₁ to P₂: 2.0 μ s (\pm 10 ns)

P₁ to P₃: 4.0 μ s (\pm 10 ns)

P₁ to P₄: 6.0 μ s (\pm 10 ns)

P₁ to P₅: 8.0 μ s (\pm 10 ns)

P₁ to P₆ (Format 0): 9.0 μ s (\pm 10 ns)

P₁ to P₆ (Formats A and B): 10.0 μ s (\pm 10 ns)

Code Format: Refer to Appendix B.

Deviation: \pm 1.95 μ s (\pm 10 ns) (P₄ + dev, max = 1.0 μ s)

P₅ Pulse Level (SLS): -19 to +6 dB

Accuracy: \pm 0.5 dB from -19 to -11 dB
 \pm 0.2 dB from -10 to +3 dB
 \pm 0.5 dB from +4 to +6 dB



OPERATION MANUAL
MODE 4 TEST SYSTEM

DI/INTRF SPACING (Controlled by ATC-1400A DBL INTERR/INTRF PULSE Thumbwheels)

INTRF Pulse: -17.5 to 399.9 μ s (\pm 50 ns)
DI Spacing: 72 to 399.9 μ s (\pm 50 ns)

REPLY OUTPUT (J10007/J10008) [Code=INT]

Pulse Width:
(J10007): 0.45 μ s (\pm 10 ns)
(J10008): 0.45 μ s (\pm 100 ns)
Pulse Spacing:
F₁ to F₃ Spacing: 3.5 μ s (\pm 10 ns)
Delay (CAL Position):
Mode 0: 230.0 μ s (\pm 50 ns)
Mode B: 260.0 μ s (\pm 50 ns)
Mode A: 200.0 μ s (\pm 50 ns)
Random: 200 to 260 μ s in quasi-random fashion
Variable (I-1402 DISPARITY
DELAY 1 and 2 Controls): 180 to 280 μ s

Level:

(J10007): >3.0 V into 90 Ω
(J10008): Nominal 4.5 V, internally adjustable from +3 to +27 V into 1 k Ω

DISPARITY (J10005) [Code=INT]

Delay:

CAL Position: 198.0 μ s (\pm 50 ns)
Variable (I-1402 DISPARITY
DELAY 1 Control): 0 to 100.0 μ s
DELAY 2 Control): 180 to 280 μ s

Pulse Width: 0.5 μ s (\pm 10 ns) Positive TTL

Level: >3.0 V into 90 Ω

TRIGGER OUTPUT (J10006) [Code=INT] (Time-Decoded Video)

P₄ rising edge to Trigger Pulse
Rising edge: 194.0 μ s (\pm 50 ns)
Pulse Width: 1.0 μ s nominal
Level: >3.0 V into 90 Ω



OPERATION MANUAL
MODE 4 TEST SYSTEM

TRIGGER OUTPUT (J10006) [Code=EXT] (UUT Pre-trigger)

Width: 1.0 μ s nominal
Level: >3.0 V into 90 Ω

DECODED VIDEO INPUT (J10004) [Code=EXT]

Stable (<0.45 μ s jitter): STABLE Indicator illuminated
Unstable (>0.65 μ s jitter): UNSTABLE Indicator illuminated

CHALLENGE VIDEO INPUT (J10001) [Code=EXT]

Polarity: Positive
Level: 2.5 to 15 V

UUT REPLY DELAY [Code=EXT, GPIB Only]

Range (P4 rising edge to first reply pulse): 0.2 to 199.9 μ s
Resolution: 25 ns
Accuracy: \pm 50 ns

1.4 RADAR ATC

MODES: 1, 2, 3/A and C (selected by ATC-1400A XPDR MODE Control and not the UUT Pulse Spacing)

RANGE DELAY: 0.0 to 200 nmi in 1 nmi steps (selected by ATC-1400A RANGE/VEL/ACCEL Thumbwheels (12.359 μ s/nmi))

ECHO (ATC-1400A SLS/ECHO ON/OFF Switch)

ON: Enables echo at fixed range delay of 15 nmi (185.4 μ s) plus range and reply delays
Accuracy: \pm 50 ns + 0.005%
Position (fixed) Leading edge is nominally 0.3 μ s prior to leading edge of generator output.
Level (ATC-1400A SLS/ECHO Thumbwheels): -19 to +6 dB in 1 dB steps for all pulses simultaneously
Accuracy: \pm 0.5 dB from -19 to -11 dB
 \pm 0.2 dB from -10 to +3 dB
 \pm 0.5 dB from +4 to +6 dB

REPLY CODES (I-1402 REPLY CODE/ALTITUDE Thumbwheels): Codes are in accordance with the test criteria in Appendix D for Modes 1, 2, 3/A and C.

