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AEROFLEX

Mode S Test System S-1403DL

Operation Manual

1002-2400-200

Issue-2

OPERATION MANUAL

MODE S TEST SYSTEM

S-1403DL

PUBLISHED BY
Aeroflex

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

Cable Statement:

Double shielded and properly terminated external interface cables must be used with this equipment when interfacing with the RS-232, IFR BUS and/or AUX BUS Connectors.

For continued EMC compliance, all external cables must be 3 meters or less in length.

The display backlight may momentarily dim if a voltage dip, interruption or surge occurs on the power line.

Nomenclature Statements:

In this manual the S-1403DL, S-1403DL Test Auxiliary, Test Auxiliary or Test Set refers to the S-1403DL Test Auxiliary.

In this manual the ATC-1400A, ATC-1400A Transponder/DME Test Set or ATC-1400A Test Set refers to the ATC-1400A-2 Transponder/DME Test Set.

S-1403DL Upgrade Statement:

An S-1403DL upgrade from other product versions retains the prior product identity. The Front Panel upgrade indicating S-1403DL implies functionality only. Test Sets with upgrade kits installed are not compliant to national or international EMC and/or safety standards.



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S-1403DL

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SAFETY FIRST: TO ALL OPERATIONS PERSONNEL

REFER ALL SERVICING OF UNIT TO QUALIFIED TECHNICAL PERSONNEL. THIS UNIT CONTAINS NO OPERATOR SERVICEABLE PARTS.

WARNING: USING THIS EQUIPMENT IN A MANNER NOT SPECIFIED BY THE ACCOMPANYING DOCUMENTATION MAY IMPAIR THE SAFETY PROTECTION PROVIDED BY THE EQUIPMENT.

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. (This symbol refers to specific CAUTIONS represented on the unit and clarified in the text.)



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 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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INTRODUCTION - MODE S TEST SYSTEM

This manual contains the information necessary to install and operate the Mode S Test System. It is designed to be used in conjunction with the ATC-1400A Operation Manual. The S-1403DL Test Auxiliary, when interfaced with the ATC-1400A Transponder/DME Test Set, forms the Mode S Test System. The additional remote commands required for ATRBS and Mode S 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.

Refer all servicing of the Mode S Test System to qualified technical personnel.

ORGANIZATION

This manual is divided into the following Chapters and Sections:

CHAPTER 1 - OPERATION

- Section 1 - DESCRIPTION (physical description of the S-1403DL; description of controls, connectors and indicators and menus and screens)
- Section 2 - OPERATION (installation; general operating procedures, performance evaluation, 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 S-1403DL/ATC-1400A (Mode S Test System) simulates an ATCRBS/Mode S equipped Secondary Surveillance Radar (SSR) ground station. The Mode S Test System provides pulse and Differential Phase Shift Keying (DPSK) modulated signals for testing Air Traffic Control Radar Beacon System (ATCRBS) and Mode Select (Mode S) transponders. Operation can be manual using front panel controls and switches or remote using a controller through one of the parallel or series remote interface connectors.

1.2 FUNCTIONAL CAPABILITIES

The Mode S Test System has the following features and capabilities:

- ATCRBS (ATC) Function
- Mode S Sequence (SEQ) Function
- ATCRBS Only All Call (All Call Short [ACS]) Function
- ATCRBS/Mode S All Call (All Call Long [ACL]) Function
- Interlacing (INTLCE) Function to simulate the real world mixed interrogation environment
- Double Interrogation (DI) Function
- Burst Function
- Two RF Input/Output Connectors with set frequency and output levels for Antenna A/Antenna B diversity testing (MLD option provides level control for Antenna B.)
- Four-line by 40 column indicator for displaying various parameters and functions
- 24 control keys for numerical data entry, function selection and cursor control
- Variable interrogation rates for ATCRBS (0 to 7999 PRF) and Mode S (0 to 2500 PRF)
- Squitter screens with decoded address, tail number and country information
- Screen dump (in ASCII) capability through the S-1403DL RS-232 Connector
- S-1403DL Stand Alone mode providing limited single antenna testing ability without the ATC-1400A Transponder/DME Test Set
- Programmable 1000-item sequence for uplink and downlink format information
- Battery backup memory for saving up to five sets of test configurations
- Extensive interrogation pulse width, position and amplitude control
- Synchronous Phase Reversal (SPR) offset control
- Easy and quick Mode S address and address parity field changes
- Remote operation through the S-1403DL or ATC-1400A (RS-232 or GPIB)



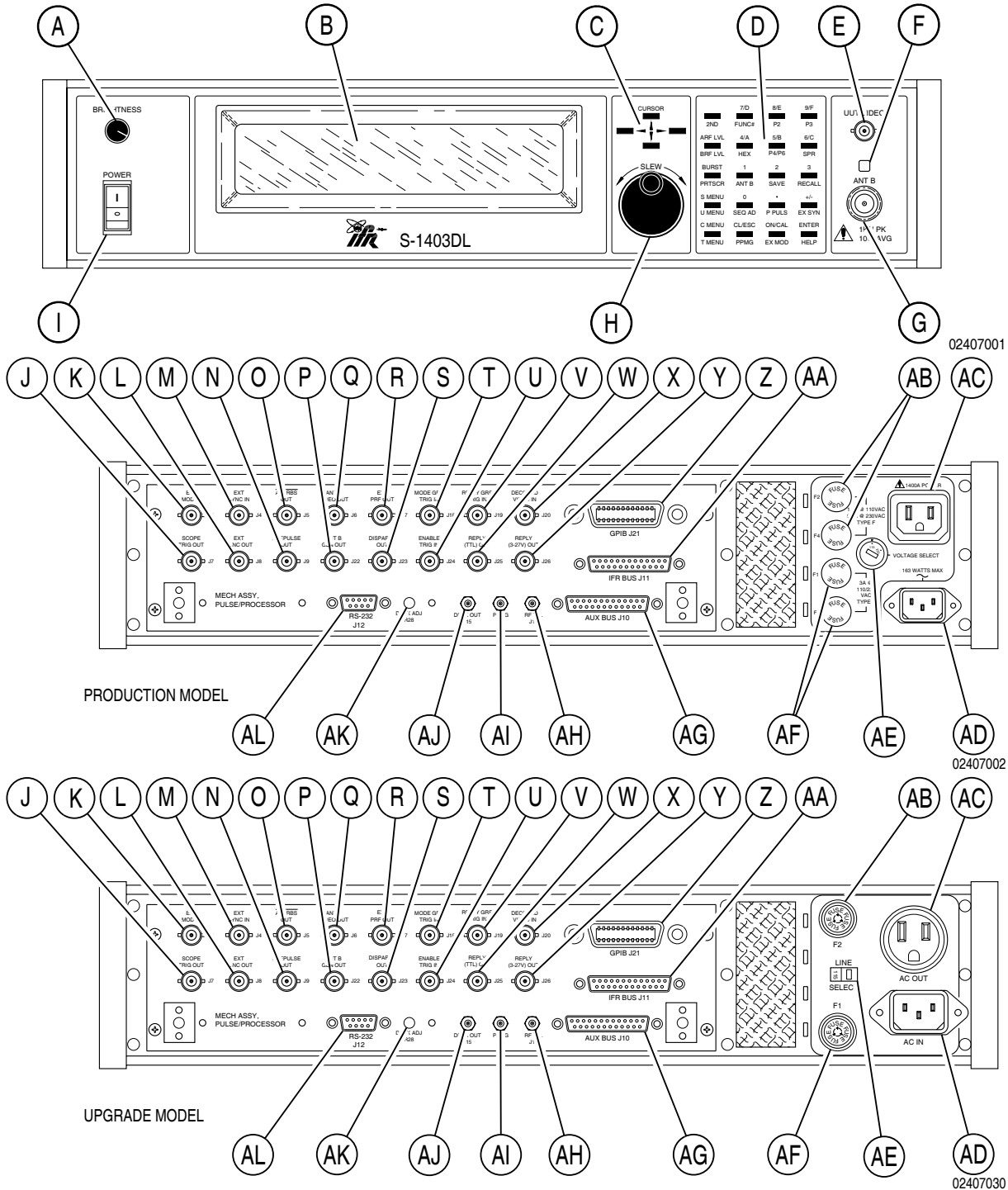
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2. CONTROLS, CONNECTORS AND INDICATORS

Refer to 1-1-2, Figure 1 to locate all S-1403DL controls, connectors and indicators. Refer to 1-1-2, Figure 48 to locate all ATC-1400A controls, connectors and indicators.



S-1403DL Front and Rear Panels
Figure 1



**S-1403DL Item Letter Location List
(Front Panel):**

- A. BRIGHTNESS Control
- B. MENU Display
- C. CURSOR Keys
- D. Keyboard
- E. UUT VIDEO Connector (J10001)
- F. UUT VIDEO Indicator
- G. ANT B Connector (J10002)
- H. SLEW Control
- I. POWER Switch

**S-1403DL Item Letter Location List
(Rear Panel):**

- J. SCOPE TRIG OUT Connector (J7)
- K. EXT MOD IN Connector (J3)
- L. EXT SYNC OUT Connector (J8)
- M. EXT SYNC IN Connector (J4)
- N. PREPULSE OUT Connector (J9)
- O. ATCRBS OUT Connector (J5)
- P. ANT B GEN OUT Connector (J22)
- Q. ANT B VIDEO OUT Connector (J6)
- R. EXT PRF OUT Connector (J17)
- S. DISPARITY OUT Connector (J23)
- T. MODE GRP TRIG IN Connector (J18)
- U. ENABLE TRIG IN Connector (J24)
- V. REPLY GRP TRIG IN Connector (J19)
- W. REPLY (TTL) OUT Connector (J25)
- X. DECODED VIDEO IN Connector (J20)
- Y. REPLY (3-27 V) OUT Connector (J26)
- Z. GPIB Connector (J21)
- AA. IFR BUS Connector (J11)
- AB. F2 and F4 Fuses
 or F2 Fuse (upgrade)
- AC. 1400A POWER Connector
 or AC OUT Connector (upgrade)
- AD. AC IN Connector
- AE. VOLTAGE SELECT Switch
- AF. F1 and F3 Fuses
 or F1 Fuse (upgrade)
- AG. AUX BUS Connector (J10)
- AH. RF LVL Connector (J13)
- AI. PPMG Connector (J14)
- AJ. DPSK OUT Connector (J15)
- AK. DPSK ADJ (R28)
- AL. RS-232 Connector (J12)

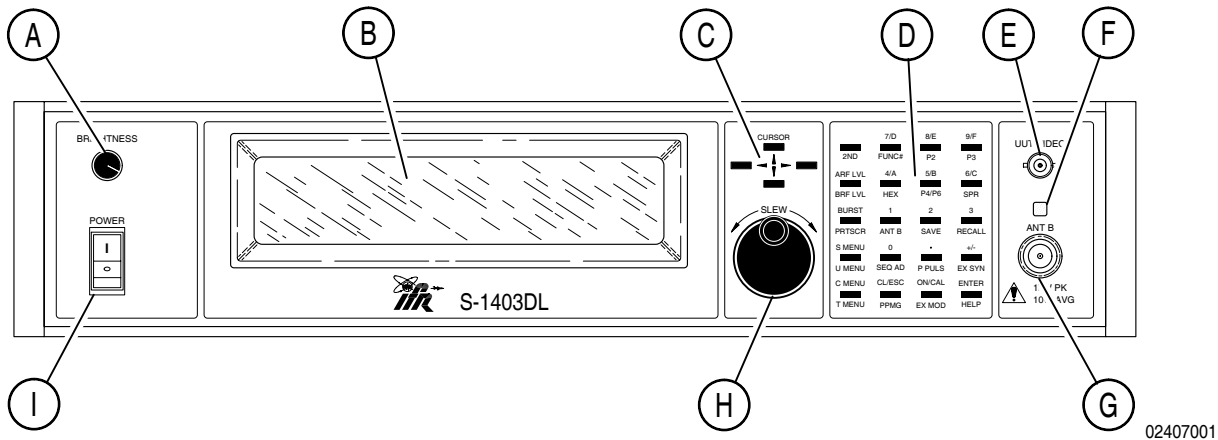
**S-1403DL Alphabetical Location List
(Front Panel):**

- ANT B Connector (J10002) G
- BRIGHTNESS Control A
- CURSOR Keys C
- Keyboard D
- MENU Display B
- POWER Switch I
- SLEW Control H
- UUT VIDEO Connector (J10001) E
- UUT VIDEO Indicator F

**S-1403DL Alphabetical Location List
(Rear Panel):**

- 1400A POWER Connector
 or AC OUT Connector (upgrade) AC
- AC IN Connector AD
- ANT B GEN OUT Connector (J22) P
- ANT B VIDEO OUT Connector (J6) Q
- ATCRBS OUT Connector (J5) O
- AUX BUS Connector (J10) AG
- DECODED VIDEO IN Connector (J20) X
- DISPARITY OUT Connector (J23) S
- DPSK ADJ (R28) AK
- DPSK OUT Connector (J15) AJ
- ENABLE TRIG IN Connector (J24) U
- EXT MOD IN Connector (J3) K
- EXT PRF OUT Connector (J17) R
- EXT SYNC IN Connector (J4) M
- EXT SYNC OUT Connector (J8) L
- F1 and F3 Fuses
 or F1 Fuse (upgrade) AF
- F2 and F4 Fuses
 or F2 Fuse (upgrade) AB
- GPIB Connector (J21) Z
- IFR BUS Connector (J11) AA
- MODE GRP TRIG IN Connector (J18) T
- PPMG Connector (J14) AI
- PREPULSE OUT Connector (J9) N
- REPLY (3-27 V) OUT Connector (J26) Y
- REPLY (TTL) OUT Connector (J25) W
- REPLY GRP TRIG IN Connector (J19) V
- RF LVL Connector (J13) AH
- RS-232 Connector (J12) AL
- SCOPE TRIG OUT Connector (J7) J
- VOLTAGE SELECT Switch AE

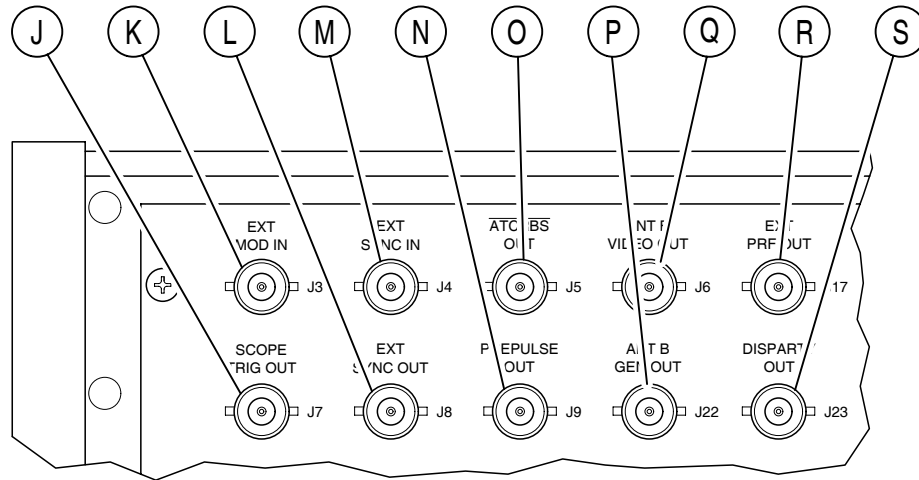
2.1 S-1403DL FRONT PANEL



ITEM	DESCRIPTION	ITEM	DESCRIPTION
A.	BRIGHTNESS Control Controls brightness of the S-1403DL MENU Display backlight. Rotating cw increases brightness. Rotating ccw decreases brightness.	F.	UUT VIDEO Indicator Green LED illuminates when receiving transmitter replies through the S-1403DL ANT B Connector.
B.	MENU Display Displays menus as selected on the S-1403DL Keyboard. Refer to 2.4 of 1-1-2 for menu descriptions.	G.	ANT B Connector (J10002) CAUTION: MAXIMUM INPUT POWER MUST NOT EXCEED 1 kW PEAK OR 10 W AVERAGE.
C.	CURSOR Keys (↑, →, ↓, ←) Select data or control fields for editing. Cursor is shown as an underline below the selected field. After positioning the cursor under the desired field, the Keyboard or SLEW Control edits the field.	H.	SLEW Control Selects data by rotating in either a cw or ccw direction. Entire command and decimal data fields are edited with one SLEW Control entry. Octal data fields are changed one character at a time. SLEW Control input allows rapid advance to desired function or data.
D.	Keyboard Controls the microprocessor and is used for data entry. A Keyboard entry changes the character at the cursor position and advances the cursor to the next character in that field. Refer to 2.3 of 1-1-2 for Keyboard key definitions.	I.	POWER Switch | or ○ Connects (I) or disconnects (O) external ac power to S-1403DL and 1400A POWER Connector.
E.	UUT VIDEO Connector (J10001) Provides detected UUT transmission video received through the S-1403DL ANT B Connector.		

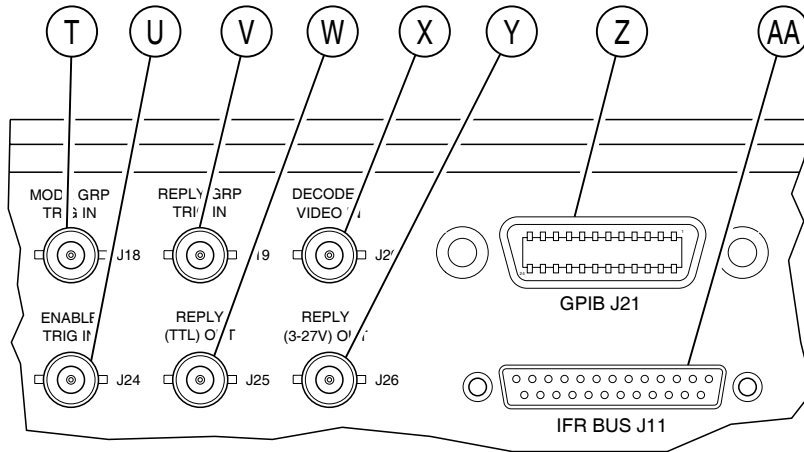
02407001

2.2 S-1403DL REAR PANEL



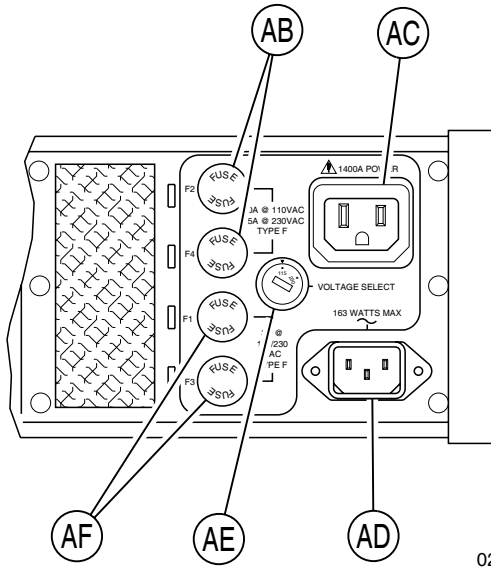
02407003

ITEM	DESCRIPTION	ITEM	DESCRIPTION
J.	SCOPE TRIG OUT Connector (J7) Provides a scope trigger for the interrogation or reply. The ATC-1400A To/TAC/TD Switch and S-1403DL C72 Setup Screen control the signal output. Refer to Appendix A for trigger pulse position.	O.	ATCRBS OUT Connector (J5) Provides an active low 3.0 μ s long <u>ATCRBS</u> Discrete pulse. The leading edge of the pulse occurs 1.0 μ s prior to the leading edge of P ₁ in an Antenna A (ATC-1400A RF I/O Connector) ATCRBS interrogation.
K.	EXT MOD IN Connector (J3) Provides the input for an external modulation source applied to the ANT A output signal and controlled in the S-1403DL C75 Setup Screen.	P.	ANT B GEN OUT Connector (J22) Provides a digital version of the Antenna B output signal.
L.	EXT SYNC OUT Connector (J8) Provides a sync pulse controlled in the S-1403DL C73 Setup Screen.	Q.	ANT B VIDEO OUT Connector (J6) Provides a digital version of the Antenna B reply signal viewed at the S-1403DL UUT VIDEO Connector.
M.	EXT SYNC IN Connector (J4) Provides the input for an external sync source controlled in the S-1403DL C71 Setup Screen.	R.	EXT PRF OUT Connector (J17) Provides a sync pulse when the S-1403DL is triggered. The trigger source selected in the C71 Setup Screen also provides the source for the EXT PRF OUT sync pulse.
N.	PREPULSE OUT Connector (J9) Provides a 1.0 μ s long TTL Prepulse controlled in the S-1403DL C75 Setup Screen.	S.	DISPARITY OUT Connector (J23) Reserved for future use.



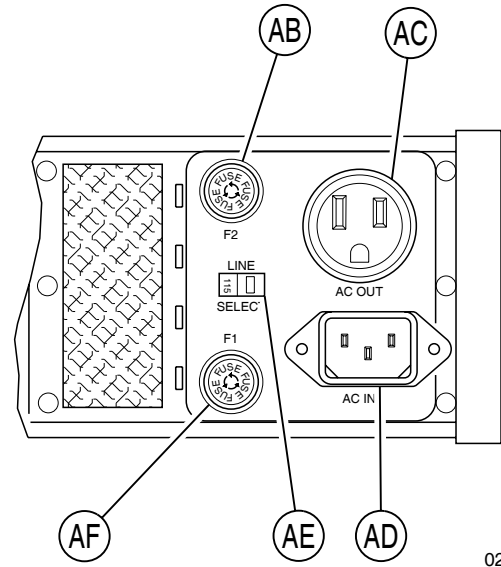
02407004

ITEM	DESCRIPTION	ITEM	DESCRIPTION
T.	MODE GRP TRIG IN Connector (J18) Reserved for future use.	Z.	GPIB Connector (J21) Provides a parallel interface for general purpose programmable instrumentation. Electrical characteristics conform to IEEE-488.2 specifications. Refer to Appendix A for pin-out table.
U.	ENABLE TRIG IN Connector (J24) Reserved for future use.	AA.	IFR BUS Connector (J11) Provides communication and control data between the ATC-1400A and the S-1403DL through the ATC-1400A IFR BUS Connector. Refer to Appendix A for pin-out table.
V.	REPLY GRP TRIG IN Connector (J19) Reserved for future use.		
W.	REPLY (TTL) OUT Connector (J25) Reserved for future use.		
X.	DECODED VIDEO IN Connector (J20) Reserved for future use.		
Y.	REPLY (3-27 V) OUT Connector (J26) Reserved for future use.		





02407031


Production Model

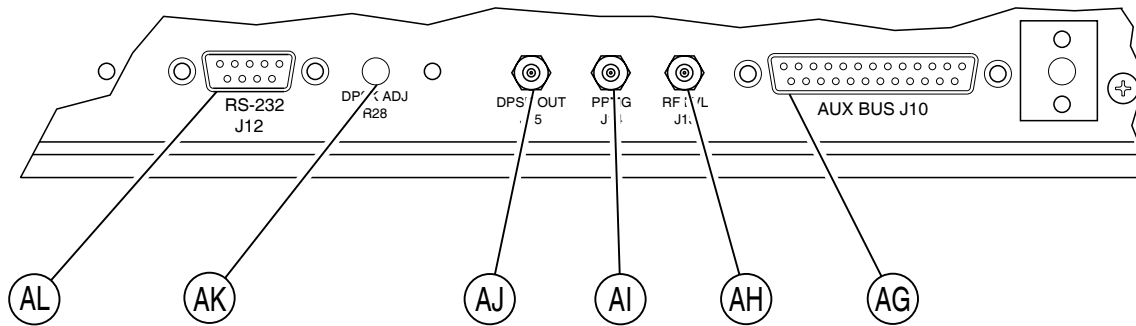


02407032

Upgrade Model

ITEM	DESCRIPTION
AB. F2 and F4 Fuses	Fuses power to the S-1403DL VOLTAGE SELECT Switch. Refer to 1.3 of 1-2-1 for correct fuse size and type.
AC. 1400A POWER Connector 	CAUTION: FOR CONNECTION TO ATC-1400A ONLY. Provides ac power to the ATC-1400A.
AD. AC IN Connector 	Provides the input for 115 or 230 VAC single phase power to the S-1403DL. The S-1403DL VOLTAGE SELECT Switch must be set to correct position before applying power.
AE. VOLTAGE SELECT Switch	Selects the line voltage applied to the S-1403DL: 115 for 100 to 120 VAC or 230 for 220 to 240 VAC.
AF. F1 and F3 Fuses	Fuses input power to the S-1403DL and 1400A POWER Connector. Refer to 1.3 of 1-2-1 for correct fuse size and type.


















ITEM	DESCRIPTION
AB. F2 Fuse	Fuses power to the S-1403DL VOLTAGE SELECT Switch. Refer to 1.3 of 1-2-1 for correct fuse size and type.
AC. AC OUT Connector	CAUTION: FOR CONNECTION TO ATC-1400A ONLY. Provides ac power to the ATC-1400A.
AD. AC IN Connector 	Provides the input for 115 or 230 VAC single phase power to the S-1403DL. The S-1403DL VOLTAGE SELECT Switch must be set to correct position before applying power.
AE. VOLTAGE SELECT Switch	Selects the line voltage applied to the S-1403DL: 115 for 100 to 120 VAC or 230 for 220 to 240 VAC.
AF. F1 Fuse	Fuses input power to the S-1403DL and 1400A POWER Connector. Refer to 1.3 of 1-2-1 for correct fuse size and type.



02407006

ITEM	DESCRIPTION	ITEM	DESCRIPTION
AG.	AUX BUS Connector (J10) Provides timing and pulse signals between the ATC-1400A and the S-1403DL through the ATC-1400A AUXILIARY Connector. Refer to Appendix A for pin-out table.	AL.	RS-232 Connector (J12) Provides a serial interface for remote control of the Mode S Test System. The S-1403DL GPIB and RS-232 Connectors support simultaneous operation along with or without ATC-1400A GPIB. The S-1403DL C81 and C82 Setup Screens provide control over remote settings. Refer to Appendix A for pin-out table.
AH.	RF LVL Connector (J13) Provides an analog output signal for vernier control over the ATC-1400A RF output level.		
AI.	PPMG Connector (J14) Provides a Pulse Power Measurement Gate (PPMG) pulse to the ATC-1400A, controlled in the S-1403DL C74 Setup Screen. The PPMG pulse selects a specific ATCRBS or Mode S Reply pulse for UUT power and frequency measurements. The ATC-1400A displays power measurements on the XMTR PWR WATTS Display and frequency measurements on the XMTR FREQ MHz Display.		
AJ.	DPSK OUT Connector (J15) Provides the DPSK modulation used in Mode S interrogations. The bipolar level signal drives the phase modulator in the ATC-1400A.		
AK.	DPSK ADJ (R28) Sets a consistent amplitude level for the Mode S interrogation phase reversals.		

2.3 KEYBOARD DEFINITION

	7/D	8/E	9/F
2ND	FUNC#	P2	P3
ARF LVL	4/A	5/B	6/C
			
BRF LVL	HEX	P4/P6	SPR
BURST	1	2	3
			
PRTSCR	ANT B	SAVE	RECALL
S MENU	0	.	+/-
			
U MENU	SEQ AD	P PULS	EX SYN
C MENU	CL/ESC	ON/CAL	ENTER
			
T MENU	PPMG	EX MOD	HELP

S-1403DL Keyboard
Figure 2

The S-1403DL Keyboard consists of 20 keys (24 keys mechanically including the CURSOR Keys). The keys allow data entry for selecting functions, menu formats and field data. All keys have at least two functions and some have three. Pressing a single key activates the selected first order function (shown above each key in black). The 2ND Key allows activation of second or third order functions. CURSOR Keys are located next to the Keyboard to expedite entering data.

2ND Key

The 2ND Key selects second order functions (shown below each key in blue) or third order functions (hexadecimal numbers >9) with the HEX Key. Pressing the 2ND Key and desired second order function key activates the selected second order function. The cursor box changes to an underline to indicate the 2ND Key has been pressed.

7 or FUNC# or D Key

The 7 Key enters the number 7 in control or data fields.

Pressing the 2ND, FUNC# and both number Keys for selected function in sequence displays the corresponding function screen according to the last used Control Menu C10 (for Antenna A) or C20 (for Antenna B) function. Refer to 1-1-2, Table 1 for Function Selections.

FUNCTION NUMBER	C10/C20 FUNCTION SCREEN	INTERROGATION FUNCTION
01	f01:ATC	ATCRBS Only
02	f02:SEQ	Mode S Only
03	f03:ACS	ATCRBS Only All Call
04	f04:ACL	ATCRBS/Mode S All Call
05	f05:INTLCE	Interlace (Mixed)
06	f06:DI	Double Interrogation (Two in one period)
07	f07:BURST	Burst (Set number of one type)
08	f08:ATC Mon	ATCRBS Monitor

Function Selections
Table 1

Pressing the 2ND, HEX and D Keys in sequence enters the number D (13) in hexadecimal data fields.

8 or P2 or E Key

The 8 Key enters the number 8 in control or data fields.

Pressing the 2ND and P2 Keys in sequence moves the cursor to the P2 field for edit, if valid for the current function. The P2 Key function operates from any menu and causes the S-1403DL to display the last entered applicable C10 function screen.

Pressing the 2ND, HEX and E Keys in sequence enters the number E (14) in hexadecimal data fields.

9 or P3 or F Key

The 9 Key enters the number 9 in control or data fields.

Pressing the 2ND and P3 Keys in sequence moves the cursor to the P3 field for edit, if valid for the current function. The P3 Key function operates from any menu and causes the S-1403DL to display the last entered applicable C10 function screen.

Pressing the 2ND, HEX and F Keys in sequence enters the number F (15) in hexadecimal data fields.

ARF LVL or BRFLVL Key

Pressing the ARF LVL Key moves the cursor to the Arf field for edit. The ARF LVL (RF Signal Level for Antenna A) Key function operates from any menu and causes the S-1403DL to display the last entered C10 function screen.

Pressing the 2ND and BRFLVL Keys in sequence moves the cursor to the Brf field for edit. The BRFLVL (RF Signal Level for Antenna B) Key function operates from any menu and causes the S-1403DL to display the C20 function screen.

4 or HEX or A Key

The 4 Key enters the number 4 in control or data fields.

Pressing the 2ND and HEX Keys in sequence allows selection of a single digit number greater than nine (A, B, C, D, E and F) for hexadecimal data fields. The Keyboard indicates hexadecimal numbers greater than nine in red above the corresponding keys.

Pressing the 2ND, HEX and A Keys in sequence enters the number A (10) in hexadecimal data fields.

5 or P4/P6 or B Key

The 5 Key enters the number 5 in control or data fields.

Pressing the 2ND and P4/P6 Keys in sequence moves the cursor to the P4 or P6 field for edit, if valid for the current function. The P4/P6 Key function operates from any menu and causes the S-1403DL to display the last entered applicable C10 function screen.

Pressing the 2ND, HEX and B Keys in sequence enters the number B (11) in hexadecimal data fields.

6 or SPR or C Key

The 6 Key enters the number 6 in control or data fields.

Pressing the 2ND and SPR Keys in sequence moves the cursor to the SPR field for edit, if valid for the current function. The SPR (Synchronous Phase Reversal) Key function operates from any menu and causes the S-1403DL to display the last entered applicable C10 function screen.

Pressing the 2ND, HEX and C Keys in sequence enters the number C (12) in hexadecimal data fields.

BURST or PRTSCR Key

The BURST Key activates the BURST Function when operating in the Burst Screen. When activated, the BURST Function transmits the number of interrogations specified in the C10/C20 f07 function screen. If enabled in the C71 Setup Screen as the trigger source, the BURST Key initiates single interrogations in other functions.

Pressing the 2ND and PRTSCR Keys in sequence performs a current screen dump out the RS-232 Connector (J12) if enabled in the C81 RS232 Control System Screen.

1 or ANT B Key

The 1 Key enters the number 1 in control or data fields.

Pressing the 2ND and ANT B Keys in sequence moves the cursor to the AntB field for edit. The ANT B (Antenna B) Key function operates from any menu and causes the S-1403DL to display the last entered applicable C10 function screen.

2 or SAVE Key

The 2 Key enters the number 2 in control or data fields.

Pressing the 2ND and SAVE Keys in sequence displays the Save Configuration Screen for saving screen configurations in up to five non-volatile memory Slots. Refer to 2.10.1 in 1-2-2 for Save operation.

3 or RECALL Key

The 3 Key enters the number 3 in control or data fields.

Pressing the 2ND and RECALL Keys in sequence displays the Recall Configuration Screen for recalling saved screen and factory default configurations. Refer to 2.10.2 in 1-2-2 for Recall operation.

S MENU or U MENU Key

Pressing the S MENU and Sequence Menu number (000 to 999) Keys in sequence displays the corresponding sequence menu. Pressing the S MENU Key without a sequence number displays the last accessed sequence menu or the default S001 Sequence Menu on power-up.

The U MENU Key is reserved for future use.

```

MS                SAVE CONFIGURATION

Slot 5:  -- Empty  --                Press ENTER
                                         to save.
    
```

```

MR                RECALL CONFIGURATION

Slot 2: Yearly Cal Test                Press ENTER
      27jul96,10:05:15                to recall.
    
```

Example Save and Recall Configuration Screens
Figure 3

0 or SEQ AD Key

The 0 Key enters the number 0 in control or control or data fields.

Pressing the 2ND and SEQ AD Keys in sequence moves cursor to the ADDR field (uplink format address) for edit in the sequence menu. The SEQ AD (Sequential Address) Key function operates from any menu and causes the S-1403DL to display the last displayed sequence menu or S001 Sequence Menu (default).

• or P PULS Key

The • Key enters the decimal point in data fields.

Pressing the 2ND and P PULS Keys in sequence moves the cursor to the C75 Setup Screen PrePulseOut field for edit. The P PULS (Prepulse) Key function operates from any menu and causes the S-1403DL to display the C75 Setup Screen.

+/- or EX SYN Key

The +/- Key changes a decimal data field value from positive (+) to negative (-) or vice versa without having to press the ENTER Key. The +/- Key function, used after editing the decimal data field, displays the plus (+) or minus (-) sign before the data. The +/- Key also cycles through active sequence menus when pressed with the cursor in the sequence menu S### field.

Pressing the 2ND and EX SYN Keys in sequence enters the C73 Setup Screen and moves the cursor to the ATC Enable field. The EX SYN (External Sync output) Key function operates from any menu.

C MENU or T MENU Key

Pressing the C MENU and Control Menu Number (0-9) Keys in sequence enters the corresponding Control Menu. The 0 Key enters the Main Control Menu. Pressing the C MENU Key without a number enters the last accessed Control Menu.

Pressing the 2ND and T MENU Keys in sequence enters the last accessed Test Screen. Pressing the 2nd, T MENU and Test Menu Number (0-6) Keys in sequence enters the corresponding Test Screen. The 0 Key enters the Main Test Menu.

CL/ESC or PPMG Key

Pressing the CL/ESC Key during an edit (before pressing the ENTER Key) clears input data and restores previous data. The CL/ESC Key function resets entire octal and hexadecimal data fields to zero. Pressing the CL/ESC Key during UUT measurements clears reply information and resets to current reply input.

Pressing the 2ND and PPMG Keys in sequence enters the C74 Setup Screen. The PPMG (Pulse Power Measurement Gate) Key function operates from any screen and allows adjustment to measure the power of selected transponder pulses.

ON/CAL or EX MOD Key

The ON/CAL Key steps through the different states or values of control fields having more than one state or value, changes interrogation addresses in address data fields and starts or stops applicable Test Menu operations.

Pressing the 2ND and EX MOD Keys in sequence enters the C75 Setup Screen. The EX MOD (External Modulation input) Key function operates from any screen and allows selection of the modulation sources.

ENTER or HELP Key

The ENTER Key enters the current data or returns to the previous screen from Help screen. Pressing the ENTER Key after editing a data field saves the changes to any and all fields in the current screen.

The HELP Key is reserved for future use.

2.4 DISPLAY MENU DEFINITION

The S-1403DL displays four menu types; Control, Sequence, Test and User. Control Menus include the function screens, Setup Menus, System Menus and Calibration Menus. Sequence menus (up to 1000 preset menus) load Mode S interrogation information and display reply content. Test Menus include the transponder capability test, Extra Length Message (ELM) tests and other special information tests. The User Menu allows up to nine user definable screens (loaded remotely).

All screens have a screen reference designator in the upper left corner of the MENU Display. The screen reference designator indicates the screen type with a letter (C for Control Menu, S for Sequence Menu, T for Test Menu, MS for Memory Save or MR for Memory Recall). The numbers for a menu screen indicates a particular subscreen.

Screens contain control and/or data fields. Control fields set test parameters and can be numeric (setting a value), select (selecting a mode or state), numeric/select (selecting a state and setting a value if required by the selected state) or string (entering text) type. Data fields contain numbers representing values or information. Fields not currently being updated or out of range display dashes. Fields immediately following a colon (:) generally specify values or settings selected by the operator. Fields immediately following an equal sign (=) generally specify values or information returned to the operator by the SI-1404. The sequence menus are an exception in that defined data fields, received or set, follow an equal sign.

NOTE: The S-1403DL provides the only valid percent reply information. Counting UUT Mode S squitter (unsolicited) transmissions makes the ATC-1400A DME-PRF Hz/XPDR-%REPLY Display invalid.

An error occurs when setting only one test set (S-1403DL or ATC-1400A) for Double Interrogations. The S-1403DL monitors the ATC-1400A DBL INTERR/INTRF PULSE Thumbwheels selections. The DOUBLE position is only valid with the S-1403DL DI Function active. The S-1403DL indicates this error by flashing the message, * **DI/INTF ERROR** * in the top line of the MENU Display in all screens.

2.4.1 Control Menus (CMENU)

C00	MAIN CMENU	
1) FUNC A	4) REPLY DELAY	7) SETUP MENU
2) FUNC B	5) SQTR 1of2	8) SYSTEM MENU
3) %REPLY	6) SQTR 2of2	9) CAL MENU

Main Control Menu
Figure 5

Pressing C MENU and a number key (1-9) in sequence enters the applicable Control Menu subscreen or last accessed screen of a particular function or subscreen group.

C10 FUNCTION A

Function A consists of screens for control and monitor of Antenna A (ATC-1400A RF I/O Connector). Pulse settings also apply to the S-1403DL ANT B Connector output.

f01 ATC

C10 f01:ATC (ATCRBS)	Arf:+1.2
	P3:CAL
Altitude:+105000 Dly= 3.0250 Sqtr= 0.85	
AntA%:ATC=100,S= 0 AntB%=100 AntB:+.95	

C10 f01:ATC (ATCRBS)	Arf:+1.2
	P3:CAL
Code=ID7777X Dly= 3.0125 Sqtr=02.10	
AntA%:ATC=100,S= 0 AntB%=100 AntB:+.95	

Example Function A ATC Screens
Figure 6

Function 01 displays the ATC Screen to operate the ATC Function. The ATC Screen allows adjustment of the ATCRBS P₃ pulse level in addition to monitoring reply information and helping set the Antenna A RF level.

NOTE: The ATC-1400A provides most of the ATCRBS control.

FIELD	DESCRIPTION
C10	Editable menu field (to enter other Control Menu screens) indicates Control Menu 10.

FIELD	DESCRIPTION
f01	Editable function field (to enter other Function A screens) indicates Function 01 ATC (ATCRBS).
Arf	Editable RF Level vernier control combines with the ATC-1400A RF LEVEL Control to set the Antenna A output level through the ATC-1400A RF I/O Connector. The field ranges from -3.0 to +3.0 dB in 0.1 dB steps. The ATC-1400A RF LEVEL - dBm Display plus the Arf field setting indicates the true Antenna A output level.

FIELD	DESCRIPTION	FIELD	DESCRIPTION
P3	Control field sets P ₃ pulse level: CAL sets P ₃ level same as P ₁ level. VAR allows the ATC-1400A SLS/ECHO Thumbwheels to adjust P ₃ level in dB from P ₁ level (only when ATC-1400A SLS/ECHO ON/OFF Switch is OFF). OFF deactivates the P ₃ pulse.	AntB	Control field activates the S-1403DL ANT B Connector and sets the diversity offset value (timing difference from Antenna A transmissions to Antenna B transmissions [P ₁ leading edge to P ₁ leading edge]). The offset value ranges from -0.95 to +0.95 μs in 0.05 μs steps. OFF disables the ANT B Connector. When disabled, the Mode S Test System shuts off all Antenna B interrogations and disregards any Antenna B squitters.
Altitude/Code	<p>The Altitude field reports the altitude in feet decoded from the replies to Mode C interrogations.</p> <p>The Code field reports the octal ID decoded from identification replies (all ATCRBS replies except for Mode C). The screen displays ID before the Code if the special position identification (SPI) pulse follows the reply (Modes 2 and A).</p> <p>NOTE: Mode 1 replies display only two digits and two spaces since only five pulses are available.</p> <p>The screen displays X if the identification reply contains the X pulse.</p> <p>Refer to Appendix E for various replies and pulse information.</p>		
Dly	UUT information field displays reply delay (P ₃ leading edge to F ₁ leading edge) in μs.		
Sqtr	UUT information field displays time interval between Mode S DF11 squitter transmissions in seconds.		
AntA%	UUT information field displays percentage of ATCRBS replies (ATC=) and Mode S replies (S=) received to interrogations transmitted through the ATC-1400A RF I/O Connector.		
AntB%	UUT information field displays percentage of replies received to interrogations transmitted through the S-1403DL ANT B Connector.		

f02 SEQ

```

C10 f02:SEQ (ModeS)                      Arf:+1.2
P6:CAL,Wd:+0.00,Dv:+0.00  P2:CAL
SPR:ON ,Dv:+0.00 Dly=128.0125 Sqtr= 1.10
AntA%:ATC= 0,S=100  AntB%=100 AntB:+.95
    
```

Example Function A SEQ Screen
Figure 7

Function 02 displays the Sequence (SEQ) Screen to operate the Mode S Sequence Function. The Sequence Screen allows adjustment to Mode S interrogation pulses in addition to monitoring reply information and helping set the Antenna A RF level.

FIELD	DESCRIPTION
C10	Refer to 2.4.1 C10 FUNCTION A, f01 ATC C10 field in 1-1-2.
f02	Editable function field (to enter other Function A screens) indicates Function 02 SEQ (ModeS).
Arf	Refer to 2.4.1 C10 FUNCTION A, f01 ATC Arf field in 1-1-2.
P6	Control fields set the P ₆ pulse: CAL activates the P ₆ pulse. OFF deactivates the P ₆ pulse. The Wd subfield controls P ₆ width. CAL sets the P ₆ pulse width to 16.25 μs for 56-bit data fields and 30.25 μs for 112-bit data fields. Entering a variable value adjusts the P ₆ pulse width in 0.05 μs steps to ±1.50 μs from the CAL width. The Dv subfield controls P ₆ position. CAL sets P ₆ (leading edge) to 3.5 μs following leading edge of P ₁ . Entering a variable value deviates the P ₃ pulse position in 0.05 μs steps to ±1.95 μs from the CAL position.

FIELD	DESCRIPTION
P2	Control field sets P ₂ pulse level: CAL sets P ₂ level same as P ₁ level. VAR allows the ATC-1400A SLS/ECHO Thumbwheels to adjust P ₂ level in dB from P ₁ level (only when ATC-1400A SLS/ECHO ON/OFF Switch is OFF). OFF deactivates the P ₂ pulse.
SPR	Control fields set the Synchronous Phase Reversal (SPR). ON activates SPR. OFF disables SPR. The Dv subfield controls SPR position. CAL sets the SPR to 1.25 μs following P ₆ leading edge. Entering a variable value deviates the SPR position in 0.05 μs steps to ±1.00 μs from the CAL position.
Dly	UUT information field displays reply delay (SPR to P ₁ leading edge of reply) in μs.
Sqtr	Refer to 2.4.1 C10 FUNCTION A, f01 ATC Sqtr field in 1-1-2. NOTE: Only unsolicited DF11 transmissions (SPR disabled or >140 μs following SPR) are accepted squitters.
AntA%	Refer to 2.4.1 C10 FUNCTION A, f01 ATC AntA% field in 1-1-2.
AntB%	Refer to 2.4.1 C10 FUNCTION A, f01 ATC AntB% field in 1-1-2.
AntB	Refer to 2.4.1 C10 FUNCTION A, f01 ATC AntB field in 1-1-2.

f03 ACS and f04 ACL

```
C10 f03:ACS (All Call Short)      Arf:+1.2
P4:CAL,Wd:+0.00,Dv:+0.00          P3:CAL
DF=--,AA=----- Dly= 3.0125 Sqtr= 0.90
AntA%:ATC= 80,S= 10 AntB%=100 AntB:+.95
```

Example Function A ACS Screen
Figure 8

```
C10 f04:ACL (All Call Long)      Arf:+1.2
P4:CAL,Wd:+0.00,Dv:+0.00          P3:CAL
DF=11,AA=123456 Dly=128.0125 Sqtr= 0.98
AntA%:ATC= 10,S= 80 AntB%=100 AntB:+.95
```

Example Function A ACL Screen
Figure 9

Function 03 displays the ACS (All Call Short) Screen for the ACS Function and Function 04 displays the ACL (All Call Long) Screen for the ACL Function. Each screen sets the Mode S Test System for sending out applicable All Call interrogations, monitors reply information and helps set the Antenna A RF level.

FIELD	DESCRIPTION
C10	Refer to 2.4.1 C10 FUNCTION A, f01 ATC C10 field in 1-1-2.
f03	Editable function field (to enter other Function A screens) indicates Function 03 ACS (All Call Short) or 04 ACL (All Call Long).
Arf	Refer to 2.4.1 C10 FUNCTION A, f01 ATC Arf field in 1-1-2.
P4	Control fields set the P4 pulse: CAL sets P4 level same as P1 level. VAR allows the ATC-1400A SLS/ECHO Thumbwheels to adjust P4 level in dB from P1 level (only when ATC-1400A SLS/ECHO ON/OFF Switch is OFF). OFF deactivates the P4 pulse. The Wd subfield controls P4 width. CAL sets P4 width to 0.8 μs (ACS) or 1.6 μs (ACL). Entering a value from -0.6 to +2.75 (ACS) or -1.40 to +1.95 (ACL) adjusts P4 width in 0.05 μs steps from CAL width.

FIELD	DESCRIPTION
	The Dv subfield controls P4 position. CAL sets P4 leading edge to 2.0 μs following P3 (active or disabled) leading edge location. Entering a variable value deviates P4 pulse position in 0.05 μs steps to ±1.95 μs from the CAL position.
P3	Refer to 2.4.1 C10 FUNCTION A, f01 ATC P3 field in 1-1-2.
DF	Information field displays downlink format from any Mode S reply.
AA	Information field shows hexadecimal aircraft address from DF11 replies.
Dly	UUT information field displays reply delay (P3 to F1 or P4 to P1 [leading edge to leading edge]) in μs.
Sqtr	Refer to 2.4.1 C10 FUNCTION A, f01 ATC Sqtr field in 1-1-2. NOTE: Accepted squitters are DF11 transmissions, unsolicited, (P4 disabled or >141.8 μs following P4 trailing edge).
AntA%	Refer to 2.4.1 C10 FUNCTION A, f01 ATC AntA% field in 1-1-2.
AntB%	Refer to 2.4.1 C10 FUNCTION A, f01 ATC AntB% field in 1-1-2.
AntB	Refer to 2.4.1 C10 FUNCTION A, f01 ATC AntB field in 1-1-2.

f05 INTLCE

```

C10 f05:INTLCE;Ratio:1to32           Arf:+1.2
                                     Dly=128.0125 Sqtr= 1.00
AntA%:ATC= 80,S= 20  AntB%=100 AntB:+.95
    
```

Example Function A Interlace Screen
Figure 10

Function 05 displays the Interlace Screen for the Interlace Function. The Interlace Screen sets the Mode S Test System for transmitting a mixture of Mode S and ATCRBS interrogations at a selected ratio.

FIELD	DESCRIPTION
C10	Refer to 2.4.1 C10 FUNCTION A, f01 ATC C10 field in 1-1-2.
f05	Editable function field (to enter other Function A screens) indicates Function 05 INTLCE.
Ratio:1to	Editable control number field sets the number (1 to 999) of ATCRBS interrogations transmitted for each Mode S interrogation transmitted.
Arf	Refer to 2.4.1 C10 FUNCTION A, f01 ATC Arf field in 1-1-2.
Dly	UUT information field displays reply delay (P ₃ to ATCRBS reply F ₁ or SPR to Mode S reply P ₁ [leading edge to leading edge]) in μ s.
Sqtr	Refer to 2.4.1 C10 FUNCTION A, f01 ATC Sqtr field in 1-1-2.
AntA%	Refer to 2.4.1 C10 FUNCTION A, f01 ATC AntA% field in 1-1-2.
AntB%	Refer to 2.4.1 C10 FUNCTION A, f01 ATC AntB% field in 1-1-2.
AntB	Refer to 2.4.1 C10 FUNCTION A, f01 ATC AntB field in 1-1-2.

f06 DI

```

C10 f06:DI;1st:SEQ,2nd:ATC           Arf:+1.2
P6:CAL,Wd:+0.00,Dv:+0.00   P2:CAL
SPR:ON ,Dv:+0.00 Dly=128.0125 Sqtr= 1.04
AntA%:ATC= 50,S= 45   AntB%=100 AntB:+.95
    
```

Example Function A Double Interrogation Screen
Figure 11

Function 06 displays the Double Interrogation (DI) Screen for the DI Function. The DI Screen sets the Mode 4/ Mode S Test System for sending out two selected types of interrogations (ATCRBS, Mode S, All Call Short or All Call Long) in the same time frame as one normal interrogation.

FIELD	DESCRIPTION
AntB	Refer to 2.4.1 C10 FUNCTION A, f01 ATC AntB field in 1-1-2.

FIELD	DESCRIPTION
-------	-------------

C10	Refer to 2.4.1 C10 FUNCTION A, f01 ATC C10 field in 1-1-2.
-----	--

f06	Editable function field (to enter other Function A screens) indicates Function 06 DI.
-----	---

The 1st field sets the first interrogation type (ATC, SEQ, ACS or ACL). Only the first interrogation type has editable control and data fields.

The 2nd field sets the second interrogation type (ATC, SEQ, ACS or ACL).

NOTE: The S-1403DL displays fields according to the 1st field setting. Refer to the particular function selected as the first interrogation for field definitions.

Arf	Refer to 2.4.1 C10 FUNCTION A, f01 ATC Arf field in 1-1-2.
-----	--

Dly	Refer to 2.4.1 C10 FUNCTION A, f05 INTLCE Dly field in 1-1-2.
-----	---

Sqtr	Refer to 2.4.1 C10 FUNCTION A, f01 ATC Sqtr field in 1-1-2.
------	---

AntA%	Refer to 2.4.1 C10 FUNCTION A, f01 ATC AntA% field in 1-1-2.
-------	--

AntB%	Refer to 2.4.1 C10 FUNCTION A, f01 ATC AntB% field in 1-1-2.
-------	--

f07 BURST

```

C10 f07: BURST; SEQ: 1000                Arf: +1.2
P6: CAL, Wd: +0.00, Dv: +0.00    P2: CAL
SPR: ON , Dv: +0.00    Dly=128.0125    Sqtr= 1.05
AntA%: ATC= 0, S= 90    AntB%= 90    AntB: +.95
    
```

Example Function A Burst Screen
Figure 12

Function 07 displays the Burst Screen for the Burst Function. The Burst Screen sets the Mode S Test System for sending out a selected type of interrogation (ATCRBS, Mode S, All Call Short or All Call Long) a selected amount of times.

FIELD	DESCRIPTION
-------	-------------

C10	Refer to 2.4.1 C10 FUNCTION A, f01 ATC C10 field in 1-1-2.
-----	--

f07	Editable function field (to enter other Function A screens) indicates Function 07 BURST.
-----	--

The ATC, SEQ, ACS or ACL field sets the type of interrogation. The number field (1 to 9999) sets the specific number of interrogations sent. For reference, the Burst Number (BN) refers to the number field value.

NOTE: The S-1403DL displays fields according to the type of interrogation. For field definitions, refer to the Function A function screen for the function selected as the interrogation type.

Arf	Refer to 2.4.1 C10 FUNCTION A, f01 ATC Arf field in 1-1-2.
-----	--

Dly	Refer to 2.4.1 C10 FUNCTION A, f05 INTLCE Dly field in 1-1-2.
-----	---

Sqtr	Refer to 2.4.1 C10 FUNCTION A, f01 ATC Sqtr field in 1-1-2.
------	---

AntA%	Refer to 2.4.1 C10 FUNCTION A, f01 ATC AntA% field in 1-1-2.
-------	--

AntB%	Refer to 2.4.1 C10 FUNCTION A, f01 ATC AntB% field in 1-1-2.
-------	--

AntB	Refer to 2.4.1 C10 FUNCTION A, f01 ATC AntB field in 1-1-2.
------	---

f08 ATC Mon

```

C10 f08:ATC Mon;Mode:1           Arf:+1.2
F1toF2=20.3000, F1Wd=0.4500, F2Wd=0.4500
Code= 0121           Dly= 3.0125 Jtr=0.2000
AntA%:ATC= 0,S= 90  AntB%= 90 AntB:-.95
    
```

Example Function A ATC Monitor Screen
Figure 13

Function 08 displays the ATC Monitor Screen for the ATCRBS Monitor Pulse Function. The ATC Monitor Screen sets the Mode S Test System for sending out selected ATCRBS interrogations and measuring reply pulse parameters and jitter.

FIELD	DESCRIPTION
C10	Refer to 2.4.1 C10 FUNCTION A, f01 ATC C10 field in 1-1-2.
f08	Editable function field (to enter other Function A screens) indicates Function 08 ATC Mon.
Mode	Information field tracks interrogation mode set by the ATC-1400A XPDR MODE Control or ATCRBS field setting in the C79 Setup Screen when operating in the Stand Alone mode (1400 Control set to STAND-ALONE in the C84 System Screen). Possible modes are 1, 2, A, B, C, D or T.
Arf	Refer to 2.4.1 C10 FUNCTION A, f01 ATC Arf field in 1-1-2.
F1toF2	UUT information field displays F ₁ to F ₂ reply pulse spacing in μ s.
F1Wd	UUT information field displays F ₁ pulse width in μ s.
F2Wd	UUT information field displays F ₂ pulse width in μ s.
Dly	Refer to 2.4.1 C10 FUNCTION A, f01 ATC Dly field in 1-1-2.

FIELD	DESCRIPTION
Altitude/Code	Refer to 2.4.1 C10 FUNCTION A, f01 ATC Altitude/Code field in 1-1-2. Additional information may be added at the end of the field according to the reply as follows: For emergency identification replies, the screen displays EM . For identification of position (I/P) replies, the screen displays IP .
Jtr	UUT information field displays reply jitter (difference between shortest and longest reply delays) in μ s.
AntA%	Refer to 2.4.1 C10 FUNCTION A, f01 ATC AntA% field in 1-1-2.
AntB%	Refer to 2.4.1 C10 FUNCTION A, f01 ATC AntB% field in 1-1-2.
AntB	Refer to 2.4.1 C10 FUNCTION A, f01 ATC AntB field in 1-1-2.

C20 FUNCTION B

```

C20 f05:INTLCE;Ratio:1to 1 Brf:-20+1.2
                                     Dly= 3.0125 Sqtr= 1.25
AntB%:ATC= 50,S= 50 AntA%=100 AntB:+.95
    
```

Example Function B Screen
Figure 14

Function B consists of the same function screens as Function A except for the Brf and AntB% fields. Function B screens set interrogation functions to control and monitor Antenna B (S-1403DL ANT B Connector). Pulse settings also apply to the ATC-1400A RF I/O Connector output.

FIELD DESCRIPTION

C20 Editable menu field (to enter other Control Menu screens) indicates Control Menu 20.

f## Editable function field (to enter other Function B function screens) indicates current function.

NOTE: The S-1403DL displays fields according to the function type. Refer to the same Function A function screen for field definitions.

Brf Two fields allow control of the Antenna B level only with the MLD option installed.

The first field sets the Antenna B main output signal level (-83 to -20) in dBm. Without MLD, the non-editable field indicates the S-1403DL transmits the Antenna B signal at a fixed -50 dBm.

The second field, the RF Level vernier control, combines with the first field to set the Antenna B output level through the S-1403DL ANT B Connector. The field, only displayed with the MLD option installed, ranges from -3.0 to +3.0 dB in 0.1 dB steps. Both fields add together to indicate the true Antenna B output level.

FIELD DESCRIPTION

AntB% UUT information field displays percentage of ATCRBS replies (ATC=) and Mode S replies (S=) received to interrogations transmitted through the S-1403DL ANT B Connector.

AntA% UUT information field displays percentage of replies received to interrogations transmitted through the ATC-1400A RF I/O Connector.

AntB Control field activates the S-1403DL ANT B Connector and sets the diversity offset value (timing difference from Antenna A transmissions to Antenna B transmissions [P₁ leading edge to P₁ leading edge]). The offset value ranges from -0.95 to +0.95 μs in 0.05 μs steps. **OFF** disables the ANT B Connector. When disabled, the Mode S Test Systems shuts off all Antenna B interrogations and disregards any Antenna B squitters.

C30 PERCENT REPLY

C30	PERCENT REPLY			
	ATC	ModeS	BAD	NOREPLY
AntA%=	80	10	5	5
AntB%=	80	10	5	5

Example Percent Reply Screen
Figure 15

FIELD	DESCRIPTION
C30	Editable menu field (to enter other Control Menu screens) indicates Control Menu 30.
AntA%	UUT information fields display percentage of replies received to interrogations transmitted through the ATC-1400A RF I/O Connector.
AntB%	UUT information fields display percentage of replies received to interrogations transmitted through the S-1403DL ANT B Connector.
ATC	UUT information fields display percentage of ATCRBS replies received to interrogations transmitted.
ModeS	UUT information fields display percentage of Mode S replies received to interrogations transmitted.
BAD	UUT information fields display percentage of bad (out of specification) replies received to interrogations transmitted.
NOREPLY	UUT information fields display percentage of interrogations transmitted having no replies received.
NOTE:	Pressing the S-1403DL CL/ESC Key with the Percent Reply Screen displayed or changing interrogation function (e.g. ATC→SEQ or SEQ→ACS) initializes percent reply fields to current percent reply readings.

C40 REPLY DELAY

```

C40                REPLY DELAY
  ATC=  3.0125,Min=  2.9875,Max=  3.0250
ModeS=128.0125,Min=128.0000,Max=128.0125
    
```

Example Reply Delay Screen
Figure 16

FIELD	DESCRIPTION
C40	Editable menu field (to enter other Control Menu screens) indicates Control Menu 40.
ATC	UUT information fields display ATCRBS reply delays in μ s (P_3 leading edge to F_1 leading edge). The first field indicates the current ATCRBS reply delay. The Min= field indicates the shortest ATCRBS reply delay during the current test. The Max= field indicates the longest ATCRBS reply delay during the current test.
ModeS	UUT information fields display Mode S reply delays in μ s (SPR to P_1 leading edge). The first field indicates the current Mode S reply delay. The Min= field indicates the shortest Mode S reply delay during the current test. The Max= field indicates the longest Mode S reply delay during the current test.
NOTE:	Pressing the S-1403DL CL/ESC Key with the Reply Delay Screen displayed or changing interrogation function (e.g. ATC→SEQ or SEQ→ACS) initializes reply delay fields to current reply delay readings.

C50 SQUITTER (1 of 2)

```
C50          SQUITTER (1of2)          Capt
Addr:h=A55A6A,o=51255152,Tail=N44KR,
          Country=United States
Counts/150s:DF11=148,DF17=301,DF17I= 24
```

Example Squitter (1 of 2) Screen
Figure 17

FIELD	DESCRIPTION	FIELD	DESCRIPTION
C50	Editable menu field (to enter other Control Menu screens) indicates Control Menu 50.		The DF17= field indicates number of DF17 squitters received during the current or last time period.
Capt	Indicates data in the squitter capture buffer. Without data in the squitter capture buffer, the Squitter Screens do not display Capt . The squitter capture buffer can only be examined using remote commands.		The DF17 X = field indicates number of DF17 X type squitters received during the current or last time period. The editable X (A, I, O, P, S or T) selects the type of DF17 squitters counted. Refer to 1-1-2, Table 3 for selection description.
Addr	<p>UUT information fields display the Mode S Address from received squitters in hexadecimal (h=) and octal (o=) formats.</p> <p>The Tail= field displays the Tail Number decoded from the UUT Mode S Address.</p> <p>The Country= field displays the name of the country, when decoded from the most significant bits of the UUT Mode S Address.</p>		
Counts	<p>Editable data field sets the time in seconds (10 to 300) to count received squitters before starting the count over.</p> <p>The DF11= field indicates number of DF11 squitters received during the current or last time period.</p>		

SELECTION	DESCRIPTION
A	Airborne Position
I	Aircraft Identification
O	Other
P	On-Demand Information (Pilot Report)
S	Surface Position
T	Airborne Supplementary Information (Trend)

DF17 Squitter Selection
Table 3

NOTE: Pressing the S-1403DL CL/ESC Key with the Squitter (1 of 2) Screen displayed or changing interrogation function (e.g. ATC→SEQ or SEQ→ACS) initializes squitter count fields to zero.

C60 SQUITTER (2 of 2)

C60		SQUITTER (2 of 2)				
DF	CA	AA	ME	II	ANT	TIME
11	6	A55A6A		*0	A	1.10
17A	6	A55A6A	50A421555420A1	0	B	0.51

Example Squitter (2 of 2) Screen
Figure 18

FIELD	DESCRIPTION	FIELD	DESCRIPTION
C60	Editable menu field (to enter other Control Menu screens) indicates Control Menu 60.	TIME	UUT information fields display time between the last two squitters in seconds.
Capt	Refer to 2.4.1 C50 SQUITTER (1 of 2) Capt field in 1-1-2.	NOTE: Pressing the S-1403DL CL/ESC Key with the Squitter (2 of 2) Screen displayed or changing interrogation function (e.g. ATC→SEQ or SEQ→ACS) initializes squitter data fields to current readings.	Squitter Period Measurement Parameters Range: DF11: 0.01 to 3.00 seconds DF17A: 0.01 to 1.50 seconds DF17S: 0.01 to 15.00 seconds DF17I: 0.01 to 30.00 seconds DF17T: 0.01 to 1.50 seconds DF17P: 0.01 to 65.53 seconds DF17O: 0.01 to 65.53 seconds Resolution: 10 ms Accuracy: ±10 ms, ±0.005%
DF11	UUT information fields display decoded DF11 squitter data.		
DF17X	UUT information fields display decoded DF17 squitter data. The editable X (A, I, O, P, S or T) selects the type of DF17 squitter displayed. Refer to 1-1-2, Table 3 for selection description.		
CA	UUT information fields display transponder capability data in hexadecimal from last squitter.		
AA	UUT information fields display aircraft address data in hexadecimal from last squitter.		
ME	UUT information field displays extended squitter message data in hexadecimal from last squitter. The first five bits indicate the type of DF17 squitter according to the tables at the end of Appendix D.		
II	UUT information fields display the last (bottom) four bits of the converted PI address field in hexadecimal (normally zero for squitters). If the first (top) 20 bits of the converted PI field (normally zero) have a non-zero value an * appears before the II field.		
ANT	UUT information fields report the last squitter received was through what antenna (A or B).		

C70 SETUP MENU

C70 SETUP MENU		
1) INTER TRIG	4) PPMG	7)
2) SCOPE TRIG	5) MISC	8)
3) EXT SYNC	6) SMENU	9) ATC1400A

Main Setup Menu
Figure 19

Pressing a number key (1-9) from the Main Setup Menu enters the applicable Setup Menu subscreen. The Setup Menu subscreens set triggering, modulation, format and other interrogation parameters.

C71 Interrogation Trigger

C71 SETUP - INTERROGATION TRIGGER	
TrigSource:ExtSyncIn	
TrigGen:10.0000Sec	

Example C71 Setup (Interrogation Trigger) Screen
Figure 20

FIELD	DESCRIPTION	FIELD	DESCRIPTION
C71	Editable menu field (to enter other Control Menu screens) indicates C71 Setup Screen.	TrigGen	Sets the S-1403DL internal trigger generator according to selected units, 0.0004 to 99.9999 (Sec) for the time between interrogations or 1 to 2500 (Hz) for the number of interrogations per second.
TrigSource	Control field selects interrogation trigger source. Refer to 1-1-2, Table 4.		

SETTING	SOURCE
SelfInterr	Self Interrogate pulse from ATC-1400A through S-1403DL AUX BUS Connector
ExtSyncIn	External source through S-1403DL EXT SYNC IN Connector
TrigGen	S-1403DL internal source as set by TrigGen field
BurstKey	Single trigger manually controlled by pressing S-1403DL BURST Key

Trigger Source
Table 4

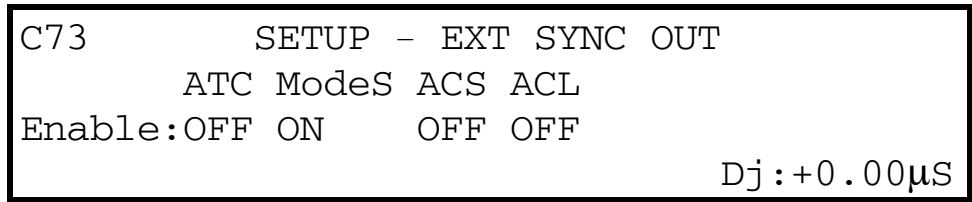
C72 Scope Trigger

C72	SETUP - SCOPE TRIGGER
	ATC ModeS ACS ACL
Enable:	OFF ON OFF OFF
Source:	CAL 150 CAL CAL (in μ S)

Example C72 Setup (Scope Trigger) Screen
Figure 21

FIELD	DESCRIPTION
C72	Editable menu field (to enter other Control Menu screens) indicates C72 Setup Screen.
Enable	Control field activates (ON) or deactivates (OFF) trigger output at the S-1403DL SCOPE TRIG OUT Connector for each interrogation type.
Source	Control field sets timing for each interrogation type: CAL to reference the ATC-1400A To/TAC/T _D Switch or a variable numeric value. Refer to Appendix A for the To and T _D pulse positions. The variable numeric value sets the trigger position in μ s referenced to the leading edge of the Antenna A interrogation P ₁ pulse. In all modes, setting the scope trigger timing to the variable numeric value fixes the scope trigger pulse width at 1 μ s.
ATC	Control fields set trigger output and timing for ATCRBS interrogations.
ModeS	Control fields set trigger output and timing for Mode S interrogations.
ACS	Control fields set trigger output and timing for All Call Short interrogations.
ACL	Control fields set trigger output and timing for All Call Long interrogations.

C73 Ext Sync Out



Example C73 Setup (Ext Sync Out) Screen
Figure 22

FIELD	DESCRIPTION
C73	Editable menu field (to enter other Control Menu screens) indicates C73 Setup Screen.
Enable	Control field activates (ON) or deactivates (OFF) external sync pulse output at the S-1403DL EXT SYNC OUT Connector for each interrogation type.
ATC	Control field activates or deactivates external sync pulse output for ATCRBS interrogations.
ModeS	Control field activates or deactivates external sync pulse output for Mode S interrogations.
ACS	Control field activates or deactivates external sync pulse output for All Call Short interrogations.
ACL	Control field activates or deactivates external sync pulse output for All Call Long interrogations.
Dv	Control field sets the sync pulse position from -9.95 to +9.95 µs, in reference to the start of the Antenna A interrogation P ₁ pulse.

C74 PPMG

C74	SETUP - PPMG (POWER)
	ATC ModeS DELM
Enable:OFF	OFF OFF
Pulse:A1	P116 1

Example C74 Setup (PPMG) Screen
Figure 23

NOTE: For the S-1403DL to control pulse power measurement, the ATC-1400A F₂/P₂ F₁/P₁ Switch must be set to **F₂/P₂**.

FIELD	DESCRIPTION
C74	Editable menu field (to enter other Control Menu screens) indicates C74 Setup Screen.
Enable	Control fields activate (ON) or deactivate (OFF) Pulse Power Measurement Gate (PPMG) operation for each reply type.
Pulse	Control fields select the reply pulse to measure for each reply type. The Mode S Test System measures power and frequency of the selected pulse.
ATC	Control fields set PPMG operation for ATCRBS replies. The ATC Enable field activates (ON) or deactivates (OFF) PPMG operation. The Mode S Test System performs power and frequency measurements on the ATCRBS reply pulse (F1, C1, A1, C2, A2, C4, A4, X, B1, D1, B2, D2, B4, D4, F2 or SPI) selected in the ATC Pulse field.
ModeS	Control fields set PPMG operation for Mode S replies. The ModeS Enable field activates (ON) or deactivates (OFF) PPMG operation. The Mode S Test System performs power and frequency measurements on the Mode S reply pulse (P001 to P116) selected in the ModeS Pulse field.
DELM	Control fields set PPMG operation for Downlink Extended Length Messages (DELM). The DELM Enable field activates (ON) or deactivates (OFF) PPMG operation. Activating the DELM Enable field automatically sets ATC Pulse field to F1 because the S-1403DL sends ATCRBS interrogations prior to the first Mode S to accurately set up the ATC-1400A PPMG operation.

NOTE: The S-1403DL DSP does not measure power on the CloseOut reply.

The Mode S Test System performs power and frequency measurements on the selected Mode S reply pulse (ModeS pulse field) in the message (1 to 16) selected in the DELM Pulse field.

C75 Misc

```

C75                SETUP - MISC
AntAEnable:ON      PrePulseOut:253µS
AntAModSrc:INT/EXT
AntBModSrc:INT
    
```

Example C75 Setup (Misc) Screen
Figure 24

FIELD	DESCRIPTION
C75	Editable menu field (to enter other Control Menu screens) indicates C75 Setup Screen.
AntAEnable	Control field activates (ON) or disables (OFF) operation through the ATC-1400A RF I/O (Antenna A) Connector. The Mode S Test System transmits interrogations and receives squitters or replies through the active ATC-1400A RF I/O Connector. When the ATC-1400A RF I/O Connector is disabled, the Mode S Test System shuts off all Antenna A interrogations and disregards any Antenna A squitters.
PrePulseOut	Control field deactivates (OFF) or activates a prepulse out the S-1403DL PREPULSE OUT Connector and sets a time delay (0 to 260 µs) between leading edges of the prepulse and the Antenna A P ₁ interrogation pulse.
AntAModSrc	Control field selects the modulation source for Antenna A (ATC-1400A RF I/O Connector) interrogations: internal (INT), external (EXT) or both (INT/EXT).
AntBModSrc	Control field selects the modulation source for Antenna B (S-1403DL ANT B Connector) interrogations: internal (INT), external (EXT) or both (INT/EXT).

C76 SMenu

```

C76          SETUP - SMENU
SmenuRadix:OCTAL      SetAllSmenu:DEFAULT
GlobalAddr:Xpdr=17725762,AP XOR=00000000
GlobalAddr:User=10273645,AP XOR=00000001
    
```

Example C76 Setup (SMenu) Screen
Figure 25

FIELD	DESCRIPTION
C76	Editable menu field (to enter other Control Menu screens) indicates C76 Setup Screen.
SmenuRadix	Control field selects the numerical format, hexadecimal (HEX) or OCTAL , of all the data fields in the sequence menus except for the decimal UF, DF and AC fields.
SetAllSmenu	Control field turns OFF all sequence menus, activates factory DEFAULT sequence menus in 1-1-2, Table 5 (turning off all others) or sets all fields to ZERO . The SetAllSmenu field also sets the ADDR field in all sequence menus to USER (User= address) or XPDR (transponder address). Changes only take affect after pressing the ENTER Key with the cursor in the SetAllSmenu field (displays NoAction until changed).

SMENU	DEFAULT
S001	Decoded UF00/DF00
S002	Decoded UF04/DF04
S003	Decoded UF05/DF05
S004	Decoded UF11/DF11
S005	Decoded UF16/DF16
S006	Decoded UF20/DF20
S007	Decoded UF21/DF21
S008	Decoded UF00/DF00

Default Sequence Menu
Table 5

Selecting **DEFAULT** or **ZERO** sets all fields except for ADDR= to zero, activates scope trigger and sets ADDR= to numeric (not global).

FIELD	DESCRIPTION
GlobalAddr:	One information and three control fields indicate four of five address choices in sequence menus. The Xpdr= information field displays the transponder reply address (from DF11 squitters, DF17 squitters, Mode S All Call replies and Mode S interrogation replies) in the format indicated by the SmenuRadix field. The top AP XOR= control field sets the XOR mask (SmenuRadix format) performed on the AP field when the selected sequence menu address is XPDR-X. The converted transponder address (real AP field) XORed with top AP XOR= field setting forms the final AP field in the sequence menu interrogation. The AP XOR= field allows transmission of bad AP fields in any sequence menu. Refer to 2.4.2 in 1-1-2. The User= control field specifies an alternative global interrogation address (in SmenuRadix format). The address, available in all sequence menus, allows easy interrogation address changes. The bottom AP XOR= control field sets the XOR mask (SmenuRadix format) performed on the AP field when USER-X is selected as the sequence menu address. The converted User= address XORed with bottom AP XOR= field setting forms the final AP field in the sequence menu interrogation. The AP XOR= field allows transmission of bad AP fields in any sequence menu. Refer to 2.4.2 in 1-1-2.

C79 ATC1400A Controls

```

C79      SETUP - ATC1400A CONTROLS
ATCRBS:C                               P123Wd: 1.05µS
RF I/O:NORM  Mode:DI                    P2Dj: CAL
Scope :To      Spc: 333.3µS             P3Dj:+1.95µS
    
```

Example C79 Setup (ATC1400A Controls) Screen
Figure 26

The C79 Setup (ATC1400A Controls) Screen displays ATC-1400A front panel control status. When the ATC-1400A is disconnected from the S-1403DL, the C79 Setup Screen allows the S-1403DL to simulate ATC-1400A front panel controls. The C79 Setup Screen parameters are only adjustable when operating the S-1403DL in the Stand-Alone mode (set in the C84 System Screen) with the ATC-1400A disconnected from the S-1403DL.

FIELD	DESCRIPTION
C79	Editable menu field (to enter other Control Menu screens) indicates C79 Setup Screen.
ATCRBS	Control field, simulating ATC-1400A XPDR MODE Control, selects mode for ATCRBS (1 , 2 , T , A , B , C or D).
RF I/O	Control field, simulating ATC-1400A CW/NORM/OFF Switch, sets the RF output through the S-1403DL ANT B Connector: OFF disables output. NORM sends interrogations (full modulated RF). CW transmits a continuous wave (unmodulated RF).
Scope	Control field, simulating ATC-1400A To/TAC/Td Switch, sets the sync pulse position through S-1403DL SCOPE TRIG OUT Connector: To sets the sync pulse for viewing interrogation pulses. Td sets sync pulse for viewing replies or second interrogations (DI function).
Mode	Control field sets the simulated ATC-1400A DBL INTERR/INTRF PULSE Thumbwheels mode (Interf [not available in Stand-Alone mode], DI or OFF).

FIELD	DESCRIPTION
Spc or Loc	Field, simulating part of ATC-1400A DBL INTERR/INTRF PULSE Thumbwheels, sets DI function spacing (Spc) or shows interference pulse location (Loc), according to Mode field setting. Spc control field sets DI spacing from 0 (40 for double SEQ) to 399.9 µs between P ₁ leading edge in first interrogation to P ₁ leading edge in second interrogation. Loc field displays interference pulse position from -17.5 to +399.9 in µs from leading edge of the interrogation P ₁ pulse.
P2Dv	Control field, simulating the ATC-1400A XPDR DEV P ₂ /CAL Switch and XPDR P ₂ /P ₃ DEV Thumbwheels (only for P ₂), sets P ₂ pulse position to CAL (nominal) or deviates position (in µs) from nominal. Deviation ranges from -1.95 to +1.95 µs.
P123Wd	Control field, simulating ATC-1400A XPDR PULSE WIDTH Thumbwheels, sets the width (in µs) of selected P ₁ , P ₂ and P ₃ pulses. Width ranges from 0 to 1.95 µs and CAL (nominal).
P3Dv	Control field, simulating the ATC-1400A XPDR DEV P ₃ /CAL Switch and XPDR P ₂ /P ₃ DEV Thumbwheels (only for P ₃), sets P ₃ pulse position to CAL (nominal) or deviates position (in µs) from nominal. Deviation ranges from -1.95 to +1.95 µs.

C80 SYSTEM MENU

C80	SYSTEM MENU		
1) RS232 CTRL	4) IFR BUS	7)	
2) RS232 INTF	5) KEYBOARD	8) SELF-TEST	
3) GPIB	6) CLOCK	9) VERSION/OPT	

Main System Menu
Figure 27

Pressing a number key (1-9) from the Main System Menu enters the applicable System Menu subscreen. The System Menu subscreens set system parameters.

C81 RS232 Control

C81	SYSTEM - RS232 CONTROL		
RCI:ENABLE	Screen Dump:ENABLE		
RCI Echo:YES	Screen Border:7BIT		
	Screen EOL:CR/LF		

Example C81 System (RS232 Control) Screen
Figure 28

The C81 System (RS232 Control) Screen sets the S-1403DL for serial remote operation through the RS-232 Connector (J12).

FIELD	DESCRIPTION
C81	Editable menu field (to enter other Control Menu screens) indicates C81 System Screen.
RCI	Control field allows remote control (ENABLE) or ignores input (DISABLE).
RCI Echo	Control field enables (YES) remote commands to echo back to the controller or disables (NO) remote echo.
Screen Dump	Control field allows (ENABLE) or prohibits (DISABLE) the use of the PRTSCR Key to perform a screen dump out the RS-232 Connector.

FIELD	DESCRIPTION
Screen Border	Control field selects the border style for a screen dump: 8BIT (IBM characters), 7BIT or NONE .
Screen EOL	Control field selects the end of line characters for a screen dump: (CR/LF , LF , CR or NUL).

C82 RS232 Interface

```

C82          SYSTEM - RS232 INTERFACE
Baud:38400          Hndshk:XON/XOFF
Data:8             HndshkOn: 90%
Stop:1           Parity:NONE   HndshkOff:10%
    
```

Example C82 System (RS232 Interface) Screen
Figure 29

The C82 System (RS232 Interface) Screen sets the interface parameters for S-1403DL serial remote operation through the RS-232 Connector (J12).

FIELD	DESCRIPTION
C82	Editable menu field (to enter other Control Menu screens) indicates C82 System Screen.
Baud	Control field selects the baud rate (110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400 or 57600) in bits per second.
Data	Control field sets the number of data bits per word (7 or 8).
Stop	Control field sets the number of stop bits per word (1 or 2).

FIELD	DESCRIPTION
Parity	Control field sets the parity check mode: NONE, ODD or EVEN .
Hndshk	Control field sets the handshake mode: NONE, XON/XOFF (software), CTS (one-way hardware) or CTS/RTS (two-way hardware).
HndshkOn:	Selects the handshake ON threshold percentage (10% to 90%), indicating available buffer room to activate handshake.
HndshkOff:	Selects the handshake OFF threshold percentage (10% to 90%), indicating available buffer room to deactivate handshake.

C83 GPIB

```

C83          SYSTEM - GPIB
RCI:ENABLE
Address:10
    
```

Example C83 System (GPIB) Screen
Figure 30

The C83 System (GPIB) Screen sets the S-1403DL for parallel remote operation through the S-1403DL GPIB Connector (J21).

FIELD	DESCRIPTION
C83	Editable menu field (to enter other Control Menu screens) indicates C83 System Screen.

FIELD	DESCRIPTION
RCI	Control field allows remote control (ENABLE) or ignores input (DISABLE).
Address	Control field sets the GPIB address (0 to 31).

C84 IFR BUS

```

C84          SYSTEM - IFR BUS
1400 Control: MASTER      Must power down
1403 Bus Address: 3      before settings
                          take effect.
    
```

Example C84 System (IFR BUS) Screen
Figure 31

FIELD	DESCRIPTION	FIELD	DESCRIPTION
C84	Editable menu field (to enter other Control Menu screens) indicates C84 System Screen.	1403 Bus Address	Control field sets IFR Bus address for S-1403DL remote commands (2 to 7) or prevents remote operation through the IFR Bus (OFF).
1400 Control	Control field sets the S-1403DL control over the ATC-1400A: MASTER places the S-1403DL in control over the ATC-1400A hardware. The Remote Command Interpreter (RCI) is not affected. SLAVE allows the S-1403DL to listen but not control the ATC-1400A. STAND-ALONE ignores input from the ATC-1400A.	NOTE:	New C84 System Screen settings only take affect after recycling power. Pressing the S-1403DL POWER Switch Off (O) and pressing the S-1403DL POWER Switch back On (I) recycles power.

C85 Keyboard

```

C85          SYSTEM - KEYBOARD
Repeat Delay:0.8sec
Repeat Rate:0.2sec
    
```

Example C85 System (Keyboard) Screen
Figure 32

FIELD	DESCRIPTION	FIELD	DESCRIPTION
C86	Editable menu field (to enter other Control Menu screens) indicates C86 System Screen.	Repeat Rate	Control field sets the time period, in 0.1 second increments, for each repeating Keyboard operation (after initial delay) when holding down a key. The default is 0.2 seconds.
Repeat Delay	Control field sets the time required, in 0.1 second increments, to hold down a key before the Keyboard operation repeats. The default is 0.8 seconds.		

C86 Clock

```

C86          SYSTEM - CLOCK

Date: 16apr99   SincePowerUp:    2.1hrs
Time: 15:24:59 TotalRunTime:    12.3hrs
    
```

Example C86 System (Clock) Screen
Figure 33

FIELD	DESCRIPTION	FIELD	DESCRIPTION
C86	Editable menu field (to enter other Control Menu screens) indicates C86 System Screen.	SincePowerUp	Information field reports the current number of hours the S-1403DL has operated since power up.
Date	Control field sets the current date: day (1 to 31), month (first three letter abbreviation) and year (last two digits).	TotalRunTime	Information field reports the total number of hours the S-1403DL has operated since leaving the factory.
Time	Control field sets the current time: hour (0 to 24), minute (0 to 60) and second (0 to 60).		

C88 Self Test

Not installed at this time.

C89 Version

```

C89          SYSTEM - VERSION      S/N=1075
MP:04.03,02feb99  Options:MLD,MODB
PP:04.03,02feb99  SRAM:1280K FLASH:2048K
FP:03.02,18may98  LCA:02.21,03.03,03.02
    
```

Example C89 System (Version) Screen
Figure 34

FIELD	DESCRIPTION	FIELD	DESCRIPTION
C89	Editable menu field (to enter other Control Menu screens) indicates C89 System Screen.	Options	Information field reports installed hardware and software options.
MP	Information field reports the Main Processor firmware version number and build date.	SRAM	Information field reports the amount of static RAM (in bytes) on the Pulse PC Board Assembly.
PP	Information field reports the Pulse Processor firmware version number and build date.	LCA	Information field reports the firmware version numbers for three Logic Cell Array chips.
FP	Information field reports the Front Panel Processor firmware version number and build date.	FLASH	Information field reports the amount of flash ROM (in bytes) on the Pulse PC Board Assembly.


```
S005:D;UF16,RL=0,AQ=0,
+ MU=00000000000000000000, ADDR=17725762
RPLY:D;DF16,VS=0,SL=0,RI=00,AC=0000,
MV=00000000000000000000, ADDR=17725762
```

```
S019:D;UF24,RC=0,NC=0,
+ MC=00000000000000000000, ADDR=3FABF2
RPLY:D;DF24,KE=0,ND=0
MD=00000000000000000000, ADDR=3FABF2
```

D Format Sequence Menu Examples in Octal and Hex Radix
Figure 37

FIELD	DESCRIPTION	FIELD	DESCRIPTION
S###	<p>Editable menu field selects current Sequence Menu screen (000 to 999). Pressing the ON/CAL Key in this field activates or deactivates (OFF) the selected sequence menu.</p> <p>The format field sets interrogation format: D (decoded subfields), N (undecoded fields with number of bits depending on uplink format), S (short 56-bit transmission), L (long 112-bit transmission) or Reply Only (no interrogation, for displaying the contents of a DELM segment).</p> <p>NOTE: Pressing the S-1403DL +/- Key with the cursor in the S### field displays the next active sequence menu.</p>	ADDR	<p>Long interrogations have an 83-bit message field (added to the 5-bit uplink format field and the 24-bit address parity field provides the total 112-bit transmission).</p> <p>The scope trigger field activates (+) or deactivates (-) the scope trigger for the selected sequence menu to provide oscilloscope display control. The Mode S Enable field must be ON in C72 Scope Trigger Setup Screen.</p> <p>Decoded interrogations display the subfields according to the uplink format. Refer to Appendix B for the Decoded Sequence Menu Formats.</p> <p>Data field sets the UUT transponder address sent in the Mode S interrogation address parity field.</p>
UF##	<p>Editable field selects the Mode S interrogation uplink format for the selected sequence menu.</p> <p>The interrogation data fields depend on the interrogation and uplink formats selected. Refer to Appendix D for the Mode S uplink field definitions.</p> <p>Short interrogations have a 27-bit message field (added to the 5-bit uplink format field and the 24-bit address parity field provides the total 56-bit transmission).</p>		<p>Pressing the ON/CAL Key in this field cycles to the next address or address/parity combination according to 1-1-2, Table 6. Refer to 1-1-2, Figure 38 for actual AP field formation according to address selected. The C76 SMenu Setup Screen provides the Global Address (Xpdr= or User=) and Global AP XOR settings used in the process. The C76 SMenu Setup Screen (SetAllSmenu) provides the ability to set the ADDR field to USER or XPDR for all active sequence menus simultaneously.</p>

FIELD	DESCRIPTION
ADDRESS	WHERE TO SET
Numeric	SMENU ADDR field or remote
XPDR	Transponder address/default
USER	C76 SMenu Setup Screen Global Addr:User= field setting
XPDR-X	Transponder address XORed with C76 SMenu Setup Screen Global Addr:Xpdr=, AP XOR= field setting
USER-X	C76 SMenu Setup Screen Global Addr:User= field XORed with C76 SMenu Setup Screen Global Addr:User=, AP XOR= field setting

SMENU Address Cycle
Table 6

RPLY Signifies the start of the sequence menu UUT reply lines.

The format field sets reply format: **N** (not decoded for unspecified short or long depending on the UUT reply received) or **D** (decoded subfields).

DF## UUT transponder information field indicates the downlink format received in reply to the selected sequence menu.

