ATC-600/A

TRANSPONDER and DME TEST SET

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TABLE OF CONTENTS

OPERATION

Page

SECTION I GENERAL DESCRIPTION AND SPECIFICATIONS

1-1 General Description 1-1

SPECIFICATIONS

1-7 Transponder Section 1-2
1-8 DME Section 1-4
1-9 General 1-5

SECTION II INSPECTION

2-1 Incoming Inspection 2-1
2-2 Grounding Requirements 2-1
2-3 Cleaning 2-1
2-4 Preliminary Inspection Procedures 2-2
2-5 Repacking for Shipping 2-3

SECTION III OPERATING PROCEDURES

3-1 Introduction 3-1
3-2 Controls, Connectors, Switches, and Indicators 3-1
3-3 Front Panel 3-1
1. XPDR % RPLY/DME PRF MTR 3-1
2. NO ALT Indicator 3-2
3. INVALID ALT Indicator 3-2
4. F2 Pulse Spacing Indicator 3-2
5. DME PRF Switch 3-2
6. IDENT Pulse Indicator 3-2
7. Numerical Readout 3-2
8. Binary Readout Indicators 3-2
9. FREQ/PWR Switch 3-3
10. FREQ/PWR Meter 3-3
11. XMTR FREQ Control 3-3
12. FREQ Gain Control 3-3
13. RF Input/Output Connector 3-3
14. DME 50% RPLY Switch 3-4
15. FAST SLEW Switch 3-4
16. VELOCITY IN/OUT Switch 3-4
17. DME RANGE/VELOCITY Switch 3-4
18. VELOCITY HI/LO Range Switch 3-4
19. SLOW SLEW Switch 3-4
20. Squitter On/OFF Switch 3-5
21. Mode Switch 3-5

		Page
	22. DME Channel Switch	3-5
	23. DME INDENT Tone Switch	3-6
	24. SLS Switch	3-6
	25. FRAMING Pulse Spacing Control	3-6
	26. Altitude ENCODER Input Connector	3-6
	27. Interrogation Spacing Control	3-6
	28. PWR AC/BAT Switch	3-7
	29. PWR Indicator	3-7
	30. BAT Test Switch	3-7
	31. SYS/LAMP Test Switch	3-7
3-4	Rear Panel	
	32. Detected RF Video Output Connector	3-8
	33. Diode Switch Input Signal Connector	3-8
	34. Sync Output Connector	3-8
	35. & 36. AC Power Connector & Fuse	3-8
3-5	Test Procedures	3-8
3-6	Transponder Operation Test Equipment Set-Up	3-8
3-7	Tests of Transponder Operation	3-9
3-7-1	Pilot's Code	3-9
3-7-2	Altitude Code	3-9
3-7-3	Peak Transponder Power	3-9
3-7-4	Transponder Frequency	3-10
3-7-5	Percent Reply	3-10
3-7-6	SLS Operation	3-10
3-7-7	IDENT (XPDR) Pulse Output	3-11
3-7-8	INVALID ALT Indicator	3-11
3-7-9	XPDR Receiver-Decoder Limits	3-11
3-7-10	Transponder Pulse Spacing	3-11
3-7-11	Receiver Sensitivity	3-11
3-8	Tests of DME Operation	3-12
3-8-1	Test Equipment Set-Up	3-12
3-8-2	DME Range or Distance Operation	3-12
3-8-3	DME Velocity Operation	3-12
3-9	DME Tests Common to Range and Velocity Operation	3-13
3-9-1	DME Transmitted PRF	3-13
3-9-2	Transmitter Peak Power and Frequency	3-13
3-9-3	Ident Tone	3-13
3-9-4	Percent Reply	3-13
3-9-5	Squitter Lock-Out	3-14
3-9-6	17Y Channel Operation	3-14
3-9-7	DME ILS Channel Operation	3-14
3-10	Encoding Altimeter Tests	3-14
3-10-1	Test Cable Wiring and Hook-Up	3-14
3-10-2	Altitude Display	3-14

Page

SECTION IV THEORY OF OPERATION

4-1	Introduction	4-1
4-2	Transponder Operation	4-1
4-2-1	SLS Circuits (ATC-600)	4-1
4-2-2	SLS Circuits (ATC-600A)	4-1
4-2-3	Interrogation	4-2
4-2-4	Reply	4-2
4-2-4-1	Clock Pulses	4-3
4-2-4-2	F1 Pulse	4-3
4-2-4-3	Altitude Code	4-3
4-2-4-4	Ident Pulse	4-4
4-2-4-5	NO ALT	4-4
4-2-4-6	INVALID ALT	4-4
4-2-4-7	Interrogation Spacing	4-4
4-2-4-8	Altitude ENCODER	4-5
4-2-4-9	1030 MHz Signal Leveling	4-5
4-3	DME Operation	4-5
4-3-1	Range	4-6
4-3-2	Velocity	4-6
4-3-3	50% Reply	4-7
4-3-4	Ident Tone	4-7
4-3-5	Squitter	4-8
4-3-6	DME PRF	4-8
4-4	Display Board	4-8
4-5	RF Section	4-9
4-6	Power Supply	4-10

LIST OF FIGURES AND TABLES

OPERATION

Page

SECTION III OPERATING PROCEDURES

Figure 3-0	DME Channel Switch	3-5
Table 3-1	DME Frequency/Spacing Assignments	3-5
Figure 3-1	ATC-600 Controls & Connectors	3-15
Figure 3-1-1	New Front Panel, ATC-600A	3-17
Figure 3-2	ATCRBS Interrogation Modes and Transponder Reply Codes	3-18
Figure 3-3	Power Transformer Lead Connections	3-19
Figure 3-4	Test Antenna Spacing	3-20
Figure 3-5	Encoder Connector Pin Assignments	3-21
Figure 3-6	Altitude Code for Mode C Reporting	3-22
Figure 3-7	Altitude Transmission Code Chart	3-23

SECTION IV THEORY OF OPERATION

Figure 4-1	XPDR Video Block Diagram	4-11
Figure 4-2	DME Signal Block Diagram	4-13
Figure 4-3	Display Block Diagram	4-15
Figure 4-4	RF Block Diagram	4-17
Figure 4-5	Blanking Circuits, Power Monitor, Modulator & Freq. Circuits	4-19
Figure 4-6	Power System Block Diagram	4-21

SECTION I

GENERAL DESCRIPTION AND SPECIFICATIONS

1-1. GENERAL DESCRIPTION. The ATC-600(A) is designed for ramp use and is capable of exacting functional test of aircraft transponder (XPDR) and distance measuring equipment (DME) systems. The test set contains built-in signal generators and modulators for XPDR and selected DME frequencies. Its radio frequency (RF) output is coupled to airborne equipment by a remote tripod mounted antenna system. Functional bench testing requires a 34 dB pad and a three foot coaxial cable between the test set and the unit under test.

1-2. The type of transponder interrogation desired is selected from Modes A/C ALT, A/C CODE, and A (Mode B on models before S/N 473 or by special order). The A/C ALT Mode displays the altitude code. The A/C CODE Mode displays the pilot's code. Code pulses and numerical readout are displayed simultaneously in all modes.

1-3. A FREQ/PWR Meter (Fig 3-1,10) indicates peak RF power and the transmitter frequency of the unit under test. The XPDR % RPLY/DME PRF MTR (Fig 3-1,1) indicates XPDR percent reply and DME interrogation pulse repetition frequency (PRF).

1-4. The Interrogation Spacing Control (Fig. 3-1,27) allows precise checking of the XPDR input pulse decoder gate. The FRAMING Pulse Spacing Control (Fig 3-1,25) allows checking of the F2 pulse width and its position relative to F1. The Front Panel Altitude ENCODER Input Connector (Fig. 3-1, 26) allows altitude display from an encoding altimeter without a transponder.

1-5. DME fixed range is variable from 0 to 399.0 NM, and velocity from 50 to 2400 knots. X Channel (108.00 or 108.10 MHz paired channel) and Y Channel (108.05 MHz paired channel) are provided.

1-6. A NICAD 2.0 AH battery permits ramp operation for over two hours. A built-in charger functions when the set is connected to an ac line.

1-7. TRANSPONDER SECTION

Signal Generator:	Output:	1030 MHz crystal controlled, ±0.006%.
	Level:	Variable from -66 dBm to -79 dBm (±1.5 dBm) with use of 34 dB pad.
	Test Antenna:	Remotely mounted coaxial antenna. VSWR at 1090 MHz. Antenna connector VSWR: 1.5:1 MAX. Antenna VSWR: 1.5:1 MAX.
Test Signals:	Interrogation Rate:	235 PPS PRF, ±10%
	Interrogation Modes:	A/C ALT and A/C CODE Modes (Mode A and Mode C, 2:1 interlace). Mode A Only (without interlace). Mode B Only standard on models before S/N 473. Available by special order S/N 474 on.
	Pulse Spacing:	Mode A 8μs, ±0.1μs Mode B 17μs, ±0.1μs Mode C 21μs, ±0.1μs (In A/C Modes)
	Variable Spacing:	P2 and P3 variable relative to P1 ±1μs, ±0.1μs
	SLS Test:	In the ATC-600(A) P2 is inserted 2μs, ±0.1μs, after P1. 0/OFF/-9 dB SLS Switch (Fig. 3-1-1) selection allows P2 amplitude equal to P1 and P3 (switch at 0); P2 amplitude 9 dB below P1 and P3 (switch at -9 dB), or OFF (switch center setting). Amplitude tolerance is ±1.0 dB. When the switch is in the OFF (center) position, P2 is not present. In the basic ATC-600 the SLS Switch (24, Fig. 3-1) has only the 0 and OFF selections. The same tolerance (±1.0 dB) applies.

Airborne Unit Test:	Percent Reply:	0-100%, either A/C or A(B) Modes.
	Pulse Spacing:	F_2 Pulse Spacing checked relative to F_1 ±0.5μs, ±0.05μs. F_2 Pulse Spacing Indicator (4) shows F_2 pulse limits.
	Transmitter (XMTR) Frequency:	Deviation from 1090 MHz measured +3 to -4 MHz, ±0.30 MHz. FREQ/PWR Meter (10) used as peak indicator. Deviation indicated on XMTR FREQ Control (11).
	XMTR Power:	10 W to 1.5 kW peak, ±20% at 500 W at 1090 MHz; direct with 34 dB pad. Accuracy typically ±3 dB at 500W with properly spaced test antenna.[1]
	Pilot's Code:	Indicated on Numerical Readout (7) 0000 to 7777. Pulse positions shown on Binary Readout Indicators.
	Encoding Altimeter Tests:	Direct connection via Altitude ENCODER Input Connector (26). Encoding altimeter must be powered by a source external to the ATC-600(A). ATC-600(A) circuit input impedance is 33K ohm.
	Altitude Code:	Indicated on Numerical Readout (7) from -1.0 to +126.7 thousand feet. The Binary Readout Indicators (8) simultaneously read the presence or absence of individual altitude pulses.

[1] See Paragraph 3-6 for proper aircraft antenna to remote test antenna spacing.

	(alt code cont'd)	The INVALID ALT Indicator (3) warns when an invalid altitude code is received. The NO ALT Indicator (2) shows when no altitude information is available.
	Indent Pulse:	IDENT Pulse Indicator (6) indicates the presence of Ident Pulse in reply.

1-8. DME SECTION

Signal Generator:	Output:	18X Channel: 979 MHz, ±0.006% (108.10 MHz paired channel). 17X Channel: 978 MHz, ±0.006% (108.0 MHz paired channel). 17Y Channel: 1104 MHz, ±0.006% (108.05 MHz paired channel).
	Level:	Approximately -45 dBm; direct with 34 dB pad or radiated from properly spaced test antenna.[1]
Test Signals:	Reply Pulses:	3.5 μs wide, ±0.5 μs
	Pulse Spacing:	X Channel: 12 μs, ±0.2 μs Y Channel: 30 μs, ±0.2 μs
	Range Reply:	Square RF pulses with range 0 to 399.0 NM, ±0.07 NM, ±0.02%. Range is manually selectable from 0 to 399.0 NM in increments of 1.0 NM using slew controls (15 & 19).
	Velocity Reply:	Crystal-controlled steps of 50, 75, 100, 150, 200, 300, 400, 600, 800, 1200, 1600, and 2400 knots, ±0.02% of setting.

[1] See Paragraph 3-6 for proper aircraft antenna to remote test antenna spacing.

	Velocity Characteristics:	Inbound or outbound from any selected range in increments of 0.025 NM (0.1 NM displayed).
	Squitter:	Frequency random, average 2700 PRF, ±50 Hz.
	Ident:	1350 Hz tone, ±8 Hz with equalizing pulses spaced 100 µs, ±10 µs.
	50% Reply:	50% of reply pulses will be detected.
Airborne Unit Test:	XMTR Frequency:	Deviations from 1041 MHz measured +4 to -3 MHz, ±0.30 MHz. FREQ/PWR Meter (10) used as peak indicator. Deviation is indicated on XMTR FREQ Control (11). Plus (+) and minus (-) signs are reversed for DME frequency checks.
	XMTR Power:	10 W to 1.5 kW peak, ±20% at 500 W at 1041 MHz; direct with 34 dB pad. Accuracy typically ±3 dB at 500 W with properly spaced test antenna.[1]
	PRF:	Track PRF measured 0-30 Hz, ±5% full scale. Search PRF measured 0-300 Hz, ±5% full scale.
1-9. GENERAL	Portable Operation:	A 2.0 AH NICAD battery permits about two hours continuous operation. A timer of approximately eight minutes is activated when the PWR AC/BAT Switch (28) is pressed down once. The set turns off when the timer runs out or when the switch is pressed down a second time. The battery is charged when the set is connected to an ac line.

[1]See Paragraph 3-6 for proper aircraft antenna to remote test antenna spacing.

AC Operation:	102 to 120 V ac, 220 to 250 V ac, 50 to 400 Hz, 20 Watts.
Physical Characteristics:	Weight: 18 pounds (8.18 Kg) Finish: Durable epoxy, scuff-resistant paint Size: Up to Serial No. 2159: 11.375" (28.893 cm) Wide; 5.125" (13.018 cm) High; 16.125" (40.95 cm) Deep. Serial No. 2160 and on: 11.5" (29.21 cm) Wide; 4.9" (12.45 cm) High; 16.25" (41.275 cm) Deep.

SECTION II

INSPECTION

2-1. INCOMING INSPECTION. Each IFR Precision Simulator is carefully inspected for mechanical and electrical quality before shipment from the factory. On receipt, the instrument should be physically free of mars and scratches, and in perfect mechanical and electrical order. The instrument should be inspected immediately for possible in-transit physical damage. A check for supplied accessories, and a test of the electrical performance of the instrument (as outlined in Section V of this manual) should also be made. Any damage or deficiency should be reported immediately to the carrier and a claim filed, if necessary. Refer to the LIMITED WARRANTY AND SERVICE INSTRUCTIONS of this manual for delineation of responsibilities and liabilities. Follow the directions in the LIMITED WARRANTY AND SERVICE INSTRUCTIONS when it becomes necessary to ship the instrument.

2-2. GROUNDING REQUIREMENTS. To protect operating personnel, the National Electrical Manufacturer's Association (NEMA) recommends that the instrument panel and cabinet be grounded. All IFR instruments are equipped with a three-conductor power cord which, when plugged into an appropriate receptacle, grounds the instrument. The offset pin on the power cord three-prong connector is the ground wire.

2-2-1. To preserve this protection feature when operating the instrument from a two-contact outlet, use a three-prong to two-prong adapter and connect the green pigtail on the adapter to ground.

2-3. CLEANING. It is wise to clean the dust, cobwebs, and other debris out of the test set prior to periodic inspection, repair or calibration. Some shops clean their test equipment on a regular basis such as biannual or annual proof-of-performance checks. Annual recalibration of the set is advisable.

2-3-1. Dust removal is best done with a hand controlled dry air jet of 25 to 50 psi (1.827 kg/cm^2 to 3.653 kg/cm^2). The Rear Panel should be cleaned with a dry cloth only. The Front Panel may be cleaned whenever necessary with a lint-free cloth moistened with rubbing alcohol.

2-3-2. CARE MUST BE TAKEN TO AVOID BREAKING WIRES OR SHORTING COMPONENT LEADS TOGETHER DURING CLEANING.

2-4. PRELIMINARY INSPECTION PROCEDURES. Preliminary inspection is necessary to determine the general condition of the test set. It has been determined through hard experience that deliberate moving, however slight, of the discrete components on the various PC Boards and other assemblies often causes unnecessary circuit problems and can quickly change simple problems into complex ones. Therefore, IFR recommends ONLY A VISUAL INSPECTION without touching the components. Test set owners and operators should be aware that ANY opening of the instrument casing can result in calibration deviations. Complex modules, such as RF modules, should NOT be opened during Preliminary Inspection.

2-4-1. Procedures:

A. Chassis. Inspect the chassis for tightness of sub-assemblies, damaged chassis-mounted connectors, and corrosion or damage to the metal surfaces. Surface damage may indicate further damage to parts in the area.

B. Capacitors. Inspect all readily available capacitors for loose mounting, deformities or obvious physical damage, and leakage or corrosion around the leads.

C. Connectors. Examine all readily available coax connectors for loose or broken parts, cracked insulation, and bad contacts. DO NOT disassemble connectors within the test set.

D. Potentiometer Controls. Any Front Panel potentiometer control that feels rough when rotated should be checked with an ohmmeter for proper operation.

E. Resistors. Inspect all readily available resistors for cracked, broken, charred, or blistered bodies and loose or corroded soldering connections.

F. Printed Circuit (PC) Boards. (Readily available PC Boards only). Check the connectors and mating plugs for corrosion and damage. Inspect all mounted components, including crystals and IC's, for damage. The PC Boards should be free of all foreign material.

G. Semiconductors. Inspect all readily available diodes, rectifiers, and transistors for cracked, broken, charred, or discolored bodies. Check the ends of the components to see that the seals around the leads are in place and in good condition.

H. Switches. Examine all readily available toggle switches for loose levers, terminals, and switch body connection to frame. The line switch contacts should not be bent or the switch action too loose.

I. Transformer. Inspect the transformer for signs of excessive heating, broken or charred insulation, and loose mounting hardware.

J. Wiring. Inspect all the wiring of the chassis for broken or loose ends and connections and for proper dress relative to other chassis parts. All the laced wiring should be tight with the ends securely tied.

2-5. REPACKING FOR SHIPPING. The LIMITED WARRANTY AND SERVICE INSTRUCTIONS contain detailed directions for repacking and shipping. Additional questions may be directed to the IFR Shipping Department.

NOTE

Any instrument shipped to IFR for any reason MUST be tagged with (1) its owner's identification, (2) the service or repair required, (3) its model number, and (4) its full serial number. Identify the instrument by prefix, model, and serial number in ALL correspondence.

2-5-1. IFR Precision Simulators should be shipped ONLY in their original containers. If the original container is not available, contact IFR for shipping instructions.

2-5-2. DO NOT return an instrument or its component parts to IFR without first receiving authorization from the IFR Customer Service Department. Refer to the LIMITED WARRANTY AND SERVICE INSTRUCTIONS for complete directions.

SECTION III

OPERATING PROCEDURES

3-1. INTRODUCTION. The ATC-600(A) is a Precision Simulator that enables one person to functionally test airborne XPDR and DME units without removing them from the aircraft or altering them in any other way. All necessary pulse generators and RF sources are contained in the test set. No additional auxiliary equipment should be required. A remote test antenna does all coupling to the airborne equipment.

3-2. CONTROLS, CONNECTORS, SWITCHES, AND INDICATORS. The location of all panel controls, connectors, switches, and indicators on the ATC-600 are shown in Figure 3-1. Switch and control improvements made on the ATC-600(A) are pointed out in Figure 3-1-1. The number preceding each control name in the following paragraphs and following the name in parentheses throughout the manual locates the control in Figure 3-1. For example, "FAST SLEW Switch (15)" identifies the FAST SLEW Switch as item 15 in Figure 3-1. Controls and switches found in Figure 3-1-1 are specifically identified as such. Example: 0/OFF/-9 dB SLS Switch (Fig. 3-1-1). Information supplied pertains to both the basic ATC-600 and the ATC-600(A) unless otherwise specified.

3-3. FRONT PANEL

1. XPDR % RPLY/DME PRF MTR. The XPDR % RPLY/DME PRF MTR indicates the percent reply of the transponder in the mode of operation selected when the Mode Switch (21) is in a transponder mode (A/C ALT, A/C CODE, or A Modes - B Mode in models before S/N 473 or specially modified models).

NOTE

The ATC-600(A) interrogation Pulse Repetition Frequency (PRF) is fixed at 235 pps. In the A/C ALT and A/C CODE Modes, the A mode pulses are interlaced with the C mode pulses in a 2:1 ratio. The interrogation rate for the A mode pulses of either A/C Mode interlace is about 156.6 pps. For the C mode pulses, the interrogation rate is about 78.3 pps. The A and C mode pulses combine for a total PRF of 235 pps, ±10%. The interrogation rate in Mode A or Mode B operation (non-interlace) is 235 pps.

In DME Mode (DME setting of the Mode Switch) the XPDR % RPLY/DME PRF MTR indicates the PRF of the DME under test. The DME PRF Switch (5) selects the full scale range of the XPDR % RPLY DME PRF MTR as 0-30 or 0-300 PRF. The 0-30 range is used for track rates, and the 0-300 range for search rates.

2. NO ALT Indicator. A lighted NO ALT Indicator shows the no altitude pulses are present between F1 and F2 of the transponder's altitude reply.

3. INVALID ALT Indicator. A lighted INVALID ALT Indicator shows when a received altitude code has an unassigned combination of codes. It does not necessary indicate the wrong altitude is being received. The conditions to VALID altitude information are: the presence of at least one of the C pulses (C1, C2, and C4) and never C1 and C4 on at the same time.

4. F2 Pulse Spacing Indicator. The F2 Pulse Spacing Indicator is used in transponder modes (A/C ALT, A/C CODE, and A or B Mode) in conjunction with the FRAMING Pulse Spacing Control (25). The indicator is on when the FRAMING Pulse Spacing Control is positioned to a time where no part of the F2 pulse is present. If the control is at or near zero and the F2 Pulse Spacing Indicator is on, the second framing pulse in the transponder reply is improperly spaced, too narrow for normal operation, or absent altogether. Generally, if F2 is out of position, all other reply pulses between F1 and F2 will be skewed out of position.

5. DME PRF Switch. The DME PRF Switch selects the full scale range of the XPDR % RPLY/DME PRF MTR (1) as 0-30 or 0-300 PRF in DME Mode for DME interrogation PRF. The 0-30 range is used for track rates. The 0-300 range is used for search rates.

6. IDENT Pulse Indicator. The IDENT Pulse Indicator is active in transponder modes only (A/C ALT, A/C CODE, and A or B Mode). When lighted, it indicates that the Ident Pulse (SPI) is present in the reply. The Ident Pulse is added by pressing the Ident button on the transponder control head. When the test set is in A/C ALT Mode, the Ident Pulse is paired with the D4 pulse.

7. Numerical Readout. In transponder operation, the Numerical Readout shows the pilot's code (as set into the control head) in A/C CODE Mode and indicates altitude from -1.0 thousand to +126.7 thousand feet in A/C ALT Mode. When an encoding altimeter is connected to the Front Panel Altitude ENCODER Input Connector (26) the altitude of the encoding altimeter is displayed on the Numerical Readout.

8. Binary Readout Indicators. The Binary Readout Indicators are active only in the transponder modes (A/C ALT, A/C CODE, Mode A or B). In A/C ALT Mode, the Binary Readout Indicators light to show which pulses are activating the Numerical Readout (7). Note that

the altitude code (A/C ALT Mode) is not binary, but a Gray Daytex Code. In A/C CODE, Mode A, or Mode B, the indicators light to show the pilot's code (set into the transponder control head) in binary form. The Binary Readout Indicators are inactive in DME Mode.

9. FREQ/PWR Switch. The FREQ/PWR Switch is a two position switch that selects the function of the FREQ/PWR Meter (10).

10. FREQ/PWR Meter. The FREQ/PWR Meter is active in both transponder and DME operation. Its function is decided by the FREQ/PWR Switch (9). In PWR, the meter indicates Peak Power from 0 to 1.5 kW (if the test antenna spacing from the aircraft is correct, or if a 34 dB pad is used). In FREQ, the meter is used to indicate the frequency deviation of the unit under test from the desired frequency.

11. XMTR FREQ Control. The XMTR FREQ Control is used to tune the RF section of the ATC-600(A) for a maximum deflection of the FREQ/PWR Meter (10) needle. In transponder modes (A/C ALT, A/C CODE, Mode A or B), the frequency deviation (from 1090 Hz) of the unit under test is read directly from the XMTR FREQ Control dial in MHz. Similarly, in DME Mode the deviation is read from 1041 MHz in MHz. However, the plus (+) and minus (-) signs of the control dial are reversed in DME operation. In DME use, the positive values are to the left of zero, and the negative values to the right. This phenomenon occurs because 1041 MHz is on the opposite side of the internal 1065.5 MHz local oscillator from 1090 MHz.

12. FREQ Gain Control. The FREQ Gain Control regulates the amount of current to the FREQ PWR Meter (10) to enable both weak and powerful signals to indicate nearly equally for optimum measurement.

13. RF Input/Output Connector. The remote test antenna, located near the aircraft antenna, is attached to the ATC-600(A) through the RF Input/Output Connector (ANTENNA on the Front Panel). A transponder or DME can connect to the test set without the test antenna by using a 34 dB pad and a three foot length of coax cable. Total desired attenuation of an input signal is 34 dB from the aircraft antenna to the connector. This figure includes space loss, antenna efficiency, and coax loss.

14. DME 50% RPLY Switch. Fifty percent of the replies to a DME under test are deleted on a 50-50 basis when the DME 50% RPLY Switch is depressed.

15. FAST SLEW Switch. The FAST SLEW Switch shows the DME replied distance or range approximately ten times faster than the SLOW SLEW Switch (19). Range can be slewed inbound or outbound, from 0 to 399.0 NM in 1.0 NM steps.

16. VELOCITY IN/OUT Switch. The VELOCITY IN/OUT Switch selects the direction of the replied range in VELOCITY Mode, either towards the ground station (IN) or away from it (OUT).

NOTE

When the inbound range reaches 0.0 NM, the range will instantly change to 399.9 NM and continue inbound. The inverse is true of the outbound range, i.e., the range will instantly change from 399.9 NM to 0.0 NM.

17. DME RANGE/VELOCITY Switch. The DME RANGE/VELOCITY Switch selects the DME Mode of operation as RANGE or VELOCITY. RANGE Mode yields fixed range replies. The starting range is set with the SLEW Switches (15 and 19) in both the RANGE and VELOCITY Modes. Each DME RANGE/VELOCITY Switch (17) VELOCITY setting has two crystal-controlled steps (50/75, 100/150, etc). The VELOCITY HI/LO Range Switch (18) determines which of the two values is selected in VELOCITY Mode.