REPLY DELAY (from TRIGGER OUTPUT Connector [J10006])

CAL: 3.0 μ s (\pm 50 ns)
Variable (I-1402 REPLY DELAY 1 and 2 Controls): 1.0 to 12 μ s



F₂ REPLY PULSE (ATC-1400A GEN Connector Output)

Deviation (ATC-1400A P₂
Deviation Controls): From F₁

CAL Position: 20.3 μ s (\pm 50 ns)

Variable: \pm 1.95 μ s in 0.05 μ s steps

Width (ATC-1400A XPDR
PULSE WIDTH Controls):

CAL Position: 0.45 μ s (\pm 10 ns)

Variable: 0.2 to 1.95 μ s in 0.05 μ s steps

SCOPE TRIGGER OUTPUT (J10006): 1.0 μ s wide, coincidental with the end of range
delay (\pm 50 ns)

Level: >3.0 V into 90 Ω

1.5 RADAR MODE 4

RANGE DELAY: 0.0 to 200 nmi in 1 nmi steps (selected by
ATC-1400A RANGE/VEL/ACCEL Thumbwheels
(12.359 μ s/nmi))

ECHO (ATC-1400A SLS/ECHO ON/OFF Switch)

ON: Enables echo at fixed range delay of 15 nmi
(185.4 μ s) plus range and reply delays

Accuracy: \pm 50 ns + 0.005%

Position (fixed): SLS pulses occur 0.3 μ s prior to leading
edge of generator pulses

Level (ATC-1400A
SLS/ECHO Thumbwheels): -19 to +6 dB in 1 dB steps for all pulses
simultaneously

Accuracy: \pm 0.5 dB from -19 to -11 dB
 \pm 0.2 dB from -10 to +3 dB
 \pm 0.5 dB from +4 to +6 dB

DISPARITY DELAY (J10005)

CAL Position: 5.9 μ s (\pm 50 ns) following P₁

Variable:

I-1402 DISPARITY
DELAY 1 Control: -6.1 to +17.9 μ s following P₁

I-1402 DISPARITY
DELAY 2 Control: 360 to 384 μ s following pre-trigger input (I-1402
EXT SYNC Connector [J10002])

Pulse Width: 0.5 μ s (\pm 10 ns)

Level: >3.0 V into 90 Ω



REPLY [Code=INT]

Variable Delay (I-1402 REPLY
DELAY 1 and 2 Controls): 180 to 280 μ s

CAL Position:

Format 0: 232 μ s (\pm 50 ns)

Format A: 202 μ s (\pm 50 ns)

Format B: 262 μ s (\pm 50 ns)

Random: 202 to 262 μ s in quasi-random fashion

Number of pulses: Three

Pulse Period: 1.75 μ s (\pm 10 ns)

Pulse Width: 0.45 μ s (\pm 10 ns) fixed

Amplitude: 3 to 27 V (Preset to 4.5 V)

REPLY (J10001) [Code=EXT]

Input from Encryption Device: +2.5 to 15 V

ENABLE TRIGGER (J10001) [Code=EXT]

Polarity: Positive TTL

Width: 1.0 μ s nominal

Delay: 0.45 μ s (\pm 50 ns) after P₄

TIME-DECODED VIDEO (J10006) [Code=INT]

Polarity: Positive TTL

Width: 1.0 μ s nominal

Delay: 261.5 μ s (\pm 10 ns) plus range delay following P₄

PRE-TRIGGER (J10002) [Code=INT]

Input to initiate interrogation: +2.5 to +15 V



CHALLENGE VIDEO OUTPUT (J10007/J10008) [Code=INT]

P₁ through P₄:

Period:

(J10007): 2.0 μ s (\pm 10 ns)

(J10008): 2.0 μ s (\pm 50 ns)

Width Cal Position:

Cal Position (J10007): 0.5 μ s (\pm 10 ns)

Cal Position (J10008): 0.5 μ s (\pm 100 ns)

Variable: 0.2 to 1.95 μ s

P₂ through P₄:

Position: Variable \pm 1.95 μ s

Control: Selectable ON/OFF

P₆ through P₃₇:

Format: A, B, 0 or Random

Width:

(J10007): 0.5 μ s (\pm 10 ns)

(J10008): 0.5 μ s (\pm 100 ns)

Spacing: Even μ s intervals (Information Pulses)

Amplitude:

(J10007): >3.0 V into 90 Ω

(J10008): +3 to +27 V adjustable (Preset to +4.5 V)

DISPARITY OUTPUT (J10005) [Code=INT]

ISLS Trigger:

Level: >3.0 V into 90 Ω

Width: 0.5 μ s (\pm 10 ns)

Position:

CAL: 5.9 μ s (\pm 10 ns) after P₁

VAR: \pm 12.0 μ s from CAL

GTC Trigger:

Level: >3.0 V into 90 Ω

Width: 0.5 μ s (\pm 10 ns)

Position: 360 to 384 μ s from pre-trigger



OPERATION MANUAL MODE 4 TEST SYSTEM

1.6 POWER REQUIREMENTS:

Source Voltage and Frequency:	100 to 120 VAC, 60 Hz. 220 to 240 VAC, 50 Hz.
Power Consumption:	43 W Maximum 163 W Maximum with ATC-1400A 26 W Nominal at 115 VAC 122 W Nominal at 115 VAC with ATC-1400A 20 W Nominal at 230 VAC 117 W Nominal at 230 VAC with ATC-1400A
Nominal Input Current:	0.33 A at 115 VAC 1.71 A at 115 VAC with ATC 1400A 0.17 A at 230 VAC 1.0 A at 230 VAC with ATC 1400A

