DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATOR'S MANUAL:

RADAR INTERFACE EQUIPMENT ALINEMENT PROCEDURES

GUIDED MISSILE AIR DEFENSE

SYSTEM AN/TSQ-73

This copy is a reprint which includes current pages from Changes 1 through 13.

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Operator's Manual: Radar Interface Equipment Alinement Procedures

GUIDED MISSILE AIR DEFENSE SYSTEM AN/TSQ-73

TM 9-1430-652-10-5, 1 August 1978, is changed as follows:

1. Remove old pages and insert new pages as indicated below. New or changed material is indicated by the applicable change number, i.e., Change 13, at the bottom of the page adjacent to the page number. Revised text will have a vertical bar in the margin next to the changed area. Revised illustrations will have suffix change letter added to the identification number.

Remove Pages	*Insert Pages*
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11-10.1 and 11-10.2	11-10.1 and 11-10.2
11-47 and 11-48	11-47 and 11-48
11-52.1 and 11-52.2	11-52.1 and 11-52.2
11-52.5 thru 11-52.8	11-52.5 thru 11-52.8
11-52.11 and 11-52.12	11-52.11 and 11-52.12
11-67 and 11-68	11-67 and 11-68

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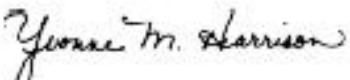

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01123

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WARNING

Radio-frequency (rf) radiation from radar antennas and associated equipment is a potential hazard to personnel. Rf radiation is not cumulative but it can be hazardous. It heats the body tissues, and, if the radiation intensity is sufficiently high, will permanently damage the tissue. This damage is not immediately apparent.

Precautions should be taken to ensure that personnel are not exposed to rf radiations of hazardous intensity levels. Personnel who must be within the hazardous distances for the below listed radars should be instructed not to place themselves on the radiating side of the antenna, and to never look into a transmitting horn or open waveguide which is connected to an energized transmitter.

Personnel are prohibited from entering areas where they may be exposed to levels of rf radiation above 0.01 watt per square centimeter. This level, though not considered hazardous, is stipulated by AR 40-583 as the maximum permissible exposure level for personnel.

A power intensity of at least 0.01 watt per square centimeter is present along the axis of each radar's transmitted beam, for the distances listed below. These distances are based on calculations and actual measurements and may be used as a guide to prevent radio-frequency radiation damage. In each instance, radiation intensity rapidly diminishes as the distance is increased.

Antenna	Distance
Improved High-powered Illuminator Radar	366 feet (111.5 meters)
Improved Cw Acquisition Radar	60 feet (18.3 meters)
Improved Pulse Acquisition Radar	50 feet (15.2 meters)
Improved Range-only Radar	148 feet (45.1 meters)

No radiation hazard exists at radar ground level *within* the distance stated if the radars are not depressed below zero degrees elevation. When at all possible during maintenance, however, place the antenna at a high elevation. Personnel are restricted from the area atop the radars in front of the antennas when radiating.

WARNING

HIGH VOLTAGE is used in the operation of this equipment. DEATH ON CONTACT may result if personnel fail to observe safety precautions. Learn the areas containing high voltage in each piece of equipment. Be careful not to contact high voltage connections when installing or operating this equipment.

Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When the technician is aided by operators, he must warn them about dangerous areas.

Do not perform adjustments during rain storm or if ground is wet or muddy.

HIGH TEMPERATURE is common for the dc/dc converters of this equipment. Severe burns may result if personnel fail to observe safety precautions.

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Insert latest change pages, dispose of superseded pages in accordance with applicable regulations.

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GUIDED MISSILE AIR DEFENSE SYSTEM AN/TSQ-73

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CHAPTER 11

RADAR INTERFACE EQUIPMENT ALINEMENT

Section I. INTRODUCTION

11-1. Scope. This volume provides information required to aline and optimize the AN/TSQ-73 (Battalion level only) Radar Interface Equipment (RIE) with various radar sets used during air defense operations. The procedures and data presented in this volume assume that the requirements of TM 9-1430-651-12 (Emplacement and Preparation for Travel) and TM 9-1430-652-10-3 (Initialization and Operating Procedures) have been complied with, i.e., the system is installed, initialized, and is operational. Control and indicator information for the RIE is provided in TM 9-1430-652-10-2. Maintenance and troubleshooting information is provided in TM 9-1430-655-20-3.

WARNING

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Improved Range-only Radar	148 feet (45.1 meters)

No radiation hazard exists at radar ground level *within* the distance stated if the radars are not depressed below zero degrees elevation. When at all possible during maintenance, however, place the antenna at a high elevation. Personnel are restricted from the area atop the radars in front of the antennas when radiating.

NOTE

Potentially hazardous power density levels do not exist in the radiation field of the improved pulse and cw acquisition radars when scanning.

11-2. Requirement for RIE Alinement. RIE initialization is accomplished separately from other equipments due to the complexity of various setup procedures. Since the RIE is designed to operate with a variety of radar and IFF parameters, and many of the elements of RIE operation have been placed under operator control (via switches and potentiometers) on the RIE control panels no standard procedure is applicable to all situations. However, correct RIE setup is imperative for proper system operation. The following sections contain procedures for alinement of the following radar sets: AN/GSS-1, AN/GSS-7, AN/MPQ-50, AN/TPS-32, AN/TPX-28, and AN/TPX-46. Each procedure should be followed in a step-by-step operation to ensure correct initialization.

11-3. Alinement Criteria. Certain switch settings on the RIE affect the automatic tracking performance of the AN/TSQ-73 system. An observable effect is related to pulse width and beam width settings. These two values determine the resolution of the system; that is, the ability to distinguish or separate two adjacent targets. Using a radar with wide antenna beam pattern and long pulse time, the resolution will be poor. Targets flying parallel paths near to each other will merge as a single track. When paths cross, the targets will merge sooner and separate later, increasing the likelihood that one will be dropped. A narrow beam pattern and short pulse time will have the opposite effect. When using a live radar, the applicable switch settings must correspond to the actual radar characteristics, and the effects described above merely warn the operator what to expect. When operating with simulated radar data from a raid tape, however, the switches may be set to simulate either good or poor resolution, according to the aim of the exercise. A related consideration in simulated exercises is that of radar rotation rate. The system drops tracks based upon how many scans produce misses. For a given time period, then, while two radar trails are merged, a fast rpm radar will produce more misses on one of the tracks than a slow rpm radar. Thus, more crossing track problems will occur with a high rotation rate. Obviously, this parameter cannot be, varied when using a live radar. If no local live radar is available, set applicable RIE switches using assumed but realistic values, when necessary, as if' a live radar were present.

11-4. Reporting Equipment Publications Improvements. Reporting of errors, omissions, and recommendations by the individual user for improving this publication is encouraged. Reports should be submitted on DA Form 2028, Recommended Changes to Publications, and forwarded to: Commander, U.S. Army Missile Command, ATTN: AMSMI-LC-ME-PMC, Redstone Arsenal, Alabama, 35898-5238.

Section II. RAPID RIE ALINEMENT

11-5. General. This procedure is provided to reduce alinement time during the tactical operating conditions where one or more types of previously alined radars will be integrated with the AN/TSQ-73. This procedure will reduce the initialization time after system shutdown for maintenance or relocation. Rapid RIE initialization assumes the following- the radar has been previously interfaced and alined; the PRF, RPM and video types are constant; the initialization is performed by personnel who are thoroughly familiar with detailed alinement procedures; and RIE sample data sheet (fig. 11-13) has been previously completed.

11-6. Rapid RIE Alinement. Perform the following steps for rapid RIE alinement using figure 11-13 sample data sheet as reference.

NOTE

The following steps must be performed with the RIE II panel RDR/CPU ON-LINE/OFF-LINE switch in the OFF-LINE position.

a. Verify RIE has been alined and is functioning properly and data sheet parameters noted.

b. Verify radar antenna rotation rate (RPM), pulse repetition frequency (PRF), video type and video level is same as noted in data sheet.

c. Set RIE switches as specified in data sheet.

d. Verify quantizer HI, LO and ACM FAR indications are normal.

e. Verify hits-per-beamwidth (HPBW) indication is as specified in data sheet.

f. Place RIE panel RDR/CPU ON-LINE/OFF-LINE switch in the ON-LINE position and enter CC100 50.

Section III. RIE CABLING REQUIREMENTS

11-7. General. This section provides cabling diagrams and information required in order to properly aline the AN/TSQ-73 with various radar sets. Refer to figure 11-1 for typical site cabling.

11-8. System Grounding. To eliminate ac ripple in radar video or high noise levels, a common ground should always be provided to the Radar, AN/TSQ-73, and the power source (refer to fig. 11-2). This means that one ground point should be used to ground all equipment whether or not they have their own earth ground. This is especially true in a desert environment.

11-9. Logic Ground. In order to avoid possible alinement problems, prior to connecting the RJB to the Radar/IFF or shelter, it is considered good practice to check the resistance between logic ground and chassis ground. This is accomplished by connecting an ohmmeter between pin 2 of any digital circuit card and chassis ground to verify that a short circuit is not present (> 100K ohms). Cables W113, W114 and W115 must be disconnected when this measurement is made.

WARNING

Prior to connecting or disconnecting cables to Radar J-Box, set AC Power Panel RADAR J-BOX circuit breaker to off position and Radar J-Box POWER circuit breaker to OFF.

11-10. Radar J-Box. Location of the Radar J-Box (RJB) is restricted by the length of the interconnecting cables. This is 125 feet (shelter to RJB) and 15 feet (RJB to radar signal source). The RJB should be located in a place providing best access and protection from wind, rain, or mud. Consideration should be given to use of existing buildings, natural shelters, available trucks, tents, jeeps, etc. Special consideration should be given to water runoff dangers and the use of available dunnage, sand bags, and natural platforms as a means of elevating and protecting the unit from the elements.

11-11. Cabling Diagrams. Refer to figures 11-3 and 11-7 thru 11-9 for appropriate cabling diagrams. Verify that all connectors are secure.

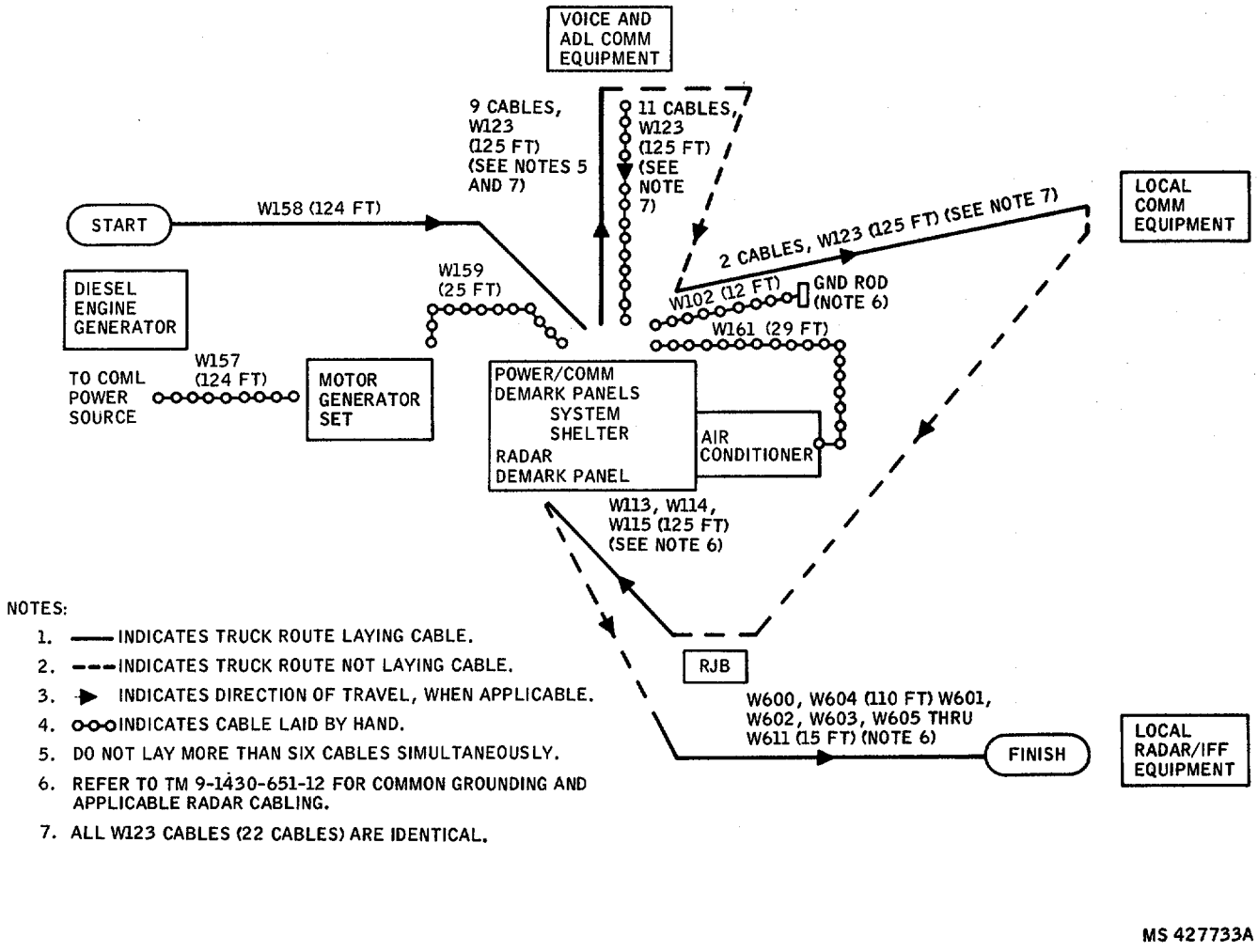

Figure 11-1. Typical Site Cabling Plan

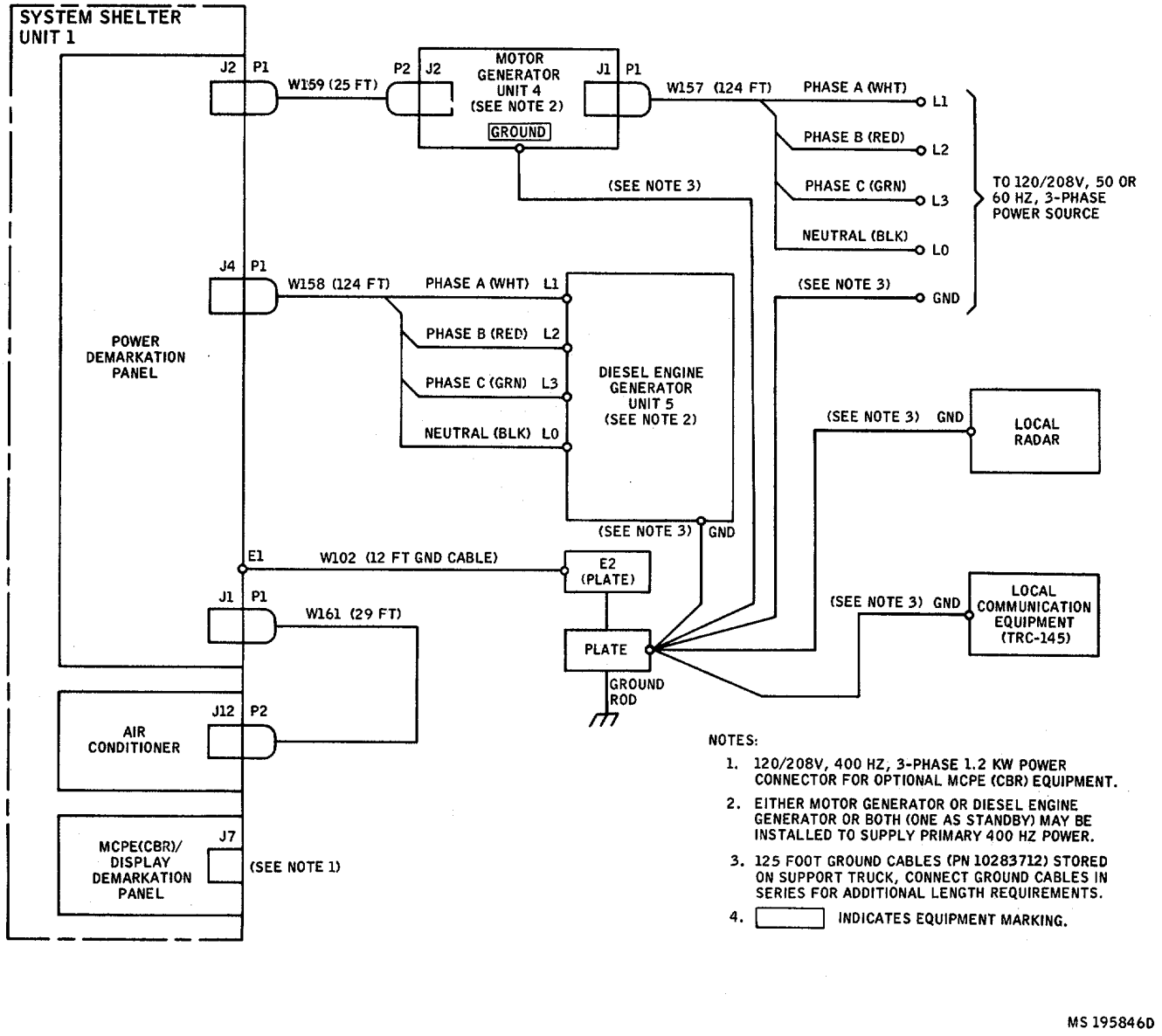

Figure 11-2. Primary Power Interconnection Diagram

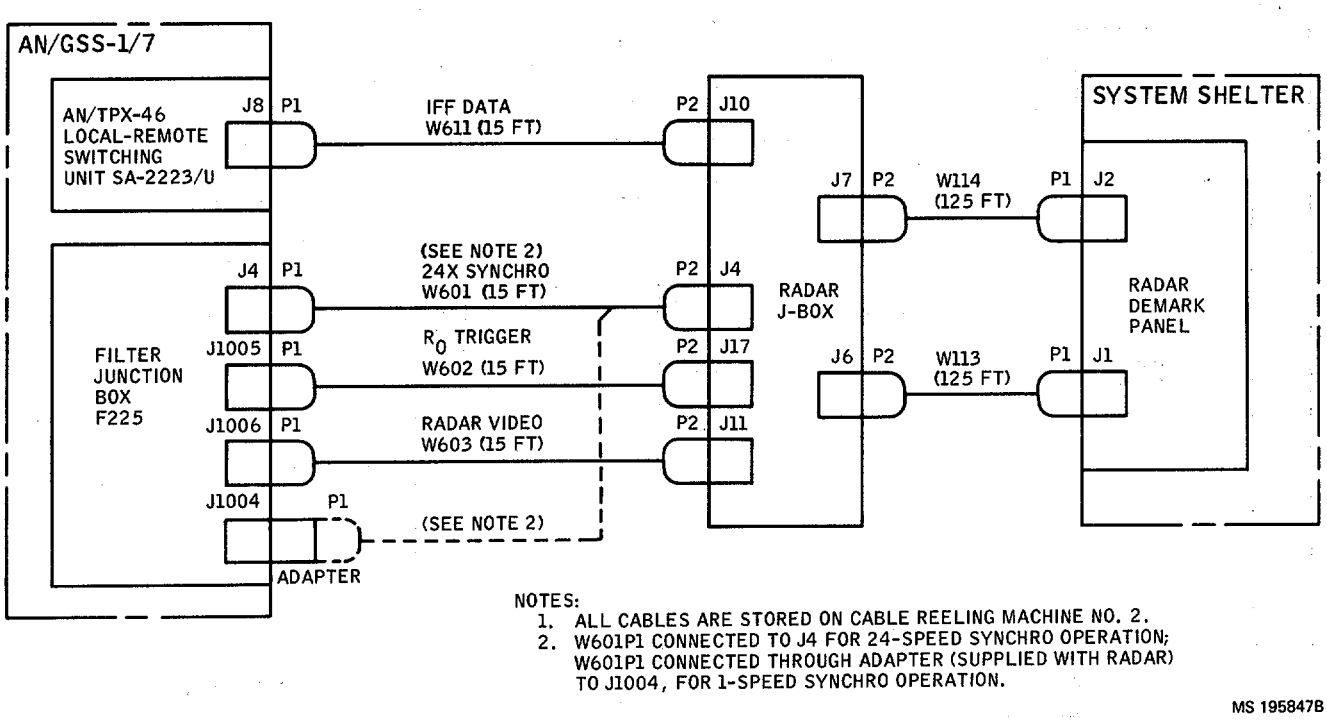

Figure 11-3. Radar Set AN/GSS-7 Interconnecting Cabling Diagram

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Figure 11-6.2. Deleted

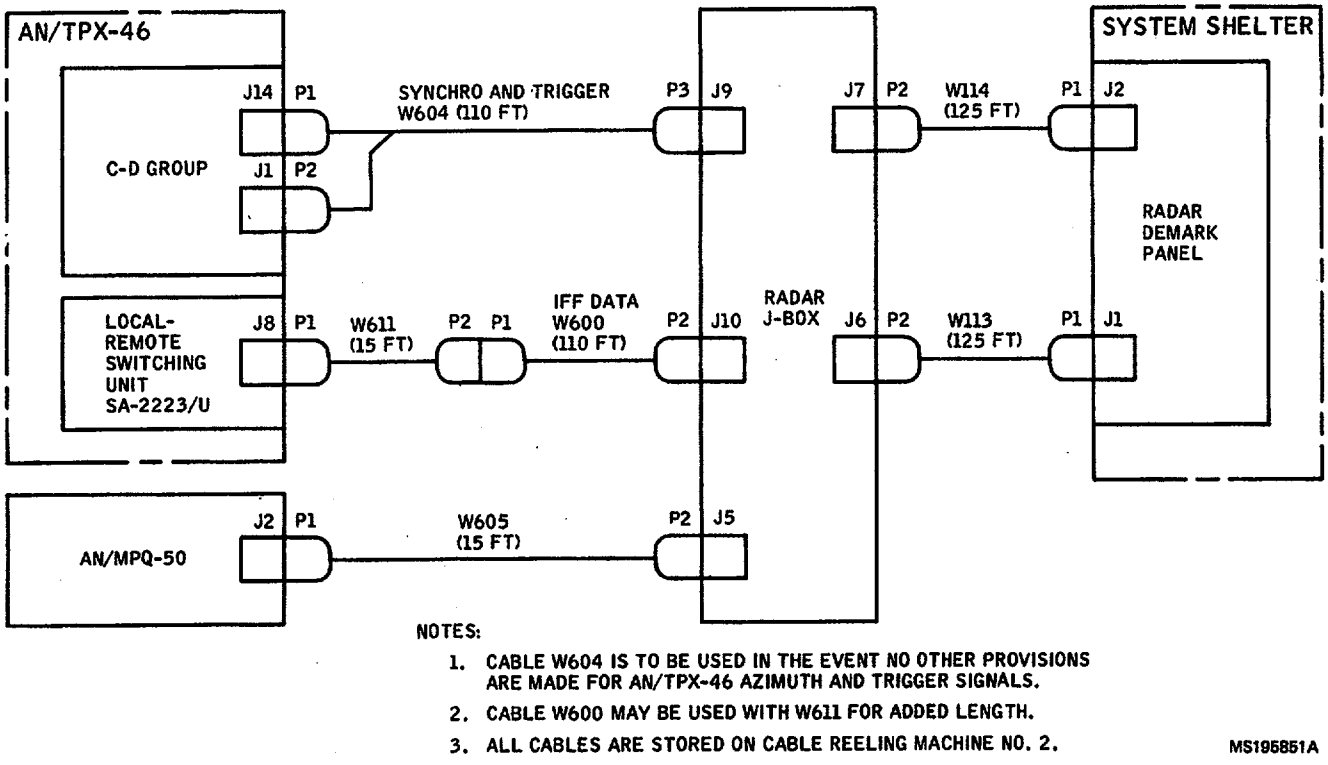


Figure 11-7. Radar Set ANIMPQ-50 Interconnecting Cabling Diagram

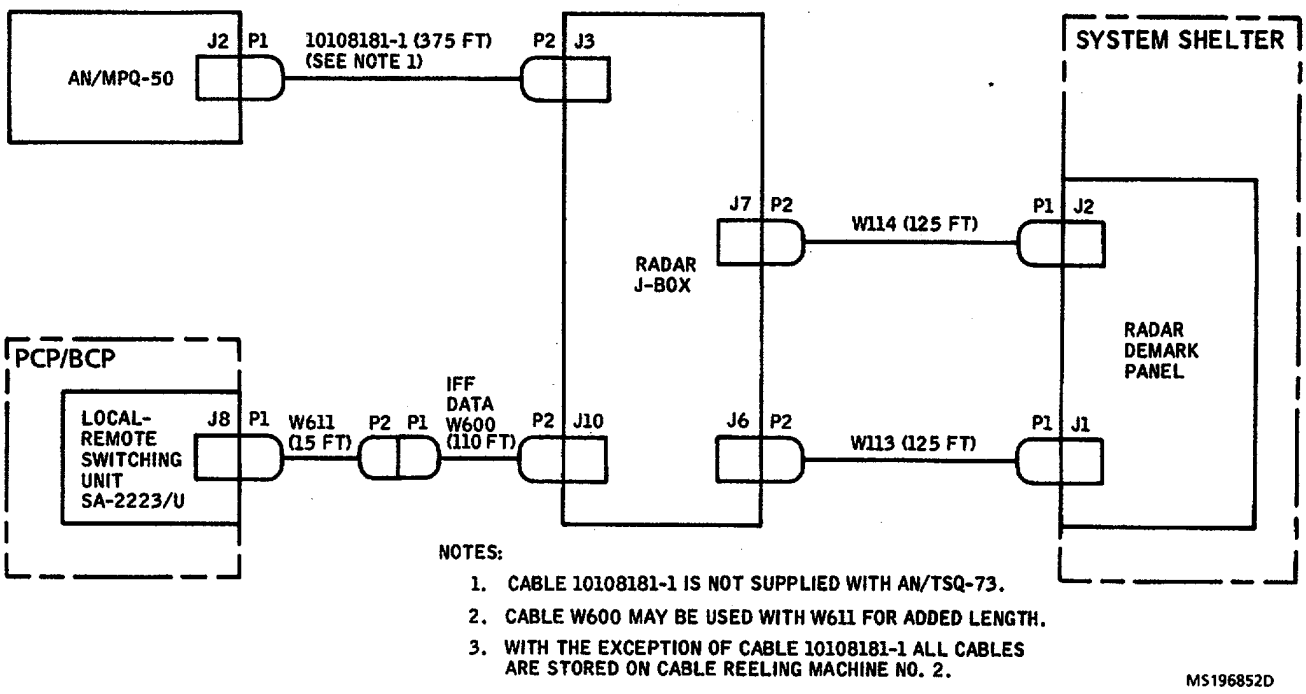
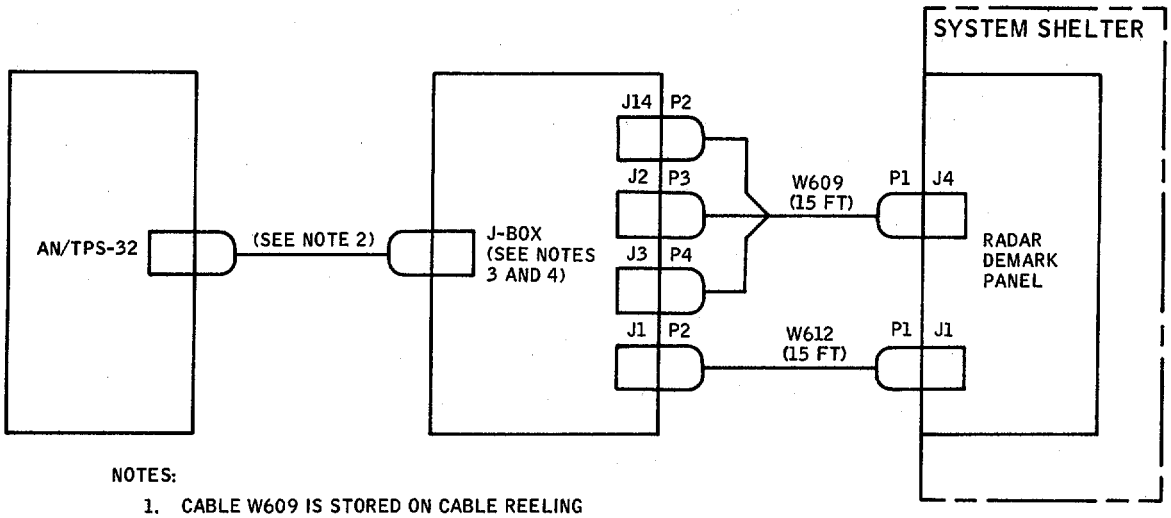


Figure 11-8. HAWK (AN/MPQ-50) Interconnecting Cabling Diagram



NOTES:

1. CABLE W609 IS STORED ON CABLE REELING MACHINE NO. 2.
2. CABLE AND MTDS J-BOX ARE PART OF AN/TPS-32.
3. J14 - DIGITAL DATA (5 LINES)
   J3 - AZIMUTH DATA (2 LINES)
   J2 - LIVETIME (1 LINE) PLUS
   RADAR VIDEO (1 LINE)
4. J4 AND J5 OR J6 AND J7 OR J8 AND J9 OR J10 AND J11 MAY BE USED IN LIEU OF J2 AND J3 RESPECTIVELY.

MS 195853A

Figure 11-9. Radar Set AN/TPS-32 Interconnecting Cabling Diagram

Section IV. OPERATION DURING ADVERSE WEATHER CONDITIONS

11-12. General. This section is provided to advise the operator/maintenance technician safety information for alinement during or after adverse weather conditions.

WARNING

Dangerous voltage levels (120 volts) exist in the radar junction box; exercise extreme care during alinement or maintenance procedures.

11-13. Radar J-Box. During emplacement if safe, practical and permissible, the Radar J-Box should be sheltered by a site structure or site equipment. If the unit must be located outside, care must be taken to select a site that will be free of standing water and mud. If this is not possible, the unit must be elevated on site dunnage. During rain, alinement and maintenance can be performed on the opened J-Box only when the unit can be completely protected from precipitation. If the opened J-Box is outside, it must either be protected with available covering or the unit must be disconnected and moved to a sheltered area then recabled.

Section V. AN/GSS-1 AND AN/GSS-7 RADAR INTERFACE ALINEMENT

11-14. General. The AN/GSS-1/7 radar set provides a single video output. This video will normally be range gated MTI/NORMAL video; however, full range NORMAL video is selectable. The MTI gate range is adjustable from zero to nearly maximum range. Both 24 SPEED, 400 HZ SYNCHRO and 1 SPEED, 400 HZ SYNCHRO azimuth data are provided by this radar. This procedure provides for use of either type. The following procedure must be performed with the RIE off-line (CC101 50 and RDR/CPU ON-LINE/OFF-LINE switch to OFF-LINE on RIE II panel).

11-15. Radar Preconditions and Adjustments. In order that an optimum interface be achieved between the radar and the AN/TSQ-73, certain preconditions and adjustments are required to be performed at the radar as follows:

a. Verify that radar is configured to provide RPPI trigger at demarcation panel J1005.

b. Verify that radar SYNCHRO DATA switch (S1) is in AN/TSQ-38 position (may be labeled AN/MSG-4 or AN/MSQ-18) if 24 SPEED SYNCHRO is to be used for azimuth data to AN/TSQ-73. Not applicable if 1 SPEED SYNCHRO is to be used.

c. Verify radar is alined in accordance with its TM and providing a signal-to-noise ratio of 3:2 (fig. 11-9.1) as seen on radar "A" scope.

d. Set Operation Selector switch to REMOTE.

e. Cable according to section III.

11-16. AN /TSO-73 Initialization.

a. Initialize the AN/TSQ-73 shelter as shown in TM 9-1430-652-10-3.

b. Set up RIE panels I and II and RJB according to table 11-1.

c. On AC power panel, set RADAR J-BOX circuit breaker to on.

d. At RJB, set POWER circuit breaker to ON and verify that POWER indicator is lit.

WARNING

Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When the technician is aided by operators, he must warn them about dangerous areas.

NOTE

This procedure is organized to present first the radar interface alinement followed by the IFF alinement. The radar alinement contains notes to indicate where certain IFF alinement procedures may be performed if it is desired to integrate the two procedures.

11-17. RJB Adjustments. RJB adjustments are accomplished using the battery-powered oscilloscope furnished with the AN/TSQ-73 system. The most efficient method is to monitor the signals at the RJB while making these adjustments. However, if these adjustments must be made during inclement weather, or for some reason it is not practical to have an oscilloscope at the RJB, an alternate procedure for using an oscilloscope at the shelter is provided in paragraph 11-17b.

NOTE

When the RJB cover is open and oscilloscope measurements are being made, RF interference from the radar may affect oscilloscope presentation (and display console presentation as well). Disregard the phenomenon during alinement. After alinement is completed, ensure that the RJB cover is closed and all latches are secured.

a. *Oscilloscope at RJB.*

(1) Synchronize oscilloscope at A5, TP15 (fig. 11-9.2) or set for internal sync. Oscilloscope ground may be connected to A1 thru A8, TP5.

(2) Monitor A5, TP13 on oscilloscope and adjust input attenuation at A5, R20 (fig. 11-9.2) such that the 50% amplitude point on the leading edge of the trigger pulse is at +1.5v (fig. 11-9.3).

(3) Monitor A5, TP16 on oscilloscope and verify that only one pulse is present each radar trigger period (approximately 2500 µs).

(4) Monitor A8, TP1 on oscilloscope and verify video signal greater than 7.5v with a signal-to-noise ratio of 3:2 as shown in figure 11-9.1.

(5) Monitor A8, TP14 on oscilloscope. Adjust A8, R34 (fig. 11-9.2) for a video amplitude of 4v at the shelter (fig. 11-9.3).

NOTE

Perform step (6) only if using 1 SPEED, 400 HZ SYNCHRO azimuth data.

(6) Monitor A11, TP6 on oscilloscope. Verify that signal is a dc level of 0 (±1.0) v. If not, reverse position of ø RVS 1 switch on RJB inside control panel. (This is a logic signal which indicates to the AN/TSQ-73

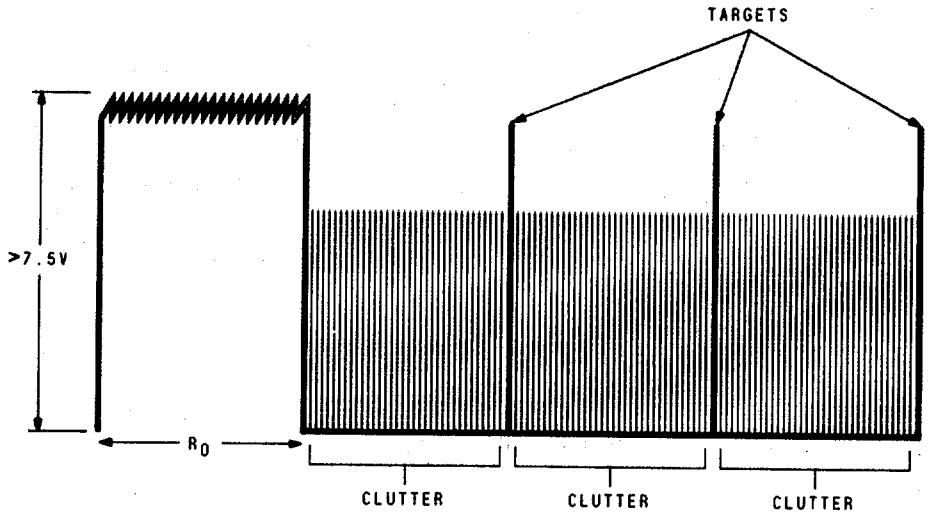


Figure 11-9.1. Required AN/GSS-1 or AN/GSS-7 Video

Table 11-1. Preliminary RIE Control Settings (AN/GSS-1 or AN/GSS-7)

Unit	Control	Setting
RADAR INTERFACE EQUIPMENT I	IFF	
	INTERROGATION	
	SELECT/CONTROL	LOCAL
	MODE INTERLACE	3
	IFF PARAMETERS	
	TPX 28/TPX 46	TPX 46
	CORRELATION (μS)	.27
	SIF ALIGNMENT (0.1 μS)	0002
	VIDEO DISTRIBUTION	
	SPECIAL VIDEO SELECT	
	CONSLE/LOCAL	LOCAL
	Select (switch)	NORM
	VPU INPUT SELECT	
	CONSLE/LOCAL	LOCAL
	VPU A	OFF

Table 11-1. Preliminary RIE Control Settings (AN/GSS-1 or AN/GSS-7)-Continued

Unit	Control	Setting
RADAR INTERFACE EQUIPMENT I (cont.)	VPU B	OFF
	DATA SOURCE SELECT	
	RADAR	RADAR/SIM (Note 1)
	IFF	RADAR/SIM (Note 1)
	PROCESSED VIDEO	
	DISPL.AY SELECT	MANUAL
	Select (thumbwheel)	1
	MTI/NORMAL	
	Q73/RADAR	RADAR
	GATE RANGE	Midrange
	AUTOMATIC CLUTTER MAPPER	
	MODE SELECT	A/B/C
	OVERLAP SELECT	DOMAIN
	SAMPLE/SCAN	1
	MAP RANGE	
	RANGE ADJ	1550
	DISPLAY	OFF
	MAPPER DECISION VALUES	
	NORMAL MAP	
	INCREMENT	00
	DECREMENT	00
	START	00
	MTI MAP	
	INCREMENT	00
	DECREMENT	00
	START	00
	AUTO/MANUAL	AUTO
	BEAM WIDTH (.088^{o})	56
	RADAR INTEGRATION	
	AZIMUTH	
	CORRECTION (.088°)	0000
	AZIMUTH MODE	36/1 SPD 400 HZ (Note 2)
	CFAR RANGE	
	ALIGNMENT (RADAR RANGE CELLS)	1560
	PRETRIGGER	
	ALIGNMENT (RADAR RANGE CELLS)	000
	PULSE WIDTH (µS)	3

Table 11-1. Preliminary RIE Control Settings (AN/GSS-1 or AN/GSS-7)-Continued

Unit	Control	Setting
RADAR INTERFACE EQUIPMENT II	RDR/CPU	OFF-LINE
	INTEGRATED MODE	OFF
	POWER	
	ON/OFF	ON
	RADAR PROCESSING	
	MEMORY	ON LINE
	TARGET PROCESSOR	
	RDR-IFF	
	AZ CORRELATION (.088°)	067
	RADAR	
	AZ OFFSET	07
	BITE	OFF
	TARGET DETECTOR	
	AUTO/A/B	AUTO
	JAM DETECTOR	
	THRESHOLD	12
	ON/OFF	OFF
	RADAR TGT DECISION VALUES	
	MISS (SWEEPS)	0
	IFF TGT DECISION VALUES	
	AZ MIN (.088°)	13
	AZ MAX (.088°)	400
	MISS (SWEEPS)	7
RADAR J-Box	FILTER	OUT
	ACP/ANP	INT
	CABLE COMP	Note 3
	INPUT TERM 1 thru 8	>1000Ω
	COMMON CHAN	1
	RADAR SELECT	1
	CW/CCW	INT
	POWER	ON
	N SPEED SYNC	Note 2
	1 SPEED SYNC	Note 2
	115V REF	ON

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Table 11-1. Preliminary RIE Control Settings (AN/GSS-1 or AN/GSS-7) -Continued

Unit	Control	Setting
RADAR J-Box (cont)	PWR SEL	Note 4
	⌀RVSN	Note 5

NOTES

1. If RIE loop test is not required, set both DATA SOURCE SELECT switches to RADAR. If local radar is not available, set SELECT RADAR DATA SOURCE to SIM, CFAR RANGE to 0000, and PRETRIGGER ALIGNMENT to 440. If local IFF is not available, set DATA SOURCE SELECT IFF to SIM.
2. If using 24 SPEED, 400 HZ SYNCHRO azimuth data, set RIE I panel AZIMUTH MODE switch to 24 SPD MICROLOCK; set RJB N SPEED SYNC to ON and 1 SPEED SYNC to OFF (ACP/ANP and CW/CCW not applicable). If using I SPEED, 400 HZ SYNCHRO azimuth data, set RIE II panel AZIMUTH MODE switch to ACP/ANP ONLY; set RJB N SPEED SYNC to OFF, 1 SPEED SYNC to ON and ACP/ANP and CW/CCW to INT.
3. Place CABLE COMP switch in appropriate position for RJB to AN/TSQ-73 shelter cable length as follows: 125 to 250 feet - SHORT, 250 to 625 feet - MED, or 625 to 1000 feet - LONG.
4. Set PWR SEL switch in either TSQ-73 or RADAR position depending on power source desired. POWER indicator lamp will indicate source available.
5. When using 24 SPEED, 400 HZ SYNCHRO azimuth data, if console PPI sweep is rotating opposite to radar, reverse position of ø RVSN switch.

the direction of antenna rotation: CW = 0 (±1.0) vdc, CCW = +9.0 (±3.0) v.)

NOTE

If IFF alinement is to be performed at this time, perform procedure in paragraph 11-20c(1).

b. *Oscilloscope at Shelter.* This method of performing RJB adjustments requires coordination of the observer at the shelter and the technician at the RJB. Use field telephones for communicating.

(1) Gain access to shelter radar/simulator card cage in rack 1 (1A1A1A6).

(2) Insert card extender 588802-153 in vacant slot A 1426. Connect oscilloscope ground to pin 2 (wirewrap pin).

(3) Use testpoint adapter 533385 on cards to be monitored. Set RIE II panel POWER switch to OFF whenever installing test point adapter on card.

(4) Use isolated oscilloscope (battery pack or powerline isolator).

(5) Set oscilloscope for internal sync.

(6) Monitor A1123, TP2 on oscilloscope. Verify presence of one pulse of +8.5 (±3.5) v amplitude each radar trigger period (approximately 2500 µs). If no pulse is present or excess pulses are present, adjust A5, R20 (fig. 11-9.2) at the RJB for correct output. Count turns of R20 between when pulse is no longer seen on crt and when excess pulses are seen. Adjust R20 midway between these points.

(7) MonitorA1210, TP23 on oscilloscope. Adjust A8, R34 (fig. 11-9.2) at the RJB for a video amplitude of 4v. If a signal-to-noise ratio of 3:2 cannot be achieved, notify radar maintenance technician.

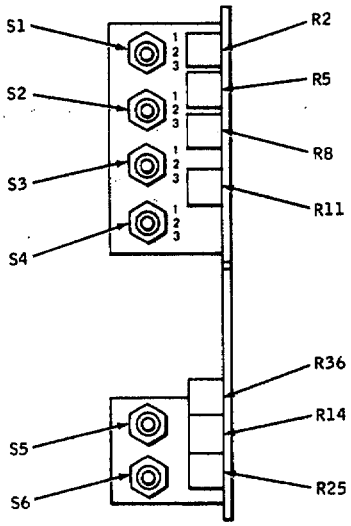
NOTE

Perform step (8) only if using I SPEED, 400 HZ SYNCHRO azimuth data.

(8) Monitor A1322, TP3 on oscilloscope. Verify that signal is a dc level of 0 (± 2.0) v. If not, reverse position of ø RVS 1 switch on RJB inside control panel. (This is a logic signal which indicates to the AN/TSQ-73 the direction of antenna rotation: CW = 0 (±2.0) vdc, CCW = >+5.0v.)