NOTE

The two SLEW Switches (15 and 19) operate in VELOCITY Mode in acutal system range increments of about 0.025 NM. However, the velocity range change is displayed on the Numerical Readout (7) in 1.0 NM steps only.

18. VELOCITY HI/LO Range Switch. In VELOCITY Mode, the VELOCITY HI/LO Range Switch determines which of the two crystal-controlled increments (50/75, 100/150, etc.) of each DME RANGE/VELOCITY Switch (17) VELOCITY setting is implemented. When the VELOCITY HI/LO Range Switch is in HI, the greater of the two values is implemented. When the VELOCITY HI/LO Range Switch is in LO, the lower value is implemented.

19. SLOW SLEW Switch. The SLOW SLEW Switch slews the DME replied distance or range approximately ten times slower than the FAST SLEW Switch (15). Range can be slewed inbound or outbound, from 0 to 399.0 NM in 1.0 NM steps.

20. Squitter ON/OFF Switch. The squitter ON/OFF switch turns the squitter on or off in DME operation. The squitter on the ATC-600(A) is fixed to an average of 2700 PRF, at a completely random rate. The rate is governed by a noise generator and a servo loop control circuit.

21. Mode Switch. The Mode Switch setting determines in which DME or transponder (A/C ALT, A/C CODE, Mode A or B) mode the ATC-600(A) will operate. In the transponder modes, either the pilot's code (A/C CODE, Mode A or B) or the altitude code (A/C ALT) may be displayed on the Numerical Readout (7). In the transponder interrogation modes A/C ALT and A/C CODE, mode A and Mode C pulses are interlaced in a 2:1 ratio. In the "A" Mode Switch setting, only Mode A pulses are present. Similarly, in the Mode B (Standard on models before S/N 473; available by special order S/N 474 on) setting, only Mode B pulses are present. The DME RANGE/VELOCITY Switch (17) determines whether the Range or the Velocity operation of DME Mode is active when the Mode Switch is at DME. All functions of the ATC-600(A) are internally switched between transponder and DME operation.

22. DME Channel Switch (X/Y Channel Switch). In DME operation, the DME Channel Switch selects one of three DME channels. The switch controls the reply frequency and pulse spacing. The switch also selects the proper spacing for the interrogation pulse decoder. (The X/Y Channel Switch, in models without 18X Channel capability, selects 17X or 17Y Channel reply pulse spacing and frequency). Table 3-1 defines the frequency and spacing assignments for the three DME test channels.

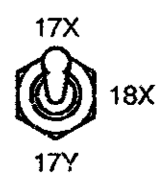


Fig. 3-0 DME Channel Switch

CHANNEL	VOR-PAIRED FREQUENCY	GND to AIR		AIR to GND	
		FREQ	SPACING	FREQ	SPACING
17X	108.00 MHz	978 MHz	12 μs	1041 MHz	12 μs
18X	108.10 MHz	979 MHz	12 μs	1042 MHz	12 μs
17Y	108.05 MHz	1104 MHz	30 μs	1041 MHz	36 μs

Table 3-1. DME Frequency/Spacing Assignments

23. DME IDENT Tone Switch. When activated, the DME IDENT Tone Switch inserts a 1350 Hz DME IDENT Tone on the modulated RF output. The Ident Tone includes all equalizing pulses for an Ident PRF of 2700 pps. While the Ident Tone is inserted, all reply and squitter pulses are deleted.

24. SLS Switch. The SLS Switch inserts P2 into the transponder interrogation pulse train at same amplitude as P1, causing the transponder to stop at least 90% of all reply pulses.

O/OFF/-9 dB SLS Switch (Fig. 3-1-1). FAR rulings (Issued December 1973, Effective January 1, 1976) added a check for -9 dB SLS operation to certification requirements for transponders. The O/OFF/-9 dB SLS Switch on the ATC-600(A) meets these new requirements. In the center (off) position, P1 and P3 of the transponder interrogation are transmitted. In the 0 dB position, P2 is added at the same level as P1. In the -9 dB position, P2 is added at -9 dB amplitude relative to P1.

25. FRAMING Pulse Spacing Control. The FRAMING Pulse Spacing Control checks the position and width of the F2 pulse. The control is rotated in both directions, during transponder reception, until the F2 Pulse Spacing Indicator (4) comes on, indicating the exact leading and trailing edge times of the F2 pulse. The approximate width of the F2 pulse equals the difference between the lowest and highest FRAMING Pulse Spacing Control settings at which the F2 Pulse Spacing Indicator (4) starts illuminating.

26. Altitude ENCODER Input Connector. The output of an encoding altimeter is tested by directly connecting the altimeter output to the ATC-600(A) through the Altitude ENCODER Input Connector. Appropriate patch cables will have to be constructed for each type of altimeter tested. The Mode Switch (21) must be in A/C ALT position for altimeter testing. Input pulses must be as per ARINC 532D (Figure 3-6).

NOTE

> The Altitude Pulse Position Assignment Chart in ARINC 532D has about seven typographical errors. The Encoder Connector Pin Assignments Chart (Figure 3-5) must be used to eliminate those errors.

27. Interrogation Spacing Control. The ATC-600(A) operates in three transponder interrogation modes. A/C ALT and A/C CODE are interlace modes (Mode A and Mode C pulses in a 2:1 ratio). Mode A is a noninterlace mode standard on models S/N 474 and on. B noninterlace mode was standard on models before S/N 473 and is available by special order. A, B, and C (in A/C interlace only) Modes have P1 and P3 spacings of 8, 17, and 21 μs respectively. P1 and P2 spacing is constant at 2 μs. The Interrogation Spacing Control moves P2 and P3 ±1.0 μs relative to P1. The P2 and P3 spacing remains constant. (Refer to Figure 3-2).

28. PWR AC/BAT Switch. When the PWR AC/BAT Switch is in the up (AC) position, the ATC-600(A) will operate from ac power. If the switch is pressed down (BAT) once (a momentary position), it turns the battery power on through a timer of approximately eight minutes. A 2.0 AH NICAD battery permits about two hours continuous operation. The set turns off when the timer runs out or when the PWR AC/BAT Switch is pressed down a second time.

29. PWR Indicator. The PWR Indicator lights when the ATC-600(A) is powered up, whether from an ac or a battery source.

30. BAT Test Switch. When the BAT Test Switch is depressed, the XPDR % RPLY /DME PRF MTR (1) is used to monitor battery voltage. The left edge of the white band on the meter indicates 12.1 V or discharge condition. A fully charged battery will indicate well inside the white band. If battery power is below 12.1 V, the battery timer will immediately switch the set off. The battery is charged when the set is connected to an ac line.

31. SYS/LAMP Test Switch. The SYS/LAMP Test Switch is a three position, center OFF switch. When the switch is in the lower position (LAMP), all the Binary Readout Indicators (8) on the Front Panel should light. When the switch is in the upper (SYS) position, the internal circuits are checked in the transponder modes (A/C ALT, A/C CODE, A or B Mode). If the Mode Switch (21) is in A/C ALT Mode, the Numerical Readout (7) should display 126.7 thousand feet. When the Mode Switch (21) is in A/C CODE, the Numerical Readout (7) should show 0042. Any other Numerical Readout (7) displays with the above Mode Switch (21) settings indicate internal malfunctions. The F2 Pulse Spacing Indicator (4) and the C4 and D2 indicators (8) should be lighted when the SYS/LAMP Test Switch is in the upper (SYS) position.

XPDR SIG Level Control (Fig. 3-1-1). FAR rulings (Issued December 1973, Effective January 1, 1976) have added a check for receiver sensitivity to the certification requirements for transponders. The XPDR SIG Level Control is designed to meet these new standards. The control varies the output signal level at the receiver antenna from -66 to -79 dBm (± 1.5 dBm). The level is valid with either the remote test antenna or a 34 dB pad in bench testing.

3-4. REAR PANEL

32. Detected RF Video Output Connector. The detected RF Video from the unit under test to the ATC-600(A) may be monitored with a high impedance probe at the test set's Detected RF Video Output Connecotr. No 50 ohm termination is necessary.

33. Diode Switch Input Signal Connector. All ATC-600(A) modulator pulses fed to the internal diode switch are also applied to the Diode Switch Input Signal Connector. These pulses may be monitored with a high impedance probe at the connector. No 50 ohm termination is necessary.

34. Sync Output Connector. During transponder operation a positive going TTL level pulse is applied to the Sync Output Connector. This pulse should be coincident with the leading edge of P1 of the transponder interrogation. The pulse may be monitored with a high impedance probe at the connector.

35 & 36. AC Power Connector and Fuse. AC Power to the test set is applied throught the AC Power Connector (36). Input maybe 115 Vac or 230 Vac, depending on the external wiring of the power transformer (as per Figure 3-3). The Fuse (35) is a type 3AG of 1A MDL rating.

3-5. TEST PROCEDURES. The ATC-600(A) was designed for simplicity of operation and maximum efficiency. No external test equipment is required except the remote test antenna and its tripod. The following procedures are intended to provide information necessary to effectively operate the ATC-600(A) as a testing instrument. Variations of the procedures may be made to suit different situations. These procedures involve ramp testing. Bench testing is identical except that the unit under test is connected to the test set through a 34 dB pad and suitable coax cables. Refer to sections 3-3 and 3-4 for detailed control function description.

3-6. TRANSPONDER OPERATION TEST EQUIPMENT SET-UP.

1. First set up the tripod and remote test antenna. Adjust the test antenna height (tripod height) to be equal to that of the aircraft transponder antenna. The bearing between the antennas is not critical. The test antenna is usually positioned for convenience.

2. Horizontally place the test antenna the distance from the aircraft antenna indicated on the test antenna's coax cable, approximately 21 inches (53.34 cm).

3. Next, route the loose end of the coax cable into the aircraft via a vent window, door, or other opening. All ramp testing with the ATC-600(A) is accomplished from the cockpit, once the remote antenna is positioned.

CAUTION

Never place the remote test antenna closer than 15 inches (38.1 cm) to the aircraft antenna while the ATC-600(A) power is on. DAMAGE TO THE TEST SET WILL RESULT.

3-7. TESTS OF TRANSPONDER OPERATION. The ATC-600(A) will test or verify (1) the Pilot's Code, (2) the Altitude Code, (3) Peak Transponder Power, (4) Transponder Frequency, (5) Percent Reply, (6) SLS Operation, (7) Ident (XPDR) Pulse Output, (8) INVALID ALT Indication, (9) Transponder Receiver-Decoder Limits, (10) Transponder Pulse Spacing, and (11) Receiver Sensitivity.

3-7-1. Pilot's Code. Put the ATC-600(A) into battery operation by pressing the PWR AC/BAT Switch (28) down once to BAT. Plug the remote test antenna coax cable into the RF Input/Output Connector (13). Position the Mode Switch (21) to A/C CODE. Power up the aircraft transponder and allow it to run in "standby" for a few minutes. Place the transponder control head in A/C Mode. Set any pilot's code into the control head. The ATC-600(A) Numerical Readout (7) should show the pilot's code, and the Binary Readout Indicators (8) should indicate the pulses that are stimulating the code display. As many codes as desired may be tested in this manner.

3-7-2. Altitude Code. Set the ATC-600(A) Mode Switch (21) to A/C ALT. The Numerical Readout (7) should indicate the output of the encoding altimeter in thousands of feet, if the Baro knob on the encoding altimeter is set to 29.92 inches (76.0 cm) Hg. The Binary Readout Indicators (8) should indicate the Gray Daytex Code stimulating the Numerical Readout (7) display.

NOTE

The encoding altimeter code output is not effected by changing the Baro knob setting and always indicates altitude referenced to 29.92 inches (76.0 cm) Hg.

3-7-3. Peak Transponder Power. With the ATC-600(A) set up to interrogate the transponder, set the FREQ/PWR Switch (9) to PWR. If the remote test antenna was carefully set up (Paragraph 3-6), the FREQ/PWR Meter (10) should indicate the peak transmitting power of the transponder.

3-7-4. Transponder Frequency. Set the ATC-600(A) FREQ/PWR Switch (9) to FREQ. Set the pilot's code into the transponder control head at 0000, and remove all altitude code pulses. Adjust the ATC-600(A) FREQ Gain Control (12) for a mid-scale FREQ/PWR Meter (10) indication. Rotate the XMTR FREQ Control (11) for a peak FREQ/PWR Meter (10) indication. At the peak, read the deviation in MHz from 1090 MHz directly from the XMTR FREQ Control (11) dial.

NOTE

In measuring transponder frequency, the pilot's code of the transponder is set to 0000, and the altitude pulses are removed in order to eliminate unnecessary responses on the ATC-600(A) FREQ/PWR Meter (10). If all information pulses were present, the XMTR FREQ Control (11) would cause the FREQ/PWR Meter (10) to peak every 0.69 MHz, as would a spectrum analyzer. So, in order to reduce the spectrum, eliminate as many information pulses as possible to find what is the primary response on the dial.

3-7-5. Percent Reply. The XPDR % RPLY/DME PRF MTR (1) indicates the percent reply of the transponder to interrogations from the ATC-600(A). The meter should indicate 100% reply under most normal operating conditions.

3-7-6. SLS Operation. Set the Mode Switch (21) to either A/C ALT or A/C CODE Mode for SLS Tests. Using the XPDR SIG Level Control (Figure 3-1-1), set the output RF level to 3 dB above minimum trigger level (MTL). (See Paragraph 3-7-11).

NOTE

If the transponder's sensitivity is near the insensitive limit, it may be necessary to move the antennas closer together in order to get 3 dB above MTL. At the closer than normal antenna spacing, re-establish the dial setting for MTL and adjust the dial 3 dB above MTL.

CAUTION

Never move the remote test antenna closer than 15 inches (38.1 cm) to the aircraft antenna while the test set's power is turned on. DAMAGE TO THE TEST SET WILL RESULT.

When the ATC-600(A) 0/OFF/-9 dB SLS Switch (Figure 3-1-1) is set in the 0 dB (up) position, the transponder should not exceed three replies per second (FAA Spec). When the switch is set at -9 dB (down), the transponder should reply at a minimum of 90%, or 211 replies per second (FAA) on the XPDR % RPLY/DME PRF MTR (1). At 0 dB, both the Numerical Readout (7) and the Binary Readout Indicators (8) will blank out in either the A/C ALT or A/C CODE Modes and both meters should drop to zero.

On the basic ATC-600, the SLS Switch (24) has only the 0 dB and OFF selections. When the ATC-600 SLS Switch is depressed, the transponder should not exceed three replies per second (FAA). There is no signal level control on the basic ATC-600.

Refer to FAR 43, Appendix F, (B), (1) and (2).

3-7-7. IDENT (XPDR) Pulse Output. The IDENT Pulse Indicator (6) will show the presence or absence of the Ident Pulse generated by the transponder. The IDENT Pulse Indicator (6) will light for the duration of the time that the Ident Pulse is added to the output, usually about thirty seconds.

3-7-8. INVALID ALT Indicator. The INVALID ALT Indicator (3) shows the reception of an unassigned combination of altitude codes. This does not necessarily mean that an incorrect altitude MEASUREMENT is being sent, only that the wrong altitude CODE is being received. VALID altitude information is shown by the presence of at least one of the "C" pulses, but never C_1 and C_4 at the same time.

3-7-9. XPDR Receiver-Decoder Limits. By varying the Interrogation Spacing Control (27) setting in both directions from zero, the transponder decoder input limits may be checked. As the limits are exceeded, the XPDR % RPLY/DME PRF MTR (1) indication will drop and eventually fall to zero. Normally, the Interrogation Spacing Control (27) is set at zero.

3-7-10. Transponder Pulse Spacing. If the F_2 Pulse Spacing Indicator (4) is lighted, the F_2 pulse of the reply is either missing or is improperly spaced. The position and approximate width of F_2 is determined by varying the FRAMING Pulse Spacing Control (25). As the control is rotated to the left or right of zero until the F_2 Pulse Spacing Indicator (4) lights, the knob calibrations in microseconds show the leading and trailing edges of F_2, respectively. The difference between the readings is the approximate width of F_2. This test is useful because when F_2 is displaced, the other reply pulses will be skewed out of position proportionally.

3-7-11. Receiver Sensitivity. Set up the remote test antenna as specified in Paragraph 3-6. Set the Mode Switch (21) to A/C CODE Mode. With the XPDR SIG Level Control (Figure 3-1-1) fully counterclockwise, verify that the percent reply shown on the XPDR % RPLY/DME PRF MTR (1) is 100%.

Rotate the XPDR SIG Level Control (Figure 3-1-1) clockwise until the XPDR % RPLY/DME PRF MTR (1) indicates 90% reply. Note the reading on the XPDR SIG Level Control (Figure 3-1-1) scale. This is the minimum trigger level (MTL) of the transponder in -dBm. For all transponders this MTL should be from -69 dBm to -77 dBm (±1.5 dBm) with a 34 dB pad. When using portable test equipment, an additional 3 dBm tolerance is allowed. Refer to FAR, Part 43, Appendix F, (2), (C), (1).

Move the ATC-600(A) Mode Switch (21) to A/C ALT and perform the tests outlined above. Note the MTL reading. According to FAR 43, receiver sensitivity between Modes A/C CODE and A/C ALT should not have a difference greater than 1.0 dBm. Return the XPDR SIG Control (Figure 3-1-1) to the full counterclockwise position.

3-8. TESTS OF DME OPERATION. DME tests are divided between checking distance accuracy and checking velocity accuracy. In addition to basic range and velocity tests, other DME characteristics common to both modes of operation are tested, including DME Transmitted PRF, Transmitter Peak Power and Frequency, Ident Tone, Percent Reply, Squitter Lock-Out, and Y Channel Operation.

3-8-1. Test Equipment Set-Up. The remote test antenna set-up and test coax cable routing are described in Paragraph 3-6. OBSERVE THE PRECAUTION ABOUT CLOSE ANTENNA SPACING. Care in proper remote test antenna to aircraft antenna spacing will give the most accurate power readings.

3-8-2. DME Range or Distance Operation. Press the PWR AC/BAT Switch (28) down once to BAT. Connect the remote test antenna to the test set. Power up the airborne DME and allow it to operate for a few minutes before testing. Put the DME into a Distance Display Mode in any desired range scale. Set the DME frequency at 108.00. After a brief warm-up, begin tests by placing the ATC-600(A) Mode Switch (21) on the DME Setting. Set the DME RANGE/VELOCITY Switch (17) on RANGE. Set the DME Channel Switch (22) on 17X, and the Squitter ON/OFF Switch (20) on SQTR. Operate the FAST and SLOW SLEW Switches (15 and 19) IN or OUT to obtain a desired distance in nautical miles. The DME should lock-on to the ATC-600(A) at the precise range programmed. Any number of different distances from 0 to 399 nmi may be similarly checked in one nautical mile increments.

3-8-3. DME Velocity Operation. Set the ATC-600(A) and airborne DME controls as in Paragraph 3-8-2 above. However, set the DME to display Velocity; and set the ATC-600(A) DME RANGE/VELOCITY Switch (17) to any desired VELOCITY setting. Use the VELOCITY HI/LO Range Switch (18) to choose one of the two values of the VELOCITY setting. Use the FAST and SLOW SLEW Switches (15 and 19) to set any desired starting range; and use the VELOCITY IN/OUT Switch (16) to track the distance toward or away from the ground station. The DME should lock-on to the ATC-600(A) and display the correct velocity. If the DME is set to display distance in nautical miles, the distance should equal the instantaneous range indicated in the ATC-600(A) displays on the Numerical Readout (7) in 0.1 NM. Distance should be tracking inbound or outbound as set with the VELOCITY IN/OUT Switch (16). Any number of velocities and instantaneous distances may be similarly checked.

3-9. DME TESTS COMMON TO RANGE AND VELOCITY OPERATION.

3-9-1. DME Transmitted PRF. Set the ATC-600(A) DME PRF Switch (5) to 0-30 while the DME is locked-on to any range or velocity. The XPDR % RPLY/DME PRF MTR (1) will indicate Track PRF. Unlock the DME by channeling the frequency or changing the ATC-600(A) distance setting. Move the DME PRF Switch (5) to 0-300. While the DME searches for a new lock-on, the XPDR % RPLY/DME PRF MTR (1) should indicate Search PRF.

NOTE

Unlocking the DME by changing the ATC-600(A) range setting by 30 to 50 Miles (48.28 to 80.47 km) is also a good way to check DME "memory time". When the range is slewed, the DME will hold the last displayed range for a certain time (usually around 8 to 10 seconds) before unlocking and searching.

3-9-2. Transmitter Peak Power and Frequency. Set the ATC-600(A) FREQ/PWR Switch (9) on PWR, while the DME is operating into the test set. The RF peak power will appear on the FREQ/PWR Meter (10) in kW. The DME is a crystal-controlled device. Reading the transmitter frequency confirms that the DME is on the correct channel but does not test crystal tolerance. To check crystal tolerance, set the FREQ/PWR Switch (9) on FREQ, adjust the FREQ GAIN Control (12) for a mid-scale deflection of the FREQ/PWR Meter (10), and adjust the XMTR FREQ Control (11) for a peak FREQ/PWR Meter (10) reading.

NOTE

The plus (+) and minus (-) signs on the XMTR FREQ Control (11) dial are reversed in DME Operation. (See Paragraph 3-3-11).

3-9-3. Ident Tone. The DME IDENT Tone Switch (23) of the basic ATC-600 and the IDENT (up) position of the ATC-600(A) IDENT/50% RPLY Switch (Figure 3-1-1) serve the same function. When the DME IDENT Tone Switch (23) is depressed or the IDENT/50% RPLY Switch (Figure 3-1-1) is flipped to the IDENT (up) position, the Ident Tone is added. A rough 1350 Hz tone should be heard through the audio system. Adding the Ident Tone can also be a good check of memory time, as the tone supersedes all range and squitter pulses.

3-9-4. Percent Reply. The DME 50% RPLY Switch (14) of the basic ATC-600 and the 50% RPLY (down) position of the ATC-600(A) IDENT/50% RPLY Switch (Figure 3-1-1) serve the same function. Depressing the DME 50% RPLY Switch (14) or throwing the IDENT/50% RPLY Switch (Figure 3-1-1) to 50% RPLY (down) should delete half of all replies to the DME on a 50-50 basis. Deleting half of the replies to the DME checks the ability of the DME to lock-on or to track under poor signal conditions.

3-9-5. Squitter Lock-Out. Turn the Squitter ON/OFF Switch (20) to OFF, slew the Range to any desired position. Set the DME frequency for the appropriate channel (108.00 for 17X Channel, 108.10 for 18X Channel, 108.05 for 17Y Channel). Check that after memory time the DME drops out and does not search. Most DME's are equipped with a squitter lock-out circuit to prevent searching until the squitter is received. Placing the Squitter ON/OFF Switch (20) in SQTR should cause the DME to begin searching.

3-9-6. 17Y Channel Operation. If the DME is equipped for Y Channels (50 kHz spacing on the DME frequency control), set the DME frequency to 108.05 and the ATC-600(A) DME Channel Switch (22) on 17Y. Repeat all tests and functions in Paragraph 3-9 through 3-9-5 in 17Y Channel.

3-9-7. DME ILS Channel Operation. If the DME is capable of operating on ILS assigned channels, set the aircraft frequency control to 108.10 and set the ATC-600(A) DME Channel Switch to 18X. Repeat the tests outlined in paragraphs 3-9 through 3-9-5 of the ATC-600(A) Manual.

NOTE

> The nominal transmitter frequency control reading will be -1 (not 0). Refer to paragraph 3-3-11 of the ATC-600(A) manual. The DME transmitter frequency will increment by 1 MHz when channeled from 108.00 to 108.10. The ATC-600(A) frequency meter does not change its nominal (zero) point when the DME Channel Switch is adjusted.

3-10. ENCODING ALTIMETER TESTS. An encoding altimeter may be directly connected to the test set through a suitable test cable and the ATC-600(A) Altitude ENCODER Input Connector (26). Such a hook-up allows testing of altitude code information. Connection should be made according to Paragraph 3-10-1.

3-10-1. Test Cable Wiring And Hook-Up. Suitable test cables will have to be constructed for each different type of altimeter tested. The cables should be wired as per Figure 3-5. Open circuit voltage on Pins 1 thru 12 (except 10) is 5 Volts dc. Input impedance is 33 k ohms. To gain correct altitude information transfer while testing, information lines must be pulled to ground (Pin 13) or within 1.0 Volt of ground. Maximum allowable altimeter leakage current is 50.0 μ Amps. The altimeter strobe input must be grounded, and Pins 14 and 15 of the ATC-600(A) Altitude ENCODER Input Connector (26) must be jumpered for proper readings during encoding altimeter tests.

3-10-2. Altitude Display. The ATC-600(A) will display altitude information from -1.0 to +126.7 thousand feet on the Numerical Readout (7). The Binary Readout Indicators (8) show causal pulse position forms. Figure 3-6 illustrates altitude code information.

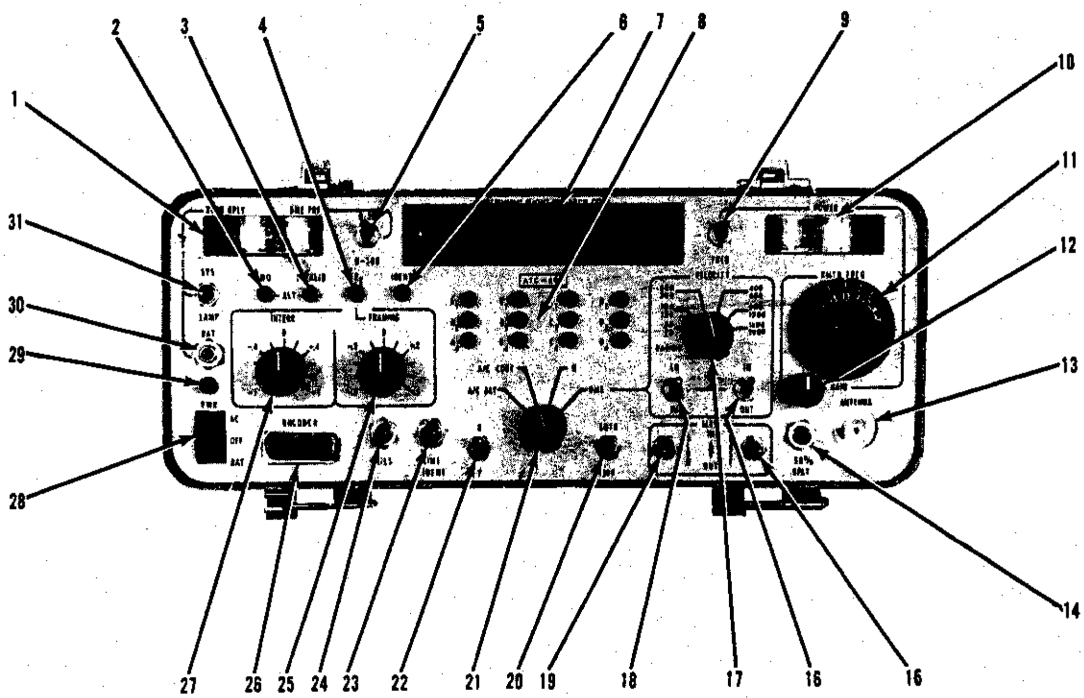
NOTE

The encoding altimeter signal common must be connected to the ATC-600(A) chassis ground. The dc power supply to the altimeter must come from a source external to the ATC-600(A). DC power ground and signal ground must be common to Pin 13 of the Altitude ENCODER Input Connector (26). Check the altimeter specifications to be sure that the altimeter will not be damaged by current on the information lines due to the ATC-600(A) +5 Volts dc through the 33 k ohms circuit input impedance.