1.7 FUSE REQUIREMENTS

F2 and F4:	
100 to 120 VAC:	1.0 A, 250 V, Type F
220 to 240 VAC:	0.5 A, 250 V, Type F
F1 and F3:	
100 to 120 VAC:	3.0 A, 250 V, Type F
220 to 240 VAC:	3.0 A, 250 V, Type F

1.8 PHYSICAL

Size:	≈3.5" (8.89 cm) high w/o feet) by ≈16.75" (42.55 cm) wide by ≈18.375" (46.67 cm) deep (Rack mount option)
Weight:	≈17.5 lbs (7.94 kg)

1.9 SAFETY CONDITIONS

Use:	Indoors
Altitude:	≤4000 meters (13,124 feet)
Temperature:	5° to 40° C
Relative Humidity:	≤80% for temperatures up to 31° C decreasing linearly to 50% at 40° C
Mains Supply Voltage Fluctuations:	≤±10% of the nominal voltage
Transient Overvoltages:	According to Installation Category II
Pollution Degree:	2



SECTION 4 - SHIPPING

1. SHIPPING TEST SETS

1.1 INFORMATION

IFR Test Sets returned to factory for calibration, service or repair must be repackaged and shipped according to the following conditions:

Authorization

Do not return any products to factory without first receiving authorization from IFR Customer Service Department.

CONTACT: IFR Systems, Inc.
Customer Service

Telephone: 800-835-2350
FAX: 316-524-2623

Tagging Test Sets

All Test Sets must be tagged with:

- Identification and address of owner.
- Nature of service or repair required.
- Model Number.
- Serial Number.

Shipping Containers

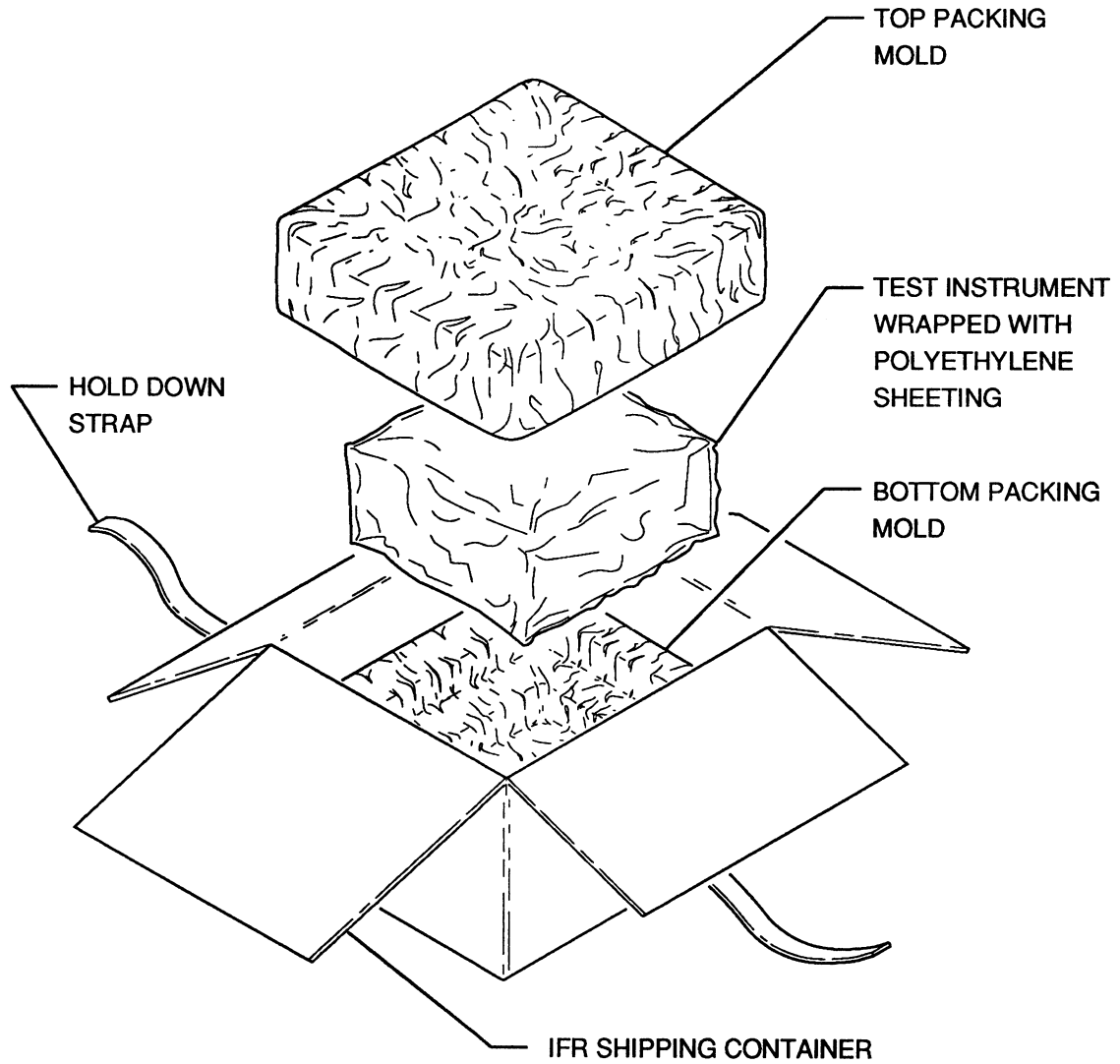
Test Sets must be repackaged in original shipping containers using IFR packing molds. If original shipping containers and materials are not available, contact IFR Customer Service for shipping instructions.

