Rockwell International

component maintenance manual
(with illustrated parts list)

Collins Air Transport Division

Collins HSI-45
Horizontal Situation Indicator

523-0768607-2K1113

Rockwell International

component maintenance manual
(with illustrated parts list)

Collins HSI-45 Horizontal Situation Indicator

This manual includes coverage of the following equipment:

	Model No	*Collins Part No*
Horizontal Situation Indicator	*HSI-45*	*622-4298-001*

Collins Air Transport Division
Rockwell International Corporation
Cedar Rapids, Iowa 52498

Printed in the United States of America

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RECORD OF REVISIONS

REV NO	ISSUE DATE	DATE INSERTED	BY	REV NO	ISSUE DATE	DATE INSERTED	BY	REV NO	ISSUE DATE	DATE INSERTED	BY
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2	Apr 15/92										

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SERVICE BULLETIN LIST

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1	Service Bulletin No 1 is superseded by Service Bulletin No 2		
2	Discrete components replacement for servo-amplifier modules containing thin films	1	Sep 1/83
3	Replacement of lamp driver devices	2	Apr 15/92
A4	Possible erroneous display of course and/or heading	2	Apr 15/92
5	Lamp voltage reduction	2	Apr 15/92
6	Compass card malfunction	2	Apr 15/92

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Record of Temporary Revisions	*1	Apr 15/92
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	*3	Apr 15/92
	*4	Apr 15/92
	*5	Apr 15/92
	*6	Apr 15/92
Service Bulletin List	*1	Apr 15/92
	2	Blank
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List of Effective Temporary Revision Pages	*1 thru 2	Deleted
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	F 9	Mar 15/78
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	125	Mar 15/78		*162B Added	Apr 15/92
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				222	Blank

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HSI-45 HORIZONTAL SITUATION INDICATOR

COMPONENT MAINTENANCE MANUAL (523-0768607)

TEMPORARY REVISION NO 34-28-25-20

Insert facing page LEP 2, 34-28-25

Subject: List of Effective Pages

In the second column of page listings after page 160 add the following:

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*160B		Blank Added

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INTRODUCTION

1. General

This component maintenance manual (with illustrated parts list) includes maintenance instructions (and parts listings) prepared in accordance with ATA Specification No 100 for Manufacturers' Technical Data for the Collins HSI-45.

The maintenance instructions are presented in the following sections: Description and Operation; Testing and Troubleshooting; Disassembly; Cleaning; Check; Repair; Assembly (Including Storage); Fits and Clearances; Special Tools, Fixtures, and Equipment; and Illustrated Parts List.

This component maintenance manual provides shop verified procedures that will enable a mechanic, unfamiliar with the component, to restore it to serviceable condition. The procedures are prepared for the mechanic that performs shop work and not for the aircraft mechanic.

The disassembly, assembly, testing, and troubleshooting procedures in this manual have actually been performed.

CAUTION: THE MATERIAL IN THIS MANUAL IS SUBJECT TO CHANGE. BEFORE ATTEMPTING ANY MAINTENANCE OPERATION ON THE EQUIPMENT COVERED IN THIS MANUAL, VERIFY THAT YOU HAVE COMPLETE AND UP-TO-DATE PUBLICATIONS BY REFERRING TO THE APPLICABLE PUBLICATIONS AND SERVICE BULLETIN INDEXES.

We welcome your comments concerning this manual. Although every effort has been made to keep it free of errors, some may occur. When reporting a specific problem, please describe it briefly and include the instruction book part number, the paragraph or figure number, and the page number.

Send your comments to: Publications Department
Collins Air Transport Division
Rockwell International
Cedar Rapids, Iowa 52498

2. List of Illustrations

3. Uncommon Abbreviations/Acronyms

ABBREVIATION/ ACRONYM	IDENTIFICATION
BCD	Binary coded decimal
CT	Control transformer
DME	Distance measuring equipment
HSI	Horizontal situation indicator
INS	Inertial navigation system
GS	Glideslope
LOC	Localizer
NAV	Navigation
UUT	Unit under test
VOR	VHF omnidirectional radio range

4. Advisories

WARNING: THIS UNIT EXHIBITS A HIGH DEGREE OF FUNCTIONAL RELIABILITY. NEVERTHELESS, USERS MUST KNOW THAT IT IS NOT PRACTICAL TO MONITOR FOR ALL CONCEIVABLE SYSTEM FAILURES, AND HOWEVER UNLIKELY, IT IS POSSIBLE THAT ERRONEOUS OPERATION COULD OCCUR WITHOUT A FAULT INDICATION. THE PILOT HAS THE RESPONSIBILITY TO FIND SUCH AN OCCURRENCE BY MEANS OF CROSS-CHECKS WITH REDUNDANT OR CORRELATED DATA AVAILABLE IN THE COCKPIT.

WARNING: SERVICE PERSONNEL ARE TO OBEY STANDARD SAFETY PRECAUTIONS, SUCH AS WEARING SAFETY GLASSES, TO PREVENT PERSONAL INJURY WHILE INSTALLING OR DOING MAINTENANCE ON THIS UNIT.

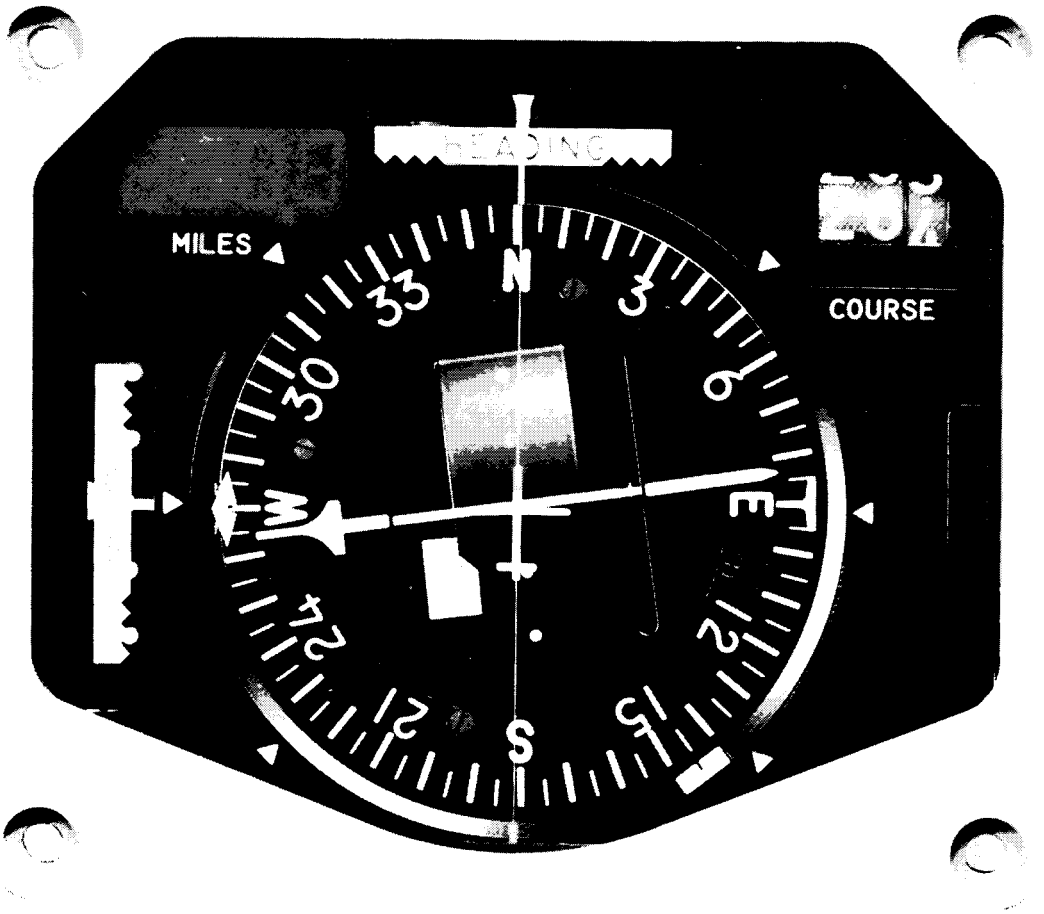
WARNING: THIS UNIT MAY HAVE COMPONENTS THAT CONTAIN MATERIALS (SUCH AS BERYLLIUM OXIDE, ACIDS, LITHIUM, RADIOACTIVE MATERIAL, MERCURY, ETC) THAT CAN BE HAZARDOUS TO YOUR HEALTH. IF THE COMPONENT ENCLOSURE IS BROKEN, HANDLE THE COMPONENT IN ACCORDANCE WITH OSHA REQUIREMENTS 29CFR 1910.1000 OR SUPERSEDING DOCUMENTS TO PREVENT PERSONAL CONTACT WITH OR INHALATION OF HAZARDOUS MATERIALS. SINCE IT IS VIRTUALLY IMPOSSIBLE TO DETERMINE WHICH COMPONENTS DO OR DO NOT CONTAIN SUCH HAZARDOUS MATERIALS, DO NOT OPEN OR DISASSEMBLE COMPONENTS FOR ANY REASON.

CAUTION: TURN OFF POWER BEFORE DISCONNECTING ANY UNIT FROM WIRING. DISCONNECTING THE UNIT WITHOUT TURNING POWER OFF MAY CAUSE VOLTAGE TRANSIENTS THAT CAN DAMAGE THE UNIT.

CAUTION: ESDS DEVICES ARE SUBJECT TO DAMAGE BY EXCESSIVE LEVELS OF VOLTAGE AND/OR CURRENT, JUST AS ARE MORE CONVENTIONAL SEMICONDUCTOR DEVICES. HOWEVER, THE PRECAUTIONS NORMALLY USED TO PROTECT SEMICONDUCTORS ARE NOT SUFFICIENT FOR THE PROTECTION OF ESDS COMPONENTS, BECAUSE OF THEIR VERY HIGH ELECTRICAL RESISTANCE. THE LOW-ENERGY SOURCE THAT MOST COMMONLY DESTROYS ESDS DEVICES IS THE HUMAN BODY, WHICH IN CONJUNCTION WITH NONCONDUCTIVE GARMENTS AND FLOOR COVERINGS GENERATES AND RETAINS STATIC ELECTRICITY. IN ORDER TO ADEQUATELY PROTECT ESDS DEVICES, THE DEVICE AND EVERYTHING THAT CONTACTS IT MUST BE BROUGHT TO GROUND POTENTIAL BY PROVIDING A CONDUCTIVE SURFACE AND DISCHARGE PATHS. THE FOLLOWING PRECAUTIONS MUST BE FOLLOWED:

A. DEENERGIZE OR DISCONNECT ALL POWER, SIGNAL SOURCES, AND LOADS.
B. PLACE THE UNIT ON GROUNDED CONDUCTIVE WORK SURFACE.
C. GROUND THE REPAIR OPERATOR THROUGH A CONDUCTIVE WRIST STRAP OR OTHER DEVICE USING A 470-kΩ OR 1-MΩ SERIES RESISTOR TO PROTECT THE OPERATOR.
D. GROUND ANY TOOLS, SUCH AS SOLDERING EQUIPMENT, THAT WILL CONTACT THE UNIT. CONTACT WITH THE OPERATOR'S HAND PROVIDES A SUFFICIENT GROUND FOR TOOLS THAT ARE OTHERWISE ELECTRICALLY ISOLATED.
E. WHEN ESDS DEVICES AND ASSEMBLIES ARE NOT IN THE UNIT, THEY SHOULD BE ON THE CONDUCTIVE WORK SURFACE OR IN CONDUCTIVE CONTAINERS. WHEN A DEVICE OR ASSEMBLY IS INSERTED IN OR REMOVED FROM A CONTAINER, THE OPERATOR SHOULD MAINTAIN CONTACT WITH THE CONDUCTIVE PORTION OF THE CONTAINER. DO NOT USE PLASTIC BAGS UNLESS THEY HAVE BEEN IMPREGNATED WITH A CONDUCTIVE MATERIAL.
F. DO NOT HANDLE ESDS DEVICES UNNECESSARILY OR REMOVE THEM FROM THEIR PACKAGES UNTIL ACTUALLY USED OR TESTED.
G. TO PREVENT DAMAGE BY TRANSIENT VOLTAGES, ONLY SOLDERING IRONS HAVING ZERO VOLTAGE AT THE TIP SHOULD BE USED.

5. Frontispiece



TP5-5239-017

HSI-45 Horizontal Situation Indicator

DESCRIPTION AND OPERATION

1. General

Refer to frontispiece for an overall view of the equipment. Figure 1 is a list of the equipment covered in this manual.

MODEL NO	DESCRIPTION	COLLINS PART NUMBER (CPN)
HSI-45	Meter movements display course deviation, glideslope deviation, and to-from information; glideslope, navigation, and heading warning flags; and INS annunciation. Servo-driven displays provide heading and bearing (either radio or INS source) information. Servo-driven course and heading displays are positioned by remote control. A digital readout displays DME or INS distance.	622-4298-001

Equipment Covered
Figure 1

2. Purpose of Equipment

The horizontal situation indicator provides a plan view of the aircraft situation in the horizontal plane.

3. Equipment Specifications

Figure 2 is a list of the specifications for the horizontal situation indicator.

4. Equipment Description

A. Mechanical Description

The horizontal situation indicator is housed in an extruded aluminum alloy case. The glass is coated with a high-efficiency antireflective coating and is sealed to the case. A tape covers the joint between case sleeve and rear cover to provide a dust-sealed enclosure. Electrical connections are made through two connectors located at the rear of the indicator. Refer to figure 4 for rear connector pin

CHARACTERISTIC	SPECIFICATION
Related documents	
ARINC characteristics	561-2 and 568.
TSO	C52a, C6c, and C66a.
Physical specifications	
Case size	103.3 mm (4.068 in) high, 122.2 mm (4.812 in) wide, and 222.5 mm (8.750 in) long (max), measured from rear of mounting flange to rear of case not including connectors.
Bezel size	108 mm (4.25 in) high. 127 mm (5.00 in) wide.
Weight	3.13 kg (6.9 lb) max.
Mounting	The indicator is front mounted using screw fastenings.
Electrical connectors	
J1	MS 24264R-22-B-55P8X (CPN 359-4118-040) mates with MS 24266-22-B-55S8 (CPN 359-4019-000).
J2	MS 24264R-22-B-55P9X (CPN 359-4118-050) mates with MS 24266R-22-B-55S9 (CPN 359-4020-00).
Viewing angle	Good readability from 30 degrees up, 30 degrees to the sides, and 0 degree from below.
Colors	
Bezel and case	Gray (FED-STD-595 color no 36118).
Course deviation bar, and course arrow and tail	Saturn yellow (CPN 005-8219-000, Switzer Bros. no 207-17).
Glideslope deviation pointer, to-from pointer, dial markings, and counter numerals	Lusterless white (CPN 005-0651-000).

CHARACTERISTIC	SPECIFICATION
Warning flags	
GS, HEADING	Day-Glo rocket red (Switzer Bros, no 207-13) with black (CPN 005-8058-000) lettering.
NAV	Red (Nazdar DL-101) and lusterless white (CPN 005-0651-000) stripes.
Selected heading index	Arc yellow (CPN 005-8335-020, Switzer Bros. no 207-16).
Bearing pointer	Aurora pink (CPN 005-8335-030, Switzer Bros. no 207-11).
INS annunciator	Black (CPN 005-8058-000) with lusterless white (CPN 005-0651-000) lettering.
Environmental specifications	
Ambient temperature range	
Continuous operation	-15 to +71 °C (-5 to +159.8 °F).
Storage	-65 to +71 °C (-85 to +159.8 °F).
Humidity	95% relative humidity at 71 °C (159.8 °F). 85% relative humidity at 38 °C (100.4 °F).
Altitude	-328 to 16 400 metres (-1000 to 50 000 ft). Unit shall not be damaged by absolute pressure equivalent of 1270 mm (50 in) of mercury.
Vibration	
The indicator shall function and not be adversely affected by the following conditions	
FREQUENCY (Hz)	DISPLACEMENT / MAX ACCELERATION (g)
5 to 17	2.54 mm (0.10 in) da
17 to 55	±1.5
55 to 2000	±0.25

Equipment Specifications
Figure 2 (Sheet 2)

CHARACTERISTIC	SPECIFICATION
Magnetic effect	5 degrees max deflection with a 1-1/2-in bar magnet held at a distance of 12 in.
Electrical specifications	
Primary power	22.62 to 29.38 V, 380 to 420 Hz.
Heading and course select servo	22.62 to 29.38 V, 380 to 420 Hz, 7 VA max.
Azimuth servo	22.62 to 29.38 V, 380 to 420 Hz, 5 VA max.
Bearing pointer servo	22.62 to 29.38 V, 380 to 420 Hz, 3 VA max.
Distance display	22.62 to 29.38 V, 380 to 420 Hz, 12 W at full intensity, 13 W max.
Lighting power	5 V ac/V dc, 1 A max.
Meter movements	
To-from pointer M1	
Resistance	160 to 240 Ω at +25 °C (+77 °F).
Sensitivity	Full deflection (either direction) 230 μA dc min, 330 μA dc max.
Course deviation bar M2	
Resistance	960 to 1040 Ω at +25 °C (+77 °F).
Range	±150 μA full-scale deflection.
Scale factor	75 μA per dot of course deviation.
Accuracy	±8 μA at first dot; ±15 μA at second dot.
Glideslope pointer M3	
Resistance	960 to 1040 Ω at +25 °C (+77 °F).
Range	±150 μA full-scale deflection.
Scale factor	75 μA per dot of glideslope deviation.

HSI-45 HORIZONTAL SITUATION INDICATOR

COMPONENT MAINTENANCE MANUAL (523-0768607)

TEMPORARY REVISION NO 34-28-25-21

Insert facing page 5, 34-28-25

Subject: Equipment Specifications

Change the first entry in the SPECIFICATION column to read:

±9 µA at first dot; ±17 µA at second dot.

CHARACTERISTIC	SPECIFICATION
Accuracy	±8 μA at first dot; ±15 μA at second dot.
Out-of-view bias	1.1 mA min to 2 mA max.
Warning flags	
NAV M5 GS M4 HEADING M7	Circuit impedance: 7 kΩ min. Meter resistance: 970 to 1030 Ω at +25 °C (+77 °F). In view: 0 to +3.5 V dc. Out of view: +18.5 to 30 V dc.
Annunciators	
INS M6	Circuit impedance: 7 kΩ min. Meter resistance: 960 to 1040 Ω at +25 °C (+77 °F). In view: +18.5 to 30 V dc. Out of view: 0 to +3.5 V dc.

Equipment Specifications
Figure 2 (Sheet 4)

assignments. The indicator is front mounted using screw fasteners. Refer to figure 3 for outline and mounting dimensions. Dimensions, weight, and type connectors are listed in figure 2.

B. Electrical Description

The horizontal situation indicator contains internal power supplies that convert 26-V ac, 400-Hz primary power to various voltages required by both the servoed displays and numerical readouts.

C. Controls and Indicators

The HSI displays are controlled remotely by appropriate dc and 3-wire synchro signals. Controls and indicators are shown in figure 5. Figure 6 lists each indicator and control and describes the function of each. All indicators are located on the front panel of the instrument.

5. Theory of Operation

A. Introduction

The HSI provides a pictorial plan view of aircraft heading, course deviation, glideslope deviation, and bearing. An annunciator flag indicates INS mode of operation, and warning flags indicate wrong or missing information. Digital readout provides DME or INS distance information.

B. Simplified Theory of Operation

(1) Servo-Driven Displays

Servos within the HSI position the course arrow, heading marker, azimuth card, and bearing pointer. External systems transmit 3-wire information to the HSI. Control transformers in the HSI generate error signals until the servo-drive display is positioned as required by the 3-wire input signal.

(2) Meter-Driven Displays

The to-from pointer, glideslope deviation pointer, course deviation pointer, INS annunciator, and warning flags are meter-driven displays. The associated navigation system supplies monitor signals to the HSI that control operation of the meter movements.

(3) Azimuth Monitor and HEADING Warning Flag

The HEADING flag is held out of view in the following conditions.

(a) 26-V ac azimuth power present

(b) +28-V dc azimuth system monitor signal present

(c) XYZ excitation power to the azimuth transolver present

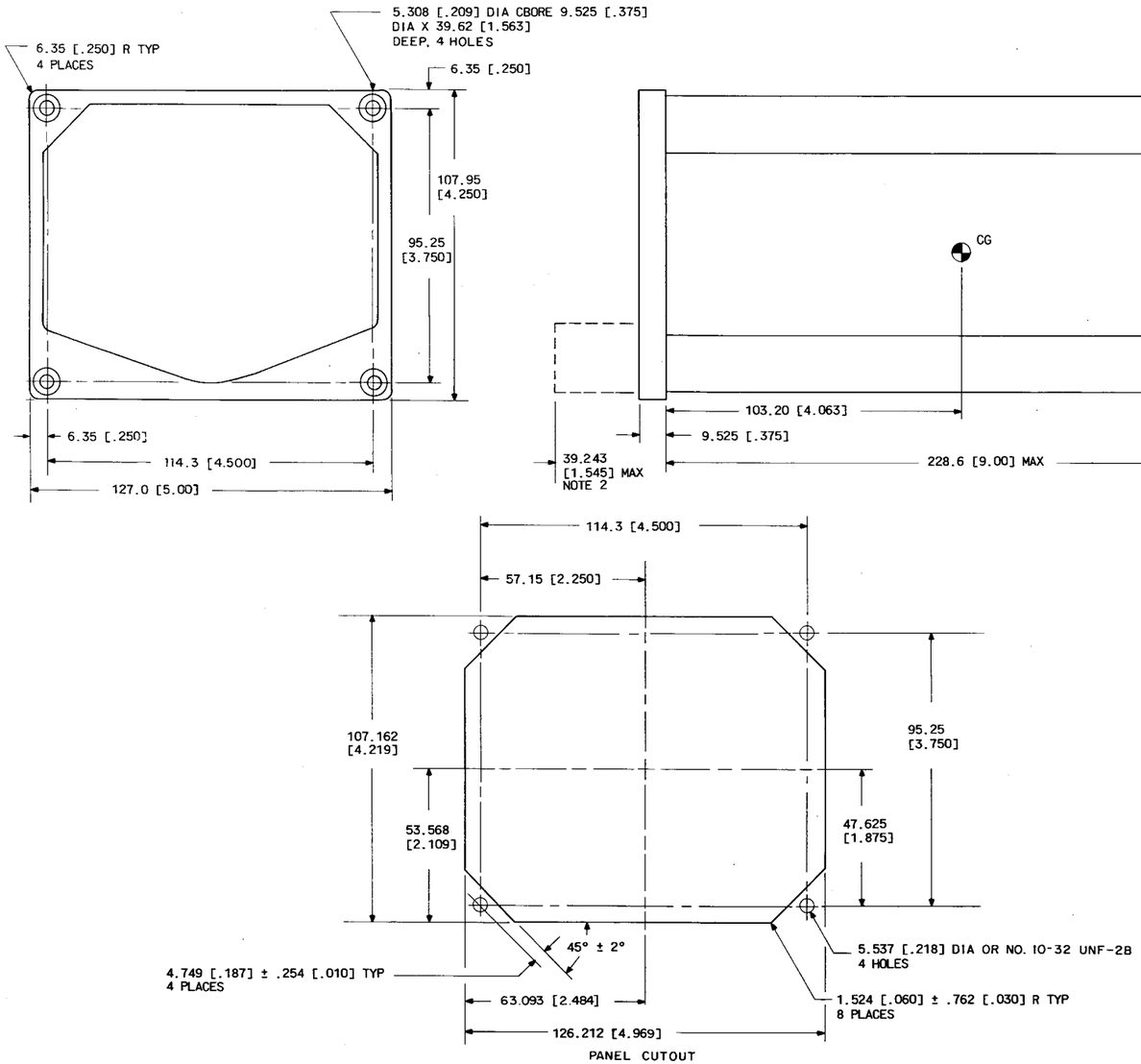
(d) Azimuth servo power supply good

(e) No more than 5 degrees nominal error input to the azimuth servo amplifier

Loss of any of the above conditions causes the HEADING flag to drop into view.

(4) Back LOC Switching

The back LOC sensing circuit supplies a 28-V dc signal whenever the indicated course is 105 to 255 degrees relative to the localizer beam.



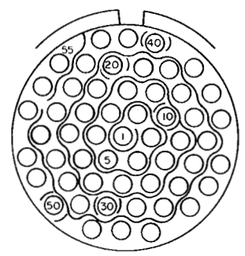
NOTES:

1. CONNECTORS: MATING PLUGS ARE MS 24266R-22-B-55S8 (COLLINS PART NO. 359-4019-00) AND MS 24266R-22-B-55S9 (COLLINS PART NO. 359-4020-00).
2. APPLICABLE ONLY TO UNITS EQUIPPED WITH KNOBS.
3. WEIGHT OF UNIT 3.171 kg [7.0 LB] MAX.
4. UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN MILLIMETRES [INCHES].

638-2790

Outline and Mounting Dimensions
Figure 3

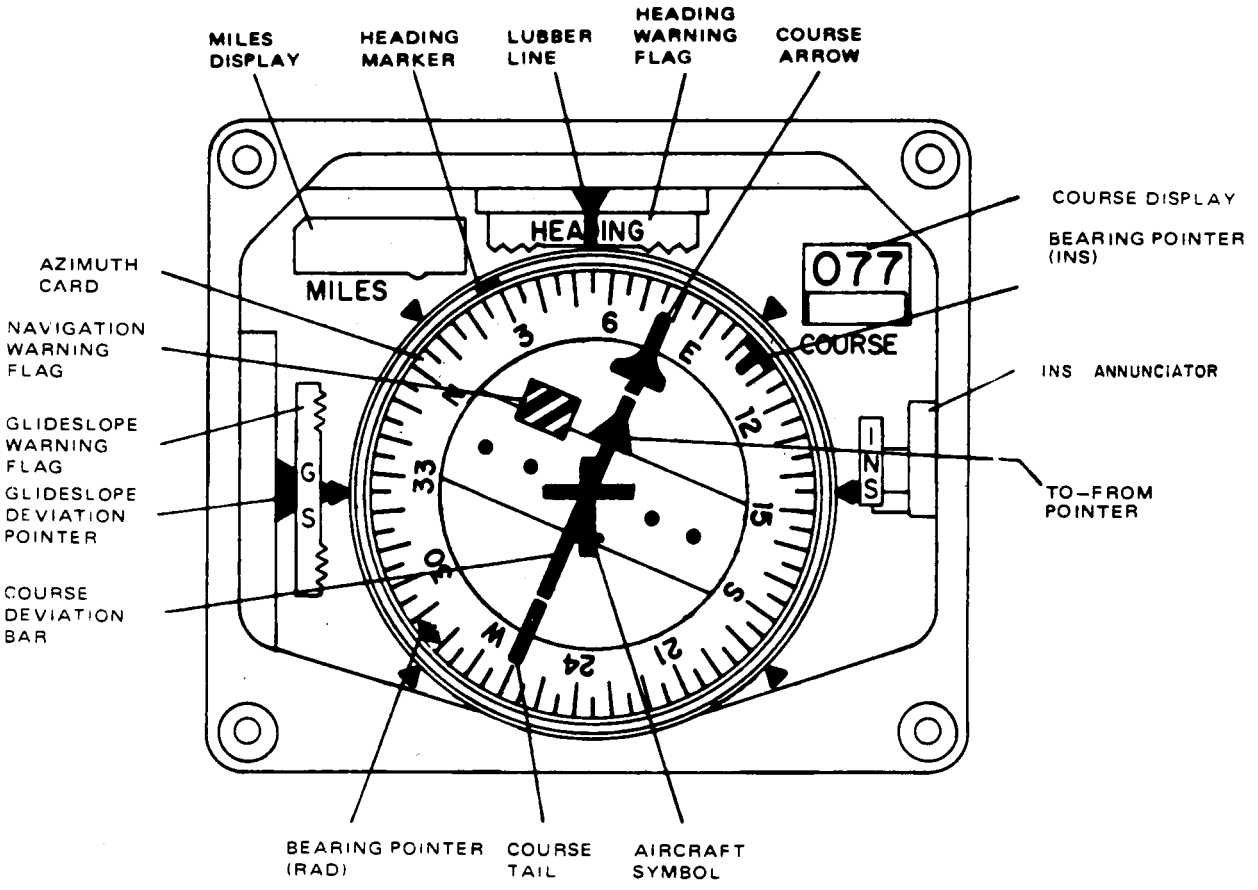
DESIGNATION		J1
COURSE RESOLVER	A	1
	B	2
	C	3
	D	4
	E	5
	F	6
	G	7
	H	8
COURSE DATUM DIFF. RESOLVER	X	9
	Y	10
	Z	11
	C'	12
	H'	13
SPARE (COURSE DATUM C.T.)	X	14
	Y	15
	Z	16
DIGITAL DISTANCE PWR 26 V AC	HI	17
	LO	18
SPARE (COURSE DATUM C.T.)	C'	19
	H'	20
AZIMUTH MONITOR TEST		21
BEARING POINTER POWER 26 V AC	HI	22
	LO	23
SPARE		24
BEARING POINTER CT	X	25
	Y	26
	Z	27
AZIMUTH TRANSOLVER	X	28
	Y	29
	Z	30
RESERVED FOR FUTURE AZIMUTH TRANSMITTER	X	31
	Y	32
	Z	33
	H	34
	C	35
AZIMUTH MONITOR SIGNAL		36
AZIMUTH POWER 26 V AC	HI	37
	LO	38
SPARE		39
COURSE DATUM LOAD		40
DC GROUND		41
BACK LOCALIZER	INPUT	42
	OUTPUT	43
SERIAL BCD DATA WORD	HI	44
	LO	45
SERIAL BCD WORD SYNC	HI	46
	LO	47
SERIAL BCD CLOCK	HI	48
	LO	49
BCD SOURCE WARNING FLAG INPUT		50
INS/DME MODE INPUT (+28 = INS)		51
DISTANCE DISPLAY INDICATOR STATUS OUTPUT		52
LAMP TEST		53
EXTERNAL DIM CONTROL		54
SPARE		55



DESIGNATION		J2
TO-FROM ANNUNCIATOR	+TO	1
	+FROM	2
COURSE DEVIATION BAR	+RIGHT	3
	+LEFT	4
GLIDESLOPE POINTER	+UP	5
	+DOWN	6
GLIDESLOPE FLAG (+28)	+	7
	-	8
HEADING DATUM CT	X	9
	Y	10
	Z	11
	C'	12
	H'	13
HEADING SELECT CT	X	14
	Y	15
	Z	16
RELATIVE COURSE ERROR OUTPUT		17
COURSE SELECT ERROR OUTPUT		18
INS ANNUNCIATOR (+28)	+	19
	-	20
SPARE		21
SPARE		22
SPARE		23
SPARE		24
SPARE		25
SPARE		26
SPARE		27
AZIMUTH COMPARATOR	X	28
	Y	29
	Z	30
	H'	31
	C'	32
	H	33
	C	34
LIGHTING 5 V AC/DC	HI	35
	LO	36
NAV FLAG (+28)	+	37
	-	38
CHASSIS GND		39
SPARE		40
SPARE		41
HEADING SEL AND CRS SEL POWER 26 V AC	HI	42
	LO	43
HEADING DATUM LOAD		44
COURSE SELECT CT	X	45
	Y	46
	Z	47
RELATIVE COURSE CT	X	48
	Y	49
	Z	50
COURSE ERROR INPUT		51
SPARE		52
SPARE		53
SPARE		54
SPARE		55

TP5-5165-014

Rear Connector Pin Assignments
Figure 4



TP5-5236-012

Controls and Indicators
Figure 5

INDICATOR/CONTROL	FUNCTION
Azimuth card	Presents a pictorial display of the heading, true or magnetic north, selected course, selected heading, or any other 3-wire information.
Aircraft symbol	Shows the aircraft relationship to the horizontal display.
Lubber line	A fixed reference for the azimuth card.
Heading index	Indicates the heading selected with respect to the azimuth card.
Course display	Indicates the selected course.
Course arrow	Indicates either the selected or relative course with respect to the azimuth card.
Course tail	Presents a pictorial display of the reciprocal of the course selected.
Course deviation bar	Indicates the deviation from the selected course.
To-from pointer	Indicates the direction to the tuned VOR.
Bearing pointer	Indicates airplane bearing using either the diamond-shaped pointer (using radio source) or T-shaped pointer (INS source).
Glideslope deviation pointer	Indicates the vertical deviations of the aircraft from the glidepath.
INS annunciator	Appears when the inertial navigation system is used as the source of navigation data. Removal of the signal causes the annunciator to retract.
HEADING warning flag	Appears when any of the following conditions exist. a. Loss of 26-V ac azimuth power. b. Faulty azimuth servo power supply. c. Faulty azimuth system monitor (+28-V) signal. d. Loss of XYZ excitation power to the azimuth transolver. e. More than 5-degree error input to the azimuth servo amplifier.