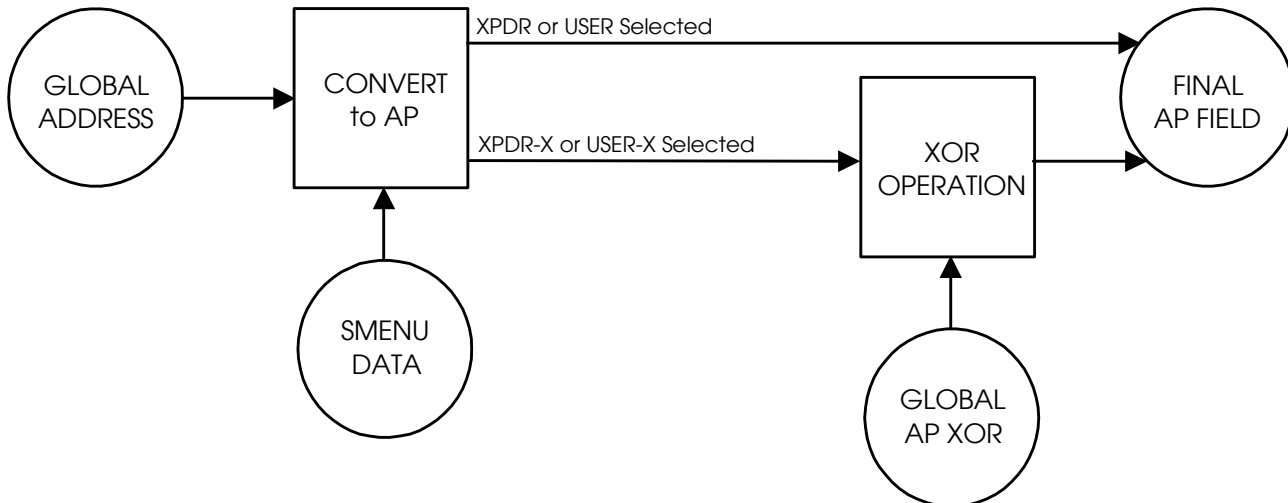
The reply data fields depend on the reply format and the UUT reply received. Refer to Appendix D for the Mode S downlink field definitions.

Short interrogations have a 27-bit message field (added to the 5-bit uplink format field and the 24-bit address parity field provides the total 56-bit transmission).

Long interrogations have an 83-bit message field (added to the 5-bit uplink format field and the 24-bit address parity field provides the total 112-bit transmission).

Decoded interrogations display the subfields according to the uplink format. Refer to Appendix B for the Decoded Sequence Menu Formats.

ADDR UUT information field provides the UUT transponder address, obtained by stripping the parity information from the AP field received in the UUT reply.



Sequence Menu Interrogation AP Field Formation
Figure 38

2.4.3 Test Menus (TMENU)

T00	MAIN TMENU	
1)	4)	7)
2) MISC MENU	5)	8)
3) ELM MENU	6)	9)

Main Test Menu
Figure 39

Pressing 2ND, T MENU and a number key in sequence enters the applicable Test Menu subscreen or last accessed screen of a particular Test Menu subscreen group.

Pressing the S-1403DL BURST Key in a test screen (any Test Menu subscreen except menus and setups) initiates that particular test. A running test stops by exiting the test screen, pressing the CL/ESC Key or by completing the test.

All test screens have status fields on the right side of the top line displaying **NOT RUN**, **RUNNING**, **PASS** or **FAIL**. Test screens with error fields also indicate a numeric and text error.

T20 MISC MENU

T20	MISC MENU	
1)	4)	7)
2)	5)	8)
3) MTL	6)	9)

Example Miscellaneous Test Menu
Figure 40

Pressing a number key (1-7) from the Miscellaneous Test Menu enters the applicable Miscellaneous Test Menu subscreen. Miscellaneous Test Menu subscreens provide setup or run specific tests. The specific tests provide detailed transponder information.

T23 Misc MTL

```

T23                MISC - MTL                PASS
Reply%:100        Time:10sec                MTL:-65.3dBm
Antenna:A         Error: 2=Pass
                  Press BURST to start test
    
```

Example T23 Miscellaneous MTL Screen
Figure 41

The T23 Miscellaneous (MTL) Test Menu Screen tests determines the minimum threshold level (MTL) of the transponder UUT. The Mode S Test System sends ATCRBS interrogations of each type, an All Call Long and Mode S interrogations requesting capability reports.

FIELD	DESCRIPTION
T23	Editable menu field (to enter other Test Menu screens) indicates Miscellaneous Test Screen 23.
Status	Information field indicates NOT RUN, RUNNING, PASS or FAIL .
Reply%	Information field reports total reply percentage.

FIELD	DESCRIPTION
Antenna	Control field selects test antenna, A through ATC-1400A RF I/O Connector or B (only if MLD option is installed) through S-1403DL ANT B Connector.
Time	Information field reports length of time test ran or has been running.
Error	Information field indicates numeric and text errors. Refer to 1-2-2, Table 8.
MTL	Information field reports the lowest transmitted power level in dBm, the UUT received and responded to, of the Mode S Test System.

T30 ELM MENU

```

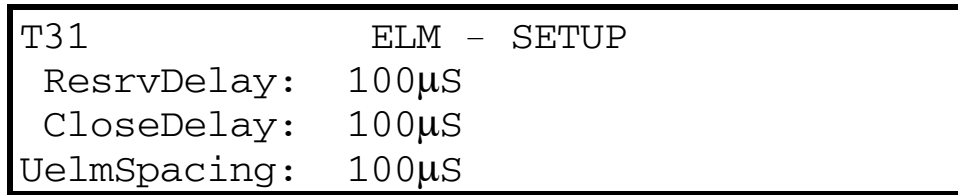
T30                ELM MENU
1) SETUP           4) DELM           7)
2) UELM            5) DELM-MULTI    8)
3) UELM-MULTI     6)                9)
    
```

Example ELM Test Menu
Figure 42

Pressing a number key (1-5) from the ELM Test Menu enters the applicable ELM Test Menu subscreen. ELM Test Menu subscreens set up and run extended length message tests (Comm-C interrogations and Comm-D replies).

The ELM Test Menu subscreens exercise the uplink and downlink ELM protocol capabilities of a transponder. The S-1403DL uses the TrigSource in the C71 Setup Screen to initiate the first interrogation for the start of each test loop.

T31 ELM Setup



Example T31 ELM Setup Screen
Figure 43

FIELD	DESCRIPTION
T31	Editable menu field (to enter other Test Menu screens) indicates T31 ELM Screen.
ResrvDelay	Control field determines the Reservation Delay by setting the spacing between the end of the reservation reply and the beginning of the first ELM interrogation. Spacing ranges from 100 to 63000 µs with 100 µs as default.
CloseDelay	Control field determines the Closeout Delay by setting the spacing between the end of the last ELM reply and the beginning of the first CloseOut interrogation. DELM tests always assume spacing relative to the end of the 16th ELM reply (if it exists or not). Spacing ranges from 100 to 63000 µs with 100 µs as default.
UelmSpacing	Control field sets the spacing between the start of the UELMs. Spacing ranges from 50 to 63000 µs with 100 µs as default.

ELM Delay and Spacing Parameters

Reservation Delay (UELm and DELM) (leading edge of P₁ in Reservation interrogation to leading edge of P₁ in first ELM Segment):

Range: (100 to 63000 µs) + 252.75 µs
Step: 1 µs
Accuracy: ±100 ns, ±0.005%

Closeout Delay (UELm) (leading edge of P₁ in last ELM Segment to leading edge of P₁ in Closeout interrogation):

Range: (100 to 63000 µs) + 252.75 µs
Step: 1 µs
Accuracy: ±100 ns, ±0.005%

Closeout Delay (DELM) (leading edge of P₁ in ELM Authorization to leading edge of P₁ in Closeout interrogation):

Range: (100 to 63000 µs) + 2292.75 µs
Step: 1 µs
Accuracy: ±100 ns, ±0.005%

UELm Spacing (leading edge of P₁ in any ELM Segment to leading edge of P₁ in next ELM Segment):

Range: 50 to 63000 µs
Step: 1 µs
Accuracy: ±100 ns, ±0.005%

T32 UELM

T32	ELM - UP	NOT RUN
ELM	XMT	ERROR
S901-904	4	
Press BURST to start test		

Example T32 UELM Test Screen
Figure 44

The UELM Test Screen exercises the UELM datalink feature (ability to receive Comm-C message segments sent in UF24 interrogations) of the transponder in singlesite operation.

FIELD	DESCRIPTION
T32	Editable menu field (to enter other Test Menu screens) indicates T32 ELM Screen.
Status	Information field indicates NOT RUN, RUNNING, PASS or FAIL .
ELM	Control field selects the starting sequence menu bin for the ELM data from S000 to S984. The second number indicates the ending sequence menu bin according to the XMT field setting. The last sequence menu bin contains the Acknowledgment Reply.
XMT	Control field sets the number of ELMs to be transmitted from 2 to 16, automatically setting the ending sequence menu bin in the ELM field.
ERROR	Information field indicates numeric and text errors. Refer to 1-2-2, Table 9.

T33 UELM Multisite

```

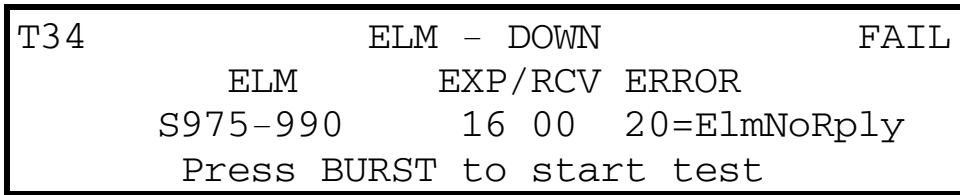
T33          ELM - UP - MULTI          FAIL
RESV        ELM   XMT  CLOS  ERROR
S900  S901-916  16  S917  10=ResvNoRply
          Press BURST to start test
    
```

Example T33 UELM-Multi Test Screen
Figure 45

The UELM Multisite Test Screen exercises the UELM datalink feature (ability to receive Comm-C message segments sent in UF24 interrogations) of the transponder in multisite operation.

FIELD	DESCRIPTION
T33	Editable menu field (to enter other Test Menu screens) indicates T33 ELM Screen.
Status	Information field indicates NOT RUN, RUNNING, PASS or FAIL .
RESV	Control field selects the sequence menu bin for the Reservation/Reservation Reply from S000 to S999.
ELM	Control field selects the starting sequence menu bin for the ELM data from S000 to S984. The second number indicates the ending sequence menu bin according to the XMT field setting. The last sequence menu bin contains the Acknowledgment Reply.
XMT	Control field sets the number of ELMs to be transmitted from 2 to 16, automatically setting the ending sequence menu bin in the ELM field.
CLOS	Control field selects the sequence menu bin for the Closeout/Closeout Reply from S000 to S999.
ERROR	Information field indicates numeric and text errors. Refer to 1-2-2, Table 9.

T34 DELM



Example T34 DELM Test Screen
Figure 46

The DELM Test Screen exercises the DELM datalink feature (ability to transmit Comm-D message segments sent in DF24 replies) of the transponder in singlesite operation.

FIELD	DESCRIPTION
-------	-------------

T34	Editable menu field (to enter other Test Menu screens) indicates T34 ELM Screen.
-----	--

Status
Information field indicates **NOT RUN, RUNNING, PASS** or **FAIL**.

ELM
Control field selects the starting sequence menu bin for the ELM reply data from S000 to S984. The second (right) number indicates the ending sequence menu bin according to the first (left) number set plus 15. The S-1403DL always reserves 16 sequence menu bins for the DELM replies. The first ELM sequence menu bin selected (first number) contains the UF24 interrogation.

EXP/RCV
Information fields indicate the ELM reception numbers. The first number indicates the number of expected ELMs (always set to the maximum 16 with singlesite). The second number indicates the number of ELMs actually received.

ERROR
Information field indicates numeric and text errors. Refer to 1-2-2, Table 10.

T35 DELM Multisite

```

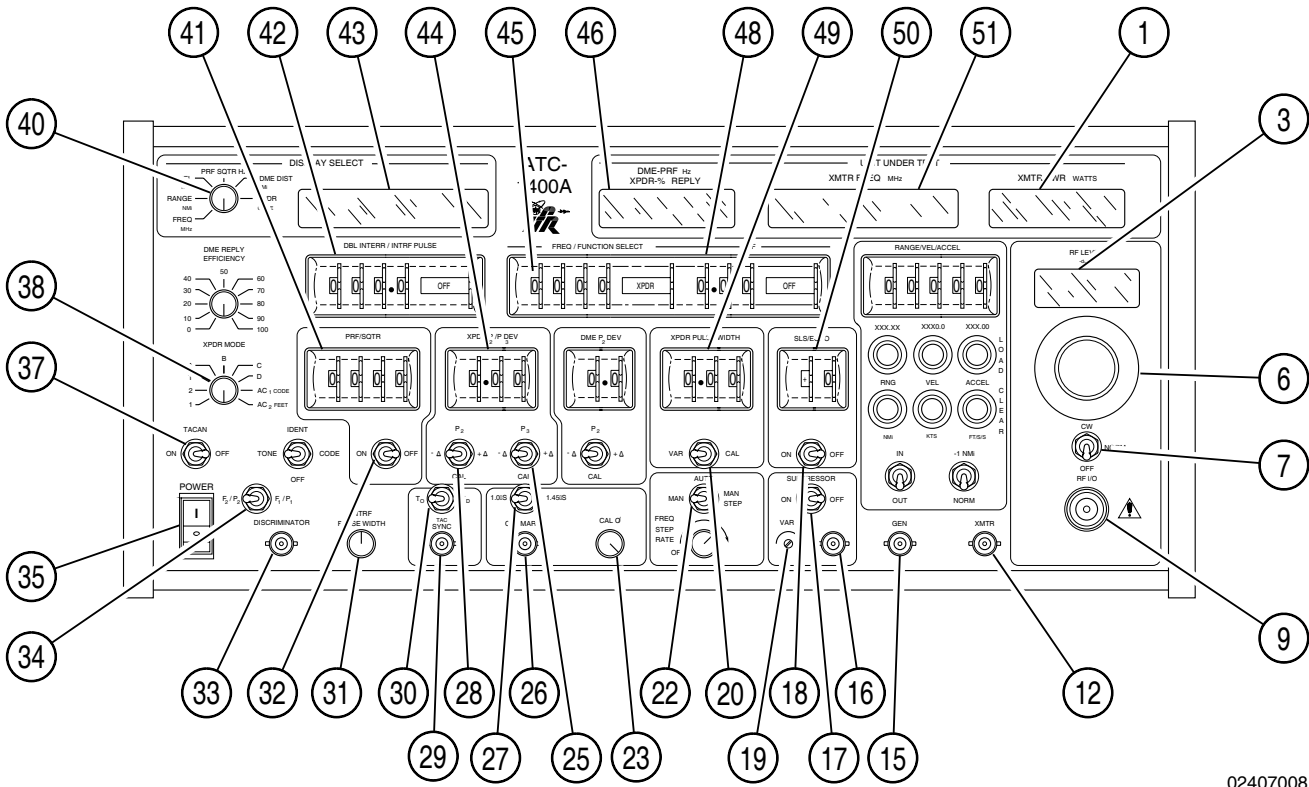
T35          ELM - DOWN - MULTI          FAIL
RESV        ELM   CLOS EXP/RCV ERROR
S950 S951-966 S967 16 14 26=ElmBadND
           Press ESC to stop test
    
```

Example T35 DELM-Multi Test Screen
Figure 47

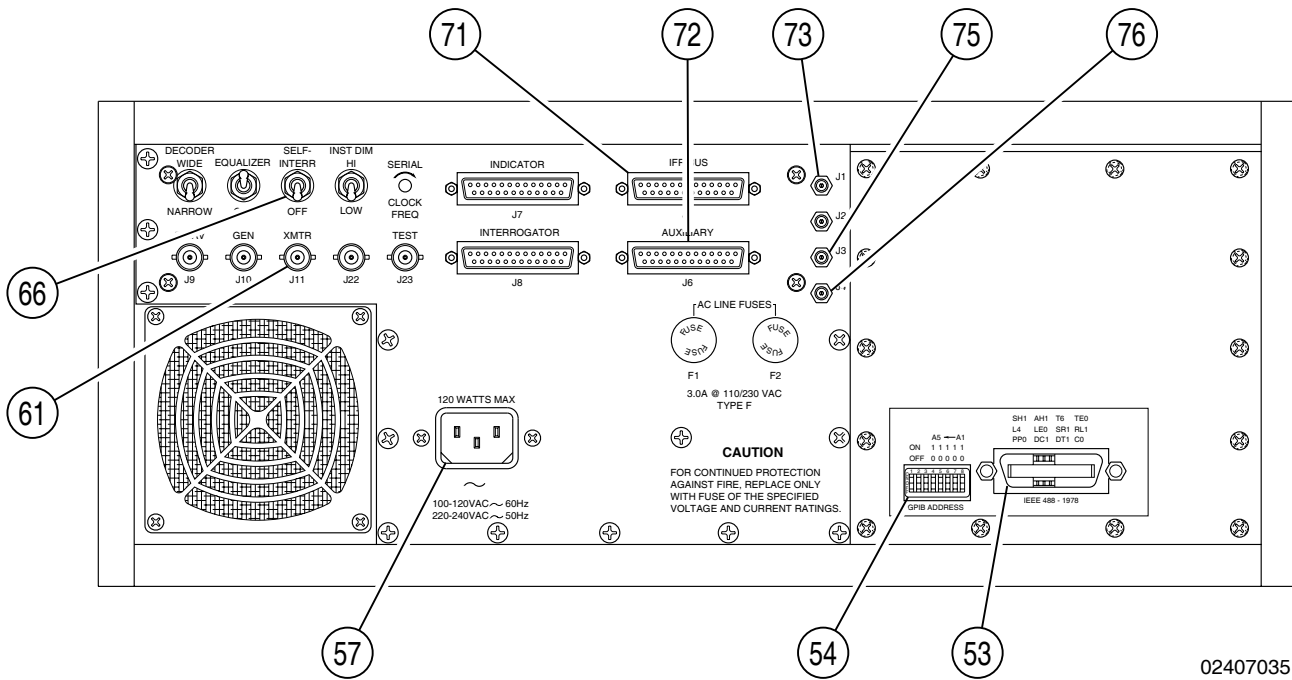
The DELM-Multisite Test Screen exercises the DELM datalink feature (ability to transmit Comm-D message segments sent in DF24 replies) of the transponder in multisite operation.

FIELD	DESCRIPTION
ERROR	Information field indicates numeric and text errors. Refer to 1-2-2, Table 10.

FIELD	DESCRIPTION
T35	Editable menu field (to enter other Test Menu screens) indicates T35 ELM Screen.
Status	Information field indicates NOT RUN, RUNNING, PASS or FAIL .
RESV	Control field selects the sequence menu bin for the Reservation/Reservation Reply from S000 to S999.
ELM	Control field selects the starting sequence menu bin for the ELM reply data from S000 to S984. The second (right) number indicates the ending sequence menu bin according to the first (left) number set plus 15. The S-1403DL always reserves 16 sequence menu bins for the DELM replies. The first ELM sequence menu bin selected (first number) contains the UF24 interrogation.
CLOS	Control field selects the sequence menu bin for the Closeout/Closeout Reply from S000 to S999.
EXP/RCV	Information fields indicate the ELM reception numbers. The first number indicates the number of expected ELMs. The second number indicates the number of ELMs actually received.



02407008



02407035

ATC-1400A Front and Rear Panels
Figure 48



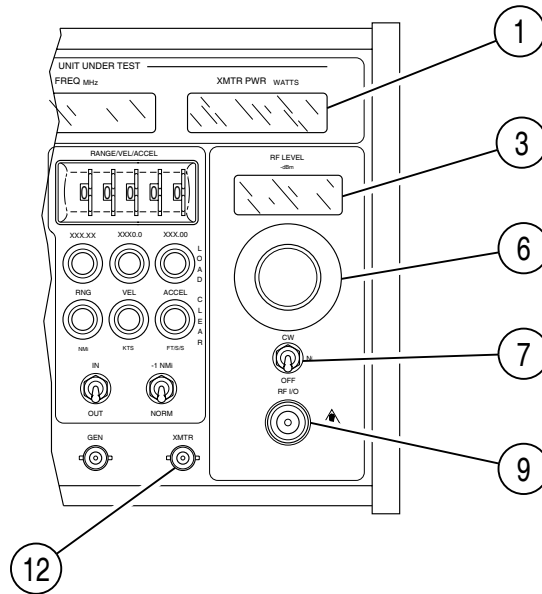
ATC-1400A Numerical Location List:

1. XMTR PWR WATTS Display
3. RF LEVEL -dBm Display
6. RF LEVEL Control
7. CW/NORM/OFF Switch
9. RF I/O Connector (J15)
12. XMTR Connector (J16)
15. GEN Connector (J17)
16. SUPPRESSOR OUTPUT Connector (J18)
17. SUPPRESSOR ON/OFF Switch
18. SLS/ECHO ON/OFF Switch
19. SUPPRESSOR VAR Adjustment
27. 1.0 μ s/1.45 μ s Switch
20. XPDR PULSE WIDTH VAR/CAL Switch
22. MAN/AUTO/MAN STEP Switch
23. CAL \emptyset Control
25. XPDR DEV P₃/CAL Switch
26. CAL MARKS Connector (J19)
28. XPDR DEV P₂/CAL Switch
29. SYNC Connector (J20)
30. TO/TAC/TD Switch
31. INTRF PULSE WIDTH Control
32. PRF/SQTR ON/OFF Switch
33. DISCRIMINATOR Connector (J21)
34. F₂/P₂ F₁/P₁ Switch
35. POWER Switch
37. TACAN ON/OFF Switch
38. XPDR MODE Control
40. DISPLAY SELECT Control
41. PRF/SQTR Thumbwheels
42. DBL INTERR/INTRF PULSE Thumbwheels
43. DISPLAY SELECT Readout
44. XPDR P₂/P₃ DEV Thumbwheels
45. FREQ/FUNCTION SELECT Thumbwheels
46. DME-PRF Hz/XPDR-%REPLY Display
48. Δ F Thumbwheels
49. XPDR PULSE WIDTH Thumbwheels
50. SLS/ECHO Thumbwheels
51. XMTR FREQ MHz Display
53. GPIB Connector (J14)
54. GPIB ADDRESS/OPTION Dip Switches
57. AC INPUT Connector
61. XMTR Connector (J11)
66. SELF-INTERR/OFF Switch
71. IFR BUS Connector (J5)
72. AUXILIARY Connector (J6)
73. DABS INPUT Connector (J1)
75. EXTERNAL MEASUREMENT GATE Connector (J3)
76. RF LEVEL INPUT Connector (J4)


ATC-1400A Alphabetical Location List:

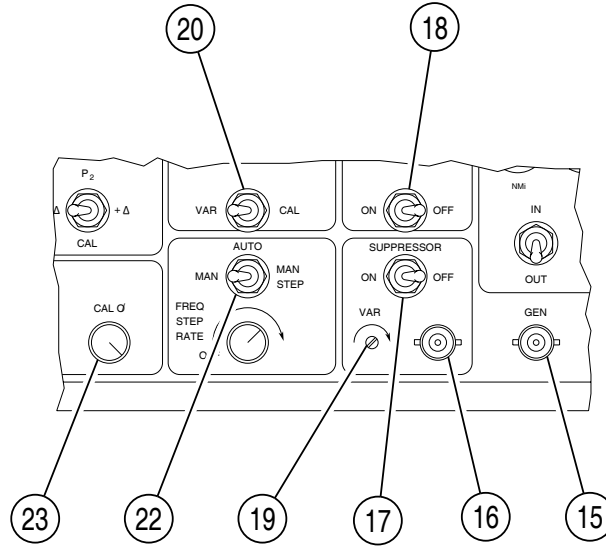
- | | |
|--|----|
| 1.0 μ s/1.45 μ s Switch | 27 |
| AC INPUT Connector | 57 |
| AUXILIARY Connector (J6) | 72 |
| CAL MARKS Connector (J19) | 26 |
| CAL \emptyset Control | 23 |
| CW/NORM/OFF Switch | 7 |
| DABS INPUT Connector (J1) | 73 |
| DBL INTERR/INTRF PULSE Thumbwheels | 42 |
| Δ F Thumbwheels | 48 |
| DISCRIMINATOR Connector (J21) | 33 |
| DISPLAY SELECT Control | 40 |
| DISPLAY SELECT Readout | 43 |
| DME-PRF Hz/XPDR-%REPLY Display | 46 |
| EXTERNAL MEASUREMENT GATE
Connector (J3) | 75 |
| F ₂ /P ₂ F ₁ /P ₁ Switch | 34 |
| FREQ/FUNCTION SELECT Thumbwheels | 45 |
| GEN Connector (J17) | 15 |
| GPIB ADDRESS/OPTION Dip Switches .. | 54 |
| GPIB Connector (J14) | 53 |
| IFR BUS Connector (J5) | 71 |
| INTRF PULSE WIDTH Control | 31 |
| MAN/AUTO/MAN STEP Switch | 22 |
| POWER Switch | 35 |
| PRF/SQTR ON/OFF Switch | 32 |
| PRF/SQTR Thumbwheels | 41 |
| RF I/O Connector (J15) | 9 |
| RF LEVEL -dBm Display | 3 |
| RF LEVEL Control | 6 |
| RF LEVEL INPUT Connector (J4) | 76 |
| SELF-INTERR/OFF Switch | 66 |
| SLS/ECHO ON/OFF Switch | 18 |
| SLS/ECHO Thumbwheels | 50 |
| SUPPRESSOR ON/OFF Switch | 17 |
| SUPPRESSOR OUTPUT Connector (J18) | 16 |
| SUPPRESSOR VAR Adjustment | 19 |
| SYNC Connector (J20) | 29 |
| TACAN ON/OFF Switch | 37 |
| TO/TAC/TD Switch | 30 |
| XMTR Connector (J11) | 61 |
| XMTR Connector (J16) | 12 |
| XMTR FREQ MHz Display | 51 |
| XMTR PWR WATTS Display | 1 |
| XPDR DEV P ₂ /CAL Switch | 28 |
| XPDR DEV P ₃ /CAL Switch | 25 |
| XPDR MODE Control | 38 |
| XPDR P ₂ /P ₃ DEV Thumbwheels | 44 |
| XPDR PULSE WIDTH Thumbwheels | 49 |
| XPDR PULSE WIDTH VAR/CAL Switch... | 20 |

2.5 ATC-1400A FRONT PANEL



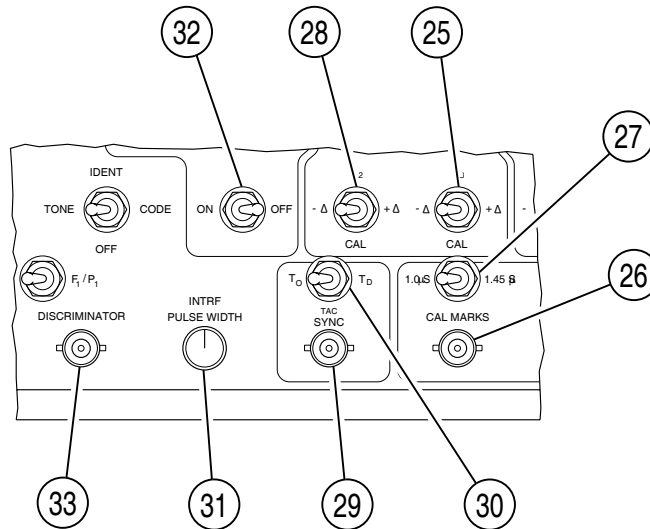
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ITEM	DESCRIPTION	ITEM	DESCRIPTION
1.	<p>XMTR PWR WATTS Display</p> <p>Continuously displays the peak pulse power of the UUT reply pulse selected in the S-1403DL-1 C74 PPMG Setup Screen.</p>		
3.	<p>RF LEVEL -dBm Display</p> <p>Displays the programmed peak RF power of the ATC-1400A generator in dB below 1 mW.</p>		
6.	<p>RF LEVEL Control</p> <p>Adjusts ATC-1400A RF generator level in 1 dB steps by slowly turning the control knob.</p>		
7.	<p>CW/NORM/OFF Switch</p> <p>Controls the signal through the ATC-1400A RF I/O Connector (Antenna A) and S-1403DL ANT B Connector (Antenna B).</p> <p>CW supplies continuous wave signal (RF signal with no modulation) at the frequency set with ATC-1400A FREQ/FUNCTION SELECT and ΔF Thumbwheels. CW setting is used to test the Mode S Test System.</p>		
			<p>NORM allows the Mode S Test System to transmit interrogations (modulated RF signal). NORM is the normal setting for Mode S Test System operation.</p>
			<p>OFF disables output. When disabled, the Mode S Test System shuts off all interrogations and disregards any squitters.</p>
		9.	<p>RF I/O Connector (J15) </p> <p>CAUTION: MAXIMUM INPUT TO THE RF I/O CONNECTOR MUST NOT EXCEED 5 kW PEAK OR 10 W AVERAGE.</p> <p>Transmits interrogation signals to and receives reply signals from the UUT primary antenna (Antenna A).</p>
		12.	<p>XMTR Connector (J16)</p> <p>Provides detected UUT reply pulses for viewing on an oscilloscope.</p>



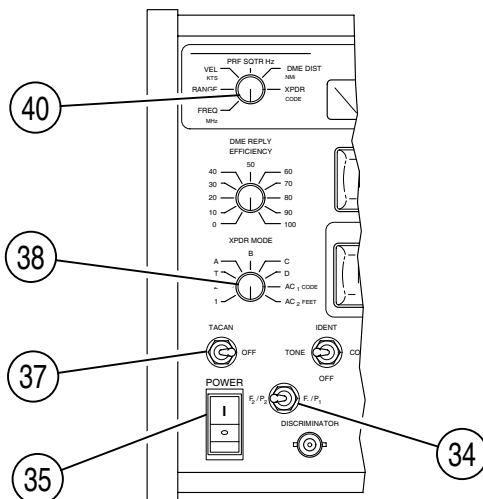
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ITEM	DESCRIPTION	ITEM	DESCRIPTION
15.	<p>GEN Connector (J17)</p> <p>Provides detected interrogation and interference pulses for viewing on an oscilloscope.</p>		
16.	<p>SUPPRESSOR OUTPUT Connector (J18)</p> <p>Provides mutual suppression pulses.</p>	19.	<p>SUPPRESSOR VAR Adjustment</p> <p>Adjusts voltage level of mutual suppression pulse from +3 to +27 V.</p>
17.	<p>SUPPRESSOR ON/OFF Switch</p> <p>Enables or disables mutual suppression pulses.</p> <p>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.</p>	20.	<p>XPDR PULSE WIDTH VAR/CAL Switch</p> <p>VAR selects a variable interrogation pulse width set by the ATC-1400A XPDR PULSE WIDTH Thumbwheels . Only the widths of P₁, P₂ (if selected) and P₃ (if applicable and selected) are controlled by this switch.</p> <p>CAL selects an interrogation pulse width of 0.8 μs.</p>
18.	<p>SLS/ECHO ON/OFF Switch</p> <p>Enables or disables Side-Lobe Suppression (SLS) pulses.</p> <p>ON adds the P₂ (ATCRBS) or P₅ (Mode S) SLS pulse to the interrogation transmission. The ATC-1400A SLS/ECHO Thumbwheels control only the amplitude of the SLS pulse when activated.</p>	22.	<p>MAN/AUTO/MAN STEP Switch</p> <p>Set to MAN position for Mode S Test System operation.</p>
		23.	<p>CAL Ø Control</p> <p>Adjusts the phase of calibration (timing) pulses with respect to interrogation pulses. Rotating control cw delays calibration pulses and enables the operator to align calibration pulses with reply pulses.</p>



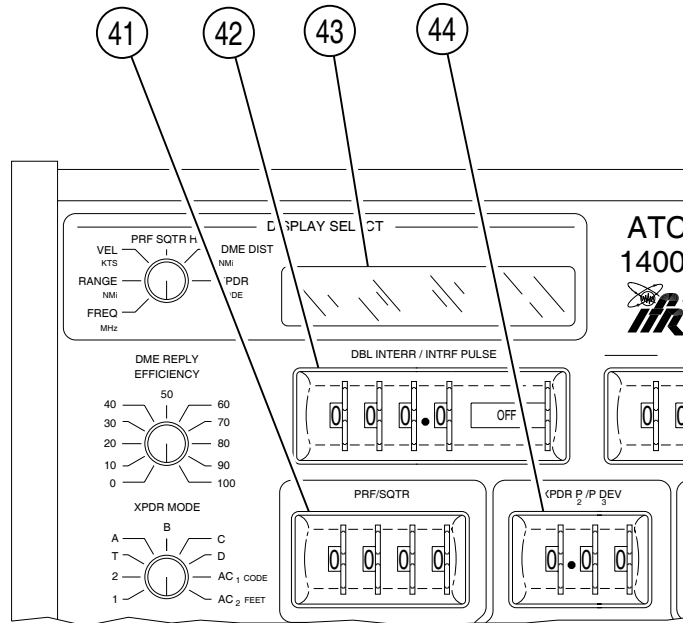
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ITEM	DESCRIPTION	ITEM	DESCRIPTION
25.	<p>XPDR DEV P₃/CAL Switch</p> <p>-Δ advances position of P₃ pulse from nominal, by value selected on XPDR P₂/P₃ DEV Thumbwheels, in μs.</p> <p>CAL sets P₃ pulse to nominal position. Refer to Appendix F.</p> <p>+Δ delays position of P₃ pulse from nominal, by value selected on XPDR P₂/P₃ DEV Thumbwheels, in μs.</p>	29.	<p>SYNC Connector (J20)</p> <p>Provides active low oscilloscope sync pulse set by To/TAC/TD Switch. The Sync pulse is 17.5 μs prior to P₁ of the interrogation for To position and coincidental with P₃ of the interrogation for TD position.</p>
26.	<p>CAL MARKS Connector (J19)</p> <p>Provides the calibration pulses output set by the 1.0 μs/1.45 μs Switch and aligned by the CAL Ø Control.</p>	30.	<p>To/TAC/TD Switch</p> <p>Controls sync pulse positions through the ATC-1400A SYNC and S-1403DL SCOPE TRIG OUT Connector (To and Td are the only valid settings).</p> <p>To positions sync pulse for viewing interrogation pulses on oscilloscope.</p> <p>Td positions sync pulse for viewing reply or second interrogation (DI function) pulses on oscilloscope.</p>
27.	<p>1.0 μs/1.45 μs Switch</p> <p>Sends 1.0 μs calibration pulses for Mode S replies or 1.45 μs calibration pulses for ATCRBS replies out the ATC-1400A CAL MARKS Connector.</p>	31.	<p>INTRF PULSE WIDTH Control</p> <p>Adjusts width of interference pulse from 0.2 to 5 μs.</p>
28.	<p>XPDR DEV P₂/CAL Switch</p> <p>-Δ advances position of the P₂ pulse from nominal, by the XPDR P₂/P₃ DEV Thumbwheels value, in μs.</p> <p>CAL sets P₂ pulse (SLS in ATCRBS) to nominal position.</p> <p>+Δ delays position of the P₂ pulse from nominal, by the XPDR P₂/P₃ DEV Thumbwheels value, in μs.</p>	32.	<p>PRF/SQTR ON/OFF Switch</p> <p>Enables/disables Ant A interrogations through the RF I/O Connector (C71 TrigSource set to SelfInterr).</p>
		33.	<p>DISCRIMINATOR Connector (J21)</p> <p>Provides discriminated RF input pulses to calculate individual reply pulse frequencies. The discriminator produces noise with no RF present.</p>



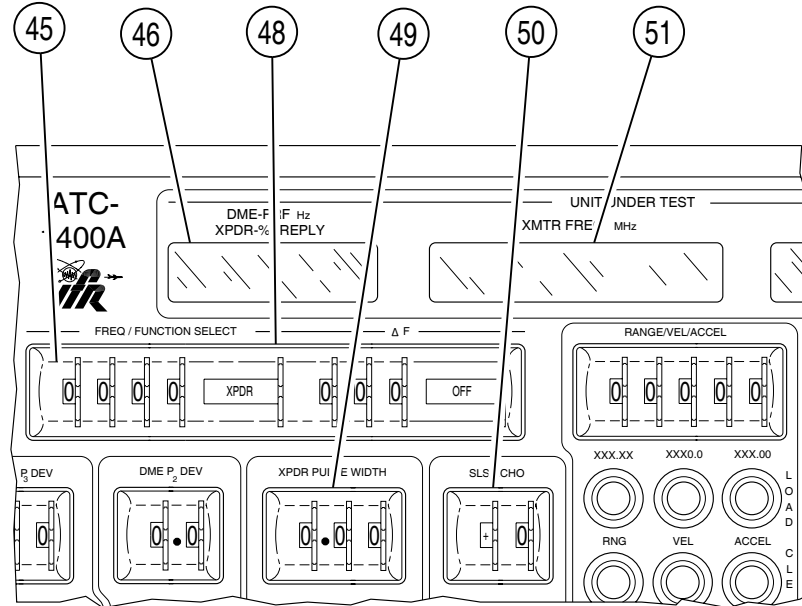
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ITEM	DESCRIPTION	ITEM	DESCRIPTION
34.	F ₂ /P ₂ F ₁ /P ₁ Switch	NOTE:	In Mode S Test System operation, AC ₁ is the same as A and AC ₂ is the same as C. The DISPLAY SELECT Readout displays Mode C altitude in feet when the DISPLAY SELECT Control is in XPDR CODE position and AC ₂ is selected on XPDR MODE Control.
	<i>F₂/P₂</i> enables PPMG control in the S-1403DL C74 Setup Screen. The ATC-1400A measures power and frequency for the selected pulse.	40.	DISPLAY SELECT Control
	<i>F₁/P₁</i> disables PPMG control by the S-1403DL. The ATC-1400A measures power and frequency of the F ₁ or P ₁ pulse in the reply.		Sets the DISPLAY SELECT Readout. Only three positions are valid for Mode S Test System operation.
35.	POWER Switch | or ○		<i>FREQ MHz</i> displays interrogation RF relating to FREQ/FUNCTION SELECT and ΔF Thumbwheels settings.
	Connects (I) or disconnects (O) external ac power to the ATC-1400A.		<i>PRF/SQTR Hz</i> displays the PRF as set by the PRF/SQTR Thumbwheels.
37.	TACAN ON/OFF Switch		<i>XPDR CODE</i> displays the octal form of code received in ATCRBS replies. When XPDR MODE Control is in AC ₂ position, Mode C altitude is displayed in feet.
	Set to OFF position for Mode S Test System operation.		
38.	XPDR MODE Control		
	Selects interrogation mode by setting nominal P ₃ pulse position for ATCRBS and All Call interrogations. Modes A and C are the primary modes of the ATC function and All Call function (ACS or ACL) operation.		



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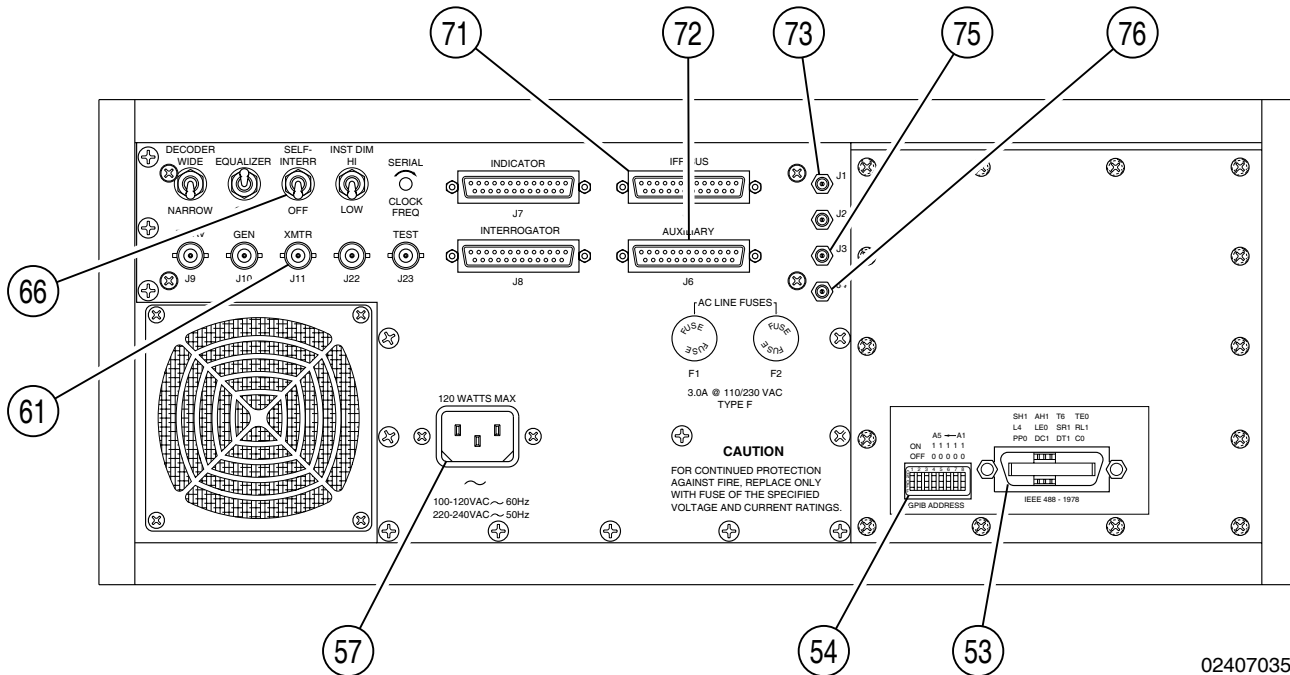
ITEM	DESCRIPTION	ITEM	DESCRIPTION
41.	<p>PRF/SQTR Thumbwheels</p> <p>Selects interrogation rate in Hz. For the DI function, interrogation rate is twice the value on the thumbwheels.</p>		
42.	<p>DBL INTERR/INTRF PULSE Thumbwheels</p> <p>OFF transmits regular interrogations (normal operating position).</p> <p>INTERF- transmits an interference pulse with each interrogation. Thumbwheels determine interference pulse position in μs prior to leading edge of P₁ in the interrogation.</p> <p>INTERF+ transmits an interference pulse with each interrogation. Thumbwheels determine interference pulse position in μs following the leading edge of P₁ in the interrogation.</p> <p>DOUBLE selects double interrogation when the S-1403DL displays the DI Screen. Thumbwheels determine spacing between interrogations.</p>		
			<p>NOTE: The S-1403DL displays the * DI/INTRF ERROR * when the DBL INTERR/INTRF PULSE Thumbwheels have DOUBLE selected and the S-1403DL is not in the DI Screen.</p> <p>NOTE: Selecting DOUBLE on the DBL INTERR/INTRF PULSE Thumbwheels with the suppression pulse active (SUPPRESSOR ON/OFF Switch) eliminates the first interrogation. Thumbwheels set delay from suppression pulse to second interrogation.</p>
		43.	<p>DISPLAY SELECT Readout</p> <p>Displays the ATC-1400A transmitting frequency, PRF or UUT reply code data, as selected with the DISPLAY SELECT Control.</p>
		44.	<p>XPDR P₂/P₃ DEV Thumbwheels</p> <p>Deviates position, in μs, of the P₂ and/or P₃ pulse(s) from nominal according to XPDR DEV P₂/CAL Switch and/or XPDR DEV P₃/CAL Switch setting(s).</p>




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ITEM	DESCRIPTION	ITEM	DESCRIPTION
45.	<p>FREQ/FUNCTION SELECT Thumbwheels</p> <p>Set to XPDR function for Mode S Test System operation. Sets transmit frequency from 962 to 1213 MHz (1030 MHz for normal operation).</p>	50.	<p>SLS/ECHO Thumbwheels</p> <p>Selects amplitude of SLS pulses (P₂, ATCRBS or P₅, Mode S) when SLS/ECHO ON/OFF Switch is ON.</p> <p>Selects amplitude of P₂, P₃ or P₄ if the respective field is set to VAR in the S-1403DL Control Menu function screen and the SLS/ECHO ON/OFF Switch is OFF.</p> <p>Selects amplitude of interference pulses when activated by the DBL INTERR/INTRF PULSE Thumbwheels, regardless of SLS/ECHO ON/OFF Switch setting.</p> <p>Selected amplitude ranges from -19 to +9 dB with respect to the level of P₁ in the interrogation.</p>
46.	<p>DME-PRF Hz/XPDR-%REPLY Display</p> <p>Set to zero during normal Mode S Test System operation. For accurate percent reply, refer to the S-1403DL C10 Function A, C20 Function B and/or C30 Percent Reply Screen(s).</p>	51.	<p>XMTR FREQ MHz Display</p> <p>Continuously displays average frequency of RF pulses received in UUT replies. The S-1403DL C74 Setup Screen selects the pulses to measure when the ATC-1400A F₂/P₂ F₁/P₁ Switch is set to F₂/P₂. The ATC-1400A measures and displays only the frequency of F₁, ATCRBS or P₁, Mode S when the F₂/P₂ F₁/P₁ Switch is set to F₁/P₁ position.</p>
48.	<p>ΔF Thumbwheels</p> <p>Deviates ATC-1400A transmitting frequency -9.99 to +9.99 MHz from frequency set on FREQ/FUNCTION SELECT Thumbwheels.</p>		
49.	<p>XPDR PULSE WIDTH Thumbwheels</p> <p>Sets width, in μs, of selected P₁, P₂ and P₃ pulses.</p>		

2.6 ATC-1400A REAR PANEL



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ITEM	DESCRIPTION	ITEM	DESCRIPTION
53.	GPIB Connector (J14) Provides a parallel interface for general purpose programmable instrumentation. Conforms to IEEE Standard 488-1978.	72.	AUXILIARY Connector (J6) Connects to S-1403DL AUXILIARY Connector for timing and pulse signals.
54.	GPIB ADDRESS/OPTION Dip Switches Sets IEEE-488 bus address for parallel remote control operation.	73.	DABS INPUT Connector (J1) Receives DPSK modulation from the S-1403DL through DPSK OUT Connector. The bipolar DPSK signal modulates the ATC-1400A RF signal to provide Mode S interrogations.
57.	AC INPUT Connector  Connects ac power from S-1403DL to ATC-1400A.	75.	EXTERNAL MEASUREMENT GATE Connector (J3) Receives the PPMG pulse from the S-1403DL MEASUREMENT GATE OUT Connector. The PPMG pulse triggers the ATC-1400A to measure UUT reply pulse power and frequency. Power measurements are displayed on the XMTR PWR WATTS Display. Frequency measurement is displayed on the XMTR FREQ MHz Display.
61.	XMTR Connector (J11) Provides the detected video received from the UUT transmitter and set at a TTL level.	76.	RF LEVEL INPUT Connector (J4) Receives additional RF level control from the S-1403DL RF VERNIER OUT Connector. The ± 3 dB vernier controls the signal level transmitted through the RF I/O Connector.
66.	SELF-INTERR/OFF Switch Set to OFF for Mode S Test System operation.		
71.	IFR BUS Connector (J5) Connects to S-1403DL IFR BUS for communication and control data.		

SECTION 2 - OPERATION

1. INSTALLATION

1.1 GENERAL

The Mode S Test System is a bench test set requiring continuous ac power to operate. Installation of the Mode S Test System includes connecting the S-1403DL 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. Aeroflex 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 S 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: 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 must not be removed by operators. The Installation Calibration, Procedure, component replacement and internal adjustments must only be performed by qualified service personnel. Refer to the Installation Calibration Procedure or Mode S Test System Maintenance Manual (1002-2400-400) for maintenance procedures.

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 S 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 S-1403DL 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 FUSES OF THE SPECIFIED VOLTAGE AND CURRENT RATINGS.

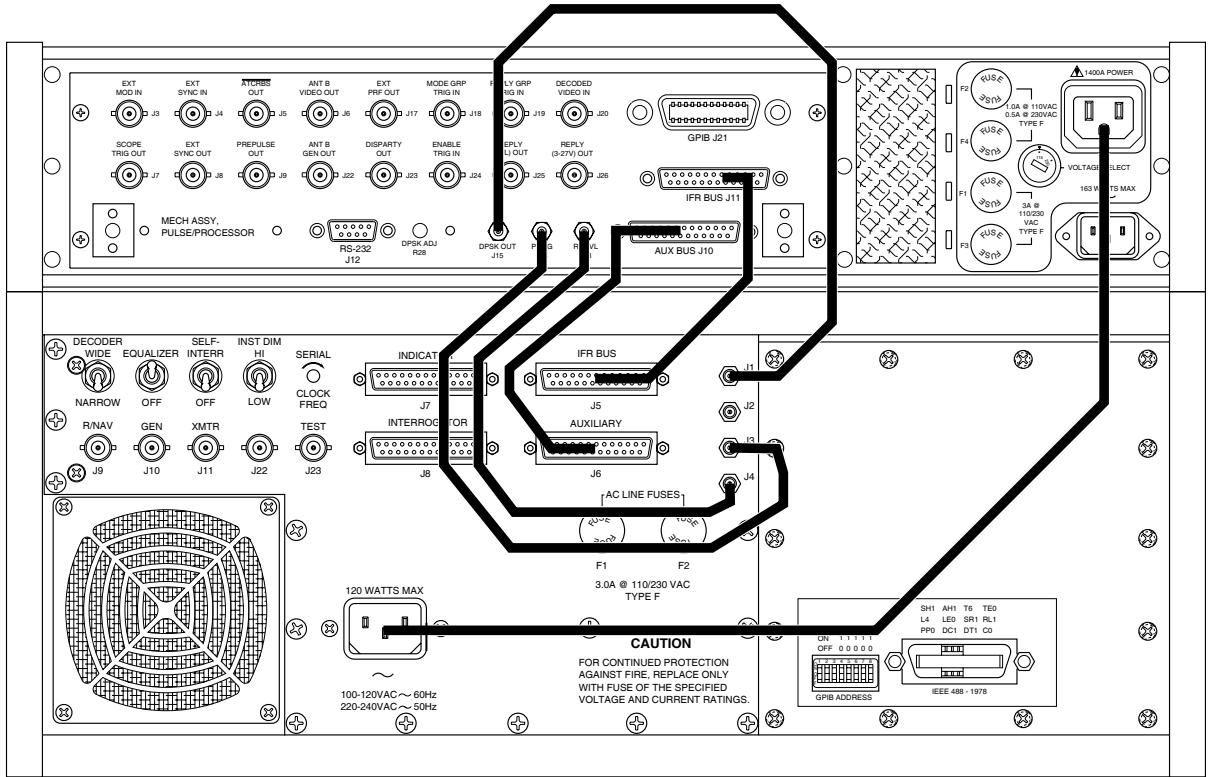
INPUT VOLTAGE	F1 AND F3 AC IN FUSES	F2 AND F4 LINE SUPPLY FUSES
100 to 120 VAC	3.0 A, 250 V Fast Blo (Type F) (Aeroflex PN: 5106-0300-600) (Bussman AGC3)	1.0 A, 250 V Fast Blo (Type F) (Aeroflex PN: 5106-4501-000) (Bussman AGC1)
220 to 240 VAC	3.0 A, 250 V Fast Blo (Type F) (Aeroflex PN: 5106-0300-600) (Bussman AGC3)	0.5 A, 250 V Fast Blo (Type F) (Aeroflex 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 S-1403DL on top of the ATC-1400A.
3.	Connect two 25-Pin D style cables: <ul style="list-style-type: none"> ● One to the S-1403DL IFR BUS Connector (J11) and ATC-1400A IFR BUS Connector (J5). ● One to the S-1403DL AUX BUS Connector (J10) and ATC-1400A AUXILIARY Connector (J6).
4.	Connect three SMB-to-SMB coaxial cables: <ul style="list-style-type: none"> ● One to the S-1403DL RF LVL Connector (J13) and ATC-1400A RF LEVEL INPUT Connector (J4). ● One to the S-1403DL PPMG Connector (J14) and ATC-1400A EXTERNAL MEASUREMENT GATE Connector (J3). ● One to the S-1403DL DPSK OUT Connector (J15) and ATC-1400A DABS INPUT Connector (J1).
5.	Connect ac power cable to the S-1403DL 1400A POWER Connector and ATC-1400A AC INPUT Connector.



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S-1403DL (production model shown) to ATC-1400A Interconnections
Figure 1

The Mode S 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	AEROFLEX PART NUMBER
Rack-Mount	ATC-1400A S-1403DL	7001-7636-800 7001-6740-800
Bench-Top/ Stack-Mount	ATC-1400A S-1403DL	7005-6743-000 One kit required per Mode S Test System

Installation Kits
Table 2

1.5 POWER-UP PROCEDURE

The Mode S Test System is configured for one-touch power control. When the ATC-1400A POWER Switch is **ON (I)**, the S-1403DL POWER Switch controls power to the S-1403DL Test Auxiliary and ATC-1400A Transponder/DME Test Set.

STEP	PROCEDURE
1.	Connect ac power cable to S-1403DL AC IN Connector and standard 3-pin grounded power receptacle.
2.	Press ATC-1400A POWER Switch ON (I) .
3.	Press S-1403DL POWER Switch ON (I) to energize Test Auxiliary and ATC-1400A.
4.	Verify ATC-1400A Displays illuminate.
5.	Verify S-1403DL MENU Display shows an active screen.

1.6 INSTALLATION CALIBRATION

Before operation, the Mode S Test System requires calibration according to the Installation Calibration Procedure. Any time the S-1403DL or ATC-1400A is replaced, another installation calibration should be performed (only by qualified service personnel) to maintain measurement accuracy.

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.

2. GENERAL OPERATING PROCEDURES

2.1 GENERAL

The General Operating Procedures contain instructions for operating the Mode S Test System using Front Panel controls (local operation). General Operating Procedures identify controls, connectors, indicators and display screens used to perform the individual functions. Data shown in sample display screens may differ with actual test settings. Refer to Unit Under Test (UUT) Manuals for specific UUT Test Procedures.

The S-1403DL GPIB Connector (J21), S-1403DL RS-232 Connector (J12) and ATC-1400A GPIB Connector (J14) provide optional inputs for remote communication with the Mode S Test System. All remote communication with the Mode S Test System is implemented with ASCII encoded character strings. Refer to 1-2-4 for description of GPIB and RS-232 operation.

Refer to 1-1-2, Figure 1 for S-1403DL controls, connectors and indicators; 1-1-2, Figure 2 for S-1403DL Keyboard references and 1-1-2, Figure 48 for ATC-1400A controls, connectors and indicators.

2.1.1 System Characteristics

The Mode S Test System has seven operational functions as follows:

- **ATCRBS (ATC) Function**

The Mode S Test System transmits standard ATCRBS interrogations. Replies are tested for accuracy, percent reply, frequency, power and reply delay. Interrogation pulse characteristics are varied to verify ATCRBS transponder receiver limitations.

- **Sequence (SEQ) Function**

The Mode S Test System transmits standard Mode S interrogations. Up to 1000 programmable interrogations are sent in sequence. Interrogation pulse characteristics are varied to verify Mode S transponder receiver limitations. The S-1403DL displays reply information.

- **All-Call Short (ACS) Function**

The Mode S Test System transmits the ATCRBS Only All Call (ATCRBS interrogation plus P₄ pulse at normal width). Reply information verifies the transponder operates correctly. Interrogation pulse characteristics including P₄ are varied to verify transponder receiver limitations.

- **All-Call Long (ACL) Function**

The Mode S Test System transmits the ATCRBS/Mode S All Call (ATCRBS interrogation plus wide P₄ pulse). Reply information verifies the transponder operates correctly. Interrogation pulse characteristics including P₄ are varied to verify transponder receiver limitations.

- **Interlace (INTLCE) Function**

The Mode S Test System transmits Mode S interrogations interlaced with ATCRBS interrogations to verify transponder operation in a normally mixed environment.

- **Double Interrogation (DI) Function**

The Mode S Test System transmits (ATCRBS, Mode S, ACS or ACL) in closely spaced interrogations to verify transponder operation and recovery.

- **BURST Function**

The Mode S Test System transmits ATCRBS or Mode S interrogation sequences at a set Pulse Repetition Frequency (PRF) to verify transponder reply rate capability.

- **ATCRBS Monitor Pulse Function**

The Mode S Test System transmits selected normal ATCRBS interrogations, measuring reply pulse parameters and reply jitter. The ATCRBS Monitor Pulse Function operates the same as the ATC Function with additional measurements and is used in the same procedure.

All functions provide diversity testing by enabling Antenna B (ANT B). Simulating disparity in amplitude or time from the Antenna A (ANT A) output (ATC-1400 RF I/O Connector) to the ANT B output (S-1403DL ANT B Connector), tests the UUT ability to switch antennas.

2.1.2 System Considerations

Some Mode S or S-1403DL functions are different from ATCRBS or ATC-1400A functions. Major differences and other considerations are as follows:

- The ATC-1400A DISPLAY SELECT Readout is not valid for Mode S replies.
- The Mode S Test System does not transmit Mode A and Mode C interrogations alternately. In ATCRBS functions, the Mode S Test System transmits only Mode A interrogations with the ATC-1400A XPDR MODE Control set to AC₁ and only Mode C interrogations with the ATC-1400A XPDR MODE Control set to AC₂.
- The S-1403DL squitter display does not discriminate between inputs to ANT A (ATC-1400A) and ANT B (S-1403DL).
- Adjusting RF level with S-1403DL SLEW Control requires 200 interrogations to stabilize. Stabilization time increases as PRF is set lower. The ATC-1400A RF LEVEL Control requires little or no stabilization time.
- The ATC-1400A DME-PRF Hz XPDR-%REPLY Display displays invalid reply percentages because of Mode S squitters. The S-1403DL displays accurate reply percentages in the Function A, Function B and %Reply Control Menu Screens.
- The ATC-1400A SLS/ECHO Thumbwheels adjust more than one pulse level at the same time if set in the S-1403DL Control Menus screens.

2.1.3 Input Considerations

CAUTION: CONTINUOUS HIGH PRF WITH HIGH UUT POWER MAY DAMAGE THE S-1403DL.

To ensure allowable input, set interrogation PRF of the Mode S Test System according to replies as follows (UUT Power is the power displayed on the ATC-1400A XMTR PWR WATTS Display):

- For ATCRBS, set $PRF \leq \frac{148 \cdot 10^6}{UUT\ POWER}$.
- For Mode S short, set $PRF \leq \frac{333 \cdot 10^3}{UUT\ POWER}$.
- For Mode S long, set $PRF \leq \frac{172 \cdot 10^3}{UUT\ POWER}$.

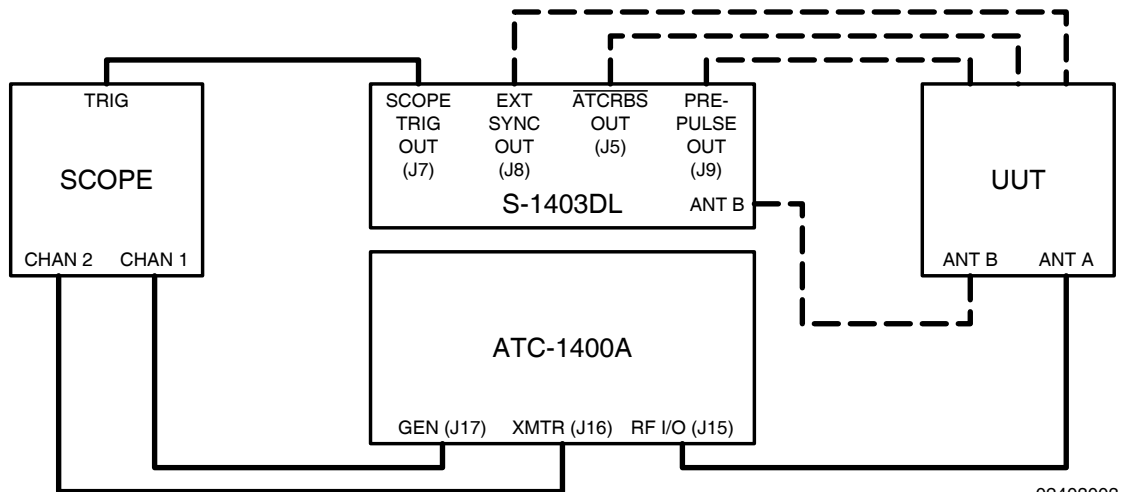
2.1.4 Initial ATC-1400A Control Settings

Set ATC-1400A as follows:

CONTROL	SETTING
CW/NORM/OFF Switch	NORM
SLS/ECHO ON/OFF Switch	OFF
MAN/AUTO/MAN STEP Switch	MAN
XPDR DEV P ₃ /CAL Switch	CAL
XPDR DEV P ₂ /CAL Switch	CAL
PRF/SQTR ON/OFF Switch	ON
TACAN ON/OFF Switch	OFF
XPDR MODE Control	A
DISPLAY SELECT Control	PRF/SQTR Hz
PRF/SQUITTER Thumbwheels	0200
DBL INTERR/INTRF Thumbwheels	000.0 OFF
FREQ/FUNCTION SELECT Thumbwheels	1030 XPDR
ΔF Thumbwheels	OFF
SELF-INTERR/OFF Switch	OFF

2.1.5 Operational Hook-Up

Refer to 1-2-2, Figure 2 for suggested hook-up used to operate the Mode S Test System. The Mode S Test System operational hook-up diagram is used with all functions.



02403003

Mode S Test System Operational Hook-Up Diagram
Figure 2

2.2 ATC FUNCTION

2.2.1 Description

In the ATC Function, the Mode S Test System simulates an ATCRBS ground station transmitting standard two-pulse interrogations shown in Appendix E. The Mode S Test System measures reply characteristics to verify the ATCRBS transponder operates correctly.

2.2.2 Procedure

STEP	PROCEDURE
1.	Connect test equipment according to 1-2-2, Figure 2.
2.	Apply power to Mode S Test System.
3.	Press S-1403DL 2ND, FUNC#, 0 and 1 Keys in sequence to select ATC Screen. If necessary, use S-1403DL CURSOR Keys and SLEW Control to set menu to C10 .

```
C10 f01:ATC (ATCRBS)           Arf:-0.5
                               P3:CAL
Altitude=+ 9700 Dly= 2.9750 Sqtr= 1.00
AntA%:ATC=100,S= 0 AntB%=100 AntB:+.95
```

4. Set test parameters as follows:

INTERROGATION MODULATION

Press S-1403DL 2ND and EX MOD Keys in sequence to move cursor to C75 Setup Screen AntAModSrc.

```
C75          SETUP - MISC
AntAEnable:ON          PrePulseOut:253µs
AntAModSrc:INT
AntBModSrc:INT
```

Press S-1403DL ON/CAL Key to set AntAModSrc (modulation for signal out ATC-1400A RF I/O Connector) to:

- **EXT** to deactivate internal pulse modulation and use external modulation through S-1403DL EXT MOD IN Connector. The Mode S Test System disregards internal pulse control settings for the applicable antenna connector.

STEP	PROCEDURE
------	-----------

- **INT/EXT** to accept external pulse modulation through S-1403DL EXT MOD IN Connector in addition to normal internal modulation.
- **INT** for normal Mode S Test System internal modulation.

Use S-1403DL CURSOR and ON/CAL Keys to set AntBModSrc (modulation for signal out S-1403DL ANT B Connector) as desired.

MODE SELECTION

Use ATC-1400A XPDR MODE Control to select interrogation mode (**1, 2, T, A, B, C** or **D**).

FREQUENCY

Adjust ATC-1400A FREQ/FUNCTION Thumbwheels and ΔF Thumbwheels to set interrogation RF from **952.01** to **1222.99** MHz. Set to **1030** MHz for normal operation.

RF LEVEL

Adjust ATC-1400A RF LEVEL Control to set RF LEVEL -dBm Display from **127** (-127 dBm) to **0** (0 dBm). Normal operating range is -69 to -21 dBm. Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set Arf field from **-3.0** to **+3.0** in dB to offset cable loss and/or other external factors. Press S-1403DL ENTER Key.

INTERROGATION RATE

Press S-1403DL C MENU, 7 and 1 Keys in sequence to display C71 Interrogation Trigger Setup Screen.

```
C71          SETUP - INTERROGATION TRIGGER
TrigSource:TrigGen
TrigGen:      450Hz
```

CAUTION: CONTINUOUS HIGH PRF WITH HIGH UUT POWER MAY DAMAGE S-1403DL (SEE 2.1.3 IN 1-2-2).

STEP	PROCEDURE
	Set interrogation rate or pulse repetition frequency (PRF) according to one of four ways as follows:
●	Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set TrigSource to TrigGen and TrigGen from 1 to 2500 Hz . Set from 1 to 500 Hz for normal operation.
●	Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set TrigSource to SelfInterr. Adjust ATC-1400A PRF/SQTR Thumbwheels to set PRF from 0 to 7999 . Set from 0 to 500 for normal operation.
●	Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set TrigSource to ExtSyncln. Connect external trigger source providing TTL level interrogation trigger pulse to S-1403DL EXT SYNC IN Connector. Leading edge of P ₁ or prepulse (when enabled) occurs 17.95 μs after leading edge of external sync pulse. Adjust external trigger source as desired.
●	Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set TrigSource to BurstKey to allow manual triggering of a single interrogation by pressing the S-1403DL BURST Key.

PULSE WIDTH

Set ATC-1400A XPDR PULSE WIDTH VAR/CAL Switch to **CAL** for 0.8 μs nominal width of P₁, P₂ (SLS) (if activated) and P₃ (if activated) interrogation pulses. Set XPDR PULSE WIDTH VAR/CAL Switch to **VAR** and use ATC-1400A XPDR PULSE WIDTH Thumbwheels to adjust width from **0.20** to **1.85** μs.

STEP	PROCEDURE
	P₂ (SLS) LEVEL
	Set ATC-1400A SLS/ECHO ON/OFF Switch to ON . Set P ₂ (SLS) level using ATC-1400A SLS/ECHO Thumbwheels. Adjust level from -19 to +6 dB, relative to P ₁ level. Verify suppression occurs when P ₂ level is ≥P ₁ level. Verify suppression does not occur when P ₂ level exceeds P ₁ level by ≥9 dB.
	P₂ (SLS) POSITION
	Set ATC-1400A XPDR DEV P ₂ /CAL Switch to CAL for nominal P ₂ (SLS) position of 2.0 μs following P ₁ leading edge. Set XPDR DEV P ₂ /CAL Switch to -Δ or +Δ and adjust ATC-1400A XPDR P ₂ /P ₃ DEV Thumbwheels from 0.00 to 1.85 to set position from 0.15 to 3.85 μs following P ₁ leading edge.
	P₃ LEVEL
	Set ATC-1400A SLS/ECHO ON/OFF Switch to OFF . Press S-1403DL 2ND and P ₃ Keys in sequence to move cursor to C10 Function 01 ATC P ₃ field. Press S-1403DL ON/CAL Key to set P ₃ to VAR . Set P ₃ level using ATC-1400A SLS/ECHO Thumbwheels. Adjust level from -19 to +6 dB, relative to P ₁ level. 0 dB is normal operating level (P ₃ : CAL). For P ₃ deactivation, press S-1403DL ON/CAL Key to set P ₃ to OFF .

P₃ POSITION

Set ATC-1400A XPDR DEV P₃/CAL Switch to **CAL** for nominal P₃ position. Refer to Appendix E for nominal position. Set ATC-1400A XPDR DEV P₃/CAL Switch to **-Δ** or **+Δ** and adjust ATC-1400A XPDR P₂/P₃ DEV Thumbwheels from **0.00** to **1.85** to deviate position -1.85 to +1.85 μs from nominal.

STEP PROCEDURE

INTERFERENCE PULSE

Set ATC-1400A DBL INTERR/INTRF PULSE Thumbwheels from **017.5 INTERF-** to **399.9 INTERF+** to enable and position interference pulse at -17.5 to +399.9 μ s from leading edge of P₁ or prepulse, if active.

- Set level from -19 to +6 dB (relative to P₁) using ATC-1400A SLS/ECHO Thumbwheels.
- Set width from 0.2 to 5 μ s using ATC-1400A INTRF PULSE WIDTH Control.

SUPPRESSOR PULSE

Connect ATC-1400A SUPPRESSOR OUTPUT Connector to UUT suppressor input. Set ATC-1400A SUPPRESSOR ON/OFF Switch to **ON** to activate 33 μ s wide (fixed) suppressor pulse.

- Adjust level from 3 to 27 V using ATC-1400A SUPPRESSOR VAR Adjustment.
- Set ATC-1400A DBL INTERR/INTRF PULSE Thumbwheels to **OFF** to position suppressor pulse 0.8 μ s prior to P₃. Set DBL INTERR/INTRF PULSE Thumbwheels from **017.5 INTERF-** to **399.9 INTERF+** to adjust suppressor pulse position from -17.5 to +399.9 μ s relative to P₁. (Suppressor pulse replaces interference pulse when both are activated.)

ANT B

Press S-1403DL 2ND and ANT B Keys in sequence to move cursor to AntB field. Press S-1403DL ON/CAL Key to activate interrogations through ANT B Connector. Use SLEW Control and Keyboard to enter value from **-0.95** to **+0.95** (offset in 0.05 μ s increments from ANT A interrogations). Without the Multi-Level Diversity (MLD) option, ANT B output level is -50 dBm.

STEP PROCEDURE

If MLD is installed, set ANT B output level. Use S-1403DL CURSOR Keys and SLEW Control to set menu to C20. Use CURSOR Keys to select Brf fields. Use SLEW Control and Keyboard to set first field from **-80** to **-20** dBm and second field from **-3.0** to **+3.0** dB (used to offset cable loss).

5. If desired, set optional outputs as follows:

PREPULSE OUT

Press S-1403DL 2ND and P PULS Keys in sequence to move cursor to C75 Setup Screen PrePulseOut field. Press S-1403DL ON/CAL Key to activate prepulse through S-1403DL PREPULSE OUT Connector. Use S-1403DL SLEW Control and Keyboard to enter **0** to **260** μ s (time from prepulse leading edge to P₁ leading edge).

EXT SYNC OUT

Press S-1403DL 2ND and EX SYN Keys in sequence to move cursor to C73 Setup Screen Enable field. Press ON/CAL Key to set ATC Enable field **ON** for activating external sync pulse through S-1403DL EXT SYNC OUT Connector. Use S-1403DL CURSOR Keys and SLEW Control or Keyboard to set Dv field from **-9.95** to **+9.95** μ s (time from external sync pulse leading edge to P₁ leading edge) (-, P₁ follows external sync; +, external sync follows P₁).

C73	SETUP - EXT SYNC OUT
	ATC ModeS ACS ACL
Enable:	ON OFF OFF OFF
	Dv: +1.00 μ S

STEP PROCEDURE

SCOPE TRIGGER OUT

Set scope trigger output through S-1403DL SCOPE TRIG OUT Connector for desired Oscilloscope display. Press S-1403DL C MENU, 7 and 2 Keys in sequence to enter C72 Setup Screen.

```
C72          SETUP - SCOPE TRIGGER
          ATC ModeS ACS ACL
Enable:ON  OFF  OFF OFF
Source:CAL 150  CAL CAL      (in μS)
```

Set scope trigger as follows:

- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set ATC Enable to **ON** for activating scope trigger.
- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set ATC Source to **CAL** (ATC-1400A controls scope trigger position).
- Set ATC-1400A To/TAC/Td Switch to **To** for viewing interrogation at ATC-1400A GEN Connector or **Td** for viewing reply at ATC-1400A XMTR Connector.

Connect S-1403DL UUT XMTR Connector to Oscilloscope for viewing UUT replies at S-1403DL ANT B Connector.

6. Verify UUT replies as follows:

FREQUENCY

Verify UUT transmit frequency on ATC-1400A XMTR FREQ MHz Display.

ACCURACY

Press S-1403DL 2ND, FUNC#, 0 and 1 Keys in sequence to select ATC Screen. Verify reply content in Altitude/ID Code field.

Press S-1403DL 0 and 8 Keys in sequence to select ATC Monitor Screen. Verify reply pulse parameters.

STEP PROCEDURE

```
C10 f08:ATC Mon;Mode:1      Arf:+1.2
F1toF2=20.3000, F1Wd=0.4500, F2Wd=0.4500
Altitude=+ 9700 Dly= 3.0125 Jtr=0.2000
AntA%:ATC= 0,S= 90 AntB%= 90 AntB:-.95
```

View reply pulses on Oscilloscope Channel 2.

REPLY DELAY

Verify reply delay (P₃ leading edge to F₁ leading edge) in Dly field. Verify Dly field indicates 3.000 μs (±0.5 μs).

For detailed reply delay information, press S-1403DL C MENU and 4 Keys in sequence to display C40 Reply Delay Control Menu. If desired, press S-1403DL CL/ESC Key to reset fields.

PERCENT REPLY

Verify percent reply in C10/C20 ATC Screen AntA% and AntB% fields.

For detailed percent reply information, press S-1403DL C MENU and 3 Keys in sequence to display C30 Percent Reply Control Menu. If desired, press S-1403DL CL/ESC Key to reset fields.

POWER

Verify UUT power (ATCRBS replies only) through ANT A (RF I/O Connector) shown on ATC-1400A XMTR PWR WATTS Display. Select reply pulse to measure as follows:

- Set ATC-1400A F₂/P₂ F₁/P₁ Switch to **F₁/P₁** to measure pulse power of F₁ reply pulse only.
- Set F₂/P₂ F₁/P₁ Switch to **F₂/P₂** for S-1403DL to control pulse power measurement selection.

Press S-1403DL 2ND and PPG Keys in sequence to display C74 PPMG Setup Screen.

```
C74          SETUP - PPMG (POWER)
          ATC ModeS DELM
Enable:ON  OFF  OFF
Pulse:D2  P116  1
```

STEP PROCEDURE

Use S-1403DL CURSOR Keys and SLEW Control to set ATC Enable field to **ON** and select one of 16 possible ATCRBS reply pulses for ATC Pulse field.

- Verify UUT Mode S squitter information as follows:

INTERVAL

Press S-1403DL 2ND, FUNC#, 0 and 1 Keys in sequence to select ATC Screen. Verify interval between DF11 squitters in Sqtr field. (Normally 0.8 to 1.2 seconds.)

For DF17 type squitter intervals, press S-1403DL C MENU and 6 Keys in sequence to display C60 Squitter (2 of 2) Control Menu.

C60	SQUITTER (2of2)					
DF	CA	AA	ME	II	ANT	TIME
11	4	A07613		0	A	1.00
17I	4	A07613	1A8C9A3124BA53	0	A	10.05

Verify squitter intervals in DF17X TIME field according to 1-2-2, Table 3.

DF17 TYPE	HIGH RATE TIME	LOW RATE TIME
A	0.4 to 0.6 s	0.4 to 0.6 s
I	4.8 to 5.2 s	9.6 to 10.4 s
O	---	---
P	Once	Once
S	0.4 to 0.6 s	4.8 to 5.2 s
T	0.4 to 0.6 s	0.4 to 0.6 s

DF17 Squitter Interval Times
Table 3

ADDRESS

Press S-1403DL C MENU and 5 Keys in sequence to display C50 Squitter (1 of 2) Control Menu. Verify Mode S Address (aircraft address) in Addr fields.

C50	SQUITTER (1of2)	
Addr:h=A07613,o=50073023,Tail=N129KS		
Country=United States		
Counts/120s:DF11=110,DF17= 36,DF17S= 24		

STEP PROCEDURE

INFORMATION

Verify Tail and Country fields.

View squitter fields in hexadecimal: press S-1403DL C MENU and 6 Keys in sequence to display C60 Squitter (2 of 2) Control Menu. Use S-1403DL CURSOR Keys and ON/CAL Key to set DF17 type (**A**, **I**, **O**, **P**, **S** or **T**). Refer to 1-2-2, Table 4 for type description.

DF17 TYPE	DESCRIPTION
A	Airborne Position
I	Aircraft Identification
O	Other
P	On-Demand Information (Pilot Report)
S	Surface Position
T	Airborne Supplementary Information (Trend)

DF17 Squitter Type
Table 4

2.2.3 General Test Sequence

Refer to 1-2-2, Figure 3.

SIGNAL	DESCRIPTION	SIGNAL	DESCRIPTION
1. <u>Self Interr In</u> (if selected)	Active low pulse from the ATC-1400A triggers the interrogation process (C71 Interrogation Trigger Setup Screen Trig Source field set to SelfInterr). The self interrogate pulse rising edge occurs 17.95 μ s prior to leading edge of P ₁ or prepulse (when enabled). The S-1403DL receives the self interrogate pulse through the AUXILIARY Connector (J10).	5. <u>Scope Trig Out</u>	The S-1403DL transmits the active high scope trigger pulse through the SCOPE TRIG OUT Connector (J7). Position, referenced to ANT A interrogations, depends on the ATC-1400A To/TAC/Td Switch setting: <ul style="list-style-type: none"> ● To (for viewing interrogations) <p>Leading edge occurs 1.0 μs prior to P₁ leading edge and trailing edge occurs 1.0 μs prior to P₃ leading edge.</p> ● Td (for viewing replies) <p>Leading edge of 20.3 μs wide pulse occurs 2.0 μs following P₃ leading edge (1.0 μs prior to F₁ leading edge of the expected reply).</p>
2. <u>Ext Sync In</u> (if selected)	Active high pulse occurs 17.95 prior to leading edge of P ₁ or prepulse (when enabled). The S-1403DL receives the pulse through the EXT SYNC IN Connector (J4). The external sync input replaces the self interrogate input in triggering the interrogation process (C71 Interrogation Trigger Setup Screen Trig Source field set to ExtSyncln).	6. <u>ATCRBS Out</u>	Active low pulse, 3.0 μ s wide, occurs 1.0 μ s prior to P ₁ leading edge. The S-1403DL transmits the pulse through the <u>ATCRBS OUT</u> Connector (J5).
3. <u>Prepulse Out</u> (when enabled)	Active high pulse, 1.0 μ s wide, occurs 17.95 μ s after the sync pulse rising edge (self interrogate, external sync input or internal trigger generator) and 0 to 260 μ s, as selected, prior to P ₁ leading edge. The S-1403DL transmits the prepulse through the PREPULSE OUT Connector (J9).	7. <u>ANT B</u> (when enabled)	Active high ANT B interrogation pulses modulate RF transmitted through the S-1403DL ANT B Connector (J2). The S-1403DL offsets P ₁ leading edge of the ANT B interrogation from P ₁ leading edge of the ANT A interrogation according to the AntB field setting in the C10/C20 ATC Screen. ANT B and ANT A pulse characteristics are the same except for pulse level.
4. <u>Ext Sync Out</u> (when enabled)	Active high pulse, 1.0 μ s wide, occurs from -9.95 to +9.95 μ s, as selected, relative to P ₁ leading edge of the interrogation. The S-1403DL transmits the pulse through the EXT SYNC OUT Connector (J8).		

SIGNAL	DESCRIPTION
--------	-------------

8. $\overline{\text{Ext Pulse}}$

Active low pulses transmitted through the S-1403DL AUXILIARY Connector (J10) modulate the ATC-1400A RF output. Pulse characteristics vary according to test parameter settings. Refer to Step 4 of ATC Function Procedure (2.2.2 in 1-2-2).

9. $\overline{\text{Ext SLS}}$ (when enabled)

Active low gate pulse enables ATC-1400A SLS/ECHO Thumbwheels to control the level of P₂ (SLS) or P₃ depending on the ATC-1400A SLS/ECHO ON/OFF Switch position and C10/C20 P₃ field setting.

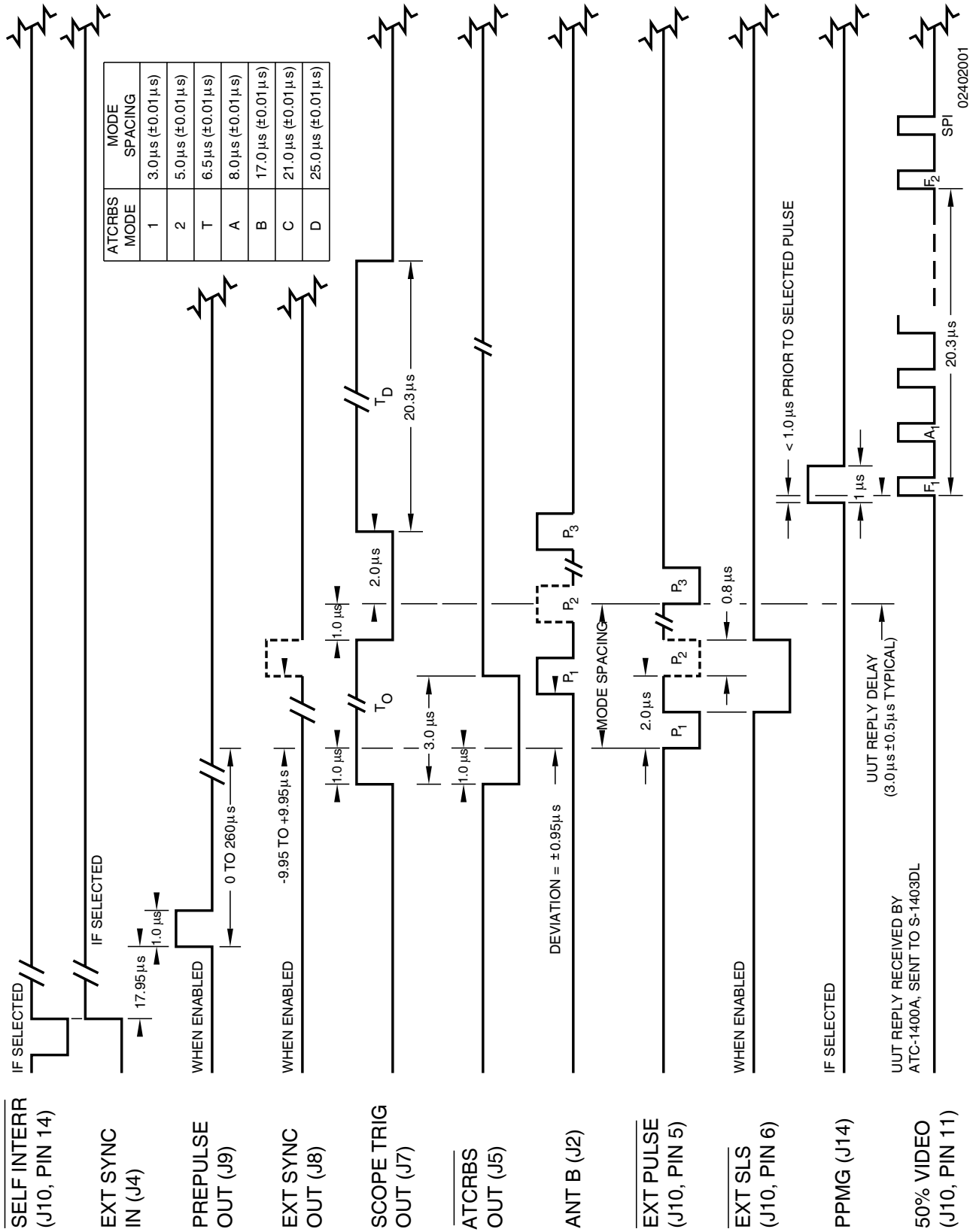
10. PPMG (if selected)

The pulse power measurement gate (PPMG) occurs <1.0 μs prior to the leading edge of the selected pulse. The S-1403DL transmits the PPMG pulse through the PPMG Connector (J14) to the ATC-1400A.

NOTE: The ATC-1400A ignores PPMG if the ATC-1400A F₂/P₂ F₁/P₁ Switch is set to **F₁/P₁**.

11. 50% Video

The Mode S Test System receives the UUT reply video through ANT A (ATC-1400A RF I/O Connector). The ATC-1400A sends the reply video to the S-1403DL through the AUXILIARY Connector (J10).



ATC Function Timing Diagram
Figure 3

2.3 SEQ FUNCTION

2.3.1 Description

In the SEQ Function, the Mode S Test System simulates a Mode S ground station transmitting standard three-pulse, DPSK modulated interrogations shown in Appendix E. The Mode S Test System measures reply characteristics to verify the Mode S transponder operates correctly.

2.3.2 Procedure

STEP	PROCEDURE
------	-----------

1. Connect test equipment according to 1-2-2, Figure 2.
2. Apply power to Mode S Test System.
3. Press S-1403DL C MENU, 7 and 6 Keys to display C76 SMENU Setup Screen. Set as follows:
 - Use S-1403DL CURSOR Keys and ON/CAL Key to set SmenuRadix to desired data format (**HEX** [hexadecimal] or **OCTAL**).
 - Use S-1403DL CURSOR, ON/CAL and ENTER Keys for changing SetAllSmenu to **OFF** (deactivates all sequence menus), **DEFAULT** (activates/resets default sequence menus, deactivates all others) or **ZERO** (sets all fields except ADDR to 0). Refer to 1-1-2, Table 5 for default sequence menus.
Use S-1403DL ON/CAL and ENTER Keys to set ADDR in all sequence menus by changing SetAllSmenu to **XPDR** (transponder address) or **USER** (address from User= field).
 - Use S-1403DL CURSOR Keys and SLEW Control to set alternate addresses (GlobalAddr:User=) and parity (AP XOR=) fields as desired for checking operation with bogus addresses or bad AP fields.

```
C76          SETUP - SMENU
SmenuRadix:OCTAL   SetAllSmenu:NoAction
GlobalAddr:Xpdr=17725762,AP XOR=00000000
GlobalAddr:User=10273645,AP XOR=00000001
```

STEP	PROCEDURE
------	-----------

4. Press S-1403DL S MENU Key to display Mode S Sequence Menu.

```
S001:D;UF00,RL=0,CL=0,AQ=0,
+                               ADDR=17725762
RPLY:D;DF00,VS=0,SL=0,RI=00,AC=+ 31200,
                               ADDR=17725762
```

5. Set interrogation sequence as follows:

ACTIVATION

Press S-1403DL ON/CAL Key to activate or deactivate sequence menu.

FORMAT

Use S-1403DL CURSOR Keys and ON/CAL Key to select format type for active sequence menu. Set to **S** (short 56-bit transmission), **L** (long 112-bit transmission) or **D** (decoded, used for formats with defined fields).

UPLINK FORMAT

Use S-1403DL CURSOR Keys and SLEW Control or Keyboard to select desired uplink format.

DATA FIELDS

Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to load data fields according to Appendix D. Refer to Appendix B for defined fields and 1-2-2, Table 5 for converting data.

SCOPE TRIGGER

Use S-1403DL CURSOR Keys and ON/CAL Key to activate + or deactivate - scope trigger. For stable display, activate scope trigger for only one sequence menu.

UUT ADDRESS

Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set ADDR (UUT transponder address) field as desired. With cursor in ADDR field, press ON/CAL Key to cycle through other preset addresses (some set remotely and those set in Step 3).

STEP PROCEDURE

SEQUENCE

Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to select next sequence menu. Repeat Step 5 to set as desired.

BINARY	OCTAL	DECIMAL	HEX
000	0	0	0
001	1	1	1
010	2	2	2
011	3	3	3
100	4	4	4
101	5	5	5
110	6	6	6
111	7	7	7
1000	10	8	8
1001	11	9	9
1010	12	10	A
1011	13	11	B
1100	14	12	C
1101	15	13	D
1110	16	14	E
1111	17	15	F

Number Systems Conversion
Table 5

- Press S-1403DL 2ND, FUNC#, 0 and 2 Keys in sequence to select SEQ Screen. If necessary, use S-1403DL CURSOR Keys and SLEW Control to set menu to **C10**.

```
C10 f02:SEQ (ModeS)           Arf:+0.7
P6:CAL,Wd:CAL ,Dv:CAL      P2:CAL
SPR:ON ,Dv:CAL   Dly=127.9875 Sqtr= 1.15
AntA%:ATC= 0,S=100 AntB%=100 AntB:+.95
```

- Set test parameters as follows:

FREQUENCY

Adjust ATC-1400A FREQ/FUNCTION Thumbwheels and ΔF Thumbwheels to set interrogation RF from **952.01** to **1222.99** MHz. Set to **1030** MHz for normal operation.