Freight Costs

All freight costs on non-warranty shipments are assumed by the customer. (See "Warranty Packet" for freight charge policy on warranty claims.)

1.2 REPACKING PROCEDURE

- Make sure bottom packing mold is seated on floor of shipping container.
- Carefully wrap Test Set with polyethylene sheeting to protect finish.
- Place Test Set into shipping container, making sure Test Set is securely seated in bottom packing mold.
- Place top packing mold over top of Test Set and press down until mold rests solidly in bottom packing mold.
- Close shipping container lids and seal with shipping tape or an industrial stapler. Tie all sides of container with break resistant rope, twine or equivalent.



Repacking Procedure
Figure 1



SECTION 5 - STORAGE

1. STORING TEST SETS

Perform the following storage precautions whenever the Test Set is stored for extended periods:

- Disconnect Test Set from any electrical power source.
- Disconnect and store ac power cable and other accessories with Test Set.
- Cover Test Set to prevent dust and debris from covering and entering Test Set.



OPERATION MANUAL
MODE 4 TEST SYSTEM

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APPENDIX A - CONNECTOR PIN-OUT TABLES

1. TABLE OF I-1402 I/O CONNECTORS

CONNECTOR	NAME	CONNECTOR TYPE	SIGNAL TYPE	INPUT/OUTPUT
J10001	EXT MOD	BNC	TTL	INPUT
J10002	EXT SYNC	BNC	TTL	INPUT
J10003	EXT CLOCK	BNC	TTL	INPUT
J10004	DECODED VIDEO	BNC	TTL	INPUT
J10005	DISPARITY	BNC	TTL	OUTPUT
J10006	TRIGGER OUTPUT	BNC	TTL	OUTPUT
J10007	REPLY (TTL)	BNC	TTL	OUTPUT
J10008	REPLY (3-27 V)	BNC	3-27 Vdc	OUTPUT
J10010	AUX BUS	25-Pin, Type D	See Pin-Out Table.	INPUT/OUTPUT
J10011	IFR BUS	25-Pin, Type D	See Pin-Out Table.	INPUT/OUTPUT
J10013	LEVEL OUTPUT	SMB	0 to 7 Vdc	OUTPUT



2. I-1402 AUX BUS CONNECTOR (J10010) (TO ATC-1400A, J6) PIN-OUT TABLE

PIN NO.	SIGNAL NAME	SIGNAL TYPE	INPUT/OUTPUT	POLARITY
1	GROUND			
2	SPARE			
3	SPARE			
4	SPARE			
5	EXT PULSE	TTL	OUTPUT	ACTIVE LOW
6	EXT SLS	TTL	OUTPUT	ACTIVE LOW
7	SPARE			
8	PULSE	TTL	INPUT	POSITIVE
9	20 MHZ	TTL	INPUT	RISING EDGE
10	A/A INT			
11	50% VIDEO	TTL	INPUT	POSITIVE
12	SPARE			
13	SPARE			
14	SELF INTERR	TRISTATE	INPUT/OUTPUT	RISING EDGE
15	GROUND			
16	GROUND			
17	GROUND			
18	GROUND			
19	GROUND			
20	GROUND			
21	GROUND			
22	GROUND			
23	SPARE			
24	GROUND			
25	SPARE			



3. I-1402 IFR BUS CONNECTOR (J10011) (TO ATC-1400A, J5) PIN-OUT TABLE

PIN NO.	SIGNAL NAME	SIGNAL TYPE	INPUT/OUTPUT	POLARITY
1	GROUND			
2	A0	TTL	INPUT	POSITIVE
3	A1	TTL	INPUT	POSITIVE
4	GROUND			
5	A2	TTL	INPUT	POSITIVE
6	D7	TTL	INPUT/OUTPUT	POSITIVE
7	D6	TTL	INPUT/OUTPUT	POSITIVE
8	A3	TTL	INPUT	POSITIVE
9	GROUND			
10	GROUND			
11	NOT USED			
12	D5	TTL	INPUT/OUTPUT	POSITIVE
13	GROUND			
14	NOT USED			
15	D4	TTL	INPUT/OUTPUT	POSITIVE
16	GROUND			
17	WRITE	TTL	INPUT	POS STROBE
18	D3	TTL	INPUT/OUTPUT	POSITIVE
19	GROUND			
20	READ	TTL	INPUT	POS STROBE
21	D2	TTL	INPUT/OUTPUT	POSITIVE
22	INTA	TRISTATE	OUTPUT	LEVEL SET
23	INTR	TRISTATE	OUTPUT	LEVEL SET
24	D1	TTL	INPUT/OUTPUT	POSITIVE
25	D0	TTL	INPUT/OUTPUT	POSITIVE