NOTE

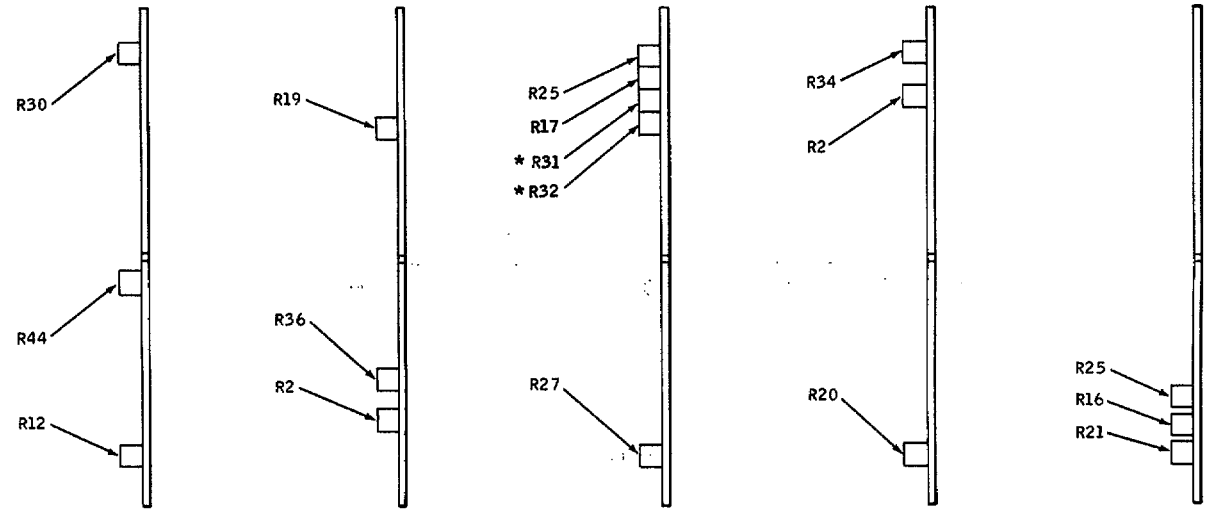
When using the 24-speed, 400-Hz azimuth data from the radar, verify that the system will seek true north when switching from radar to simulation, then back. The sweep should realine itself to the radar; if not, perform checks provided in paragraph c below.



SW S1 THRU S4 POSITION	INPUT AMPLITUDE
1	-4V,-100V
2	+8V,+100V
3	+4V,+8V

SW S5 AND S6 POSITION	POLARITY
UP	NEG (-)
DOWN	POS (+)

LINE RECEIVER CARD (10281656)
A1123, A1208, A1210, A1212
A1218, A1322



VIDEO MIXER CARD
(10282719)
A1220, A1221, A1222

LINE DRIVER CARD
(10281662) A1214,
A1215, A1216, A1323
A1326, A1327

CFAR-QUANTIZER CARD
(10285432-1) A1519,
A1520, A1521

RJB CARDS
(10282351)
A1 THRU A8

RJB CARD
(10282372)
A10

* NOT PRESENT ON BASIC CARD WHICH IS ACCEPTABLE SUBSTITUTE.

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Figure 11-9.2. AN/GSS-1 and AN/GSS-7 Test Point and Adjustment Locations (Sheet 1 of 2)

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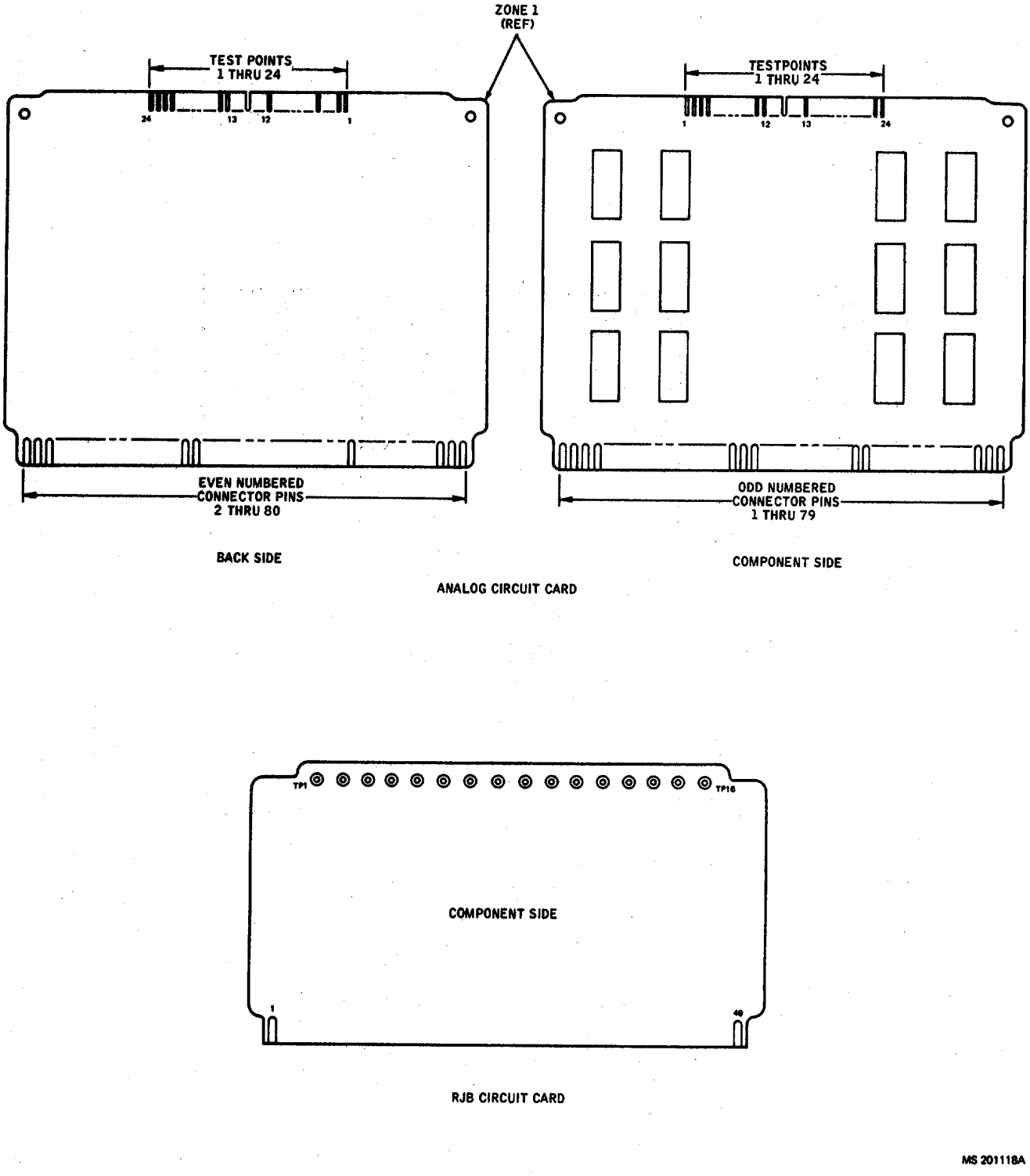


Figure 11-9.2. AN/GSS-1 and AN/GSS-7 Test Point and Adjustment Locations (Sheet 2 of 2)

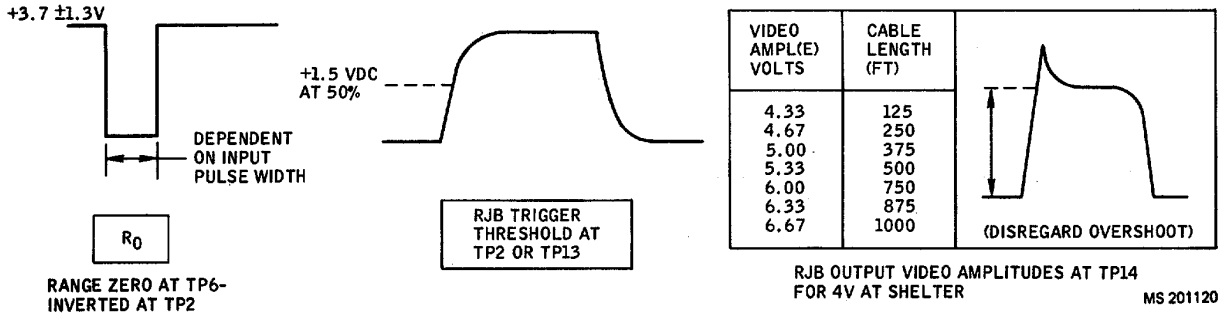


Figure 11-9.3. AN/GSS-1 and AN/GSS-7 Alinement Waveforms

c. *24-Speed Microlock Adjustment.* At the radar set, have technician verify that microlock system is operational and that antenna rotation is set at 10 rpm.

(1) Set oscilloscope controls as follows:

Control	Setting
VERT MODE	CHOP
CH 1 VOLTS/DIV	2
CH 2 VOLTS/DIV	2
A and B TIME/DIV	50 ms
Trigger SOURCE	CH 1 positive

(2) At radar/simulator card cage, connect oscilloscope channel 1 to A1322, TP8 and channel 2 to pin 53 of connector J1320.

(3) Adjust trigger level to obtain oscilloscope display once each antenna rotation as shown in figure 11-9.4 below. The trailing edge of the null pulse on channel 2 must occur before the trailing edge of the microlock signal on channel 1.

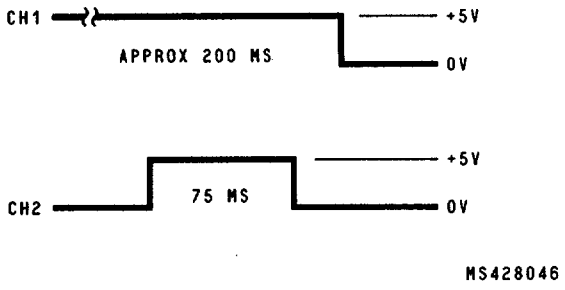


Figure 11-9.4. Microlock Signal Alinement

(4) If necessary, the 24X synchro in the antenna base at the radar set must be rotated 60° clockwise for each 50 ms of additional delay required. If this is done, the synchro receiver in the radar indicator chassis must be realined. All procedures for the radar set are in TM 11-5840-222-15.

NOTE

If IFF interface alinement is to be accomplished at this time, perform the procedure in paragraph 11-20c(2).

11-18. RIE Checks and Adjustments.

a. Gain access to radar/simulator card cage in rack 1 (1A1A1A6).

b. Insert card extender 588802-153 in vacant slot XA1426. Connect oscilloscope ground to pin 2 (wirewrap pin).

c. Use testpoint adapter 533385 on cards to be monitored.

d. Use isolated oscilloscope (battery pack or powerline isolator).

e. Set oscilloscope for internal sync.

f. Monitor A1123, TP2 on oscilloscope. Verify presence of one pulse of +8.5 (+3.5) v amplitude each radar trigger period (approximately 2500 μs).

g. Set A1123, S2 (fig. 11-9.2) to +4v, +8v range (position 3).

h. Monitor A1123, TP6 on oscilloscope. Verify presence of logic level R_o (fig. 11-9.3). One pulse should be present each radar trigger period. If not, adjust A1123, R5 for correct output.

i. Monitor A1210, TP23 on oscilloscope. Verify presence of video with an amplitude of approximately +4v.

j. Set A1210, S6 (fig. 11-9.2) in the POS (+) position (down).

k. Monitor A1210, TP16 on oscilloscope. Adjust A1210, R25 (fig. 11-9.2) for a video amplitude of +4.0v.

NOTE

If IFF interface alinement is to be accomplished at this point, perform procedure in paragraph 11-20d.

l. On RIE II panel, set VPU A and VPU B AUTO/MANUAL switches to MANUAL and HIGH and LOW THRESHOLD and AUTO CLUTTER MAPPER THRESHOLD switches to 00.

NOTE

Use a dc voltmeter for measurements in steps m thru p. Use TP21 on A1519, A1520 or A1521 for ground.

m. On A1519, A1520 and A1521, measure voltage at TP10. Adjust R17 (fig. 11-9.2), if necessary, for voltage of 2.5v.

n. On A1519, A1520 and A1521, measure voltage at TP23. Adjust R27 (fig. 11-9.2), if necessary, for voltage of 0.25v.

o. On A1519 and A1520, measure voltage at TP2. Adjust R25 (fig. 11-9.2), if necessary, for voltage of 1.0v.

p. On A1521, measure voltage at TP2. Adjust R25 (fig. 11-9.2), if necessary, for voltage of 0.25v.

NOTE

If alternate card 10285432 (basic) is used, skip steps q thru u below for that card.

q. On RIE II panel, set VPU A and VPU B HIGH and LOW THRESHOLD and AUTO CLUTTER MAPPER THRESHOLD switches to 77.

r. On A1519 and A1520, measure voltage at TP2. Adjust R31 (fig. 11-9.2), if necessary, for voltage of 3.5v.

s. On A1521, measure voltage at TP2. Adjust R31 (fig. 11-9.2), if necessary, for voltage of 2.75v.

t. On A1519, A1520 and A1521, measure voltage at TP23. Adjust R32 (fig. 11-9.2), if necessary, for voltage of 2.75v.

u. Repeat steps l thru t above as necessary until no further adjustment is required.

NOTE

In the following steps, do not adjust tunable capacitors on A1220, A1221 or A1222 or video mixers will not operate properly.

v. On RIE I panel, set VPU INPUT SELECT VPU A and VPU B and SPECIAL VIDEO SELECT switches to NORM.

w. Monitor A1221, TP1 on oscilloscope. Adjust A1221, R30 (fig. 11-9.2) for video amplitude of +4.0v.

x. Monitor A1220, TP1 on oscilloscope. Adjust A1220, R30 (fig. 11-9.2) for video amplitude of +4.0v.

y. Monitor A1220, TP20 on oscilloscope. Adjust A1220, R12 (fig. 11-9.2) for video amplitude of +4.0v.

z. Monitor A1221, TP20 on oscilloscope. Adjust A1221, R12 (fig. 11-9.2) for video amplitude of +4.0v.

aa. Monitor A1221, TP6 on oscilloscope. Adjust A1221, R44 (fig. 11-9.2) for video amplitude of +4.0v.

ab. Monitor A1222, TP1 on oscilloscope. Adjust A1222, R30 (fig. 11-9.2) for video amplitude of +4.0v.

ac. Monitor A1222, TP20 on oscilloscope. Adjust A1222, R12 (fig. 11-9.2) for video amplitude of +4.0v.

ad. Monitor A1322, TP4 on oscilloscope. Verify dc voltage of +15.0 (±10.0) v which switches to +1.0 (± 1.0) v once each radar antenna rotation.

ae. Set A1322, S4 (fig. 11-9.2) to +4v, +8v range (position 3).

af. Monitor A1322, TP8 on oscilloscope. Verify dc voltage of 0 (±1.0) v which switches to +3.7 (±1.3) v once each radar antenna rotation. If not, adjust A1322, R11 (fig. 11-9.2) for correct output.

ag. Monitor A1218, TP4 on oscilloscope (or dc voltmeter). Verify dc voltage of 0 (±1.0) v. Momentarily remove power from RJB by setting ac power panel RADAR J-BOX circuit breaker to OFF. Verify that dc voltage at A1218, TP4 is now +5.0 (±1.0) v.

ah. Set A1218, S4 (fig. 11-9.2) to +4v, +8v range (position 3).

ai. Monitor A1218, TP8 on oscilloscope (or dc voltmeter). Verify dc voltage of +3.7 (±1.3) v when RJB power is on and 0 (±1.0) v when RJB power is off. If not, adjust A1218, R11 (fig. 11-9.2) for correct output. When completed, ensure that ac power panel RADAR J-BOX circuit breaker is left in ON position.

aj. Set A1218, S1 and S2 (fig. 11-9.2) to -4v, -100v range (position 1).

ak. Monitor A1218, TP5 on oscilloscope. Verify presence of dc level of 0 (±1.0) v. If not, adjust A1218, R2 (fig. 11-9.2) for correct output.

al. Monitor A1218, TP6 on oscilloscope. Verify presence of dc level of 0 (±1.0) v. If not, adjust A1218, R5 (fig. 11-9.2) for correct output.

11-19. RIE Alinement.

a. *CFAR Range Alinement.*

(1) On RIE I panel, set PRETRIGGER ALIGNMENT (RADAR RANGE CELLS) thumbwheel switches to 000.

(2) Set CFAR RANGE ALIGNMENT (RADAR RANGE CELLS) thumbwheel switches to 0000 and adjust thumbwheel switches as follows:

(a) Adjust MSD until MISALIGNED indicator lights and then back off one digit.

(b) Adjust 2nd MSD until indicator lights and then back off one digit.

(c) Adjust 2nd LSD until indicator lights and then back off one digit. Adjust LSD until indicator lights and back off one digit or until indicator goes off.

(3) Decrease CFAR RANGE ALIGNMENT (RADAR RANGE CELLS) switch by 0030_8.

b. *Azimuth Correction*

NOTE

Preset AZIMUTH CORRECTION (.088°) thumbwheel switches to 0000. If AN/TSQ-73 is alined to true north, proceed to paragraph 11-19c; otherwise complete steps (1), (2) or (3) as appropriate.

(1) *Radars with known ground clutter land-marks*.

(a) At radar PPI scope, determine azimuth of a known landmark and enter jam strobe through AN/TSQ-73 console keyboard at position corresponding to landmark position. To enter jam strobe, press display console TASK SELECTIONS TRACK DATA switch. Enter three numerics at console keyboard corresponding to landmark location (359 maximum). Press TASK FUNCTIONS ENTER JAM STROBE switch. To observe jam strobe, press BACKGROUND DATA DISPLAY JAM STROBE switch. Select normal video (NORM) on console.

(b) Adjust AZIMUTH CORRECTION (.088°) thumbwheel switches until landmark video coincides with jam strobe video. One digit on thumbwheels equals:

MSB = ±45° or 800 mils shift of video
2nd MSB = ±5.6° or 100 mils shift of video
2nd LSB = ± 0.7° or 12.5 mils shift of video
LSB = ± 0.09° or 1.5 mils shift of video

(2) *Radars with track marker.*

(a) Notify radar operator to put track marker at known angle (180°, or landmark, etc.)

(b) Adjust AZIMUTH CORRECTION (.088°) thumbwheel switches until displayed track marker coincides with known angle.

(*3) Radars without track marker or known ground clutter position* (Use as last choice for setting azimuth correction.)

(a) Notify radar operator to turn off transmitter and allow antenna rotation to stop.

(b) Obtain from radar operator exact angle of antenna direction. If angle is obtained from radar PPI, radar sweep (on PPI) must have been previously alined to true north.

(c) Using table 11-17, locate azimuth angle (in degrees) of antenna direction and note corresponding azimuth correction value.

(d) Adjust AZIMUTH CORRECTION (.088°) thumbwheel switches to obtain azimuth correction value from step (c) on AZIMUTH PROCESSOR (.088°) LED readout.

(e) Have radar operator restore radar to normal operation.

c. *Hits/Beamwidth Setup.* Set RADAR AZ OFF-SET (SWEEPS), TARGET DETECTOR MATRIX, RADAR TARGET DECISION VALUES STOP, and START as shown in table 11-2 according to HITS/BEAMWIDTH readout on RIE I panel.

d. *Target Minimum Width Setting.* Perform the following steps:

(1) Observe HITS/BEAMWIDTH readout on RIE I panel and obtain minimum width (sweeps) value from table 11-2.

(2) Adjust RIE I panel BEAMWIDTH (.088°) thumbwheel switches until HITS/BEAMWIDTH readout displays number of sweeps obtained in step 1.

(3) Set RIE II panel RADAR TGT DECISION VALUES MIN WIDTH (.088°) thumbwheel switches to match BEAMWIDTH (0.88°) switches.

(4) Return BEAMWIDTH (.088°) switches to radar beamwidth value.

e. *Line Driver Adjustment*. Perform the following steps (fig. 11-9.2):

(1) On RIE I panel, set AUTOMATIC CLUTTER MAPPER MODE SELECT switch to A/C.

(2) On shelter display console, deselect all VIDEO SELECTIONS switches and set all VIDEO BRIGHTNESS thumbwheel switches to 4.

(3) Adjust A1216, R19 until normal video is displayed; then back off adjustment until display disappears.

(4) Adjust A1327, R36 until special video is displayed on display console; then back off adjustment until display disappears.

(5) Adjust A1323, R36 until processed video is displayed on display console; then back off adjustment until display disappears.

(6) Adjust A1216, R2 until IFF video is displayed on display console; then back off adjustment until display disappears.

NOTE

If no remote display console is in use, proceed to paragraph f.

(7) On remote display console, deselect all VIDEO SELECTIONS switches and set all VIDEO BRIGHTNESS thumbwheel switches to 4.

(8) Adjust A1215, R2 until normal video is displayed on remote display console; then back off adjustment until display disappears.

Table 11-2. Hits/Beamwidth Setup

HITS/ BEAMWIDTH readout	RADAR AZ OFFSET (SWEEPS) switch	TARGET DETECTOR MATR1X switch	TARGET DECISION VALUES START switch	TARGET DECISION VALUES STOP switch	Min width (sweeps)
1-3	02	0	3	1	02
4-6	04	1	7	1	03
7-14	07	2	9	3	05
15-26	14	3	13	1	11
27-44	22	4	15	1	14
45-74	31	5	15	1	22

(9) Adjust A1327, R19 until special video is displayed on remote display console; then back off adjustment until display disappears.

(10) Adjust A1323, R19 until processed video is displayed on remote display console; then back off adjustment until display disappears.

(11) Adjust A1216, R36 until IFF video is displayed on remote display console; then back off adjustment until display disappears.

f. *VPU Alinement*. There are two modes of VPU operation: AUTO and MANUAL. In the AUTO mode, the HIGH and LOW THRESHOLD biases have a fixed differential of 0.75v during RIE alinement and are varied automatically (remaining 0.75v apart) by the RIE processor. In the MANUAL mode, the threshold voltages are independently set by the HIGH and LOW THRESHOLD switches and each bias remains fixed at the selected level. AUTO mode is normally used for videos containing relatively large amounts of clutter (e.g., normal video) and MANUAL mode is normally used for videos containing little clutter (e.g., MTI video). The following steps (1) thru (5) are for AUTO VPU alinement and steps (6) thru (11) are for MANUAL VPU alinement.

(1) Set VPU A (VPU B) AUTO/MANUAL switch to AUTO.

(2) Set VPU A (VPU B) HIGH and LOW THRESHOLD switches to 03.

(3) Set VPU A (VPU B) AUTOMATIC CLUTTER MAPPER THRESHOLD switches to 40 (this is the AUTO mode setting).

(4) Set AUTOMATIC CLUTTER MAPPER MODE SELECT switch to A (B).

(5) Adjust VPU A (VPU B) HIGH and LOW THRESHOLD switches together until HIGH FAR readout is 20 (±15) and stable in that region. In AUTO mode, HIGH and LOW THRESHOLD settings must be the same and within the 01 to 05 range.

NOTE

Steps (6) thru (11) are for MANUAL VPU alinement.

(6) Set VPU A (VPU B) AUTO/MANUAL switch to MANUAL.

(7) Set AUTOMATIC CLUTTER MAPPER MODE SELECT switch to A (B).

(8) Set VPU A (VPU B) HIGH and LOW THRESHOLD switches to 34.

(9) On display console VIDEO SELECTIONS, select both NORM and PROC video. Adjust VIDEO BRIGHTNESS thumbwheel switches so that processed video is brighter than normal video, but both are visible.

(10) Verify that processed video (slash with strobe tail) is associated with targets and not clutter. Adjust VPU A (VPU B) HIGH THRESHOLD switches upward, if necessary, until only targets are processed.

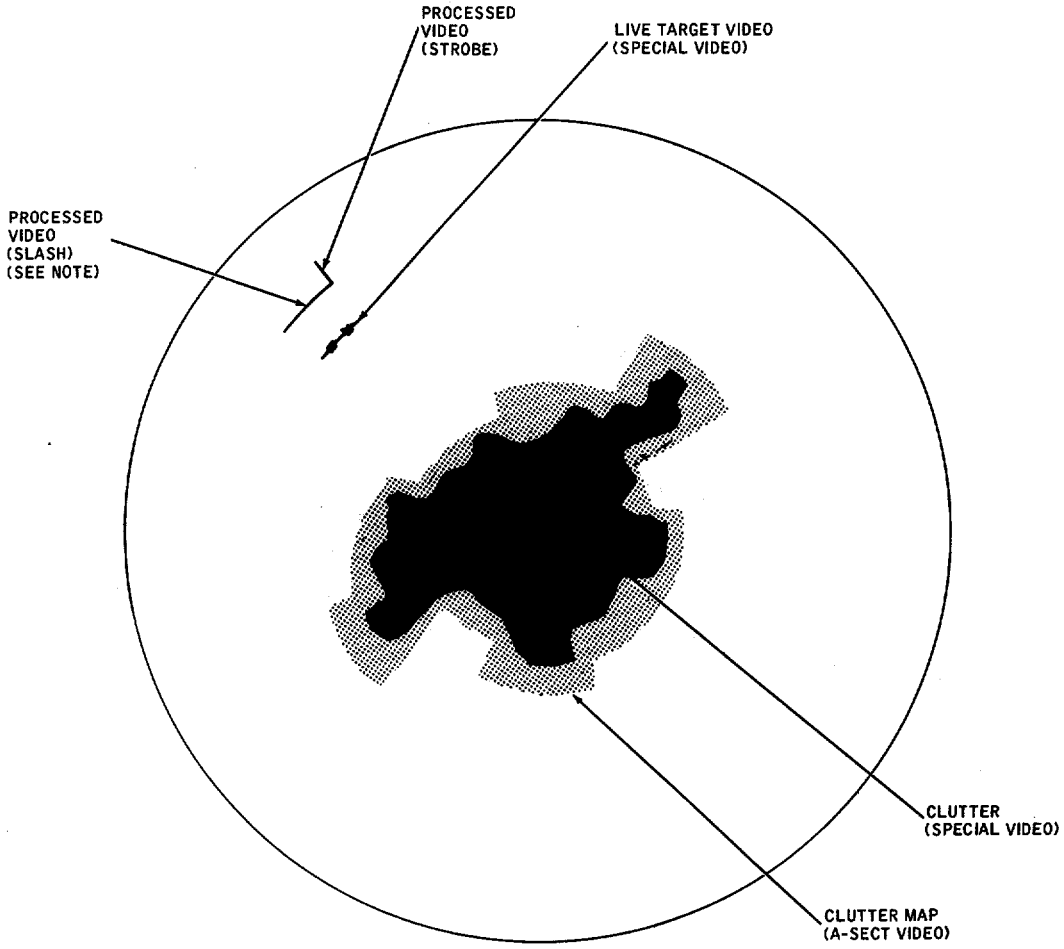
(11) Adjust VPU A (VPU B) AUTO CLUTTER MAPPER THRESHOLD switches until VPU A (VPU B) AUTO CLUTTER MAPPER FAR count stabilizes at 40 (±15%).

g. *Automatic Clutter Mapper Alinement.*

(1) At display console, select NORM and A SECT video.

(2) On RIE I panel, set AUTOMATIC CLUTTER MAPPER MAP RANGE DISPLAY switch to ON. Set AUTOMATIC CLUTTER MAPPER MODE SELECT switch to A/C (B/C). Set RANGE ADJUST switches so that the range ring on the display encompasses the areas of clutter or clutter residue (fig. 11-10). Set MAP RANGE DISPLAY switch to OFF.

Table 11-3 deleted



NOTE:

STROBE INDICATES TARGET WAS REPORTED OUT, FROM TARGET PROCESSOR, TO COMPUTER, NO STROBE ON PROCESSED VIDEO INDICATES A REJECTED TARGET (USUALLY FOR BEING TOO NARROW).

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Figure 11-10. Sample Correct Video Display

(3) On RIE I panel, press MAPPER RESET switch. Wait several scans for clutter map to stabilize.

(4) Adjust intensity of NORM and A SECT video such that NORM video clutter (or clutter residue) can be seen through A SECT video. Verify that A SECT video covers all areas of clutter (or clutter residue). Readjust RANGE ADJUST switches (step (2) above) if necessary to encompass all clutter.

NOTE

If A SECT video does not cover all areas of clutter (clutter varies faster than map is generated), change the setting of the RIE I panel AUTOMATIC CLUTTER MAPPER SAMPLES/SCAN switch in a clockwise direction (higher value) such that all clutter is covered. As an aid in determining effectiveness of the clutter map, select processed (PROC) video on the display console. Areas of clutter which are properly covered by the map should not produce processed video.

The clutter mapper samples range/azimuth cells and censors video in which video remains from scan to scan. Targets which move too slowly and remain in a cell too long are also censored. The SAMPLES/SCAN switch determines the rate at which the cells are sampled. Therefore, the higher the setting the higher the velocity of targets that will be censored. It is necessary then to compromise in the setting of this switch, that is, high enough to provide the best clutter elimination possible without censoring desired moving tar- gets.

If IFF interface alinement is to be accomplished at this point, perform procedure in paragraph 11-20c.

h. *Operation.*

(1) On RIE II panel, set RDR/CPU ON-LINE/OFF-LINE switch to ON-LINE.

(2) Enter CC100 50 on KPU. The RIE is now operational.

11-20. IFF Interface Alinement. The IFF equipment associated with the AN/GSS-1/7 radar is the AN/TPX-46. Interface with the AN/TSQ-73 is accomplished via a local remote switching unit (LRSU) located adjacent to the Coder-Decoder (C-D) Group OX-7(V)1/TPX-46(V). When the LRSU CONTROL SELECT switch is in the REMOTE position, the AN/TSQ-73 has exclusive control of IFF interrogation. When this switch is in the LOCAL position, the AN/TSQ-73 IFF interrogation control may be overridden by local control. The following interface alinement procedure assumes that the AN/TSQ-73 RIE has been alined in accordance with the preceding procedure and is operating.

a. C*abling.* If cabling to IFF equipment was accomplished, proceed to step b. If not, cable according to section III.

b. 4N/TPX-46 Adjustments.

(1) On LRSU, set CONTROL SELECT switch to appropriate position as required.

(2) On C-D Group synchronizer unit, set IFF TRIG SELECT switch to EXT and COUNTDOWN switch to HIGH if it is desired to operate the IFF synchronized to the radar trigger. Set IFF TRIG SELECT switch to INT if asynchronous operation is desired.

(3) In C-D Group synchronizer unit, ensure that R1 of display video card A17 is adjusted for an output pulse width of 0.5 to 1.4 µs. (Refer to TM 1-5895-532-12, Adjustment of Target Arc Range Dimension.)

c. *RJB Adjustments.* Perform the following steps:

(1) *Oscilloscope at RJB.*

(a) Synchronize oscilloscope at A2, TP15. Oscilloscope ground may be connected to A1 thru A8, TP5.

NOTE

In order for IFF video to be observed on the oscilloscope and adjusted, the operator must interrogate a target.

(b) Monitor A2, TP13 on oscilloscope and adjust A2, R20 (fig. 11-9.2) such that 50% amplitude point of leading edge of trigger pulse (fig. 11-9.3) is at 1.5v.

(c) Monitor A3, TP13 on oscilloscope and adjust A3, R20 (fig. 11-9.2) such that the 50% amplitude point of the leading edge of either pulse is at +1.5v.

(d) Monitor A5, TP14 on oscilloscope and adjust A5, R34 (fig. 11-9.2) for video amplitude of 4v at shelter as shown in figure 11-9.3.

(*2) Oscilloscope at shelter.*

(a) Gain access to radar/simulator card cage in rack 1 (1A1A1A6).

(b) Set oscilloscope for internal sync.

NOTE

In order for IFF video to be observed on the oscilloscope and adjusted, the operator must interrogate a target.

(c) Monitor A1124, TP8 on oscilloscope. Verify presence of one pulse of +8.5 (± 3.5) v amplitude each IFF trigger period. If no pulse is present or excess pulses (noise) arc present, adjust A2, R20 (fig. 11-9.2) at RJB for correct output. Ensure that R20 is left in a position which may be adjusted at least one turn in each direction while maintaining correct output.

(d) Monitor A1124, TP7 on oscilloscope. Verify presence of one pulse pair of +8.5 (±3.5) v amplitude (pulse spacing of 8.0, s) for each I FF trigger period. If no pulses are present or excess pulses (noise) are present, adjust A3, R20 (fig. 11-9.2) at RJB for correct output. Ensure that R20 is left in a position which may be adjusted at least one turn in each direction while maintaining correct output.

(e) Monitor A 1123, TP24 on oscilloscope. Verify presence of IFF video of + 1.0 to ± 5.0v amplitude. If

not, adjust A5, R34 (fig. 11-9.2) at RJB for correct output.

d. *RIE Input Checks and Adjustments.*

(1) Gain access to radar/simulator card cage in rack 1 (1A1A1A6).

(2) Set oscilloscope for internal sync.

(3) Monitor A1124, TP8 on oscilloscope. Verify presence of one pulse of +8.5 (±3.5) v amplitude each IFF trigger period.

(4) Monitor A1124, TP7 on oscilloscope. Verify presence of one pulse pair of +8.5 (±3.5) v amplitude (pulse spacing 8.0 µs) for each IFF trigger period.

(5) Monitor A1123, TP24 on oscilloscope. Verify presence of IFF video of +1.0 to +5.0v amplitude.

(6) Ensure that A1123, S5 (fig. 11-9.2) is in POS (+) (down) position.

(7) Monitor A1123, TP15 on oscilloscope. Adjust A1123, R 14 (fig. 11-9.2) for video amplitude of + 4.0v.

(8) Monitor A1222, TP6 on oscilloscope. Adjust A1222, R44 (fig. 11-9.2) for video amplitude of + 4.0v.

(9) Monitor A1123, TP4 on oscilloscope (or dc voltmeter). Verify dc level of +1.0 (±1.0) v. If not, check to see that AN/TPX-46 transmitter is interrogating (transmitting).

(10) Ensure that A1123, S4 (fig. 11-9.2) is set to +4v, +8v range (position 3).

(11) Monitor A1123, TP8 on oscilloscope (or dc voltmeter). Verify dc level of +3.7 (±1.3) v. If not, adjust A1123, R11 (fig. 11-9.2) for correct output.

NOTE

The IFF INTERROGATION INTERROGATE indicator remains lit until the IFF radar stops transmissions.

(12) On RIE I panel, verify that IFF INTERROGATION INTERROGATE indicator is lit.

e. *IFF Operation.*

(1) Obtain position of DELAY switch inside AN/TPX-46 synchronizer unit and use this position to set RIE I panel SIF ALIGNMENT (0.1 µs*)* thumbwheels as follows:

DELAY switch position IN: set thumbwheels to 3448

DELAY switch position OUT: set thumbwheels to 3072

NOTE

If Mode C is selected, it must b selected in combination with one other SIF mode (1,C;2,C or 3,C).

(2) On RIE I panel, set IFF PARAMETERS TPX-28/TPX-46 switch to TPX-46 if a two SIF MODE INTERFACE (1,2;1,3 or 2,3) setting is required and set switch to TPX-28 if Mode C is required. If only one SIF mode (1, 2 or 3) is required, this switch may be in either position.

(3) Select required IFF mode interlace on RIE I panel IFF INTERROGATION MODE INTERLACE switch if RIE I panel IFF INTERROGATION SELECT/CONTROL switch is in LOCAL position. Select IFF mode to be interlaced at display console if SELECT/CONTROL switch is in CONSLE position.

NOTE

In the event that operation indicates radar and IFF video do not correlate to produce a single target report, it may be necessary to adjust RIE I panel SIF ALIGNMENT (0.1 µs) switches to achieve correlation.

(4) Select NORM or SPCL, IFF-SIF, and PROC on display console.

(5) Select 1/8 range scale on display console.

(6) Observe PPI and verify that radar and IFF video from any one target coincide and produce one processed video display. If two processed videos are displayed for one target, proceed to steps (7) and (8).

(7) Adjust SIF ALIGNMENT (0.1 µs) switches until only one processed video is displayed.

(8) After step 7 is accomplished, reset M4 ALIGNMENT (0.1 µs) switches by same amount that SIF ALIGNMENT (01 µs**)** switches were changed.

All data on pages 11-25 thru 11-38, Including figure 11-11 and tables 11-4 thru 11-6, deleted.

Section VII. AN/MPQ-50 RADAR INTERFACE ALINEMENT

11-28. General. The AN/MPQ-50 radar provides a single video output. The characteristics of this video may be changed by the operator to accommodate the operational environment. For use with the AN/TSQ-73, these videos are grouped into two categories: those to be processed by VPU A and those to be processed by VPU B. This procedure must be performed with the RIE offline (CC101 50) and RDR/CPU ON-LINE/OFF-LINE switch to OFF-LINE on RIE II. After alinement, the AN/TSQ-73 operator action will normally be limited to changing the position of the RIE I panel AUTOMATIC CLUTTER MAPPER MODE SELECT switch from A/C to B/C (or vice-versa) and entering CC 100 50 on the KPU.

a. *VPU A Video Categories.* All Normal (Back Bias (BB), Dicke-Fix (DF), Dicke-Fix-Fix (DFF) or Auto): Integrator OFF.

b. *VPU B Video Categories.*

(1) All Normal (Back Bias (BB), Dicke-Fix (DF), Dicke-Fix-Fix (DFF) or Auto): Integrator ON.

(2) All MTI, Standard or Dicke-Fix (DF).

(3) Gated (2) above, during first half of range; and (1) above, during last half of range.

11-29. AN/MPQ-50 Dedicated to AN/TSQ-73.

a. Set radar LOCAL/REMOTE switch to LOCAL.

b. Add jumpers to radar power cabinet as follows:

TB 19-25 to TB 20-29
TB 19-24 to TB 20-30

c. Cable according to section III.

d. Set the LOCAL/REMOTE TERMINATION switch at the radar to REMOTE.

NOTE

This procedure is organized to present first the radar interface alinement followed by the IFF alinement. The radar alinement has occasional notes to indicate where certain IFF alinement procedures may be performed, if it is desired to combine the two procedures.

11-30. AN/MPQ-50 Shared With Hawk BCC. Cable according to section III.

11-31. AN/TSQ-73 Initialization.

a. Initialize AN/TSQ-73 shelter as required in TM 9-1430-652-10-3.

b. Set up Radar Interface Equipment (RIE) panels I and II and Radar Junction Box (RJB) common control settings as shown in table 11-7.

c. On AC power panel set RADAR J-BOX circuit breaker to ON.

d. At RJB, set POWER circuit breaker to ON and verify that POWER indicator is lit.

Table 11-7. Preliminary RIE Control Settings (AN/MPQ-50)

Unit	Control	Setting
RADAR INTERFACE EQUIPMENT I	INTERROGATION SELECT/CONTROL	LOCAL
	MODE INTERLACE	3
	IFF PARAMETERS	TPX-28
	IFF CORRELATION (μs)	0.27
	M4 ALIGNMENT (0.1 μs)	3332
	AUTOMATIC CLUTTER MAPPER	
	OVERLAP SELECT	DOMAIN
	MAPPER DECISION VALUES	AUTO (MANUAL for backup only)
	SPECIAL VIDEO SELECT	LOCAL AND MTI
	VPU INPUT SELECT	LOCAL

Table 11-7. Preliminary RIE Control Settings (AN/MPQ-50) -Continued

Unit	Control	Setting
RADAR INTERFACE EQUIPMENT I (cont)	VPU INPUT SELECT VPU A	NORM
	VPU INPUT SELECT VPU B	MTI
	DATA SOURCE SELECT RADAR	RADAR/SIM (Note 1)
	DATA SOURCE SELECT IFF	RADAR/SIM (Note 1)
	PROCESSED VIDEO DISPLAY SELECT	MANUAL
	PROCESSED VIDEO DISPLAY SELECT THUMBWHEEL	1
	MTI/NORMAL	Q73
	GATE RANGE	Fully CCW
	AUTOMATIC CLUTTER MAPPER OVERLAP SELECT	DOMAIN
	AUTOMATIC CLUTTER MAPPER SAMPLE/SCAN	1/3
	MAPPER DECISION VALUES	AUTO
	BEAMWIDTH (0.088)	25
	RADAR INTEGRATION AZIMUTH MODE	ACP/ANP
	CFAR RANGE ALIGNMENT (RADAR RANGE CELLS)	0370
	PRETRIGGER ALIGNMENT (RADAR RANGE CELLS)	000
	PULSE WIDTH (AS)	3
RADAR INTERFACE EQUIPMENT II	POWER	ON
	RDR/CPU	OFF-LINE
	MEMORY	ON-LINE
	RADAR J-BOX	FI ON
	BITE	OFF
	TARGET DETECTOR	AUTO
	MATRIX	2
	RADAR AZ OFFSET (SWEEPS)	07
	JAM DETECTOR THRESHOLD	12
	JAM DETECTOR ON/OFF	OFF
	RADAR TGT DECISION VALUES	
	MISS (SWEEPS)	2
	START	9
	STOP	3
	MIN WIDTH (0.088)	12
	RANGE RESOLN	0

Table 11-7. Preliminary RIE Control Settings (AN/MPQ-50) - Continued

Unit	Control	Setting
RADAR INTERFACE EQUIPMENT II (cont)	IFF TGT DECISION VALUES	
	AZ MIN (0.088)	13
	AZ MAX (0.088)	400
	MISS (SWEEPS)	7
	RDR-IFF AZ CORRELATION (.088)	067
Radar J-Box (Dedicated Radar)	FILTER	OUT
	ACP/ANP	INT
	CABLE COMP	Note 2
	INPUT TERM 1	75 Ω
	INPUT TERM 2	>1000 Ω
	INPUT TERM 3	>1000 Ω
	INPUT TERM 4	>1000 Ω
	INPUT TERM 5	>1000 Ω
	INPUT TERM 6	>1000 Ω
	INPUT TERM 7	>1000 Ω
	INPUT TERM 8	>1000 Ω
	COMMON CHAN	2
	RADAR SELECT	2
	N SPEED SYNC	OFF
	1 SPEED SYNC	ON
	115V REF.	ON
	PWR SEL	Note 3
	CW/CCW	INT
	POWER	ON
Radar J-Box (Shared Radar)	FILTER	OUT
	ACP/ANP	INT
	CABLE COMP	Note 2
	INPUT TERM 1	>1000 Ω
	INPUT TERM 2	>1000 Ω
	INPUT TERM 3	>1000 Ω
	INPUT TERM 4	>1000 Ω
	INPUT TERM 5	>1000 Ω
	INPUT TERM 6	>1000 Ω
	INPUT TERM 7	>1000 Ω
	INPUT TERM 8	>1000 Ω
	COMMON CHAN	2
	RADAR SELECT	2

Table 11-7. Preliminary RIE Control Settings (AN/MPQ-50) -Continued

Unit	Control	Setting
Radar J-Box (Shared Radar) (cont)	N SPEED SYNC	OFF
	1 SPEED SYNC	ON
	115V REF.	ON
	PWR SEL	Note 3
	CW/CCW	INT
	POWER	ON

NOTES

1. If RIE Loop Test is not required, set both DATA SOURCE SELECT switches to RADAR. If local radar is not available, set SELECT RADAR DATA SOURCE to SIM, CFAR RANGE to 0000, and PRETRIGGER ALIGNMENT to 440. If local IFF is not available, set DATA SOURCE SELECT IFF to SIM.
2. Place CABLE COMP switch in appropriate position for RJB to AN/TSQ-73 shelter cable length as follows: 125 to 250 feet-SHORT, 250 to 625-MED, or 625 to 1000 feet-LONG.
3. Set PWR SEL switch to either TSQ-73 or RADAR position depending on power source desired. AC Power Indicator Lamp will indicate source available.