NOTE

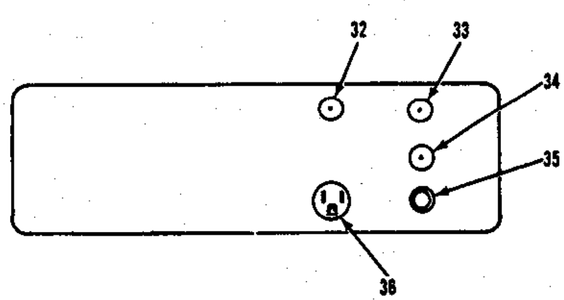
The input impedance at Plug 10 in ATC-600(A) models S/N 101 to 175 is 22 k ohms. Models S/N 175 to 445 have a 100 k ohms input impedance. Those sets after S/N 445 have a 33 k ohms input impedance.

Fig 3-1



FRONT PANEL ATC-600

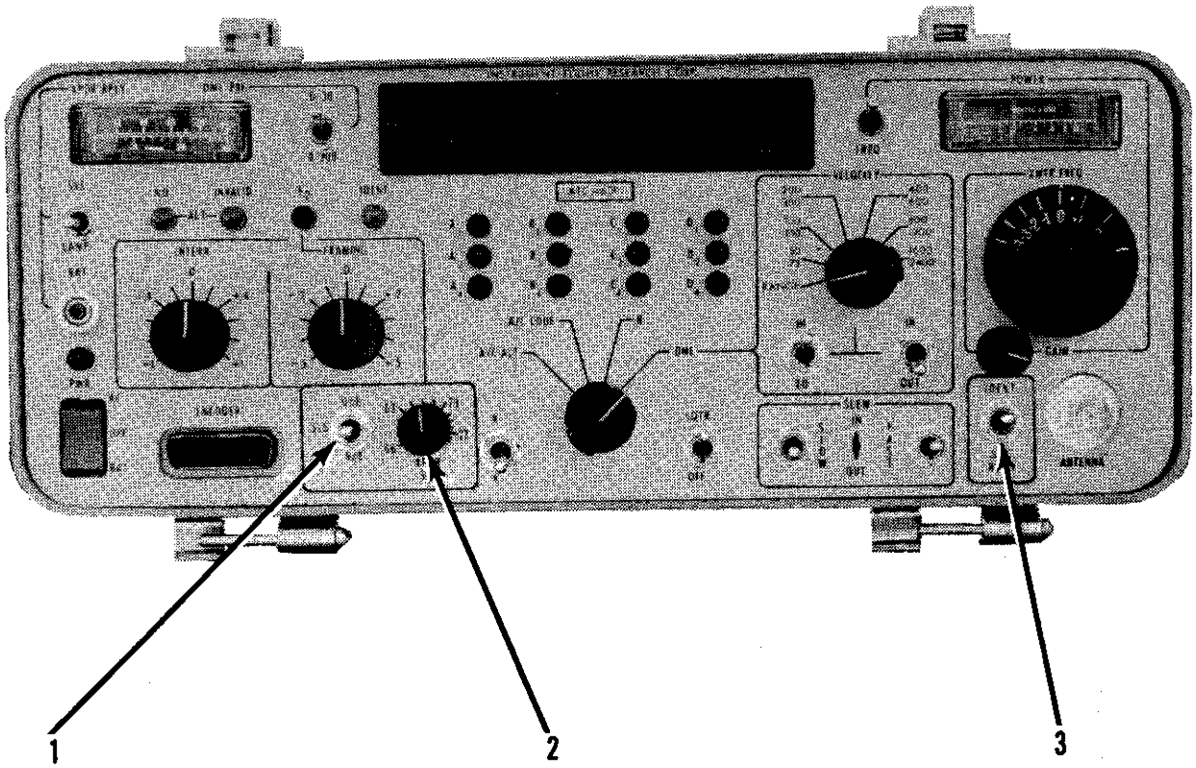
1. XPDR % RPLY/DME PRF MTR
2. NO ALT Indicator
3. INVALID ALT Indicator
4. F_2 Pulse Spacing Indicator
5. DME PRF Switch
6. IDENT Pulse Indicator
7. Numerical Readout
8. Binary Readout Indicators
9. FREQ/PWR Switch
10. FREQ/PWR Meter
11. XMTR FREQ Control
12. FREQ GAIN Control
13. RF Input/Output Connector
14. DME 50% RPLY Switch
15. FAST SLEW Switch
16. VELOCITY IN/OUT Switch
17. DME RANGE/VELOCITY Switch
18. VELOCITY HI/LO Range Switch
19. SLOW SLEW Switch
20. Squitter On/OFF Switch
21. Mode Switch
22. X/Y Channel Switch
23. DME IDENT Tone Switch
24. SLS Switch
25. FRAMING Pulse Spacing Control
26. Altitude ENCODER Input Connector
27. Interrogation Spacing Control
28. PWR A/C BAT Switch
29. PWR Indicator
30. BAT Test Switch
31. SYS/LAMP Test Switch



REAR PANEL

32. Detected RF Video Output Connector
33. Diode Switch Input Signal Connector
34. Sync Output Connector
35. Fuse
36. AC Power Connector

ATC-600 Controls and Connectors



NEW FRONT PANEL
ATC-600A

1. 0/OFF/-9 dB SLS Switch
2. XPDR SIG Control
3. IDENT/50% RPLY Switch

Fig. 3-1-1

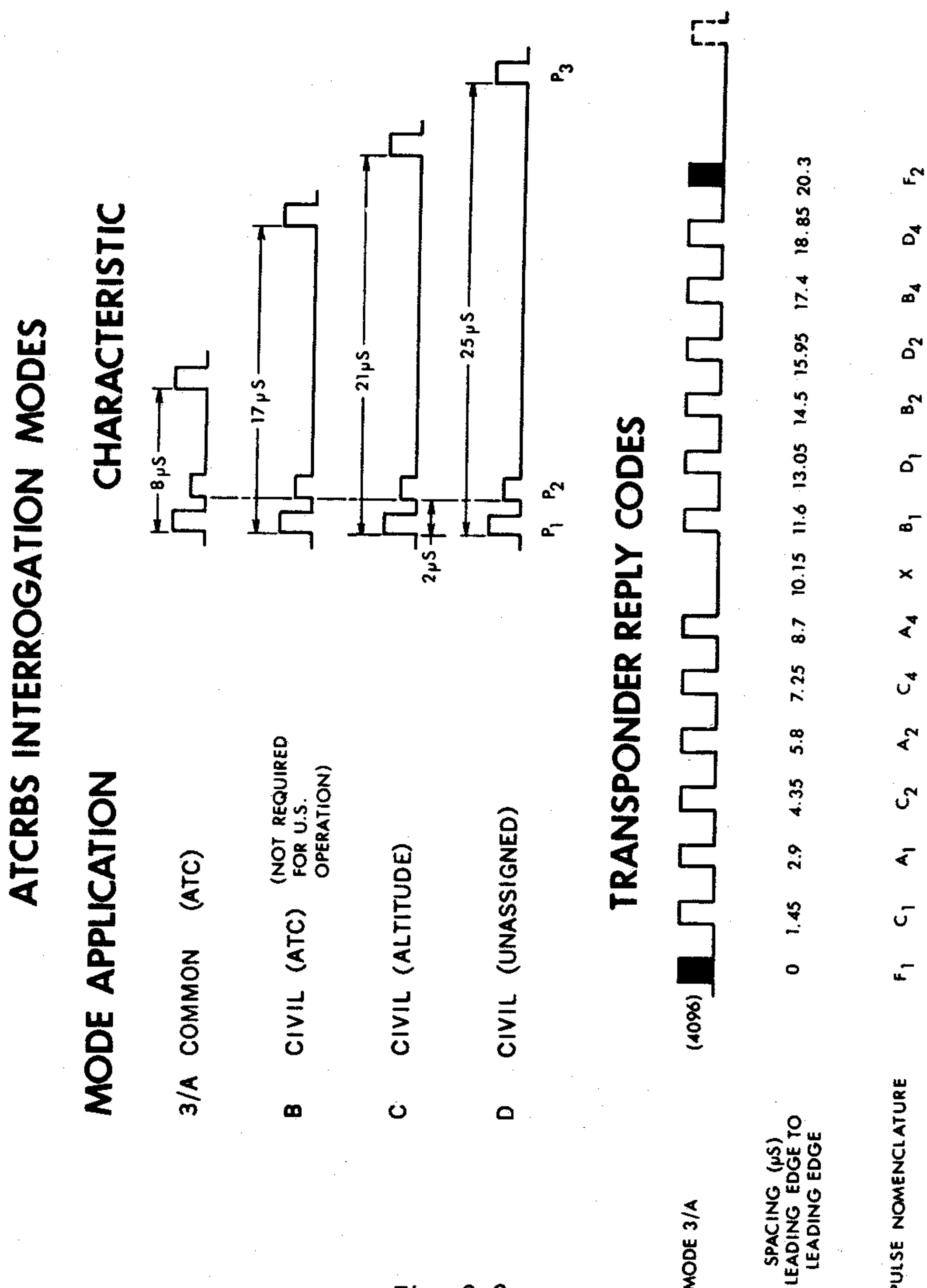
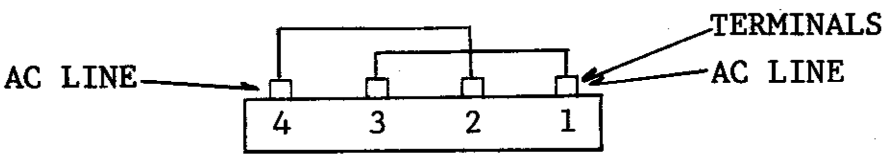


Fig. 3-2

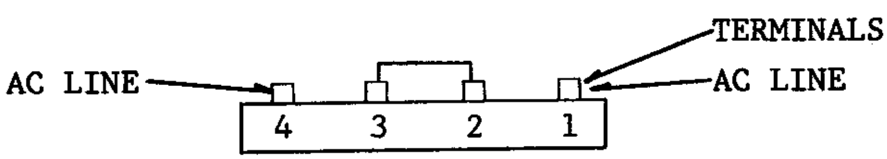
ATCRBS INTERROGATION MODES AND TRANSPONDER REPLY CODES

FOR 115 VAC INPUT OPERATION CONNECT POWER TRANSFORMER LEADS AS FOLLOWS:



Jumper 1 to 3, 2 to 4.

FOR 230 VAC INPUT OPERATION CONNECT POWER TRANSFORMER LEADS AS FOLLOWS:



Jumper 2 to 3.

Fig. 3-3

POWER TRANSFORMER LEAD CONNECTIONS

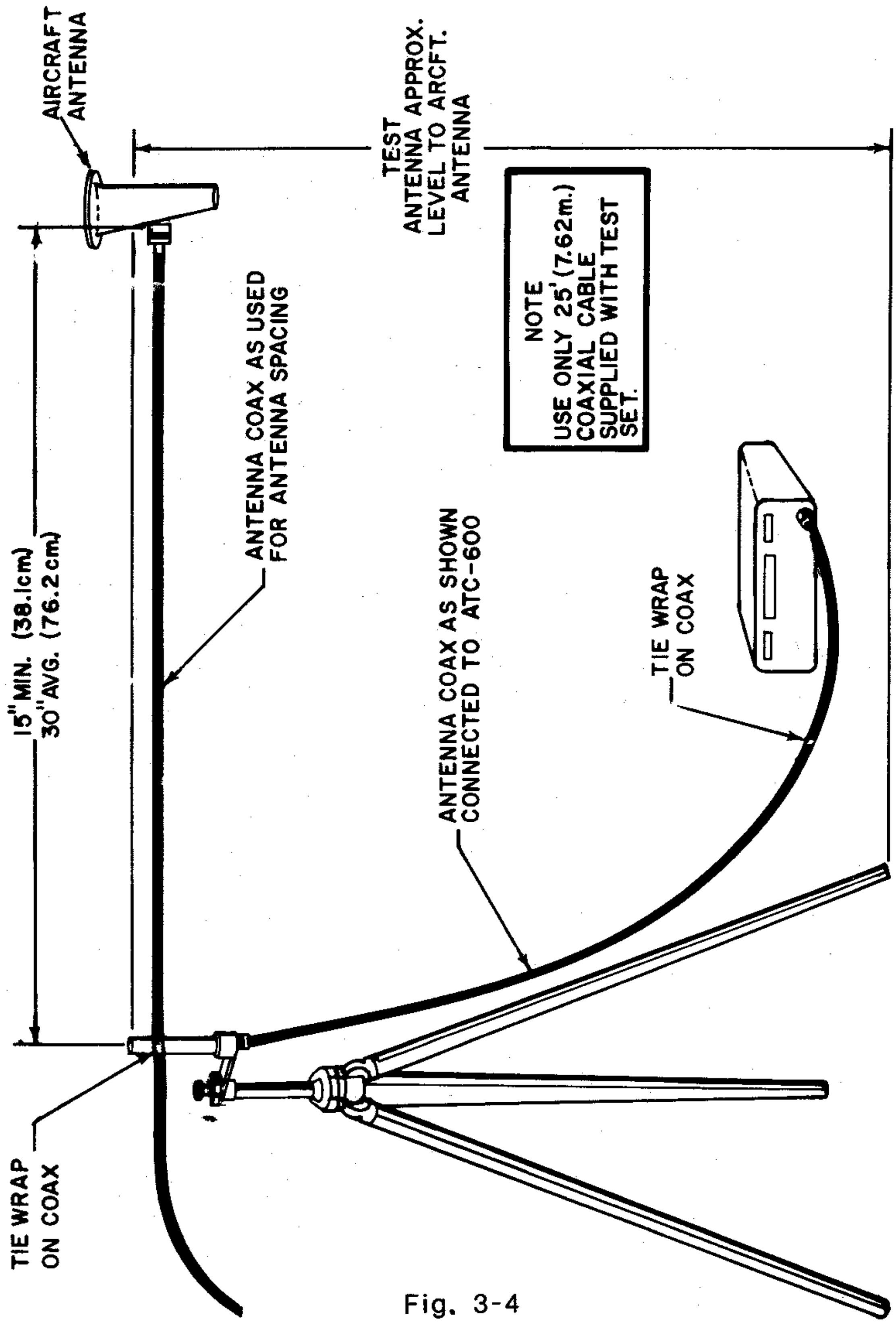


Fig. 3-4

TEST ANTENNA SPACING

Encoder Connector
Pin Assignments

Pin	Function
1.	A1
2.	A2
3.	A4
4.	B1
5.	B2
6.	B4
7.	C1
8.	C2
9.	C4
10.	Blank
11.	D2
12.	D4
13.	Gnd (Common)
14.	+5V
15.	Test Input

Connect a jumper between pin 14 and 15 on the encoder plug.

Fig. 3-5

TABLE

UNIT DISTANCE REFLECTED BINARY CODE FOR 8 BITS

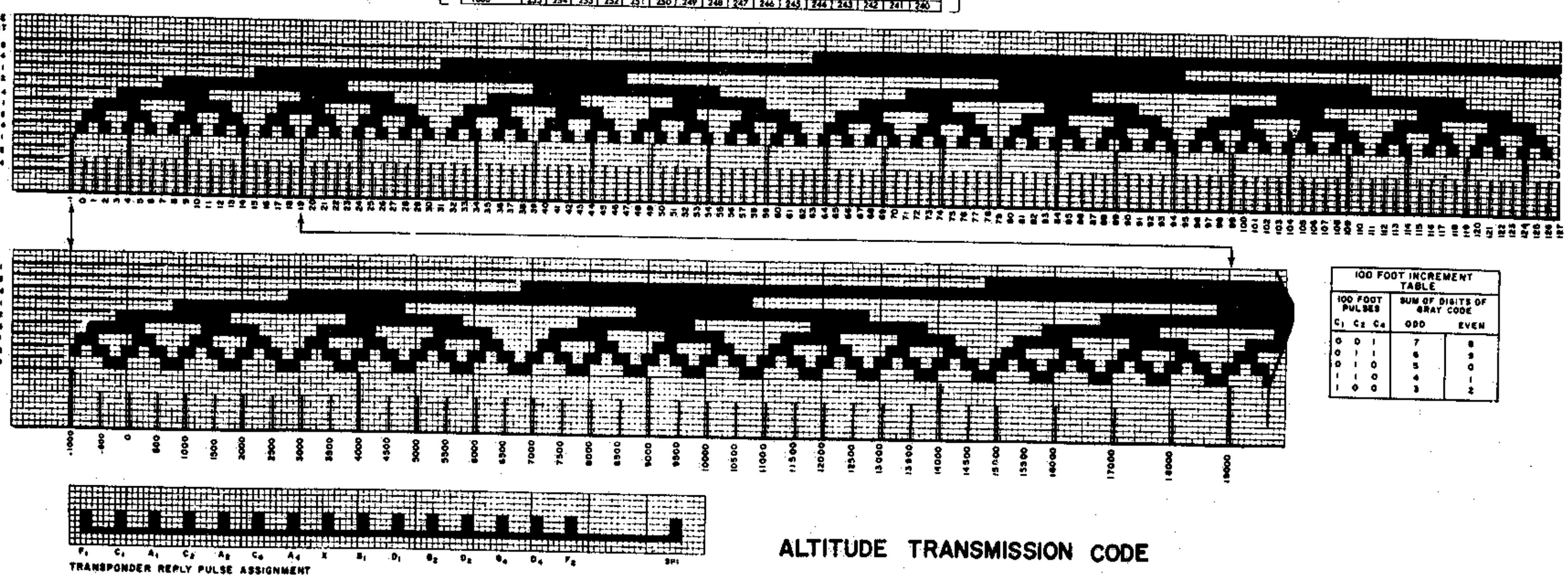
A_4, B_1, B_2, B_4, Pulses * (columns)

D_2, D_4, A_1, A_2 Pulses (rows)

	0000	0001	0011	0010	0110	0111	0101	0100	1100	1101	1111	1110	1010	1011	1001	1000
0000	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0001	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
0011	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
0010	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48
0110	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
0111	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80
0101	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111
0100	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112
1100	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143
1101	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144
1111	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
1110	191	190	189	188	187	186	185	184	183	182	181	180	179	178	177	176
1010	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207
1011	223	222	221	220	219	218	217	216	215	214	213	212	211	210	209	208
1001	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239
1000	255	254	253	252	251	250	249	248	247	246	245	244	243	242	241	240

256 Increments (500 foot each)
Giving altitude from -1000 feet to 127,000 feet

* 0 or 1 in a pulse position indicates the absence or presence of a pulse respectively.



100 FOOT INCREMENT TABLE

100 FOOT PULSES C_1 C_2 C_4	SUM OF DIGITS OF GRAY CODE ODD	SUM OF DIGITS OF GRAY CODE EVEN
0 0 1	7	8
0 1 1	6	9
0 1 0	5	0
1 1 0	4	1
1 0 0	3	2

ALTITUDE TRANSMISSION CODE

Fig. 3-6

ALTITUDE CODE FOR MODE C REPORTING

ALTITUDE TRANSMISSION CODE CHART

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
-1.0	0	0	0	0	0	0	0	0	0	1	0
-0.9	0	0	0	0	0	0	0	0	1	1	0
-0.8	0	0	0	0	0	0	0	0	1	0	0
-0.7	0	0	0	0	0	0	0	1	1	0	0
-0.6	0	0	0	0	0	0	0	1	1	1	0
-0.5	0	0	0	0	0	0	0	1	0	1	0
-0.4	0	0	0	0	0	0	0	1	0	1	1
-0.3	0	0	0	0	0	0	0	1	0	0	1
-0.2	0	0	0	0	0	0	1	1	0	0	1
-0.1	0	0	0	0	0	0	1	1	0	1	1
0.0	0	0	0	0	0	0	1	1	0	1	0
0.1	0	0	0	0	0	0	1	1	1	1	0
0.2	0	0	0	0	0	0	1	1	1	0	0
0.3	0	0	0	0	0	0	1	0	1	0	0
0.4	0	0	0	0	0	0	1	0	1	1	0
0.5	0	0	0	0	0	0	1	0	0	1	0
0.6	0	0	0	0	0	0	1	0	0	1	1
0.7	0	0	0	0	0	0	1	0	0	0	1
0.8	0	0	0	0	0	1	1	0	0	0	1
0.9	0	0	0	0	0	1	1	0	0	1	1
1.0	0	0	0	0	0	1	1	0	0	1	0
1.1	0	0	0	0	0	1	1	0	1	1	0
1.2	0	0	0	0	0	1	1	0	1	0	0
1.3	0	0	0	0	0	1	1	1	1	0	0
1.4	0	0	0	0	0	1	1	1	1	1	0
1.5	0	0	0	0	0	1	1	1	0	1	0
1.6	0	0	0	0	0	1	1	1	0	1	1
1.7	0	0	0	0	0	1	1	1	0	0	1