STEP PROCEDURE

RF LEVEL

Adjust ATC-1400A RF LEVEL Control from **127** to **0** on RF LEVEL -dBm Display (-69 to -21 dBm is normal). Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set Arf field from **-3.0** to **+3.0** in dB to offset cable loss and/or other external factors. Press S-1403DL ENTER Key.

INTERROGATION RATE

Press S-1403DL C MENU, 7 and 1 Keys in sequence to enter C71 Interrogation Trigger Setup Screen.

```
C71 SETUP - INTERROGATION TRIGGER
TrigSource:TrigGen
TrigGen:      34Hz
```

CAUTION: CONTINUOUS HIGH PRF WITH HIGH UUT POWER MAY DAMAGE S-1403DL (SEE 2.1.3 IN 1-2-2).

Set interrogation rate or PRF one of four ways as follows:

- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set TrigSource to **TrigGen** and TrigGen from **1** to **2500 Hz**. Set from **1** to **50 Hz** for normal operation.
- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set TrigSource to **SelfInterr**. Set PRF from **0** to **2500** with ATC-1400A PRF/SQTR Thumbwheels. Set from **0** to **50** for normal operation.
- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set TrigSource to **ExtSyncln**. Connect external trigger source providing TTL level interrogation trigger pulse to S-1403DL EXT SYNC IN Connector. Leading edge of P₁ or prepulse (when enabled) occurs 17.95 μs after leading edge of external sync pulse. Adjust external trigger source as desired.

STEP	PROCEDURE
	<ul style="list-style-type: none"> ● Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set TrigSource to BurstKey to allow manual triggering of a single interrogation by pressing the S-1403DL BURST Key.

PULSE WIDTH

Set ATC-1400A XPDR PULSE WIDTH VAR/CAL Switch to **CAL** for 0.8 μ s nominal width of P₁ and P₂ (if activated) interrogation pulses. Set XPDR PULSE WIDTH VAR/CAL Switch to **VAR** and use ATC-1400A XPDR PULSE WIDTH Thumbwheels to adjust width from **0.20** to **1.85** μ s.

P₂ LEVEL

Set ATC-1400A SLS/ECHO ON/OFF Switch to **OFF**. Press S-1403DL 2ND and P₂ Keys in sequence to move cursor to C10 Function 02 SEQ P₂ field. Press S-1403DL ON/CAL Key to set P₂ to **VAR**. Set P₂ level using ATC-1400A SLS/ECHO Thumbwheels. Adjust level from **-19** to **+6** dB, relative to P₁ level. **0** dB is normal operating level (P₂:**CAL**). For P₂ deactivation, press S-1403DL ON/CAL Key to set P₂ to **OFF**.

P₂ POSITION

Set ATC-1400A XPDR DEV P₂/CAL Switch to **CAL** for nominal P₂ position of 2.0 μ s following P₁ leading edge. Set ATC-1400A XPDR DEV P₂/CAL Switch to **-Δ** or **+Δ** and adjust ATC-1400A XPDR P₂/P₃ DEV Thumbwheels from **0.00** to **1.85** to set position from 0.15 to 3.85 μ s following P₁ leading edge.

STEP	PROCEDURE
	<p>P₅ (SLS) LEVEL</p> <p>Set ATC_1400A SLS/ECHO ON/OFF Switch to ON. Set P₅ (SLS) level using ATC-1400A SLS/ECHO Thumbwheels. Adjust level from -19 to +6 dB, relative to P₁ level. Verify suppression occurs when P₅ level exceeds P₆ level by 3 dB or more. Verify suppression does not occur when P₆ level exceeds P₅ level by 12 dB or more.</p>

P₅ (SLS) POSITION

Adjust P₅ (SLS) position by changing SPR position (center of P₅ tracks SPR). Use S-1403DL CURSOR Keys and SLEW Control or Keyboard to set SPR:Dv field from **-1.00** to **+1.00** (time deviated from nominal position in 0.05 μ s increments).

P₆ CONTROL

Press S-1403DL 2ND and P₄/P₆ Keys in sequence to move cursor to C10 Function 02 SEQ P₆ field. Press ON/CAL Key to activate (**CAL**) or deactivate (**OFF**) P₆.

P₆ WIDTH

Use S-1403DL CURSOR Keys, ON/CAL Key and SLEW Control to set P₆:Wd: field as desired. Set to **CAL** for nominal P₆ pulse width (16.25 μ s for short 56-bit data field or 30.25 μ s for long 112-bit data field). Vary P₆ pulse width from **-1.50** to **+1.50** (μ s from nominal width).

P₆ POSITION

Use S-1403DL CURSOR Keys, ON/CAL Key and SLEW Control to set P₆:Dv: field as desired. Set to **CAL** for nominal P₆ leading edge position (3.5 μ s following P₁ leading edge). Set P₆ position from 1.55 to 5.45 μ s following P₁ by setting P₆:Dv: field from **-1.95** to **+1.95** (μ s from nominal position).

STEP **PROCEDURE**

POWER

Verify UUT power through ANT A (RF I/O Connector) shown on ATC-1400A XMTR PWR WATTS Display. Select reply pulse to measure as follows:

- Set ATC-1400A F₂/P₂ F₁/P₁ Switch to **F₁/P₁** to measure pulse power of P₁ reply pulse only.
- Set F₂/P₂ F₁/P₁ Switch to **F₂/P₂** for S-1403DL to control pulse power measurement selection.

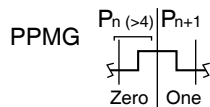
Press S-1403DL 2ND and PPG Keys in sequence to display C74 PPMG Setup Screen.

C74	SETUP - PPMG (POWER)
	ATC ModeS DELM
Enable:OFF	ON OFF
Pulse:A1	P100 1

Use S-1403DL CURSOR Keys and SLEW Control to set ModeS Enable field to **ON**. Select from **1** to **60** (short reply) or **116** (long reply) possible Mode S reply pulses for ModeS Pulse field.

NOTE: The S-1403DL enables the measurement gate prior to the rising edge of the pulse to be measured. Measurement continues until the next falling edge. Adjacent pulses in the pulse position modulated Mode S replies may cause erroneous power readings with conditions as follows:

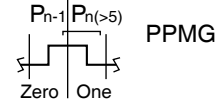
- If the measurement pulse data is Zero followed by a One, the selected pulse and following pulse are measured together because the following pulse has the first detectable falling edge.



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STEP **PROCEDURE**

- If the measurement pulse data is One and the preceding pulse data is Zero, the power reading is zero because of not detecting a rising edge.



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DATA

Press S-1403DL S MENU Key. Use S-1403DL SLEW Control (cursor in S field) to display each active sequence menu. Verify reply data shown in S-1403DL Sequence Menu screens. Use S-1403DL CURSOR Keys and ON/CAL Key to set desired format type in RPLY field (**D** for decoded subfields or **N** for not decoded data). (S-1403DL displays reply data using the radix selected in Step 3.)

10. Verify UUT Mode S squitter information as follows:

INTERVAL

Press S-1403DL 2ND, FUNC#, 0 and 2 Keys in sequence to select SEQ Screen. Verify interval between squitters in Sqtr field. (Normally 0.8 to 1.2 seconds.)

For DF17 type squitter intervals, press S-1403DL C MENU and 6 Keys in sequence to display C60 Squitter (2 of 2) Control Menu.

C60	SQUITTER (2of2)					
DF CA	AA	ME	II	ANT	TIME	
11 4	A07613		0	A	1.00	
17I 4	A07613	1A8C9A3124BA53	0	A	10.05	

Verify squitter intervals in DF17X PERIOD field according to 1-2-2, Table 3.

SIGNAL	DESCRIPTION
--------	-------------

ADDRESS

Press S-1403DL C MENU and 5 Keys in sequence to display C50 Squitter (1 of 2) Control Menu. Verify Mode S Address (aircraft address) in Addr fields.

C50 SQUITTER (1of2)
 Addr:h=A07613,o=50073023,Tail=N129KS
 Country=United States
 Counts/120s:DF11=110,DF17= 36,DF17S= 24

INFORMATION

Verify Tail and Country fields.

View squitter fields in hexadecimal: press S-1403DL C MENU and 6 Keys in sequence to display C60 Squitter (2 of 2) Control Menu. Use S-1403DL CURSOR Keys and ON/CAL Key to set DF17 type (**A**, **I**, **O**, **P**, **S** or **T**). Refer to 1-2-2, Table 4 for type description.

2.3.3 General Test Sequence

Refer to 1-2-2, Figure 4.

SIGNAL	DESCRIPTION
--------	-------------

1. Self Interr In (if selected)

Active low pulse from the ATC-1400A triggers the interrogation process (C71 Interrogation Trigger Setup Screen Trig Source field set to **SelfInterr**). The self interrogate pulse rising edge occurs 17.95 μ s prior to leading edge of P₁ or prepulse (when enabled). The S-1403DL receives the self interrogate pulse through the AUXILIARY Connector (J10).
2. Ext Sync In (if selected)

Active high pulse occurs 17.95 prior to leading edge of P₁ or prepulse (when enabled). The S-1403DL receives the pulse through the EXT SYNC IN Connector (J4). The external sync input replaces the self interrogate input in triggering the interrogation process (C71 Interrogation Trigger Setup Screen Trig Source field set to **ExtSyncIn**).
3. Prepulse Out (when enabled)

Active high pulse, 1.0 μ s wide, occurs 17.95 μ s after the sync pulse rising edge (self interrogate, external sync input or internal trigger generator) and 0 to 260 μ s, as selected, prior to P₁ leading edge. The S-1403DL transmits the prepulse through the PREPULSE OUT Connector (J9).
4. Ext Sync Out (when enabled)

Active high pulse, 1.0 μ s wide, occurs from -9.95 to +9.95 μ s, as selected, relative to P₁ leading edge of the interrogation. The S-1403DL transmits the pulse through the EXT SYNC OUT Connector (J8).

SIGNAL DESCRIPTION

5. Scope Trig Out

The S-1403DL transmits the active high scope trigger pulse through the SCOPE TRIG OUT Connector (J7). Position, referenced to ANT A interrogations, depends on the ATC-1400A To/TAC/Td Switch setting:

● **To** (for viewing interrogations)

Leading edge of 4.75 μ s wide pulse occurs 1.0 μ s prior to P₁ leading edge. Trailing edge occurs 1.0 μ s prior to SPR.

● **Td** (for viewing replies)

Leading edge of 8.0 μ s wide pulse occurs 127 μ s after SPR (1.0 μ s prior to P₁ leading edge of the expected reply).

Setting S-1403DL C72 Scope Trigger Setup Screen ModeS Source field to a numeric value sets scope trigger leading edge at 0 to 255 μ s from P₁ of the ANT A interrogation.

6. ANT B (when enabled)

Active high ANT B interrogation pulses and DPSK data modulate RF transmitted through the S-1403DL ANT B Connector (J2). The S-1403DL offsets P₁ leading edge of the ANT B interrogation from P₁ leading edge of the ANT A interrogation according to the AntB field setting in the C10/C20 SEQ Screen. ANT B and ANT A pulse characteristics are the same except for pulse level.

SIGNAL DESCRIPTION

7. $\overline{\text{Ext Pulse}}$

Active low pulses transmitted through the S-1403DL AUXILIARY Connector (J10) modulate the ATC-1400A RF output. Pulse characteristics vary according to test parameter settings. Refer to Step 7 of SEQ Function Procedure (2.3.2 in 1-2-2).

8. DPSK Out

The DPSK output contains the uplink format data information used to modulate the ANT A interrogation signal. The data constantly changes according to the uplink formats selected for the interrogation sequence. Refer to Step 5 of SEQ Function Procedure (2.3.2 in 1-2-2). The S-1403DL transmits the DPSK modulation through the DPSK OUT Connector (J15) to the ATC-1400A.

9. $\overline{\text{Ext SLS}}$ (when enabled)

Active low gate pulse enables ATC-1400A SLS/ECHO Thumbwheels to control the level of P₅ (SLS) or P₂ depending on the ATC-1400A SLS/ECHO ON/OFF Switch position and C10/C20 P₂ field setting.

10. PPMG (if selected)

The pulse power measurement gate (PPMG) occurs <1.0 μ s prior to the leading edge of the selected pulse. The S-1403DL transmits the PPMG pulse through the PPMG Connector (J14) to the ATC-1400A.

NOTE: The ATC-1400A ignores PPMG if the ATC-1400A F₂/P₂ F₁/P₁ Switch is set to **F₁/P₁**.

11. 50% Video

The Mode S Test System receives the UUT reply video through ANT A (ATC-1400A RF I/O Connector). The ATC-1400A sends the reply video to the S-1403DL through the AUXILIARY Connector (J10).

2.4 ACS FUNCTION

2.4.1 Description

In the ACS Function, the Mode S Test System transmits ATCRBS Only All Call interrogations shown in Appendix E. The Mode S Test System uses the ACS Function to verify Mode S transponders do not reply and ATCRBS only transponders reply correctly.

2.4.2 Procedure

STEP	PROCEDURE
1.	Connect test equipment according to 1-2-2, Figure 2.
2.	Apply power to Mode S Test System.
3.	Press S-1403DL 2ND, FUNC#, 0 and 3 Keys in sequence to select ACS Screen. If necessary, use S-1403DL CURSOR Keys and SLEW Control to set menu to C10 .

```
C10 f03:ACS (All Call Short) Arf:-1.1
P4:VAR,Wd:CAL ,Dv:CAL P3:CAL
DF=---,AA=----- Dly= 3.0000 Sqtr= 1.10
AntA%:ATC=100,S= 0 AntB%=100 AntB:+.95
```

4. Set test parameters as follows:

INTERROGATION MODULATION

Press S-1403DL 2ND and EX MOD Keys in sequence to move cursor to C75 Setup Screen AntAModSrc.

```
C75 SETUP - MISC
AntAEnable:ON PrePulseOut:253µs
AntAModSrc:INT
AntBModSrc:INT
```

Press S-1403DL ON/CAL Key to set AntAModSrc (modulation for signal out ATC-1400A RF I/O Connector) to:

- **EXT** to deactivate internal pulse modulation and use external modulation through S-1403DL EXT MOD IN Connector. The Mode S Test System disregards internal pulse control settings for the applicable antenna connector.

STEP	PROCEDURE
------	-----------

- **INT/EXT** to accept external pulse modulation through S-1403DL EXT MOD IN Connector in addition to normal internal modulation.
- **INT** for normal Mode S Test System internal modulation.

Use S-1403DL CURSOR and ON/CAL Keys to set AntBModSrc (modulation for signal out S-1403DL ANT B Connector) as desired.

MODE SELECTION

Use ATC-1400A XPDR MODE Control to select interrogation mode (**1, 2, T, A, B, C** or **D**).

FREQUENCY

Adjust ATC-1400A FREQ/FUNCTION Thumbwheels and ΔF Thumbwheels to set interrogation RF from **952.01** to **1222.99** MHz. Set to **1030** MHz for normal operation.

RF LEVEL

Adjust ATC-1400A RF LEVEL Control to set RF LEVEL -dBm Display from **127** (-127 dBm) to **0** (0 dBm). Normal operating range is -69 to -21 dBm. Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set Arf field from **-3.0** to **+3.0** in dB to offset cable loss and/or other external factors. Press S-1403DL ENTER Key.

INTERROGATION RATE

Press S-1403DL C MENU, 7 and 1 Keys in sequence to enter C71 Interrogation Trigger Setup Screen.

```
C71 SETUP - INTERROGATION TRIGGER
TrigSource:TrigGen
TrigGen: 450Hz
```

STEP	PROCEDURE
------	-----------

CAUTION: CONTINUOUS HIGH PRF WITH HIGH UUT POWER MAY DAMAGE S-1403DL (SEE 2.1.3 IN 1-2-2).

Set interrogation rate or pulse repetition frequency (PRF) according to one of four ways as follows:

- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set TrigSource to **TrigGen** and TrigGen from **1** to **2500 Hz**. Set from **1** to **500 Hz** for normal operation.
- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set TrigSource to **SelfInterr**. Adjust ATC-1400A PRF/SQTR Thumbwheels to set PRF from **0** to **7999**. Set from **0** to **500** for normal operation.
- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set TrigSource to **ExtSyncln**. Connect external trigger source providing TTL level interrogation trigger pulse to S-1403DL EXT SYNC IN Connector. Leading edge of P₁ or prepulse (when enabled) occurs 17.95 μs after leading edge of external sync pulse. Adjust external trigger source as desired.
- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set TrigSource to **BurstKey** to allow manual triggering of a single interrogation by pressing the S-1403DL BURST Key.

PULSE WIDTH

Set ATC-1400A XPDR PULSE WIDTH VAR/CAL Switch to **CAL** for 0.8 μs nominal width of P₁, P₂ (SLS) (if activated) and P₃ (if activated) interrogation pulses. Set XPDR PULSE WIDTH VAR/CAL Switch to **VAR** and use ATC-1400A XPDR PULSE WIDTH Thumbwheels to adjust width from **0.20** to **1.85** μs.

STEP	PROCEDURE
------	-----------

P₂ (SLS) LEVEL

Set ATC-1400A SLS/ECHO ON/OFF Switch to **ON**. Set P₂ (SLS) level using ATC-1400A SLS/ECHO Thumbwheels. Adjust level from **-19** to **+6** dB, relative to P₁ level. Verify suppression occurs when P₂ level is ≥P₁ level. Verify suppression does not occur when P₂ level exceeds P₁ level by ≥9 dB.

P₂ (SLS) POSITION

Set ATC-1400A XPDR DEV P₂/CAL Switch to **CAL** for nominal P₂ (SLS) position of 2.0 μs following P₁ leading edge. Set XPDR DEV P₂/CAL Switch to **-Δ** or **+Δ** and adjust ATC-1400A XPDR P₂/P₃ DEV Thumbwheels from **0.00** to **1.85** to set position from 0.15 to 3.85 μs following P₁ leading edge.

P₃ LEVEL

Set ATC-1400A SLS/ECHO ON/OFF Switch to **OFF**. Press S-1403DL 2ND and P₃ Keys in sequence to move cursor to C10 Function 03 ACS P₃ field. Press S-1403DL ON/CAL Key to set P₃ to **VAR**. Set P₃ level using ATC-1400A SLS/ECHO Thumbwheels. Adjust level from **-19** to **+6** dB, relative to P₁ level. **0** dB is normal operating level (P₃:**CAL**). For P₃ deactivation, press S-1403DL ON/CAL Key to set P₃ to **OFF**.

P₃ POSITION

Set ATC-1400A XPDR DEV P₃/CAL Switch to **CAL** for nominal P₃ position. Refer to Appendix E for nominal position. Set ATC-1400A XPDR DEV P₃/CAL Switch to **-Δ** or **+Δ** and adjust ATC-1400A XPDR P₂/P₃ DEV Thumbwheels from **0.00** to **1.85** to deviate position -1.85 to +1.85 μs from nominal.

STEP	PROCEDURE	STEP	PROCEDURE
P₄ LEVEL	<p>Set ATC-1400A SLS/ECHO ON/OFF Switch to OFF. Press S-1403DL 2ND and P4/P6 Keys in sequence to move cursor to C10 Function 03 ACS P4 field. Press S-1403DL ON/CAL Key to set P4 to VAR. Set P₄ level using ATC-1400A SLS/ECHO Thumbwheels. Adjust level from -19 to +6 dB, relative to P₁ level. 0 dB is normal operating level (P4:CAL). For P₄ deactivation, press S-1403DL ON/CAL Key to set P4 to OFF.</p>	<ul style="list-style-type: none"> ● Set level from -19 to +6 dB (relative to P₁) using ATC-1400A SLS/ECHO Thumbwheels. ● Set width from 0.2 to 5 μs using ATC-1400A INTRF PULSE WIDTH Control. 	
P₄ WIDTH	<p>Use S-1403DL CURSOR Keys, ON/CAL Key and SLEW Control to set P4:Wd: field as desired. Set to CAL for nominal 0.8 μs P₄ pulse width. Vary P₄ pulse width (0.2 to 3.55 μs) by setting P4:Wd: field from -0.60 to +2.75 (μs from nominal width).</p>	SUPPRESSOR PULSE	
NOTE:	<p>Setting P₄ wider than 1.5 μs turns an ATCRBS Only All Call to an ATCRBS/Mode S All Call. ATCRBS Only All Call interrogations require P₄ width <1.2 μs.</p>	<p>Connect ATC-1400A SUPPRESSOR OUTPUT Connector to UUT suppressor input. Set ATC-1400A SUPPRESSOR ON/OFF Switch to ON to activate 33 μs wide (fixed) suppressor pulse.</p>	
P₄ POSITION	<p>Use S-1403DL CURSOR Keys, ON/CAL Key and SLEW Control to set P4:Dv: field as desired. Set to CAL for nominal P₄ leading edge position (2.0 μs following P₃ leading edge). Set P₄ position from 0.05 to 3.95 μs following P₃ by setting P4:Dv: field from -1.95 to +1.95 (μs from nominal position).</p>	<ul style="list-style-type: none"> ● Adjust level from 3 to 27 V using ATC-1400A SUPPRESSOR VAR Adjustment. ● Set ATC-1400A DBL INTERR/INTRF PULSE Thumbwheels to OFF to position suppressor pulse 0.8 μs before P₃. Set DBL INTERR/INTRF PULSE Thumbwheels from 017.5 INTERF- to 399.9 INTERF+ to adjust suppressor pulse position from -17.5 to +399.9 μs relative to P₁. (Suppressor pulse replaces interference pulse when both are activated.) 	
INTERFERENCE PULSE	<p>Set ATC-1400A DBL INTERR/INTRF PULSE Thumbwheels from 017.5 INTERF- to 399.9 INTERF+ to enable and position interference pulse at -17.5 to +399.9 μs from leading edge of P₁ or prepulse, if active.</p>	ANT B	
		<p>Press S-1403DL 2ND and ANT B Keys in sequence to move cursor to AntB field. Press S-1403DL ON/CAL Key to activate interrogations through ANT B Connector. Use SLEW Control and Keyboard to enter value from -0.95 to +0.95 (offset in 0.05 μs increments from ANT A interrogations). Without the Multi-Level Diversity (MLD) option, ANT B output level is -50 dBm.</p>	
		<p>If MLD is installed, set ANT B output level. Use S-1403DL CURSOR Keys and SLEW Control to set menu to C20. Use CURSOR Keys to select Brf fields. Use SLEW Control and Keyboard to set first field from -80 to -20 dBm and second field from -3.0 to +3.0 dB (used to offset cable loss).</p>	

STEP PROCEDURE

5. If desired, set optional outputs as follows:

PREPULSE OUT

Press S-1403DL 2ND and P PULS Keys in sequence to move cursor to C75 Setup Screen PrePulseOut field. Press S-1403DL ON/CAL Key to activate prepulse through S-1403DL PREPULSE OUT Connector. Use S-1403DL SLEW Control and Keyboard to enter **0** to **260** μ s (time from prepulse leading edge to P₁ leading edge).

EXT SYNC OUT

Press S-1403DL 2ND and EX SYN Keys in sequence to move cursor to C73 Setup Screen Enable field. Use S-1403DL CURSOR Keys and ON/CAL Key to set ACS Enable field **ON** for activating external sync pulse through S-1403DL EXT SYNC OUT Connector. Use S-1403DL CURSOR Keys and SLEW Control or Keyboard to set Dv field from **-9.95** to **+9.95** μ s (time from external sync pulse leading edge to P₁ leading edge) (-, P₁ follows external sync; +, external sync follows P₁).

C73	SETUP - EXT SYNC OUT
	ATC ModeS ACS ACL
Enable:	OFF OFF ON OFF
	Dv:+1.00 μ S

SCOPE TRIG OUT

Set scope trigger output through S-1403DL SCOPE TRIG OUT Connector for desired Oscilloscope display. Press S-1403DL C MENU, 7 and 2 Keys in sequence to enter C72 Setup Screen.

C72	SETUP - SCOPE TRIGGER
	ATC ModeS ACS ACL
Enable:	ON ON ON OFF
Source:	CAL 200 CAL CAL (in μ S)

STEP PROCEDURE

Set scope trigger as follows:

- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set ACS Enable to **ON** to activate scope trigger.
- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set ACS Source to **CAL** (ATC-1400A controls scope trigger position).
- Set ATC-1400A To/TAC/T_D Switch to **To** for viewing interrogation at ATC-1400A GEN Connector or T_D for viewing reply at ATC-1400A XMTR Connector.

Connect S-1403DL UUT XMTR Connector to Oscilloscope for viewing UUT replies at S-1403DL ANT B Connector.

6. Verify UUT replies as follows:

Verify ATCRBS only transponders reply to normal interrogations without suppression. Verify Mode S transponders do not reply.

FREQUENCY

Verify UUT transmit frequency on ATC-1400A XMTR FREQ MHz Display.

ACCURACY

Set ATC-1400A DISPLAY SELECT Control to **XPDR CODE** and verify reply code on ATC-1400A DISPLAY SELECT Readout.

View reply pulses on Oscilloscope Channel 2.

REPLY DELAY

Verify reply delay (P₃ leading edge to F₁ leading edge) in Dly field. Verify Dly field indicates 3.000 μ s (± 0.5 μ s).

For detailed reply delay information, press S-1403DL C MENU and 4 Keys in sequence to display C40 Reply Delay Control Menu. If desired, press S-1403DL CL/ESC Key to reset fields.

STEP PROCEDURE

PERCENT REPLY

Verify percent reply in C10/C20 ACS Screen AntA% and AntB% fields.

For detailed percent reply information, press S-1403DL C MENU and 3 Keys in sequence to display C30 Percent Reply Control Menu. If desired, press S-1403DL CL/ESC Key to reset fields.

POWER

Verify UUT power through ANT A (RF I/O Connector) shown on ATC-1400A XMTR PWR WATTS Display. Select reply pulse to measure as follows:

- Set ATC-1400A F₂/P₂ F₁/P₁ Switch to **F₁/P₁** to measure pulse power of F₁ reply pulse only.
- Set F₂/P₂ F₁/P₁ Switch to **F₂/P₂** for S-1403DL to control pulse power measurement selection.

Press S-1403DL 2ND and PPG Keys in sequence to display C74 PPMG Setup Screen.

C74	SETUP - PPMG (POWER)		
	ATC	ModeS	DELM
Enable:	ON	OFF	OFF
Pulse:	A2	P116	1

Use S-1403DL CURSOR Keys and SLEW Control to set ATC Enable field to **ON** and select one of 16 possible ATCRBS reply pulses for ATC Pulse field.

STEP PROCEDURE

7. Verify UUT Mode S squitter information as follows:

INTERVAL

Press S-1403DL 2ND, FUNC#, 0 and 3 Keys in sequence to select ACS Screen. Verify interval between squitters in Sqtr field. (Normally 0.8 to 1.2 seconds.)

For DF17 type squitter intervals, press S-1403DL C MENU and 6 Keys in sequence to display C60 Squitter (2 of 2) Control Menu.

C60	SQUITTER (2of2)					
DF	CA	AA	ME	II	ANT	TIME
11	4	A07613		0	A	1.00
17I	4	A07613	1A8C9A3124BA53	0	A	10.05

Verify squitter intervals in DF17X PERIOD field according to 1-2-2, Table 3.

ADDRESS

Press S-1403DL C MENU and 5 Keys in sequence to display C50 Squitter (1 of 2) Control Menu. Verify Mode S Address (aircraft address) in Addr fields.

C50	SQUITTER (1of2)	
Addr:	h=A07613,o=50073023,Tail=N129KS	
	Country=United States	
Counts/120s:	DF11=110,DF17= 36,DF17S= 24	

INFORMATION

Verify Tail and Country fields.

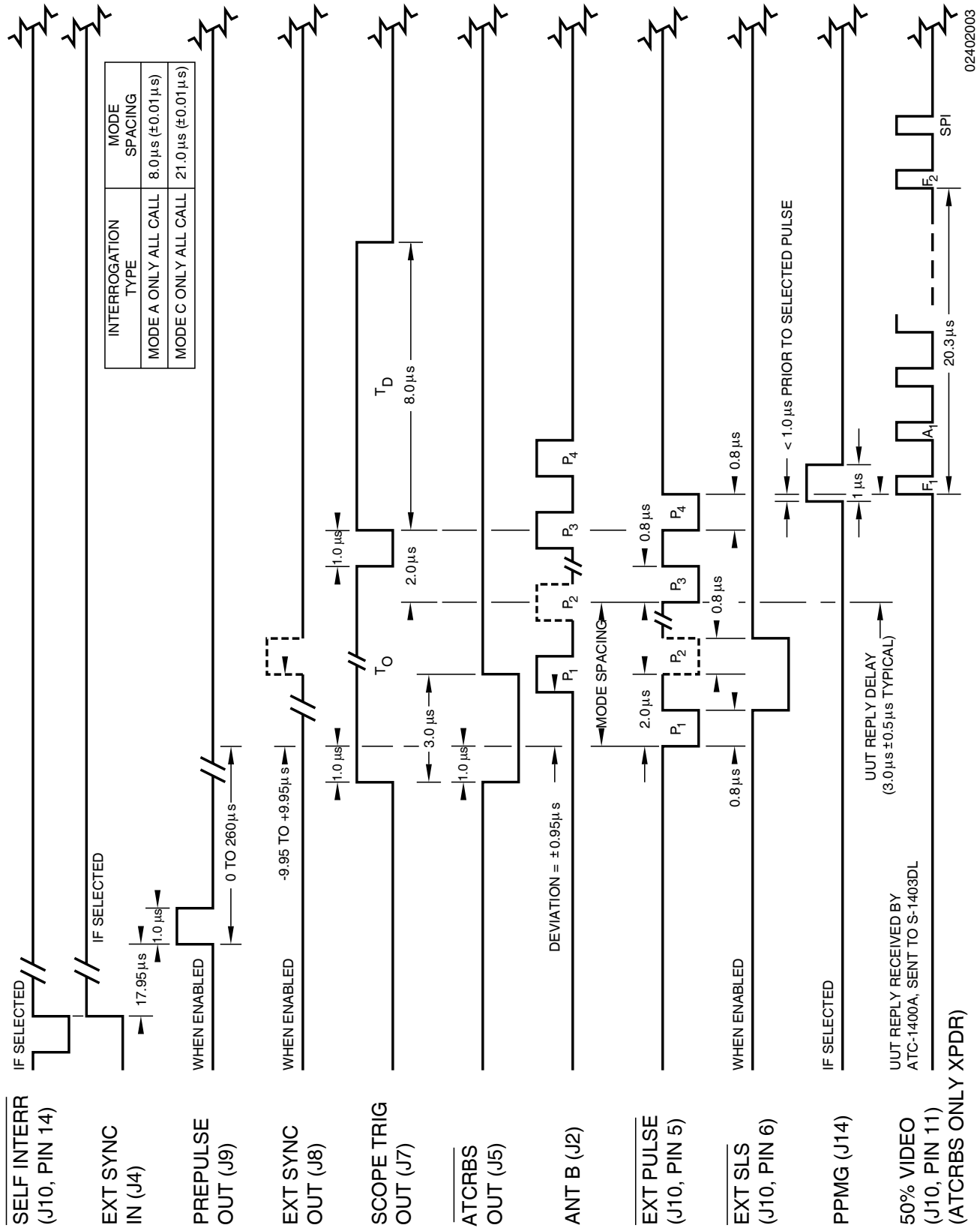
View squitter fields in hexadecimal: press S-1403DL C MENU and 6 Keys in sequence to display C60 Squitter (2 of 2) Control Menu. Use S-1403DL CURSOR Keys and ON/CAL Key to set DF17 type (**A, I, O, P, S** or **T**). Refer to 1-2-2, Table 4 for type description.

2.4.3 General Test Sequence

Refer to 1-2-2, Figure 5.

SIGNAL	DESCRIPTION
1. Self Interr In (if selected)	Active low pulse from the ATC-1400A triggers the interrogation process (C71 Interrogation Trigger Setup Screen Trig Source field set to SelfInterr). The self interrogate pulse rising edge occurs 17.95 μ s prior to leading edge of P ₁ or prepulse (when enabled). The S-1403DL receives the self interrogate pulse through the AUXILIARY Connector (J10).
2. Ext Sync In (if selected)	Active high pulse occurs 17.95 prior to leading edge of P ₁ or prepulse (when enabled). The S-1403DL receives the pulse through the EXT SYNC IN Connector (J4). The external sync input replaces the self interrogate input in triggering the interrogation process (C71 Interrogation Trigger Setup Screen Trig Source field set to ExtSyncln).
3. Prepulse Out (when enabled)	Active high pulse, 1.0 μ s wide, occurs 17.95 μ s after the sync pulse rising edge (self interrogate, external sync input or internal trigger generator) and 0 to 260 μ s, as selected, prior to P ₁ leading edge of the interrogation. The S-1403DL transmits the prepulse through the PREPULSE OUT Connector (J9).
4. Ext Sync Out (when enabled)	Active high pulse, 1.0 μ s wide, occurs from -9.95 to +9.95 μ s, as selected, relative to P ₁ leading edge of the interrogation. The S-1403DL transmits the pulse through the EXT SYNC OUT Connector (J8).

SIGNAL	DESCRIPTION
5. Scope Trig Out	The S-1403DL transmits the active high scope trigger pulse through the SCOPE TRIG OUT Connector (J7). Position, referenced to ANT A interrogations, depends on the ATC-1400A To/TAC/Td Switch setting: <ul style="list-style-type: none"> ● To (for viewing interrogations) <ul style="list-style-type: none"> Leading edge occurs 1.0 μs prior to P₁ leading edge and trailing edge occurs 1.0 μs prior to P₄ leading edge. ● Td (for viewing replies) <ul style="list-style-type: none"> Leading edge of 8.0 μs wide pulse occurs 2.0 μs following P₃ (1.0 μs prior to F₁ leading edge of the expected reply).
6. $\overline{\text{ATCRBS}}$ Out	Active low pulse, 3.0 μ s wide, occurs 1.0 μ s prior to P ₁ leading edge. The S-1403DL transmits the pulse through the $\overline{\text{ATCRBS}}$ OUT Connector (J5).
7. ANT B (when enabled)	Active high ANT B interrogation pulses modulate RF transmitted through the S-1403DL ANT B Connector (J2). The S-1403DL offsets P ₁ leading edge of the ANT B interrogation from P ₁ leading edge of the ANT A interrogation according to the AntB field setting in the C10/C20 ATC Screen. ANT B and ANT A pulse characteristics are the same except for pulse level.



02402003

ACS Function Timing Diagram
Figure 5

SIGNAL	DESCRIPTION
--------	-------------

8. $\overline{\text{Ext Pulse}}$

Active low pulses transmitted through the S-1403DL AUXILIARY Connector (J10) modulate the ATC-1400A RF output. Pulse characteristics vary according to test parameter settings. Refer to Step 4 of ACS Function Procedure (2.4.2 in 1-2-2).

9. $\overline{\text{Ext SLS}}$ (when enabled)

Active low gate pulse enables ATC-1400A SLS/ECHO Thumbwheels to control the level of P₂ (SLS), P₃ and/or P₄ depending on the ATC-1400A SLS/ECHO ON/OFF Switch position, C10/C20 P3 field setting and C10/C20 P4 field setting.

10. PPMG (if selected)

The pulse power measurement gate (PPMG) occurs <1.0 μs prior to the leading edge of the selected pulse. The S-1403DL transmits the PPMG pulse through the PPMG Connector (J14) to the ATC-1400A.

NOTE: The ATC-1400A ignores PPMG if the ATC-1400A F₂/P₂ F₁/P₁ Switch is set to **F₁/P₁**.

11. 50% Video

The Mode S Test System receives the UUT (ATCRBS only transponder) reply video through ANT A (ATC-1400A RF I/O Connector). The ATC-1400A sends the reply video to the S-1403DL through the AUXILIARY Connector (J10). When the ACS Function operates without pulse adjustments, the Mode S Test System expects no reply video from Mode S transponders.

2.5 ACL FUNCTION

2.5.1 Description

In the ACL Function, the Mode S Test System transmits ATCRBS/Mode S All Call interrogations shown in Appendix E. The Mode S Test System uses the ACL Function to verify ATCRBS and Mode S transponders respond and operate correctly.

2.5.2 Procedure

- | STEP | PROCEDURE |
|------|---|
| 1. | Connect test equipment according to 1-2-2, Figure 2. |
| 2. | Apply power to Mode S Test System. |
| 3. | Press S-1403DL 2ND, FUNC#, 0 and 4 Keys in sequence to select ACL Screen. If necessary, use S-1403DL CURSOR Keys and SLEW Control to set menu to C10 . |

```
C10 f04:ACL (All Call Long)      Arf:-0.2
P4:CAL,Wd:-0.10,Dv:+1.05        P3:CAL
DF=11,AA=123456  Dly=128.0000  Sqtr= 0.98
AntA%:ATC= 0,S= 90  AntB%= 90  AntB:+.95
```

4. Set test parameters as follows:

INTERROGATION MODULATION

Press S-1403DL 2ND and EX MOD Keys in sequence to move cursor to C75 Setup Screen AntAModSrc.

```
C75          SETUP - MISC
AntAEnable:ON          PrePulseOut:253µs
AntAModSrc:INT
AntBModSrc:INT
```

Press S-1403DL ON/CAL Key to set AntAModSrc (modulation for signal out ATC-1400A RF I/O Connector) to:

- **EXT** to deactivate internal pulse modulation and use external modulation through S-1403DL EXT MOD IN Connector. The Mode S Test System disregards internal pulse control settings for the applicable antenna connector.

- | STEP | PROCEDURE |
|------|---|
| ● | INT/EXT to accept external pulse modulation through S-1403DL EXT MOD IN Connector in addition to normal internal modulation. |
| ● | INT for normal Mode S Test System internal modulation. |

Use S-1403DL CURSOR and ON/CAL Keys to set AntBModSrc (modulation for signal out S-1403DL ANT B Connector) as desired.

MODE SELECTION

Use ATC-1400A XPDR MODE Control to select interrogation mode (**1, 2, T, A, B, C** or **D**).

FREQUENCY

Adjust ATC-1400A FREQ/FUNCTION Thumbwheels and ΔF Thumbwheels to set interrogation RF from **952.01** to **1222.99** MHz. Set to **1030** MHz for normal operation.

RF LEVEL

Adjust ATC-1400A RF LEVEL Control to set RF LEVEL -dBm Display from **127** (-127 dBm) to **0** (0 dBm). Normal operating range is -69 to -21 dBm. Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set Arf field from **-3.0** to **+3.0** in dB to offset cable loss and/or other external factors. Press S-1403DL ENTER Key.

INTERROGATION RATE

Press S-1403DL C MENU, 7 and 1 Keys in sequence to enter C71 Interrogation Trigger Setup Screen.

```
C71  SETUP - INTERROGATION TRIGGER
TrigSource:TrigGen
TrigGen:      450Hz
```

STEP	PROCEDURE
------	-----------

CAUTION: CONTINUOUS HIGH PRF WITH HIGH UUT POWER MAY DAMAGE S-1403DL (SEE 2.1.3 IN 1-2-2).

Set interrogation rate or pulse repetition frequency (PRF) according to one of four ways as follows:

- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set TrigSource to **TrigGen** and TrigGen from **1** to **2500 Hz**. Set from **1** to **500 Hz** for normal operation.
- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set TrigSource to **SelfInterr**. Adjust ATC-1400A PRF/SQTR Thumbwheels to set PRF from **0** to **2500**. Set from **0** to **500** for normal operation.
- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set TrigSource to **ExtSyncln**. Connect external trigger source providing TTL level interrogation trigger pulse to S-1403DL EXT SYNC IN Connector. Leading edge of P₁ or prepulse (when enabled) occurs 17.95 μs after leading edge of external sync pulse. Adjust external trigger source as desired.
- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set TrigSource to **BurstKey** to allow manual triggering of a single interrogation by pressing the S-1403DL BURST Key.

PULSE WIDTH

Set ATC-1400A XPDR PULSE WIDTH VAR/CAL Switch to **CAL** for 0.8 μs nominal width of P₁, P₂ (SLS) (if activated) and P₃ (if activated) interrogation pulses. Set XPDR PULSE WIDTH VAR/CAL Switch to **VAR** and use ATC-1400A XPDR PULSE WIDTH Thumbwheels to adjust width from **0.20** to **1.85** μs.

STEP	PROCEDURE
------	-----------

P₂ (SLS) LEVEL

Set ATC-1400A SLS/ECHO ON/OFF Switch to **ON**. Set P₂ (SLS) level using ATC-1400A SLS/ECHO Thumbwheels. Adjust level from **-19** to **+6** dB, relative to P₁ level. Verify suppression occurs when P₂ level is ≥P₁ level. Verify suppression does not occur when P₂ level exceeds P₁ level by ≥9 dB.

P₂ (SLS) POSITION

Set ATC-1400A XPDR DEV P₂/CAL Switch to **CAL** for nominal P₂ (SLS) position of 2.0 μs following P₁ leading edge. Set XPDR DEV P₂/CAL Switch to **-Δ** or **+Δ** and adjust ATC-1400A XPDR P₂/P₃ DEV Thumbwheels from **0.00** to **1.85** to set position from 0.15 to 3.85 μs following P₁ leading edge.

P₃ LEVEL

Set ATC-1400A SLS/ECHO ON/OFF Switch to **OFF**. Press S-1403DL 2ND and P₃ Keys in sequence to move cursor to C10 Function 04 ACL P₃ field. Press S-1403DL ON/CAL Key to set P₃ to **VAR**. Set P₃ level using ATC-1400A SLS/ECHO Thumbwheels. Adjust level from **-19** to **+6** dB, relative to P₁ level. **0** dB is normal operating level (P₃:**CAL**). For P₃ deactivation, press S-1403DL ON/CAL Key to set P₃ to **OFF**.

P₃ POSITION

Set ATC-1400A XPDR DEV P₃/CAL Switch to **CAL** for nominal P₃ position. Refer to Appendix E for nominal position. Set ATC-1400A XPDR DEV P₃/CAL Switch to **-Δ** or **+Δ** and adjust ATC-1400A XPDR P₂/P₃ DEV Thumbwheels from **0.00** to **1.85** to deviate position -1.85 to +1.85 μs from nominal.

STEP	PROCEDURE	STEP	PROCEDURE
P₄ LEVEL	<p>Set ATC-1400A SLS/ECHO ON/OFF Switch to OFF. Press S-1403DL 2ND and P4/P6 Keys in sequence to move cursor to C10 Function 04 ACL P4 field. Press S-1403DL ON/CAL Key to set P₄ to VAR. Set P₄ level using ATC-1400A SLS/ECHO Thumbwheels. Adjust level from -19 to +6 dB, relative to P₁ level. 0 dB is normal operating level (P₄:CAL). For P₄ deactivation, press S-1403DL ON/CAL Key to set P₄ to OFF.</p>	<ul style="list-style-type: none"> ● Set level from -19 to +6 dB (relative to P₁) using ATC-1400A SLS/ECHO Thumbwheels. ● Set width from 0.2 to 5 μs using ATC-1400A INTRF PULSE WIDTH Control. 	
P₄ WIDTH	<p>Use S-1403DL CURSOR Keys, ON/CAL Key and SLEW Control to set P₄:Wd: field as desired. Set to CAL for nominal 1.6 μs P₄ pulse width. Vary P₄ pulse width (0.2 to 3.55 μs) by setting P₄:Wd: field from -1.40 to +1.95 (μs from nominal width).</p>	SUPPRESSOR PULSE	
NOTE:	<p>Setting P₄ width <1.2 μs turns an ATCRBS/Mode-S All Call to an ATCRBS Only All Call. ATCRBS/Mode S All Call interrogations require P₄ width >1.5 μs.</p>	<p>Connect ATC-1400A SUPPRESSOR OUTPUT Connector to UUT suppressor input. Set ATC-1400A SUPPRESSOR ON/OFF Switch to ON to activate 33 μs wide (fixed) suppressor pulse.</p>	
P₄ POSITION	<p>Use S-1403DL CURSOR Keys, ON/CAL Key and SLEW Control to set P₄:Dv: field as desired. Set to CAL for nominal P₄ leading edge position (2.0 μs following P₃ leading edge). Set P₄ position from 0.05 to 3.95 μs following P₃ by setting P₄:Dv: field from -1.95 to +1.95 (μs from nominal position).</p>	<ul style="list-style-type: none"> ● Adjust level from 3 to 27 V using ATC-1400A SUPPRESSOR VAR Adjustment. ● Set ATC-1400A DBL INTERR/INTRF PULSE Thumbwheels to OFF to position suppressor pulse 0.8 μs before P₃. Set DBL INTERR/INTRF PULSE Thumbwheels from 017.5 INTERF- to 399.9 INTERF+ to adjust suppressor pulse position from -17.5 to +399.9 μs relative to P₁. (Suppressor pulse replaces interference pulse when both are activated.) 	
INTERFERENCE PULSE	<p>Set ATC-1400A DBL INTERR/INTRF PULSE Thumbwheels from 017.5 INTERF- to 399.9 INTERF+ to enable and position interference pulse at -17.5 to +399.9 μs from leading edge of P₁ or prepulse, if active.</p>	ANT B	
		<p>Press S-1403DL 2ND and ANT B Keys in sequence to move cursor to AntB field. Press S-1403DL ON/CAL Key to activate interrogations through ANT B Connector. Use SLEW Control and Keyboard to enter value from -0.95 to +0.95 (offset in 0.05 μs increments from ANT A interrogations). Without the Multi-Level Diversity (MLD) option, ANT B output level is -50 dBm.</p>	
		<p>If MLD is installed, set ANT B output level. Use S-1403DL CURSOR Keys and SLEW Control to set menu to C20. Use CURSOR Keys to select Brf fields. Use SLEW Control and Keyboard to set first field from -80 to -20 dBm and second field from -3.0 to +3.0 dB (used to offset cable loss).</p>	

STEP PROCEDURE

5. If desired, set optional outputs as follows:

PREPULSE OUT

Press S-1403DL 2ND and P PULS Keys in sequence to move cursor to C75 Setup Screen PrePulseOut field. Press S-1403DL ON/CAL Key to activate prepulse through S-1403DL PREPULSE OUT Connector. Use S-1403DL SLEW Control and Keyboard to enter **0** to **260** μ s (time from prepulse leading edge to P₁ leading edge).

EXT SYNC OUT

Press S-1403DL 2ND and EX SYN Keys in sequence to move cursor to C73 Setup Screen Enable field. Use S-1403DL CURSOR Keys and ON/CAL Key to set ACL Enable field **ON** for activating external sync pulse through S-1403DL EXT SYNC OUT Connector. Use S-1403DL CURSOR Keys and SLEW Control or Keyboard to set Dv field to **-9.95** to **+9.95** μ s (time from external sync pulse leading edge to P₁ leading edge) (-, P₁ follows external sync; +, external sync follows P₁).

```
C73          SETUP - EXT SYNC OUT
          ATC ModeS ACS ACL
Enable:OFF OFF   OFF ON
                                     Dv:+1.00 $\mu$ S
```

SCOPE TRIG OUT

Set scope trigger output through S-1403DL SCOPE TRIG OUT Connector for desired Oscilloscope display. Press S-1403DL C MENU, 7 and 2 Keys in sequence to enter C72 Setup Screen.

```
C72          SETUP - SCOPE TRIGGER
          ATC ModeS ACS ACL
Enable:ON  ON   OFF ON
Source:CAL CAL  CAL CAL   (in  $\mu$ S)
```

STEP PROCEDURE

Set scope trigger as follows:

- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set ACL Enable to **ON** to activate scope trigger.
- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set ACL Source to **CAL** (ATC-1400A controls trigger position) or a numeric value (S-1403DL controls trigger position).
- For S-1403DL control, use S-1403DL SLEW Control or Keyboard to delay trigger in μ s following P₁ leading edge of the ANT A interrogation. For detailed reply view, set ACL Source field according to the following sum (Maximum field setting is 255 μ s):

P₁-P₃ Mode Spacing (5 to 25 μ s) +
P₃-P₄ spacing (0.05 to 3.95 μ s) +
expected reply delay (128 μ s) +
reply P₁ to desired trigger point (0 to 120 μ s).
- Set ATC-1400A To/TAC/TD Switch to **To** for viewing interrogation at ATC-1400A GEN Connector or **TD** for viewing reply at ATC-1400A XMTR Connector.

Connect S-1403DL UUT XMTR Connector to Oscilloscope for viewing replies at S-1403DL ANT B Connector.

6. Verify UUT replies as follows:

FREQUENCY

Verify UUT transmit frequency on ATC-1400A XMTR FREQ MHz Display.

ACCURACY

Press S-1403DL 2ND, FUNC#, 0 and 4 Keys in sequence to select ACL Screen. Verify DF field indicates **11** and AA field indicates correct aircraft address.

View reply pulses on Oscilloscope Channel 2.

STEP **PROCEDURE**

REPLY DELAY

Verify reply delay (SPR to P₁ leading edge in reply) in Dly field. Verify Dly field indicates 128.000 μs (±0.5 μs).

For detailed reply delay information, press S-1403DL C MENU and 4 Keys in sequence to display C40 Reply Delay Control Menu. If desired, press S-1403DL CL/ESC Key to reset fields.

PERCENT REPLY

Verify percent reply in C10/C20 ACL Screens, AntA% and AntB% fields.

For detailed percent reply information, press S-1403DL C MENU and 3 Keys in sequence to display C30 Percent Reply Control Menu. If desired, press S-1403DL CL/ESC Key to reset fields.

POWER

Verify UUT power through ANT A (RF I/O Connector) shown on ATC-1400A XMTR PWR WATTS Display. Select reply pulse to measure as follows:

- Set ATC-1400A F₂/P₂ F₁/P₁ Switch to **F₁/P₁** to measure pulse power of P₁ reply pulse only.
- Set F₂/P₂ F₁/P₁ Switch to **F₂/P₂** for S-1403DL to control pulse power measurement selection.

Press S-1403DL 2ND and PPG Keys in sequence to display C74 PPMG Setup Screen.

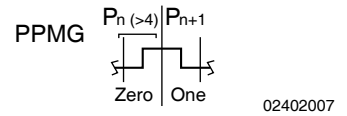
C74	SETUP - PPMG (POWER)		
	ATC	ModeS	DELM
Enable:ON	ON	OFF	
Pulse:A2	P116	1	

Use S-1403DL CURSOR Keys and SLEW Control to set ModeS Enable field to **ON**. Select from **1** to **116** possible Mode S reply pulses for ModeS Pulse field.

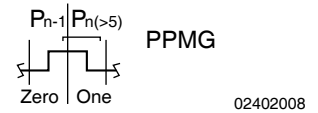
STEP **PROCEDURE**

NOTE: The S-1403DL enables the measurement gate prior to the rising edge of the pulse to be measured. Measurement continues until the next falling edge. Adjacent pulses in the pulse position modulated Mode S replies may cause erroneous power readings with conditions as follows:

- If the measurement pulse data is Zero followed by a One, the selected pulse and following pulse are measured together because the following pulse has the first detectable falling edge.



- If the measurement pulse data is One and the preceding pulse data is Zero, the power reading is zero because of not detecting a rising edge.



STEP	PROCEDURE
------	-----------

7. Verify UUT Mode S squitter information as follows:

INTERVAL

Press S-1403DL 2ND, FUNC#, 0 and 4 Keys in sequence to select ACL Screen. Verify interval between squitters in Sqtr field. (Normally 0.8 to 1.2 seconds.)

For DF17 type squitter intervals, press S-1403DL C MENU and 6 Keys in sequence to display C60 Squitter (2 of 2) Control Menu.

C60 SQUITTER (2of2)						
DF	CA	AA	ME	II	ANT	TIME
11	4	A07613		0	A	1.00
17I	4	A07613	1A8C9A3124BA53	0	A	10.05

Verify squitter intervals in DF17X PERIOD field according to 1-2-2, Table 3.

ADDRESS

Press S-1403DL C MENU and 5 Keys in sequence to display C50 Squitter (1 of 2) Control Menu. Verify Mode S Address in Addr fields.

C50 SQUITTER (1of2)	
Addr:h=A07613,o=50073023,Tail=N129KS	Country=United States
Counts/120s:DF11=110,DF17= 36,DF17S= 24	

INFORMATION

Verify Tail and Country fields.

View squitter fields in hexadecimal: press S-1403DL C MENU and 6 Keys in sequence to display C60 Squitter (2 of 2) Control Menu. Use S-1403DL CURSOR Keys and ON/CAL Key to set DF17 type (**A**, **I**, **O**, **P**, **S** or **T**). Refer to 1-2-2, Table 4.

2.5.3 General Test Sequence

Refer to 1-2-2, Figure 6.

SIGNAL	DESCRIPTION
--------	-------------

1. Self Interr In (if selected)

Active low pulse from the ATC-1400A triggers the interrogation process (C71 Interrogation Trigger Setup Screen Trig Source field set to **SelfInterr**). The self interrogate pulse rising edge occurs 17.95 μ s prior to leading edge of P₁ or prepulse (when enabled). The S-1403DL receives the self interrogate pulse through the AUXILIARY Connector (J10).

2. Ext Sync In (if selected)

Active high pulse occurs 17.95 μ s prior to leading edge of P₁ or prepulse (when enabled). The S-1403DL receives the pulse through the EXT SYNC IN Connector (J4). The external sync input replaces the self interrogate input in triggering the interrogation process (C71 Interrogation Trigger Setup Screen Trig Source field set to **ExtSyncIn**).

3. Prepulse Out (when enabled)

Active high pulse, 1.0 μ s wide, occurs 17.95 μ s after the sync pulse rising edge (self interrogate, external sync input or internal trigger generator) and 0 to 260 μ s, as selected, prior to P₁ leading edge of the interrogation. The S-1403DL transmits the prepulse through the PREPULSE OUT Connector (J9).

4. Ext Sync Out (when enabled)

Active high pulse, 1.0 μ s wide, occurs from -9.95 to +9.95 μ s, as selected, relative to P₁ leading edge of the interrogation. The S-1403DL transmits the pulse through the EXT SYNC OUT Connector (J8).

SIGNAL DESCRIPTION

5. Scope Trig Out

The S-1403DL transmits the active high scope trigger pulse through the SCOPE TRIG OUT Connector (J7). Position, referenced to ANT A interrogations, depends on the ATC-1400A To/TAC/Td Switch setting:

- **To** (for viewing interrogations)

Leading edge occurs 1.0 μ s prior to P₁ leading edge and trailing edge occurs 1.0 μ s prior to P₄ leading edge.

- **Td** (for viewing replies)

Leading edge of 8.0 μ s wide pulse occurs 127 μ s following P₄ (1.0 μ s prior to P₁ leading edge of the expected reply).

Setting S-1403DL C72 Scope Trigger Setup Screen ModeS Source to a numeric value sets scope trigger leading edge at 0 to 255 μ s from P₁ of the ANT A interrogation.

6. ATCRBS Out

Active low pulse, 3.0 μ s wide, occurs 1.0 μ s prior to P₁ leading edge of the ANT A interrogation. The S-1403DL transmits the pulse through the ATCRBS OUT Connector (J5).

7. ANT B (when enabled)

Active high ANT B interrogation pulses modulate RF transmitted through the S-1403DL ANT B Connector (J2). The S-1403DL offsets P₁ leading edge of the ANT B interrogation from P₁ leading edge of the ANT A interrogation according to the AntB field setting in the C10/C20 ATC Screen. ANT B and ANT A pulse characteristics are the same except for pulse level.

SIGNAL DESCRIPTION

8. Ext Pulse

Active low pulses transmitted through the S-1403DL AUXILIARY Connector (J10) modulate the ATC-1400A RF output. Pulse characteristics vary according to test parameter settings. Refer to Step 4 of ACL Function Procedure (2.5.2 in 1-2-2).

9. Ext SLS (when enabled)

Active low gate pulse enables ATC-1400A SLS/ECHO Thumbwheels to control the level of P₂ (SLS) or P₃ depending on the ATC-1400A SLS/ECHO ON/OFF Switch position and C10/C20 P3 field setting.

10. PPMG (if selected)

The pulse power measurement gate (PPMG) occurs <1.0 μ s prior to the leading edge of the selected pulse. The S-1403DL transmits the PPMG pulse through the PPMG Connector (J14) to the ATC-1400A.

NOTE: The ATC-1400A ignores PPMG if the ATC-1400A F₂/P₂ F₁/P₁ Switch is set to **F₁/P₁**.

11. 50% Video

The Mode S Test System receives the UUT reply video through ANT A (ATC-1400A RF I/O Connector). The ATC-1400A sends the reply video to the S-1403DL through the AUXILIARY Connector (J10).

2.6 INTLCE FUNCTION

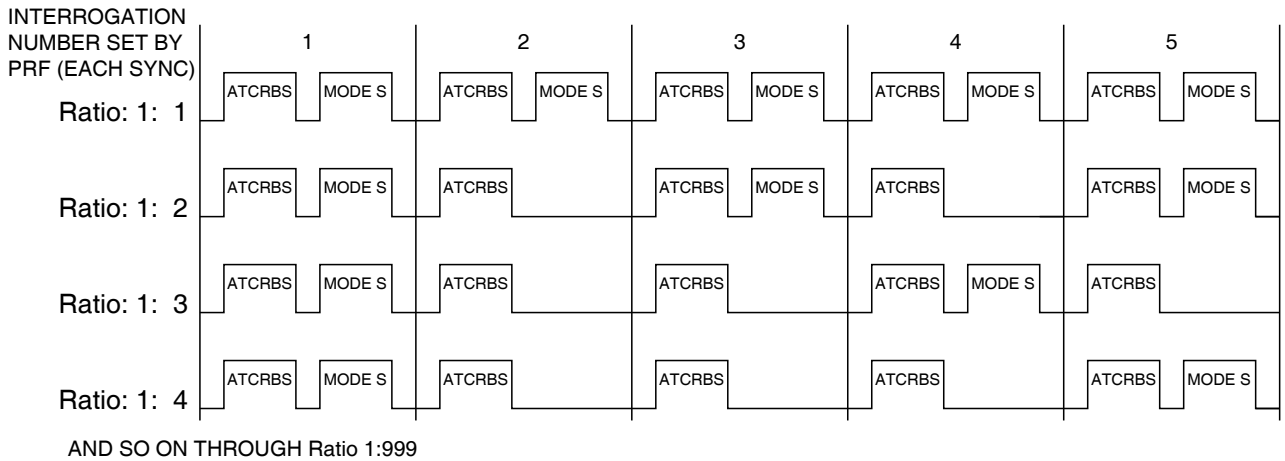
2.6.1 Description

In the INTLCE Function, the Mode S Test System transmits ATCRBS interrogations interlaced with Mode S interrogations. The Mode S Test System measures reply characteristics to verify UUT operation in a normal mixed environment.

The Mode S Test System transmits:

- ATCRBS interrogations according to the selected mode and PRF.
- Mode S interrogations according to the sequence menus and S-1403DL C10/C20 f05 Ratio:1to field setting.

A Mode S interrogation follows the first ATCRBS interrogation. After sending the number of ATCRBS interrogations set in the S-1403DL C10/C20 f05 Ratio:1to field, the Mode S Test System transmits the next Mode S interrogation. Each Mode S interrogation thereafter follows the set number of ATCRBS interrogations. Refer to 1-2-2, Figure 7. When transmitted, P₁ of the Mode S interrogation follows P₁ of the ATCRBS interrogation after a 200 μs fixed delay.



02402009

INTLCE Function Interrogation Sequence
Figure 7

2.6.2 Procedure

- | STEP | PROCEDURE |
|------|--|
| 1. | Connect test equipment according to 1-2-2, Figure 2. |
| 2. | Apply power to Mode S Test System. |
| 3. | Verify Mode S Test System is not in any function using sequence menus. (S-1403DL C10/C20 Control Menu Screen does not indicate f02:SEQ, f05:INTLCE; f06:DI;1st:SEQ, f06:DI;2nd:SEQ or f07:BURST;SEQ.) Use S-1403DL Keyboard to select any other function, if necessary. |
| 4. | Press S-1403DL C MENU, 7 and 6 Keys to display C76 SMENU Setup Screen. Set as follows: <ul style="list-style-type: none"> ● Use S-1403DL CURSOR Keys and ON/CAL Key to set SmenuRadix to desired data format (HEX [hexadecimal] or OCTAL). ● Use S-1403DL CURSOR, ON/CAL and ENTER Keys for changing SetAllSmenu to OFF (deactivates all sequence menus), DEFAULT (activates/resets default sequence menus, deactivates all others) or ZERO (sets all fields except ADDR to 0). Refer to 1-1-2, Table 5 for default sequence menus.

Use S-1403DL ON/CAL and ENTER Keys to set ADDR in all sequence menus by changing SetAllSmenu to XPDR (transponder address) or USER (address from User= field). ● Use S-1403DL CURSOR Keys and SLEW Control to set alternate addresses (GlobalAddr:User=) and parity (AP XOR=) fields as desired for checking operation with bogus addresses or bad AP fields. |

```
C76          SETUP - SMENU
SmenuRadix:OCTAL      SetAllSmenu:XPDR
GlobalAddr:Xpdr=17725762,AP XOR=00000000
GlobalAddr:User=10273645,AP XOR=00000001
```

- | STEP | PROCEDURE |
|------|--|
| 5. | Press S-1403DL S MENU Key to display Mode S Sequence Menu. |

```
S001:D;UF00,RL=0,CL=0,AQ=0,
+                               ADDR=17725762
RPLY:D;DF00,VS=0,SL=0,RI=00,AC=+ 31200,
                               ADDR=17725762
```

6. Set interrogation sequence as follows:
- ACTIVATION**
- Press S-1403DL ON/CAL Key to activate or deactivate sequence menu.

FORMAT

Use S-1403DL CURSOR Keys and ON/CAL Key to select format type for active sequence menu. Set to **S** (short 56-bit transmission), **L** (long 112-bit transmission) or **D** (decoded, used for formats with defined fields).

UPLINK FORMAT

Use S-1403DL CURSOR Keys and SLEW Control or Keyboard to select desired uplink format.

DATA FIELDS

Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to load data fields according to Appendix D. Refer to Appendix B for defined fields and 1-2-2, Table 5 for converting data.

7. Press S-1403DL 2ND, FUNC#, 0 and 5 Keys in sequence to select Interlace Screen. If necessary, use S-1403DL CURSOR Keys and SLEW Control to set menu to **C10**.

```
C10 f05:INTLCE;Ratio:1to 25      Arf:+1.0
                                   Dly=  2.9875 Sqtr= 1.05
AntA%:ATC= 98,S=  2  AntB%=100 AntB:+.95
```

8. Press S-1403DL CURSOR Key (→) to move cursor to Ratio:1to field. Use S-1403DL SLEW Control or Keyboard to set number of ATCRBS interrogations (**1** to **999**) transmitted for each Mode S interrogation.

STEP PROCEDURE

9. Set test parameters as follows:

MODE SELECTION

Use ATC-1400A XPDR MODE Control to select interrogation mode (**1, 2, T, A, B, C** or **D**).

FREQUENCY

Adjust ATC-1400A FREQ/FUNCTION Thumbwheels and ΔF Thumbwheels to set interrogation RF from **952.01** to **1222.99** MHz. Set to **1030** MHz for normal operation.

RF LEVEL

Adjust ATC-1400A RF LEVEL Control to set RF LEVEL -dBm Display from **127** (-127 dBm) to **0** (0 dBm). Normal operating range is -69 to -21 dBm. Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set Arf field from **-3.0** to **+3.0** in dB to offset cable loss and/or other external factors. Press S-1403DL ENTER Key.

INTERROGATION RATE

Press S-1403DL C MENU, 7 and 1 Keys in sequence to enter C71 Interrogation Trigger Setup Screen.

```
C71  SETUP - INTERROGATION TRIGGER
TrigSource:TrigGen
TrigGen:      450Hz
```

CAUTION: CONTINUOUS HIGH PRF WITH HIGH UUT POWER MAY DAMAGE S-1403DL (SEE 2.1.3 IN 1-2-2).

Set interrogation rate or pulse repetition frequency (PRF) according to one of four ways as follows:

- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set TrigSource to **TrigGen** and TrigGen from **1** to **1250 Hz**. Set from **1** to **500 Hz** for normal operation.

STEP PROCEDURE

- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set TrigSource to **SelfInterr**. Set PRF from **0** to **1250** Hz on ATC-1400A PRF/SQTR Thumbwheels. Set from **0** to **500** for normal operation.
- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set TrigSource to **ExtSyncln**. Connect external trigger source providing TTL level interrogation trigger pulse to S-1403DL EXT SYNC IN Connector. Leading edge of P₁ or prepulse (when enabled) occurs 17.95 μ s after leading edge of external sync pulse. Adjust external trigger source as desired.
- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set TrigSource to **BurstKey** to allow manual triggering of a single interrogation by pressing the S-1403DL BURST Key.

P₂ (SLS) LEVEL

Set ATC-1400A SLS/ECHO ON/OFF Switch to **ON**. Set P₂ (SLS) level using ATC-1400A SLS/ECHO Thumbwheels. Adjust level from **-19** to **+6** dB, relative to P₁ level. Verify suppression occurs when P₂ level is \geq P₁ level. Verify suppression does not occur when P₂ level exceeds P₁ level by \geq 9 dB.

INTERFERENCE PULSE

Set ATC-1400A DBL INTERR/INTRF PULSE Thumbwheels from **017.5 INTERF-** to **399.9 INTERF+** to enable and position interference pulse at -17.5 to +399.9 μ s from leading edge of P₁ or prepulse, if active.

- Set level from -19 to +6 dB (relative to P₁) using ATC-1400A SLS/ECHO Thumbwheels.
- Set width from 0.2 to 5 μ s using ATC-1400A INTRF PULSE WIDTH Control.

STEP	PROCEDURE
------	-----------

Use S-1403DL CURSOR Keys and SLEW Control to set ATC Enable field to **ON** and select one of 16 possible ATCRBS reply pulses for ATC Pulse field.

12. Verify UUT Mode S squitter information as follows:

INTERVAL

Press S-1403DL 2ND, FUNC#, 0 and 5 Keys in sequence to select Interlace Screen. Verify interval between squitters in Sqtr field. (Normally 0.8 to 1.2 seconds.)

For DF17 type squitter intervals, press S-1403DL C MENU and 6 Keys in sequence to display C60 Squitter (2 of 2) Control Menu.

C60 SQUITTER (2of2)						
DF	CA	AA	ME	II	ANT	TIME
11	4	A07613		0	A	1.00
17I	4	A07613	1A8C9A3124BA53	0	A	10.05

Verify squitter intervals in DF17X PERIOD field according to 1-2-2, Table 3.

ADDRESS

Press S-1403DL C MENU and 5 Keys in sequence to display C50 Squitter (1 of 2) Control Menu. Verify Mode S Address in Addr fields.

C50 SQUITTER (1of2)	
Addr:	h=A07613,o=50073023,Tail=N129KS
	Country=United States
Counts/120s:	DF11=110,DF17= 36,DF17S= 24

INFORMATION

Verify Tail and Country fields.

View squitter fields in hexadecimal: press S-1403DL C MENU and 6 Keys in sequence to display C60 Squitter (2 of 2) Control Menu. Use S-1403DL CURSOR Keys and ON/CAL Key to set DF17 type (**A**, **I**, **O**, **P**, **S** or **T**). Refer to 1-2-2, Table 4.

2.6.3 General Test Sequence

Refer to 1-2-2, Figure 8.

SIGNAL	DESCRIPTION
--------	-------------

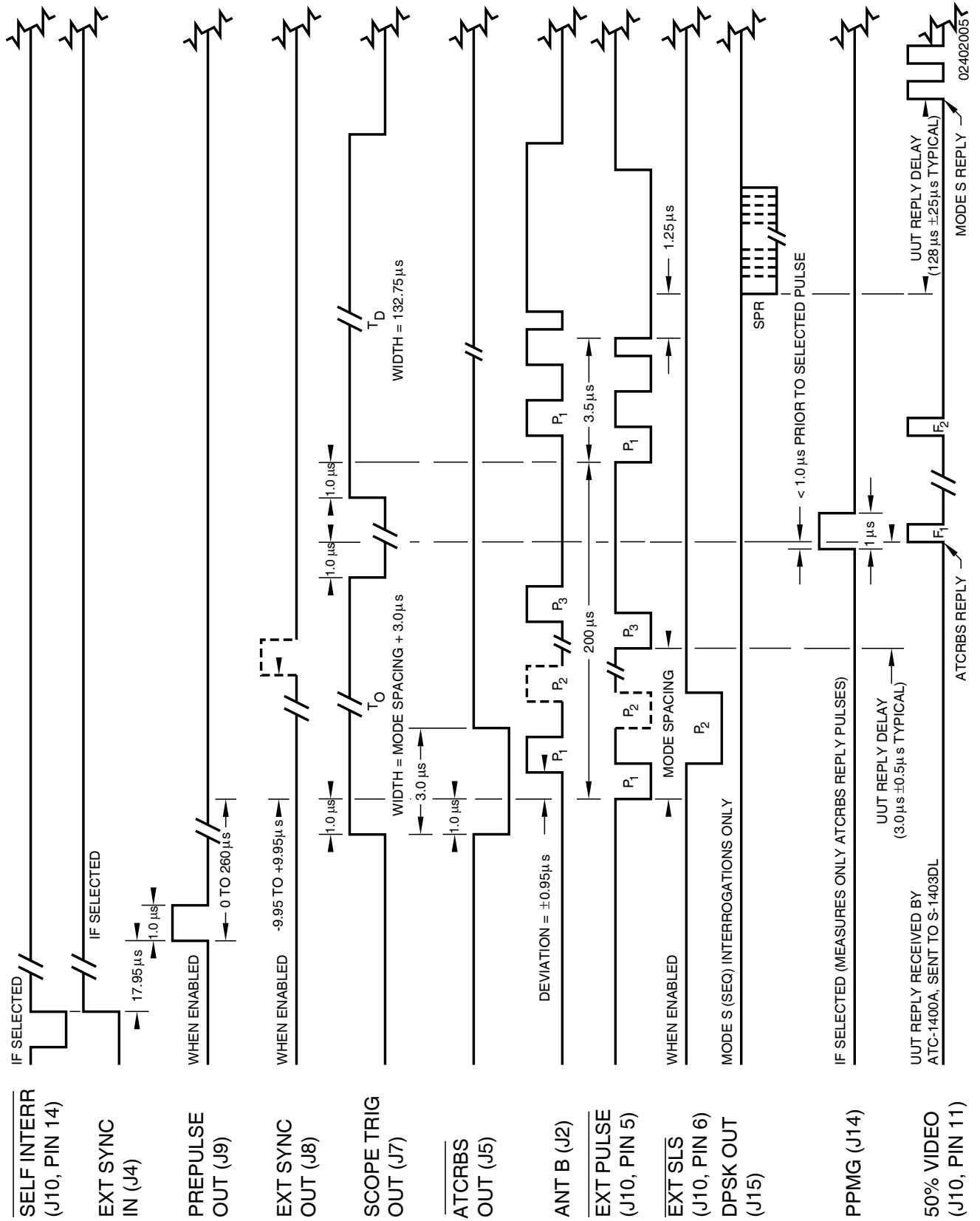
- Self Interr In (if selected)**

Active low pulse from the ATC-1400A triggers the interrogation process (C71 Interrogation Trigger Setup Screen Trig Source field set to **SelfInterr**). The self interrogate pulse rising edge occurs 17.95 μ s prior to leading edge of the ATCRBS interrogation P₁ or prepulse (when enabled). The S-1403DL receives the self interrogate pulse through the AUXILIARY Connector (J10).
- Ext Sync In (if selected)**

Active high pulse occurs 17.95 prior to leading edge of P₁ or prepulse (when enabled). The S-1403DL receives the pulse through the EXT SYNC IN Connector (J4). The external sync input replaces the self interrogate input in triggering the interrogation process (C71 Interrogation Trigger Setup Screen Trig Source field set to **ExtSyncIn**).
- Prepulse Out (when enabled)**

Active high pulse, 1.0 μ s wide, occurs 17.95 μ s after the sync pulse rising edge (self interrogate, external sync input or internal trigger generator) and 0 to 260 μ s, as selected, prior to the ATCRBS interrogation P₁ leading edge. The S-1403DL transmits the prepulse through the PREPULSE OUT Connector (J9).
- Ext Sync Out (when enabled)**

Active high pulse, 1.0 μ s wide, occurs from -9.95 to +9.95 μ s, as selected, relative to the ATCRBS interrogation P₁ leading edge. The S-1403DL transmits the pulse through the EXT SYNC OUT Connector (J8).



INTLCE Function Timing Diagram
Figure 8

SIGNAL DESCRIPTION

5. Scope Trig Out

The S-1403DL transmits the active high scope trigger pulse through the SCOPE TRIG OUT Connector (J7). Position, referenced to ANT A interrogations, depends on the ATC-1400A To/TAC/Td Switch setting:

- **To** (for viewing ATCRBS interrogations and replies)

Leading edge occurs 1.0 μ s prior to P₁ leading edge of the ATCRBS interrogation and trailing edge occurs 1.0 μ s prior to F₁ leading edge of the expected reply.

- **Td** (for viewing Mode S interrogations and replies)

Leading edge of 132.75 μ s wide pulse occurs 1.0 μ s prior to P₁ leading edge of the Mode S interrogation.

6. ATCRBS Out

Active low pulse, 3.0 μ s wide, occurs 1.0 μ s prior to P₁ leading edge of the ATCRBS interrogation. The S-1403DL transmits the pulse through the ATCRBS OUT Connector (J5).

7. ANT B (when enabled)

Active high ANT B interrogation pulses modulate RF transmitted through the S-1403DL ANT B Connector (J2). The S-1403DL offsets P₁ leading edge of the ANT B interrogation from P₁ leading edge of the ANT A interrogation according to the AntB field setting in the C10/C20 ATC Screen. ANT B and ANT A pulse characteristics are the same except for pulse level.

SIGNAL DESCRIPTION

8. Ext Pulse

Active low pulses transmitted through the S-1403DL AUXILIARY Connector (J10) modulate the ATC-1400A RF output to provide the interrogation pulses. The Mode S interrogation, when transmitted, occurs 200 μ s following P₁ leading edge of the ATCRBS interrogation.

9. Ext SLS (when enabled)

Active low gate pulse enables ATC-1400A SLS/ECHO Thumbwheels to control the level of P₂ (SLS) depending on the ATC-1400A SLS/ECHO ON/OFF Switch position.

10. DPSK Out

The DPSK output contains the uplink format data information used to modulate the ANT A interrogation signal. The data constantly changes according to the uplink formats selected for the interrogation sequence. Refer to Step 6 of INTLCE Function Procedure (2.6.2 in 1-2-2). The S-1403DL transmits the DPSK modulation through the DPSK OUT Connector (J15) to the ATC-1400A.

11. PPMG (if selected)

The pulse power measurement gate (PPMG) occurs <1.0 μ s prior to the leading edge of the selected ATCRBS reply pulse. The S-1403DL transmits the PPMG pulse through the PPMG Connector (J14) to the ATC-1400A.

NOTE: The ATC-1400A ignores PPMG if the ATC-1400A F₂/P₂ F₁/P₁ Switch is set to **F₁/P₁**.

12. 50% Video

The Mode S Test System receives the UUT reply video through ANT A (ATC-1400A RF I/O Connector). The ATC-1400A sends the reply video to the S-1403DL through the AUXILIARY Connector (J10).

2.7 DI FUNCTION

2.7.1 Description

In the DI Function, the Mode S Test System transmits two interrogations in a single interrogation period. The interrogations consist of any combination of ATCRBS, All Call and/or Mode S. The Mode S Test System uses the DI function to verify transponder operation and recovery.

2.7.2 Procedure

STEP	PROCEDURE
------	-----------

1. Connect test equipment according to 1-2-2, Figure 2.
2. Apply power to Mode S Test System.
3. Press S-1403DL 2ND, FUNC#, 0 and 6 Keys in sequence to select Double Interrogation Screen. If necessary, use S-1403DL CURSOR Keys and SLEW Control to set menu to **C10**.

```
C10 f06:DI;1st:ACS,2nd:SEQ      Arf:+0.0
P4:CAL,Wd:+0.00,Dv:+0.00      P3:CAL
                               Dly= 3.0125 Sqtr= 1.00
AntA%:ATC= 70,S= 30  AntB%=100 AntB:+.50
```

4. Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set 1st: (first interrogation) and 2nd: (second interrogation) fields to **ATC** (ATCRBS), **SEQ** (Mode S interrogations set in sequence menus), **ACS** (ATCRBS Only All Call) or **ACL** (ATCRBS/Mode S All Call).
5. Set ATC-1400A DBL INTERR/INTRF PULSE Thumbwheels to **DOUBLE**. Set desired spacing between interrogations (DI delay, P₁ leading edge to P₁ leading edge) from **000.0** (or **040.0** if 1st:**SEQ** and 2nd:**SEQ** in Step 4) to **399.9** μs.

NOTE: Some settings of the ATC-1400A DBL INTERR/INTRF PULSE Thumbwheels may cause invalid reply delay information. Refer to **REPLY DELAY** in Step 12.

STEP	PROCEDURE
------	-----------

If using Mode S interrogations (**SEQ**), set sequence menus according to Steps 6 through 8 prior to selecting **SEQ** as first or second interrogation. If using only ATCRBS and/or All Call interrogations, go to Step 9.

6. Press S-1403DL C MENU, 7 and 6 Keys to display C76 SMENU Setup Screen. Set as follows:

- Use S-1403DL CURSOR Keys and ON/CAL Key to set SmenuRadix to desired data format (**HEX** [hexadecimal] or **OCTAL**).
- Use S-1403DL CURSOR, ON/CAL and ENTER Keys for changing SetAllSmenu to **OFF** (deactivates all sequence menus), **DEFAULT** (activates/resets default sequence menus, deactivates all others) or **ZERO** (sets all fields except ADDR to 0). Refer to 1-1-2, Table 5 for default sequence menus.

Use S-1403DL ON/CAL and ENTER Keys to set ADDR in all sequence menus by changing SetAllSmenu to **XPDR** (transponder address) or **USER** (address from User= field).

- Use S-1403DL CURSOR Keys and SLEW Control to set alternate addresses (GlobalAddr:User=) and parity (AP XOR=) fields as desired for checking operation with bogus addresses or bad AP fields.

```
C76          SETUP - SMENU
SmenuRadix:OCTAL      SetAllSmenu:DEFAULT
GlobalAddr:Xpdr=17725762,AP XOR=00000000
GlobalAddr:User=10273645,AP XOR=00000001
```

7. Press S-1403DL S MENU Key to display Mode S Sequence Menu.

```
S001:D;UF00,RL=0,CL=0,AQ=0,
+                               ADDR=17725762
RPLY:D;DF00,VS=0,SL=0,RI=00,AC=+ 31200,
                               ADDR=17725762
```

STEP PROCEDURE

8. Set interrogation sequence as follows:

ACTIVATION

Press S-1403DL ON/CAL Key to activate or deactivate sequence menu.

FORMAT

Use S-1403DL CURSOR Keys and ON/CAL Key to select format type for active sequence menu. Set to **S** (short 56-bit transmission), **L** (long 112-bit transmission) or **D** (decoded, used for formats with defined fields).

UPLINK FORMAT

Use S-1403DL CURSOR Keys and SLEW Control or Keyboard to select desired uplink format.

DATA FIELDS

Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to load data fields according to Appendix D. Refer to Appendix B for defined fields and 1-2-2, Table 5 for converting data.

SCOPE TRIGGER

Use S-1403DL CURSOR Keys and ON/CAL Key to activate + or deactivate - scope trigger. For stable display, activate scope trigger for only one sequence menu.

9. Set test parameters as follows:

MODE SELECTION

If **ATC**, **ACS** or **ACL** was selected as first and/or second interrogation in Step 4, use ATC-1400A XPDR MODE Control to select interrogation mode (**1**, **2**, **T**, **A**, **B**, **C** or **D**).

NOTE: Interrogation Mode Selected sets one or both interrogations depending on interrogations selected in Step 4.

STEP PROCEDURE

FREQUENCY

Adjust ATC-1400A FREQ/FUNCTION Thumbwheels and ΔF Thumbwheels to set interrogation RF from **952.01** to **1222.99** MHz. Set to **1030** MHz for normal operation.

RF LEVEL

Adjust ATC-1400A RF LEVEL Control to set RF LEVEL -dBm Display from **127** (-127 dBm) to **0** (0 dBm). Normal operating range is -69 to -21 dBm. Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set Arf field from **-3.0** to **+3.0** in dB to offset cable loss and/or other external factors. Press S-1403DL ENTER Key.

INTERROGATION RATE

Press S-1403DL C MENU, 7 and 1 Keys in sequence to enter C71 Interrogation Trigger Setup Screen.

```
C71  SETUP - INTERROGATION TRIGGER
TrigSource:TrigGen
TrigGen:      450Hz
```

CAUTION: CONTINUOUS HIGH PRF WITH HIGH UUT POWER MAY DAMAGE S-1403DL (SEE 2.1.3 IN 1-2-2).

Set interrogation rate or pulse repetition frequency (PRF) according to one of four ways as follows:

- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set TrigSource to **TrigGen** and TrigGen from **1** to **1250 Hz**.
- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set TrigSource to **SelfInterr**. Adjust ATC-1400A PRF/SQTR Thumbwheels to set PRF from **0** to **4000** when both interrogations are set to **ATC** (1st:ATC,2nd:ATC) in Step 4. Set from **0** to **1250** for other interrogation combinations.

STEP	PROCEDURE
●	Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set TrigSource to ExtSyncln . Connect external trigger source providing TTL level interrogation trigger pulse to S-1403DL EXT SYNC IN Connector. Leading edge of P ₁ or prepulse (when enabled) occurs 17.95 μs after leading edge of external sync pulse. Adjust external trigger source as desired.
●	Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set TrigSource to BurstKey to allow manual triggering of a single interrogation by pressing the S-1403DL BURST Key.

SUPPRESSOR PULSE

Connect ATC-1400A SUPPRESSOR OUTPUT Connector to UUT suppressor input. Set ATC-1400A SUPPRESSOR ON/OFF Switch to **ON** to activate 33 μs wide (fixed) suppressor pulse to replace first interrogation.

- Adjust level from 3 to 27 V using ATC-1400A SUPPRESSOR VAR Adjustment.
- Set ATC-1400A DBL INTERR/INTRF PULSE Thumbwheels from **000.0** to **399.9** μs to set spacing between suppressor pulse leading edge to second interrogation P₁ leading edge.

ANT B

Press S-1403DL 2ND and ANT B Keys in sequence to move cursor to AntB field. Press S-1403DL ON/CAL Key to activate interrogations through ANT B Connector. Use SLEW Control and Keyboard to enter value from **-0.95** to **+0.95** (offset in 0.05 μs increments from ANT A interrogations). Without the Multi-Level Diversity (MLD) option, ANT B output level is -50 dBm.

STEP	PROCEDURE
	If MLD is installed, set ANT B output level. Use S-1403DL CURSOR Keys and SLEW Control to set menu to C20. Use CURSOR Keys to select Brf fields. Use SLEW Control and Keyboard to set first field from -80 to -20 dBm and second field from -3.0 to +3.0 dB (used to offset cable loss).
10.	Set pulse characteristics for first interrogation according to 1st: field setting (second interrogation pulse characteristics not adjustable).

PULSE WIDTH

Set ATC-1400A XPDR PULSE WIDTH VAR/CAL Switch to **CAL** for 0.8 μs nominal width of P₁, P₂ (if activated) and P₃ (if activated and applicable) interrogation pulses. Set XPDR PULSE WIDTH VAR/CAL Switch to **VAR** and use ATC-1400A XPDR PULSE WIDTH Thumbwheels to adjust width from **0.20** to **1.85** μs.

P₂ LEVEL (1st:SEQ)

Set ATC-1400A SLS/ECHO ON/OFF Switch to **OFF**. Press S-1403DL 2ND and P2 Keys in sequence to move cursor to C10 Function 06 DI P2 field. Press S-1403DL ON/CAL Key to set P2 to **VAR**. Set P2 level using ATC-1400A SLS/ECHO Thumbwheels. Adjust level from **-19** to **+6** dB, relative to P₁ level. **0** dB is normal operating level (P2:**CAL**). For P2 deactivation, press S-1403DL ON/CAL Key to set P2 to **OFF**.

P₂ POSITION (1st:SEQ)

Set ATC-1400A XPDR DEV P₂/CAL Switch to **CAL** for nominal P₂ position of 2.0 μs following P₁ leading edge. Set ATC-1400A XPDR DEV P₂/CAL Switch to **-Δ** or **+Δ** and adjust ATC-1400A XPDR P₂/P₃ DEV Thumbwheels from **0.00** to **1.85** to set position from 0.15 to 3.85 μs following P₁ leading edge.