11-32. RJB Adjustments. RJB adjustments are accomplished using an oscilloscope. The most efficient method is to monitor the signals at the RJB, while making these adjustments. However, if these adjustments must be made during inclement weather, or for some reason it is not practical to have an oscilloscope at the RJB, an alternate procedure for using an oscilloscope at the shelter is provided in paragraph 11-32b.

NOTE

When RJB cover is open and oscilloscope measurements are being made, RF interference from the radar may affect oscilloscope presentation (and shelter display console presentation as well). Disregard the phenomenon during alinement. After alinement is completed, be sure that RJB cover is closed and all latches are secured.

WARNING

Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When the technician is aided by operators, he must warn them about dangerous areas.

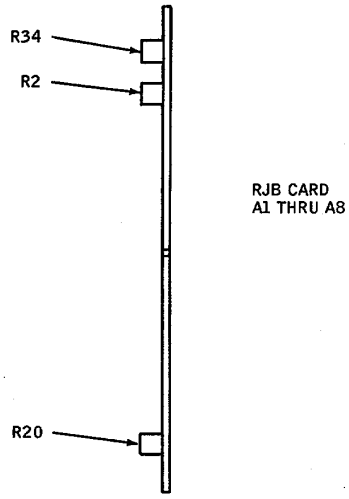
a. *Oscilloscope at RJB.* To perform RJB adjustments using an oscilloscope:

(1) Synchronize oscilloscope at A5, TP15 or set for internal sync. (This signal is R_o trigger and video mixed. Be sure that oscilloscope is triggered from R0 trigger only and not video.) Oscilloscope ground may be connected to A1 thru A8, TP5.

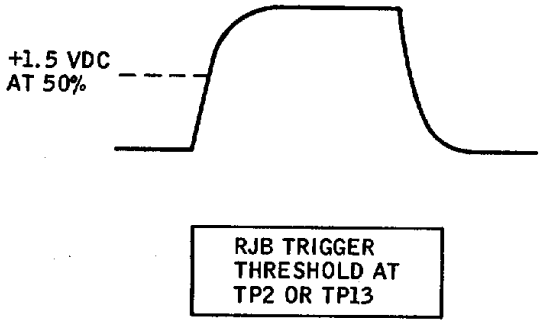
(2) Monitor A5, TP13 on oscilloscope and adjust input attenuation at A5, R20 (Sketch 30) such that 50% amplitude point of leading edge of trigger pulse is at +1.5v (Sketch 31). (Although dc baseline may not be at 0 v, adjust for 50% amplitude at +1.5v.)

(3) Monitor A5, TP16 on oscilloscope and verify that only one pulse is present for each radar trigger period (1250 as or 1500 μs).

(4) Monitor A8, TP14 on oscilloscope. Have radar operator select All Normal, DF, Integrator OFF. Adjust A8, R34 (Sketch 30) for peak noise level of approximately +1.0v.



Sketch 30. Video/Trigger Buffer Card (10282351)



Sketch 31. RJB Trigger Threshold

(5) Monitor A7, TP14 on oscilloscope. Have radar operator select All Normal, DF, Integrator ON. Adjust A7, R34 (Sketch 30) for peak noise level of approximately +1.0v.

(6) Monitor A11**,** TP6 on oscilloscope. Verify that signal is a dc level of 0 (±1.0)v. If not, reverse position of ø RVS 1 switch on RJB inside control panel. (This is a logic signal which indicates the direction of antenna rotation to the AN/TSQ-73. CW = 0 (± 1.0)v, CCW = +9.0 (±3.0)v.)

b *Oscilloscope at Shelter.* This method of performing RJB adjustments requires the coordination of the observer at the shelter and the adjuster at the RJB. Use field telephones for communicating.

(1) Gain access to shelter Radar/Simulator card cage in rack 1 (1A1A1A6).

(2) Insert card extender 588802-153 in vacant slot XA 1426. Connect oscilloscope ground to pin 2 (wirewrap pin).

CAUTION

Set RIE II Panel POWER switch to OFF when installing test point adapter on card. Use isolated oscilloscope (battery, jack or powerline isolator) or damage to equipment may result.

(3) Use testpoint adapter 533385 on cards to be monitored.

(4) Set oscilloscope for internal sync.

(5) Monitor A1123, TP2 on oscilloscope. Verify presence of one pulse of +8.5 (±3.5)v amplitude each radar trigger period (1250 μs or 1500 μs). If no pulse is present or excess pulses are present, adjust A5, R20 (Sketch 30) at RJB for correct output. Count turns of R20 between when pulse is lost and when excess pulses are seen and set adjustment midway between these points. This will ensure reliable operation.

(6) Monitor A1210, TP23 on oscilloscope. Have radar operator select All Normal, DF, Integrator OFF. Adjust A8, R34 (Sketch 30) at RJB for peak noise level of approximately +1.0v.

(7) Monitor A1210, TP24 on oscilloscope. Have radar operator select All Normal, DF, Integrator ON. Adjust A7, R34 (Sketch 30) at RJB for peak noise level of approximately +1.0v.

(8) Monitor A1322, TP3 on oscilloscope. Verify that signal is a dc level of 0 (±2.0)v. If not, reverse position of the ø RVS 1 switch on RJB inside control panel. (This is a logic signal which indicates the direction of antenna rotation to the AN/TSQ-73. CW = 0 (±2.0)v, CCW > +5.0v.)

NOTE

If IFF interface alinement is to be accomplished at this time, perform procedure in paragraph 11-34a thru c.

11-33. Shelter RIE Checks and Adjustments. To perform shelter RIE checks and adjustments:

a *Line Receiver Alinement.*

(1) Gain access to Radar/Simulator card cage in rack 1 (1A1A1A6).

(2) Insert card extender 588802-153 in vacant slot XA1426. Connect oscilloscope ground to pin 2 (wire wrap pin).

CAUTION

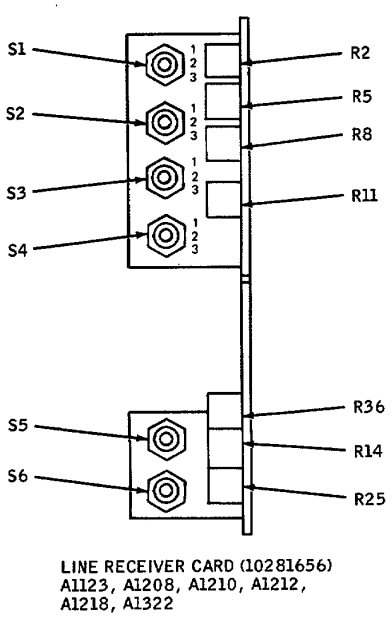
Set RIE II Panel POWER switch to OFF when installing test point adapter on card or damage to equipment may result. Use isolated oscilloscope (battery pack or powerline isolator).

(3) Use testpoint adapter 533385 on cards to be monitored.

(4) Set oscilloscope for internal sync.

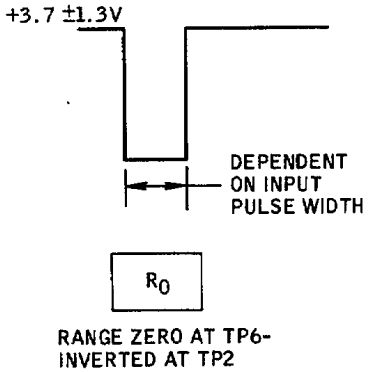
(5) Monitor A1123, TP2 on oscilloscope. Verify I presence of one pulse of +8.5 (±3.5)v amplitude each radar trigger period (1250 µs or 1500 µs).

(6) Set A1123, S2 (Sketch 32) to +4v, +8v range (position 3).



Sketch 32. Line Receiver Card (10281656)

(7) Monitor A1123, TP6 on oscilloscope. Verify presence of logic level R_o (Sketch 33). One pulse should be present each radar trigger period; If not, adjust A1123, R5 (Sketch 32) for correct output.



Sketch 33. Range Zero Pulse

(8) Monitor A1322, TP1 on oscilloscope. Verify presence of ACP pulses of +8.5 (±3.5)v amplitude, pulse width of 3.0 (±1.0) µs and spacing of approximately 700 to 800 µs.

(9) Set A1322, S3 (Sketch 32) to +4v, +8v range (position 3).

(10) Monitor A1322, TP7 on oscilloscope. Verify presence of logic level ACPs (as in step 8). If pulses are not present adjust A1322, R8 for correct output.

(11) Monitor A1322, TP2 on oscilloscope. Verify presence of ANP pulses of +8.5 (±3.5)v amplitude, pulse width of 3.0 (±1.0) µs and spacing of approximately 3 seconds.

(12) Set A1322, S2 (Sketch 32) to +4v, +8v (position 3) range.

(13) Monitor A1322, TP6 on oscilloscope. Verify presence of logic level ANPs (as in step (11)). If pulses are not present adjust A1322, R5 (Sketch 32) for correct output.

(14) Monitor A1322, TP3 on oscilloscope. Verify presence of a dc level of 0 (± 2.0)v.

(15) Set A1322, S1 (Sketch 32) to +4v, +8v range (position 3).

(16) Monitor A1322, TP5 on oscilloscope. Verify presence of a dc level of +3.7 (±1.3)v. If not adjust A1322, R2 (Sketch 32) for correct output.

(17) Set A1218, S1 and S2 (Sketch 32) to -4v, -100v range (position 1).

(18) Monitor A1218, TP5 on oscilloscope. Verify presence of a dc level of 0 (± 1.0)v. If not, adjust A1218, R2 (Sketch 32) for correct output.

(19) Monitor A1218, TP6 on oscilloscope. Verify presence of a dc level of 0 (± 1.0)v. If not ,adjust A1218, R5 (Sketch 32) for correct output.

(20) Monitor A1210, TP23 on oscilloscope. Verify presence of radar video.

(21) Set A1210, S6 (Sketch 32) in POS (+) position (down)

(23) Set A1210, S5 (Sketch 32) in POS (+) position (down).

(24) Monitor A1218, TP4 with oscilloscope (or dc voltmeter). Verify dc voltage of 0 (±1.0)v. Momentarily remove power from RJB by setting AC power panel RADAR J-BOX circuit breaker to OFF. Verify that dc voltage at A1218, TP4 is now +5.0 (±1.0)v.

(25) A1218, S4 (Sketch 32) to +4v, +8v (position 3).

(26) Monitor A1218, TPB with oscilloscope (or DC voltmeter). Verify dc voltage of +3.7 (±1.3)v when RJB power is on and 0 (±1.0)v when RJB power is off. If not, adjust A1218, R11 (Sketch 32) for correct output. When completed, be sure that AC power panel RADAR J-BOX breaker is left in ON position.

NOTE

If IFF interface alinement is to be accomplished at this point, perform procedure in paragraph 11-34d.

b. *CFAR/Quantizer.*

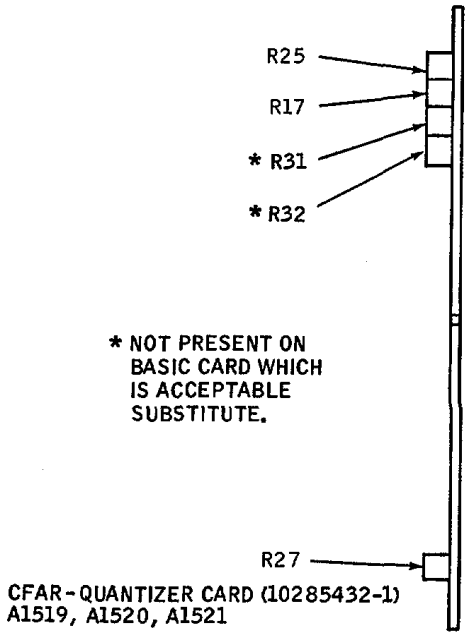
(1) Gain access to the Radar/Simulator card cage in rack 1 (1A1A1A6).

(2) On RIE II panel, set VPU A and VPU B AUTO/MANUAL switches to MANUAL and HIGH and LOW THRESHOLD and AUTO CLUTTER MAPPER THRESHOLD switches to 00.

NOTE

It is recommended that a DC voltmeter be used for the measurement in steps (3) thru (11). Use TP21 on A1519, A1520 and A1521 for ground.

(3) On A1519, A1520 and A1521, measure voltage at TP10. Adjust R17 (Sketch 34) if necessary, for voltage of 2.5v.



Sketch 34. CFAR-Quantizer Card (10285432-1)

(4) On A1519, A1520 and A1521, measure voltage at TP23. Adjust R27, if necessary, for voltage of 0.25v.

(5) On A1519 and A1520, measure voltage at TP2. Adjust R25, if necessary, for voltage of 1.0v.

(6) On A1521, measure voltage at TP2. AdjustR25, if necessary, for voltage of 0.25v.

NOTE

If alternate card 10285432 (basic) is used, skip steps (7) thru (11) below for that card.

(7) On RIE II panel, set APU A and VPU B HIGH and LOW THRESHOLD and AUTO CLUTTER MAPPER THRESHOLD switches to 77.

(8) On A1519, A1520 and A1521, measure voltage at TP23. Adjust R32, if necessary, for voltage of 2.75v.

(9) On A1519 and A1520, measure voltage at TP2. Adjust R31, if necessary, for voltage of 3.5v.

(10) On A1521, measure voltage at TP2. Adjust R31, if necessary, for voltage of 2.75v.

(11) Repeat steps (2) thru (10) as necessary until no further adjustment is required.

(12) At RIE II panel, set QUANTIZERS and CFAR VPU A AUTO/MANUAL switch to MANUAL, LOW THRESHOLD switches to 37 and AUTO CLUTTER MAPPER THRESHOLD switches to 40.

(13) Gain access to Radar/Simulator card cage in rack 1 (1A1A1A6).

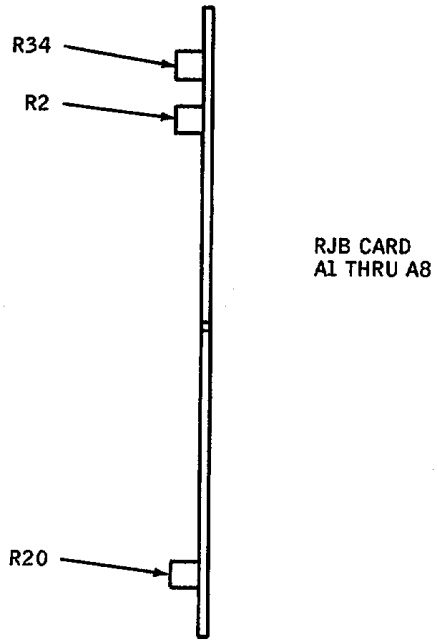
(14) Have radar operator select All Normal, Integrator OFF and switch between BB, DF, and DFF.

(15) Adjust A1210, R25 (Sketch 32) for average RIE II panel LOW FAR readout of 036 as BB, DF and DFF are selected (average of highest and lowest of three readout values should be 036).

NOTE

If clutter returns exist at or near the end of the radar range, erratic FAR readings may result which cause difficulty in performing this alinement. If this situation exists, have the radar operator stop the antennae at an azimuth where only noise exists at the end of range while performing this alinement.

If the correct FAR readout cannot be achieved with this adjustment, increase the RJB output amplitude (RJB A8, R34) (Sketch 35). This adjustment (step 15) ensures that the dynamic range of the quantizer threshold as controlled by the CFAR circuit will be adequate to maintain a constant false alarm rate whether BB, DF or DFF video has been selected.

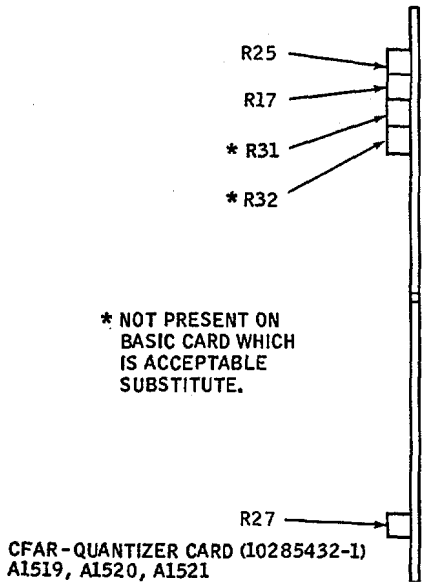


(16) Adjust A1521, R25 (Sketch 34) for average RIE II panel AUTO CLUTTER MAPPER FAR readout of 040 as BB, DF and DFF are selected (average of highest and lowest of three readout values should be 040).

(17) Set VPU A AUTO/MANUAL switch to AUTO and the LOW and HIGH THRESHOLD switches to 02. The LOW FAR should read 036 average and the AUTO CLUTTER MAPPER FAR 040 average whether BB, DF or DFF video has been selected at radar.

Sketch 35. Video/Trigger Buffer Card (10282351)

(18) Adjust A1519, R25 (Sketch 36) for HIGH FAR readout which alternates between 000 and 001. Check this readout with BB, DF and DFF video selected at radar. Adjust R25 as necessary to achieve this readout on video which results in lowest value even if one or both of other selections results in higher readout.



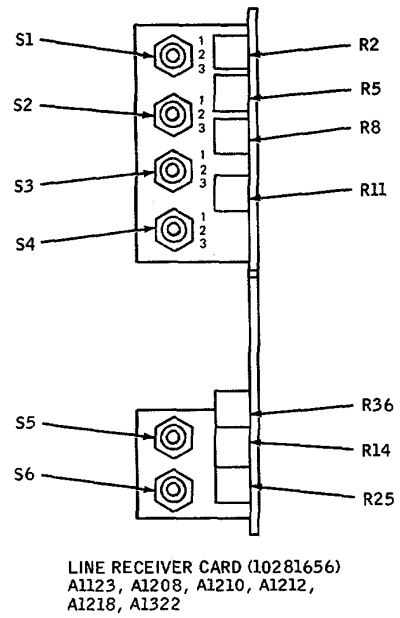
Sketch 36. CFAR-Quantizer Card (10285432-1)

(19) At RIE II panel, set QUANTIZER and CFAR VPU B AUTO/MANUAL switch to MANUAL, LOW THRESHOLD switches to 37 and AUTO CLUTTER MAPPER THRESHOLD switches to 40.

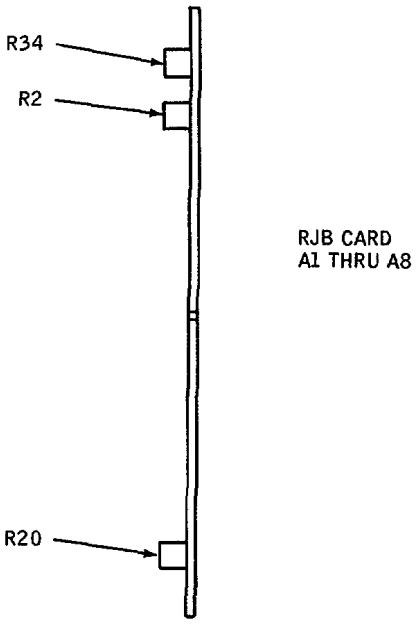
(20) Gain access to radar/simulator card cage in rack 1 (1A1A1A6).

(21) Have radar operator set DF/AUTO/BB switch to DF, DF/DFF switch to DF and MTI switch to DF.

(22) Adjust A1210, R14 (Sketch 37) for average RIE II panel LOW FAR readout of 016 as radar operator switches between GATED (MTI DF/NORMAL DF) and All MTI (DF). Allow time for FAR readout to stabilize after switching. If correct LOW FAR readouts cannot be achieved with this adjustment, increase RJB output amplitude (RJB A7, R34) (Sketch 38).



Sketch 37. Line Receiver Card (10281656)



Sketch 38. Video/Trigger Buffer Card (10282351)

NOTE

This adjustment ensures that the dynamic range of the quantizer threshold as controlled by the CFAR circuits will be adequate to maintain a constant false alarm rate whether GATED or All MTI video has been selected.

(23) Adjust A1521, R27 (Sketch 36) for average RIE II panel AUTO CLUTTER MAPPER FAR readout of 040 as radar operator switches between GATED and All MTI. Allow time for this FAR readout to stabilize after switching. If reading of 040 cannot be attained, adjust for highest reading possible.

(24) Have radar operator set the All NORMAL/GATED All MTI switch to GATED.

(25) At RIE I Panel, set CFAR RANGE ALIGNMENT switches to 0150.

(26) Have radar operator adjust A3, R34 (radar range gate circuit card) for LOW FAR readout of 016 average at RIE.

(27) At RIE I panel, set CFAR RANGE ALIGNMENT switches to 0370 (Normal value).

(28) At RIE II panel, set VPU B AUTO/MANUAL switch to AUTO and LOW and HIGH THRESHOLD switches to 01. LOW FAR should read 016 average and AUTO CLUTTER MAPPER FAR 040 average whether All Normal (BB, DF, DFF), Integrator ON or All MTI (Standard or DF) or GATED has been selected at radar.

(29) Adjust A1520, R25 (Sketch 36) for HIGH FAR readout which alternates between 000 and 001. Check this readout with each of the videos listed in step 23 above selected. Adjust R25, as necessary, to achieve this readout on at least one of the videos.

c. *Azimuth Correction.*

NOTE

Preset AZIMUTH CORRECTION (.088°) switches to 0000. If AN/TSQ-73 is alined to true north, proceed to step d, otherwise complete steps 1, 2, and 3 as appropriate.

d. *Radars with known ground clutter landmark.*

(a) At radar PPI scope, determine azimuth of known landmark and enter jam strobe through AN/TSQ-73 console keyboard at position corresponding to landmark's true position.

(b) Adjust AZIMUTH CORRECTION (.088°) switches until landmark video coincides with jam strobe video. Digits on the thumbwheels are:

MSB = ±45° or 800 mils shift of video
2nd MSB = ±5.6° or 100 mils shift of video
2nd LSB = ±0.7° or 12.5 mils shift of video
LSB = 0.09± or 1.5 mils shift video

(1) *Radars with track markers.*

(a) Notify radar operator to put track marker at known angle (180°, or landmark, etc.).

(b) Adjust AZIMUTH CORRECTION (.088°) thumbwheel switches until displayed track marker coincides with known angle.

(2) *Radars without track marker or known ground clutter position.* (Use this as last choice for setting azimuth correction.)

(a) Notify radar operator to turn off transmitter and allow antenna rotation to set.

(b) Obtain from radar operator exact angle of antenna direction. If angle is obtained from radar PPI, radar sweep (on PPI) must have been previously alined to true north.

(c). Using table 11-17, locate azimuth angle (in degrees) of antenna direction and note corresponding azimuth correction value.

(d) Adjust AZIMUTH CORRECTION (.088°) thumbwheel switches to obtain azimuth correction value from step (c) on AZIMUTH PROCESSOR (.088°) LED readout.

e. *Automatic Clutter Mapper Alinement.*

(1) Have radar operator select All Normal, BB, Integrator OFF.

(2) At RIE I panel, set AUTOMATIC CLUTTER MAPPER MODE SELECT TO A/C.

(3) At display console, select Normal Video and A SECT video.

(4) At RIE I panel, set AUTOMATIC CLUTTER MAPPER MAP RANGE DISPLAY to ON. Set RANGE

ADJ switches so that range ring on display encompasses areas of clutter (fig. 11-12). Set MAP RANGE DISPLAY switch to OFF.

(5) At RIE I panel, press MAPPER RESET switch. Wait approximately 20 scans (1 minute) for clutter map to stabilize.

(6) Adjust intensity of A SECT video and NORMAL video such that NORMAL video (clutter only) can be seen through A SECT video. Verify that A SECT video covers all areas of clutter.

NOTE

If A SECT video does not cover all areas of clutter (clutter varies faster than map is generated) change the setting of the RIE I Panel AUTOMATIC CLUTTER MAPPER SAMPLES/SCAN switch in a clockwise direction (higher value) such that all clutter is covered. As an aid in determining effectiveness of the clutter map, select processed (PROC) video on the display console. Areas of clutter which are properly covered by the map should not produce processed video.

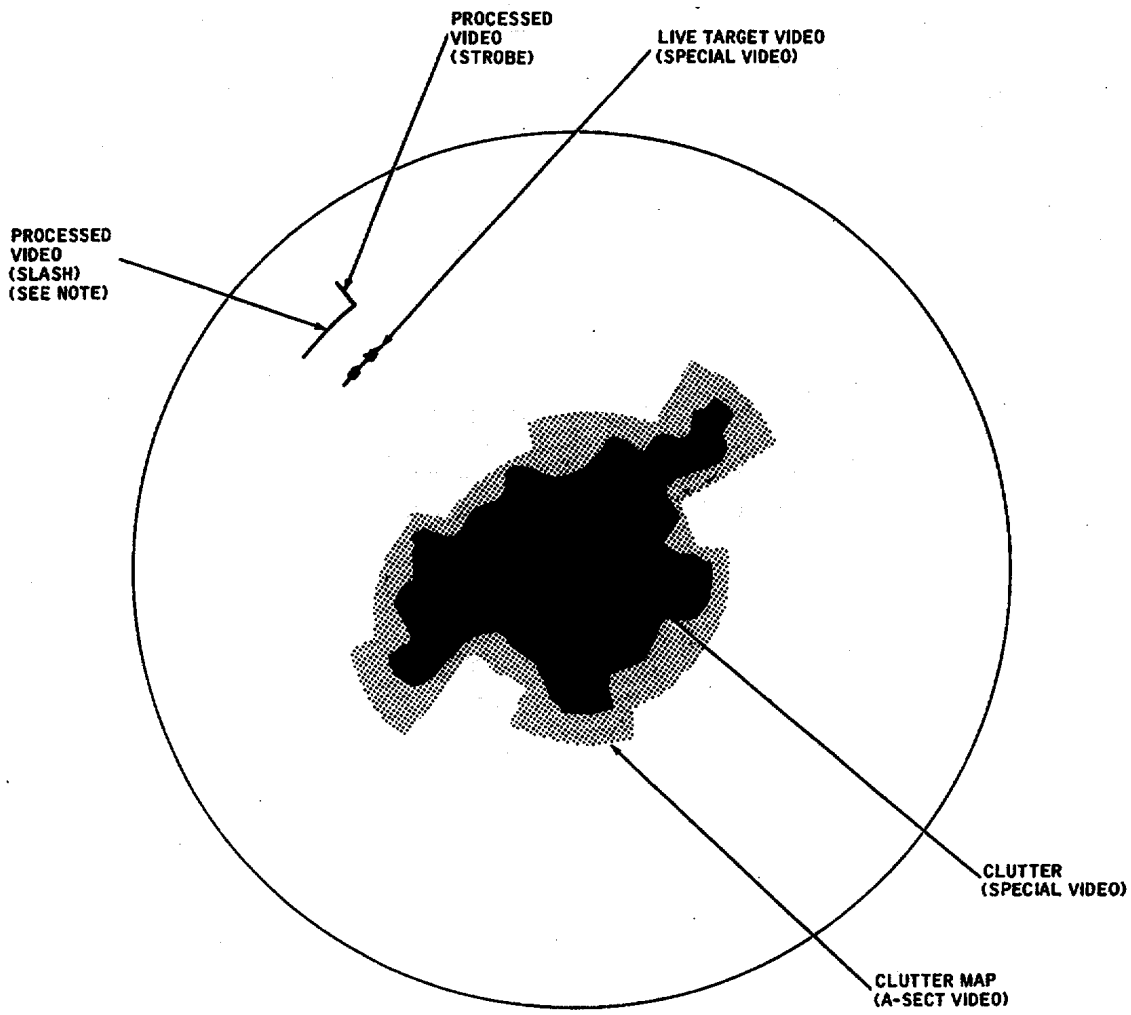


Figure 11-12. Sample Correct Video Display

NOTE

The clutter mapper samples range/azimuth cells and censors video in cells in which video remains from scan to scan. Targets which move too slowly and remain in a cell too long are also censored. The SAMPLES/SCAN switch determines the rate at which the cells are sampled. Therefore, the higher the setting the higher the velocity of targets that will be censored. It is necessary then to compromise in the setting of this switch. That is, high enough to provide the best clutter elimination possible without censoring desired moving targets. Tables 11-8 and 11-9 list the average velocity of targets, below which censoring may occur, for each position of the SAMPLES/SCAN switch. This velocity is in data miles or kilometers per hour depending on the range scale selected. This restriction only applies inside the clutter map area. Additional information is given in paragraph 11-36.

(7) Repeat steps (5) and (6) for DF and DFF video.

(8) Have radar operator select All NORMAL BB, INTEGRATOR ON.

(9) At RIE I panel, set AUTOMATIC CLUTTER MAPPER MODE SELECT switch to B/C.

(10) At display console, select SPECIAL video and A SECT video.

(11) At RIE I panel, press MAPPER RESET switch. Wait approximately 20 scans (1 minute) for clutter map to stabilize.

(12) Verify that A SECT video covers all areas of clutter (or clutter residue).

(13) Repeat steps (11) and (12) for All Normal DF, Integrator ON; All Normal DFF, Integrator ON; All MTI Standard; All MTI DF and GATED video.

(14) At RIE II panel, set RDR/CPU ONLINE/OFF-LINE switch to ON-LINE.

(15) Enter CC100 50 ow KPU. RIE is now operational.

11-34. IFF Interface Alinement. The IFF equipment associated with the AN/MPQ-50 radar is the AN/TPX-46. interface with the AN/TSQ-73 is accomplished via a Local Remote Switching Unit (LRSU) located adjacent to the Coder-Decoder (C-D) Group 0X-7(V) 1/TPX-46(V). When the LRSU Control Select switch is in the Remote position, the AN/TSQ-73 has exclusive control of IFF interrogation. When this switch is in the LOCAL position, the AN/TSQ-73 IFF interrogation control may be overridden by local control (normally only an associated Hawk system). The following interface alinement procedure assumes that the AN/TSQ-73 RIE has been alined in accordance with the preceding procedure and is operating.

a. *Cabling.* If cabling to IFF equipment was accomplished, proceed to step b. If not, cable according to section III.

b. *AN/TPX-46 Adjustments.*

(1) On C-D Group LRSU, set CONTROL SELECT switch to appropriate position as required.

(2) On C-D Group Synchronizer Unit, set IFF TRIG SELECT switch to EXT and the COUNTDOWN switch to HIGH.

Table 11-8. Average Target Cutoff Velocity in DM/H and KM/H

	SAMPLES/SCAN SWITCH SETTING						
Range DM or KM	1/5	1/4	1/3	1/2	1	2	3
10	7	8	11	16	33	65	98
20	13	16	22	33	65	130	196
30	20	25	33	49	98	196	293
40	25	33	43	65	130	261	391
50	33	41	54	82	163	326	489
60	39	49	65	98	196	391	587
70	46	57	76	114	228	456	685
80	52	65	87	131	261	522	782
90	58	73	98	147	293	587	880
100	65	82	109	164	326	652	978
110	72	90	120	180	359	717	1076

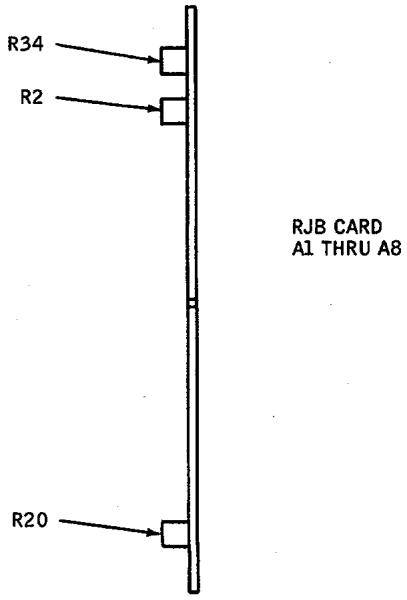
(3) In C-D Group Synchronizer Unit, verify that R1 of Display Video card A17 is adjusted for output pulse width of 0.5 to 1.4 μs. (Refer to TM 11-5895-532-12, adjustment of Target Arc Range Dimension.)

c. *RJB Adjustment* The following adjustments may be performed independently or as a result of reference.

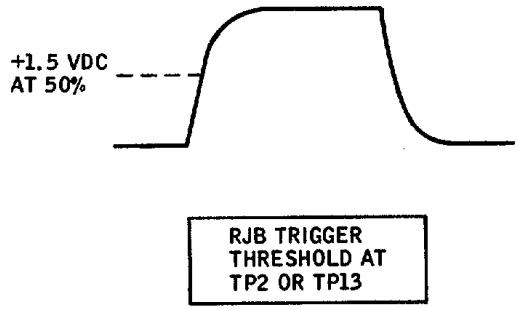
(1) *Oscilloscope at RJB.*

(a) Synchronize oscilloscope at A2, TP15. Oscilloscope ground may be connected to A1 thru A8, TP5.

(b) Monitor A2, TP13 on oscilloscope and adjust A2, R20 (Sketch 39) such that 50% amplitude point of leading edge of trigger pulse is at +1.5v (Sketch 40).



Sketch 39. Video/Trigger Buffer Card (10282351)



Sketch 40. RJB Trigger Threshold

(c) Monitor A3, TP13 on oscilloscope and adjust A3, R20 (Sketch 39) such that 50% amplitude point of leading edge of either pulse is at +1.5v.

(d) Monitor A5, TP14 on oscilloscope and adjust A5, R34 (Sketch 39) for correct video amplitude.

(*2) Oscilloscope at shelter.*

(a) Gain access to Radar/Simulator card cage in rack 1 (1A1A1A6).

(b) Set oscilloscope for internal sync.

(c) Monitor A1124, TP8 on oscilloscope. Verify presence of one pulse of +8.5 (±3.5)v amplitude each IFF trigger period. If no pulse is present or excess pulses (noise) are present, adjust A2, R20 (Sketch 39) at RJB for correct output. Be sure that R20 is left in a position which may be adjusted at least one turn in each direction while maintaining correct output.

(d) Monitor A1124, TP7 on oscilloscope. Verify presence of one pulse pair of +8.5 (±3.5)v amplitude (pulse spacing 8.0 μs) for each IFF trigger period (2250 or 2500 μs). If no pulses are present or excess pulses (noise) are present, adjust A3, R20 (Sketch 39) at RJB for correct output. Be sure that R20 is left in a position which may be adjusted at least one turn in each direction while maintaining correct output.

(e) Monitor A1123, TP24 on oscilloscope. Verify presence of IFF video of +1.0 to 5.0v amplitude. If not, adjust A5, R34 (Sketch 39) at RJB for correct output.

d. *Shelter RIE Checks and Adjustments*.

(1) Gain access to Radar/Simulators card cage in rack 1 (1A1A1A6).

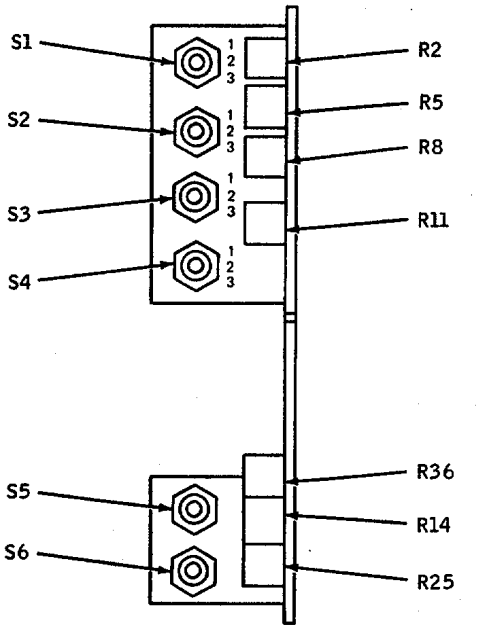
(2) Set oscilloscope for internal sync.

(3) Monitor A1124, TP8 on oscilloscope. Verify presence of one pulse of +8.5 (±3.5)v amplitude each IFF trigger period.

(4) Monitor A1124, TP7 on oscilloscope. Verify presence of one pulse pair of +8.5 (±3.5)v amplitude (pulse spacing 8.0 μs) for each IFF trigger period (2250 or 2500 μs).

(5) Monitor A1123, TP24 on oscilloscope. Verify presence of IFF video of +1.0 to 5.0v amplitude.

(6) Be sure A1123, S5 (Sketch 41) is in POS (+) position (down).



Sketch 41. Line Receiver Card (10281656)

(7) Monitor A1123, TP15 on oscilloscope. Adjust A1123, R14 (Sketch 41) for video amplitude of +3.0 (±1.0) volts.

(8) Monitor A1123, TP4 on oscilloscope (or DC voltmeter). Verify a DC level of +1.0 (±1.0)V. If not, check to see that AN/TPX-46 transmitter is interrogating (transmitting).

(9) Verify A1123, S4 (Sketch 41) is set to +4V, +8V range (position 3).

(10) Monitor A1123, TP8 on oscilloscope (or DC voltmeter). Verify a DC level of +3.7 (±1.3)V. If not, adjust A1123, R11 (Sketch 41) for correct output.

(11) On RIE I panel, verify that IFF INTERROGATION indicator is lit.

e. *IFF* Operat*ion*

(1) Obtain setting of DELAY switch inside the AN/TPX-46 Synchronizer Unit and set the RIE I panel SIF ALIGNMENT (0.1 μS) as follows:

DELAY IN-Setting 3448
DELAY OUT-Setting 3072

NOTE

If Mode C is selected, it must be selected in combination with one other SIF mode (1,C; 2,C or 3,C).

(2) On RIE I panel, set the IFF PARAMETERS TPX-28/TPX-46 switch to TPX-46 if two SIF mode interlace (1,2; 1,3 or 2,3) is required and set to TPX-28 if Mode C is required. If only one SIF mode (1,2 or 3) is required, this switch may be in either position.

(3) Select IFF mode interlace as required on RIE I panel IFF INTERROGATION MODE INTERLACE switch if RIE I panel IFF INTERROGATION SELECT/CONTROL switch is in LOCAL position. Select IFF mode to be interlaced at display console if SELECT/CONTROL switch is in CONSOLE position.

NOTE

In the event that operation indicates radar and IFF video do not correlate to produce a single target report, it may be necessary to adjust RIE I Panel SIF ALIGNMENT (0.1 μS) switches to achieve correlation.

(4) Select NORM or SPCL, IFF-SIF, and PROC on display console.

(5) Select 1/8 range scale on display console.

(6) Observe PPI and verify radar and IFF video from any one target coincide and produce one processed video display. If two processed videos are displayed for one target, proceed to steps 7 and 8.

(7) Adjust SIF ALIGNMENT (0.1 μS) Switches until only one processed video is displayed.

(8) After step 7 is accomplished, reset M4 ALIGNMENT (0.1 μS) Switches by the same amount that the SIF ALIGNMENT (0.1 μS) Switches were changed.

Section VII.I. PIP AN/MPQ-50 RADAR INTERFACE ALINEMENT

11-34.1. General. The PIP AN/MPQ-50 radar provides a single video output whose characteristics the operator can change to accommodate the operational environment. For the following procedure, the video amplitude and receiver gain must stay constant, since any change in either could necessitate realignment.

11-34.2. Requirements. VPU A has the primary video assignment. However, because VPU B must be available instantly if VPU A fails, procedures are given for both.

11-34.3. PIP AN/MPQ-50 Dedicated to AN/TSQ-73. When the PIP AN/MPQ-50 is dedicated to the AN/TSQ-73, perform the following steps before proceeding to paragraph 11-34.5.

a. At radar, set LOCAL/REMOTE switch to LOCAL.

b. Add jumpers to radar power cabinet as follows:

TB 19-25 to TB 20-29
TB 19-24 to TB 20-30

c. Cable as described in section III for AN/MPQ-50 radar.

d. At radar, set LOCAL/REMOTE TERMINATION switch to REMOTE (refer to fig. 2-12 in TM 9-1430-1534-12-1).

e. Set radar to staggered PRT and MTI video.

11-34.4. PIP AN/MPQ-50 Shared With Hawk BCC. When the PIP AN/MPQ-50 is shared with the Hawk BCC, perform the cabling as described in section III before proceeding to paragraph 11-34.5.

NOTE

In the alinement procedures, the RIE is presented first, then the IFF. However, a note appearing after step (8) of paragraph 11-34.6(b), after step x of paragraph 11-34.7, and after step f(4) of paragraph 11-34.8 shows where IFF alinement can be performed if the radar and IFF procedures are to be combined.

11-34.5. AN/TSQ-73 Initialization. Initialize the AN/TSQ-73 shelter as described in TM 9-1430-652-10-3, then proceed as follows to prepare the AN/TSQ-73 for alinement. (These procedures require that the RIE be offline (CC101 50) and that the RDR/CPU ON-LINE/OFF-LINE switch on RIE II be set to OFF-LINE.)

a. Set up controls for RIE panels I and II and for RJB, as shown in table 11-8.1.

b. On ac power panel, set RADAR J-BOX circuit breaker to on position (up).

c. At RJB, set POWER circuit breaker to ON and verify that POWER indicator lights.

11-34.6. RJB Adjustments. RJB adjustments are made with an oscilloscope. The most efficient method is to monitor the signals at the RJB while making these adjustments. However, if the adjustments must be made during inclement weather, or if for some reason an oscilloscope at the RJB is not practical, an alternative procedure for using an oscilloscope at the shelter is given in step b.

NOTE

When the RJB cover is open and the oscilloscope measurements are being made, rf interference from the radar may affect oscilloscope presentation (and shelter display console presentation as well). Disregard the phenomenon during alinement. After alinement is completed, make sure that the RJB cover is closed and that all latches are secured.

WARNING

Do not work on electronic equipment unless another person is nearby who is familiar with the operation of the equipment and the hazards, and who can administer first aid. A technician who is aided by operators must warn them of dangerous areas.

a *Oscilloscope at RJB.* The following procedure is to be used when an oscilloscope is available at the RJB.

(1) Synchronize oscilloscope at A5, TP15, or set it for internal sync. Oscilloscope ground may be connected to A1 thru A8, TP5. (This signal is mixed R_o trigger and video. Make sure that oscilloscope is triggered from R_o trigger only and not from video.)

(2) On oscilloscope, monitor A5, TP13 and adjust input attenuation at A5, R20 (sketch 41.1) for 3v signal.