Fig. 3-7

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
1.8	0	0	0	0	0	1	0	1	0	0	1
1.9	0	0	0	0	0	1	0	1	0	1	1
2.0	0	0	0	0	0	1	0	1	0	1	0
2.1	0	0	0	0	0	1	0	1	1	1	0
2.2	0	0	0	0	0	1	0	1	1	0	0
2.3	0	0	0	0	0	1	0	0	1	0	0
2.4	0	0	0	0	0	1	0	0	1	1	0
2.5	0	0	0	0	0	1	0	0	0	1	0
2.6	0	0	0	0	0	1	0	0	0	1	1
2.7	0	0	0	0	0	1	0	0	0	0	1
2.8	0	0	0	0	1	1	0	0	0	0	1
2.9	0	0	0	0	1	1	0	0	0	1	1
3.0	0	0	0	0	1	1	0	0	0	1	0
3.1	0	0	0	0	1	1	0	0	1	1	0
3.2	0	0	0	0	1	1	0	0	1	0	0
3.3	0	0	0	0	1	1	0	1	1	0	0
3.4	0	0	0	0	1	1	0	1	1	1	0
3.5	0	0	0	0	1	1	0	1	0	1	0
3.6	0	0	0	0	1	1	0	1	0	1	1
3.7	0	0	0	0	1	1	0	1	0	0	1
3.8	0	0	0	0	1	1	1	1	0	0	1
3.9	0	0	0	0	1	1	1	1	0	1	1
4.0	0	0	0	0	1	1	1	1	0	1	0
4.1	0	0	0	0	1	1	1	1	1	1	0
4.2	0	0	0	0	1	1	1	1	1	0	0
4.3	0	0	0	0	1	1	1	0	1	0	0
4.4	0	0	0	0	1	1	1	0	1	1	0
4.5	0	0	0	0	1	1	1	0	0	1	0
4.6	0	0	0	0	1	1	1	0	0	1	1
4.7	0	0	0	0	1	1	1	0	0	0	1
4.8	0	0	0	0	1	0	1	0	0	0	1
4.9	0	0	0	0	1	0	1	0	0	1	1
5.0	0	0	0	0	1	0	1	0	0	1	0
5.1	0	0	0	0	1	0	1	0	1	1	0
5.2	0	0	0	0	1	0	1	0	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
5.3	0	0	0	0	1	0	1	1	1	0	0
5.4	0	0	0	0	1	0	1	1	1	1	0
5.5	0	0	0	0	1	0	1	1	0	1	0
5.6	0	0	0	0	1	0	1	1	0	1	1
5.7	0	0	0	0	1	0	1	1	0	0	1
5.8	0	0	0	0	1	0	0	1	0	0	1
5.9	0	0	0	0	1	0	0	1	0	1	1
6.0	0	0	0	0	1	0	0	1	0	1	0
6.1	0	0	0	0	1	0	0	1	1	1	0
6.2	0	0	0	0	1	0	0	1	1	0	0
6.3	0	0	0	0	1	0	0	0	1	0	0
6.4	0	0	0	0	1	0	0	0	1	1	0
6.5	0	0	0	0	1	0	0	0	0	1	0
6.6	0	0	0	0	1	0	0	0	0	1	1
6.7	0	0	0	0	1	0	0	0	0	0	1
6.8	0	0	0	1	1	0	0	0	0	0	1
6.9	0	0	0	1	1	0	0	0	0	1	1
7.0	0	0	0	1	1	0	0	0	0	1	0
7.1	0	0	0	1	1	0	0	0	1	1	0
7.2	0	0	0	1	1	0	0	0	1	0	0
7.3	0	0	0	1	1	0	0	1	1	0	0
7.4	0	0	0	1	1	0	0	1	1	1	0
7.5	0	0	0	1	1	0	0	1	0	1	0
7.6	0	0	0	1	1	0	0	1	0	1	1
7.7	0	0	0	1	1	0	0	1	0	0	1
7.8	0	0	0	1	1	0	1	1	0	0	1
7.9	0	0	0	1	1	0	1	1	0	1	1
8.0	0	0	0	1	1	0	1	1	0	1	0
8.1	0	0	0	1	1	0	1	1	1	1	0
8.2	0	0	0	1	1	0	1	1	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
8.3	0	0	0	1	1	0	1	0	1	0	0
8.4	0	0	0	1	1	0	1	0	1	1	0
8.5	0	0	0	1	1	0	1	0	0	1	0
8.6	0	0	0	1	1	0	1	0	0	1	1
8.7	0	0	0	1	1	0	1	0	0	0	1
8.8	0	0	0	1	1	1	1	0	0	0	1
8.9	0	0	0	1	1	1	1	0	0	1	1
9.0	0	0	0	1	1	1	1	0	0	1	0
9.1	0	0	0	1	1	1	1	0	1	1	0
9.2	0	0	0	1	1	1	1	0	1	0	0
9.3	0	0	0	1	1	1	1	1	1	0	0
9.4	0	0	0	1	1	1	1	1	1	1	0
9.5	0	0	0	1	1	1	1	1	0	1	0
9.6	0	0	0	1	1	1	1	1	0	1	1
9.7	0	0	0	1	1	1	1	1	0	0	1
9.8	0	0	0	1	1	1	0	1	0	0	1
9.9	0	0	0	1	1	1	0	1	0	1	1
10.0	0	0	0	1	1	1	0	1	0	1	0
10.1	0	0	0	1	1	1	0	1	1	1	0
10.2	0	0	0	1	1	1	0	1	1	0	0
10.3	0	0	0	1	1	1	0	0	1	0	0
10.4	0	0	0	1	1	1	0	0	1	1	0
10.5	0	0	0	1	1	1	0	0	0	1	0
10.6	0	0	0	1	1	1	0	0	0	1	1
10.7	0	0	0	1	1	1	0	0	0	0	1
10.8	0	0	0	1	0	1	0	0	0	0	1
10.9	0	0	0	1	0	1	0	0	0	1	1
11.0	0	0	0	1	0	1	0	0	0	1	0
11.1	0	0	0	1	0	1	0	0	1	1	0
11.2	0	0	0	1	0	1	0	0	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
11.3	0	0	0	1	0	1	0	1	1	0	0
11.4	0	0	0	1	0	1	0	1	1	1	0
11.5	0	0	0	1	0	1	0	1	0	1	0
11.6	0	0	0	1	0	1	0	1	0	1	1
11.7	0	0	0	1	0	1	0	1	0	0	1
11.8	0	0	0	1	0	1	1	1	0	0	1
11.9	0	0	0	1	0	1	1	1	0	1	1
12.0	0	0	0	1	0	1	1	1	0	1	0
12.1	0	0	0	1	0	1	1	1	1	1	0
12.2	0	0	0	1	0	1	1	1	1	0	0
12.3	0	0	0	1	0	1	1	0	1	0	0
12.4	0	0	0	1	0	1	1	0	1	1	0
12.5	0	0	0	1	0	1	1	0	0	1	0
12.6	0	0	0	1	0	1	1	0	0	1	1
12.7	0	0	0	1	0	1	1	0	0	0	1
12.8	0	0	0	1	0	0	1	0	0	0	1
12.9	0	0	0	1	0	0	1	0	0	1	1
13.0	0	0	0	1	0	0	1	0	0	1	0
13.1	0	0	0	1	0	0	1	0	1	1	0
13.2	0	0	0	1	0	0	1	0	1	0	0
13.3	0	0	0	1	0	0	1	1	1	0	0
13.4	0	0	0	1	0	0	1	1	1	1	0
13.5	0	0	0	1	0	0	1	1	0	1	0
13.6	0	0	0	1	0	0	1	1	0	1	1
13.7	0	0	0	1	0	0	1	1	0	0	1
13.8	0	0	0	1	0	0	0	1	0	0	1
13.9	0	0	0	1	0	0	0	1	0	1	1
14.0	0	0	0	1	0	0	0	1	0	1	0
14.1	0	0	0	1	0	0	0	1	1	1	0
14.2	0	0	0	1	0	0	0	1	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
14.3	0	0	0	1	0	0	0	0	1	0	0
14.4	0	0	0	1	0	0	0	0	1	1	0
14.5	0	0	0	1	0	0	0	0	0	1	0
14.6	0	0	0	1	0	0	0	0	0	1	1
14.7	0	0	0	1	0	0	0	0	0	0	1
14.8	0	0	1	1	0	0	0	0	0	0	1
14.9	0	0	1	1	0	0	0	0	0	1	1
15.0	0	0	1	1	0	0	0	0	0	1	0
15.1	0	0	1	1	0	0	0	0	1	1	0
15.2	0	0	1	1	0	0	0	0	1	0	0
15.3	0	0	1	1	0	0	0	1	1	0	0
15.4	0	0	1	1	0	0	0	1	1	1	0
15.5	0	0	1	1	0	0	0	1	0	1	0
15.6	0	0	1	1	0	0	0	1	0	1	1
15.7	0	0	1	1	0	0	0	1	0	0	1
15.8	0	0	1	1	0	0	1	1	0	0	1
15.9	0	0	1	1	0	0	1	1	0	1	1
16.0	0	0	1	1	0	0	1	1	0	1	0
16.1	0	0	1	1	0	0	1	1	1	1	0
16.2	0	0	1	1	0	0	1	1	1	0	0
16.3	0	0	1	1	0	0	1	0	1	0	0
16.4	0	0	1	1	0	0	1	0	1	1	0
16.5	0	0	1	1	0	0	1	0	0	1	0
16.6	0	0	1	1	0	0	1	0	0	1	1
16.7	0	0	1	1	0	0	1	0	0	0	1
16.8	0	0	1	1	0	1	1	0	0	0	1
16.9	0	0	1	1	0	1	1	0	0	1	1
17.0	0	0	1	1	0	1	1	0	0	1	0
17.1	0	0	1	1	0	1	1	0	1	1	0
17.2	0	0	1	1	0	1	1	0	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
17.3	0	0	1	1	0	1	1	1	1	0	0
17.4	0	0	1	1	0	1	1	1	1	1	0
17.5	0	0	1	1	0	1	1	1	0	1	0
17.6	0	0	1	1	0	1	1	1	0	1	1
17.7	0	0	1	1	0	1	1	1	0	0	1
17.8	0	0	1	1	0	1	0	1	0	0	1
17.9	0	0	1	1	0	1	0	1	0	1	1
18.0	0	0	1	1	0	1	0	1	0	1	0
18.1	0	0	1	1	0	1	0	1	1	1	0
18.2	0	0	1	1	0	1	0	1	1	0	0
18.3	0	0	1	1	0	1	0	0	1	0	0
18.4	0	0	1	1	0	1	0	0	1	1	0
18.5	0	0	1	1	0	1	0	0	0	1	0
18.6	0	0	1	1	0	1	0	0	0	1	1
18.7	0	0	1	1	0	1	0	0	0	0	1
18.8	0	0	1	1	1	1	0	0	0	0	1
18.9	0	0	1	1	1	1	0	0	0	1	1
19.0	0	0	1	1	1	1	0	0	0	1	0
19.1	0	0	1	1	1	1	0	0	1	1	0
19.2	0	0	1	1	1	1	0	0	1	0	0
19.3	0	0	1	1	1	1	0	1	1	0	0
19.4	0	0	1	1	1	1	0	1	1	1	0
19.5	0	0	1	1	1	1	0	1	0	1	0
19.6	0	0	1	1	1	1	0	1	0	1	1
19.7	0	0	1	1	1	1	0	1	0	0	1
19.8	0	0	1	1	1	1	1	1	0	0	1
19.9	0	0	1	1	1	1	1	1	0	1	1
20.0	0	0	1	1	1	1	1	1	0	1	0
20.1	0	0	1	1	1	1	1	1	1	1	0
20.2	0	0	1	1	1	1	1	1	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
20.3	0	0	1	1	1	1	1	0	1	0	0
20.4	0	0	1	1	1	1	1	0	1	1	0
20.5	0	0	1	1	1	1	1	0	0	1	0
20.6	0	0	1	1	1	1	1	0	0	1	1
20.7	0	0	1	1	1	1	1	0	0	0	1
20.8	0	0	1	1	1	0	1	0	0	0	1
20.9	0	0	1	1	1	0	1	0	0	1	1
21.0	0	0	1	1	1	0	1	0	0	1	0
21.1	0	0	1	1	1	0	1	0	1	1	0
21.2	0	0	1	1	1	0	1	0	1	0	0
21.3	0	0	1	1	1	0	1	1	1	0	0
21.4	0	0	1	1	1	0	1	1	1	1	0
21.5	0	0	1	1	1	0	1	1	0	1	0
21.6	0	0	1	1	1	0	1	1	0	1	1
21.7	0	0	1	1	1	0	1	1	0	0	1
21.8	0	0	1	1	1	0	0	1	0	0	1
21.9	0	0	1	1	1	0	0	1	0	1	1
22.0	0	0	1	1	1	0	0	1	0	1	0
22.1	0	0	1	1	1	0	0	1	1	1	0
22.2	0	0	1	1	1	0	0	1	1	0	0
22.3	0	0	1	1	1	0	0	0	1	0	0
22.4	0	0	1	1	1	0	0	0	1	1	0
22.5	0	0	1	1	1	0	0	0	0	1	0
22.6	0	0	1	1	1	0	0	0	0	1	1
22.7	0	0	1	1	1	0	0	0	0	0	1
22.8	0	0	1	0	1	0	0	0	0	0	1
22.9	0	0	1	0	1	0	0	0	0	1	1
23.0	0	0	1	0	1	0	0	0	0	1	0
23.1	0	0	1	0	1	0	0	0	1	1	0
23.2	0	0	1	0	1	0	0	0	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
23.3	0	0	1	0	1	0	0	1	1	0	0
23.4	0	0	1	0	1	0	0	1	1	1	0
23.5	0	0	1	0	1	0	0	1	0	1	0
23.6	0	0	1	0	1	0	0	1	0	1	1
23.7	0	0	1	0	1	0	0	1	0	0	1
23.8	0	0	1	0	1	0	1	1	0	0	1
23.9	0	0	1	0	1	0	1	1	0	1	1
24.0	0	0	1	0	1	0	1	1	0	1	0
24.1	0	0	1	0	1	0	1	1	1	1	0
24.2	0	0	1	0	1	0	1	1	1	0	0
24.3	0	0	1	0	1	0	1	0	1	0	0
24.4	0	0	1	0	1	0	1	0	1	1	0
24.5	0	0	1	0	1	0	1	0	0	1	0
24.6	0	0	1	0	1	0	1	0	0	1	1
24.7	0	0	1	0	1	0	1	0	0	0	1
24.8	0	0	1	0	1	1	1	0	0	0	1
24.9	0	0	1	0	1	1	1	0	0	1	1
25.0	0	0	1	0	1	1	1	0	0	1	0
25.1	0	0	1	0	1	1	1	0	1	1	0
25.2	0	0	1	0	1	1	1	0	1	0	0
25.3	0	0	1	0	1	1	1	1	1	0	0
25.4	0	0	1	0	1	1	1	1	1	1	0
25.5	0	0	1	0	1	1	1	1	0	1	0
25.6	0	0	1	0	1	1	1	1	0	1	1
25.7	0	0	1	0	1	1	1	1	0	0	1
25.8	0	0	1	0	1	1	0	1	0	0	1
25.9	0	0	1	0	1	1	0	1	0	1	1
26.0	0	0	1	0	1	1	0	1	0	1	0
26.1	0	0	1	0	1	1	0	1	1	1	0
26.2	0	0	1	0	1	1	0	1	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
26.3	0	0	1	0	1	1	0	0	1	0	0
26.4	0	0	1	0	1	1	0	0	1	1	0
26.5	0	0	1	0	1	1	0	0	0	1	0
26.6	0	0	1	0	1	1	0	0	0	1	1
26.7	0	0	1	0	1	1	0	0	0	0	1
26.8	0	0	1	0	0	1	0	0	0	0	1
26.9	0	0	1	0	0	1	0	0	0	1	1
27.0	0	0	1	0	0	1	0	0	0	1	0
27.1	0	0	1	0	0	1	0	0	1	1	0
27.2	0	0	1	0	0	1	0	0	1	0	0
27.3	0	0	1	0	0	1	0	1	1	0	0
27.4	0	0	1	0	0	1	0	1	1	1	0
27.5	0	0	1	0	0	1	0	1	0	1	0
27.6	0	0	1	0	0	1	0	1	0	1	1
27.7	0	0	1	0	0	1	0	1	0	0	1
27.8	0	0	1	0	0	1	1	1	0	0	1
27.9	0	0	1	0	0	1	1	1	0	1	1
28.0	0	0	1	0	0	1	1	1	0	1	0
28.1	0	0	1	0	0	1	1	1	1	1	0
28.2	0	0	1	0	0	1	1	1	1	0	0
28.3	0	0	1	0	0	1	1	0	1	0	0
28.4	0	0	1	0	0	1	1	0	1	1	0
28.5	0	0	1	0	0	1	1	0	0	1	0
28.6	0	0	1	0	0	1	1	0	0	1	1
28.7	0	0	1	0	0	1	1	0	0	0	1
28.8	0	0	1	0	0	0	1	0	0	0	1
28.9	0	0	1	0	0	0	1	0	0	1	1
29.0	0	0	1	0	0	0	1	0	0	1	0
29.1	0	0	1	0	0	0	1	0	1	1	0
29.2	0	0	1	0	0	0	1	0	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
29.3	0	0	1	0	0	0	1	1	1	0	0
29.4	0	0	1	0	0	0	1	1	1	1	0
29.5	0	0	1	0	0	0	1	1	0	1	0
29.6	0	0	1	0	0	0	1	1	0	1	1
29.7	0	0	1	0	0	0	1	1	0	0	1
29.8	0	0	1	0	0	0	0	1	0	0	1
29.9	0	0	1	0	0	0	0	1	0	1	1
30.0	0	0	1	0	0	0	0	1	0	1	0
30.1	0	0	1	0	0	0	0	1	1	1	0
30.2	0	0	1	0	0	0	0	1	1	0	0
30.3	0	0	1	0	0	0	0	0	1	0	0
30.4	0	0	1	0	0	0	0	0	1	1	0
30.5	0	0	1	0	0	0	0	0	0	1	0
30.6	0	0	1	0	0	0	0	0	0	1	1
30.7	0	0	1	0	0	0	0	0	0	0	1
30.8	0	1	1	0	0	0	0	0	0	0	1
30.9	0	1	1	0	0	0	0	0	0	1	1
31.0	0	1	1	0	0	0	0	0	0	1	0
31.1	0	1	1	0	0	0	0	0	1	1	0
31.2	0	1	1	0	0	0	0	0	1	0	0
31.3	0	1	1	0	0	0	0	1	1	0	0
31.4	0	1	1	0	0	0	0	1	1	1	0
31.5	0	1	1	0	0	0	0	1	0	1	0
31.6	0	1	1	0	0	0	0	1	0	1	1
31.7	0	1	1	0	0	0	0	1	0	0	1
31.8	0	1	1	0	0	0	1	1	0	0	1
31.9	0	1	1	0	0	0	1	1	0	1	1
32.0	0	1	1	0	0	0	1	1	0	1	0
32.1	0	1	1	0	0	0	1	1	1	1	0
32.2	0	1	1	0	0	0	1	1	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
32.3	0	1	1	0	0	0	1	0	1	0	0
32.4	0	1	1	0	0	0	1	0	1	1	0
32.5	0	1	1	0	0	0	1	0	0	1	0
32.6	0	1	1	0	0	0	1	0	0	1	1
32.7	0	1	1	0	0	0	1	0	0	0	1
32.8	0	1	1	0	0	1	1	0	0	0	1
32.9	0	1	1	0	0	1	1	0	0	1	1
33.0	0	1	1	0	0	1	1	0	0	1	0
33.1	0	1	1	0	0	1	1	0	1	1	0
33.2	0	1	1	0	0	1	1	0	1	0	0
33.3	0	1	1	0	0	1	1	1	1	0	0
33.4	0	1	1	0	0	1	1	1	1	1	0
33.5	0	1	1	0	0	1	1	1	0	1	0
33.6	0	1	1	0	0	1	1	1	0	1	1
33.7	0	1	1	0	0	1	1	1	0	0	1
33.8	0	1	1	0	0	1	0	1	0	0	1
33.9	0	1	1	0	0	1	0	1	0	1	1
34.0	0	1	1	0	0	1	0	1	0	1	0
34.1	0	1	1	0	0	1	0	1	1	1	0
34.2	0	1	1	0	0	1	0	1	1	0	0
34.3	0	1	1	0	0	1	0	0	1	0	0
34.4	0	1	1	0	0	1	0	0	1	1	0
34.5	0	1	1	0	0	1	0	0	0	1	0
34.6	0	1	1	0	0	1	0	0	0	1	1
34.7	0	1	1	0	0	1	0	0	0	0	1
34.8	0	1	1	0	1	1	0	0	0	0	1
34.9	0	1	1	0	1	1	0	0	0	1	1
35.0	0	1	1	0	1	1	0	0	0	1	0
35.1	0	1	1	0	1	1	0	0	1	1	0
35.2	0	1	1	0	1	1	0	0	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
35.3	0	1	1	0	1	1	0	1	1	0	0
35.4	0	1	1	0	1	1	0	1	1	1	0
35.5	0	1	1	0	1	1	0	1	0	1	0
35.6	0	1	1	0	1	1	0	1	0	1	1
35.7	0	1	1	0	1	1	0	1	0	0	1
35.8	0	1	1	0	1	1	1	1	0	0	1
35.9	0	1	1	0	1	1	1	1	0	1	1
36.0	0	1	1	0	1	1	1	1	0	1	0
36.1	0	1	1	0	1	1	1	1	1	1	0
36.2	0	1	1	0	1	1	1	1	1	0	0
36.3	0	1	1	0	1	1	1	0	1	0	0
36.4	0	1	1	0	1	1	1	0	1	1	0
36.5	0	1	1	0	1	1	1	0	0	1	0
36.6	0	1	1	0	1	1	1	0	0	1	1
36.7	0	1	1	0	1	1	1	0	0	0	1
36.8	0	1	1	0	1	0	1	0	0	0	1
36.9	0	1	1	0	1	0	1	0	0	1	1
37.0	0	1	1	0	1	0	1	0	0	1	0
37.1	0	1	1	0	1	0	1	0	1	1	0
37.2	0	1	1	0	1	0	1	0	1	0	0
37.3	0	1	1	0	1	0	1	1	1	0	0
37.4	0	1	1	0	1	0	1	1	1	1	0
37.5	0	1	1	0	1	0	1	1	0	1	0
37.6	0	1	1	0	1	0	1	1	0	1	1
37.7	0	1	1	0	1	0	1	1	0	0	1
37.8	0	1	1	0	1	0	0	1	0	0	1
37.9	0	1	1	0	1	0	0	1	0	1	1
38.0	0	1	1	0	1	0	0	1	0	1	0
38.1	0	1	1	0	1	0	0	1	1	1	0
38.2	0	1	1	0	1	0	0	1	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
38.3	0	1	1	0	1	0	0	0	1	0	0
38.4	0	1	1	0	1	0	0	0	1	1	0
38.5	0	1	1	0	1	0	0	0	0	1	0
38.6	0	1	1	0	1	0	0	0	0	1	1
38.7	0	1	1	0	1	0	0	0	0	0	1
38.8	0	1	1	1	1	0	0	0	0	0	1
38.9	0	1	1	1	1	0	0	0	0	1	1
39.0	0	1	1	1	1	0	0	0	0	1	0
39.1	0	1	1	1	1	0	0	0	1	1	0
39.2	0	1	1	1	1	0	0	0	1	0	0
39.3	0	1	1	1	1	0	0	1	1	0	0
39.4	0	1	1	1	1	0	0	1	1	1	0
39.5	0	1	1	1	1	0	0	1	0	1	0
39.6	0	1	1	1	1	0	0	1	0	1	1
39.7	0	1	1	1	1	0	0	1	0	0	1
39.8	0	1	1	1	1	0	1	1	0	0	1
39.9	0	1	1	1	1	0	1	1	0	1	1
40.0	0	1	1	1	1	0	1	1	0	1	0
40.1	0	1	1	1	1	0	1	1	1	1	0
40.2	0	1	1	1	1	0	1	1	1	0	0
40.3	0	1	1	1	1	0	1	0	1	0	0
40.4	0	1	1	1	1	0	1	0	1	1	0
40.5	0	1	1	1	1	0	1	0	0	1	0
40.6	0	1	1	1	1	0	1	0	0	1	1
40.7	0	1	1	1	1	0	1	0	0	0	1
40.8	0	1	1	1	1	1	1	0	0	0	1
40.9	0	1	1	1	1	1	1	0	0	1	1
41.0	0	1	1	1	1	1	1	0	0	1	0
41.1	0	1	1	1	1	1	1	0	1	1	0
41.2	0	1	1	1	1	1	1	0	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
41.3	0	1	1	1	1	1	1	1	1	0	0
41.4	0	1	1	1	1	1	1	1	1	1	0
41.5	0	1	1	1	1	1	1	1	0	1	0
41.6	0	1	1	1	1	1	1	1	0	1	1
41.7	0	1	1	1	1	1	1	1	0	0	1
41.8	0	1	1	1	1	1	0	1	0	0	1
41.9	0	1	1	1	1	1	0	1	0	1	1
42.0	0	1	1	1	1	1	0	1	0	1	0
42.1	0	1	1	1	1	1	0	1	1	1	0
42.2	0	1	1	1	1	1	0	1	1	0	0
42.3	0	1	1	1	1	1	0	0	1	0	0
42.4	0	1	1	1	1	1	0	0	1	1	0
42.5	0	1	1	1	1	1	0	0	0	1	0
42.6	0	1	1	1	1	1	0	0	0	1	1
42.7	0	1	1	1	1	1	0	0	0	0	1
42.8	0	1	1	1	0	1	0	0	0	0	1
42.9	0	1	1	1	0	1	0	0	0	1	1
43.0	0	1	1	1	0	1	0	0	0	1	0
43.1	0	1	1	1	0	1	0	0	1	1	0
43.2	0	1	1	1	0	1	0	0	1	0	0
43.3	0	1	1	1	0	1	0	1	1	0	0
43.4	0	1	1	1	0	1	0	1	1	1	0
43.5	0	1	1	1	0	1	0	1	0	1	0
43.6	0	1	1	1	0	1	0	1	0	1	1
43.7	0	1	1	1	0	1	0	1	0	0	1
43.8	0	1	1	1	0	1	1	1	0	0	1
43.9	0	1	1	1	0	1	1	1	0	1	1
44.0	0	1	1	1	0	1	1	1	0	1	0
44.1	0	1	1	1	0	1	1	1	1	1	0
44.2	0	1	1	1	0	1	1	1	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
44.3	0	1	1	1	0	1	1	0	1	0	0
44.4	0	1	1	1	0	1	1	0	1	1	0
44.5	0	1	1	1	0	1	1	0	0	1	0
44.6	0	1	1	1	0	1	1	0	0	1	1
44.7	0	1	1	1	0	1	1	0	0	0	1
44.8	0	1	1	1	0	0	1	0	0	0	1
44.9	0	1	1	1	0	0	1	0	0	1	1
45.0	0	1	1	1	0	0	1	0	0	1	0
45.1	0	1	1	1	0	0	1	0	1	1	0
45.2	0	1	1	1	0	0	1	0	1	0	0
45.3	0	1	1	1	0	0	1	1	1	0	0
45.4	0	1	1	1	0	0	1	1	1	1	0
45.5	0	1	1	1	0	0	1	1	0	1	0
45.6	0	1	1	1	0	0	1	1	0	1	1
45.7	0	1	1	1	0	0	1	1	0	0	1
45.8	0	1	1	1	0	0	0	1	0	0	1
45.9	0	1	1	1	0	0	0	1	0	1	1
46.0	0	1	1	1	0	0	0	1	0	1	0
46.1	0	1	1	1	0	0	0	1	1	1	0
46.2	0	1	1	1	0	0	0	1	1	0	0
46.3	0	1	1	1	0	0	0	0	1	0	0
46.4	0	1	1	1	0	0	0	0	1	1	0
46.5	0	1	1	1	0	0	0	0	0	1	0
46.6	0	1	1	1	0	0	0	0	0	1	1
46.7	0	1	1	1	0	0	0	0	0	0	1
46.8	0	1	0	1	0	0	0	0	0	0	1
46.9	0	1	0	1	0	0	0	0	0	1	1
47.0	0	1	0	1	0	0	0	0	0	1	0
47.1	0	1	0	1	0	0	0	0	1	1	0
47.2	0	1	0	1	0	0	0	0	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
47.3	0	1	0	1	0	0	0	1	1	0	0
47.4	0	1	0	1	0	0	0	1	1	1	0
47.5	0	1	0	1	0	0	0	1	0	1	0
47.6	0	1	0	1	0	0	0	1	0	1	1
47.7	0	1	0	1	0	0	0	1	0	0	1
47.8	0	1	0	1	0	0	1	1	0	0	1
47.9	0	1	0	1	0	0	1	1	0	1	1
48.0	0	1	0	1	0	0	1	1	0	1	0
48.1	0	1	0	1	0	0	1	1	1	1	0
48.2	0	1	0	1	0	0	1	1	1	0	0
48.3	0	1	0	1	0	0	1	0	1	0	0
48.4	0	1	0	1	0	0	1	0	1	1	0
48.5	0	1	0	1	0	0	1	0	0	1	0
48.6	0	1	0	1	0	0	1	0	0	1	1
48.7	0	1	0	1	0	0	1	0	0	0	1
48.8	0	1	0	1	0	1	1	0	0	0	1
48.9	0	1	0	1	0	1	1	0	0	1	1
49.0	0	1	0	1	0	1	1	0	0	1	0
49.1	0	1	0	1	0	1	1	0	1	1	0
49.2	0	1	0	1	0	1	1	0	1	0	0
49.3	0	1	0	1	0	1	1	1	1	0	0
49.4	0	1	0	1	0	1	1	1	1	1	0
49.5	0	1	0	1	0	1	1	1	0	1	0
49.6	0	1	0	1	0	1	1	1	0	1	1
49.7	0	1	0	1	0	1	1	1	0	0	1
49.8	0	1	0	1	0	1	0	1	0	0	1
49.9	0	1	0	1	0	1	0	1	0	1	1
50.0	0	1	0	1	0	1	0	1	0	1	0
50.1	0	1	0	1	0	1	0	1	1	1	0
50.2	0	1	0	1	0	1	0	1	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
50.3	0	1	0	1	0	1	0	0	1	0	0
50.4	0	1	0	1	0	1	0	0	1	1	0
50.5	0	1	0	1	0	1	0	0	0	1	0
50.6	0	1	0	1	0	1	0	0	0	1	1
50.7	0	1	0	1	0	1	0	0	0	0	1
50.8	0	1	0	1	1	1	0	0	0	0	1
50.9	0	1	0	1	1	1	0	0	0	1	1
51.0	0	1	0	1	1	1	0	0	0	1	0
51.1	0	1	0	1	1	1	0	0	1	1	0
51.2	0	1	0	1	1	1	0	0	1	0	0
51.3	0	1	0	1	1	1	0	1	1	0	0
51.4	0	1	0	1	1	1	0	1	1	1	0
51.5	0	1	0	1	1	1	0	1	0	1	0
51.6	0	1	0	1	1	1	0	1	0	1	1
51.7	0	1	0	1	1	1	0	1	0	0	1
51.8	0	1	0	1	1	1	1	1	0	0	1
51.9	0	1	0	1	1	1	1	1	0	1	1
52.0	0	1	0	1	1	1	1	1	0	1	0
52.1	0	1	0	1	1	1	1	1	1	1	0
52.2	0	1	0	1	1	1	1	1	1	0	0
52.3	0	1	0	1	1	1	1	0	1	0	0
52.4	0	1	0	1	1	1	1	0	1	1	0
52.5	0	1	0	1	1	1	1	0	0	1	0
52.6	0	1	0	1	1	1	1	0	0	1	1
52.7	0	1	0	1	1	1	1	0	0	0	1
52.8	0	1	0	1	1	0	1	0	0	0	1
52.9	0	1	0	1	1	0	1	0	0	1	1
53.0	0	1	0	1	1	0	1	0	0	1	0
53.1	0	1	0	1	1	0	1	0	1	1	0
53.2	0	1	0	1	1	0	1	0	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
53.3	0	1	0	1	1	0	1	1	1	0	0
53.4	0	1	0	1	1	0	1	1	1	1	0
53.5	0	1	0	1	1	0	1	1	0	1	0
53.6	0	1	0	1	1	0	1	1	0	1	1
53.7	0	1	0	1	1	0	1	1	0	0	1
53.8	0	1	0	1	1	0	0	1	0	0	1
53.9	0	1	0	1	1	0	0	1	0	1	1
54.0	0	1	0	1	1	0	0	1	0	1	0
54.1	0	1	0	1	1	0	0	1	1	1	0
54.2	0	1	0	1	1	0	0	1	1	0	0
54.3	0	1	0	1	1	0	0	0	1	0	0
54.4	0	1	0	1	1	0	0	0	1	1	0
54.5	0	1	0	1	1	0	0	0	0	1	0
54.6	0	1	0	1	1	0	0	0	0	1	1
54.7	0	1	0	1	1	0	0	0	0	0	1
54.8	0	1	0	0	1	0	0	0	0	0	1
54.9	0	1	0	0	1	0	0	0	0	1	1
55.0	0	1	0	0	1	0	0	0	0	1	0
55.1	0	1	0	0	1	0	0	0	1	1	0
55.2	0	1	0	0	1	0	0	0	1	0	0
55.3	0	1	0	0	1	0	0	1	1	0	0
55.4	0	1	0	0	1	0	0	1	1	1	0
55.5	0	1	0	0	1	0	0	1	0	1	0
55.6	0	1	0	0	1	0	0	1	0	1	1
55.7	0	1	0	0	1	0	0	1	0	0	1
55.8	0	1	0	0	1	0	1	1	0	0	1
55.9	0	1	0	0	1	0	1	1	0	1	1
56.0	0	1	0	0	1	0	1	1	0	1	0
56.1	0	1	0	0	1	0	1	1	1	1	0
56.2	0	1	0	0	1	0	1	1	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
56.3	0	1	0	0	1	0	1	0	1	0	0
56.4	0	1	0	0	1	0	1	0	1	1	0
56.5	0	1	0	0	1	0	1	0	0	1	0
56.6	0	1	0	0	1	0	1	0	0	1	1
56.7	0	1	0	0	1	0	1	0	0	0	1
56.8	0	1	0	0	1	1	1	0	0	0	1
56.9	0	1	0	0	1	1	1	0	0	1	1
57.0	0	1	0	0	1	1	1	0	0	1	0
57.1	0	1	0	0	1	1	1	0	1	1	0
57.2	0	1	0	0	1	1	1	0	1	0	0
57.3	0	1	0	0	1	1	1	1	1	0	0
57.4	0	1	0	0	1	1	1	1	1	1	0
57.5	0	1	0	0	1	1	1	1	0	1	0
57.6	0	1	0	0	1	1	1	1	0	1	1
57.7	0	1	0	0	1	1	1	1	0	0	1
57.8	0	1	0	0	1	1	0	1	0	0	1
57.9	0	1	0	0	1	1	0	1	0	1	1
58.0	0	1	0	0	1	1	0	1	0	1	0
58.1	0	1	0	0	1	1	0	1	1	1	0
58.2	0	1	0	0	1	1	0	1	1	0	0
58.3	0	1	0	0	1	1	0	0	1	0	0
58.4	0	1	0	0	1	1	0	0	1	1	0
58.5	0	1	0	0	1	1	0	0	0	1	0
58.6	0	1	0	0	1	1	0	0	0	1	1
58.7	0	1	0	0	1	1	0	0	0	0	1
58.8	0	1	0	0	0	1	0	0	0	0	1
58.9	0	1	0	0	0	1	0	0	0	1	1
59.0	0	1	0	0	0	1	0	0	0	1	0
59.1	0	1	0	0	0	1	0	0	1	1	0
59.2	0	1	0	0	0	1	0	0	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
59.3	0	1	0	0	0	1	0	1	1	0	0
59.4	0	1	0	0	0	1	0	1	1	1	0
59.5	0	1	0	0	0	1	0	1	0	1	0
59.6	0	1	0	0	0	1	0	1	0	1	1
59.7	0	1	0	0	0	1	0	1	0	0	1
59.8	0	1	0	0	0	1	1	1	0	0	1
59.9	0	1	0	0	0	1	1	1	0	1	1
60.0	0	1	0	0	0	1	1	1	0	1	0
60.1	0	1	0	0	0	1	1	1	1	1	0
60.2	0	1	0	0	0	1	1	1	1	0	0
60.3	0	1	0	0	0	1	1	0	1	0	0
60.4	0	1	0	0	0	1	1	0	1	1	0
60.5	0	1	0	0	0	1	1	0	0	1	0
60.6	0	1	0	0	0	1	1	0	0	1	1
60.7	0	1	0	0	0	1	1	0	0	0	1
60.8	0	1	0	0	0	0	1	0	0	0	1
60.9	0	1	0	0	0	0	1	0	0	1	1
61.0	0	1	0	0	0	0	1	0	0	1	0
61.1	0	1	0	0	0	0	1	0	1	1	0
61.2	0	1	0	0	0	0	1	0	1	0	0
61.3	0	1	0	0	0	0	1	1	1	0	0
61.4	0	1	0	0	0	0	1	1	1	1	0
61.5	0	1	0	0	0	0	1	1	0	1	0
61.6	0	1	0	0	0	0	1	1	0	1	1
61.7	0	1	0	0	0	0	1	1	0	0	1
61.8	0	1	0	0	0	0	0	1	0	0	1
61.9	0	1	0	0	0	0	0	1	0	1	1
62.0	0	1	0	0	0	0	0	1	0	1	0
62.1	0	1	0	0	0	0	0	1	1	1	0
62.2	0	1	0	0	0	0	0	1	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
62.3	0	1	0	0	0	0	0	0	1	0	0
62.4	0	1	0	0	0	0	0	0	1	1	0
62.5	0	1	0	0	0	0	0	0	0	1	0
62.6	0	1	0	0	0	0	0	0	0	1	1
62.7	0	1	0	0	0	0	0	0	0	0	1
62.8	1	1	0	0	0	0	0	0	0	0	1
62.9	1	1	0	0	0	0	0	0	0	1	1
63.0	1	1	0	0	0	0	0	0	0	1	0
63.1	1	1	0	0	0	0	0	0	1	1	0
63.2	1	1	0	0	0	0	0	0	1	0	0
63.3	1	1	0	0	0	0	0	1	1	0	0
63.4	1	1	0	0	0	0	0	1	1	1	0
63.5	1	1	0	0	0	0	0	1	0	1	0
63.6	1	1	0	0	0	0	0	1	0	1	1
63.7	1	1	0	0	0	0	0	1	0	0	1
63.8	1	1	0	0	0	0	1	1	0	0	1
63.9	1	1	0	0	0	0	1	1	0	1	1
64.0	1	1	0	0	0	0	1	1	0	1	0