INDICATOR/CONTROL	FUNCTION
Navigation warning flag	Appears in view near the course arrow to indicate a failure in the NAV receiver.
GS warning flag	Appears in view and covers the glideslope scale to indicate a failure in the glideslope receiver.
MILES display	Presents distance information from either DME or INS.

Functions of Controls and Indicators
Figure 6 (Sheet 2)

(5) Distance Readout

The distance readout circuit converts serial bcd information into a 4-digit distance display. The distance readout displays distance from 0.0 to 399.9 nautical miles in the DME mode of operation and 0 to 3999 nautical miles in the INS mode.

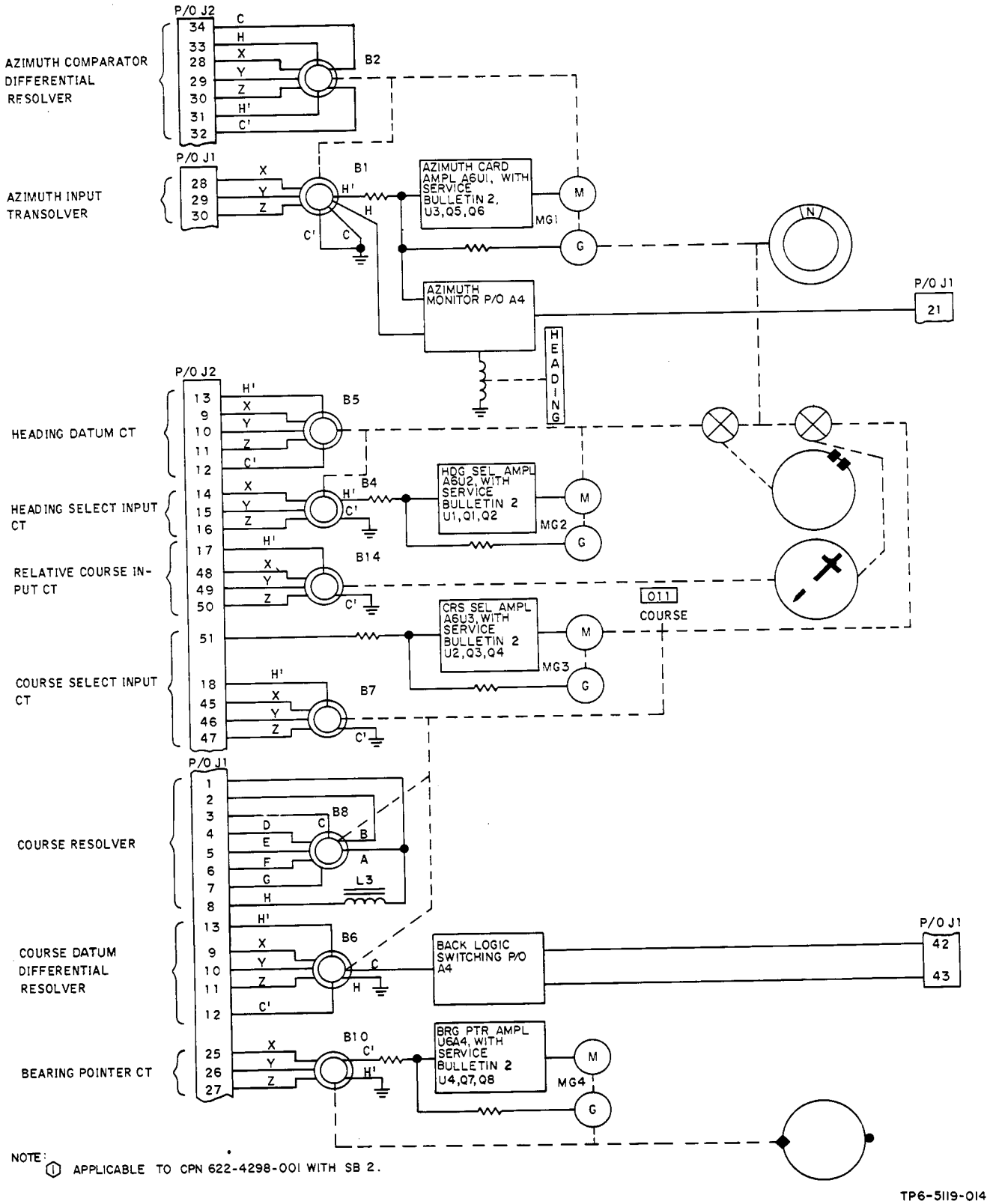
C. Detailed Theory of Operation (Refer to figure 207.)

(1) Servo Display (Refer to figure 7.)

Three-wire (XYZ) synchro information (from an external system) is applied to the input control transformer (CT) for the bearing, heading select, and course select servos. The azimuth servo uses a transolver (CSD) at the input to facilitate monitoring. When the XYZ input signal does not match the input CT or CSD rotor position, an error signal is generated and applied to the servo amplifier through an input resistor. The amplified error signal output is applied to the drive motor (part of the motor-generator) which, in turn, positions the display. The rate generator (part of the motor-generator) provides a rate feedback signal to the servo amplifier through a feedback resistor. The rotor of the input CT or CSD is also connected to the display gear train so that positioning of the display also rotates the rotor to reduce the error signal until a null position is reached. The rate feedback signal prevents undesirable display characteristics such as overshooting, oscillating, etc.

(2) Azimuth Monitor and HEADING Flag

The azimuth monitor circuit receives inputs from the magnetic compass system, azimuth input transolver B1, and servo power supply A3. The compass system supplies a +28-V dc azimuth monitor input at J1-36. Azimuth



Servo-Driven Displays, Block Diagram
Figure 7

input transolver B1 supplies an H' signal to A4Q1 and an H signal to A4Q2. Servo power supply A3 supplies power to A4Q3. With these four inputs present, A4Q1 and A4Q2 conduct and turn on A4Q3. The conduction of A4Q3 energizes HEADING flag meter M7 and causes it to retract out of view. When any of the four inputs fail, or a greater than 5-degree error exists between the azimuth card position and the compass input, A4Q3 will not conduct and the HEADING flag will come into view.

(3) Back LOC Sensing (Refer to figure 8.)

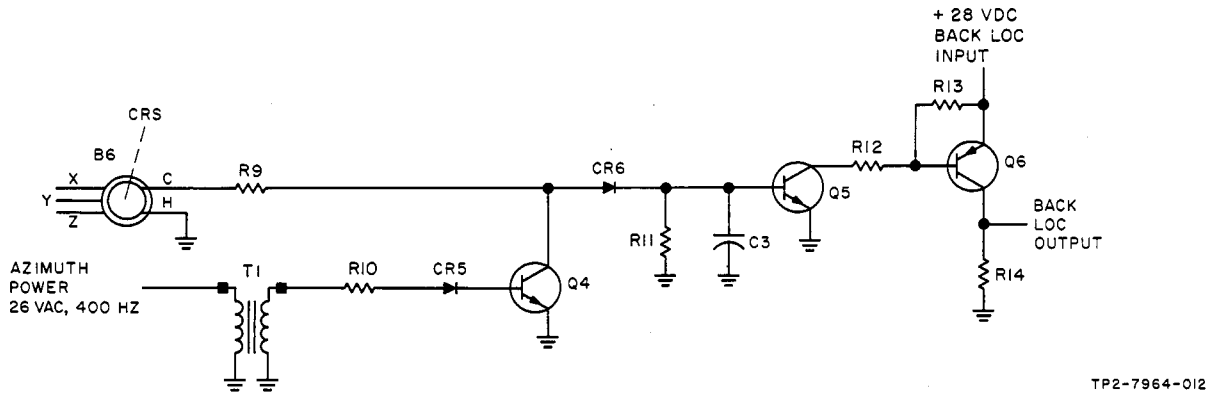
The back LOC output is dependent upon the phase relationship between the B6-HC output and the azimuth power input to A4T1. The A4T1 secondary output is rectified by A4CR5 and applied to the base of A4Q4. When the B6-HC output and the azimuth power input are in phase (B6 rotor between 270 and 90 degrees), A4Q4 conducts and the B6-HC output is dropped across A4R9. With A4Q4 on, A4Q5 is off and prevents A4Q6 from conducting. Therefore, the back LOC switch (A4Q6) is off and the back LOC output is 0 V dc.

When the B6-HC output and the azimuth power input are out of phase (B6 rotor between 105 and 255 degrees), A4Q4 is cut off and A4C3 begins to charge. When A4C3 charges to a level adequate to turn on A4Q5, A4Q5 conducts. With A4Q5 on, A4Q6 conducts and the +28-V dc back LOC input is switched to become the back LOC output.

(4) Distance Readout Board A1 (Refer to figures 9 and 207.)

(a) Line Receiver

The line receiver changes high-level input logic (+12-V dc logic 1, 0-V dc logic 0) to low-level TTL logic (+3-V dc logic 1, 0-V dc logic 0). Input data is in serial form with the least significant bit first and the most significant bit last.



Back Localizer Sensing, Simplified Schematic Diagram
Figure 8

(b) Address Recognition

When $\overline{\text{SYND}}$ goes high, $\overline{Q}$ of U27A is set to a logic 1. An 8-bit clock made up of $\overline{\text{GATED CLOCK}}$ and Q_H clocks U27A and U22 through U30D. After 8 bits, Q_H is a logic 1, which disables U30 and holds the clock inputs to U27A and U22 high. If only bit 8 is a logic 1, the output of U23 will remain high until $\overline{\text{SYNC}}$ is clocked through U27B, causing U23 to switch low. When this happens, the logic 0 is transmitted to the timer that is simultaneously set and reset, maintaining a logic 1 on the maintenance monitor output.

(c) Serial-to-Parallel Data Processing

Data from the line receiver is fed into 8-bit shift register U7, and the output of U7 is fed into 8-bit shift register U10, forming a single 16-bit shift register. This register is clocked by the 32-bit $\overline{\text{GATED CLOCK}}$. Bits 1 through 8 are used for address; bits 9 through 16 are not used; and bits 17 through 32 are used for the display. Bits 1 through 8 are saved by the 9-bit shift register consisting of U27A and U22, and bits 17 through 32 are saved by the 16-bit shift register consisting of U7 and U10. When $\overline{\text{GATED CLOCK}}$ goes high and stays high, the first 16 bits are output in parallel form from U7 and U10, and the last 16 bits are loaded into U7 and U10 in serial form.

(d) 4-Bit Latch

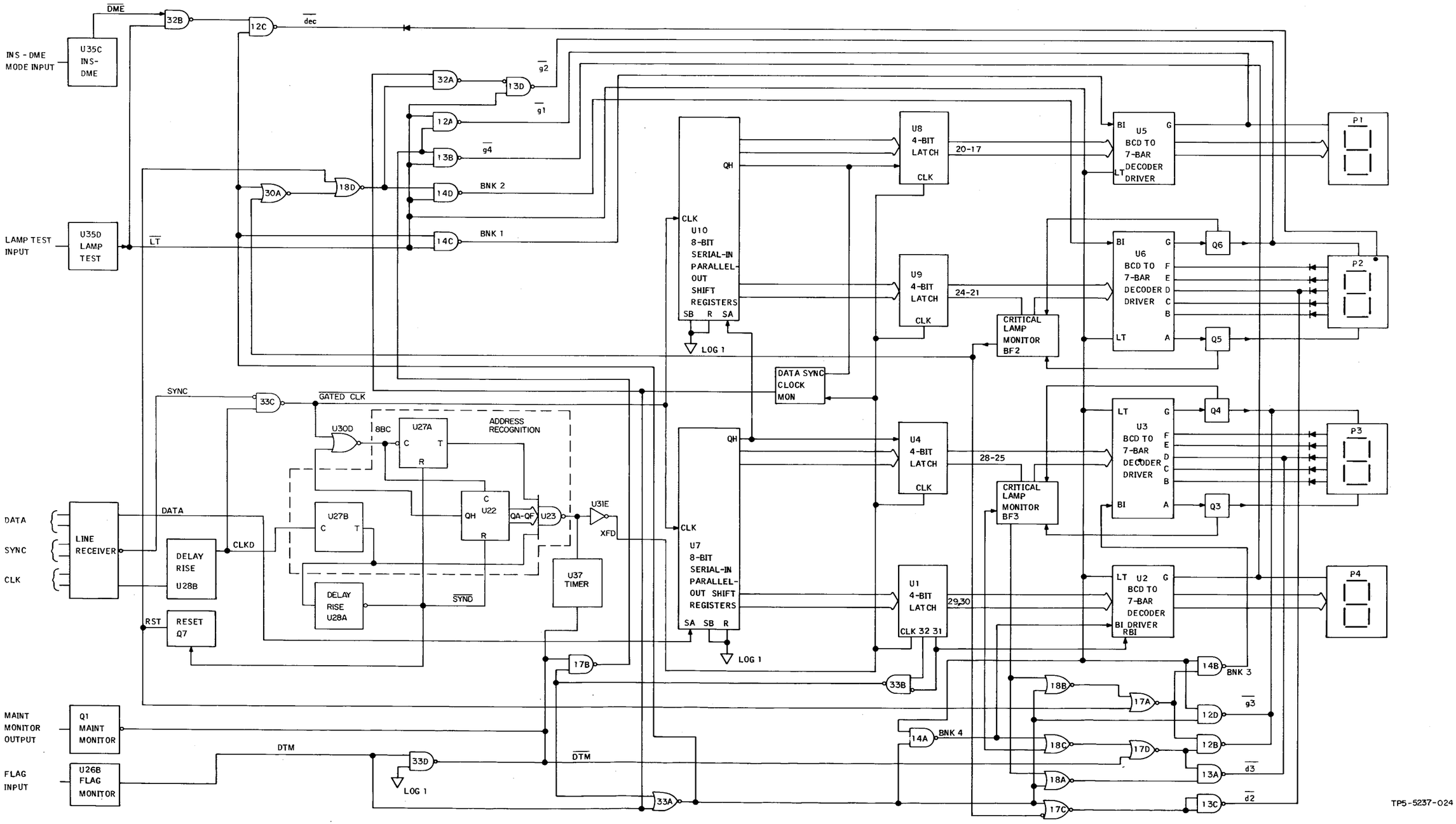
When XFD goes high, the 16 data bits loaded in U7 and U10 are clocked into the 4-bit latches, U1, U4, U8, and U9. This data is locked in the output of the 4-bit latches until the next time XFD goes high, when it is released.

(e) 7-Bar Decoder Driver

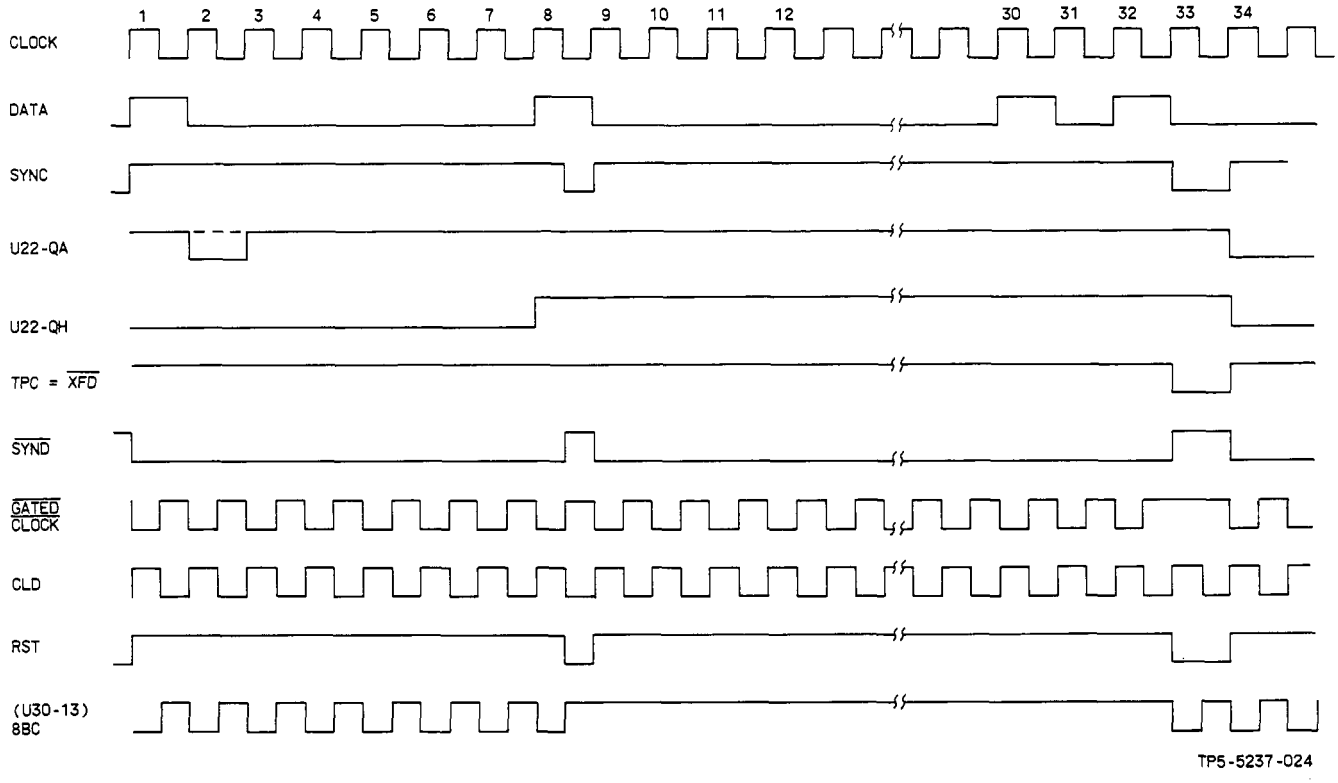
Data bits locked in the outputs of the 4-bit latches are transferred into the 7-bar decoder driver when XFD goes high. The 7-bar decoder drivers take the bcd data from the 4-bit latches and convert it to 7-bar information. This information is then fed to the lamps of the digital readout displays, P1, P2, P3, and P4.

(f) Critical Lamp Monitor (Refer to figures 10 and 11.)

The critical bar monitor circuit detects failures (open or shorted lamps) in the designated critical lamps. The critical lamps are the top ("a" lamp) and center ("g" lamp) segments of the center two digits. A failure of any one of these four lamps will result in a digit displayed that is either incorrect or that could be misinterpreted. If a critical lamp failure is detected, the critical bar monitor circuit supplies an error output to the digital display control logic circuit. The error output causes the digit with the failure to be blanked momentarily and an equal sign (=)



Distance Readout (Distance Board A1, CPN 638-2777-001), Block Diagram
Figure 9 (Sheet 1 of 2)



Distance Readout (Distance Board A1, CPN 638-2777-001), Block Diagram
Figure 9 (Sheet 2)

to be displayed. The bottom ("d" lamp) and center ("g" lamp) are used to display the equal sign. The equal sign cannot be displayed if either the bottom or center lamps are open.

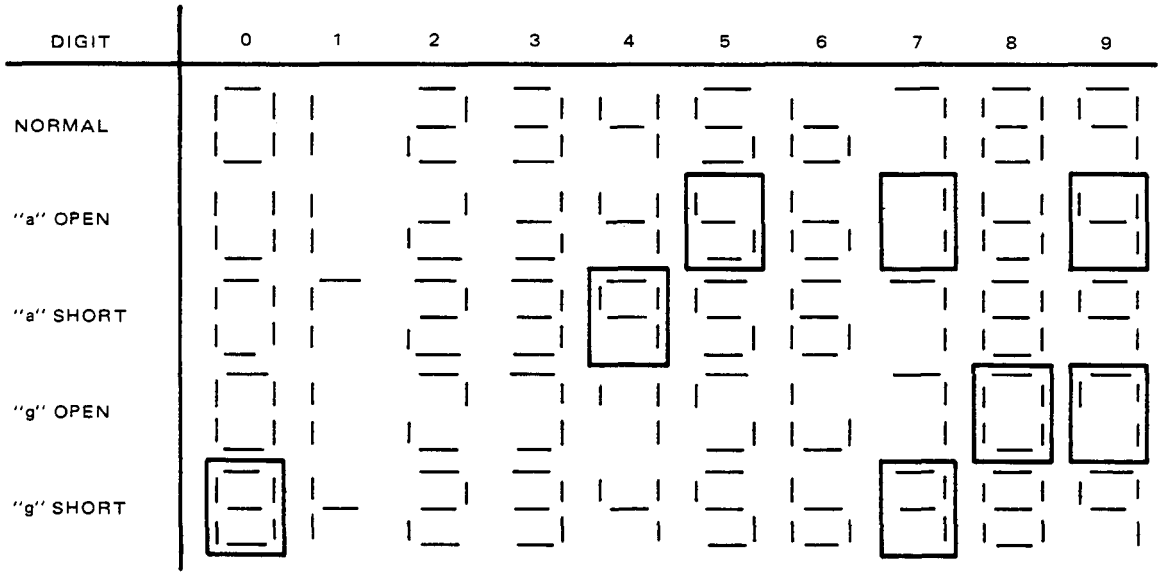
(5) Power Supply (Refer to figure 207.)

(a) +5-V DC Supply

The 26-V, 400-Hz input power is stepped down by T1 and rectified by A5CR3/CR4, RC filtered, and applied to series regulators A6Q1 and A6Q2. Regulator A1U25 senses the +5-V dc output and controls the base drive to A6Q2. The +5-V dc logic output is applied through fusible resistor A1R56 to the logic circuits.

(b) +20-V DC Supply

The 26-V, 400-Hz input power is stepped down by T1 and rectified by A5CR1/CR2, RC filtered, and regulated by A2VR1 and A2Q2 (A1CR20).



7-Bar Display of Critical Lamp Failures, Diagram
Figure 10

The +20-V dc output is applied to +5-V dc regulator A1U25, distance display dimming control A1U24, HL/TTL converter A1U26, and lamp test circuit A1U35D.

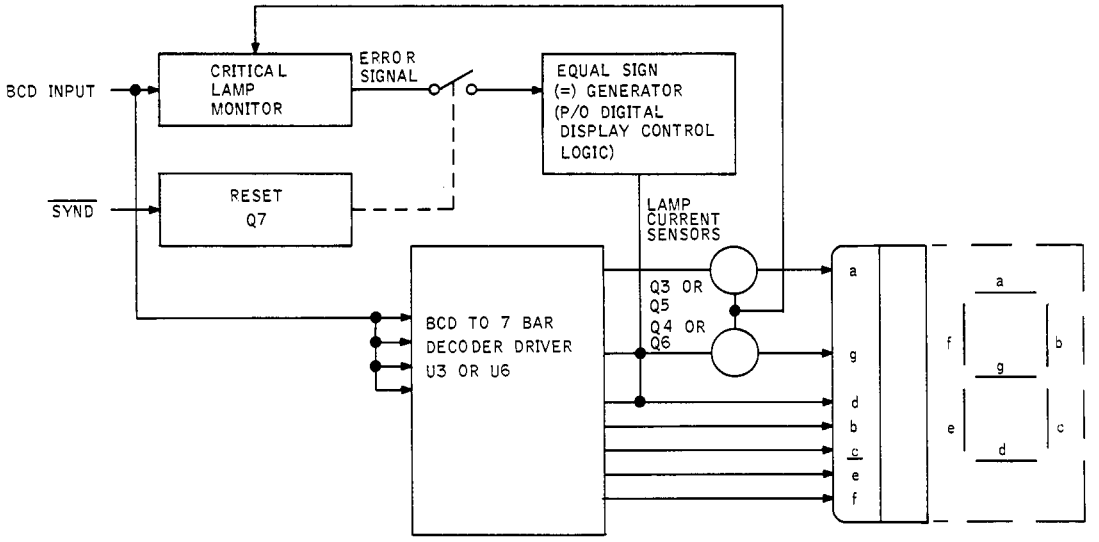
(c) Distance Display Lamp Supply

The distance display lamp supply consists of A1U24, A1Q8, and A6Q1. The external dimming control input, 0 to +5 V dc, at J1-54 is applied to regulator A1U24. The A1U24-10 output controls series regulator A6Q1. The lamp supply output is applied through A1R57 to the distance display.

(6) Servo Power Supply A3 (Refer to figure 207.)

(a) Azimuth and Bearing Pointer Supply

The 26-V, 400-Hz zaimuth power at J1-37, J1-38 is applied to A3J1-4. The positive dc output at A3J1-10 is applied to A6U1 and A6U4 (A7U1A and with SB 2).



Critical Lamp Monitor, Block Diagram
Figure 11

(b) Heading and Course Select Supply (Refer to figure 207.)

The 26-V, 400-Hz heading and course select power at J2-42, J2-43 is applied to A3J1-3. The positive dc output at A3J1-9 is applied to A6U2 and A6U3 (A7U2A and A7U1A with SB 2).

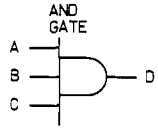
D. Integrated Circuit Descriptions

Numerous types of integrated circuits are used in the HSI-45. Refer to Collins Integrated Circuit Descriptions Reference Manual, CPN 523-0775443, for figures that contain a brief description, functional diagram, truth table, and/or timing diagram for each representative type. Manufacturers' data books should be consulted if more detailed information is required. Always refer to the illustrated parts list (IPL) when ordering replacement parts.

The devices illustrated in the reference manual are intended to be a guide to the purpose and function of an integrated circuit device type. Many of the devices illustrated are manufactured in a variety of processes (CMOS, metal gate CMOS, TTL, fast gate) to meet a number of design applications. To provide complete coverage of all these varieties would not be economical, so the illustrations presented are intended to be representative of the device function only, not necessarily a specific device. Generally, the logic families are pin-for-pin compatible (but not necessarily interchangeable). The differences between the varieties of processes are in the characteristics considered in the design of a circuit, such as switching speed, low power consumption, noise immunity, and power supply range. A list of the integrated circuits used in this equipment follows.