Table 11-8.1. Preliminary RIE Control Settings (PIP AN/MPQ-50)

Unit	Control	Setting
RADAR INTERFACE EQUIPMENT I	INTERROGATION SELECT/CONTROL	LOCAL
	MODE INTERLACE	OFF
	IFF PARAMETERS	TPX-28
	IFF CORRELATION (μs)	0.27
	SIF ALIGNMENT (0.1μs)	3332
	AUTOMATIC CLUTTER MAPPER	
	OVERLAP SELECT	OFF
	SAMPLE SCAN	1
	MAPPER DECISION VALUES	AUTO (MANUAL for backup only)
	SPECIAL VIDEO SELECT	LOCAL AND NORM
	VPU INPUT SELECT	LOCAL
	VPU INPUT SELECT VPU A	OFF
	VPU INPUT SELECT VPU B	OFF
	DATA SOURCE SELECT RADAR	RADAR/SIM (Note 1)
	DATA SOURCE SELECT IFF	RADAR/SIM (Note 1)
	PROCESSED VIDEO DISPLAY SELECT	MANUAL
	PROCESSED VIDEO DISPLAY SELECT THUMBWHEEL	1
	MTI/NORMAL	Q73
	GATE RANGE	Mid-range
	BEAMWIDTH (.088°)	32
	RADAR INTEGRATION AZIMUTH MODE	ACP/ANP
	CFAR RANGE ALIGNMENT (RADAR RANGE CELLS)	0400
	PRETRIGGER ALIGNMENT (RADAR RANGE CELLS)	000
	PULSE WIDTH (µS)	3
RADAR INTERFACE EQUIPMENT II	POWER	ON
	RDR/CPU	OFF-LINE
	MEMORY	ON-LINE
	QUANTIZERS AND CFAR	
	VPU A AUTO/MANUAL	MANUAL
	VPU B AUTO/MANUAL	MANUAL
	RADAR J-BOX	FI ON
	BITE	OFF
	TARGET DETECTOR	AUTO

Table 11-8.1. Preliminary RIE Control Settings (PIP ANIMPQ-50)- Continued

Unit	Control	Setting
	MATRIX	2
	RADAR AZ OFFSET (SWEEPS)	07
	JAM DETECTOR THRESHOLD	12
	JAM DETECTOR ON/OFF	OFF
	RADAR TGT DECISION VALUES	
	MISS (SWEEPS)	2
	START	9
	STOP	3
	MIN WIDTH (.088°)	12
	RANGE RESOLN	0
	IFF TGT DECISION VALUES	
	AZ MIN (.088°)	13
	AZ MAX (.088°)	400
	MISS (SWEEPS)	7
	RDR-IFF AZ CORRELATION (.088°)	067
Radar J-Box (Dedicated Radar)	FILTER	OUT
	ACP/ANP	INT
	CABLE COMP	Note 2
	INPUT TERM 1	75 Ω
	INPUT TERM 2	> 1000 Ω
	INPUT TERM 3	> 1000 Ω
	INPUT TERM 4	> 1000Ω
	INPUT TERM 5	> 1000 Ω
	INPUT TERM 6	> 1000 Ω
	INPUT TERM 7	75 Ω
	INPUT TERM 8	75 Ω
	COMMON CHAN	1
	RADAR SELECT	2
	N SPEED SYNC	OFF
	1 SPEED SYNC	ON
	115V REF.	ON
	PWR SEL	Note 3
	CW/CCW	INT
	POWER	ON
Radar J-Box (Shared Radar)	FILTER	OUT
	ACP/ANP	INT

Table 11-8.1. Preliminary RIE Control Settings (PIP AN/MPQ-50) -Continued

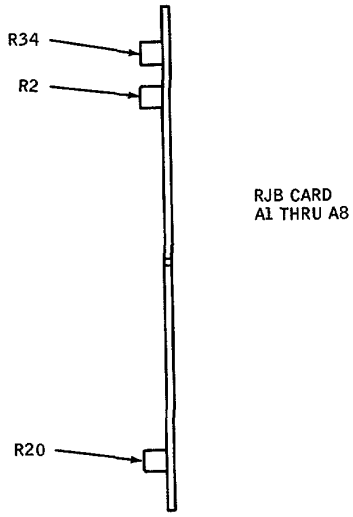
Unit	Control	Setting
	CABLE COMP	Note 2
	INPUT TERM 1	>1000Ω
	INPUT TERM 2	>1000Ω
	INPUT TERM 3	>1000Ω
	INPUT TERM 4	>1000Ω
	INPUT TERM 5	>1000Ω
	INPUT TERM 6	>1000Ω
	INPUT TERM 7	75Ω
	INPUT TERM 8	75Ω
	COMMON CHAN	1
	RADAR SELECT	2
	N SPEED SYNC	OFF
	I SPEED SYNC	ON
	115V REF.	ON
	PWR SEL	Note 3
	CW/CCW	INT
	POWER	ON

NOTES

1. If an RIE loop test is not required, set both DATA SOURCE SELECT switches to RADAR. If local radar is not available, set SELECT RADAR DATA SOURCE to SIM, CFAR RANGE to 0000, and PRETRIGGER ALIGNMENT to 440. If local IFF is not available, set DATA SOURCE SELECT IFF to SIM.

2. Set the CABLE COMP switch for the correct cable length between the RJB and the AN/TSQ-73 shelter as follows: 125 to 250 feet-SHORT; 250 to 625-MED; or 625 to 1000 feet-LONG.

3. Set the PWR SEL switch either to TSQ-73 or RADAR, depending on the power source. The ac power indicator lamp indicates the available source.



Sketch 41.1. Video/Trigger Buffer Card (10282351)

Sketch 41.2. Deleted

(3) On oscilloscope, monitor A5, TP16 and verify that only one pulse is present for each radar trigger period (1486 ± 80 μs).

NOTE

The following adjustment may not be attainable if the amplitude of the video from the radar (A8, TP1) is less than +2.0v peak. This adjustment may cause a positive offset in the dc baseline at A8, TP14. If so, adjust A8, R34 for the maximum amplitude achievable without baseline offset occurring. A video level above +1v peak may be acceptable.

(4) On oscilloscope, monitor A11, TP6. Verify that signal is dc level of 0 (±1.0)v. If it is not, reverse position of ø RVS 1 switch on RJB inside control panel. (This is logic signal that indicates the direction of antenna rotation to AN/TSQ-73. Cw = 0 (±1.0) vdc; ccw = +9.0 (±3.0) vdc.)

b. *Oscilloscope at Shelter.* This method of performing RJB adjustments requires the coordination of the observer at the shelter and the adjuster at the RJB. Use field telephones for communicating.

(1) Gain access to shelter radar/simulator card cage in rack 1 (1A1A1A6).

CAUTION,

Set the RIE II panel POWER switch to OFF when installing the test point adapter on the card.

NOTE

Use an isolated oscilloscope (battery pack or powerline isolator), or video baseline ripple can result causing difficulty in alinement.

(2) Insert card extender 588802-153 in vacant slot XA 1426. Connect oscilloscope ground to pin 2.

(3) Use testpoint adapter 533385 on cards to be monitored.

(4) Set oscilloscope for internal sync.

(5) On oscilloscope, monitor A1123, TP2. Verify presence of one pulse of +8.5 (±3.5)v amplitude each radar trigger period (1486 ± 80 μs). If no pulse is present or if excess pulses are present, adjust A5, R20 (sketch 41.1) at RJB for correct output. If excess pulses are present, ensure reliable operation by counting turns of R20 between time pulse is lost and time excess pulses are seen, and set adjustment midway between these points.

NOTE

The following adjustment may not be attainable if the amplitude of the video from the radar (A8, TP1) is less than +2.0v peak. This adjustment may cause a positive offset in the dc baseline at A8, TP14. If so, adjust A8, R34 for the maximum amplitude achievable without baseline offset occurring. A video level above +1v peak may be acceptable.

(6) On oscilloscope, monitor A1210, TP23. Adjust A8, R34 (sketch 41.1) at RJB for a peak signal level of approximately +4.0 vdc.

(7) On oscilloscope, monitor A1210, TP16. Adjust A1210, R25 (sketch 41.3) for a 4.0v signal.

(8) On oscilloscope, monitor A1322, TP3. Verify that signal is a dc level of 0 (±2.0)v. If it is not, reverse position of ø RVS 1 switch on RJB inside control panel. (This is logic signal that indicates the direction of antenna rotation to AN/TSQ-73. Cw = 0 (±2.0) vdc; ccw > +5.0 vdc.)

NOTE

If IFF interface alinement is to be accomplished at this time, perform procedure in paragraph 11-34.9a thru c.

11-34.7. Shelter RIE Checks and Adjustments.

a. Gain access to shelter radar/simulator card cage in rack 1 (1A1A1A6).

CAUTION

Set the RIE II panel POWER switch to OFF when installing the test point adapter on a card, or damage to equipment can result.

b. Insert card extender 588802-153 in vacant slot A1426. Connect oscilloscope ground to pin 2.

NOTE

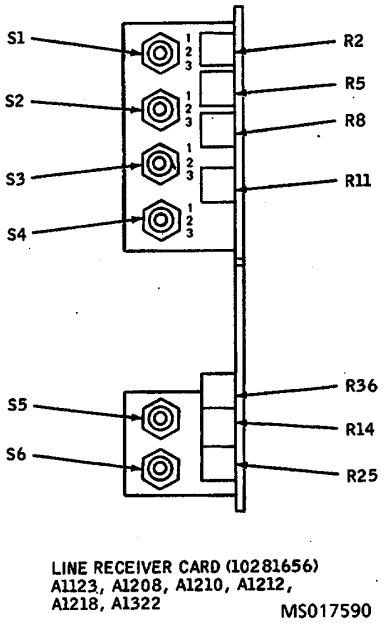
Use an isolated oscilloscope (battery pack or powerline isolator), or video baseline ripple can result, causing difficulty in alinement.

c. Use test point adapter 533385 on cards to be monitored.

d. Set oscilloscope for internal sync.

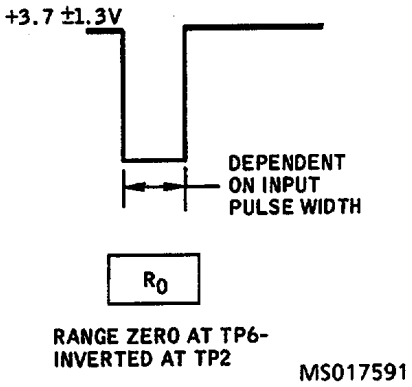
e. On oscilloscope, monitor A1123, TP2. Verify presence of one pulse of + 8.5 (±3.5)v amplitude each radar trigger period (1486 ±80 µs).

f. Set A1123, S2 (sketch 41.3) to +4v, +8v range (position 3).



Sketch 41.3. Line Receiver Card (10281656) (A60.4-260-1)

g. On oscilloscope, monitor A1123, TP6. Verify presence of logic level R_0 (sketch 41.4). One pulse should be present each radar trigger period. If it is not, adjust A1123, R5 (sketch 41.3) for correct output.



Sketch 41.4. Range Zero Pulse

h. On oscilloscope, monitor A1322, TP1. Verify presence of ACP pulses of +8.5 (±3.5)v amplitude, pulse width of 3.0 (±1.0 µs), and spacing of approximately 700 to 800 µs.

i. Set A1322, S3 (sketch 41.3) to +4v, +8v range (position 3).

j. On oscilloscope, monitor A1322, TP7. Verify presence of logic level ACPs (as in step h). If pulses are not present, adjust A1322, R8 for correct output.

k. On oscilloscope, monitor A1322, TP2. Verify presence of ANP pulses of +8.5 (±3.5)v amplitude, pulse width of 3.0 (±1.0) µs, and spacing of approximately 3 seconds.

l. Set A1322, S2 (sketch 41.3) to +4v, +8v (position 3) range.

m. On oscilloscope, monitor A1322, TP6. Verify presence of logic level ANPs (as in step k). If pulses are not present, adjust A1322, R5 (sketch 41.3) for correct output.

n. On oscilloscope, monitor A1322, TP3. Verify presence of a dc level of 0 (±2.0)v.

o. Set A1322, S1 (sketch 41.3) to +4v, +8v range (position 3).

p. On oscilloscope, monitor A1322, TP5. Verify presence of a dc level of +3.7 (±1.3)v. If this is not present, adjust A1322, R2 (sketch 41.3) for correct output.

q. Set A1218, S1 and S2 (sketch 41.3) to -4v, -100v range (position 1).

r. On oscilloscope, monitor A1218, TP5. Verify presence of a dc level of 0 (±1.0)v. If this is not present, adjust A1218, R2 (sketch 41.3) for correct output.

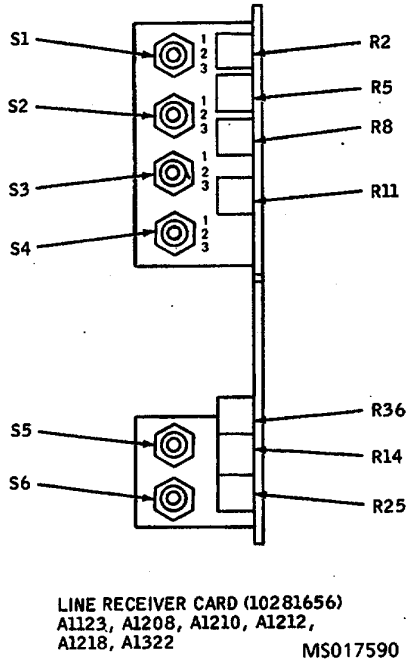
s. On oscilloscope, monitor A1218, TP6. Verify presence of a dc level of 0 (± 1.0)v. If this is not present, adjust A1218, R5 (sketch 41.3) for correct output.

t. On oscilloscope, monitor A1210, TP23. Verify presence of radar video.

u. Set A1210, S6 (sketch 41.3) in POS (+) position (down).

v. With oscilloscope (or dc voltmeter), monitor A1218, TP4. Verify dc voltage of 0 (±1.0)v. Momentarily remove power from RJB by setting ac power panel RADAR J-BOX circuit breaker to off position (down). Verify that dc voltage at A1218, TP4 is now +5.0 (±1.0)v. Return power to RADAR J-BOX by setting circuit breaker to on (up) position.

w. Set A1218, S4 (sketch 41.5) to +4v, +8v (position 3).



Sketch 41.5 Line Receiver Card (10281656)

x. With oscilloscope (or dc voltmeter), monitor A1218, TP8. Verify a dc voltage of +3.7 (±1.3)v when RJB power is on, and 0 (±1.0)v when RJB power is off. If this voltage is not present, adjust A1218, R11 (sketch 41.5) for correct output. Make sure that ac power panel RADAR-BOX breaker is in on position (up).

NOTE

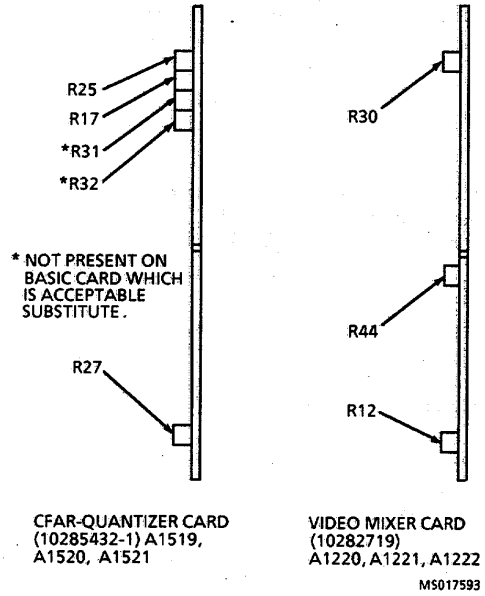
If IFF interface alinement is to be accomplished at this point, perform procedure in paragraph 11-34.9d

y. On RIE II set VPU A and VPU B HIGH and LOW THRESHOLD and AUTO MAPPER THRESHOLD switches to 00.

NOTE

Use a dc voltmeter for measurements in steps z thru ac. Use TP21 on A1519, A1520, or A1521 for ground.

z. On A1519, A1520, and A1521, measure voltage TP10. Adjust R17 (sketch 41.6), if necessary, for voltage of 2.5v.



Sketch 41.6 CFAR-Quantizer Card (10285432-1) and Video Mixer Card (10282719)

aa. On A1519, A1520, and A1521, measure voltage at TP23. Adjust R27 (sketch 41.6), if necessary, for voltage of 0.25v.

ab. On A1519 and A1520, measure voltage at TP2. Adjust R25 (sketch 41.6), if necessary, for voltage of 1.0v.

ac. On A1521, measure voltage at TP2. Adjust R25 (sketch 41.6), if necessary, for voltage of 0.25v.

NOTE

If alternate card 10285432 (basic) is used, skip steps ad thru ah below for that card.

ad. On RIE II Panel, set VPU A and VPU B HIGH and LOW THRESHOLD and AUTO CLUTTER MAPPER THRESHOLD switches to 77.

ae. On A1519 and A1520, measure voltage at TP2. Adjust R31 (sketch 41.6), if necessary, for voltage of 3.5v.

af. On A1521, measure voltage at TP2. Adjust R31 (sketch 41.6), if necessary, for voltage of 2.75v.

ag. On A1519, A1520 and A1521, measure voltage at TP23. Adjust R32 (sketch 41.6), if necessary, for voltage of 2.75v.

ah. Repeat steps y thru ag above as necessary until no further adjustment is required.

NOTE

In the following steps, do not adjust tunable capacitors on A1220, A1221, or A1222 or video mixers will not operate properly.

ai. On RIE I panel, set VPU INPUT SELECT VPU A and VPU B and SPECIAL VIDEO SELECT switches to NORM.

aj. Monitor A1221, TP1 on oscilloscope. Adjust A1221, R30 (sketch 41.6) for video amplitude of +4.0v.

ak. Monitor A1220, TP1 on oscilloscope. Adjust A1220, R30 (sketch 41.6) for video amplitude of +4.0v.

al. Monitor A1220, TP20 on oscilloscope. Adjust A1220, R12 (sketch 41.6) for video amplitude of +4.0v.

am. Monitor A1221, TP20 on oscilloscope. Adjust A1221, R12 (sketch 41.6) for video amplitude of +4.0v.

an. Monitor A1221, TP6 on oscilloscope. Adjust A1221, R44 (sketch 41.6) for video amplitude of +4.0v.

ao. Monitor A1222, TP1 on oscilloscope. Adjust A1222, R30 (sketch 41.6) for video amplitude of +4.0v.

ap. Monitor A1222, TP20 on oscilloscope. Adjust A1222, R12 (sketch 41.6) for video amplitude of +4.0v.

11-34.8. Video Processing Adjustments. RIE alinement includes procedures for azimuth correction, ACM range adjustment, and VPU A and B alinement.

a. *Azimuth Correction*. Two procedures for azimuth correction are given below. Preset RIE I panel AZIMUTH CORRECTION (.088°) switches to 4000. If AN/TSQ-73 is alined to true north, proceed to step b, otherwise, complete (1) or (2) below as appropriate. (Procedure (1) is preferred.)

(1) Environment with known ground clutter (permanent echo) landmark.

(a) At radar PPI scope, determine azimuth of known landmark. Enter jam strobe at AN/TSQ-73 display console keyboard, at position corresponding to true azimuth of landmark.

(b) Adjust RIE I panel AZIMUTH CORRECTION (.088°) thumbwheel switches until landmark coincides with displayed jam strobe. Digits on thumbwheels are

MSD = ± 45° or 800 mils shift of video
2nd MSD = ±5.6° or 100 mils shift of video
2nd LSD = ±0.7° or 12.5 mils shift of video
LSD = 0.088° or 1.5 mils shift of video

(2) Environment without known ground clutter po-sition. (Use this as second choice for setting azimuth correction.)

(a) Notify radar operator to turn off transmitter and allow antenna rotation to stop.

(b) From radar operator, obtain exact angle of antenna direction. If angle is obtained from radar PPI, radar sweep (on PPI) must previously have been alined to true north.

(c) Using table 11-17, locate azimuth angle difference (in degrees) between antenna direction and AN/TSQ-73 console PPI and note corresponding azimuth correction value.

(d) Adjust AZIMUTH CORRECTION (.088°) thumbwheel switches to obtain azimuth correction value from step (c) on AZIMUTH PROCESSOR (.088°) LED readout.

(e) Have radar operator restore radar to normal operation.

b. *Hits/Beamwidth Setup*. Set RADAR AZ OFFSET (SWEEPS), TARGET DETECTOR MATRIX, RADAR TARGET DECISION VALUES STOP, and START as shown in table 11-8.2 according to HITS/BEAMWIDTH readout on RIE I panel.

c. *Target Minimum Width Setting*. Perform the following steps:

(1) Observe HITS/BEAMWIDTH readout on RIE I panel and obtain minimum width (sweeps) value from table 11-8.2.

(2) Adjust RIE I panel BEAMWIDTH (.088°) thumbwheel switches until HITS/BEAMWIDTH readout displays number of sweeps obtained in step 1.

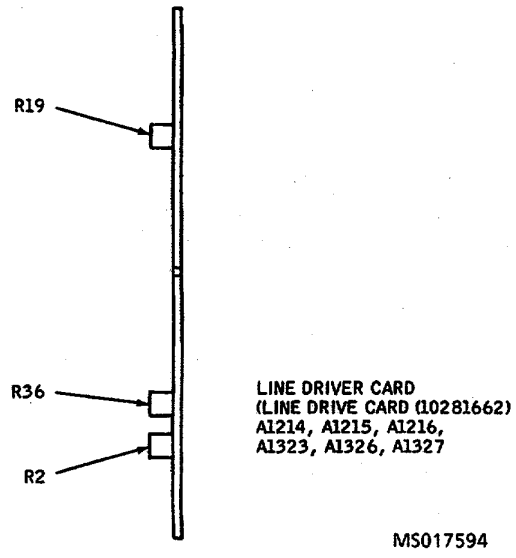
(3) Set RIE II panel RADAR TGT DECISION VALUES MIN WIDTH (.088°) thumbwheel switches to match BEAMWIDTH (.088°) switches.

Table 11-8.2. Hits/Beamwidth Setup

HITS/ BEAMWIDTH readout	RADAR AZ OFFSET (SWEEPS) switch	TARGET DETECTOR MATRIX switch	TARGET DECISION VALUES START switch	TARGET DECISION VALUES STOP switch	Min width (sweeps)
1-3	02	0	3	1	02
4-6	04	1	7	1	03
7-14	07	2	9	3	05
15-26	14	3	13	1	11
27-44	22	4	15	1	14
45-74	31	5	15	1	22

(4) Return BEAMWIDTH (.088°) switches to radar beamwidth value.

d. *Line Driver Adjustment*. Adjust line drivers as follows (sketch 41.7):



Sketch 41.7 Line Driver Card (10281662)

(1) On RIE I panel, set AUTOMATIC CLUTTER MAPPER MODE SELECT switch to A/C.

(2) On shelter display console, deselect all VIDEO SELECTIONS switches and set all VIDEO BRIGHT- NESS thumbwheel switches to 4.

(3) Adjust A1216, R19 until normal video is displayed; then back off adjustment until display disappears.

(4) Adjust A1327, R36 until special video is displayed on display console; then back off adjustment until display disappears.

(5) Adjust A1323, R36 until processed video is displayed on display console; then back off adjustment until display disappears.

(6) Adjust A1216, R2 until IFF video is displayed on display console; then back off adjustment until display disappears.

NOTE

If no remote display console is in use, proceed to paragraph e.

(7) On remove display console, deselect all VIDEO SELECTIONS switches and set all VIDEO BRIGHT- NESS thumbwheel switches to 4.

(8) Adjust A1215, R2 until normal video is displayed on remote display console; then back off adjustment until display disappears.

(9) Adjust A1327, R19 until special video is displayed on remote display console; then back off adjustment until display disappears.

(10) Adjust A1323, R19 until processed video is displayed on remote display console; then back off adjustment until display disappears.

(11) Adjust A1216, R36 until IFF video is displayed on remote display console; then back off adjustment until display disappears.

e. *VPU Alinement*. There are two modes of VPU operation: AUTO and MANUAL. In the AUTO mode, the HIGH and LOW THRESHOLD biases have a fixed differential of 0.75v during RIE alinement and are varied automatically (remaining 0.75v apart) by the RIE processor. In the MANUAL mode, the threshold voltages are independently set by the HIGH and LOW THRESHOLD switches and each bias remains fixed at

the selected level. AUTO mode is normally used for videos containing relatively large amounts of clutter (eg, normal video) and MANUAL mode is normally used for videos containing little clutter (eg, MTI video). The following steps (1) thru (5) are for AUTO VPU alinement and steps (6) thru (11) are for MANUAL VPU alinement.

(1) Set VPU A (VPU B) AUTO/MANUAL switch to AUTO.

(2) Set VPU A (VPU B) HIGH and LOW THRESHOLD switches to 03.

(3) Set VPU A (VPU B) AUTOMATIC CLUTTER MAPPER THRESHOLD switches to 40 (this is AUTO mode setting).

(4) Set AUTOMATIC CLUTTER MAPPER MODE SELECT switch to A (B).

(5) Adjust VPU A (VPU B) HIGH and LOW THRESHOLD switches together until HIGH FAR readout is 20 (±15) and stable in that region. In AUTO mode, HIGH and LOW THRESHOLD settings must be the same and within the 01 to 05 range.

NOTE

Steps (6) thru (11) are for MANUAL VPU alinement.

(6) Set VPU A (VPU B) AUTO/MANUAL switch to MANUAL.

(7) Set AUTOMATIC CLUTTER MAPPER MODE SELECT switch to A (B).

(8) Set VPU A (VPU B) HIGH and LOW THRESHOLD switches to 34.

(9) On display console VIDEO SELECTIONS, select both NORM and PROC video. Adjust VIDEO BRIGHTNESS thumbwheel switches so that processed video is brighter than normal video, but both are visible.

(10) Verify that processed video (slash with strobe tail) is associated with targets and not clutter. Adjust VPU A (VPU B) HIGH THRESHOLD switches upward, if necessary, until only targets are processed.

(11) Adjust VPU A (VPU B) AUTO CLUTTER MAPPER THRESHOLD switches until VPU A (VPU B) AUTO CLUTTER MAPPER FAR count stablizes at 40 (±15).

f. *Automatic Clutter Mapper Alinement.*

(1) At display console, select NORM and A SECT video.

(2) On RIE I panel, set AUTOMATIC CLUTTER MAPPER MAP RANGE DISPLAY switch to ON. Set AUTOMATIC CLUTTER MAPPER MODE SELECT switch to A/C (B/C). Set RANGE ADJUST switches so that range ring on display encompasses areas of clutter or clutter residue (fig. 11-12.1). Set MAP RANGE DISPLAY switch to OFF.

(3) On RIE I panel, press MAPPER RESET switch. Wait several scans for clutter map to stabilize.

(4) Adjust intensity of NORM and A SECT video such that NORM video clutter (or clutter residue) can be seen through A SECT video. Verify that A SECT video covers all areas of clutter (or clutter residue). Readjust RANGE ADJUST switches (step (2) above) if necessary to encompass all clutter.

NOTE

If A SECT video does not cover all areas of clutter (clutter varies faster than map is generated), change the setting of the RIE I panel AUTOMATIC CLUTTER MAPPER SAM- PLES/SCAN switch in a clockwise direction (higher value) so that all clutter is covered. As an aid in determining effectiveness of the clutter map, select processed (PROC) video on the display console. Areas of clutter which are properly covered by the map should not produce processed video.

The clutter mapper samples range/azimuth cells and censors video in cells in which video remains from scan to scan. Targets which move too slowly and remain in a cell too long are also censored. The SAMPLES/SCAN switch deter- mines the rate at which the cells are sampled. Therefore, the higher the setting the higher the velocity of targets that will be censored. It is necessary then to compromise in the setting of this switch; that is, high enough to provide the best clutter elimination possible without censoring desired moving targets.

If IFF interface alinement is to be accomplished at this point, perform procedure in paragraph 11-34.9e.

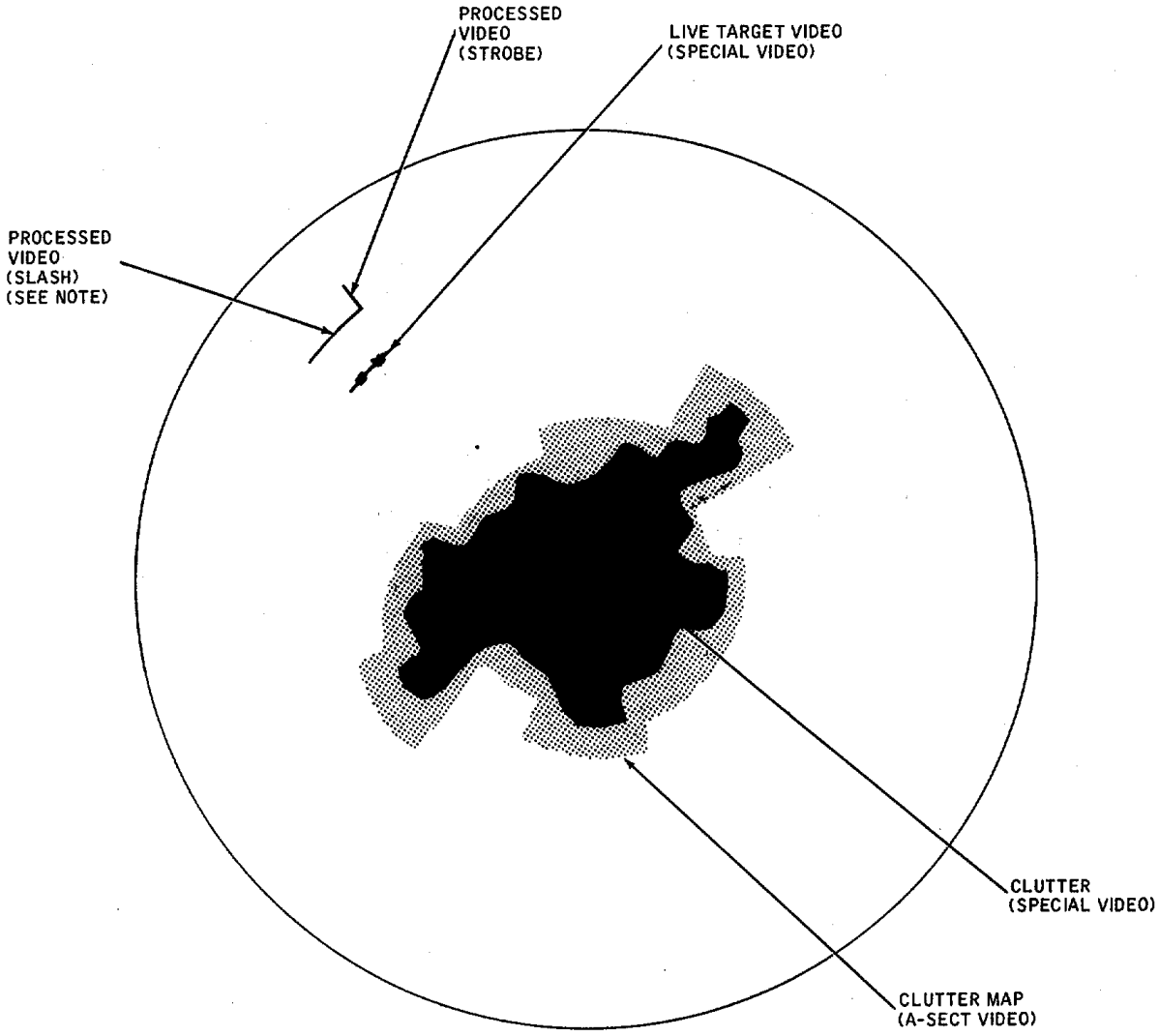
Sketch 41.8. Deleted

g. *Operation*.

(1) At RIE II panel, set RDR/CPU ON LINE/ OFF LINE switch to ON LINE.

(2) Enter CC100 50. The RIE is now operational.

11-34.9. IFF Interface Alinement. The AN/TPX-46 is the IFF equipment associated with the PIP AN/MPQ-50 radar. It is interfaced with the AN/TSQ-73 by means of a local/remote switching unit (LRSU) located adjacent to the Coder-Decoder (C-D) Group 0X-7(V)1/TPX-46(V). When the LRSU CONTROL SELECT switch is in the REMOTE position, the AN/TSQ-73 has exclusive control of IFF interrogation. When this switch is in the LOCAL position, the AN/TSQ-73 IFF interrogation control can be overridden by local control (usually an associated Hawk system). For the following interface alinement procedure, the AN/TSQ-73 RIE is



NOTE:

STROBE INDICATES TARGET WAS REPORTED OUT, FROM TARGET PROCESSOR, TO COMPUTER, NO STROBE ON PROCESSED VIDEO INDICATES A REJECTED TARGET (USUALLY FOR BEING TOO NARROW).

Figure 11-12.1. Sample Correct Video Display

presumed to have been alined in accordance with the preceding paragraphs and is operating.

a. *Cabling*. If cabling to IFF equipment is completed, proceed to step b. If it is not, cable according to section III.

b. *AN/TPX46. Adjustments*. To make the AN/TPX-46 adjustments, proceed as follows:

(1) On C-D group LRSU, set CONTROL SELECT switch to appropriate position.

(1.1) On RIE I panel, set MODE INTERLACE switch to 3.

(2) On C-D group synchronizer unit, set IFF TRIG SELECT switch to EXT and COUNTDOWN switch to HIGH if IFF is to be synchronized with radar trigger. Set IFF TRIG SELECT to INT if operation is to be asynchronous.

(3) In C-D group synchronizer unit, make sure that R1 of display video card A17 is adjusted for an output pulse width of O.5 to 1.4 ps. (Refer to TM 11-5895-532-12, Adjustment of Target Arc Range Dimension.)

c. RJB Adjustments. To make the RJB adjustments, proceed as follows:

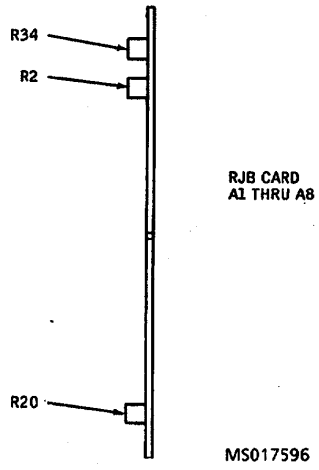
(1) Oscilloscope at RJB.

(a) Synchronize oscilloscope at A2, TP15. (Oscilloscope ground can be connected to A1 thru A8, TP5.)

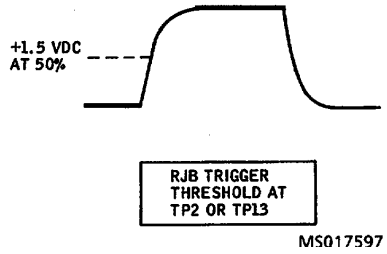
NOTE

In order for IFF video to be observed on the oscilloscope and adjusted, the operator must interrogate a target.

(b) On oscilloscope, monitor A2, TP13 and adjust A2, R20 (sketch 41.9) so that 50% amplitude point of leading edge of trigger pulse is at +1.5v (sketch 41.10).



Sketch 41.9. Video/Trigger Buffer Card (10282351)

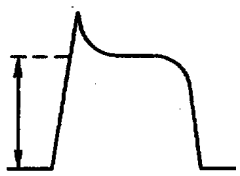


Sketch 41.10. RLB Trigger Threshold

(c) On oscilloscope, monitor A3, TP13 and adjust A3, R20 (sketch 41.9) so that 50% amplitude point of leading edge of either pulse is at +1.5v.

(d) On oscilloscope, monitor A5, TP14 and adjust A5, R34 (sketch 41.9) for video amplitude of 4v at shelter (sketch 41.11).

VIDEO AMPLI(E) VOLTS	CABLE LENGTH (FT)
4.35	125
4.67	250
5.00	375
5.33	500
6.00	750
6.33	875
6.67	1000



RJB OUTPUT VIDEO AMPLITUDES AT TP14 FOR 4V AT SHELTER

Sketch 41.11. RJB Output Video Amplitude

(2) *Oscilloscope at shelter.*

(a) Gain access to radar/simulator card cage in rack 1 (1A1A1A6).

(b) Set oscilloscope for internal sync.

NOTE

In order for IFF video to be observed on the oscilloscope and adjusted, the operator must interrogate a target.

(c) On oscilloscope, monitor A1124, TP8. Verify presence of one pulse of +8.5 (±3.5)v amplitude each IFF trigger period. If no pulse is present or if excess pulses (noise) are present, adjust A2, R20 (sketch 41.9) at RJB for correct output. Make sure that R20 is left in a position that can be adjusted at least one turn in each direction while correct output is being maintained.

(d) On oscilloscope, monitor A1124, TP7. Verify presence of one pulse pair of +8.5 (±3.5)v amplitude (pulse spacing 8.0 μs) for each IFF trigger period. If no pulses are present or if excess pulses (noise) are present, adjust A3, R20 (sketch 41.9) at RJB for correct output. Make sure that R20 is left in position that can be adjusted at least one turn in each direction while correct output is being maintained.

(e) On oscilloscope, monitor A1123, TP24. Verify presence of IFF video of +1.0 to 5.0v amplitude. If correct video is not present, adjust A5, R34 (sketch 41.9) at RJB for correct output.

d. *RIE Input Checks and Adjustments*. To make the RIE checks and adjustments, proceed as follows:

(1) Gain access to radar/simulator card cage in rack 1 (1A1A1A6).

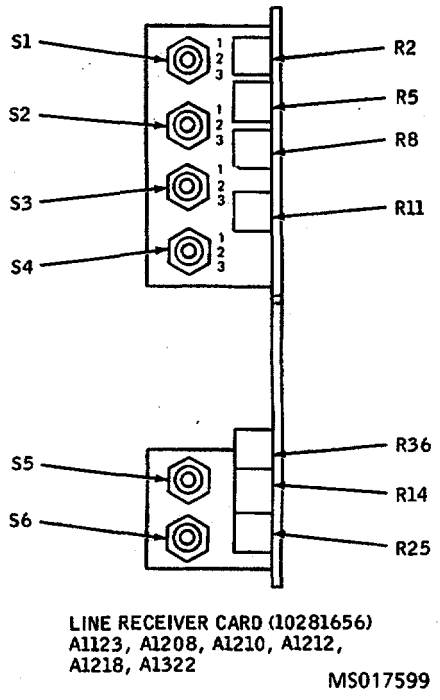
(2) Set oscilloscope for internal sync.

(3) On oscilloscope, monitor A124, TP8. Verify presence of one pulse of +8.5 (±3.5)v amplitude each IFF trigger period.

(4) On oscilloscope, monitor A1124, TP7. Verify presence of one pulse pair of +8.5 (±3.5)v amplitude (pulse spacing 8.0 μs) for each IFF trigger period.

(5) On oscilloscope, monitor A1123, TP24. Verify presence of IFF video of + 1.0 to 5.Ov amplitude.

(6) Make sure that A1123, S5 (sketch 41.12) is in POS (+) position (down).



Sketch 41.12. Line Receiver Card (10281656)

(7) On oscilloscope, monitor A1123, TP15. Adjust A1123, R14 (sketch 41.12) for video amplitude of 4.0v.

(8) On oscilloscope, monitor A1222, TP6. Adjust R44 on video mixer card (sketch 41.6) for video amplitude of 4.0v.

(9) On oscilloscope (or dc voltmeter), monitor A1123, TP4. Verify dc level of +1.0 (±1.0)v. If this is not present, check that AN/TPX-46 transmitter is interrogating (transmitting).

(10) Make sure that A1123, S4 (sketch 41.12) is set to +4v, +8v range (position 3).

(11) On oscilloscope (or dc voltmeter), monitor A1123, TP8. Verify dc level of +3.7 (±1.3)v. If this is not present, adjust A1123, R11 (sketch 41.12) for correct output.

NOTE

The IFF INTERROGATION INTERROGATE indicator remains lit until the IFF transmitter stops transmissions.

(12) On RIE I panel, verify that IFF INTERROGATION indicator is lighted.

e. *IFF Operation*. To adjust the RIE for IFF operation, proceed as follows:

(1) Obtain setting of DELAY switch inside AN/TPX-46 synchronizer unit; on RIE I panel, set SIF ALIGNMENT (0.1 µs) as follows:

DELAY IN-Setting 3448

DELAY OUT-Setting 3072

NOTE

If Mode C is selected, it must be in combination with one other SIF mode (1,C; 2,C or 3,C).

(2) On RIE I panel, set IFF PARAMETERS TPX-46/TPX-28 switch to TPX-46 if interlacing of two SIF modes (1,2; 1,3 or 2,3) is required. Set switch to TPX-28 if Mode C is required. If only one SIF mode (1, 2 or 3) is required, this switch can be in either position.

NOTE

When RIE I panel MODE INTERLACE switch is set to any position other than OFF, the IFF transmitter transmits continuously. Set MODE INTERLACE switch to OFF as soon as testing is completed.

(3) Select IFF mode interlace, as required, on RIE I panel IFF INTERROGATION MODE INTERLACE switch if RIE I panel IFF INTERROGATION SELECT/CONTROL switch is in LOCAL position. Select IFF mode to be interlaced at display console if SELECT/CONTROL switch is in CONSOLE position.

NOTE

If the operation indicates that radar and IFF video do not correlate to produce a single target report, the RIE I Panel SIF ALIGNMENT (0.1 μs) switches might need adjusting.

(4) On display console, select NORM or SPCL, IFF-SIF, and PROC.

(5) On display console, select 1/8 range scale.

(6) Observe PPI and verify that radar and IFF video from any one target coincide and produce one processed video display. If two processed videos are displayed for one target, proceed to steps 7 and 8.

(7) Adjust SIF ALIGNMENT (0.1 μs) switches until only one processed video is displayed.

(8) After step 7 is accomplished, reset M4 ALIGNMENT (0.1 μs) switches by the same amount that the SIF ALIGNMENT (0.1 µs) switches were changed.

Section VIII. AN/TPS-32 RADAR INTERFACE ALINEMENT

11-35. General.-his section provides the interface and alinement procedures necessary to optimize operation between the AN/TSQ-73 and the AN/TPS-32 radar set. Any switch settings not mentioned in the following procedure are irrelevant and should be ignored.

NOTE

Because the RIE performs no video processing when interfaced with the AN/TPS-32, it is essential that the clutter elimination features of the AN/TPS-32 be used. This requires setting up the range gated MTI and the manual clutter gates at the AN/TPS-32. If this is not done properly, excessive clutter false alarms will occur.

a. Press KPU REQ SEND switch and verify CLEAR SEND indicator lights. Enter CC101 50 on keyboard. Press KPU REQ SEND switch and verify CLEAR SEND indicator goes off.

b. On RIE II panel, set RDR/CPU ON LINE/OFF LINE switch to OFF LINE.

c. On RIE I panel, press IFF INTERROGATION SELECT/CONTROL switch and verify LOCAL indicator lights.

d. Set IFF INTERROGATION SELECT/ CONTROL MODE INTERLACE switch to OFF so that no IFF video processing is done by RIE.

e. Press VIDEO DISTRIBUTION VPU INPUT SELECT switch and verify LOCAL indicator lights.

f. Set VPU INPUT SELECT VPU A and VPU B switches to OFF so that no video processing is done by RIE.

g. Set DATA SOURCE SELECT RADAR switch to RADAR or RADAR/SIM.

h. Set DATA SOURCE SELECT IFF switch to SIM. No IFF video input is supplied to RIE.

i. Access radar/simulator card cage (A1A1A6) line receiver cards A1208 and A1218.

NOTE

All test point and adjustment locations are shown in figure 11-12.2.

j. Set input polarity switches (S1, S2, S3) on A1208 and A1218 to position [1] (-4v, -100v,-100v).

k. Using table 11-8.3, monitor applicable output test points and, if necessary, adjust appropriate potentiometers so that the voltage level changes are from 0v to approximately 4v.

Table 11-8.3. Output Test point Data

Card 1A1A1A6	TP	Adjust	Signal
A1218	5	R2	Azimuth Change Pulse (ACP)
A1218	6	R5	Azimuth North Pulse (ANP)
A1218	7	R8	Livetime
A1208	5	R2	Data word 1
A1208	6	R5	Data word 2
A1208	7	R8	Data word 3
A1327	12	R36	Special video (use only when NORM video selected)
A1216	10	R19	Analog video (normal)

l. Set ACM MODE SELECT to A; clutter mapper is disabled.

m. Set CFAR RANGE ALIGNMENT (RADAR RANGE CELLS) thumbwheel switches to 0530.

n. Set PRETRIGGER ALIGNMENT (RADAR RANGE CELLS) thumbwheel switches to 000.

o. Set PULSE WIDTH (μs) switch to 3.

p. Set AZIMUTH MODE switch to ACP ANP ONLY.

q. For radars with known ground clutter landmarks, perform steps r thru t. For radars with track marker, perform steps u and v. For radar without track marker or known ground clutter position, perform steps w thru z (use as last choice for setting azimuth correction).