OPERATION MANUAL
MODE 4 TEST SYSTEM

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APPENDIX B - MODE 4 INTERROGATION WORD FORMAT CODE POSITION CHART

INTERROGATION WORD FORMAT				
PULSE	0 (μ s)	A (μ s)	B (μ s)	Random (μ s)
P ₆	9	10	10	9, 10 or OFF
P ₇	11	13	12	11, 12 or OFF
P ₈	13	15	15	13, 14 or OFF
P ₉	15	17	17	15, 16 or OFF
P ₁₀	17	OFF	19	17, 18 or OFF
P ₁₁	19	20	OFF	19, 20 or OFF
P ₁₂	21	OFF	22	21, 22 or OFF
P ₁₃	23	24	25	23, 24 or OFF
P ₁₄	25	26	OFF	25, 26 or OFF
P ₁₅	27	OFF	28	27, 28 or OFF
P ₁₆	29	30	30	29, 30 or OFF
P ₁₇	31	33	32	31, 32 or OFF
P ₁₈	33	35	35	33, 34 or OFF
P ₁₉	35	OFF	37	35, 36 or OFF
P ₂₀	37	38	OFF	37, 38 or OFF
P ₂₁	39	41	40	39, 40 or OFF
P ₂₂	41	43	OFF	41, 42 or OFF
P ₂₃	43	45	44	43, 44 or OFF
P ₂₄	45	OFF	OFF	45, 46 or OFF
P ₂₅	47	48	48	47, 48 or OFF
P ₂₆	49	50	51	49, 50 or OFF
P ₂₇	51	52	53	51, 52 or OFF
P ₂₈	53	54	55	53, 54 or OFF
P ₂₉	55	OFF	57	55, 56 or OFF
P ₃₀	57	58	OFF	57, 58 or OFF
P ₃₁	59	61	60	59, 60 or OFF
P ₃₂	61	63	62	61, 62 or OFF
P ₃₃	63	OFF	64	63, 64 or OFF
P ₃₄	65	66	66	65, 66 or OFF
P ₃₅	67	68	OFF	67, 68 or OFF
P ₃₆	69	OFF	70	69, 70 or OFF
P ₃₇	71	71	OFF	71, 72 or OFF
<p>P₁ Reference P₂ 2 μs (\pmDev) with P₂ Dev ON P₃ 4 μs (\pmDev) with P₃ Dev ON P₄ 6 μs (\pmDev) with P₄ Dev ON P₅ 8 μs (\pmDev) with SLS ON</p>				



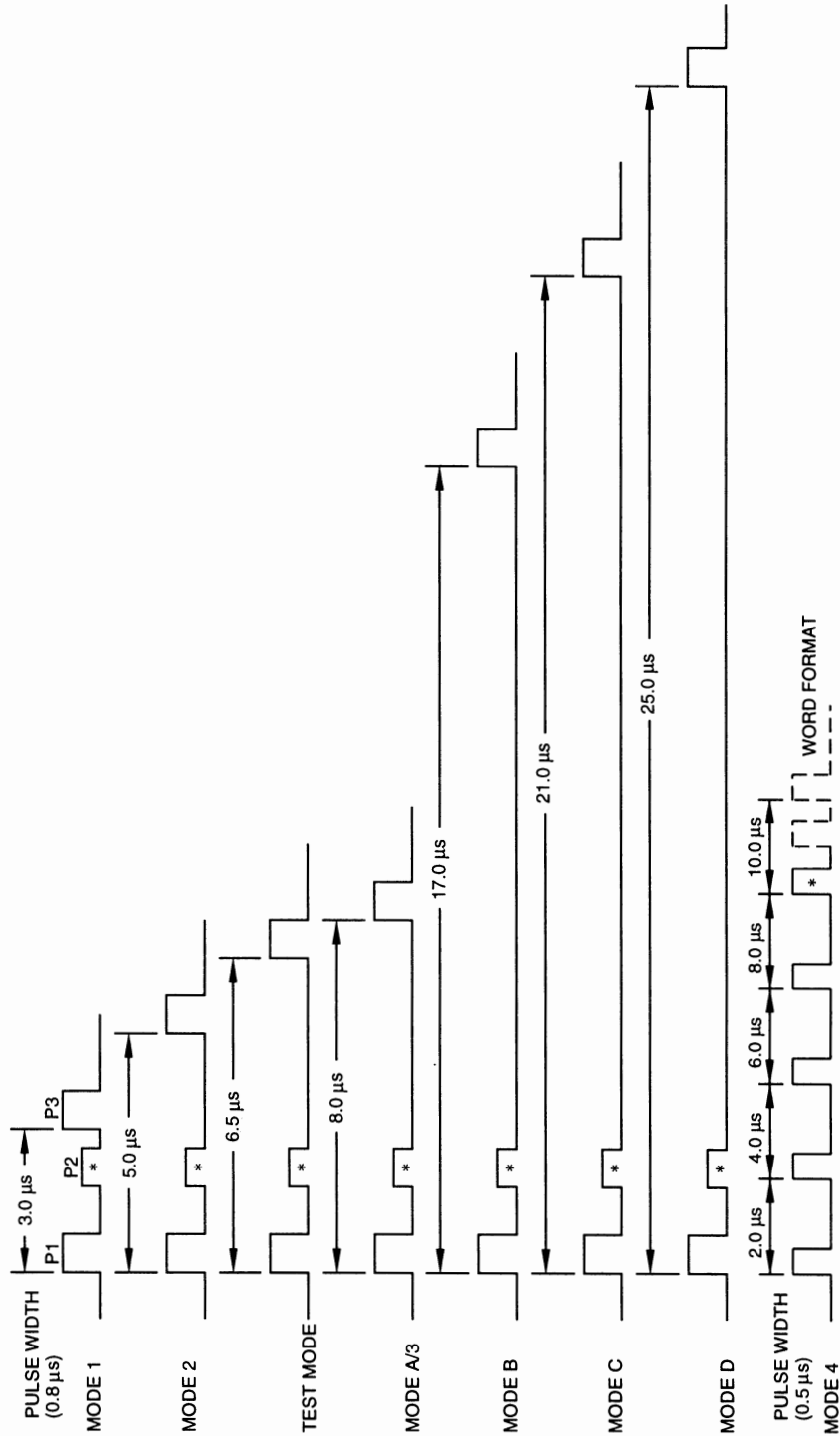
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APPENDIX C - INTERROGATION AND REPLY PULSE SPACING CHARTS