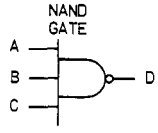
TYPE	DESCRIPTION
555	Timer
54164	8-bit shift register
5475	Bistable latch
9317	BCD-to-7 segment decoder/driver
723	Voltage regulator
139/239/339	Voltage comparator
CPN 350-0083-030	Servo amplifier (blue cube)
5447	7-segment decoder/driver

(Figures 13 through 21 deleted)
(Pages 23 through 32 deleted)



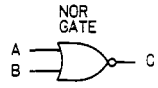
D = ABC

A	B	C	D
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1



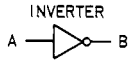
$D = \overline{ABC}$

A	B	C	D
0	0	0	1
1	0	0	1
0	1	0	1
1	1	0	1
0	0	1	1
1	0	1	1
0	1	1	1
1	1	1	0



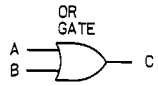
$C = \overline{A+B}$

A	B	C
0	0	1
1	0	0
0	1	0
1	1	0



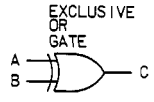
$B = \bar{A}$

A	B
1	0
0	1



C = A+B

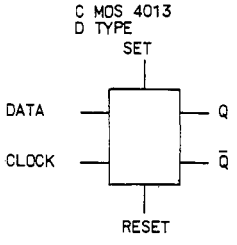
A	B	C
0	0	0
1	0	1
0	1	1
1	1	1

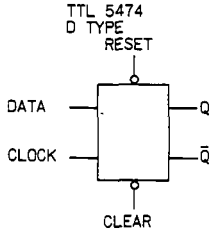


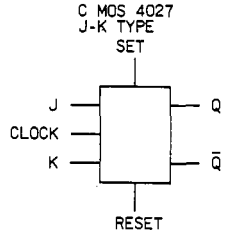
$C = A\bar{B} + \bar{A}B$

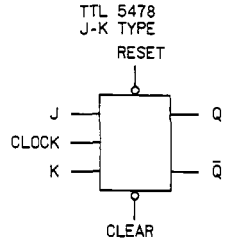
A	B	C
0	0	0
1	0	1
0	1	1
1	1	0

TYPICAL FLIP-FLOP DEVICES









C MOS 4013

INPUTS				OUTPUTS	
CLOCK	DATA	RESET	SET	Q	$\bar{Q}$
⌐	0	0	0	0	1
⌐	1	0	0	1	0
⌐	X	0	0	Q_0	$\bar{Q}_0$
X	X	1	0	0	1
X	X	0	1	1	0
X	X	1	1	1	1

NO CHANGE

④ TTL 5474

INPUTS				OUTPUTS	
CLOCK	DATA	CLEAR	RESET	Q	$\bar{Q}$
⌐	1	1	1	1	0
⌐	0	1	1	0	1
⌐	X	1	1	Q_0	$\bar{Q}_0$
X	X	1	0	1	0
X	X	0	1	0	1
X	X	0	0	1*	1*

* NONSTABLE, WILL NOT STAY WHEN PRESET AND CLEAR INPUTS RETURN TO THEIR INACTIVE (HIGH) LEVEL.

C MOS 4027

INPUTS						OUTPUTS	
CLOCK	J	K	S	R	Q_0	Q	$\bar{Q}$
⌐	1	X	0	0	0	1	0
⌐	X	0	0	0	1	1	0
⌐	0	X	0	0	0	0	1
⌐	X	1	0	0	1	0	1
⌐	X	X	0	0	X	Q_0	$\bar{Q}_0$
X	X	X	1	0	X	1	0
X	X	X	0	1	X	0	1
X	X	X	1	1	X	1	1

TTL 5478

INPUTS					OUTPUTS	
CLOCK	J	K	P	CLEAR	Q	$\bar{Q}$
⌐	0	0	1	1	Q_0	$\bar{Q}_0$
⌐	1	0	1	1	1	0
⌐	0	1	1	1	0	1
⌐	1	1	1	1	TOGGLE	
X	X	X	0	1	1	0
X	X	X	1	0	0	1
X	X	X	0	0	1*	1*

* NONSTABLE, WILL NOT STAY WHEN PRESET AND CLEAR INPUTS RETURN TO THEIR INACTIVE (HIGH) LEVEL.

NOTES:

① FLIP FLOP DEVICES SHOWN ARE POSITIVE EDGE TRIGGERED DEVICES.

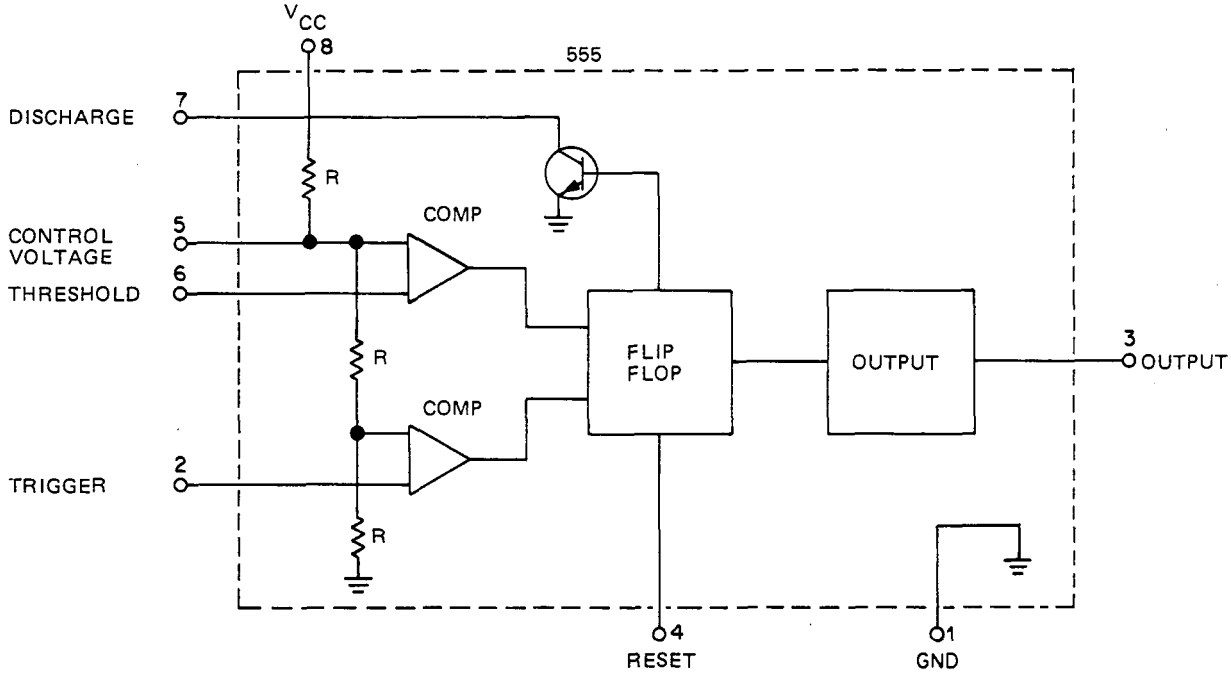
② 1 = HIGH LEVEL, 0 = LOW LEVEL, X = DON'T CARE.

③ Q_0=Q STATE BEFORE CLOCK TRANSITION.

④ POSITIVE LOGIC - LOW INPUT TO PRESET SETS Q TO HIGH LEVEL, LOW INPUT TO CLEAR SETS Q TO LOW LEVEL. PRESET AND CLEAR ARE INDEPENDENT OF CLOCK.

TP5-3436-014

THE 555 IS A HIGHLY STABLE DEVICE FOR GENERATING ACCURATE TIME DELAYS OR OSCILLATION. IN THE TIME DELAY MODE OF OPERATION, THE TIME IS PRECISELY CONTROLLED BY ONE EXTERNAL RESISTOR AND CAPACITOR. FOR ASTABLE OPERATION AS AN OSCILLATOR, THE FREE-RUNNING FREQUENCY AND DUTY CYCLE ARE ACCURATELY CONTROLLED WITH TWO EXTERNAL RESISTORS AND ONE CAPACITOR. THE CIRCUIT MAY BE TRIGGERED AND RESET ON FALLING WAVEFORMS.



TP5-2212-011

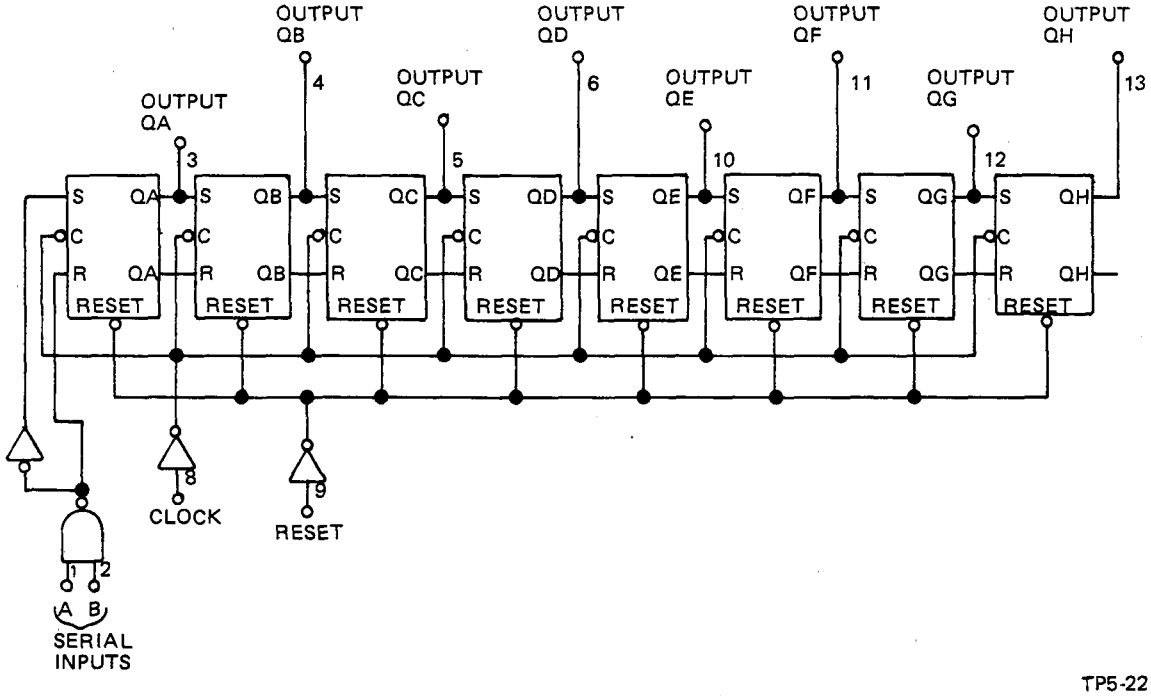
Type 555 Timer
Figure 14

THE 54164 OR 54LS164 IS AN 8-BIT SHIFT REGISTER WITH GATED SERIAL INPUTS AND AN ASYNCHRONOUS CLEAR FACILITY. THE GATED SERIAL INPUTS (A AND B) PERMIT CONTROL OVER INCOMING DATA, AS A LOW AT EITHER OR BOTH INPUTS INHIBITS ENTRY OF THE NEW DATA AND RESETS THE FIRST FLIP-FLOP TO THE LOW LEVEL AT THE NEXT CLOCK PULSE. A HIGH-LEVEL INPUT ENABLES THE OTHER INPUT, WHICH WILL THEN DETERMINE THE STATE OF THE FIRST FLIP-FLOP. DATA AT THE SERIAL INPUTS MAY BE CHANGED WHILE THE CLOCK IS HIGH, BUT ONLY INFORMATION MEETING THE SETUP REQUIREMENTS WILL BE ENTERED. CLOCKING OCCURS ON THE LOW-TO HIGH-LEVEL TRANSISTION OF THE CLOCK INPUT.

TRUTH TABLE

SERIAL INPUTS A AND B		
INPUTS AT t_n		OUTPUT AT $t_n + 1$
A	B	Q_A
H	H	H
L	H	L
H	L	L
L	L	L

8-BIT SHIFT REGISTER, TYPE 54164 OR 54LS164

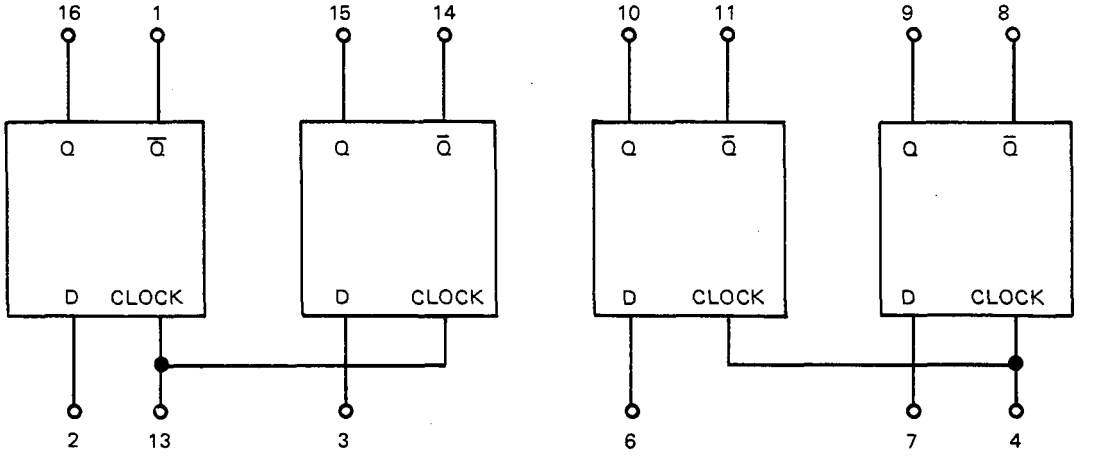


TP5-2210-011

Type 54164 8-Bit Shift Register
Figure 15

THE 5475 IS A QUADRUPLE, BISTABLE LATCH WITH COMPLEMENTARY Q AND $\overline{Q}$ OUTPUTS. INFORMATION PRESENT AT A DATA (D) INPUT IS TRANSFERRED TO THE Q OUTPUT WHEN THE CLOCK IS HIGH, AND THE Q OUTPUT WILL FOLLOW THE DATA INPUT AS LONG AS THE CLOCK REMAINS HIGH. WHEN THE CLOCK GOES LOW, THE INFORMATION (THAT WAS PRESENT AT THE DATA INPUT AT THE TIME THE TRANSITION OCCURRED) IS RETAINED AT THE Q OUTPUT UNTIL THE CLOCK IS PERMITTED TO GO HIGH.

THIS LATCH IS IDEALLY SUITED FOR USE AS TEMPORARY STORAGE FOR BINARY INFORMATION BETWEEN PROCESSING UNITS AND INPUT/OUTPUT OR INDICATOR UNITS.



TRUTH TABLE

(EACH LATCH)		
t_n	t_{n+1}	
D	Q	$\overline{Q}$
1	1	0
0	0	1

NOTES:

1. t_n = BIT TIME BEFORE CLOCK PULSE.
2. t_{n+1} = BIT TIME AFTER CLOCK PULSE
3. THESE VOLTAGES ARE WITH RESPECT TO NETWORK GROUND TERMINAL.

TP5-4861-011

Type 5475 Latch
Figure 16

THE 9317 IS A SEVEN SEGMENT DECODER/DRIVER DESIGNED TO ACCEPT FOUR INPUTS IN 8421 BCD CODE AND PROVIDE THE APPROPRIATE OUTPUTS TO DRIVE A SEVEN SEGMENT NUMERICAL DISPLAY. THE DECODER CAN BE USED TO DIRECTLY DRIVE SEVEN SEGMENT INCANDESCENT LAMP DISPLAYS AND LIGHT EMITTING DIODE INDICATORS (OR INDIRECTLY DRIVE NEON, ELECTRO-LUMINESCENT, NUMERIC DISPLAYS).

PIN NAMES

A_0, A_1, A_2, A_3	ADDRESS INPUTS
$\overline{LT}$	LAMP TEST (ACTIVE LOW) INPUT
$\overline{RBI}$	RIPPLE BLANKING (ACTIVE LOW) INPUT
$\overline{RBO}$	RIPPLE BLANKING (ACTIVE LOW) OUTPUT
$\bar{a},\bar{b},\bar{c},\bar{d},\bar{e},\bar{f},\bar{g}$	(ACTIVE LOW) OUTPUTS

OPTIONS

PARAMETER	9317B	9317C
LATCH VOLTAGE	20 VOLTS	30 VOLTS
OUTPUT CURRENT (PINS 9-15)	40 mA	20 mA

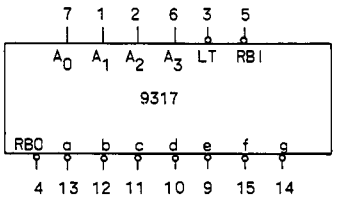
LOADING

HIGH	LOW
1.0 U.L.	1.0 U.L.
5.0 U.L.	4.0 U.L.
1.0 U.L.	1.0 U.L.
1.5 U.L.	1.5 U.L.

SEE OPTIONS

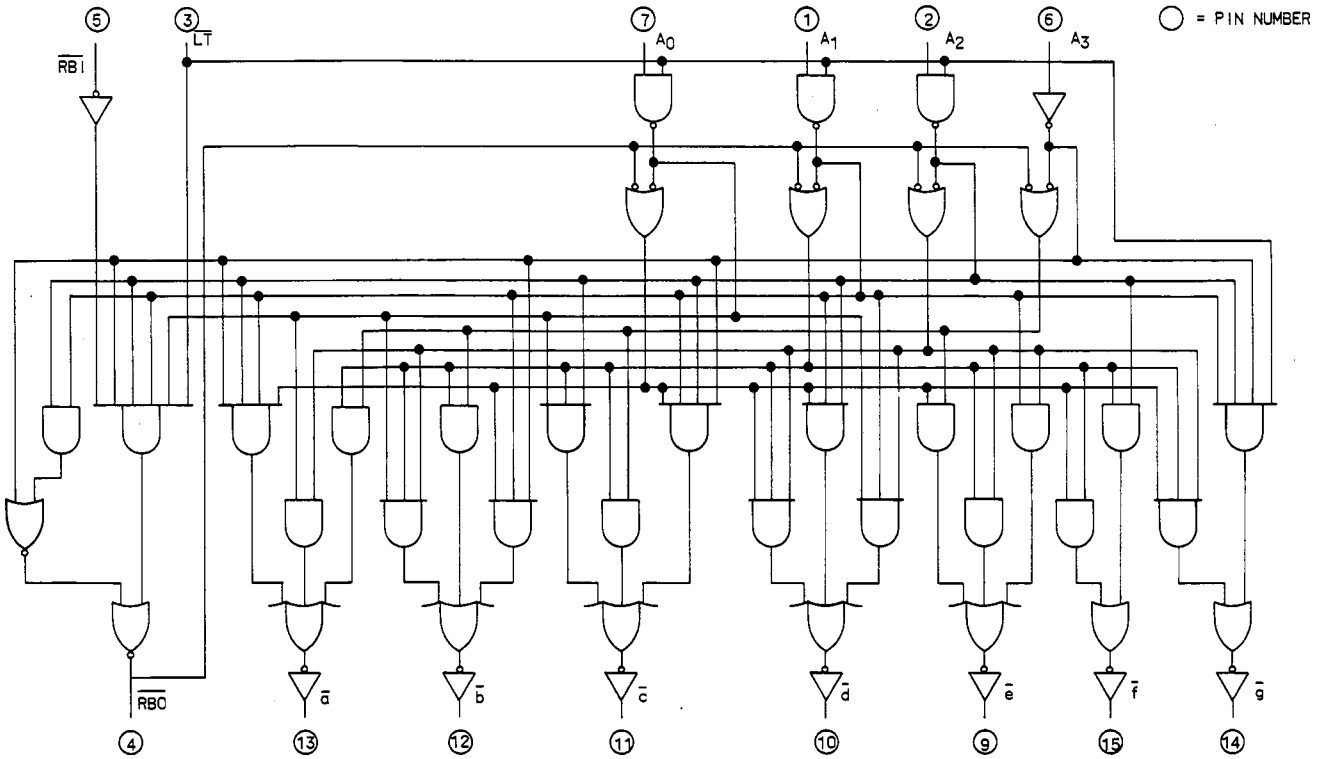
1 UNIT LOAD (U.L.) = 40 uA HIGH/1.6 mA LOW

LOGIC SYMBOL



VCC = PIN 16 GND = PIN 8

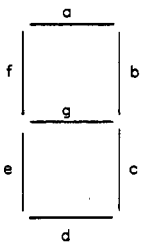
LOGIC DIAGRAM



$\overline{LT}$	$\overline{RBI}$	A_0	A_1	A_2	A_3	a b c d e f g	$\overline{RBO}$	DECIMAL OR FUNCTION
L	X	X	X	X	X	L L L L L L L	H	
H	L	L	L	L	L	H H H H H H H	L	0
H	H	L	L	L	L	L L L L L L H	H	0
H	X	H	L	L	L	H H H L L H H	H	1
H	X	L	H	L	L	L L H L L H L	H	2
H	X	H	H	L	L	L L L L H H L	H	3
H	X	L	L	H	L	H L L H H L L	H	4
H	X	H	L	H	L	L H L L H L L	H	5
H	X	L	H	H	L	H H L L L L L	H	6
H	X	H	H	H	L	L L L H H H H	H	7
H	X	L	L	L	H	L L L L L L L	H	8
H	X	H	L	L	H	L L L H H L L	H	9
H	X	L	H	L	H	H H H H H H L	H	10
H	X	H	H	L	H	H H H H H H L	H	11
H	X	L	L	H	H	H H H H H H L	H	12
H	X	H	L	H	H	H H H H H H L	H	13
H	X	L	H	H	H	H H H H H H L	H	14
H	X	H	H	H	H	H H H H H H L	H	15

TRUTH TABLE

NOTE
H= HIGH VOLTAGE LEVEL
L= LOW VOLTAGE LEVEL
X= DON'T CARE CONDITION

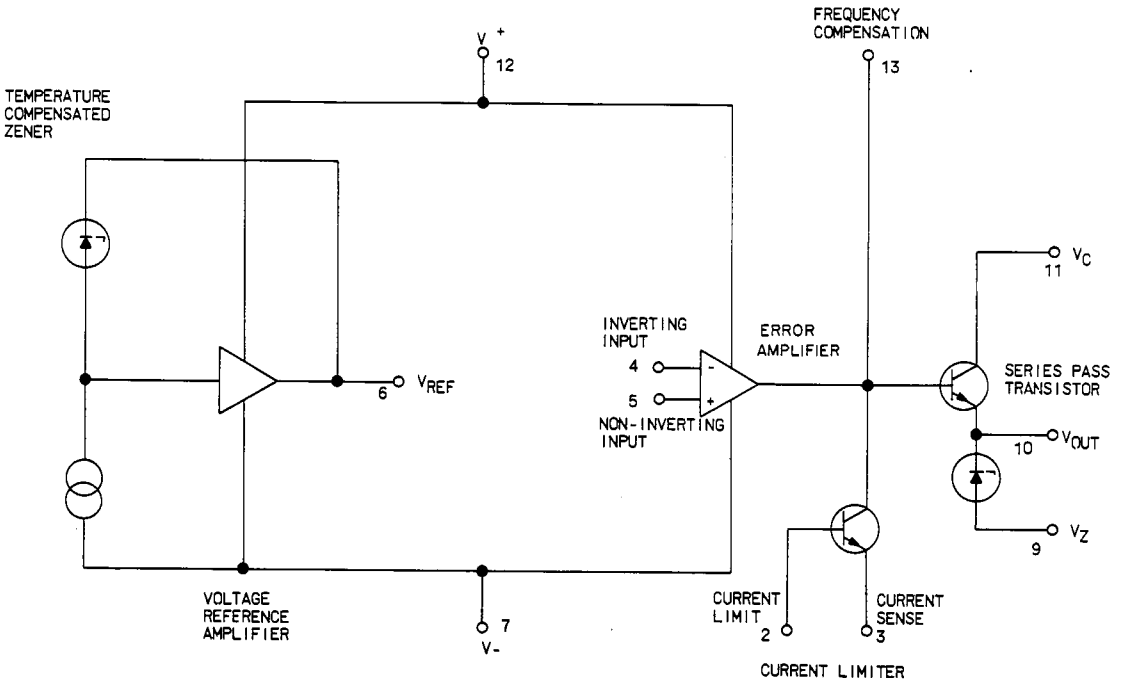


SEGMENT DESIGNATION

TP5-4860-014

Type 9317 7-Segment Decoder/Driver
Figure 17

THE 723 IS A MONOLITHIC VOLTAGE REGULATOR THAT CONSIST OF A TEMPERATURE COMPENSATED REFERENCE AMPLFIFER, ERROR AMPLIFIER, POWER SERIES PASS TRANSISTOR AND CURRENT LIMIT CIRCUITRY. THE 723 IS USED WITH POSITIVE OR NEGATIVE SUPPLIES AS A SERIES, SHUNT, SWITCHING OR FLOATING REGULATOR. THE OUTPUT VOLTAGE IS ADJUSTABLE FROM 2 TO 37 V DC, WITH AN OUTPUT CURRENT UP TO 150 mA.

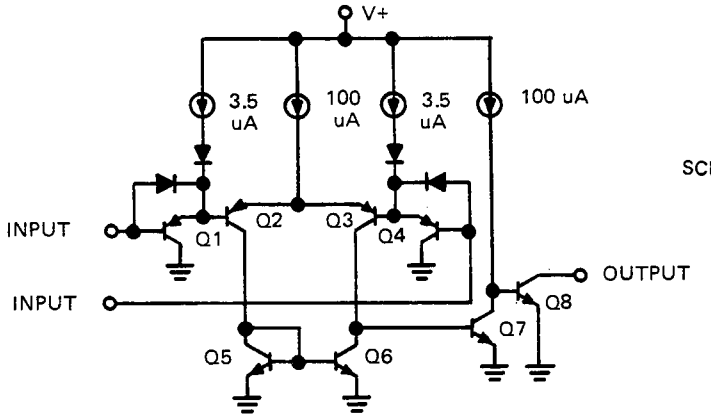


TP5-3445-014

Type 723 Voltage Regulator
Figure 18

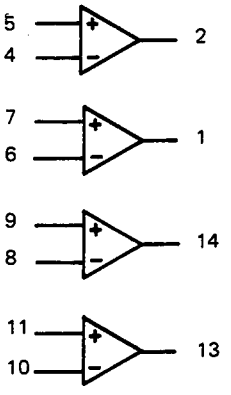
THE TYPE 139/239/339 CONSISTS OF FOUR INDEPENDENT PRECISION VOLTAGE COMPARATORS WITH AN OFFSET VOLTAGE SPECIFICATION AS LOW AS 2 mV MAX FOR ALL FOUR COMPARATORS. THESE WERE DESIGNED SPECIFICALLY TO OPERATE FROM A SINGLE POWER SUPPLY OVER A WIDE RANGE OF VOLTAGES. OPERATION FROM SPLIT POWER SUPPLIES IS ALSO POSSIBLE AND THE LOW POWER SUPPLY CURRENT DRAIN IS INDEPENDENT OF THE MAGNITUDE OF THE POWER SUPPLY VOLTAGE. THESE COMPARATORS ALSO HAVE A UNIQUE CHARACTERISTIC IN THAT THE INPUT COMMON-MODE VOLTAGE RANGE INCLUDES GROUND, EVEN THOUGH OPERATED FROM A SINGLE POWER SUPPLY VOLTAGE.

APPLICATION AREAS INCLUDE LIMIT COMPARATORS, SIMPLE ANALOG TO DIGITAL CONVERTERS; PULSE, SQUARE-WAVE AND TIME DELAY GENERATORS; WIDE RANGE CO; MOS CLOCK TIMERS; MULTIVIBRATORS AND HIGH VOLTAGE DIGITAL LOGIC GATES. THE LM139 SERIES WAS DESIGNED TO DIRECTLY INTERFACE WITH TTL AND CMOS. WHEN OPERATED FROM BOTH PLUS AND MINUS POWER SUPPLIES, THEY WILL DIRECTLY INTERFACE WITH MOS LOGIC–WHERE THE LOW POWER DRAIN OF THE LM339 IS A DISTINCT ADVANTAGE OVER STANDARD COMPARATORS.



SCHEMATIC DIAGRAM

CONNECTION DIAGRAM



V + = 3
GND = 12

TP5-4859-011

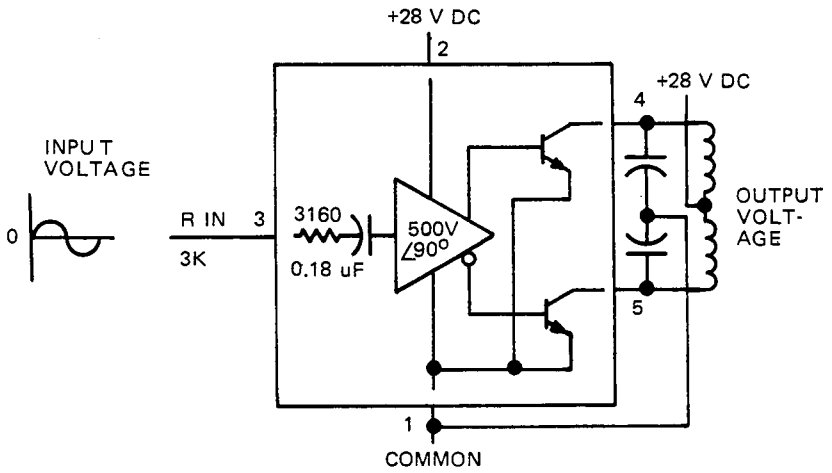
Type 139/239/339 Voltage Comparator
Figure 19

THE AC SERVO AMPLIFIER, COLLINS PART NUMBER 350-0083-030, IS A CLASS A-B AMPLIFIER USED TO DRIVE THE CENTER TAPPED CONTROL WINDING OF A TWO PHASE MOTOR .