64.1	1	1	0	0	0	0	1	1	1	1	0
64.2	1	1	0	0	0	0	1	1	1	0	0
64.3	1	1	0	0	0	0	1	0	1	0	0
64.4	1	1	0	0	0	0	1	0	1	1	0
64.5	1	1	0	0	0	0	1	0	0	1	0
64.6	1	1	0	0	0	0	1	0	0	1	1
64.7	1	1	0	0	0	0	1	0	0	0	1
64.8	1	1	0	0	0	1	1	0	0	0	1
64.9	1	1	0	0	0	1	1	0	0	1	1
65.0	1	1	0	0	0	1	1	0	0	1	0
65.1	1	1	0	0	0	1	1	0	1	1	0
65.2	1	1	0	0	0	1	1	0	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
65.3	1	1	0	0	0	1	1	1	1	0	0
65.4	1	1	0	0	0	1	1	1	1	1	0
65.5	1	1	0	0	0	1	1	1	0	1	0
65.6	1	1	0	0	0	1	1	1	0	1	1
65.7	1	1	0	0	0	1	1	1	0	0	1
65.8	1	1	0	0	0	1	0	1	0	0	1
65.9	1	1	0	0	0	1	0	1	0	1	1
66.0	1	1	0	0	0	1	0	1	0	1	0
66.1	1	1	0	0	0	1	0	1	1	1	0
66.2	1	1	0	0	0	1	0	1	1	0	0
66.3	1	1	0	0	0	1	0	0	1	0	0
66.4	1	1	0	0	0	1	0	0	1	1	0
66.5	1	1	0	0	0	1	0	0	0	1	0
66.6	1	1	0	0	0	1	0	0	0	1	1
66.7	1	1	0	0	0	1	0	0	0	0	1
66.8	1	1	0	0	1	1	0	0	0	0	1
66.9	1	1	0	0	1	1	0	0	0	1	1
67.0	1	1	0	0	1	1	0	0	0	1	0
67.1	1	1	0	0	1	1	0	0	1	1	0
67.2	1	1	0	0	1	1	0	0	1	0	0
67.3	1	1	0	0	1	1	0	1	1	0	0
67.4	1	1	0	0	1	1	0	1	1	1	0
67.5	1	1	0	0	1	1	0	1	0	1	0
67.6	1	1	0	0	1	1	0	1	0	1	1
67.7	1	1	0	0	1	1	0	1	0	0	1
67.8	1	1	0	0	1	1	1	1	0	0	1
67.9	1	1	0	0	1	1	1	1	0	1	1
68.0	1	1	0	0	1	1	1	1	0	1	0
68.1	1	1	0	0	1	1	1	1	1	1	0
68.2	1	1	0	0	1	1	1	1	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
68.3	1	1	0	0	1	1	1	0	1	0	0
68.4	1	1	0	0	1	1	1	0	1	1	0
68.5	1	1	0	0	1	1	1	0	0	1	0
68.6	1	1	0	0	1	1	1	0	0	1	1
68.7	1	1	0	0	1	1	1	0	0	0	1
68.8	1	1	0	0	1	0	1	0	0	0	1
68.9	1	1	0	0	1	0	1	0	0	1	1
69.0	1	1	0	0	1	0	1	0	0	1	0
69.1	1	1	0	0	1	0	1	0	1	1	0
69.2	1	1	0	0	1	0	1	0	1	0	0
69.3	1	1	0	0	1	0	1	1	1	0	0
69.4	1	1	0	0	1	0	1	1	1	1	0
69.5	1	1	0	0	1	0	1	1	0	1	0
69.6	1	1	0	0	1	0	1	1	0	1	1
69.7	1	1	0	0	1	0	1	1	0	0	1
69.8	1	1	0	0	1	0	0	1	0	0	1
69.9	1	1	0	0	1	0	0	1	0	1	1
70.0	1	1	0	0	1	0	0	1	0	1	0
70.1	1	1	0	0	1	0	0	1	1	1	0
70.2	1	1	0	0	1	0	0	1	1	0	0
70.3	1	1	0	0	1	0	0	0	1	0	0
70.4	1	1	0	0	1	0	0	0	1	1	0
70.5	1	1	0	0	1	0	0	0	0	1	0
70.6	1	1	0	0	1	0	0	0	0	1	1
70.7	1	1	0	0	1	0	0	0	0	0	1
70.8	1	1	0	1	1	0	0	0	0	0	1
70.9	1	1	0	1	1	0	0	0	0	1	1
71.0	1	1	0	1	1	0	0	0	0	1	0
71.1	1	1	0	1	1	0	0	0	1	1	0
71.2	1	1	0	1	1	0	0	0	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
71.3	1	1	0	1	1	0	0	1	1	0	0
71.4	1	1	0	1	1	0	0	1	1	1	0
71.5	1	1	0	1	1	0	0	1	0	1	0
71.6	1	1	0	1	1	0	0	1	0	1	1
71.7	1	1	0	1	1	0	0	1	0	0	1
71.8	1	1	0	1	1	0	1	1	0	0	1
71.9	1	1	0	1	1	0	1	1	0	1	1
72.0	1	1	0	1	1	0	1	1	0	1	0
72.1	1	1	0	1	1	0	1	1	1	1	0
72.2	1	1	0	1	1	0	1	1	1	0	0
72.3	1	1	0	1	1	0	1	0	1	0	0
72.4	1	1	0	1	1	0	1	0	1	1	0
72.5	1	1	0	1	1	0	1	0	0	1	0
72.6	1	1	0	1	1	0	1	0	0	1	1
72.7	1	1	0	1	1	0	1	0	0	0	1
72.8	1	1	0	1	1	1	1	0	0	0	1
72.9	1	1	0	1	1	1	1	0	0	1	1
73.0	1	1	0	1	1	1	1	0	0	1	0
73.1	1	1	0	1	1	1	1	0	1	1	0
73.2	1	1	0	1	1	1	1	0	1	0	0
73.3	1	1	0	1	1	1	1	1	1	0	0
73.4	1	1	0	1	1	1	1	1	1	1	0
73.5	1	1	0	1	1	1	1	1	0	1	0
73.6	1	1	0	1	1	1	1	1	0	1	1
73.7	1	1	0	1	1	1	1	1	0	0	1
73.8	1	1	0	1	1	1	0	1	0	0	1
73.9	1	1	0	1	1	1	0	1	0	1	1
74.0	1	1	0	1	1	1	0	1	0	1	0
74.1	1	1	0	1	1	1	0	1	1	1	0
74.2	1	1	0	1	1	1	0	1	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
74.3	1	1	0	1	1	1	0	0	1	0	0
74.4	1	1	0	1	1	1	0	0	1	1	0
74.5	1	1	0	1	1	1	0	0	0	1	0
74.6	1	1	0	1	1	1	0	0	0	1	1
74.7	1	1	0	1	1	1	0	0	0	0	1
74.8	1	1	0	1	0	1	0	0	0	0	1
74.9	1	1	0	1	0	1	0	0	0	1	1
75.0	1	1	0	1	0	1	0	0	0	1	0
75.1	1	1	0	1	0	1	0	0	1	1	0
75.2	1	1	0	1	0	1	0	0	1	0	0
75.3	1	1	0	1	0	1	0	1	1	0	0
75.4	1	1	0	1	0	1	0	1	1	1	0
75.5	1	1	0	1	0	1	0	1	0	1	0
75.6	1	1	0	1	0	1	0	1	0	1	1
75.7	1	1	0	1	0	1	0	1	0	0	1
75.8	1	1	0	1	0	1	1	1	0	0	1
75.9	1	1	0	1	0	1	1	1	0	1	1
76.0	1	1	0	1	0	1	1	1	0	1	0
76.1	1	1	0	1	0	1	1	1	1	1	0
76.2	1	1	0	1	0	1	1	1	1	0	0
76.3	1	1	0	1	0	1	1	0	1	0	0
76.4	1	1	0	1	0	1	1	0	1	1	0
76.5	1	1	0	1	0	1	1	0	0	1	0
76.6	1	1	0	1	0	1	1	0	0	1	1
76.7	1	1	0	1	0	1	1	0	0	0	1
76.8	1	1	0	1	0	0	1	0	0	0	1
76.9	1	1	0	1	0	0	1	0	0	1	1
77.0	1	1	0	1	0	0	1	0	0	1	0
77.1	1	1	0	1	0	0	1	0	1	1	0
77.2	1	1	0	1	0	0	1	0	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
77.3	1	1	0	1	0	0	1	1	1	0	0
77.4	1	1	0	1	0	0	1	1	1	1	0
77.5	1	1	0	1	0	0	1	1	0	1	0
77.6	1	1	0	1	0	0	1	1	0	1	1
77.7	1	1	0	1	0	0	1	1	0	0	1
77.8	1	1	0	1	0	0	0	1	0	0	1
77.9	1	1	0	1	0	0	0	1	0	1	1
78.0	1	1	0	1	0	0	0	1	0	1	0
78.1	1	1	0	1	0	0	0	1	1	1	0
78.2	1	1	0	1	0	0	0	1	1	0	0
78.3	1	1	0	1	0	0	0	0	1	0	0
78.4	1	1	0	1	0	0	0	0	1	1	0
78.5	1	1	0	1	0	0	0	0	0	1	0
78.6	1	1	0	1	0	0	0	0	0	1	1
78.7	1	1	0	1	0	0	0	0	0	0	1
78.8	1	1	1	1	0	0	0	0	0	0	1
78.9	1	1	1	1	0	0	0	0	0	1	1
79.0	1	1	1	1	0	0	0	0	0	1	0
79.1	1	1	1	1	0	0	0	0	1	1	0
79.2	1	1	1	1	0	0	0	0	1	0	0
79.3	1	1	1	1	0	0	0	1	1	0	0
79.4	1	1	1	1	0	0	0	1	1	1	0
79.5	1	1	1	1	0	0	0	1	0	1	0
79.6	1	1	1	1	0	0	0	1	0	1	1
79.7	1	1	1	1	0	0	0	1	0	0	1
79.8	1	1	1	1	0	0	1	1	0	0	1
79.9	1	1	1	1	0	0	1	1	0	1	1
80.0	1	1	1	1	0	0	1	1	0	1	0
80.1	1	1	1	1	0	0	1	1	1	1	0
80.2	1	1	1	1	0	0	1	1	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
80.3	1	1	1	1	0	0	1	0	1	0	0
80.4	1	1	1	1	0	0	1	0	1	1	0
80.5	1	1	1	1	0	0	1	0	0	1	0
80.6	1	1	1	1	0	0	1	0	0	1	1
80.7	1	1	1	1	0	0	1	0	0	0	1
80.8	1	1	1	1	0	1	1	0	0	0	1
80.9	1	1	1	1	0	1	1	0	0	1	1
81.0	1	1	1	1	0	1	1	0	0	1	0
81.1	1	1	1	1	0	1	1	0	1	1	0
81.2	1	1	1	1	0	1	1	0	1	0	0
81.3	1	1	1	1	0	1	1	1	1	0	0
81.4	1	1	1	1	0	1	1	1	1	1	0
81.5	1	1	1	1	0	1	1	1	0	1	0
81.6	1	1	1	1	0	1	1	1	0	1	1
81.7	1	1	1	1	0	1	1	1	0	0	1
81.8	1	1	1	1	0	1	0	1	0	0	1
81.9	1	1	1	1	0	1	0	1	0	1	1
82.0	1	1	1	1	0	1	0	1	0	1	0
82.1	1	1	1	1	0	1	0	1	1	1	0
82.2	1	1	1	1	0	1	0	1	1	0	0
82.3	1	1	1	1	0	1	0	0	1	0	0
82.4	1	1	1	1	0	1	0	0	1	1	0
82.5	1	1	1	1	0	1	0	0	0	1	0
82.6	1	1	1	1	0	1	0	0	0	1	1
82.7	1	1	1	1	0	1	0	0	0	0	1
82.8	1	1	1	1	1	1	0	0	0	0	1
82.9	1	1	1	1	1	1	0	0	0	1	1
83.0	1	1	1	1	1	1	0	0	0	1	0
83.1	1	1	1	1	1	1	0	0	1	1	0
83.2	1	1	1	1	1	1	0	0	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
83.3	1	1	1	1	1	1	0	1	1	0	0
83.4	1	1	1	1	1	1	0	1	1	1	0
83.5	1	1	1	1	1	1	0	1	0	1	0
83.6	1	1	1	1	1	1	0	1	0	1	1
83.7	1	1	1	1	1	1	0	1	0	0	1
83.8	1	1	1	1	1	1	1	1	0	0	1
83.9	1	1	1	1	1	1	1	1	0	1	1
84.0	1	1	1	1	1	1	1	1	0	1	0
84.1	1	1	1	1	1	1	1	1	1	1	0
84.2	1	1	1	1	1	1	1	1	1	0	0
84.3	1	1	1	1	1	1	1	0	1	0	0
84.4	1	1	1	1	1	1	1	0	1	1	0
84.5	1	1	1	1	1	1	1	0	0	1	0
84.6	1	1	1	1	1	1	1	0	0	1	1
84.7	1	1	1	1	1	1	1	0	0	0	1
84.8	1	1	1	1	1	0	1	0	0	0	1
84.9	1	1	1	1	1	0	1	0	0	1	1
85.0	1	1	1	1	1	0	1	0	0	1	0
85.1	1	1	1	1	1	0	1	0	1	1	0
85.2	1	1	1	1	1	0	1	0	1	0	0
85.3	1	1	1	1	1	0	1	1	1	0	0
85.4	1	1	1	1	1	0	1	1	1	1	0
85.5	1	1	1	1	1	0	1	1	0	1	0
85.6	1	1	1	1	1	0	1	1	0	1	1
85.7	1	1	1	1	1	0	1	1	0	0	1
85.8	1	1	1	1	1	0	0	1	0	0	1
85.9	1	1	1	1	1	0	0	1	0	1	1
86.0	1	1	1	1	1	0	0	1	0	1	0
86.1	1	1	1	1	1	0	0	1	1	1	0
86.2	1	1	1	1	1	0	0	1	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
86.3	1	1	1	1	1	0	0	0	1	0	0
86.4	1	1	1	1	1	0	0	0	1	1	0
86.5	1	1	1	1	1	0	0	0	0	1	0
86.6	1	1	1	1	1	0	0	0	0	1	1
86.7	1	1	1	1	1	0	0	0	0	0	1
86.8	1	1	1	0	1	0	0	0	0	0	1
86.9	1	1	1	0	1	0	0	0	0	1	1
87.0	1	1	1	0	1	0	0	0	0	1	0
87.1	1	1	1	0	1	0	0	0	1	1	0
87.2	1	1	1	0	1	0	0	0	1	0	0
87.3	1	1	1	0	1	0	0	1	1	0	0
87.4	1	1	1	0	1	0	0	1	1	1	0
87.5	1	1	1	0	1	0	0	1	0	1	0
87.6	1	1	1	0	1	0	0	1	0	1	1
87.7	1	1	1	0	1	0	0	1	0	0	1
87.8	1	1	1	0	1	0	1	1	0	0	1
87.9	1	1	1	0	1	0	1	1	0	1	1
88.0	1	1	1	0	1	0	1	1	0	1	0
88.1	1	1	1	0	1	0	1	1	1	1	0
88.2	1	1	1	0	1	0	1	1	1	0	0
88.3	1	1	1	0	1	0	1	0	1	0	0
88.4	1	1	1	0	1	0	1	0	1	1	0
88.5	1	1	1	0	1	0	1	0	0	1	0
88.6	1	1	1	0	1	0	1	0	0	1	1
88.7	1	1	1	0	1	0	1	0	0	0	1
88.8	1	1	1	0	1	1	1	0	0	0	1
88.9	1	1	1	0	1	1	1	0	0	1	1
89.0	1	1	1	0	1	1	1	0	0	1	0
89.1	1	1	1	0	1	1	1	0	1	1	0
89.2	1	1	1	0	1	1	1	0	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
89.3	1	1	1	0	1	1	1	1	1	0	0
89.4	1	1	1	0	1	1	1	1	1	1	0
89.5	1	1	1	0	1	1	1	1	0	1	0
89.6	1	1	1	0	1	1	1	1	0	1	1
89.7	1	1	1	0	1	1	1	1	0	0	1
89.8	1	1	1	0	1	1	0	1	0	0	1
89.9	1	1	1	0	1	1	0	1	0	1	1
90.0	1	1	1	0	1	1	0	1	0	1	0
90.1	1	1	1	0	1	1	0	1	1	1	0
90.2	1	1	1	0	1	1	0	1	1	0	0
90.3	1	1	1	0	1	1	0	0	1	0	0
90.4	1	1	1	0	1	1	0	0	1	1	0
90.5	1	1	1	0	1	1	0	0	0	1	0
90.6	1	1	1	0	1	1	0	0	0	1	1
90.7	1	1	1	0	1	1	0	0	0	0	1
90.8	1	1	1	0	0	1	0	0	0	0	1
90.9	1	1	1	0	0	1	0	0	0	1	1
91.0	1	1	1	0	0	1	0	0	0	1	0
91.1	1	1	1	0	0	1	0	0	1	1	0
91.2	1	1	1	0	0	1	0	0	1	0	0
91.3	1	1	1	0	0	1	0	1	1	0	0
91.4	1	1	1	0	0	1	0	1	1	1	0
91.5	1	1	1	0	0	1	0	1	0	1	0
91.6	1	1	1	0	0	1	0	1	0	1	1
91.7	1	1	1	0	0	1	0	1	0	0	1
91.8	1	1	1	0	0	1	1	1	0	0	1
91.9	1	1	1	0	0	1	1	1	0	1	1
92.0	1	1	1	0	0	1	1	1	0	1	0
92.1	1	1	1	0	0	1	1	1	1	1	0
92.2	1	1	1	0	0	1	1	1	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
92.3	1	1	1	0	0	1	1	0	1	0	0
92.4	1	1	1	0	0	1	1	0	1	1	0
92.5	1	1	1	0	0	1	1	0	0	1	0
92.6	1	1	1	0	0	1	1	0	0	1	1
92.7	1	1	1	0	0	1	1	0	0	0	1
92.8	1	1	1	0	0	0	1	0	0	0	1
92.9	1	1	1	0	0	0	1	0	0	1	1
93.0	1	1	1	0	0	0	1	0	0	1	0
93.1	1	1	1	0	0	0	1	0	1	1	0
93.2	1	1	1	0	0	0	1	0	1	0	0
93.3	1	1	1	0	0	0	1	1	1	0	0
93.4	1	1	1	0	0	0	1	1	1	1	0
93.5	1	1	1	0	0	0	1	1	0	1	0
93.6	1	1	1	0	0	0	1	1	0	1	1
93.7	1	1	1	0	0	0	1	1	0	0	1
93.8	1	1	1	0	0	0	0	1	0	0	1
93.9	1	1	1	0	0	0	0	1	0	1	1
94.0	1	1	1	0	0	0	0	1	0	1	0
94.1	1	1	1	0	0	0	0	1	1	1	0
94.2	1	1	1	0	0	0	0	1	1	0	0
94.3	1	1	1	0	0	0	0	0	1	0	0
94.4	1	1	1	0	0	0	0	0	1	1	0
94.5	1	1	1	0	0	0	0	0	0	1	0
94.6	1	1	1	0	0	0	0	0	0	1	1
94.7	1	1	1	0	0	0	0	0	0	0	1
94.8	1	0	1	0	0	0	0	0	0	0	1
94.9	1	0	1	0	0	0	0	0	0	1	1
95.0	1	0	1	0	0	0	0	0	0	1	0
95.1	1	0	1	0	0	0	0	0	1	1	0
95.2	1	0	1	0	0	0	0	0	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
95.3	1	0	1	0	0	0	0	1	1	0	0
95.4	1	0	1	0	0	0	0	1	1	1	0
95.5	1	0	1	0	0	0	0	1	0	1	0
95.6	1	0	1	0	0	0	0	1	0	1	1
95.7	1	0	1	0	0	0	0	1	0	0	1
95.8	1	0	1	0	0	0	1	1	0	0	1
95.9	1	0	1	0	0	0	1	1	0	1	1
96.0	1	0	1	0	0	0	1	1	0	1	0
96.1	1	0	1	0	0	0	1	1	1	1	0
96.2	1	0	1	0	0	0	1	1	1	0	0
96.3	1	0	1	0	0	0	1	0	1	0	0
96.4	1	0	1	0	0	0	1	0	1	1	0
96.5	1	0	1	0	0	0	1	0	0	1	0
96.6	1	0	1	0	0	0	1	0	0	1	1
96.7	1	0	1	0	0	0	1	0	0	0	1
96.8	1	0	1	0	0	1	1	0	0	0	1
96.9	1	0	1	0	0	1	1	0	0	1	1
97.0	1	0	1	0	0	1	1	0	0	1	0
97.1	1	0	1	0	0	1	1	0	1	1	0
97.2	1	0	1	0	0	1	1	0	1	0	0
97.3	1	0	1	0	0	1	1	1	1	0	0
97.4	1	0	1	0	0	1	1	1	1	1	0
97.5	1	0	1	0	0	1	1	1	0	1	0
97.6	1	0	1	0	0	1	1	1	0	1	1
97.7	1	0	1	0	0	1	1	1	0	0	1
97.8	1	0	1	0	0	1	0	1	0	0	1
97.9	1	0	1	0	0	1	0	1	0	1	1
98.0	1	0	1	0	0	1	0	1	0	1	0
98.1	1	0	1	0	0	1	0	1	1	1	0
98.2	1	0	1	0	0	1	0	1	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
98.3	1	0	1	0	0	1	0	0	1	0	0
98.4	1	0	1	0	0	1	0	0	1	1	0
98.5	1	0	1	0	0	1	0	0	0	1	0
98.6	1	0	1	0	0	1	0	0	0	1	1
98.7	1	0	1	0	0	1	0	0	0	0	1
98.8	1	0	1	0	1	1	0	0	0	0	1
98.9	1	0	1	0	1	1	0	0	0	1	1
99.0	1	0	1	0	1	1	0	0	0	1	0
99.1	1	0	1	0	1	1	0	0	1	1	0
99.2	1	0	1	0	1	1	0	0	1	0	0
99.3	1	0	1	0	1	1	0	1	1	0	0
99.4	1	0	1	0	1	1	0	1	1	1	0
99.5	1	0	1	0	1	1	0	1	0	1	0
99.6	1	0	1	0	1	1	0	1	0	1	1
99.7	1	0	1	0	1	1	0	1	0	0	1
99.8	1	0	1	0	1	1	1	1	0	0	1
99.9	1	0	1	0	1	1	1	1	0	1	1
100.0	1	0	1	0	1	1	1	1	0	1	0
100.1	1	0	1	0	1	1	1	1	1	1	0
100.2	1	0	1	0	1	1	1	1	1	0	0
100.3	1	0	1	0	1	1	1	0	1	0	0
100.4	1	0	1	0	1	1	1	0	1	1	0
100.5	1	0	1	0	1	1	1	0	0	1	0
100.6	1	0	1	0	1	1	1	0	0	1	1
100.7	1	0	1	0	1	1	1	0	0	0	1
100.8	1	0	1	0	1	0	1	0	0	0	1
100.9	1	0	1	0	1	0	1	0	0	1	1
101.0	1	0	1	0	1	0	1	0	0	1	0
101.1	1	0	1	0	1	0	1	0	1	1	0
101.2	1	0	1	0	1	0	1	0	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
101.3	1	0	1	0	1	0	1	1	1	0	0
101.4	1	0	1	0	1	0	1	1	1	1	0
101.5	1	0	1	0	1	0	1	1	0	1	0
101.6	1	0	1	0	1	0	1	1	0	1	1
101.7	1	0	1	0	1	0	1	1	0	0	1
101.8	1	0	1	0	1	0	0	1	0	0	1
101.9	1	0	1	0	1	0	0	1	0	1	1
102.0	1	0	1	0	1	0	0	1	0	1	0
102.1	1	0	1	0	1	0	0	1	1	1	0
102.2	1	0	1	0	1	0	0	1	1	0	0
102.3	1	0	1	0	1	0	0	0	1	0	0
102.4	1	0	1	0	1	0	0	0	1	1	0
102.5	1	0	1	0	1	0	0	0	0	1	0
102.6	1	0	1	0	1	0	0	0	0	1	1
102.7	1	0	1	0	1	0	0	0	0	0	1
102.8	1	0	1	1	1	0	0	0	0	0	1
102.9	1	0	1	1	1	0	0	0	0	1	1
103.0	1	0	1	1	1	0	0	0	0	1	0
103.1	1	0	1	1	1	0	0	0	1	1	0
103.2	1	0	1	1	1	0	0	0	1	0	0
103.3	1	0	1	1	1	0	0	1	1	0	0
103.4	1	0	1	1	1	0	0	1	1	1	0
103.5	1	0	1	1	1	0	0	1	0	1	0
103.6	1	0	1	1	1	0	0	1	0	1	1
103.7	1	0	1	1	1	0	0	1	0	0	1
103.8	1	0	1	1	1	0	1	1	0	0	1
103.9	1	0	1	1	1	0	1	1	0	1	1
104.0	1	0	1	1	1	0	1	1	0	1	0
104.1	1	0	1	1	1	0	1	1	1	1	0
104.2	1	0	1	1	1	0	1	1	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
104.3	1	0	1	1	1	0	1	0	1	0	0
104.4	1	0	1	1	1	0	1	0	1	1	0
104.5	1	0	1	1	1	0	1	0	0	1	0
104.6	1	0	1	1	1	0	1	0	0	1	1
104.7	1	0	1	1	1	0	1	0	0	0	1
104.8	1	0	1	1	1	1	1	0	0	0	1
104.9	1	0	1	1	1	1	1	0	0	1	1
105.0	1	0	1	1	1	1	1	0	0	1	0
105.1	1	0	1	1	1	1	1	0	1	1	0
105.2	1	0	1	1	1	1	1	0	1	0	0
105.3	1	0	1	1	1	1	1	1	1	0	0
105.4	1	0	1	1	1	1	1	1	1	1	0
105.5	1	0	1	1	1	1	1	1	0	1	0
105.6	1	0	1	1	1	1	1	1	0	1	1
105.7	1	0	1	1	1	1	1	1	0	0	1
105.8	1	0	1	1	1	1	0	1	0	0	1
105.9	1	0	1	1	1	1	0	1	0	1	1
106.0	1	0	1	1	1	1	0	1	0	1	0
106.1	1	0	1	1	1	1	0	1	1	1	0
106.2	1	0	1	1	1	1	0	1	1	0	0
106.3	1	0	1	1	1	1	0	0	1	0	0
106.4	1	0	1	1	1	1	0	0	1	1	0
106.5	1	0	1	1	1	1	0	0	0	1	0
106.6	1	0	1	1	1	1	0	0	0	1	1
106.7	1	0	1	1	1	1	0	0	0	0	1
106.8	1	0	1	1	0	1	0	0	0	0	1
106.9	1	0	1	1	0	1	0	0	0	1	1
107.0	1	0	1	1	0	1	0	0	0	1	0
107.1	1	0	1	1	0	1	0	0	1	1	0
107.2	1	0	1	1	0	1	0	0	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
107.3	1	0	1	1	0	1	0	1	1	0	0
107.4	1	0	1	1	0	1	0	1	1	1	0
107.5	1	0	1	1	0	1	0	1	0	1	0
107.6	1	0	1	1	0	1	0	1	0	1	1
107.7	1	0	1	1	0	1	0	1	0	0	1
107.8	1	0	1	1	0	1	1	1	0	0	1
107.9	1	0	1	1	0	1	1	1	0	1	1
108.0	1	0	1	1	0	1	1	1	0	1	0
108.1	1	0	1	1	0	1	1	1	1	1	0
108.2	1	0	1	1	0	1	1	1	1	0	0
108.3	1	0	1	1	0	1	1	0	1	0	0
108.4	1	0	1	1	0	1	1	0	1	1	0
108.5	1	0	1	1	0	1	1	0	0	1	0
108.6	1	0	1	1	0	1	1	0	0	1	1
108.7	1	0	1	1	0	1	1	0	0	0	1
108.8	1	0	1	1	0	0	1	0	0	0	1
108.9	1	0	1	1	0	0	1	0	0	1	1
109.0	1	0	1	1	0	0	1	0	0	1	0
109.1	1	0	1	1	0	0	1	0	1	1	0
109.2	1	0	1	1	0	0	1	0	1	0	0
109.3	1	0	1	1	0	0	1	1	1	0	0
109.4	1	0	1	1	0	0	1	1	1	1	0
109.5	1	0	1	1	0	0	1	1	0	1	0
109.6	1	0	1	1	0	0	1	1	0	1	1
109.7	1	0	1	1	0	0	1	1	0	0	1
109.8	1	0	1	1	0	0	0	1	0	0	1
109.9	1	0	1	1	0	0	0	1	0	1	1
110.0	1	0	1	1	0	0	0	1	0	1	0
110.1	1	0	1	1	0	0	0	1	1	1	0
110.2	1	0	1	1	0	0	0	1	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
110.3	1	0	1	1	0	0	0	0	1	0	0
110.4	1	0	1	1	0	0	0	0	1	1	0
110.5	1	0	1	1	0	0	0	0	0	1	0
110.6	1	0	1	1	0	0	0	0	0	1	1
110.7	1	0	1	1	0	0	0	0	0	0	1
110.8	1	0	0	1	0	0	0	0	0	0	1
110.9	1	0	0	1	0	0	0	0	0	1	1
111.0	1	0	0	1	0	0	0	0	0	1	0
111.1	1	0	0	1	0	0	0	0	1	1	0
111.2	1	0	0	1	0	0	0	0	1	0	0
111.3	1	0	0	1	0	0	0	1	1	0	0
111.4	1	0	0	1	0	0	0	1	1	1	0
111.5	1	0	0	1	0	0	0	1	0	1	0
111.6	1	0	0	1	0	0	0	1	0	1	1
111.7	1	0	0	1	0	0	0	1	0	0	1
111.8	1	0	0	1	0	0	1	1	0	0	1
111.9	1	0	0	1	0	0	1	1	0	1	1
112.0	1	0	0	1	0	0	1	1	0	1	0
112.1	1	0	0	1	0	0	1	1	1	1	0
112.2	1	0	0	1	0	0	1	1	1	0	0
112.3	1	0	0	1	0	0	1	0	1	0	0
112.4	1	0	0	1	0	0	1	0	1	1	0
112.5	1	0	0	1	0	0	1	0	0	1	0
112.6	1	0	0	1	0	0	1	0	0	1	1
112.7	1	0	0	1	0	0	1	0	0	0	1
112.8	1	0	0	1	0	1	1	0	0	0	1
112.9	1	0	0	1	0	1	1	0	0	1	1
113.0	1	0	0	1	0	1	1	0	0	1	0
113.1	1	0	0	1	0	1	1	0	1	1	0
113.2	1	0	0	1	0	1	1	0	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
113.3	1	0	0	1	0	1	1	1	1	0	0
113.4	1	0	0	1	0	1	1	1	1	1	0
113.5	1	0	0	1	0	1	1	1	0	1	0
113.6	1	0	0	1	0	1	1	1	0	1	1
113.7	1	0	0	1	0	1	1	1	0	0	1
113.8	1	0	0	1	0	1	0	1	0	0	1
113.9	1	0	0	1	0	1	0	1	0	1	1
114.0	1	0	0	1	0	1	0	1	0	1	0
114.1	1	0	0	1	0	1	0	1	1	1	0
114.2	1	0	0	1	0	1	0	1	1	0	0
114.3	1	0	0	1	0	1	0	0	1	0	0
114.4	1	0	0	1	0	1	0	0	1	1	0
114.5	1	0	0	1	0	1	0	0	0	1	0
114.6	1	0	0	1	0	1	0	0	0	1	1
114.7	1	0	0	1	0	1	0	0	0	0	1
114.8	1	0	0	1	1	1	0	0	0	0	1
114.9	1	0	0	1	1	1	0	0	0	1	1
115.0	1	0	0	1	1	1	0	0	0	1	0
115.1	1	0	0	1	1	1	0	0	1	1	0
115.2	1	0	0	1	1	1	0	0	1	0	0
115.3	1	0	0	1	1	1	0	1	1	0	0
115.4	1	0	0	1	1	1	0	1	1	1	0
115.5	1	0	0	1	1	1	0	1	0	1	0
115.6	1	0	0	1	1	1	0	1	0	1	1
115.7	1	0	0	1	1	1	0	1	0	0	1
115.8	1	0	0	1	1	1	1	1	0	0	1
115.9	1	0	0	1	1	1	1	1	0	1	1
116.0	1	0	0	1	1	1	1	1	0	1	0
116.1	1	0	0	1	1	1	1	1	1	1	0
116.2	1	0	0	1	1	1	1	1	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
116.3	1	0	0	1	1	1	1	0	1	0	0
116.4	1	0	0	1	1	1	1	0	1	1	0
116.5	1	0	0	1	1	1	1	0	0	1	0
116.6	1	0	0	1	1	1	1	0	0	1	1
116.7	1	0	0	1	1	1	1	0	0	0	1
116.8	1	0	0	1	1	0	1	0	0	0	1
116.9	1	0	0	1	1	0	1	0	0	1	1
117.0	1	0	0	1	1	0	1	0	0	1	0
117.1	1	0	0	1	1	0	1	0	1	1	0
117.2	1	0	0	1	1	0	1	0	1	0	0
117.3	1	0	0	1	1	0	1	1	1	0	0
117.4	1	0	0	1	1	0	1	1	1	1	0
117.5	1	0	0	1	1	0	1	1	0	1	0
117.6	1	0	0	1	1	0	1	1	0	1	1
117.7	1	0	0	1	1	0	1	1	0	0	1
117.8	1	0	0	1	1	0	0	1	0	0	1
117.9	1	0	0	1	1	0	0	1	0	1	1
118.0	1	0	0	1	1	0	0	1	0	1	0
118.1	1	0	0	1	1	0	0	1	1	1	0
118.2	1	0	0	1	1	0	0	1	1	0	0
118.3	1	0	0	1	1	0	0	0	1	0	0
118.4	1	0	0	1	1	0	0	0	1	1	0
118.5	1	0	0	1	1	0	0	0	0	1	0
118.6	1	0	0	1	1	0	0	0	0	1	1
118.7	1	0	0	1	1	0	0	0	0	0	1
118.8	1	0	0	0	1	0	0	0	0	0	1
118.9	1	0	0	0	1	0	0	0	0	1	1
119.0	1	0	0	0	1	0	0	0	0	1	0
119.1	1	0	0	0	1	0	0	0	1	1	0
119.2	1	0	0	0	1	0	0	0	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
119.3	1	0	0	0	1	0	0	1	1	0	0
119.4	1	0	0	0	1	0	0	1	1	1	0
119.5	1	0	0	0	1	0	0	1	0	1	0
119.6	1	0	0	0	1	0	0	1	0	1	1
119.7	1	0	0	0	1	0	0	1	0	0	1
119.8	1	0	0	0	1	0	1	1	0	0	1
119.9	1	0	0	0	1	0	1	1	0	1	1
120.0	1	0	0	0	1	0	1	1	0	1	0
120.1	1	0	0	0	1	0	1	1	1	1	0
120.2	1	0	0	0	1	0	1	1	1	0	0
120.3	1	0	0	0	1	0	1	0	1	0	0
120.4	1	0	0	0	1	0	1	0	1	1	0
120.5	1	0	0	0	1	0	1	0	0	1	0
120.6	1	0	0	0	1	0	1	0	0	1	1
120.7	1	0	0	0	1	0	1	0	0	0	1
120.8	1	0	0	0	1	1	1	0	0	0	1
120.9	1	0	0	0	1	1	1	0	0	1	1
121.0	1	0	0	0	1	1	1	0	0	1	0
121.1	1	0	0	0	1	1	1	0	1	1	0
121.2	1	0	0	0	1	1	1	0	1	0	0
121.3	1	0	0	0	1	1	1	1	1	0	0
121.4	1	0	0	0	1	1	1	1	1	1	0
121.5	1	0	0	0	1	1	1	1	0	1	0
121.6	1	0	0	0	1	1	1	1	0	1	1
121.7	1	0	0	0	1	1	1	1	0	0	1
121.8	1	0	0	0	1	1	0	1	0	0	1
121.9	1	0	0	0	1	1	0	1	0	1	1
122.0	1	0	0	0	1	1	0	1	0	1	0
122.1	1	0	0	0	1	1	0	1	1	1	0
122.2	1	0	0	0	1	1	0	1	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
122.3	1	0	0	0	1	1	0	0	1	0	0
122.4	1	0	0	0	1	1	0	0	1	1	0
122.5	1	0	0	0	1	1	0	0	0	1	0
122.6	1	0	0	0	1	1	0	0	0	1	1
122.7	1	0	0	0	1	1	0	0	0	0	1
122.8	1	0	0	0	0	1	0	0	0	0	1
122.9	1	0	0	0	0	1	0	0	0	1	1
123.0	1	0	0	0	0	1	0	0	0	1	0
123.1	1	0	0	0	0	1	0	0	1	1	0
123.2	1	0	0	0	0	1	0	0	1	0	0
123.3	1	0	0	0	0	1	0	1	1	0	0
123.4	1	0	0	0	0	1	0	1	1	1	0
123.5	1	0	0	0	0	1	0	1	0	1	0
123.6	1	0	0	0	0	1	0	1	0	1	1
123.7	1	0	0	0	0	1	0	1	0	0	1
123.8	1	0	0	0	0	1	1	1	0	0	1
123.9	1	0	0	0	0	1	1	1	0	1	1
124.0	1	0	0	0	0	1	1	1	0	1	0
124.1	1	0	0	0	0	1	1	1	1	1	0
124.2	1	0	0	0	0	1	1	1	1	0	0
124.3	1	0	0	0	0	1	1	0	1	0	0
124.4	1	0	0	0	0	1	1	0	1	1	0
124.5	1	0	0	0	0	1	1	0	0	1	0
124.6	1	0	0	0	0	1	1	0	0	1	1
124.7	1	0	0	0	0	1	1	0	0	0	1
124.8	1	0	0	0	0	0	1	0	0	0	1
124.9	1	0	0	0	0	0	1	0	0	1	1
125.0	1	0	0	0	0	0	1	0	0	1	0
125.1	1	0	0	0	0	0	1	0	1	1	0
125.2	1	0	0	0	0	0	1	0	1	0	0