1. INTERROGATION PULSE SPACING



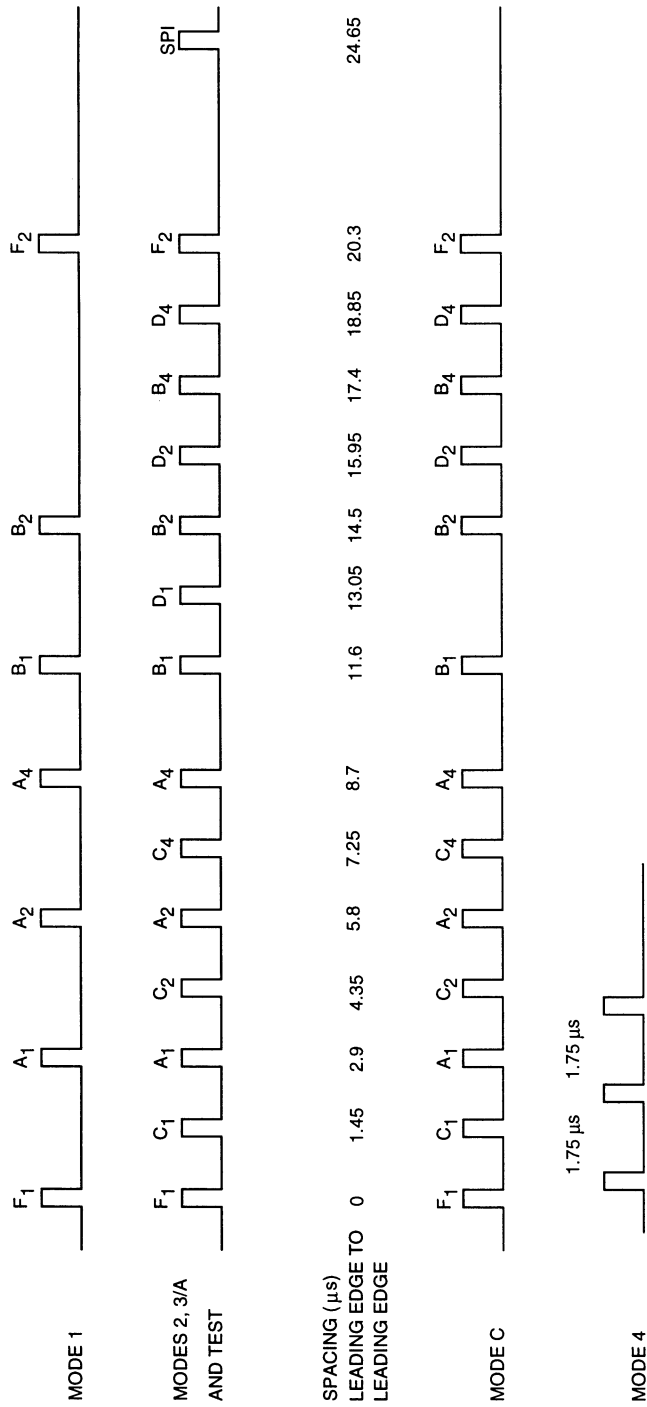
* SIDE-LOBE SUPPRESSION (SLS)

THE WORD FORMAT CONSISTS OF UP TO 32 PULSES STARTING AT 9 OR 10 μs AND USUALLY SPACED ≥ 2 μs APART.