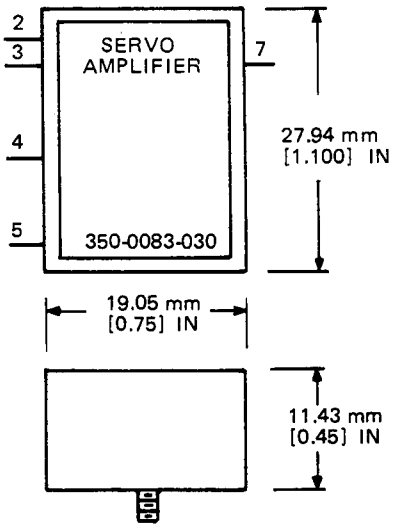
THE AMPLIFIER HAS A MINIMUM VOLTAGE GAIN OF 500 AT 400 Hz. THE OUTPUT VOLTAGE, WITH REFERENCE TO THE INPUT VOLTAGE, HAS A 90 ± 15 DEGREE PHASE SHIFT.

WITH A SUPPLY VOLTAGE OF 18 TO 28 VOLTS DC, THE MAXIMUM INSTANTANEOUS VOLTAGE THAT CAN BE BE APPLIED TO TERMINALS 4 AND 5 IS +60 OR -5 VOLTS DC.

FUNCTIONAL CIRCUIT

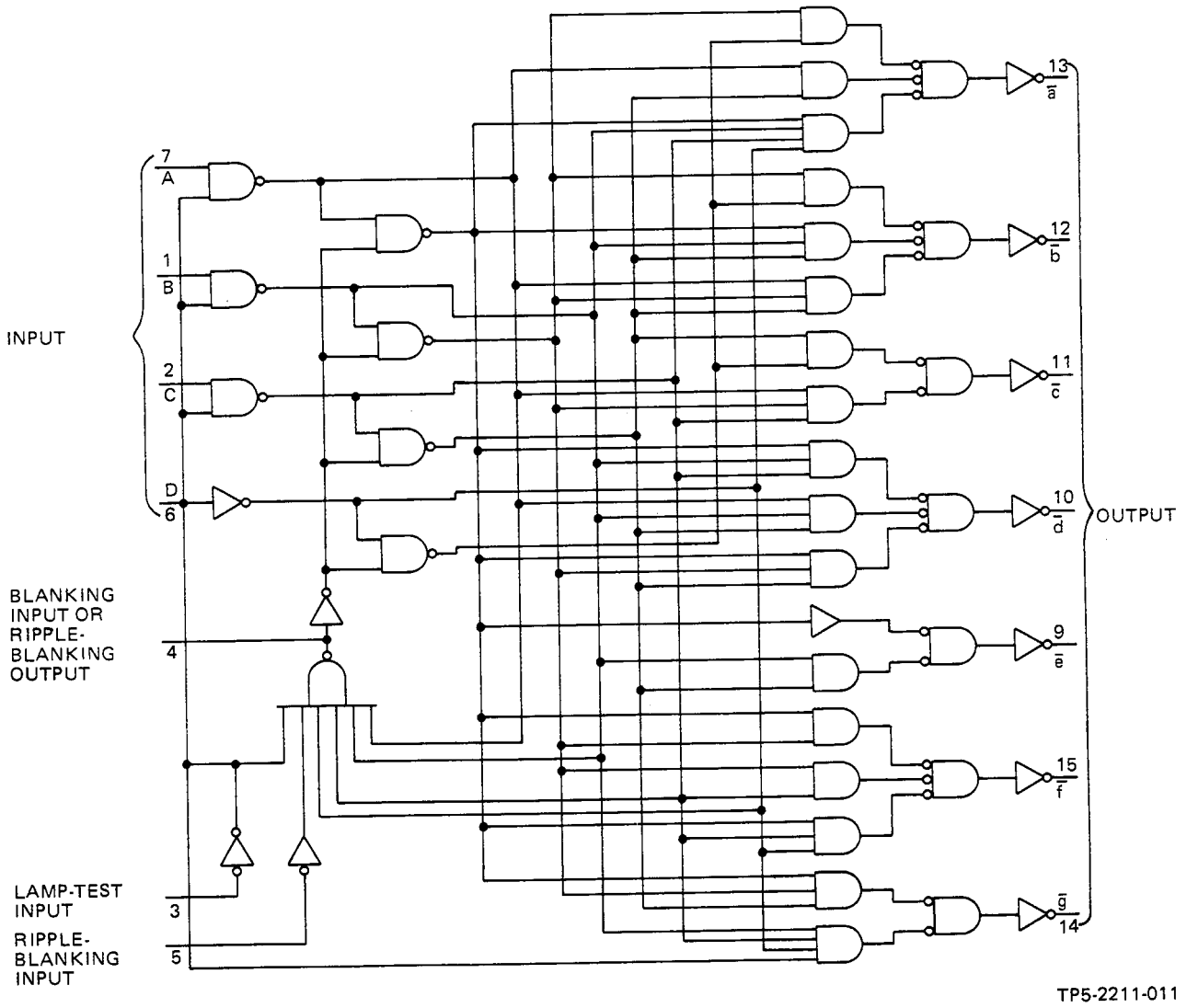


OUTLINE AND DIMENSIONS



NOTE
DIMENSIONS ARE
IN MILLIMETRES [INCHES]

TP6-5107-011



TP5-2211-011

Type 5447 7-Segment Decoder/Driver
Figure 21

TESTING

1. Introduction

Avionics equipment requiring testing usually falls into the following categories.

A. New units received from a manufacturer that must be verified as "ready" for installation into the aircraft.

B. Units received from the line maintenance personnel with a general complaint of "bad" or "won't work" that require testing to verify that a fault exists and to establish the baseline for any necessary troubleshooting.

C. Units that have been repaired and must be verified as "ready" for reinstallation into the aircraft or placed into the rotational equipment pool.

The testing information included in this section of the manual is provided to assist the technician in accomplishing the above three categories.

The performance test provides a functional operational check of the equipment, and it is recommended to be used as a "customer acceptance test" if the customer elects to conduct such tests. In addition, this test must be performed on units removed from an aircraft for test or repair prior to reinstallation of that unit. Refer to figure 101 for index of test procedures.

Two testing procedures are presented. Figure 102 tests the instrument using standard test equipment with a breakout box. Figure 102A tests the instrument using the 980L-1/1A Test Set with 440Y-23 Adapter and customer fabricated adapter box (figures 901, 904, and 905). Figure 101A shows the matrix switch function assignments for the 980L-1/1A.

In the event a unit from an aircraft is received with a specific complaint, the performance test does not have to be performed. Instead, save time and refer to the troubleshooting chart (figure 201) to begin immediate troubleshooting tactics.

2. Test Equipment and Power Requirements

Refer to the Special Tools, Fixtures, and Equipment section for test equipment and power sources required.

3. Test Setup

A. Standard Test Equipment

Connect the one-to-one breakout box (figure 902) P1 and P2, respectively, to J1 and J2 of the instrument. Connect the positive side of the meter tester to the breakout box post corresponding to J2-1 and the negative side to J2-2.

B. 980L-1/1A Test Set

Refer to figure 102A, steps 0.0 thru 0.4.

4. Test Procedures

TEST NO STANDARD TEST EQUIPMENT (Refer to figure 102)	TEST NO 980L-1A/440Y-23 TEST EQUIPMENT (Refer to figure 102A)	TITLE
	0.0	Test Setup
1.0	1.0	To-From Meter (M1) Test
2.0	2.0	Course Deviation Meter (M2) Test
3.0	3.0	Glideslope Meter (M3) Test
4.0	4.0	Glideslope Flag Meter (M4) Test
5.0	5.0	NAV Flag Meter (M5) Test
6.0	6.0	INS Annunciator Meter (M6) Test
7.0		Course Pointer and Counter Alignment Test
8.0		Airplane Symbol Alignment Test
9.0	7.0	Azimuth Card Servo (B1) Test
10.0	8.0	Azimuth Comparator Differential Resolver (B2) Test
11.0	9.0	Heading Select Servo (B4) Test
12.0	10.0	Heading Datum Control Transformer (B5) Test
13.0	11.0	Course Select Servo (B7) Test
14.0	12.0	Course Datum Differential Resolver (B6) Test
15.0	13.0	Course Resolver (B8) Test
16.0	14.0	Bearing Pointer Servo (B10) Test
17.0	15.0	Back Localizer Sensing Circuit Operation Test

TEST NO STANDARD TEST EQUIPMENT (Refer to figure 102)	TEST NO 980L-1A/440Y-23 TEST EQUIPMENT (Refer to figure 102A)	TITLE
18.0	16.0	Distance Display Test Power Supply Test
19.0	17.0	Heading Flag (M7) and Azimuth Monitor Operation Test
20.0	18.0	Integral Lighting Test
	19.0	Posttest

Index of Test Procedures
Figure 101 (Sheet 2)

	1	2	3	4	5	6	7	8	9	10	11	12	13
A					GS FLAG VOLTAGE	NAV FLAG VOLTAGE				TO-FR/ CRS DEV /G S DEV CURRENT			
B	AZ DIFF. RESOLV XH VO LT.	AZ D IFF. RESO LV XY VO LTAGE	AZ DIFF. RESOLV XH VOLTAGE				AZ FLAG VOLTAGE	CRS RESOLV AD VOLTAGE	CR S RESOLV AD VOLTAGE		CRS RESOLV BF VOLTAGE		
C	FIX ED DC FLAG INPUT VAR. DC FLAG IN- PUT		AZ MON. DC INPUT		GS FLAG DC INPUT	NAV FLAG DC INPUT	GS DEV DC INPUT	TO-FR DC INPUT	CRS DEV DC INPUT	DIST DISPLAY LAMP TEST			
D	HDG SELCT/ BRG PTR XY INPUT CRS DAT XY INPUT	BRG PTR CT XY INPUT HDG SEL CT XY INPUT		REL CRS CT/ CRS SELCT XY INPUT HDG DAT CT XY IN- PUT	REL CRS CT XY INPUT CRS SELECT XY INPUT	CRS RESOLV AC INPUT	CRS RESOLV BC INPUT	AZ DIFF. RESOLV HC VOLT- AGE	AZ DIFF RESOLV H'C' VOLT				
E	AZ TRANSLV FXD 0 XY INPUT AZ TRANSLV VAR. XY INPUT	CRS/HDG/ BRG FXD 0 XY INPUT CRS/HDG/ BRG VAR. XY INPUT	REL CRS/CRS SEL/HDG DAT 0 CY INPUT REL CRS/CRS SEL/HDG DAT VAR XY IN- PUT	CRS AT (NO 2) FXD 0 XY INPUT CR DAT(NO 2) VAR. XY INPUT	AZ EXCITATION REMOVED	GS DEV/ TO-FR/ CRS DEV 1.5 MA INPUT	CRS RESOLV CE CRS RESOLV CG			VAR DC LIGHT INPUT	DME/INS FLAG DC INPUT	DME FLAG DC INPUT	
F						BIT 17	BIT 18			BIT 2I	BIT 22		
G				DIST. LTG VAR DC INPUT		BIT 25	BIT 26			BIT 29	BIT 30	BIT 3I	BIT 32
H	HSI-45 AC POWER INPUT					BIT 1							BIT 8

ATPO-0773-013

980L-1/1A Switch Matrix for Testing HSI-45
Figure 101A

TEST NO	PROCEDURE	RESULTS	COMMENTS
1.0	To-from meter (M1) test		
1.1	To-from meter operation and clearance a. Connect meter tester to J2-1 (+) and J2-2 (-). b. Slowly vary meter tester current from 0 to 220 μA and repeat with polarity opposite for each position of unit under test (UUT). (1) Face vertical, top up. (2) Face vertical, top right. (3) Face vertical, top down. (4) Face horizontal. c. Disconnect meter tester.	b. To-from meter should operate smoothly without mechanical interference.	
1.2	To-from meter balance a. Place UUT in normal position (face vertical, top up). b. Rotate UUT about its longitudinal axis to four positions approximately 90° apart and observe to-from pointer.	b. To-from pointer should remain hidden in all positions.	
1.3 (Cont)	To-from meter stop adhesion a. Connect meter tester to J2-1 (+) and J2-2 (-). b. Adjust meter tester to +450 μA to cause deflection in the to position, then reduce	b. To-from pointer should go out of view when M2 is disconnected.	J2-1 is positive for the to position and negative for the from position.

TEST NO	PROCEDURE	RESULTS	COMMENTS
1.3 (Cont)	current to +225 μA and disconnect meter tester. c. Repeat with meter tester polarity reversed.		
1.4	To-from meter stop position a. Adjust meter tester so to-from pointer is against stop in the from position. b. Observe misalignment between to-from pointer tip and center line of course arrow. c. Repeat with meter tester polarity positive on J2-1 (to position).	b. Not more than 0.8 mm (0.031 in).	
1.5	To-from meter sensitivity and polarity a. Adjust meter tester until to-from meter just touches stop in the to position. Observe current. b. Repeat with meter tester polarity reversed (from position). c. Disconnect meter tester.	a. +242 μA max. b. -242 μA max.	Tap UUT lightly.
2.0	Course deviation meter (M2) test		
2.1 (Cont)	Course deviation meter operation and clearance a. Connect meter tester to J2-3 (+) and J2-4 (-).		

TEST NO	PROCEDURE	RESULTS	COMMENTS
2.1 (Cont)	b. Slowly vary meter tester current from 0 to 150 μA and repeat with polarity opposite. Perform this cycle for each position of UUT listed in test 1.1. c. Observe that there is visible clearance between course deviation bar and adjacent elements.	b. Course deviation meter should operate smoothly without mechanical interference between stops. c. Clearance at ends of course deviation bar should be 0.51 to 1.4 mm (0.020 to 0.055 in).	
2.2	Course deviation meter balance a. Disconnect meter tester. b. For each position listed in test 1.1, observe deflection of course deviation bar from an in-line position with course arrow. c. Reconnect meter tester to J2-3 (+) and J2-4 (-).	 b. 0.38 mm (0.015 in) max either side.	 Tap UUT lightly.
2.3 (Cont)	Course deviation meter stop adhesion a. Adjust meter tester until course deviation bar just touches stop. Record current value. b. Increase current to twice the value recorded. c. Slowly decrease current until bar just leaves stop. Record current value. d. Calculate difference between 2.4a and 2.4c.	 a. _____ μA c. _____ μA d. 33 μA max.	 Do not vibrate the unit under test.

TEST NO	PROCEDURE	RESULTS	COMMENTS
2.3 (Cont)	e. Repeat using opposite meter tester polarity.		
2.4	Course deviation meter stop position a. Adjust meter tester until course deviation bar touches stop. b. Observe distance between inner edge of second dot and inner edge of bar. c. Repeat with meter tester polarity at J2-3 (+) and J2-4 (-).	b. 0.38 to 1.52 mm (0.015 to 0.060 in).	
2.5	Course deviation meter sensitivity and polarity a. Apply current (J2-3 is positive) and note direction course deviation bar deflects. b. Adjust meter tester to align deviation bar with first dot and then second dot. Observe current. c. Reverse meter tester polarity and repeat. d. Disconnect meter tester.	a. Bar should move to right if course arrowhead is pointing upward. b. First dot - 66 to 84 μA; second dot - 133 to 167 μA.	

TEST NO	PROCEDURE	RESULTS	COMMENTS
3.0	Glideslope meter (M3) test		
3.1	Glideslope meter operation and clearance		
	a. Connect meter tester to J2-5 (+) and J2-6 (-) and 28 V dc to J2-7 (+) and J2-8 (-).		28 V dc biases glideslope flag out of view.
	b. Slowly vary meter tester current from 0 to 150 μA and repeat with polarity opposite. Perform this cycle for each position of UUT listed in test 1.1.	b. Glideslope meter should operate smoothly without mechanical interference.	
	c. Observe clearance between rear surface of pointer and tops of scale reference marks.	c. 0.38 mm (0.015 in) max.	
3.2	Glideslope pointer alignment		
	a. Disconnect meter tester and place UUT in normal (face vertical, top up) position.		
	b. Observe vertical alignment of pointer relative to center line of scale center reference mark.	b. ±0.25 mm (0.01 in).	
	c. Observe lateral alignment of pointer tip relative to center line of dots.	c. 0.0 to 0.51 mm (0.0 to 0.020 in).	Tap unit lightly.

TEST NO	PROCEDURE	RESULTS	COMMENTS
3.3	Glideslope meter balance For each position listed in test 1.1, observe deflection of glideslope pointer from zero position.	 0.76 mm (0.030 in) max on either side of zero.	
3.4	Glideslope meter stop adhesion a. Connect meter tester to J2-5 (+) and J2-6 (-). b. Adjust meter tester until glideslope pointer just touches stop. Record current. c. Increase current to twice value recorded. d. Slowly decrease current until pointer just leaves stop. Record current. e. Calculate difference between 3.5b and 3.5d. f. Repeat using opposite meter tester polarity.	 b._____ μA. d._____ μA. e. 33 μA max.	Do not vibrate UUT.
3.5 (Cont)	Glideslope pointer stop position a. Connect meter tester so that polarity is J2-5 (-) and J2-6 (+), then adjust until pointer is against lower stop. b. Measure pointer deflection from scale center reference mark to center of pointer.	 b. 17.5 mm (0.69 in).	

HSI-45 HORIZONTAL SITUATION INDICATOR

COMPONENT MAINTENANCE MANUAL (523-0768607)

TEMPORARY REVISION NO 34-28-25-21

Insert facing page 108, 34-28-25

Subject: Test Procedures

Change the RESULTS coumn of TEST NO 3.4 e. to read:

e. 32 µA max.

HSI-45 HORIZONTAL SITUATION INDICATOR

COMPONENT MAINTENANCE MANUAL (523-0768607)

TEMPORARY REVISION NO 34-28-25-21

Insert facing page 109, 34-28-25

Subject: Test Procedures

Change the RESULTS column for TEST NO 3.6 c. (1), (2), (3), (4) to read:

(1) 75 ±9 μA.
(2) 150 ±17 μA.
(3) 475 μA min.
(4) 1.1 mA max.

Change the RESULTS column for TEST NO 3.6 d. (1), (2) to read:

(1) -75 ±9 μA.
(2) -150 ±17 μA.

TEST NO	PROCEDURE	RESULTS	COMMENTS
3.5 (Cont)	c. Reverse meter tester polarity and adjust current to deflect pointer to its upper stop. Observe pointer.	c. Out of view.	
3.6	Glideslope pointer meter sensitivity and polarity a. Connect meter tester so that polarity is J2-5 (+) and J2-6 (-). b. Apply current and note direction pointer moves. c. Adjust meter tester to position the pointer at: (1) First dot. (2) Second dot. (3) 17.8 mm (0.70 in) from scale center reference mark. (4) Out of view d. Reverse meter tester polarity and adjust to position pointer at: (1) First dot. (2) Second dot.	 b. Upward. (1) 65 to 85 μA. (2) 129 to 171 μA. (3) 466 μA min. (4) 1.2 mA max. (1) -65 to -85 μA. (2) -129 to -171 μA.	 Tap unit lightly.
3.7	Disconnect meter tester and 28-V dc supply.		
4.0	Glideslope flag meter (M4) test		
4.1 (Cont)	Glideslope flag meter clearance a. Connect a variable 28-V dc supply to J2-7 (+) and J2-8 (-).		 Unit is in normal position.

TEST NO	PROCEDURE	RESULTS	COMMENTS
4.1 (Cont)	b. Vary voltage from 0 to +18 V dc to move flag through its travel. Observe clearance between glideslope flag and side mask.	b. 0.38 mm (0.015 in) min.	
	c. Observe clearance between glideslope flag and glideslope pointer.	c. 0.25 mm (0.010 in) min.	
	d. Observe points of contact between moving strut and beads on stop arm.	d. Beads should be approximately perpendicular to and centered on strut.	
4.2	Glideslope flag meter alignment		
	a. Set variable supply to 0 V dc.		a. Deenergizes flag.
	b. Observe alignment of edge of flag with edge of side mask.	b. The edge of the flag should be parallel to the vertical edge of the side mask.	
4.3	Glideslope flag meter balance		
	a. Connect ammeter in series with supply and adjust supply for 2.0 mA. Check flag in each position of instrument listed in test 1.1.	a. Flag should remain fully out of view.	
	b. Adjust supply to 0.5 mA and repeat.	b. Flag should remain fully in view.	

TEST NO	PROCEDURE	RESULTS	COMMENTS
4.4	Glideslope flag meter stop position a. Set variable supply to 0 V dc and observe position of outer edge of flag relative to edge of side mask. b. Set variable supply to +28 V dc and observe position of inner edge of flag relative to edge of side mask.	a. Flag is in view. Distance from edge of flag to edge of mask should be 0.0 to 1.56 mm (0.0 to 0.063 in). b. Flag is out of view. Inner edge of flag must be completely hidden.	
4.5	Glideslope flag meter sensitivity and polarity a. Adjust the supply for the following current values and observe the flag. (1) +0.9 mA. (2) +2.2 mA. (3) +4.0 mA. (4) +1.0 mA. b. Disconnect variable supply.	(1) In view. (2) Out of view. (3) Out of view. (4) In view.	
5.0	NAV flag meter (M5) test		
5.1	NAV flag meter clearance a. Connect variable 28 V dc supply to J2-37 (+) and J2-38 (-). b. Vary voltage from 0 to 18 V dc to move flag through its travel. Observe clearance between NAV flag and center section mask.	b. 0.38 mm (0.015 in) min.	Instrument in normal position.

TEST NO	PROCEDURE	RESULTS	COMMENTS
5.2	NAV flag meter alignment a. Set variable supply to 0 V dc. b. Observe alignment of edge of flag with edge of center section mask.	 b. Edge of flag should be parallel to edge of mask.	
5.3	NAV flag meter balance a. With ammeter in series with supply, adjust supply for 2.0 mA. Check flag in each position of instrument listed in test 1.1. b. Adjust supply to 0.5 mA and repeat.	 a. Flag should remain fully out of view. b. Flag should remain fully in view.	
5.4	NAV flag meter stop position a. With supply at 0 V dc, observe position of inner edge of flag relative to edge of center mask. b. Adjust supply voltage to +28 V dc and observe position of outer edge of flag relative to edge of mask.	 a. Flag is in view. Distance from edge of flag to edge of mask should be 0.0 to 1.56 mm (0.0 to 0.063 in). b. Flag is out of view. Outer edge of flag should be completely hidden.	
5.5 (Cont)	NAV flag meter sensitivity and polarity a. Adjust supply for following current values and observe flag.		

TEST NO	PROCEDURE	RESULTS	COMMENTS
5.5 (Cont)	(1) +0.4 mA. (2) +2.1 mA. (3) +4.0 mA. (4) +0.2 mA. b. Disconnect variable dc supply.	(1) In view. (2) Out of view. (3) Out of view. (4) In view.	
6.0	INS annunciator meter (M6) test		
6.1	INS annunciator meter clearance a. Connect variable 28-V dc supply to J2-19 (+) and J2-20 (-). b. Vary voltage from 0 to +18 V dc to move meter through its travel. Observe clearance between annunciator and side mask.	b. 0.38 mm (0.015 in) min.	Instrument in normal position.
6.2	INS annunciator meter alignment a. Increase supply voltage to +28.0 V dc. b. Observe alignment of edge of annunciator with edge of side mask.	b. Edge of annunciator should be parallel with side mask.	
6.3 (Cont)	INS annunciator meter balance a. Adjust variable supply to position the meter at its approximate mid-point of travel. Use this as a reference position.		

TEST NO	PROCEDURE	RESULTS	COMMENTS
6.3 (Cont)	b. Observe movement of flag from reference position for each position listed in test 1.1.	b. Movement from reference should not exceed ±1.59 mm (0.063 in).	Tap instrument lightly.
6.4	INS annunciator meter stop position a. Set variable dc supply to 0 V, and observe position of inner edge of annunciator relative to edge of side mask. b. Adjust dc supply to +28 V dc to put annunciator in view. Observe outer edge of annunciator relative to edge of side mask.	a. Inner edge of annunciator must be completely hidden. b. Distance from edge of mask to annunciator should be 0.0 to 1.59 mm (0.0 to 0.063 in).	
6.5	INS annunciator meter sensitivity and polarity a. With ammeter in series with supply, adjust for following current values and observe flag. (1) +0.4 mA. (2) +2.1 mA. (3) +4.0 mA. (4) +0.2 mA. b. Disconnect variable dc supply.	(1) Out of view. (2) In view. (3) In view. (4) Out of view.	
7.0 (Cont)	Course pointer and counter alignment test a. Observe alignment of course arrowhead and tail with course deviation bar.	a. Course head and tail should be aligned with deviation bar ±0.38 mm (0.015 in).	

TEST NO	PROCEDURE	RESULTS	COMMENTS
7.0 (Cont)	b. Observe course arrow reading compared to course counter reading.	b. Counter and course arrow should indicate within ±1° of each other.	
8.0	Airplane symbol alignment test Observe alignment of airplane wing symbol with dots on course deviation scale.	Wing should be aligned with center line of course deviation scale dots.	Course deviation scale must be in a horizontal position.
9.0	Azimuth card servo (B1) test		
9.1	Azimuth transolver zero a. Apply 26 V ac, 400 Hz to J1-37 (high) and J1-38 (ground). b. Connect synchro 1 X to J1-28, Y to J1-29, and Z to J1-30. Excite transmitter by applying 26 V ac, 400 Hz (same phase as above) to H and C. c. With synchro 1 set at 0.0°, observe azimuth card. d. Rotate synchro transmitter in direction of increasing numbers.	c. 0° (N) should be precisely aligned with tip of lubber line. d. Azimuth card should rotate in direction of increasing numbers.	
9.2 (Cont)	Azimuth servo accuracy a. Starting at 0°, rotate synchro 1 in direction of increasing numbers to align the following		

TEST NO	PROCEDURE	RESULTS	COMMENTS
9.2 (Cont)	azimuth card indexes with lubber line and observe synchro 1 indication. AZIMUTH CARD (degrees) / SYNCHRO 1 (degrees) 60 — 58.9 to 61.1 120 — 118.9 to 121.1 180 — 178.9 to 181.1 240 — 238.9 to 241.1 300 — 298.9 to 301.1 360 (0) — 358.9 to 1.1 b. Repeat, starting at 30° and rotating in decreasing numbers direction. AZIMUTH CARD (degrees) / SYNCHRO 1 (degrees) 330 — 328.9 to 331.1 270 — 268.9 to 271.1 210 — 208.9 to 211.1 150 — 148.9 to 151.1 90 — 88.9 to 91.1 30 — 28.9 to 31.1		
9.3 (Cont)	Azimuth servo sensitivity a. Rotate synchro transmitter in direction of increasing numbers to 60.0°. b. Disconnect the 26 V ac from J1-37 and J1-38. c. Rotate synchro transmitter in increasing numbers direction to precisely 60.8°.		

TEST NO	PROCEDURE	RESULTS	COMMENTS
9.3 (Cont)	d. Reconnect 26 V ac to J1-37 and J1-38 and observe azimuth card. e. Rotate synchro transmitter in decreasing numbers direction to 60.0°. f. Disconnect 26 V ac from J1-37 and J1-38. g. Rotate synchro transmitter in decreasing numbers direction to 59.2°. h. Reconnect 26 V ac to J1-37 and J1-38 and observe the azimuth card.	d. Should move. h. Should move.	
9.4	Azimuth servo response a. Set synchro 1 to 0°, then disconnect 26 V ac from J1-37 and J1-38. b. Rotate synchro transmitter 90° in increasing numbers direction. c. Reconnect 26 V ac to J1-37 and J1-38 and measure time required for azimuth card to arrive at new setting. d. Repeat in decreasing numbers direction.	c. 2.0 seconds max.	There should be no overshoot.

TEST NO	PROCEDURE	RESULTS	COMMENTS
10.0	Azimuth comparator differential resolver (B2) test		
10.1	Azimuth comparator differential resolver zero and phasing a. With 26 V ac connected to J1-37 (high) and J1-38 (ground), connect 26 V ac to J2-33 (high) and J2-34 (ground). b. Connect vtvm 1 across J2-33 and J2-28 to read ac voltage. c. Connect vtvm 2 across J2-28 and J2-29. d. Jumper J2-30 to J2-34. e. Synchro 1 is connected (X, Y, and Z to J1-28, 29, and 30 respectively). f. Adjust synchro 1 to precisely align 0° index of azimuth card directly under lubber line. Observe vtvm 1 and 2. g. Starting at 0°, rotate synchro 1 in an increasing numbers direction. Observe V ac on J2-33 to J2-28. h. Disconnect 26 V ac from J2-33 and J2-34 and reconnect to J2-31 (high) and J2-32 (ground). i. Connect vtvm 1 across J2-31 and J2-28.	 f. Vtvm 1 - 34 to 38 V ac. Vtvm 2 - not more than 0.060 V. g. Voltage should increase first, then decrease.	
(Cont)			

TEST NO	PROCEDURE	RESULTS	COMMENTS
10.1 (Cont)	j. Remove jumper from J2-34 and jumper J2-32 to J2-30.		
	k. Adjust synchro 1 to precisely align 270° index of azimuth card directly under lubber line. Observe vtvm 1 and 2.	k. Vtvm 1 - 34 to 38 V ac. Vtvm 2 - not more than 0.060 V ac.	
	l. Starting at 270°, rotate synchro 1 in increasing numbers direction and observe vtvm 1.	l. The voltage should increase first, then decrease.	
	m. Remove jumper between J2-30 and J2-32 and disconnect 26 V ac from J2-31 and J2-32. Disconnect both vtvm's.		
10.2	Azimuth comparator differential resolver accuracy		
	a. Connect synchro 2 X to J2-28, Y to J2-29, and Z to J2-30.		
	b. Connect a vtvm across J2-31 and J2-32.		
	c. Adjust synchro 1 in increasing numbers direction to precisely align 0° index of azimuth card under lubber line.		
(Cont)	d. Adjust synchro 2 to 0° and further adjust for null on the vtvm close to 0°. Observe synchro 2 indication.	d. 359 to 1°.	