NOTE

Preset AZIMUTH CORRECTION (.088°) thumbwheel switches to 0000 and SPECIAL VIDEO SELECT to LOCAL. At display console, activate VIDEO SELECTIONS NORM switch.

r. At the radar PPI scope, determine the azimuth of a known landmark and enter a jam strobe through AN/TSQ-73 console keyboard at a position corresponding to the landmark position.

s. To enter a jam strobe, press TASK SELECTIONS TRACK DATA switch. Enter three numerics at console keyboard corresponding to landmark location (359 maximum). Press TASK FUNCTIONS ENTER JAM STROBE. To observe jam strobe, press BACKGROUND

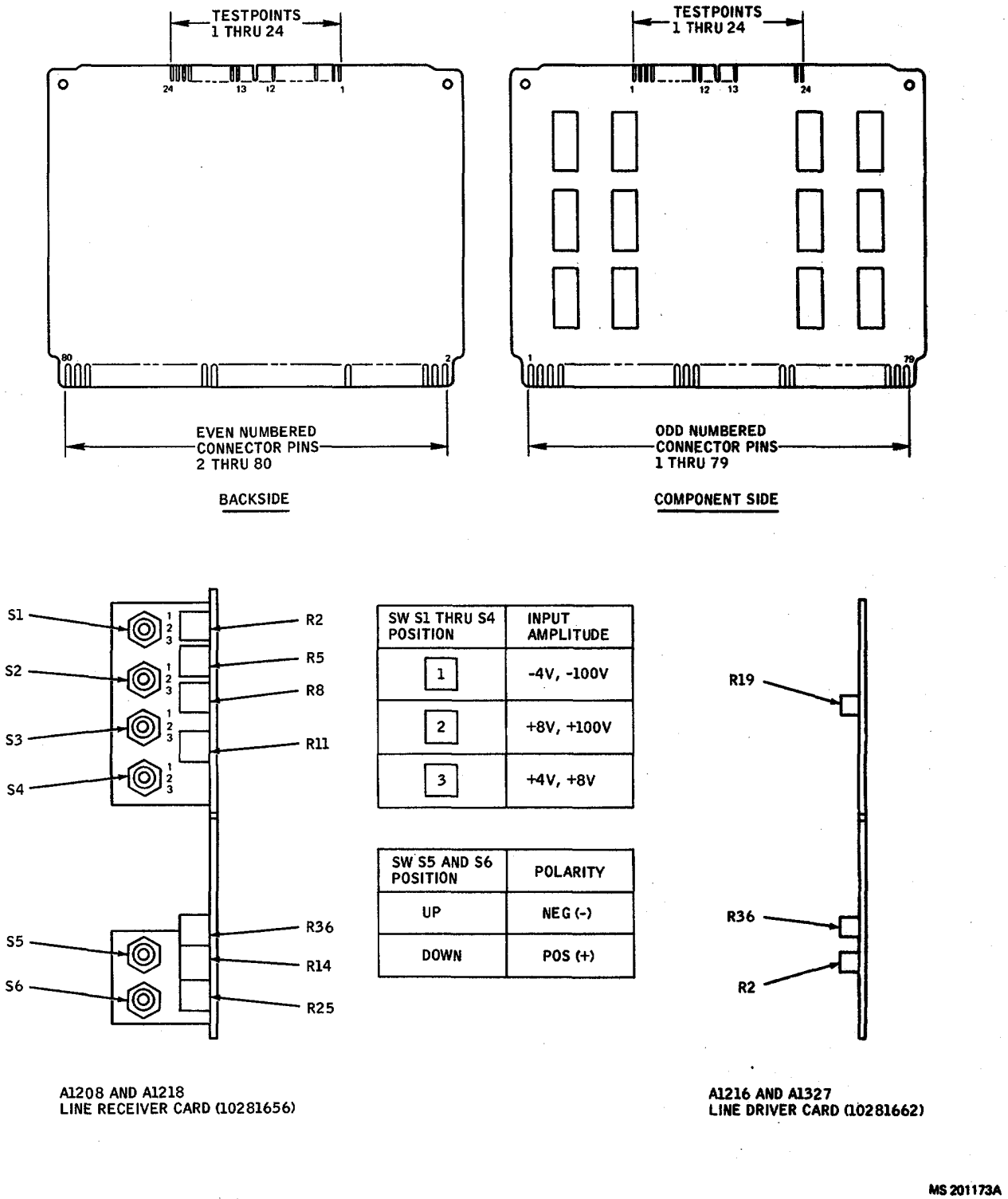


Figure 11-12.2. AN/TPS-32 Alinement Testpoint and Alinement Locations

DATA DISPLAY JAM STROBE switch. Select Normal Video (NORM) at console.

t. Adjust AZIMUTH CORRECTION (.088°) thumbwheel switches until the landmark video coincides with the jam strobe video. One digit on the thumbwheel equals:

MSB = ± 45° or 800 mils shift of video
2nd MSB = ±5.6° or 100 mils shift of video
2nd LSB = ±0.7° or 12.5 mils shift of video
LSB = ±0.09° or 1.5 mils shift of video

u. Notify radar operator to put a track marker at a known angle (180°, or landmark etc.).

v. Adjust AZIMUTH CORRECTION (.088°) thumbwheel switches until displayed track marker coincides with known angle.

w. Notify radar operator to turn off transmitter and allow antenna rotation to stop.

x. Obtain from radar operator the exact angle of antenna direction. If angle is obtained from radar PPI, the radar sweep must have been previously alined to true north.

y. Using table 11-17, locate the azimuth angle, in degrees or mils, of antenna direction and note the corresponding azimuth correction value.

z. Adjust the AZIMUTH CORRECTION (.088°) thumbwheel switches to obtain the azimuth correction value from step w on the AZIMUTH PROCESSOR (.088°) LED readout.

aa. Set RIE II panel RDR/CPU switch to ON- LINE.

ab. Press KPU REQ SEND switch and verify CLEAR SEND indicator lights.

ac. ENTER CC100 50 on keyboard.

ad. Press KPU REQ SEND switch and verify CLEAR SEND indicator goes off.

Section VIII.1. VIDEO SIMULATOR UNIT ALINEMENT

11-35.1. General. This section provides the alinement procedure necessary to optimize operation between the video simulator unit (VSU) and the RIE. This nonperiodic alinement procedure should be made when RIE FI procedures fail or there is an improper CRT video presentation and Radar/Sim Bay Sim Normal and Sim MTI video levels are suspected due to improper alinement. Sim Normal and Sim MTI videos come from the VSU into the Radar/Sim Bay of the RIE on line receiver A1 208.

11-35.2. Preliminary VSU Adjustment Procedures. These procedures include AN/TSQ-73 initialization, RIE panel settings, and RIE fault isolation, as follows:

a. Initialize the AN/TSQ-73 shelter as required in TM 9-1430-652-10-3 in a battalion configuration which allows auxiliary functions (see table 3-9 in the 10-3).

b. If command console is not online, enter CC100 40 or CC100 41.

c. Set up RIE panels I and II and Radar Simulator Panel according to table 11-8.4.

d. Module of the RIE FI will be run using the following procedure:

NOTE

All KPU entries must be preceded and followed by pressing the KPU REQ SEND switch.

(1) Enter CC50 on KPU.

(2) After KPU response requesting control number, enter 6. Following a wait of approximately 2 minutes, KPU prints out Module 1 and Module 6.

NOTE

Any time a six-digit number is output, this is an error stop number. If designated module runs without detecting a fault, KPU will output: RIE FAULT FREE.

(3) Comply with directions and respond as appropriate to queries printed on KPU. For Module 6, answer YES to SHOULD VDU TEST BE RUN. Answer YES for Sim Normal and Sim MTI videos. While Sim Normal is being run (should be displayed on console CRT), checks and adjustments (para 11-39 and 11-40) can be made if required.

NOTE

Make sure processed video is being displayed before entering Y (3-6 scans). Confirm that program is still running by observing azimuth counter LEDs on RIE 1 panel. If counter does not change over a 2-minute period, abort test and rerun Module 6 of the FI per figure 3-17 (sheet 13 of 68) in TM 9-1430-655-20-3.

11-35.3. RIE Checks and Adjustments. Perform the following:

a. Gain access to radar/simulator card cage in rack 1 (1A1A1A6).

b. Insert card extender 588802-153 in vacant slot XA 1426. Connect oscilloscope ground to pin 2 (wirewrap pin).

CAUTION

Set RIE II panel POWER switch to OFF whenever installing test point adapter on card or damage to equipment may result. Use isolated oscilloscope (battery pack or powerline isolator).

c. Use testpoint adapter 533385 on cards to be monitored.

d. Set oscilloscope for internal sync.

e. Monitor A1208, TP23 on oscilloscope. Verify presence of Sim Normal video.

f. Set A1208, S6 (fig. 11-12.3) to POS (+) position (down).

g. Monitor A1208, TP16 on oscilloscope. Adjust A1208, R-25 (fig. 11-12.3) for video amplitude of +4.0v.

h. On KPU enter "Y" for Sim Normal video being displayed on CRT. Sim MTI video should then be displayed on console CRT.

i. Monitor A1208, TP24 on oscilloscope. Verify the presence of Sim MTI video.

j. Set A1208, S-5 (fig. 11-12.3) to POS (+) position (down).

k. Monitor A1208, TP15 on oscilloscope. Adjust A1208, R-14 (fig. 11-12.3) for video amplitude of +4.0v.

I. This completes the line receiver adjustments for Sim Normal and Sim MTI from the VSU. IFF targets use Sim MTI video to generate Sim IFF targets.

11-35.4. Test Video Line Driver Card Alinement.

NOTE

It may be necessary to check and adjust the TEST VIDEO line driver outputs for either Sim Normal or Sim MTI video on Line Driver Card in slot A1215 if test video is not displayed on console.

a. While Module 6 is running with either Sim Normal or Sim MTI Video being displayed, monitor A1215, TP12 (TEST VIDEO to Local Display) and adjust R-36 (fig. 11-12.3) for +4.0v.

b. If remote consoles are being used, repeat step a. above using A1215, TP10 and R-19 (fig. 11-12.3) for +4.0v.

Table 11-8.4. Preliminary RIE and Radar Simulator Settings, SIM Video Alinement

Unit	Control	Setting
RADAR INTERFACE EQUIPMENT I	IFF	
	INTERROGATION	
	SELECT/CONTROL	CONSOLE
	MODE INTERLACE	OFF
	IFF PARAMETERS	
	TPX 28/TPX 46	TPX 46
	CORRELATION (μS)	.27
	SIF ALIGNMENT (0.1 μS)	0225
	M4 ALIGNMENT (0.1 μS)	0225
	VIDEO DISTRIBUTION	
	SPECIAL VIDEO	
	SELECT	LOCAL
	(Rotary Switch)	MTI
	VPU INPUT SELECT	
	CONSLE/LOCAL	LOCAL
	VPU A	NORM
	VPU B	MTI
	DATA SOURCE SELECT	
	RADAR	SIM
	IFF	SIM
	PROCESSED VIDEO	
	DISPLAY SELECT	MANUAL
	Select (thumbwheel)	1
	MTI/NORMAL	
	Q73/RADAR	Q73
	GATE RANGE	Midrange
	AUTOMATIC CLUTTER MAPPER	
	MODE SELECT	A
	MAPPER DECISION VALUES	
	NORMAL MAP	
	INCREMENT	04
	DECREMENT	04
	START	32
	AUTO/MANUAL	AUTO
	MTI MAP	
	INCREMENT	04

Table 11-8.4. Preliminary RIE and Radar Simulator Settings, SIM Video Alinement - Continued

Unit	Control	Setting
RADARINTERFACE EQUIPMENT I (cont)	DECREMENT	04
	START	32
	BEAM WIDTH (.088°)	55
	RADAR INTEGRATION	
	CFAR RANGE	
	ALIGNMENT (RADAR RANGE CELLS)	0000
	PRETRIGGER	
	ALIGNMENT (RADAR RANGE CELLS)	444
	PULSE WIDTH (μS)	3
RADAR INTERFACE EQUIPMENT II	RDR/CPU	ON-LINE
	INTEGRATED MODE	OFF
	POWER	
	ON/OFF	ON
	RADAR PROCESSING	
	MEMORY	ON-LINE
	QUANTIZERS AND CFAR	
	VPU A	
	AUTO/MANUAL	AUTO
	HIGH THRESHOLD	04
	LOW THRESHOLD	04
	AUTO CLUTTER MAPPER	
	THRESHOLD	40
	VPU B	
	AUTO/MANUAL	AUTO
	HIGH THRESHOLD	04
	LOW THRESHOLD	04
	AUTO CLUTTER MAPPER	
	THRESHOLD	40
	RADAR J-BOX	SEE NOTE
	TARGET PROCESSOR	
	RDR-IFF	
	AZ CORRELATION (.088°)	377
	RADAR	
	AZ OFFSET (SWEEPS)	00
	BITE	ON

Table 11-8.4. Preliminary RIE and Radar Simulator Settings, SIM Video Alinement - Continued

Unit	Control	Setting
RADAR INTERFACE EQUIPMENT II (cont)	TARGET DETECTOR	
	AUTO/A/B	A
	MATRIX	4
	JAM DETECTOR	
	ON/OFF	OFF
	RADAR TGT DECISION VALUES	
	START	15
	STOP	1
	MIN WIDTH (.088°)	00
	MISS (SWEEPS)	0
	RANGE RESOLN	0
	IFF TGT DECISION VALUES	
	AZ MIN (.088°)	00
	AZ MAX (.088°)	377
	MISS (SWEEPS)	7
RADAR SIMULATOR EQUIPMENT	POWER	ON
	MODE	STD
	PRF HZ	229
	ANTENNA	
	RATE RPM	10
	DIRECTION	CW
	RCVR NOISE VOLTS PEAK	OFF

NOTE

Verify that RADAR J-BOX toggle switch set to FI ON position unless operator without AN/TSQ-73 Radar J-box (i.e., set to FI INHIBIT only for operator in SIM mode or with AN/TPS-32 radar).

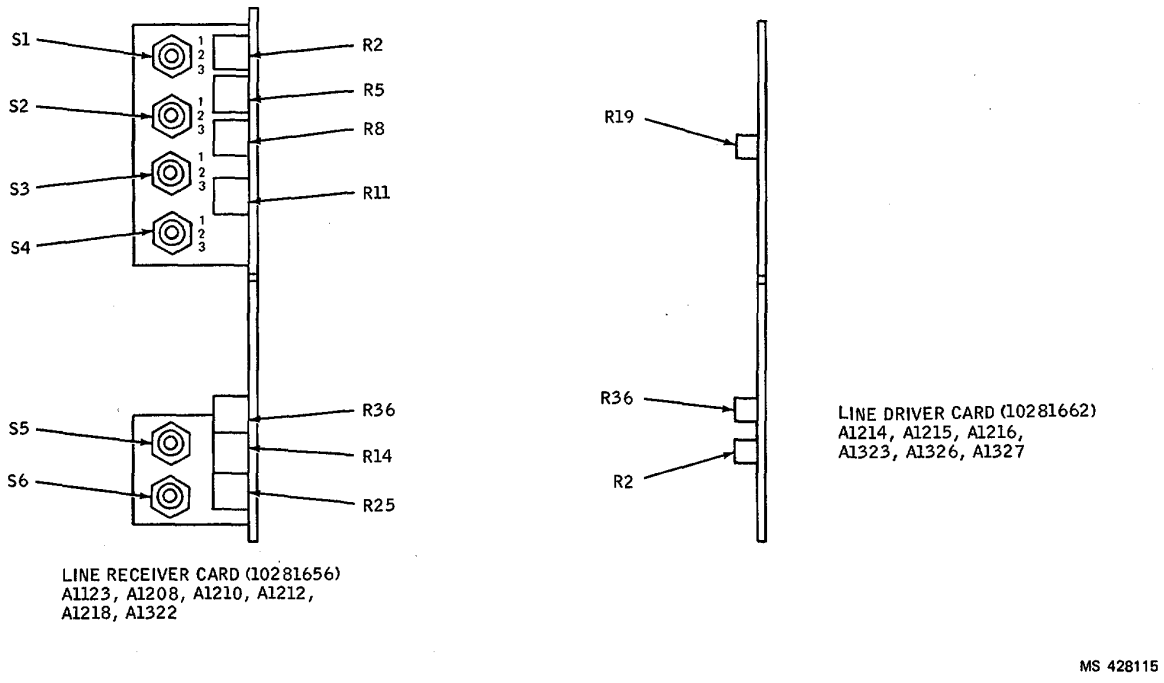


Figure 11-12.3. Line Receiver Card (10281656) and Line Driver Card (10281662)

Section IX. RIE ALINEMENT DATA

11-36. General. The following data is provided for RIE alinement and adjustment presented in sections I thru VIII.

11-37. RIE Sample Data Sheet. Figure 11-13 is provided for use as a sample data sheet. Copies should be procured for use during rapid RIE initialization performed in section II.

11-38. PRF HZ Switch Settings. Figure 11-14 is provided to calculate PRF HZ switch setting for the RADAR SIMULATOR PANEL. For a given range, there is a maximum PRF beyond which ambiguous reports will be produced. After a pulse is transmitted, it is necessary to wait enough time for the signal to travel (at the speed of light) to the target and back before transmitting the next pulse. If this time is not allowed, it will not be possible to decide whether a received signal is from the latest pulse from close in or from the previous pulse from far out. The correct PRF setting for a given range is shown in figure 11-14 and should assist in avoiding this problem. The real-time simulation program which interprets a raid tape and drives the VSU will cut off any radar report whose range is too great for the PRF being used. As a result, if the PRF setting is too high, the AN/TSQ-73 system will not get erroneous positions, but the scripted targets outside the maximum unambiguous range will not be displayed on the operator's display console.

11-39. Automatic Clutter Mapper Radar Cutoff Velocities. Radar cutoff velocity table 11-9 is provided to allow the operator to determine the correct SAMPLE/SCAN setting for a given application. The table indicates a range of values for sets of pulse width, beamwidths, and antenna speeds. Cutoff velocity is defined as the average speed of a target below which it will be considered as clutter, if it is positioned at the value of TARGET RANGE (in the table) and it starts in the lower left-hand corner of a range azimuth cell and is caused to fly at all angles (i.e., 0 to 90 degrees) across the range-azimuth cell. The average time required to cross the range-azimuth cell is then compared with the times required to guarantee a 40 to 50 percent probability that a strong target will be mapped by the clutter mapper. From these numbers the velocity of cutoff is determined. As the SAMPLE/SCAN is assumed to be 1 for all of these tables, setting the SAMPLE/SCAN control to the 1/2 position is equivalent to dividing the values in the table by 2. Similarly, a value of 2 doubles the values in the table. In the same fashion, the velocity of cutoff is directly proportional to the antenna rate. Doubling the antenna rotation rate doubles the velocity of cutoff; all other parameters remain constant.

a. Use of Table. To use the table for a given radar, find the table with the required pulse width and beamwidth combination. Then use the range of the map range ring to address the MAP RANGE column of the table. The table then gives a set of cutoff velocities as a function of the range of the target. In the RANGE CELLS/CLUTTER CELLS column of table 11-9, one range cell is equal in length to the radar pulse width. A clutter cell is the unit of area examined by the ACM for clutter mapping. Its azimuth dimension is one radar beamwidth. Its range dimension is defined by the range cells/clutter cell value. The range cells/clutter cell value is determined automatically by the ACM as a function of the selected map range and the amount of ACM core memory (56,000 clutter cells). Since velocity of cutoff values are only affected if a change of map range causes an increment in range cells/clutter cell, redundant target range and range cells/clutter cell combinations have not been shown in the table.

b. Examples. As an example, assume that the radar has a pulse width of 6 microseconds, a beamwidth of 1.3 degrees and antenna rotation of 5 rpm. First, note that the table giving the parameters for 6 microseconds, 1.3 degrees and 10 rpm is used. Next, assume that the map range is 150 and the minimum velocity at all ranges is required to be 50 mph. For a map range of 150, the target range of 150 has a worst-case cutoff velocity of 217.64 mph. Since the radar is rotating at 5 rpm instead of 10 rpm, the actual worst case velocity is 108.82 mph. Thus, a setting of 1/2 of the SAMPLE/ SCAN switch will allow a worst-case cutoff velocity of 54.41 mph. Decreasing the control one more setting to the 1/3 position reduces the velocity to 36.27 mph. The samples per scan should be set as high as possible consistent with an acceptable minimum velocity.

Table 11-9. Radar Cutoff Velocities

PW	BW	RPM	Map range	Target range	Range cells/ clutter cell	Cutoff velocity
2	1.10	10	50	50	2	68.59
			75	50	3	73.78
			100	50	4	74.80
			100	100	4	97.98
			125	50	5	73.94
			125	100	5	98.92
			150	59	6	92.85
			150	100	6	126.48
			150	150	6	146.97
			200	50	7	53.93
			200	100	7	74.63
			200	150	7	87.42
			200	200	7	96.59
			250	250	7	103.71
2	1.20	6	50	50	2	42.39
			75	50	3	45.80
			100	50	4	46.59
			100	100	4	60.56
			150	50	5	46.19
			150	100	5	61.28
			150	150	5	70.29
			175	50	6	58.14
			175	100	6	78.51
			175	150	6	90.84
		6	200	50	7	33.84
			200	100	7	46.41
			200	150	7	54.11
			200	200	7	59.62
			250	250	7	63.89
2	1.40	6	50	50	2	44.58
			100	50	3	48.52
			100	100	3	60.83
			125	50	4	49.66
			125	100	4	63.69
			150	150	4	71.91

Table 11-9. Radar Cutoff Velocities - Continued

PW	BW	RPM	Map range	Target range	Range cells/ clutter cell	Cutoff velocity
2	1.40 (cont)	6	175	50	5	49.47
			175	100	5	64.70
			175	150	5	73.71
			200	50	6	62.53
			200	100	6	83.18
			200	150	6	95.53
			200	200	6	104.28
			250	50	7	36.52
			250	100	7	49.32
			250	150	7	57.07
			250	200	7	62.57
			250	250	7	66.82
2	4.00	10	50	50	2	98.79
			100	100	2	113.96
			150	150	2	122.14
			200	200	2	126.32
			225	50	3	111.82
			225	100	3	131.41
			225	150	3	142.45
			225	200	3	149.43
			250	250	3	154.42
3	1.30	5	50	50	1	37.20
			75	50	2	47.21
			100	100	2	59.52
			125	50	3	50.15
			125	100	3	65.39
			150	150	3	74.40
			175	50	4	50.34
			175	100	4	67.44
			175	150	4	77.73
			200	200	4	85.03
			225	50	5	49.37
			225	100	5	67.63
			225	150	5	78.82
			225	200	5	86.81
			250	250	5	93.00

Table 11-9. Radar Cutoff Velocities - Continued

PW	BW	RPM	Map range	Target range	Range cells/ clutter cell	Cutoff velocity
3	1.80	20	50	50	1	163.15
			75	50	2	211.95
			100	100	2	261.04
			150	50	3	228.98
			150	100	3	290.49
			150	150	3	326.30
			200	200	3	351.29
			225	50	4	232.96
			225	100	4	302.79
			225	150	4	343.98
			225	200	4	372.92
			250	250	4	395.17
3	2.3	20	50	50	1	To Be Supplied
			75	50	2	To Be Supplied
			100	100	2	To Be Supplied
			150	50	3	To Be Supplied
			150	100	3	To Be Supplied
			150	150	3	To Be Supplied
			200	200	3	To Be Supplied
			225	50	4	To Be Supplied
			225	100	4	To Be Supplied
			225	150	4	To Be Supplied
			225	200	4	To Be Supplied
			250	250	4	To Be Supplied
3	2.50	10	50	50	1	88.74
			100	100	1	103.05
			125	50	2	117.66
			125	100	2	141.98
			150	150	2	155.61
			200	200	2	164.88
			225	50	3	129.03
			225	100	3	159.75
			225	150	3	177.47
			225	200	3	189.61
			250	250	3	198.88

Table 11-9. Radar Cutoff Velocities - Continued

PW	BW	RPM	Map range	Target range	Range cells/ clutter cell	Cutoff velocity
3	4	10	50	50	2	To Be Supplied
			100	100	2	To Be Supplied
			150	150	2	To Be Supplied
			200	200	2	To Be Supplied
			225	50	3	To Be Supplied
			225	100	3	To Be Supplied
			225	150	3	To Be Supplied
			225	200	3	To Be Supplied
			250	250	3	To Be Supplied
6	0.85	5	50	50	1	49.73
			75	50	2	56.89
			100	100	2	79.57
			150	50	3	56.56
			150	100	3	82.46
			150	150	3	99.46
			200	200	3	111.98
			225	50	4	54.22
			225	100	4	81.27
			225	150	4	99.76
			225	200	4	113.67
			250	250	4	124.74
6	1.10	10	50	50	1	110.67
			100	50	2	129.99
			100	100	2	177.07
			150	150	2	205.76
			200	50	3	131.20
			200	100	3	186.32
			200	150	3	221.34
			200	200	3	246.75
			250	250	3	266.57
6	1.2	10	50	50	1	To Be Supplied
			100	50	2	To Be Supplied
			100	100	2	To Be Supplied
			150	150	2	To Be Supplied
			200	50	3	To Be Supplied
			200	100	3	To Be Supplied

Table 11-9. Radar Cutoff Velocities - Continued

PW	BW	RPM	Map range	Target range	Range cells/ clutter cell	Cutoff velocity
6	1.2	10	200	150	3	To Be Supplied
	(cont)		200	200	3	To Be Supplied
			250	250	3	To Be Supplied
6	1.30	10	50	50	1	118.02
			100	100	1	148.80
		10	125	50	2	140.96
			125	100	2	188.84
			150	150	2	217.64
			200	200	2	238.08
			225	50	3	143.71
			225	100	3	200.59
			225	150	3	236.05
			225	200	3	261.58
			250	250	3	281.46
6	1.50	6	50	50	1	74.62
			100	100	1	93.08
			125	50	2	90.34
			125	100	2	119.39
			150	150	2	136.69
			200	200	2	148.92
			250	50	3	92.91
			250	100	3	127.80
			250	150	3	149.23
			250	200	3	164.58
			250	250	3	176.50
8	1.10	6	50	50	1	78.54
			100	100	1	102.88
		6	125	50	2	89.57
			125	100	2	125.67
			150	150	2	148.29
			200	200	2	164.61
			250	50	3	88.90
			250	100	3	129.99
			250	150	3	157.09
			250	200	3	177.07
			250	250	3	192.81

Table 11-9. Radar Cutoff Velocities - Continued

PW	BW	RPM	Map range	Target range	Range cells/ clutter cell	Cutoff velocity
24	1.50	6	50	50	1	159.41
			100	100	1	225.86
			150	150	1	267.96
			200	200	1	298.46
			250	250	1	322.26

RIE DATA SHEET

Radar type	Video type
PRF	Video level
RPM	Bn serial number
IFF type	

RIE I control panel switch settings		**RIE II control panel switch settings**	
IFF INTERROGATION	_____	POWER ON/OFF	ON
SELECT/CONTROL	_____	RDR/CPU	
MODE INTERLACE	_____	**QUANTIZERS AND CFAR**	_____
IFF IFF PARAMETERS	_____	**VPU A**	_____
TPX 28/TPX 46	_____	AUTO/MANUAL	_____
CORRELATION µs.)	_____	HIGH THRESHOLD	_____
SIF ALIGNMENT (0.1 µs.)	_____	LOW THRESHOLD	_____
M4 ALIGNMENT (0.1 µs.)	_____	AUTO CLUTTER MAPPER	_____
VIDEO DISTRIBUTION	_____	THRESHOLD	_____
SPECIAL VIDEO SELECT	_____	**VPU B**	_____
CONSLE/LOCAL	_____	AUTO/MANUAL	_____
Select Switch	_____	HIGH THRESHOLD	_____
VPU INPUT SELECT	_____	LOW THRESHOLD	_____
CONSLE/LOCAL	_____	AUTO CLUTTER MAPPER	_____
VPU A Select Switch	_____	THRESHOLD	
VPU B Select Switch	_____		
	_____	TARGET PROCESSOR	
DATA SOURCE SELECT			
	_____	RDR-IFF AZ	
RADAR	_____	CORRELATION	_____
IFF			
PROCESSED VIDEO	_____	RADAR AZ OFFSET	_____
DISPLAY SELECT	_____	(SWEEPS)	_____
THUMBWHEEL	_____		

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Figure 11-13. Radar Interface Equipment Sample Data Sheet (Sheet 1 of 3)

RIE I control panel switch settings		RIE II control panel switch settings	
MTI/NORMAL		**TARGET DETECTOR**	
Q73/RADAR	_____	AUTO/A/B	_____
GATE RANGE	_____	MATRIX	_____
AUTOMATIC CLUTTER MAPPER		**JAM DETECTOR**	
		THRESHOLD	_____
MODE SELECT	_____	ON/OFF	_____
OVERLAP SELECT	_____	**RADAR TGT DECISION VALUES**	
SAMPLE/SCAN	_____		
MAP RANGE		START	_____
RANGE ADJ	_____	STOP	_____
DISPLAY	_____	MIN WIDTH (.088°)	_____
MAPPER DECISION VALUES	_____	MISS (SWEEPS)	_____
AUTO/MANUAL	_____	RANGE RESOLN	_____
BEAMWIDTH (.088°)	_____	**IFF TGT DECISION VALUES**	_____
RADAR INTEGRATION	_____	AZ MIN (.088°)	_____
AZIMUTH	_____	AZ MAX (.088°)	_____
CORRECTION (.088°)	_____	MISS (SWEEPS)	_____
AZIMUTH MODE	_____		
CFAR RANGE			
ALIGNMENT (RADAR RANGE CELLS)	_____		
PRETRIGGER			
PULSE WIDTH (μs.)	_____		
ALIGNMENT (RADAR RANGE CELLS)	_____		

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Figure 11-13. Radar Interface Equipment Sample Data Sheet (Sheet 2 of 3)

Radar junction box switch settings

ACP/ANP	_____	FILTER IN/OUT	_____
CABLE COMP	_____	COMMON CHAN	_____
INPUT TERM 1	_____	RADAR SELECT	_____
INPUT TERM 2	_____	N SPEED SYNC	_____
INPUT TERM 3	_____	1 SPEED SYNC	_____
INPUT TERM 4	_____	Ø RVS 1	_____
INPUT TERM 5	_____	115V REF.	_____
INPUT TERM 6	_____	PWR SEL	_____
INPUT TERM 7	_____	CW/CCW	_____
INPUT TERM 8	_____	Ø RVSN	_____

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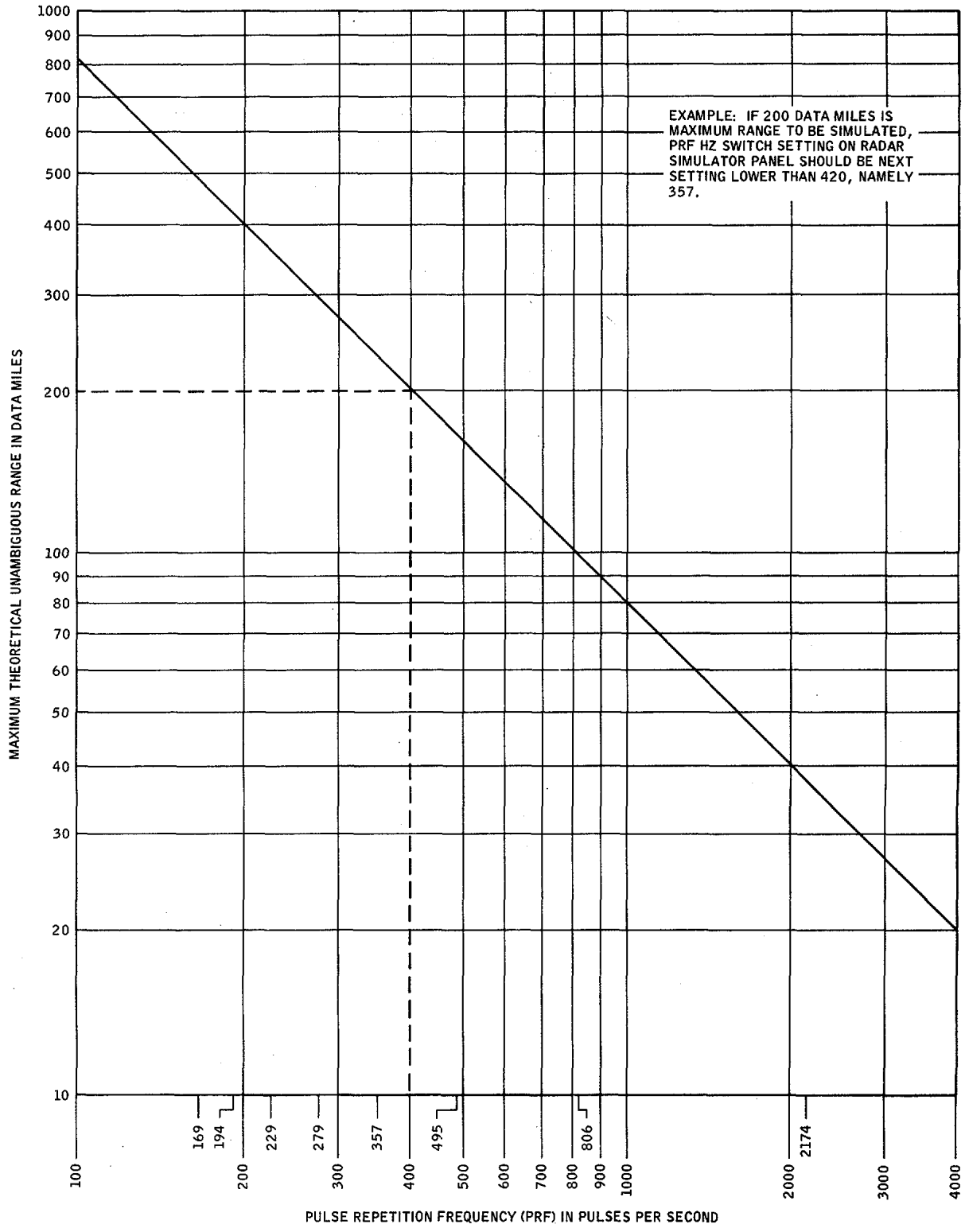
Figure 11-13. Radar Interface Equipment Sample Data Sheet (Sheet 3 of 3)



NOTE:
TO USE THIS CHART, FIND MAXIMUM RANGE TO BE SIMULATED ALONG LEFT SIDE, READ HORIZONTALLY TO THE SLANT LINE, READ DOWN TO FIND MAXIMUM PRF. USE THE NEXT LOWER RADAR SIMULATOR PRF HZ SWITCH SETTING. THE EIGHT STANDARD PRF HZ SWITCH SETTINGS ARE SHOWN ABOVE THE PRF SCALE.

Figure 11-14. Radar Interface Equipment Pulse Rate Frequency Settings

11-40. RIE Switch Message. The RIE switch message (fig. 11-15) is printed out after the configuration is loaded or as a result of changing switch settings at the RIE panels. A 45-second delay is provided after the last switch setting change to allow time for additional switch setting changes. This message provides a hard copy record of 48 critical switch settings to aid in analyzing system operation with an active radar.

11-41. RIE Loop Test Messages. These messages are output as a result of RIE Fault Detection. The messages consist of text amplifying text, message reference number, severity code and error history. Figure 11-16 illustrates the RIE Loop Test Message.

11-42. RIE Reference Data. Table 11-10 provides reference data for various RIE switches and explains techniques used to achieve desired results.

Table 11-10. Radar Interface Equipment Reference Data

Control	Optional settings	Definition
	NOTE All controls are located on RIE I panel unless otherwise indicated.	
VIDEO DISTRIBUTION		
SPECIAL VIDEO		
SELECT	CONSLE	Allows special video selection at console.
	LOCAL	Allows special video selection at RIE panel.
Switch	As selected	Selects type of video to be processed by special video channel when switch is in LOCAL mode.
VPU INPUT SELECT	CONSLE	Same as special video select for video processor channels A and B.
	LOCAL	
VPU A	As selected	Selects type of video to be processed by video processor channels A and B when SELECT switch is in LOCAL.
VPU B	As selected	
PROCESSED VIDEO		
DISPLAY SELECT	NORMAL	Routes processed video direct to console.
	MANUAL	Allows selection of various points in the radar and IFF processing chains for display in order to verify correct RIE operation or to determine the logic area where a target processing error might be occurring. If tracking programs are not running, the processed video verification checks should be performed with the RIE off-line (RIE II panel RDR/CPU switch OFF-LINE).
Thumbwheel switch	0 thru 15	Selects the point in the processing chain to be displayed when DISPLAY SELECT switch is in MANUAL setting.
	0	= Spare
	1	= Memory video-strobed
	2	= Processed test video
	3	= Processed IFF video
	4	= Processed radar video
	5	= Memory video-test targets

Table 11-10. Radar Interface Equipment Reference Data - Continued

Control	Optional settings	Definition
Thumbwheel switch (cont)	6	= Memory video-all types
	7	= Memory, radar/IFF video-correlated
	8	= Memory video-IFF
	9	= Memory video-radar
	10	= IFF video present
	11	= Target detector threshold
	12	= Target detector start
	13	= Target detector stop
	14	= Quantizer B (high threshold)
	15	= Quantizer A (high threshold)
		Processed video appears as dots at the time a target report is made. Memory video appears as a slash whose duration in azimuth is equal to the time the target word is held in the target processor unit (TPU) memory file. Failure of a selection to be displayed properly indicates that functional area or type of video which is in error.
AUTOMATIC CLUTTER MAPPER		
MODE SELECT	As selected	Determines the order of priorities for ACM selection of video for each range azimuth cell. A = VPU A B = VPU B C = Censor
	A	Use channel A video only, no clutter mapping performed.
	B	Use channel B video only, no clutter mapping performed.
	A/B	Treat channel A as normal video, channel B as MTI video. Map channel A video and, in all range azimuth cells where clutter is detected, gate channel B video to the Target Detector Unit (TDU); otherwise, gate channel A video to the TDU.
	B/A	Treat channel B as normal video, and channel A as MTI video. Map channel B video and, in all range azimuth cells where clutter is detected, gate channel A video to the TDU; otherwise, gate channel B video to the TDU.
	A/C	Map channel A video and, in all range azimuth cells where clutter is detected, censor this video so that no video is passed on to the TDU; otherwise, gate channel A video to the TDU.
	B/C	Map channel B video and, in all range azimuth cells where clutter is detected, censor this video so that no video is passed on to the TDU; otherwise, gate channel B video to the TDU.

Table 11-10. Radar Interface Equipment Reference Data - Continued

Control	Optional settings	Definition
MODE SELECT (cont)	A/BIC	Normally, channel A video is treated as normal video, channel B video is treated as MTI video, and channel A video (normal video) is mapped in all range-azimuth cells. However, if clutter is found in normal video, channel B (MTI) video is used in the clutter range-azimuth cells. Then, if clutter is found in the MTI range-azimuth cells, these cluttered cells are censored and no video is passed on to the TDU.
	B/A/C	Normally, channel B video is treated as normal video, channel A video is treated as MTI video, and channel B video (normal video) is mapped in all range-azimuth cells. However, if clutter is found in normal video, channel A (MTI) video is used in the clutter range-azimuth cells. Then, if clutter is found in the MTI range-azimuth cells, these cluttered cells are censored and no video is passed on to the TDU.
		NOTE **Aircraft having low velocities may remain in a range azimuth cell long enough to cause a clutter decision to be made in that cell to drop the track. This is referred to as the target self mapout problem, and is resolved by reducing the cell dimensions and by artificially restricting the number of hits per beamwidth. The following lists the hits per beamwidth to be expected from respective radar types (additional information concerning the automatic clutter mapper control settings is provided in para 11-36 to aid the operator in resolving the target self mapout problem):**
		Radar type: AN/MPQ-50 PRF: 673 Beamwidth (degrees): 1.8 Antenna speed (RPM): 20 Hits per beamwidth: 12
SAMPLE SCAN	As selected	Should be set to the highest setting possible consistent with an acceptable minimum velocity. The acceptable minimum is just above the velocity at which the target is mapped out by the ACM and is determined by the number of false alarms in a given region due to the amount of clutter buildup. The setting of the SAMPLE/SCAN switch along with the RPM determines the actual cutoff velocity of the target. To determine the setting of the SAMPLE/SCAN switch: a. Be sure map range is properly adjusted (see MAP RANGE below). b. If the map range was not readjusted, press the MAP PER RESET switch to reinitialize the map to cause the mapper to go into a fast buildup mode.

Table 11-10. Radar Interface Equipment Reference Data-Continued

Control	Optional settings	Definition
SAMPLE/SCAN (cont)		c. Set the SAMPLE SCAN switch to 1. d. Using table 11-9, determine the cutoff velocity (average speed of target when positioned at the range specified in the target range column of table 11-8) of the slowest track as follows: (1) Locate the radar parameters (pulse width, beamwidth, and antenna RPM combination) that matches the radar being used. (2) Locate, in the map range column, the map range that corresponds to the maximum map range on the PPI. (3) In the target range column, locate the range, corresponding to the maximum map range, at which it is desired to track the slowest moving targets. (4) Locate, in the cutoff velocity column, the cutoff velocity that corresponds to the selected target range. (This is the slowest speed at which a target can be tracked with the given map/target range.) **NOTE** **Cutoff velocity is directed proportional to antenna speed (for example, if the table antenna speed is 10 rpm and the actual antenna speed is 5 rpm, the listed cutoff velocity must be halved).** (5) Vary the SAMPLE/SCAN switch to obtain the acceptable minimum cutoff velocity. SAMPLE/SCAN setting is directly proportional to cutoff velocity, i.e., double SAMPLE/SCAN; cutoff velocity doubles.
	1/5	Each clutter cell, sample the video one sweep only, one scan out of every five.
	1/4	Each clutter cell, sample the video one sweep only, one scan out of every four.
	1/3	Each clutter cell, sample the video one sweep only, one scan out of every three.
	1/2	Each clutter cell, sample the video one sweep only, one scan out of every two.
	1	Each clutter cell, sample the video one sweep only, every scan.
	2	Each clutter cell, sample the video two sweeps out of every scan.
	3	Each clutter cell, sample the video three sweeps out of every scan.

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Table 11-10. Radar Interface Equipment Reference Data-Continued

Control	Optional settings	Definition
MAP RANGE		
RANGE ADJ	As set	Sets range of ACM map.
DISPLAY ON/OFF	As set	a. Display the PROCESSED VIDEO (MANUAL position 1) on the console PPI. This video line will display slashes for the duration of the targets and strobes when targets are reported out. Simultaneously display the SPECIAL VIDEO channel with the video (usually normal) selected. Set RDR/CPU ON LINE/ OFF LINE (RIE II panel) switch to OFF LINE. b. On the RIE I control panel, press MAP RANGE DISPLAY switch to ON position, and activate M SECT switch. Range ring appears on the PPI scope at the range of the maximum range of the clutter map. **NOTE** **Wait two or three scans after changing the MAP RANGE switches to allow internal RIE resets to clear and target processing to commence before making a final evaluation of the map range setup.** c. Adjust the value of MAP RANGE ADJ thumbwheel octal switches until all processed video outputs and raw video targets, as observed on the PPI scope, are contained within the range ring. The MAP RANGE thumbwheels will be left in the final position chosen. d. Press MAP RANGE DISPLAY switch to OFF position if a range ring display is not desired. e. Set RDR/CPU ON LINE/OFF LINE switch to ON LINE.