STEP	PROCEDURE
	<p>P₂ (SLS) LEVEL (1st:ATC, ACS or ACL)</p> <p>Set ATC-1400A SLS/ECHO ON/OFF Switch to ON. Set P₂ (SLS) level using ATC-1400A SLS/ECHO Thumbwheels. Adjust level from -19 to +6 dB, relative to P₁ level. Verify suppression occurs when P₂ level is \geqP₁ level. Verify suppression does not occur when P₂ level exceeds P₁ level by \geq9 dB.</p> <p>P₂ (SLS) POSITION (1st:ATC, ACS or ACL)</p> <p>Set ATC-1400A XPDR DEV P₂/CAL Switch to CAL for nominal P₂ (SLS) position of 2.0 μs following P₁ leading edge. Set XPDR DEV P₂/CAL Switch to -1 or +1 and adjust ATC-1400A XPDR P₂/P₃ DEV Thumbwheels from 0.00 to 1.85 to set position from 0.15 to 3.85 μs following P₁ leading edge.</p> <p>P₃ LEVEL (1st:ATC, ACS or ACL)</p> <p>Set ATC-1400A SLS/ECHO ON/OFF Switch to OFF. Press S-1403DL 2ND and P₃ Keys in sequence to move cursor to C10 Function 06 DI P₃ field. Press S-1403DL ON/CAL Key to set P₃ to VAR. Set P₃ level using ATC-1400A SLS/ECHO Thumbwheels. Adjust level from -19 to +6 dB, relative to P₁ level. 0 dB is normal operating level (P₃:CAL). For P₃ deactivation, press S-1403DL ON/CAL Key to set P₃ to OFF.</p> <p>P₃ POSITION (1st:ATC, ACS or ACL)</p> <p>Set ATC-1400A XPDR DEV P₃/CAL Switch to CAL for nominal P₃ position. Refer to Appendix E for nominal position. Set ATC-1400A XPDR DEV P₃/CAL Switch to -1 or +1 and adjust ATC-1400A XPDR P₂/P₃ DEV Thumbwheels from 0.00 to 1.85 to deviate position -1.85 to +1.85 μs from nominal.</p>

STEP	PROCEDURE
	<p>P₄ LEVEL (1st:ACS or ACL)</p> <p>Set ATC-1400A SLS/ECHO ON/OFF Switch to OFF. Press S-1403DL 2ND and P₄/P₆ Keys in sequence to move cursor to C10 Function 06 DI P₄ field. Press S-1403DL ON/CAL Key to set P₄ to VAR. Set P₄ level using ATC-1400A SLS/ECHO Thumbwheels. Adjust level from -19 to +6 dB, relative to P₁ level. 0 dB is normal operating level (P₄:CAL). For P₄ deactivation, press S-1403DL ON/CAL Key to set P₄ to OFF.</p> <p>P₄ WIDTH (1st:ACS or ACL)</p> <p>Use S-1403DL CURSOR Keys, ON/CAL Key and SLEW Control to set P₄:Wd: field as desired. Set to CAL for nominal P₄ pulse width (0.8 μs for ACS, 1.6 μs for ACL). Vary P₄ pulse width by setting P₄:Wd: field in 0.05 μs increments from nominal width. Vary P₄ pulse width from 0.2 to 3.55 μs by setting P₄:Wd: field from -0.60 to +2.75 for ACS or from -1.40 to +1.95 for ACL.</p> <p>NOTE: Setting P₄ wider than 1.5 μs turns an ACS to an ACL. Setting P₄ width <1.2 μs turns an ACL to an ACS. ACS interrogations require P₄ width <1.2 μs. ACL interrogations require P₄ width >1.5 μs.</p> <p>P₄ POSITION (1st:ACS or ACL)</p> <p>Use S-1403DL CURSOR Keys, ON/CAL Key and SLEW Control to set P₄:Dv: field as desired. Set to CAL for nominal P₄ leading edge position (2.0 μs following P₃ leading edge). Set P₄ position from 0.05 to 3.95 μs following P₃ by setting P₄:Dv: field from -1.95 to +1.95 (μs from nominal position).</p>

STEP PROCEDURE

P₅ (SLS) LEVEL (1st:SEQ)

Set ATC_1400A SLS/ECHO ON/OFF Switch to **ON**. Set P₅ (SLS) level using ATC-1400A SLS/ECHO Thumbwheels. Adjust level from **-19** to **+6** dB, relative to P₁ level. Verify suppression occurs when P₅ level exceeds P₆ level by 3 dB or more. Verify suppression does not occur when P₆ level exceeds P₅ level by 12 dB or more.

P₅ (SLS) POSITION (1st:SEQ)

Adjust P₅ (SLS) position by changing SPR position (center of P₅ tracks SPR). Use S-1403DL CURSOR Keys and SLEW Control or Keyboard to set SPR:Dv field from **-1.00** to **+1.00** (time deviated from nominal position in 0.05 μ s increments).

P₆ CONTROL (1st:SEQ)

Press S-1403DL 2ND and P4/P6 Keys in sequence to move cursor to C10 Function 02 SEQ P₆ field. Press ON/CAL Key to activate (**CAL**) or deactivate (**OFF**) P₆.

P₆ WIDTH (1st:SEQ)

Use S-1403DL CURSOR Keys, ON/CAL Key and SLEW Control to set P₆:Wd: field as desired. Set to **CAL** for nominal P₆ pulse width (16.25 μ s for short 56-bit data field or 30.25 μ s for long 112-bit data field). Vary P₆ pulse width from **-1.50** to **+1.50** (μ s from nominal width).

P₆ POSITION (1st:SEQ)

Use S-1403DL CURSOR Keys, ON/CAL Key and SLEW Control to set P₆:Dv: field as desired. Set to **CAL** for nominal P₆ leading edge position (3.5 μ s following P₁ leading edge). Set P₆ position from 1.55 to 5.45 μ s following P₁ by setting P₆:Dv: field from **-1.95** to **+1.95** (μ s from nominal position).

STEP PROCEDURE

SPR CONTROL (1st:SEQ)

Press S-1403DL 2ND and SPR Keys in sequence to move cursor to C10 Function 02 SEQ SPR field. Press ON/CAL Key to activate (**ON**) or deactivate (**OFF**) SPR.

SPR POSITION (1st:SEQ)

Use S-1403DL CURSOR Keys, ON/CAL Key and SLEW Control to set SPR:Dv: field as desired. Set to **CAL** for nominal SPR position (1.25 μ s following P₆ leading edge). Set SPR position from 0.25 to 2.25 μ s following P₆ by setting SPR:Dv: field from **-1.00** to **+1.00** (in μ s from nominal position). (All DPSK modulated data shifts accordingly.)

11. If desired, set optional outputs as follows:

PREPULSE OUT

Press S-1403DL 2ND and P PULS Keys in sequence to move cursor to C75 Setup Screen PrePulseOut field. Press S-1403DL ON/CAL Key to activate prepulse through S-1403DL PREPULSE OUT Connector. Use S-1403DL SLEW Control and Keyboard to enter **0** to **260** μ s (time from prepulse leading edge to P₁ leading edge).

C75	SETUP - MISC
AntAEnable:ON	PrePulseOut:253 μ s
AntAModSrc:INT	
AntBModSrc:INT	

STEP PROCEDURE

EXT SYNC OUT

Press S-1403DL 2ND and EX SYN Keys in sequence to move cursor to C73 Setup Screen Enable field. Use S-1403DL CURSOR Keys and ON/CAL Key to set applicable Enable field **ON** for activating external sync pulse through S-1403DL EXT SYNC OUT Connector. Use S-1403DL CURSOR Keys and SLEW Control or Keyboard to set Dv field from **-9.95** to **+9.95** μ s (time from external sync pulse leading edge to P₁ leading edge) (-, P₁ follows external sync; +, external sync follows P₁).

C73	SETUP - EXT SYNC OUT
	ATC ModeS ACS ACL
Enable:	ON OFF OFF OFF
	Dv: -2.25 μ S

SCOPE TRIG OUT

Set scope trigger output through S-1403DL SCOPE TRIG OUT Connector for desired Oscilloscope display. Press S-1403DL C MENU, 7 and 2 Keys in sequence to enter C72 Setup Screen.

C72	SETUP - SCOPE TRIGGER
	ATC ModeS ACS ACL
Enable:	OFF OFF ON OFF
Source:	CAL CAL CAL CAL (in μ S)

Set scope trigger as follows:

- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set Enable field of first interrogation type to **ON**, depending on scope trigger field setting in individual sequence menus if **SEQ** is selected as first interrogation.
- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set Source field of first interrogation type to **CAL** (ATC-1400A controls trigger position) or a numeric value (S-1403DL controls trigger position).

STEP PROCEDURE

- For S-1403DL control, use S-1403DL SLEW Control or Keyboard to delay trigger in μ s following P₁ leading edge of the first ANT A interrogation. For detailed Mode S reply view, set applicable Source field as follows according to the first interrogation type (Maximum field settings are 35 μ s for ATC or 255 μ s for Mode S [SEQ], ACS and ACL):

For **SEQ** (Mode S), P₁-SPR Spacing (1.8 to 7.7 μ s) + expected reply delay (128 μ s) + reply P₁ to desired trigger point (0 to 120 μ s).

For **ACL**, P₁-P₃ Mode Spacing (5 to 25 μ s) + P₃-P₄ spacing (0.05 to 3.95 μ s) + expected reply delay (128 μ s) + reply P₁ to desired trigger point (0 to 120 μ s).

- Set ATC-1400A To/TAC/Td Switch to **To** (first interrogation/reply at ATC-1400A GEN Connector) or **Td** (second interrogation/reply at ATC-1400A XMTR Connector).

Connect S-1403DL UUT XMTR Connector to Oscilloscope for viewing UUT replies at S-1403DL ANT B Connector.

12. Verify UUT replies as follows:

FREQUENCY

Verify UUT transmit frequency on ATC-1400A XMTR FREQ MHz Display.

ACCURACY

For ATCRBS replies, set ATC-1400A DISPLAY SELECT Control to **XPDR CODE**. Verify ATCRBS reply shown on ATC-1400A DISPLAY SELECT Readout.

- Set ATC-1400A XPDR MODE Control to **A** to verify octal ID.
- Set ATC-1400A XPDR MODE Control to **AC₂** to verify altitude in feet.

STEP PROCEDURE

For Mode S replies, press S-1403DL S MENU Key. Use S-1403DL SLEW Control (cursor in S field) to display each active sequence menu. Verify reply data shown in S-1403DL Sequence Menu screens. Use S-1403DL CURSOR Keys and ON/CAL Key to set desired format type in RPLY field (**D** for decoded subfields or **N** for not decoded data). (S-1403DL displays reply data using the radix selected in Step 6.)

View reply pulses on Oscilloscope Channel 2.

REPLY DELAY

Press S-1403DL C MENU and 4 Keys in sequence to display C40 Reply Delay Control Menu. If desired, press S-1403DL CL/ESC Key to reset fields.

If applicable, verify ATCRBS reply delay (P_3 leading edge to F_1 leading edge) in ATC fields. Verify ATC fields indicate **3.0000** μs ($\pm 0.5 \mu s$), Min = $\geq 2.5000 \mu s$ and Max = $\leq 3.5000 \mu s$.

If applicable, verify Mode S reply delay (SPR or P_4 leading edge to P_1 leading edge in reply) in ModeS fields. Verify ModeS fields indicate **128.0000** μs ($\pm 0.5 \mu s$), Min = $\geq 127.5000 \mu s$ and Max = $\leq 128.5000 \mu s$.

NOTE: Invalid reply delay information may result if DI delay set by the ATC-1400A DBL INTERR/INTRF PULSE Thumbwheels causes the following conditions:

- P_1 of second interrogation placed within reply delay range of possible Mode S reply to first interrogation (1st:SEQ, ACS or ACL).

STEP PROCEDURE

- First reply is to second interrogation, but is within the reply delay range of possible Mode S reply to first interrogation (1st:ACS and 2nd:ATC, ACS or ACL).
- P_1 of second interrogation occurs prior to expected ATCRBS reply delay from first interrogation (1st:ATC, ACS or ACL).
- P_1 of second interrogation occurs prior to trailing edge of last pulse in first interrogation.

PERCENT REPLY

Verify percent reply in C10/C20 DI Screen AntA% and AntB% fields.

For detailed percent reply information, press S-1403DL C MENU and 3 Keys in sequence to display C30 Percent Reply Control Menu. If desired, press S-1403DL CL/ESC Key to reset fields.

POWER

Verify UUT power through ANT A (RF I/O Connector) shown on ATC-1400A XMTR PWR WATTS Display. Select reply pulse (only for replies to first interrogation) to measure as follows:

- Set ATC-1400A F_2/P_2 F_1/P_1 Switch to **F_1/P_1** to measure pulse power of F_1 or P_1 reply pulse only.
- Set F_2/P_2 F_1/P_1 Switch to **F_2/P_2** for S-1403DL to control pulse power measurement selection.

Press S-1403DL 2ND and PPG Keys in sequence to display C74 PPMG Setup Screen.

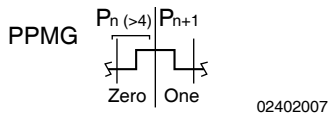
C74	SETUP - PPMG (POWER)
	ATC ModeS DELM
Enable:OFF	ON OFF
Pulse:A1	P24 1

STEP **PROCEDURE**

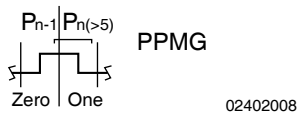
Use S-1403DL CURSOR Keys and SLEW Control to set ATC and ModeS Enable fields to **ON**.
Select one of 16 possible ATCRBS reply pulses for ATC Pulse field.
Select from **1** to **60** (short reply) or **116** (long reply) possible Mode S reply pulses for ModeS Pulse field.

NOTE: The S-1403DL enables the measurement gate prior to the rising edge of the pulse to be measured. Measurement continues until the next falling edge. Adjacent pulses in the pulse position modulated Mode S replies may cause erroneous power readings with conditions as follows:

- If the measurement pulse data is Zero followed by a One, the selected pulse and following pulse are measured together because the following pulse has the first detectable falling edge.



- If the measurement pulse data is One and the preceding pulse data is Zero, the power reading is zero because of not detecting a rising edge.



STEP **PROCEDURE**

13. Verify UUT Mode S squitter information as follows:

INTERVAL

Press S-1403DL 2ND, FUNC#, 0 and 6 Keys in sequence to select DI Screen. Verify interval between squitters in Sqtr field. (normally 0.8 to 1.2 seconds.)

For DF17 type squitter intervals, press S-1403DL C MENU and 6 Keys in sequence to display C60 Squitter (2 of 2) Control Menu.

C60	SQUITTER (2of2)					
DF CA	AA	ME	II	ANT	TIME	
11	4	A07613		0	A	1.00
17I	4	A07613	1A8C9A3124BA53	0	A	10.05

Verify squitter intervals in DF17X PERIOD field according to 1-2-2, Table 3.

ADDRESS

Press S-1403DL C MENU and 5 Keys in sequence to display C50 Squitter (1 of 2) Control Menu. Verify Mode S Address in Addr fields.

C50	SQUITTER (1of2)					
Addr:h=A07613,o=50073023,Tail=N129KS						
Country=United States						
Counts/120s:DF11=110,DF17= 36,DF17S= 24						

INFORMATION

Verify Tail and Country fields.

View squitter fields in hexadecimal: press S-1403DL C MENU and 6 Keys in sequence to display C60 Squitter (2 of 2) Control Menu. Use S-1403DL CURSOR Keys and ON/CAL Key to set DF17 type (**A, I, O, P, S** or **T**). Refer to 1-2-2, Table 4.

2.7.3 General Test Sequence

Refer to 1-2-2, Figure 9.

SIGNAL	DESCRIPTION
1. Self Interr In (if selected)	Active low pulse from the ATC-1400A triggers the interrogation process (C71 Interrogation Trigger Setup Screen Trig Source field set to SelfInterr). The self interrogate pulse rising edge occurs 17.95 μ s prior to leading edge of the ATCRBS interrogation P ₁ or prepulse (when enabled). The S-1403DL receives the self interrogate pulse through the AUXILIARY Connector (J10).
2. Ext Sync In (if selected)	Active high pulse occurs 17.95 prior to leading edge of P ₁ or prepulse (when enabled). The S-1403DL receives the pulse through the EXT SYNC IN Connector (J4). The external sync input replaces the self interrogate input in triggering the interrogation process (C71 Interrogation Trigger Setup Screen Trig Source field set to ExtSyncln).
3. Prepulse Out (when enabled)	Active high pulse, 1.0 μ s wide, occurs 17.95 μ s after the sync pulse rising edge (self interrogate, external sync input or internal trigger generator) and 0 to 260 μ s, as selected, prior to the first interrogation P ₁ leading edge. The S-1403DL transmits the prepulse through the PREPULSE OUT Connector (J9).
4. Ext Sync Out (when enabled)	Active high pulse, 1.0 μ s wide, occurs from -9.95 to +9.95 μ s, as selected, relative to the first interrogation P ₁ leading edge. The S-1403DL transmits the pulse through the EXT SYNC OUT Connector (J8).

SIGNAL	DESCRIPTION
5. Scope Trig Out	<p>The S-1403DL transmits the active high scope trigger pulse through the SCOPE TRIG OUT Connector (J7). Position, referenced to ANT A interrogations, depends on the ATC-1400A To/TAC/Td Switch setting:</p> <ul style="list-style-type: none"> ● To (for viewing first interrogations and replies) <p>Leading edge occurs 1.0 μs prior to P₁ leading edge of the first interrogation and trailing edge occurs 1.0 μs prior to F₁ or P₁ leading edge of the expected reply.</p> ● Td (for viewing second interrogations and replies) <p>Leading edge occurs 1.0 μs prior to P₁ leading edge of the second interrogation and trailing edge occurs 1.0 μs prior to F₁ or P₁ leading edge of the expected reply.</p>
6. ATCRBS Out (1st:ATC, ACS or ACL)	Active low pulse, 3.0 μ s wide, occurs 1.0 μ s prior to P ₁ leading edge of the first interrogation. The S-1403DL transmits the pulse through the ATCRBS OUT Connector (J5).
7. ANT B (when enabled)	Active high ANT B interrogation pulses modulate RF transmitted through the S-1403DL ANT B Connector (J2). The S-1403DL offsets P ₁ leading edge of the ANT B interrogation from P ₁ leading edge of the ANT A interrogation according to the AntB field setting in the C10/C20 ATC Screen. ANT B and ANT A pulse characteristics are the same except for pulse level.

SIGNAL	DESCRIPTION
--------	-------------

8. $\overline{\text{Ext Pulse}}$

Active low pulses transmitted through the S-1403DL AUXILIARY Connector (J10) modulate the ATC-1400A RF output to provide the interrogation pulses. The second interrogation follows P_1 leading edge of the first interrogation according to the ATC-1400A DBL INTERR/INTRF Thumbwheels setting in μs .

9. $\overline{\text{Ext SLS}}$ (when enabled)

Active low gate pulse enables ATC-1400A SLS/ECHO Thumbwheels to control the level of P_2 (SLS) depending on the ATC-1400A SLS/ECHO ON/OFF Switch position.

10. DPSK Out (1st:SEQ or 2nd:SEQ)

The DPSK output contains the uplink format data information used to modulate the ANT A interrogation signal. The data constantly changes according to the uplink formats selected for the interrogation sequence. Refer to Step 8 of DI Function Procedure (2.7.2 in 1-2-2). The S-1403DL transmits the DPSK modulation through the DPSK OUT Connector (J15) to the ATC-1400A.

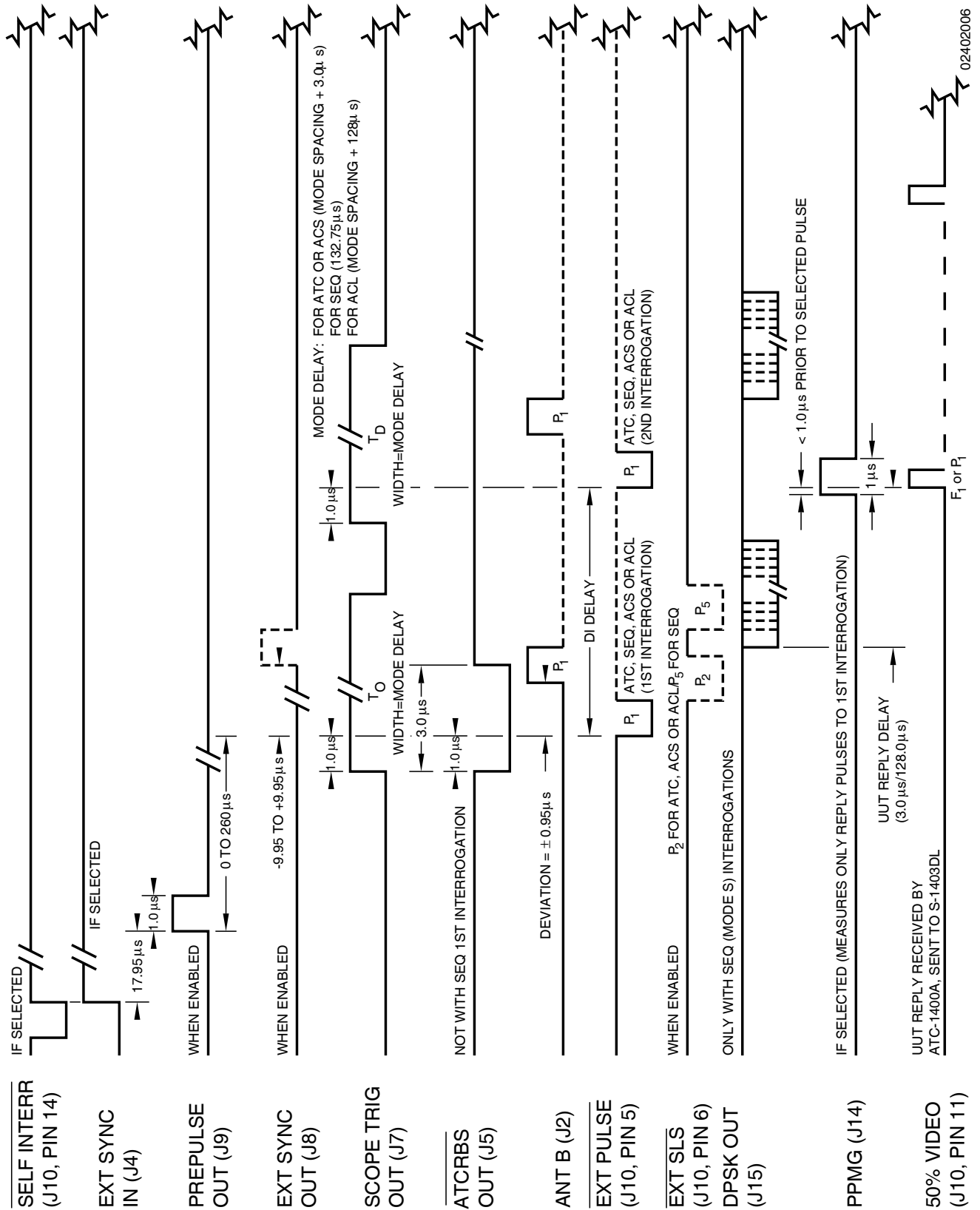
11. PPMG (if selected)

The pulse power measurement gate (PPMG) occurs $<1.0 \mu\text{s}$ prior to the leading edge of the selected reply pulse to the first interrogation. The S-1403DL transmits the PPMG pulse through the PPMG Connector (J14) to the ATC-1400A.

NOTE: The ATC-1400A ignores PPMG if the ATC-1400A F_2/P_2 F_1/P_1 Switch is set to F_1/P_1 .

12. 50% Video

The Mode S Test System receives the UUT reply video through ANT A (ATC-1400A RF I/O Connector). The ATC-1400A sends the reply video to the S-1403DL through the AUXILIARY Connector (J10).



02402006

DI Function Timing Diagram
Figure 9

2.8 BURST FUNCTION

2.8.1 Description

In the Burst Function, the Mode S Test System transmits a certain number of interrogations for a specified time period. The Mode S Test System uses the Burst Function to verify the reply rate capability of the transponder against specifications listed in RTCA DO-181.

2.8.2 Procedure

STEP	PROCEDURE
------	-----------

1. Connect test equipment according to 1-2-2, Figure 2.
2. Apply power to Mode S Test System.
3. Press S-1403DL 2ND, FUNC#, 0 and 7 Keys in sequence to select Burst Screen. If necessary, use S-1403DL CURSOR Keys and SLEW Control to set menu to **C10**.

```
C10 f07: BURST; SEQ: 400 Arf: +0.8
P6: CAL, Wd: +0.00, Dv: +0.00 P2: CAL
SPR: ON, Dv: +0.00 Dly: 128.0000 Sqtr: 1.00
AntA%: ATC= 0, S= 95 AntB%= 90 AntB: +.90
```

4. Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set interrogation type to **ATC** (ATCRBS), **SEQ** (Mode S interrogations set in sequence menus), **ACS** (ATCRBS Only All Call) or **ACL** (ATCRBS/ Mode S All Call).
5. Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to enter Burst Number (BN) (ATC:, SEQ:, ACS: or ACL: field). (The Burst Number sets the number of interrogations sent out in a single BURST activation.) Set BN according to 1-2-2, Tables 6 and 7 for testing RTCA DO-181 reply rate requirements.

REPLY RATE TEST	RATIO/FORMAT	BN	PRF
60/s	2 Shorts/1 Long	60	60
120/100 ms	≤10 unique UF16	120	1200

TCAS Reply Rate Testing
Table 6

STEP	PROCEDURE
------	-----------

REPLY RATE TEST	MESSAGE RATIO	BN	PRF
50/s	2 Shorts/1 Long	50	50
18/100 ms	2 Shorts/1 Long	18	180
8/25 ms	1 Short/1 Long	8	400
4/1.6 ms	1 Short/1 Long	4	2500

Mode S Reply Rate Testing
Table 7

- If using Mode S interrogations (**SEQ**), set sequence menus according to Steps 6 through 8 prior to selecting **SEQ** as interrogation type. If using only **ATC**, **ACS** or **ACL**, go to Step 9.
6. Press S-1403DL C MENU, 7 and 6 Keys to display C76 SMENU Setup Screen. Set as follows:

- Use S-1403DL CURSOR Keys and ON/CAL Key to set SmenuRadix to desired data format (**HEX** [hexadecimal] or **OCTAL**).
- Use S-1403DL CURSOR, ON/CAL and ENTER Keys for changing SetAllSmenu to **OFF** (deactivates all sequence menus), **DEFAULT** (activates/resets default sequence menus, deactivates all others) or **ZERO** (sets all fields except ADDR to 0). Refer to 1-1-2, Table 5 for default sequence menus.

Use S-1403DL ON/CAL and ENTER Keys to set ADDR in all sequence menus by changing SetAllSmenu to **XPDR** (transponder address) or **USER** (address from User= field).

- Use S-1403DL CURSOR Keys and SLEW Control to set alternate addresses (GlobalAddr:User=) and parity (AP XOR=) fields as desired for checking operation with bogus addresses or bad AP fields.

```
C76 SETUP - SMENU
SmenuRadix: OCTAL SetAllSmenu: DEFAULT
GlobalAddr: Xpdr=17725762, AP XOR=00000000
GlobalAddr: User=10273645, AP XOR=00000001
```

STEP	PROCEDURE
7.	Press S-1403DL S MENU Key to display Mode S Sequence Menu.

```
S001:D;UF00,RL=0,CL=0,AQ=0,
+                               ADDR=17725762
RPLY:D;DF00,VS=0,SL=0,RI=00,AC=+ 31200,
                               ADDR=17725762
```

8. Set interrogation sequence as follows:

ACTIVATION

Press S-1403DL ON/CAL Key to activate or deactivate sequence menu.

NOTE: Each Mode S interrogation sequence uses the same active sequence menus starting with the first active sequence menu. If SEQ: value is less than number of active sequence menus, the sequence continuously starts over running through the active sequence menus until the BURST sequence finishes.

FORMAT

Use S-1403DL CURSOR Keys and ON/CAL Key to select format type for active sequence menu. Set to **S** (short 56-bit transmission), **L** (long 112-bit transmission) or **D** (decoded, used only for uplink formats with defined subfields). Program using formats and requests for replies containing short and long messages according to 1-2-2, Tables 6 and 7, for testing reply rate requirements.

UPLINK FORMAT

Use S-1403DL CURSOR Keys and SLEW Control or Keyboard to select desired uplink format.

DATA FIELDS

Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to load data fields according to Appendix D. Refer to Appendix B for defined fields and 1-2-2, Table 5 for converting data.

STEP	PROCEDURE
9.	Set test parameters as follows:

MODE SELECTION

If **ATC**, **ACS** or **ACL** was selected as interrogation type in Step 4, use ATC-1400A XPDR MODE Control to select interrogation mode (**1**, **2**, **T**, **A**, **B**, **C** or **D**).

FREQUENCY

Adjust ATC-1400A FREQ/FUNCTION Thumbwheels and ΔF Thumbwheels to set interrogation RF from **952.01** to **1222.99** MHz. Set to **1030** MHz for normal operation.

RF LEVEL

Adjust ATC-1400A RF LEVEL Control to set RF LEVEL -dBm Display from **127** (-127 dBm) to **0** (0 dBm). Normal operating range is -69 to -21 dBm. Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set Arf field from **-3.0** to **+3.0** in dB to offset cable loss and/or other external factors. Press S-1403DL ENTER Key.

INTERROGATION RATE

Press S-1403DL C MENU, 7 and 1 Keys in sequence to enter C71 Interrogation Trigger Setup Screen.

```
C71  SETUP - INTERROGATION TRIGGER
TrigSource:TrigGen
TrigGen:      450Hz
```

Set interrogation rate or pulse repetition frequency (PRF) one of two ways as follows:

- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set TrigSource to **TrigGen** and TrigGen from **1** to **2500 Hz**.

STEP PROCEDURE

- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set TrigSource to **SelfInterr**. Adjust ATC-1400A PRF/SQTR Thumbwheels to set PRF from **0** to **7999** for ATC or ACS interrogations. Set from **0** to **2500** for ACL or SEQ (Mode S) interrogations.

For specific reply rate requirements, set PRF according to 1-2-2, Tables 6 and 7.

INTERFERENCE PULSE

Set ATC-1400A DBL INTERR/INTRF PULSE Thumbwheels from **017.5 INTERF-** to **399.9 INTERF+** to enable and position interference pulse at -17.5 to +399.9 μ s from leading edge of P₁ or prepulse, if active.

- Set level from -19 to +6 dB (relative to P₁) using ATC-1400A SLS/ECHO Thumbwheels.
- Set width from 0.2 to 5 μ s using ATC-1400A INTRF PULSE WIDTH Control.

SUPPRESSOR PULSE

Connect ATC-1400A SUPPRESSOR OUTPUT Connector to UUT suppressor input. Set ATC-1400A SUPPRESSOR ON/OFF Switch to **ON** to activate 33 μ s wide (fixed) suppressor pulse.

- Adjust level from 3 to 27 V using ATC-1400A SUPPRESSOR VAR Adjustment.
- Set ATC-1400A DBL INTERR/INTRF PULSE Thumbwheels to **OFF** to position suppressor pulse 0.8 μ s before P₃. Set DBL INTERR/INTRF PULSE Thumbwheels from **017.5 INTERF-** to **399.9 INTERF+** to adjust suppressor pulse position from -17.5 to +399.9 μ s relative to P₁. (Suppressor pulse replaces interference pulse when both are activated.)

STEP PROCEDURE

ANT B

Press S-1403DL 2ND and ANT B Keys in sequence to move cursor to AntB field. Press S-1403DL ON/CAL Key to activate interrogations through ANT B Connector. Use SLEW Control and Keyboard to enter value from **-0.95** to **+0.95** (offset in 0.05 μ s increments from ANT A interrogations). Without the Multi-Level Diversity (MLD) option, ANT B output level is -50 dBm.

If MLD is installed, set ANT B output level. Use S-1403DL CURSOR Keys and SLEW Control to set menu to C20. Use CURSOR Keys to select Brf fields. Use SLEW Control and Keyboard to set first field from **-80** to **-20** dBm and second field from **-3.0** to **+3.0** dB (used to offset cable loss).

10. Set pulse characteristics according to interrogation type as follows:

PULSE WIDTH

Set ATC-1400A XPDR PULSE WIDTH VAR/CAL Switch to **CAL** for 0.8 μ s nominal width of P₁, P₂ (if activated) and P₃ (if activated and applicable) interrogation pulses. Set XPDR PULSE WIDTH VAR/CAL Switch to **VAR** and use ATC-1400A XPDR PULSE WIDTH Thumbwheels to adjust width from **0.20** to **1.85** μ s.

P₂ LEVEL (SEQ)

Set ATC-1400A SLS/ECHO ON/OFF Switch to **OFF**. Press S-1403DL 2ND and P2 Keys in sequence to move cursor to C10 Function 07 BURST P2 field. Press S-1403DL ON/CAL Key to set P2 to **VAR**. Set P2 level using ATC-1400A SLS/ECHO Thumbwheels. Adjust level from **-19** to **+6** dB, relative to P₁ level. **0** dB is normal operating level (P2:**CAL**). For P2 deactivation, press S-1403DL ON/CAL Key to set P2 to **OFF**.

STEP	PROCEDURE	STEP	PROCEDURE
	<p>P₂ POSITION (SEQ)</p> <p>Set ATC-1400A XPDR DEV P₂/CAL Switch to CAL for nominal P₂ position of 2.0 μs following P₁ leading edge. Set ATC-1400A XPDR DEV P₂/CAL Switch to -Δ or +Δ and adjust ATC-1400A XPDR P₂/P₃ DEV Thumbwheels from 0.00 to 1.85 to set position from 0.15 to 3.85 μs following P₁ leading edge.</p> <p>P₂ (SLS) LEVEL (ATC, ACS or ACL)</p> <p>Set ATC-1400A SLS/ECHO ON/OFF Switch to ON. Set P₂ (SLS) level using ATC-1400A SLS/ECHO Thumbwheels. Adjust level from -19 to +6 dB, relative to P₁ level. Verify suppression occurs when P₂ level is ≥P₁ level. Verify suppression does not occur when P₂ level exceeds P₁ level by ≥9 dB.</p> <p>P₂ (SLS) POSITION (ATC, ACS or ACL)</p> <p>Set ATC-1400A XPDR DEV P₂/CAL Switch to CAL for nominal P₂ (SLS) position of 2.0 μs following P₁ leading edge. Set XPDR DEV P₂/CAL Switch to -Δ or +Δ and adjust ATC-1400A XPDR P₂/P₃ DEV Thumbwheels from 0.00 to 1.85 to set position from 0.15 to 3.85 μs following P₁ leading edge.</p> <p>P₃ LEVEL (ATC, ACS or ACL)</p> <p>Set ATC-1400A SLS/ECHO ON/OFF Switch to OFF. Press S-1403DL 2ND and P₃ Keys in sequence to move cursor to C10 Function 07 BURST P₃ field. Press S-1403DL ON/CAL Key to set P₃ to VAR. Set P₃ level using ATC-1400A SLS/ECHO Thumbwheels. Adjust level from -19 to +6 dB, relative to P₁ level. 0 dB is normal operating level (P₃:CAL). For P₃ deactivation, press S-1403DL ON/CAL Key to set P₃ to OFF.</p>		<p>P₃ POSITION (ATC, ACS or ACL)</p> <p>Set ATC-1400A XPDR DEV P₃/CAL Switch to CAL for nominal P₃ position. Refer to Appendix E for nominal position. Set ATC-1400A XPDR DEV P₃/CAL Switch to -Δ or +Δ and adjust ATC-1400A XPDR P₂/P₃ DEV Thumbwheels from 0.00 to 1.85 to deviate position -1.85 to +1.85 μs from nominal.</p> <p>P₄ LEVEL (ACS or ACL)</p> <p>Set ATC-1400A SLS/ECHO ON/OFF Switch to OFF. Press S-1403DL 2ND and P₄/P₆ Keys in sequence to move cursor to C10 Function 07 BURST P₄ field. Press S-1403DL ON/CAL Key to set P₄ to VAR. Set P₄ level using ATC-1400A SLS/ECHO Thumbwheels. Adjust level from -19 to +6 dB, relative to P₁ level. 0 dB is normal operating level (P₄:CAL). For P₄ deactivation, press S-1403DL ON/CAL Key to set P₄ to OFF.</p> <p>P₄ WIDTH (ACS or ACL)</p> <p>Use S-1403DL CURSOR Keys, ON/CAL Key and SLEW Control to set P₄:Wd: field as desired. Set to CAL for nominal P₄ pulse width (0.8 μs for ACS, 1.6 μs for ACL). Vary P₄ pulse width by setting P₄:Wd: field in 0.05 μs increments from nominal width. Vary P₄ pulse width from 0.2 to 3.55 μs by setting P₄:Wd: field from -0.60 to +1.95 for ACS or from -1.40 to +1.95 for ACL.</p> <p>NOTE: Setting P₄ wider than 1.5 μs turns an ACS to an ACL. Setting P₄ width <1.2 μs turns an ACL to an ACS. ACS interrogations require P₄ width <1.2 μs. ACL interrogations require P₄ width >1.5 μs.</p>

STEP PROCEDURE

P4 POSITION (ACS or ACL)

Use S-1403DL CURSOR Keys, ON/CAL Key and SLEW Control to set P4:Dv: field as desired. Set to **CAL** for nominal P4 leading edge position (2.0 μs following P3 leading edge). Set P4 position from 0.05 to 3.95 μs following P3 by setting P4:Dv: field from **-1.95** to **+1.95** (μs from nominal position).

P5 (SLS) LEVEL (SEQ)

Set ATC_1400A SLS/ECHO ON/OFF Switch to **ON**. Set P5 (SLS) level using ATC-1400A SLS/ECHO Thumbwheels. Adjust level from **-19** to **+6** dB, relative to P1 level. Verify suppression occurs when P5 level exceeds P6 level by 3 dB or more. Verify suppression does not occur when P6 level exceeds P5 level by 12 dB or more.

P5 (SLS) POSITION (SEQ)

Adjust P5 (SLS) position by changing SPR position (center of P5 tracks SPR). Use S-1403DL CURSOR Keys and SLEW Control or Keyboard to set SPR:Dv field from **-1.00** to **+1.00** (time deviated from nominal position in 0.05 μs increments).

P6 CONTROL (SEQ)

Press S-1403DL 2ND and P4/P6 Keys in sequence to move cursor to C10 Function 02 SEQ P6 field. Press ON/CAL Key to activate (**CAL**) or deactivate (**OFF**) P6.

P6 WIDTH (SEQ)

Use S-1403DL CURSOR Keys, ON/CAL Key and SLEW Control to set P6:Wd: field as desired. Set to **CAL** for nominal P6 pulse width (16.25 μs for short 56-bit data field or 30.25 μs for long 112-bit data field). Vary P6 pulse width from **-1.50** to **+1.50** (μs from nominal width).

STEP PROCEDURE

P6 POSITION (SEQ)

Use S-1403DL CURSOR Keys, ON/CAL Key and SLEW Control to set P6:Dv: field as desired. Set to **CAL** for nominal P6 leading edge position (3.5 μs following P1 leading edge). Set P6 position from 1.55 to 5.45 μs following P1 by setting P6:Dv: field from **-1.95** to **+1.95** (μs from nominal position).

SPR CONTROL (SEQ)

Press S-1403DL 2ND and SPR Keys in sequence to move cursor to C10 Function 02 SEQ SPR field. Press ON/CAL Key to activate (**ON**) or deactivate (**OFF**) SPR.

SPR POSITION (SEQ)

Use S-1403DL CURSOR Keys, ON/CAL Key and SLEW Control to set SPR:Dv: field as desired. Set to **CAL** for nominal SPR position (1.25 μs following P6 leading edge). Set SPR position from 0.25 to 2.25 μs following P6 by setting SPR:Dv: field from **-1.00** to **+1.00** (in μs from nominal position). (All DPSK modulated data shifts accordingly.)

11. If desired, set optional outputs as follows:

PREPULSE OUT

Press S-1403DL 2ND and P PULS Keys in sequence to move cursor to C75 Setup Screen PrePulseOut field. Press S-1403DL ON/CAL Key to activate prepulse through S-1403DL PREPULSE OUT Connector. Use S-1403DL SLEW Control and Keyboard to enter **0** to **260** μs (time from prepulse leading edge to P1 leading edge).

```
C75                      SETUP - MISC
AntAEnable:ON                      PrePulseOut: 10μs
AntAModSrc:INT
AntBModSrc:INT
```


STEP PROCEDURE

EXT SYNC OUT

Press S-1403DL 2ND and EX SYN Keys in sequence to move cursor to C73 Setup Screen Enable field. Use S-1403DL CURSOR Keys and ON/CAL Key to set applicable Enable field **ON** for activating external sync pulse through S-1403DL EXT SYNC OUT Connector. Use S-1403DL CURSOR Keys and SLEW Control or Keyboard to set Dv field from **-9.95** to **+9.95** μ s (time from external sync pulse leading edge to P₁ leading edge) (-, P₁ follows external sync; +, external sync follows P₁).

C73	SETUP - EXT SYNC OUT
	ATC ModeS ACS ACL
Enable:	ON OFF OFF OFF
	Dv: -2.25 μ S

SCOPE TRIG OUT

Set scope trigger output through S-1403DL SCOPE TRIG OUT Connector for desired Oscilloscope display. Press S-1403DL C MENU, 7 and 2 Keys in sequence to enter C72 Setup Screen.

C72	SETUP - SCOPE TRIGGER
	ATC ModeS ACS ACL
Enable:	OFF ON ON OFF
Source:	CAL CAL CAL CAL (in μ S)

Set scope trigger as follows:

- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set Enable field of interrogation type to **ON**.
- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set Source field of interrogation type to **CAL** (ATC-1400A controls trigger position) or a numeric value (S-1403DL controls trigger position).

STEP PROCEDURE

- For S-1403DL control, use S-1403DL SLEW Control or Keyboard to delay trigger in μ s following P₁ leading edge of the first ANT A interrogation. For detailed Mode S reply view, set applicable Source field as follows according to the interrogation type selected in Step 4 (Maximum field settings are ATC:35 μ s or 255 μ s for Mode S [SEQ], ACS and ACL):

For **SEQ**, P₁-SPR Spacing (1.8 to 7.7 μ s) + expected reply delay (128 μ s) + reply P₁ to desired trigger point (0 to 120 μ s).

For **ACL**, P₁-P₃ Mode Spacing (5 to 25 μ s) + P₃-P₄ spacing (0.05 to 3.95 μ s) + expected reply delay (128 μ s) + reply P₁ to desired trigger point (0 to 120 μ s).

- Set ATC-1400A To/TAC/Td Switch to **To** (interrogation at ATC-1400A GEN Connector) or **Td** (reply at ATC-1400A XMTR Connector).

Connect S-1403DL UUT XMTR Connector to Oscilloscope for viewing UUT replies at S-1403DL ANT B Connector.

12. Press S-1403DL BURST Key to activate Burst function, transmitting specified interrogation sequence.
13. Verify UUT replies as follows:

FREQUENCY

Verify UUT transmit frequency on ATC-1400A XMTR FREQ MHz Display.

STEP PROCEDURE

ACCURACY

For ATCRBS replies, set ATC-1400A DISPLAY SELECT Control to **XPDR CODE**. Verify ATCRBS reply shown on ATC-1400A DISPLAY SELECT Readout.

- Set ATC-1400A XPDR MODE Control to **A** to verify octal ID.
- Set ATC-1400A XPDR MODE Control to **AC₂** to verify altitude in feet.

For Mode S replies, press S-1403DL S MENU Key. Use S-1403DL SLEW Control (cursor in S field) to display each active sequence menu. Verify reply data shown in S-1403DL Sequence Menu screens. Use S-1403DL CURSOR Keys and ON/CAL Key to set desired format type in RPLY field (**D** for decoded subfields or **N** for not decoded data). (S-1403DL displays reply data using the radix selected in Step 6.)

View reply pulses on Oscilloscope Channel 2.

REPLY DELAY

Press S-1403DL 2ND, FUNC#, 0 and 7 Keys in sequence to select Burst Screen. Verify reply delay in Dly field.

For ATCRBS replies, verify Dly field indicates 3.000 μ s ($\pm 0.5 \mu$ s) reply delay (P₃ leading edge to F₁ leading edge).

For Mode S replies, verify Dly field indicates 128.000 μ s ($\pm 0.5 \mu$ s) reply delay (SPR or P₄ leading edge to P₁ leading edge in reply).

For detailed reply delay information, press S-1403DL C MENU and 4 Keys in sequence to display C40 Reply Delay Control Menu. If desired, press S-1403DL CL/ESC Key to reset fields.

STEP PROCEDURE

PERCENT REPLY

Verify percent reply in C10/C20 Burst Screen AntA% and AntB% fields.

For detailed percent reply information, press S-1403DL C MENU and 3 Keys in sequence to display C30 Percent Reply Control Menu. If desired, press S-1403DL CL/ESC Key to reset fields.

NOTE: The S-1403DL measures percent reply for the total number of Burst interrogations.

14. Verify UUT Mode S squitter information as follows:

INTERVAL

Press S-1403DL 2ND, FUNC#, 0 and 7 Keys in sequence to select Burst Screen. Verify interval between squitters in Sqtr field. (Normally 0.8 to 1.2 seconds.)



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2.9 TEST MENU TESTS

2.9.1 MTL Test

STEP	PROCEDURE
1.	Connect test equipment according to 1-2-2, Figure 2.
2.	Apply power to Mode S Test System.
3.	Press S-1403DL C MENU, 7 and 1 Keys in sequence to display C71 Interrogation Trigger Setup Screen.

```
C71  SETUP - INTERROGATION TRIGGER
TrigSource:TrigGen
TrigGen:    100Hz
```

Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set TrigSource to **SelfInterr**, **TrigGen** or **ExtSyncln**.

Set PRF for selected source ≥ 100 Hz (500 to 1000 Hz for ATC).

For **SelfInterr**, set ATC-1400A PRF/SQTR Thumbwheels.

For **TrigGen**, set TrigGen field.

For **ExtSyncln**, adjust external device PRF through S-1403DL EXT SYNC IN Connector.

NOTE: The higher the PRF, the quicker the MTL Test runs.

4.	Press S-1403DL C MENU, 1 and 0 Keys in sequence to display C10 Control Menu.
----	--

Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set function field to **f01:ATC**, **f02:SEQ**, **f03:ACS** or **f04:ACL**.

If using Mode S Sequence function (**SEQ**), set sequence menus according to Steps 6 through 8 prior to setting C10 Control Menu to **f02:SEQ**. Otherwise, go to Step 8.

STEP	PROCEDURE
5.	Press S-1403DL C MENU, 7 and 6 Keys to display C76 SMENU Setup Screen. Set as follows:

- Use S-1403DL CURSOR Keys and ON/CAL Key to set SmenuRadix to desired data format (**HEX** [hexadecimal] or **OCTAL**).
- Use S-1403DL CURSOR, ON/CAL and ENTER Keys for changing SetAllSmenu to **OFF** (deactivates all sequence menus), **DEFAULT** (activates/resets default sequence menus, deactivates all others) or **ZERO** (sets all fields except ADDR to 0). Refer to 1-1-2, Table 5 for default sequence menus.

Use S-1403DL ON/CAL and ENTER Keys to set ADDR in all sequence menus by changing SetAllSmenu to **XPDR** (transponder address) or **USER** (address from User= field).

- Use S-1403DL CURSOR Keys and SLEW Control to set alternate addresses (GlobalAddr:User=) and parity (AP XOR=) fields as desired for checking operation with bogus addresses or bad AP fields.

```
C76  SETUP - SMENU
SmenuRadix:OCTAL  SetAllSmenu:DEFAULT
GlobalAddr:Xpdr=17725762,AP XOR=00000000
GlobalAddr:User=10273645,AP XOR=00000001
```

6.	Press S-1403DL S MENU Key to display Mode S Sequence Menu.
----	--

```
S001:D;UF00,RL=0,CL=0,AQ=0,
+ ADDR=17725762
RPLY:D;DF00,VS=0,SL=0,RI=00,AC+= 31200,
ADDR=17725762
```

STEP PROCEDURE

7. Set interrogation sequence as follows:

ACTIVATION

Press S-1403DL ON/CAL Key to activate or deactivate sequence menu.

FORMAT

Use S-1403DL CURSOR Keys and ON/CAL Key to select format type for active sequence menu. Set to **S** (short 56-bit transmission), **L** (long 112-bit transmission) or **D** (decoded, used for formats with defined fields).

UPLINK FORMAT

Use S-1403DL CURSOR Keys and SLEW Control or Keyboard to select desired uplink format.

DATA FIELDS

Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to load data fields according to Appendix D. Refer to Appendix B for defined fields and 1-2-2, Table 5 for converting data.

Go to Step 9.

8. If **ATC**, **ACS** or **ACL** was selected as operating function in Step 5, set ATC-1400A XPDR MODE Control to **A** or **C**.

9. Press S-1403DL 2ND, T MENU, 2 and 3 Keys in sequence to display Miscellaneous MTL Test Menu Screen.

T23	MISC - MTL	PASS
Reply%:100	Time:25sec	MTL:-65.7dBm
Antenna:B	Error: 2=Pass	

STEP PROCEDURE

10. If MLD option is installed, use S-1403DL CURSOR Keys, SLEW Control and Keyboard to select Antenna **A** or **B** (otherwise Antenna A is only selection).

11. Press S-1403DL BURST Key to initiate test.

12. After completion (test has 99 second limit to find MTL) or pressing S-1403DL CL/ESC Key to stop test, verify status field on the right side of the top line and ERROR field. Refer to 1-2-2, Table 8.

#	ERROR	DESCRIPTION
3	High RF Check Fail	<90% (ATCRBS and all calls) or <99% (Mode S) reply at ≥-21 dBm.
4	Low RF Check Fail	>10% reply at <-81 dBm.
5	MTL Too High	Found MTL >-69 dBm (ATCRBS and all calls) or >-71 dBm (Mode S).
6	MTL Too Low	Found MTL <-77 dBm.
7	MTL+3dB Check Fail	Found MTL, but <90% (ATCRBS and all calls) or <99% (Mode S) reply at MTL+3dB.
8	Can't find MTL	Can't find MTL or MTL not stable.
9	User Aborted Test	Test stopped by user.

MTL Error Codes
Table 8

Before accepting tests resulting in errors, verify test interrogations are set correctly and check percent reply under normal conditions.

2.9.2 ELM Tests

- | STEP | PROCEDURE |
|------|--|
| 1. | Connect test equipment according to 1-2-2, Figure 2. |
| 2. | Apply power to Mode S Test System. |
| 3. | Press S-1403DL C MENU, 7 and 1 Keys in sequence to display C71 Interrogation Trigger Setup Screen. |

```
C71  SETUP - INTERROGATION TRIGGER
TrigSource:TrigGen
TrigGen:      10Hz
```

Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set TrigSource to **SelfInterr**, **TrigGen** or **ExtSyncln**.

Set PRF for selected source to 10 Hz.

For **SelfInterr**, set ATC-1400A PRF/SQTR Thumbwheels.

For **TrigGen**, set TrigGen field.

For **ExtSyncln**, adjust external device PRF through S-1403DL EXT SYNC IN Connector.

- | | |
|----|---|
| 4. | Press S-1403DL 2ND, T MENU, 3 and 1 Keys in sequence to display ELM Setup Screen. |
|----|---|

```
T31  ELM - SETUP
ResrvDelay: 100µs
CloseDelay: 100µs
UelmSpacing: 100µs
```

Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set fields as desired. Refer to 1-2-2, Figures 10 and 11.

- | | |
|----|---|
| 5. | For power measurements, set Mode S Test System as follows: <ul style="list-style-type: none"> ● Set ATC-1400A F₂/P₂ F₁/P₁ Switch to F₁/P₁ to measure pulse power of P₁ reply pulse only or F₂/P₂ for S-1403DL to control pulse power measurement selection. |
|----|---|

- | STEP | PROCEDURE |
|------|--|
| ● | If ATC-1400A F ₂ /P ₂ F ₁ /P ₁ Switch is set to F₂/P₂ , press S-1403DL 2ND and PPG Keys in sequence to display C74 PPMG Setup Screen. |

```
C74  SETUP - PPMG (POWER)
      ATC  ModeS  DELM
Enable:ON  ON     ON
Pulse:F1  P100   1
```

Use S-1403DL CURSOR Keys and SLEW Control to set ModeS Enable field to **ON**. Select from **1** to **116** possible Mode S reply pulses for ModeS Pulse field.

If conducting DELM testing, set DELM field to **ON** and DELM Pulse field from **1** to **16** to select desired reply segment.

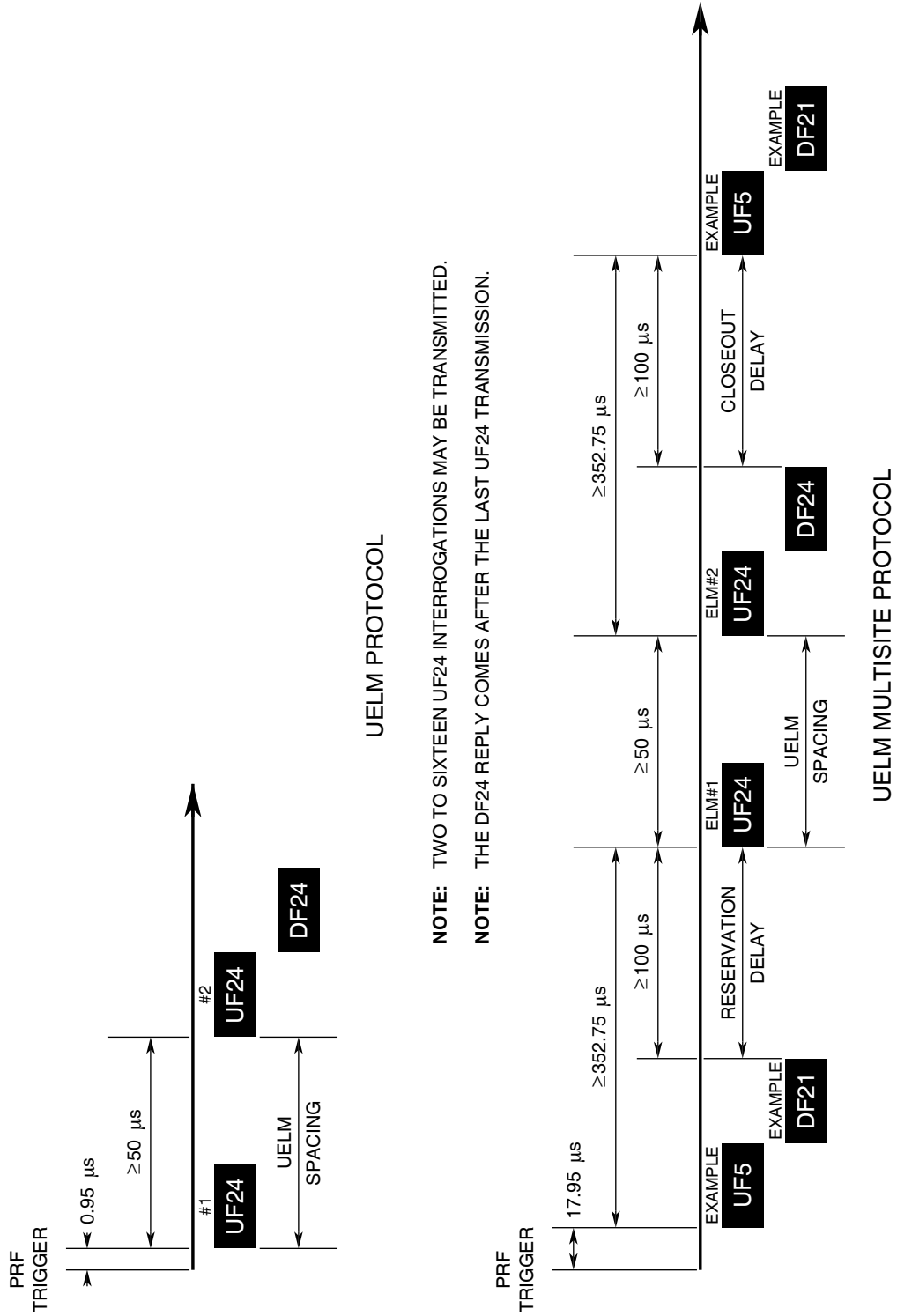
- | | |
|----|--|
| 6. | Press S-1403DL C MENU, 7 and 6 Keys to display C76 SMENU Setup Screen. |
|----|--|

```
C76  SETUP - SMENU
SmenuRadix:OCTAL  SetAllSmenu:XPDR
GlobalAddr:Xpdr=17725762,AP XOR=00000000
GlobalAddr:User=10273645,AP XOR=00000001
```

Set as follows:

- Use S-1403DL CURSOR Keys and ON/CAL Key to set SmenuRadix to desired data format (**HEX** [hexadecimal] or **OCTAL**).
 - Use S-1403DL ON/CAL and ENTER Keys for changing SetAllSmenu, setting ADDR field in all currently active sequence menus, to **XPDR** (transponder address for normal operation).
- | | |
|----|--|
| 7. | Press S-1403DL 2ND, T MENU, 3 and 0 Keys in sequence to display ELM Test Menu. |
|----|--|

```
T30  ELM MENU
1)          4)DELM          7)
2)UELML    5)DELM-MULTI  8)
3)UELML-MULTI 6)          9)
```



UEL M Sample Timing Diagrams
Figure 10

STEP **PROCEDURE**

8. For UELM Singlesite operation, continue with Step 9. For UELM Multisite operation, go to Step 14. For DELM Singlesite operation, go to Step 19. For DELM Multisite operation, go to Step 24.

UEL M Singlesite

9. Press S-1403DL 2 Key to display T32 UELM Test Screen.

T32	ELM - UP	PASS
	ELM XMT	ERROR
	S415-419 5	2=Pass
	Press BURST to start test	

Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to select Sequence Menu for ELM data.

- Set ELM field to desired Sequence Menu for first ELM segment.
- Set XMT field to number of desired Comm-C message segments to be transmitted (automatically setting second ELM field to Sequence Menu for last ELM segment).

10. Press S-1403DL S MENU and applicable number Keys to display Sequence Menu for first ELM segment.

S415:D;UF24,RC=0,NC=04,MC=71000000000000	ADDR=17725762
+ 00000000000000,	
RPLY:D;	
*** No Reply ***	

- If OFF, press S-1403DL ON/CAL Key to activate Sequence Menu.
- Refer to section 9 in Appendix B. Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set Sequence Menu format field to **D**, UF to **24**, RC= to **0** and NC= to T32 UELM Test Screen XMT field setting minus one.
- Refer to Appendix D and set MC= as desired, considering subfields.

STEP **PROCEDURE**

11. Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set S## field to next Sequence Menu.

S416:D;UF24,RC=1,NC=03,MC=71000000000000	ADDR=17725762
+ 00000000000000,	
RPLY:D;	
*** No Reply ***	

- If OFF, press S-1403DL ON/CAL Key to activate Sequence Menu.
- Refer to section 9 in Appendix B. Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set Sequence Menu format field to **D**, UF to **24**, RC= to **1** if intermediate segment or **2** if final segment and NC= to NC= field setting in prior Sequence Menu minus one.
- Refer to Appendix D and set MC= as desired.
- For final segment, set RPLY format field to **D**.

12. Repeat Step 11 until all applicable Sequence Menus are set as desired.

S419:D;UF24,RC=2,NC=00,MC=71000000000000	ADDR=17725762
+ 00000000000000,	
RPLY:D;DF24,KE=1,ND=00,MD=00174000000000	ADDR=17725762
00000000000000,	

13. Press S-1403DL 2ND, T MENU, 3 and 2 Keys in sequence to display T32 UELM Test Menu subscreen.

Go to Step 29.

NOTE: UELM UF24 interrogations limit some variable parameters as follows:

- Fixes ANT B deviation at 0 μs.
- Fixes prepulse offset at 0 μs.
- Limits external sync pulse to only positive deviation (0 to 9.95 μs).
- Fixes scope trigger to coincide with P₁.
- Provides PPMG for only the last UELM.

STEP PROCEDURE

UELML Multisite

14. Press S-1403DL 3 Key to display T33 UELML Multisite Test Menu subscreen.

```
T33          ELM - UP - MULTI          FAIL
RESV        ELM  XMT  CLOS  ERROR
S813  S814-829  16  S830  10=ResvNoRply
          Press BURST to start test
```

Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to select Sequence Menu bins for ELM data.

- Set RESV field to Sequence Menu used for Reservation Interrogation.
- Set ELM field to desired Sequence Menu for first ELM segment (no need to be in sequence with RESV).
- Set XMT field to number of desired Comm-C message segments to be transmitted (automatically setting ELM second field to Sequence Menu for last ELM segment).
- Set CLOS field to Sequence Menu for Closeout Interrogation (no need to be in sequence with ELM).

15. Press S-1403DL S MENU and applicable number Keys to display Sequence Menu for Reservation Interrogation.

```
S813:D;UF05,PC=0,RR=22,DI=1,SD=171240,
+          ADDR=17725762
RPLY:D;DF21,FS=1,DR=00,UM=76,ID=0123,
MB=0403473337000000000, ADDR=17725762
```

- If OFF, press S-1403DL ON/CAL Key to activate Sequence Menu.
- Refer to Appendix D and sections 3 and 4 in Appendix B. Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set Sequence Menu format field to **D**, UF to **4** or **5**, RR= to ≥ 200 , DI= to code corresponding to SD= contents and SD= as desired, considering subfields (according to DI= setting for normal operation) (SD:MES=1 or 5).

STEP PROCEDURE

16. Perform Steps 10 through 12 until all Sequence Menus with ELMs are set.

17. Press S-1403DL S MENU and applicable number Keys to display Sequence Menu for Closeout Interrogation.

```
S830:D;UF05,PC=0,RR=22,DI=1,SD=170440,
+          ADDR=17725762
RPLY:D;DF21,FS=1,DR=00,UM=74,ID=0123,
MB=0403473337000000000 ADDR=17725762
```

- If OFF, press S-1403DL ON/CAL Key to activate Sequence Menu.
- Refer to Appendix D and sections 3 and 4 in Appendix B. Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set Sequence Menu format field to **D**, UF to **4** or **5**, RR= to ≥ 200 , DI= to code corresponding to SD= contents and SD= as desired, considering subfields (according to DI= setting for normal operation) (SD:MES=2).

18. Press S-1403DL 2ND, T MENU, 3 and 3 Keys in sequence to display T33 UELML Multisite Test Menu subscreen.

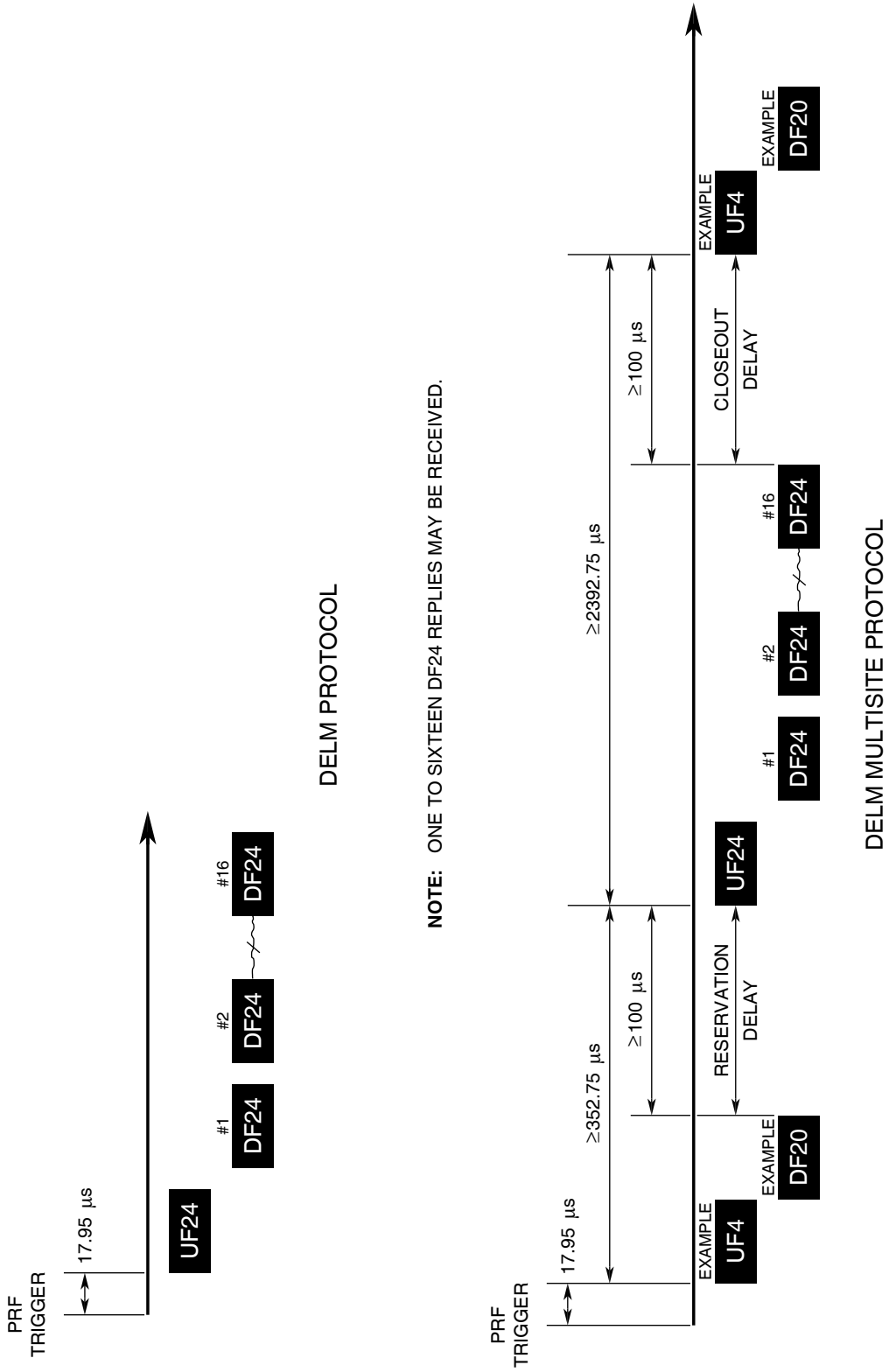
Go to Step 29.

DELM Singlesite

19. Press S-1403DL 4 Key to display T34 DELM Test Menu subscreen.

```
T34          ELM - DOWN          PASS
          ELM  EXP/RCV  ERROR
S975-990    16  16  2=Pass
          Press BURST to start test
```

Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to select Sequence Menu for ELM data. Set ELM field to desired Sequence Menu for first ELM segment.



DELM Sample Timing Diagrams
Figure 11

STEP PROCEDURE

27. Press S-1403DL S MENU and applicable number Keys to display Sequence Menu for Closeout Interrogation.

```
S967:D;UF04,PC=0,RR=22,DI=1,SD=171000,
+                               ADDR=17725762
RPLY:D;DF20,FS=1,DR=00,UM=74,AC=+   0,
MB=04034733370000000000 ADDR=17725762
```

- If OFF, press S-1403DL ON/CAL Key to activate Sequence Menu.
- Refer to Appendix D and sections 3 and 4 in Appendix B. Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set Sequence Menu format field to **D**, UF to **4** or **5**, RR= to ≥ 200 , DI= to code corresponding to SD= contents and SD= as desired, considering subfields (according to DI= setting for normal operation) (SD:MES=4).

28. Press S-1403DL 2ND, T MENU, 3 and 5 Keys in sequence to display T35 DELM Multisite Test Menu subscreen.
29. Press S-1403DL BURST Key to initiate test.
30. After completion or pressing S-1403DL CL/ESC Key to stop test, verify status field on the right side of the top line and ERROR field. Refer to 1-2-2, Tables 9 and 10.
31. Press S-1403DL S MENU and applicable S### Keys in sequence to view data. Repeat for other applicable Sequence Menus.
32. Verify power shown on ATC-1400A XMTR PWR WATTS Display.

#	ERROR	DESCRIPTION
10	ResvNoRply	Mode S reply not received.
12	ResvBadDF	DF20 or DF21 not received.
14	ResvBadIDS	IDS≠2.
15	ResvBadIIS	IIS≠IIS in reservation interrogation.
20	AckNoRply	Mode S reply not received.
22	AckBadDF	DF24 not received.
24	AckBadKE	KE≠1.
25	AckBadTAS	TAS≠number of UELM segments transmitted.
30	ClosNoRply	Mode S reply not received.
32	ClosBadDF	DF20 or DF21 not received.
34	ClosBadIDS	IDS≠2.
35	ClosBadIIS	IIS≠0.

UELME Error Codes
Table 9

#	ERROR	DESCRIPTION
10	ResvNoRply	Mode S reply not received.
12	ResvBadDF	DF20 or DF21 not received.
14	ResvBadDR	DR<16.
15	ResvBadIIS	IIS≠IIS in reservation interrogation.
20	ElmNoRply	Mode S reply not received.
22	ElmBadDF	DF24 not received.
24	ElmBadKE	KE≠0.
25	ElmBadTAS	TAS≠SRS in reservation interrogation.
26	ElmBadND	ND≠correct unique segment number, 0 to number of last segment minus 1.
27	ElmExpRcv	EXP/RCV fields do not match-missing reply/replies.
30	ClosNoRply	Mode S reply not received.
32	ClosBadDF	DF20 or DF21 not received.
34	ClosBadDR	DR≠0.
35	ClosBadIIS	IIS≠IIS in closeout interrogation.
36	ClosBadIIS	IIS≠IIS in reservation interrogation.

DELM Error Codes
Table 10

2.10 MEMORY OPERATION

2.10.1 Save

The Save function allows storage of up to five sets of particular user settings (not UUT data). Calibration, setup for remote operation, IFR Bus control and ATC-1400A setup are not affected or stored in the available memory slots.

STEP	PROCEDURE
1.	Apply power to S-1403DL.
2.	Refer to 1-1-2 or 1-2-2 to configure S-1403DL screens as desired.
3.	Press S-1403DL 2ND and SAVE Keys in sequence to enter Save Configuration Screen.

MS	SAVE CONFIGURATION	Saved
Slot 1:	xpdrtest1 26mar97,14:45:10	Press ENTER to save.

- Use S-1403DL SLEW Control to select desired memory Slot 1 to 5.
 - Press S-1403DL ENTER Key with cursor in Slot # field to save configuration. Verify S-1403DL displays **Saved** in upper right corner of screen to confirm save action.
- NOTE:** The S-1403DL displays the date and time of storage, and name if applicable.
- If optional name is desired, use S-1403DL CURSOR Keys to enter name field.

Use S-1403DL CURSOR Keys to select character (move cursor) and SLEW Control to set or edit selected characters. (Name can be up to 16 characters in length.)

NOTE: By performing only Steps 1, 3, 4 and 6, the name field can be edited any time without affecting the contents of the memory slot.

2.10.2 Recall

STEP	PROCEDURE
1.	Apply power to S-1403DL.
2.	Press S-1403DL 2ND and RECALL Keys in sequence to enter Recall Configuration Screen.

MR	RECALL CONFIGURATION	Recalled
Slot 1:	xpdrtest1 26mar97,14:45:10	Press ENTER to recall.

- Use S-1403DL SLEW Control to select desired memory Slot 0 to 5. (Memory Slot 0 contains Factory Default settings.)
- Press S-1403DL ENTER Key to recall configuration. Verify S-1403DL displays **Recalled** in upper right corner of screen to confirm recall action.

2.11 PRINT SCREEN

The print screen feature allows an ASCII capture of any display screen complete with data.

STEP	PROCEDURE
1.	Apply power to S-1403DL.
2.	Press S-1403DL C MENU, 8 and 1 Keys in sequence to enter C81 System Screen.

```
C81      SYSTEM - RS232 CONTROL
RCI:ENABLE      Screen Dump:ENABLE
RCI Echo:YES    Screen Border:7BIT
                Screen EOL:CR/LF
```

Use S-1403DL CURSOR Keys and ON/CAL Key or SLEW Control to set screen dump parameters as follows:

- Set Screen Dump to **ENABLE**.
 - Set Screen Border to **8BIT** (IBM characters), **7BIT** or **NONE**; as desired and according to output device (printer or computer with program to view data).
 - Set Screen EOL (end of line output terminator) to **CR/LF**, **LF**, **CR** or **NUL** according to output device.
3. Perform desired function or test with S-1403DL or Mode S Test System.
 4. Use S-1403DL Keyboard to display desired screen.
 5. Connect S-1403DL RS-232 Connector to input connector of output device.
 6. Press S-1403DL 2ND and PRTSCR Keys in sequence to send data.

2.12 STAND ALONE OPERATION

The S-1403DL Stand Alone mode allows Mode S testing through a single antenna without connecting the ATC-1400A. Only SLS, interference and suppressor pulses cannot be simulated. All UUT data and measurements are obtainable in Stand Alone mode except for power and frequency.

STEP	PROCEDURE
1.	Apply power to S-1403DL without ATC-1400A connected.
2.	Press S-1403DL C MENU, 7 and 9 Keys in sequence to enter C79 Setup Screen.

```
C79      SETUP - ATC1400A CONTROLS
ATCRBS:C      P123Wd: 1.05µS
RF I/O:NORM  Mode:DI      P2Dv: CAL
Scope :To     Spc: 333.3µS  P3Dv:+1.95µS
```

Use S-1403DL CURSOR Keys and ON/CAL Key or SLEW Control to set fields according to simulated ATC-1400A controls (1-2-2, Table 11).

3. Connect transponder UUT to S-1403DL ANT B Connector.
4. Perform testing, as desired, according to procedures in 2.2 through 2.9 in 1-2-2 with following stipulations:
 - Omit step portions involving power and frequency measurements.
 - Omit step portions involving SLS, interference or suppressor pulses.
 - Repeat Step 2 of this procedure for step portions involving applicable ATC-1400A controls.

FIELD	SIMULATED ATC-1400A CONTROLS
ATCRBS	XPDR MODE Control
P123Wd	XPDR PULSE WIDTH Thumbwheels
RF I/O	CW/NORM/OFF Switch
Mode	DBL INTERR/INTRF PULSE Thumbwheels (mode part)
P2Dv	XPDR DEV P ₂ /CAL Switch and XPDR P ₂ /P ₃ DEV Thumbwheels
Scope	To/TAC/Td Switch
Spc	DBL INTERR/INTRF PULSE Thumbwheels (spacing part)
P3Dv	XPDR DEV P ₃ /CAL Switch and XPDR P ₂ /P ₃ DEV Thumbwheels

Stand Alone Mode Simulated ATC-1400A Controls
Table 11

3. PERFORMANCE EVALUATION

3.1 GENERAL

The Performance Evaluation verifies S-1403DL display and Mode S Test System front panel control operation. The Performance Evaluation Procedure is a covers-on test designed to give the user a high level of confidence the Mode S Test System is operating properly. Use the Performance Evaluation when the operating condition of the Mode S Test System is in question or when orientation to the Mode S Test System is desired (new or infrequent user). The Performance Evaluation Procedure requires approximately three hours to perform.

Refer to 1-1-2, Figure 1 for S-1403DL controls, connectors and indicators. Refer to 1-1-2, Figure 2 for S-1403DL Keyboard references. Refer to 1-1-2, Figure 48 for ATC-1400A controls, connectors and indicators.

3.2 PRE-OPERATIONAL CONDITIONS

Read all steps prior to performing the Performance Evaluation Procedure.

Connect the S-1403DL to the ATC-1400A according to 1.4 in 1-2-1.

3.3. TEST EQUIPMENT REQUIREMENTS

Appendix C contains a comprehensive list of test equipment suitable for performing the Performance Evaluation Procedure. Other test equipment meeting the specifications listed in Appendix C may be substituted for the recommended models.

NOTE: For certain procedures in this manual, the test equipment listed in Appendix C may exceed the minimum required specifications.

3.4 CORRECTIVE MAINTENANCE

Performance checks validate specific hardware, software and signal operation. Should the performance checks confirm incorrect operation, the S-1403DL must be recalibrated. Service including calibration must be performed only by qualified service personnel. Refer to 1-4-1.

3.5 TEST RECORD

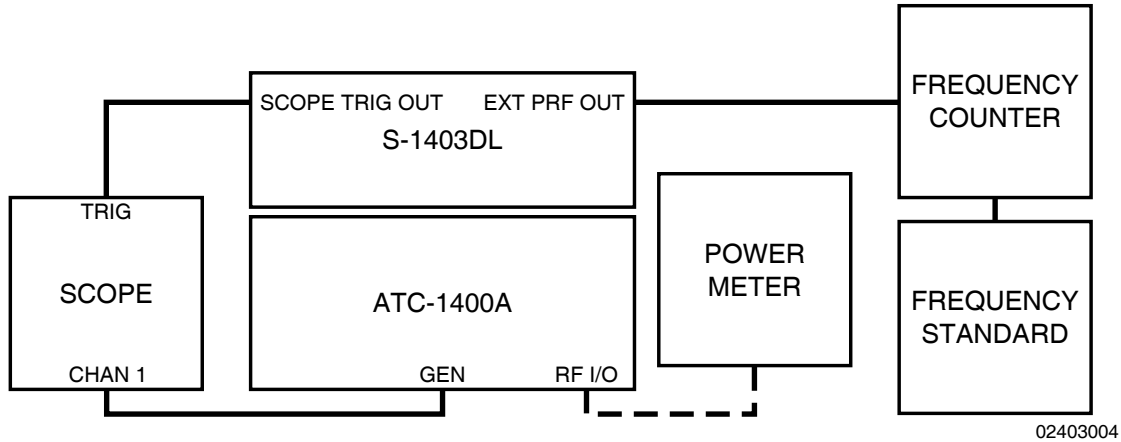
A Performance Evaluation Data Sheet is provided for recording the results obtained while performing the Performance Evaluation Procedure.

NOTE: Reproducing copies of the Performance Evaluation Data Sheet is recommended, rather than using the copy in this manual.

3.6 PERFORMANCE EVALUATION PROCEDURE

TEST EQUIPMENT: Dual Pulse Generator
Frequency Counter
Frequency Standard
Oscilloscope
Power Meter
Spectrum Analyzer

STEP	PROCEDURE																																
INITIAL CONDITIONS AND SETTINGS																																	
1.	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>MAN/AUTO/MAN STEP Switch</td> <td>MAN</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>PRF/SQTR ON/OFF Switch</td> <td>ON</td> </tr> <tr> <td>TACAN ON/OFF Switch</td> <td>OFF</td> </tr> <tr> <td>XPDR MODE Control</td> <td>C</td> </tr> <tr> <td>DISPLAY SELECT Control</td> <td>PRF SQTR Hz</td> </tr> <tr> <td>PRF/SQUITTER Thumbwheels</td> <td>0200</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>ΔF Thumbwheels</td> <td>OFF</td> </tr> <tr> <td>SELF-INTERR/OFF Switch</td> <td>OFF</td> </tr> <tr> <td>All other controls</td> <td>initial setting not required</td> </tr> </tbody> </table>	CONTROL	SETTING	CW/NORM/OFF Switch	NORM	SLS/ECHO ON/OFF Switch	OFF	MAN/AUTO/MAN STEP Switch	MAN	XPDR DEV P ₃ /CAL Switch	CAL	XPDR DEV P ₂ /CAL Switch	CAL	PRF/SQTR ON/OFF Switch	ON	TACAN ON/OFF Switch	OFF	XPDR MODE Control	C	DISPLAY SELECT Control	PRF SQTR Hz	PRF/SQUITTER Thumbwheels	0200	DBL INTERR/INTRF Thumbwheels	000.0 OFF	FREQ/FUNCTION SELECT Thumbwheels	1030 XPDR	ΔF Thumbwheels	OFF	SELF-INTERR/OFF Switch	OFF	All other controls	initial setting not required
CONTROL	SETTING																																
CW/NORM/OFF Switch	NORM																																
SLS/ECHO ON/OFF Switch	OFF																																
MAN/AUTO/MAN STEP Switch	MAN																																
XPDR DEV P ₃ /CAL Switch	CAL																																
XPDR DEV P ₂ /CAL Switch	CAL																																
PRF/SQTR ON/OFF Switch	ON																																
TACAN ON/OFF Switch	OFF																																
XPDR MODE Control	C																																
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FREQ/FUNCTION SELECT Thumbwheels	1030 XPDR																																
ΔF Thumbwheels	OFF																																
SELF-INTERR/OFF Switch	OFF																																
All other controls	initial setting not required																																
2.	Connect ATC-1400A GEN Connector to Oscilloscope Channel 1 input according to 1-2-3, Figure 12.																																



Function and RF Level Tests Setup Diagram
Figure 12

- | STEP | PROCEDURE |
|------|---|
| 3. | Connect Oscilloscope External Trigger to S-1403DL SCOPE TRIG OUT Connector according to 1-2-3, Figure 12. |
| 4. | Apply power to Mode S Test System. |
| 5. | Press S-1403DL C MENU, 7 and 2 Keys in sequence to enter C72 Setup Screen. |

```

C72          SETUP - SCOPE TRIGGER
          ATC ModeS ACS ACL
Enable: ON  ON   ON  ON
Source:CAL CAL  CAL CAL      (in μS)
    
```

- Use S-1403DL CURSOR Keys and ON/CAL Key to set all Enable fields to **ON** and all Source fields to **CAL**.
- Press S-1403DL C MENU, 7 and 5 Keys in sequence to enter the C75 Setup Screen

```

C75          SETUP - MISC
AntAEnable:ON          PrePulseOut:OFF
AntAModSrc:INT
AntBModSrc:INT
    
```

- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set AntAEnable to **ON**, AntAModSrc to **INT**, AntBModSrc to **INT** and PrePulseOut to **OFF**.
- Press S-1403DL C MENU, 8 and 4 Keys in sequence to enter the C84 System Screen

STEP	PROCEDURE
C84	SYSTEM - IFR BUS
1400	Control: MASTER Must power down
1403	Bus Address: 3 before settings take effect.

- If necessary, use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set 1400 Control to **MASTER**. If 1400 Control setting changed, press S-1403DL POWER Switch **OFF (O)** and back **ON (I)** to recycle power.

S-1403DL TO ATC-1400A COMMUNICATION

- Verify S-1403DL shows sign on sequence screens: Front Panel Processor F/W, Startup Applications, Restore Environment Settings and Main Processor F/W Screens.
- After sign on period has ended, verify S-1403DL MENU Display shows Main Control Menu.

C00	MAIN CMENU
1) FUNC A	4) REPLY DELAY 7) SETUP MENU
2) FUNC B	5) SQTR 1of2 8) SYSTEM MENU
3) %REPLY	6) SQTR 2of2 9) CAL MENU

- Press S-1403DL 2ND, FUNC#, 0 and 1 Keys in sequence.
- Verify S-1403DL MENU Display shows ATC Screen with P3:CAL. If needed, press S-1403DL 2ND, P3 and ON/CAL Keys to set P3:**CAL**.



STEP PROCEDURE

44. Set ATC-1400A SLS/ECHO ON/OFF Switch to **OFF**.

SEQ FUNCTION

45. Press S-1403DL 2ND, FUNC#, 0 and 2 Keys in sequence.

46. Verify S-1403DL MENU Display shows Sequence Screen with P6, P2 and SPR,Dv: fields set to CAL and SPR:ON. If needed, use S-1403DL CURSOR Keys and SLEW Control to set P6, P2 and SPR,Dv fields to **CAL** and SPR:**ON**.

```
C10 f02:SEQ (ModeS)                      Arf:+1.2
P6:CAL,Wd: CAL ,Dv: CAL    P2:CAL
SPR:ON ,Dv: CAL    Dly=----- Sqtr=-----
AntA%:ATC= 0,S= 0    AntB%= 0    AntB:+.95
```

47. Press S-1403DL C MENU, 7 and 6 Keys in sequence to display C76 Setup Screen.

```
C76                      SETUP - SMENU
SmenuRadix:OCTAL            SetAllSmenu:DEFAULT
GlobalAddr:Xpdr=17725762,AP XOR=00000000
GlobalAddr:User=10273645,AP XOR=00000001
```

48. Use S-1403DL CURSOR Keys and SLEW Control to set SmenuRadix to **OCTAL** and SetAllSmenu to **DEFAULT**.

49. Press S-1403DL ENTER Key.

50. Press S-1403DL S MENU Key.

51. Verify Sequence Menu S001 displays decoded UF00 in octal format.

```
S001:D;UF00,RL=0,AQ=0,BD=000,
+                                              ADDR=XPDR
RPLY:D;    *** NO REPLY ***
```

52. Use S-1403DL SLEW Control to enter Sequence Menu S002.

53. Verify Sequence Menu S002 displays decoded UF04 in octal format.

```
S002:D;UF04,PC=0,RR=00,DI=0,SD=000000,
+                                              ADDR=XPDR
RPLY:D;    *** NO REPLY ***
```

STEP PROCEDURE

54. Use S-1403DL SLEW Control to enter Sequence Menu S003.

55. Verify Sequence Menu S003 displays decoded UF05 in octal format.

```
S003:D;UF05,PC=0,RR=00,DI=0,SD=000000,
+                                              ADDR=XPDR
RPLY:D;    *** NO REPLY ***
```

56. Use S-1403DL SLEW Control to enter Sequence Menu S004.

57. Verify Sequence Menu S004 displays decoded UF11 in octal format.

```
S004:D;UF11,PR=00,IC=00,CL=0
+                                              ADDR=XPDR
RPLY:D;    *** NO REPLY ***
```

58. Press S-1403DL C MENU, 7 and 6 Keys in sequence to display C76 Setup Screen.

59. Use S-1403DL CURSOR Keys and SLEW Control to set SMENU Radix to **HEX**.

60. Press S-1403DL S MENU Key.

61. Use S-1403DL SLEW Control to enter Sequence Menu S005.

62. Verify Sequence Menu S005 displays decoded UF16 in hexadecimal format.

```
S005:D;UF16,RL=0,AQ=0,
+ MU=0000000000000000,                      ADDR=3FABF2
RPLY:D;    *** NO REPLY ***
```

63. Use S-1403DL SLEW Control to enter Sequence Menu S006.

64. Verify Sequence Menu S006 displays decoded UF20 in hexadecimal format.

```
S006:D;UF20,PC=0,RR=14,DI=0,SD=0000,
+ MA=0000000000000000,                      ADDR=3FABF2
RPLY:D;    *** NO REPLY ***
```

65. Use S-1403DL SLEW Control to enter Sequence Menu S007.

STEP	PROCEDURE	STEP	PROCEDURE
66.	Verify Sequence Menu S07 displays decoded UF21 in hexadecimal format.	81.	Press S-1403DL ON/CAL Key to set Sequence Screen P2: CAL .
	S007:D;UF21,PC=0,RR=14,DI=0,SD=0000, + MA=0000000000000000, ADDR=3FABF2 RPLY:D; *** NO REPLY ***	82.	Press S-1403DL 2ND, P4(P6) and ON/CAL Keys in sequence to set Sequence Screen P6: OFF .
67.	Use S-1403DL SLEW Control to enter Sequence Menu S008.	83.	Verify P ₆ is not displayed on Oscilloscope.
68.	Verify Sequence Menu S008 displays decoded UF00 in hexadecimal format.	84.	Press S-1403DL ON/CAL Key to set Sequence Screen P6: CAL .
	S008:D;UF00,RL=0,AQ=0,BD=00, + ADDR=3FABF2 RPLY:D; *** NO REPLY ***	85.	Press S-1403DL → CURSOR Key and ON/CAL Key to set Sequence Screen P6:CAL,Wd: +0.00 .
69.	Press S-1403DL C MENU, 7 and 6 Keys in sequence to display C76 Setup Screen.	86.	Use S-1403DL SLEW Control to adjust P ₆ ;,Wd: field from negative to positive and verify P ₆ width varies accordingly.
70.	Use S-1403DL CURSOR Keys and SLEW Control to set Set All to OFF .	87.	Press S-1403DL ON/CAL Key to set Sequence Screen P6:CAL,Wd: CAL .
71.	Press S-1403DL ENTER Key.	88.	Press S-1403DL → CURSOR Key and ON/CAL Key to set Sequence Screen P6:CAL,Wd: CAL,Dv: +0.00 .
72.	Press S-1403DL S MENU Key.	89.	Use S-1403DL SLEW Control to adjust P ₆ ;,Dv: field from negative to positive and verify P ₆ position changes accordingly.
73.	Use S-1403DL CURSOR and ON/CAL Keys to activate and set S000:D;UF00 with active trigger +.	90.	Press S-1403DL ON/CAL Key to set Sequence Screen P6:CAL,Wd: CAL,Dv: CAL .
74.	Verify P ₁ leading edge to P ₂ leading edge is 2.0 μs (±10 ns).	91.	Set ATC-1400A SLS/ECHO ON/OFF Switch to ON and SLS/ECHO Thumbwheels to +0 .
75.	Verify P ₁ leading edge to P ₆ leading edge is 3.5 μs (±10 ns).	92.	Verify P ₅ SLS pulse overlaps SPR.
76.	Verify P ₂ leading edge to Synchronous Phase Reversal (SPR) is 2.75 μs (±10 ns).	93.	Adjust ATC-1400A SLS/ECHO Thumbwheels and verify P ₅ level changes accordingly.
77.	Press S-1403DL 2ND, P2 and ON/CAL Keys in sequence to set Sequence Screen P2: VAR .	94.	Press S-1403DL 2ND, SPR and ON/CAL Keys in sequence to set SPR:OFF .
78.	Adjust ATC-1400A SLS/ECHO Thumbwheels and verify P ₂ level changes accordingly.	95.	Verify SPR is not displayed on Oscilloscope.
79.	Press S-1403DL ON/CAL Key to set Sequence Screen P2: OFF .	96.	Press S-1403DL ON/CAL Key to set Sequence Screen SPR: ON .
80.	Verify P ₂ is not displayed on Oscilloscope.		