TEST NO	PROCEDURE	RESULTS	COMMENTS
10.2 (Cont)	e. Repeat in a decreasing numbers direction using a 30° index setting instead of 0°. f. Remove synchro 2 and vtvm.	e. 29 to 31°.	
11.0	Heading select servo (B4) test		
11.1	Heading select control transformer zero a. Connect 26 V, 400 Hz to J2-42 (high) and J2-43 (ground). b. Connect synchro 2, X to J2-14, Y to J2-15, and Z to J2-16. Synchro 1 is connected, X, Y, and Z to J1-28, 29, and 30 respectively. c. Set synchro 2 to 0.0°. d. Set synchro 1 so that 0° index of azimuth card is precisely under lubber line. Observe heading marker. e. Rotate synchro 2 in increasing numbers direction.	d. Heading marker should be precisely aligned with 0° index on azimuth card. e. Heading marker should rotate in increasing numbers direction.	
11.2 (Cont)	Heading select servo accuracy a. Adjust synchro 1 to align 0° index of azimuth card under lubber line.		

TEST NO	PROCEDURE	RESULTS	COMMENTS
11.2 (Cont)	b. Adjust synchro 2 in increasing numbers direction to align heading marker with following azimuth card indexes. HEADING MARKER (degrees) / SYNCHRO (degrees) 60 / 58.9 to 61.1 120 / 118.9 to 121.1 180 / 178.9 to 181.1 240 / 238.9 to 241.1 300 / 298.9 to 301.1 360 (0) / 358.9 to 1.1 c. Repeat, starting at 30° and rotating in decreasing numbers direction. HEADING MARKER (degrees) / SYNCHRO (degrees) 330 / 328.9 to 331.1 270 / 268.9 to 271.1 210 / 208.9 to 211.1 150 / 148.9 to 151.1 90 / 88.9 to 91.1 30 / 28.9 to 31.1		
11.3 (Cont)	Heading select servo sensitivity a. With azimuth card 0° index under lubber line, rotate synchro 2 in increasing numbers direction to precisely align heading marker with 60° index of azimuth card. b. Disconnect 26 V ac from J2-42 and rotate synchro 2 to 60.8°.		

TEST NO	PROCEDURE	RESULTS	COMMENTS
11.3 (Cont)	c. Reconnect 26 V ac to J2-42 and observe heading marker. d. Rotate synchro 2 in decreasing numbers direction to 60.0°. e. Disconnect 26 V ac from J2-42 and rotate synchro 2 to 59.2°. f. Reconnect 26 V ac to J2-42 and observe heading marker.	c. Should move. f. Should move.	
11.4	Heading select servo response a. With synchro 1 at 0.0°, set synchro 2 to 270.0°. b. Disconnect 26 V ac from J2-42 and adjust synchro 2 to 0.0°. c. Reconnect 26 V ac to J2-42 and observe time required for azimuth card to arrive at 0°. d. Repeat with synchro 2 initially set to 90°.	c. 2 seconds max.	There should be no overshoot.
11.5	Heading marker clearance Adjust synchro 2 through entire 360° range. Observe heading marker clearance relative to lubber line, azimuth card, main mask, course pointer, and heading flag.	Not less than 0.25 mm (0.010 in).	

TEST NO	PROCEDURE	RESULTS	COMMENTS
12.0	Heading datum control transformer (B5) test		
12.1	Heading datum control transformer zero and phasing a. Connect 26 V, 400 Hz to J2-13 (high) and J2-12 (ground). J2-42 (high) and J2-43 (ground) are connected. b. Connect vtvm 1 across J2-13 and J2-9 and vtvm 2 between J2-9 and J2-10. Jumper J2-11 to J2-12. c. Synchro 1 X, Y, and Z are connected to J1-28, 29, and 30 respectively. Synchro 2 X, Y, and Z are connected to J2-14, 15, and 16 respectively. d. With synchro 1 at 0° adjust synchro 2 so that heading marker is aligned with azimuth card 270° index. e. Observe vtvm 1 and 2. f. Starting at 270°, rotate synchro 2 in increasing numbers direction and observe vtvm 1. g. Disconnect vtvm 1 and 2, 26 V ac from J2-13 and J2-12 and jumper from J2-11 and J2-12.	e. Vtvm 1 - 34 to 38 V ac. Vtvm 2 - not more than 0.060 V ac (null). f. V ac should increase first, then decrease.	

TEST NO	PROCEDURE	RESULTS	COMMENTS
12.2	Heading datum control transformer accuracy a. Connect a third synchro transmitter (synchro 3) X to J2-9, Y to J2-10, and Z to J2-11. b. Connect a vtvm across J2-12 and J2-13. c. With synchro 1 at 0.0°, rotate synchro 2 in increasing numbers direction to place heading marker precisely at 0°. d. With synchro 3 at 0°, adjust further to find a null voltage reading. Observe synchro 3 dial setting. e. Repeat at 60° intervals for one complete revolution of heading marker (per procedure 9.2a). f. Repeat, starting at 30° and rotating in a decreasing numbers direction (per procedure 9.2b). g. Disconnect synchro 2 and 3 and vtvm.	d. Indication on synchro 3 dial should agree with heading marker ±1.1°.	
13.0	Course select servo (B7) test		
13.1 (Cont)	Course select input control transformer zero a. Synchro 1 X, Y, and Z are connected to J1-28, 29, and 30 respectively.		

TEST NO	PROCEDURE	RESULTS	COMMENTS
13.1 (Cont)	b. 26 V, 400 Hz is connected to J2-42 (high) and J2-43 (ground). c. Connect synchro 2 X to J2-45, Y to J2-46, and Z to J2-47. d. Jumper J2-51 to J2-18. e. Adjust synchro 1 to precisely align 0° index of azimuth with lubber line. f. Adjust synchro 2 to 0.0° and observe course arrow pointer. g. Rotate synchro 2 in increasing numbers direction and observe course arrow.	f. Should be aligned with 0° index of azimuth card. g. Course arrow rotates in direction of increasing numbers.	
13.2	Course select servo accuracy a. With synchro 1 at precisely 0°, rotate synchro 2 in increasing numbers direction and precisely align course arrow with the 60° index of azimuth card. Observe synchro 2 dial setting. b. Repeat at 60° intervals for one complete revolution of course arrow (per procedure 9.2a). c. Repeat, starting at 30° and rotating in decreasing numbers direction (per procedure 9.2b).	a. Indication on synchro 2 should agree with course arrow within ±1.1°.	

TEST NO	PROCEDURE	RESULTS	COMMENTS
13.3	Course select servo sensitivity a. With synchro 1 at precisely 0°, rotate synchro 2 in increasing numbers direction to align course arrow with 60° azimuth card index mark. b. Disconnect 26 V ac from J2-42 and rotate synchro 2 to 60.8°. c. Reconnect 26 V ac to J2-42 and observe course arrow. d. Rotate synchro 2 in decreasing numbers direction to 60.0°. e. Disconnect 26 V ac from J2-42 and rotate synchro 2 to 59.2°. f. Reconnect 26 V ac to J2-42 and observe course arrow.	c. Should move. f. Should move.	
13.4 (Cont)	Course select servo response a. With synchro 1 set at precisely 0°, set synchro 2 to 270°. b. Disconnect 26 V ac from J2-42 and rotate synchro 2 to 0°.		

TEST NO	PROCEDURE	RESULTS	COMMENTS
13.4 (Cont)	c. Reconnect 26 V ac to J2-42 and measure time required for course arrow to stabilize at 0°. d. Repeat with synchro 2 initially set at 90°.	c. 2 seconds max.	c. Overshoot should not exceed 1.5°.
13.5	Relative course input control transformer zero a. Change synchro 2 connection to connect X, Y, and Z to J2-48, 49, and 50 respectively. b. Remove jumper between J2-51 and 18 and connect J2-51 to J2-17. c. Repeat procedure 13.1e - 13.1f.		
13.6	Relative course servo accuracy (Same as 13.2)		
13.7	Relative course servo sensitivity (Same as 13.3)		
13.8	Relative course servo response (Same as 13.4)		
13.9	Remove synchro 2 and jumper from J2-51 and 17.		

TEST NO	PROCEDURE	RESULTS	COMMENTS
14.0	Course datum differential resolver (B6) test		
14.1	Course datum differential resolver zero and phasing a. The 26-V, 400-Hz supply is connected to J2-42 and 43. Synchro 1 is connected to J1-28, 29, 30. b. Connect synchro 2 X to J2-45, Y to J2-56, and Z to J2-47. c. Connect J2-51 to J2-18 and J1-11 to J1-12. d. Connect 26 V, 400 Hz to J1-13 (high) and J1-12 (ground). e. Connect vtvm 1 across J1-13 and J1-9 and vtvm 2 across J1-9 and J1-10. f. With synchro 1 at 0.0°, adjust synchro 2 to precisely align course arrow with 270° index on azimuth card. g. Observe both vtvm's. h. Starting at 270°, rotate synchro 2 in increasing numbers direction. Observe vtvm 1.	g. Vtvm 1 - 34 to 38 V ac. Vtvm 2 - 0.050 V ac max. h. Voltage should increase first, then decrease.	
(Cont)			

TEST NO	PROCEDURE	RESULTS	COMMENTS
14.1 (Cont)	i. Remove vtvm 1 and 2, jumper between J1-11 and J1-12, and 26 V ac to J1-12 and J1-13.		
14.2	Course datum differential resolver accuracy a. Connect synchro 3 X to J1-9, Y to J1-10, Z to J1-11. b. Connect a vtvm across J1-12 and J1-13. c. With synchro 1 precisely at 0°, rotate synchro 2 in increasing numbers direction until course arrow is precisely aligned with 0°. d. Adjust synchro 3 to 0°, and further adjust for null on vtvm close to 0°. Observe synchro 3 dial indication. e. Leaving synchro 1 at 0°, repeat at 60° intervals for one revolution of course arrow. f. Starting at 30°, repeat above procedure for one revolution in decreasing numbers direction. g. Disconnect synchros 1 and 3, vtvm's 1 and 2, jumper across J2-51 and J2-18, and jumper across J1-11 and 12.	d. Synchro 3 dial should agree with course arrow within 1.1°.	

TEST NO	PROCEDURE	RESULTS	COMMENTS
15.0	Course resolver (B8) test		
15.1	Course resolver phasing and electrical zero		
	a. With synchro 2 connected to J2-45, 46, and 47, and 26 V ac connected to J2-42 and 43, adjust synchro 2 until course indicator reads 300°.		
	b. Connect 26 V, 400 Hz to J1-1 (high) and J1-3 (ground).		
	c. Connect a vtvm across J1-4 and J1-5 and observe.	c. 20 V ac min.	
	d. Jumper J1-3 and J1-4 gether, connect vtvm across J1-1 and J1-5, and observe.	d. 40 V ac min.	
	e. Set course selector indicator to 30°, remove 26-V ac high from J1-1 and reconnect it to J1-2.		
	f. Remove jumper from J1-3 and J1-4, connect vtvm across J1-4 and J1-5, and observe.	f. 20 V ac min.	
(Cont)	g. Reconnect jumper across J1-3 and J1-4, connect vtvm across J1-2 and J1-5, and observe.	g. 40 V ac min.	

TEST NO	PROCEDURE	RESULTS	COMMENTS
15.1 (Cont)	h. Remove jumper from J1-3 and J1-4 and adjust course indicator for 300°.		
	i. Connect vtvm across J1-6 and J1-7 and observe.	i. 20 V ac min.	
	j. Jumper J1-3 to J1-6, connect vtvm across J1-2 and J1-7, and observe.	j. 40 V ac min.	
	k. Remove jumper from J1-3 to J1-6.		
	l. With course indicator at 300°, connect vtvm across J1-4 and J1-5, and observe.	l. 0.20 V ac max.	
	m. Remove 26 V ac.		
15.2	Course resolver compensated omnirange zero Refer to the 479X-2 instruction book (CPN 520-5345-000) for test procedure.		
16.0	Bearing pointer servo (B10) test		
16.1	Bearing pointer control transformer zero a. Connect synchro 1 X to J1-28, Y to J1-29, and Z to J1-30.		
(Cont)	b. Connect synchro 2 X to J1-25, Y to J1-26, and Z to J1-27.		

TEST NO	PROCEDURE	RESULTS	COMMENTS
16.1 (Cont)	c. Connect 26 V, 400 Hz to J1-22 (high) and J1-23 (ground) and J1-37 (high) and J1-38 (ground). d. Adjust synchro 1 to align the 0° index of the azimuth card precisely under the lubber line. e. Adjust synchro 2 to 0.0° and observe desired track symbol (T). f. Adjust synchro 2 in increasing numbers direction and observe the T symbol.	e. T symbol should be under lubber line. f. T symbol should rotate in increasing numbers direction.	
16.2	Bearing pointer to desired track alignment e. With 0° index of azimuth card under lubber line, adjust synchro 2 in increasing numbers direction to precisely align bearing pointer with 180° index mark on azimuth card. Observe synchro 2 dial setting. b Repeat in decreasing numbers direction.	a. Synchro 2 should be 178.9 to 181.1°.	
16.3 (Cont)	Bearing pointer servo accuracy a. With 0° index of azimuth card under lubber line, adjust synchro 2 in increasing numbers direction to precisely align	a. Indication on synchro 2 should agree with T symbol within ±1.1°.	

TEST NO	PROCEDURE	RESULTS	COMMENTS
16.3 (Cont)	T symbol with 60° index on azimuth card. Observe synchro 2 dial. b. Repeat at 60° intervals for one complete revolution of T symbol (per procedure 9.2a). c. Repeat, starting at 30° and rotating in decreasing numbers direction (per procedure 9.2b).		
16.4	Bearing pointer servo sensitivity a. With 0° index of azimuth card directly under lubber line, adjust synchro 2 in increasing numbers direction to align T symbol with 60° azimuth card index mark. b. Disconnect 26 V ac from J1-22 and rotate synchro 2 to 60.8°. c. Reconnect 26 V ac to J1-22 and observe T symbol. d. Rotate synchro 2 in decreasing numbers direction to 60.0°. e. Disconnect 26 V ac from J1-22 and rotate synchro 2 to 59.2°. f. Reconnect 26 V ac to J1-22 and observe T symbol.	c. Should move. f. Should move.	

TEST NO	PROCEDURE	RESULTS	COMMENTS
16.5	Bearing pointer servo response a. With synchro 1 at 0°, set synchro 2 to 270°. b. Disconnect 26 V ac from J1-22 and rotate synchro 2 to 0°. c. Reconnect 26 V ac to J1-22 and measure time required for T symbol to stabilize at 0°. d. Repeat with synchro 2 initially set at 90°. e. Disconnect 26 V ac and synchro 2.	c. 2 seconds max.	c. There should be no overshoot.
17.0 (Cont)	Back localizer sensing circuit operation test a. Synchro 1 is connected to J1-28, 29, and 30. b. Connect synchro 2 X to J1-9, Y to J1-10, and Z to J1-11. c. With 26 V ac connected to J1-37 (high) and J1-38 (ground), connect 26 V ac to J2-42 (high) and J2-43 (ground). d. Connect synchro 3 X to J2-45, Y to J2-46, and Z to J2-47.		

TEST NO	PROCEDURE	RESULTS	COMMENTS
17.0 (Cont)	e. Jumper J2-51 to J2-18. f. Connect 270 Ω, 1%, 5-W resistor between J1-43 and J1-41. g. Apply 28.0 V dc to J1-42 (+) and J1-41 (-). h. Connect dvm between J1-43 (+) and J1-41 (-). i. Set synchro 1 and synchro 2 to precisely 0°. j. Rotate synchro 3 to move course arrow through a complete revolution in increasing numbers direction. k. Record position of course arrow at which voltage between J1-43 (+) and J1-41 (-) is on or off. Voltage on is +25.2 to +30.8 V dc and voltage off is +0.15 V dc max. l. Remove all connections to the breakout box.	k. Voltage on - 107 to 252°. Voltage off - 272 to 88°.	
18.0	Distance display test		
18.1 (Cont)	Distance display preliminary checks a. Connect serial bit generator as follows: Clock High J1-48 Low J1-49		

TEST NO	PROCEDURE	RESULTS	COMMENTS
18.1 (Cont)	Sync High J1-46 Low J1-47 Data High J1-44 Low J1-45 b. Connect 26 V, 400 Hz to J1-17 (high) and J1-18 (ground). c. Connect +28.0 V dc to J1-50 (+) and J1-41 (-). d. Connect a variable (0 to +5 V dc) supply to J1-54 (+) and J1-41 (-). e. Jumper J1-51 to J1-41. f. Set bcd generator DATA bits 1, 8, and 31 to logic 1. All others are logic 0. Observe MILES display.	f. 000.0.	Adjust the variable (0 to +5 V dc) supply to +5.00 V dc.
18.2	Power supply checks a. Use A1-TPQ as ground for following voltage checks. b. Bus coupler supply A1-TPA c. Lamp supply A1-TPB d. Logic supply A1-TPP	b. +19 to +21 V dc. c. +4.9 to +5.7 V dc. d. +4.5 to +4.9 V dc.	

TEST NO	PROCEDURE	RESULTS	COMMENTS
18.3	Distance display numeral checks a. Set DATA bit 31 to 0 (bits 1 and 8 still high). b. Sequence DATA bits 17 through 30 per the following table.		

LINE	BIT														MILES DISPLAY
	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	*BB0.0
2	1	0	0	0	1	0	0	0	1	0	0	0	1	0	111.1
3	0	1	0	0	0	1	0	0	0	1	0	0	0	1	222.2
4	1	1	0	0	1	1	0	0	1	1	0	0	1	1	333.3
5	0	0	1	0	0	0	1	0	0	0	1	0	1	1	344.4
6	1	0	1	0	1	0	1	0	1	0	1	0	1	1	355.5
7	0	1	1	0	0	1	1	0	0	1	1	0	1	1	366.6
8	1	1	1	0	1	1	1	0	1	1	1	0	1	1	377.7
9	0	0	0	1	0	0	0	1	0	0	0	1	1	1	388.8
10	1	0	0	1	1	0	0	1	1	0	0	1	1	1	399.9

*B = Blank

18.4	Dashes display check a. With all bits per line 10 of table in test 18.3, change bit 32 to logic 1. b. Observe distance display and decimal point.	b. Distance display is ---- and decimal point is extinguished.	
18.5 (Cont)	Mode control check a. Remove jumper between J1-51 and J1-41, and connect +28.0 V dc to J1-51 (+) and J1-41 (-).		

TEST NO	PROCEDURE	RESULTS	COMMENTS
18.5 (Cont)	b. Transmit DATA per line 10 of table in test 18.3 and observe distance display. c. Disconnect +28 V dc from J1-51 and J1-41 and reconnect J1-51 to J1-41.	b. 3999.	
18.6	Flag input check a. With DATA bits per line 10 of table in test 18.3, reduce V dc on J1-50 to 4.0 V dc. b. Observe distance display. c. Adjust V dc on J1-50 back to +28.0 V dc.	b. All numbers blank.	
18.7	Lamp test input check a. Jumper J1-53 to J1-41. b. Transmit DATA per line 1 of table in test 18.3 and observe distance display. c. Remove jumper from J1-53 to J1-41.	b. 888.8.	
18.8 (Cont)	Indicator status output check a. Connect dvm to J1-52 and J1-41. b. Set DATA bits 1, 8, and 31 to 1, all others to 0, and observe dvm.	b. +27.5 to +28.5 V dc.	

TEST NO	PROCEDURE	RESULTS	COMMENTS
18.8 (Cont)	c. Set bits 1, 8, and 31 to 0, observe voltages at J1-52, and following times:	c. Before 2 seconds, +27.5 to +28.5 V dc. After 4 seconds, 0.5 V dc max.	
18.9	Monitor delay timing check a. Set DATA bits 1, 8, and 31 to 1 and all others to 0. b. Disconnect J1-48 connection from bit generator and observe display. c. Reconnect J1-48 to bit generator.	b. Display should remain lit for 2 seconds and should be blank after 4 seconds.	
18.10	Dimming control linearity and operation a. With bits 1, 8, and 31 at logic 1, transmit DATA per line 3 of table in test 18.3. b. Connect dvm to A1-TPB and A1-TPQ (ground). c. Adjust variable dc supply at J1-54 to following values and observe dvm. d. Slowly vary dc supply at J1-54 from 0 to +5 V dc and back to 0 again. e. Disconnect bit generator, 26 V ac from J1-17 and J1-18, 28 V dc	c. J1-54 (V dc) / TP-B (V dc): 0.0 / +0.90 to +1.1 3.0 / +3.48 to +3.68 4.0 / +5.20 to +5.40 d. Display intensity should vary smoothly and evenly over range of dimming control.	
(Cont)			

TEST NO	PROCEDURE	RESULTS	COMMENTS
18.10 (Cont)	from J1-50 and J1-41, 5 V dc variable supply from J1-54 and J1-41, and jumper from J1-51 to J1-41.		
19.0	Heading flag (M7) and azimuth monitor operation test		
19.1	Heading flag alignment and stop position a. Connect synchro 1 X to J1-28, Y to J1-29, and Z to J1-30. b. Connect 26 V, 400 Hz to J1-37 (high) and J1-38 (ground) c. Connect +28-V dc variable supply to J1-36 (+) and J1-41 (-). d. Adjust variable dc supply to 28 V dc and note position of flag. e. Adjust variable dc supply to 0 V dc, and observe distance from lower edge of flag to a line tangent to main mask opening.	d. Flag should be completely hidden. e. 0 to 1 mm (0 to 0.040 in).	e. Upper edge of flag is parallel to lower edge of flag mask.
19.2 (Cont)	Heading flag clearance a. Adjust variable dc supply so that flag moves from upper stop to lower stop.		

TEST NO	PROCEDURE	RESULTS	COMMENTS
19.2 (Cont)	b. Observe clearance between flag and upper mask and lubber line.	b. 0.38 mm (0.015 in) min.	b. Flag should move freely with no evidence of mechanical interference.
19.3	Azimuth monitor validity signal		
	a. Starting at 0 V, slowly increase variable dc supply until flag is completely out of view. Measure supply voltage.	a. Not more than +18.5 V dc.	
	b. Increase supply voltage to +30 V dc and then decrease until flag is completely in view. Measure supply voltage.	b. Not less than 3.0 V dc.	
19.4	Azimuth monitor transolver excitation signal		
	a. With variable dc supply at +28 V dc, remove excitation voltage from synchro 1. Note position of flag.	a. Entirely in view.	
	b. Restore excitation to synchro 1 and note flag.	b. Entirely out of view.	
19.5	Azimuth monitor power input		
	a. With variable dc supply at +28 V dc, remove the 26 V ac from J1-37 and J1-38. Observe flag.	a. Entirely in view.	
	b. Restore 26 V ac to J1-37 and J1-38. Observe flag.	b. Entirely out of view.	

TEST NO	PROCEDURE	RESULTS	COMMENTS
19.6	Azimuth monitor error input CAUTION: NEVER ALLOW 26 V AC TO BE APPLIED TO J1-37 AND J1-38 AT THE SAME TIME 28 V DC IS APPLIED TO J1-21. a. Adjust synchro 1 to align azimuth card to any convenient reference mark. Remove 26 V ac from J1-37 and J1-38. b. Connect 28 V dc to J1-21 (+) and J1-41 (-). Observe heading flag. c. Rotate synchro 1 precisely 1.5° in increasing numbers direction. Observe heading flag. d. Rotate synchro 1 another 3° in increasing numbers direction (total of 4.5°). Observe position of heading flag. e. Disconnect 28 V dc from J1-21 (observe the caution) and reconnect 26 V ac to J1-37 and J1-38. Repeat steps a through d, except rotate synchro 1 in decreasing numbers direction in steps c and d. f. Remove all connections to breakout box.	b. Fully out of view. c. Fully out of view. d. Fully in view.	

TEST NO	PROCEDURE	RESULTS	COMMENTS
20.0	Integral lighting test a. Connect a variable 5-V dc supply to J2-35 (+) and J2-36 (-). b. With variable supply adjusted to +5.0 V dc, observe lighting. c. Disconnect 5-V dc variable supply.	b. All lights on.	

HSI-45 Test Procedures
Figure 102 (Sheet 41)

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
0.0	Test setup and power supply test					
0.1	Remove instrument case per disassembly procedures.					
0.2	Connect adapter box (figures 904 and 905) cables P1 and P2 to instrument rear connectors J1 and J2 respectively. Connect test set cables P1 and P2 to adapter box connectors J1 and J2 respectively.					
0.3	Apply an external variable dc power supply to the DC SOURCE INPUT jacks on the adapter box. Adjust the power supply for 28 V dc and do not change until told to do so.					
0.4	Apply power to the test set.					
0.5	Establish initial conditions.	S1 - OFF S2 - OPEN S3 - EXT DIM S4 - BACK LOC S5 - B7/B14 ERROR S6 - LNAV S7 - ON	All matrix switches			
0.6	Apply primary power, 26 V ac to J1-17(H) and J1-18(L).			H1		
0.7 (Cont)	Externally measure supply voltages at the following test points on the A1 distance board. TP-B (+) to TP-Q (-)				+5.1 to +5.9 V dc	Check voltage from C14 junction (+) to TP-Q (-). Voltage should be +8 to +10 V dc. If not, check A1C13, A1C14, A1C12, A5CR3, and A5CR4. Repair as required. If voltage checks OK, check A6Q1, A1R57, and A1U24. Repair as required.

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
0.7 (Cont)	TP-P (+) to TP-Q (-) TP-A (+) to TP-Q (-)				+4.5 to +4.9 V dc +19 to +21 V dc	Check A6Q2 and A1U25. Repair as required. Check voltage from A5CR2/CR1 junction (+) to TP-Q (-). Voltage should be +24 to +26 V dc. If not, check A5CR1, A5CR2. Repair as required. If voltage checks OK, check A1VR20. Repair as required.
0.8	Remove ac and dc power.		H1			
0.9	Install instrument case per assembly procedures.					
1.0	TO-FROM meter (M1) test					
1.1	Establish initial conditions.	S1 - OFF S2 - OPEN S3 - EXT DIM S4 - BACK LOC S5 - B7/B14 ERROR S6 - LNAV S7 - ON	All matrix switches			
1.2 (Cont)	Apply DC SOURCE and dvm to J2-1 (+) and J2-2 (-). Vary DC SOURCE between -220 μA and +220 μA (switch polarity to - for negative source).			A10 C8 H1	TO-FROM pointer operates smoothly in each of the attitudes below: Face vertical, top up Face vertical, top right	Adjust or repair TO-FROM meter, M1, as required.

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
1.2 (Cont)					Face vertical, top left Face vertical, top down Face horizontal, face up	
1.3	Apply 3-WIRE SOURCE to J2-45 (X), J2-46 (Y), J2-47 (Z). Adjust 3-WIRE SOURCE to position course arrow to 0°, 90°, 180°, and 270°. Adjust course arrow back to 0°.		C8	D5 E3	In each position, the TO-FROM pointer is hidden out of view.	Adjust or repair TO-FROM meter, M1, as required.
1.4	Apply DC SOURCE to J2-1 (+) and J2-2 (-). Adjust DC SOURCE until TO-FROM pointer just touches the meter stop. NOTE: SOURCE POLARITY is + for TO position. Adjust DC SOURCE for maximum output. Slowly decrease DC SOURCE until TO-FROM pointer just leaves the meter stop.			C8	Record dvm reading (maximum NMT 230 μA). The difference between the recorded dvm reading and the present reading is less than 33 μA.	Adjust or repair TO-FROM meter, M1, as required. Clean or replace meter stop as required.
1.5	Switch DC SOURCE POLARITY to - and repeat step 1.4 to check other meter stop.				Same as step 1.4.	Same as step 1.4.

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
2.0	Course deviation meter (M2) test					
2.1	Establish initial conditions. NOTE: Ensure that +28 V dc is applied to DC SOURCE INPUT jacks on adapter box.	S1 - OFF S2 - OPEN S3 - EXT DIM S4 - BACK LOC S5 - B7/B14 ERROR S6 - LNAV S7 - ON	All matrix switches			
2.2	Apply DC SOURCE and dvm to J2-3 (+) and J2-4 (-) (DC SOURCE POLARITY is +). Vary source between +150 μA to -150 μA (switch POLARITY to - for negative source).			A10 C9 H1	Course deviation pointer operates smoothly in each of the attitudes below. Face vertical, top up Face vertical, top right Face vertical, top left Face vertical, top down Face horizontal, face up	Adjust or repair course deviation meter, M2, as required.
2.3	Ensure course arrow is pointed up. (Adjust 3-WIRE SOURCE.) Adjust DC SOURCE to position pointer over second dot left of center. Adjust DC SOURCE to position pointer over first dot left of center.				Dvm reads -136 to -164 μA. Dvm reads -67 to -83 μA.	Adjust meter sensitivity.