11-43. RIE Input Signal Verification. If the RIE fails to aline properly after correct performance of the alinement procedures, the radar input signals should be checked prior to initiating troubleshooting procedures. Tables 11-11 and 11-12 give RIE input signals. For more complete signal information, refer to TM 9-1430-655-20-3 which shows all possible interface signals, their application parameters, location of test points or connector pins where the signals can be checked, and a brief description of what the signals should look like. The signals are grouped by type (videos, triggers, azimuth, etc.) in order to allow elimination of non-suspect signals. To use the table, first determine the types of signals in use for your particular radar. Second, eliminate the signal group(s) which could not possibly affect the setup procedure which failed; if it is impossible to eliminate any signal group, check all signals. Third, locate on the table the appropriate signal group, then the specific signal corresponding to the group and application. Check the signal with the oscilloscope at the indicated test point or connector pin and verify its correctness with the description. If all signals check good, initiate fault isolation procedures in TM 9-1430-655-20-3. Once the RIE is operating, refer to TM 9-1430-652-10-3 for correct operation verification procedure.

11-44. Azimuth Correction Data. Azimuth correction data, used during RIE alinement, is provided in table 11-17.

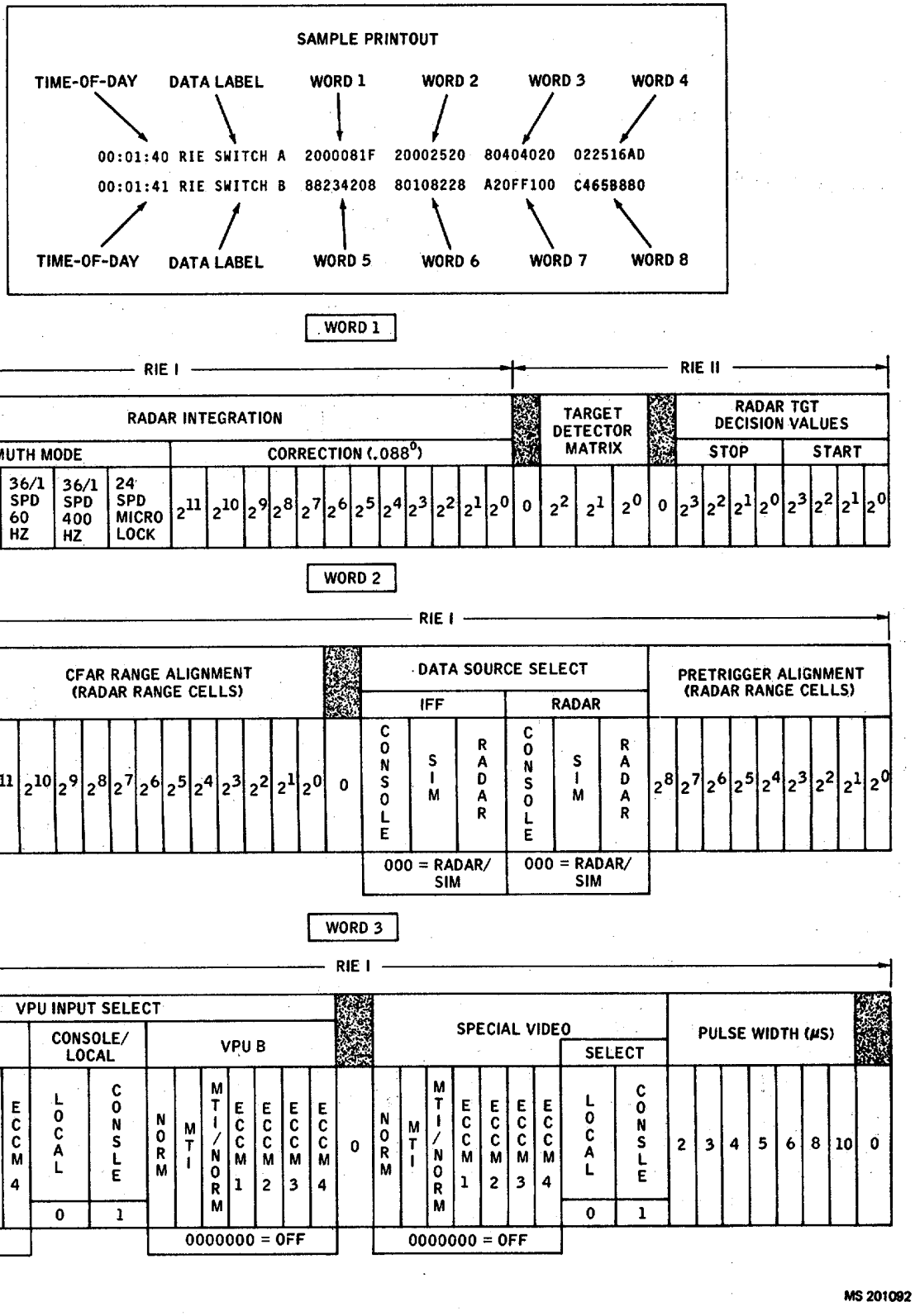

Figure 11-15.RIE Switch Message Conversion (Sheet 1 of 3)

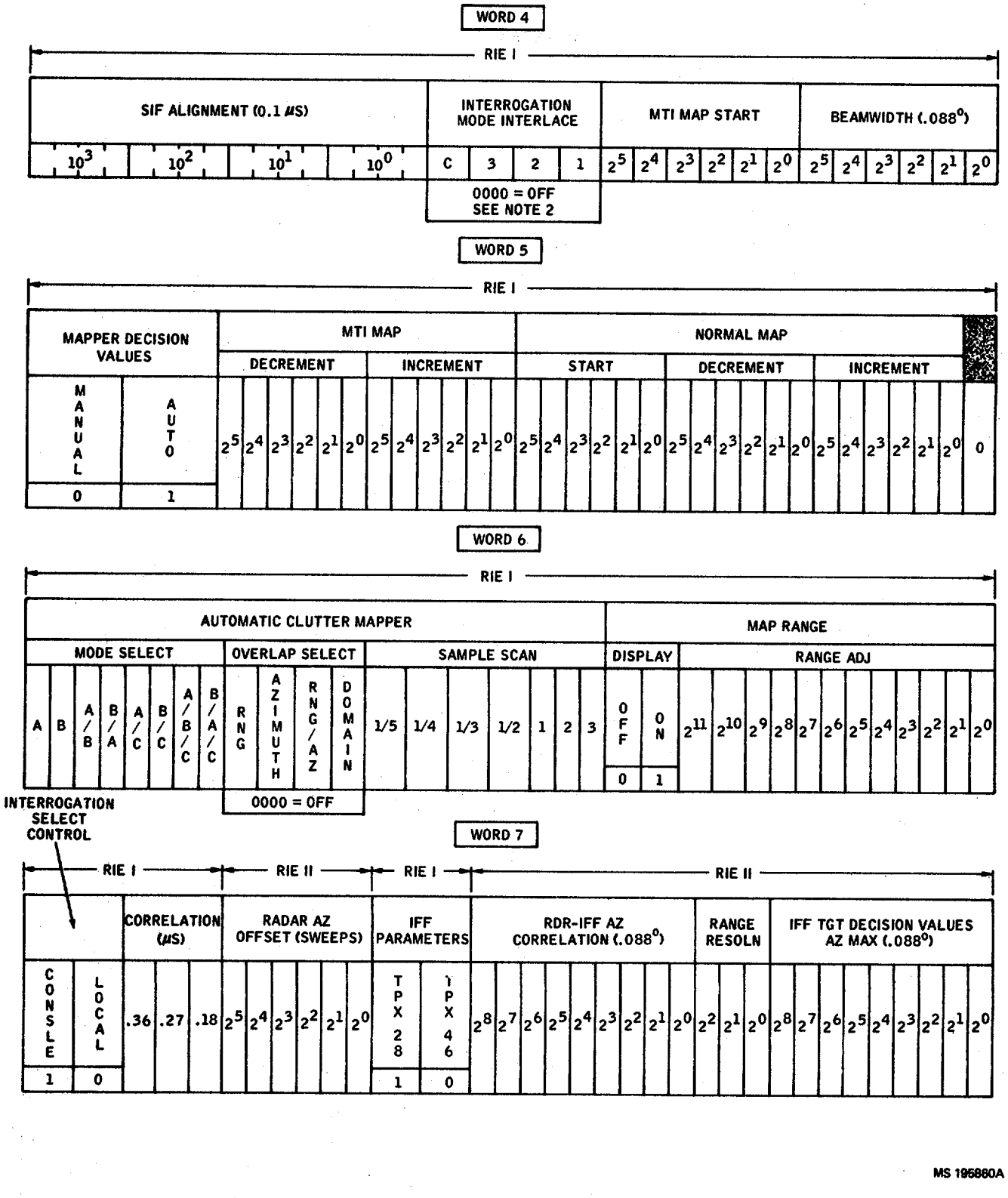

Figure 11-15. RIE Switch Message Conversion (Sheet 1 of 3)

WORD 8

← RIE II →				← RIE I →		← RIE II →		← RIE I →						← RIEII →																							
JAM DETECTOR THRESHOLD				PROCESSED VIDEO DISPLAY SELECT		JAM DETECTOR		PROCESSED VIDEO DISPLAY SELECT				QUANTIZERS AND CFAR VPU A		IFF TGT DECISION VALUES AZ MIN (.088°)						QUANTIZERS AND CFAR VPU B		IFF TGT DECISION VALUES MISS (SWEEPS)				RADAR TGT DECISION VALUES											
																										MIN WIDTH (.088°)							MISS (SWEEPS)				
2^3	2^2	2^1	2^0	NORMAL	MANUAL	ON	OFF	2^3	2^2	2^1	2^0	AUTO	MANUAL	2^5	2^4	2^3	2^2	2^1	2^0	AUTO	MANUAL	2^2	2^1	2^0	0	2^5	2^4	2^3	2^2	2^1	2^0	0	2^2	2^1	2^0		
				1	0	0	1					0	1							0	1																

EXAMPLE - WORD 4

5281AED2 - WHEN CONVERTED TO BINARY CORRESPONDS TO THE FOLLOWING SWITCH SETTINGS.

SIF ALIGNMENT (0.1US) = 5281
MODE INTERLACE = 2, C
MTI MAP START = 73 **(OCTAL)**
BEAMWIDTH (.088°) = 22 **(OCTAL)**

NOTES:

1. UNLESS OTHERWISE SPECIFIED, A 1 APPEARING IN THE BIT POSITION INDICATES THE SWITCH IS SET TO THE CORRESPONDING VALUE APPEARING IN THE FORMAT.
2. **THIS SWITCH CAN HAVE MORE THAN ONE BIT SET.**
3. THIS MESSAGE IS IN HEXADECIMAL AND MUST BE CONVERTED TO BINARY IN ORDER TO DETERMINE SWITCH SETTINGS.
4. **REFER TO TM 9-1430-652-10-6 FOR HEXADECIMAL TO BINARY CONVERSION TABLE.**

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Figure 11-15. RIE Switch/Message Conversion (Sheet 3 of 3)

RIE LOOP MESSAGE

hh: mm: ss <RIE LOOP> CCCC MN 'AMPLIFYING MESSAGE'
HHHHHHHH

FIELD DEFINITIONS:

hh: mm: ss = TIME OF DAY IN HOURS:MINUTES:SECONDS OF EVENT OCCURRENCE.

CCCC = THIS FOUR CHARACTER FIELD REPRESENTS THE ERROR SEVERITY CODE AS FOLLOWS:
INFO = INFORMATION
WARN = WARNING
ERR = ERROR
SEV = SEVERE ERROR
NOTE:
REFERENCE TM 9-1430-655-20-1 (TABLE 4-2)

MN = THIS FIELD IS THE MESSAGE NUMBER USED FOR REFERENCE PURPOSES.

AMPLIFYING MESSAGE AND CORRESPONDING MESSAGE NUMBER AS FOLLOWS:

01	RADAR TARGET MISSING
02	IFF TARGET MISSING
04	RADAR/IFF CORRELATION FAILURE
05	AZIMUTH DATA ERROR
06	RANGE DATA ERROR
07	IFF DATA ERROR
08	MODE C DATA ERROR
09	TPS-43 HEIGHT ERROR
10	TPS43 AZIMUTH ERROR
11	TPS43RANGE ERROR
12	RIE DEVICE TIMEOUT
13	TPS43 HEIGHT REPORT MISSING
14	SPURIOUS RADAR REPORTS
15	SPURIOUS IFF REPORTS
16	SPURIOUS HEIGHT REPORTS
20	VSU DEVICE TIMEOUT
21	VSU INTERNAL FAILURE
22	VSU INTERFACE FAILURE
23	VSU 110 ERROR
24	VSU AUTO OUTPUT INCOMPLETE
30	NO ANTENNA ROTATION
31	SLOW ANTENNA ROTATION
32	NO RADAR TRIGGER
33	NO IFF TRIGGER
34	RIE SWITCHES INCORRECT
40	COMMAND INHIBIT
41	TEST INHIBITED
42	VSU SWITCHES INCORRECT

H H H H H H H H THIS FIELD REPRESENTS AN EIGHT-DIGIT NUMBER GIVING A SCAN BY SCAN ERROR HISTORY; THE LEAST SIGNIFICANT DIGIT (RIGHTMOST) IS THE ONE WHICH OCCURRED ON THE MOST RECENT SCAN; THE ALPHA 'X' OCCURRING IN ANY COLUMN INDICATES THAT THERE ARE MORE THAN NINE ERRORS IN THE SCAN.

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Figure 11-16. RIE Loop Test/Message

**Pages 11-75/(11-76 blank) thru 1 1-95/(1 1-96 blank),
Including figures 11-17 thru 11-25, deleted**

Table 11-11. Radar Interface Equipment Input Signal Verification

Signal group	Application	Signal name	Card 1A1A1A6	TP	Conn pin	Description
Radar Videos		Normal	A1210	23		2v to 15v peak; signal-to-noise ratio 3:1 or better; correct pulse width per radar. Be sure no excessive noise spikes or video baseline ripple is present.
		MTI	A1210	24		
Videos		ECCM 1	A1212	23		
		ECCM 2	A1212	24		
		ECCM 3	A1322	23		
		ECCM 4	A1322	24		
Sim Videos		Normal	A1208	23		
		MTI	A1208	24		
Radar Triggers		R_o	A1123	2		4v to 100v; no jitter, no overshoot; correct PRF per radar.
		Pretrigger	A1123	1		
		Triggers				
	AN/TPS-32	Livetime	A1218	1		
AN/TPS-43		Go pulse	A1208	4		
Height		500 ft	A1210	3		
		1,000 ft	A1210	2		
		2,000 ft	A1210	1		
		4,000 ft	A1210	4		4v to 100v.
		8,000 ft	A1212	3		
		16,000 ft	A1212	2		
		32,000 ft	A1212	1		
		64,000 ft	A1212	4		
AN/TPS-32	From radar	Data Word 1	A1208	3		333 (±18) kHz; 26-bit word length;
Data and control		Data Word 2	A1208	2		true level = -1.6 (± 0.6)v;
		Data Word 3	A1208	1		false level = -6.2 (±0.6)v.
		Clock	A1219		3	333 kHz: pulse width = 210 ns; true level =-2.8 (±0.3)v; false level = +0.2 (±0.3)v.
		Data Request	A1219		24	3 µs. pulse; true level = -1.1 (± 0.2)v; false level = -6.2 to 0.6v.
Azimuth from synchros	24-speed and	24 x S1	A1320		26	Voltage level line to line = 90 vac.
	micro-lock	24 x S2	A1320		17	
	(115v ref)	24 x S3	A1320		21	

Table 11-11. Radar Interface Equipment Input Signal Verification-Continued

Signal group	Application	Signal name	Card 1A1A1A6	TP	Conn pin	Description
Azimuth from synchros (cont)		115v ref	A1320		13	referenced to pin 1
		Micro-lock	A1219		5	Micro-lock switch closes at north. Signal either +27V or ground. Coincides with 24 x 0 degrees at north only.

Table 11-11. Radar Interface Equipment Input Signal Verification-Continued

Signal group	Application	Signal name	Card 1A1A1A6	TP	Conn pin	Description
Azimuth from synchros (cont)	36/1-speed 400 Hz or 36/1-speed 60 Hz (115v ref)	1 x S1	A1320		14	Voltage level line to line = 90 vac.
		1 x S2	A1320		3	
		1 x S3	A1320		6	
		36 x S1	A1320		26	Voltage level line to line = 90 vac.
		36 x S2	A1320		17	
		36 x S3	A1320		21	
		115v ref	A1320		13	referenced to pin 1
Azimuth from resolver	4 kHz	Cos S1	A1320		18	Voltage level line to line = 23 vac. Voltage level relative to 70 vac reference.
		Sin S2	A1320		10	
		Cos S3	A1320		20	
		Sin S4	A1320		9	
		Ref	A1320		22	referenced to pin 23
Azimuth Change Pulse (ACP) 's	AN/TPS-43 or other	ANP	A1322	2		4096 pulses per 360° scan; positive going pulses, 4-100v peak; pulse width from 2 μs to 50% duty cycle.
		ACP	A1322	1		
	AN/TPS-32	ANP	A1218	2		pulse width 4-8 μs true level = -6.2 (±0.6)v
		ACP	A1218	3		pulse width 4-5 μs false level = -1.6 (±0.6)v 512 ACP pulses per 360° scan.
IFF	Mode enables (to interrogator)	Mode 1	A1124	2		Enable-ground; not enabled = open
		Mode 2	A1124	4		AN/TPX-46: only one mode at range 0. Unless mode C which must be accompanied by either mode 1, 2 or 3
		Mode 3	A1124	6		
		Mode 4	A1124	5		AN/TPX-28: may have two modes enabled at once.
		Mode C	A1124	3		
	From AN/TPX-46	Challenge Indicator	A1123	8		True level = ground False level = open
	To AN/TPX-46	Challenge Request	A1124		34	True level = ground False level = open

Table 11-11. Radar Interface Equipment Input Signal Verification-Continued

Signal group	Application	Signal name	Card 1A1A1A6	TP	Conn pin	Description
IFF (cont)	Video	Mode 4	A1123	23		AN/TPX-46: 3v-5v levels 0.45 μs
		SIF	A1123	24		AN/TPX-28: pulse 1.5v-3v levels width
		Trigger	A1124	8		8.5 (±3.5)v pulse once per IFF sweep.
	AN/TPX-28	Mode tags	A1124	7		8.5 (± 3.5)v pulses, 0.8 (± 0.1) ,μs width; coincident with rf transmission; spacing indicates mode.

Table 11-12. Radar Junction Box Adjustments and Test Points for Trigger/Video and ANP/ACP Data

	Configuration		Adjustments				
No.	(Radar type)	Sig	Scope sync (TP15)	Buffer no.1 (R20)	Buffer no.2 (R2)	Video (R34)	Unused cards
1	AN/GSS-1, -7	IFF Pretrigger	A2	A2, A3	-	A5	A1 A4 A6
		Radar (R_o)	A5	A5	---	A8	A7
2	AN/MPQ-50 Dedicated	IFF Pretrigger	A2	A2, A3	---	A5	A1 A4 A6
		Radar (R_o)	A5	A5	A7, A8	A8	
3	AN/MPQ-50 Hawk	IFF Pretrigger	A2	A2, A3	---	A5	A1 A4 A6
		Radar (R_o)	A5	A5	A7, A8	A8	
4	Deleted						
5	Deleted						
6	Deleted						
7	AN/TPS-43, Dedicated	IFF Pretrigger	A2	A2, A3	---	A5	None
		Radar (R_o)	A5	A5, A7, A8	A1-A8	A6, A7, A8	

Pages 11-101/(11-102 blank) thru 11-117/(11-118 blank) Including tables 11-13 thru 11-16, deleted

Table 11-17. Azimuth Correction Data

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
0.1	1.7778	1	5.1	90.6667	72
0.2	3.5556	2	5.2	92.4444	73
0.3	5.3333	3	5.3	94.2222	74
0.4	7.1111	4	5.4	96.0000	75
0.5	8.8889	5	5.5	97.7778	76
0.6	10.6667	6	5.6	99.5556	77
0.7	12.4444	7	5.7	101.3333	100
0.8	14.2222	11	5.8	103.1111	101
0.9	16.0000	12	5.9	104.8889	103
1.0	17.7778	13	6.0	106.6667	104
1.1	19.5556	14	6.1	108.4444	105
1.2	21.3333	15	6.2	110.2222	106
1.3	23.1111	16	6.3	112.0000	107
1.4	24.8889	17	6.4	113.7778	110
1.5	26.6667	21	6.5	115.5556	111
1.6	28.4444	22	6.6	117.3333	113
1.7	30.2222	23	6.7	119.1111	114
1.8	32.0000	24	6.8	120.8889	115
1.9	33.7778	25	6.9	122.6667	116
2.0	35.5556	26	7.0	124.4444	117
2.1	37.3333	27	7.1	126.2222	120
2.2	39.1111	31	7.2	128.0000	121
2.3	40.8889	32	7.3	129.7778	123
2.4	42.6667	33	7.4	131.5556	124
2.5	44 4444	34	7.5	133.3333	125
2.6	46.2222	35	7.6	135.1111	126
2.7	48.0000	36	7.7	136.8889	127
2.8	49.7778	37	7.8	138.6667	130
2.9	51.5556	40	7.9	140.4444	131
3.0	53.3333	42	8.0	142.2222	133
3.1	55.1111	43	8.1	144.0000	134
3.2	56.8889	44	8.2	145.7778	135
3.3	58.6667	45	8.3	147.5556	136
3.4	60.4444	46	8.4	149.3333	137
3.5	62.2222	47	8.5	151.1111	140
3.6	64.0000	50	8.6	152.8889	141
3.7	65.7778	52	8.7	154.6667	142
3.8	67.5556	53	8.8	156.4444	144
3.9	69.3333	54	8.9	158.2222	145
4.0	71.1111	55	9.0	160.0000	146
4.1	72.8889	56	9.1	161.7778	147
4.2	74.6667	57	9.2	163.5556	150
4.3	76.4444	60	9.3	165.3333	151
4.4	78.2222	62	9.4	167.1111	152
4.5	80.0000	63	9.5	168.8889	154
4.6	81.7778	64	9.6	170.6667	155
4.7	83.5556	65	9.7	172.4444	156
4.8	85.3333	66	9.8	174.2222	157
4.9	87.1111	67	9.9	176.0000	160
5.0	88.8889	70	100	177.7778	161

Table 11-17. Azimuth Correction Data-Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
10.1	179.5556	162	15.1	268.4444	253
10.2	181.3333	164	15.2	270.2222	254
10.3	183.1111	165	15.3	272.0000	256
10.4	184.8889	166	15.4	273.7778	257
10.5	186.6667	167	15.5	275.5556	260
10.6	188.4444	170	15.6	277.3333	261
10.7	190.2222	171	15.7	279.1111	262
10.8	192.0000	172	15.8	280.8889	263
10.9	193.7778	174	15.9	282.6667	264
11.0	195.5556	175	16.0	284.4444	266
11.1	197.3333	176	16.1	286.2222	267
11.2	199.1111	177	16.2	288.0000	270
11.3	200.8889	200	16.3	289.7778	271
11.4	202.6667	201	16.4	291.5556	272
11.5	204.4444	202	16.5	293.3333	273
11.6	206.2222	203	16.6	295.1111	274
11.7	208.0000	205	16.7	296.8889	276
11.8	209.7778	206	16.8	298.6667	277
11.9	211.5556	207	16.9	300.4444	300
12.0	213.3333	210	17.0	302.2222	301
12.1	215.1111	211	17.1	304.0000	302
12.2	216.8889	212	17.2	305.7778	303
12.3	218.6667	213	17.3	307.5556	304
12.4	220.4444	215	17.4	309.3333	305
12.5	222.2222	216	17.5	311.1111	307
12.6	224.0000	217	17.6	312.8889	310
12.7	225.7778	220	17.7	314.6667	311
12.8	227.5556	221	17.8	316.4444	312
12.9	229.3333	222	17.9	318.2222	313
13.0	231.1111	223	18.0	320.0000	314
13.1	232.8889	225	18.1	321.7778	315
13.2	234.6667	226	18.2	323.5556	317
13.3	236.4444	227	18.3	325.3333	320
13.4	238.2222	230	18.4	327.1111	321
13.5	240.0000	231	18.5	328.8889	322
13.6	241.7778	232	18.6	330.6667	323
13.7	243.5556	233	18.7	332.4444	324
13.8	245.3333	235	18.8	334.2222	325
13.9	247.1111	236	18.9	336.0000	327
14.0	248.8889	237	19.0	337.7778	330
14.1	250.6667	240	19.1	339.5556	331
14.2	252.4444	241	19.2	341.3333	332
14.3	254.2222	242	19.3	343.1111	333
14.4	256.0000	243	19.4	344.8889	334
14.5	257.7778	244	19.5	346.6667	335
14.6	259.5556	246	19.6	348.4444	337
14.7	261.3333	247	19.7	350.2222	340
14.8	263.1111	250	19.8	352.0000	341
14.9	264.8889	251	19.9	353.7778	342
15.0	266.6667	252	20.0	355.5556	343

Table 11-17. Azimuth Correction Data-Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
20.1	357.3333	344	25.1	446.2222	435
20.2	359.1111	345	25.2	448.0000	436
20.3	360.8889	346	25.3	449.7778	437
20.4	362.6667	350	25.4	451.5556	440
20.5	364.4444	351	25.5	453.3333	442
20.6	366.2222	352	25.6	455.1111	443
20.7	368.0000	353	25.7	456.8889	444
20.8	369.7778	354	25.8	458.6667	445
20.9	371.5556	355	25.9	460.4444	446
21.0	373.3333	356	26.0	462.2222	447
21.1	375.1111	360	26.1	464.0000	450
21.2	376.8889	361	26.2	465.7778	452
21.3	378.6667	362	26.3	267.5556	453
21.4	380.4444	363	26.4	469.3333	454
21.5	382.2222	364	26.5	471.1111	455
21.6	384.0000	365	26.6	472.8889	456
21.7	385.7778	366	26.7	474.6667	457
21.8	387.5556	370	26.8	476.4444	460
21.9	389.3333	371	26.9	478.2222	462
22.0	391.1111	372	27.0	480.0000	463
22.1	392.8889	373	27.1	481.7778	464
22.2	394.6667	374	27.2	483.5556	465
22.3	396.4444	375	27.3	485.3333	466
22.4	398.2222	376	27.4	487.1111	467
22.5	400.0000	400	27.5	488.8889	470
22.6	401.7778	401	27.6	490.6667	472
22.7	403.5556	402	27.7	492.4444	473
22.8	405.3333	403	27.8	494.2222	474
22.9	407.1111	404	27.9	496.0000	475
23.0	408.8889	405	28.0	497.7778	476
23.1	410.6667	406	28.1	499.5556	477
23.2	412.4444	407	28.2	501.3333	500
23.3	414.2222	411	28.3	503.1111	501
23.4	416.0000	412	28.4	504.8889	503
23.5	417.7778	413	28.5	506.6667	504
23.6	419.5556	414	28.6	508.4444	505
23.7	421.3333	415	28.7	510.2222	506
23.8	423.1111	416	28.8	512.0000	507
23.9	424.8889	417	28.9	513.7778	510
24.0	426.6667	421	29.0	515.5556	511
24.1	428.4444	422	29.1	517.3333	513
24.2	430.2222	423	29.2	519.1111	514
24.3	432.0000	424	29.3	520.8889	515
24.4	433.7778	425	29.4	522.6667	516
24.5	435.5556	426	29.5	524.4444	517
24.6	437.3333	427	29.6	526.2222	520
24.7	439.1111	431	29.7	528.0000	521
24.8	440.8889	432	29.8	529.7778	523
24.9	442.6667	433	29.9	531.5556	524
25.0	444.4444	434	30.0	533.3333	525

Table 11-17. Azimuth Correction Data- Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
30.1	535.1111	526	35.1	624.0000	617
30.2	536.8889	527	35.2	625.7778	620
30.3	538.6667	530	35.3	627.5556	621
30.4	540.4444	531	35.4	629.3333	622
30.5	542.2222	533	35.5	631.1111	623
30.6	544.0000	534	35.6	632.8889	625
30.7	545.7778	535	35.7	634.6667	626
30.8	547.5556	536	35.8	636.4444	627
30.9	549.3333	537	35.9	638.2222	630
31.0	551.1111	540	36.0	640.0000	631
31.1	552.8889	541	36.1	641.7778	632
31.2	554.6667	542	36.2	643.5556	633
31.3	556.4444	544	36.3	645.3333	635
31.4	558.2222	545	36.4	647.1111	636
31.5	560.0000	546	36.5	648.8889	637
31.6	561.7778	547	36.6	650.6667	640
31.7	563.5556	550	36.7	652.4444	641
31.8	565.3333	551	36.8	654.2222	642
31.9	567.1111	552	36.9	656.0000	643
32.0	568.8889	554	37.0	657.7778	644
32.1	570.6667	555	37.1	659.5556	646
32.2	572.4444	556	37.2	661.3333	647
32.3	574.2222	557	37.3	663.1111	650
32.4	576.0000	560	37.4	664.8889	651
32.5	577.7778	561	37.5	666.6667	652
32.6	579.5556	562	37.6	668.4444	653
32.7	581.3333	564	37.7	670.2222	654
32.8	583.1111	565	37.8	672.0000	656
32.9	584.8889	566	37.9	673.7778	657
33.0	586.6667	567	38.0	675.5556	660
33.1	588.4444	570	38.1	677.3333	661
33.2	590.2222	571	38.2	679.1111	662
33.3	592.0000	572	38.3	680.8889	663
33.4	593.7778	574	38.4	682.6667	664
33.5	595.5556	575	38.5	684.4444	666
33.6	597.3333	576	38.6	686.2222	667
33.7	599.1111	577	38.7	688.0000	670
33.8	600.8889	600	38.8	689.7778	671
33.9	602.6667	601	38.9	691.5556	672
34.0	604.4444	602	39.0	693.3333	67q.
34.1	606.2222	603	39.1	695.1111	674
34.2	608.0000	605	39.2	696.8889	676
34.3	609.7778	606	39.3	698.6667	677
34.4	611.5556	607	39.4	700.4444	700
34.5	613.3333	610	39.5	702.2222	701
34.6	615.1111	611	39.6	704.0000	702
34.7	616.8889	612	39.7	705.7778	703
34.8	618.6667	613	39.8	707.5556	704
34.9	620.4444	615	39.9	709.3333	705
35.0	622.2222	616	40.0	711.1111	707

Table 11-17. Azimuth Correction Data-Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
40.1	712.8889	710	45.1	801.7778	1001
40.2	714.6667	711	45.2	803.5556	1002
40.3	716.4444	712	45.3	805.3333	1003
40.4	718.2222	713	45.4	807.1111	1004
40.5	720.0000	714	45.5	808.8889	1005
40.6	721.7778	715	45.6	810.6667	1006
40.7	723.5556	717	45.7	812.4444	1007
40.8	725.3333	720	45.8	814.2222	1011
40.9	727.1111	721	45.9	816.0000	1012
41.0	728.8889	722	46.0	817.7778	1013
41.1	730.6667	723	46.1	819.5556	1014
41.2	732.4444	724	46.2	821.3333	1015
41.3	734.2222	725	46.3	823.1111	1016
41.4	736.0000	727	46.4	824.8889	1017
41.5	737.7778	730	46.5	826.6667	1021
41.6	739.5556	731	46.6	828.4444	1022
41.7	741.3333	732	46.7	830.2222	1023
41.8	743.1111	733	46.8	832.0000	1024
41.9	744.8889	734	46.9	833.7778	1025
42.0	746.6667	735	47.0	835.5556	1026
42.1	748.4444	737	47.1	837.3333	1027
42.2	750.2222	740	47.2	839.1111	1031
42.3	752.0000	741	47.3	840.8889	1032
42.4	753.7778	742	47.4	842.6667	1033
42.5	755.5556	743	47.5	844.4444	1034
42.6	757.3333	744	47.6	846.2222	1035
42.7	759.1111	745	47.7	848.0000	1036
42.8	760.8889	746	47.8	849.7778	1037
42.9	762.6667	750	47.9	851.5556	1040
43.0	764.4444	751	48.0	853.3333	1042
43.1	766.2222	752	48.1	855.1111	1043
43.2	768.0000	753	48.2	856.8889	1044
43.3	769.7778	754	48.3	858.6667	1045
43.4	771.5556	755	48.4	860.4444	1046
43.5	773.3333	756	48.5	862.2222	1047
43.6	775.1111	760	48.6	864.0000	1050
43.7	776.8889	761	48.7	865.7768	1052
43.8	778.6667	762	48.8	867.5556	1053
43.9	780.4444	763	48.9	869.3333	1054
44.0	782.2222	764	49.0	871.1111	1055
44.1	784.0000	765	49.1	872.8889	1056
44.2	785.7778	766	49.2	874.6657	1057
44.3	787.5556	770	49.3	876.4444	1060
44.4	789.3333	771	49.4	878.2222	1062
44.5	791.1111	772	49.5	880.0000	1063
44.6	792.8889	773	49.6	881.7778	1064
44.7	794.6667	774	49.7	883.5556	1065
44.8	796.4444	775	49.8	885.3333	1066
44.9	798.2222	776	49.9	887.1111	1067
45.0	800.0000	1000	50.0	888.8889	1070

Table 11-17. Azimuth Correction Data-Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
50.1	890.6667	1072	55.1	979.5556	1162
50.2	892.4444	1073	55.2	981.3333	1164
50.3	894.2222	1074	55.3	983.1111	1165
50.4	896.0000	1075	55.4	984.8889	1166
50.5	897.7778	1076	55.5	986.6667	1167
50.6	899.5556	1077	55.6	988.4444	1170
50.7	901.3333	1100	55.7	990.2222	1171
50.8	903.1111	1101	55.8	992.0000	1172
50.9	904.8889	1103	55.9	993.7778	1174
51.0	906.6667	1104	56.0	995 5556	1175
51.1	908.4444	1105	56.1	997.3333	1176
51.2	910.2222	1106	56.2	999.1111	1177
51.3	912.0000	1107	56.3	1000.8889	1200
51.4	913.7778	1110	56.4	1002.6667	1201
51.5	915.5556	1111	56.5	1004.4444	1202
51.6	917.3333	1113	56.6	1006.2222	1203
51.7	919.1111	1114	56.7	1008.0000	1205
51.8	920.8889	1115	56.8	1009.7778	1206
51.9	922.6667	1116	56.9	1011.5556	1207
52.0	924.4444	1117	57.0	1013.3333	1210
52.1	926.2222	1120	57.1	1015.1111	1211
52.2	928.0000	1121	57.2	1016.8889	1212
52.3	929.7778	1123	57.3	1018.6667	1213
52.4	931.5556	1124	57.4	1020.4444	1215
52.5	933.3333	1125	57.5	1022.2222	1216
52.6	935.1111	1126	57.6	1024.0000	1217
52.7	936.8889	1127	57.7	1025.7778	1220
52.8	938.6667	1130	57.8	1027.5556	1221
52.9	940.4444	1131	57.9	1029.3333	1222
53.0	942.2222	1133	58.0	1031.1111	1223
53.1	944.0000	1134	58.1	1032.8889	1225
53.2	945.7778	1135	58.2	1034.6667	1226
53.3	947.5556	1136	58.3	1036.4444	1227
53.4	949.3333	1137	58.4	1038.2222	1230
53.5	951.1111	1140	58.5	1040.0000	1231
53.6	952.8889	1141	58.6	1041.7778	1232
53.7	954.6667	1142	58.7	1043.5556	1233
53.8	956.4444	1144	58.8	1045.3333	1235
53.9	958.2222	1145	58.9	1047.1111	1236
54.0	960.0000	1146	59.0	1048.8889	1237
54.1	961.7778	1147	59.1	1050.6667	1240
54.2	963.5556	1150	59.2	1052.4444	1241
54.3	965.3333	1151	59.3	1054.2222	1242
54.4	967.1111	1152	59.4	1056.0000	1243
54.5	968.8889	1154	59.5	1057.7778	1244
54.6	970.6667	1155	59.6	1059.5556	1246
54.7	972.4444	1156	59.7	1061.3333	1247
54.8	974.2222	1157	59.8	1063.1111	1250
54.9	976.0000	1160	59.9	1064.8889	1251
55.0	977.7778	1161	60.0	1066.6667	1252

Table 11-17. Azimuth Correction Data-Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
60.1	1068.4444	1253	65.1	1157.3333	1344
60.2	1070.2222	1254	65.2	1159.1111	1345
60.3	1072.0000	1256	65.3	1160.8889	1346
60.4	1073.7778	1257	65.4	1162.6667	1350
60.5	1075.5556	1260	65.5	1164.4444	1351
60.6	1077.3333	1261	65.6	1166.2222	1352
60.7	1079.1111	1262	65.7	1168.0000	1353
60.8	1080.8889	1263	65.8	1169.7778	1354
60.9	1082.6667	1264	65.9	1171.5556	1355
61.0	1084.4444	1266	66.0	1173.3333	1356
61.1	1086.2222	1267	66.1	1175.1111	1360
61.2	1088.0000	1270	66.2	1176.8889	1361
61.3	1089.7778	1271	66.3	1178.6667	1362
61.4	1091.5556	1272	66.4	1180.4444	1363
61.5	1093.3333	1273	66.5	1182.2222	1364
61.6	1095.1111	1274	66.6	1184.0000	1365
61.7	1096.8889	1276	66.7	1185.7778	1366
61.8	1098.6667	1277	66.8	1187.5556	1370
61.9	1100.4444	1300	66.9	1189.3333	1371
62.0	1102.2222	1301	67.0	1191.1111	1372
62.1	1104.0000	1302	67.1	1192.8889	1373
62.2	1105.7778	1303	67.2	1194.6667	1374
62.3	1107.5556	1304	67.3	1196.4444	1375
62.4	1109.3333	1305	67.4	1198.2222	1376
62.5	1111.1111	1307	67.5	1200.0000	1400
62.6	1112.8889	1310	67.6	1201.7778	1401
62.7	1114.6667	1311	67.7	1203.5556	1402
62.8	1116.4444	1312	67.8	1205.8333	1403
62.9	1118.2222	1313	67.9	1207.1111	1404
63.0	1120.0000	1314	68.0	1208.8889	1405
63.1	1121.7778	1315	68.1	1210.6667	1406
63.2	1123.5556	1317	68.2	1212.4444	1407
63.3	1125.3333	1320	68.3	1214.2222	1411
63.4	1127.1111	1321	68.4	1216.0000	1412
63.5	1128.8889	1322	68.5	1217.7778	1413
63.6	1130.6667	1323	68.6	1219.5556	1414
63.7	1132.4444	1324	68.7	1221.3333	1415
63.8	1134.2222	1325	68.8	1223.1111	1416
63.9	1136.0000	1327	68.9	1224.8889	1417
64.0	1137.7778	1330	69.0	1226.6667	1421
64.1	1139.5556	1331	69.1	1228.4444	1422
64.2	1141.3333	1332	69.2	1230.2222	1423
64.3	1143.1111	1333	69.3	1232.0000	1424
64.4	1144.8889	1334	69.4	1233.7778	1425
64.5	1146.6667	1335	69.5	1235.5556	1426
64.6	1148.4444	1337	69.6	1237.3333	1427
64.7	1150.2222	1340	69.7	1239.1111	1431
64.8	1152.0000	1341	69.8	1240.8889	1432
64.9	1153.7778	13421	69.9	1242.6667	1433
65.0	1155.5556	1343	70.0	1244.4444	1434

Table 11-17. Azimuth Correction Data-Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
70.1	1246.2222	1435	75.1	1335.1111	1526
70.2	1248.0000	1436	75.2	1336.8889	1527
70.3	1249.7778	1437	75.3	1338.6667	1530
70.4	1251.5556	1440	75.4	1340.4444	1531
70.5	1253.3333	1442	75.5	1342.2222	1533
70.6	1255.1111	1443	75.6	1344.0000	1534
70.7	1256.8889	1444	75.7	1345.7778	1535
70.8	1258.6667	1445	75.8	1347.5556	1536
70.9	1260.4444	1446	75.9	1349.3333	1537
71.0	1262.2222	1447	76.0	1351.1111	1540
71.1	1264.0000	1450	76.1	1352.8889	1541
71.2	1265.7778	1452	76.2	1354.6667	1542
71.3	1267.5556	1453	76.3	1356.4444	1544
71.4	1269.3333	1454	76.4	1358.2222	1545
71.5	1271.1111	1455	76.5	1360.0000	1546
71.6	1272.8889	1456	76.6	1361.7778	1547
71.7	1274.6667	1457	76.7	1363.5556	1550
71.8	1276.4444	1460	76.8	1365.3333	1551
71.9	1278.2222	1462	76.9	1367.1111	1552
72.0	1280.0000	1463	77.0	1368.8889	1554
72.1	1281.7778	1464	77.1	1370.6667	1555
72.2	1283.5556	1465	77.2	1372.4444	1556
72.3	1285.3333	1466	77.3	1374.2222	1557
72.4	1287.1111	1467	77.4	1376.0000	1560
72.5	1288.8889	1470	77.5	1377.7778	1561
72.6	1290.6667	1472	77.6	1379.5556	1562
72.7	1292.4444	1473	77.7	1381.3333	1564
72.8	1294.2222	1474	77.8	1383.1111	1565
72.9	1296.0000	1475	77.9	1384.8889	1566
73.0	1297.7778	1476	78.0	1386.6667	1567
73.1	1299.5556	1477	78.1	1388.4444	1570
73.2	1301.3333	1500	78.2	1390.2222	1571
73.3	1303.1111	1501	78.3	1392.0000	1572
73.4	1304.8889	1503	78.4	1393.7778	1574
73.5	1306.6667	1504	78.5	1395.5556	1575
73.6	1308.4444	1505	78.6	1397.3333	1576
73.7	1310.2222	1506	78.7	1399.1111	1577
73.8	1312.0000	1507	78.8	1400.8889	1600
73.9	1313.7778	1510	78.9	1402.6667	1601
74.0	1315.5556	1511	79.0	1404.4444	1602
74.1	1317.3333	1513	79.1	1406.2222	1603
74.2	1319.1111	1514	79.2	1408.0000	1605
74.3	1320.8889	1515	79.3	1409.7778	1606
74.4	1322.6667	1516	79.4	1411.5556	1607
74.5	1324.4444	1517	79.5	1413.3333	1610
74.6	1326.2222	1520	79.6	1415.1111	1611
74.7	1328.0000	1521	79.7	1416.8889	1612
74.8	1329.7778	1523	79.8	1418.6667	1613
74.9	1331.5556	1524	79.9	1420.4444	1615
75.0	1333.3333	1525	80.0	1422.2222	1616