RANGE	PULSE POSITION										
Altitude in Thousands	D_2	D_4 and SPI	A_1	A_2	A_4	B_1	B_2	B_4	C_1	C_2	C_4
125.3	1	0	0	0	0	0	1	1	1	0	0
125.4	1	0	0	0	0	0	1	1	1	1	0
125.5	1	0	0	0	0	0	1	1	0	1	0
125.6	1	0	0	0	0	0	1	1	0	1	1
125.7	1	0	0	0	0	0	1	1	0	0	1
125.8	1	0	0	0	0	0	0	1	0	0	1
125.9	1	0	0	0	0	0	0	1	0	1	1
126.0	1	0	0	0	0	0	0	1	0	1	0
126.1	1	0	0	0	0	0	0	1	1	1	0
126.2	1	0	0	0	0	0	0	1	1	0	0
126.3	1	0	0	0	0	0	0	0	1	0	0
126.4	1	0	0	0	0	0	0	0	1	1	0
126.5	1	0	0	0	0	0	0	0	0	1	0
126.6	1	0	0	0	0	0	0	0	0	1	1
126.7	1	0	0	0	0	0	0	0	0	0	1

SECTION IV

THEORY OF OPERATION

4-1. INTRODUCTION. Section IV is intended to give information about the theory of circuit operation of the ATC-600(A). Such information is useful both in test set operation and in calibration and troubleshooting techniques. Schematic diagrams referred to can be located in Section VIII. Unless otherwise specified, all information given applies to both the ATC-600 and the ATC-600(A). The differences between the two lie chiefly in transponder operation.

<u>NOTE:</u>

PC-1 Component Identification is shown as PC-1 to S/N 1032/PC-1 SN 1033 & on (e.g., X102/X109) where applicable.

4-2. TRANSPONDER OPERATION. (Refer to the Transponder Video Block Diagram, Figure 4-1 and to the Transponder Board Schematic (PC-1), Figure 8-2). The PRF for transponder interrogations is generated by the 260 Hz PRF Oscillator (Q101/Q110), an unijunction oscillator, at a fixed rate of 235 pulses per second. The PRF rate can be altered externally for testing purposes. (See Section VI, CALIBRATION PROCEDURES).

4-2-1. <u>SLS Circuits (ATC-600)</u>. The PRF is applied through a Divide-by-Three Circuit to the P_2 Pulse One-Shot (X102/X109) and to the Output One-Shot X104. Therefore, The P_1 Pulse is formed at each PRF output by the Output One-Shot X104, and P_2 is started. Two microseconds later, the P_2 Pulse One-Shot (X102/X109) resets, applying another pulse to the Output One-Shot X104, if the ATC-600 SLS Switch (24) is depressed. The P_2 Pulse One-Shot (X102/X109) also triggers the P_3 Pulse One-Shot (X103/X114).

4-2-2. <u>SLS Circuits (ATC-600A)</u>. In the ATC-600(A), PC-08-1075, (ATC-600A SLS and RF Leveler Schematic, Figure 8-9-2) provides for attenuation of the P_2 Pulse by 9 dB, if desired, through the 0/OFF/-9 dB SLS Switch (Figure 3-1-1). From PC-1, pin S (Figure 8-2), the transponder pulses are applied to the two one-shots, X17501A and X17501B (Figure 8-9-2).

<u>NOTE:</u>

Normally, when the 0/OFF/-9 dB Switch (Figure 3-1-1) is in center (OFF) position, only P_1 and P_3 are present. In either the 0 dB (up) or the -9 dB (down) position, P_2 is added to the pulse train. This function is performed by PC-1 and the 0/OFF/-9 dB SLS Switch through Pin 17 of PC-1 (Figure 8-2).

If the 0/OFF/-9 dB SLS Switch is in the 0 dB (up) position, Pin 3 of X17501A (Figure 8-9-2) is held at a logic 0 level, and X17501A does not operate. X17501B will operate in either the 0 dB (up) or the -9 dB (down) switch position, but has no effect in the 0 dB mode. When the 0/OFF/-9 dB switch (Figure 3-1-1) is in the -9 dB (down) position, +65 Volts is applied to R17504, placing a high level on Pin 3 of X17501A and enabling it to also operate on incoming pulses. X17501A is further enabled to operate by X17501B's applying a high level to Pin 2 of X17501A until X17501B is fired. When the trailing edge of P_1 is applied to the one-shots with the 0/OFF/-9 dB SLS Switch (Figure 3-1-1) in the 0 dB position, X17501A does not fire. Q17501 will remain off or nonconducting. If the 0/OFF/-9 dB SLS Switch (Figure 3-1-1) is placed in the -9 dB position, X17501A fires, along with X17501B, on the trailing (negative-going edge) of P_1. The approximate time of X17501A is four microseconds. During that four microseconds, the $\overline{Q}$ of X17501A goes low, causing Q 17501 to turn on. The collector of Q17501 goes to +5 Volts and pulls on the attenuator portion of the leveler block, consisting of the 132 ohm resistor, the 182 ohm resistor, the two associated PSO-83B diodes, and the 76.8 ohm resistor. An adjustment for the amount of signal attenuation is provided, R17519. It is set to provide 9 dB of signal attenuation from the normal (P_1 and P_3) level. X17501A resets in four microseconds, providing 9 dB of signal attenuation during the P_2 Pulse time. However, X17501B does not reset for 30 microseconds. This keeps X17051A from operating again during the time of the P_3 pulse.

4-2-3. <u>Interrogation</u>. In either A/C interlace mode, the time of the P_3 Pulse One-Shot (X103/X114) is altered on a two to one basis by the Divide-by-Three Circuit that follows the 260 Hz PRF Oscillator (Q101/Q110). Q103 is on for two PRF outputs and off for one. Therefore, the timing of the P_3 Pulse One Shot (X103/X114) is eight microseconds for two output PRF cycles, and twenty-one microseconds for one cycle, forming the two to one A/C Interlace pattern. When the P_3 Pulse One-Shot (X103/X114) timing is complete, it also triggers the Output One-Shot (X104), forming P_3 of the interrogation. Positive sync is taken from either the A portion or C portion of the Divide-by-Three Circuit to observe the interrogation pulses referenced to the eight microsecond or twenty-one microsecond P_3 timing. In Mode B (Standard on models prior to S/N 473. Available by special order S/N 474 on.), sync is taken from the P_2 Pulse One-Shot (X102/X109) only.

4-2-4. <u>Reply</u>. All other transponder circuits are concerned with processing the reply pulses. The Reply Gating One-Shot (X122/X102) is triggered by the P_3 Pulse One-Shot's (X103/X114) resetting. As the Reply Gating One-Shot (X122/X102) sets, it applies a reset pulse to the XPDR Pulse Storage Register (X121/X101), (X108/X105), (X109/X110), and (X110/X115), to the Output Control Flip-Flop (X106B/X118), to the Alt. Register Clock Control Flip-Flop (X114B/X107), and to the entire Altitude Register on PC-2 (Altitude Register Schematic, Figure 8-3). Thus, the system is cleared to accept new reply pulses. Detected Video Input is applied to Pin A of PC-1 and is squared by Q109. If the reply Gating One-Shot (X122/X102) is set, the pulses are fed to the XPDR Pulse Storage Register. F_1 is first to enter; F_2 is last.

4-2-4-1. Clock Pulses. The first pulse into the XPDR Pulse Storage Register sets the Register Clock Control Flip-Flop (X114A/X106). The Register Clock Control Flip-Flop (X114A/X106), in turn, enables Gate (X119B/X123). The Register Clock Control Flip-Flop (X114A/X106) also allows pulses from the 20.68 MHz PRF Oscillator (Q101/Q110) to be applied to the Divide-by-Three Circuit and to trigger One-Shot (X113/X112). The pulses from One-Shot are the clock pulses to the XPDR Pulse Storage Register. The clock rate is 1.45 microseconds, the spacing of the reply pulses.