- | STEP | PROCEDURE |
|------|--|
| 97. | Press S-1403DL → CURSOR Key and ON/CAL Key to set SPR: ON,Dv: +0.00 . |
| 98. | Use S-1403DL SLEW Control to adjust SPR:,Dv: field from a negative to positive value and verify P5 and SPR positions change accordingly. |
| 99. | Press S-1403DL ON/CAL Key to set Sequence Screen SPR: ON,Dv: CAL . |
| 100. | Set ATC-1400A SLS/ECHO ON/OFF Switch to OFF . |

ACS FUNCTION

- | | |
|------|--|
| 101. | Press S-1403DL 2ND, FUNC#, 0 and 3 Keys in sequence. |
| 102. | Verify S-1403DL MENU Display shows ACS Screen with P4 and P3 fields set to CAL. If needed, use S-1403DL CURSOR Keys and SLEW Control to set P4 and P3 fields to CAL . |

```
C10 f03:ACS (All Call Short)   Arf:+1.2
P4:CAL,Wd: CAL ,Dv: CAL       P3:CAL
DF=--,AA=----- Dly=----- Sqtr=-----
AntA%:ATC= 0,S= 0 AntB%= 0 AntB:+.95
```

- | | |
|------|--|
| 103. | Verify P1 leading edge to P4 leading edge is 10.0 μs (±10 ns). |
| 104. | Verify P4 width is 0.8 μs (±10 ns). |

ACL FUNCTION

- | | |
|------|--|
| 105. | Press S-1403DL 2ND, FUNC#, 0 and 4 Keys in sequence. |
| 106. | Verify S-1403DL MENU Display shows ACL Screen with P4 and P3 fields set to CAL. If needed, use S-1403DL CURSOR Keys and SLEW Control to set P4 and P3 fields to CAL . |

```
C10 f04:ACL (All Call Long)   Arf:+1.2
P4:CAL,Wd: CAL ,Dv: CAL       P3:CAL
DF=--,AA=----- Dly=----- Sqtr=-----
AntA%:ATC= 0,S= 0 AntB%= 0 AntB:+.95
```

- | | |
|------|---|
| 107. | Press S-1403DL 2ND, P4(P6) and ON/CAL Keys to set ACL Screen P4: VAR . |
|------|---|

- | STEP | PROCEDURE |
|------------------------|---|
| 108. | Adjust ATC-1400A SLS/ECHO Thumbwheels and verify P4 level changes accordingly. |
| 109. | Press S-1403DL ON/CAL Key to set ACL Screen P4: OFF . |
| 110. | Verify P4 is not displayed on Oscilloscope. |
| 111. | Press ON/CAL Key to set ACL Screen P4: CAL . |
| 112. | Verify P4 pulse width is 1.6 μs (±10 ns). |
| 113. | Press S-1403DL → CURSOR Key and ON/CAL Key to set P4:CAL,Wd: +0.00 . |
| 114. | Use S-1403DL SLEW Control to adjust P4:,Wd: field from a negative to positive value and verify P4 width varies accordingly. |
| 115. | Press S-1403DL ON/CAL Key to set ACL Screen P4:CAL,Wd: CAL . |
| 116. | Press S-1403DL → CURSOR Key and ON/CAL Key to set ACL Screen P4:CAL,Wd: CAL,Dv: +0.00 . |
| 117. | Use S-1403DL SLEW Control to adjust P4:,Dv: field from negative to positive and verify P4 position varies accordingly. |
| 118. | Press S-1403DL ON/CAL Key to set ACL Screen P4:CAL,Wd: CAL,Dv: CAL . |
| INTLCE FUNCTION | |
| 119. | Press S-1403DL C MENU, 7 and 2 Keys in sequence to enter C72 Setup Screen. |
| 120. | Use S-1403DL CURSOR and ON/CAL Keys to set Mode S Enable field to OFF . |
| 121. | Press S-1403DL 2ND, FUNC#, 0 and 5 Keys in sequence. |



STEP PROCEDURE

153. Press S-1403DL ON/CAL Key to set DI,2nd:**ACL**.

154. Verify second interrogation ATCRBS/ Mode S All Call pulse pattern consists of P₁, P₃ and long P₄.

BURST FUNCTION

155. Press S-1403DL 2ND, FUNC#, 0 and 7 Keys in sequence.

156. Verify * DI/INTF ERROR * indication flashes in top line of S-1403DL MENU Display.

157. Set ATC-1400A DBL INTERR/INTRF PULSE Thumbwheels to **200.0 OFF**.

158. Verify S-1403DL MENU Display shows Burst Screen.

```
C10 f07:BURST;SEQ:250                      Arf:+1.2
P6:CAL,Wd: CAL ,Dv: CAL    P2:CAL
SPR:ON ,Dv: CAL    Dly=----- Sqtr=-----
AntA%:ATC= 0,S= 0    AntB%= 0 AntB:+.95
```

159. Press S-1403DL → CURSOR, 1, 0, 0, 0 and ENTER Keys to set BURST;**ATC: 1000**.

160. Press S-1403DL BURST Key to activate BURST Function.

161. Verify ATCRBS interrogation is displayed on Oscilloscope for five seconds.

162. Use S-1403DL CURSOR Keys and Keyboard to set **SEQ: 250**.

163. Set ATC-1400A PRF/SQTR Thumbwheels to **50**.

164. Press S-1403DL BURST Key to activate BURST Function.

165. Verify Mode S interrogation is displayed on Oscilloscope for five seconds.

ANT A RF VERNIER

166. Press S-1403DL S MENU Key.

167. Use S-1403DL CURSOR and ON/CAL Keys to set **S000:L;UF00** with active trigger +.

STEP PROCEDURE

```
S000:L;UF00,000000000000000000000000
+                                              ADDR=XPDR
RPLY:D;    *** NO REPLY ***
```

168. Press S-1403DL 2ND, FUNC#, 0 and 2 Keys in sequence to enter SEQ Screen.

169. Connect Power Meter to ATC-1400A RF I/O Connector according to 1-2-3, Figure 12.

170. Set ATC-1400A CW/NORM/OFF Switch to **CW**.

171. Press S-1403DL ARF LVL, 0 and ENTER Keys in sequence to set Arf:**+0.0**.

172. Adjust ATC-1400A RF LEVEL Control until RF LEVEL -dBm Display reads **04** (-4 dBm).

173. Record Power Meter reading for reference level.

174. Adjust S-1403DL SLEW Control to set Arf:**+3.0**.

175. Verify Power Meter displays Step 173 reference level + 3.0 dB (±0.3 dB).

176. Adjust S-1403DL SLEW Control to set Arf:**-3.0**.

177. Verify Power Meter displays Step 173 reference level - 3.0 dB (±0.3 dB).

178. Disconnect Power Meter from ATC-1400A RF I/O Connector.

NOTE: Steps 179 through 188 pertain to S-1403DL Test Auxiliaries without the MLD option installed. Steps 189 through 210 pertain to S-1403DL Test Auxiliaries with the MLD option installed.

ANT B RF LEVEL (w/o MLD)

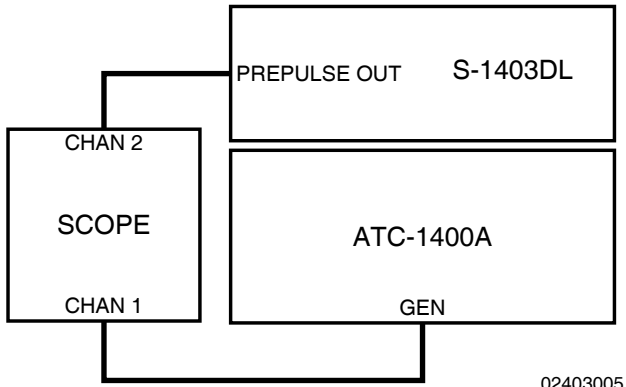
179. Connect Spectrum Analyzer to ATC-1400A RF I/O Connector.

180. Adjust ATC-1400A RF LEVEL Control until RF LEVEL -dBm Display reads **50** (-50 dBm).

- | STEP | PROCEDURE | | | | | | | | | | | | |
|----------------------|---|---------|---------|----------------|------|----------------------|-------|------------|-----------------|-----------|---------------|------------|-------|
| 181. | Adjust S-1403DL SLEW Control to set Arf: +0.0 . | | | | | | | | | | | | |
| 182. | Set Spectrum Analyzer as follows:
<table border="1"> <thead> <tr> <th>CONTROL</th> <th>SETTING</th> </tr> </thead> <tbody> <tr> <td>Frequency Span</td> <td>Zero</td> </tr> <tr> <td>Resolution Bandwidth</td> <td>3 MHz</td> </tr> <tr> <td>Sweep Rate</td> <td>5 or 10 μs</td> </tr> <tr> <td>Log Scale</td> <td>1 or 2 dB/Div</td> </tr> <tr> <td>Triggering</td> <td>Video</td> </tr> </tbody> </table> | CONTROL | SETTING | Frequency Span | Zero | Resolution Bandwidth | 3 MHz | Sweep Rate | 5 or 10 μ s | Log Scale | 1 or 2 dB/Div | Triggering | Video |
| CONTROL | SETTING | | | | | | | | | | | | |
| Frequency Span | Zero | | | | | | | | | | | | |
| Resolution Bandwidth | 3 MHz | | | | | | | | | | | | |
| Sweep Rate | 5 or 10 μ s | | | | | | | | | | | | |
| Log Scale | 1 or 2 dB/Div | | | | | | | | | | | | |
| Triggering | Video | | | | | | | | | | | | |
| 183. | Set ATC-1400A CW/NORM/OFF Switch to NORM . | | | | | | | | | | | | |
| 184. | Adjust Spectrum Analyzer for stable display and record signal level as reference. | | | | | | | | | | | | |
| 185. | Press S-1403DL 2ND, ANT B and ON/CAL Keys in sequence to set AntB: field to numerical value. | | | | | | | | | | | | |
| 186. | Disconnect Spectrum Analyzer from ATC-1400A RF I/O Connector. | | | | | | | | | | | | |
| 187. | Connect Spectrum Analyzer to S-1403DL ANT B Connector. | | | | | | | | | | | | |
| 188. | Verify level equals Step 184 reference (± 1 dB).
ANT B RF LEVEL/VERNIER (w/ MLD) | | | | | | | | | | | | |
| 189. | Connect Spectrum Analyzer to ATC-1400A RF I/O Connector. | | | | | | | | | | | | |
| 190. | Adjust ATC-1400A RF LEVEL Control until RF LEVEL -dBm Display reads 20 (-20 dBm). | | | | | | | | | | | | |
| 191. | Adjust S-1403DL SLEW Control to set Arf: +0.0 . | | | | | | | | | | | | |
| 192. | Set Spectrum Analyzer as follows:
<table border="1"> <thead> <tr> <th>CONTROL</th> <th>SETTING</th> </tr> </thead> <tbody> <tr> <td>Frequency Span</td> <td>Zero</td> </tr> <tr> <td>Resolution Bandwidth</td> <td>3 MHz</td> </tr> <tr> <td>Sweep Rate</td> <td>5 or 10 μs</td> </tr> <tr> <td>Log Scale</td> <td>1 or 2 dB/Div</td> </tr> <tr> <td>Triggering</td> <td>Video</td> </tr> </tbody> </table> | CONTROL | SETTING | Frequency Span | Zero | Resolution Bandwidth | 3 MHz | Sweep Rate | 5 or 10 μ s | Log Scale | 1 or 2 dB/Div | Triggering | Video |
| CONTROL | SETTING | | | | | | | | | | | | |
| Frequency Span | Zero | | | | | | | | | | | | |
| Resolution Bandwidth | 3 MHz | | | | | | | | | | | | |
| Sweep Rate | 5 or 10 μ s | | | | | | | | | | | | |
| Log Scale | 1 or 2 dB/Div | | | | | | | | | | | | |
| Triggering | Video | | | | | | | | | | | | |
| 193. | Set ATC-1400A CW/NORM/OFF Switch to NORM . | | | | | | | | | | | | |
| 194. | Adjust Spectrum Analyzer for stable display and record signal level as reference. | | | | | | | | | | | | |

- | STEP | PROCEDURE |
|------|--|
| 195. | Press S-1403DL 2ND, ANT B and ON/CAL Keys in sequence to set AntB: field to numerical value. |
| 196. | Disconnect Spectrum Analyzer from ATC-1400A RF I/O Connector. |
| 197. | Connect Spectrum Analyzer to S-1403DL ANT B Connector. |
| 198. | Press S-1403DL C MENU and 2 Keys to enter the Function B Screen. |
| 199. | Use S-1403DL CURSOR Keys and SLEW Control to set Brf: -20+0.0 . |
| 200. | Verify level is equal to Step 194 reference (± 0.5 dB). |
| 201. | Disconnect Spectrum Analyzer from S-1403DL ANT B Connector. |
| 202. | Connect Power Meter to S-1403DL ANT B Connector. |
| 203. | Set CW/NORM/OFF Switch to CW . |
| 204. | Record Power Meter reading for reference level. |
| 205. | Use S-1403DL CURSOR Keys and SLEW Control to set Brf: -20+3.0 . |
| 206. | Verify Power Meter reading is equal to Step 204 reference level + 3.0 dB (± 0.3 dB). |
| 207. | Use S-1403DL CURSOR Keys and SLEW Control to set Brf: -20-3.0 . |
| 208. | Verify Power Meter reading is equal to Step 204 reference level - 3.0 dB (± 0.3 dB). |
| 209. | Disconnect Power Meter from S-1403DL ANT B Connector. |
| 210. | Set ATC-1400A CW/NORM/OFF Switch to NORM .
PREPULSE |
| 211. | Press S-1403DL 2ND, FUNC#, 0 and 1 Keys in sequence to enter ATC Screen. |
| 212. | Set ATC-1400A PRF/SQTR Thumbwheels to 200 . |

- | STEP | PROCEDURE |
|------|--|
| 213. | Disconnect S-1403DL SCOPE TRIG OUT Connector from Oscilloscope External Trigger. |
| 214. | Connect S-1403DL PREPULSE OUT Connector to Oscilloscope Channel 2 input according to 1-2-3, Figure 13. |



Prepulse Test Setup Diagram
Figure 13

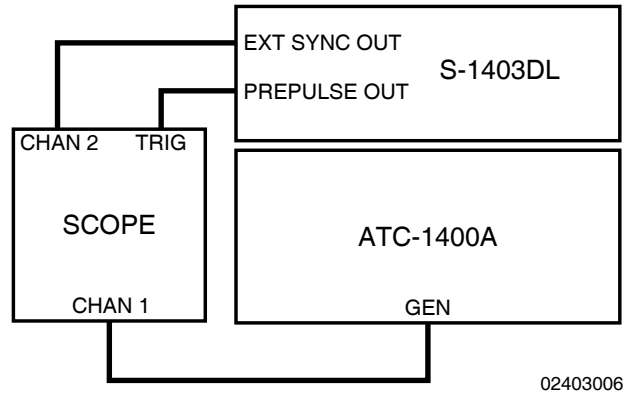
- | | |
|------|--|
| 215. | Set Oscilloscope to trigger on Channel 2. |
| 216. | Press S-1403DL 2ND, P PULS and ON/CAL Keys in sequence to activate C75 Setup Screen PrePulseOut field. |

```

C75          SETUP - MISC
AntAEnable:ON          PrePulseOut: 0µS
AntAModSrc:INT
AntBModSrc:INT
    
```

- | | |
|------|---|
| 217. | Press S-1403DL 0 and ENTER Keys to set PrePulseOut: 0 µS. |
| 218. | Verify prepulse is coincident with P ₁ (±100 ns). |
| 219. | Use S-1403DL SLEW Control to set PrePulseOut: 260 µS. |
| 220. | Verify P ₁ leading edge moves to 260 µs following prepulse leading edge (±100 ns). |
| 221. | Disconnect S-1403DL PREPULSE OUT Connector from Oscilloscope Channel 2 input. |

- | STEP | PROCEDURE |
|---------------------|---|
| EXT SYNC OUT | |
| 222. | Connect S-1403DL PREPULSE OUT Connector to Oscilloscope External Trigger according to 1-2-3, Figure 14. |



Ext Sync Out Test Setup Diagram
Figure 14

- | | |
|------|--|
| 223. | Use S-1403DL SLEW Control to set PrePulseOut: 12 µS. |
| 224. | Connect S-1403DL EXT SYNC OUT Connector to Oscilloscope Channel 2 input according to 1-2-3, Figure 14. |
| 225. | Set Oscilloscope for external trigger. |
| 226. | Press S-1403DL 2ND, EXT SYN and, if needed, ON/CAL Keys in sequence to set C73 Setup Screen ATC Enable field ON . |
| 227. | Use S-1403DL CURSOR Keys and SLEW Control to set Dv: +0.00 µS. |
| 228. | Set Oscilloscope for External Trigger with both active channels displayed. |
| 229. | Verify Ext Sync pulse is coincident with P ₁ (±100 ns). |
| 230. | Use S-1403DL SLEW Control to set Dv: +9.95 µS. |
| 231. | Verify Ext Sync pulse follows P ₁ accordingly. |
| 232. | Press S-1403DL +/- Key to change Dv: -9.95 µS. |
| 233. | Verify Ext Sync pulse precedes P ₁ accordingly. |

STEP PROCEDURE

- 234. Disconnect S-1403DL PREPULSE OUT Connector from Oscilloscope External Trigger.
- 235. Disconnect S-1403DL EXT SYNC OUT Connector from Oscilloscope Channel 2 input.

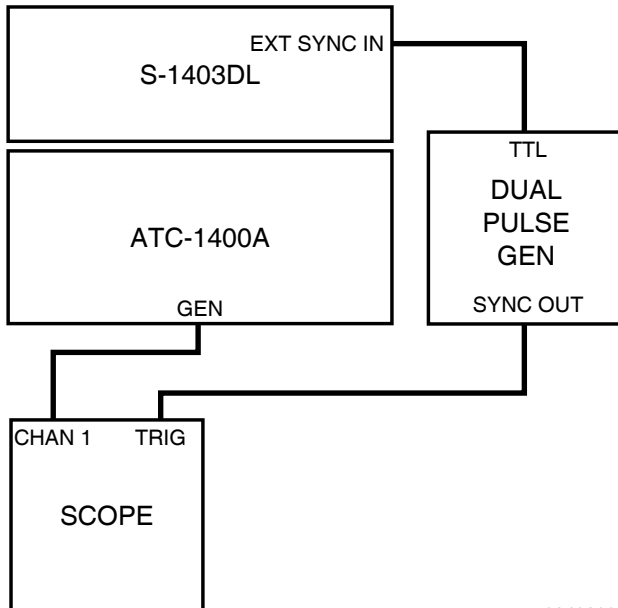
EXT SYNC IN

- 236. Press S-1403DL C MENU, 7 and 1 Keys in sequence to display C71 Setup Screen.

```

C71  SETUP - INTERROGATION TRIGGER
TrigSource:ExtSyncIn
TrigGen:10.0000Sec
    
```

- 237. Press S-1403DL ON/CAL Key to set TrigSource:**ExtSyncln**.
- 238. Connect Dual Pulse Generator TTL Output to S-1403DL EXT SYNC IN Connector according to 1-2-3, Figure 15.
- 239. Connect Dual Pulse Generator Sync Out to Oscilloscope External Trigger according to 1-2-3, Figure 15.



02403007

Ext Sync In Test Setup Diagram
Figure 15

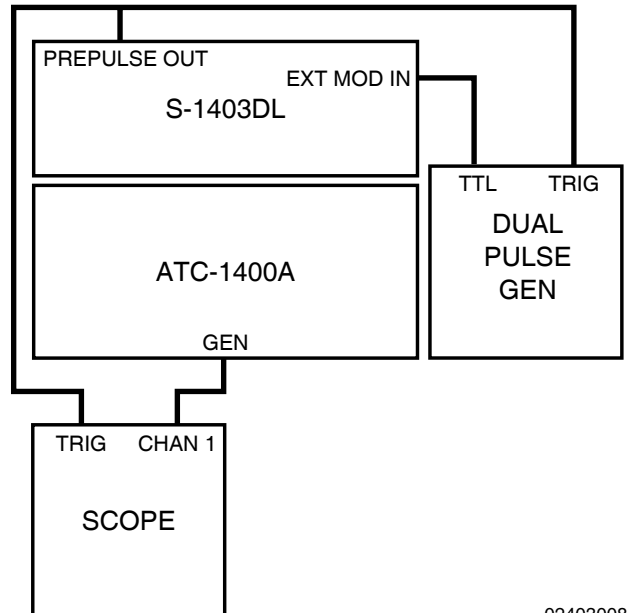
STEP PROCEDURE

- 240. Set Dual Pulse Generator to approximately 1 kHz Single Pulse Output and Internal Sync.
- 241. Verify P₁ occurs approximately 18 μs after Oscilloscope trigger.
- 242. Vary Dual Pulse Generator PRF Control.
- 243. Verify interrogation rate tracks Dual Pulse Generator PRF.
- 244. Press ON/CAL Key to set TrigSource:**SelfInterr**.

- 245. Disconnect Dual Pulse Generator Sync Out from Oscilloscope External Trigger.
- 246. Disconnect Dual Pulse Generator TTL Output from S-1403DL EXT SYNC IN Connector.

EXT MOD IN

- 247. Connect S-1403DL PREPULSE OUT Connector to Dual Pulse Generator Trigger input and Oscilloscope External Trigger according to 1-2-3, Figure 16.



02403008

Ext Mod In Test Setup Diagram
Figure 16

STEP PROCEDURE

- 248. Select External Trigger mode on Dual Pulse Generator. Set for dual pulse output.
- 249. Connect Dual Pulse Generator TTL Output to S-1403DL EXT MOD IN Connector according to 1-2-3, Figure 16.
- 250. Press S-1403DL 2ND, EX MOD and ON/CAL Keys in sequence to set C75 Setup Screen AntAModSrc: **EXT**.

NOTE: The S-1403DL EX MOD and ON/CAL Keys are the same key.

- 251. Verify pulses present at ATC-1400A GEN Connector coincide with Dual Pulse Generator output.
- 252. Use S-1403DL CURSOR Keys and ON/CAL Key to set AntAModSrc: **INT** and PrePulseOut: **OFF**.
- 253. Disconnect Dual Pulse Generator from S-1403DL and Oscilloscope.

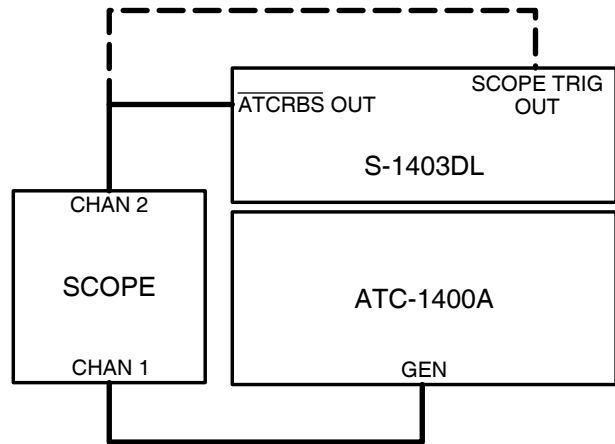
ATCRBS DISCRETE

- 254. Press S-1403DL 2ND, FUNC#, 0 and 5 Keys in sequence to display Interlace Screen.
- 255. Press S-1403DL → CURSOR and 1 Keys to set INTLCE, Ratio: 1 to **1**.
- 256. Connect S-1403DL ATCRBS OUT Connector to Oscilloscope Channel 2 according to 1-2-3, Figure 17.
- 257. Select Oscilloscope Internal Trigger Channel 2, negative slope.
- 258. Verify 3.0 μs wide TTL active low pulse occurs 1.0 μs prior to P₁.

SCOPE TRIGGER

- 259. Disconnect Oscilloscope Channel 2 input from S-1403DL ATCRBS OUT Connector and reconnect to S-1403DL SCOPE TRIG OUT Connector according to 1-2-3, Figure 17.

STEP PROCEDURE



02403009

ATCRBS Discrete and Scope Trigger Tests
Setup Diagram
Figure 17

- 260. Select Oscilloscope positive slope trigger.
- 261. Set ATC-1400A To/TAC/TD Switch to **To**.
- 262. Verify Oscilloscope displays two scope trigger pulses.
- 263. Verify first scope trigger pulse leading edge occurs before P₁ of ATCRBS interrogation.
- 264. Verify second scope trigger pulse leading edge occurs before P₁ of Mode S interrogation.
- 265. Set ATC-1400A To/TAC/TD Switch to **TD**.
- 266. Verify leading edge of first scope trigger pulse occurs 2.0 μs after leading edge of P₃ in ATCRBS interrogation.
- 267. Verify leading edge of second scope trigger pulse occurs approximately 132 μs after P₁ in Mode S interrogation.
- 268. Remove power from the Mode S Test System.
- 269. Disconnect test equipment.



3.7 PERFORMANCE EVALUATION DATA SHEET

The following data sheet may be reproduced by individual users.

TECHNICIAN: _____ DATE: _____

ATC-1400A S/N: _____ S-1403DL S/N: _____

STEP	DATA	RESULT
S-1403DL to ATC-1400A COMMUNICATION		
11.	S-1403DL displays sign on sequence screens.	_____ (√)
12.	S-1403DL displays Main Control Menu.	_____ (√)
14.	S-1403DL displays ATC Screen with CAL settings.	_____ (√)
18.	S-1403DL PRF 1500 Hz (1498.0475 to 1500.1525 Hz)	_____
ATC FUNCTION		
21.	Mode C P ₃ position from P ₁ 21.0 μs (20.99 to 21.01 μs)	_____
23.	Mode A P ₃ position from P ₁ 8.0 μs (7.99 to 8.01 μs)	_____
25.	P ₃ level varies.	_____ (√)
27.	P ₃ is deactivated.	_____ (√)
30.	P ₂ position from P ₁ 2.0 μs (1.99 to 2.01 μs)	_____
31.	P ₂ (SLS) level varies.	_____ (√)
33.	P ₂ (SLS) position moves closer to P ₁ .	_____ (√)
35.	P ₂ (SLS) position moves away from P ₁ .	_____ (√)
38.	P ₃ position moves closer to P ₁ .	_____ (√)
40.	P ₃ position moves away from P ₁ .	_____ (√)
43.	P ₁ , P ₂ (SLS) and P ₃ pulse widths vary.	_____ (√)
SEQ FUNCTION		
46.	S-1403DL displays SEQ Screen with CAL settings.	_____ (√)
51.	Sequence Menu S001 displays decoded UF00 in octal.	_____ (√)
53.	Sequence Menu S002 displays decoded UF04 in octal.	_____ (√)
55.	Sequence Menu S003 displays decoded UF05 in octal.	_____ (√)
57.	Sequence Menu S004 displays decoded UF11 in octal.	_____ (√)
62.	Sequence Menu S005 displays decoded UF16 in hexadecimal.	_____ (√)
64.	Sequence Menu S006 displays decoded UF20 in hexadecimal.	_____ (√)
66.	Sequence Menu S007 displays decoded UF21 in hexadecimal.	_____ (√)
68.	Sequence Menu S008 displays decoded UF00 in hexadecimal.	_____ (√)

STEP	DATA	RESULT
74.	P ₂ position from P ₁ 2.0 μs (1.99 to 2.01 μs)	-----
75.	P ₆ position from P ₁ 3.5 μs (3.49 to 3.51 μs)	-----
76.	SPR position from P ₂ 2.75 μs (2.74 to 2.76 μs)	-----
78.	P ₂ level varies.	----- (√)
80.	P ₂ is deactivated.	----- (√)
83.	P ₆ is deactivated.	----- (√)
86.	P ₆ width varies.	----- (√)
89.	P ₆ position varies.	----- (√)
92.	P ₅ (SLS) overlaps SPR position.	----- (√)
93.	P ₅ (SLS) level varies.	----- (√)
95.	SPR is deactivated.	----- (√)
98.	P ₅ (SLS) and SPR positions vary.	----- (√)
ACS FUNCTION		
102.	S-1403DL displays ACS Screen with CAL settings.	----- (√)
103.	P ₄ position from P ₁ 10.0 μs (9.99 to 10.01 μs)	-----
104.	P ₄ width 0.8 μs (0.79 to 0.81 μs)	-----
ACL FUNCTION		
106.	S-1403DL displays ACL Screen with CAL settings.	----- (√)
108.	P ₄ level varies.	----- (√)
110.	P ₄ is deactivated.	----- (√)
112.	P ₄ width 1.6 μs (1.59 to 1.61 μs)	-----
114.	P ₄ width varies.	----- (√)
117.	P ₄ position varies.	----- (√)
INTLCE FUNCTION		
122.	S-1403DL displays INTLCE Screen.	----- (√)
124.	ATCRBS pulse pattern consists of P ₁ and P ₃ .	----- (√)
126.	P ₁ of Mode S interrogation position from P ₁ of ATCRBS interrogation 200 μs (199.9 to 200.1 μs)	-----
127.	Mode S pulse pattern consists of P ₁ , P ₂ and P ₆ .	----- (√)
129.	Two ATCRBS interrogations occur between Mode S interrogations for Ratio:1: 2.	----- (√)

STEP	DATA	RESULT
DI FUNCTION		
131.	S-1403DL displays * DI/INTF ERROR * message.	_____ (√)
134.	S-1403DL displays DI Screen.	_____ (√)
136.	First interrogation ATCRBS pulse pattern consists of P ₁ and P ₃ .	_____ (√)
140.	First interrogation Mode S pulse pattern consists of P ₁ , P ₂ and P ₆ .	_____ (√)
142.	First interrogation ATCRBS Only All Call pulse pattern consists of P ₁ , P ₃ and short P ₄ .	_____ (√)
144.	First interrogation ATCRBS/Mode S All Call pulse pattern consists of P ₁ , P ₃ and long P ₄ .	_____ (√)
147.	P ₁ of second interrogation position from P ₁ of first interrogation 200 μs (199.985 to 200.015 μs)	_____
148.	Second interrogation ATCRBS pulse pattern consists of P ₁ and P ₃ .	_____ (√)
150.	Second interrogation Mode S pulse pattern consists of P ₁ , P ₂ and P ₆ .	_____ (√)
152.	Second interrogation ATCRBS Only All Call pulse pattern consists of P ₁ , P ₃ and short P ₄ .	_____ (√)
154.	Second interrogation ATCRBS/Mode S All Call pulse pattern consists of P ₁ , P ₃ and long P ₄ .	_____ (√)
BURST FUNCTION		
156.	S-1403DL displays * DI/INTF ERROR * message.	_____ (√)
158.	S-1403DL displays BURST Screen.	_____ (√)
161.	ATCRBS interrogation displays for 5 seconds.	_____ (√)
165.	Mode S interrogation displays for 5 seconds.	_____ (√)
ANT A RF VERNIER		
173.	-4 dBm Power Meter reference level	_____
175.	Step 173 reference level + 3.0 dB (±0.3 dB)	_____
177.	Step 173 reference level - 3.0 dB (±0.3 dB)	_____
ANT B RF LEVEL (w/o MLD)		
184.	-50 dBm Spectrum Analyzer reference level	_____
188.	ANT B level = Step 184 reference level (±1 dB)	_____

STEP	DATA	RESULT
ANT B RF LEVEL/VERNIER (w/ MLD)		
194.	-20 dBm Spectrum Analyzer reference level	-----
200.	ANT B level = Step 194 reference level (± 0.5 dB)	-----
204.	-20 dBm Power Meter reference level	-----
206.	Step 204 reference level + 3.0 dB (± 0.3 dB)	-----
208.	Step 204 reference level - 3.0 dB (± 0.3 dB)	-----
PREPULSE		
218.	Prepulse position coincident with P ₁ (± 100 ns)	-----
220.	P ₁ position 260 μ s after prepulse (259.9 to 260.1 μ s)	-----
EXT SYNC OUT		
229.	Ext Sync pulse position coincident with P ₁ (± 100 ns)	-----
231.	Ext Sync pulse follows P ₁ .	----- (√)
233.	Ext Sync pulse precedes P ₁ .	----- (√)
EXT SYNC IN		
241.	P ₁ position ≈ 18 μ s after Oscilloscope trigger	----- (√)
243.	Interrogation tracks Dual Pulse Generator PRF.	----- (√)
EXT MOD IN		
251.	ATC-1400A GEN Connector pulses coincide with Dual Pulse Generator output.	----- (√)
ATCRBS DISCRETE		
258.	3.0 μ s wide <u>ATCRBS</u> discrete pulse occurs 1.0 μ s prior to P ₁ .	----- (√)
SCOPE TRIGGER		
262.	Oscilloscope displays two scope trigger pulses.	----- (√)
263.	To first scope trigger pulse leading edge occurs before P ₁ of ATCRBS interrogation.	----- (√)
264.	To second scope trigger leading edge occurs before P ₁ of Mode S interrogation.	----- (√)
266.	To first scope trigger pulse leading edge occurs 2.0 μ s after leading edge of P ₃ in ATCRBS interrogation.	----- (√)
267.	To second scope trigger leading edge occurs ≈ 132 after leading edge of P ₁ in Mode S interrogation.	----- (√)

4. REMOTE OPERATION

4.1 GENERAL

The Mode S Test System with the S-1403DL provides multiple options for remote operation: parallel GPIB control through the ATC-1400A, serial RS-232 control through the S-1403DL or parallel GPIB control through the S-1403DL. All remote options can operate simultaneously as long as commands used do not interfere with each other (convenient for sending queries through one connector while controlling operation through another).

4.2 FRONT PANEL OPERATION

Sending a command through the ATC-1400A GPIB Connector (J14) automatically locks out front panel operation (local operation). Front panel controls remain locked out until an exclamation mark (!) is sent to the ATC-1400A to return to normal operation.

The S-1403DL has front panel control capabilities during remote operation through the S-1403DL RS-232 Connector (J12) or GPIB Connector (J21), unless commanded otherwise. Adjusting front panel controls during remote operation may interfere with normal operation.

4.3 OPERATING PROCEDURES

4.3.1 ATC-1400A GPIB Configuration

STEP	PROCEDURE
1.	Apply power to Mode S Test System.
2.	Connect external GPIB control device to ATC-1400A GPIB Connector (J14) using IEEE-488 GPIB cable. Use a double shielded and properly terminated IEEE-488 interface cable.
3.	Set desired GPIB address with ATC-1400A GPIB ADDRESS Dip Switches.
4.	Initiate parallel remote operation.
5.	Start all command lines to S-1403DL with AXn= where <i>n</i> equals S-1403DL C84 System Screen 1403 Bus Address setting (default is 3). Send old-style commands using the default old-style parser. Send new commands using the SCPI parser. <ul style="list-style-type: none"> ● Send AXn=SCPI as last command on old-style command line to switch to SCPI parser. ● Send AXn=S1403c or AXn=SYSTEM:LANGUAGE:S1403C as last command on SCPI command line to switch back to old-style parser.
6.	Send ATC-1400A commands before and on a separate line from S-1403DL commands. NOTE: Failure to place commands on separate lines may return false indications. NOTE: Command lines through the ATC-1400A have a maximum length of 68 characters including prefix and line terminator characters.
7.	When finished with remote operation, send ! command to return to front panel operation (local control).

4.3.2 S-1403DL RS-232 Configuration

STEP	PROCEDURE
------	-----------

1. Apply power to S-1403DL.
2. Connect external serial control device to S-1403DL RS-232 Connector (J12).
Use a double shielded and properly terminated RS-232 interface cable.
Refer to 1-2-4, Figures 18 through 21.

NOTE: The S-1403DL RS-232 Connector (J12) connects directly to a computer type device or through a null modem adapter to a modem type device.

3. Press S-1403DL C MENU, 8 and 1 Keys in sequence to display C81 System Screen.

```

C81      SYSTEM - RS232 CONTROL
RCI:ENABLE      Screen Dump:DISABLE
RCI Echo:YES    Screen Border:7BIT
                Screen EOL:CR/LF
    
```

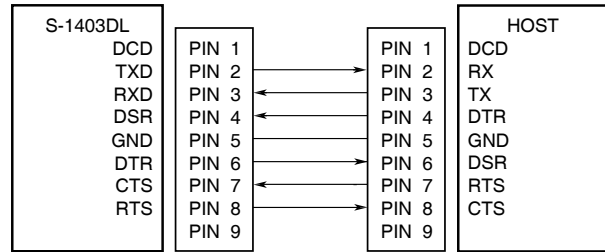
Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set fields as follows:

- Set RCI to **ENABLE**.
- Set RCI Echo to **YES** to echo back commands to controller or **NO** to disable remote echo (usual modem operation).
- Set Screen Dump to **DISABLE** for normal remote operation.

4. Press S-1403DL C MENU, 8 and 2 Keys in sequence to display C82 System Screen.

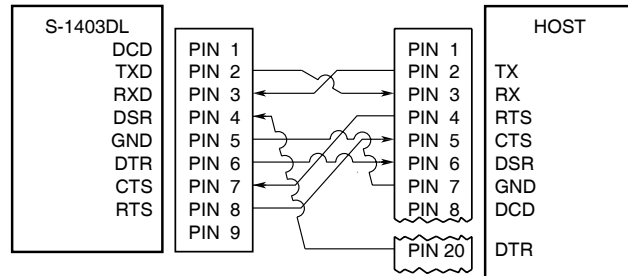
```

C82      SYSTEM - RS232 INTERFACE
Baud:38400      Hndshk:XON/XOFF
Data:8          HndshkOn: 90%
Stop:1         Parity:NONE    HndshkOff:10%
    
```



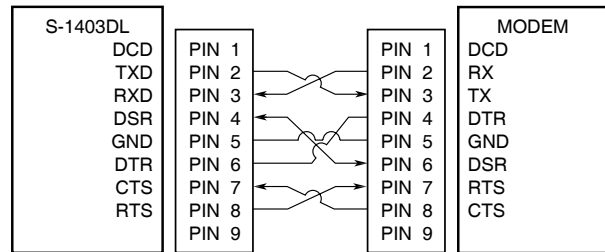
02403016

RS-232 Host Cable Connections (9-Pin)
Figure 18



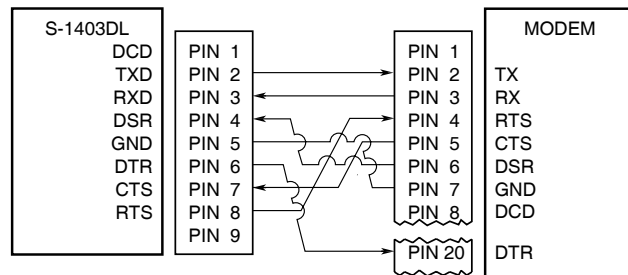
02403017

RS-232 Host Cable Connections (25-Pin)
Figure 19



02403018

RS-232 Modem Cable Connections (9-Pin)
Figure 20



02403019

RS-232 Modem Cable Connections (25-Pin)
Figure 21

4.3.3 S-1403DL GPIB Configuration

STEP	PROCEDURE
------	-----------

Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set fields as follows:

- Set Baud to baud rate compatible with serial controller and modem, if used.
- Set Hndshk to handshake mode compatible with serial controller or **NONE** for modem operation.
- Set Data to number of data bits per word according to serial controller setting.
- Set Stop to number of stop bits per word according to serial controller setting.
- Set Parity according to serial controller parity setting.
- If needed, set HndshkOn to **90%** and HndshkOff to **10%** (defaults).

5. If applicable, call modem.
6. Initiate serial remote operation.

Send new commands using the default SCPI parser. Send old-style commands using the old-style parser.

- Send **SCPI** as last command on old-style command line to switch to SCPI parser.
- Send **S1403c** or **SYSTem:LANGuage:S1403C** as last command on SCPI command line to switch back to old-style parser.

STEP	PROCEDURE
------	-----------

1. Apply power to S-1403DL.
2. Connect external GPIB control device to S-1403DL GPIB Connector (J21) using IEEE-488 GPIB cable.

Use a double shielded and properly terminated IEEE-488 interface cable.
3. Press S-1403DL C MENU, 8 and 3 Keys in sequence to display C83 System Screen.

C82	SYSTEM - GPIB
RCI:ENABLE	
Address:31	

Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set fields as follows:

- Set RCI to **ENABLE**.
 - Set Address to desired GPIB address.
4. Initiate parallel remote operation, sending commands to GPIB address set in Step 3.

Send new commands using the default SCPI parser. Send old-style commands using the old-style parser.
- Send **SCPI** as last command on old-style command line to switch to SCPI parser.
 - Send **S1403C** or **SYSTem:LANGuage:S1403C** as last command on SCPI command line to switch back to old-style parser.

4.4 TEST MACRO LANGUAGE (TMAC)

TMAC is the Remote Command Interpreter (RCI) used for programming and remotely operating the S-1403DL Test Auxiliary (new SCPI-style commands only). TMAC provides a format to store and perform user defined test sequences. TMAC, based on the IEEE-488.2 format, supports the SCPI Standard.

A main strength of TMAC is the capability to define macro commands. Step by step test procedures are developed, stored and remotely implemented through TMAC. TMAC also provides a variety of data structures to assist in developing test procedures. Macros can be executed from other macros, passing parameters from one macro to another, allowing complicated procedures to be divided into smaller tasks. Multitasking commands allow several macros to alternate command execution, giving the appearance of being executed simultaneously.

Macros declared as programs can be assigned by remote operation. Macro programs may then be activated through front panel operation under the User Menu.

A full explanation of the TMAC language is beyond the scope of the Mode S Test System Operation Manual. Tables 13 and 12 in 1-2-4 list the specific instrument commands. For a complete explanation of the TMAC language including the use of macros, macro programs, variables, data structures, flow control commands and multitasking commands, refer to the S-1403DL TMAC Users Manual (1002-2400-600).

4.5 COMMAND SYNTAX

The S-1403DL accepts and executes both old-style S-1403C commands and new IEEE-488.2/SCPI commands. To ensure full backward compatibility of the S-1403C commands, the old-style commands cannot be mixed with the new commands on the same line. Many old-style commands have a corresponding new command.

The S-1403DL has two commands for changing between the old-style and SCPI-style parsers. Both commands, **SCPI** (for SCPI parser) and **S1403c** (for old-style parser), are available on either parser. The SCPI parser also provides a new command, **SYStem:LANGuage S1403C**, for the old-style parser. The command to change parsers must be the last command on the line.

All commands and data are printable ASCII characters.

Commands are entered using short or long form. The parser accepts the exact short or long form but not other variations. The short form is shown in upper case and the long form is shown as the entire command in upper and lower case. All old and new commands, though, are case insensitive. Italicized items indicate variables.

Delimiters separate or classify commands. The S-1403DL uses the following delimiters:

- = represents a *set value to* operation.
- ? represents a *get value* operation.
- . represents an *enable* operation.
- ; separates individual *set value to* fields (and same fields in replies).
- : separates old-style individual commands to the S-1403DL or ATC-1400A.

Command lines sent through the ATC-1400A to the S-1403DL Test Auxiliary must include the prefix, **AXn=** with *n* set according to the C84 IFR BUS System Screen 1403 Bus Address setting (2 to 7). For backward compatibility, the IFR Bus Address is set to **3** (default). The prefix, **AXn=** is optional through the S-1403DL GPIB or RS-232 Connectors.

Error conditions identified in local operation are also active in remote operation. The S-1403DL only sends error messages, though, when requested by an error query. Valid error messages from the S-1403DL cause the ATC-1400A to set bit 1 of the SRQ register. While bit 1 of the SRQ register is active, the error query, **ERRM?** (old-style) or **SYStem:ERRor:S1403c?** (SCPI), is sent to receive the message and clear the register. If bit 1 of the SRQ register is not set when the command is issued the reply is **NONE** to indicate no errors.

Remote operation and local operation perform the same functions except for decoded sequence menus. For remote operation, data for sequence menus must be entered as short or long data fields.

A helpful hint for setting sequence menu data is setting the desired data in decoded format from the front panel. After setting desired data, changing the sequence menu to an undecoded format allows the operator to see and record the data field required to set the sequence menu remotely.

4.6 COMMANDS

Command line descriptions signify variable entry fields as follows:

<*italics*> where *italics* represents the value, data or control entry field.

Entry fields are set to default or front panel values set before switching to remote operation.

For quick reference, Table 13 in 1-2-4 shows old-style commands and Table 12 shows new SCPI-style commands in operating order. Detailed explanation of commands with reference to screen location for comparable front panel operation are listed in alphabetical order. Old-style commands are listed in 4.6.1 and new SCPI-style commands are listed in 4.6.2. Table 14 in 1-2-4 compares old-style and new SCPI-style commands.

4.6.1 SCPI/IEEE-488.2 Commands

Brackets [] indicate optional command words or data (e.g. GENERator ANTA,ON or GENERator:STATE ANTA,ON work the same for the command GENERator[:STATE] <ant>, <on/off>).

The two-state variables represented by <on/off>, <ant> and <true/false> also accept the number 1 for ON, ANTB or TRUE; and 0 for OFF, ANTA or FALSE.

Most string inputs require quotation marks (“”) around the string as indicated in the command descriptions.

COMMAND	RANGE/VALUES	DEFINITION
FORMat <type>	ASCIi/BINary/HEXadecimal/OCTal	Sets format for numerical data returns.
S1403c		Switches to old-style command interpreter.
SCPI		Switches to new SCPI-style command interpreter.
SYSTem:LANGUage S1403C		Switches to old-style command interpreter.
INTerrogation:TRIGger:BURSt		Same as pressing BURST Key.
HCOPY[:IMMEDIATE]		Performs screen dump out RS-232 Connector.
HCOPY:SDUMp[:IMMEDIATE]		Performs screen dump out RS-232 Connector.
PSCReen		Performs screen dump out RS-232 Connector.
C10/C20 Function Screens		
GENErator[:STATe] <ant>,<on/off>	ANTA/ANTB (0/1),ON/OFF (1/0)	Enables/disables interrogation for specified antenna.
GENErator[:STATe]?		Returns interrogation status for specified antenna.
GENErator:LEVel:OFFSet <ant>,<fine>	ANTA/ANTB (0/1),-3.0 to +3.0	Sets ANTB vernier in dB.
GENErator:LEVel:OFFSet?		Returns ANTB vernier setting in dB.
GENErator:TIME:OFFSet <value>	-0.95 to +0.95	Sets ANTB interrogation position in μ s, relative to ANTA.

S-1403DL SCPI-Style Command List
Table 12

COMMAND	RANGE/VALUES	DEFINITION
GENerator:TIME:OFFSet?		Returns ANTB interrogation position setting in μ s from ANTA.
GENerator:LEVel <ant>,<course>	ANTB (1),-20 to -83	Sets ANTB level in dBm.
GENerator:LEVel? <ant>	ANTB (1)	Returns ANTB level setting in dBm.
INTerrogation:FUNcTion:ATCrbs		Starts ATC function.
INTerrogation:FUNcTion:SEQuence		Starts SEQ function.
INTerrogation:FUNcTion:ACS		Starts ACS function.
INTerrogation:FUNcTion:ACL		Starts ACL function.
INTerrogation:FUNcTion:INTerlace [<n>]	1 to 999	Starts Interlace/sets ATCRBS to Mode S interrogation ratio.
INTerrogation:FUNcTion:INTerlace?		Returns ATCRBS to Mode S interrogation ratio setting.
INTerrogation:FUNcTion:DI [<f1>,<f2>]	"ATC"/"SEQ"/"ACS"/"ACL", "ATC"/"SEQ"/"ACS"/"ACL"	Starts DI/sets both interrogation types.
INTerrogation:FUNcTion:DI?		Returns DI interrogation types.
INTerrogation:FUNcTion:BURSt [<f1>,<BN>]	1 to 9999	Starts Burst/sets interrogation type and number.
INTerrogation:FUNcTion:BURSt?		Returns Burst number setting.
INTerrogation:FUNcTion:BURSt:CONDition?		Returns Burst Function status.
INTerrogation:FUNcTion:ATCMonitor		Starts ATCRBS Monitor Pulse Function.
INTerrogation:FUNcTion?		Returns active interrogation function with parameters.
INTerrogation:P3 <level>	"CAL"/"VAR"/"OFF"	Sets P ₃ pulse level.
INTerrogation:P3?		Returns P ₃ pulse level setting.
INTerrogation:P6 <level>[,<width>[,<dev>]]	"CAL"/"OFF", "CAL"/-1.50 to +1.50, "CAL"/-1.95 to +1.95	Sets P ₆ pulse level, width and position.
INTerrogation:P6?		Returns P ₆ pulse level, width and position setting.
INTerrogation:P2 <level>	"CAL"/"VAR"/"OFF"	Sets P ₂ pulse level.
INTerrogation:P2?		Returns P ₂ pulse level setting.
INTerrogation:P6:SPR <on/off>[,<dev>]	ON/OFF, "CAL"/-1.00 to +1.00	Sets SPR control and position.
INTerrogation:P6:SPR?		Returns SPR control and position setting.
INTerrogation:P4 <level>[,<width>[,<dev>]]	"CAL"/"VAR"/"OFF", "CAL"/0.20 to 3.55, "CAL"/-1.95 to +1.95	Sets P ₄ pulse level, width and position.
INTerrogation:P4?		Returns P ₄ pulse level, width and position setting.
REPLy:ATCrbs?		Returns Mode C reply altitude or Mode A reply identification.
REPLy:DELay:FIRSt?		Returns reply delay for current function.

 S-1403DL SCPI-Style Command List
 Table 12 (Cont)

COMMAND	RANGE/VALUES	DEFINITION
REPLY:JITTer? <rtype>	"ATC" or "MODES"	Returns measured reply jitter.
REPLY:MODES? [<rformat>]	"A"/"N"	Returns data in set format from Mode S replies to ATC, ACS or ACL interrogations.
REPLY:SPACing? "ATC"		Returns F ₁ to F ₂ pulse spacing.
REPLY:WIDTh? <rtype>	"ATC" or "MODES"	Returns reply pulse widths.
REPLY:TIMeout <time>	1.000 to 65.535	Sets time limit to look for reply in seconds.
C30 Percent Reply Screen		
REPLY:PERCent? [<ant>[,<rtype>]]	ANTA/ANTB,"TOTAL"/"ATC"/ "MODES"/"BAD"/"NOREPLY"	Sets percent reply through selected antenna for set type.
REPLY:PERCent:CLEar		Clears percent reply readings.
C40 Reply Delay Screen		
REPLY:DELay? [<type>]	"ATC"/"MODES"	Returns reply delay in μ s.
REPLY:DELay:CLEar		Clears reply delay readings.
C50/C60 Squitter Screens		
SQTR:ADDRess?		Returns squitter address.
SQTR:TAIL?		Returns squitter tail number and country.
SQTR:COUNT:PERiod <t>	10 to 300	Sets period in seconds for counting squitters.
SQTR:COUNT:PERiod?		Returns period setting in seconds for counting squitters.
SQTR:COUNT? [<type>]	"ATC"/"DF11"/"DF17"/"DF17A"/ "DF17E"/"DF17I"/"DF17O"/ "DF17P"/"DF17S"/"DF17T"/ "DF17V"/"MODES"	Returns squitter count during set period for selected type.
SQTR:COUNT:CLEar		Clears squitter count readings.
SQTR:TIMe? <type>[,<format>]	"DF11"/"DF17A"/"DF17E"/ "DF17I"/"DF17O"/"DF17P"/ "DF17S"/"DF17T"/"DF17V"/ "MODES","A"/"N"	Returns squitter time intervals in seconds and data in selected format.
SQTR:TIMe:CLEar		Clears squitter time readings.
SQTR:CAPTure:CONDition?		Returns capture buffer status.
SQTR:CAPTure[:STATe] <on/off>	ON/OFF (1/0)	Enables/disables squitter capture.
SQTR:CAPTure[:STATe]?		Returns squitter capture status.
SQTR:CAPTure:CLEar		Clears all buffer entries.
SQTR:CAPTure:COUNT?		Returns number of entries in capture buffer and capacity.
SQTR:CAPTure:FILTer <filter>	1 to 256	Sets squitter capture filter.
SQTR:CAPTure:FILTer?		Returns squitter capture filter setting.
SQTR:CAPTure:GET? [<format>]	"A"/"N"	Returns squitter capture buffer data.

S-1403DL SCPI-Style Command List
Table 12 (Cont)

COMMAND	RANGE/VALUES	DEFINITION
SQTR:CAPTURE:MODE <mode>	CONTInuous or SINGleshot	Sets squitter capture buffer mode.
SQTR:CAPTURE:MODE?		Returns squitter capture buffer mode.
SQTR:TIME:TIMEout <type>,<time>	"ATC"/"DF11"/"DF17A"/ "DF17E"/"DF17I"/"DF17O"/ "DF17P"/"DF17S"/"DF17T"/ "DF17V"/"MODE4"/"MODES", 1.000 to 65.535	Sets time limit to look for selected squitters in seconds.
SQTR:TIME:TIMEout:DEFault		Sets time limits to look for squitters to default values.
C71 Setup Interrogation Trigger Screen		
INTerrogation:TRIGger:SOURce <src>	"SELFinT"/"SYNC"/"TRIGgen"/ "BURSt"	Sets interrogation trigger source.
INTerrogation:TRIGger:SOURce?		Returns interrogation trigger source setting.
INTerrogation:TRIGger:GENerator <num> <hz/sec>	0.004 to 99.9999 SEC or 1 to 2500 HZ	Sets internal trigger generator.
INTerrogation:TRIGger:GENerator?		Returns internal trigger generator setting.
C72 Setup Scope Trigger Screen		
INTerrogation:SCOPE <type>,<on/off>[,<dev>]	"ATC"/"MODES"/"ACS"/"ACL", ON/OFF (1/0),0 to 255 (varies with <type>)	Sets SCOPE TRIG OUT Connector pulse.
INTerrogation:SCOPE?		Returns SCOPE TRIG OUT Connector pulse settings.
C73 Setup Ext Sync Out Screen		
INTerrogation:SYNC:OUT <type>,<on/off>	"ATC"/"MODES"/"ACS"/"ACL", ON/OFF	Sets EXT SYNC OUT Connector output.
INTerrogation:SYNC:OUT?		Returns EXT SYNC OUT Connector output setting.
INTerrogation:SYNC:OUT:DEVIation <value>	-9.95 to +9.95	Sets EXT SYNC OUT Connector pulse position in μ s from P ₁ .
INTerrogation:SYNC:OUT:DEVIation?		Returns set EXT SYNC OUT Connector pulse position.
C74 Setup PPMG Screen		
INTerrogation:PPMG <type>,<on/off>[,<pulse#>]	"ATC"/"MODES"/"DELM", ON/OFF (0/1),(<pulse#> varies with <type>)	Sets PPMG control for specified pulse.
INTerrogation:PPMG? <type>	"ATC"/"MODES"/"DELM"	Returns PPMG control pulse setting for specified type.
C75 Setup Miscellaneous Screen		
GENerator[:STATE] <ant>,<on/off>	ANTA/ANTB (0/1),ON/OFF (1/0)	Enables/disables interrogation for specified antenna.
GENerator[:STATE]?		Returns interrogation status for specified antenna.

S-1403DL SCPI-Style Command List
Table 12 (Cont)

COMMAND	RANGE/VALUES	DEFINITION
INTerrogation:MODulation <ant>,<src>	ANTA/ANTB (0/1), "INT"/"EXT"/"INTExt"	Specifies modulation source for selected antenna.
INTerrogation:MODulation? <ant>	ANTA/ANTB (0/1)	Returns modulation source setting for selected antenna.
INTerrogation:PPULse <on/off>[,<dev>]	ON/OFF (1/0),0 to 260	Sets prepulse status and position.
INTerrogation:PPULse?		Returns prepulse status and position settings.
C76 Setup SMenu Screen		
INTerrogation:SMENu:FORMat <f>	"HEXadecimal"/"OCTal"	Sets numerical format for sequence menu data.
INTerrogation:SMENu:FORMat?		Returns numerical format setting for sequence menu data.
INTerrogation:SMENu:SET:ALL <x>	"OFF"/"XPDR"/"USER"/"ZERO"/ "DEFault"	Modifies all sequence menus.
INTerrogation:SMENu:GLOBal: ADDRes <gtype>,<addr>	"USER",0 to #HFFFFFF	Sets global transponder address.
INTerrogation:SMENu:GLOBal: ADDRes? <gtype>	"XPDR"/"USER"	Returns global transponder address setting.
INTerrogation:SMENu:GLOBal: APXor <gtype>,<xor>	"XPDR"/"USER",0 to #HFFFFFF	Sets global XOR mask.
INTerrogation:SMENu:GLOBal: APXor? <gtype>	"XPDR"/"USER"	Returns global XOR mask setting.
C79 Setup ATC-1400A Controls Screen		
ATC1400a:ATCrbs <m>	"1", "2", "T", "A", "B", "C" or "D"	Specifies ATCRBS mode.
ATC1400a:ATCrbs?		Returns ATCRBS mode setting.
ATC1400a:RF <o>	"NORM" or "CW"	Specifies RF output control.
ATC1400a:RF?		Returns RF output control setting.
ATC1400a:SCOPE <r>	"TO" or "TD"	Specifies scope sync position.
ATC1400a:SCOPE?		Returns scope sync position setting.
ATC1400a:MODE <m>,<loc>	"DI or "OFF" and 0 to 399.9	Specifies DI spacing in μ s.
ATC1400a:MODE?		Returns DI spacing setting.
ATC1400a:P123:WIDTh <w>	"CAL" or 0 to 1.95	Specifies pulse width in μ s.
ATC1400a:P123:WIDTh?		Returns pulse width setting.
ATC1400a:P2:DEVIation <d>	"CAL" or -1.95 to +1.95	Specifies P ₂ deviation in μ s.
ATC1400a:P2:DEVIation?		Returns P ₂ deviation setting.
ATC1400a:P3:DEVIation <d>	"CAL" or -1.95 to +1.95	Specifies P ₃ deviation in μ s.
ATC1400a:P3:DEVIation?		Returns P ₃ deviation setting.
C81 System RS232 Control Screen		
SYSTem:COMMunicate:SERial:RCI <on/off>	ON/OFF (1/0)	Enables/disables control through RS-232 Connector.
SYSTem:COMMunicate:SERial: RCI?		Returns control status through RS-232 Connector.

S-1403DL SCPI-Style Command List
Table 12 (Cont)

COMMAND	RANGE/VALUES	DEFINITION
SYSTem:COMMunicate:SERial: ECHO <on/off>	ON/OFF (1/0)	Enables/disables RS-232 remote command echo.
SYSTem:COMMunicate:SERial: ECHO?		Returns RS-232 remote command echo status.
SYSTem:COMMunicate:SERial: DUMP <on/off>[,<bdr>,<eol>]	ON/OFF (1/0),8/7/0,"CRLF"/ "LF"/"CR"/"NUL"	Sets RS-232 screen dump parameters.
SYSTem:COMMunicate:SERial: DUMP?		Returns RS-232 screen dump parameter settings.
C82 System RS232 Interface Screen		
SYSTem:COMMunicate:SERial: BAUD <rate>	110/150/300/600/1200/2400/ 4800/9600/19200/38400/57600	Sets RS-232 baud rate.
SYSTem:COMMunicate:SERial: BAUD?		Returns RS-232 baud rate setting.
SYSTem:COMMunicate:SERial: BITS 	7/8	Sets RS-232 bits per word.
SYSTem:COMMunicate:SERial: BITS?		Returns RS-232 bits per word setting.
SYSTem:COMMunicate:SERial: SBITs 	1/2	Sets RS-232 stop bits per word.
SYSTem:COMMunicate:SERial: SBITs?		Returns RS-232 stop bits per word setting.
SYSTem:COMMunicate:SERial: PARity <p>	NONE/ODD/EVEN	Sets RS-232 parity check mode.
SYSTem:COMMunicate:SERial: PARity?		Returns RS-232 check mode setting.
SYSTem:COMMunicate:SERial: PACE <hndshk>	NONE/XON	Sets RS-232 software handshaking (pacing) mode.
SYSTem:COMMunicate:SERial: PACE?		Returns RS-232 software handshaking mode setting.
SYSTem:COMMunicate:SERial: CONTrol:RTS <hndshk>	ON/STANdard/RFR	Sets RS-232 hardware handshaking (pacing) mode.
SYSTem:COMMunicate:SERial: CONTrol:RTS?		Returns RS-232 hardware handshaking mode setting.
C83 System GPIB Screen		
SYSTem:COMMunicate:GPIB:RCI <on/off>	ON/OFF (1/0)	Enables/disables control through GPIB Connector.
SYSTem:COMMunicate:GPIB:RCI?		Returns control status through GPIB Connector.
SYSTem:COMMunicate:GPIB: ADDRes <a>	0 to 31	Sets S-1403DL GPIB address.
SYSTem:COMMunicate:GPIB: ADDRes?		Returns S-1403DL GPIB address.

S-1403DL SCPI-Style Command List
Table 12 (Cont)

COMMAND	RANGE/VALUES	DEFINITION
C84 System IFR Bus Screen		
SYSTem:COMMunicate:ATC1400:CONTROL <c>	"MASTer"/"SLAVE"/"ALONe"	Sets S-1403DL control relationship with ATC-1400A.
SYSTem:COMMunicate:ATC1400:CONTROL?		Returns S-1403DL control relationship with ATC-1400A.
SYSTem:COMMunicate:ATC1400:S1403c:ADDRess <a>	2 to 7	Sets S-1403DL IFR BUS address.
SYSTem:COMMunicate:ATC1400:S1403c:ADDRess?		Returns S-1403DL IFR BUS address setting.
C85 System Keyboard Screen		
SYSTem:KEY:REPeat <delay>,<rate>	0.1 to 2.0,0.1 to 2.0	Sets Keyboard control parameters.
SYSTem:KEY:REPeat?		Returns Keyboard control parameter settings.
C86 System Clock Screen		
SYSTem:DATE <y>,<m>,<d>	0000 to 9999,1 to 12,1 to 31	Sets current date.
SYSTem:DATE?		Returns current date setting.
SYSTem:TIME <h>,<m>,<s>	0 to 23,0 to 59,0 to 59	Sets current time.
SYSTem:TIME?		Returns current time setting.
C89 Version System Screen		
*IDN?		Returns identification, serial number and firmware versions.
*OPT?	(1-no option/3-MLD option)	Returns option code.
S000 to S999 Sequence Menu Screens		
INTerrogation:SMENu <smenu#>,<on/off>[,<ifformat>[,<data>]]	0 to 999,ON/OFF (1/0), "A"/"D"/"N"/"R"/"S"/"L",(<data> varies with <ifformat>)	Sets interrogation data for specific sequence menu.
INTerrogation:SMENu? <smenu#>[,<ifformat>]	0 to 999,"A"/"N"	Returns interrogation data settings for specific sequence menu.
INTerrogation:SMENu:BITS <smenu#>,<startbit#>,<bitlen>,<data>	0 to 999,1 to 112,1 to 112, (value for up to 112 bits of data in quotes)	Sets selected interrogation data bits of selected sequence menu.
INTerrogation:SMENu:BITS? <smenu#>,<startbit#>,<bitlen>	0 to 999,1 to 112,1 to 112	Returns setting of selected data bits of selected sequence menu.
INTerrogation:SCOPE:SMENu <smenu#>,<on/off>	0 to 999,ON/OFF (1/0)	Activates/deactivates SCOPE TRIG OUT Connector pulse for selected sequence menu.
INTerrogation:SCOPE:SMENu? <smenu#>	0 to 999	Returns status of SCOPE TRIG OUT Connector pulse for selected sequence menu.
REPLy:SMENu? <smenu#>[,<rformat>]	0 to 999,"A"/"N"	Returns selected sequence menu reply data in set format.
REPLy:SMENu:BITS? <smenu#>,<startbit#>,<bitlen>	0 to 999,1 to 112,1 to 32	Returns selected sequence menu reply data.

S-1403DL SCPI-Style Command List
Table 12 (Cont)

COMMAND	RANGE/VALUES	DEFINITION
T23 Miscellaneous MTL Screen		
TEST:MTL:ANTenna	ANTA/ANTB (0/1)	Selects MTL test antenna.
TEST:MTL:ANTenna?		Returns MTL test antenna setting.
TEST:MTL:START		Initiates MTL test.
TEST:MTL:TIME?		Returns MTL test run time in s.
TEST:MTL?		Returns MTL test errors.
TEST:MTL:LEVel?		Returns MTL with units.
T31 ELM Setup Screen		
TEST:ELM:SETup:REServation: DElay <time>	100 to 63000	Sets reservation delay in μ s.
TEST:ELM:SETup:REServation: DElay?		Returns reservation delay setting in μ s.
TEST:ELM:SETup:CLOseout:DElay <time>	100 to 63000	Sets closeout delay in μ s.
TEST:ELM:SETup:CLOseout: DElay?		Returns closeout delay setting in μ s.
TEST:ELM:SETup:UELM:SPACing <time>	50 to 63000	Sets UELM spacing in μ s.
TEST:ELM:SETup:UELM:SPACing?		Returns UELM spacing in μ s.
T32/T33 UELM Test Screens		
TEST:ELM:UP:SMENu <rsmenu#>[, <csmenu#>[,<esmenu#>[,<elm#>]]]	0 to 999,0 to 999,0 to 984,2 to 16	Selects UELM sequence menus.
TEST:ELM:UP:SMENu? [m]	"MULTIsite"	Returns selected UELM sequence menus.
TEST:ELM:UP:STARt [m]	"MULTIsite"	Initiates UELM test.
TEST:ELM:UP? [m]	"MULTIsite"	Returns UELM test errors.
T34/T35 DELM Test Screens		
TEST:ELM:DOWN:SMENu <rsmenu#>[,<csmenu#>[, <esmenu#>]]	0 to 999,0 to 999,0 to 984	Selects DELM sequence menus.
TEST:ELM:DOWN:SMENu? [m]	"MULTIsite"	Returns selected DELM sequence menus.
TEST:ELM:DOWN:STARt [m]	"MULTIsite"	Initiates DELM test.
TEST:ELM:DOWN:ELM:RECEived?		Returns number of expected and received DELM segments.
TEST:ELM:DOWN? [m]	"MULTIsite"	Returns DELM test errors.
General Test Menu Commands		
TEST:RUNning?		Returns current running status of Test Menu test.
TEST:STOP		Stops any running test.

S-1403DL SCPI-Style Command List
Table 12 (Cont)

COMMAND	RANGE/VALUES	DEFINITION
MS/MR Save and Recall Configuration Screens		
MEMory:STORe <n> or "<name>"	1 to 5 or "(stored name)"	Saves current settings in selected memory slot.
MEMory:CATalog? <n>	0 to 5	Returns stored memory slot name.
MEMory:LOAD <n> or "<name>"	0 to 5 or "(stored name)"	Recalls settings from selected memory slot.
MEMory:NAME <n>,"<name>"	1 to 5,"(≤16 characters)"	Renames selected saved memory slot.
MEMory:CLEar <n>	1 to 5	Clears selected memory slot.
MEMory:CLEar:ALL		Clears all memory slots.
MENU Display Commands		
DISPlay:CMENU <n>	0 to 99	Displays specified Control Menu screen.
DISPlay:CURRent?		Returns screen designator.
DISPlay:SMENU <n>	0 to 999	Displays specified Sequence Menu screen.
DISPlay:TMENU <n>	0 to 99	Displays specified Test Menu screen.

S-1403DL SCPI-Style Command List
 Table 12 (Cont)

SCPI/IEEE-488.2 Command Details

*IDN?

Screen: C89
 Purpose: Returns Test Set identification parameters
 Command: *IDN?
 Reply: AEROFLEX,S1403DL,<sn>, <mp>-<bi>-<pp>-<fp> where <sn> is the serial number of the queried S-1403DL, <mp> is 0300 to 9999 (Main Processor firmware version number), <bi> is 0100 to 9999 (Bios version number), <pp> is 0300 to 9999 (Pulse Processor firmware version number) and <fp> is 0300 to 9999 (Front Panel Processor firmware version number).

Example:
 *IDN?
 AEROFLEX,S1403DL,1001,0403-0104-0403-0302

*OPT?

Screen: C89
 Purpose: Returns installed option information.
 Command: *OPT?
 Reply: <n> where <n> is 0 (not set), 1 (no options), 2 (MLD option installed), 4 (ModB pulse board installed) or 6 (2+4).

Example: *OPT?
 1

ATC1400a:ATCrbs

(Stand Alone only)
 Screen: C79
 Purpose: Specifies the ATCRBS mode (simulates ATC-1400A XPDR MODE Control).

Command: ATC1400a:ATCrbs <m> where <m> is "1", "2", "T", "A", "B", "C" or "D".

Reply: None
 Example: ATC1400a:ATCrbs "A" or
 ATC1400a:ATCrbs "1"

ATC1400a:ATCrbs?

Screen: C79
 Purpose: Returns the specified ATCRBS mode.
 Command: ATC1400a:ATCrbs?
 Reply: <m> where <m> is 1, 2, T, A, B, C or D.
 Example: ATC1400a:ATCrbs?
 D

ATC1400a:MODE

(Stand Alone only)
 Screen: C79
 Purpose: Activates and specifies Double Interrogation spacing (simulates ATC-1400A DBL INTERR/INTRF PULSE Thumbwheels).
 Command: ATC1400a:MODE <m>,<loc> where <m> is "DI" or "OFF" and <loc> is 0 to 399.9 in μ s (0.1 μ s steps).
 Reply: None
 Example: ATC1400a:MODE "DI",399.9

ATC1400a:MODE?

Screen: C79
 Purpose: Returns status of the Interference Pulse or Double Interrogation spacing.
 Command: ATC1400a:MODE?
 Reply: <m>,<loc> where <m> is INTRF, DI or OFF and <loc> is -17.5 to 399.9 in μ s for Interference Pulse location or 0 to 399.9 in μ s for DI spacing.
 Example: ATC1400a:MODE?
 INTRF,-17.5

ATC1400a:P123:WIDTH

(Stand Alone only)
 Screen: C79
 Purpose: Specifies the P₁, P₂ and P₃ pulse width.
 Command: ATC1400a:P123:WIDTH <w> where <w> is "CAL" or 0 to 1.95 in μ s (0.05 μ s steps).
 Reply: None
 Example: ATC1400a:P123:WIDTH 1.50

ATC1400a:P123:WIDTH?

Screen: C79
 Purpose: Returns the P₁, P₂ and P₃ pulse width.
 Command: ATC1400a:P123:WIDTH?
 Reply: <w> where <w> is CAL or 0 to 1.95 in μ s.
 Example: ATC1400a:P123:WIDTH?
 CAL

ATC1400a:P2:DEVIation

(Stand Alone only)

Screen: C79

Purpose: Specifies the P₂ pulse deviation.

Command: ATC1400a:P2:DEVIation <d> where <d> is "CAL" or -1.95 to +1.95 in μs (0.05 μs steps).

Reply: None

Example: ATC1400a:P2:DEVIation 0.95

ATC1400a:P2:DEVIation?

Screen: C79

Purpose: Returns the P₂ pulse deviation.

Command: ATC1400a:P2:DEVIation?

Reply: <d> where <d> is CAL or -1.95 to +1.95 in μs.

Example: ATC1400a:P2:DEVIation?
0.95

ATC1400a:P3:DEVIation

(Stand Alone only)

Screen: C79

Purpose: Specifies the P₃ pulse deviation.

Command: ATC1400a:P3:DEVIation <d> where <d> is "CAL" or -1.95 to +1.95 in μs (0.05 μs steps).

Reply: None

Example: ATC1400a:P3:DEVIation 0.95

ATC1400a:P3:DEVIation?

Screen: C79

Purpose: Returns the P₃ pulse deviation.

Command: ATC1400a:P3:DEVIation?

Reply: <d> where <d> is CAL or -1.95 to +1.95 in μs.

Example: ATC1400a:P3:DEVIation?
-1.95

ATC1400a:RF

(Stand Alone only)

Screen: C79 Stand-alone only.

Purpose: Specifies the RF output control.

Command: ATC1400a:RF<o> where<o> is "OFF", "NORM" or "CW".

Reply: None

Example: ATC1400a:RF "NORM"

ATC1400a:RF?

Screen: C79

Purpose: Returns the RF output control.

Command: ATC1400a:RF?

Reply: <o> where <o> is OFF, NORM or CW.

Example: ATC1400a:RF?
CW

ATC1400a:SCOPE

(Stand Alone only)

Screen: C79

Purpose: Specifies the scope sync location.

Command: ATC1400a:SCOPE <r> where <r> is "TO" or "TD".

Reply: None

Example: ATC1400a:SCOPE "TD"

ATC1400a:SCOPE?

Screen: C79

Purpose: Returns the scope sync location.

Command: ATC1400a:SCOPE?

Reply: <r> where <r> is TO or TD.

Example: ATC1400a:SCOPE?
TO

DISPlay:CMENU

Screen: C00 to C99

Purpose: Displays the specified Control Menu screen.

Command: DISPlay:CMENU [<n>] where <n> is value 0 - 99

Reply: None

Example: DISPlay:CMENU 20

DISPlay:CURREnt?

Screen: All screens

Purpose: Returns screen designator.

Command: DISPlay:CURREnt?

Reply: <scrn des> where <scrn des> is C00 - C99, S0 - S999, T0 - T99, MR, MS, etc.

Example: DISPlay:CURREnt?
C10

DISPlay:SMENU

Screen: S0 to S999

Purpose: Displays the specified Sequence Menu screen.

Command: DISPlay:SMENU [<n>] where <n> is value 0 - 999

Reply: None

Example: DISPlay:SMENU 100

DISPlay:TMENU

Screen: T00 to T99

Purpose: Displays the specified Test Menu screen.

Command: DISPlay:TMENU [<number>] where <number> is 00 to 99.

Reply: None

Example: DISPlay:TMENU 35

FORMat

Screen: (Remote Only)
 Purpose: Sets format for numerical data returns (sequence menus use **INTERrogation:SMENU:FORMat**).
 Command: FORMat <type> where <type> is ASCii (decimal), BINary, HEXadecimal or OCTal
 Reply: None
 Example: FORMat HEXadecimal

GENERator[:STATe]

Screen: C10, C20, C75
 Purpose: Enables or disables the interrogation signal for the specified antenna.
 Command: GENERator[:STATe] <ant>, <on/off>
 Reply: None
 Example: GENERator:STATe ANTA,ON
 GENERator 0,1

GENERator[:STATe]?

Screen: C10, C20, C75
 Purpose: Returns the status of the interrogation signal for the specified antenna.
 Command: GENERator[:STATe]?<ant>
 Reply: <on/off> (1 or 0)
 Example: GENERator:STATe? ANTA
 GENERator? 0
 1

GENERator:LEVel

Screen: C20
 Purpose: Sets the ANTB output attenuation level.
 Command: GENERator:LEVel <ant>,<coarse> where <ant> is ANTB (currently, only valid entry) and <coarse> is -20 to -83 in dBm if MLD option is installed or -50 (only valid value) in dBm if MLD option is not installed.
 Reply: None
 Example: GENERator:LEVel ANTB,-20

GENERator:LEVel?

Screen: C20
 Purpose: Returns the ANT B output attenuation level.
 Command: GENERator:LEVel? <ant> where <ant> is ANTB (currently, only valid entry)
 Reply: <coarse> where <coarse> is -20 to -83 in dBm.
 Example: GENERator:LEVel? 1
 -20

GENERator:LEVel:OFFSet

Screen: C10, C20
 Purpose: Sets the RF vernier for specified antenna.
 Command: GENERator:LEVel:OFFSet <ant>,<fine> where <ant> is ANTA or ANTB and <fine> is -3.0 to +3.0 in dB (0.1 dB steps).
 Reply: None
 Example: GENERator:LEVel:OFFSet ANTA,3.0

GENERator:LEVel:OFFSet?

Screen: C10, C20
 Purpose: Returns the RF vernier setting for the specified antenna.
 Command: GENERator:LEVel:OFFSet? <ant> where <ant> is ANTA or ANTB
 Reply: <fine> where <fine> is -3.0 to +3.0 in dB.
 Example: GENERator:LEVel:OFFSet? ANTA
 3.0

GENERator:TIME:OFFSet

Screen: C10, C20
 Purpose: Sets the ANT B interrogation signal position in relation to the ANT A signal.
 Command: GENERator:TIME:OFFSet <value> where <value> is -0.95 to +0.95 in μ s (0.05 μ s steps).
 Reply: None
 Example: GENERator:TIME:OFFSet 0.10

GENERator:TIME:OFFSet?

Screen: C10, C20
 Purpose: Returns the ANT B interrogation signal position in relation to the ANT A signal.
 Command: GENERator:TIME:OFFSet?
 Reply: <value> where <value> is -0.95 to +0.95 in μ s.
 Example: GENERator:TIME:OFFSet?
 0.95

HCOPY[:IMMediate]

Screen: Varies
 Purpose: Same as pressing the 2ND and PRTSCR Keys in sequence on the Front Panel to perform a screen dump of the current screen out the RS-232 Connector if enabled.
 Command: HCOPY[:IMMediate]
 Reply: screen dump data
 Example: HCOPY

HCOPY:SDUMP[:IMMediate]

Screen: Varies
Purpose: Same as pressing the 2ND and PRTSCR Keys in sequence on the Front Panel to perform a screen dump of the current screen out the RS-232 Connector if enabled.
Command: HCOPY:SDUMP[:IMMediate]
Reply: screen dump data
Example: HCOP:SDUM

INTERrogation:FUNCTION:ACL

Screen: C10, C20
Purpose: Enables the ACL function.
Command: INTERrogation:FUNCTION:ACL
Reply: None
Example: INTERrogation:FUNCTION:ACL

INTERrogation:FUNCTION:ACS

Screen: C10, C20
Purpose: Enables the ACS function.
Command: INTERrogation:FUNCTION:ACS
Reply: None
Example: INTERrogation:FUNCTION:ACS

INTERrogation:FUNCTION:ATCMonitor

Screen: C10, C20
Purpose: Enables the ATCRBS Monitor Pulse Function.
Command: INTERrogation:FUNCTION:ATCMonitor
Reply: None
Example: INTERrogation:FUNCTION:ATCM

INTERrogation:FUNCTION:ATCrbs

Screen: C10, C20
Purpose: Enables the ATC function.
Command: INTERrogation:FUNCTION:ATC
Reply: None
Example: INTERrogation:FUNCTION:ATC

INTERrogation:FUNCTION:BURSt

Screen: C10, C20
Purpose: Enables the BURST function, selecting the interrogation function type and number of interrogations for the BURST function.
Command: INTERrogation:FUNCTION:BURSt [*<f1>*,*<n1>*] where *<f1>* is "ATC", "SEQ", "ACS" or "ACL" and *<BN>* is 1 to 9999. No entry uses current settings.
Reply: None
Example: INT:FUNC:BURS "ATC",5

INTERrogation:FUNCTION:BURSt?

Screen: C10, C20
Purpose: Returns the interrogation function type and the number of interrogations for the BURST function.
Command: INTERrogation:FUNCTION:BURSt?
Reply: *<f1>*,*<BN>* where *<f1>* is ATC, SEQ, ACS or ACL and *<BN>* is 1 to 9999.
Example: INTERrogation:FUNCTION:BURSt? ATC,100

INTERrogation:FUNCTION:BURSt:CONDition?

Screen: C10, C20
Purpose: Returns the BURST Function status.
Command: INTERrogation:FUNCTION:BURSt:CONDition?
Reply: *<bursting/finished>* (1 or 0)
Example: INT:FUNC:BURS:COND? 0

INTERrogation:FUNCTION:DI

Screen: C10, C20
Purpose: Enables the Double Interrogation (DI) function and specifies the interrogation function types for the DI function.
Command: INTERrogation:FUNCTION:DI [*<f1>*,*<f2>*] where *<f1>* is "ATC", "SEQ", "ACS" or "ACL" and *<f2>* is "ATC", "SEQ", "ACS" or "ACL". No entry uses current settings.
Reply: None
Example: INTERrogation:FUNCTION:DI "ATC" or INT:FUNC:DI "ATC","SEQ"

INTERrogation:FUNCTION:DI?

Screen: C10, C20
Purpose: Returns the interrogation function types selected for the Double Interrogation function.
Command: INTERrogation:FUNCTION:DI?
Reply: *<f1>*,*<f2>* where *<f1>* is ATC, SEQ, ACS or ACL and *<f2>* is ATC, SEQ, ACS or ACL
Example: INTERrogation:FUNCTION:DI? ATC,SEQ

INterrogation:FUNcTion:INterlace

Screen: C10, C20
 Purpose: Enables the Interlace (INTLCE) function and sets the ratio of ATCRBS to Mode S interrogations.
 Command: INterrogation:FUNcTion:INterlace [*<n>*] where *<n>* is 1 to 999
 Reply: None
 Example: INterrogation:FUNcTion:INT 5

INterrogation:FUNcTion:INterlace?

Screen: C10, C20
 Purpose: Returns the Interlace function ATCRBS interrogation ratio.
 Command: INterrogation:FUNcTion:INterlace?
 Reply: *<n>* where *<n>* is 1 to 999
 Example: INterrogation:FUNcTion:INT? 10

INterrogation:FUNcTion:SEquence

Screen: C10, C20
 Purpose: Enables the Sequence (SEQ) function.
 Command: INterrogation:FUNcTion:SEquence
 Reply: None
 Example: INterrogation:FUNcTion:SEquence

INterrogation:FUNcTion?

Screen: C10,C20
 Purpose: Returns the active test function with selected parameters.
 Command: INterrogation:FUNcTion?
 Reply: *<f>* where *<f>* is ATC, SEQ, ACL, ACS, INT, DI, BURS or ATCM.
 Example: INterrogation:FUNcTion? ATC

INterrogation:MODulation

Screen: C75
 Purpose: Specifies the modulation source for selected antenna
 Command: INterrogation:MODulation *<ant>*,*<src>* where *<ant>* is ANTA or ANTB and *<src>* is "INT", "EXT" or "INTExt".
 Reply: None
 Example: INT:MOD ANTA,"EXT"

INterrogation:MODulation?

Screen: C75
 Purpose: Returns modulation source for the selected antenna
 Command: INterrogation:MODulation? *<ant>* where *<ant>* is ANTA or ANTB.
 Reply: *<src>* where *<src>* is INT, EXT or INTE
 Example: INterrogation:MODulation? ANTA EXT

INterrogation:P2 (SEQ functions)

Screen: C10, C20
 Purpose: Sets the P₂ pulse level when operating with Mode S interrogations (must be first in DI).
 Command: INterrogation:P2 *<level>* where *<level>* is "CAL" (sets pulse level to P₁), "VAR" (allows ATC-1400A ES= command to set pulse level) or "OFF" (disables P₂ pulse).
 Reply: None
 Example: INterrogation:P2 "CAL"

INterrogation:P2? (SEQ functions)

Screen: C10, C20
 Purpose: Returns the current status of the P₂ pulse.
 Command: INterrogation:P2?
 Reply: *<level>* where *<level>* is CAL, VAR or OFF.
 Example: INterrogation:P2? CAL

INterrogation:P3 (ATC, ACS or ACL functions)

Screen: C10, C20
 Purpose: Sets the P₃ pulse level when operating with ATCRBS or All Call interrogations (must be first in DI).
 Command: INterrogation:P3 *<level>* where *<level>* is "CAL" (sets pulse level to P₁), "VAR" (allows ATC-1400A ES= command to set pulse level) or "OFF" (disables P₃ pulse).
 Reply: None
 Example: INterrogation:P3 "VAR"

INTerrogation:P3?

(ATC, ACS or ACL functions)

Screen: C10, C20

Purpose: Returns the current status of the P₃ pulse level.

Command: INTerrogation:P3?

Reply: <level> where <level> is CAL, VAR or OFF.

Example: INTerrogation:P3?
VAR**INTerrogation:P4**

(ACS or ACL functions)

Screen: C10, C20

Purpose: Sets P₄ pulse conditions when operating with All Call interrogations (must be first in DI).Command: INTerrogation:P4 <level>[,<width>[,<dev>]] where <level> is "CAL" (sets pulse level to P₁), "VAR" (allows ATC-1400A ES= command to set pulse level) or "OFF" (disables P₄ pulse); <width> is "CAL" or 0.20 to 3.55 in μ s and <dev> is "CAL" or -1.95 to +1.95 from CAL in μ s.

Reply: None

Example: INTerrogation:P4 "CAL","CAL","CAL"
INTerrogation:P4 "VAR",0.20,1.95**INTerrogation:P4?**

(ACS or ACL functions)

Screen: C10, C20

Purpose: Returns P₄ pulse conditions with current settings.

Command: INTerrogation:P4?

Reply: <level>,<width>,<dev> where <level> is CAL, VAR or OFF (pulse level), <width> is CAL or 0.20 to 3.55 in μ s (pulse width) and <dev> is CAL or -1.95 to +1.95 from CAL in μ s (pulse position).Example: INTerrogation:P4?
CAL,1.00,0.0**INTerrogation:P6**

(SEQ functions)

Screen: C10, C20

Purpose: Sets P₆ pulse conditions when operating with Mode S interrogations (must be first in DI).Command: INTerrogation:P6 <level>[,<width>[,<dev>]] where <level> is "CAL" (enables P₆ pulse) or "OFF" (disables P₆ pulse), <width> is "CAL" or -1.50 to +1.50 from CAL in 0.05 μ s increments (pulse width) and <dev> is "CAL" or -1.95 to +1.95 from CAL in 0.05 μ s increments (pulse position)

Reply: None

Example: INTerrogation:P6 "CAL",-1.50,1.95
INTerrogation:P6 "CAL","CAL","CAL"**INTerrogation:P6?**

(SEQ functions)

Screen: C10, C20

Purpose: Returns P₆ pulse conditions with current settings.

Command: INTerrogation:P6?

Reply: <level>,<width>,<dev> where <level> is CAL or OFF (pulse status), <width> is CAL or -1.50 to +1.50 from CAL in μ s (pulse width) and <dev> is CAL or -1.95 to +1.95 from CAL in μ s (pulse position)

Reply: None

Example: INTerrogation:P6?
CAL,-1.50,1.95**INTerrogation:P6:SPR**

(SEQ functions)

Screen: C10, C20

Purpose: Controls SPR in Mode S test functions.