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
2.4	Switch source POLARITY to + and repeat step 2.3 to check first and second dots to right of center scale.				Dvm reads +136 to +164 μA for second dot right. Dvm reads +67 to +83 μA for first dot right.	
2.5	Adjust DC SOURCE until deviation pointer just touches meter stop. Adjust DC SOURCE for maximum output. Slowly decrease DC SOURCE until deviation pointer just leaves the meter stop.				Record dvm reading. The difference between the recorded dvm reading and the present reading is less than 32 μA.	Clean or replace meter stop as required.
2.6	Switch DC SOURCE POLARITY to - and repeat step 2.5 to check other meter stop.				Same as step 2.5.	Same as step 2.5.
3.0	Glideslope meter (M3) test					
3.1	Establish initial conditions. NOTE: Ensure that +28 V dc is applied to DC SOURCE INPUT jacks on adapter box.	S1 - OFF S2 - OPEN S3 - EXT DIM S4 - BACK LOC S5 - B7/B14 ERROR S6 - LNAV S7 - ON	All matrix switches			
3.2 (Cont)	Bias GS flag out of view by applying 28 V dc to J2-7(+) and J2-8(-). Apply DC SOURCE and dvm to J2-5(+) and J2-6(-). Vary DC SOURCE between +150 and -150 μA. (Switch POLARITY to - for negative source.)			C5 H1 A10 C7	Glideslope pointer operates smoothly in each of the attitudes below: Face vertical, top up	Adjust or repair glideslope meter, M3, as required.

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
3.2 (Cont)					Face vertical, top right Face vertical, top left Face vertical, top down Face horizontal, face up	
3.3	Adjust DC SOURCE to position glideslope pointer over second dot up from center scale. Adjust DC SOURCE to position glideslope pointer over first dot up from center scale.				Dvm reads +133 to +167 μA. Dvm reads +66 to +84 μA.	Adjust meter sensitivity.
3.4	Switch DC SOURCE POLARITY to - and repeat step 3.3 to check second and first dots below center scale.				Dvm reads -133 to -167 μA for second dot. Dvm reads -66 to -84 μA for first dot.	
3.5	Adjust DC SOURCE until glideslope pointer just touches meter stop. Increase SOURCE current to twice the value recorded above. Slowly decrease DC SOURCE until glideslope pointer just leaves the meter stop.			E6	Record dvm reading. The difference between the recorded dvm reading and the present reading is less than 32 μA.	Clean or replace meter stops.
3.6	Switch DC SOURCE POLARITY to + and repeat step 3.5 to check other meter stop.				Same as step 3.5.	Same as step 3.5.
3.7	Adjust DC SOURCE until glideslope pointer is half in view at the top of the glideslope scale. Adjust DC SOURCE until glideslope pointer goes completely out of view.				Dvm reading is NLT 500 μA. Dvm reading is NMT 1 mA.	

HSI-45 Horizontal Situation Indicator

COMPONENT MAINTENANCE MANUAL with IPL (523-0768607)

TEMPORARY REVISION NO. 34-28-25-22

Insert facing page 149, 34-28-25

Subject: Revise Test Procedure Results

Revise test 4.3 result to read as follows:

RESULTS

Flag movement is smooth.

Record dvm reading.

The difference between
the recorded dvm reading
and the present reading
is less than 220 mVdc.

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
4.0	Glideslope flag meter (M4) test					
4.1	Establish initial conditions. NOTE: Ensure that +28 V dc is applied to DC SOURCE INPUT jacks on adapter box.	S1 - OFF S2 - OPEN S3 - EXT DIM S4 - BACK LOC S5 - B7/B14 ERROR S6 - LNAV S7 - ON	All matrix switches			
4.2	Apply variable AC SOURCE and dvm to J2-7(+) and J2-8(-). Adjust AC SOURCE so that glideslope flag is half in view.			C1 C5 A5 H1	Glideslope flag movement is less than 1/16 inch when instrument is placed in each of the attitudes below: Face vertical, top up Face vertical, top right Face vertical, top left Face vertical, top down Face horizontal, face up.	Adjust glideslope flag meter balance as required.
4.3	Vary AC SOURCE from 0 to 18 V dc. Adjust AC SOURCE until flag is out of view and just touches meter stop. Adjust AC SOURCE for maximum output. Slowly decrease AC SOURCE until flag strut just leaves the meter stop.				Flag movement is smooth. Record dvm reading. The difference between the recorded dvm reading and the present reading is less than 220 μA.	Clean or replace meter stops as required.

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
4.4	Beginning at 0 V dc, increase AC SOURCE until flag is just out of view. Decrease AC SOURCE until flag is in full view and stops moving.				Dvm reading is NMT +18.2 V dc. Dvm reading is NLT +3.5 V dc.	Repair or replace glideslope flag meter, M4.
5.0	NAV flag meter (M5) test					
5.1	Establish initial conditions NOTE: Ensure that +28 V dc is applied to DC SOURCE INPUT jacks on adapter box.	S1 - OFF S2 - OPEN S3 - EXT DIM S4 - BACK LOC S5 - B7/B14 ERROR S6 - LNAV S7 - ON	All matrix switches			
5.2	Apply variable AC SOURCE and dvm to J2-37(+) and J2-38(-). Adjust AC SOURCE so NAV flag is half in view.			A6 C1 C6 H1	NAV flag movement is less than 1/16 inch when instrument is placed in each of the attitudes below: Face vertical, top up Face vertical, top right Face vertical, top left Face vertical, top down Face horizontal, face up	Adjust NAV flag balance as required.
5.3 (Cont)	Vary AC SOURCE from 0 to 18 V dc. Adjust AC SOURCE until NAV flag is out of view and just touches meter stop. Adjust AC SOURCE for maximum output.				NAV flag should move smoothly. Record dvm reading.	

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
5.3 (Cont)	Slowly decrease AC SOURCE until NAV flag strut just begins to leave meter stop.				The difference between the recorded dvm reading above and the present reading should be less than 220 μA.	Clean or replace meter stops as required.
5.4	Beginning at 0 V dc, increase AC SOURCE until NAV flag is just out of view. Decrease AC SOURCE until NAV flag is in full view and stops moving.				The dvm reading is NMT +18.2 V dc. The dvm reading is NLT +3.5 V dc.	Repair or replace NAV flag, meter M5.
6.0	INS annunciator meter (M6) test					
6.1	Establish initial conditions. NOTE: Ensure that +28 V dc is applied to DC SOURCE INPUT jacks on adapter box.	S1 - OFF S2 - OPEN S3 - EXT DIM S4 - BACK LOC S5 - B7/B14 ERROR S6 - LNAV S7 - ON	All matrix switches			
6.2	Apply a variable dc source to J2-19(+) and J2-20(-) by selecting VNAV/GS (INS). Adjust external dc source (input to adapter box) so that the INS annunciator is half in view.	S6 - VNAV/GS (INS)			INS annunciator movement is less than 1/16 inch when instrument is placed in each of the attitudes below: Face vertical, top up Face vertical, top right Face vertical, top left Face vertical, top down Face horizontal, face up	Adjust INS annunciator balance as required.

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
6.3	Vary external dc source from 0 to +18 V dc. (Voltage can be measured at J16 on adpater box.) Adjust external dc source until INS annunciator is out of view and just touches the meter stop. Increase source to twice the value recorded above. Slowly decrease source until annunciator meter strut just leaves that meter stop.				INS annunciator moves smoothly.	
6.4	Beginning at 0 V dc, increase external dc source until annunciator is in full view and stops moving. Decrease external dc source until INS annunciator is just out of view.				The dvm reading is NMT +18.2 V dc. The dvm reading is NLT +3.5 V dc.	Repair or replace INS annunciator, meter M6.
7.0	Azimuth card servo (B1) test					
7.1	Establish initial conditions. NOTE: Ensure that +28 V dc is applied to DC SOURCE INPUT jacks on adapter box.	S1 - OFF S2 - OPEN S3 - EXT DIM S4 - BACK LOC S5 - B7/B14 ERROR S6 - LNAV S7 - ON	All matrix switches			
7.2 (Cont)	Apply 3-WIRE SOURCE to J1-28 (X), J1-29 (Y), and J1-30 (Z). Apply +28 V dc to azimuth monitor, J1-36. Observe that when 3-WIRE SOURCE is rotated in a direction of increasing numbers,			E1 H1 C3	HEADING flag should bias out of view. Compass card rotates in a direction of increasing numbers.	Refer to trouble-shooting in step 19.0 if HEADING flag will not go out of view. Check phasing and wiring of B1 if rotation is opposite.

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES OFF ON	RESULTS	TROUBLESHOOTING
7.2 (Cont)	the compass card rotates in a direction of increasing numbers. Rotate compass card for 360° in both cw and ccw directions to check for smooth operation.			Compass card rotates smoothly in either direction.	If compass card is inoperative, check A6-18 to A6-21 (A6-30 to A6-40 with SB 2) for smooth changing ac signal as 3-WIRE SOURCE is rotated. If not ok, check B1. If signal is ok at A6-18 to A6-21 (A6-30 to A6-40 with SB 2), check for smooth changing ac signal from A6U1-1 to A6U1-5 (A7-9 to A7-15 with SB 2) as a 3-WIRE SOURCE is rotated. If not ok, check A6U1 (A7U3, A7Q5, and A7Q6 with SB 2) and A3 power supply. If signal is ok from A6U1-1 to A6U1-5 (A7-9 to A7-15 with SB 2), check MG1 and possible binding in gear train.
7.3	Rotate 3-WIRE SOURCE to position 0° index on compass card directly under lubber line.			3-WIRE SOURCE dial reads 359.1° to 0.9°.	Loosen clamps on synchro B1 and rotate B1 until 0° index on compass card aligns precisely under the lubber line.
7.4	Beginning at 0°, rotate 3-WIRE SOURCE in a direction of increasing numbers to align compass card to every 60° increment (0, 60, 120, 180, 240, 300).			At each incremented position the 3-WIRE SOURCE dial reading should be within ±0.9° of the compass card position.	Repair or replace B1.
7.5	Beginning at 30°, rotate 3-WIRE SOURCE in a direction of decreasing numbers to align compass card to every 60° increment (030, 330, 270, 210, 150, 090).			At each incremented position the 3-WIRE SOURCE dial reading should be with ±0.9° of the compass card position.	Repair or replace B1.

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
7.6	Adjust 3-WIRE SOURCE in a direction of increasing numbers to precisely 60°, and then adjust 3-WIRE SOURCE another 0.5° in the same direction.				Movement of the compass card should be visible between 60° and 60.5° on the 3-WIRE SOURCE dial.	Check MG1. Repair or replace as required.
7.7	Adjust 3-WIRE SOURCE in a direction of decreasing numbers to precisely 60°; then adjust 3-WIRE SOURCE another 0.5° in the same direction.				Movement of the compass card should be visible between 60° and 59.5° on the 3-WIRE SOURCE dial.	Check MG1. Repair or replace as required.
7.8	Adjust compass card to 0°, remove exciter voltage from J1-37, and readjust 3-WIRE SOURCE to 90°. Apply exciter voltage back to J1-37.		H1	 H1	Compass card should remain at 0°. Compass card should rotate to 90° in NMT 1.5 seconds with no overshoot.	 Check A6R8 (A7R62 with SB 2) and MG1. Repair as required.
7.9	Repeat step 7.8, except rotate 3-WIRE SOURCE to 270° after removing exciter voltage.				Compass card should rotate to 270° in NMT 1.5 seconds with no overshoot.	Same as step 7.8.
8.0	Azimuth comparator differential resolver (B2) test					
8.1	Establish initial conditions. NOTE: Ensure that +28 V dc is applied to DC SOURCE INPUT jacks on adapter box. NOTE: Connect jumper wire from J11 (B2 Z EXT IN) to J15 (GND).	S1 - OFF S2 - OPEN S3 - EXT DIM S4 - BACK LOC S5 - B7/B14 ERROR S6 - LNAV S7 - ON	All matrix switches			
8.2 (Cont)	Apply 26 V ac to J2-33 (H) and J2-34 (L) and externally measure ac voltage from B2-X EXT IN to B2-H (on adapter box).			H1 D8	Dvm reads 33 to 39 V ac.	Loosen clamps on synchro B2 and rotate B2 until voltage is correct.

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
8.2 (Cont)	Rotate compass card in a direction of increasing numbers (using 3-WIRE SOURCE) while monitoring the B2-X to B2-H voltage.			E1	Voltage should increase before decreasing.	Loosen clamps of synchro B2 and rotate B2 180°.
8.3	Rotate compass card back to 0° and externally measure null voltage from B2-X EXT IN to B2-Y EXT IN (on adapter box).				Dvm reads NMT 60 mV ac.	Loosen clamps on synchro B2 and rotate B2 to obtain null.
8.4	Remove 26 V ac from J2-33 (H) and J2-34 (L), and reapply it to J2-31 (H) and J2-32 (L).		D8	D9		
	Rotate compass card to 270° and externally measure ac voltage from B2-H' to B2-X EXT IN (on adapter box).				Dvm reads 33 to 39 V ac.	Repair or replace B2.
	Rotate compass card in a direction of increasing numbers while monitoring B2-H' to B2-X voltage.				Voltage should increase before decreasing.	Check B2 wiring.
	Rotate compass card back to 270° and externally measure null voltage from B2-X EXT IN to B2-Y EXT IN (on adapter box).				Dvm reads NMT 60 mV ac.	Repair or replace B2.
	Remove 26 V ac from J2-31 and J2-32 and dvm from B2-H' and B2-X (on adapter box).		D9			
8.5	Rotate compass card to 60° using 3-WIRE SOURCE.					
(Cont)	Remove exciter voltage from J1-37.		H1			

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
8.5 (Cont)	Externally jumper the 3-WIRE SOURCE from the test set to B2-X EXT IN, B2-Y EXT IN, and B2-Z EXT IN on the adapter box. Externally connect dvm to B2-H' (H) and GND (L) and adjust 3-WIRE SOURCE for a null indication on dvm. NOTE: Remove jumper wire J11 (B2 Z EXT IN) to J15 (GND). Apply exciter voltage back to J1-37 and remove external 3-WIRE SOURCE from adapter box.			H1	At null position, the 3-WIRE SOURCE dial reads 58.9° to 61.1°.	Rezero or replace B2. NOTE: The null tolerance in step 8.3 must be maintained if rezeroing is attempted.
8.6	Repeat the procedure in step 8.5 for every 60° increment cw from 60°.				At null position for each increment, the 3-WIRE SOURCE dial reads within ±1.1° of the compass card position.	Same as step 8.5.
8.7	Repeat the procedure in step 8.5 for every 60° increment ccw from 30°.				Same as step 8.6.	Same as step 8.5.
9.0	Heading select servo (B4) test					
9.1	Establish initial conditions. NOTE: Ensure that +28 V dc is applied to DC SOURCE INPUT jacks on adapter box.	S1 - OFF S2 - OPEN S3 - EXT DIM S4 - BACK LOC S5 - B7/B14 ERROR S6 - LNAV S7 - ON	All matrix switches			
9.2 (Cont)	Apply 3-WIRE SOURCE to J2-14 (X), J2-15 (Y), and J2-16 (Z). Rotate 3-WIRE SOURCE in a direction of increasing numbers while observing the heading bug.			D2 E2 H1	Heading bug rotates around compass card in a direction of increasing numbers.	Check phasing and wiring of B4 if rotation is opposite.

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
9.2 (Cont)						If heading bug is inoperative, check A6-3 (A7-17 with SB 2) to gnd for smooth changing ac signal as 3-WIRE SOURCE is rotated. If not, check B4. If signal is ok at A6-3 (A7-17 with SB 2) to gnd, check for smooth changing ac signal from A6U2-4 (A7-13 with SB 2) to A6U2-5 (A7-14 with SB 2) as 3-WIRE SOURCE is rotated. If not ok, check A6U2 (A7U1, A7Q1, and A7Q2 with SB 2) and A3 power supply. If signal is ok from A6U2-4 to A6U2-5 (A7-13 to A7-14 with SB 2), check MG2 and possible binding in gear train.
9.3	Adjust 3-WIRE SOURCE to position heading bug directly under lubber line (aligns with 0° on compass card.)				3-WIRE SOURCE dial should read 358.9° to 361.1°.	Loosen clamps on synchro B4 and rotate B4 until heading bug is aligned precisely with the 0° index mark.
9.4	Beginning at 60°, align heading bug (using 3-WIRE SOURCE) in a direction of increasing numbers, to every 60° increment on compass card (60, 120, 180, 240, 300, 360).				At each incremental position, 3-WIRE SOURCE dial should read within ±1.1° of the heading bug position to the compass card.	Repair or replace synchro B4.
9.5	Repeat step 9.4 in a direction of decreasing numbers beginning at 30 degrees.				Same as step 9.4.	Same as step 9.4.

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
9.6	Adjust 3-WIRE SOURCE in a direction of increasing numbers to precisely 60°; then adjust 3-WIRE SOURCE another 0.5° in the same direction.				Movement of the heading bug should be visible between 60° and 60.5° on the 3-WIRE SOURCE dial.	Check MG2. Repair or replace as required.
9.7	Adjust 3-WIRE SOURCE in a direction of decreasing numbers to precisely 60°; then adjust 3-WIRE SOURCE another 0.5° in the same direction.				Movement of the heading bug should be visible between 60° and 59.5° on the 3-WIRE SOURCE dial.	Check MG2. Repair or replace as required.
9.8	Adjust 3-WIRE SOURCE to position heading bug to 0° on compass card. Remove exciter voltage from J2-42, and adjust 3-WIRE SOURCE for 270°. Apply exciter voltage back to J2-42.		H1	 H1	Heading bug should remain at 0°. Heading bug should rotate to 270° position on compass card in NMT 1.5 seconds with NMT 1° of overshoot.	 Check A6R4 (A7R64 with SB 2) and MG2. Repair as required.
9.9	Repeat step 9.8 except rotate 3-WIRE SOURCE to 90° after removing exciter voltage.				Heading bug should rotate to 90° in NMT 1.5 seconds with NMT 1° of overshoot.	Same as step 9.8.
10.0	Heading datum control transformer (B5) test					
10.1	Establish initial conditions. NOTE: Ensure that +28 V dc is applied to DC SOURCE INPUT jacks on adapter box.	S1 - OFF S2 - OPEN S3 - EXT DIM S4 - BACK LOC S5 - B7/B14 ERROR S6 - LNAV S7 - ON	All matrix switches			
10.2 (Cont)	Apply 3-WIRE SOURCE to J2-14 (X), J2-15 (Y), and J2-16 (Z).			D2 E2		

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
10.2 (Cont)	Apply 26 V ac from J2-13 (H) to J2-12 (L). Rotate 3-WIRE SOURCE to position heading bug to 270° on compass card. Externally measure ac voltage from B5-H to B5-X on adapter box. Rotate heading bug in a direction of increasing numbers (using 3-WIRE SOURCE) while monitoring B5-H to B5-X voltage. Rotate heading bug back to 270° on compass card. Externally measure null voltage from B5-X to B5-Y on adapter box.	S2 - 26 V ac		H1	Dvm reads 34 to 38 V ac. Voltage increases before decreasing. Dvm reads NMT 50 mV ac.	Loosen clamps on B5 and rotate B5 until voltage is correct. Loosen clamps on B5 and rotate B5 180°. Loosen clamps on B5 and rotate B5 to obtain null.
10.3	Remove 26 V ac from J2-13. Apply 3-WIRE SOURCE to J2-9 (X), J2-10 (Y), and J2-11 (Z). Rotate heading bug to 60° on compass card (using 3-WIRE SOURCE. Remove exciter voltage from J1-42. Externally connect dvm from B5-H' to GND on adapter box, and adjust 3-WIRE SOURCE for a null indication. Apply exciter voltage back to J1-42.	S2 - OPEN	H1	D4 E3 H1	At null position the 3-WIRE SOURCE dial reads 58.9° to 61.1°.	Rezero or replace B5. NOTE: The null tolerance in step 10.2 must be maintained if rezeroing is attempted.

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
10.4	Repeat the procedures in step 10.3 for every 60° increment cw from 60° on the compass card.				At null position for each increment, the 3-WIRE SOURCE dial reads within ±1.1° of the heading bug position to the compass card.	Same as step 10.3
10.5	Repeat the procedures in step 10.3 for every 60° increment ccw from 30° on compass card.				Same as step 10.4.	Same as step 10.3.
11.0	Course select servo (B7) test					
11.0A	Course pointer and counter alignment test a. Observe alignment of course arrowhead and tail with course deviation bar. b. Observe course arrow reading compared to course counter reading.				a. Course head and tail should be aligned with deviation bar ±0.38 mm (±0.015 in). b. Counter and course arrow should indicate within ±1° of each other.	
11.1	Establish initial conditions. NOTE: Ensure that +28 V dc is applied to DC SOURCE INPUT jacks on adapter box.	S1 - ON S2 - OPEN S3 - EXT DIM S4 - BACK LOC S5 - B7/B14 ERROR S6 - LNAV S7 - ON	All matrix switches			

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
11.2 (Cont)	Apply 3-WIRE SOURCE to J2-45 (X), J2-46 (Y), and J2-47 (Z). Rotate the 3-WIRE SOURCE in a direction of increasing numbers and observe course arrow.			D5 E3 H1	Course arrow should rotate smoothly in a direction of increasing numbers.	Check phasing and wiring of B7 if rotation is opposite. If course arrow is inoperative, check A6-10 (A7-1 with SB 2) to gnd for smooth changing ac signal as 3-WIRE SOURCE is rotated. If not ok, check B7. If signal is ok at A6-10 (A7-1 with SB 2) to gnd, check for smooth changing ac signal from A6U3-4 to A6U3-5 (A7-19 to A7-6 with SB 2) as 3-WIRE SOURCE is rotated. If not ok, check

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
11.2 (Cont)						A6U3 (A7U2, A7Q3, and A7Q4 with SB 2) and A3 power supply. If signal is ok from A6U3-4 to A6U3-5 (A7-19 to A7-6 with SB 2), check MG3 and possible binding in gear train.
11.3	Adjust 3-WIRE SOURCE to position course arrow directly under lubber line (aligns with 0° on compass card also).				3-WIRE SOURCE dial reads 358.9° to 361.1°.	Loosen clamps on synchro B7 and rotate B7 until course arrow is aligned precisely with 0° index mark.
11.4	Beginning at 60°, align course arrow (using 3-WIRE SOURCE) in a direction of increasing numbers to every 60° increment on compass card (60, 120, 180, 240, 300, 360).				At each incremental position, the 3-WIRE SOURCE dial should read within ±1.1° of the course arrow position to the compass card.	Repair or replace synchro B7.
11.5	Repeat step 11.4 in a direction of decreasing numbers.				Same as step 11.4.	Same as step 11.4.
11.6	Adjust 3-WIRE SOURCE in a direction of increasing numbers to precisely 60°; then adjust 3-WIRE SOURCE another 0.5° in the same direction.				Movement of the course arrow should be visible between 60° and 60.5° on 3-WIRE SOURCE dial.	Check MG3. Repair or replace as required.
11.7	Adjust 3-WIRE SOURCE in a direction of decreasing numbers to precisely 60°; then adjust 3-WIRE SOURCE another 0.5° in the same direction.				Movement of the course arrow should be visible between 60° and 59.5° on the 3-WIRE SOURCE dial.	Same as step 11.6.
11.8 (Cont)	Adjust 3-WIRE SOURCE to position course arrow to 0° on compass card. Remove exciter voltage from J2-42 and adjust 3-WIRE SOURCE to 270°.		H1		Course arrow should remain at 0°.	

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
11.8 (Cont)	Apply exciter voltage back to J2-42.			H1	Course arrow should rotate to 270° position on compass card in NMT 1.5 seconds with NMT 1° of overshoot.	Check A6R6 (A7R66 with SB 2) and MG3. Repair or replace as required.
11.9	Repeat step 11.8 except rotate 3-WIRE SOURCE to 90° after removing exciter voltage.				Course arrow should rotate to 90° position on compass card in NMT 1.5 seconds with NMT 1° of overshoot.	Same as step 11.8.
11A.	Course Select Servo (B14) Test					
11A.1	Establish initial conditions NOTE: Ensure that +28 V dc is applied to DC SOURCE INPUT jacks on adapter box.	S1 - OFF S2 - OPEN S3 - EXT DIM S4 - BACK LOC S5 - B7/B14 ERROR S6 - LNAV S7 - ON	All matrix switches			
11A.2 (Cont)	Apply 3-WIRE SOURCE to J2-48 (X), J2-49 (Y), and J2-50 (Z). Rotate 3-WIRE SOURCE in a direction of increasing numbers and observe course arrow.			E3 H1	Course arrow rotates smoothly in a direction of increasing numbers.	Check phasing and wiring of B14 if rotation is opposite. If course arrow is inoperative, check A6-10 (A7-1 with SB 2) to gnd for a smooth changing ac signal as 3-WIRE SOURCE is rotated. If not, check B14. If signal is OK at A6-10 (A7-1 with SB 2) to gnd, check for a smoothly changing ac signal from A6U3-4 to A6U3-5 (A7-19 to A7-6 with SB 2), as 3-WIRE SOURCE is rotated. If not OK, check A6U3 (A7U2, A7Q3, and A7Q4 with SB 2), and A3 power supply.

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
(Cont)						If signal is OK from A6U3-4 to A6U3-5 (A7-19 to A7-6 with SB 2), check MG3 and possible binding in gear train.
11A.3	Adjust 3-WIRE SOURCE to position course arrow directly under lubber line (aligns with 0° on compass card also).				3-WIRE SOURCE dial reads 358.9° to 1.1°.	Loosen clamps on synchro B14 and rotate B14 until course arrow is aligned precisely with the 0° index mark.
11A.4	Beginning at 60°, align course arrow from a direction of increasing numbers to every 60° increment on compass card (60, 120, 180, 240, 300, 360).				At each incremental position, the 3-WIRE SOURCE dial should read within ±1.1° of the course arrow position on the compass card.	Repair or replace synchro B14 as required.
11A.5	Repeat step 4 in a direction of decreasing numbers.				Same as step 4.	Same as step 4.
11A.6	Adjust 3-WIRE SOURCE in a direction of increasing numbers to precisely 60°, then adjust 3-WIRE SOURCE another 0.5° in the same direction.				Movement of the course arrow should be visible between 60° and 60.5° on the 3-WIRE SOURCE dial.	Check MG3. Repair or replace as required.
11A.7	Adjust 3-WIRE SOURCE in a direction of decreasing numbers to precisely 60°, then adjust 3-WIRE SOURCE another 0.5° in the same direction.				Movement of the course arrow should be visible between 60° and 59.5° on the 3-WIRE SOURCE dial.	Check MG3. Repair or replace as required.
11A.8	Adjust 3-WIRE SOURCE to position course arrow to 0° on compass card. Remove exciter voltage from J2-4 and adjust 3-WIRE SOURCE 270°. Apply exciter voltage back to J2-42.		H1	 H1	 Course arrow should remain at 0°. Course arrow should rotate to 270° position on compass card in NMT 1.5 seconds with NMT 1° of overshoot.	 Check A6R6 (A7R66 with SB 2) and MG3. Repair or replace as required.
11A.9	Repeat step 8, except rotate 3-WIRE SOURCE to 90° after removing exciter voltage.				Course arrow should rotate to 90° position on compass card in NMT 1.5 seconds with NMT 1° of overshoot.	Same as step 8.

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
12.0	Course datum differential resolver (B6) test					
12.1	Establish initial conditions. NOTE: Ensure that +28 V dc is applied to DC SOURCE INPUT jacks on adapter box.	S1 - OFF S2 - OPEN S3 - EXT DIM S4 - BACK LOC S5 - B7/B14 ERROR S6 - LNAV S7 - ON	All matrix switches			
12.2	Apply 3-WIRE SOURCE to J2-45 (X), J2-46 (Y), and J2-47 (Z).			D5 E3		
	Apply 26 V ac from J1-13 (H) to J1-12 (L).	S2 - 26 VAC		H1		
	Rotate 3-WIRE SOURCE to position course arrow to 270° on compass card.					
	Externally measure ac voltage from B6-H' to B6-X on adapter box.				Dvm reads 33 to 39 V ac.	Loosen clamps on B6 and rotate B6 to obtain correct voltage.
	Rotate course arrow in a direction of increasing numbers (using 3-WIRE SOURCE) while monitoring B6-H' to B6-X voltage.				Voltage increases before decreasing.	Loosen clamps on B6 and rotate B6 180°.
(Cont)	Rotate course arrow back to 270° on compass card.					