4-2-4-2. F_1 Pulse. As each reply pulse enters the ATC-600(A), it is clocked into the XPDR Pulse Storage Register as a High (Logic 1) or a Low (Logic 0) Level. After a maximum of 17 pulses are stored, the First Framing Pulse (F_1) will be in its final position. When F_1 reaches the end of the XPDR Pulse Storage Register, it (F_1) causes the Register Clock Control Flip-Flop (X114A/X106) to reset, and it stops the clock to the XPDR Pulse Storage Register. F_1 also enables the Numerical Readout (7) to be unblanked and enables the XPDR % REPLY/DME PRF MTR (1) to show percent reply. In A/C CODE Mode, XPDR Pulse Storage Outputs A_1 through D_4 are applied directly to the Numerical Readout (7) display board. A set of transistor switches or gates are then enabled to decode and display numerically the pilot's code received. In A/C ALT Mode, XPDR Pulse Storage Register Outputs A_1 through D_4 are applied to a set of three comparators on the Altitude Register Board, PC-2 (Figure 8-3).

4-2-4-3. Altitude Code. Resetting the Register Clock Control Flip-Flop (X114A/X106) when all pulses are loaded into the XPDR Pulse Storage Register, sets the Alt Register Clock Control Flip-Flop, (X114B/X107), a flip-flop that gates an altitude clock frequency to the display board. There, a series of four counters start at an altitude (preset) of minus one thousand feet and count up at the Altitude Clock frequency rate. Simultaneously, on PC-2 (Figure 8-3) the Altitude Clock is running a counter designed to count in the fashion of the altitude code, a form of Gray Daytex Code. So a counter on the display board and a counter on PC-2 clock together, starting at minus one thousand feet, counting up to zero, and then up to a maximum of +126.7 thousand feet. When the counter on PC-2 reaches the same count as the inputs from the XPDR Pulse Storage Register have numerically, the comparators enable Gate X202, and the Altitude Coincidence Output is formed. The Altitude Coincidence Output is applied back to PC-1 and resets the Alt Register Clock Control Flip-Flop (X114B/X107), stopping the altitude clock, and thus, stopping the counters on the display board. The counters on the display board indicate the received altitude. The Numerical Readout (7), which has been blanked during the counting process, is then unblanked to display the received altitude.

4-2-4-4. Ident Pulse. An Ident Pulse applied to the transponder will load into the last position of the XPDR Pulse Storage Register. The Ident Pulse activates (X110/X115) of the XPDR Pulse Storage Register which, in turn, lights the IDENT Pulse Indicator (6). A pulse is applied to the Framing Pulse Control Flip-Flop (X106A/X118) 5.8 microseconds before the XPDR Pulse Storage Register will be fully loaded. As the Framing Pulse Control Flip-Flop (X106A/X118) sets, it triggers the Framing Pulse Delay One-Shot (X107/X119). The time of the Framing Pulse Delay One-Shot (X107/X119) can be varied with the Front Panel FRAMING Pulse Spacing Control (25). When the Framing Pulse Delay One-Shot (X107/X119) resets, it applies a short pulse, a product of the action of (X107/X119) and (X117C/X103B), to Gate (X117C/X103B). The other input to Gate (R124/R137) is the input to the XPDR Pulse Storage Register. The Framing Pulse Delay One-Shot's (C118/C121) timing is approximately 5.8 microseconds, which places the input to Gate (X117C/X103B) at the timing of the F_2 Pulse to the XPDR Pulse Storage Register. If the two are in coincidence, Gate (X117C/X103B) is enabled, setting the Output Control Flip-Flop (X106B/X118). When the Output Control Flip-Flop (X106B/X118) is set, the F_2 Pulse Spacing Indicator (4) is off. If the Framing Pulse Delay One Shot's (CR117/CR121) time is varied greater or lesser than the coincidence time of the F_2 Pulse, the Output Control Flip-Flop (CR106/CR121) will not be set, and (Q104/Q108) will be turned on to light the F_2 Pulse Spacing Indicator (4).

4-2-4-5. NO ALT. Diodes (X106B/X118) through (X107/X119) are used to sense pulses present between F_1 and F_2 of the reply. If no pulses are present, (Q113/Q106) is off, which enables (X118A/X111C). (X118A/X111C) lights the NO ALT Indicator (2). In Mode A operation (either Mode A only or A/C Interlace) (Q113/Q106) is turned on continuously through (R140/R150) and (CR105/CR126). Any one pulse between F_1 and F_2 will also turn (Q113/Q106) on, which turns the NO ALT indicator (2) off.

4-2-4-6. INVALID ALT. On PC-2 (Figure 8-3), a circuit senses the C_1, C_2, and C_4 Pulses. For a received altitude code to be valid, at least one C Pulse must be present. However, C_1 and C_4 cannot be present at the same time in valid altitude code reception. Q213, Q214, and Q215 are inverters for the C_1, C_2, and C_4 Pulses. The Invalid Sensing Circuit (Q213 through Q217 and X201) ascertains whether a valid or invalid reply is being received. The output of X201C will be high if the received code is invalid.

4-2-4-7. Interrogation Spacing. The timing of P_2 and P_3 (relative to P_1 of the interrogation) can be slewed with the Interrogation Spacing Control (27), which changes the P_2 Pulse One-Shot (X102/X109) timing. Changing the P_2 Pulse One-Shot (X102/X109) timing shifts P_2 and P_3 together. In Mode A (B) the P_3 spacing is set to 8 μs (17 μs) by a separate internal control and is varied, as are the spacings in the A/C interlace modes, with the Interrogation Spacing Control (27).

4-2-4-8. Altitude ENCODER. When an encoding altimeter is tested through the ATC-600(A) Altitude ENCODER Input Connector (26), pulse inputs A_1 through D_4 are applied to the display board where they are routed to the A_1 through D_4 lines coming from the XPDR Pulse Storage Register on PC-1. These pulse inputs simulate transponder operation for the test set. Therefore, a transponder cannot be operated while pulses A_1 through D_4 are being processed. The PRF rate (235 pps) is used to initiate the reset, altitude clock, and counter action. One pulse, simulating F_1, is loaded into the XPDR Pulse Storage Register. All circuitry operates just as if a transponder were being tested. The altitude clock will cause the counters to find the altitude being applied and to display the correct information. The P^3 Pulse One-Shot (X103/X114) sets the No Reply Flip-Flop (X105A/X106) on each transponder interrogation that contains no reply pulse output. When reply pulses are present, the first pulse (F_1) resets the No Reply Flip-Flop (X105A/X106).

4-2-4-9. 1030 MHz Signal Leveling. The circuits on PC Board 08-0175 (Figure 8-9-1) provide 1030 MHz signal leveling to the diode switch and provide for varying the 1030 MHz signal level from -66 to -79 dBm (with properly positioned remote test antenna or with a 34 dB pad) through the XPDR SIG Control (Figure 3-1-1). The signal from the 1030 MHz oscillator is applied to the leveler block, and the RF level is detected by the HP2800 diode. This dc level is applied to the inverting input of Amplifier X17502. Three trim pots, R17507 (-66 dBm set), R17511 (-79 dBm set), and R17514 (a linearity adjust), and the Front Panel XPDR SIG Control (R17575) set the reference level on the other input of X17502. If the 1030 MHz oscillator is too high, the amplifier output will go more negative and reduce the conduction of the input PSO-83B Diode. This decreases the signal level to the one desired. The Front Panel XPDR SIG Control (Figure 3-1-1) can vary the reference level to cause output RF levels from the test set (including coax and space loss) to vary from -66 to -79 dBm (with properly positioned remote test antenna or 34 dB pad). The output from the leveler block is applied to the diode switch.

4-3 DME OPERATION. (Refer to the DME Signal Block Diagram, Figure 4-2 and to the DME Signal PC Board Schematic [PC-3], Figure 8-4). The detected Video Input is applied to the AGC (Q301 through Q304) on PC-3. FET Q301 is used as a gain control for the incoming signal. The signal at the collector of Q303 will be constant in peak to peak amplitude for a very wide range of input signal levels. This is necessary to assure proper range timing and delay for a variance of DME output powers and antenna installations, etc. The differential transistor pair, Q305 and Q306, sense the 50% point of the input signal from Q303 and form a spike for P_1 from Q307 to begin range reply timing. The spike from Q307 is applied to One-Shot X301, which has a time in X Channel of nine microseconds and in Y Channel of 32.5 microseconds.

One initial setting, One-Shot X301 applies a negative pulse through C308 as the Decoder Video Output Signal. At this time, One-Shot X301 also resets Flip-Flop X303A. When One-Shot X301 resets, it sets X302, which has a time of approximately six microseconds (±1.5 microseconds) from the Input Pulse Spacing of 12 microseconds in X Channel, and of 36 microseconds in Y channel. During the time X302 is reset, the Second Input Pulse (P_2) is applied from the AGC. It has no effect on One-Shot X301, but sets X303A. (If P_2 is greater or less than about three microseconds, it will not be able to set X303A). If X303A is set, Q308 is maintained off. If X303A is left reset for an appreciable length of time, Q308 will be brought into conduction and will clamp out pulses from the Decoder Output. R322, C308, and R323 form an averaging delay, so that Q308 does not turn swiftly on and off each time X303A toggles.

4-3-1. Range. For sets S/N 1049 on, see Range/Velocity Board Theory in Section VIII. From the Decoder Output, the pulse is applied to the Range Control Flip-Flop (X423A) on PC-4 (Range Velocity Board Schematic (PC-4), Figure 8-5). When reset, the Range Control Flip-Flop (X423A) lets the pulses from the Range Oscillator pass to the Real Time Range Counter (X425 through X428B). The Real Time Range Counter (X425 through X428B) starts at zero and counts up to coincidence count with the Range Storage Counter (X413 through X416). When coincidence is reached, the Comparator's (X417 through X420) outputs are summed together and set the Range Control Flip-Flop (X423A). This process stops the Real Time Range Counter (X425 through X428B), resets it, and forms the Range Output Pulse. The Range Storage Counter (X413 through X416) controls the desired range delay. The Range Storage Counter (X413 through X416) receiver counts from either the Slew Oscillator or the Velocity Pulse circuit. The Slew Oscillator, which is activated by the FAST and SLOW SLEW Switches (15 and 19), sets the Range Storage Counter (X413 through X416) to the desired distance in RANGE operation or quickly sets the starting range in VELOCITY operation.

4-3-2. Velocity. For models S/N 1049 on, see Range/Velocity Board Theory in Section VIII. In VELOCITY Mode, a separate oscillator runs a Velocity Counter (X401A through X406) which gives six output frequencies corresponding to 50, 100, 200, 400, 800, and 1600 knots. A Divide-by-Two or -Three circuit allows each velocity to be increased by 50%, i.e., 50 or 75 knots, when the VELOCITY HI/LO Range Switch (18) is in HI position. The range from the Velocity Counter (X401A through X406) is applied to the Range Storage Counter (X413 through X416). The VELOCITY IN/OUT Switch (16) position determines whether the Range Storage Counter (X413 through X416) counts up (outbound) or down (inbound). When an interrogation signal is received from a DME, the Range Control Flip-Flop (X423A) is reset. When reset, the Range Control Flip-Flop (X423A) applies range clock pulses from the Range Oscillator to the Real Time Range Counter (X425 through X428B). The Real Time Range Counter (X425 through X428B) begins counting up until its count (or range) coincides with that of the Range Storage Counter

(X413 through X416). At that instant, the four Comparators (X417 through X420) sense coincidence and set the Range Control Flip-Flop (X423A) again. The Range Control Flip-Flop (X423A) stops output pulses from the Range Oscillator by inhibiting Gate X422B and by resetting the Real Time Range Counter (X425 through X428B) to zero count. The reset signal is also used as the Range Output Pulse.

4-3-3. 50% Reply. The Range Output Pulse is applied to the 50% Reply Flip-Flop (X303B) and to Gate X304 on PC-3. In normal operation, the 50% Reply Flip-Flop (X303B) is held reset, and all input signals are passed directly through Gate X304 to the Range Delay One-Shot (X305). However, if the Front Panel DME 50% RPLY Switch (14) is depressed on the ATC-600, or the IDENT/50% RPLY Switch (Figure 3-1-1) on the ATC-600(A) is in the 50% RPLY (down) position, the 50% Reply Flip-Flop (X303B) toggles on the input signal and inhibits Gate X304 on every other input pulse. Thus, only every other input signal will fire the Range Delay One-Shot (X305). The Range Delay One-Shot (X305) sets the P_1 Range One-Shot (Q310 and Q311) for the precise time of 50 microseconds in X Channel (56 microseconds in Y Channel) providing the proper range delays. When the P_1 Range One-Shot (Q310 and Q311) resets, it fires the Output Pulse One-Shot (X307) for 3.5 microseconds, producing the P_1 Pulse of the reply. When the P_1 Range One-Shot (Q310 and Q311) resets again, it sets the P_2 Range One-Shot (X306). After 12 microseconds in X Channel (30 microseconds in Y Channel) the P_2 Range One-Shot (X306) resets, firing the Output Pulse One-Shot (X307) again for 3.5 microseconds (nominal) and forming the P_2 Pulse of the reply. Q309 assures that the collector of Q310 is pulled up on initial firing of the P_1 Range One-Shot (Q310 and Q311). This assures accurate, repeatable timing of the critical 50 microsecond (or 56 microsecond) range delay.

4-3-4. Ident Tone. On the ATC-600, the DME IDENT Tone Switch (23) is depressed to activate the Ident Tone (1356 Hz plus equalizing pulses). On the ATC-600(A), the Ident Tone is activated when the IDENT/50% RPLY Switch (Figure 3-1-1) is in the IDENT (up) position. When one of these switches is activated, +11 Volts are applied to the Ident Oscillator (X311). The Ident Oscillator (X311) output fires the P_1 Range One-Shot (Q310 and Q311), initiating the P_1 and P_2 reply pulses, as though for a range reply. Each time the Ident Oscillator (X311) puts out a signal, it also fires the Ident Equalizing Pulse One-Shot (X308) which sets itself for 100 microseconds. (Note: Here the DME Signal Block Diagram, Figure 4-2, is reversed from the DME Signal PC Board Schematic, Figure 8-4, for readability). When the Ident Equalizing Pulse One-Shot (X308) resets, it again fires the P_1 Range One-Shot (Q310 and Q311), causing the second pulse pair (P_1 and P_2) to appear in the output. The second pulse pair will be spaced 100 microseconds from the first pair.

4-3-5. Squitter. When +11 volts is applied to the Ident Oscillator (X311), it is also applied to the Squitter/Range Clamp (Q312 and Q313), which clamps out all squitter input and range reply pulses. While the Ident Tone is on, no squitter or reply pulses should appear in the output. Squitter is generated by using a zener diode (ZD301) as a noise source. The zener noise is further amplified by Q314, Q315 and Q316, forming the Noise Generator. The noise signal in the emitter of Q316 operates the Squitter One-Shot (X309) on a controlled basis. The Squitter One-Shot (X309) output triggers the reply one-shots and operates Driner Q318. The output is rectified by the Pulse Rectifier (CR316 and CR317). The average dc level of the Pulse Rectifier (CR316 and CR317) is filtered and applied to the Servo Control (X310). The reference level for the Servo Control (X310) is set by the Squitter Frequency Adjust (R375). As squitter frequency varies, the dc rectified level will vary, changing the output level of the Servo Control (X310). The Servo Control (X310) controls the bias to Q317. Capacitor C329 regulates an average dc level to the Servo Control (X310). Squitter frequency averages 2700 Hz at the Squitter One-Shot (X309) output over a long period of time. Squitter is turned on and off when the Squitter One-Shot (X309) is enabled or disabled.

4-3-6. DME PRF. Output pulses from the transponder board (Figure 8-2) and the DME board (Figure 8-4) are applied to PC-5 (Figure 8-6), where they operate the Q521 and Q522 modulators. The output from Q522 is applied to the diode switch to turn the RF on and off to form output pulses. DME PRF is measured through Q520 and X503 detecting RF input video. This circuit is used in DME Mode only. The one-shot timing is changed to switch between the two PRF ranges (0-30 and 0-300 pps). Q519 is the meter driver.

4-4. DISPLAY BOARD. (Refer to the Display Block Diagram, Figure 4-3, the Display Section Schematic (PC-6), through S/N 174, Figure 8-7, and the Sperry Readout Board Schematic (PC-6), S/N 175 on, Figure 8-7-1). The Display Board consists of four 7 - Bar Displays and four BCD (Binary-Coded Decimal) to 7 - Bar Decoders. Early ATC-600's (through S/N 174) have incandescent (fiber optic) displays. Later units (S/N 175 on) use high voltage gas discharge displays. The incandescent display circuits are made up of transistors, whereas the high voltage gas discharge display utilizes the more reliable and versatile integrated circuits (IC's). The incandescent display has no separate power supply. It draws its power on the +5 volts input from the transponder and DME modes. The high voltage gas discharge display operates from a separate dc-to-dc converter power supply that provides 180 to 220 volts under normal operations. The incandescent display uses a S/N 7447 decoder driver. There are two types of decoder driver used in the high voltage gas discharge display - the DM8880 and the DD700. (See Figure 8-7-1). The DM8880 and the DD700 are interchangeable. The S/N 7447, however, differs radically from the other two decoder drivers. Only the S/N 7447 should be used in the incandescent display. There are three sources of input to the decoder drivers of both displays. The code input in A/C CODE Mode and the altitude counters output in A/C ALT Mode give transponder input to the decoder drivers. In DME Mode, range information is applied to the decoder drivers to show range in 0.1 NM increments. (NOTE: Even though range is displayed in 0.1 NM increments, the range in VELOCITY Mode is actually counted-up in 0.25 NM steps). When the Altitude ENCODER Input Connector (26) is used, the connector input line pulses are gated through the display board and back onto the code lines that come from the XPDR Pulse Storage Register on PC-1 (Figure 4-1 and Figure 8-2). Thus, the input from the Altitude ENCODER Input connector (26) is processed just as if it had come from a transponder.

4-5. RF SECTION. (Refer to the RF Block Diagram, Figure 4-4; the Blanking Circuits, Power Monitor, Modulator, and Frequency Circuits Block Diagram, Figure 4-5; Interconnect Diagram, Figures 8-1-2 and 8-1-2a the RF Oscillators Schematic [Assembly 1], Figures 8-8 and 8-8A; and the RF Frequency Power Schematic and Mechanical Layout [Assembly 2], Figure 8-9; and the SLS and RF Leveler Schematic, Figure 8-9-1). Three oscillators - a 1030 MHz for transponder interrogations, a 978/979 MHz for DME 17X/18X Channel replies, and a 1104 MHz for DME 17Y Channel replies - are incorporated in Assembly 1 to generate RF output. A separate 1065.5 MHz oscillator is used primarily in the RF Section to beat against the input frequency of the unit-under-test. All the oscillator boards are identical except for the 17X/18X oscillator board which has two crystals. When Channel 17X is selected, +11 volts power is applied to (J8-8) E2 and (J8-3) E3. When 18X is selected, +11 volts power is applied to (J8-9) E1 and (J8-3) through the DME Channel Switch (S8). The oscillator's (Q1501) frequency is determined by one of the crystals (either Y1501 or Y1502). CR1501 enables the oscillator's feedback current through Y1501 in Channel 17X. CR1502 enables the oscillator's feedback current through Y1502 in Channel 18X. The oscillator output is buffered and amplified by Q1502 and Q1503. The output of this buffer drives a multiplier. The fundamental frequency (97.8 or 97.9 MHz) is multiplied by ten to produce the final output frequency at CR12001. Z12001 is a bandpass filter tuned to the tenth harmonic of the oscillator. L1505 and C1515 form a tank circuit tuned to the fundamental frequency. When Channel 17Y is selected, +11 volts power is applied to (J8-4) and sent to 1104 oscillator. The 1030 oscillator has 11 volts power applied when Mode Switch (S20) is in transponder mode. Each single crystal-controlled oscillator, tuned for peak output and proper frequency by L702 (only 700 series components are referenced but theory is same for the single crystal oscillators), drives amplifiers Q702 and Q703. The output of Q702 and Q703 is peaked by L704 and C711 and is applied to the Snap Diode (CR701, CR702, or CR703). A two-sectioned, tuned filter (filter cavities) on each oscillator picks off the tenth harmonic of the crystal frequency and applies it to the output connector of the oscillator assembly. The outputs of the three Assembly 1 oscillators are summed in the Diode Switch Block. Only one of the Assembly 1 oscillators will operate at one time. The 1065.5 MHz oscillator operates continuously. The video input to the Diode Switch is used to modulate the RF output of the selected RF oscillator into a series of DME or transponder RF pulses. The output of the Diode Switch is applied through the Circulator to the RF Input/Output Connector (13). Incoming RF is processed by Assembly 2 through CR801 and CR802. CR801 in conjunction with its associated circuitry, acts as an input power detector. The power measuring circuit on PC-5 provides a slide-back voltage for constant power readings. The Detected Power Monitor Video from CR801 is amplified by Q801 and is applied to the power circuit on PC-5. On PC-5, the Detected Power Monitor Video is applied to the Power Monitor One-Shot (X501). The output of the Power Monitor One-Shot (X501) operates the Pulse Integrator (Q517) and the Power Calibrate (X502B). The Detected Power Monitor Video will fire the Power Monitor One-Shot (X501) until the output of the Power Calibrate (X502B) becomes great enough to reverse the bias on CR801. A bias reverse on CR801 stops the Power Monitor One-Shot (X501). The voltage at the output of the Power Calibrate (X502B) is applied to the FREQ/PWR Meter (10) for power measurement. For frequency measurement, the incoming RF is applied through Diode CR802 and is combined with the output of the 1065.5 MHz local oscillator. The resultant signal is amplified by Q802 and is applied to Amplifier Q803. The signal is then routed through a tuned circuit (L803, C808, C809, and C810). The capacitance of C808 is adjusted by the Front Panel XMTR FREQ Control (11) and is varied until the tuned circuit is tuned to the incoming RF signal from Q803. The output will peak at that time and is applied to PC-5, where it is amplified by Q518 and X502A, and is then applied to the FREQ/PWR Meter (10). The detected video from the incoming RF is processed through Q802 and separated for DME and transponder inputs. DME Detected Video is routed through R809 and C813 to the Video Input on PC-3, Pin 4 for decoding and processing. Transponder Detected Video is routed through L807 and C814 to Amplifier Q805. The signal at the collector of Q805 is then routed to the detector input on PC-1, Pin A, for its processing.

4-6. POWER SUPPLY. (Refer to the Power System Block Diagram, Figure 4-6). Power for the ATC-600(A) comes from two sources. One is an external ac source of either 115 or 240 volts. The other is a built-in battery of 13.2 volts (2.0 Amps/Hour) capacity. Both power sources are mounted on the Power Supply Assembly (Assembly 3) on the back of the test set. AC power is converted by a transformer and a rectifier to +20 volts dc whenever the test set is connected to an ac source. There is no ac line switching in the ATC-600(A). The +20 volts is applied continuously to the Battery Charger circuit on PC-5. Therefore, whenever the test set is plugged into ac power, the battery is being charged. The charger is self-limiting to charge a discharged battery at a high rate and to trickle-charge a fully-charged battery. In ac operation, the +20 volts is applied by the PWR AC/BAT Switch (28) to PC-5 and to Assembly 4 (the +5 Volt Power Supply). On PC-5, the +20 volts is regulated to +11 volts and is applied to the +11 volts line. +11 volts is also internally applied on PC-5 to the -6.2 Volts Regulator. Negative voltage developed by the +5 Volts Regulator is also applied to PC-5 and is dropped to -6.2 volts. The +5 volts within the test set is applied at all times the set is energized. When BAT power is in use, a timer of approximately eight minutes does the actual power switching. When the PWR AC/BAT Switch (28) is pressed down once, the timer is activated and the battery voltage is applied to the remainder of the power system. After approximately eight minutes, the test set will shut OFF. Pressing the PWR AC/BAT Switch (28) a second time will turn the test set OFF before the timer runs out.