Command: INTerrogation:P6:SPR <on/off>[,<dev>] where <on/off> enables or disables SPR and <dev> controls SPR position ("CAL" or -1.00 to +1.00 from CAL, rounded to nearest 0.05 μ s).

Reply: None

Example: INTerrogation:P6:SPR ON,1.00

INTerrogation:P6:SPR?

(SEQ functions)

Screen: C10, C20

Purpose: Returns current status of SPR.

Command: INTerrogation:P6:SPR?

Reply: *<on/off>*,*<dev>* where *<on/off>* is the SPR status (1 or 0) and *<dev>* is SPR position (CAL or -1.00 to +1.00 from CAL in μ s.)

Example: INTerrogation:P6:SPR?
1,1.00

INTerrogation:PPMG

Screen: C74

Purpose: Sets Pulse Power Measurement Gate (PPMG) control for specified pulse in the UUT reply.

Command: INTerrogation:PPMG *<type>*,
<on/off>[,*<pulse#>*] where *<type>*
is "ATC", "MODES" or "DELM";
<on/off> enables or disables power
and frequency measurement on
selected pulse and *<pulse#>* is the
selected pulse, dependent on the
<type> as follows:

ATC: "F1", "F2", "A1", "A2", "A4",
"B1", "B2", "B4", "C1", "C2", "C4",
"D1", "D2", "D4", "X" or "SPI"

MODES: 1 to 116.

DELM: 1 to 16.

Reply: None

Example: INTerrogation:PPMG "ATC",ON,"D1"

INTerrogation:PPMG?

Screen: C74

Purpose: Returns the Pulse Power Measurement Gate (PPMG) settings for the specified type.

Command: INTerrogation:PPMG?*<type>* where
<type> is ATC, MODES or DELM

Reply: *<on/off>*,*<pulse#>* where *<on/off>*
is PPMG status (1 or 0) according
to *<type>* and *<pulse#>* is the
selected pulse.

Example: INTerrogation:PPMG? "ATC"
1,B2

INTerrogation:PPULse

Screen: C75

Purpose: Sets the status and position of prepulse through the S-1403DL PREPULSE OUT Connector.

Command: INTerrogation:PPULse
<on/off>[,*<dev>*] where *<on/off>*
enables/disables prepulse control
and *<dev>* sets the prepulse
position (0 to 260) in μ s prior to
rising edge of P₁.

Reply: None

Example: INTerrogation:PPULse ON,100

INTerrogation:PPULse?

Screen: C75

Purpose: Returns the status and position of prepulse through the S-1403DL PREPULSE OUT Connector.

Command: INTerrogation:PPULse?

Reply: *<on/off>*,*<dev>* where *<on/off>* is
prepulse control status (1 or 0) and
<dev> is the prepulse position (0 to
260) in μ s prior to rising edge of
P₁.

Example: INTerrogation:PPULse?
1,100

INTerrogation:SCOPE

Screen: C72

Purpose: Specifies settings for the trigger pulse through the S-1403DL SCOPE TRIG OUT Connector.

Command: INTerrogation:SCOPE
<type>,*<on/off>*[,*<dev>*] where
<type> is "ATC", "MODES", "ACS"
or "ACL"; *<on/off>* enables/disables
trigger for interrogation type and
<dev> is "CAL" (allows ATC-1400A
T \emptyset or TD command to set scope
trigger position) or time in μ s after
P₁ of Antenna A interrogation.
Valid *<dev>* values vary according
to type as follows:

ATC: 0 to 35 in μ s.

MODES: 0 to 255 in μ s.

ACS: 0 to 255 in μ s.

ACL: 0 to 255 in μ s.

Reply: None

Example: INTerrogation:SCOPE "ATC",ON,30

INTerrogation:SCOPE?

Screen: C72
 Purpose: Returns the status and position of the trigger pulse through the S-1403DL SCOPE TRIG OUT Connector according to selected interrogation type.
 Command: INTerrogation:SCOPE? <type> where <type> is "ATC", "MODES", "ACS" or "ACL".
 Reply: <on/off>,<dev> where <on/off> is the scope trigger status (1 or 0) and <dev> is "CAL" or a numeric time in μ s after P₁ of Antenna A interrogation (scope trigger position).
 Example: INTerrogation:SCOPE? "ATC"
 1,30

INTerrogation:SCOPE:SMENU

Screen: S0 to S999
 Purpose: Enables/disables scope trigger for specific sequence menu interrogation.
 Command: INTerrogation:SCOPE:SMENU <smenu#>,<on/off> where <smenu#> is 0 to 999
 Reply: None
 Example: INTerrogation:SCOPE:SMENU 100,ON

INTerrogation:SCOPE:SMENU?

Screen: S0 to S999
 Purpose: Returns the scope trigger status for specific sequence menu interrogation.
 Command: INTerrogation:SCOPE:SMENU? <smenu#> where <smenu#> is 0 to 999
 Reply: <on/off> (1 or 0)
 Example: INTerrogation:SCOPE:SMENU? 100
 1

INTerrogation:SMENU

Screen: S0 to S999
 Purpose: Sets interrogation data for specific sequence menu.
 Command: INTerrogation:SMENU <smenu#>,<on/off>[,<ifformat>,<data>] where <smenu#> is 0 to 999; <on/off> activates/deactivates sequence menu, <ifformat> (N/A with <on/off> set to OFF) is "A" (all bits), "N" (auto size according to uplink format), "S" (short), "L" (long), "D" (decoded display) or "R" (reply only display) and <data> (N/A with <on/off> set to OFF or <ifformat> set to "D" or "R") is according to <ifformat> as follows:
 A: "56 or 112 bits in set numerical format" (must be in quotes).
 N: <uf#>,"<sbits or lbits>",<addr>
 S: <uf#>,"<sbits>",<addr>
 L: <uf#>,"<lbits>",<addr> where <uf#> is uplink format number in decimal, <sbits> is 27 bits in set numerical format (must be in quotes), <lbits> is 83 bits in set numerical format (must be in quotes) and <addr> is 24-bit address in set numerical format or "XPDR" or "USER" or "XPDR-X" or "USER-X" (see C76 Setup Menu description in 1-1-2).

Reply: None
 Example:
 INT:SMEN 1,ON,"A", "#H12345670000123"
 INT:SMEN 2,ON,"N",4,"#H0000000",#H3FABF2

INTerrogation:SMENU?

Screen: S0 to S999
 Purpose: Returns set interrogation data for specific sequence menu.
 Command: INTerrogation:SMENU? <smenu#>, <iformat> where <smenu#> is 0 to 999 and <iformat> is "A" (all bits) or "N" (bits with uplink format # and address broken out)
 Reply: <on/off>,<iformat>,<data> where <on/off> is 1 or 0,<iformat> is A, N, S or L (set interrogation format) and <data> is according to <iformat> as follows:
A: 56 or 112 bits in numerical format set by **INT:SMEN:FORM** command.
N: <uf#>,<sbits or lbits>,<addr>
S: <uf#>,"<sbits>",<addr>
L: <uf#>,"<lbits>",<addr> where <uf#> is uplink format number in decimal, <sbits> is 27 bits in numerical format set by **INT:SMEN:FORM** command, <lbits> is 83 bits in numerical format set by **INT:SMEN:FORM** command and <addr> is 24-bit address in numerical format set by **INT:SMEN:FORM** command or XPDR or USER or XPDR-X or USER-X.
 Example: INT:SMEN? 1,"N"
 1,N,2,#H2345670,#H000123
 INT:SMEN? 2,"A"
 1,A,#H200000003FABF2

INTerrogation:SMENU:BITS

Screen: S0 to S999 (Remote Only).
 Purpose: Sets selected bits (interrogation data) in selected sequence menu.
 Command: INTerrogation:SMENU:BITS <smenu#>,<startbit#>,<bitlen>,"<data>" where <smenu#> is 0 to 999, <startbit#> is 1 to 112 (start bit according to Appendix D), <bitlen> is 1 to 112 (number of bits to modify) and "<data>" is new value for bit field in set numerical format.
 Example: INTerrogation:SMENU:BITS 5,32,16,"#HF013"

INTerrogation:SMENU:BITS?

Screen: S0 to S999 (Remote Only).
 Purpose: Returns data settings for selected bits in selected sequence menu.
 Command: INTerrogation:SMENU:BITS? <smenu#>,<startbit#>,<bitlen> where <smenu#> is 0 to 999, <startbit#> is 1 to 112 and <bitlen> is 1 to 112.
 Reply: <data> where <data> is in numerical format set by **INT:SMEN:FORM** command.
 Example: INT:SMEN:BITS? 5,32,16
 #HF013

INTerrogation:SMENU:FORMat

Screen: C76
 Purpose: Specifies the radix for all data fields in sequence menus except for UF, DF, AC and ID.
 Command: INTerrogation:SMENU:FORMat <f> where <f> is "HEXadecimal" or "OCTal".
 Reply: None
 Example: INTerrogation:SMENU:FORMat "HEX"

INTerrogation:SMENU:FORMat?

Screen: C76
 Purpose: Returns the specified radix for data fields in sequence menus.
 Command: INTerrogation:SMENU:FORMat?
 Reply: <f> where <f> is HEX or OCT.
 Example: INTerrogation:SMENU:FORMat?
 HEX

INTerrogation:SMENU:GLOBal:ADDRess

Screen: C76
 Purpose: Sets the global transponder address used in sequence menus.
 Command: INTerrogation:SMENU:GLOBal:ADDRess <gtype>,<addr> where <gtype> is "USER" and <addr> is the desired transponder address.
 Reply: None
 Example: INT:SMEN:GLOB:ADDR "USER",#Q17725762

INTerrogation:SMENu:GLOBal:ADDRess?

Screen: C76
 Purpose: Returns the global transponder address.
 Command: INTerrogation:SMENu:GLOBal:ADDRess? <gtype> where <gtype> is "USER" or "XPDR".
 Reply: <addr> where <addr> is the user address setting in numerical format set by **INT:SMEN:FORM** command.
 Example: INT:SMEN:GLOB:ADDR? "USER" #Q17725762

INTerrogation:SMENu:GLOBal:APXor

Screen: C76
 Purpose: Specifies XOR mask used after the AP conversion of the selected global transponder address.
 Command: INTerrogation:SMENu:GLOBal:APXor <gtype>,<xor> where <gtype> is "XPDR" or "USER" and <xor> is the 24-bit mask in set numerical format.
 Reply: None
 Example: INT:SMEN:GLOBal:APX "XPDR",#Q00000001

INTerrogation:SMENu:GLOBal:APXor?

Screen: C76
 Purpose: Returns the AP field XOR mask setting for the selected global transponder/user address.
 Command: INTerrogation:SMENu:GLOBal:APXor? <gtype> where <gtype> is "XPDR" or "USER".
 Reply: <xor> where <xor> is the 24-bit mask in numerical format set by **INT:SMEN:FORM** command.
 Example: INT:SMEN:GLOB:APX? "USER" #H000001

INTerrogation:SMENu:SCOPE

Screen: S0 to S999 (same as **INTerrogation:SCOPE:SMENu**)
 Purpose: Enables/disables scope trigger for specific sequence menu interrogation.
 Command: INTerrogation:SMENu:SCOPE <smenu#>,<on/off> where <smenu#> is 0 to 999
 Reply: None
 Example: INTerrogation:SMENu:SCOPE 100,ON

INTerrogation:SMENu:SCOPE?

Screen: S0 to S999 (same as **INTerrogation:SCOPE:SMENu**)
 Purpose: Returns the scope trigger status for specific sequence menu interrogation.
 Command: INTerrogation:SMENu:SCOPE? <smenu#> where <smenu#> is 0 to 999
 Reply: <on/off> (1 or 0)
 Example: INTerrogation:SMENu:SCOPE? 100 1

INTerrogation:SMENu:SET:ALL

Screen: C76
 Purpose: Modifies all sequence menus.
 Command: INTerrogation:SMENu:SET:ALL <x> where <x> is "OFF" (turns all sequence menus off), "XPDR", (sets ADDR interrogation field in all sequence menus to the received transponder address), "USER" (sets ADDR interrogation field in all sequence menus to the address set by the **INT:SMEN:GLOB:ADDR** command), "ZERO" (sets data fields to zero, activates scope trigger and sets ADDR to regular numeric, not global) or "DEFault" (sets all sequence menus to factory default according to C76 Setup Menu description in 1-1-2).
 Reply: None
 Example: INTerrogation:SMENu:SET:ALL "DEFault"

INTerrogation:SYNC:OUT

Screen: C73
 Purpose: Enables/disables the pulse out the S-1403DL EXT SYNC OUT Connector for the specified interrogation type.
 Command: INTerrogation:SYNC:OUT <type>,<on/off> where <type>is "ATC", "MODES", "ACS" or "ACL".
 Reply: None
 Example: INT:SYNC:OUT "ATC",OFF

INterrogation:SYNC:OUT?

Screen: C73
 Purpose: Returns the status of the pulse out the S-1403DL EXT SYNC OUT Connector for the specified interrogation type.
 Command: INterrogation:SYNC:OUT? <type> where <type> is "ATC", "MODES", "ACS" or "ACL".
 Reply: <on/off> (1 or 0)
 Example: INT:SYNC:OUT? "MODES"
 0

INterrogation:SYNC:OUT:DEVIation

Screen: C73
 Purpose: Deviates position of pulse out the S-1403DL EXT SYNC OUT Connector in reference to Antenna A P₁ leading edge.
 Command: INterrogation:SYNC:OUT:DEVIation <value> where <value> is -9.95 to +9.95 in μ s (0.05 μ s steps).
 Reply: None
 Example: INT:SYNC:OUT:DEVIation 1.00

INterrogation:SYNC:OUT:DEVIation?

Screen: C73
 Purpose: Returns deviation setting for pulse out the S-1403DL EXT SYNC OUT Connector in reference to Antenna A P₁ leading edge.
 Command: INterrogation:SYNC:OUT:DEVIation?
 Reply: <value> where <value> is -9.95 to +9.95 in μ s.
 Example: INT:SYNC:OUT:DEV?
 1.00

INterrogation:TRIGger:BURSt

Screen: Varies
 Purpose: Same as pressing the BURST Key on the Front Panel.
 Command: INterrogation:TRIGger:BURSt
 Reply: None
 Example: INterrogation:TRIGger:BURSt

INterrogation:TRIGger:GENerator

Screen: C71
 Purpose: Sets internal trigger generator.
 Command: INterrogation:TRIGger:GENerator <num> <hz/sec> where <num> is 0.0004 to 99.9999 for seconds between interrogations (<hz/sec> is SEC) or 1 to 2500 for number of interrogations per second (<hz/sec> is HZ) and <hz/sec> is the unit of <num>.
 Reply: None
 Example: INT:TRIG:GEN 1.0 SEC

INterrogation:TRIGger:GENerator?

Screen: C71
 Purpose: Returns internal trigger generator setting.
 Command: INterrogation:TRIGger:GENerator?
 Reply: <num> <hz/sec> where <num> <hz/sec> is 0.004 to 99.9999 sec or 1 to 2500 Hz.
 Example: INterrogation:TRIGger:GENerator?
 0.999 sec

INterrogation:TRIGger:SOURce

Screen: C71
 Purpose: Sets interrogation trigger source.
 Command: INterrogation:TRIGger:SOURce <src> where <src> is "SELFint", "SYNC", "TRIGgen" or "BURSt".
 Reply: None
 Example: INterrogation:TRIGger:SOURce SELFint

INterrogation:TRIGger:SOURce?

Screen: C71
 Purpose: Returns the selected interrogation trigger source.
 Command: INterrogation:TRIGger:SOURce?
 Reply: <src> where <src> is SELFint, SYNC, TRIGgen or BURSt.
 Example: INterrogation:TRIGger:SOURce?
 TRIGGEN

MEMory:CATalog?

Screen: MS, MR
 Purpose: Returns specific memory slot name.
 Command: MEMory:CATalog? <n> where <n> is 0 to 5 (memory slot).
 Reply: "<name>" where <name> is the stored name, if applicable.
 Example: MEMory:CATalog? 1
 "goodsave"

MEMory:CLEar

Screen: (Remote Only)
 Purpose: Clears selected memory slot.
 Command: MEMory:CLEar <n> or "<name>"
 where <n> is 1 to 5 (memory slot)
 or <name> is the stored name.
 Reply: None
 Example: MEMory:CLEar "mysave"
 MEMory:CLEar 2

MEMory:CLEar:ALL

Screen: (Remote Only)
 Purpose: Clears all memory slots.
 Command: MEMory:CLEar:ALL
 Reply: None
 Example: MEMory:CLEar:ALL

MEMory:LOAD

Screen: MR
 Purpose: Recalls settings from selected
 memory slot.
 Command: MEMory:LOAD <n> or "<name>"
 where <n> is 0 to 5 memory Slot (0
 -default settings except interpreter)
 or <name> is the stored name.
 Reply: None
 Example: MEMory:LOAD "yoursave"
 MEMory:LOAD 5

MEMory:NAME

Screen: MS, MR
 Purpose: Renames specific memory slot.
 Command: MEMory:NAME <n>,"<name>"
 where <n> is 1 to 5 (memory slot)
 and <name> is the user defined
 name (≤16 characters).
 Reply: None
 Example: MEMory:NAME 1,"testsave"

MEMory:STORE

Screen: MS
 Purpose: Saves settings in memory slot.
 Command: MEMory:STORE <n> or <name>
 where <n> is 1 to 5 (memory slot)
 or <name> is the stored name.
 Reply: None
 Example: MEMory:STORE 1
 MEMory:STORE "mysave"

PSCreen

Screen: Varies
 Purpose: Same as pressing the 2ND and
 PRTSCR Keys in sequence on the
 Front Panel to perform a screen
 dump of the current screen out the
 RS-232 Connector if enabled.
 Command: PSCreen
 Reply: screen dump data
 Example: PSCREEN

REPLY:ATCrbs?

Screen: C10
 Purpose: Returns altitude from Mode C or
 identification from Mode A replies.
 Command: REPLY:ATCrbs?
 Reply: <atype>,<value>,<X>,<IP/EM>
 where <atype> is ALT or ID,
 <value> is in feet for altitude or the
 four octal numbers for the
 identification code (preceded by ID
 with SPI present), <X> is X if the X
 pulse is present (blank otherwise)
 and <IP/EM> is EM for an
 emergency identification reply or IP
 for an identification of position
 reply (blank otherwise).
 Example: REPLY:ATCrbs?
 ALT,+105000
 REPLY:ATCrbs?
 ID,ID7777,X,EM

REPLY:DELay?

Screen: C40
 Purpose: Returns reply delay measurements.
 Command: REPLY:DELay? [<type>] where
 <type> is "ATC" or "MODES" if
 specified. Not specifying <type>
 returns both types in succession
 (ATC,MODES).
 Reply: <time>,<min>,<max> where <time>
 is current reply delay measurement
 in μs, <min> is the minimum reply
 delay measurement in μs and
 <max> is the maximum reply delay
 measurement in μs.
 Example: REPLY:DELay? "MODES"
 127.0125,127.0125,127.075

REPLY:DELay:CLEar

Screen: C40 (equivalent to pressing the
 CL/ESC Key in this screen)
 Purpose: Initializes the min/max readings of
 the reply delay measurement to 0.
 Command: REPLY:DELay:CLEar
 Reply: None
 Example: REPLY:DELay:CLEar

REPLY:DElay:FIRSt?

Screen: C10, C20
 Purpose: Returns the reply delay reading for the current function.
 Command: REPLY:DElay:FIRSt?
 Reply: <time> where <time> is the current reply delay measurement in μ s.
 Example: REPLY:DElay:FIRSt?
 127.0125

REPLY:JITTer?

Screen: (ATCRBS, C10/C20 ATC Mon Function; Mode S, Remote Only)
 Purpose: Returns the measured reply delay jitter for the selected type of reply.
 Command: REPLY:JITTer? <rtype> where <rtype> is "ATC" or "MODES".
 Reply: <jitter> where <jitter> is the reply jitter in μ s.
 Example: REPLY:JITTer? "ATC"
 0.2

REPLY:MODES?

Screen: C10,C20
 Purpose: Returns Mode S reply data when received with ATC, ACS or ACL interrogations.
 Command: REPLY:MODES? [<rformat>] where optional <rformat> is "A" (all bits) or "N" (auto size according to downlink format). "N" is the default <rformat>.
 Reply: <rformat>,<data> where <rformat> is A or N (set reply format) and <data> is according to <rformat> as follows:
A: 56 or 112 bits in numerical format set by **INT:SMEN:FORM** command
N: <df#>,<sbits or lbits>,<addr>
S: <df#>,"<sbits>",<addr>
L: <df#>,"<lbits>",<addr> where <df#> is downlink format number in decimal, <sbits> is 27 bits in numerical format set by **INT:SMEN:FORM** command, <lbits> is 83 bits in numerical format set by **INT:SMEN:FORM** command and <addr> is 24-bit transponder address in numerical format set by **INT:SMEN:FORM** command.
 Example: REPLY:MODES? "A"
 "A",#FFFFFFF34123456

REPLY:PERCent?

Screen: C30
 Purpose: Returns the percent reply through the selected antenna for the specified reply type.
 Command: REPLY:PERCent? [<ant>[,<rtype>]] where <rtype> is "TOTAL", "ATC", "MODES", "BAD" or "NOREPLY". Not specifying <ant> and <rtype> returns all percentages for both antennas (ANTA,ANTB). Not specifying <rtype> returns all percentages through the selected antenna (TOTAL,ATC,MODES,BAD,NOREPLY).
 Reply: <percent> where <percent> is the current reply percentage.
 Example: REPLY:PERCent? ANTA,"ATC"
 80
 Reply:PERCent? ANTA
 100,80,10,5,5

REPLY:PERCent:CLEar

Screen: C30 (equivalent to pressing the CL/ESC Key in this screen)
 Purpose: Initializes the reported percent reply measurement to 0%.
 Command: REPLY:PERCent:CLEar
 Reply: None
 Example: REPLY:PERCent:CLEar

REPLY:SMENU?

Screen: S0 to S999
 Purpose: Returns reply data for specific sequence menu.
 Command: REPLY:SMENU? <smenu#>[, <rformat>] where <smenu#> is 0 to 999 and optional <rformat> is "A" (all bits) or "N" (auto size according to downlink format). "N" is the default <rformat>.
 Reply: <rformat>,<data> where <rformat> is A or N (set reply format) and <data> is according to <rformat> as follows:
A: 56 or 112 bits in numerical format set by **INT:SMEN:FORM** command
N: <df#>,<sbits or lbits>,<addr>
S: <df#>,"<sbits>",<addr>
L: <df#>,"<lbits>",<addr> where <df#> is downlink format number in decimal, <sbits> is 27 bits in numerical format set by **INT:SMEN:FORM** command, <lbits> is 83 bits in numerical format set by **INT:SMEN:FORM** command and <addr> is 24-bit transponder address in numerical format set by **INT:SMEN:FORM** command.
 Example: REPLY:SMENU? 10,"A"
 "A",#HFFFFFFF34123456

REPLY:SMENU:BITS?

Screen: S0 to S999
 Purpose: Returns selected reply data for specific sequence menu.
 Command: REPLY:SMENU:BITS? <smenu#>,<startbit#>,<bitlen> where <smenu#> is 0 to 999, <startbit#> is 1 to 112 (start bit according to Appendix D), <bitlen> is 1 to 32 (number of bits to get data).
 Reply: <data> where, <data> is the value of the selected reply data bits in the numerical format set by the **INT:SMEN:FORM** command.
 Example: REPLY:SMENU:BITS? 5,32,16
 #HF013

REPLY:SPACing?

(ATC Mon Function)
 Screen: C10, C20
 Purpose: Returns ATCRBS F₁ to F₂ reply pulse spacing in μ s.
 Command: REPLY:SPACing? <rtype> where <rtype> is "ATC" (only valid entry)
 Reply: <F1-F2space>
 Example: REPLY:SPAC? "ATC"
 20.3000

REPLY:TIMEout

Screen: (Remote Only)
 Purpose: Sets the time limit for getting no reply.
 Command: REPLY:TIMEout <time> where <time> is 1.000 to 65.535 in seconds.
 Reply: None
 Example: REPLY:TIM 65

REPLY:WIDTH?

Screen: (ATCRBS, C10/C20 ATC Mon Function; Mode S, Remote Only)
 Purpose: Returns width of reply pulses.
 Command: REPLY:WIDTH? <rtype> where <rtype> is "ATC" or "MODES".
 Reply: <F1width>,<F2width> for ATCRBS or <P1width> for Mode S; all in μ s.
 Example: REPLY:WIDTH? "MODES"
 0.5

S1403c

Screen: (Remote Only)
 Purpose: Switches current RCI port to S1403C command interpreter.
 Command: S1403c
 Reply: None
 Example: S1403c

SCPI

Screen: (Remote Only)
 Purpose: Switches current RCI port to SCPI-style command interpreter.
 Command: SCPI
 Reply: None
 Example: SCPI

SQTR:ADDRESS?

Screen: C50
 Purpose: Reports the transponder address.
 Command: SQTR:ADDRESS?
 Reply: <addr> where <addr> is the transponder squitter address.
 Example: SQTR:ADDRESS?
 #HA55A6A

SQTR:CAPTure[:STATe]

Screen: (Remote Only)
 Purpose: Enables/disables squitter capturing.
 Command: SQTR:CAPTure[:STATe] <on/off>
 Reply: None
 Example: SQTR:CAPTure 1
 SQTR:CAPTure:STATe ON

SQTR:CAPTure[:STATe]?

Screen: (Remote Only)
 Purpose: Returns squitter capturing status.
 Command: SQTR:CAPTure[:STATe]?
 Reply: <on/off> (1 or 0)
 Example: SQTR:CAPTure?
 SQTR:CAPTure:STATe?
 ON

SQTR:CAPTure:CLEar

Screen: (Remote Only)
 Purpose: Clears all buffer entries.
 Command: SQTR:CAPTure:CLEar
 Reply: None
 Example: SQTR:CAPTure:CLEar

SQTR:CAPTure:CONDition?

Screen: C50, C60
 Purpose: Returns the squitter capture buffer status.
 Command: SQTR:CAPTure:CONDition?
 Reply: <data/empty> (1 or 0)
 Example: SQTR:CAPTure:CONDition?
 1

SQTR:CAPTure:COUNT?

Screen: (Remote Only) Indication in C50,C60.
 Purpose: Returns number of entries held in capture buffer and total buffer size.
 Command: SQTR:CAPTure:COUNT?
 Reply: <count>,<size> where <count> is the number of entries currently in the buffer and <size> is the maximum number of buffer entries the capture buffer can hold.
 Example: SQTR:CAPTure:COUNT?
 3,256

SQTR:CAPTure:FILTer

Screen: (Remote Only)
 Purpose: Sets the squitter capture buffer filter for capturing specific squitter types.
 Command: SQTR:CAPTure:FILTer <filter> where <filter> is an OR mask of following values in set numerical format:
 1 = ATCRBS FRUIT,
 2 = Non-DF11/17/MODE S FRUIT,
 4 = DF11 squitter,
 8 = DF17I squitter,
 16 = DF17S squitter,
 32 = DF17A squitter,
 64 = DF17T/DF17V squitter,
 128 = DF17E/DF17P squitter,
 256 = DF17O squitter.
 Reply: None
 Example: SQTR:CAPTure:FILTer #H1C
 (DF17S, DF17I and DF11 squitters)

SQTR:CAPTure:FILTer?

Screen: (Remote Only)
 Purpose: Returns the squitter capture buffer filter setting.
 Command: SQTR:CAPTure:FILTer?
 Reply: <filter> where <filter> is the OR mask setting with the following values:
 1 = ATCRBS FRUIT,
 2 = Non-DF11/17/MODE S FRUIT,
 4 = DF11 squitter,
 8 = DF17I squitter,
 16 = DF17S squitter,
 32 = DF17A squitter,
 64 = DF17T/DF17V squitter,
 128 = DF17E/DF17P squitter,
 256 = DF17O squitter.
 Example: SQTR:CAPTure:FILTer?
 192 (DF17P and DF17T squitters)

SQTR:CAPtUre:GET?

Screen: (Remote Only)
 Purpose: Returns an entry from the capture buffer.
 Command: SQTR:CAPtUre:GET? [*<format>*]
 where *<format>* is "A" (all bits) or "N" (data with downlink format and address fields broken out). "N" is the default *<format>*.
 Reply: *<time>*,*<ant>*,*<format>*,*<data>*
 where *<time>* is time since previous squitter in seconds, *<ant>* is receiving antenna (0 or 1), *<format>* is A or N and *<data>* is according to *<format>* as follows:
A: 56 or 112 bits in numerical format set by **INT:SMEN:FORM** command
N: *<df#>*,*<sbits or lbits>*,*<addr>*
 where *<df#>* is downlink format number in decimal, *<sbits>* is 27 bits in numerical format set by **INT:SMEN:FORM** command, *<lbits>* is 83 bits in numerical format set by **INT:SMEN:FORM** command and *<addr>* is 24-bit transponder address in numerical format set by **INT:SMEN:FORM** command.

Example: SQTR:CAPtUre:GET? "N"
 0.2,0,N,17,#H00000000000000000000,#HFFFFFF3

SQTR:CAPtUre:MODE

Screen: (Remote Only)
 Purpose: Sets buffer operation mode.
 Command: SQTR:CAPtUre:MODE *<mode>*
 where *<mode>* is CONTInuous (keeps filling replacing oldest bits) or SINGleshot (stops when full).
 Reply: None
 Example: SQTR:CAPtUre:MODE SING

SQTR:CAPtUre:MODE?

Screen: (Remote Only)
 Purpose: Returns buffer operation mode.
 Command: SQTR:CAPtUre:MODE? *<mode>*
 where *<mode>* is CONTInuous (keeps filling replacing oldest bits) or SINGleshot (stops when full).
 Reply: *<mode>* where *<mode>* is CONTINUOUS or SINGLESHOT.
 Example: SQTR:CAPtUre:MODE?
 SINGLESHOT

SQTR:COUNT?

Screen: C50
 Purpose: Returns number of squitters received during set time period.
 Command: SQTR:COUNT? [*<type>*] where *<type>* is "ATC", "DF11", "DF17", "DF17A", "DF17E", "DF17I", "DF17O", "DF17P", "DF17S", "DF17T", "DF17V" or "MODES".
 Not specifying *<type>* returns count for each of the squitter types (DF11, DF17, DF17A, DF17I, DF17O, DF17P/DF17E, DF17S, DF17T/DF17V)
 Reply: *<count>* where *<count>* is the number of squitters received.
 Example: SQTR:COUNT? "DF17A"
 3
 SQTR:COUNT?
 0,11,3,1,0,1,3,3

SQTR:COUNT:CLEAr

Screen: C50 (equivalent to pressing the CL/ESC Key in this screen)
 Purpose: Initializes (clears) the squitter count measurements.
 Command: SQTR:COUNT:CLEAr
 Reply: None
 Example: SQTR:COUNT:CLEAr

SQTR:COUNT:PERiod

Screen: C50
 Purpose: Sets the time to count squitters.
 Command: SQTR:COUNT:PERiod *<t>* where *<t>* is 10 to 300 in seconds.
 Reply: None
 Example: SQTR:COUNT:PERiod 120

SQTR:COUNT:PERiod?

Screen: C50
 Purpose: Returns the time period set to count squitters.
 Command: SQTR:COUNT:PERiod?
 Reply: *<t>* where *<t>* is 10 to 300 in seconds.
 Example: SQTR:COUNT:PERiod?
 120

SQTR:GROUPing:DF17

Screen: (Remote Only)
 Purposes: Initializes and sets the type parameters for counting, timing and capturing DF17 squitters.
 Command: SQTR:GROUPing:DF17 <group> where <group> is ORIGINAL (squitter types according to Table D-6 [unchanging]) or RTCA (squitter types according to Table D-7 [subject to change with later Main Processor versions to comply with latest RTCA guidelines])

NOTE: Recycling Test Set power resets the grouping to ORIGINAL, the default.

Example: SQTR:GROUP:DF17 RTCA

SQTR:TAIL?

Screen: C50
 Purpose: Returns the aircraft tail number and country.
 Command: SQTR:TAIL?
 Reply: <tail>,<country> where <tail> is the tail number and <country> is the country name.
 Example: SQTR:TAIL?
 N44KR,United States

SQTR:TIME?

Screen: C60
 Purpose: Returns requested squitter information for specified field.
 Command: SQTR:TIME? <type>[,<format>] where <type> is "DF11", "DF17A", "DF17E", "DF17I", "DF17O", "DF17P", "DF17S", "DF17T" or "DF17V" and <format> is "A" (all bits) or "N" (data with downlink format and address fields broken out). "N" is the default <format>.
 Reply: <prev>,<min>,<max>,<ant>,<format>,<data> where <prev> is time since previous squitter in seconds, <min> is lowest value of all <prev> readings since power up or last **SQTR:TIME:CLEAr** command, <max> is highest value of all <prev> readings since power up or last **SQTR:TIME:CLEAr** command, <ant> is receiving antenna (0 or 1), <format> is A or N and <data> is according to <format> as follows:
A: 56 or 112 bits in numerical format set by **INT:SMEN:FORM** command.
N: <df#><sbits or lbits>,<addr> where <df#> is downlink format number in decimal, <sbits> is 27 bits in numerical format set by **INT:SMEN:FORM** command, <lbits> is 83 bits in numerical format set by **INT:SMEN:FORM** command and <addr> is 24-bit transponder address in numerical format set by **INT:SMEN:FORM** command.

Example:
 SQTR:TIME? "DF11","A"
 1.10,0.98,1.20,0,A,#H5C3217863FABF2

SQTR:TIME:CLEAr

Screen: C60 (equivalent to pressing the CL/ESC Key in this screen)
 Purpose: Initializes (clears) the squitter time measurements.
 Command: SQTR:TIME:CLEAr
 Reply: None
 Example: SQTR:TIME:CLEAr

SQTR:Time:TIMEout

Screen: (Remote Only)
 Purpose: Sets time limit for looking at period between squitters.
 Command: SQTR:Time:TIMEout <type>,<time> where <type> is "ATC", "DF11", "DF17A", "DF17E", "DF17I", "DF17O", "DF17P", "DF17S", "DF17T", "DF17V" or "MODES" and <time> is 1.000 to 65.535 in seconds.
 Reply: None
 Example: SQTR:Time:TIME "DF11",1.5

SQTR:Time:TIMEout:DEFault

Screen: (Remote Only)
 Purpose: Sets time limits for looking at periods between squitters to default values. (Time limits for ATCRBS fruit, DF17E, DF17O, DF17P and Mode S fruit default to 65.535 seconds. Time limits for DF17A, DF17T and DF17V default to 1.5 seconds. The time limits for DF11, DF17I and DF17S default to 3, 30 and 15 seconds, respectively.
 Command: SQTR:Time:TIMEout:DEFault
 Reply: None
 Example: SQTR:Time:TIME:DEFault

SYSTem:COMMunicate:ATC1400a:CONTRol

Screen: C84
 Purpose: Specifies S-1403DL control relationship with ATC-1400A.
 Command: SYSTem:COMMunicate:ATC1400a:CONTRol <c> where <c> is "MASTer" (S-1403DL controls ATC-1400A), "SLAVe" (S-1403DL only listens to ATC-1400A) or "ALONe" (S-1403DL Stand Alone mode).
 Reply: None
 Example: SYST:COMM:ATC1400:CONT "MAST"

SYSTem:COMMunicate:ATC1400a:CONTRol?

Screen: C84
 Purpose: Returns the S-1403DL control relationship ATC-1400A control setting.
 Command: SYSTem:COMMunicate:ATC1400a:CONTRol?
 Reply: <type> where <type> is MAST, SLAV or ALON.
 Example: SYST:COMM:ATC1400:CONT?
 MAST

SYSTem:COMMunicate:ATC1400a:S1403c:ADDRESS

Screen: C84
 Purpose: Sets the IFR Bus address for S-1403DL remote commands.
 Command: SYSTem:COMMunicate:ATC1400a:S1403c:ADDRESS <a> where <a> is 2 to 7.
 Reply: None
 Example: SYST:COMM:ATC1400:S1403:ADDR 3

SYSTem:COMMunicate:ATC1400a:S1403c:ADDRESS?

Screen: C84
 Purpose: Returns the set IFR Bus address for S-1403DL remote commands.
 Command: SYSTem:COMMunicate:ATC1400a:S1403c:ADDRESS?
 Reply: <a> where <a> is 2 to 7.
 Example: SYST:COMM:ATC1400:S1403:ADDR?
 3

SYSTem:COMMunicate:GPIB:ADDRESS

Screen: C83
 Purpose: Sets S-1403DL GPIB address.
 Command: SYSTem:COMMunicate:GPIB:ADDRESS <a> where <a> is 0 to 31.
 Reply: None
 Example: SYST:COMM:GPIB:ADDRESS 15

SYSTem:COMMunicate:GPIB:ADDRESS?

Screen: C83
 Purpose: Returns the S-1403DL GPIB address setting.
 Command: SYSTem:COMMunicate:GPIB:ADDRESS?
 Reply: <a> where <a> is 0 to 31.
 Example: SYST:COMM:GPIB:ADDRESS?
 15

SYSTem:COMMunicate:GPIB:RCI

Screen: C83
 Purpose: Enables/disables remote control through S-1403DL GPIB Connector.
 Command: SYSTem:COMMunicate:GPIB:RCI <on/off>
 Reply: None
 Example: SYST:COMM:GPIB:RCI ON

SYSTEM:COMMunicate:GPIB:RCI?

Screen: C83
Purpose: Returns the S-1403DL GPIB remote control status.
Command: SYSTem:COMMunicate:GPIB:RCI?
Reply: <on/off> (1 or 0)
Example: SYSTem:COMMunicate:GPIB:RCI?
1

SYSTEM:COMMunicate:SERial:BAUD

Screen: C82
Purpose: Sets RS-232 baud rate.
Command: SYSTem:COMMunicate:SERial:BAUD <rate> where <rate> is 110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400 or 57600 in bits per second.
Reply: None
Example: SYST:COMM:SER:BAUD 9600

SYSTEM:COMMunicate:SERial:BAUD?

Screen: C82
Purpose: Returns the RS-232 baud rate setting.
Command: SYSTem:COMMunicate:SERial:BAUD?
Reply: <rate> where <rate> is 110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400 or 57600 in bits per second.
Example: SYST:COMM:SER:BAUD?
9600

SYSTEM:COMMunicate:SERial:BITS

Screen: C82
Purpose: Sets RS-232 bits per word.
Command: SYSTem:COMMunicate:SERial:BITS where is 7 or 8.
Reply: None
Example: SYST:COMM:SER:BITS 8

SYSTEM:COMMunicate:SERial:BITS?

Screen: C82
Purpose: Returns the RS-232 bits per word setting.
Command: SYSTem:COMMunicate:SERial:BITS?
Reply: where is 7 or 8.
Example: SYST:COMM:SER:BITS?
8

SYSTEM:COMMunicate:SERial:CONTrol:RTS

Screen: C82
Purpose: Sets RS-232 hardware handshaking (pacing) mode.
Command: SYSTem:COMMunicate:SERial:CONTrol:RTS <hndshk> where <hndshk> is ON, STANdard or RFR.
Reply: None
Example: SYST:COMM:SER:CONT:RTS STAN

SYSTEM:COMMunicate:SERial:CONTrol:RTS?

Screen: C82
Purpose: Returns the RS-232 hardware handshaking (pacing) mode setting.
Command: SYSTem:COMMunicate:SERial:CONTrol:RTS?
Reply: <hndshk> where <hndshk> is ON, STANdard or RFR.
Example: SYST:COMM:SER:CONT:RTS?
STAN

SYSTEM:COMMunicate:SERial:DUMP

Screen: C81
Purpose: Sets screen dump parameters.
Command: SYSTem:COMMunicate:SERial:DUMP <on/off> [,<bdr>,<eol>] where <on/off> enables/disables PRTSCR Key to perform screen dump (1 or 0), <bdr> is the border style (8 [8-bit], 7 [7-bit] or 0 [none]) and <eol> is the end of line characters ("CRLF", "LF", "CR" or "NUL"). Default <bdr> and <eol> are current settings.
Reply: None
Example: SYST:COMM:SER:DUMP ON,8,"CRLF"

SYSTEM:COMMunicate:SERial:DUMP?

Screen: C81
Purpose: Returns the screen dump parameter settings.
Command: SYSTem:COMMunicate:SERial:DUMP?
Reply: <on/off>,<bdr>,<eol> where <on/off> is 1 or 0, <bdr> is 8, 7 or 0 and <eol> is CRLF, LF, CR or NUL.
Example: SYST:COMM:SER:DUMP?
1,7,CR



SYSTEM:COMMunicate:SERial:ECHO

Screen: C81
Purpose: Enables/disables RS-232 remote commands to echo back to the controller.
Command: SYSTem:COMMunicate:SERial:ECHO <on/off> (1 or 0).
Reply: None
Example: SYST:COMM:SER:ECHO ON

SYSTEM:COMMunicate:SERial:ECHO?

Screen: C81
Purpose: Returns the RS-232 echo setting.
Command: SYSTem:COMMunicate:SERial:ECHO?
Reply: <on/off> where <on/off> is 1 or 0.
Example: SYST:COMM:SER:ECHO?
1

SYSTEM:COMMunicate:SERial:PACE

Screen: C82
Purpose: Sets RS-232 software handshaking (pacing) mode.
Command: SYSTem:COMMunicate:SERial:PACE <hndshk> where <hndshk> is NONE or XON (XON/XOFF).
Reply: None
Example: SYST:COMM:SER:PACE XON

SYSTEM:COMMunicate:SERial:PACE?

Screen: C82
Purpose: Returns the RS-232 software handshaking (pacing) mode setting.
Command: SYSTem:COMMunicate:SERial:PACE?
Reply: <hndshk> where <hndshk> is NONE or XON.
Example: SYST:COMM:SER:PACE?
XON

SYSTEM:COMMunicate:SERial:PARity

Screen: C82
Purpose: Sets RS-232 parity check mode.
Command: SYSTem:COMMunicate:SERial:PARity <p> where <p> is NONE, ODD or EVEN.
Reply: None
Example: SYST:COMM:SER:PAR NONE

SYSTEM:COMMunicate:SERial:PARity?

Screen: C82
Purpose: Returns the RS-232 parity check mode setting.
Command: SYSTem:COMMunicate:SERial:PARity?
Reply: <p> where <p> is NONE, ODD or EVEN.
Example: SYST:COMM:SER:PAR?
NONE

SYSTEM:COMMunicate:SERial:RCI

Screen: C81
Purpose: Enables/disables remote control through S-1403DL RS-232 Connector.
Command: SYSTem:COMMunicate:SERial:RCI <on/off>
Reply: None
Example: SYST:COMM:SER:RCI ON

SYSTEM:COMMunicate:SERial:RCI?

Screen: C81
Purpose: Returns S-1403DL RS-232 remote control status.
Command: SYSTem:COMMunicate:SERial:RCI?
Reply: <on/off> (1 or 0)
Example: SYST:COMM:SERial:RCI?
1

SYSTEM:COMMunicate:SERial:SBITs

Screen: C82
Purpose: Sets RS-232 stop bits per word.
Command: SYSTem:COMMunicate:SERial:SBITs where is 1 or 2.
Reply: None
Example: SYST:COMM:SER:SBIT 1

SYSTEM:COMMunicate:SERial:SBITs?

Screen: C82
Purpose: Returns the RS-232 stop bits per word setting.
Command: SYSTem:COMMunicate:SERial:SBITs?
Reply: where is 1 or 2.
Example: SYST:COMM:SER:SBIT?
1

SYSTEM:DATE

Screen: C86
Purpose: Sets the current date.
Command: SYSTem:DATE <y>,<m>,<d> where <y> is 0000 to 9999 (year), <m> is 1 to 12 (month) and <d> is 1 to 31 (day).
Reply: None
Example: SYSTem:DATE 1997,4,14

SYSTem:DATE?

Screen: C86
 Purpose: Returns the current date.
 Command: SYSTem:DATE?
 Reply: <y>,<m>,<d> where <y> is 0000 to 9999 (year), <m> is 1 to 12 (month) and <d> is 1 to 31 (day).
 Example: SYSTem:DATE?
 1997,4,14

SYSTem:KEY:REPeat

Screen: C85
 Purpose: Sets S-1403DL Keyboard control parameters.
 Command: SYSTem:KEY:REPeat <delay>,<rate> where <delay> is 0.1 to 2.0 in sec (0.1 sec increments) (time to hold down a key before operation repeats) and <rate> is 0.1 to 2.0 in sec (0.1 sec increments) (time period for each repeat operation after initial delay).
 Reply: None
 Example: SYSTem:KEY:REPeat 0.8,0.2

SYSTem:KEY:REPeat?

Screen: C85
 Purpose: Returns the S-1403DL Keyboard control parameter settings.
 Command: SYSTem:KEY:REPeat?
 Reply: <delay>,<rate> where <delay> is 0.1 to 2.0 in seconds (time to hold down a key before operation repeats) and <rate> is 0.1 to 2.0 in seconds (time period for each repeat operation after initial delay).
 Example: SYSTem:KEY:REPeat?
 1.1,0.5

SYSTem:LANGUage S1403C

Screen: (Remote Only)
 Purpose: Switches current RCI port to S1403C command interpreter.
 Command: SYSTem:LANGUage S1403C
 Reply: None
 Example: SYSTem:LANGUage S1403C

SYSTem:TIME

Screen: C86
 Purpose: Sets the current time.
 Command: SYSTem:TIME <h>,<m>,<s> where <h> is 0 to 23 (hour), <m> is 0 to 59 (minute) and <s> is 0 to 59 (second).
 Reply: None
 Example: SYSTem:TIME 8,28,32

SYSTem:TIME?

Screen: C86
 Purpose: Returns the current time.
 Command: SYSTem:TIME?
 Reply: <h>,<m>,<s> where <h> is 0 to 23 (hour), <m> is 0 to 59 (minute) and <s> is 0 to 59 (second).
 Example: SYSTem:TIME?
 8,28,32

TEST:ELM:DOWN?

Screen: T34, T35
 Purpose: Returns the DELM test status.
 Command: TEST:ELM:DOWN? [<m>] where <m> is "MULTIsite" to select multisite test status.
 Reply: <error#>,<error> where <error#> is the numeric error result of the DELM test and <error> is the text error result of the DELM test. Refer to Table 10 in 1-2-2.
 Example: TEST:ELM:DOWN?
 2,PASS

TEST:ELM:DOWN:ELM:RECEived?

Screen: T34, T35
 Purpose: Returns the number of expected and actual ELMs.
 Command: TEST:ELM:DOWN:ELM:RECEived?
 Reply: <expect>,<actual> where <expect> is the number of expected ELMs and <actual> is the number of ELMs actually received.
 Example: TEST:ELM:DOWN:ELM:RECEived?
 16,14

TEST:ELM:DOWN:SMENU

Screen: T34, T35
 Purpose: Specifies the sequence menus for the downlink ELM reply data, Reservation and Closeout.
 Command: TEST:ELM:DOWN:SMENU <rsmenu#>[,<csmenu#> [, <esmenu#>]] where <rsmenu#> is 0 to 999, <csmenu#> is 0 to 999 and <esmenu#> is 0 to 984.
 Reply: None
 Example: TEST:ELM:DOWN:SMENU 950,951,967

TEST:ELM:DOWN:SMENU?

Screen: T34, T35
Purpose: Returns the numbers of the sequence menus selected for the downlink ELM reply data, Reservation and Closeout.
Command: TEST:ELM:DOWN:SMENU?
Reply: <rsmenu#>, <csmenu#>, <esmenu#> where <rsmenu#> is 0 to 999, <csmenu#> is 0 to 999 and <esmenu#> is 0 to 984.
Example: TEST:ELM:DOWN:SMENU?
950,951,967

TEST:ELM:DOWN:START

Screen: T34, T35 (equivalent to pressing the BURST Key in this screen)
Purpose: Exercises the downlink ELM datalink feature of the transponder.
Command: TEST:ELM:DOWN:START [<m>] where <m> is "MULTisite" to select multisite operation testing.
Reply: None
Example: TEST:ELM:DOWN:STAR
TEST:ELM:DOWN:STAR "MULT"

TEST:ELM:SETup:CLOseout:DELay

Screen: T31
Purpose: Sets the delay from the end of the last ELM reply to the start of the first Closeout interrogation.
Command: TEST:ELM:SETup:CLOseout:DELay <time> where <time> is 100 to 63000 in μ s.
Reply: None
Example: TEST:ELM:SETup:CLOseout:DELay
1000

TEST:ELM:SETup:CLOseout:DELay?

Screen: T31
Purpose: Returns the set delay from the end of the last ELM reply to the start of the first Closeout interrogation.
Command: TEST:ELM:SETup:CLOseout:DELay?
Reply: <time> where <time> is 100 to 63000 in μ s.
Example: TEST:ELM:SETup:CLOseout:DELay?
1000

TEST:ELM:SETup:REServation:DELay

Screen: T31
Purpose: Sets the delay from the end of the reservation reply to the start of the first ELM interrogation.
Command: TEST:ELM:SETup:REServation:DELay <time> where <time> is 100 to 63000 in μ s.
Reply: None
Example: TEST:ELM:SETup:REServation:DELay
1000

TEST:ELM:SETup:REServation:DELay?

Screen: T31
Purpose: Returns the set delay from the end of the reservation reply to the start of the first ELM interrogation.
Command: TEST:ELM:SETup:REServation:DELay?
Reply: <time> where <time> is 100 to 63000 in μ s.
Example: TEST:ELM:SETup:REServation:DELay?
1000

TEST:ELM:SETup:UELM:SPACing

Screen: T31
Purpose: Sets the spacing between the start of UELMs.
Command: TEST:ELM:SETup:UELM:SPACing <time> where <time> is 50 to 63000 in μ s.
Reply: None
Example: TEST:ELM:SETup:UELM:SPACing
65

TEST:ELM:SETup:UELM:SPACing?

Screen: T31
Purpose: Returns the set spacing between the start of UELMs.
Command: TEST:ELM:SETup:UELM:SPACing?
Reply: <time> where <time> is 50 to 63000 μ s.
Example: TEST:ELM:SETup:UELM:SPACing?
65

TEST:ELM:UP?

Screen: T32, T33
 Purpose: Returns the UELM test status.
 Command: TEST:ELM:UP? [*m*] where *m* is "MULTIsite" to select multisite test status.
 Reply: <error#>, <error> where <error#> is the numeric error result of the UELM test and <error> is the text error result of the UELM test. Refer to Table 9 in 1-2-2.
 Example: TEST:ELM:UP?
 2,PASS
 Example: TEST:ELM:UP?
 10,ResvNoRply

TEST:ELM:UP:SMENU

Screen: T32, T33
 Purpose: Specifies the sequence menus for the uplink ELM data, Reservation and Closeout.
 Command: TEST:ELM:UP:SMENU <rsmenu#>[, <csmenu#>[, <esmenu#>[, <elm#>]]] where <rsmenu#> is 0 to 999, <csmenu#> is 0 to 999, <esmenu#> is 0 to 984 and <elm#> is 2 to 16 (number of ELM segments to transmit).
 Reply: None
 Example: TEST:ELM:UP:SMENU 800,851,700,2

TEST:ELM:UP:SMENU?

Screen: T32, T33
 Purpose: Returns the numbers of the sequence menus selected for the uplink ELM data, Reservation and Closeout.
 Command: TEST:ELM:UP:SMENU?
 Reply: <rsmenu#>, <csmenu#>, <esmenu#>, <elm#> where <rsmenu#> is 0 to 999, <csmenu#> is 0 to 999, <esmenu#> is 0 to 984 and <elm#> is 2 to 16.
 Example: TEST:ELM:UP:SMENU?
 800,851,700,2

TEST:ELM:UP:START

Screen: T32, T33 (equivalent to pressing the BURST Key in this screen)
 Purpose: Exercises the uplink ELM datalink feature of the transponder.
 Command: TEST:ELM:UP:START [*m*] where *m* is "MULTIsite" to select multisite operation testing.
 Reply: None
 Example: TEST:ELM:UP:START
 TEST:ELM:UP:START "MULTIsite"

TEST:MTL?

Screen: T23
 Purpose: Returns the current status of the MTL measurement.
 Command: TEST:MTL?
 Reply: <Error#>, <Error> where <Error#> is the numeric error result of the MTL test and <error> is the text error result of the MTL test. Refer to Table 8 in 1-2-2.
 Example: TEST:MTL?
 1,NOTRUN

TEST:MTL:ANTenna

Screen: T23
 Purpose: Specifies the antenna for the MTL test.
 Command: TEST:MTL:ANTenna <ant> where <ant> is ANTA or ANTB (0 or 1)
 Reply: None
 Example: TEST:MTL:ANTenna ANTA
 TEST:MTL:ANTenna 1

TEST:MTL:ANTenna?

Screen: T23
 Purpose: Returns the antenna selected for the MTL test.
 Command: TEST:MTL:ANTenna?
 Reply: <ant> where <ant> is 0 (ANTA) or 1 (ANTB).
 Example: TEST:MTL:ANTenna?
 0

TEST:MTL:LEVel?

Screen: T23
 Purpose: Returns the minimum triggering level (MTL) of the tested transponder.
 Command: TEST:MTL:LEVel?
 Reply: <value> <units> where <value> is MTL value and <units> are measurement units (currently only dBm).
 Example: TEST:MTL:LEVel?
 78 dBm

TEST:MTL:START

Screen: T23 (equivalent to pressing the BURST Key in this screen)
 Purpose: Finds minimum triggering level (MTL) of the transponder.
 Command: TEST:MTL:START
 Reply: None
 Example: TEST:MTL:START

TEST:MTL:TIME?

Screen: T23
 Purpose: Returns length of time the MTL test ran or has been running.
 Command: TEST:MTL:TIME?
 Reply: <value> where <value> is test run time in seconds.
 Example: TEST:MTL:TIME?
 52

TEST:RUNning?

Screen: (Remote Only)
 Purpose: Returns current running status of a Test Menu test.
 Command: TEST:RUNning?
 Reply: <status> where <status> is 1 (test running) or 0 (test not running).
 Example: TEST:RUNning?
 1

TEST:STOP

Screen: (Remote Only)
 Purpose: Stops any running test.
 Command: TEST:STOP
 Reply: None
 Example: TEST:STOP

4.6.2 Old-Style Commands

Old-style command lines have a maximum length of 68 characters including the length of the **AXn=** prefix, if used, and line terminator characters, if used.

Loading data into entry fields is optional if change is not desired. Each field preceding the field to be changed is skipped by sending only the field delimiter: e.g. "AX3=P4=;;+1.0" only updates P4 pulse deviation without changing the preceding level or width control fields.

Replies to old-style queries contain the AX number prefix, **3:** to set apart S-1403DL information strings from ATC-1400A information strings.

COMMAND	RANGE/VALUES	DEFINITION
VER?	mm.mm;ff.ff (01.00 to 99.99)	Returns Main (mm.mm) and Front Panel (ff.ff) CPU software version numbers.
NEWPB?	y (yes) or n (no)	Returns old Pulse PC Board status.
MLDECL?	y (yes) or n (no)	Finds whether the MLD option is installed or not.
SCPI		Switches to new SCPI command interpreter (new for S-1403DL).
S1403C		Switches to old-style command interpreter (new for S-1403DL).
ATC.		Enables ATC function.
SEQ.		Enables SEQ function.
ACS.		Enables ACS function.
ACL.		Enable ACL function.
INTLCE=<n>	1 to 999	Enables INTLCE function and sets Mode S to ATCRBS ratio.
DI=<itype>;<itype>	ATC/ACS/ACL/SEQ; ATC/ACS/ACL/SEQ	Enables DI function and sets type of interrogations.
BURST=<itype>;<BN>	ATC/ACS/ACL/SEQ; 1 to 9999	Enables BURST function (type and number of interrogations).
BURST.	No range or value	Activate BURST function.

S-1403DL Old-Style Command List
Table 13

COMMAND	RANGE/VALUES	DEFINITION
MODE?	ATC/SEQ/ACS/ACL/ INTLCE;<n>/DI;<itype>;<itype>/ BURST;<itype>;<BN>	Returns current test function settings.
RFLV=<n>	-3.0 to 3.0	Sets ANT A RF vernier level (dB).
RFLV?	-3.0 to 3.0	Returns ANT A RF vernier level (dB).
P4=<level>;<width>;<dev>	CAL/VAR/OFF;CAL/0.20 to 3.55; CAL/-1.95 to 1.95	Sets P ₄ (ACS/ACL) pulse level control, width and position.
P4?	CAL/VAR/OFF; CAL/0.20 to 3.20; CAL/-1.95 to 1.95	Returns status of P ₄ pulse.
P6=<level>;<width>;<dev>	CAL/OFF; CAL/-1.50 to 1.50; CAL/-1.95 to 1.95	Activates and sets P ₆ (SEQ) pulse level, width and position.
P6?	CAL/OFF; CAL/-1.50 to 1.50; CAL/-1.95 to 1.95	Returns status of P ₆ pulse.
P2=<level>	CAL/VAR/OFF	Sets P ₂ level control
P2?	CAL/VAR/OFF	Returns P ₂ level control status.
P3=<level>	CAL/VAR/OFF	Sets P ₃ level control.
P3?	CAL/VAR/OFF	Returns P ₃ level control status.
SPR=<switch>;<dev>	ON/OFF; CAL/-1.00 to 1.00	Activates and sets SPR position.
SPR?	ON/OFF; CAL/-1.00 to 1.00	Returns SPR status.
RPDLY?	000.000 to 399.000	Returns UUT reply delay (μs).
SQTR?	0.00 to 9.99	Returns UUT squitter period (seconds).
SQTR<type>?	DF11/DF17A/DF17I/DF17O/ DF17P/DF17S/DF17T	Returns selected squitter period in seconds.
PRPLY?	0 to 100, 0 to 100; 0 to 100	Returns UUT % reply for ANT A ATC, ANT A Mode S and ANT B.
APER?	0 to 100	Returns UUT ANT A ATCRBS % reply.
SPER?	0 to 100	Returns UUT ANT A Mode S % reply.
BPER?	0 to 100	Returns UUT ANT B % reply.
ANTB=<off/n>	OFF/-0.95 to 0.95	Activates ANT B (μs from ANT A P ₁).
ANTB?	OFF/-0.95 to 0.95	Returns ANT B status.
SQADD?	00000000 to 77777777	Returns squitter address.
PPULSE=<off/n>	0 to 260/OFF	Activates prepulse (μs prior to P ₁).
PPULSE?	0 to 260/OFF	Returns prepulse status.
EXSYN=<switch>;<n>;<switch>	ON/OFF;-9.95 to 9.95;ON/OFF	Activates Ext Sync output and sets Ext Sync output position (μs from P ₁) or activates Ext Sync Input.
EXSYN?	ON/OFF; -9.95 to 9.95 ON/OFF	Returns Ext Sync output and input status.

 S-1403DL Old-Style Command List
 Table 13 (Cont)

Old-Style Command Details

ACL.

Enables ACL Test Function (ATCRBS/Mode S All-Call interrogations [long P₄]).

ACS.

Enables ACS Test Function (ATCRBS Only All-Call interrogations [short P₄]).

ANTB=<off/n>

Controls ANT B interrogation signal position (S-1403DL ANT B Connector). Entry field disables ANT B signal (OFF) or offsets ANT B signal (-1.95 to +1.95, rounded to nearest 0.05 μ s) from ANT A signal (ATC-1400A RF I/O Connector).

ANTB?

Returns status of ANT B signal position (OFF or -1.95 to +1.95 in microseconds) from ANT A signal.

APER?

Returns ANT A ATCRBS percent reply (0 to 100).

ATC.

Enables ATC Test Function (ATCRBS interrogations only).

BPER?

Returns ANT B percent reply (0 to 100).

BRF=<coarse> (only with MLD option)

Sets ANT B attenuation by selecting an output level (20 to 83) in -dBm.

BRF?

Returns ANT B output level setting in -dBm.

BRFLV=<fine> (only with MLD option)

Sets ANT B RF vernier (-3.0 to +3.0) in 0.1 dB increments.

BRFLV?

Returns ANT B RF vernier setting in dB.

BURST=<itype>;<BN>

Enables BURST function. The <itype> field selects interrogation type (ATC, SEQ, ACS or ACL). Percent reply is tested for the number of interrogations (1 to 9999) set in the Burst Number, <BN>, field.

BURST.

Activates BURST Test Function when enabled.

CMENU<n>.

Displays current Control Menu Function A (<n>=1) or Function B screen (<n>=2).

DFSQ<nn>?

Returns Mode S reply data as received according to sequence menu (<nn>=00 to 999). Data is returned with type of format (sequence menu is off [F], short data field [S] or long data field [L]), downlink format number in decimal (00 to 31), short (9 octal digits) or long (28 octal digits) data field and transponder address in octal. If no data exists, S-1403DL returns **NO DATA** message.

DFSQA<nn>?

Returns the transponder address (8 octal digits) received in Mode S reply according to sequence menu (<nn>=00 to 999).

DFSQD<nn>?

Returns the short (9 octal digits) or long (28 octal digits) downlink data field received in Mode S reply according to sequence menu (<nn>=00 to 999).

DFSQF<nn>?

Returns the downlink format number in decimal, received in Mode S reply according to sequence menu (<nn>=00 to 999).

DFSQT<nn>?

Returns only the downlink format data type (sequence menu is off [F], short data field [S] or long data field [L]) received in Mode S reply according to sequence menu (<nn>=00 to 999).

DI=<itype>;<itype>

Enables Double Interrogation function. Entry fields select first and second interrogation types (ATC, SEQ, ACS or ACL) respectively.

ERRM?

Returns error status for when the GPIB controller receives serial poll data indicating auxiliary error (SRQ bit active). GPIB replies with one of the following error messages:

DI/INTF indicates S-1403DL or ATC-1400A (not both) is set for Double Interrogations.

INPUT indicates invalid RCI command.

NONE indicates no errors.

RECALL indicates an attempt to recall information data (**RECALL<n>**.) from an empty memory location.

EXMOD=<switch>

Enables (OFF) or disables (ON) internal ANT A modulation.

EXMOD?

Returns status of external modulation source. Only external modulation is accepted for ANT A (ON) or both external and internal modulation is accepted for ANT A (OFF).

EXSYN=<switch>;<n>;<switch>

Controls external sync output and input. First entry field enables (ON) or disables (OFF) external sync output through S-1403DL EXT SYNC OUT Connector. Second entry field sets external sync pulse output position from -9.95 to +9.95, rounded to nearest 0.05 μ s, from rising edge of P₁. Third entry field enables (ON) or disables (OFF) external sync input through S-1403DL EXT SYNC IN Connector. Both external sync output and external sync input cannot be enabled simultaneously.

EXSYN?

Returns external sync status with current entry field settings.

INTLCE=<n>

Enables Interlace function and sets the number <n> (1 to 999) of ATCRBS interrogations for every Mode S interrogation transmitted.

MLDECL?

Returns status of MLD option. The reply is *y* (yes, the S-1403 series Test Set contains the MLD option) or *n* (no, the S-1403 series Test Set does not contain the MLD option). This command is for programs operating Mode S Test Systems with and without the MLD option. Programs use the reply to this command to overlook commands that do not apply to the currently operating Mode S Test System.

NOTE: A reply of **3:?** indicates an old software version (before 2.0) . Refer to **VER?** command.

MODE?

Returns active function with selected options (ATC, SEQ, ACS, ACL, INTLCE;<n>, DI;<itype>;<itype> or BURST=<itype>;<BN>).

MTL=<itype>

Activates the test for measuring minimum triggering level (MTL) of the UUT for the selected interrogation type (ATC, SEQ, ACS or ACL).

NOTE: Test operation time depends on PRF rate and the final MTL RF level.

MTL?

Returns the MTL value in -dBm for the UUT.

NEWPB?

Returns old Pulse PC Board status. The reply is *y* (yes, the S-1403 series Test Set contains the S-1403C style Pulse PC Board) or *n* (no, the S-1403 series Test Set does not contain the S-1403C style Pulse PC Board). This command is for programs operating Mode S Test Systems with older Test Sets.

NOTE: A reply of **3:?** indicates an old software version (before 2.0) . Refer to **VER?** command.

P2=<level>

Sets P₂ pulse level when operating in Mode S test functions. Entry field sets pulse level to P₁ (CAL), allows ATC-1400A **ES=** command to set pulse level (VAR) or disables P₂ pulse (OFF).

P2?

Returns current status of P₂ pulse (CAL, VAR or OFF).

P3=<level>

Sets P₃ pulse level when operating in ATCRBS or All-Call test functions. Entry field sets pulse level to P₁ (CAL), allows ATC-1400A **ES=** command to set pulse level (VAR) or disables P₃ pulse (OFF).

P3?

Returns current status of P₃ pulse (CAL, VAR or OFF).

P4=<level>;<cal/n>;<cal/n>

Sets P₄ pulse conditions when operating in All-Call test functions. First entry field sets pulse level to P₁ (CAL), allows ATC-1400A **ES=** command to set pulse level (VAR) or disables P₄ pulse (OFF). Second entry field sets pulse width (CAL or 0.20 to 3.55 in μ s). Third entry field controls pulse position (CAL or -1.95 to +1.95 from CAL, rounded to nearest 0.05 μ s).

P4?

Returns status of P₄ pulse with current entry field settings.

P6=<level>;<cal/n>;<cal/n>

Sets P₆ pulse conditions when operating in Mode S test functions. First entry field enables or disables P₆ pulse (CAL or OFF). Second entry field sets pulse width (CAL or -1.50 to +1.50 from CAL in 0.05 μ s increments). Third entry field controls pulse position (CAL or -1.95 to +1.95 from CAL, rounded to nearest 0.05 μ s).

P6?

Returns status of P₆ pulse with current entry field settings.

PPMG=<off/n>

Sets Pulse Power Measurement Gate (PPMG) control for any pulse in the UUT reply. Entry field disables PPMG (OFF) or selects pulse to be measured for frequency and power. Pulse selection is 1 to 16 for ATCRBS replies and 1 to 116 for Mode S downlink formats.

PPMG?

Returns PPMG control status.

PPULSE=<off/n>

Sets control for prepulse through the S-1403DL PREPULSE OUT Connector. Entry field disables prepulse (OFF) or sets prepulse position (0 to 260) in microseconds prior to rising edge of P₁.

PPULSE?

Returns status of prepulse control.

PRPLY?

Returns percent reply (0 to 100) for ATCRBS (ANT A), Mode S (ANT A) and ANT B.

RECALL<n>.

Recalls and activates all S-1403DL settings stored in memory location (<n> =1 or 2). If memory location is empty, bit 1 of the SRQ register is set indicating an error.

RFLV=<n>

Sets RF vernier level (-3.0 to +3.0) in 0.1 dB increments.

RFLV?

Returns current RF vernier level (-3.0 to +3.0) in dB.

RPDLY?

Returns UUT reply delay in microseconds.

SCPI

Switches to new SCPI command interpreter.

SAVE<n>.

Enables S-1403DL to store all current settings in memory location (<n>=1 or 2).

NOTE: Saving only stores S-1403DL settings, not ATC-1400A settings.

SEQ.

Enables SEQ Test Function (Mode S interrogations only).

SEQN=<nn>

Displays selected Sequence Menu (<nn>=00 to 999).

SPER?

Returns percent reply (0 to 100) for Mode S (ANT A) only.

SPR=<switch>;<cal/n>

Controls SPR in Mode S test functions. First entry field enables (ON) or disables SPR (OFF). Second entry field controls SPR position (CAL or -1.00 to +1.00 from CAL, rounded to nearest 0.05 µs).

SPR?

Returns current status of SPR.

SQ<nn>=<format>;<uf#>;<data>;<addr>

Programs sequence menu (<nn>=00 to 999). Entry fields set format type (sequence menu off [F], short data field [S] or long data field [L]), uplink format number in decimal (00 to 31), short (9 octal digits) or long (28 octal digits) data field and UUT address in octal.

Program sequence menus prior to operating in desired Mode S test function. Refer to 4.7 in 1-2-4 for programming data fields.

SQ<nn>?

Returns status of sequence menu (<nn>=00 to 999) showing entry field settings.

SQADD?

Returns the octal conversion of the UUT address received in latest squitter.

SQTR?

Returns UUT squitter period (0.00 to 9.99) in seconds.

SQTR<type>?

Returns squitter period (0.00 to 9.99) for selected type of squitter in seconds (<type> = DF11, DF17A, DF17I, DF17O, DF17P, DF17S or DF17T).

STATMTL?

Returns status of MTL test. Reply possibilities are:

BUSY indicates MTL test in progress.

DONE indicates MTL test is complete and successful (UUT passed).

ERR1 indicates <90% reply (ATCRBS and all calls) or <99% reply (Mode S) at ≥ -21 dBm.

ERR2 indicates >10% reply at < -81 dBm.

ERR3 indicates MTL is > -69 dBm (ATCRBS and all calls) or > -71 dBm (Mode S).

ERR4 indicates MTL is < -77 dBm or MTL within range but <90% reply (ATCRBS and all calls) or <99% reply (Mode S) at MTL + 3 dB.

ERR5 indicates MTL cannot be found, MTL is unstable or test was stopped by user.

Initiate this command at greater than half-second intervals for minimal MTL acquisition time.

VER?

Returns Main Processor and Front Panel Processor software versions. The reply is $<mm.mm>;<ff.ff>$, where $<mm.mm>$ is the Main Processor software version number and $<ff.ff>$ is the Front Panel Processor software version number. Possible replies are:

3:? indicates an old software version (before 1.5).

01.nn;01.nn indicates S-1403 software versions.

02.nn;02.nn indicates S-1403C software versions.

03.nn;03.nn indicates S-1403DL software versions.

04.nn;04.nn indicates S-1403DL (current with SI-1404) software versions.

OLD-STYLE	SCPI-STYLE	OLD-STYLE	SCPI-STYLE
CMENU _n .	DISPlay:CMENU	SQTRDF17P?	SQTR:TIME?
SEQN=	DISPlay:SMENU	SQTRDF17S?	SQTR:TIME?
MODE?	CMENU:FUNCTion?	SQTRDF17T?	SQTR:TIME?
ATC.	CMENU:FUNCTion:ATCrbs	RPDLY?	REPLY:DELay?
SEQ.	CMENU:FUNCTion:SEQuence	PRPLY?	REPLY:PERCent?
ACS.	CMENU:FUNCTion:ACS	APER?	REPLY:PERCent?
ACL.	CMENU:FUNCTion:ACL	SPER?	REPLY:PERCent?
INTLCE=	CMENU:FUNCTion:INTerlace	BPER?	REPLY:PERCent?
DI=	CMENU:FUNCTion:DI	PPULSE=	INTerrogation:PPulse
BURST=	CMENU:FUNCTion:BURSt	PPULSE?	INTerrogation:PPulse?
BURST.	INTerrogation:TRIGger:BURSt	EXSYN=	INTerrogation:SYNC:OUT
ANTB=	GENerator[:STATe] and GENerator:TIME:OFFSet	EXSYN?	INTerrogation:SYNC:OUT?
ANTB?	GENerator[:STATe]? and GENerator:TIME:OFFSet?	PPMG=_	INTerrogation:PPMG
BRF=	GENerator:LEVel	PPMG?	INTerrogation:PPMG?
BRF?	GENerator:LEVel?	SQ<nn>=	INTerrogation:SMENU
RFLV=	GENerator:LEVel:OFFSet	SQ<nn>?	INTerrogation:SMENU?
BRFLV=	GENerator:LEVel:OFFSet	DFSQ<nn>?	REPLY:SMENU?
RFLV?	GENerator:LEVel:OFFSet?	DFSQT<nn>?	REPLY:SMENU?
BRFLV?	GENerator:LEVel:OFFSet?	DFSQF<nn>?	REPLY:SMENU?
P2=	INTerrogation:P2	DFSQD<nn>?	REPLY:SMENU?
P2?	INTerrogation:P2?	DFSQA<nn>?	REPLY:SMENU?
P3=	INTerrogation:P3	SAVE<n>	MEMory:STORe
P3?	INTerrogation:P3?	RECALL<n>	MEMory:LOAD
P4=	INTerrogation:P4	MTL=	TEST:MTL:STARt
P4?	INTerrogation:P4?	MTL?	TEST:MTL:LEVEL?
P6=	INTerrogation:P6	STATMTL?	TEST:MTL?
P6?	INTerrogation:P6?	SCPI	SCPI
SPR=	INTerrogation:P6:SPR	S1403C	S1403C or SYSTem:LANGUage S1403C
SPR?	INTerrogation:P6:SPR?	SQTRDFCLEAR	SQTR:TIME:CLEar
EXMOD=	INTerrogation:MODulation	SQTRBUFCAPTURE=	SQTR:CAPTure[:STATe]
EXMOD?	INTerrogation:MODulation?	SQTRBUFFILTER=	SQTR:CAPTure:FILTer
SQTR?	SQTR:TIME?	SQTRBUFCLEAR	SQTR:CAPTure:CLEar
SQADD?	SQTR:ADDReSS?	SQTRBUFCOUNT?	SQTR:CAPTure:COUNt?
SQTRDF11?	SQTR:TIME?	SQTRBUFGET?	SQTR:CAPTure:GET?
SQTRDF17A?	SQTR:TIME?	MLDECL?	*OPT?
SQTRDF17I?	SQTR:TIME?	VER?	*IDN?
SQTRDF17O?	SQTR:TIME?		

Old-Style/SCPI-Style Command Comparison
Table 14

4.7 EXAMPLES

4.7.1 Example #1

Send Uplink Format 05 (Short Format) in Sequence Menu S002.

Example transponder address: 17725762o or 3FABF2h.

Example data field settings (refer to Appendix D):

FIELD	SETTING DEFINITION
PC	Data being sent is for information only.
RR	Request identification of aircraft being interrogated.
DI	SD field contains multisite information.
SD	Field is composed of subfields IIS, MBS, LOS, RSS and TMS.
IIS	Interrogator identification.
MBS	Reserve COMM-B for use.
MES	Close out COMM-C and COMM-D from use.
LOS	Lockout field listed in IIS, from further All Call interrogations. Continue to acknowledge other All Call requests.
RSS	No request for field UM (not used).
TMS	Unlinked Message/Request, acknowledge receipt.

Binary representation of the 27 example data field bits:

100	10010	001	0100	01	111	1	00	0010
PC	RR	DI	IIS	MBS	MES	LOS	RSS	TMS
SD								

To convert the binary representation to nine octal digits, refer to 1-2-2, Table 5 and create a table similar to the following:

BINARY	100	100	100	010	100	011	111	000	010
OCTAL	4	4	4	2	4	3	7	0	2

To convert the binary representation to seven hexadecimal digits, refer to 1-2-2, Table 5 and create a table similar to the following:

BINARY	100	1001	0001	0100	0111	1100	0010
HEX	4	9	1	4	7	C	2

Set Example #1 old-style command as follows:

COMMAND	DEFINITION
AX3=	Instructs S-1403DL to transfer command of tests to be conducted from the Front Panel to remote.
SQ1	Sequence Menu S001.
S	Short data field length.
05	Uplink Format 05 (decimal).
444243702	Nine-digit (octal) data field.
17725762	Eight-digit (octal) transponder address.
Command: AX3=SQ01;S;05;444243702;17725762	

Set Example #1 SCPI-style command as follows:

COMMAND	DEFINITION
INTERrogation: SMENU	Initiates sequence menu command under the interrogation subsystem.
1	Sequence Menu S001.
ON	Activates sequence menu.
"S"	Short data field length.
5	Uplink Format 05 (decimal).
"#Q444243702" or "H49147C2"	Nine-digit (octal) or seven-digit (hexadecimal) data field.
#Q17725762 or #H3FABF2	Eight-digit (octal) or six-digit (hexadecimal) transponder address.
Command (on one line): INTERrogation:SMENU 1,ON,"S",5,"#Q444243702,#Q17725762 or INTERrogation:SMENU 1,ON,"S",5,"#H49147C2,#H3FABF2	

4.7.2 Example #2

Send Uplink Format 21 (Long Format) in Sequence Menu S002.

Example transponder address: 17725762o or 3FABF2h.

Example data field settings (refer to Appendix D):

FIELD	SETTING DEFINITION
PC	Non-selective All-Call lockout.
RR	Identification of aircraft being interrogated.
DI	Notice to expect extended information.
SD	Field is composed of subfields IIS, RRS, LOS and TMS.
IIS	Interrogator Identification.
RRS	Transmit reply in extended format.
LOS	Lockout all All-Call responses.
TMS	Linked first segment, multiple addresses, priority individual call, acknowledge.
MA	Field is composed of subfields ADS and message.
ADS	Extended message immediately follows.
*	Data bits not used in uplink format message.

Binary representation of the 83 example data field bits:

001 PC	10010 RR	111 DI	0100 IIS	0101 RRS	0 *	1 LOS	00 *	1011 TMS
SD								
01011100 ADS				48-Zeros Message				
MA								

To convert the binary representation to 28 octal digits, refer to 1-2-2, Table 5 and create a table similar to the following:

BINARY	00	110	010	111	010	001	010
OCTAL	0	6	2	7	2	1	2
BINARY	100	101	101	011	100	000	000
OCTAL	4	5	5	3	4	0	0
BINARY	000	000	000	000	000	000	000
OCTAL	0	0	0	0	0	0	0
BINARY	000	000	000	000	000	000	000
OCTAL	0	0	0	0	0	0	0

To convert the binary representation to 21 hexadecimal digits, refer to 1-2-2, Table 5 and create a table similar to the following:

BINARY	001	1001	0111	0100	0101	0100	1011
HEX	1	9	7	4	5	4	B
BINARY	0101	1100	0000	0000	0000	0000	0000
HEX	5	C	0	0	0	0	0
BINARY	0000	0000	0000	0000	0000	0000	0000
HEX	0	0	0	0	0	0	0



Set Example #2 old-style command as follows:

COMMAND	DEFINITION
AX3=	Command instructs S-1403DL to transfer command of tests from Front Panel control to remote.
SQ2	Sequence Menu S002.
L	Long data field length.
21	Uplink Format 21 (decimal).
0627...000	28-digit (octal) data field.
17725762	Eight-digit (octal) transponder address.
Command (on one line): AX3=SQ02;L;21;0627212455340000000000000000;17725762	

Set Example #2 SCPI-style command as follows:

COMMAND	DEFINITION
INTerrogation: SMENU	Initiates sequence menu command under the interrogation subsystem.
2	Sequence Menu S002.
ON	Activates sequence menu.
"L"	Long data field length.
5	Uplink Format 05 (decimal).
"#Q0627212455340000000000000000" or "H197454B5C0000000000000"	28-digit (octal) or 21-digit (hexadecimal) data field.
#Q17725762 or #H3FABF2	Eight-digit (octal) or six-digit (hexadecimal) transponder address.
Command (on one line): INTerrogation:SMENU 1,ON,"S",5, "#Q0627212455340000000000000000", #Q17725762 or INTerrogation:SMENU 1,ON,"S",5, "#H197454B5C0000000000000",#H3FABF2	

4.7.3 Example #3

Receive Downlink Format 04 (Altitude Reply)

Example transponder address: 17725762o or 3FABF2h.

Old-Style Command: AX3=DFSQ<nn>? with <nn> set to an applicable UF04 (RR<21o) sequence menu.

Old-Style Return: " 3:S;4;2035;17725762"

RESPONSE	DEFINITION
3	Indicates reply from S-1403DL.
S	Short format.
4	Downlink Format 04.
2035	Octal data field.
17725762	Example transponder address.

SCPI-Style Command:
REPLY:SMENU? <smenu#>,<rformat> with <smenu#> set to an applicable UF04 (RR<21o) sequence menu and <rformat> set to "N".

SCPI-Style Return:
N,4,#Q2035,#Q17725762
or
N,4,#H10D,#H3FABF2

RESPONSE	DEFINITION
N	Indicates auto size reply format.
4	Downlink Format 04.
#H10D	Hexadecimal data field.
#H3FABF2	Example transponder address.

To convert hexadecimal data to decimal altitude in feet, start at Step 4 in following procedure.

To convert octal data to decimal altitude in feet, perform following procedure.

STEP	PROCEDURE
------	-----------

1. Refer to 1-2-2, Table 5 and convert the octal data field digits to binary using the following format:

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
B ₁₀	B ₉	B ₈	B ₇	B ₆	B ₅	M	B ₄	Q	B ₃	B ₂	B ₁	B ₀
0	0	1	0	0	0	0	0	1	1	1	0	1
0	2		0			3			5			

STEP	PROCEDURE
------	-----------

Refer to Appendix D for breakdown of individual data fields. (The AC field contains the last 13 bits shown in the grid. The reply indicates no active bits for the FS, DR and UM fields.)

If bit position Q (D₁) is 0, go to Step 7 for altitude readout.

BINARY ALTITUDE CODE (Q=1)

2. Discard bit positions M and Q.
3. Separate bits into three fields and convert to hexadecimal as follows (refer to 1-2-2, Table 5):

B ₁₀	B ₉	B ₈	B ₇	B ₆	B ₅	B ₄	B ₃	B ₂	B ₁	B ₀
0	0	1	0	0	0	0	1	1	0	1
1			0				D			

4. Convert 3-digit (hexadecimal) altitude code to decimal code.

$$10D = 269 ([1 \times 256 = 256] + [0 \times 16 = 0] + 13)$$

5. Multiply decimal number by 25.

$$269 \times 25 = 6725$$

6. Subtract 1000 from answer in Step 5.

$$6725 - 1000 = 5725 \text{ feet}$$

(This altitude should agree with the AC= field displayed in the sequence menu with UF04 active.)

MODE C ALTITUDE CODE (Q=0)

NOTE: For an example of Q=0, the new example field is 2015.

7. Discard bit positions X and D₁.

8. Rearrange data bits as follows:

D ₂	D ₄	A ₁	A ₂	A ₄	B ₁	B ₂	B ₄	C ₁	C ₂	C ₄
1	1	0	0	0	0	1	0	0	1	0

9. Refer to ATC-1400A Operation Manual for conversion to altitude (Altitude Transmission Code Chart).

(The example field translates to 64,500 feet.)

4.7.4 Example #4

Receive Downlink Format 05 (Identification Reply)

Example transponder address: 17725762o or 3FABF2h.

Old-Style Command: AX3=DFSQ<nn>? with <nn> set to an applicable UF05 (RR<21o) sequence menu.

Old-Style Return: " 3:S;5;11026;17725762"

RESPONSE	DEFINITION
3	Indicates reply from S-1403DL.
S	Short format.
5	Downlink Format 05.
11026	Octal data field.
17725762	Example transponder address.

SCPI-Style Command:
REPLY:SMENU? <smenu#>,<rformat> with <smenu#> set to an applicable UF05 (RR<21o) sequence menu and <rformat> set to "N".

SCPI-Style Return:
N,4,#Q11026,#Q17725762
or
N,4,#H10D,#H3FABF2

RESPONSE	DEFINITION
N	Indicates auto size reply format.
5	Downlink Format 05.
#H1216	Hexadecimal data field.
#H3FABF2	Example transponder address.

To convert data to ID code, perform following procedure.

STEP PROCEDURE

1. Refer to 1-2-2, Table 5 and convert the octal data field digits to binary using the following format:

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
1	0	0	1	0	0	0	0	1	0	1	1	0
1	1		0			2		6				

STEP PROCEDURE

- Refer to 1-2-2, Table 5 and convert the octal data field digits to binary using the following format:

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
1	0	0	1	0	0	0	0	1	0	1	1	0
1	2			1			6					

- Refer to Appendix D for breakdown of individual data fields. (The ID field contains the last 13 bits shown in the grids. The reply indicates no active bits for the FS, DR and UM fields.)

2. Rearrange binary bits to the following format, discarding bit position X:

A ₄	A ₂	A ₁	B ₄	B ₂	B ₁	C ₄	C ₂	C ₁	D ₄	D ₂	D ₁
0	1	0	1	0	0	0	0	1	0	1	1

3. Refer to 1-2-2, Table 5 and convert the binary bits to octal:

0	1	0	1	0	0	0	0	1	0	1	1
2			4			1			3		

- (This identification code should agree with the ID= field displayed in the sequence menu with UF05 active.)

SECTION 3 - SPECIFICATIONS

1. MODE S TEST SYSTEM SPECIFICATIONS

NOTE: These specifications supersede ATC-1400A Specifications when the ATC-1400A is connected with the S-1403DL. Refer to 1-3-1 in the ATC-1400A Operation Manual for specifications not outlined in this section.

1.1 RF

1.1.1 Antenna A (ANT A), RF I/O Connector

Frequency: Per ATC-1400A Specifications

Level: Per ATC-1400A Specifications

Vernier Control:

Range: ± 3.0 dB

Step: 0.1 dB

Accuracy: ± 0.05 dB or $\pm 10\%$

1.1.2 Antenna B (ANT B), ANT B Connector

Frequency: 1030 MHz

Accuracy: 0.001%

Level:

Range: -50 dBm (without MLD)
-20 to -83 dBm (with MLD)

Step: 1 dB (with MLD)

Accuracy: ± 1 dB relative to ATC-1400A at -50 dBm into 50 Ω (without MLD)
 ± 0.5 dB relative to ATC-1400A at -20 dBm into 50 Ω (with MLD)

Attenuator Accuracy:
(with MLD)

LEVEL	ACCURACY
-30 dBm	± 0.4 dB
-40 dBm	± 0.4 dB
-50 dBm	± 0.4 dB
-60 dBm	± 0.5 dB
-70 dBm	± 0.61 dB
-80 dBm	± 0.72 dB

Vernier Control:

Range: ± 3.0 dB

Step: 0.1 dB

Accuracy: ± 0.05 dB or $\pm 10\%$

1.2 PULSE CHARACTERISTICS

NOTE: Pulse characteristics are verified from the RF I/O or ANT B Connectors using a Heterodyne Monitor.