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
12.2 (Cont)	Externally measure null voltage from B6-X to B6-Y on adapter box.				Dvm reads NMT 50 mV ac.	Loosen clamps on B6 and rotate B6 to obtain null.
12.3	Remove 26 V ac from J1-13 to J1-12. Apply 3-WIRE SOURCE to J1-9 (X), J1-10 (Y), and J1-11 (Z). Rotate course arrow to 60° on compass card (using 3-WIRE SOURCE). Remove exciter voltage from J1-42. Externally connect dvm from B6-H' to GND on adapter box and adjust 3-WIRE SOURCE for a null indication on dvm. Apply exciter voltage back to J1-42.	S2 - OPEN	H1	D1 E2 H1	At null position, the 3-WIRE SOURCE dial reads 58.9° to 61.1°.	Rezero or replace B6. NOTE: The null tolerance in step 12.2 must be maintained if rezeroing is attempted.
12.4	Repeat the procedures in step 12.3 for every 60° increment cw from 60° on the compass card.				At null position for each increment, the 3-WIRE SOURCE dial reads within ±1.1° of the course arrow position on the compass card.	Same as step 12.3.
12.5	Repeat the procedures in step 12.3 for every 60° increment ccw from 30° on the compass card.				Same as step 12.4.	Same as step 12.3.
13.0	Course resolver (B8) test					
13.1	Establish initial conditions. NOTE: Ensure that +28 V dc is applied to DC SOURCE INPUT jacks on adapter box.	S1 - OFF S2 - OPEN S3 - EXT DIM S4 - BACK LOC S5 - B7/B14 ERROR S6 - LNAV S7 - ON	All matrix switches			

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
13.2	Apply 3-WIRE SOURCE to J2-45 (X), J2-46 (Y), and J2-47 (Z). Apply 26 V ac from J1-1 (H) to J1-3 (L), ground to J1-5, and dvm from J1-1 (H) to J1-4 (L). Rotate course arrow to 300° using 3-WIRE SOURCE and read dvm.			D5 E3 H1 B9 D6	Dvm reads NMT 8 V ac.	Loosen clamps on B8 and rotate B8 until voltage is correct. If correct voltage cannot be obtained, check B8 wiring. If wiring is correct, repair or replace B8.
13.3	Remove 26 V ac from J1-1 to J1-3, ground from J1-5, and the dvm from J1-1 to J1-4. Apply 26 V ac from J1-2 (H) to J1-3 (L), ground to J1-7, and the dvm from J1-4 (H) to J1-5 (L). Read the dvm.		B9 D6	B11 D7 E7	Dvm reads NMT 8 V ac.	Check B8 wiring. If ok, repair or replace B8.
13.4	Remove dvm from J1-4 to J1-5, and reapply it from J1-2 (H) to J1-6 (L). Rotate course arrow to 30° on compass card and read dvm.		B11	B8	Dvm reads 21 to 27 V ac.	Check B8 wiring. If ok, replace B8.
13.5	Rotate course arrow to 300° and read dvm.				Dvm reads NMT 120 mV ac.	Loosen clamps on B8 and rotate B8 to obtain null.
14.0	Bearing pointer servo (B10) test					
14.1	Establish initial conditions. NOTE: Ensure that +28 V dc is applied to DC SOURCE INPUT jacks on adapter box.	S1 - OFF S2 - OPEN S3 - EXT DIM S4 - BACK LOC S5 - B7/B14 ERROR S6 - LNAV S7 - ON	All matrix switches			

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
14.2	Apply 3-WIRE SOURCE to J1-25(X), J1-26(Y), J1-27(Z). Rotate 3-WIRE SOURCE in a direction of increasing numbers while observing the bearing pointer. NOTE: Bearing pointer is a T.			H1 E2	Bearing pointer rotates smoothly in a direction of increasing numbers around the compass card.	Check phasing and wiring of B10 if rotation is opposite. If bearing pointer is inoperative, check A6-25 (A7-22 with SB 2) to gnd for a smooth changing ac signal as 3-WIRE SOURCE is rotated. If not ok, check B10. If signal is ok at A6-25 (A7-22 with SB 2) to gnd, check for smooth changing ac signal from A6-31 to A6-32 (A7-11 to A7-12 with SB 2) as 3-WIRE SOURCE is rotated. If not ok, check A6U2 (A7U4, A7Q7, A7Q8 with SB 2) and A3 power supply. If signal is ok from A6-31 to A6-32 (A7-11 to A7-12 with SB 2), check MG4 and possible binding in gear train.
14.3	Rotate 3-WIRE SOURCE to align bearing pointer with 0° on compass.				3-WIRE SOURCE dial reads 358.9° to 361.1°.	Loosen clamps on B10 and rotate B10 until bearing pointer is aligned precisely with 0° on compass card.
14.4	Rotate 3-WIRE SOURCE to align bearing pointer to every 60° increment in a cw direction around the compass card from 0° (60, 120, 180, 240, 300, 0).				At each increment, the 3-WIRE SOURCE dial reads within ±1.1° of the bearing pointer position to the compass card.	Repair or replace B10.
14.5	Rotate 3-WIRE SOURCE to align bearing pointer to every 60° increment in a ccw direction around compass card from 330° (270, 210, 150, 90, 30, 330).				Same as step 14.4.	Same as step 14.4.

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
14.6	Rotate 3-WIRE SOURCE in a direction of increasing numbers to precisely 60°; then adjust 3-WIRE SOURCE another 0.5° in the same direction.				Movement of the bearing pointer should be visible between 60° and 60.5° on the 3-WIRE SOURCE dial.	Check MG4. Repair or replace as required.
14.7	Rotate 3-WIRE SOURCE in a direction of decreasing numbers to precisely 60°, then adjust 3-WIRE SOURCE another 0.5° in the same direction.				Movement of the bearing pointer should be visible between 60° and 59.5° on 3-WIRE SOURCE dial.	Same as step 14.6.
14.8	Rotate 3-WIRE SOURCE to 0°. Remove exciter voltage from J1-22; then rotate 3-WIRE SOURCE to 270°. Apply exciter voltage back to J1-22.		H1	 H1	 Bearing pointer should remain at 0°. Bearing pointer should rotate to 270° on compass card in NMT 1.5 second with NMT 1° of overshoot.	 Check A6R10 (A7R68 with SB 2) and MG4. Repair as required.
14.9	Rotate 3-WIRE SOURCE to 0°. Remove exciter voltage from J1-22 and then rotate 3-WIRE SOURCE to 90°. Apply exciter voltage back to J1-22.		H1	 H1	 Bearing pointer should remain at 0. Bearing pointer should rotate to 90° on compass card in NMT 1.5 seconds with NMT 1° of overshoot.	
15.0	Back localizer sensing circuit operation test					
15.1	Establish initial conditions. NOTE: Ensure that +28 V dc is applied to DC SOURCE INPUT jacks on adapter box.	S1 - OFF S2 - OPEN S3 - EXT DIM S4 - BACK LOC S5 - B7/B14 ERROR S6 - LNAV S7 - ON	All matrix switches			

HSI-45 Horizontal Situation Indicator

COMPONENT MAINTENANCE MANUAL with IPL (523-0768607)

TEMPORARY REVISION NO. 34-28-25-22

Insert facing page 167, 34-28-25

Subject: Revise Test Procedure Results

Revise test 15.2 result to read as follows:

RESULTS

The dvm should read +28 V dc while the 3-WIRE SOURCE dial reads >100° but <260°.

At >270° but <90°, the dvm should read +0.2 V dc.

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
15.2	Apply 3-WIRE SOURCE to J1-9(X), J1-10(Y), and J1-11(Z). Connect the dvm externally to BACK LOC OUT (+) and GND (-) on adapter box. Monitor dvm voltage while rotating 3-WIRE SOURCE a full 360°.			H1 D1 E2	The dvm should read +28 V dc while the 3-WIRE SOURCE dial reads >105° but <255°. At >270° but <90°, the dvm should read +0.2 V dc.	Check A4T1, A4Q4, A4Q5, and A4Q6. Repair as required.
16.0	Distance display test					
16.1	Establish initial conditions. NOTE: Ensure that +28 V dc is applied to DC SOURCE INPUT jacks on adapter box.	S1 - OFF S2 - OPEN S3 - EXT DIM S4 - BACK LOC S5 - B7/B14 ERROR S6 - LNAV S7 - ON	All matrix switches			
16.2	Apply 28 V dc to DME flag input, J1-50. Apply DME CLK signal to J1-48(H), J1-49(L). Apply VAR DC SOURCE and dvm to dim control input J1-54(+) to J1-41(-). Adjust DC SOURCE for 5 V dc. Set bits 1, 8, 31 to logic 1 and observe distance display.	S1-DME CLK		H1 E12 E10 G4 H13 H6 G12	Distance display reads 000.0.	Check to ensure data, clock, and sync signals are present. If ok, perform power supply test (step 16.0A). If power supply is ok, repair A1 distance display board.

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
16.3	Vary DC SOURCE between 0 and 5 V dc.				Distance display lamps vary evenly in intensity from full brilliance at 5 V dc to completely off at 0 V dc.	Check power supply.
16.4	Apply ground to lamp test input, J1-53. Remove ground from lamp test input.		 C10	C10	Distance display reads 888.8. Distance display reads 000.0.	Remove lamp test ground (C10 off), and test all display lamp segments by grounding the BCD 7-segment decoder/driver outputs. This is A1U2 for P4 display, A1U3 for P3, A1U6 for P2 display, and A1U5 for P1 display on the A1 board. If all lamps light, replace the BCD 7-segment decoder/driver controlling the affected display. If any of the segments fail to light, first check the wiring; then replace the entire display if required.
16.5	Set bits 17, 18, 21, 22, 25, 26, 29, and 30 to 1 and bit 31 to 0.		G12	F6 F7 F10 F11 G6 G7 G10 G11	Distance display should read 333.3.	Repair or replace A1 board.
16.6	Apply 28 V dc to the DME/INS flag input, J1-51. Remove 28 V dc from J1-51.		 E11	E11	Distance display should read 3333. Distance display should read 333.3.	Repair or replace A1 board.

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
16.7	Set bit 32 to logic 1.			G13	Distance display reads all dashes (----) and decimal point is extinguished.	Repair or replace A1 board.
	Set bit 32 back to logic 0.		G13		Distance display should read 333.3.	
16.8	Remove 28 V dc from DME flag input, J1-50.		E12		Distance display goes blank.	Repair or replace A1 board.
	Reapply 28 V dc to DME flag input, J1-50.			E12	Distance display should read 333.3.	
16.9	Remove DME CLK signal from J1-48(H) and J1-49(L) and observe the time it takes for the distance display to blank.	S1 - OFF			Distance display blanks in NLT 2 seconds, but NMT 4 seconds.	Repair or replace A1 board.
	Reapply DME CLK signal to J1-48(H) and J1-49(L).	S1 - DME CLK			Distance display should read 333.3.	
16.10	Externally measure MAINT MON OUT (+) to GND (-) voltage on adapter box.				Dvm reads 27 to 29 V dc.	Repair or replace A1 board.
	Set all data bits to logic 0 and observe the time it takes for the dvm reading to switch to 0 volt after the last bit is switched to logic 0.		F6 F7 F10 F11 G6 G7 G10 G11 H13		Dvm reading switches to 0 ±0.5 V dc in NLT 2 seconds, but NMT 4 seconds.	

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
17.0	Heading flag (A7) and azimuth monitor operation test					
17.1	Establish initial conditions. NOTE: Ensure that +28 V dc is applied to DC SOURCE INPUT jacks on adapter box.	S1 - OFF S2 - OPEN S3 - EXT DIM S4 - BACK LOC S5 - B7/B14 ERROR S6 - LNAV S7 - ON	All matrix switches			

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
17.2	Apply VAR AC SOURCE and dvm to azimuth monitor J1-36(H) and J1-41(L).			H1 C1 C3 B7		
	Adjust VAR AC SOURCE until HEADING flag is completely out of view.				Dvm reads < 18 V dc.	Check A6VR1, A4VR1, and associated circuitry. Repair as required.
	Adjust VAR AC SOURCE until HEADING flag is in full view and stops moving.				Dvm reads > 3.5 V dc.	Same as above.
	Remove VAR AC SOURCE and apply a fixed 28 V dc to azimuth monitor J1-36(H) and J1-41(L).		C1		HEADING flag is out of view.	
17.3	Remove azimuth transolver (B1) exciter voltage, J1-28, J1-29.			E5	HEADING flag is in full view.	Check A4Q1, A4Q2, and associated circuitry. Repair as required.
	Reapply exciter voltage to J1-28 and J1-29.		E5		HEADING flag is out of view.	
17.4	Remove azimuth power from MG1, J1-37(H), and J1-38(L).	S7 - OFF			HEADING flag is in full view.	Check HEADING flag meter, M7, for binding.
17.5	CAUTION: ENSURE AZIMUTH POWER IS STILL REMOVED FROM J1-37(H), J1-38(L) BEFORE PERFORMING THIS TEST.					
	Apply 28 V dc to azimuth monitor test input, J1-21.	S4 - AZ MON TEST			HEADING flag is out of view.	Check A4Q3. Repair as required.
	Apply 3-WIRE SOURCE to J1-28(X), J1-29(Y), and J1-30(Z).			E1		
(Cont)	Rotate 3-WIRE SOURCE in a direction of increasing numbers to 1.5° on the 3-WIRE SOURCE dial. Observe HEADING flag.				HEADING flag is out of view.	

TEST NO	PROCEDURE	ADAPTER BOX SWITCHES	980L-1/1A MATRIX SWITCHES		RESULTS	TROUBLESHOOTING
			OFF	ON		
17.5 (Cont)	Continue rotating 3-WIRE SOURCE in same direction to 4.5°. Observe HEADING flag.				HEADING flag is in full view.	Check to see if the voltage from A6-18 (A6-40 with SB 2) to the anode of A4CR4 is changing as the 3-WIRE SOURCE is rotated. If not, check B1.
	Rotate 3-WIRE SOURCE in a direction of decreasing numbers to 358.5° on the 3-WIRE SOURCE dial. Observe HEADING flag.				HEADING flag is out of view.	
	Continue rotating 3-WIRE SOURCE in the same direction to 355.5°. Observe HEADING flag.				HEADING flag is in full view.	
18.0	Integral lighting test					
18.1	Apply primary ac power to instrument.			H1	All integral lamps are illuminated.	Check DS1 through DS6. Repair as required.
19.0	Posttest					
19.1	Remove power from test set. Disconnect instrument from adapter box and adapter box from test set.					
19.2	(Deleted)					
19.3	Using an ohmmeter, measure the resistance between the instrument case at each one of the rear connector pins.				Pins J2-35, J2-36, J2-39 should short to the case, but all other pins should be 5 MΩ or greater.	

TROUBLESHOOTING

1. Philosophy

This section is the focal point for repair personnel to isolate faults in the unit. All sections of this manual contain important information to aid in the accomplishment of total repair and understanding the unit. These sections are referenced, as necessary, to complete the repair task.

Troubleshooting avionics equipment usually falls into two categories: failures with a specific complaint, and failures with an unspecified complaint. The first function of this manual is to guide isolation to a specific malfunction, and then isolation to the applicable circuit area. Voltages and waveforms, in addition to the theory of operation, help lead the technician to rapid isolation of faulty parts.

2. Troubleshooting Approach

A. Unspecified Complaint

Troubleshooting a unit with an unspecified complaint requires you, the technician, to test the unit according to the performance test to determine if a fault actually exists.

In cases where the unit passes all portions of the test and no fault is discovered, the unit can be returned to the aircraft and reinstalled. However, an actual fault may still persist and all associated equipment and aircraft wiring should be checked.

When a unit does fail the performance test, the first objective is to isolate the actual fault and begin in-depth troubleshooting procedures.

B. Specified Complaint

Units tagged with specific complaints aid the technician in his troubleshooting methods. The performance test, therefore, is not required to determine if the unit is actually faulty, and the specific problem can be addressed.

The technician should begin by performing the applicable test of the fault isolation test procedures to isolate the faulty card and stage, using the troubleshooting aids provided throughout this manual.

3. Troubleshooting Aids

A. Maintenance Aid Diagrams

Maintenance aid diagrams illustrate the physical location of all components on the major assemblies, and can be found adjacent to each applicable schematic diagram.

B. Test Points

Test points are physical points located on an assembly to allow a technician to make necessary voltage and waveform measurements during fault isolation procedures.

Test points are identified, in a red rectangle, on the schematic and maintenance aid diagrams. Each test point identifies a major voltage or waveform important for circuit operation. These points may also be referenced in test and troubleshooting procedures.

C. Waveforms

Waveforms are an important tool in troubleshooting, and can be used to fault isolate to a defective stage when used properly. Waveforms are located on the maintenance aid diagrams, when applicable, and are keyed to the proper test points to aid in their physical location. Beneath each waveform are listed the oscilloscope settings to be used to enable the technician to reconstruct the conditions required to obtain the power measurement; for example, vertical, horizontal, sync point.

D. Signal Paths

Major signal paths are shown, in red, on the schematic and the corresponding maintenance aid diagrams to aid the technician in troubleshooting to the component level.

E. Voltages

Circuit voltages are illustrated, in red, on the schematic diagram to aid the technician in circuit fault isolation. These are normally dc levels, but, if applicable, the ac level is listed.

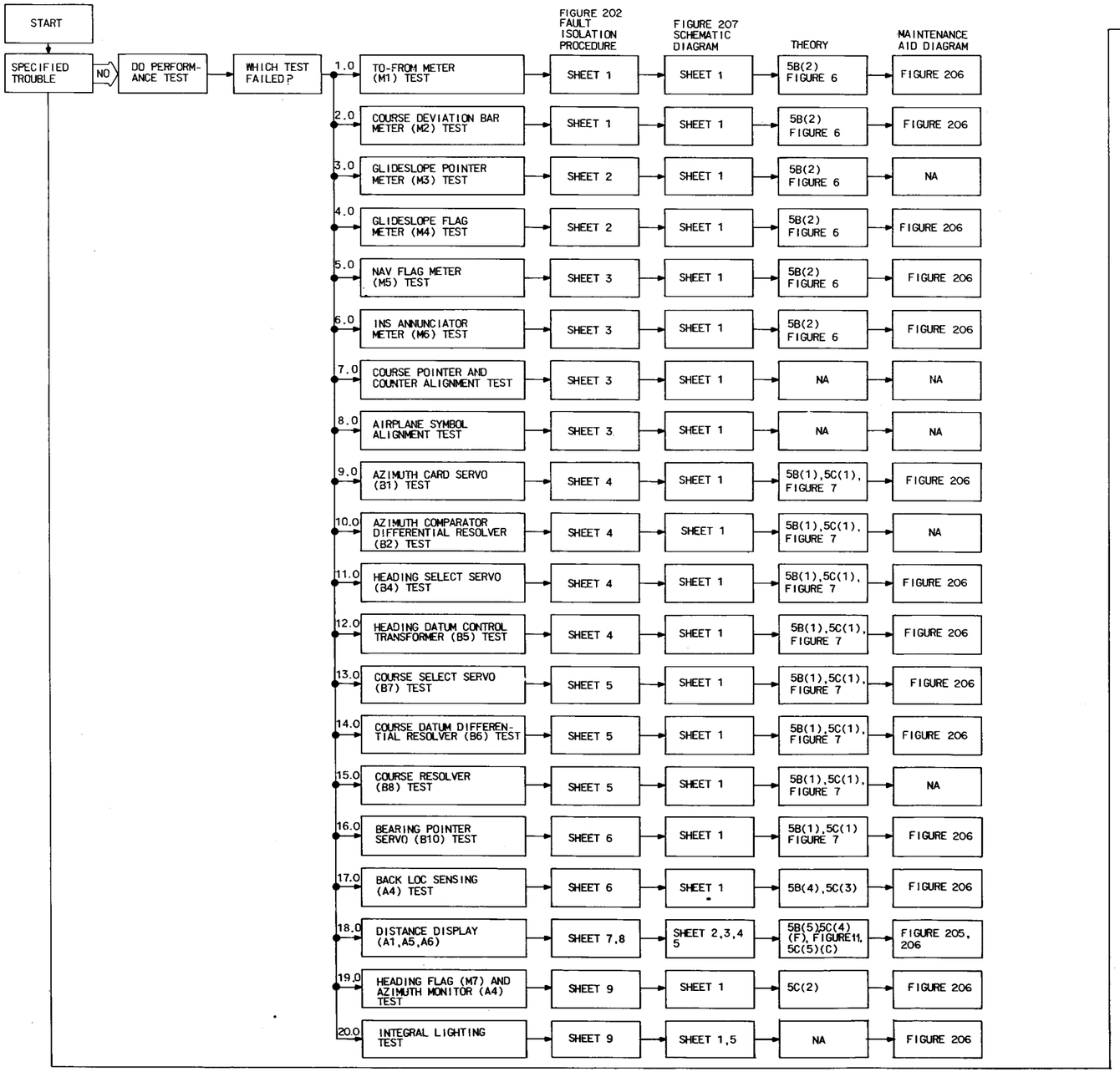
4. Introduction to HSI-45 Troubleshooting

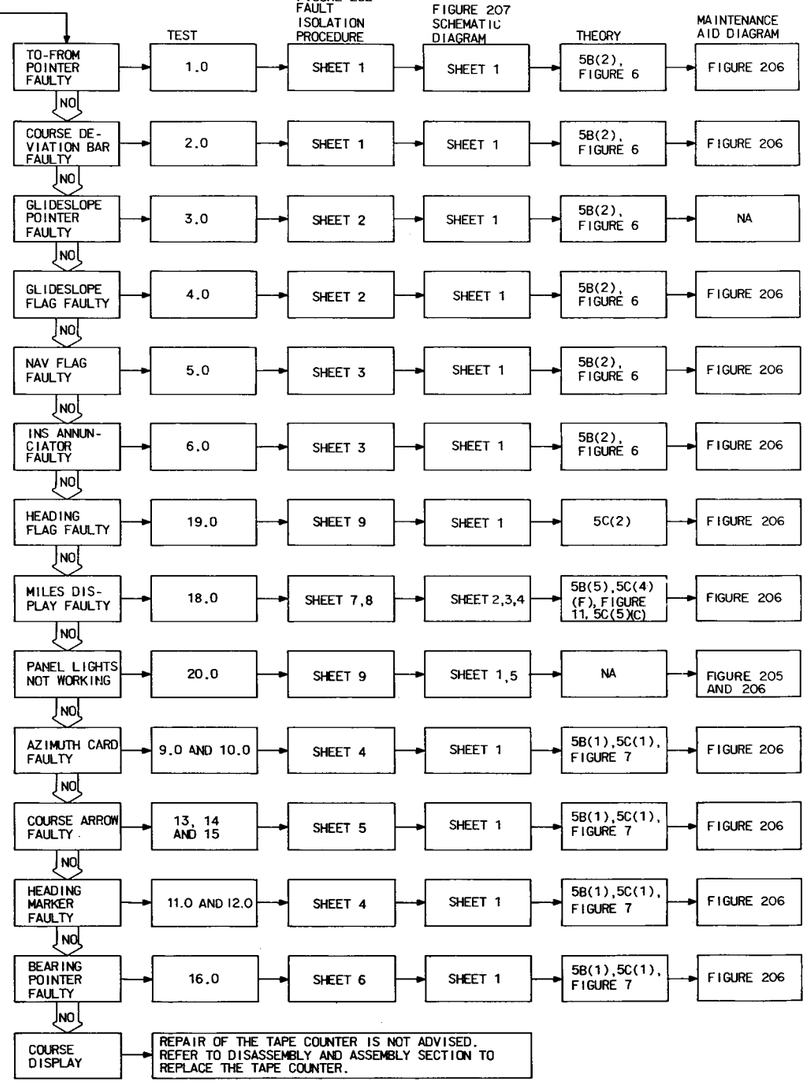
A. Troubleshooting Chart

To aid the technician in determining the most direct approach for troubleshooting, especially on units with specific gripes, refer to the troubleshooting chart, figure 201.

The chart provides possible fault indications and directs the technician to the most applicable fault isolation procedure to be performed to help isolate the faulty card/component. In addition, the chart references module fault isolation procedures, schematic diagram, theory paragraphs, and maintenance aid figures.

NOTE: The symptoms, listed on the troubleshooting chart, are those thought to be most common, and may not cover all possible complaints. In the event a symptom is encountered that is not listed on the chart, refer to the SPECIFIED TROUBLE column, and perform those steps listed.





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Troubelshooting Chart
Figure 201

B. Fault Isolation Procedures

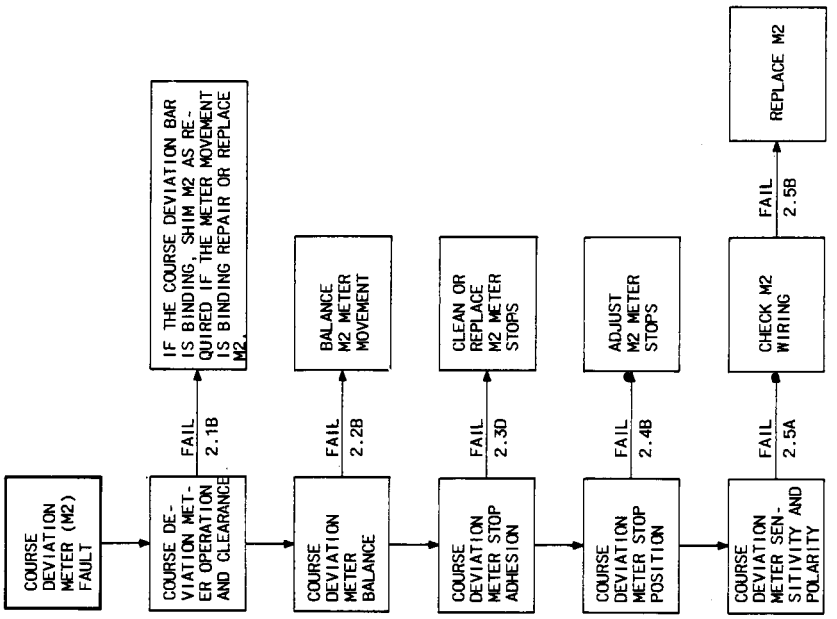
The HSI-45 fault isolation procedures, figures 202 through 207, are structured to allow the technician to perform a complete functional test on a specific unit function without having to perform the entire procedure. When used in conjunction with the troubleshooting chart and other aids, these procedures allow troubleshooting to a stage or component level.

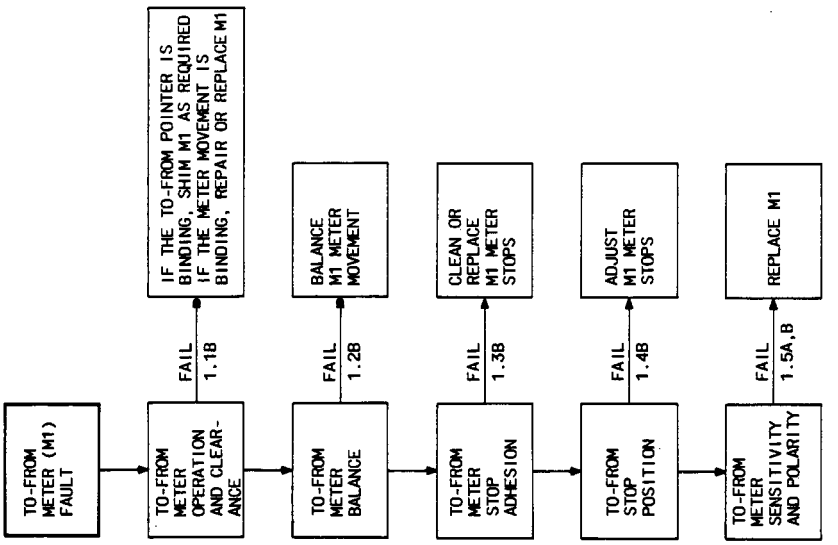
NOTE: The fault isolation procedures indicate that certain meter, synchro, and servo faults are corrected by making adjustments and/or repairs. These adjustments and repairs are covered in overhaul manuals that are specifically for the devices. These manuals are listed in figure 601 of the repair section.

If replacement is necessary, refer to Disassembly and Assembly section of this manual.

C. Maintenance Aid Diagrams

Illustrations are provided, facing the schematic diagrams, to aid in component location, identification, and location of test points. Waveforms, if applicable, are shown at test points most significant for troubleshooting.