06702010



2. REPLY PULSE SPACING



THE MODE 4 REPLY OCCURS BETWEEN
200 AND 360 μs AFTER A MODE 4 TRIGGER.

6702011



APPENDIX D - ATC CODES/PULSE BINARY CONVERSION TABLE

MODE C (random altitude, in feet)																	
CODE	ALTITUDE	F ₁	C ₁	A ₁	C ₂	A ₂	C ₄	A ₄	X	B ₁	D ₁	B ₂	D ₂	B ₄	D ₄	F ₂	(verify)
9010	-1000	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	_____
0000	0	1	0	0	1	0	0	0	0	0	0	1	0	1	0	1	_____
0099	9,900	1	0	0	1	1	1	1	0	1	0	0	0	1	0	1	_____
0555	55,500	1	0	0	1	0	0	1	0	0	0	0	0	1	1	1	_____
1001	100,100	1	1	1	1	0	0	1	0	1	0	1	1	1	0	1	_____
1267	126,700	1	0	0	0	0	1	0	0	0	0	0	1	0	0	1	_____
MODES 1, 2, 3/A (random IDENT codes)																	
CODE	DESC	F ₁	C ₁	A ₁	C ₂	A ₂	C ₄	A ₄	X	B ₁	D ₁	B ₂	D ₂	B ₄	D ₄	F ₂	(verify)
0000	octal	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	_____
4210	octal	1	1	0	0	0	0	1	0	0	0	1	0	0	0	1	_____
0124	octal	1	0	0	1	0	0	0	0	1	0	0	0	0	1	1	_____
7700	octal	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	_____
0077	octal	1	1	0	1	0	1	0	0	0	1	0	1	0	1	1	_____
9999	>7777	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	_____
X Pulse		1	x	x	x	x	x	x	1	x	x	x	x	x	x	1	_____

Pulse Positions:	F ₁	0.00 μs (reference)
	C ₁	1.45 μs
	A ₁	2.90 μs
	C ₂	4.35 μs
	A ₂	5.80 μs
	C ₄	7.25 μs
	A ₄	8.70 μs
	X	10.15 μs
	B ₁	11.60 μs
	D ₁	13.05 μs
	B ₂	14.50 μs
	D ₂	15.95 μs
	B ₄	17.40 μs
	D ₄	18.85 μs
	F ₂	20.30 μs
	SPI	24.65 μs



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APPENDIX E - TEST EQUIPMENT REQUIREMENTS

1. GENERAL

This Appendix contains a list of test equipment suitable for performing all test procedures contained in this manual. Other equipment meeting specifications listed in this Appendix may be substituted in place of recommended models. Equipment listed in this Appendix may exceed minimum required specifications for some procedures contained in this manual.

2. RECOMMENDED TEST EQUIPMENT

TYPE	MODEL	SPECIFICATIONS
Oscilloscope	TEK 2465 or Equivalent	Capability: Dual Trace Bandwidth: dc to 100 MHz Vertical Accuracy: $\pm 10\%$ Time Accuracy: $\pm 0.7\%$ of Time Interval $\pm 0.6\%$ of Full Scale Δ Time Accuracy: $\pm 0.5\%$ of Time Interval $\pm 0.3\%$ of Full Scale
RF Power Meter with Power Sensor	BOONTON 4200 with BOONTON 4200-5B or Equivalent	Range: -30 to +10 dBm Accuracy: ± 0.1 dB



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APPENDIX F - METRIC/BRITISH IMPERIAL CONVERSION TABLE WITH NAUTICAL DISTANCE CONVERSIONS

TO CONVERT:	INTO:	MULTIPLY BY:	TO CONVERT:	INTO:	MULTIPLY BY:
cm	feet	0.03281	meters	feet	3.281
cm	inches	0.3937	meters	inches	39.37
feet	cm	30.48	m/sec	ft/sec	3.281
feet	meters	0.3048	m/sec	km/hr	3.6
ft/sec	km/hr	1.097	m/sec	miles/hr	2.237
ft/sec	knots	0.5921	miles	feet	5280
ft/sec	miles/hr	0.6818	miles	km	1.609
ft/sec ²	cm/sec ²	30.48	miles	meters	1609
ft/sec ²	m/sec ²	0.3048	miles	nmi	0.8684
grams	ounces	0.03527	miles/hr	ft/sec	1.467
inches	cm	2.54	miles/hr	km/hr	1.609
kg	pounds	2.205	miles/hr	knots	0.8684
kg/cm ²	psi	0.0703	nmi	feet	6080.27
km	feet	3281	nmi	km	1.8532
km	miles	0.6214	nmi	meters	1853.2
km	nmi	0.5396	nmi	miles	1.1516
km/hr	ft/sec	0.9113	ounces	grams	28.34953
km/hr	knots	0.5396	pounds	kg	0.4536
km/hr	miles/hr	0.6214	psi	kg/cm ²	0.0703
knots	ft/sec	1.689	100 ft	km	3.048
knots	km/hr	1.8532	100 ft	miles	1.894
knots	miles/hr	1.1516	100 ft	nmi	1.645