1.2.1 General

ANT A:

Rise and Fall times: Per ATC-1400A Specifications

ANT B:

Rise Time: 50 to 90 ns

Fall Time: 50 to 200 ns

On/Off Ratio: >80 dB

P₁ Position (CAL): Relative to ANT A P₁

Deviation: Variable from CAL ($\pm 0.95 \mu\text{s}$)

Step: 0.05 μs

ANT A to ANT B Tracking Accuracy: $\pm 15 \text{ ns}$

PRF Limitations:

ATC Function: 7999 Hz

SEQ Function: 2500 Hz

ACS Function: 2500 Hz

ACL Function: 2500 Hz

INTLCE Function: 1250 Hz

DI Function: 1250 Hz

BURST Function: 7999 Hz (ATC)
2500 Hz (All others)

ATCRBS Monitor Pulse Function: 4000

PRF Accuracy (TrigGen):

Range (Hz): 1 to 2500 Hz (All functions except INTLCE and DI)
1 to 1250 Hz (INTLCE and DI)

Step Size: 1 Hz

Accuracy: $\pm 1 \text{ Hz}$, $\pm 0.0035\%$ of setting

Range (Sec): 0.0004 to 99.9999 Sec (All functions except INTLCE and DI)
0.0008 to 99.9999 Sec (INTLCE and DI)

Step Size: 0.1 ms

Accuracy: $\pm 100 \text{ ns}$, $\pm 0.0035\%$ of setting

External Sync Input,
EXT SYNC IN Connector (J4):

Maximum Input Frequency:

ATC Function:	7999 Hz
SEQ Function:	2500 Hz
ACS Function:	2500 Hz
ACL Function:	2500 Hz
INTLCE Function:	1250 Hz
DI Function:	1250 Hz
BURST Function:	7999 Hz (ATC) 2500 Hz (All others)

Minimum Input Low Time: 200 ns

1.2.2 ATC Function

P₂ SLS:

Amplitude (CAL) (ANT A):	0 dB, relative to P ₁
Range:	Variable from -19 to +6 dB
Step:	1 dB
Accuracy:	±0.3 dB for -10 to +3 dB
Width (CAL) (ANT A):	0.8 μs
Range:	Variable from 0.2 to 1.85 μs
Step:	0.05 μs
Accuracy:	±10 ns
Width (CAL) (ANT B):	0.8 μs
Range:	Variable from 0.2 to 1.85 μs
Step:	0.05 μs
Accuracy (CAL):	±10 ns
(Variable ≤0.8 μs):	±20 ns
(Variable >0.8 μs):	±10 ns
Position (CAL) (ANT A and ANT B):	2.0 μs following leading edge of P ₁
Deviation:	Variable from CAL (±1.85 μs)
Step:	0.05 μs
Accuracy:	±10 ns

P₃:

Amplitude (CAL) (ANT A):	0 dB, relative to P ₁
Range:	Variable from -19 to +6 dB
Step:	1 dB
Accuracy:	±0.3 dB for -10 to +3 dB
Width (CAL) (ANT A):	0.8 μs
Range:	Variable from 0.20 to 1.85 μs
Step:	0.05 μs
Accuracy:	±10 ns
Width (CAL) (ANT B):	0.8 μs
Range:	Variable from 0.20 to 1.85 μs
Step:	0.05 μs
Accuracy (CAL):	±10 ns
(Variable <0.8 μs):	±20 ns
(Variable ≥0.8 μs):	±10 ns
Position (CAL) (P ₁ to P ₃):	3.0 μs (Mode 1) 5.0 μs (Mode 2) 6.5 μs (Mode T) 8.0 μs (Mode 3/A) 17.0 μs (Mode B) 21.0 μs (Mode C) 25.0 μs (Mode D)
Deviation:	Variable from CAL (±1.85 μs)
Step:	0.05 μs
Accuracy:	±10 ns
Interference Pulse (PrePulseOut OFF or 0) (<1200 PRF):	
Amplitude:	0 dB, relative to P ₁
Range:	Variable from -19 to +6 dB
Step:	1 dB
Accuracy:	±0.3 dB for -10 to +3 dB
Width:	Variable from 0.2 to 5 μs
Position:	Variable from 17.5 μs prior to P ₁ to 399.9 μs following P ₁
Step:	0.1 μs
Accuracy:	±0.1 μs, ±0.005% of pulse position selected on the ATC-1400A

Suppressor Pulse (PrePulseOut OFF or 0)
(<1200 PRF) through SUPPRESSOR
OUTPUT Connector:

Amplitude:	Per ATC-1400A Specifications
Width:	Per ATC-1400A Specifications
Position:	$0.8 \mu\text{s}$ prior to leading edge of P_3
Deviation:	Variable from $17.5 \mu\text{s}$ prior to P_1 to $399.9 \mu\text{s}$ following P_1
Step:	$0.1 \mu\text{s}$
Accuracy:	$\pm 0.1 \mu\text{s}$, $\pm 0.005\%$ of pulse position selected on the ATC-1400A

Prepulse through PREPULSE OUT
Connector:

Position:	Variable from 0 to $260 \mu\text{s}$ prior to leading edge of P_1
Step:	$1 \mu\text{s}$
Accuracy:	$\pm 50 \text{ ns}$ $\pm 0.005\%$

External Sync Output through EXT SYNC
OUT Connector:

Position:	Variable from -9.95 to $+9.95 \mu\text{s}$ from rising edge of P_1
Step:	$0.05 \mu\text{s}$
Accuracy:	$\pm 50 \text{ ns}$

ATCRBS Discrete Pulse through ATCRBS
OUT Connector:

Width:	$3.0 \mu\text{s}$
Accuracy:	$\pm 50 \text{ ns}$
Position:	$1.0 \mu\text{s}$ prior to leading edge of P_1
Accuracy:	$\pm 50 \text{ ns}$

1.2.3 SEQ Function

P₂:

Amplitude (CAL) (ANT A):	0 dB, relative to P ₁
Range:	Variable from -19 to +6 dB
Step:	1 dB
Accuracy:	±0.3 dB for -10 to +3 dB
Width (CAL) (ANT A):	0.8 μs
Range:	Variable from 0.20 to 1.85 μs
Step:	0.05 μs
Accuracy:	±10 ns
Width (CAL) (ANT B):	0.8 μs
Range:	Variable from 0.20 to 1.85 μs
Step:	0.05 μs
Accuracy (CAL):	±10 ns
(Variable <0.8 μs):	±20 ns
(Variable ≥0.8 μs):	±10 ns
Position (CAL) (ANT A and ANT B):	2.0 μs following leading edge of P ₁
Deviation:	Variable from CAL (±1.85 μs)
Step:	0.05 μs
Accuracy (CAL):	±10 ns

P₅ SLS:

Amplitude (CAL) (ANT A):	0 dB, relative to P ₁
Range:	Variable from -19 to +6 dB
Step:	1 dB
Accuracy:	±0.5 dB for -10 to +3 dB
Width (CAL) (ANT A):	0.8 μs
Accuracy:	±100 ns
Position (CAL) (ANT A):	0.4 μs before Sync Phase Reversal (SPR)
Deviation:	Controlled by SPR deviation
Accuracy:	±100 ns

P₆ (ANT A and ANT B):

Width (CAL):	16.25 μ s for short formats 30.25 μ s for long formats
Range:	Variable from CAL (\pm 1.5 μ s)
Step:	0.05 μ s
Accuracy:	\pm 10 ns
Position (CAL):	3.5 μ s following leading edge of P ₁
Deviation:	Variable from CAL (\pm 1.95 μ s)
Step:	0.05 μ s
Accuracy:	\pm 10 ns

SPR (ANT A and ANT B):

Position (CAL):	2.75 μ s following leading edge of P ₂ (CAL)
Deviation:	Variable from CAL (\pm 1 μ s) (DPSK data deviates accordingly.)
Step:	0.05 μ s
Accuracy:	\pm 10 ns

DPSK:

Phase Reversal Time:	<80 ns (10° to 170°)
----------------------	----------------------

Interference Pulse:

Same as in ATC Function

Suppressor Pulse (PrePulseOut OFF or 0)
(<1200 PRF) through SUPPRESSOR
OUTPUT Connector:

Amplitude:	Per ATC-1400A Specifications
Width:	Per ATC-1400A Specifications
Position:	0.8 μ s prior to SPR (CAL)
Deviation:	Variable from 17.5 μ s prior to P ₁ to 399.9 μ s following P ₁
Step:	0.1 μ s
Accuracy:	\pm 0.1 μ s, \pm 0.005% of pulse position selected on the ATC-1400A

Prepulse through PREPULSE OUT
Connector:

Same as in ATC Function

External Sync Output through EXT SYNC
OUT Connector:

Same as in ATC Function

1.2.4 ACS/ACL Functions

P ₂ SLS:	Same as in ATC Function
P ₃ (ANT A and ANT B):	Same as in ATC Function
P ₄ :	
Amplitude (CAL) (ANT A):	0 dB, relative to P ₁
Range:	Variable from -19 to +6 dB
Step:	1 dB
Accuracy:	±0.3 dB for -10 to +3 dB
Width (CAL) (ANT A):	0.8 μs for short P ₄ (ACS) or 1.6 μs for long P ₄ (ACL)
Range:	Variable (independent of P ₁ , P ₂ and P ₃) from 0.2 to 3.55 μs
Step:	0.05 μs
Accuracy:	±10 ns
Width (CAL) (ANT B):	0.8 μs for short P ₄ (ACS) or 1.6 μs for long P ₄ (ACL)
Range:	Variable (independent of P ₁ , P ₂ and P ₃) from 0.2 to 3.55 μs
Step:	0.05 μs
Accuracy (CAL):	±10 ns
(Variable <0.8 μs):	±20 ns
(Variable ≥0.8 μs):	±10 ns
Position (CAL):	2.0 μs following leading edge of P ₃
Deviation:	Variable from CAL (±1.95 μs)
Step:	0.05 μs
Accuracy:	±10 ns
Interference Pulse:	Same as in ATC Function
Suppressor Pulse through SUPPRESSOR OUTPUT Connector:	Same as in ATC Function
Prepulse through PREPULSE OUT Connector:	Same as in ATC Function
External Sync Output through EXT SYNC OUT Connector:	Same as in ATC Function

1.2.5 INTLCE Function

ATC Interrogations:

Same as in ATC Function (CAL settings)

SEQ Interrogations:

Same as in SEQ Function (CAL settings)

Position:

200 μ s from ATC interrogation P₁ leading edge to SEQ interrogation P₁ leading edge

Accuracy:

± 100 ns

1.2.6 DI Function

First Interrogation:

Refer to applicable function.

Second Interrogation:

Refer to applicable function (CAL settings).

DI Spacing (P₁ leading edge of 1st interrogation to P₁ leading edge of 2nd interrogation):

ATC, ACS or ACL (either interrogation):

Range:

0 to 399.9 μ s

Step:

0.1 μ s

Accuracy:

± 50 ns, $\pm 0.005\%$

SEQ (both interrogation):

Range:

40.0 to 399.9 μ s

Step:

0.1 μ s

Accuracy:

± 50 ns, $\pm 0.005\%$

1.2.7 BURST Function

Interrogations:

Refer to applicable function.

1.2.8 ELM Function

SEQ Interrogations:

Refer to applicable function (CAL settings).

1.3 UUT MEASUREMENTS

1.3.1 Reply Delay

ANT A:

ATC (leading edge of P₃ [CAL] to leading edge of F₁):

Range:	2 to 4 μ s
Resolution:	12.5 ns
Accuracy:	\pm 50 ns

SEQ (SPR to leading edge of reply P₁):

Range:	126 to 130 μ s
Resolution:	12.5 ns
Accuracy:	\pm 50 ns, \pm 1 count

ACS/ACL:

ATCRBS Reply (leading edge of P₃ [CAL] to leading edge of F₁):

Range:	2 to 4 μ s
Resolution:	12.5 ns
Accuracy:	\pm 50 ns, \pm 1 count

Mode S Reply (leading edge of P₄ [CAL] to leading edge of reply P₁):

Range:	126 to 130 μ s
Resolution:	12.5 ns
Accuracy:	\pm 50 ns, \pm 1 count

ANT B:

ATC (leading edge of P₃ [CAL] to leading edge of F₁):

Range:	2 to 4 μ s
Resolution:	12.5 ns
Accuracy:	\pm 100 ns, \pm 1 count (UUT VIDEO Connector unterminated) \pm 200 ns, \pm 1 count (UUT VIDEO Connector terminated into 50 Ω)

ANT B (Cont):

SEQ (SPR to leading edge of reply P₁):

Range:	126 to 130 μ s
Resolution:	12.5 ns
Accuracy:	± 100 ns, ± 1 count (UUT VIDEO Connector unterminated) ± 200 ns, ± 1 count (UUT VIDEO Connector terminated into 50 Ω)

ACS/ACL:

ATCRBS Reply (leading edge of P₃ [CAL] to leading edge of F₁):

Range:	2 to 4 μ s
Resolution:	12.5 ns
Accuracy:	± 100 ns, ± 1 count (UUT VIDEO Connector unterminated) ± 200 ns, ± 1 count (UUT VIDEO Connector terminated into 50 Ω)

Mode S Reply (leading edge of P₄ [CAL] to leading edge of reply P₁):

Range:	126 to 130 μ s
Resolution:	12.5 ns
Accuracy:	± 100 ns, ± 1 count (UUT VIDEO Connector unterminated) ± 200 ns, ± 1 count (UUT VIDEO Connector terminated into 50 Ω)

1.3.2 %Reply

ATCRBS Valid Reply (ANT A and ANT B):

Range:	0 to 100%
Resolution:	1%
Accuracy:	± 1 step

Mode S Valid Reply (ANT A and ANT B):

Range:	0 to 100%
Resolution:	1%
Accuracy:	± 1 step

1.3.3 Pulse Characteristics

ATCRBS Monitor Pulse Function (ATC Mon):

Reply Pulse F₁ and F₂ Width (into ANT A or ANT B at 500 W):

Resolution:	12.5 ns
Accuracy:	
(ANT A):	±50 ns
(ANT B):	±100 ns

Reply Pulse F₁ to F₂ Spacing (into ANT A or ANT B at 500 W):

Resolution:	12.5 ns
Accuracy:	
(ANT A):	±50 ns
(ANT B):	±100 ns

1.4 INPUT/OUTPUT DRIVE LEVELS

1.4.1 Miscellaneous Outputs

SIGNAL NAME (CONNECTOR)	LEVEL		LOAD IMPEDANCE
	V _{oh} (Min)	V _{ol} (Max)	
SCOPE TRIG OUT (J7)	2.4 V	0.6 V	≥90 Ω
EXT SYNC OUT (J8)	2.4 V	0.6 V	≥90 Ω
EXT PRF OUT (J17)	2.4 V	0.6 V	≥90 Ω
ATCRBS OUT (J5)	2.4 V	0.6 V	≥90 Ω
PREPULSE OUT (J9)	2.4 V	0.6 V	≥90 Ω
ANT B VIDEO OUT (J6)	2.4 V	0.6 V	≥90 Ω
ANT B GEN OUT (J22)	2.4 V	0.6 V	≥90 Ω

1.4.2 Miscellaneous Inputs

SIGNAL NAME (CONNECTOR)	LEVEL		INPUT IMPEDANCE
	V _{ih} (Min)	V _{il} (Max)	
EXT MOD IN (J3)	+2 to +15 V	0.0 to 0.7 V	≥1 kΩ (Typical)
EXT SYNC IN (J4)	+2 to +15 V	0.0 to 0.7 V	≥1 kΩ (Typical)

1.5 POWER REQUIREMENTS

Source Voltage and Frequency: 100 to 120 VAC, 60 Hz.
220 to 240 VAC, 50 Hz.

NOTE: Power consumption and nominal input current specifications do not apply to S-1403DL Test Sets upgraded from S-1403 or S-1403C Test Sets.

Power Consumption: 48 W Maximum
180 W Maximum with ATC-1400A
40 W Nominal at 115 VAC
136 W Nominal at 115 VAC with ATC-1400A
33 W Nominal at 230 VAC
129 W Nominal at 230 VAC with ATC-1400A

Nominal Input Current: 0.44 A at 115 VAC
1.72 A at 115 VAC with ATC 1400A
0.23 A at 230 VAC
1.0 A at 230 VAC with ATC 1400A

1.6 FUSE REQUIREMENTS

NOTE: Only F1 and F2 Fuse specifications apply to S-1403DL Test Sets upgraded from S-1403 or S-1403C Test Sets.

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

1.7 SAFETY CONDITIONS

NOTE: Test Sets with upgrade kits installed are not compliant to national or international EMC and/or safety standards.

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



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SECTION 4 - SHIPPING

1. SHIPPING TEST SETS

1.1 INFORMATION

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 Aeroflex Customer Service Department.

CONTACT: Aeroflex
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

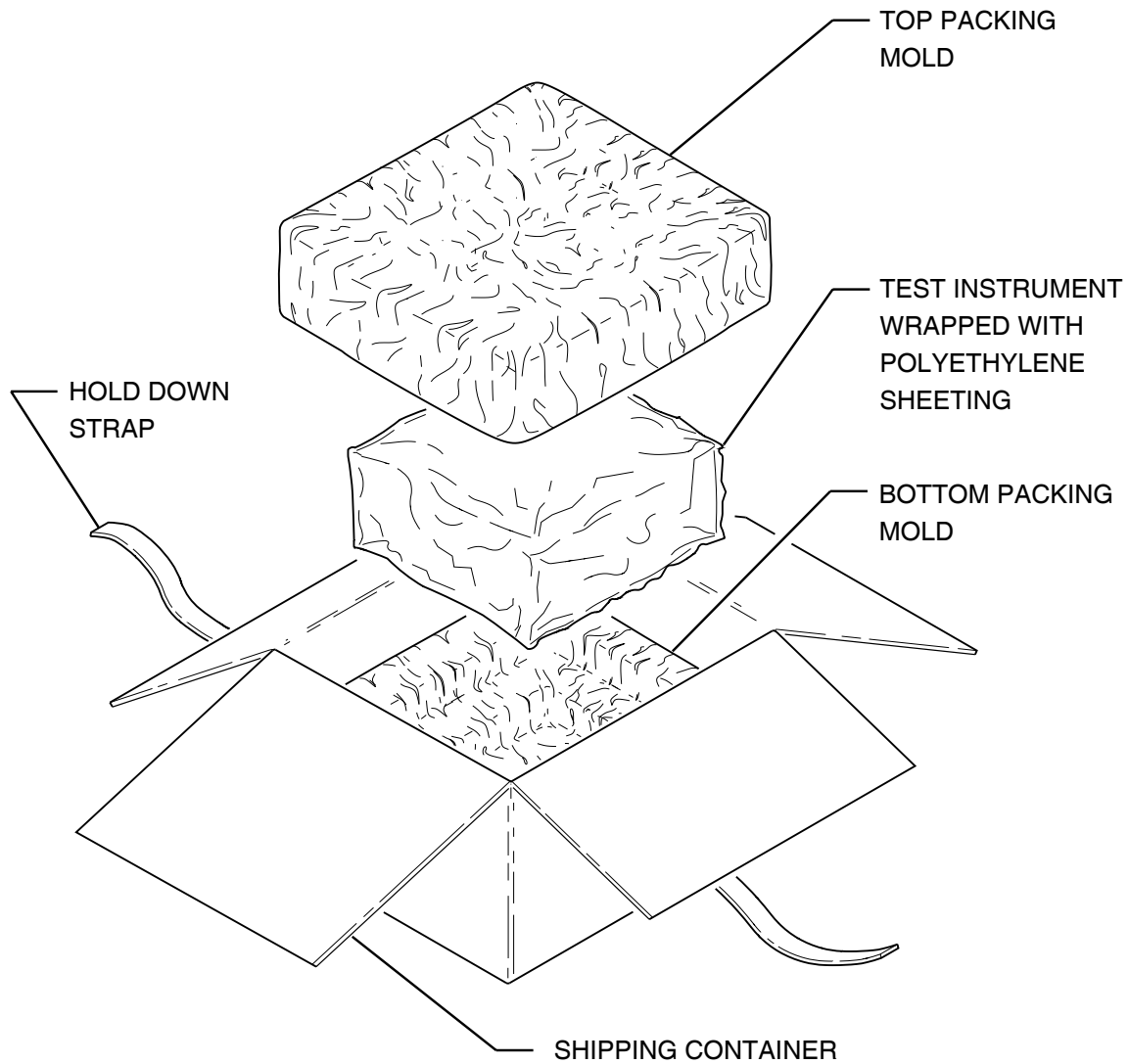
Test Sets must be repackaged in original shipping containers using original packing molds. If original shipping containers and materials are not available, contact Aeroflex Customer Service for shipping instructions.

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.



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APPENDIX A - CONNECTOR PIN-OUT TABLES

1. TABLE OF S-1403DL I/O CONNECTORS

CONNECTOR	TYPE	SIGNAL NAME	SIGNAL TYPE	INPUT/OUTPUT
J10001	BNC Female	UUT VIDEO	50 Ω	OUTPUT
J10002	N Female	ANT B	50 Ω	INPUT/OUTPUT
A5A3J3	BNC Female	EXT MOD IN	TTL	INPUT
A5A3J4	BNC Female	EXT SYNC IN	TTL	INPUT
A5A3J5	BNC Female	ATCRBS OUT	TTL	OUTPUT
A5A3J6	BNC Female	ANT B VIDEO OUT	TTL	OUTPUT
A5A3J7	BNC Female	SCOPE TRIG OUT	TTL	OUTPUT
A5A3J8	BNC Female	EXT SYNC OUT	TTL	OUTPUT
A5A3J9	BNC Female	PREPULSE OUT	TTL	OUTPUT
A5A1J10	DB-25 Female	AUX BUS	VARIOUS	INPUT/OUTPUT
A5W2J11	DB-25 Female	IFR BUS	TTL	INPUT/OUTPUT
A5A1J12	DB-9 Male	RS-232	RS-232C	INPUT/OUTPUT
A5A1J13	SMB Male	RF LVL	0 TO 7 Vdc	OUTPUT
A5A1J14	SMB Male	PPMG	TTL	OUTPUT
A5A1J15	SMB Male	DPSK OUT	BIPOLAR	OUTPUT
J16	AC Receptacle Female	AC	ac Power	OUTPUT
J17	RFI Pwr Filter/AC Receptacle Male	AC	ac Power	INPUT
A5A3J17	BNC Female	EXT PRF OUT	TTL	OUTPUT
A5A3J18	BNC Female	MODE GRP TRIG IN	TTL	INPUT
A5A3J19	BNC Female	REPLY GRP TRIG IN	TTL	INPUT
A5A3J20	BNC Female	DECODED VIDEO IN	TTL	INPUT
A5W1J21	Champ-24 Female	GPIB	IEEE-488.2	INPUT/OUTPUT
A5A3J22	BNC Female	ANT B GEN OUT	TTL	OUTPUT
A5A3J23	BNC Female	DISPARITY OUT	TTL	OUTPUT
A5A3J24	BNC Female	ENABLE TRIG IN	TTL	INPUT
A5A3J25	BNC Female	REPLY (TTL) OUT	TTL	OUTPUT
A5A3J26	BNC Female	REPLY (3-27 V) OUT	3-27 Vdc	OUTPUT

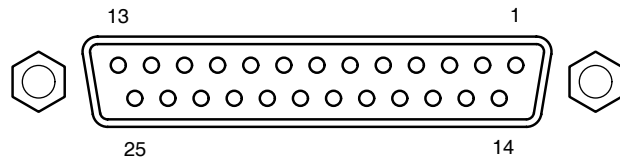
NOTE: Prefix all connector reference designators (except J10001 and J10002) with 24A1 for S-1403DL w/o MLD or 27A1 for S-1403DL w/ MLD.

I/O Connectors
Table 1

2. S-1403DL AUX BUS CONNECTOR (J10) (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	$\overline{\text{EXT PULSE}}$	TTL	OUTPUT	ACTIVE LOW
6	$\overline{\text{EXT SLS}}$	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	SPARE			
17	GROUND			
18	GROUND			
19	GROUND			
20	GROUND			
21	GROUND			
22	GROUND			
23	SPARE			
24	GROUND			
25	SPARE			

Pin-Out for AUX BUS Connector
Table 2



AUX BUS J10

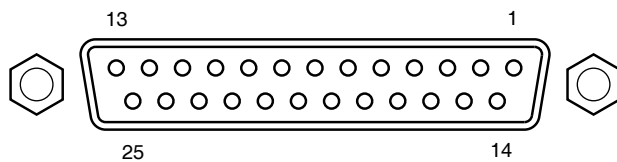
02418002

AUX BUS Connector
Figure 1

3. S-1403DL IFR BUS CONNECTOR (J11) (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	TRI-STATE	OUTPUT	LEVEL SET
23	INTR	TRI-STATE	INPUT	LEVEL SET
24	D1	TTL	INPUT/OUTPUT	POSITIVE
25	D0	TTL	INPUT/OUTPUT	POSITIVE

Pin-Out for IFR BUS Connector
Table 3



IFR BUS J11

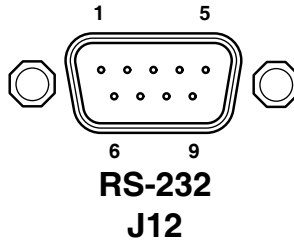
02418003

IFR BUS Connector
Figure 2

4. S-1403DL RS-232 CONNECTOR (J12) PIN-OUT TABLE

PIN NO.	SIGNAL NAME	SIGNAL TYPE	INPUT/OUTPUT	POLARITY
1	DCD			
2	TXD	TTL	OUTPUT	POSITIVE
3	RXD	TTL	INPUT	POSITIVE
4	DSR		INPUT	
5	GROUND			POSITIVE
6	DTR	TTL	OUTPUT	POSITIVE
7	$\overline{\text{CTS}}$	TTL	INPUT	POSITIVE
8	$\overline{\text{RTS}}$	TTL	OUTPUT	POSITIVE
9	$\overline{\text{RI}}$			

Pin-Out for RS-232 Connector
Table 4



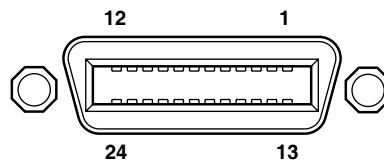
02418004

RS-232 Connector
Figure 3

5. S-1403DL GPIB CONNECTOR (J21) PIN-OUT TABLE

PIN NO.	SIGNAL NAME	DEFINITION	INPUT/OUTPUT	SIGNAL TYPE
1	DIO1	Data Input/Output	INPUT/OUTPUT	TTL
2	DIO2	Data Input/Output	INPUT/OUTPUT	TTL
3	DIO3	Data Input/Output	INPUT/OUTPUT	TTL
4	DIO4	Data Input/Output	INPUT/OUTPUT	TTL
5	EOI	End or Identify	INPUT	TTL
6	DAV	Data Valid	INPUT	TTL
7	NRFD	Not Ready For Data	OUTPUT	TTL
8	NDAC	Data Not Accepted	OUTPUT	TTL
9	IFC	Interface Clear	INPUT	TTL
10	SRQ	Service Request	OUTPUT	TTL
11	ATN	Attention	INPUT	TTL
12	GROUND			
13	DIO5	Data Input/Output	INPUT/OUTPUT	TTL
14	DIO6	Data Input/Output	INPUT/OUTPUT	TTL
15	DIO7	Data Input/Output	INPUT/OUTPUT	TTL
16	DIO8	Data Input/Output	INPUT/OUTPUT	TTL
17	REN	Remote Enable	INPUT	TTL
18	GROUND			
19	GROUND			
20	GROUND			
21	GROUND			
22	GROUND			
23	GROUND			
24	GROUND			

Pin-Out for GPIB Connector
Table 5



GPIB J21

02418005

GPIB Connector
Figure 4

6. S-1403DL SCOPE TRIG OUT CONNECTOR (J7) PULSE DESCRIPTION

6.1 ATC FUNCTION

CAL To Setting:

Width: 3.0 μ s (Mode 1)
 5.0 μ s (Mode 2)
 6.5 μ s (Mode T)
 8.0 μ s (Mode 3/A)
 17.0 μ s (Mode B)
 21.0 μ s (Mode C)
 25.0 μ s (Mode D)

Accuracy: ± 50 ns

Position: 1.0 μ s prior to P₁ leading edge

Accuracy: ± 50 ns

CAL Td Setting:

Width: 20.3 μ s

Accuracy: ± 50 ns

Position: 2.0 μ s following P₃ leading edge

Accuracy: ± 50 ns

VAR Setting:

Width: 1.0 μ s

Position:

Range: 0 to 35 μ s following P₁ leading edge

Step: 1 μ s

Accuracy: ± 50 ns

6.2 SEQ FUNCTION

CAL To Setting:

Width: 4.75 μ s

Accuracy: ± 50 ns

Position: 1.0 μ s prior to P₁ leading edge

Accuracy: ± 50 ns

CAL Td Setting:

Width: 8.0 μ s

Accuracy: ± 50 ns

Position: 127 μ s following SPR

Accuracy: ± 50 ns, $\pm 0.005\%$

VAR Setting:

Width: 1.0 μ s

Accuracy: ± 50 ns

Position:

Range: 0 to 255 μ s following P₁ leading edge

Step: 1 μ s

Accuracy: ± 50 ns, $\pm 0.005\%$

6.3 ACS/ACL FUNCTIONS

CAL To Setting:

Width: 5.0 μ s (Mode 1)
7.0 μ s (Mode 2)
8.5 μ s (Mode T)
10.0 μ s (Mode 3/A)
19.0 μ s (Mode B)
23.0 μ s (Mode C)
27.0 μ s (Mode D)

Accuracy: ± 50 ns

Position: 1.0 μ s prior to P₁ leading edge

Accuracy: ± 50 ns

CAL Td Setting:

Width: 8.0 μ s

Accuracy: ± 50 ns

Position: 2.0 μ s following P₃ leading edge (ACS)
127.0 μ s following P₄ leading edge (ACL)

Accuracy: ± 50 ns (ACS)

± 50 ns, $\pm 0.005\%$ (ACL)

VAR Setting:

Width: 1.0 μ s

Accuracy: ± 50 ns

Position:

Range: 0 to 255 μ s following P₁ leading edge

Step: 1 μ s

Accuracy: ± 50 ns, $\pm 0.005\%$

6.4 INTLCE FUNCTION

Same as in ATC and SEQ functions.

NOTE: For best Oscilloscope operation, only one type should be enabled (C72 Setup Screen) at one time.

6.5 DI FUNCTION

Same as in selected functions.

NOTE: For best Oscilloscope operation, only one type should be enabled (C72 Setup Screen) at one time.

6.6 ATCRBS MONITOR PULSE FUNCTION

Same as in ATC function.



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APPENDIX B - DECODED SEQUENCE MENU FORMATS

1. GENERAL

The S-1403DL contains ten decoded sequence menu formats, nine with both uplink and downlink decoded fields and another for the decoded DF17 squitter. The flexibility of the Mode S Test System allows any of the 1000 sequence menus to use any decoded sequence menu format in the programming.

The S-1403DL displays UF and DF fields in decimal form (base10). The S-1403DL converts the decoded AC field to the decimal altitude in feet. For consistency, the S-1403DL always displays the 4096 code ID field in the standard octal format. The S-1403DL displays all other uplink and downlink fields according to the SMenu Radix (OCTAL [base8] or HEX [base16]) selected in the C76 SMenu Setup Screen. Appendix B shows the Sample Decoded sequence menus in octal and hexadecimal. Descriptions explain fields using octal, hexadecimal and decimal values.

The C76 Setup (SMenu) Screen controls global address fields and sets sequence menus to default. Refer to C76 SMenu in 2.4.1 of 1-1-2. Refer to Appendix D for detailed explanation of the various uplink and downlink format fields.

2. UF00/DF00

The S-1403DL displays the decoded Uplink/Downlink Format 00 (Short Air-to-Air Surveillance) as follows:

```
S012:D;UF00,RL=0,AQ=0,BD=000,
+                               ADDR=17725762
RPLY:D;DF00,VS=0,SL=0,RI=00,AC=+ 31200,
CC=0                             ADDR=17725762
```

Sample Decoded UF00/DF00 Sequence Menu in Octal
Figure 1

```
S012:D;UF00,RL=0,AQ=0,BD=00,
+                               ADDR=3FABF2
RPLY:D;DF00,VS=0,SL=0,RI=0,AC=+ 31200,
CC=0                             ADDR=3FABF2
```

Sample Decoded UF00/DF00 Sequence Menu in Hexadecimal
Figure 2

2.1 UF00

UF00 interrogations contain three variable fields. The **RL=** (Reply Length) field selects the reply format depending on UUT transponder type. If the UUT is associated with Airborne Collision Avoidance System (ACAS) equipment, **RL=0** selects DF00 replies and **RL=1** selects DF16 replies. Otherwise, **RL=0** selects DF00 replies and **RL=1** selects no replies. The **AQ=** (Acquisition) field requests specific information in the reply (**RI=** field). **AQ=0** requests UUT TCAS capability information, if applicable. **AQ=1** requests UUT airspeed information. The **BD=** (Comm-B Data) field selects the identity of the ground initiated Comm-B register to appear in the MV field of the corresponding DF16 reply. The S-1403DL sends the interrogations to the UUT address specified in the **ADDR=** field. If set to **XPDR** or **XPDR-X**, the Mode S Test System overlays the UUT address with parity data to form the AP field. If set to **USER** or **USER-X**, the Mode S Test System overlays the global address set in the C76 Setup Screen with parity data to form the AP field. An OR function is performed on the **XPDR-X** or **USER-X** AP field with the AP XOR field set in the C76 Setup Screen.

2.2 DF00

The S-1403DL displays replies from the UUT as either DF00 or DF16, depending on **RL=** field setting in the interrogation and normal UUT operation. DF00 contains five displayed fields. The **VS=** (Vertical Status) field provides UUT flight status. **VS=0** indicates UUT aircraft is airborne and **VS=1** indicates UUT aircraft is on the ground. **SL=** (Sensitivity Level) field reports current UUT TCAS sensitivity level (**SL=0** indicates no sensitivity level reported). The **RI=** field provides the information requested in the interrogation (**AQ=** field). **RI=00** to **07** provides TCAS capability information. **RI=10** to **17o**, **08** to **0Fh** (8 to 15, decimal) provides airspeed information. **AC=** field reports UUT altitude in feet, calculated from the AC field value received in the reply. The **CC=** (Crosslink Capability) field reports the UUT ability to decode the BD field and provide the corresponding Comm-B message in a DF16 reply. **CC=1** indicates UUT aircraft supports crosslink capability. The **ADDR=** field provides the UUT address taken from the AP field value received in the reply.

3. UF04/DF04

The S-1403DL displays the decoded Uplink/Downlink Format 04 (Surveillance/Altitude) as follows:

```
S102:D;UF04,PC=0,RR=00,DI=0,SD=000000,
+                               ADDR=17725762
RPLY:D;DF04,FS=0,DR=00,UM=00,AC=+ 31200,
+                               ADDR=17725762
```

Sample Decoded UF04/DF04 Sequence Menu in Octal
Figure 3

```
S102:D;UF04,PC=0,RR=00,DI=0,SD=0000,
+                               ADDR=3FABF2
RPLY:D;DF04,FS=0,DR=00,RI=0,AC=+ 31200,
+                               ADDR=3FABF2
```

Sample Decoded UF04/DF04 Sequence Menu in Hexadecimal
Figure 4

3.1 UF04

UF04 interrogations contain five variable fields. The **PC=** (Protocol) field provides operating instructions to the UUT. The **RR=** (Reply Request) field instructs the UUT what reply and information to send. **RR=00** to **17o**, **00** to **0Fh** (0 to 15, decimal) requests a DF04 reply. **RR=20o**, **10h** (16, decimal) requests a DF20 reply (Comm-B) containing the message the UUT requested to send in an earlier reply (**DR=01** or **03**). **RR=21o**, **11h** (17, decimal) requests a DF20 reply containing UUT data link capability. **RR=22o**, **12h** (18, decimal) requests a DF20 reply containing UUT aircraft identification (tail number). **RR=23o**, **13h** (19, decimal) requests a DF20 reply containing TCAS resolution advisory information. **RR=24** to **37o**, **14** to **1Fh** (20 to 31, decimal) requests a DF20 reply (not assigned to specific information). The **DI=** field designates the content of the **SD=** field. The **SD=** field contains the Interrogator Identifier, Mode S Only All Call lockout instructions, multisite information, specific reply requests and/or message information. The **ADDR=** field operates the same as in UF00.

3.2 DF04

The S-1403DL displays replies from the UUT as either DF04 or DF20, depending on the **RR=** field setting in the interrogation and normal UUT operation. DF04 contains five displayed fields. **FS=** (Flight Status) field reports UUT flight status and alert conditions. **DR=** (Downlink Request) field indicates UUT request to send message. **UM=** (Utility Message) field contains UUT status (message reservations). **AC=** and **ADDR=** fields operate the same as in DF00.

4. UF05/DF05

The S-1403DL displays the decoded Uplink/Downlink Format 05 (Surveillance/Identity) as follows:

```
S300:D;UF05,PC=0,RR=00,DI=0,SD=000000,
+                               ADDR=17725762
RPLY:D;DF05,FS=0,DR=00,UM=00,ID=0123,
                               ADDR=17725762
```

Sample Decoded UF05/DF05 Sequence Menu in Octal
Figure 5

```
S300:D;UF05,PC=0,RR=00,DI=0,SD=0000,
+                               ADDR=3FABF2
RPLY:D;DF05,FS=0,DR=00,UM=00,ID=0123,
                               ADDR=3FABF2
```

Sample Decoded UF05/DF05 Sequence Menu in Hexadecimal
Figure 6

4.1 UF05

UF05 interrogations contain the same five variable fields as in UF04. The **PC=**, **DI=**, **SD=** and **ADDR=** fields operate the same as in UF04. **RR=** field operates the same as in UF04, but requests different replies. **RR=00** to **17o**, **00** to **0Fh** (0 to 15, decimal) requests a DF05 reply. **RR=20o**, **10h** (16, decimal) requests a DF21 reply (Comm-B) containing the message the UUT requested to send in an earlier reply (**DR=01** or **03**). **RR=21o**, **11h** (17, decimal) requests a DF21 reply containing UUT data link capability. **RR=22o**, **12h** (18, decimal) requests a DF21 reply containing UUT aircraft identification (tail number). **RR=23o**, **13h** (19, decimal) requests a DF21 reply containing TCAS resolution advisory information. **RR=24** to **37o**, **14** to **1Fh** (20 to 31, decimal) requests a DF21 reply (not assigned to specific information).

4.2 DF05

The S-1403DL displays replies from the UUT as either DF05 or DF21, depending on the **RR=** field setting in the interrogation and normal UUT operation. DF05 contains five displayed fields. The **FS=**, **DR=**, **UM=** and **ADDR=** fields operate the way as in DF04. The **ID=** (Identification) field contains the 4096 identification code set on the UUT (always in octal).

5. UF11/DF11

The S-1403DL displays the decoded Uplink/Downlink Format 11 (Mode S Only All Call) as follows:

```
S044:D;UF11,PR=00,IC=00,CL=0,
+                               ADDR=17725762
RPLY:D;DF11,CA=0,AA=00000000,
                               ADDR=17725762
```

Sample Decoded UF11/DF11 Sequence Menu in Octal
Figure 7

```
S044:D;UF11,PR=0, IC=0, CL=0,
+                               ADDR=3FABF2
RPLY:D;DF11,CA=0,AA=000000,
                               ADDR=3FABF2
```

Sample Decoded UF11/DF11 Sequence Menu in Hexadecimal
Figure 8

5.1 UF11

UF11 is the Mode S Only All Call. Interrogations contain four variable fields. **PR=** (Probability of Reply) field specifies UUT reply probability and overrides lockout instructions if desired. This reply probability is used to separate replies in a saturated ATC environment. **PR=00** or **10** (0 or 8, decimal) requests the UUT to reply normally. **PR=05** to **07** or **15** to **17** (5 to 7 or 13 to 15, decimal) requests the UUT to not reply. Other **PR=** field codes request the UUT to reply at a specific ratio to interrogations (refer to Appendix D). **IC=** (Interrogator Code) field contains the Interrogator Identifier (II) or part of the Surveillance Identifier (SI) assigned to the interrogator. The **IC=** field is the same information as the first two (IIS) or first four (SIS) digits of the **SD=** field in UF04, UF05, UF20, and UF21 interrogations. **CL=** (Code Label) indicates what the **IC=** field contains. **CL=0** indicates the **IC=** field contains the II and **CL≠0** indicates the SI code range of the **IC=** field. The six digits after the **CL=** field represent the 16 undefined bits in UF11 and are set to zero. The **ADDR=** field operates the same as in UF00.

5.2 DF11

DF11 replies contain three displayed fields. The **CA=** (Capability) field reports UUT transponder capabilities. **CA=0** indicates the UUT only receives and transmits short formats. **CA=1** indicates the UUT receives short or Comm-A message formats and transmits short or Comm-B message formats. **CA=2** indicates the UUT receives short, Comm-A message or Extended Length Message (ELM) formats and transmits short or Comm-B message formats. **CA=3** indicates the UUT receives short, Comm-A message or Extended Length Message (ELM) formats and transmits short, Comm-B message or ELM formats. The **AA=** (Aircraft Address) field contains the UUT address. The **PI=** field contains the parity code overlaid on the Interrogator Identifier code.

6. UF16/DF16

The S-1403DL displays the decoded Uplink/Downlink Format 16 (Long Air-to-Air Surveillance) as follows:

```
S075:D;UF16,RL=0,AQ=0,
+ MU=00000000000000000000, ADDR=17725762
RPLY:D;DF16,VS=0,SL=0,RI=00,AC=+ 31200,
MV=00000000000000000000, ADDR=17725762
```

Sample Decoded UF16/DF16 Sequence Menu in Octal
Figure 9

```
S075:D;UF16,RL=0,AQ=0,
+ MU=0000000000000000, ADDR=3FABF2
RPLY:D;DF16,VS=0,SL=0,RI=0,AC=+ 31200,
MV=0000000000000000, ADDR=3FABF2
```

Sample Decoded UF16/DF16 Sequence Menu in Hexadecimal
Figure 10

6.1 UF16

UF16 interrogations contain four variable fields. The **RL=** (Reply Length) field selects the reply format depending on UUT transponder type. If the UUT is associated with Airborne Collision Avoidance System (ACAS) equipment, **RL=0** selects DF00 replies and **RL=1** selects DF16 replies. Otherwise, **RL=0** selects DF16 replies and **RL=1** selects no replies. The **AQ=** and **ADDR=** fields operate the same as in UF00. The **MU=** (Comm-U Message) field contains information used in air-to-air exchanges (TCAS messages).

6.2 DF16

The S-1403DL displays replies from the UUT as either DF00 or DF16, depending on the **RL=** field setting in the interrogation and normal UUT operation. DF16 contains six defined fields. The **VS=**, **SL=**, **RI=**, **AC=** and **ADDR=** fields operate the same as in DF00. The **MV=** (Comm-V Message) field contains information used in air-to-air exchanges (coordination reply messages) and does not follow Comm-B format.

7. UF20/DF20

The S-1403DL displays the decoded Uplink/Downlink Format 20 (Comm-A/Comm-B/Altitude) as follows:

```
S097:D;UF20,PC=0,RR=24,DI=0,SD=000000,
+ MA=00000000000000000000, ADDR=17725762
RPLY:D;DF20,FS=0,DR=00,UM=00,AC=+ 31200,
MB=00000000000000000000, ADDR=17725762
```

Sample Decoded UF20/DF20 Sequence Menu in Octal
Figure 11

```
S097:D;UF20,PC=0,RR=14,DI=0,SD=0000,
+ MA=0000000000000000, ADDR=3FABF2
RPLY:D;DF20,FS=0,DR=00,UM=00,AC=+ 31200,
MB=0000000000000000, ADDR=3FABF2
```

Sample Decoded UF20/DF20 Sequence Menu in Hexadecimal
Figure 12

7.1 UF20

UF20 interrogations contain six variable fields. The **PC=**, **RR=**, **DI=**, **SD=** and **ADDR=** fields operate the same as in UF04. The **MA=** (Comm-A Message) field contains messages to the UUT.

7.2 DF20

The S-1403DL displays replies from the UUT as either DF04 or DF20, depending on the **RR=** field setting in the interrogation and normal UUT operation. DF20 contains six displayed fields. The **FS=**, **DR=**, **UM=**, **AC=** and **ADDR=** fields operate the same as in DF04. The **MB=** (Comm-B Message) field contains messages to the interrogator.

8. UF21/DF21

The S-1403DL displays the decoded Uplink/Downlink Format 21 (Comm-A/Comm-B/Identity) as follows:

```
S081:D;UF21,PC=0,RR=24,DI=0,SD=000000,
+ MA=00000000000000000000, ADDR=17725762
RPLY:D;DF21,FS=0,DR=00,UM=00,ID=0123,
MB=00000000000000000000, ADDR=17725762
```

Sample Decoded UF21/DF21 Sequence Menu in Octal
Figure 13

```
S081:D;UF21,PC=0,RR=14,DI=0,SD=0000,
+ MA=0000000000000000, ADDR=3FABF2
RPLY:D;DF21,FS=0,DR=00,UM=0,ID=0123,
MB=0000000000000000, ADDR=3FABF2
```

Sample Decoded UF21/DF21 Sequence Menu in Hexadecimal
Figure 14

8.1 UF21

UF21 interrogations contain six variable fields. The **PC=**, **RR=**, **DI=**, **SD=** and **ADDR=** fields operate the same as in UF05. The **MA=** field operates the same as in UF20.

8.2 DF21

The S-1403DL displays replies from the UUT as either DF05 or DF21, depending on the **RR=** field setting in the interrogation and normal UUT operation. DF21 contains six displayed fields. The **FS=**, **DR=**, **UM=**, **ID=** and **ADDR=** fields operate the same as in DF05. The **MB=** field operates the same as in DF20.

9. UF24/DF24

The S-1403DL displays the decoded Uplink/Downlink Format 24 (Comm-C/Comm-D) as follows:

```
S500:D;UF24,RC=2,NC=00,MC=0000000000000000
+ 0000000000000000, ADDR=17725762
RPLY:D;DF24,KE=1,ND=00,MD=0014000000000000
0000000000000000, ADDR=17725762
```

Sample Decoded UF24/DF24 Sequence Menu in Octal
Figure 15

```
S500:D;UF24,RC=2,NC=0,
+ MC=000000000000000000000000, ADDR=3FABF2
RPLY:D;DF24,KE=1,ND=0,
MD=00C0000000000000000000, ADDR=3FABF2
```

Sample Decoded UF24/DF24 Sequence Menu in Hexadecimal
Figure 16

9.1 UF24

UF24 interrogations contain four variable fields. The **RC=** (Reply Control) field provides the transmitted segment designation to control the reply. **RC=0** indicates initial segment (default) for transponder to setup to receive number of segments indicated by the **NC=** field (do not reply). **RC=1** indicates an intermediate segment (do not reply). **RC=2** indicates final segment (do reply). **RC=3** requests immediate Comm-D downlink action (do reply). The **NC=** (Number of C-segment) field indicates the message segment number with 0 signifying the first segment. The last message segment should be sent in the same interrogation as the initial segment designation (**RC=0**). The **MC=** (Comm-C Message) field contains one message segment of a sequence of segments (≥ 2) to the transponder. The **ADDR=** field operates the same as in UF00.

9.2 DF24

DF24 replies display four fields. The **KE=** (ELM Control) field defines the content of the **ND=** and **MD=** fields. **KE=1** acknowledges receipt of the final uplink Comm-C message segment and the **MD=** field will contain the TAS subfield for reporting what segments of the uplink ELM were received. The **ND=** (Number of D-segment) field indicates the message segment number with 0 signifying the first segment. The **MD=** (Comm-D Message) field contains one message segment. The **ADDR=** field operates the same as in DF00.

10. DF17

The S-1403DL displays the decoded Downlink Format 17 (Extended Squitter) as follows:

NOTE: Sequence menus only show replies to interrogations. Therefore, only an interrogation that solicits DF17 replies (unknown at this time) or any Mode S interrogation and perfect timing to a squitter causes the S-1403DL to display the decoded DF17 in a sequence menu.

```
S100:
-
RPLY:D;DF17,CA=0,AA=00000000,
  ME=00000000000000000000,  ADDR=17725762
```

Sample Decoded DF17 Extended Squitter in Octal
Figure 17

```
S100:
-
RPLY:D;DF17,CA=0,AA=000000,
  ME=0000000000000000,  ADDR=3FABF2
```

Sample Decoded DF17 Extended Squitter in Hexadecimal
Figure 18

DF17 extended squitters contain four displayed fields. The **CA=**, **AA=** and **ADDR=** fields operate the same as in DF11. The **ME=** field contains broadcast messages.

APPENDIX C - 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
Dual Pulse Generator	WAVETEK 145 or Equivalent	Functions: Pulse Pulse Delay: 50 ns to 10 ms Pulse Width: 25 ns to 1 ms Output Level: 15 V _{P-P} into 50 Ω
Frequency Counter	HP53131A or Equivalent	Frequency: 10 Hz to 10 MHz Resolution: ±0.001 Hz Sensitivity: 150 mV
Frequency Standard	HP58503A or Equivalent	Accuracy: 1 X 10 ⁻⁹
Oscilloscope	TEK 2465 or Equivalent	Capability: Dual Trace Bandwidth: dc to 100 MHz Vertical Accuracy: ±10% Time Accuracy: ±0.7% of Time Interval ±0.6% of Full Scale Δ Time Accuracy: ±0.7% of Time Interval ±0.3% of Full Scale
Power Meter	HP437B with (HP8481A Sensor) or Equivalent	Range: -25 to -15 dBm Accuracy: ±0.05 dB
Spectrum Analyzer	HP8569B or Equivalent	Range: 10 kHz to 2.6 GHz RBW: 300 Hz to 3.0 MHz Display (Log) Accuracy: <±0.1 dB/dB <±1.5 dB/70 dB Display (Lin) Accuracy: <±3% of reference level over 8 division reflection



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APPENDIX D - MODE S SIGNAL FORMATS

1. OPERATING GOALS

Mode S combines secondary surveillance radar and a ground-air-ground data link system to provide aircraft surveillance and communications necessary for supporting automated ATC in dense traffic environments. Mode S provides common-channel interoperability with the ATC beacon system and may be implemented over an extended ATCRBS-to-Mode S transition period. In supporting ATC automation, Mode S provides the reliable communications necessary for data link services.

2. MODE S MESSAGE CONTENT

2.1 ADDRESS/PARITY (FIELD AP)

All discrete Mode S interrogations (56-bit or 112-bit) and replies (except the All Call reply) contain the 24-bit discrete address of the Mode S transponder upon which the 24 error-detecting parity check bits are overlaid. In the All Call reply, the 24 parity check bits are overlaid on the address of the Mode S interrogator. The text of the reply includes the discrete address of the transponder.

2.2 SURVEILLANCE

The primary function of Mode S is surveillance. For the Mode S transponder, this function is accomplished by using short (56-bit) transmissions in both directions. In these transmissions, the aircraft reports altitude (DF04) or ATCRBS 4096 code as well as flight status (airborne, on the ground, alert, Special Position Identification [SPI], etc.).

2.3 DATA LINK COMMUNICATIONS

The discrete addressing and digital encoding allow Mode S transmissions to be used as digital data links. Interrogation and reply formats of the Mode S system contain sufficient coding space to transmit data. Most Mode S data link transmissions are handled as one 56-bit message included as part of long 112-bit interrogations or replies. The transmissions include the message in addition to surveillance data, and is generally used in place of a surveillance interrogation and/or reply.

An efficient transmission of longer messages is accomplished by the extended length message (ELM) capability (UF24 and DF24). Using this capability, a sequence of up to sixteen 80-bit message segments (each with a 112-bit transmission) is transmitted, either ground-to-air or air-to-ground and is acknowledged with a single reply/interrogation. ELMs do not contain surveillance data and thus cannot substitute for a surveillance interrogation-reply cycle.

3. SIGNAL FORMATS

Chapter 2 of RTCA DO-181A and Chapter 2, Volume I of RTCA DO-185 outline the signal formats for uplink and downlink messages. Appendix D, Tables 1 through 7 contain the signal formats and definitions but the RTCA documents are the final authority on the data information. Data is expressed in decimal unless otherwise specified. For conversion to hexadecimal, octal or binary; refer to 1-2-2, Table 5.

NOTE: TCAS operates in Mode S and many signals pertain only to TCAS.

Bits are numbered in transmission order beginning with bit one. Unless otherwise stated, the most significant bit (MSB) is the first bit transmitted for numerical values encoded by groups of bits (fields and subfields).

FORMAT

NO.	UF	
0	(0 0000)	— 3 —(RL:1)— 4 —(AQ:1) (BD:8)— 10 — (AP:24).....Short Air-Air Surveillance
1	(0 0001)	_____ 27 _____ (AP:24)
2	(0 0010)	_____ 27 _____ (AP:24)
3	(0 0011)	_____ 27 _____ (AP:24)
4	(0 0100)	(PC:3) (RR:5) (DI:3) (SD:16) (AP:24).. Surveillance, Altitude Request
5	(0 0101)	(PC:3) (RR:5) (DI:3) (SD:16) (AP:24).. Surveillance, Identity Request
6	(0 0110)	_____ 27 _____ (AP:24)
7	(0 0111)	_____ 27 _____ (AP:24)
8	(0 1000)	_____ 27 _____ (AP:24)
9	(0 1001)	_____ 27 _____ (AP:24)
10	(0 1010)	_____ 27 _____ (AP:24)
11	(0 1011)	(PR:4) (IC:4) (CL:3) _____ 16 _____ (AP:24).....Mode S Only All Call
12	(0 1100)	_____ 27 _____ (AP:24)
13	(0 1101)	_____ 27 _____ (AP:24)
14	(0 1110)	_____ 27 _____ (AP:24)
15	(0 1111)	_____ 27 _____ (AP:24)
16	(1 0000)	— 3 —(RL:1)— 4 —(AQ:1)— 18 —(MU:56) (AP:24)..... Long Air-Air Surveillance
17	(1 0001)	_____ 83 _____ (AP:24)
18	(1 0010)	_____ 83 _____ (AP:24)
19	(1 0011)	_____ 83 _____ (AP:24)
20	(1 0100)	(PC:3) (RR:5) (DI:3) (SD:16) (MA:56) (AP:24).....Comm-A, Altitude Request
21	(1 0101)	(PC:3) (RR:5) (DI:3) (SD:16) (MA:56) (AP:24).....Comm-A, Identity Request
22	(1 0110)	_____ 83 _____ (AP:24)
23	(1 0111)	_____ 83 _____ (AP:24)
24	(1 1)	(RC:2) (NC:4) (MC:80) (AP:24).....Comm-C (ELM)

NOTE: (XX:M) represents a field designated XX containing M number of assigned bits.

NOTE: —N— represents free coding space with N available bits, coded as Zeros for transmission.

NOTE: For Uplink Formats (UF) 0 through 23, the format number corresponds to the binary code in the first 5 bits of the interrogation. Format number 24 is arbitrarily defined as the format beginning with Ones in the first two bit positions.

NOTE: All formats are shown for completeness, although a number of them are unused.

Overview of Mode S Interrogation Formats
Table 1

**FORMAT
NO. DF**

0	(0 0000)	(VS:1) (CC:1)-1-(SL:3)-2-(RI:4)-2-(AC:13) (AP:24)	.....	Short Air-Air Surveillance
1	(0 0001)	_____ 27 _____	(P:24)	
2	(0 0010)	_____ 27 _____	(P:24)	
3	(0 0011)	_____ 27 _____	(P:24)	
4	(0 0100)	(FS:3) (DR:5) (UM:6) (AC:13) (AP:24)	.....	Surveillance, Altitude Reply
5	(0 0101)	(FS:3) (DR:5) (UM:6) (ID:13) (AP:24)	.....	Surveillance, Identity Reply
6	(0 0110)	_____ 27 _____	(P:24)	
7	(0 0111)	_____ 27 _____	(P:24)	
8	(0 1000)	_____ 27 _____	(P:24)	
9	(0 1001)	_____ 27 _____	(P:24)	
10	(0 1010)	_____ 27 _____	(P:24)	
11	(0 1011)	(CA:3) (AA:24) (PI:24)	.....	All Call Reply/AQ Squitter
12	(0 1100)	_____ 27 _____	(P:24)	
13	(0 1101)	_____ 27 _____	(P:24)	
14	(0 1110)	_____ 27 _____	(P:24)	
15	(0 1111)	_____ 27 _____	(P:24)	
16	(1 0000)	(VS:1)-2-(SL:3)-2-(RI:4)-2-(AC:13)(MV:56)(AP:24)	.....	Long Air-Air Surveillance
17	(1 0001)	(CA:3) (AA:24) (ME:56) (PI:24)	.....	Extended Squitter
18	(1 0010)	_____ 83 _____	(P:24)	
19	(1 0011)	_____ 83 _____	(P:24)	
20	(1 0100)	(FS:3) (DR:5) (UM:6) (AC:13) (MB:56) (AP:24)	.....	Comm-B, Altitude Reply
21	(1 0101)	(FS:3) (DR:5) (UM:6) (ID:13) (MB:56) (AP:24)	.....	Comm-B, Identity Reply
22	(1 0110)	_____ 83 _____	(P:24)	
23	(1 0111)	_____ 83 _____	(P:24)	
24	(1 11)	(KE:1) (ND:4) (MD:80) (AP:24)	.....	Comm-D (ELM)

NOTE: (XX:M) represents a field designated XX containing M number of assigned bits.

NOTE: (P:24) represents a 24-bit field reserved for parity information.

NOTE: —N— represents free coding space with N available bits, coded as Zeros for transmission.

NOTE: For Downlink Formats (DF) 0 through 23, the format number corresponds to the binary code in the first 5 bits of the reply. Format number 24 is arbitrarily defined as the format beginning with Ones in the first three bit positions.

NOTE: All formats are shown for completeness, although a number of them are unused.

Overview Of Mode S Reply Formats
Table 2



FIELD	SUB FIELD	NO. OF BITS	BITS POSITION	FORMATS		CONTENT
				UP	DOWN	
AA		24	9-32	X		The aircraft address announced in the clear, used in DF=11, 17.
AC		13	20-32	X		The altitude code used in formats DF=0, 4, 16 and 20. All bits are Zeros if altitude information is not available. Contains metric altitude if M-bit (26) is One.
AP		24 24	33-56 89-112	X	X	Parity overlaid on the Address appears at the end of all transmissions, uplink and downlink, with exception of format DF11.
AQ		1	14	X		Designates formats UF=0, 16 as acquisition transmissions. Bit 14 (RI, DF=0, 16), repeats AQ as received by transponder.
BD		8	15-22	X		Contains the identity of the ground-initiated Comm-B register contents to appear in the MV field of the corresponding reply, used in UF=0.
CA		3	6-8	X		Used in DF=11 or DF17 to report transponder capability. Codes are: 0 = Level 1, no communications capability (surveillance only,) Transponder accepts UF=0, 4, 5, 11; Transponder transmits DF=0, 4, 5, 11. 1 = Level 2, Comm-A and Comm-B capability, Transponder accepts UF=0, 4, 5, 11, 20, 21; Transponder transmits DF=0, 4, 5, 11, 20, 21. 2 = Level 3, Comm-A, Comm-B and uplink ELM capability, Transponder accepts UF=0, 4, 5, 11, 20, 21, 24; Transponder transmits DF=0, 4, 5, 11, 20, 21. 3 = Level 4, Comm-A, Comm-B, uplink and downlink ELM capability, Transponder accepts UF=0, 4, 5, 11, 20, 21, 24; Transponder transmits DF=0, 4, 5, 11, 20, 21, 24. 4 = Level 2, 3 or 4; ability to set code 7, and is on the ground. 5 = Level 2, 3 or 4; ability to set code 7, and is airborne. 6 = Level 2, 3 or 4; ability to set code 7. 7 = DR≠0 or FS=3, 4 or 5. NOTE: Codes 4-7 are for squitters only.
CC		1	7		X	Indicates transponder has ability to support crosslink capability (decode the contents of the UF=0 BD field and respond with the contents of the specified ground-initiated Comm-B register in the MV field of the corresponding DF=16 reply. Used in DF=0.

Overview of Format Definitions
Table 3



FIELD	SUB FIELD	NO. OF BITS	BITS POSITION	FORMATS UP DOWN	CONTENT
CL		3	14-16	X	Code Label defines IC field as follows: 0 = IC field contains the II code. 1 = IC field contains SI codes 1 to 15. 2 = IC field contains SI codes 16 to 31. 3 = IC field contains SI codes 32 to 47. 4 = IC field contains SI codes 48 to 63. 5-7 = Not assigned.
DF		5	1-5	X	The first field in all downlink formats is the transmission descriptor.
DI		3	14-16	X	Identifies coding contained in the SD field in formats UF=4, 5, 20, 21. Codes are: 0 = SD has Interrogator Identifier (IIS). 1 = SD contains (IIS, MBS, MES, LOS, RSS, TMS). 2 = SD contains (TCS, RCS, SAS) 3 = SD contains (SIS, LSS, RRS) 4-6 = Not assigned. 7 = SD contains (IIS, RRS, LOS, TMS)
DR		5	9-13	X	Requests extraction of downlink messages from transponder by interrogator. Appears in formats DF=4, 5, 20, 21. Codes are: 0 = No downlink request. 1 = Request to send Comm-B (B bit set), 2 = TCAS information available. 3 = TCAS information available and request to send Comm-B message. 4 = Comm-B Broadcast #1 available. 5 = Comm-B Broadcast #2 available. 6 = TCAS information and Comm-B Broadcast #1 available. 7 = TCAS information and Comm-B Broadcast #2 available. 8-15 = Not assigned. 16-31 = Request to send n-segments, signified by 15 + n. Codes 1-15 take priority over codes 16-31.
FS		3	6-8	X	Reports flight status of aircraft and is used in formats DF=4, 5, 20, 21. Codes are:

CODE	ALERT	SPI	AIRBORNE	ON THE GROUND
0	no	no	yes	no
1	no	no	no	yes
2	yes	no	yes	no
3	yes	no	no	yes
4	yes	yes	either	
5	no	yes	either	
6, 7 are not assigned.				

Overview of Format Definitions
Table 3 (Cont)



FIELD	SUB FIELD	NO. OF BITS	BITS POSITION	FORMATS UP DOWN	CONTENT
IC		4	10-13	X	Identifies the interrogator and appears in UF=11, the Mode S Only All Call. NOTE: The same information may also appear in SIS or IIS subfields of SD.
ID		13	2-32	X	The 4096 identification code, numbers , as, set by the pilot, in DF=5, 21.
KE		1	4	X	Indicates TAS subfield exists in MD field, Comm-D replies/DF24, if 1 (UELM protocol) or does not exist if 0 (DELM protocol).
MA		56	33-88	X	Messages directed to the aircraft, part of Comm-A interrogations, UF=20, 21.
	ADS	8	33-40	X	Defines the content of the MA message field in Comm-A requests and is expressed in two groups of 4 bits each, ADS1 (33-36) and ADS2 (37-40).
	ADS1	4	33-36	X	Part of the A-Definition Subfield and is set to 0 for TCAS Sensitivity Level Commands.
	ADS2	4	37-40	X	Part of the A-Definition Subfield and is set to 5 for TCAS Sensitivity Level Commands.
	SLC	4	41-44	X	Sensitivity Level Command for the TCAS aircraft. The codes are: 0 = No command. 1 = Not Assigned. 2 = Select TA_ONLY mode of operation. 3 = Set TCAS Sensitivity Level to 3. 4 = Set TCAS Sensitivity Level to 4. 5 = Set TCAS Sensitivity Level to 5. 6 = Set TCAS Sensitivity Level to 6. 7 = Set TCAS Sensitivity Level to 7. 8-14 = Not Assigned. 15 = Cancel previous Sensitivity Level.
MB		56	33-88	X	Messages to be transmitted to interrogator, part of the Comm-B replies, DF=20, 21. The field contains Data Link, Capability Reports or Aircraft Identification Reports or TCAS Resolution Advisory Reports.
	ACS	20	45-64	X	Comm-A capability subfield reports data link service(s) supported by the installation. If all bits are Zeros, no Comm-A data link services are supported.
	AIS	48	41-88	X	Aircraft Identification, reported when a surveillance or Comm-A interrogation (UF=4, 5, 20, 21) contains RR=18 and DI=anything but 7. AIS contains up to eight 6-bit characters as defined in Table 4.

Overview of Format Definitions
Table 3 (Cont)

FIELD	SUB FIELD	NO. OF BITS	BITS POSITION	FORMATS UP DOWN	CONTENT
MB	ARA	14	41-54	X	TCAS Resolution Advisory Report indicating current Active Resolution Advisories (if any) generated by own TCAS unit against one or more threat aircraft. Each bit indicates a specific resolution advisory with One being active and Zero being inactive. Bit indications are: 41-Climb. 42-Don't descend. 43-Don't descend faster than 500 FPM. 44-Don't descend faster than 1000 FPM. 45-Don't descend faster than 2000 FPM. 46-Descend. 47-Don't climb. 48-Don't climb faster than 500 FPM. 49-Don't climb faster than 1000 FPM. 50-Don't climb faster than 2000 FPM. 51-Turn left. 52-Turn right. 53-Don't turn left. 54-Don't turn right.
	ATS	1	35	X	Altitude Type subfield in Squitter Capability Report (requested with RR=16,DI=7,RRS=7) is 0 to report barometric altitude or 1 to report navigation-derived height.
	BCS	16	65-80	X	Comm-B capability subfield reports installed data sources that can be accessed by the ground for transmission via a ground-initiated Comm-B. If all bits are Zeros, no data is accessible by a ground-initiated Comm-B.
	BDS	8	33-40	X	Defines the content of the MB message field in reply to ground-initiated Comm-B and is expressed in two groups of 4 bits each, BDS1 (33-36) and BDS2 (37-40).
	BDS1	4	33-36	X	Corresponds with RR in UF=4, 5, 20, 21. The codes are: 0 = MB contains Air-initiated Comm-B. 1 = MB contains Data Link Capability Report. 2 = MB contains Aircraft Identification. 3 = MB contains TCAS Resolution Advisory. 4-15 = Not assigned.
	BDS2	4	37-40	X	Basic report uses BDS2=0. More complex Mode S installations report additional capabilities in various formats assigned to BDS2 codes other than 0 as requested by interrogator, specified in the RRS subfield of SD.

Overview of Format Definitions
Table 3 (Cont)



FIELD	SUB FIELD	NO. OF BITS	BITS POSITION	FORMATS UP DOWN	CONTENT
MB	CFS	4	41-44	X	Continuation subfield contains the BDS2 value of the next additional capability report available from the installation.
	ECS	8	81-88	X	Data Link Capability subfield reports ELM capability of installation. No ELM data link services are supported if all bits are Zeros.
	MTE	1	60	X	Multiple Threat Encounter bit indicates ≥ 2 simultaneous TCAS threats.
	RAC	4	55-58	X	Resolution Advisory Complements subfield indicates currently active resolution, advisory complements (if any) received from all other TCAS aircraft with on-board resolution capability. Bits are set to One when active and Zero when inactive. Bit indications are: 55-Don't descend. 56-Don't climb. 57-Don't turn left. 58-Don't turn right.
	RAT	1	59	X	Resolution Advisory Terminated indicator is set to One for 18 seconds (± 1 second) following termination of a previously reported resolution advisory.
	TID	26	33-88	X	Threat Identity Data subfield contains data according to TTI field. If TTI=1, TID contains Mode S address of threat in bits 63-85 (bits 87-88 are Zero). If TTI=2, TID contains altitude, range and bearing data.
	TIDA	13	63-75	X	Threat Identity Data, Altitude subfield reports Mode C altitude code of the threat.
	TIDB	6	83-88	X	Threat Identity, Bearing subfield reports most recent bearing of the threat.
	TIDR	7	76-82	X	Threat Identity, Range subfield reports most recent range of the threat.
	TRS	2	33-34	X	Transmission Rate subfield in Squitter Capability Report (requested with RR=16, DI=7,RRS=7) value indications are: 0 = No capability to automatically determine surface squitter (Sqtr) rate. 1 = Aircraft selected high surface Sqtr rate. 2 = Aircraft selected low surface Sqtr rate. 3 = Not assigned.
	TTI	2	61-62	X	Threat Type Indicator subfield defines type of data in TID field.
MC		80	9-88	X	Comm-C field contains one segment of a sequence of segments transmitted to the transponder in the ELM mode. MC is part of UF=24.

Overview of Format Definitions
Table 3 (Cont)

FIELD	SUB FIELD	NO. OF BITS	BITS POSITION	FORMATS UP DOWN	CONTENT
MC	IIS	4	9-12 (if RC=0 to 2) or 25-28 (if RC=3)	X	Interrogator Identifier subfield reports the identity of the interrogator (See SD and UM fields).
	SRS	16	9-24	X	If a Comm-C interrogation (UF=24) contains RC=3, the SRS subfield contains a list of segment request-authorizations for DELMs in the 16-bit (9-24) SRS subfield. Starting with bit 9, denoting the first segment, each of the following bits is set to One if the transmission of the corresponding segment is requested. Refer to Table 5.
MD		80	9-88	X	Comm-D field, part of DF=24, contains one segment of a sequence of segments transmitted by the transponder in the ELM mode. It may contain a summary of received MC segments of an uplink ELM.
	TAS	16	17-32	X	Reports segments received in a Comm-C sequence. Starting with bit 17 denoting the first segment, each successive bit is One if the corresponding segment was received. TAS appears if KE=1 in the same reply. Refer to Table 5 for values.
ME		56	33-88	X	Extended squitter message, part of DF=17, contains broadcast messages. First five bits indicate type of DF=17 message according to Table 6.
	ACS	12	41-52	X	Altitude Code subfield reports altitude in DF17A same as AC field without the M bit.
	SSS	2	38-39	X	Surveillance Status subfield reports status in DF17A as follows: 0 = No status information. 1 = Transponder reports permanent alert. 2 = Transponder reports temporary alert. 3 = Transponder reports SPI condition.
MU		56	33-88	X	Field, part of the long air-air surveillance interrogation UF=16, contains information for air-to-air exchanges (TCAS, Resolution Messages and TCAS Broadcast Messages).
	CHC	3	47-49	X	Cancel Horizontal Resolution Advisory Complement. In TCAS Resolution Messages transmitted by TCAS without horizontal resolution capability, CHC is set to 0. The codes are: 0 = No cancellation. 1 = Cancel, don't turn left. 2 = Cancel, don't turn right. 3-7 = Not assigned.

Overview of Format Definitions
Table 3 (Cont)



FIELD	SUB FIELD	NO. OF BITS	BITS POSITION	FORMATS UP DOWN	CONTENT
MU	CVC	2	43-44	X	Cancel Vertical Resolution Advisory Complement. The codes are: 0 = No cancellation. 1 = Cancel, don't descend. 2 = Cancel, don't climb. 3 = Not assigned.
	HRC	3	50-52	X	Horizontal Resolution Advisory Complement. In TCAS Resolution Messages transmitted by TCAS without horizontal resolution capability, HRC is set to 0. The codes are: 0 = No horizontal resolution advisory complement sent. 1 = Intruder TCAS sense is turn left/do not turn left. 2 = Intruder TCAS sense is turn left/do not turn right. 3-4 = Not assigned. 5 = Intruder TCAS sense is turn right/do not turn left. 6 = Intruder TCAS sense is turn right/do not turn right. 7 = Not assigned.
	HSB	5	56-60	X	Encoded Sense Bits for Horizontal Resolution Complements provide a parity coding field protecting the six horizontal sense bits (CHC and HRC) and are used in TCAS III Resolution Messages.
	MID	24	65-88	X	Contains discrete address of interrogating aircraft and is in TCAS Resolution Advisories Lock Requests, TCAS Resolution Messages and TCAS Broadcast Messages. NOTE: TCAS Broadcast Message is sent at 10-second intervals.
	MTB	1	42	X	Multiple Threat Bit indicates more than one TCAS threat when set to One and no more than one threat when set to Zero.
	UDS	8	33-40	X	Defines the content of the MU message field and is expressed in two 4-bit groups, UDS1 (33-36) and UDS2 (37-40).
	UDS1	4	33-36	X	Is set to 3 for TCAS Resolution Messages and TCAS Broadcast Messages.
	UDS2	4	37-40	X	Is set to 0 for TCAS Resolution Messages or set to 2 for TCAS Broadcast Messages.
	VRC	2	45-46	X	Vertical Resolution Advisory Complement (VRC) contains code as follows: 0 = No VRC sent. 1 = Don't descend. 2 = Don't climb. 3 = Not assigned.

Overview of Format Definitions
Table 3 (Cont)

FIELD	SUB FIELD	NO. OF BITS	BITS POSITION	FORMATS UP DOWN	CONTENT																																																																																																																																								
MU	VSB	4	61-64	X	Encoded Sense Bits for Vertical Resolution Complements provide a parity coding field to protect four vertical sense bits (CVC and VRC) in all TCAS Resolution Messages. If bits 43-46 do not agree with bits 61-64, the TCAS receiver assumes an error and disregards message. Bits are as follows:																																																																																																																																								
					<table border="1"> <thead> <tr> <th>43</th> <th>44</th> <th>45</th> <th>46</th> <th>61</th> <th>62</th> <th>63</th> <th>64</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td></tr> <tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td></tr> <tr><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td></tr> <tr><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td></tr> <tr><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr> <tr><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td></tr> <tr><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td></tr> <tr><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr> <tr><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td></tr> <tr><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td></tr> <tr><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td></tr> <tr><td>1</td><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr> </tbody> </table>	43	44	45	46	61	62	63	64	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	1	0	0	1	1	1	0	0	1	1	1	0	0	1	0	1	0	0	1	0	1	1	0	1	0	1	0	1	0	1	0	1	1	0	1	1	0	0	0	1	1	1	0	0	1	0	1	0	0	0	1	1	0	1	1	0	0	1	0	0	1	1	1	0	1	0	1	0	1	0	1	0	1	1	0	1	0	0	1	1	0	0	0	1	1	0	1	1	0	1	1	0	0	0	1	1	1	0	0	0	0	1	1	1	1	1	1	1	1	1
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MV		56	33-88	X	Field, part of the long air-air surveillance reply DF=16, contains information used in air-to-air exchanges (Coordination Reply Message).																																																																																																																																								
	ARA	14	41-54	X	Same as in MB field.																																																																																																																																								
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	RAC	4	55-58	X	Same as in MB field.																																																																																																																																								
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	VDS	8	33-40	X	Defines the content of the MV message field and is expressed in two 4-bit groups, VDS1 (33-36) and VDS2 (37-40).																																																																																																																																								
	VDS1	4	33-36	X	Is set to 3 for Coordination Reply Message.																																																																																																																																								
	VDS2	4	37-40	X	Is set to 0 for Coordination Reply Message.																																																																																																																																								
NC		4	5-8	X	Provides the segment number transmitted in an uplink ELM and is part of a Comm-C interrogation, UF=24.																																																																																																																																								
ND		4	5-8	X	Provides the segment number transmitted in a downlink ELM and is part of a Comm-D reply, DF=24.																																																																																																																																								

Overview of Format Definitions
Table 3 (Cont)



FIELD	SUB FIELD	NO. OF BITS	BITS POSITION	FORMATS UP DOWN	CONTENT
PC		3	6-8	X	<p>Contains operating commands to the transponder and is part of surveillance and Comm-A interrogations UF=4, 5, 20, 21 (ignored when DI=3). The codes are:</p> <p>0 = No changes in transponder state. 1 = Non-selective All Call lockout. 2 = Not assigned. 3 = Not assigned. 4 = Cancel B. 5 = Cancel C. 6 = Cancel D. 7 = Not assigned.</p>
PI		24	33-56	X	<p>Contains the parity overlaid on the interrogator code. PI is in DF=11 or DF17.</p>
PR		4	6-9	X	<p>Field contains commands to the transponder specifying the reply probability to the Mode S Only All Call interrogation, UF=11 containing the PR. A command to disregard any lockout state can also be given. The assigned codes are:</p> <p>0 = Reply with probability = 1. 1 = Reply with probability = 1/2. 2 = Reply with probability = 1/4. 3 = Reply with probability = 1/8. 4 = Reply with probability = 1/16. 5,6,7 = Do not Reply. 8 = Disregard lockout, reply with probability = 1. 9 = Disregard lockout, reply with probability = 1/2. 10 = Disregard lockout, reply with, probability = 1/4. 11 = Disregard lockout, reply with probability = 1/8. 12 = Disregard lockout, reply with probability = 1/16. 13, 14, 15 = Do not reply.</p> <p>NOTE: On receipt of a Mode S Only All Call containing a PR code other than 0 or 8, transponder executes a random process and makes a reply decision for the interrogation in accordance with the commanded probability. Random occurrence of replies enables interrogator to acquire closely spaced aircraft when replies would otherwise synchronously garble each other.</p>

Overview of Format Definitions
Table 3 (Cont)

FIELD	SUB FIELD	NO. OF BITS	BITS POSITION	FORMATS UP DOWN	CONTENT
RC		2	3-4	X	Designates transmitted segment as initial, intermediate or final if coded 0, 1 or 2 respectively. RC=3 is used to request Comm-D DELMs by the transponder. RC is part of Comm-C interrogation, UF=24.
RI		4	14-17	X	Information in DF=0, 16. The codes are: 0 = No on-board TCAS. 1 = Not assigned. 2 = On-board TCAS with resolution capability inhibited. 3 = On-board TCAS with vertical-only resolution capability. 4 = On-board TCAS with vertical and horizontal resolution capability. 5-7 = Not assigned. 8 = No maximum airspeed data available. 9 = Airspeed is ≤75 kts. 10 = Airspeed is >75 kts and ≤150 kts. 11 = Airspeed is >150 kts and ≤300 kts. 12 = Airspeed is >300 kts and ≤600 kts. 13 = Airspeed is >600 kts and ≤1200 kts. 14 = Airspeed is >1200 kts. 15 = Not assigned.
RL		1	9	X	Command, sent in UF=0, 16; solicits DF=0 reply if Zero and DF=16 reply if One (only if transponder is associated with Airborne Collision Avoidance System [ACAS] equipment). Otherwise, in UF=0, Zero solicits DF=0 reply and One solicits no reply. In UF=16, Zero solicits DF=16 reply and One solicits no reply.
RR		5	9-13	X	Contains length and content of interrogator requested reply. RR is part of surveillance and Comm-A interrogations UF=4, 5, 20, 21.

RR CODE	REPLY LENGTH	MB CONTENT
0-15	Short	N/A
16	Long	Air initiated Comm-B
17	Long	Data link capability
18	Long	Aircraft Identification
19	Long	Resolution Advisories
20-31	Long	Not Assigned

NOTE: If first bit of RR code is One, decimal equivalent of last four bits of RR code designates code for BDS1 in reply (ground initiated). BDS2 is assumed to be Zero if not specified by DI=7 and RRS.

Overview of Format Definitions
Table 3 (Cont)



FIELD	SUB FIELD	NO. OF BITS	BITS POSITION	FORMATS UP DOWN	CONTENT
SD		16	17-32	X	Contains control codes, as specified by the DI field affecting transponder protocol and is part of surveillance and Comm-A interrogations UF=4, 5, 20, 21.
	IIS	4	17-20	X	Interrogator Identifier subfield contains the self-identification code of the interrogator and is numerically identical to the II code transmitted by the interrogator in Mode S Only All Calls. IIS codes are 0 through 15; IIS=0 is not a valid interrogator identifier for multisite purposes. IIS is sent only when DI=0, 1 or 7.
	LOS	1	26	X	Lockout subfield, if set to One, initiates a multisite All Call lockout to Mode S Only All Calls (UF=11) from the Interrogator indicated in IIS of the interrogation. If LOS is set to Zero, no change in lockout state is commanded. LOS is sent only if DI=1 or 7.
	LSS	1	23	X	Lockout Surveillance subfield signifies multisite lockout from interrogator indicated in SIS field. Sent when DI=3.
	MBS	2	21-22	X	Multisite Comm-B subfield, sent when DI=1, is assigned the following codes: 0 = No Comm-B action. 1 = Comm-B reservation. 2 = Comm-B closeout.
	MES	3	23-25	X	Multisite ELM subfield, sent when DI=1, contains reservation and closeout commands for ELM as follows: 0 = No ELM action. 1 = Comm-C reservation. 2 = Comm-C closeout. 3 = Comm-D reservation. 4 = Comm-D closeout. 5 = Comm-C reservation and Comm-D closeout. 6 = Comm-C closeout and Comm-D reservation. 7 = Comm-C and Comm-D closeouts.
	RCS	3	24-26	X	Rate Control subfield, sent when DI=2, controls surface squitter (Sqtr) (DF17S) rate with codes as follows: 0 = No squitter rate command. 1 = Report high surface Sqtr rate for 60 Sec. 2 = Report low surface Sqtr rate for 60 Sec. 3 = Suppress all surface Sqtrs for 60 Sec. 4 = Suppress all surface Sqtrs for 120 Sec. 5-7 = Not assigned.

Overview of Format Definitions
Table 3 (Cont)



FIELD	SUB FIELD	NO. OF BITS	BITS POSITION	FORMATS UP DOWN	CONTENT
SD	RRS	4	21-24	X	Reply Request subfield, sent when DI=7, contains coding corresponding to the requested BDS2 code.
	RSS	2	27-28	X	Reservation Status subfield, sent when DI=1, requests transponder to report reservation status in the UM field. The codes are: 0 = No request. 1 = Report Comm-B reservation status. 2 = Report Comm-C reservation status. 3 = Report Comm-D reservation status.
	SAS	2	27-28	X	Surface Antenna subfield, sent when DI=2, controls diversity antenna used for squitters sent from aircraft on the ground as follows: 0 = No antenna command, use top antenna. 1 = Alternate top and bottom antennas for 120 Sec. 2 = Use bottom antenna for 120 Sec. 3 = Return to default.
	SIS	6	17-22	X	Surveillance Identifier subfield, sent when DI=3, contains assigned interrogator SI code.
	TCS	3	21-23	X	Type Control subfield, sent when DI=2, controls reported position type as follows: 0 = No position type command. 1 = Use surface position for next 15 Sec. 2 = Use surface position for next 60 Sec. 3 = Cancel surface type command. 4-7 = Not assigned.

Overview of Format Definitions
Table 3 (Cont)



FIELD	SUB FIELD	NO. OF BITS	BITS POSITION	FORMATS UP DOWN	CONTENT
SD	TMS	4	29-32	X	<p>Tactical Message subfield, sent when DI=1 or 7, contains coding for linking the Comm-A message segments. The codes are:</p> <p>0 = No Action. 1 = Unlinked, Priority. 2 = Unlinked, Acknowledge. 3 = Unlinked, Priority, Acknowledge. 4 = Linked 1st Segment, Single ADS. 5 = Linked 1st Segment, Single ADS Priority. 6 = Linked 1st Segment, Single ADS Acknowledge. 7 = Linked 1st Segment, Single ADS, Priority, Acknowledge. 8 = Linked 1st Segment, Multiple ADS. 9 = Linked 1st Segment, Multiple ADS, Priority. 10 = Linked 1st Segment, Multiple ADS, Acknowledge. 11 = Linked 1st Segment, Multiple ADS, Priority, Acknowledge. 12 = Second Segment. 13 = Third Segment. 14 = Final Segment. 15 = Not Assigned.</p>
SL		3	9-11	X	<p>Reports the current operating sensitivity level of the TCAS unit and is a part of air-air surveillance replies, DF=0, 16. The codes are:</p> <p>0 = No TCAS sensitivity level reported. 1 = TCAS operates at sensitivity level 1. 2 = TCAS operates at sensitivity level 2. 3 = TCAS operates at sensitivity level 3. 4 = TCAS operates at sensitivity level 4. 5 = TCAS operates at sensitivity level 5. 6 = TCAS operates at sensitivity level 6. 7 = TCAS operates at sensitivity level 7.</p> <p>NOTE: The SL field has no meaning for aircraft with RI=0 (no on-board capability to generate resolution, advisories).</p>
UF		5	1-5	X	<p>The first field in all uplink formats is the transmission descriptor in all interrogations.</p>
UM		6	14-19	X	<p>Contains transponder status readouts in replies DF=4, 5, 20, 21.</p>

Overview of Format Definitions
Table 3 (Cont)

FIELD	SUB FIELD	NO. OF BITS	BITS POSITION	FORMATS UP DOWN	CONTENT
UM	IDS	2	18-19	X	Identifier Designator subfield reports the type of reservation made by the interrogator identified in IIS and corresponds with the RSS subfield of SD. Assigned coding is: 0 = No information available. 1 = Comm-B reservation active. 2 = Comm-C reservation active. 3 = Comm-D reservation active.
	IIS	4	14-17	X	Interrogator Identifier subfield reports the identity of the interrogator that has made a multisite reservation.
VS		1	6	X	Indicates aircraft is airborne when Zero or aircraft is on the ground when One. VS is a part of DF=0, 16.

Overview of Format Definitions
Table 3 (Cont)

				B5	0	0	1	1
				B6	0	1	0	1
B4	B3	B2	B1					
0	0	0	0			P	SP	0
0	0	0	1		A	Q		1
0	0	1	0		B	R		2
0	0	1	1		C	S		3
0	1	0	0		D	T		4
0	1	0	1		E	U		5
0	1	1	0		F	V		6
0	1	1	1		G	W		7
1	0	0	0		H	X		8
1	0	0	1		I	Y		9
1	0	1	0		J	Z		
1	0	1	1		K			
1	1	0	0		L			
1	1	0	1		M			
1	1	1	0		N			
1	1	1	1		O			
SP=SPACE code								

6-Bit Character Set for AIS Subfield
Table 4

SRS OR TAS SUBFIELD VALUE		NUMBER OF SEGMENTS
OCTAL	HEXADECIMAL	
100000	8000	1
140000	C000	2
160000	E000	3
170000	F000	4
174000	F800	5
176000	FC00	6
177000	FE00	7
177400	FF00	8
177600	FF80	9
177700	FFC0	10
177740	FFE0	11
177760	FFF0	12
177770	FFF8	13
177774	FFFC	14
177776	FFFE	15
177777	FFFF	16

Valid Values for SRS and TAS Subfields
Table 5



LETTER TYPE (SQUITTER SCREENS)	DF17 TYPE (DECIMAL VALUE)	FIRST TWO DIGITS OF ME FIELD IN SQUITTER (2of2) SCREEN (HEX)	DESCRIPTION
O	0	00-07	Invalid, No Data or Unused
I	1	08-0F	Aircraft Identification, Aircraft Type Set D
I	2	10-17	Aircraft Identification, Aircraft Type Set C
I	3	18-1F	Aircraft Identification, Aircraft Type Set B
I	4	20-27	Aircraft Identification, Aircraft Type Set A
S	5	28-2F	Surface Position, 5 meter ANP
S	6	30-37	Surface Position, 100 meter ANP
A	7	38-3F	Airborne Position, 5 meter ANP, 25/100 Ft barometric altitude
A	8	40-47	Airborne Position, 100 meter ANP, 25/100 Ft barometric altitude
A	9	48-4F	Airborne Position, 0.25 nm ANP, 25/100 Ft barometric altitude
A	10	50-57	Airborne Position, 1.0 nm ANP, 25/100 Ft barometric altitude
A	11	58-5F	Airborne Position, 4.5 nm ANP, 25/100 Ft barometric altitude
A	12	60-67	Airborne Position, 20 nm ANP, 25/100 Ft barometric altitude
A	13	68-6F	Airborne Position, 5 meter ANP, GPS height
A	14	70-77	Airborne Position, 100 meter ANP, GPS height
T	15	78-7F	Airborne Supplementary Information
O	16	80-87	Unused
O	17	88-8F	Unused
O	18	90-97	Unused
O	19	98-9F	Unused
O	20	A0-A7	Unused
O	21	A8-AF	Unused
O	22	B0-B7	Unused
O	23	B8-BF	Unused
O	24	C0-C7	Unused
O	25	C8-CF	Unused
O	26	D0-D7	Unused
O	27	D8-DF	Unused
O	28	E0-E7	Unused
P	29	E8-EF	On-Demand Information, Message C
P	30	F0-F7	On-Demand Information, Message B
P	31	F8-FF	On-Demand Information, Message A

Original DF17 Squitter Types
Table 6

LETTER TYPE (SQUITTER SCREENS)	DF17 TYPE (DECIMAL VALUE)	DESCRIPTION (POSITION/ALTITUDE ACCURACY)
A	0	Airborne Position, No position information, barometric altitude (25/100 Ft)
I	1	Aircraft Identification, Aircraft Type Set D
I	2	Aircraft Identification, Aircraft Type Set C
I	3	Aircraft Identification, Aircraft Type Set B
I	4	Aircraft Identification, Aircraft Type Set A
S	5	Surface Position (<3 m)
S	6	Surface Position (≥3 m but <10 m)
S	7	Surface Position (≥10 m but <0.05 NM)
S	8	Surface Position (≥0.05 NM)
A	9	Airborne Position (<3 m), barometric altitude (25/100 Ft)
A	10	Airborne Position (≥3 m but <10 m), barometric altitude (25/100 Ft)
A	11	Airborne Position (≥10 m but <0.05 NM), barometric altitude (25/100 Ft)
A	12	Airborne Position (≥0.05 NM but <0.1 NM), barometric altitude (25/100 Ft)
A	13	Airborne Position (≥0.10 NM but <0.25 NM), barometric altitude (25/100 Ft)
A	14	Airborne Position (≥0.25 NM but <0.5 NM), barometric altitude (25/100 Ft)
A	15	Airborne Position (≥0.5 NM but <1 NM), barometric altitude (25/100 Ft)
A	16	Airborne Position (≥1 NM but <5 NM), barometric altitude (25/100 Ft)
A	17	Airborne Position (≥5 NM but <10 NM), barometric altitude (25/100 Ft)
A	18	Airborne Position (≥10 NM), barometric altitude (25/100 Ft)
V	19	Airborne Velocity
A	20	Airborne Position (<3 meter) and GPS height (<4 meter)
A	21	Airborne Position, (<10 meter) and GPS height (<15 meter)
A	22	Airborne Position, (>10 meter) or GPS height (≥ 15 meter)
O	23	Unused
O	24	Unused
O	25	Unused
O	26	Unused
O	27	Unused
O	28	Unused
E	29	Event-Driven Information, Message C
E	30	Event-Driven Information, Message B
E	31	Event-Driven Information, Message A

NOTE: The first two digits of the ME field in the C60 Squitter (2 of 2) are the same according to the DF17 type decimal value as in Appendix D, Table 6.