Table 11-17. Azimuth Correction Data-Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
80.1	1424.0000	1617	85.1	1512.8889	1710
80.2	1425.7778	1620	85.2	1514.6667	1711
80.3	1427.5556	1621	85.3	1516.4444	1712
80.4	1429.3333	1622	85.4	1518.2222	1713
80.5	1431.1111	1623	85.5	1520.0000	1714
80.6	1432.8889	1625	85.6	1521.7778	1715
80.7	1434.6667	1626	85.7	1523.5556	17?7
80.8	1436.4444	1627	85.8	1525.3333	1720
80.9	1438.2222	1630	85.9	1527.1111	1721
81.0	1440.0000	1631	86.0	1528.8889	1722
81.1	1441.7778	1632	86.1	1530.6667	1723
81.2	1443.5556	1633	86.2	1532.4444	1724
81.3	1445.3333	1635	86.3	1534.2222	1725
81.4	1447.1111	1636	86.4	1536.0000	1727
81.5	1448.8889	1637	86.5	1537.7778	1730
81.6	1450.6667	1640	86.6	1539.5556	1731
81.7	1452.4444	1641	86.7	1541.3333	1732
81.8	1454.2222	1642	86.8	1543.1111	1733
81.9	1456.0000	1643	86.9	1544.8889	1734
82.0	1457.7778	1644	87.0	1546.6667	1735
82.1	1459.5556	1646	87.1	1548.4444	1737
82.2	1461.3333	1647	87.2	1550.2222	1740
82.3	1463.1111	1650	87.3	1552.0000	1741
82.4	1464.8889	1651	87.4	1553.7778	1742
82.5	1466.6667	1652	87.5	1555.5556	1743
82.6	1468.4444	1653	87.6	1557.3333	1744
82.7	1470.2222	1654	87.7	1559.1111	1745
82.8	1472.0000	1656	87.8	1560.8889	1746
82.9	1473.7778	1657	87.9	1562.6667	1750
83.0	1475.5556	1660	88.0	1564.4444	1751
83.1	1477.3333	1661	88.1	1566.2222	1752
83.2	1479.1111	1662	88.2	1568.0000	1753
83.3	1480.8889	1663	88.3	1569.7778	1754
83.4	1482.6667	1664	88.4	1571.5556	1755
83.5	1484.4444	1666	88.5	1573.3333	1756
83.6	1486.2222	1667	88.6	1575.1111	1760
83.7	1488.0000	1670	88.7	1576.8889	1761
83.8	1489.7778	1671	88.8	1578.6667	1762
83.9	1491.5556	1672	88.9	1580.4444	1763
84.0	1493.3333	1673	89.0	1582.2222	1764
84.1	1495.1111	1674	89.1	1584.0000	1765
84.2	1496.8889	1676	89.2	1585.7778	1766
84.3	1498.6667	1677	89.3	1587.5556	1770
84.4	1500.4444	1700	89.4	1589.3333	1771
84.5	1502.2222	1701	89.5	1591.1111	1772
84.6	1504.0000	1702	89.6	1592.8889	1773
84.7	1505.7778	1703	89.7	1594.6667	1774
84.8	1507.5556	1704	89.8	1596.4444	1775
84.9	1509.3333	1705	89.9	1598.2222	1776
85.0	1511.1111	1707	90.0	1600.0000	2000

Table 11-17. Azimuth Correction Data-Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
90.1	1601.7778	2001	95.1	1690.6667	2072
90.2	1603.5556	2002	95.2	1692.4444	2073
90.3	1605.3333	2003	95.3	1694.2222	2074
90.4	1607.1111	2004	95.4	1696.0000	2075
90.5	1608.8889	2005	95.5	1697.7778	2076
90.6	1610.6667	2006	95.6	1699.5556	2077
90.7	1612.4444	2007	95.7	1701.3333	2100
90.8	1614.2222	2011	95.8	1703.1111	2101
90.9	1616.0000	2012	95.9	1704.8889	2103
91.0	1617.7778	2013	96.0	1706.6667	2104
91.1	1619.5556	2014	96.1	1708.4444	2105
91.2	1621.3333	2015	96.2	1710.2222	2106
91.3	1623.1111	2016	96.3	1712.0000	2107
91.4	1624.8889	2017	96.4	1713.7778	2110
91.5	1626.6667	2021	96.5	1715.5556	2111
91.6	1628.4444	2022	96.6	1717.3333	2113
91.7	1630.2222	2023	96.7	1719.1111	2114
91.8	1632.0000	2024	96.8	1720.8889	2115
91.9	1633.7778	2025	96.9	1722.6667	2116
92.0	1635.5556	2026	97.0	1724.4444	2117
92.1	1637.3333	2027	97.1	1726.2222	2120
92.2	1639.1111	2031	97.2	1728.0000	2121
92.3	1640.8889	2032	97.3	1729.7778	2123
92.4	1642.6667	2033	97.4	1731.5556	2124
92.5	1644.4444	2034	97.5	1733.3333	2125
92.6	1646.2222	2035	97.6	1735.1111	2126
92.7	1648.0000	2036	97.7	1736.8889	2127
92.8	1649.7778	2037	97.8	1738.6667	2130
92.9	1651.5556	2040	97.9	1740.4444	2131
93.0	1653.3333	2042	98.0	1742.2222	2133
93.1	1655.1111	2043	98.1	1744.0000	2134
93.2	1656.8889	2044	98.2	1745.7778	2135
93.3	1658.6667	2045	98.3	1747.5556	2136
93.4	1660.4444	2046	98.4	1749.3333	2137
93.5	1662.2222	2047	98.5	1751.1111	2140
93.6	1664.0000	2050	98.6	1752.8889	2141
93.7	1665.7778	2052	98.7	1754.6667	2142
93.8	1667.5556	2053	98.8	1756.4444	2144
93.9	1669.3333	2054	98.9	1758.2222	2145
94.0	1671.1111	2055	99.0	1760.0000	2146
94.1	1672.8889	2056	99.1	1761.7778	2147
94.2	1674.6667	2057	99.2	1763.5556	2150
94.3	1676.4444	2060	99.3	1765.3333	2151
94.4	1678.2222	2062	99.4	1767.1111	2152
94.5	1680.0000	2063	99.5	1768.8889	2154
94.6	1681.7778	2064	99.6	1770.6667	2155
94.7	1683.5556	2065	99.7	1772.4444	2156
94.8	1685.3333	2066	99.8	1774.2222	2157
94.9	1687.1111	2067	99.9	1776.0000	2160
95.0	1688.8889	2070	100.0	1777.7778	2161

Table 11-17. Azimuth Correction Data-Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
100.1	1779.5556	2162	105.1	1868.4444	2253
100.2	1781.3333	2164	105.2	1870.2222	2254
100.3	1783.1111	2165	105.3	1872.0000	2256
100.4	1784.8889	2166	105.4	1873.7778	2257
100.5	1786.6667	2167	105.5	1875.5556	2260
100.6	1788.4444	2170	105.6	1877.3333	2261
100.7	1790.2222	2171	105.7	1879.1111	2262
100.8	1792.0000	2172	105.8	1880.8889	2263
100.9	1793.7778	2174	105.9	1882.6667	2264
101.0	1795.5556	2175	106.0	1884.4444	2266
101.1	1797.3333	2176	106.1	1886.2222	2267
101.2	1799.1111	2177	106.2	1888.0000	2270
101.3	1800.8889	2200	106.3	1889.7778	2271
101.4	1802.6667	2201	106.4	1891.5556	2272
101.5	1804.4444	2202	106.5	1893.3333	2273
101.6	1806.2222	2203	106.6	1895.1111	2274
101.7	1808.0000	2205	106.7	1896.8889	2276
101.8	1809.7778	2206	106.8	1898.6667	2277
101.9	1811.3556	2207	106.9	1900.4444	2300
102.0	1813.3333	2210	107.0	1902.2222	2301
102.1	1815.1111	2211	107.1	1904.0000	2302
102.2	1816.8889	2212	107.2	1905.7778	2303
102.3	1818.6667	2213	107.3	1907.5556	2304
102.4	1820.4444	2215	107.4	1909.3333	2305
102.5	1822.2222	2216	107.5	1911.1111	2307
102.6	1824.0000	2217	107.6	1912.8889	2310
102.7	1825.7778	2220	107.7	1914.6667	2311
102.8	1827.5556	2221	107.8	1916.4444	2312
102.9	1829.3333	2222	107.9	1918.2222	2313
103.0	1831.1111	2223	108.0	1920.0000	2314
103.1	1832.8889	2225	108.1	1921.7778	2315
103.2	1834.6667	2226	108.2	1923.5556	2317
103.3	1836.4444	2227	108.3	1925.3333	2320
103.4	1838.2222	2230	108.4	1927.1111	2321
103.5	1840.0000	2231	108.5	1928.8889	2322
103.6	1841.7778	2232	108.6	1930.6667	2323
103.7	1843.5556	2233	108.7	1932.4444	2324
103.8	1845.3333	2235	108.8	1934.2222	2325
103.9	1847.1111	2236	108.9	1936.0000	2327
104.0	1848.8889	2237	109.0	1937.7778	2330
104.1	1850.6667	2240	109.1	1939.5556	2331
104.2	1852.4444	2241	109.2	1941.3333	2332
104.3	1854.2222	2242	109.3	1943.1111	2333
104.4	1856.0000	2243	109.4	1944.8889	2334
104.5	1857.7778	2244	109.5	1946.6667	2335
104.6	1859.5556	2246	109.6	1948.4444	2337
104.7	1861.3333	2247	109.7	1950.2222	2340
104.8	1863.1111	2250	109.8	1952.0000	2341
104.9	1864.8889	2251	109.9	1953.7778	2342
105.0	1866.6667	2252	110.0	1955.5556	2343

Table 11-17. Azimuth Correction Data-Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
110.1	1957.3333	2344	115.1	2046.2222	2435
110.2	1959.1111	2345	115.2	2048.0000	2436
110.3	1960.8889	2346	115.3	2049.7778	2437
110.4	1962.6667	2350	115.4	2051.5556	2440
110.5	1964.4444	2351	115.5	2053.3333	2442
110.6	1966.2222	2352	115.6	2055.1111	2443
110.7	1968.0000	2353	115.7	2056.8889	2444
110.8	1969.7778	2354	115.8	2058.6667	2445
110.9	1971.5556	2355	115.9	2060.4444	2446
111.0	1973.3333	2356	116.0	2062.2222	2447
111.1	1975.1111	2360	116.1	2064.0000	2450
111.2	1976.8889	2361	116.2	2065.7778	2452
111.3	1978.6667	2362	116.3	2067.5556	2453
111.4	1980.4444	2363	116.4	2069.3333	2454
111.5	1982.2222	2364	116.5	2071.1111	2455
111.6	1984.0000	2365	116.6	2072.8889	2456
111.7	1985.7778	2366	116.7	2074.6667	2457
111.8	1987.5556	2370	116.8	2076.4444	2460
111.9	1989.3333	2371	116.9	2078.3222	2462
112.0	1991.1111	2372	117.0	2080.0000	2463
112.1	1992.8889	2373	117.1	2081.7778	2464
112.2	1994.6667	2374	117.2	2083.5556	2465
112.3	1996.4444	2375	117.3	2085.3333	2466
112.4	1998.2222	2376	117.4	2087.1111	2467
112.5	2000.0000	2400	117.5	2088.8889	2470
112.6	2001.7778	2401	117.6	2090.6667	2472
112.7	2003.5556	2402	117.7	2092.4444	2473
112.8	2005.3333	2403	117.8	2094.2222	2474
112.9	2007.1111	2404	117.9	2096.0000	2475
113.0	2008.8889	2405	118.0	2097.7778	2476
113.1	2010.6667	2406	118.1	2099.5556	2477
113.2	2012.4444	2407	118.2	2101.3333	2500
113.3	2014.2222	2411	118.3	2103.1111	2501
113.4	2016.0000	2412	118.4	2104.8889	2503
113.5	2017.7778	2413	118.5	2106.6667	2504
113.6	2019.5556	2414	118.6	2108.4444	2505
113.7	2021.3333	2415	118.7	2110.2222	2506
113.8	2023.1111	2416	118.8	2112.0000	2507
113.9	2024.8889	2417	118.9	2113.7778	2510
114.0	2026.6667	2421	119.0	2115.5556	2511
114.1	2028.4444	2422	119.1	2117.3333	2513
114.2	2030.2222	2423	119.2	2119.1111	2514
114.3	2032.0000	2424	119.3	2120.8889	2515
114.4	2033.7778	2425	119.4	2122.6667	2516
114.5	2035.5556	2426	119.5	2124.4444	2517
114.6	2037.3333	2427	119.6	2126.2222	2520
114.7	2039.1111	2431	119.7	2128.0000	2521
114.8	2040.8889	2432	119.8	2129.7778	2523
114.9	2042.6667	2433	119.9	2131.5556	2524
115.0	2044.4444	2434	120.0	2133.3333	2525

Table 11-17. Azimuth Correction Data-Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
120.1	2135.1111	2526	125.1	2224.0000	2617
120.2	2136.8889	2527	125.2	2225.7778	2620
120.3	2138.6667	2530	125.3	2227.5556	2621
120.4	2140.4444	2531	125.4	2229.3333	2622
120.5	2142.2222	2533	125.5	2231.1111	2623
120.6	2144.0000	2534	125.6	2232.8889	2625
120.7	2145.7778	2535	125.7	2234.6667	2626
120.8	2147.5556	2536	125.8	2236.4444	2627
120.9	2149.3333	2537	125.9	2238.2222	2630
121.0	2151.1111	2540	126.0	2240.0000	2631
121.1	2152.8889	2541	126.1	2241.7778	2632
121.2	2154.6667	2542	126.2	2243.5556	2633
121.3	2156.4444	2544	126.3	2245.3333	2635
121.4	2158.2222	2545	126.4	2247.1111	2636
121.5	2160.0000	2546	126.5	2248.8889	2637
121.6	2161.7778	2547	126.6	2250.6667	2640
121.7	2163.5556	2550	126.7	2252.4444	2641
121.8	2165.3333	2551	126.8	2254.2222	2642
121.9	2167.1111	2552	126.9	2256.0000	2643
122.0	2168.8889	2554	127.0	2257.7778	2644
122.1	2170.6667	2555	127.1	2259.5556	2646
122.2	2172.4444	2556	127.2	2261.3333	2647
122.3	2174.2222	2557	127.3	2263.1111	2650
122.4	2176.0000	2560	127.4	2264.8889	2651
122.5	2177.7778	2561	127.5	2266.6667	2652
122.6	2179.5556	2562	127.6	2268.4444	2653
122.7	2181.3333	2564	127.7	2270.2222	2654
122.8	2183.1111	2565	127.8	2272.0000	2656
122.9	2184.8889	2566	127.9	2273.7778	2657
123.0	2186.6667	2567	128.0	2275.5556	2660
123.1	2188.4444	2570	128.1	2277.3333	2661
123.2	2190.2222	2571	128.2	2279.1111	2662
123.3	2192.0000	2572	128.3	2280.8889	2663
123.4	2193.7778	2574	128.4	2282.6667	2664
123.5	2195.5556	2575	128.5	2284.4444	2666
123.6	2197.3333	2576	128.6	2286.2222	2667
123.7	2199.1111	2577	128.7	2288.0000	2670
123.8	2200.8889	2600	128.8	2289.7778	2671
123.9	2202.6667	2601	128.9	2291.5556	2672
124.0	2204.4444	2602	129.0	2293.3333	2673
124.1	2206.2222	2603	129.1	2295.1111	2674
124.2	2208.0000	2605	129.2	2296.8889	2676
124.3	2209.7778	2606	129.3	2298.6667	2677
124.4	2211.5556	2607	129.4	2300.4444	2700
124.5	2213.3333	2610	129.5	2302.2222	2701
124.6	2215.1111	2611	129.6	2304.0000	2702
124.7	2216.8889	2612	129.7	2305.7778	2703
124.8	2218.6667	2613	129.8	2307.5556	2704
124.9	2220.4444	2615	129.9	2309.3333	2705
125.0	2222.2222	2616	130.0	2311.1111	2707

Table 11-17. Azimuth Correction Data-Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
130.1	2312.8889	2710	135.1	2401.7778	3001
130.2	2314.6667	2711	135.2	2403.5556	3002
130.3	2316.4444	2712	135.3	2405.3333	3003
130.4	2318.2222	2713	135.4	2407.1111	3004
130.5	2320.0000	2714	135.5	2408.8889	3005
130.6	2321.7778	2715	135.6	2410.6667	3006
130.7	2323.5556	2717	135.7	2412.4444	3007
130.8	2325.3333	2720	135.8	2414.2222	3011
130.9	2327.1111	2721	135.9	2416.0000	3012
131.0	2328.8889	2722	136.0	2417.7778	3013
131.1	2320.6667	2723	136.1	2419.5556	3014
131.2	2332.4444	2724	136.2	2421.3333	3015
131.3	2334.2222	2725	136.3	2423.1111	3016
131.4	2336.0000	2727	136.4	2424.8889	3017
131.5	2337.7778	2730	136.5	2426.6667	3021
131.6	2339.5556	2731	136.6	2428.4444	3022
131.7	2341.3333	2732	136.7	2430.2222	3023
131.8	2343.1111	2733	136.8	2432.0000	3024
131.9	2344.8889	2734	136.9	2433.7778	3025
132.0	2346.6667	2735	137.0	2435.5556	3026
132.1	2348.4444	2737	137.1	2437.3333	3027
132.2	2350.2222	2740	137.2	2439.1111	3031
132.3	2352.0000	2741	137.3	2440.8889	3032
132.4	2353.7778	2742	137.4	2442.6667	3033
132.5	2355.5556	2743	137.5	2444.4444	3034
132.6	2357.3333	2744	137.6	2446.2222	3035
132.7	2359.1111	2745	137.7	2448.0000	3036
132.8	2360.8889	2746	137.8	2449.7778	3037
132.9	2362.6667	2750	137.9	2451.5556	3040
133.0	2364.4444	2751	138.0	2453.3333	3042
133.1	2366.2222	2752	138.1	2455.1111	3043
133.2	2368.0000	2753	138.2	2456.8889	3044
133.3	2369.7778	2754	138.3	2458.6667	3045
133.4	2371.5556	2755	138.4	2460.4444	3046
133.5	2373.3333	2756	138.5	2462.2222	3047
133.6	2375.1111	2760	138.6	2464.0000	3050
133.7	2376.8889	2761	138.7	2465.7778	3052
133.8	2378.6667	2762	138.8	2467.5556	3053
133.9	2380.4444	2763	138.9	2469.3333	3054
134.0	2382.2222	2764	139.0	2471.1111	3055
134.1	2384.0000	2765	139.1	2472.8889	3056
134.2	2385.7778	2766	139.2	2474.6667	3057
134.3	2387.5556	2770	139.3	2476.4444	3060
134.4	2389.3333	2771	139.4	2478.2222	3062
134.5	2391.1111	2772	139.5	2480.0000	3063
134.6	2392.8889	2773	139.6	2481.7778	3064
134.7	2394.6667	2774	139.7	2483.5556	3065
134.8	2396.4444	2775	139.8	2485.3333	3066
134.9	2398.2222	2776	139.9	2487.1111	3067
135.0	2400.0000	3000	140.0	2488.8889	3070

Table 11-17. Azimuth Correction Data-Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
140.1	2490.6667	3072	145.1	2579.5556	3162
140.2	2492.4444	3073	145.2	2581.3333	3164
140.3	2494.2222	3074	145.3	2583.1111	3165
140.4	2496.0000	3075	145.4	2584.8889	3166
140.5	2497.7778	3076	145.5	2586.6667	3167
140.6	2499.5556	3077	145.6	2588.4444	3170
140.7	2501.3333	3100	145.7	2590.2222	3171
140.8	2503.1111	3101	145.8	2592.0000	3172
140.9	2504.8889	3103	145.9	2593.7778	3174
141.0	2506.6667	3104	146.0	2595.5556	3175
141.1	2508.4444	3105	146.1	2597.3333	3176
141.2	2510.2222	3106	146.2	2599.1111	3177
141.3	2512.0000	3107	146.3	2600.8889	3200
141.4	2513.7778	3110	146.4	2602.6667	3201
141.5	2515.5556	3111	146.5	2604.4444	3202
141.6	2517.3333	3113	146.6	2606.2222	3203
141.7	2519.1111	3114	146.7	2608.0000	3205
141.8	2520.8889	3115	146.8	2609.7778	3206
141.9	2522.6667	3116	146.9	2611.5556	3207
142.0	2524.4444	3117	147.0	2613.3333	3210
142.1	2526.2222	3120	147.1	2615.1111	3211
142.2	2528.0000	3121	147.2	2616.8889	3212
142.3	2529.7778	3123	147.3	2618.6667	3213
142.4	2531.5556	3124	147.4	2620.4444	3215
142.5	2533.3333	3125	147.5	2622.2222	3216
142.6	2535.1111	3126	147.6	2624.0000	3217
142.7	2536.8889	3127	147.7	2625.7778	3220
142.8	2538.6667	3130	147.8	2627.5556	3221
142.9	2540.4444	3131	147.9	2629.3333	3222
143.0	2542.2222	3133	148.0	2631.1111	3223
143.1	2544.0000	3134	148.1	2632.8889	3225
143.2	2545.7778	3135	148.2	2634.6667	3226
143.3	2547.5556	3136	148.3	2636.4444	3227
143.4	2549.3333	3137	148.4	2638.2222	3230
143.5	2551.1111	3140	148.5	2640.0000	3231
143.6	2552.8889	3141	148.6	2641.7778	3232
143.7	2554.6667	3142	148.7	2643.5556	3233
143.8	2556.4444	3144	148.8	2645.3333	3235
143.9	2558.2222	3145	148.9	2647.1111	3236
144.0	2560.0000	3146	149.0	2648.8889	3237
144.1	2561.7778	3147	149.1	2650.6667	3240
144.2	2563.5556	3150	149.2	2652.4444	3241
144.3	2565.3333	3151	149.3	2654.2222	3242
144.4	2567.1111	3152	149.4	2656.0000	3243
144.5	2568.8889	3154	149.5	2657.7778	3244
144.6	2570.6667	3155	149.6	2659.5556	3246
144.7	2572.4444	3156	149.7	2661.3333	3247
144.8	2574.2222	3157	149.8	2663.1111	3250
144.9	2576.0000	3160	149.9	2664.8889	3251
145.0	2577.7778	3161	150.0	2666.6667	3252

Table 11-17. Azimuth Correction Data-Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
150.1	2668.4444	3253	155.1	2757.3333	3344
150.2	2670.2222	3254	155.2	2759.1111	3345
150.3	2672.0000	3256	155.3	2760.8889	3346
150.4	2673.7778	3257	155.4	2762.6667	3350
150.5	2675.5556	3260	155.5	2764.4444	3351
150.6	2677.3333	3261	155.6	2766.2222	3352
150.7	2679.1111	3262	155.7	2768.0000	3353
150.8	2680.8889	3263	155.8	2769.7778	3354
150.9	2682.6667	3264	155.9	2771.5556	3355
151.0	2684.4444	3266	156.0	2773.3333	3356
151.1	2686.2222	3267	156.1	2775.1111	3360
151.2	2688.0000	3270	156.2	2776.8889	3361
151.3	2689.7778	3271	156.3	2778.6667	3362
151.4	2691.5556	3272	156.4	2780.4444	3363
151.5	2693.3333	3273	156.5	2782.2222	3364
151.6	2695.1111	3274	156.6	2784.0000	3365
151.7	2696.8889	3276	156.7	2785.7778	3366
151.8	2698.6667	3277	156.8	2787.5556	3370
151.9	2700.4444	3300	156.9	2789.3333	3371
152.0	2702.2222	3301	157.0	2791.1111	3372
152.1	2704.0000	3302	157.1	2792.8889	3373
152.2	2705.7778	3303	157.2	2794.6667	3374
152.3	2707.5556	3304	157.3	2796.4444	3375
152.4	2709.3333	3305	157.4	2798.2222	3376
152.5	2711.1111	3307	157.5	2800.0000	3400
152.6	2712.8889	3310	157.6	2801.7778	3401
152.7	2714.6667	3311	157.7	2803.5556	3402
152.8	2716.4444	3312	157.8	2805.3333	3403
152.9	2718.2222	3313	157.9	2807.1111	3404
153.0	2720.0000	3314	158.0	2808.8889	3405
153.1	2721.7778	3315	158.1	2810.6667	3406
153.2	2723.5556	3317	158.2	2812.4444	3407
153.3	2725.3333	3320	158.3	2814.2222	3411
153.4	2727.1111	3321	158.4	2816.0000	3412
153.5	2728.8889	3322	158.5	2817.7778	3413
153.6	2730.6667	3323	158.6	2819.5556	3414
153.7	2732.4444	3324	158.7	2821.3333	3415
153.8	2734.2222	3325	158.8	2823.1111	3416
153.9	2736.0000	3327	158.9	2824.8889	3417
154.0	2737.7778	3330	159.0	2826.6667	3421
154.1	2739.5556	3331	159.1	2828.4444	3422
154.2	2741.3333	3332	159.2	2830.2222	3423
154.3	2743.1111	3333	159.3	2832.0000	3424
154.4	2744.8889	3334	159.4	2833.7778	3425
154.5	2746.6667	3335	159.5	2835.5556	3426
154.6	2748.4444	3337	159.6	2837.3333	3427
154.7	2750.2222	3340	159.7	2839.1111	3431
154.8	2752.0000	3341	159.8	2840.8889	3432
154.9	2753.7779	3342	159.9	2842.6667	3433
155.0	2755.5556	3343	160.0	2844.4444	3434

Table 11-17. Azimuth Correction Data-Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
160.1	2846.2222	3435	165.1	2935.1111	3526
160.2	2848.0000	3436	165.2	2936.8899	3527
160.3	2849.7778	3437	165.3	2938.6667	3530
160.4	2851.5556	3440	165.4	2940.4444	3531
160.5	2853.3333	3442	165.5	2942.2222	3533
160.6	2855.1111	3443	165.5	2944.0000	3534
160.7	2856.8889	3444	165.7	2945.7778	3535
160.8	2858.6667	3445	165.8	2947.5556	3536
160.9	2860.4444	3446	165.9	2949.3333	3537
161.0	2862.2222	3447	166.0	2951.1111	3540
161.1	2864.0000	3450	166.1	2952.8889	3541
161.2	2865.7778	3452	166.2	2954.6667	3542
161.3	2867.5556	3453	166.3	2956.4444	3544
161.4	2869.3333	3454	166.4	2958.2222	3545
161.5	2871.1111	3455	166.5	2960.0000	3546
161.6	2872.8889	3456	166.6	2961.7778	3547
161.7	2874.6667	3457	166.7	2963.5556	3550
161.8	2876.4444	3460	166.8	2965.3333	3551
161.9	2878.2222	3462	166.9	2967.1111	3552
162.0	2880.0000	3463	167.0	2968.8889	3554
162.1	2881.7778	3464	167.1	2970.6667	3555
162.2	2883.5556	3465	165.2	2972.4444	3556
162.3	2885.3333	3466	167.3	2974.2222	3557
162.4	2887.1111	3467	167.4	2976.0000	3568
162.5	2888.8889	3470	167.5	2977.7778	3561
162.6	2890.6667	3472	167.6	2979.5556	3562
162.7	2892.4444	3473	167.7	2981.3333	3564
162.8	2894.2222	3474	167.8	2983.1111	3565
162.9	2896.0000	3475	167.9	2984.8889	3566
163.0	2897.7778	3476	168.0	2986.6667	3567
163.1	2899.5556	3477	168.1	2988.4444	3570
163.2	2901.3333	3500	168.2	2990.2222	3571
163.3	2903.1111	3501	168.3	2992.0000	3572
163.4	2904.8889	3503	168.4	2993.7778	3574
163.5	2906.6667	3504	168.5	2995.5556	3575
163.6	2908.4444	3505	168.6	2997.3333	3576
163.7	2910.2222	3506	168.7	2999.1111	3577
163.8	2912.0000	3507	168.8	3000.8889	3600
163.9	2913.7778	3510	168.9	3002.6667	3601
164.0	2915.5556	3511	169.0	3004.4444	3602
164.1	2917.3333	3513	169.1	3006.2222	3603
164.2	2919.1111	3514	169.2	3008.0000	3605
164.3	2920.8889	3515	169.3	3009.7778	3606
164.4	2922.6667	3516	169.4	3011.5556	3607
164.5	2924.4444	3517	169.5	3013.3333	3610
164.6	2926.2222	3520	169.6	3015.1111	3611
164.7	2928.0000	3521	169.7	3016.8889	3612
164.8	2929.7778	3523	169.8	3018.6667	3613
164.9	2931.5556	3524	169.9	3020.4444	3615
165.0	2933.3333	3525	170.0	3022.2222	3616

Table 11-17. Azimuth Correction Data-Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
170.1	3024.0000	3617	175.1	3112.8889	3710
170.2	3025.7778	3620	175.2	3114.6667	3711
170.3	3027.5556	3621	175.3	3116.4444	3712
170.4	3029.3333	3622	175.4	3118.2222	3713
170.5	3031.1111	3623	175.5	3120.0000	3714
170.6	3032.8889	3625	175.6	3121.7778	3715
170.7	3034.6667	3626	175.7	3123.5556	3717
170.8	3036.4444	3627	175.8	3125.3333	3720
170.9	3038.2222	3630	175.9	3127.1111	3721
171.0	3040.0000	3631	176.0	3128.8889	3722
171.1	3041.7778	3632	176.1	3130.6667	3723
171.2	3043.5556	3633	176.2	3132.4444	3724
171.3	3045.3333	3635	176.3	3134.2222	3725
171.4	3047.1111	3636	176.4	3136.0000	3727
171.5	3040.8889	3637	176.5	3137.7778	3730
171.6	3050.6667	3640	176.6	3139.5556	3731
171.7	3052.4444	3641	176.7	3141.3333	3732
171.8	3054.2222	3642	176.8	3143.1111	3733
171.9	3056.0000	3643	176.9	3144.8889	3734
172.0	3057.7778	3644	177.0	3146.6667	3735
172.1	3059.5556	3646	177.1	3148.4444	3737
172.2	3061.3333	3647	177.2	3150.2222	3740
172.3	3063.1111	3650	177.3	3152.0000	3741
172.4	3064.8889	3651	177.4	3153.7778	3742
172.5	3066.6667	3652	177.5	3155.5556	3743
172.6	3068.4444	3653	177.6	3157.3333	3744
172.7	3070.2222	3654	177.7	3159.1111	3745
172.8	3072.0000	3656	177.8	3160.8889	3746
172.9	3073.7778	3657	177.9	3162.6667	3750
173.0	3075.5556	3660	178.0	3164.4444	3751
173.1	3077.3333	3661	178.1	3166.2222	3752
173.2	3079.1111	3662	178.2	3168.0000	3753
173.3	3080.8889	3663	178.3	3169.7778	3754
173.4	3082.6667	3664	178.4	3171.5556	3755
173.5	3084.4444	3666	178.5	3173.3333	3756
173.6	3086.2222	3667	178.6	3175.1111	3760
173.7	3088.0000	3670	178.7	3176.8889	3761
173.8	3089.7778	3671	178.8	3178.6667	3762
173.9	3091.5556	3672	178.9	3180.4444	3763
174.0	3093.3333	3673	179.0	3182.2222	3764
174.1	3095.1111	3674	179.1	3184.0000	3765
174.2	3096.8889	3676	179.2	3185.7778	3766
174.3	3098.6667	3677	179.3	3187.5556	3770
174.4	3100.4444	3700	179.4	3189.3333	3771
174.5	3102.2222	3701	179.5	3191.1111	3772
174.6	3104.0000	3702	179.6	3192.8889	3773
174.7	3105.7778	3703	179.7	3194.6667	3774
174.8	3107.5556	3704	179.8	3196.4444	3775
174.9	3109.3333	3075	179.9	3198.2222	3776
175.0	3111.1111	3707	180.0	3200.0000	4000

Table 11-17. Azimuth Correction Data-Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
180.1	3201.7778	4001	185.1	3290.6667	4072
180.2	3203.5556	4002	185.2	3292.4444	4073
180.3	3205.3333	4003	185.3	3294.2222	4074
180.4	3207.1111	4004	185.4	3296.0000	4075
180.5	3208.8889	4005	185.5	3297.7778	4076
180.6	3210.6667	4006	185.6	3299.5556	4077
180.7	3212.4444	4007	185.7	3301.3333	4100
180.8	3214.2222	4011	185.8	3303.1111	4101
180.9	3216.0000	4012	185.9	3304.8889	4103
181.0	3217.7778	4013	186.0	3306.6667	4104
181.1	3219.5556	4014	186.1	3308.4444	4105
181.2	3221.3333	4015	186.2	3310.2222	4106
181.3	3223.1111	4016	186.3	3312.0000	4107
181.4	3224.8889	4017	186.4	3313.7778	4110
181.5	3226.6667	4021	186.5	3315.5556	4111
181.6	3228.4444	4022	186.6	3317.3333	4113
181.7	3230.2222	4023	186.7	3319.1111	4114
181.8	3232.0000	4024	186.8	3320.8889	4115
181.9	3233.7778	4025	186.9	3322.6667	4116
182.0	3235.5556	4026	187.0	3324.4444	4117
182.1	3237.3333	4027	187.1	3326.2222	4120
182.2	3239.1111	4031	187.2	3328.0000	4121
182.3	3240.8889	4032	187.3	3329.7778	4123
182.4	3242.6667	4033	187.4	3331.5556	4124
182.5	3244.4444	4034	187.5	3333.3333	4125
182.6	3246.2222	4035	187.6	3335.1111	4126
182.7	3248.0000	4036	187.7	3336.8889	4127
182.8	3249.7778	4037	187.8	3338.6667	4130
182.9	3251.5556	4040	187.9	3340.4444	4131
183.0	3253.3333	4042	188.0	3342.2222	4133
183.1	3255.1111	4043	188.1	3344.0000	4134
183.2	3256.8889	4044	188.2	3345.7778	4135
183.3	3258.6667	4045	188.3	3347.5556	4136
183.4	3260.4444	4046	188.4	3349.3333	4137
183.5	3262.2222	4047	188.5	3351.1111	4140
183.6	3264.0000	4050	188.6	3352.8889	4141
183.7	3265.7778	4052	188.7	3354.6667	4142
183.8	3267.5556	4053	188.8	3356.4444	4144
183.9	3269.3333	4054	188.9	3358.2222	4145
184.0	3271.1111	4055	189.0	3360.0000	4146
184.1	3272.8889	4056	189.1	3361.7778	4147
184.2	3274.6667	4057	189.2	3363.5556	4150
184.3	3276.4444	4060	189.3	3365.3333	4151
184.4	3278.2222	4062	189.4	3367.1111	4152
184.5	3280.0000	4063	189.5	3368.8889	4154
184.6	3281.7778	4064	189.6	3370.6667	4155
184.7	3283.5556	4065	189.7	3372.4444	4156
184.8	3285.3333	4066	189.8	3374.2222	4157
184.9	3287.1111	4067	189.9	3376 0000	4160
185.0	3288.8889	4070	190.0	3377.7778	4161

Table 11-17. Azimuth Correction Data-Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
190.1	3379.5556	4162	195.1	3468.4444	4253
190.2	3381.3333	4164	195.2	3470.2222	4254
190.3	3383.1111	4165	195.3	3472.0000	4256
190.4	3384.8889	4166	195.4	3473.7778	4257
190.5	3386.6667	4167	195.5	3475.5556	4260
190.6	3388.4444	4170	195.6	3477.3333	4261
190.7	3390.2222	4171	195.7	3479.1111	4262
190.8	3392.0000	4172	195.8	3480.8889	4263
190 9	3393.7778	4174	195.9	3482.6667	4264
191.0	3395.5556	4175	196.0	3484.4444	4266
191.1	3397.3333	4176	196.1	3486.2222	4267
191.2	3399.1111	4177	196.2	3488.0000	4270
191.3	3400.8889	4200	196.3	3489.7778	4271
191.4	3402.6667	4201	196.4	3491.5556	4272
191.5	3404.4444	4202	196.5	3493.3333	4273
191.6	3406.2222	4203	196.6	3495.1111	4274
191.7	3408.0000	4205	196.7	3496.8889	4276
191.8	3409.7778	4206	196.8	3498.6667	4277
191.9	3411.5556	4207	196.9	3500.4444	4300
192.0	3413.3333	4210	197.0	3502 2222	4301
192.1	3415.1111	4211	197.1	3504.0000	4302
192.2	3416.8889	4212	197.2	3505 7778	4303
192.3	3418.6667	4213	197.3	3507.5556	4304
192.4	3420.4444	4215	197 4	3509.3333	4305
192.5	3422.2222	4216	197.5	3511.1111	4307
192.6	3424.0000	4217	197.6	3512.8889	4310
192 7	3425.7778	4220	197.7	3514.6667	4311
192.8	3427.5556	4221	197.8	3516.4444	4312
192 9	3429.3333	4222	197.9	3518.2222	4313
193.0	3431.1111	4223	198.0	3520.0000	4314
193.1	3432.8889	4225	198.1	3521.7778	4315
193.2	3434.6667	4226	198.2	3523.5556	4317
193.3	3436.4444	4227	198.3	3525.3333	4320
193.4	3438.2222	4230	198.4	3527.1111	4321
193.5	3440.0000	4231	198.5	3528.8889	4322
193.6	3441.7778	4232	198.6	3530.6667	4323
193.7	3443.5556	4233	198.7	3532.4444	4324
193.8	3445.3333	4235	198.8	3534.2222	4325
193.9	3447.1111	4236	198.9	3536.0000	4327
194.0	3448.8889	4237	199.0	3537.7778	4330
194.1	3450.6667	4240	199.1	3539.5556	4331
194.2	3452.4444	4241	199.2	3541.3338	4332
194.3	3454.2222	4242	199.3	3543.1111	4333
194.4	3456.0000	4243	199.4	3544.8889	4334
194.5	3457.7778	4244	199.5	3546.6667	4335
194.6	3459.5556	4246	199.6	3548.4444	4337
194.7	3461.3333	4247	199.7	3558.2222	4348
194.8	3463.1111	4250	199.8	3552.0000	4341
194 9	3464.8889	4251	199 9	3553.7778	4342
195.0	3466.6667	4252	200.0	3555.5556	4343

Table 11-17. Azimuth Correction Data

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
200.1	3557.3333	4344	205.1	3646.2222	4435
200.2	3559.1111	4345	205.2	3648.0000	4436
200.3	3560.8889	4346	205.3	3649.7778	4437
200.4	3562.6667	4350	205.4	3651.5556	4440
200.5	3564.4444	4351	205.5	3653.3333	4442
200.6	3565.2222	4352	205.6	3655.1111	4443
200.7	3568.0000	4353	205.7	3656.8889	4444
200.8	3569.7778	4354	205.8	3658.6667	4445
200.9	3571.5556	4355	205.9	3660.4444	4446
201.0	3573.3333	4356	206.0	3662.2222	4447
201.1	3575.1111	4360	206.1	3664.0000	4450
201.2	3576.8889	4361	206.2	3665.7778	4452
201.3	3578.6667	4362	206.3	3667.5556	4453
201.4	3580.4444	4363	206.4	3669.3333	4454
201.5	3582.2222	4364	206.5	3671.1111	4455
201.6	3584.0000	4365	206.6	3672.8889	4456
201.7	3585.7778	4366	206.7	3674.6667	4457
201.8	3587.5556	4370	206.8	3676.4444	4460
201.9	3589.3333	4371	206.9	3678.2222	4462
202.0	3591.1111	4372	207.0	3680.0000	4463
202.1	3592.8889	4373	207.1	3681.7778	4464
202.2	3594.6667	4374	207.2	3683.5556	4465
202.3	3596.4444	4375	207.3	3685.3333	4466
202.4	3598.2222	4376	207.4	3687.1111	4467
202.5	3600.0000	4400	207.5	3688.8889	4470
202.6	3601.7778	4401	207.6	3690.6667	4472
202.7	3603.5556	4402	207.7	3692.4444	4473
202.8	3605.3333	4403	207.8	3694.2222	4474
202.9	3607.1111	4404	207.9	3696.0000	4475
203.0	3608.8889	4405	208.0	3697.7778	4476
203.1	3610.6667	4406	208.1	3699.5556	4477
203.2	3612.4444	4407	208.2	3701.3333	4500
203.3	3614.2222	4411	208.3	3703.1111	4501
203.4	3616.0000	4412	208.4	3704.8889	4503
203.5	3617.7778	4413	208.5	3706.6667	4504
203.6	3619.5556	4414	208.6	3708.4444	4505
203.7	3621.3333	4415	208.7	3710.2222	4506
203.8	3623.1111	4416	208.8	3712.0000	4507
203.9	3624.8889	4417	208.9	3713.7778	4510
204.0	3626.6667	4421	209.0	3715.5556	4511
204.1	3628.4444	4422	209.1	3717.3333	4513
204.2	3630.2222	4423	209.2	3719.1111	4514
204.3	3632.0000	4424	209.3	3720.8889	4515
204.4	3633.7778	4425	209.4	3722.6667	4516
204.5	3635.5556	4426	209.5	3724.4444	4517
204.6	3637.3333	4427	209.6	3726.2222	4520
204.7	3639.1111	4431	209.7	3728.0000	4521
204.8	3640.8889	4432	209.8	3729.7778	4523
204.9	3642.6667	4433	209.9	3731.5556	4524
205.0	3644.4444	4434	210.0	3733.3333	4525

Table 11-17. Azimuth Correction Data-Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
220.1	3912.8889	4710	225.1	4001.7778	5001
220.2	3914.6667	4711	225.2	4003.5556	5002
220.3	3916.4444	4712	225.3	4005.3333	5003
220.4	3918.2222	4713	225 4	4007.1111	5004
220.5	3920.0000	4714	225.5	4008.8889	5005
220.6	3921.7778	4715	225 6	4010.6667	5006
220.7	3923.5556	4717	225.7	4012 4444	5007
220.8	3925.3333	4720	225.8	4014.2222	5011
220.9	3927.1111	4721	225.9	4016 0000	5012
221.0	3928.8889	4722	226.0	4017.7778	5013
221.1	3930.6667	4723	226.1	4019.5556	5014
221.2	3932.4444	4724	226.2	4021.3333	5015
221.3	3934.2222	4725	226.3	4023.1111	5016
221.4	3936.0000	4727	226.4	4024.8889	5017
221.5	3937.7778	4730	226.5	4026.6667	5021
221.6	3939.5556	4731	226.6	4028.4444	5022
221.7	3941.3333	4732	226.7	4030.2222	5023
221.8	3943.1111	4733	226.8	4032.0000	5024
221.9	3944.8889	4734	226 9	4033.7778	5025
222.0	3946.6667	4735	227.0	4035.5556	5026
222.1	3948.4444	4737	227.1	4037.3333	5027
222.2	3950.2222	4740	227.2	4039.1111	5031
222.3	3952.0000	4741	227.3	4040.8889	5032
222.4	3953.7778	4742	227.4	4042 6667	5033
222.5	3955.5556	4743	227.5	4044.4444	5034
222.6	3957.3333	4744	227.6	4046.2222	5035
222.7	3959.1111	4745	227.7	4048.0000	5036
222.8	3960.8889	4746	227.8	4049.7778	5037
222.9	3962.6667	4750	227.9	4051.5556	5040
223.0	3964.4444	4751	228.0	4053.3333	5042
223.1	3965.2222	4752	228.1	4055.1111	5043
223.2	3968.0000	4753	228.2	4056.8889	5044
223.3	3969.7778	4754	228.3	4058.6667	5045
223.4	3971.5556	4755	228.4	4060.4444	5046
223.5	3973.3333	4756	228.5	4062.2222	5047
223.6	3975.1111	4760	228.6	4064.0000	5050
223.7	3976.8889	4761	228.7	4065.7778	5052
223.8	3978.6667	4762	228.8	4067.5556	5053
223.9	3980.4444	4763	228.9	4069.3333	5054
224.0	3982.2222	4764	229.0	4071.1111	5055
224.1	3984 0000	4765	229.1	4072.8889	5056
224.2	3985.7778	4766	229.2	4074.6667	5057
224.3	3987.5556	4770	229.3	4076.4444	5060
224.4	3989.3333	4771	229.4	4078.2222	5062
224.5	3991.1111	4772	229.5	4080.0000	5063
224.6	3992.8889	4773	229.6	4081.7778	5064
224.7	3994.6667	4774	229.7	4083.5556	5065
224.8	3996.4444	4775	229.8	4085.3333	5066
224.9	3998.2222	4776	229.9	4087.1111	5067
225.0	4000.0000	5000	230.0	4088.8889	5070