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APPENDIX G - EMC AND SAFETY COMPLIANCE

1. EMC

The I-1402-2 complies with the following EMC standards:

- EN 55011, Group 1, Class B for emissions
- EN 50082-1:1992 for immunity

2. SAFETY

The I-1402-2 complies with the following safety standards:

- EN 61010-1:1993
- UL 3111-1, 1st Edition
- CSA C22.2, No. 1010.1-92



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APPENDIX H - ABBREVIATIONS

A		F	
A	Amperes	F ₁	First Framing Pulse (reply)
ac	Alternating Current	F ₂	Second Framing Pulse (reply)
ASCII	American National Standard Code for Information Interchange	FREQ	Frequency
ATC	ATCRBS	G	
ATCRBS	Air Traffic Control Radar Beacon System	GEN	Generator or Generated
ATE	Automatic Test Equipment	GPIB	General Purpose Interface Bus
AUX	Auxiliary	GTC	Gain Time Trigger
C		H	
C	Celsius or Centigrade	h	Hexadecimal
CAL	Calibration or Calibrated Position	Hz	Hertz
ccw	Counterclockwise	I	
CHAL	Challenge	IDENT	Identification Reply
CHAN	Channel	IEEE	Institute of Electrical and Electronics Engineers
Cont	Continued	IFF	Identification Friend or Foe
CW	Continuous Wave	IFR	IFR Systems Inc.
cw	Clockwise	INT	Internal
D		Int	Internal
dB	Decibel	INTF	Interface
DBL	Double	INTRF	Interference
dBm	Decibels above one milliwatt	INTERR	Interrogation
DESC	Description	INTERRF	Interference
DEV	Deviation	I/O	Input/Output
Dev	Deviation	ISLS	Interrogation Sidelobe Suppression
DI	Double Interrogation	K	
DISP	Disparity	kHz	Kilohertz (10 ³ Hertz)
DSD1	DISPARITY DELAY 1 Control (GPIB)	KIR	Interrogator Computer (Cryptographic Device)
DSD2	DISPARITY DELAY 2 Control (GPIB)	KIT	Transponder Computer (Cryptographic Device)
DSDL	Disparity Delay	L	
E		LED	Light Emitting Diode
EMC	Electromagnetic Compatibility	LVL	Level
EMER	Emergency		
EMI	Electromagnetic Interference		
ESD	Electrostatic Discharge		
EXT	External		
Ext	External		
EXT MOD	External Modulation		
EXT SYNC	External Synchronization		



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M		S	
MAX	Maximum	SCOPE	Oscilloscope
MHz	Megahertz (10 ⁶ Hertz)	SLS	Side-Lobe Suppression
μs	Microsecond (10 ⁻⁶ Seconds)	SPI	Special Identifier Pulse
ms	Millisecond (10 ⁻³ Seconds)	Sqtr	Squitter
MTL	Minimum Triggering or Threshold Level	STAB	Time-Decoded Video
			Stability (GPIB)
		SYNC	Synchronous
		sync	Synchronous
N		T	
NMI	Nautical Miles	T _D	Reply Sync
nmi	Nautical Miles	TDCD	Time-Decoded
NORM	Normal	T _O	Interrogation Sync
ns	Nanosecond (10 ⁻⁹ Seconds)	TRIG	Trigger
		TTL	Transistor-Transistor Logic
		TX	Transmit
		TYP	Typical
O		U	
o	Octal	UUT	Unit Under Test
Ω	Ohm	UUTD	UUT Reply Delay (GPIB)
P		V	
PC	Personal Computer	V	Volt
PC	Printed Circuit	VAC	Volts, Alternating Current
PN	Part Number	VAR	Variation
PRF	Pulse Repetition Frequency	Vdc	Volts, Direct Current
PULS	X Pulse (GPIB)	VID	Video
PWR	Power	V _{P-P}	Volts, Peak to Peak
		Vrms	Volts Root Mean Square
R		W	
RATC	RADAR ATC Test Function (GPIB)	W	Watt
REV NO.	Revision Number	w/	With
RCV	Receive	w/o	Without
RF	Radio Frequency		
RFLV	RF Level (GPIB)	X	
RLCD	Reply Code (GPIB)	XATC	XPDR ATC Test Function (GPIB)
RLDL	Reply Delay (GPIB)	XM4	XPDR Mode 4 (GPIB)
RLD1	REPLY DELAY 1 Control (GPIB)	XMTR	Transmitter
RLD2	REPLY DELAY 2 Control (GPIB)	XPDR	Transponder
RLFM	Reply Format (GPIB)		
RM4	RADAR Mode 4 Test Function (GPIB)		
RMS	Root Mean Square		
RNG	Range		
RPLY	Reply (GPIB)		



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