RTCA DF17 Squitter Types
Table 7

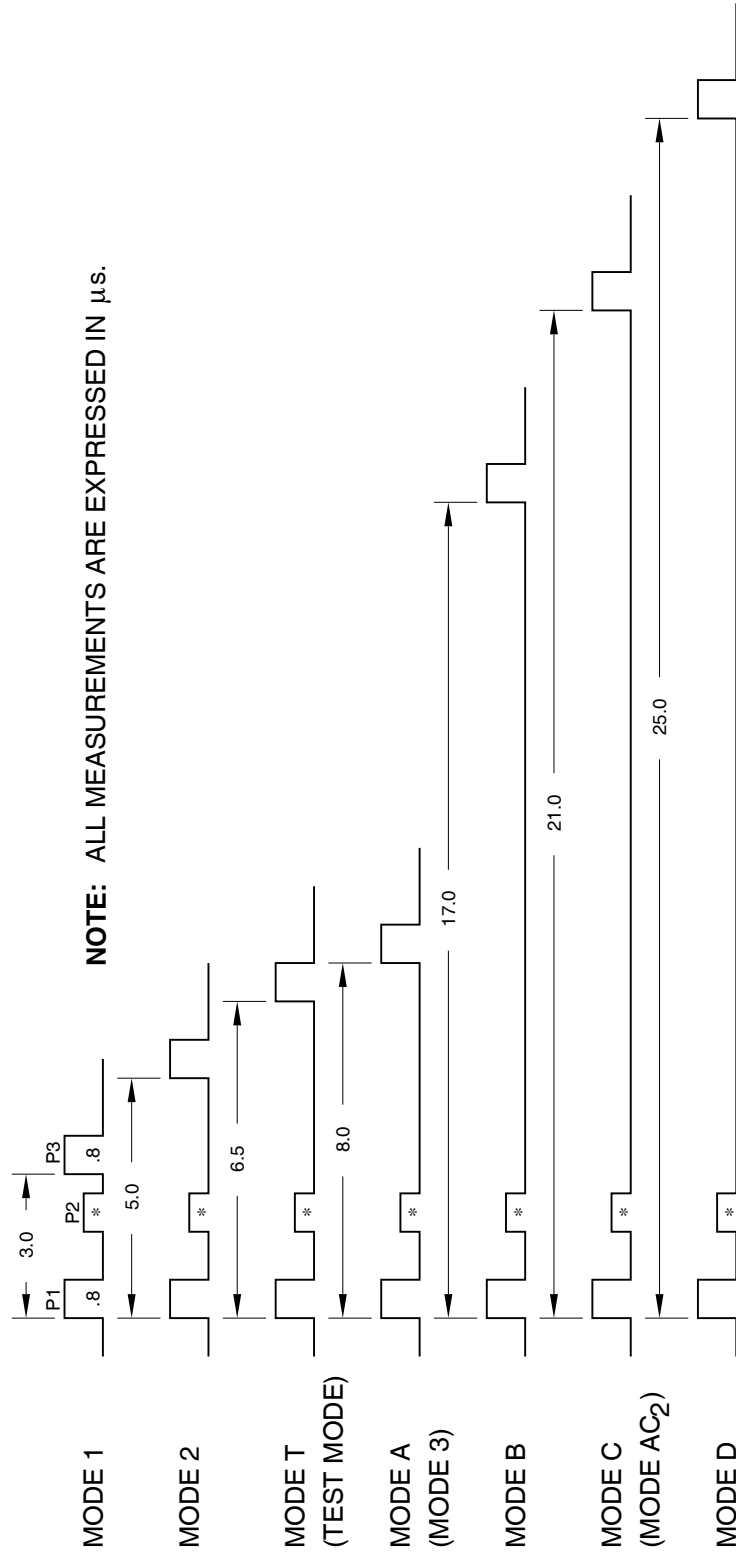


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APPENDIX E - INTERROGATION AND REPLY TIMING

The following timing diagrams contain the interrogation and reply pulse patterns normally encountered by transponders operating in the ATCRBS/Mode S environment.

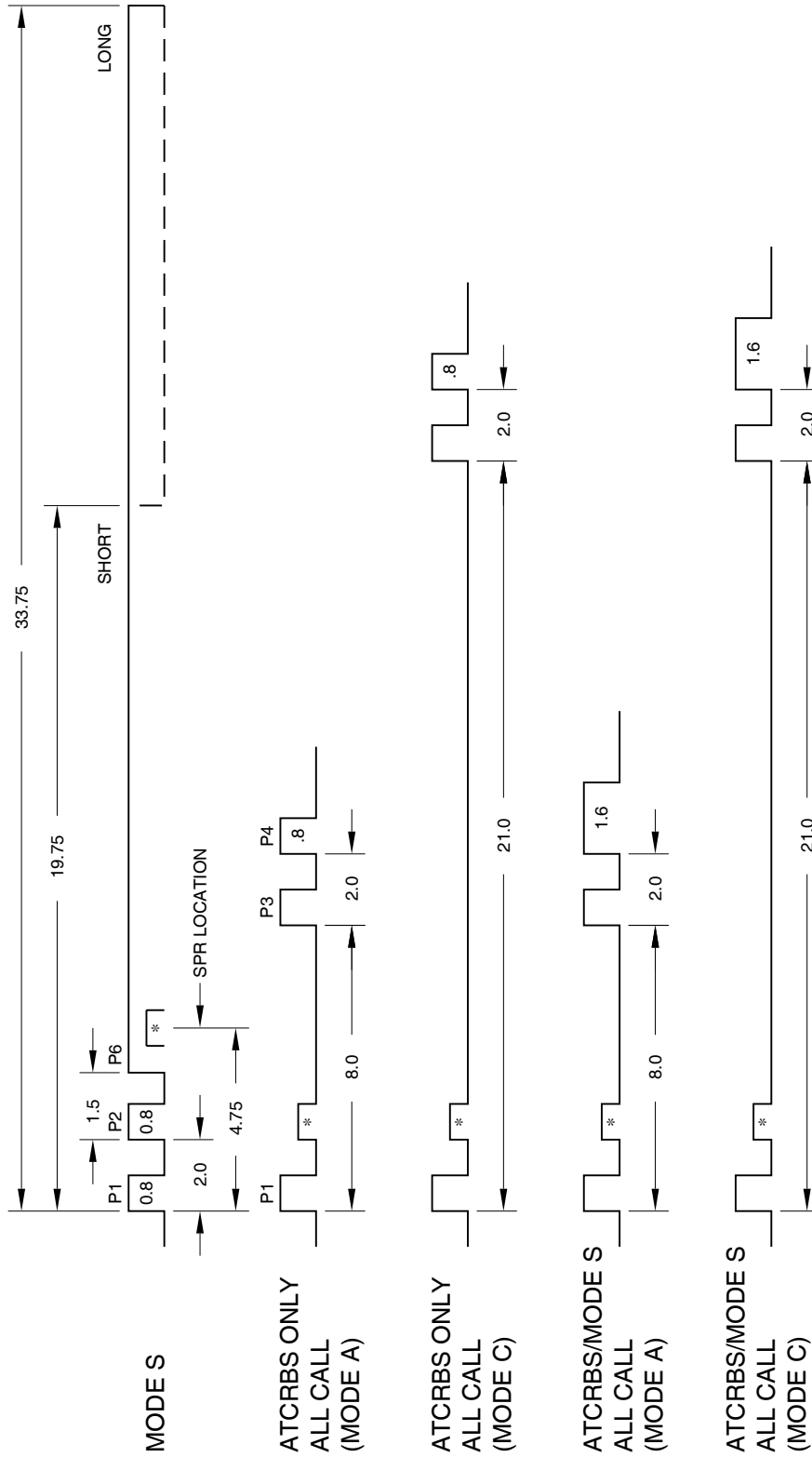
NOTE: ATCRBS Only All Call and ATCRBS/Mode S All Call interrogations may contain any valid ATCRBS P₁ to P₃ spacing. Appendix E, Figure 2 shows only Modes A and C.



ATCRBS Interrogations
Figure 1

02402010

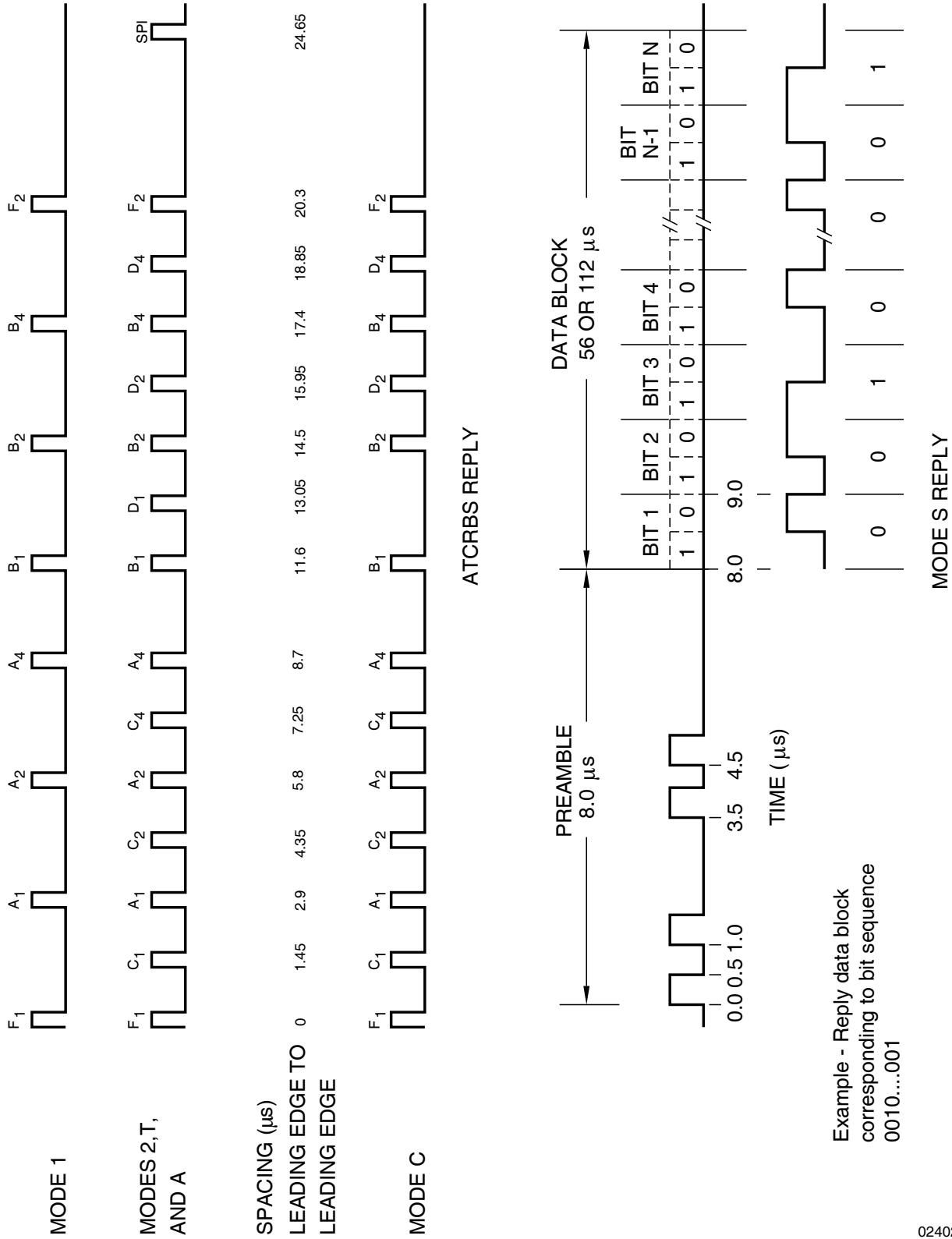
NOTE: ALL MEASUREMENTS ARE EXPRESSED IN μ s.



* SIDE-LOBE SUPPRESSION (SLS)

Mode S and All Call Interrogations
Figure 2

02402011



ATCRBS and Mode S Expected Replies
Figure 3

02402012

APPENDIX F - RELATED DOCUMENTS

Aeronautical Telecommunications, Annex 7, January 1996; *ICAO*

Aeronautical Telecommunications, Annex 10, Volume 1, Part 1, October 1994; *ICAO*

ARINC718-4 Mark3 Air Traffic Control Transponder, December 1989; *ARINC*

ATC-1400A Operation Manual (1002-7501-500), Rev 1 (1002-7501-510), Rev 2 (1002-7501-520), EMC1 (1002-7503-200) and SAFE1 (1002-7504-200); *Aeroflex*

DO181A Minimum Operational Performance Standards for ATCRBS/ModeS Airborne Equipment, January 1993; Errata, (no date); Change 1, January 1993; Change 2, January 1997; *RTCA Inc.*

DO181A draft change for ModeS Extended Squitter, 31Oct95; Technical Work Group, *RTCA Inc.*

DO185 Minimum Operational Performance Standards for TCAS Airborne Equipment, November 1993; Change 1, February 1997; *RTCA Inc.*

DO218 Minimum Operational Performance Standards for the ModeS Airborne Data Link Processor, August 1993; Change 1, 1997; *RTCA Inc.*

IEEE Standard Codes, Formats, Protocols, and Common Commands, Std 488.2-1992; *The Institute of Electrical and Electronics Engineers, Inc. (IEEE)*

Mode S Test System TMAC Manual (1002-2400-600), *Aeroflex*

SCPI Syntax & Style, Volume 1; *SCPI Consortium*



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APPENDIX G - 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 H - COMPARISON WITH THE S-1403C

1. NEW FEATURES

- Automatic saving of last S-1403DL settings
 - New screens for software controlled calibrations providing tighter precision
 - Detailed data screens for UUT Percent Reply, Reply Delay and Squitter information
 - Reply Delay measurement on every reply
 - DF17 decoded extended squitter capability
 - ELM decoded data link (UF24/DF24) capability
 - Pulse Power Measurement Gate (PPMG) location updated after every reply
 - Power measurement for selected pulse in an ELM reply segment
 - Faster processor for quicker response time
 - Flash memory for easier firmware upgrades
 - Screen dump capability
 - Setup screens for easier control of test parameters
 - Increased number of available sequence menu screens from 16 to 1000
 - Increased user saved memory from two to five memory slots
 - Maximum PRF increased as follows:
- | FUNCTIONS | WAS | IS |
|-----------|-------------|-----------|
| ATC | 2400 | 7999 |
| SEQ, ACL | 200 | 2500 |
| ACS | 2400 | 2500 |
| INTLCE | 200-900 | 1250 |
| DI | 750/100 | 1250 |
| BURST | 2400/Limits | 7999/2500 |
- S-1403DL Stand-Alone operation for testing everything except transponder power and frequency (interference and suppressor pulses not available during Stand-Alone operation)
 - Special tests for ELM and MTL
 - Additional flexibility for SCOPE TRIG OUT, EXT SYNC OUT and PPMG signals
 - System screens for control of user interface parameters
 - TMAC language and extended remote operation capabilities (S-1403DL RS-232 and GPIB Connectors)
 - Added screen reference designators shown in the upper left corner of the MENU Display to indicate screen and menu hierarchy position
 - Hexadecimal or octal modes supported with the ability to enter hexadecimal data directly from the Keyboard
 - Rear panel TTL outputs that drive 90 Ω loads
 - Screen indicates 2nd key function in effect (cursor changes from a block to an underline after pressing 2ND Key)
 - Increased MTL testing capabilities (more validity checking and front panel operation)
 - Increased validity checking on ATCRBS (must contain F1 and F2 pulses) and Mode S (must contain valid preamble and phase transitions for data bits) replies
 - Increased maximum BURST number from 999 to 9999 (valid at any PRF)
 - Tightened reply delay measurement resolution from 25 ns to 12.5 ns
 - Increased Antenna B level range (was -80 to -20 dBm, now -83 to -20 dBm)

PRF Changes
Table 1

2. OTHER DIFFERENCES

- Minimum spacing for DI SEQ:SEQ is 40 μ s.
- When Antenna A and/or Antenna B are disabled (S-1403DL C10 or C20 AntB field set to **OFF**, S-1403DL C75 AntAEnable field set to **OFF** or ATC-1400A CW/NORM/OFF Switch set to **OFF**), the Mode S Test System shuts off all interrogations and disregards all squitters through the affected antenna connector(s). The S-1403C recognized squitters in the **OFF** position.
- In sequence menus for the S-1403C, data entered in the undefined fields (S or L) did not carry over to the defined fields (undefined fields were cleared). For the S-1403DL, data entered in undefined fields carry over when changing to defined fields (even if the bits set in the undefined fields are not displayed in the defined mode). The opposite is also true (defined fields to undefined).
- In the INTLCE and DI functions for the S-1403C, only the first four sequence menus were cycled through regardless of how many were active. In the same functions for the S-1403DL, all active sequence menus are cycled through.
- In INTLCE and DI functions for the S-1403C, the SCOPE SYNC OUT Connector (J7) switches between the ATRBS (To) and Mode S (Td) interrogations according to the ATC-1400A TO/TAC/Td Switch setting. Since the sync for either type can be selected (C72 Setup Screen) on the S-1403DL, the SCOPE SYNC OUT (J7) Connector operates according to interrogation types used in the INTLCE or DI functions.
- The S-1403DL AUX BUS and IFR BUS Connectors changed locations.
- Recalling Memory Slot 0 sets the S-1403DL to the Factory Default (S-1403C) settings.

3. BACKWARDS COMPATIBILITY

- Capability to accept all old-style S-1403C remote commands
- Equivalent or better timing for electrical signals
- Similar screen operation for the seven basic functions (ATC, SEQ, ACS, ACL, INTLCE, DI and BURST)
- Similar screen operation for the sequence menus
- Keyboard shortcuts (100% backward compatible) move cursor to desired control fields
- Same default sequence menus

4. CMENU#2 FIELDS LOCATION

Some fields in the S-1403C Control Menu #2 have been relocated as follows:

OLD FIELDS	NEW SCREEN	NEW FIELDS
Sqtr.Add.	C50 Squitter (1of2)	Addr:
Prepulse	C75 Misc Setup	PrePulseOut
Ext.Sync.: Out=, Dv=	C73 Ext Sync Out Setup	Enable and Dv
Ext.Sync.: In=	C71 Interrogation Trigger Setup	TrigSource
Pulse Power Gate	C74 PPMG Setup	Enable and Pulse
Ext.Mod.In	C75 Misc Setup	AntAModSource

Control Menu #2 Relocated Fields
Table 2

APPENDIX I - ABBREVIATIONS

A		C	
A	Amperes	C	Celsius or Centigrade
AA	Address Announced	CA	Transponder Capability
AC	Altitude Code	CAL	Calibration or Calibrated
AC	Alternating Current	CC	Crosslink Capability
ac	Alternating Current	ccw	Counterclockwise
ACAS	Airborne Collision Avoidance System	CFS	Continuation Subfield
ACL	All Call Long	CH	Channel
ACS	All Call Short	CHAN	Channel
ACS	Comm-A Capability Subfield	CL/ESC	Clear/Escape
ADDR	Address	CLOS	Closeout
Addr	Address	cm	Centimeter (10 ⁻² Meters)
ADLP	Airborne Data Link Processor	C MENU	Control Menu
ADJ	Adjust	Cont	Continued
ADS	A-Definition Subfield	CR	Carriage Return
AIS	Comm-A Capability Subfield	CTRL	Control
AM	Amplitude Modulation	CTS	Clear to Send/(One-way hardware)
ANG	Analog	CTS/RTS	Two-way hardware
ANT	Antenna	CVC	Cancel Vertical Resolution
Ant	Antenna		Advisory Complement
ANT A	Antenna A	CW	Continuous Wave
AntA	Antenna A	cw	Clockwise
ANT B	Antenna B		
AntB	Antenna B		
AP	Address Parity		D
APER	Antenna A Percent Reply	DABS	Discrete Address Beacon System
AQ	Acquisition Special	DAC	Digital to Analog Converter
Arf	RF through Antenna A	DCD	Data Carrier Detect
ARF LVL	Antenna A RF Level	dB	Decibel
ASCII	American National Standard Code for Information Interchange	DBL	Double
		dBm	Decibels above one milliwatt
ATC	Air Traffic Control	DELM	Downlink Extended Length Message
ATC	ATCRBS (screen/function abbreviation)	DEV	Deviation
ATCRBS	Air Traffic Control Radar Beacon System	DF	Downlink Format
ATE	Automatic Test Equipment	DI	Designator Identification
AUX	Auxiliary	DI	Double Interrogation
		Dly	Delay
		DME	Distance Measuring Equipment
	B	DMM	Digital Multimeter
BD	Comm-B Data	DO	Document
BCS	Comm-B Capability Subfield	DPSK	Differential Phase Shift Keying
BDS	B-Definition Subfield		
BN	Burst Number	DR	Downlink Request
BPER	Antenna B Percent Reply	DSP	Digital Signal Processor
bps	Bits per Second	DSR	Data Set Ready
Brf	RF through Antenna B	DTR	Data Terminal Ready
BRF LVL	Antenna B RF Level	Dv	Deviation

E

ECL	Extended Command Language
ECS	Extended Capability Subfield
ELM	Extended Length Message
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EOL	End of Line
ERRM	Error Message
ESC	Escape
ESD	Electrostatic Discharge
EX MOD	External Modulation
EXP	Expected
EX SYN	External Synchronization
EXT	External
Ext	External

F

FP	Front Panel Processor
FPM	Feet Per Minute
FREQ	Frequency
FS	Flight Status
FUNC	Function
FUNC#	Function Number
F/W	Firmware
Ft	Foot/Feet

G

GEN	Generator
GHz	Gigahertz (10 ⁹ Hertz)
GND	Ground
GPIB	General Purpose Interface Bus
GPS	Global Positioning System
GRP	Group

H

h	Hexadecimal
HEX	Hexadecimal
Hndshk	Handshake
HRC	Horizontal Resolution Advisory Complement
hrs	Hours
Hz	Hertz

I

ID	Identification (4096 Code)
IEEE	Institute of Electrical and Electronics Engineers
IDS	Identifier Designators Subfield
IFF	Identification Friend or Foe
II	Interrogator Identification
IIS	Interrogator Identification Subfield
IN	Input
INTF	Interface
INTRF	Interference
INTERR	Interrogation
INTERRF	Interference
INTLCE	Interlace
I/O	Input/Output

K

KE	Control, ELM
kg	Kilogram (10 ³ Grams)
kHz	Kilohertz (10 ³ Hertz)
Kts	Knots (Velocity)

L

LCA	Logic Cell Array
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LF	Line Feed
LOS	Lockout Subfield
LVL	Level

M

MA	Message, COMM-A
MAN	Manual
MAX	Maximum
MB	Message, COMM-B
MBS	Multisite COMM-B Subfield
MC	Message, COMM-C
MD	Message, COMM-D
ME	Message, COMM-E
MES	Multisite ELM Subfield
MHz	Megahertz (10 ⁶ Hertz)
MIN	Minimum
μs	Microsecond (10 ⁻⁶ Seconds)
MLD	Multi-Level Diversity
MOD	Modulation
MP	Main Processor
ms	Millisecond (10 ⁻³ Seconds)
MTE	Multiple Threat Encounter
MTL	Minimum Threshold Level
MU	Message, COMM-U
MV	Message, COMM-V

N

NA Not Applicable
 NC C-Segment Number
 ND D-Segment Number
 Neg Negative
 NORM Normal
 ns Nanosecond (10^{-9} Seconds)

O

o Octal
 OCT Octal
 OPT Option
 OUT Output
 Ω Ohm

P

PC Personal Computer
 PC Printed Circuit
 PC Protocol
 PLCS Places
 PN Part Number
 PP Pulse Processor
 PPM Pulse Position Modulation
 ppm Parts per Million
 P PULSE Prepulse
 PR Probability of Reply
 PRF Pulse Repetition Frequency
 PRTSCR Print Screen
 PWR Power

R

RAM Random Access Memory
 RAC Resolution Advisory
 Complement
 RAT Resolution Advisory
 Termination
 RC Reply Control
 RCI Remote Control Interface
 RCV Receive
 RESV Reservation
 RF Radio Frequency
 RI Reply Information Air-to-Air
 RL Reply Length
 RMS Root Mean Square
 ROM Read Only Memory
 RPDLY Reply Delay
 RPLY Reply
 RR Reply Request
 RRS Reply Request Subfield
 RSS Reservation Status Subfield
 RTCA Requirements and Technical
 Concepts for Aviation
 organization
 RTS Request to Sent
 RXD Receive Data

S

SCOPE Oscilloscope
 SCPI Standard Commands for
 Programmable Instruments
 organization
 SD Special Designator
 Sec Second
 SEQ Sequence
 SEQ AD Sequence Address
 SLM Standard Length Message
 SLS Side-Lobe Suppression
 SMENU Sequence Menu
 SPER Antenna A Mode S Percent
 Reply
 SPI Special Identifier Pulse
 spi Special Identifier Pulse
 SPR Synchronous Phase Reversal
 SQTR Squitter
 Sqtr Squitter
 SRQ Service Request
 SRS Segment Request Subfield
 SSR Secondary Surveillance
 Radar
 STATMTL MTL Status
 SYNC Synchronous
 sync Synchronous

T

W

TAC Tacan
 TCAS Traffic Alert and Collision Avoidance System
 TCXO Temperature Compensated Crystal Oscillator
 T_D Reply Sync
 TID Threat Identity Data
 TMAC Test Macro Language
 T MENU Test Menu
 TMS Tactical Message Subfield
 To Interrogation Sync
 TRIG Trigger
 Trig Trigger
 TTI Threat Type Indicator
 TTL Transistor-Transistor Logic
 TX Transmit
 TXD Transmit Data
 TYP Typical

W
 w/
 Wd
 w/o

Watt
 With
 Width
 Without

X

XMT
 XMTR
 XON/XOFF
 XPDR

Transmit
 Transmitter
 Software Handshake
 Transponder

U

UDS U-Definition Subfield
 UELM Uplink Extended Length Message
 UF Uplink Format
 UM Utility Message
 U MENU User Menu
 UUT Unit Under Test

V

V Volt
 VAC Volts, Alternating Current
 VAR Variation
 VCO Voltage Controlled Oscillator
 Vdc Volts, Direct Current
 VDS V-Definition Subfield
 VERS Version
 V_{ih} High Level Input Voltage
 V_{il} Low Level Input Voltage
 V_{oh} High Level Output Voltage
 V_{ol} Low Level Output Voltage
 V_{p-p} Volts, Peak to Peak
 VRAM Video Random Access Memory
 VRC Vertical Resolution Advisory Complement
 V_{rms} Volts Root Mean Square
 VS Vertical Status
 VSWR Voltage Standing Wave Ratio

INDEX

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OPERATION MANUAL
S-1403DL

FOR QUALIFIED SERVICE PERSONNEL ONLY

INSTALLATION CALIBRATION PROCEDURE



OPERATION MANUAL
S-1403DL

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WARNING:

HIGH VOLTAGE EQUIPMENT

THIS EQUIPMENT CONTAINS CERTAIN CIRCUITS AND/OR COMPONENTS OF EXTREMELY HIGH VOLTAGE POTENTIALS, CAPABLE OF CAUSING SERIOUS BODILY INJURY OR DEATH. WHEN PERFORMING ANY OF THE PROCEDURES CONTAINED IN THIS MANUAL, HEED ALL APPLICABLE SAFETY PRECAUTIONS.

SAFETY FIRST: TO ALL OPERATIONS AND SERVICE PERSONNEL

REFER ALL SERVICING OF UNIT TO QUALIFIED TECHNICAL PERSONNEL.

WARNING: USING THIS EQUIPMENT IN A MANNER NOT SPECIFIED BY THE ACCOMPANYING DOCUMENTATION MAY IMPAIR THE SAFETY PROTECTION PROVIDED BY THE EQUIPMENT.

CASE, COVER OR PANEL REMOVAL

Removing protective covers, casings or panels from this Test Set exposes the technician to electrical hazards that can result in electrical shock or equipment damage.

SAFETY IDENTIFICATION IN TECHNICAL MANUAL

This manual uses the following terms to draw attention to possible safety hazards, that may exist when operating or servicing 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 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

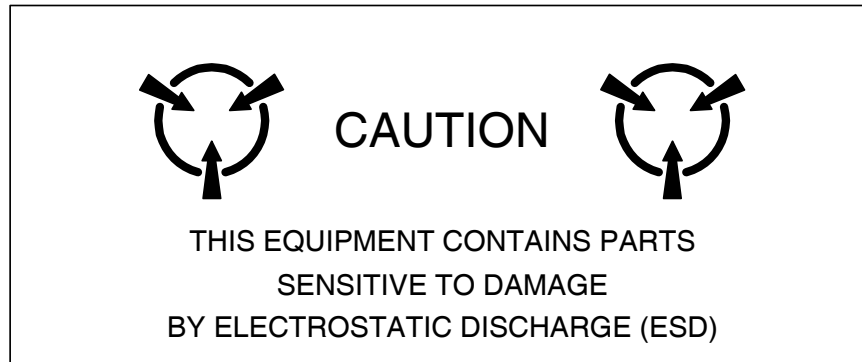
Use only fuses specifically recommended for the equipment at the specified current and voltage ratings.

WARNING: THE PROCESSOR PC BOARD ASSEMBLY USES A LITHIUM BATTERY. LITHIUM IS A TOXIC SUBSTANCE AND THE FOLLOWING WARNINGS CONCERNING LITHIUM BATTERIES MUST BE HEEDED:

- DO NOT CRUSH, INCINERATE OR DISPOSE OF IN NORMAL WASTE.
- DO NOT ATTEMPT TO RECHARGE.
- DO NOT SHORT CIRCUIT OR FORCE DISCHARGE AS THIS MIGHT CAUSE THE BATTERY TO VENT, OVERHEAT OR EXPLODE.

CAUTION: INTEGRATED CIRCUITS AND SOLID STATE DEVICES SUCH AS MOS FETS, ESPECIALLY CMOS TYPES, ARE SUSCEPTIBLE TO DAMAGE BY ELECTROSTATIC DISCHARGES RECEIVED FROM IMPROPER HANDLING, THE USE OF UNGROUNDED TOOLS AND IMPROPER STORAGE AND PACKAGING. ANY MAINTENANCE TO THIS UNIT MUST BE PERFORMED WITH THE FOLLOWING PRECAUTIONS:

- BEFORE USE IN A CIRCUIT, KEEP ALL LEADS SHORTED TOGETHER EITHER BY THE USE OF VENDOR-SUPPLIED SHORTING SPRINGS OR BY INSERTING LEADS INTO A CONDUCTIVE MATERIAL.
- WHEN REMOVING DEVICES FROM THEIR CONTAINERS, GROUND THE HAND BEING USED WITH A CONDUCTIVE WRISTBAND.
- TIPS OF SOLDERING IRONS AND/OR ANY TOOLS USED MUST BE GROUNDED.
- DEVICES MUST NEVER BE INSERTED INTO NOR REMOVED FROM CIRCUITS WITH POWER ON.
- PC BOARDS, WHEN TAKEN OUT OF THE SET, MUST BE LAID ON A GROUNDED CONDUCTIVE MAT OR STORED IN A CONDUCTIVE STORAGE BAG. REMOVE ANY BUILT-IN POWER SOURCE, SUCH AS A BATTERY, BEFORE LAYING PC BOARDS ON A CONDUCTIVE MAT OR STORING IN A CONDUCTIVE BAG.
- PC BOARDS, IF BEING SHIPPED TO THE FACTORY FOR REPAIR, MUST BE PACKAGED IN A CONDUCTIVE BAG AND PLACED IN A WELL-CUSHIONED SHIPPING CONTAINER.



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 ENSURE COMPLIANCE WITH INSTRUCTIONS IN FAA CIRCULAR AC 170-6C, DATED FEBRUARY 19, 1981.

CAUTION: KEEP ALL VENT OPENINGS CLEAR AND UNOBSTRUCTED FOR PROPER EQUIPMENT COOLING AND CONTINUED RELIABILITY. WHEN OPERATING THE EQUIPMENT IN THE NORMAL HORIZONTAL POSITION, MAINTAIN AT LEAST TWO INCHES (≈FIVE CENTIMETERS) OF CLEARANCE BETWEEN THE EQUIPMENT SIDE WITH EXHAUST FAN AND OBJECTS OR WALLS. IF OPERATING IN A RACK, MAXIMUM AMBIENT TEMPERATURE MUST BE AT OR BELOW 40° C.

FOR QUALIFIED SERVICE PERSONNEL ONLY

The Mode S Test System Installation Calibration requires a calibrated S-1403DL connected to a calibrated ATC-1400A according to the S-1403DL Operation Manual.

TEST EQUIPMENT: Refer to Table 1.

CAUTION: ELECTROSTATIC DISCHARGE (ESD) MAY DAMAGE THE PULSE/PROCESSOR, FRONT PANEL AND DIVERSITY ASSEMBLIES. PERSONNEL PERFORMING THE INSTALLATION CALIBRATION PROCEDURE MUST FOLLOW ACCEPTED ESD PRACTICES.

STEP	PROCEDURE																												
1.	Remove power from S-1403DL.																												
2.	Remove 12 top cover screws and two bracket screws (Figure 1).																												
3.	Lift top cover with mounting bracket from Chassis Assembly (Figure 1).																												
4.	Apply power to Mode S Test System.																												
5.	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 PULSE WIDTH VAR/CAL Switch</td> <td>CAL</td> </tr> <tr> <td>MAN/AUTO/MAN STEP Switch</td> <td>MAN</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>PRF/SQTR ON/OFF Switch</td> <td>ON</td> </tr> <tr> <td>TACAN ON/OFF Switch</td> <td>OFF</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>ΔF Thumbwheels</td> <td>OFF</td> </tr> <tr> <td>SELF-INTERR/OFF Switch</td> <td>OFF</td> </tr> </tbody> </table>	CONTROL	SETTING	CW/NORM/OFF Switch	NORM	SLS/ECHO ON/OFF Switch	OFF	XPDR PULSE WIDTH VAR/CAL Switch	CAL	MAN/AUTO/MAN STEP Switch	MAN	XPDR DEV P ₃ /CAL Switch	CAL	XPDR DEV P ₂ /CAL Switch	CAL	PRF/SQTR ON/OFF Switch	ON	TACAN ON/OFF Switch	OFF	PRF/SQUITTER Thumbwheels	1000	DBL INTERR/INTRF Thumbwheels	000.0 OFF	FREQ/FUNCTION SELECT Thumbwheels	1030 XPDR	ΔF Thumbwheels	OFF	SELF-INTERR/OFF Switch	OFF
CONTROL	SETTING																												
CW/NORM/OFF Switch	NORM																												
SLS/ECHO ON/OFF Switch	OFF																												
XPDR PULSE WIDTH VAR/CAL Switch	CAL																												
MAN/AUTO/MAN STEP Switch	MAN																												
XPDR DEV P ₃ /CAL Switch	CAL																												
XPDR DEV P ₂ /CAL Switch	CAL																												
PRF/SQTR ON/OFF Switch	ON																												
TACAN ON/OFF Switch	OFF																												
PRF/SQUITTER Thumbwheels	1000																												
DBL INTERR/INTRF Thumbwheels	000.0 OFF																												
FREQ/FUNCTION SELECT Thumbwheels	1030 XPDR																												
ΔF Thumbwheels	OFF																												
SELF-INTERR/OFF Switch	OFF																												

STEP	PROCEDURE
6.	Press S-1403DL C MENU, 7 and 1 Keys in sequence to enter the C71 Setup Screen.

```
C71  SETUP - INTERROGATION TRIGGER
TrigSource:SelfInterr
TrigGen:      450Hz
```

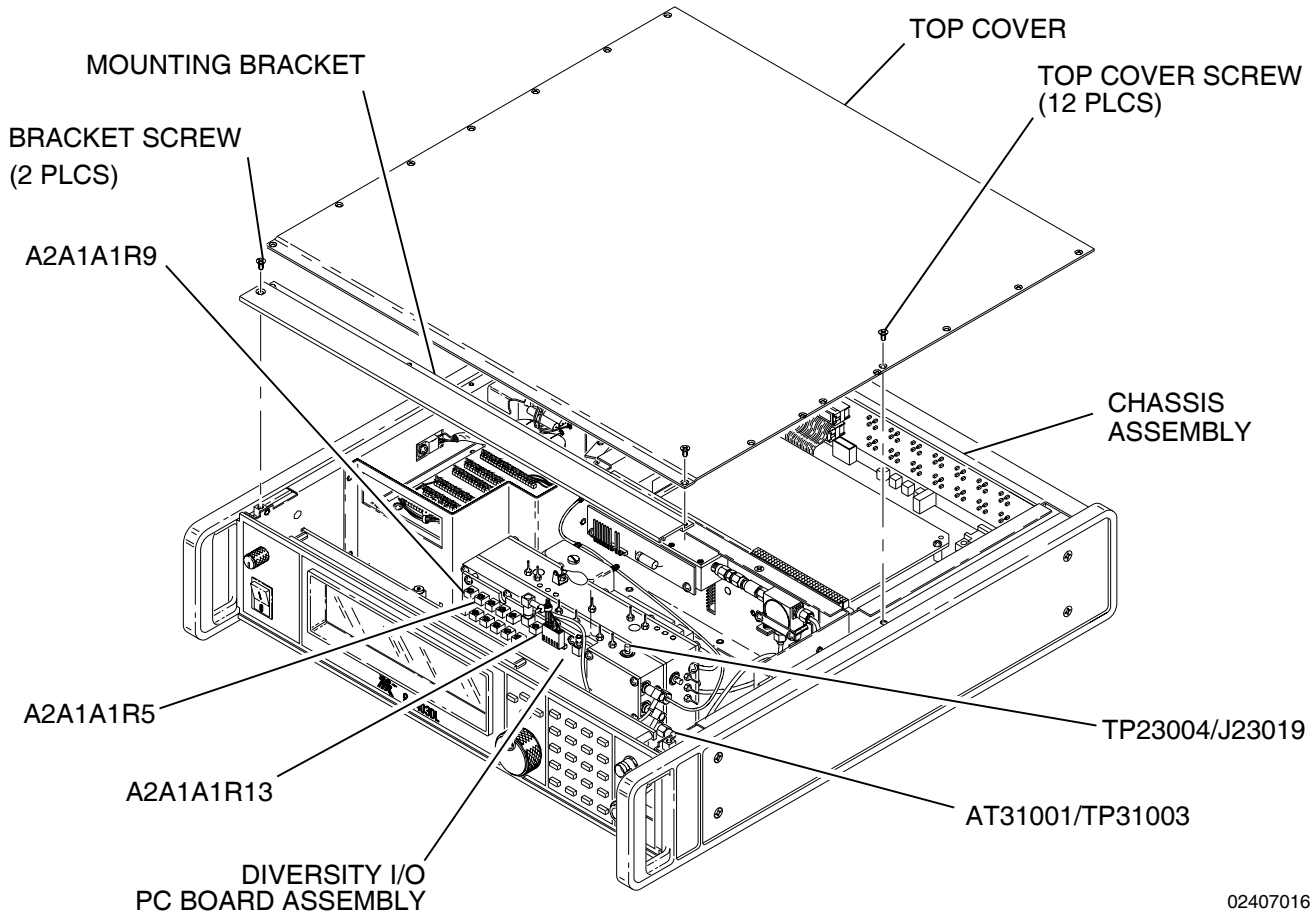
- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set TrigSource to **SelfInterr**.
- Press S-1403DL C MENU, 7 and 5 Keys in sequence to enter the C75 Setup Screen

```
C75  SETUP - MISC
AntAEnable:ON           PrePulseOut:OFF
AntAModSrc:INT
AntBModSrc:INT
```

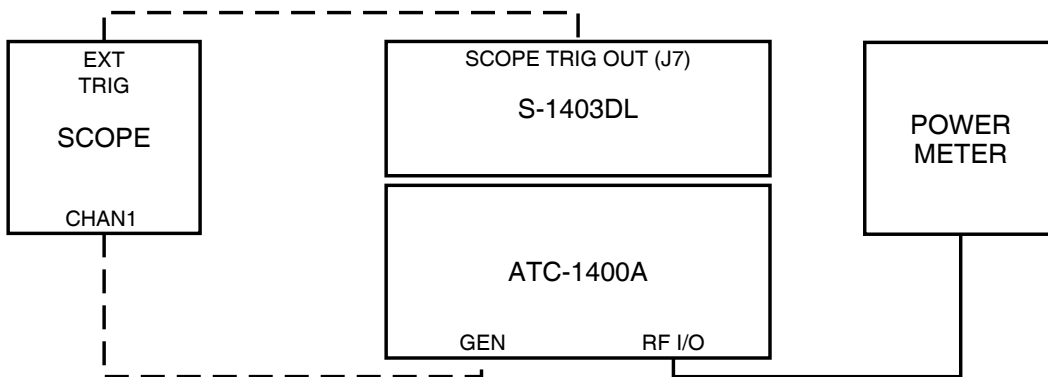
- Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set AntAEnable to **ON**, PrePulseOut to **OFF**, AntAModSrc to **INT** and AntBModSrc to **INT**.
- Press S-1403DL C MENU, 8 and 4 Keys in sequence to enter the C84 System Screen

```
C84  SYSTEM - IFR BUS
1400 Control: MASTER    Must power down
1403 Bus Address: 3     before settings
                        take effect.
```

- If necessary, use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set 1400 Control to **MASTER**. If 1400 Control setting changed, press S-1403DL POWER Switch **OFF (O)** and back **ON (I)** to recycle power.
- Press S-1403DL 2ND, FUNC#, 0 and 1 Keys in sequence to enter the ATC Screen. If necessary, use S-1403DL CURSOR Keys and SLEW Control to set menu to **C10**.
- Press S-1403DL C MENU Key once and 9 Key twice in sequence to enter Calibration Password Screen.



Installation Calibration Internal Adjustments
Figure 1



Installation Calibration Test Setup #1 Diagram
Figure 2

STEP PROCEDURE

14. Use S-1403DL Keyboard to enter Calibrations Password.

```
C99                      CAL - PASSWORD

                            PASSWORD:067215
```

15. Press S-1403DL ENTER Key to display Calibration Menu Screen.

```
C90                      CAL MENU              Last:10aug98
1)Pulse Alignment      4)RF Level (AntB)
2)Reply Delay            5)Reply Width
3)RF Level (AntA)      6)
```

RF LEVEL

16. Press 3 Key on S-1403DL to enter RF Level (AntA) Calibration Screen.

```
C93                      CAL - RF LEVEL (AntA)

                            -3.0dB   -1.5dB   0.0dB   1.5dB   3.0dB
DAC:                      33            205            410            4095            974
```

17. Use S-1403DL CURSOR Keys to set cursor to 0.0dB DAC field.
18. Adjust ATC-1400A RF LEVEL Control to read **00** on the RF LEVEL -dBm Display.
19. Disconnect cable from S-1403DL RF LVL Connector (J13) (Rear Panel).
20. Set ATC-1400A CW/NORM/OFF Switch to **CW**.
21. Connect Power Meter (through Power Sensor) to ATC-1400A RF I/O Connector as shown in Figure 2. Record Power Meter reading as reference.
22. Reconnect cable to RF LVL Connector (J13).
23. Use S-1403DL SLEW Control to adjust 0.0dB DAC field until Power Meter displays reference recorded in Step 21 (± 0.05 dB).

STEP PROCEDURE

24. Use S-1403DL CURSOR Keys and SLEW Control to adjust +1.5dB DAC field until Power Meter displays reference recorded in Step 21 plus 1.5 dB (± 0.15 dB).
25. Use S-1403DL CURSOR Keys and SLEW Control to adjust +3.0dB DAC field until Power Meter displays reference recorded in Step 21 plus 3.0 dB (± 0.3 dB).
26. Use S-1403DL CURSOR Keys and SLEW Control to adjust -1.5dB DAC field until Power Meter displays reference recorded in Step 21 minus 1.5 dB (± 0.15 dB).
27. Use S-1403DL CURSOR Keys and SLEW Control to adjust -3.0dB DAC field until Power Meter displays reference recorded in Step 21 minus 3.0 dB (± 0.3 dB).
28. Repeat Steps 19 through 27 until no adjustments are required. Verify Power Meter readings as follows:
 - Reading with cable disconnected to S-1403DL RF LVL Connector (J13) equals reading with cable to S-1403DL RF LVL Connector (J13) connected and 0.0dB offset selected (± 0.05 dB).
 - Reading with S-1403DL +3.0dB offset selected equals Step 21 reading plus 3.0 dB (± 0.2 dB).
 - Reading with S-1403DL -3.0dB offset selected equals Step 21 reading minus 3.0 dB (± 0.2 dB).
29. Press S-1403DL C MENU, 7 and 6 Keys in sequence to enter SMenu Setup Screen.
30. Use S-1403DL CURSOR Keys and SLEW Control to set SmenuRadix to **OCTAL** and SetAllSmenu to **OFF**. With cursor in SetAllSmenu field, press S-1403DL ENTER Key.
31. Press S-1403DL S MENU, 0, 0 and 1 Keys in sequence to display S001 Sequence Menu.

- | STEP | PROCEDURE |
|------|---|
| 32. | Press S-1403DL ON/CAL Key to activate S001 Sequence Menu. |
| 33. | Use S-1403DL CURSOR Keys, Keyboard and SLEW Control to set format to D , UF 04 and ADDR= to 17725762 . |

```
S001:D;UF04,PC=0,RR=00,DI=0,SD=000000,
+
+ ADDR=17725762
RPLY:D;
*** No Reply ***
```

34. Press S-1403DL 2ND, FUNC#, 2 and ENTER Keys in sequence. Verify S-1403DL displays C10 Sequence Screen for operating Mode S Sequence function. If not, use S-1403DL CURSOR Keys and SLEW Control to set menu to **C10**.
35. Use S-1403DL CURSOR Keys, Keyboard and SLEW Control to activate and set Arf to **0.0** and AntB to **.00**.
36. Set ATC-1400A CW/NORM/OFF Switch to **NORM**.
37. Connect ATC-1400A GEN Connector to Oscilloscope. Refer to Figure 2.
38. Connect S-1403DL SCOPE TRIG OUT Connector (J7) to Oscilloscope EXT TRIG input. Refer to Figure 2.
39. Press S-1403DL C MENU, 7 and 2 Keys in sequence to enter C72 Setup Screen.

```
C72          SETUP - SCOPE TRIGGER
           ATC ModeS ACS ACL
Enable: ON  ON  OFF OFF
Source:CAL CAL  CAL CAL  (in μS)
```

40. Use S-1403DL CURSOR Keys and ON/CAL Key to set ATC Enable to **ON**, ATC Source to **CAL**, ModeS Enable to **ON** and ModeS Source to **CAL**.
41. Set ATC-1400A To/TAC/TD Switch to **To**.

- | STEP | PROCEDURE | | | | | | | | | | | | | | |
|------------|---|---------|---------|--------|----------|------|------|-----------|-------|------------|-----------|-----------|---------------|---------|-------|
| 42. | Observe Mode S interrogation on Oscilloscope and adjust DPSK ADJ (R28) on S-1403DL rear panel until P ₆ phase shift peaks are relatively even. | | | | | | | | | | | | | | |
| 43. | Rotate ATC-1400A RF LEVEL Control until RF LEVEL -dBm Display shows - 50 dBm (- 20 dBm if the Multi-Level Diversity option is installed). | | | | | | | | | | | | | | |
| 44. | Set ATC-1400A CW/NORM/OFF Switch to CW . | | | | | | | | | | | | | | |
| 45. | Disconnect Power Meter from ATC-1400A RF I/O Connector. | | | | | | | | | | | | | | |
| 46. | Connect Spectrum Analyzer to ATC-1400A RF I/O Connector. | | | | | | | | | | | | | | |
| 47. | Set Spectrum Analyzer controls as follows: | | | | | | | | | | | | | | |
| | <table border="1"> <thead> <tr> <th>CONTROL</th> <th>SETTING</th> </tr> </thead> <tbody> <tr> <td>Tuning</td> <td>1030 MHz</td> </tr> <tr> <td>Span</td> <td>Zero</td> </tr> <tr> <td>Bandwidth</td> <td>3 MHz</td> </tr> <tr> <td>Sweep Rate</td> <td>2 or 5 μs</td> </tr> <tr> <td>Log Scale</td> <td>1 or 2 dB/Div</td> </tr> <tr> <td>Trigger</td> <td>Video</td> </tr> </tbody> </table> | CONTROL | SETTING | Tuning | 1030 MHz | Span | Zero | Bandwidth | 3 MHz | Sweep Rate | 2 or 5 μs | Log Scale | 1 or 2 dB/Div | Trigger | Video |
| CONTROL | SETTING | | | | | | | | | | | | | | |
| Tuning | 1030 MHz | | | | | | | | | | | | | | |
| Span | Zero | | | | | | | | | | | | | | |
| Bandwidth | 3 MHz | | | | | | | | | | | | | | |
| Sweep Rate | 2 or 5 μs | | | | | | | | | | | | | | |
| Log Scale | 1 or 2 dB/Div | | | | | | | | | | | | | | |
| Trigger | Video | | | | | | | | | | | | | | |
| 48. | Set ATC-1400A CW/NORM/OFF Switch to NORM . | | | | | | | | | | | | | | |
| 49. | Adjust Spectrum Analyzer for stable display and record signal level as a reference. | | | | | | | | | | | | | | |

NOTE: Steps 50 and 51 only apply if the Multi-Level Diversity option is installed.

50. Use S-1403DL CURSOR Keys and SLEW Control to set menu to **C20**.
51. Use S-1403DL CURSOR Keys and SLEW Control to set Brf to **-20 0.0** (-20 dBm with no vernier control set).
52. Disconnect Spectrum Analyzer from ATC-1400A RF I/O Connector.
53. Connect Spectrum Analyzer to S-1403DL ANT B Connector.

STEP PROCEDURE

54. Refer to Figure 1 and adjust A2A1A1R13 on the S-1403DL Diversity I/O PC Board Assembly to set Spectrum Analyzer signal at reference level recorded in Step 49 (± 0.5 dB).

NOTE: Steps 55 through 65 only apply if the Multi-Level Diversity option is installed.

- 55. Set ATC-1400A CW/NORM/OFF Switch to **CW**.
- 56. Disconnect Spectrum Analyzer from S-1403DL ANT B Connector.
- 57. Connect Power Meter (through Power Sensor) to S-1403DL ANT B Connector.
- 58. Verify Power Meter reading indicates -20 dBm (± 0.5 dB). Record signal level for reference.
- 59. Press S-1403DL C MENU, 9 and 4 Keys in sequence to enter RF Level (AntB) Calibration Screen.

C94	CAL - RF LEVEL (AntB)				
	-3.0dB	-1.5dB	0.0dB	1.5dB	3.0dB
DAC:	33	205	410	1023	974

- 60. Use S-1403DL SLEW Control to adjust 0.0dB DAC field until Power Meter displays reference recorded in Step 58 (± 0.05 dB).
- 61. Use S-1403DL CURSOR Keys and SLEW Control to adjust +1.5dB DAC field until Power Meter displays reference recorded in Step 58 plus 1.5 dB (± 0.15 dB).
- 62. Use S-1403DL CURSOR Keys and SLEW Control to adjust +3.0dB DAC field until Power Meter displays reading recorded in Step 58 plus 3.0 dB (± 0.3 dB).
- 63. Use S-1403DL CURSOR Keys and SLEW Control to adjust -1.5dB DAC field until Power Meter displays reference recorded in Step 58 minus 1.5 dB (± 0.15 dB).

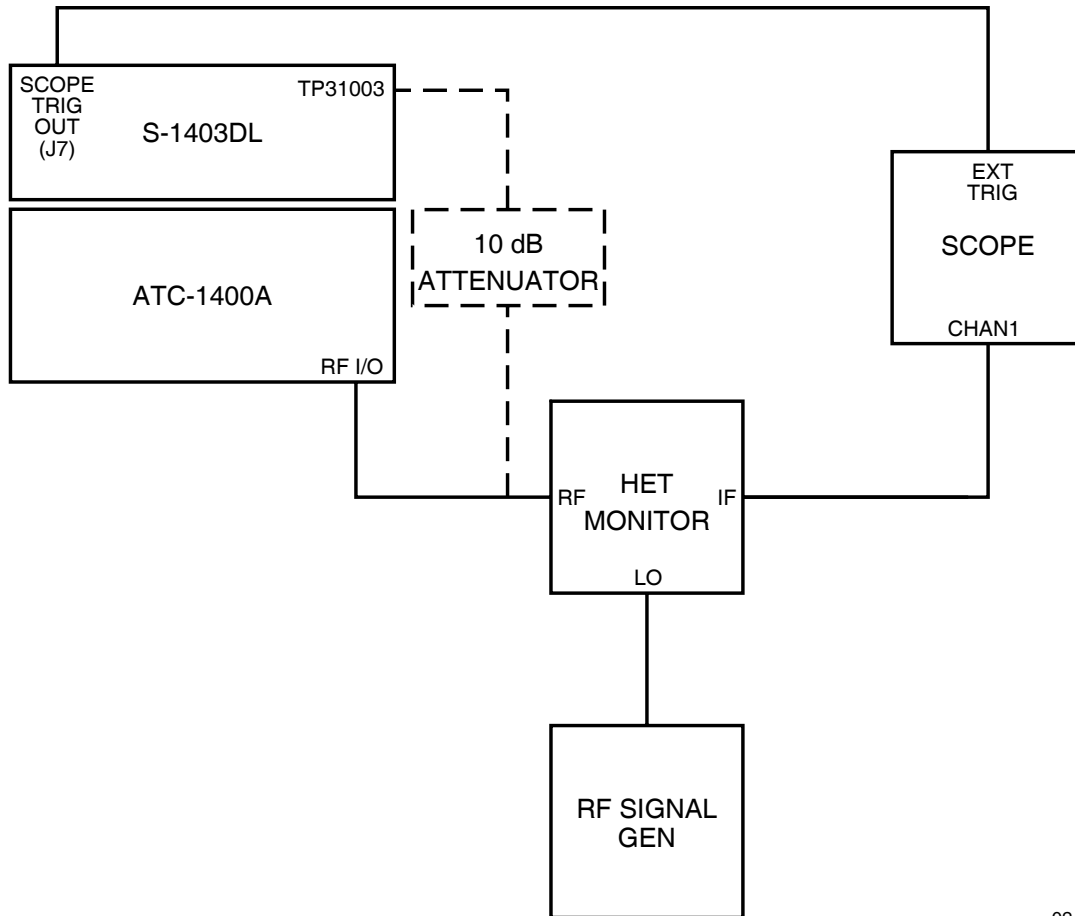
STEP PROCEDURE

- 64. Use S-1403DL CURSOR Keys and SLEW Control to adjust -3.0dB DAC field until Power Meter displays reference recorded in Step 58 minus 3.0 dB (± 0.3 dB).
- 65. Repeat Steps 60 through 64 until no adjustments are required.
- 66. Disconnect Oscilloscope and Power Meter from Mode S Test System.

PULSE ALIGNMENT

- 67. Connect Oscilloscope EXT TRIG to S-1403DL SCOPE TRIG OUT Connector. Refer to Figure 3.
- 68. Connect Oscilloscope Channel 1 to Heterodyne Monitor IF Connector. Refer to Figure 3.
- 69. Connect Heterodyne Monitor RF Connector to ATC-1400A RF I/O Connector. Refer to Figure 3.
- 70. Refer to Figure 3. Connect RF Signal Generator (1030 MHz at +6 dBm) to Heterodyne Monitor LO Connector.
- 71. Set ATC-1400A CW/NORM/OFF Switch to **NORM**.
- 72. Set ATC-1400A RF LEVEL Control for 0 dBm on RF LEVEL -dBm Display.
- 73. Press S-1403DL 2ND, FUNC#, 2 and ENTER Keys in sequence.
- 74. Use S-1403DL CURSOR Keys and SLEW Control to set menu to **C10**.
- 75. Press S-1403DL C MENU, 9 and 1 Keys in sequence to enter Pulse Alignment Calibration Screen.
- 76. Use S-1403DL CURSOR Keys and SLEW Control to adjust AntA SPR first (coarse ± 50 ns increments) and second (fine +0.5 ns increments) fields until 50% point of P₂ leading edge to SPR center point is 2.75 μ s (± 1 ns).

C91	CAL - PULSE ALIGNMENT	
	AntA SPR :	-50nS +00.0nS
	AntB Pulse:	+950nS +25.5nS
	AntB SPR :	-950nS +55.0nS



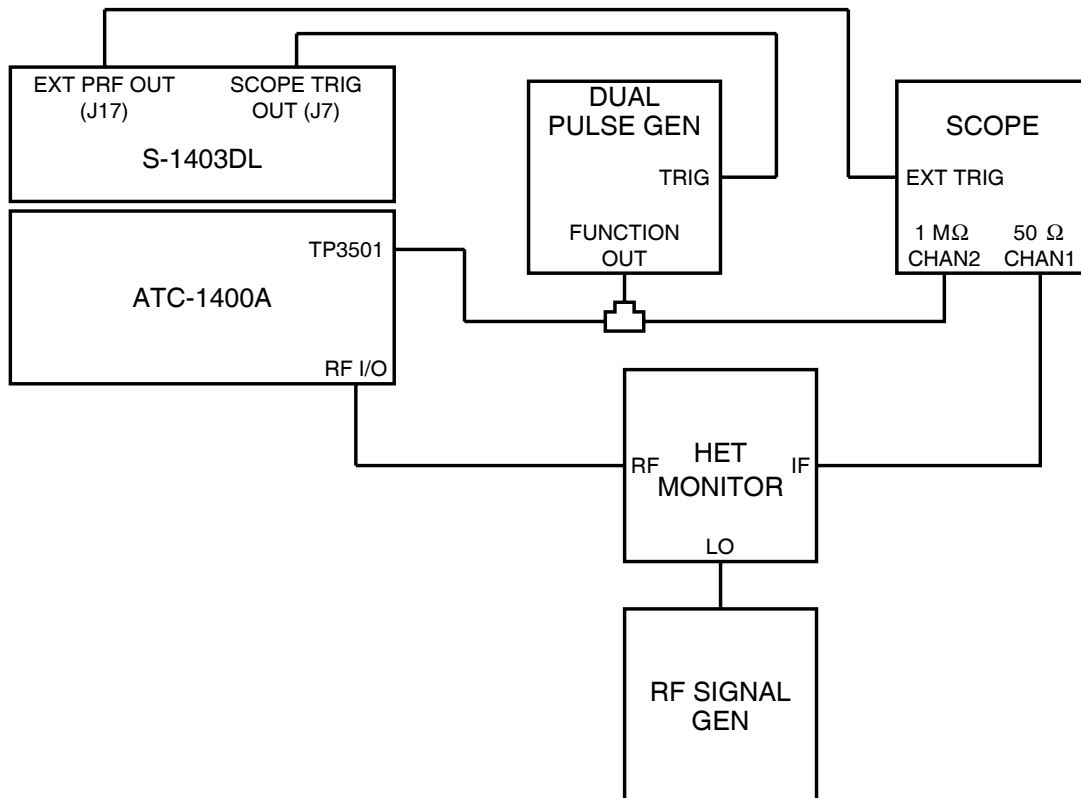
02403002

Installation Calibration Test Setup #2 Diagram
Figure 3

STEP	PROCEDURE	STEP	PROCEDURE
77.	Align 50% point of P ₁ (Ant A) leading edge with major vertical axis on Oscilloscope for reference.	81.	Use S-1403DL CURSOR Keys and SLEW Control to adjust AntB Pulse first (coarse ±50 ns increments) and second (fine +0.5 ns increments) fields until 50% point of P ₁ leading edge aligns with major vertical axis on Oscilloscope.
78.	Disconnect Heterodyne Monitor RF Connector from ATC-1400A RF I/O Connector.	82.	Adjust A2A1A2R9 on S-1403DL Diversity I/O PC Board Assembly for P ₁ pulse width of 800 ns (±10 ns).
79.	Disconnect S-1403DL AT31001 from TP31003.	83.	Use S-1403DL CURSOR Keys and SLEW Control to adjust AntB SPR first (coarse ±50 ns increments) and second (fine +1 ns increments) fields until P ₂ 50% point leading edge to SPR center point spacing is 2.75 μs (±1 ns).
80.	Connect Heterodyne Monitor RF Connector (through 10 dB Attenuator if MLD is installed) to S-1403DL TP31003.		

STEP	PROCEDURE
84.	Adjust S-1403DL A2A1A2R5 on Diversity I/O PC Board Assembly until spacing between SPR and next phase transition is 1.0 μ s (\pm 10 ns).
85.	Press S-1403DL 2ND, SAVE, 1 and ENTER Keys in sequence.
86.	Press S-1403DL POWER Switch OFF (O). After \approx 30 seconds, press POWER Switch ON (I).
87.	Press 2ND, RECALL and 1 Keys in sequence.
88.	Verify P ₂ to SPR is 2.75 μ s (\pm 25 ns).
89.	Remove power from Mode S Test System.
90.	Disconnect Heterodyne Monitor RF Connector (and 10 dB Attenuator, if applicable) from S-1403DL TP31003.
91.	Reconnect S-1403DL AT31001 to TP31003.

STEP	PROCEDURE
ANTENNA A REPLY DELAY	
NOTE: Top covers must be removed from the ATC-1400A (included in procedure) while still maintaining the connections with the S-1403DL to perform the reply delay calibration.	
92.	Connect Heterodyne Monitor RF Connector to ATC-1400A RF I/O Connector. Refer to Figure 4.
93.	Disconnect Oscilloscope EXT TRIG from S-1403DL SCOPE TRIG OUT Connector (J7).
94.	Connect Oscilloscope EXT TRIG to S-1403DL EXT PRF OUT Connector (J17). Refer to Figure 4.
95.	Connect S-1403DL SCOPE TRIG OUT Connector (J7) to Dual Pulse Generator TRIG input.

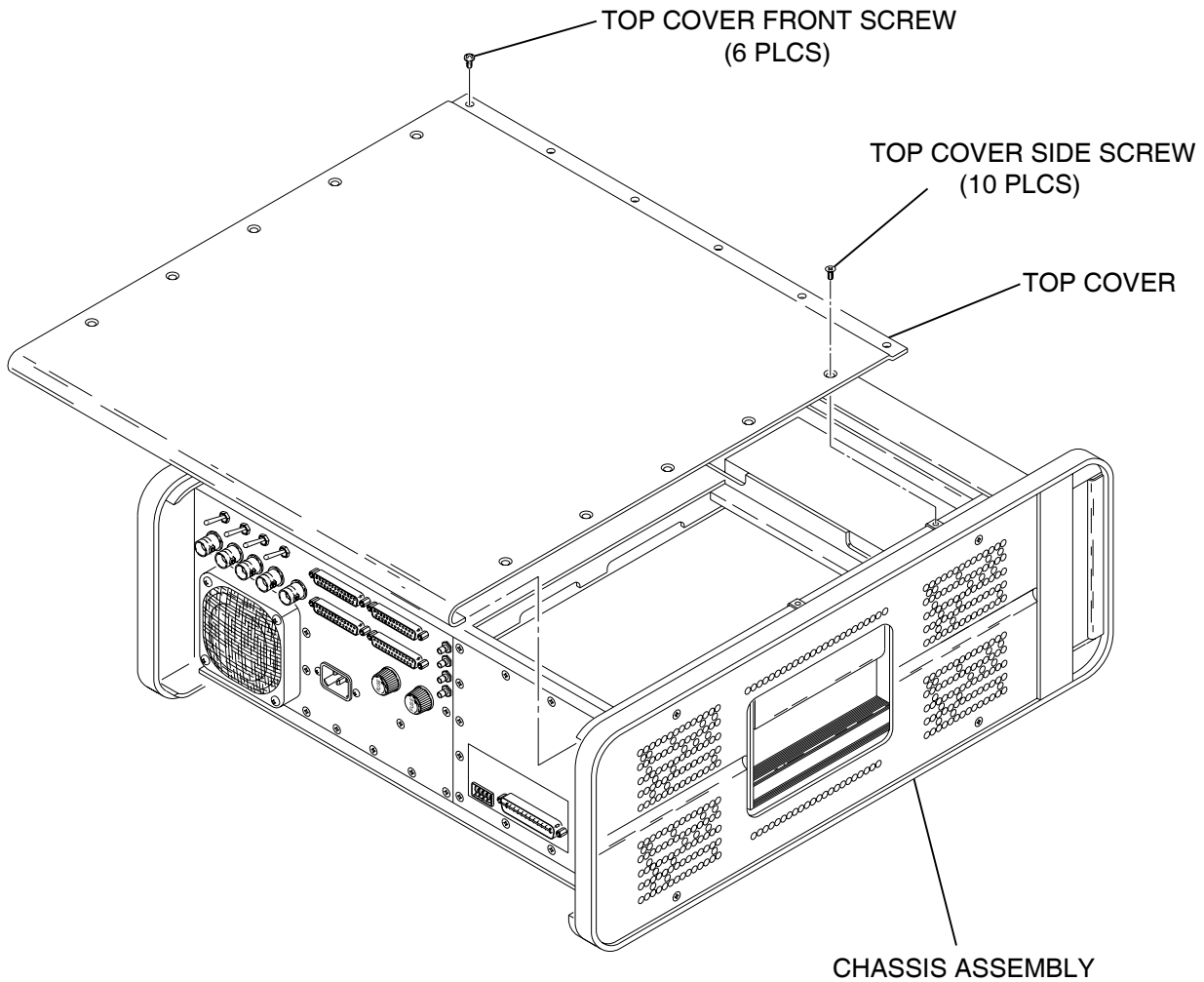


02403010

Installation Calibration Test Setup #3 Diagram
Figure 4

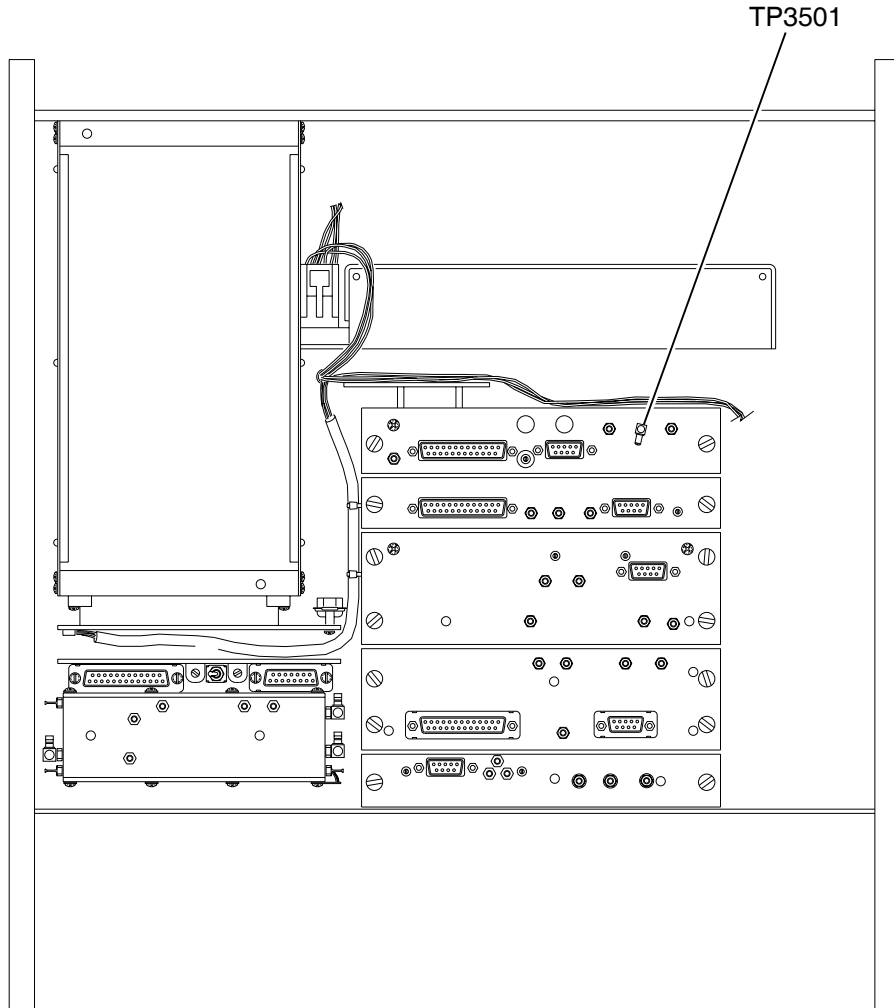
- | STEP | PROCEDURE |
|------|---|
| 96. | Refer to Figure 5 and remove top cover from ATC-1400A as follows: <ul style="list-style-type: none"> ● Remove six top cover front screws. ● Remove ten top cover side screws. ● Slide top cover to rear and off of Chassis Assembly. |
| 97. | Refer to Figure 6 and remove AT3501 termination from ATC-1400A TP3501. |

- | STEP | PROCEDURE |
|------|---|
| 98. | Connect Oscilloscope Channel 2 and Dual Pulse Generator Function Out to ATC-1400A TP3501. |
| 99. | Apply power to Mode S Test System. |
| 100. | Set RF Signal Generator output to +7 dBm with no modulation. |



7520035

ATC-1400A Top Cover Removal
Figure 5



7520033

ATC-1400A TP3501 Location
Figure 6



STEP PROCEDURE

101. Set Oscilloscope as follows:

CONTROL	SETTING
Mode	50 Ω DC/CHAN1, 1 MΩ DC/CHAN2
Volts/Div	20 mV/CHAN1, 100 mV/CHAN2
Sec/Div	50 μs
Trigger	Ext/Positive Slope

102. Set Dual Pulse Generator as follows:

CONTROL	SETTING
Function	Neg Pulse/Double
Frequency	≈100 kHz
Mode	Ext Trig
Pulse Delay (Spacing)	20.3 μs
Pulse Width	0.45 μs

103. Set ATC-1400A as follows:

CONTROL	SETTING
RF LEVEL Control	0 dBm
CW/NORM/OFF Switch	NORM
SUPPRESSOR ON/OFF Switch	OFF
SLS/ECHO ON/OFF Switch	OFF
XPDR PULSE WIDTH	
VAR/CAL Switch	CAL
MAN/AUTO/MAN STEP Switch	MAN
XPDR DEV P ₃ /CAL Switch	CAL
1.0 μs/1.45 μs Switch	1.0 μs
XPDR DEV P ₂ /CAL Switch	CAL
To/TAC/T _D Switch	To
PRF/SQTR ON/OFF Switch	ON
TACAN ON/OFF Switch	OFF
PRF/SQUITTER Thumbwheels	1000
F ₂ /P ₂ F ₁ /P ₁ Switch	F₁/P₁
DBL INTERR/INTRF	
Thumbwheels	000.0 OFF
FREQ/FUNCTION SELECT	
Thumbwheels	1030
	XPDR
ΔF Thumbwheels	OFF

104. Press S-1403DL C MENU, 7 and 2 Keys in sequence to enter C72 Setup Screen.

C72	SETUP - SCOPE TRIGGER
	ATC ModeS ACS ACL
Enable:ON	OFF OFF ON
Source:CAL 150	CAL 147 (in μs)

STEP PROCEDURE

105. Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set ACL Enable to **ON** and ACL Source to **147**.
106. Press S-1403DL C MENU, 1 and 0 Keys in sequence to enter Control Menu 10.

C10 f04:ACL (All Call Long)	Arf:+0.0
P4:CAL,Wd: CAL ,Dv: CAL	P3:CAL
	Dly=----- Sqtr=-----
AntA%:ATC= 0,S= 0	AntB%= 0 AntB:0.00

107. Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set function field to **f04**, Arf to **0.0**, P4 to **CAL**, P4 Wd: to **CAL**, P4 Dv: to **CAL**, P3 to **CAL** and AntB to **0.00**.
108. Adjust Oscilloscope to display the heterodyned interrogation and the simulated reply video.
109. Adjust Dual Pulse Generator output level until ATC-1400A XMTR PWR WATTS Display indicates ≈**500 W**.
110. Adjust Dual Pulse Generator frequency to set time from P₃ of the interrogation to F₁ of the reply, shown on the Oscilloscope, to ≈128 μs.

NOTE: It may be necessary to adjust C72 Setup Screen ACL Source field to obtain the desired delay.

111. Using Oscilloscope Δ time function, measure actual replay delay from the 50% point on P₃ leading edge in the interrogation to the 50% point on F₁ leading edge in the reply. Record as reference.
112. Press S-1403DL C MENU Key once and 9 Key twice in sequence to enter Calibration Password Screen.
113. Use S-1403DL Keyboard to enter Calibrations Password.

C99	CAL - PASSWORD
	PASSWORD:067215

STEP PROCEDURE

114. Press S-1403DL ENTER and 2 Keys in sequence to enter Reply Delay Calibration Screen.

C92	CAL - REPLY DELAY	
Ainterr/Areply:	-12.5nS	
Ainterr/Breply:	-987.5nS	MeasDelay:
Binterr/Breply:	+987.5nS	128.0125µS

115. Use S-1403DL CURSOR Keys and SLEW Control to adjust Ainterr/Areply field until MeasDelay reading equals reference recorded in Step 111.

ANTENNA A REPLY PULSE WIDTH

116. Adjust Oscilloscope to display only the simulated reply video.

117. Use Oscilloscope to measure actual width of first simulated reply video pulse F₁ from 50% point on leading edge to 50% point on trailing edge. Record as reference.

118. Press S-1403DL C MENU, 9 and 5 Keys in sequence to enter Reply Width Calibration Screen.

C95	CAL - REPLY WIDTH	
AntA:	+0.0nS	ATC F1 Width=
AntB:	-25.0nS	0.4625µS

119. Use S-1403DL CURSOR Keys and SLEW Control to adjust AntA field until ATC F1 Width reading equals reference recorded in Step 117.

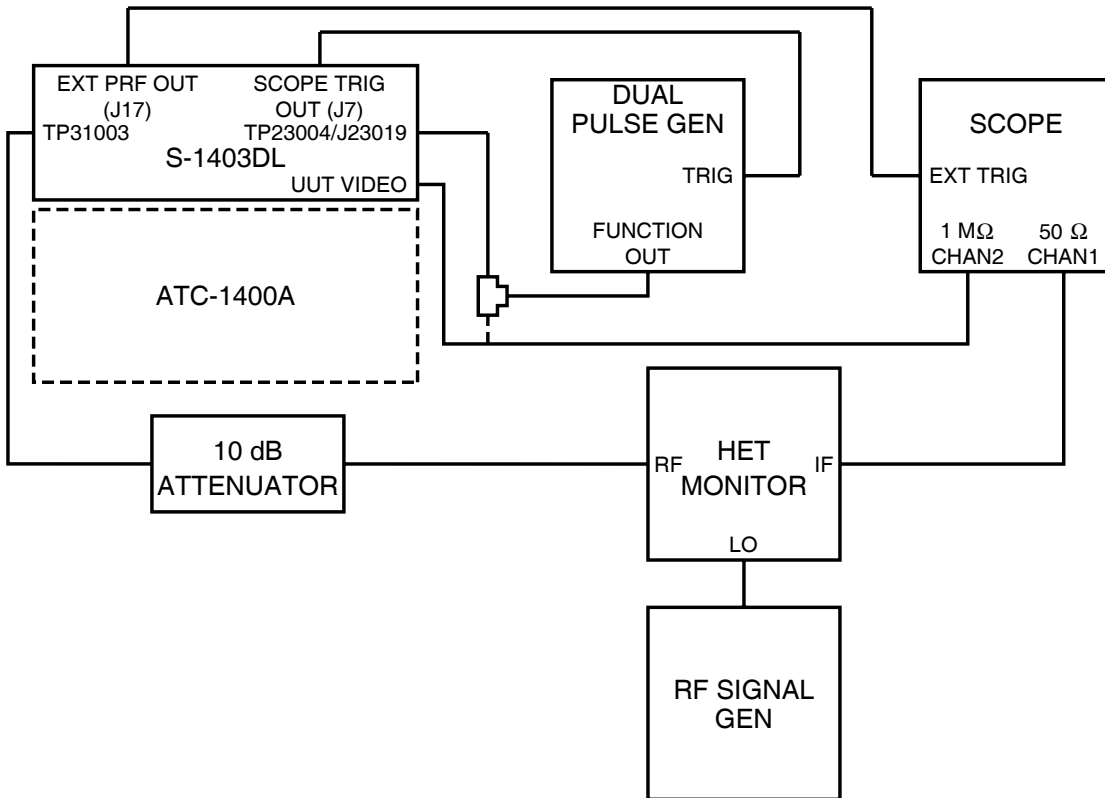
ANTENNA B REPLY DELAY

120. Disconnect Heterodyne Monitor RF Connector from ATC-1400A RF I/O Connector.

121. Disconnect Oscilloscope Channel 2 and Dual Pulse Generator Function Out from ATC-1400A TP3501.

122. Reconnect AT3501 termination to ATC-1400A TP3501.

STEP	PROCEDURE	STEP	PROCEDURE
123.	Connect Oscilloscope Channel 2 to S-1403DL UUT VIDEO Connector (J1). Refer to Figure 7.	127.	Adjust Oscilloscope to display the heterodyned interrogation and the simulated reply video.
124.	Refer to Figures 1 and 7. Connect Dual Pulse Generator Function Out through T-Connector to S-1403DL TP23004. If the Multi-Level Diversity option is installed: <ul style="list-style-type: none"> ● Disconnect coaxial cable from S-1403DL J23019. ● Connect Dual Pulse Generator Function Out through T-Connector to S-1403DL J23019. 	128.	Set Dual Pulse Generator for Positive Pulse/Double function and adjust output level until level at S-1403DL UUT VIDEO Connector (J1) is 400 mV _{P-P} as shown on Oscilloscope.
125.	Refer to Figure 1 and disconnect S-1403DL AT31001 from TP31003.	129.	Disconnect Oscilloscope Channel 2 from S-1403DL UUT VIDEO Connector (J1).
126.	Refer to Figures 1 and 7. Connect Heterodyne Monitor RF Connector (through 10 dB Attenuator if MLD is installed) to S-1403DL TP31003.	130.	Refer to Figure 7 and connect Oscilloscope Channel 2 to T-Connector with Dual Pulse Generator Function Out and S-1403DL TP23004/J23019.



02403011

Installation Calibration Test Setup #4 Diagram
Figure 7

STEP	PROCEDURE
------	-----------

131. Adjust Dual Pulse Generator frequency to set time from P₃ of the interrogation to F₁ of the reply, shown on the Oscilloscope, to ≈128 μs.

NOTE: It may be necessary to adjust C72 Setup Screen ACL Source field to obtain the desired delay.

132. Using Oscilloscope Δ time function, measure actual replay delay from the 50% point on P₃ leading edge in the interrogation to the 50% point on F₁ leading edge in the reply. Record as reference.

133. Use S-1403DL CURSOR Keys and SLEW Control to adjust Ainterr/Breply field until MeasDelay reading equals reference recorded in Step 132.

ANTENNA B REPLY PULSE WIDTH

134. Adjust Oscilloscope to display only the simulated reply video.

135. Use Oscilloscope to measure actual width of first simulated reply video pulse F₁ from 50% point on leading edge to 50% point on trailing edge. Record as reference.

136. Press S-1403DL C MENU, 9 and 5 Keys in sequence to enter Reply Width Calibration Screen.

137. Use S-1403DL CURSOR Keys and SLEW Control to adjust AntB field until ATC F1 Width reading is 25 ns greater than the reference recorded in Step 135.

PULSE WIDTH

138. Press S-1403DL C MENU, 8 and 4 Keys in sequence to enter the C84 System Screen.

C84 SYSTEM - IFR BUS
1400 Control: STAND-ALONE must power down
1403 Bus Address: 3 before settings take effect.

139. Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set 1400 Control to **STAND-ALONE**.

STEP	PROCEDURE
------	-----------

140. Press S-1403DL POWER Switch to **OFF (O)**.

141. Disconnect ATC-1400A from S-1403DL:

- Disconnect ATC-1400A AC INPUT Connector from S-1403DL 1400A POWER Connector.
- Disconnect ATC-1400A DABS INPUT Connector (J1) from S-1403DL DPSK OUT Connector (J15).
- Disconnect ATC-1400A EXTERNAL MEASUREMENT GATE Connector (J3) from S-1403DL PPMG Connector (J14).
- Disconnect ATC-1400A RF LEVEL INPUT Connector (J4) from S-1403DL RF LVL Connector (J13).
- Disconnect ATC-1400A AUXILIARY Connector (J6) from S-1403DL AUX BUS Connector (J10).
- Disconnect ATC-1400A IFR BUS Connector (J5) from S-1403DL IFR BUS Connector (J11).

142. Press S-1403DL POWER Switch to **ON (I)**.

143. Press S-1403DL C MENU, 7 and 1 Keys in sequence to enter the C71 Setup Screen.

C71 SETUP - INTERROGATION TRIGGER
TrigSource: TrigGen
TrigGen: 1000Hz

144. Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set TrigSource to **TrigGen** and TrigGen to **1000Hz**.

STEP	PROCEDURE
------	-----------

145. Press S-1403DL C MENU, 7 and 9 Keys in sequence to enter the C79 Setup Screen.

C79	SETUP - ATC1400A CONTROLS
ATCRBS:C	P123Wd: CAL
RF I/O:NORM	Mode:OFF
Scope :To	P2Dv: CAL
	P3Dv: CAL

146. Use S-1403DL CURSOR Keys, SLEW Control and Keyboard to set:

- ATCRBS to **C**.
- P123Wd to **CAL**.
- RF I/O to **NORM**.
- Mode to **OFF**.
- P2Dv to **CAL**.
- Scope to **To**.
- P3Dv to **CAL**.

147. Adjust Oscilloscope to display the heterodyned interrogation and the simulated reply video.

148. Adjust Dual Pulse Generator frequency to set time from P₃ of the interrogation to F₁ of the reply, shown on the Oscilloscope, to ≈128 μs.

NOTE: It may be necessary to adjust C72 Setup Screen ACL Source field to obtain the desired delay.

149. Using Oscilloscope Δ time function, measure actual replay delay from the 50% point on P₃ leading edge in the interrogation to the 50% point on F₁ leading edge in the reply. Record as reference.

150. Press S-1403DL C MENU Key once and 9 Key twice in sequence to enter Calibration Password Screen.

STEP	PROCEDURE
------	-----------

151. Use S-1403DL Keyboard to enter Calibrations Password.

C99	CAL - PASSWORD
	PASSWORD:067215

152. Press S-1403DL ENTER and 2 Keys in sequence to enter Reply Delay Calibration Screen.

153. Use S-1403DL CURSOR Keys and SLEW Control to adjust Binterr/Breply field until MeasDelay reading equals reference recorded in Step 149.

154. Remove power and disconnect test equipment.

155. Reconnect S-1403DL AT31001 to TP31003.

156. Refer to Figure 1 and install S-1403DL top cover as follows:

- Place S-1403DL top cover with mounting bracket on Chassis Assembly.
- Install 12 top cover screws and two bracket screws.

157. Refer to Figure 5 and reinstall ATC-1400A top cover as follows:

- Slide top cover to front and onto Chassis Assembly.
- Install ten top cover side screws.
- Install six top cover front screws.

TYPE	MODEL	SPECIFICATIONS
10 dB Attenuator	HP8491A or Equivalent	Frequency: dc to 12.4 GHz
Dual Pulse Generator	WAVETEK 145 or Equivalent	Frequency: 100 kHz Accuracy: $\pm 3\%$ Functions: Dual Pulse Rise and Fall Time: < 20 ns Pulse Width: 1 to 5 μ s Output Level: 0 to -500 mV Peak
Heterodyne Monitor	ANZAC MD-141 or Equivalent	
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: ± 0.7 of Time Interval $\pm 0.3\%$ of Full Scale
Power Meter	HP437B (with HP8481A Sensor) or Equivalent	Range: -25 to -15 dBm Accuracy: ± 0.05 dB
RF Signal Generator	HP8640B or Equivalent	Frequency: 1 to 1030 MHz Resolution: 0.1 to 100 Hz Accuracy: 2×10^{-6} RF Output: -130 to +13 dBm
Spectrum Analyzer	HP8569B or Equivalent	Range: 10 kHz to 2.6 GHz RBW: 300 Hz to 3.0 MHz Display (Log) Accuracy: $< \pm 0.1$ dB/dB $< \pm 1.5$ dB/70 dB Display (Lin) Accuracy: $< \pm 3\%$ of reference level over 8 division reflection

Test Equipment Requirements
Table 1

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As we are always seeking to improve our products, the information in this document gives only a general indication of the product capacity, performance and suitability, none of which shall form part of any contract. We reserve the right to make design changes without notice.

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The logo for AEROFLEX features a stylized 'A' with a blue triangle at its base, followed by the word 'AEROFLEX' in a bold, sans-serif font. The logo is positioned within a large, light blue curved shape that sweeps across the bottom right of the page.

Our passion for performance is defined by three attributes represented by these three icons: solution-minded, performance-driven, customer-focused.