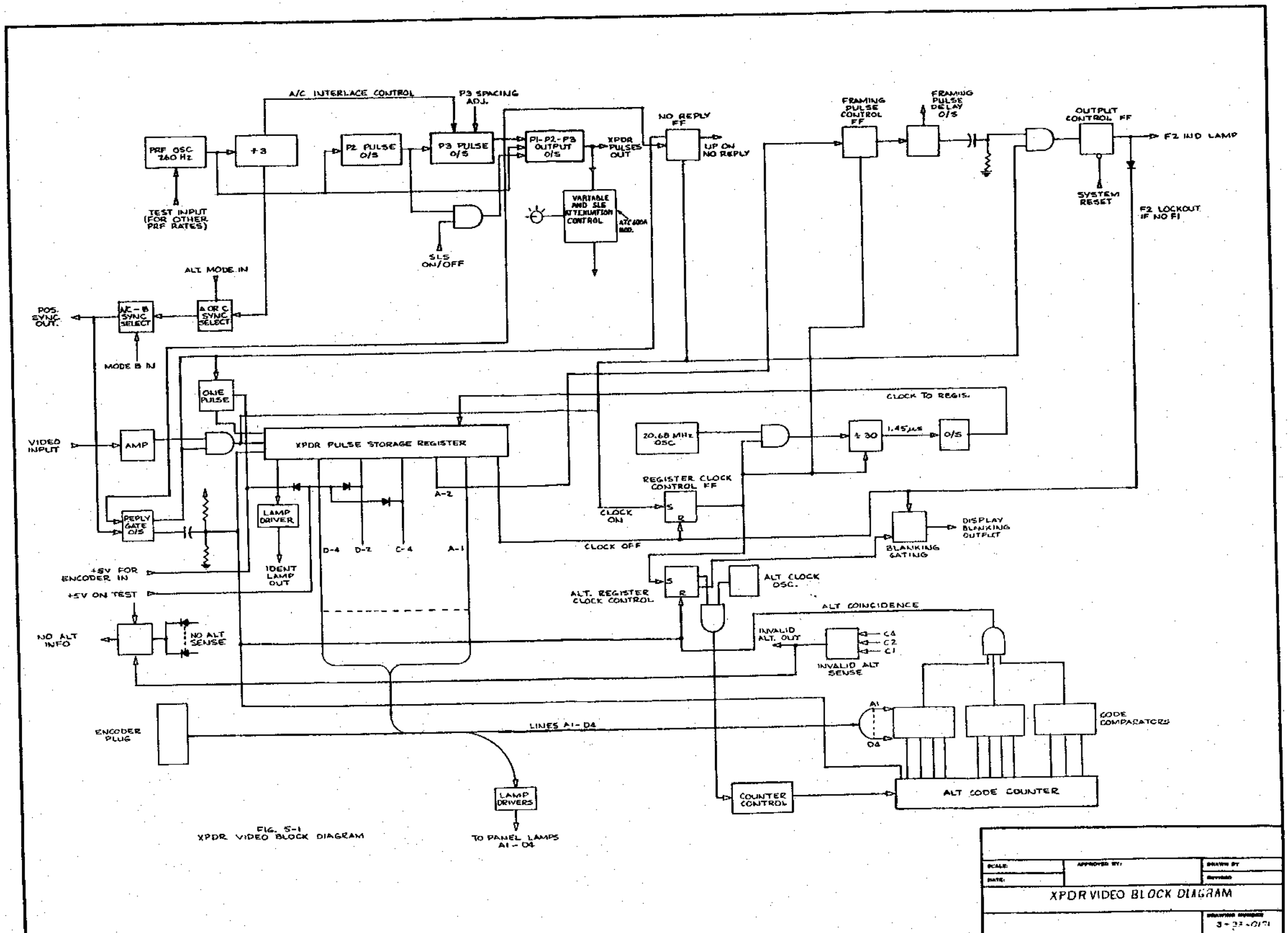

A/C INTERLACE CONTROL
P3 SPACING ADJ.
PRF OSC 260 Hz
÷3
P2 PULSE O/S
P3 PULSE O/S
P1-P2-P3 OUTPUT O/S
XPDR PULSES OUT
NO REPLY FF
UP ON NO REPLY
FRAMING PULSE CONTROL FF
FRAMING PULSE DELAY O/S
OUTPUT CONTROL FF
F2 IND LAMP
SYSTEM RESET
F2 LOCKOUT IF NO F1
TEST INPUT (FOR OTHER PRF RATES)
SLS ON/OFF
VARIABLE AND SLS ATTENUATION CONTROL
ALT MODE IN
POS. SYNC OUT.
A/C - B SYNC SELECT
A OR C SYNC SELECT
MODE B IN
ONE PULSE
VIDEO INPUT
AMP
XPDR PULSE STORAGE REGISTER
CLOCK TO REGIS.
20.68 MHz OSC
÷ 30
1.45µs
O/S
REGISTER CLOCK CONTROL FF
CLOCK ON
CLOCK OFF
REPLY GATE O/S
LAMP DRIVER
IDENT LAMP OUT
D-4
D-2
C-4
A-1
A-2
DISPLAY BLANKING OUTPUT
BLANKING GATING
+5V FOR ENCODER IN
+5V ON TEST
ALT. REGISTER CLOCK CONTROL
ALT CLOCK OSC.
ALT COINCIDENCE
NO ALT INFO
NO ALT SENSE
INVALID ALT. OUT
INVALID ALT SENSE
C4
C2
C1
ENCODER PLUG
LINES A1 - D4
A1
D4
CODE COMPARATORS
COUNTER CONTROL
ALT CODE COUNTER
LAMP DRIVERS
TO PANEL LAMPS A1 - D4
FIG. 5-1
XPDR VIDEO BLOCK DIAGRAM
SCALE:
DATE:
APPROVED BY:
DRAWN BY
XPDR VIDEO BLOCK DIAGRAM

Fig. 4-1

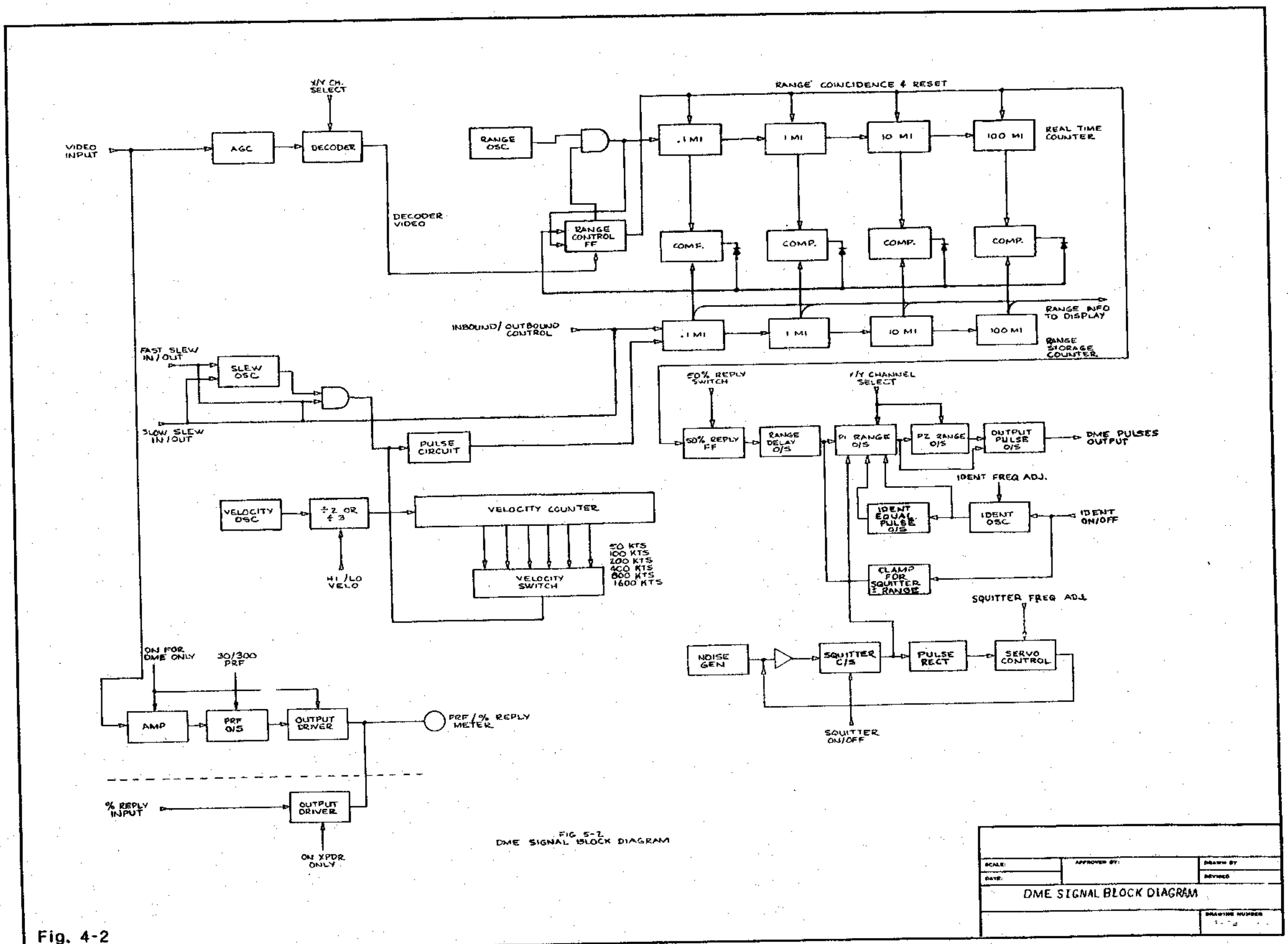

VIDEO INPUT
AGC
X/Y CH. SELECT
DECODER
DECODER VIDEO
RANGE OSC.
RANGE CONTROL FF
RANGE COINCIDENCE & RESET
.1 MI
1 MI
10 MI
100 MI
REAL TIME COUNTER
COMP.
INBOUND/ OUTBOUND CONTROL
RANGE INFO TO DISPLAY
RANGE STORAGE COUNTER
FAST SLEW IN/OUT
SLEW OSC
SLOW SLEW IN/OUT
PULSE CIRCUIT
VELOCITY OSC
÷ 2 OR ÷ 3
HI/LO VELO
VELOCITY COUNTER
VELOCITY SWITCH
50 KTS
100 KTS
200 KTS
400 KTS
800 KTS
1600 KTS
50% REPLY SWITCH
50% REPLY FF
RANGE DELAY O/S
X/Y CHANNEL SELECT
P1 RANGE O/S
P2 RANGE O/S
OUTPUT PULSE O/S
DME PULSES OUTPUT
IDENT FREQ ADJ.
IDENT EQUAL PULSE O/S
IDENT OSC
IDENT ON/OFF
CLAMP FOR SQUITTER ± RANGE
SQUITTER FREQ ADJ.
NOISE GEN
SQUITTER C/S
PULSE RECT
SERVO CONTROL
SQUITTER ON/OFF
ON FOR DME ONLY
30/300 PRF
AMP
PRF O/S
OUTPUT DRIVER
PRF/% REPLY METER
% REPLY INPUT
ON XPDR ONLY
FIG 5-2
DME SIGNAL BLOCK DIAGRAM
SCALE:
DATE:
APPROVED BY:
DRAWN BY
REVISED
DME SIGNAL BLOCK DIAGRAM
DRAWING NUMBER

Fig. 4-2

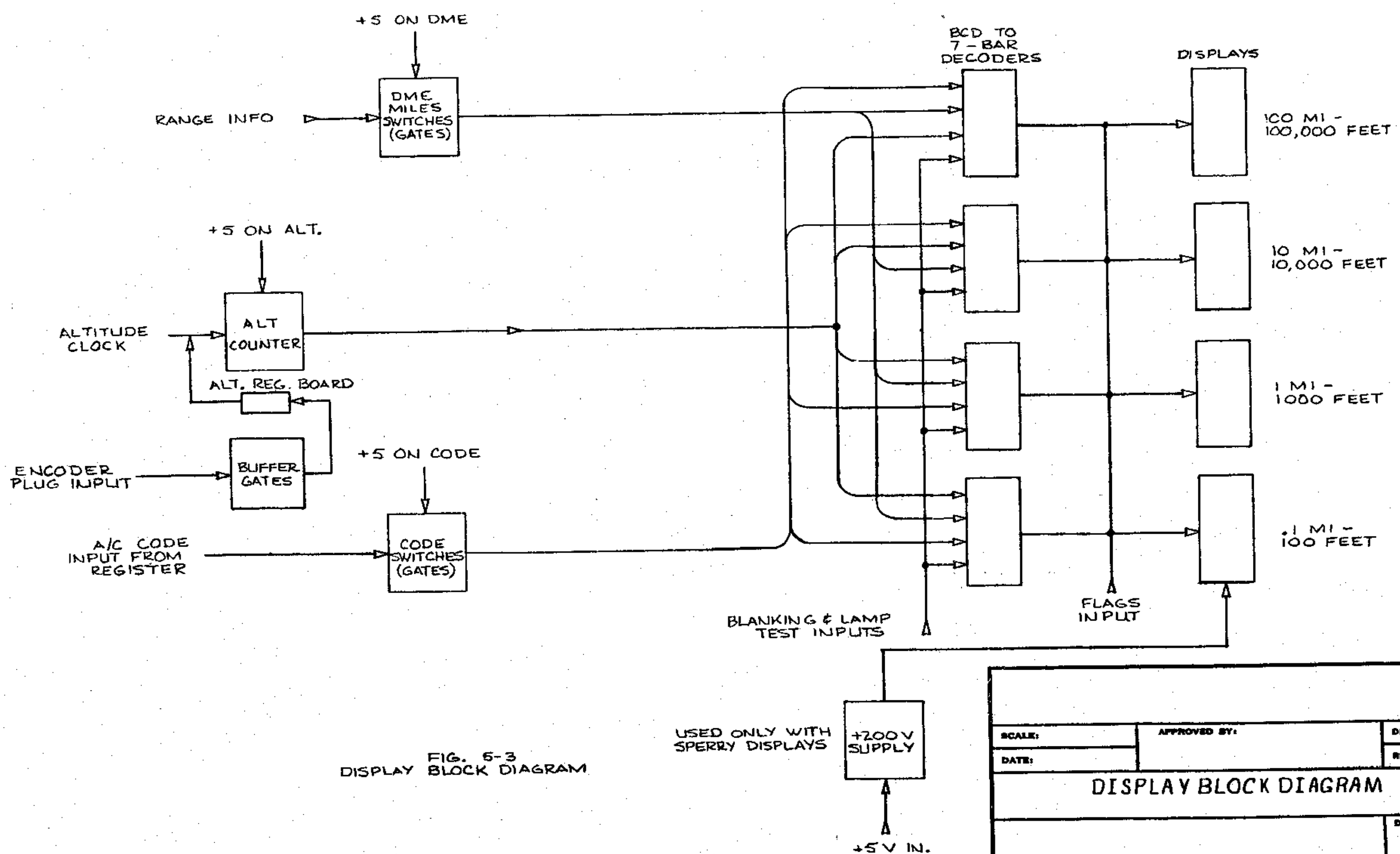


FIG. 5-3
DISPLAY BLOCK DIAGRAM

SCALE:	APPROVED BY:	DRAWN BY
DATE:		REVISED

DISPLAY BLOCK DIAGRAM

DRAWING NUMBER 2-08-0169

Fig. 4-3

11X17 PRINTED ON NO. 1000H CLEARPRINT

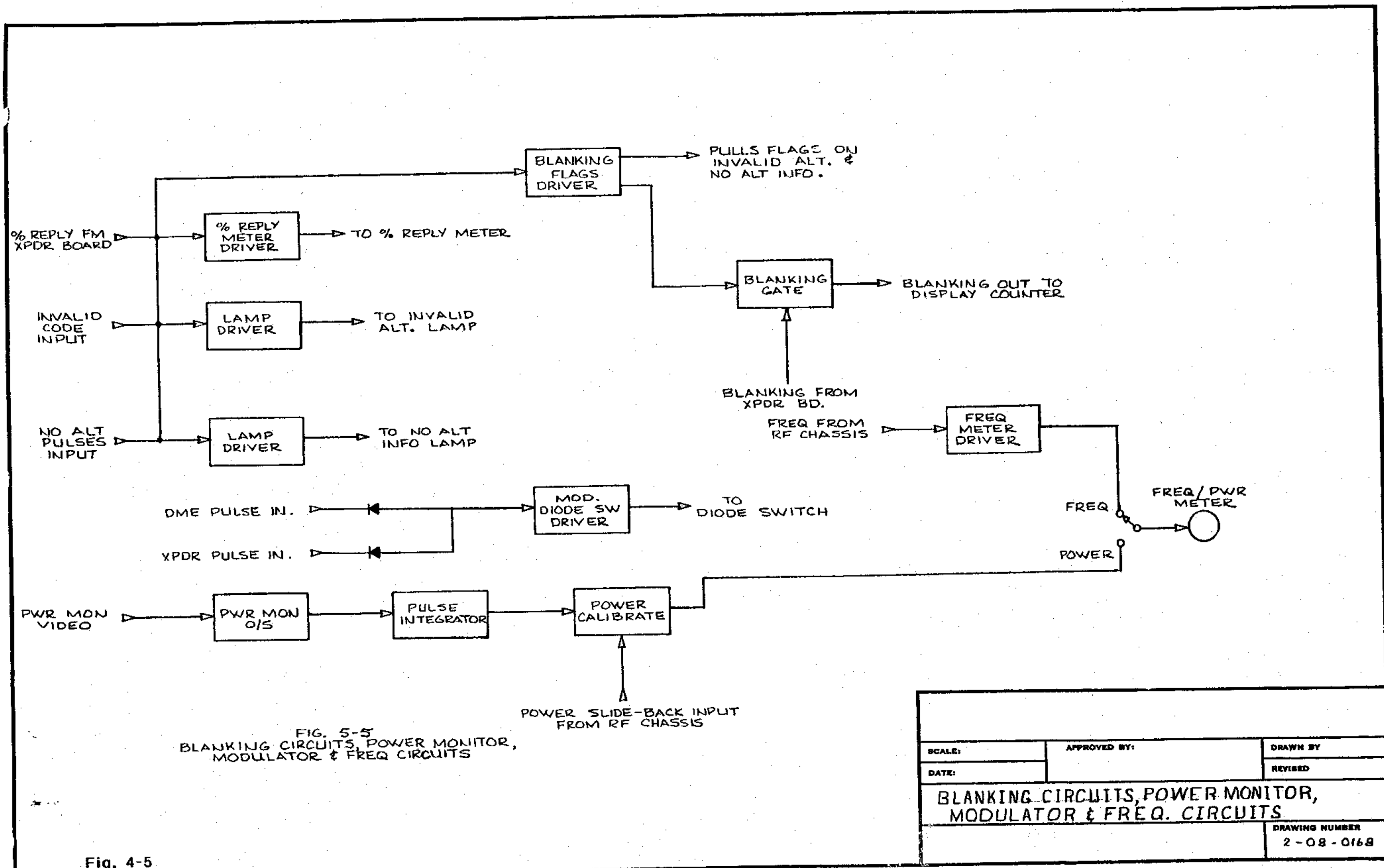

% REPLY FM XPDR BOARD
INVALID CODE INPUT
NO ALT PULSES INPUT
% REPLY METER DRIVER
TO % REPLY METER
LAMP DRIVER
TO INVALID ALT. LAMP
LAMP DRIVER
TO NO ALT INFO LAMP
BLANKING FLAGS DRIVER
PULLS FLAGS ON INVALID ALT. & NO ALT INFO.
BLANKING GATE
BLANKING OUT TO DISPLAY COUNTER
BLANKING FROM XPDR BD.
FREQ FROM RF CHASSIS
FREQ METER DRIVER
FREQ
POWER
FREQ/PWR METER
DME PULSE IN.
XPDR PULSE IN.
MOD. DIODE SW DRIVER
TO DIODE SWITCH
PWR MON VIDEO
PWR MON O/S
PULSE INTEGRATOR
POWER CALIBRATE
POWER SLIDE-BACK INPUT FROM RF CHASSIS
FIG. 5-5
BLANKING CIRCUITS, POWER MONITOR, MODULATOR & FREQ CIRCUITS
SCALE:
DATE:
APPROVED BY:
DRAWN BY
REVISED
BLANKING CIRCUITS, POWER MONITOR, MODULATOR & FREQ. CIRCUITS
DRAWING NUMBER
2-08-0168

Fig. 4-5

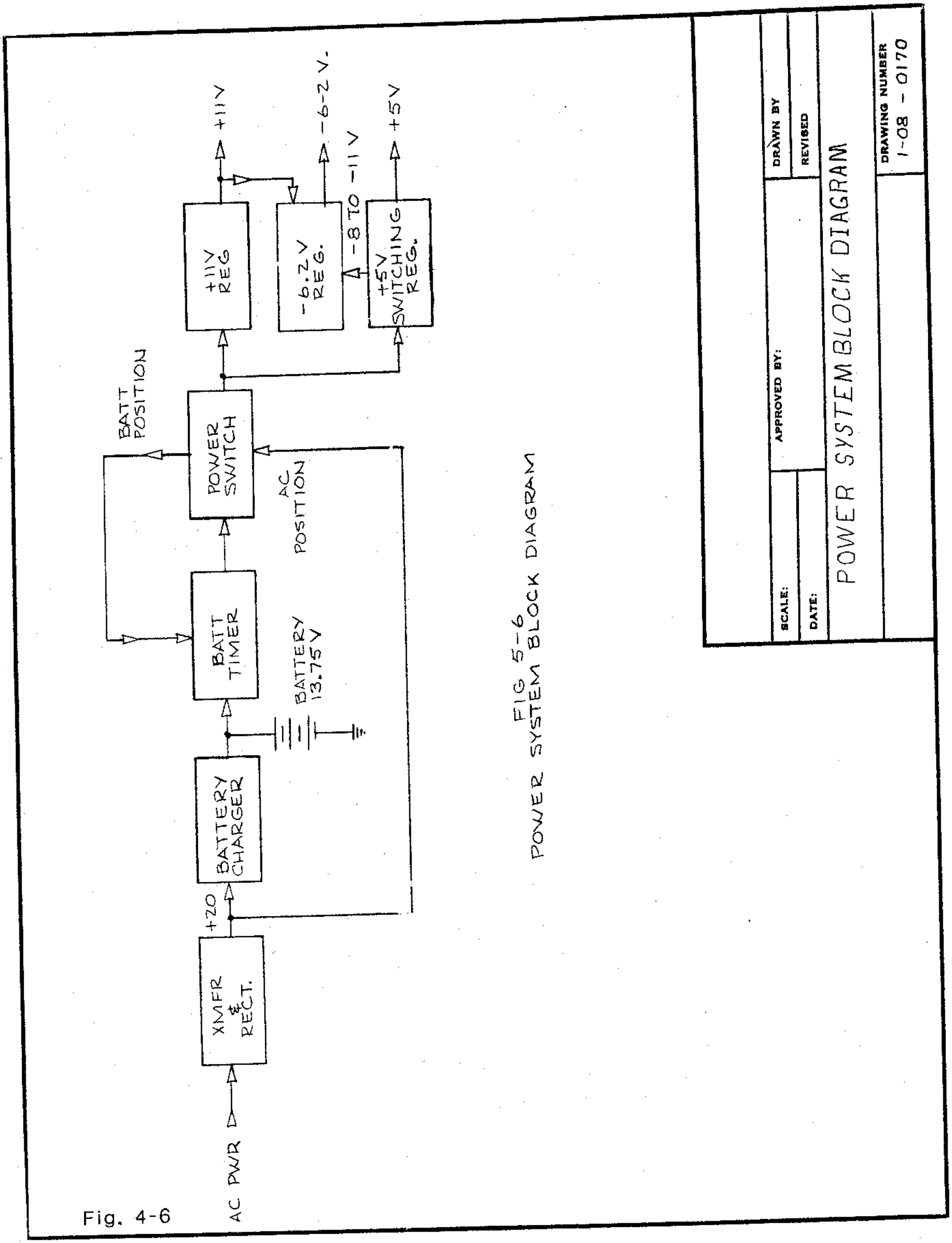

AC PWR
XMFR & RECT.
+20
BATTERY CHARGER
BATTERY 13.75V
BATT TIMER
BATT POSITION
POWER SWITCH
AC POSITION
+11V REG
-6.2V REG.
+5V SWITCHING REG.
-8 TO -11V
+11V
-6.2V.
+5V
FIG 5-6
POWER SYSTEM BLOCK DIAGRAM
DRAWN BY
REVISED
APPROVED BY:
SCALE:
DATE:
POWER SYSTEM BLOCK DIAGRAM
DRAWING NUMBER
1-08-0170

Fig. 4-6

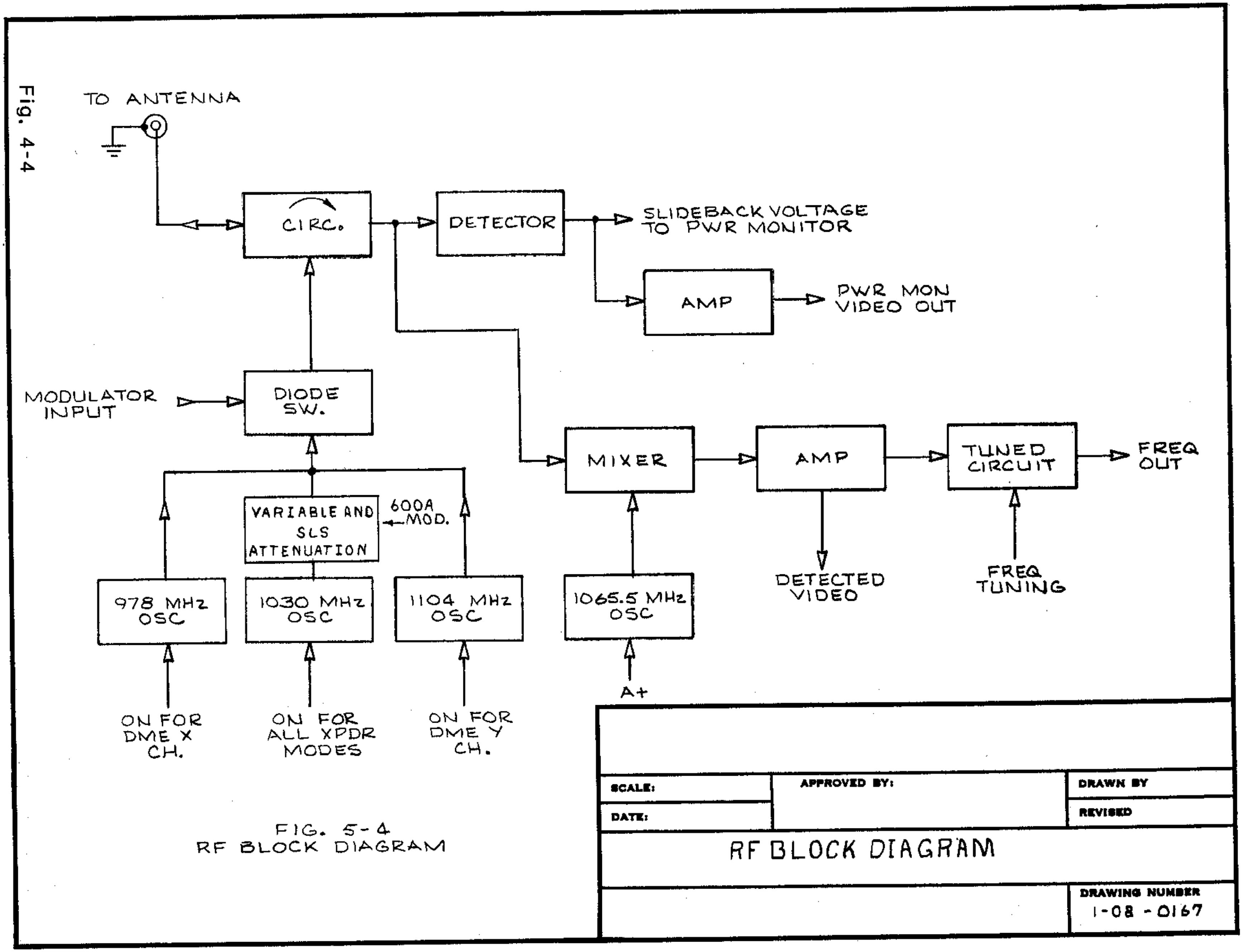

TO ANTENNA
CIRC.
DETECTOR
SLIDEBACK VOLTAGE TO PWR MONITOR
AMP
PWR MON VIDEO OUT
MODULATOR INPUT
DIODE SW.
VARIABLE AND SLS ATTENUATION
600A MOD.
MIXER
AMP
TUNED CIRCUIT
FREQ OUT
DETECTED VIDEO
FREQ TUNING
978 MHz OSC
1030 MHz OSC
1104 MHz OSC
1065.5 MHz OSC
A+
ON FOR DME X CH.
ON FOR ALL XPDR MODES
ON FOR DME Y CH.
FIG. 5-4 RF BLOCK DIAGRAM
SCALE:
DATE:
APPROVED BY:
DRAWN BY
REVISED
RF BLOCK DIAGRAM
DRAWING NUMBER 1-08-0167

Fig. 4-4