Table 11-17. Azimuth Correction Data-Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
230.1	4090.6667	5072	235.1	4179.5556	5162
230.2	4092.4444	5073	235.2	4181.3333	5164
230.3	4094.2222	5074	235.3	4183.1111	5165
230.4	4096.0000	5075	235.4	4184.8889	5166
230.5	4097.7778	5076	235.5	4186.6667	5167
230.6	4099.5556	5077	235.6	4188.4444	5170
230.7	4101.3333	5100	235.7	4190.2222	5171
230.8	4103.1111	5101	235.8	4192.0000	5172
230.9	4104.8889	5103	235.9	4193.7778	5174
231.0	4106.6667	5104	236.0	4195.5556	5175
231.1	4108.4444	5105	236.1	4197.3333	5176
231.2	4110.2222	5106	236.2	4199.1111	5177
231.3	4112.0000	5107	236.3	4200.8889	5200
231.4	4113.7778	5110	236.4	4202.6667	5201
231.5	4115.5556	5111	236.5	4204.4444	5202
231.6	4117.3333	5113	236.6	4206.2222	5203
231.7	4119.1111	5114	236.7	4208.0000	5205
231.8	4120.8889	5115	236.8	4209.7778	5206
231.9	4122.6667	5116	236.9	4211.5556	5207
232.0	4124.4444	5117	237.0	4213.3333	5210
232.1	4126.2222	5120	237.1	4215.1111	5211
232.2	4128.0000	5121	237.2	4216.8889	5212
232.3	4129.7778	5123	237.3	4218.6667	5213
232.4	4131.5556	5124	237.4	4220.4444	5215
232.5	4133.3333	5125	237.5	4222.2222	5216
232.6	4135.1111	5126	237.6	4224.0000	5217
232.7	4136.8889	5127	237.7	4225.7778	5220
232.8	4138.6667	5130	237.8	4227.5556	5221
232.9	4140.4444	5131	237.9	4229.3333	5222
233.0	4142.2222	5133	238.0	4231.1111	5223
233.1	4144.0000	5134	238.1	4232.8889	5225
233.2	4145.7778	5135	238.2	4234.6667	5226
233.3	4147.5556	5136	238.3	4236.4444	5227
233.4	4149.3333	5137	238.4	4238.2222	5230
233.5	4151.1111	5140	238.5	4240.0000	5231
233.6	4152.8889	5141	238.6	4241.7778	5232
233.7	4154.6667	5142	238.7	4243.5556	5233
238.8	4156.4444	5144	238.8	4245.3333	5235
238.9	4158.2222	5145	238.9	4247.1111	5236
234.0	4160.0000	5146	239.0	4248.8889	5237
234.1	4161.7778	5147	239.1	4250.6667	5240
234.2	4163.5556	5150	239.2	4252.4444	5241
234.3	4165.3333	5151	239.3	4254.2222	5242
234.4	4167.1111	5152	239.4	4256.0000	5243
234.5	4168.8889	5154	239.5	4257.7778	5244
234.6	4170.6667	5155	239.6	4259.5556	5246
234.7	4172.4444	5156	239.7	4261.3333	5247
234.8	4174.2222	5157	239.8	4263.1111	5250
234.9	4176.0000	5160	239.9	4264.8889	5251
235.0	4177.7778	5161	240.0	4266.6667	5252

Table 11-17. Azimuth Correction Data-Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
240.1	4268.4444	5253	245.1	4357.3333	5344
240.2	4270.2222	5254	245.2	4359.1111	5345
240.3	4272.0000	5256	245.3	4360.8889	5346
240.4	4273.7778	5257	245.4	4362.6667	5350
240.5	4275.5556	5260	245.5	4364.4444	5351
240.6	4277.3333	5261	245.6	4366.2222	5352
240.7	4279.1111	5262	245.7	4368.0000	5353
240.8	4280.8889	5263	245.8	4369.7778	5354
240.9	4282.6667	5264	245.9	4371.5556	5355
241.0	4284.4444	5266	246.0	4373.3333	5356
241.1	4286.2222	5267	246.1	4375.1111	5360
241.2	4288.0000	5270	246.2	4376.8889	5361
241.3	4289.7778	5271	246.3	4378.6667	5362
241.4	4291.5556	5272	246.4	4380.4444	5363
241.5	4293.3333	5273	246.5	4382.2222	5364
241.6	4295.1111	5274	246.6	4384.0000	5365
241.7	4296.8889	5276	246.7	4385.7778	5366
241.8	4298.6667	5277	246.8	4387.5556	5370
241.9	4300.4444	5300	246.9	4389.3333	5371
242.0	4302.2222	5301	247.0	4391.1111	5372
242.1	4304.0000	5302	247.1	4392.8889	5373
242.2	4305.7778	5303	247.2	4394.6667	5374
242.3	4307.5556	5304	247.3	4396.4444	5375
242.4	4309.3333	5305	247.4	4398.2222	5376
242.5	4311.1111	5307	247.5	4400.0000	5400
242.6	4312.8889	5310	247.6	4401.7778	5401
242.7	4314.6667	5311	247.7	4403.5556	5402
242.8	4316.4444	5312	247.8	4405.3333	5403
242.9	4318.2222	5313	247.9	4407.1111	5404
243.0	4320.0000	5314	248.0	4408.8889	5405
243.1	4321.7778	5315	248.1	4410.6667	5406
243.2	4323.5556	5317	248.2	4412.4444	5407
243.3	4325.3333	5320	248.3	4414.2222	5411
243.4	4327.1111	5321	248.4	4416.0000	5412
243.5	4328.8889	5322	248.5	4417.7778	5413
243.6	4330.6667	5323	248.6	4419.5556	5414
243.7	4332.4444	5324	248.7	4421.3333	5415
243.8	4334.2222	5325	248.8	4423.1111	5416
243.9	4336.0000	5327	248.9	4424.8889	5417
244.0	4337.7778	5330	249.0	4426.6667	5421
244.1	4339.5556	5331	249.1	4428.4444	5422
244.2	4341.3333	5332	249.2	4430.2222	5423
244.3	4343.1111	5333	249.3	4432.0000	5424
244.4	4344.8889	5334	249.4	4433.7778	5425
244.5	4346.6667	5335	249.5	4435.5556	5426
244.6	4348.4444	5337	249.6	4437.3333	5427
244.7	4350.2222	5340	249.7	4439.1111	5431
244.8	4352.0000	5341	249.8	4440.8889	5432
244.9	4353.7778	5342	249.9	4442.6667	5433
245.0	4355.5556	5343	250.0	4444.4444	5434

Table 11-17. Azimuth Correction Data

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
250.1	4446.2222	5435	255.1	4535.1111	5526
250.2	4448.0000	5436	255.2	4536.8889	5527
250.3	4449.7778	5437	255.3	4538.6667	5530
250.4	4451.5556	5440	255.4	4540.4444	5531
250.5	4453.3333	5442	255.5	4542.2222	5533
250.6	4455.1111	5443	255.6	4544.0000	5534
250.7	4456.8889	5444	255.7	4545.7778	5535
250.8	4458.6667	5445	255.8	4547.5556	5536
250.9	4460.4444	5446	255.9	4549.3333	5537
251.0	4462.2222	5447	256.0	4551.1111	5540
251.1	4464.0000	5450	256.1	4552.8889	5541
251.2	4465.7778	5452	256.2	4554.6667	5542
251.3	4467.5556	5453	256.3	4556.4444	5544
251.4	4469.3333	5454	256.4	4558.2222	5545
251.5	4471.1111	5455	256.5	4560.0000	5546
251.6	4472.8889	5456	256.6	4561.7778	5547
251.7	4474.6667	5457	256.7	4563.5556	5550
251.8	4476.4444	5460	256.8	4565.3333	5551
251.9	4478.2222	5462	256.9	4567.1111	5552
252.0	4480.0000	5463	257.0	4568.8889	5554
252.1	4481.7778	5464	257.1	4570.6667	5555
252.2	4483.5556	5465	257.2	4572.4444	5556
252.3	4485.3333	5466	257.3	4574.2222	5557
252.4	4487.1111	5467	257.4	4576.0000	5560
252.5	4488.8889	5470	257.5	4577.7778	5561
252.6	4490.6667	5472	257.6	4579.5556	5562
252.7	4492.4444	5473	257.7	4581.3333	5564
252.8	4494.2222	5474	257.8	4583.1111	5565
252.9	4496.0000	5475	257.9	4584.8889	5566
253.0	4497.7778	5476	258.0	4586.6667	5567
253.1	4499.5556	5477	258.1	4588.4444	5570
253.2	4501.3333	5500	258.2	4590.2222	5571
253.3	4503.1111	5501	258.3	4592.0000	5572
253.4	4504.8889	5503	258.4	4593.7778	5574
253.5	4506.6667	5504	258.5	4595.5556	5575
253.6	4508.4444	5505	258.6	4597.3333	5576
253.7	4510.2222	5506	258.7	4599.1111	5577
253.8	4512.0000	5507	258.8	4600.8889	5600
253.9	4513.7778	5510	258.9	4602.6667	5601
254.0	4515.5556	5511	259.0	4604.4444	5602
254.1	4517.3333	5513	259.1	4606.2222	5603
254.2	4519.1111	5514	259.2	4608.0000	5605
254.3	4520.8889	5515	259.3	4609.7778	5606
254.4	4522.6667	5516	259.4	4611.5556	5607
254.5	4524.4444	5517	259.5	4613.3333	5610
254.6	4526.2222	5520	259.6	4615.1111	5611
254.7	4528.0000	5521	259.7	4616.8889	5612
254.8	4529.7778	5523	259.8	4618.6667	5613
254.9	4531.5556	5524	259.9	4620.4444	5615
255.0	4533.3333	5525	260.0	4622.2222	5616

Table 11-17. Azimuth Correction Data-Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
260.1	4624.0000	5617	265.1	4712.8889	5710
260.2	4625.7778	5620	265.2	4714.6667	5711
260.3	4627.5556	5621	265.3	4716.4444	5712
260.4	4629.3333	5622	265.4	4718.2222	5713
260.5	4631.1111	5623	265.5	4720.0000	5714
260.6	4632.8889	5625	265.6	4721.7778	5715
260.7	4634.6667	5626	265.7	4723.5556	5717
260.8	4636.4444	5627	265.8	4725.3333	5720
260.9	4638.2222	5630	265.9	4727.1111	5721
261.0	4640.0000	5631	266.0	4728.8889	5722
261.1	4641.7778	5632	266.1	4730.6667	5723
261.2	4643.5556	5633	266.2	4732.4444	5724
261.3	4645.3333	5635	266.3	4734.2222	5725
261.4	4647.1111	5636	266.4	4736.0000	5727
261.5	4648.8889	5637	266.5	4737.7778	5730
261.6	4650.6667	5640	266.6	4739.5556	5731
261.7	4652.4444	5641	266.7	4741.3333	5732
261.8	4654.2222	5642	266.8	4743.1111	5733
261.9	4656.0000	5643	266.9	4744.8889	5734
262.0	4657.7778	5644	267.0	4746.6667	5735
262.1	4659.5556	5646	267.1	4748.4444	5737
262.2	4661.3333	5647	267.2	4750.2222	5740
262.3	4663.1111	5650	267.3	4752.0000	5741
262.4	4664.8889	5651	267.4	4753.7778	5742
262.5	4666.6667	5652	267.5	4755.5556	5743
262.6	4668.4444	5653	267.6	4757.3333	5744
262.7	4670.2222	5654	267.7	4759.1111	5745
262.8	4672.0000	5656	267.8	4760.8889	5746
262.9	4673.7778	5657	267.9	4762.6667	5750
263.0	4675.5556	5660	268.0	4764.4444	5751
263.1	4677.3333	5661	268.1	4766.2222	5752
263.2	4679.1111	5662	268.2	4768.0000	5753
263.3	4680.8889	5663	268.3	4769.7778	5754
263.4	4682.6667	5664	268.4	4771.5556	5755
263.5	4684.4444	5666	268.5	4773.3333	5756
263.6	4686.2222	5667	268.6	4775.1111	5760
263.7	4688.0000	5670	268.7	4776.8889	5761
263.8	4689.7778	5671	268.8	4778.6667	5762
263.9	4691.5556	5672	268.9	4780.4444	5763
264.0	4693.3333	5673	269.0	4782.2222	5764
264.1	4695.1111	5674	269.1	4784.0000	5765
264.2	4696.8889	5676	269.2	4785.7778	5766
264.3	4698.6667	5677	269.3	4787.5556	5770
264.4	4700.4444	5700	269.4	4789.3333	5771
264.5	4702.2222	5701	269.5	4791.1111	5772
264.6	4704.0000	5702	269.6	4792.8889	5773
264.7	4705.7778	5703	269.7	4794.6667	5774
264.8	4707.5556	5704	269.8	4796.4444	5775
264.9	4709.3333	5705	269.9	4798.2222	5776
265.0	4711.1111	5707	270.0	4800.0000	6000

Table 11-17. Azimuth Correction Data-Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
270.1	4801.7778	6001	275.1	4890.6667	6072
270.2	4803.5556	6002	275.2	4892.4444	6073
270.3	4805.3333	6003	275.3	4894.2222	6074
270.4	4807.1111	6004	275.4	4896.0000	6075
270.5	4808.8889	6005	275.5	4897.7778	6076
270.6	4810.6667	6006	275.6	4899.5556	6077
270.7	4812.4444	6007	275.7	4901.3333	6100
270.8	4814.2222	6011	275.8	4903.1111	6101
270.9	4816.0000	6012	275.9	4904.8889	6103
271.0	4817.7778	6013	276.0	4906.6667	6104
271.1	4819.5556	6014	276.1	4908.4444	6105
271.2	4821.3333	6015	276.2	4910.2222	6106
271.3	4823.1111	6016	276.3	4912.0000	6107
271.4	4824.8889	6017	276.4	4913.7778	6110
271.5	4826.6667	6021	276.5	4915.5556	6111
271.6	4828.4444	6022	276.6	4917.3333	6113
271.7	4830.2222	6023	276.7	4919.1111	6114
271.8	4832.0000	6024	276.8	4920.8889	6115
271.9	4833.7778	6025	276.9	4922.6667	6116
272.0	4835.5556	6026	277.0	4924.4444	6117
272.1	4837.3333	6027	277.1	4926.2222	6120
272.2	4839.1111	6031	277.2	4928.0000	6121
272.3	4840.8889	6032	277.3	4929.7778	6123
272.4	4842.6667	6033	277.4	4931.5556	6124
272.5	4844.4444	6034	277.5	4933.3333	6125
272.6	4846.2222	6035	277.6	4935.1111	6126
272.7	4848.0000	6036	277.7	4936.8889	6127
272.8	4849.7778	6037	277.8	4938.6667	6130
272.9	4851.5556	6040	277.9	4940.4444	6131
273.0	4853.3333	6042	278.0	4942.2222	6133
273.1	4855.1111	6043	278.1	4944.0000	6134
273.2	4856.8889	6044	278.2	4945.7778	6135
273.3	4858.6667	6045	278.3	4947.5556	6136
273.4	4860.4444	6046	278.4	4949.3333	6137
273.5	4862.2222	6047	278.5	4951.1111	6140
273.6	4864.0000	6050	278.6	4952.8889	6141
273.7	4865.7778	6052	278.7	4954.6667	6142
273.8	4867.5556	6053	278.8	4956.4444	6144
273.9	4869.3333	6054	278.9	4958.2222	6145
274.0	4871.1111	6055	279.0	4960.0000	6146
274.1	4872.8889	6056	279.1	4961.7778	6147
274.2	4874.6667	6057	279.2	4963.5556	6150
274.3	4876.4444	6060	279.3	4965.3333	6151
274.4	4878.2222	6062	279.4	4967.1111	6152
274.5	4880.0000	6063	279.5	4968.8889	6154
274.6	4881.7778	6064	279.6	4970.6667	6155
274.7	4883.5556	6065	279.7	4972.4444	6156
274.8	4885.3333	6066	279.8	4974.2222	6157
274.9	4887.1111	6067	279.9	4976.0000	6160
275.0	4888.8889	6070	280.0	4977.7778	6161

Table 11-17. Azimuth Correction Data-Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
280.1	4979.5556	6162	285.1	5068.4444	6253
280.2	4981.3333	6164	285.2	5070.2222	6254
280.3	4983.1111	6165	285.3	5072.0000	6256
280.4	4984.8889	6166	285.4	5073.7778	6257
280.5	4986.6667	6167	285.5	5075.5556	6260
280.6	4988.4444	6170	285.6	5077.3333	6261
280.7	4990.2222	6171	285.7	5079.1111	6262
280.8	4992.0000	6172	285.8	5080.8889	6263
280.9	4993.7778	6174	285.9	5082.6667	6264
281.0	4995.5556	6175	286.0	5084.4444	6266
281.1	4997.3333	6176	286.1	5086.2222	6267
281.2	4999.1111	6177	286.2	5088.0000	6270
281.3	5000.8889	6200	286.3	5089.7778	6271
281.4	5002.6667	6201	286.4	5091.5556	6272
281.5	5004.4444	6202	286.5	5093.3333	6273
281.6	5006.2222	6203	286.6	5095.1111	6274
281.7	5008.0000	6205	286.7	5096.8889	6276
281.8	5009.7778	6206	286.8	5098.6667	6277
281.9	5011.5556	6207	286.9	5100.4444	6300
282.0	5013.3333	6210	287.0	5102.2222	6301
282.1	5015.1111	6211	287.1	5104.0000	6302
282.2	5016.8889	6212	287.2	5105.7778	6303
282.3	5018.6667	6213	287.3	5107.5556	6304
282.4	5020.4444	6215	287.4	5109.3333	6305
282.5	5022.2222	6216	287.5	5111.1111	6307
282.6	5024.0000	6217	287.6	5112.8889	6310
282.7	5025.7778	6220	287.7	5114.6667	6311
282.8	5027.5556	6221	287.8	5116.4444	6312
282.9	5029.3333	6222	287.9	5118.2222	6313
283.0	5031.1111	6223	288.0	5120.0000	6314
283.1	5032.8889	6225	288.1	5121.7778	6315
283.2	5034.6667	6226	288.2	5123.5556	6317
283.3	5036.4444	6227	288.3	5125.3333	6320
283.4	5038.2222	6230	288.4	5127.1111	6321
283.5	5040.0000	6231	288.5	5128.8889	6322
283.6	5041.7778	6232	288.6	5130.6667	6323
283.7	5043.5556	6233	288.7	5132.4444	6324
283.8	5045.3333	6235	288.8	5134.2222	6325
283.9	5047.1111	6236	288.9	5136.0000	6327
284.0	5048.8889	6237	289.0	5137.7778	6330
284.1	5050.6667	6240	289.1	5139.5556	6331
284.2	5052.4444	6241	289.2	5141.3333	6332
284.3	5054.2222	6242	289.3	5143.1111	6333
284.4	5056.0000	6243	289.4	5144.8889	6334
284.5	5057.7778	6244	289.5	5146.6667	6335
284.6	5059.5556	6246	289.6	5148.4444	6337
284.7	5061.3333	6247	289.7	5150.2222	6340
284.8	5063.1111	6250	289.8	5152.0000	6341
284.9	5064.8889	6251	289.9	5153.7778	6342
285.0	5066.6667	6252	290.0	5155.5556	6343

Table 11-17. Azimuth Correction Data-Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
290.1	5157.3333	6344	295.1	5246.2222	6435
290.2	5159.1111	6345	295.2	5248.0000	6436
290.3	5160.8889	6346	295.3	5249.7778	6437
290.4	5162.6667	6350	295.4	5251.5556	6440
290.5	5164.4444	6351	295.5	5253.3333	6442
290.6	5166.2222	6352	295.6	5255.1111	6443
290.7	5168.0000	6353	295.7	5256.8889	6444
290.8	5169.7778	6354	295.8	5258.6667	6445
290.9	5171.5556	6355	295.9	5260.4444	6446
291.0	5173.3333	6356	296.0	5262.2222	6447
291.1	5175.1111	6360	296.1	5264.0000	6450
291.2	5176.8889	6361	296.2	5265.7778	6452
291.3	5178.6667	6362	296.3	5267.5556	6453
291.4	5180.4444	6363	296.4	5269.3333	6454
291.5	5182.2222	6364	296.5	5271.1111	6455
291.6	5184.0000	6365	296.6	5272.8889	6456
291.7	5185.7778	6366	296.7	5274.6667	6457
291.8	5187.5556	6370	296.8	5276.4444	6460
291.9	5189.3333	6371	296.9	5278.2222	6462
292.0	5191.1111	6372	297.0	5280.0000	6463
292.1	5192.8889	6373	297.1	5281.7778	6464
292.2	5194.6667	6374	297.2	5283.5556	6465
292.3	5196.4444	6375	297.3	5285.3333	6466
292.4	5198.2222	6376	297.4	5287.1111	6467
292.5	5200.0000	6400	297.5	5288.8889	6470
292.6	5201.7778	6401	297.6	5290.6667	6472
292.7	5203.5556	6402	297.7	5292.4444	6473
292.8	5205.3333	6403	297.8	5294.2222	6474
292.9	5207.1111	6404	297.9	5296.0000	6475
293.0	5208.8889	6405	298.0	5297.7778	6476
293.1	5210.6667	6406	298.1	5299.5556	6477
293.2	5212.4444	6407	298.2	5301.3333	6500
293.3	5214.2222	6411	298.3	5303.1111	6501
293.4	5216.0000	6412	298.4	5304.8889	6503
293.5	5217.7778	6413	298.5	5306.6667	6504
293.6	5219.5556	6414	298.6	5308.4444	6505
293.7	5221.3333	6415	298.7	5310.2222	6506
293.8	5223.1111	6416	298.8	5312.0000	6507
293.9	5224.8889	6417	298.9	5313.7778	6510
294.0	5226.6667	6421	299.0	5315.5556	6511
294.1	5228.4444	6422	299.1	5317.3333	6513
294.2	5230.2222	6423	299.2	5319.1111	6514
294.3	5232.0000	6424	299.3	5320.8889	6515
294.4	5233.7778	6425	299.4	5322.6667	6516
294.5	5235.5556	6426	299.5	5324.4444	6517
294.6	5237.3333	6427	299.6	5326.2222	6520
294.7	5239.1111	6431	299.7	5328.0000	6521
294.8	5240.8889	6432	299.8	5329.7778	6523
294.9	5242.6667	6433	299.9	5331.5556	6524
295.0	5244.4444	6434	300.0	5333.3333	6525

Table 11-17. Azimuth Correction Data-Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
300.1	5335.1111	6526	305.1	5424.0000	6617
300.2	5336.8889	6527	305.2	5425.7778	6620
300.3	5338.6667	6530	305.3	5427.5556	6621
300.4	5340.4444	6531	305.4	5429.3333	6622
300.5	5342.2222	6533	305.5	5431.1111	6623
300.6	5344.0000	6534	305.6	5432.8889	6625
300.7	5345.7778	6535	305.7	5434.6667	6626
300.8	5347.5556	6536	305.8	5436.4444	6627
300.9	5349.3333	6537	305.9	5438.2222	6630
301.0	5351.1111	6540	306.0	5440.0000	6631
301.1	5352.8889	6541	306.1	5441.7778	6632
301.2	5354.6667	6542	306.2	5443.5556	6633
301.3	5356.4444	6544	306.3	5445.3333	6635
301.4	5358.2222	6545	306.4	5447.1111	6636
301.5	5360.0000	6546	306.5	5448.8889	6637
301.6	5361.7778	6547	306.6	5450.6667	6640
301.7	5363.5556	6550	306.7	5452.4444	6641
301.8	5365.3333	6551	306.8	5454.2222	6642
301.9	5367.1111	6552	306.9	5456.0000	6643
302.0	5368.8889	6554	307.0	5457.7778	6644
302.1	5370.6667	6555	307.1	5459.5556	6646
302.2	5372.4444	6556	307.2	5461.3333	6647
302.3	5374.2222	6557	307.3	5463.1111	6650
302.4	5376.0000	6560	307.4	5464.8889	6651
302.5	5377.7778	6561	307.5	5466.6667	6652
302.6	5379.5556	6562	307.6	5468.4444	6653
302.7	5381.3333	6564	307.7	5470.2222	6654
302.8	5383.1111	6565	307.8	5472.0000	6656
302.9	5384.8889	6566	307.9	5473.7778	6657
303.0	5386.6667	6567	308.0	5475.5556	6660
303.1	5388.4444	6570	308.1	5477.3333	6661
303.2	5390.2222	6571	308.2	5479.1111	6662
303.3	5392.0000	6572	308.3	5480.8889	6663
303.4	5393.7778	6574	308.4	5482.6667	6664
303.5	5395.5556	6575	308.5	5484.4444	6666
303.6	5397.3333	6576	308.6	5486.2222	6667
303.7	5399.1111	6577	308.7	5488.0000	6670
303.8	5400.8889	6600	308.8	5489.7778	6671
303.9	5402.6667	6601	308.9	5491.5556	6672
304.0	5404.4444	6602	309.0	5493.3333	6673
304.1	5406.2222	6603	309.1	5495.1111	6674
304.2	5408.0000	6605	309.2	5496.8889	6676
304.3	5409.7778	6606	309.3	5498.6667	6677
304.4	5411.5556	6607	309.4	5500.4444	6700
304.5	5413.3333	6610	309.5	5502.2222	6701
304.6	5415.1111	6611	309.6	5504.0000	6702
304.7	5416.8889	6612	309.7	5505.7778	6703
304.8	5418.6667	6613	309.8	5507.5556	6704
304.9	5420.4444	6615	309.9	5509.3333	6705
305.0	5422.2222	6616	310.0	5511.1111	6707

Table 11-17. Azimuth Correction Data-Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
310.1	5512.8889	6710	315.1	5601.7778	7001
310.2	5514.6667	6711	315.2	5603.5556	7002
310.3	5516.4444	6712	315.3	5605.3333	7003
310.4	5518.2222	6713	315.4	5607.1111	7004
310.5	5520.0000	6714	315.5	5608.8889	7005
310.6	5521.7778	6715	315.6	5610.6667	7006
310.7	5523.5556	6717	315.7	5612.4444	7007
310.8	5525.3333	6720	315.8	5614.2222	7011
310.9	5527.1111	6721	315.9	5616.0000	7012
311.0	5528.8889	6722	316.0	5617.7778	7013
311.1	5530.6667	6723	316.1	5619.5556	7014
311.2	5532.4444	6724	316.2	5621.3333	7015
311.3	5534.2222	6725	316.3	5623.1111	7016
311.4	5536.0000	6727	316.4	5624.8889	7017
311.5	5537.7778	6730	316.5	5626.6667	7021
311.6	5539.5556	6731	316.6	5628.4444	7022
311.7	5541.3333	6732	316.7	5630.2222	7023
311.8	5543.1111	6733	316.8	5632.0000	7024
311.9	5544.8889	6734	316.9	5633.7778	7025
312.0	5546.6667	6735	317.0	5635.5556	7026
312.1	5548.4444	6737	317.1	5637.3333	7027
312.2	5550.2222	6740	317.2	5639.1111	7031
312.3	5552.0000	6741	317.3	5640.8889	7032
312.4	5553.7778	6742	317.4	5642.6667	7033
312.5	5555.5556	6743	317.5	5644.4444	7034
312.6	5557.3333	6744	317.6	5646.2222	7035
312.7	5559.1111	6745	317.7	5648.0000	7036
312.8	5560.8889	6746	317.8	5649.7778	7037
312.9	5562.6667	6750	317.9	5651.5556	7040
313.0	5564.4444	6751	318.0	5653.3333	7042
313.1	5566.2222	6752	318.1	5655.1111	7043
313.2	5568.0000	6753	318.2	5656.8889	7044
313.3	5569.7778	6754	318.3	5658.6667	7045
313.4	5571.5556	6755	318.4	5660.4444	7046
313.5	5573.3333	6756	318.5	5662.2222	7047
313.6	5575.1111	6760	318.6	5664.0000	7050
313.7	5576.8889	6761	318.7	5665.7778	7052
313.8	5578.6667	6762	318.8	5667.5556	7053
313.9	5580.4444	6763	318.9	5669.3333	7054
314.0	5582.2222	6764	319.0	5671.1111	7055
314.1	5584.0000	6765	319.1	5672.8889	7056
314.2	5585.7778	6766	319.2	5674.6667	7057
314.3	5587.5556	6770	319.3	5676.4444	7060
314.4	5589.3333	6771	319.4	5678.2222	7062
314.5	5591.1111	6772	319.5	5680.0000	7063
314.6	5592.8889	6773	319.6	5681.7778	7064
314.7	5594.6667	6774	319.7	5683.5556	7065
314.8	5596.4444	6775	319.8	5685.3333	7066
314.9	5598.2222	6776	319.9	5687.1111	7067
315.0	5600.0000	7000	320.0	5688.8889	7070

Table 11-17. Azimuth Correction Data

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
320.1	5690.6667	7072	325.1	5779.5556	7162
320.2	5692.4444	7073	325.2	5781.3333	7164
320.3	5694.2222	7074	325.3	5783.1111	7165
320.4	5696.0000	7075	325.4	5784.8889	7166
320.5	5697.7778	7076	325.5	5786.6667	7167
320.6	5699.5556	7077	325.6	5788.4444	7170
320.7	5701.3333	7100	325.7	5790.2222	7171
320.8	5703.1111	7101	325.8	5792.0000	7172
320.9	5704.8889	7103	325.9	5793.7778	7174
321.0	5706.6667	7104	326.0	5795.5556	7175
321.1	5708.4444	7105	326.1	5797.3333	7176
321.2	5710.2222	7106	326.2	5799.1111	7177
321.3	5712.0000	7107	326.3	5800.8889	7200
321.4	5713.7778	7110	326.4	5802.6667	7201
321.5	5715.5556	7111	326.5	5804.4444	7202
321.6	5717.3333	7113	326.6	5806.2222	7203
321.7	5719.1111	7114	326.7	5808.0000	7205
321.8	5720.8889	7115	326.8	5809.7778	7206
321.9	5722.6667	7116	326.9	5811.5556	7207
322.0	5724.4444	7117	327.0	5813.3333	7210
322.1	5726.2222	7120	327.1	5818.1111	7211
322.2	5728.0000	7121	327.2	5816.8889	7212
322.3	5729.7778	7123	327.3	5815.6667	7213
322.4	5731.5556	7124	327.4	5820.4444	7215
322.5	5733.3333	7125	327.5	5822.2222	7216
322.6	5735.1111	7126	327.6	5824.0000	7217
322.7	5736.8889	7127	327.7	5825.7778	7220
322.8	5738.6667	7130	327.8	5827.5556	7221
322.9	5740.4444	7131	327.9	5829.3333	7222
323.0	5742.2222	7133	328.0	5831.1111	7223
323.1	5744.0000	7134	328.1	5832.8869	7225
323.2	5745.7778	7135	328.2	5834.6667	7226
323.3	5747.5556	7136	328.3	5836.4444	7227
323.4	5749.3333	7137	328.4	5838.2222	7230
323.5	5751.1111	7140	328.5	5840.0000	7231
323.6	5752.8889	7141	328.6	5841.7778	7232
323.7	5754.6667	7142	328.7	5843.5556	7233
323.8	5756.4444	7144	328.8	5845.3333	7235
323.9	5758.2222	7145	328.9	5847.1111	7236
324.0	5760.0000	7146	329.0	5848.8889	7237
324.1	5761.7778	7147	329.1	5850.6667	7240
324.2	5763.5556	7150	329.2	5852.4444	7241
324.3	5765.3333	7151	329.3	5854.2222	7242
324.4	5767.1111	7152	329.4	5856.0000	7243
324.5	5768.8889	7154	329.5	5857.7778	7244
324.6	5770.6667	7155	329.6	5859.5556	7246
324.7	5772.4444	7156	329.7	5861.3333	7247
324.8	5774.2222	7157	329.8	5863.1111	7250
324.9	5776.0000	7160	329.9	5864.8889	7251
325.0	5777.7778	7161	330.0	5866.6667	7252

Table 11-17. Azimuth Correction Data-Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
330.1	5868.4444	7253	335.1	5957.3333	7344
330.2	5870.2222	7254	335.2	5959.1111	7345
330.3	5872.0000	7256	335.3	5960.8889	7346
330.4	5873.7778	7257	335.4	5962.6667	7350
330.5	5875.5556	7260	335.5	5964.4444	7351
330.6	5877.3333	7261	335.6	5966.2222	7352
330.7	5879.1111	7262	335.7	5968.0000	7353
330.8	5880.8889	7263	335.8	5969.7778	7354
330.9	5882.6667	7264	335.9	5971.5556	7355
331.0	5884.4444	7266	336.0	5973.3333	7356
331.1	5886.2222	7267	336.1	5975.1111	7360
331.2	5888.0000	7270	336.2	5976.8889	7361
331.3	5889.7778	7271	336.3	5978.6667	7362
331.4	5891.5556	7272	336.4	5980.4444	7363
331.5	5893.3333	7273	336.5	5982.2222	7364
331.6	5895.1111	7274	336.6	5984.0000	7365
331.7	5896.8889	7276	336.7	5985.7778	7366
331.8	5898.6667	7277	336.8	5987.5556	7370
331.9	5900.4444	7300	336.9	5989.3333	7371
332.0	5902.2222	7301	337.0	5991.1111	7372
332.1	5904.0000	7302	337.1	5992.8889	7373
332.2	5905.7778	7303	337.2	5994.6667	7374
332.3	5907.5556	7304	337.3	5996.4444	7375
332.4	5909.3333	7305	337.4	5998.2222	7376
332.5	5911.1111	7307	337.5	6000.0000	7400
332.6	5912.8889	7310	337.6	6001.7778	7401
332.7	5914.6667	7311	337.7	6003.5556	7402
332.8	5916.4444	7312	337.8	6005.3333	7403
332.9	5918.2222	7313	337.9	6007.1111	7404
333.0	5920.0000	7314	338.0	6008.8889	7405
333.1	5921.7778	7315	338.1	6010.6667	7406
333.2	5923.5556	7317	338.2	6012.4444	7487
333.3	5925.3333	7320	338.3	6014.2222	7411
333.4	5927.1111	7321	338.4	6016.0000	7412
333.5	5928.8889	7322	338.5	6017.7778	7413
333.6	5930.6667	7323	338.6	6019.5556	7414
333.7	5932.4444	7324	338.7	6021.3333	7415
333.8	5934.2222	7325	338.8	6023.1111	7416
333.9	5936.0000	7327	338.9	6024.8889	7417
334.0	5937.7778	7330	339.0	6026.6667	7421
334.1	5939.5556	7331	339.1	6028.4444	7422
334.2	5941.3333	7332	339.2	6030.2222	7423
334.3	5943.1111	7333	339.3	6032.0000	7424
334.4	5944.8889	7334	339.4	6033.7778	7425
334.5	5946.6667	7335	339.5	6035.5556	7426
334.6	5948.4444	7337	339.6	6037.3333	7427
334.7	5950.2222	7340	339.7	6039.1111	7431
334.8	5952.0000	7341	339.8	6040.8889	7432
334.9	5953.7778	7342	339.9	6042.6667	7433
335.0	5955.5556	7343	340.0	6044.4444	7434

Table 11-17. Azimuth Correction Data-Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
340.1	6046.2222	7435	345.1	6135.1111	7526
340.2	6048.0000	7436	345.2	6136.8889	7527
340.3	6049.7778	7437	345.3	6138.6667	7530
340.4	6051.5556	7440	345.4	6140.4444	7531
340.5	6053.3333	7442	345.5	6142.2222	7533
340.6	6055.1111	7443	345.6	6144.0000	7534
340.7	6056.8889	7444	345.7	6145.7778	7535
340.8	6058.6667	7445	345.8	6147.5556	7536
340.9	6060.4444	7446	345.9	6149.3333	7537
341.0	6062.2222	7447	346.0	6151.1111	7540
341.1	6064.0000	7450	346.1	6152.8889	7541
341.2	6065.7778	7452	346.2	6154.6667	7542
341.3	6067.5556	7453	346.3	6156.4444	7544
341.4	6069.3333	7454	346.4	6158.2222	7545
341.5	6071.1111	7455	346.5	6160.0000	7546
341.6	6072.8889	7456	346.6	6161.7778	7547
341.7	6074.6667	7457	346.7	6163.5556	7550
341.8	6076.4444	7460	346.8	6165.3333	7551
341.9	6076.2222	7462	346.9	6167.1111	7552
342.0	6080.0000	7463	347.0	6168.8899	7554
342.1	6081.7778	7464	347.1	6170.6667	7555
342.2	6083.5556	7465	347.2	6172.4444	7556
342.3	6085.3333	7466	347.3	6174.2222	7557
342.4	6087.1111	7467	347.4	6176.0000	7560
342.5	6088.8889	7470	347.5	6177.7778	7561
342.6	6090.6667	7472	347.6	6179.5556	7562
342.7	6092.4444	7473	347.7	6181.3333	7564
342.8	6094.2222	7474	347.8	6183.1111	7565
342.9	6096.0000	7475	347.9	6184.8889	7566
343.0	6097.7778	7476	348.0	6186.6667	7567
343.1	6099.5556	7477	348.1	6188.4444	7570
343.2	6101.3333	7500	348.2	6190.2222	7571
343.3	6103.1111	7501	348.3	6192.0000	7572
343.4	6104.8889	7503	348.4	6193.7778	7574
343.5	6106.6667	7504	348.5	6195.5556	7575
343.6	6108.4444	7505	348.6	6197.3333	7576
343.7	6110.2222	7506	348.7	6199.1111	7577
343.8	6112.0000	7507	348.8	6200.8889	7600
343.9	6113.7778	7510	348.9	6202.6667	7601
344.0	6115.5556	7511	349.0	6204.4444	7602
344.1	6117.3333	7513	349.1	6206.2222	7603
344.2	6119.1111	7514	349.2	6208.0000	7605
344.3	6120.8889	7515	349.3	6209.7778	7606
344.4	6122.6667	7516	349.4	6211.5556	7607
344.5	6124.4444	7517	349.5	6213.3333	7610
344.6	6126.2222	7520	349.6	6215.1111	7611
344.7	6128.0000	7521	349.7	6216.8889	7612
344.8	6129.7778	7523	349.8	6218.6667	7613
344.9	6131.5556	7524	349.9	6220.4444	7615
345.0	6133.3333	7525	350.0	6222.2222	7616

Table 11-17. Azimuth Correction Data-Continued

AZ in degrees	AZ in mills	AZ correction	AZ in degrees	AZ in mills	AZ correction
350.1	6224.0000	7617	355.1	6312.8889	7710
350.2	6225.7778	7620	355.2	6314.6667	7711
350.3	6227.5556	7621	355.3	6316.4444	7712
350.4	6229.3333	7622	355.4	6318.2222	7713
350.5	6231.1111	7623	355.5	6320.0000	7714
350.6	6232.8889	7625	355.6	6321.7778	7715
350.7	6234.6667	7626	355.7	6323.5556	7717
350.8	6236.4444	7627	355.8	6325.3333	7720
350.9	6238.2222	7630	355.9	6327.1111	7721
351.0	6240.0000	7631	356.0	6328.8889	7722
351.1	6241.7778	7632	356.1	6330.6667	7723
351.2	6243.5556	7633	356.2	6332.4444	7724
351.3	6245.3333	7635	356.3	6334.2222	7725
351.4	6247.1111	7636	356.4	6336.0000	7727
351.5	6248.8889	7637	356.5	6337.7778	7730
351.6	6250.6667	7640	356.6	6339.5556	7731
351.7	6252.4444	7641	356.7	6341.3333	7732
351.8	6254.2222	7642	356.8	6343.1111	7733
351.9	6256.0000	7643	356.9	6344.8889	7734
352.0	6257.7778	7644	357.0	6346.6667	7735
352.1	6259.5556	7646	357.1	6348.4444	7737
352.2	6261.3333	7647	357.2	6350.2222	7740
352.3	6263.1111	7650	357.3	6352.0000	7741
352.4	6264.8889	7651	357.4	6353.7778	7742
352.5	6266.6667	7652	357.5	6355.5556	7743
352.6	6268.4444	7653	357.6	6357.3333	7744
352.7	6270.2222	7654	357.7	6359.1111	7745
352.8	6272.0000	7656	357.8	6360.8889	7746
352.9	6273.7778	7657	357.9	6362.6667	7750
353.0	6275.5556	7660	358.0	6364.4444	7751
353.1	6277.3333	7661	358.1	6366.2222	7752
353.2	6279.1111	7662	358.2	6368.0000	7753
353.3	6280.8889	7663	358.3	6369.7778	7754
353.4	6282.6667	7664	358.4	6371.5556	7755
353.5	6284.4444	7666	358.5	6373.3333	7756
353.6	6286.2222	7667	358.6	6375.1111	7760
353.7	6288.0000	7670	358.7	6376.8889	7761
353.8	6289.7778	7671	358.8	6378.6667	7762
353.9	6291.5556	7672	358.9	6380.4444	7763
354.0	6293.3333	7673	359.0	6382.2222	7764
354.1	6295.1111	7674	359.1	6384.0000	7765
354.2	6296.8889	7676	359.2	6385.7778	7766
354.3	6298.6667	7677	359.3	6387.5556	7770
354.4	6300.4444	7700	359.4	6389.3333	7771
354.5	6302.2222	7701	359.5	6391.1111	7772
354.6	6304.0000	7702	359.6	6392.8889	7773
354.7	6305.7778	7703	359.7	6394.6667	7774
354.8	6307.5556	7704	359.8	6396.4444	7775
354.9	6309.3333	7705	359.9	6398.2222	7776
355.0	6311.1111	7707	360.0	6400.0000	0000

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General, United States Army
Chief of Staff

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THE METRIC SYSTEM AND EQUIVALENTS

'NEAR MEASURE

. Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
1 Kilometer = 1000 Meters = 0.621 Miles

'VEIGHTS

Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 lb.
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches
1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet
1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches
1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

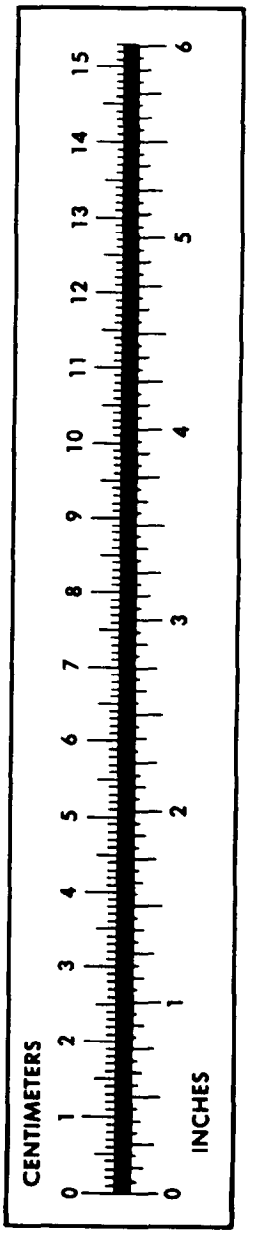
TEMPERATURE

5/9(°F - 32) = °C
212° Fahrenheit is evuivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
32° Fahrenheit is equivalent to 0° Celsius
9/5C° + 32 =°F

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
ıts	Liters	0.473
arts	Liters	0.946
allons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
ers	Gallons	0.264
ms	Ounces	0.035
ograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pounds-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
lometers per Liter	Miles per Gallon	2.354
meters per Hour	Miles per Hour	0.621



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