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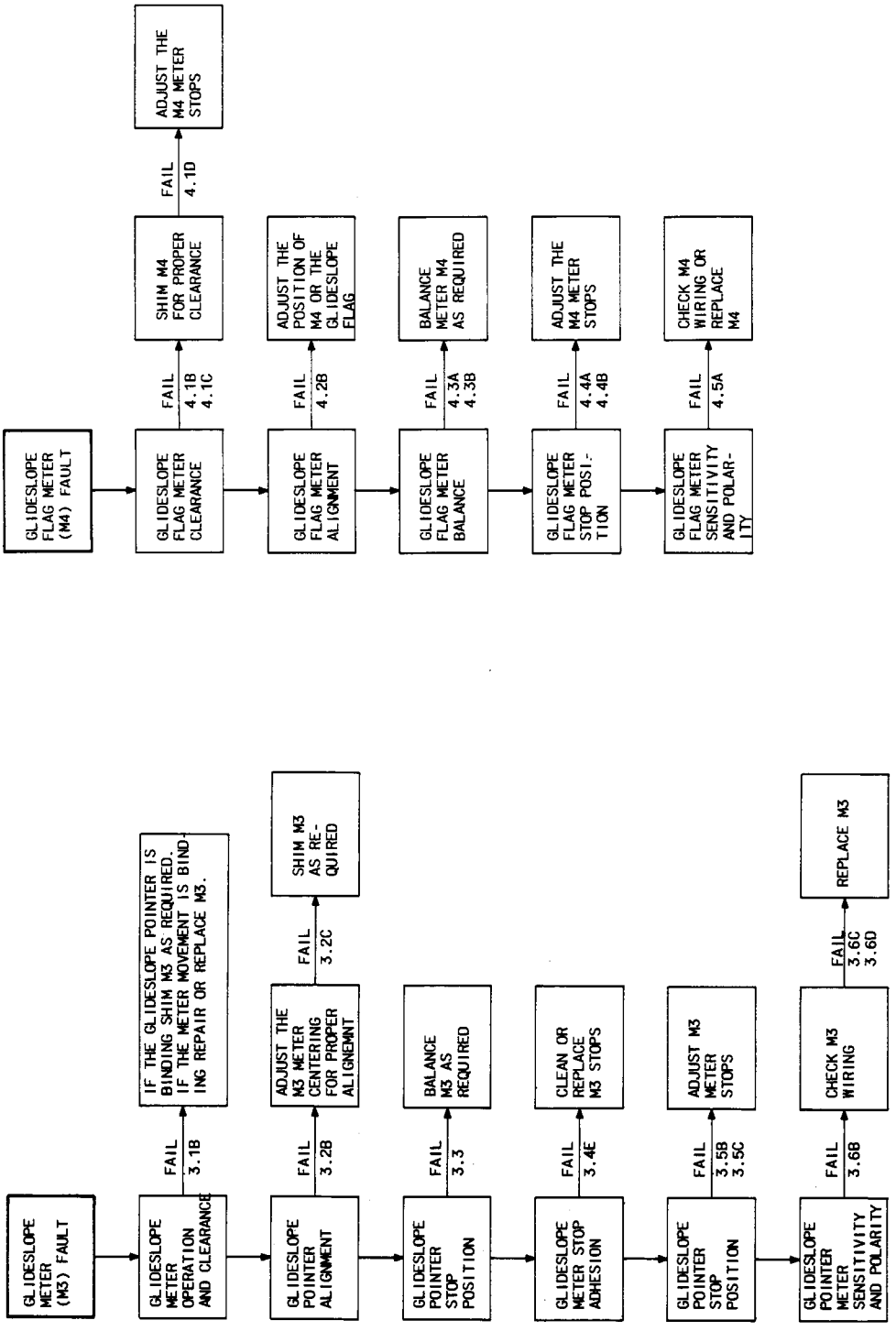
HSI-45 Fault Isolation Procedures
Figure 202 (Sheet 1 of 9)



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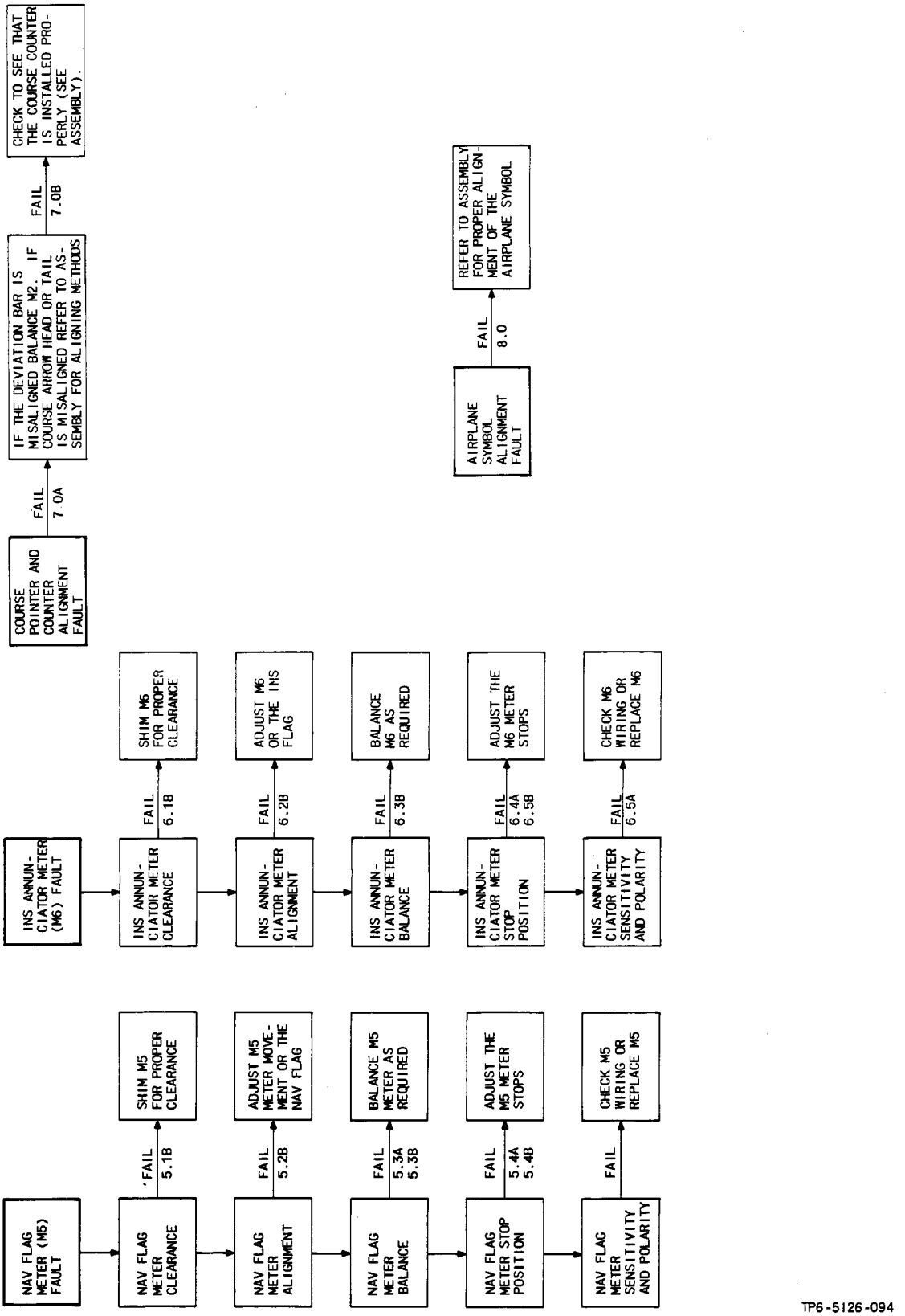
HSI-45 Fault Isolation Procedures
Figure 202 (Sheet 2)



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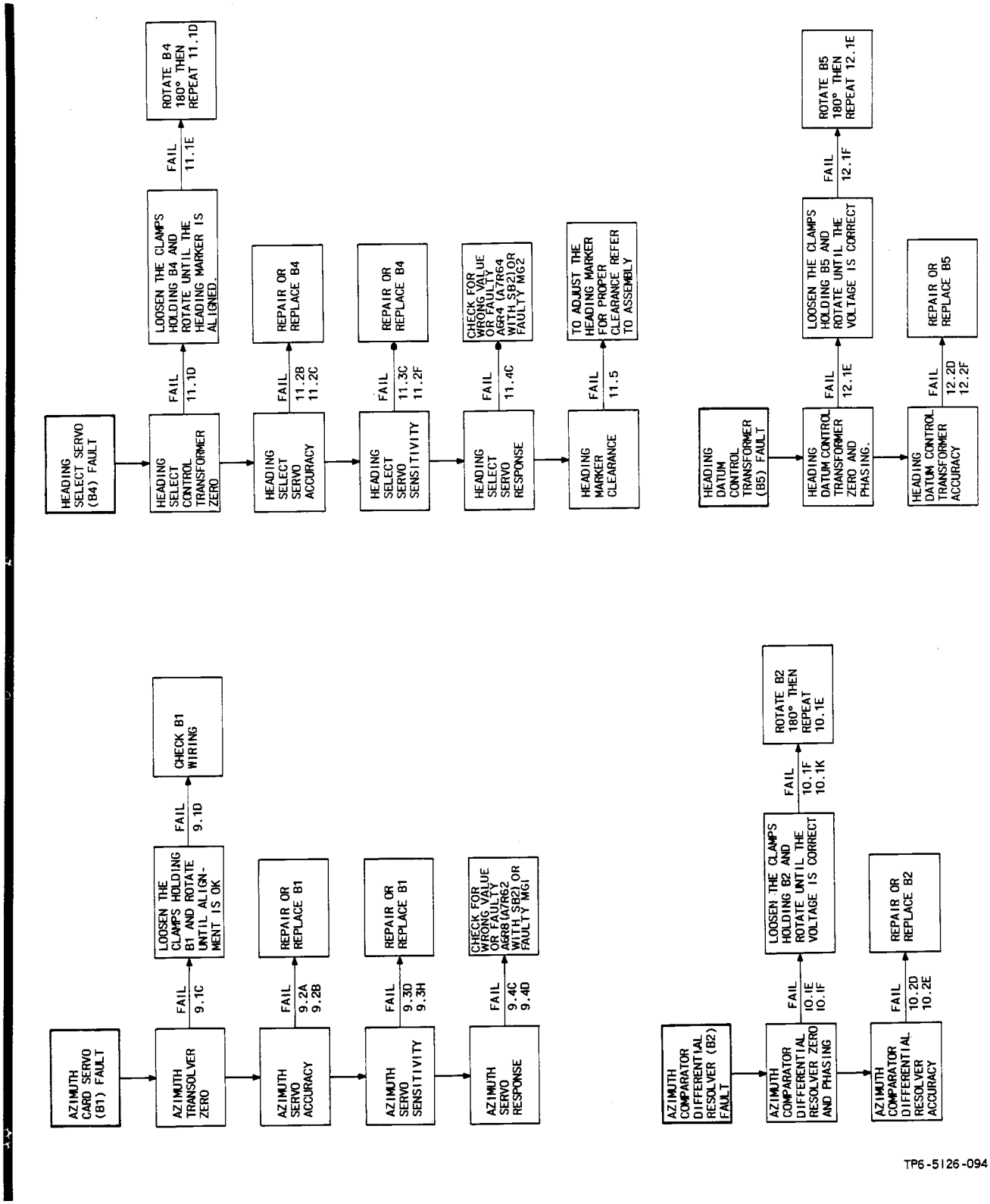
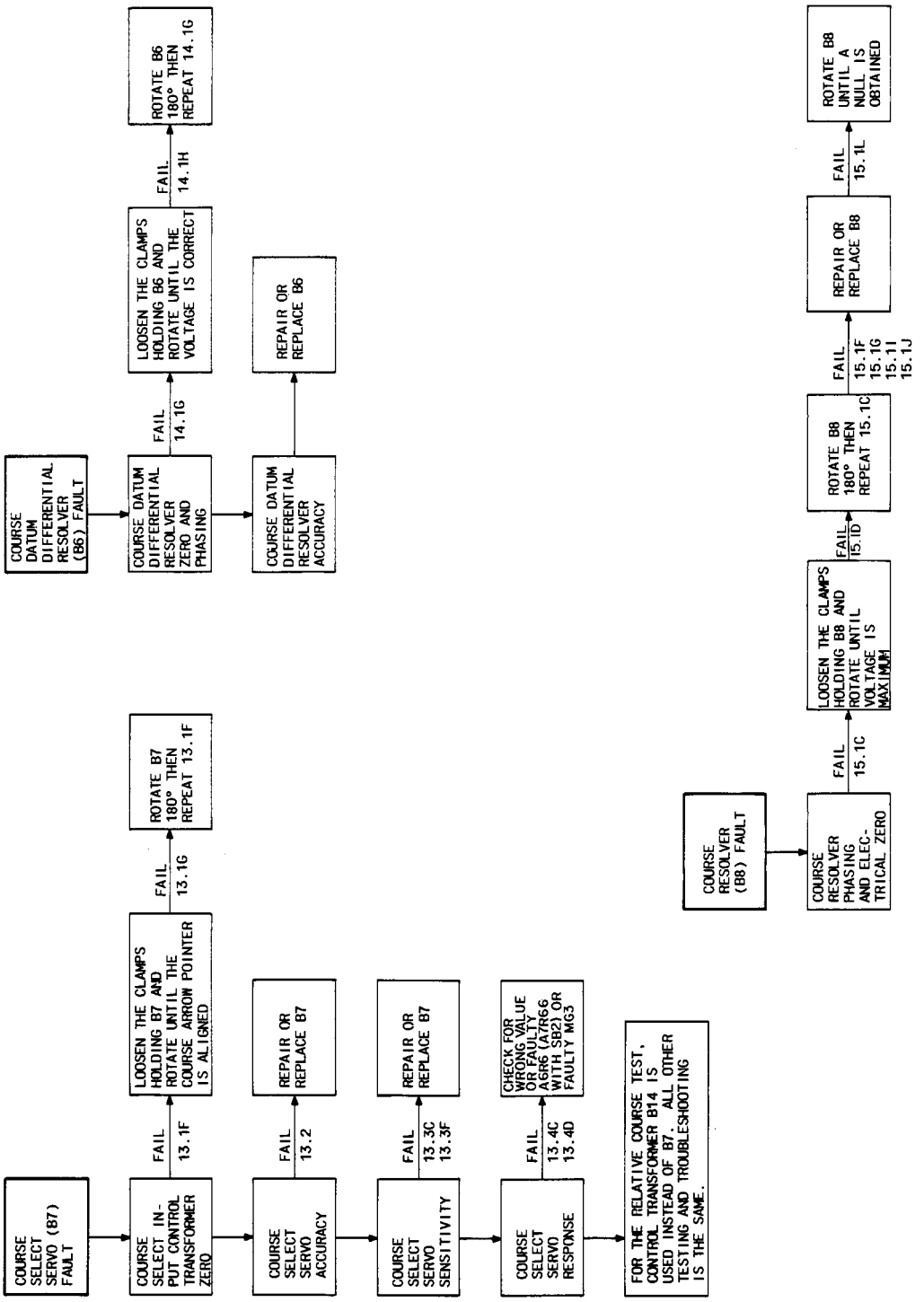
HSI-45 Fault Isolation Procedures
Figure 202 (Sheet 3)



HSI-45 Fault Isolation Procedures
Figure 202 (Sheet 4)



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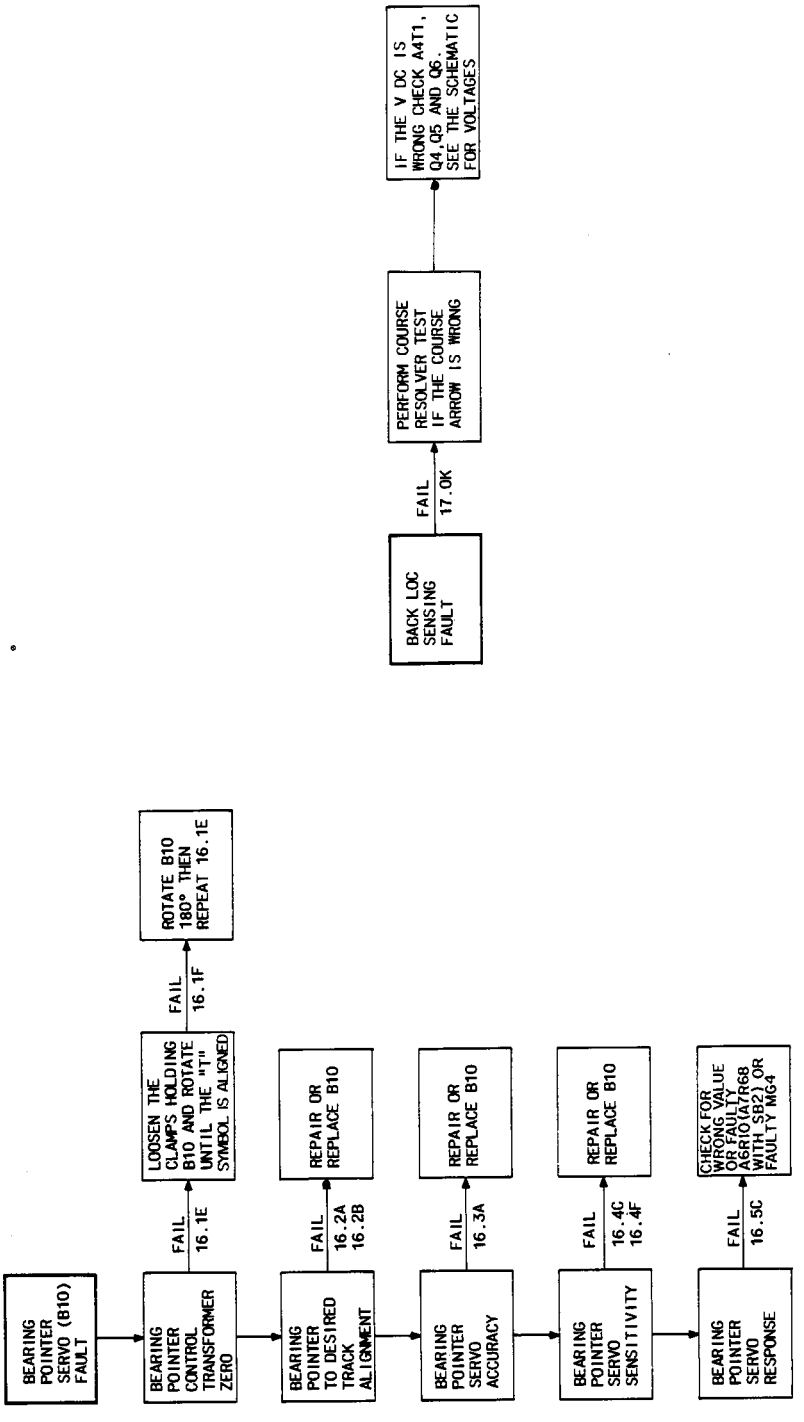
HSI-45 Fault Isolation Procedures
Figure 202 (Sheet 5)



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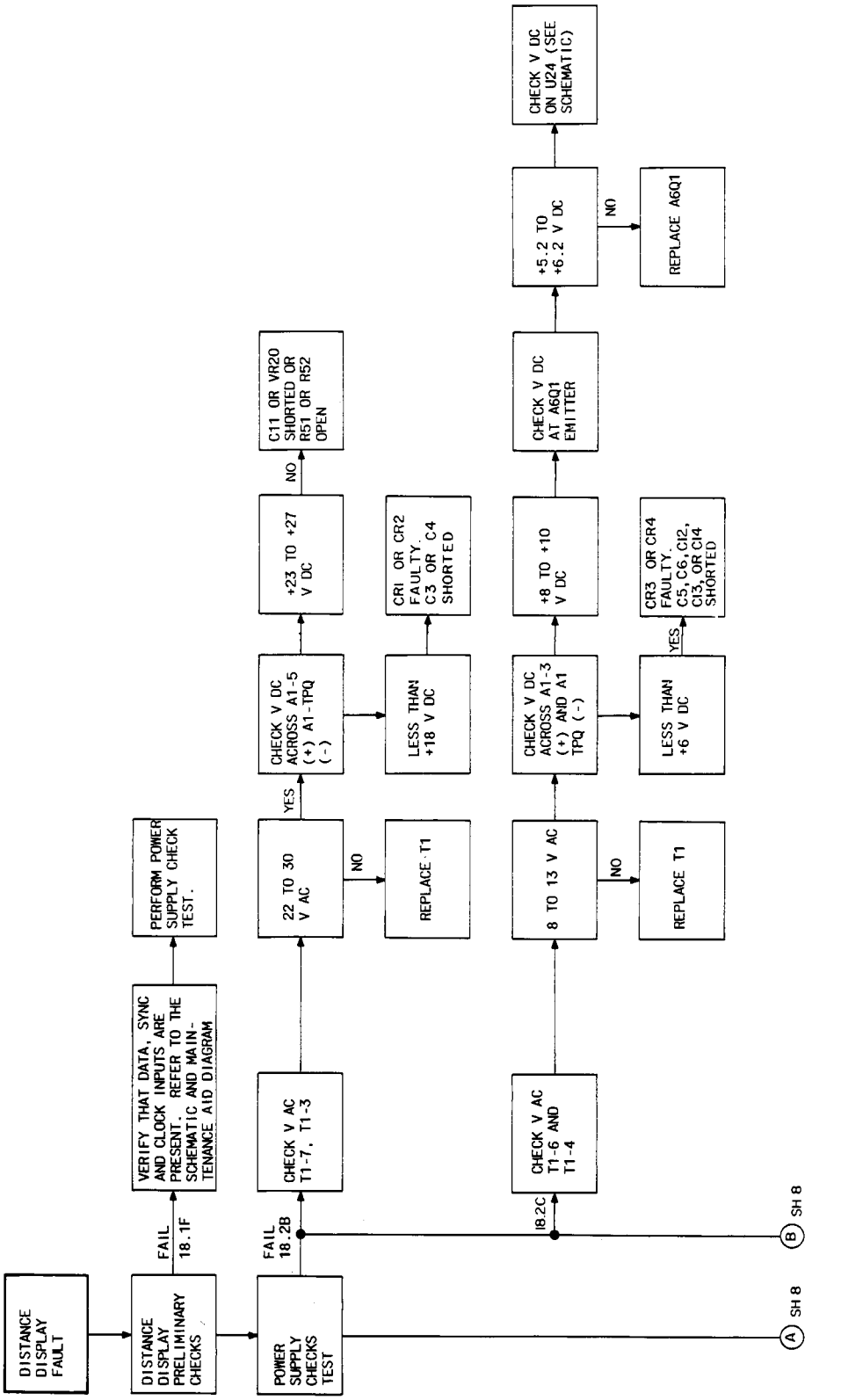
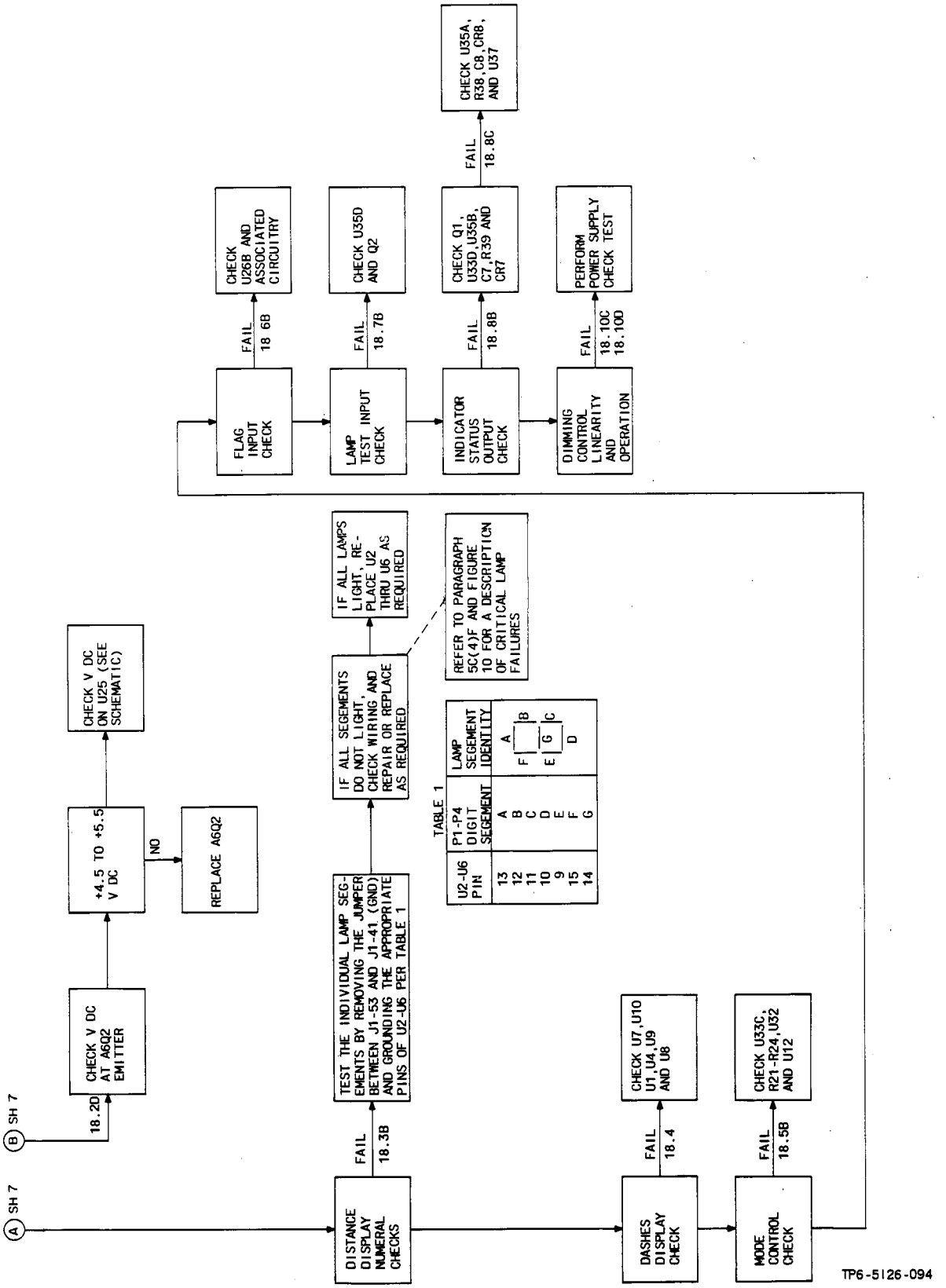
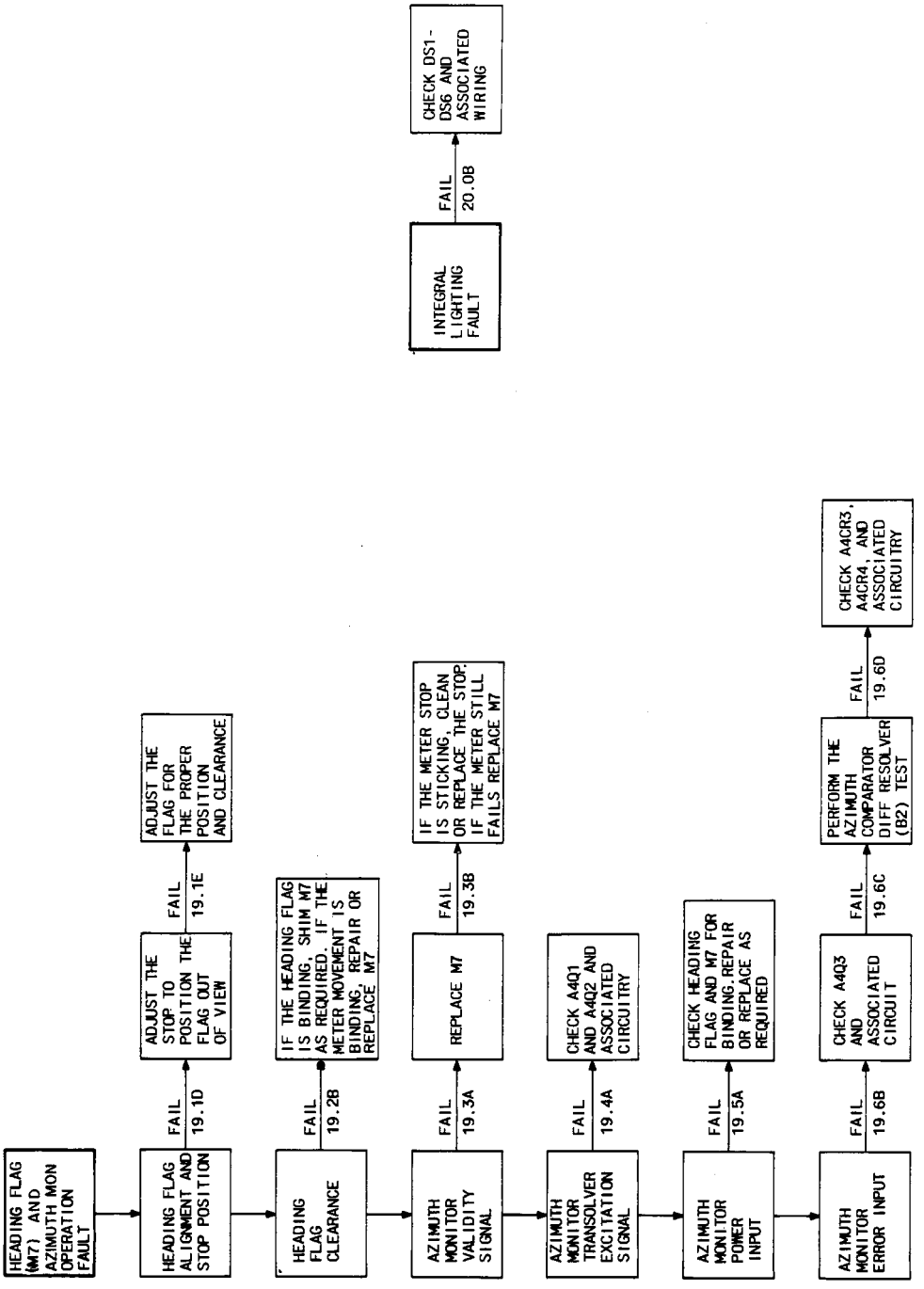
HSI-45 Fault Isolation Procedures
Figure 202 (Sheet 6)



HSI-45 Fault Isolation Procedures
Figure 202 (Sheet 7)



HSI-45 Fault Isolation Procedures
Figure 202 (Sheet 8)



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HSI-45 Fault Isolation Procedures
Figure 202 (Sheet 9)

5. Modification History

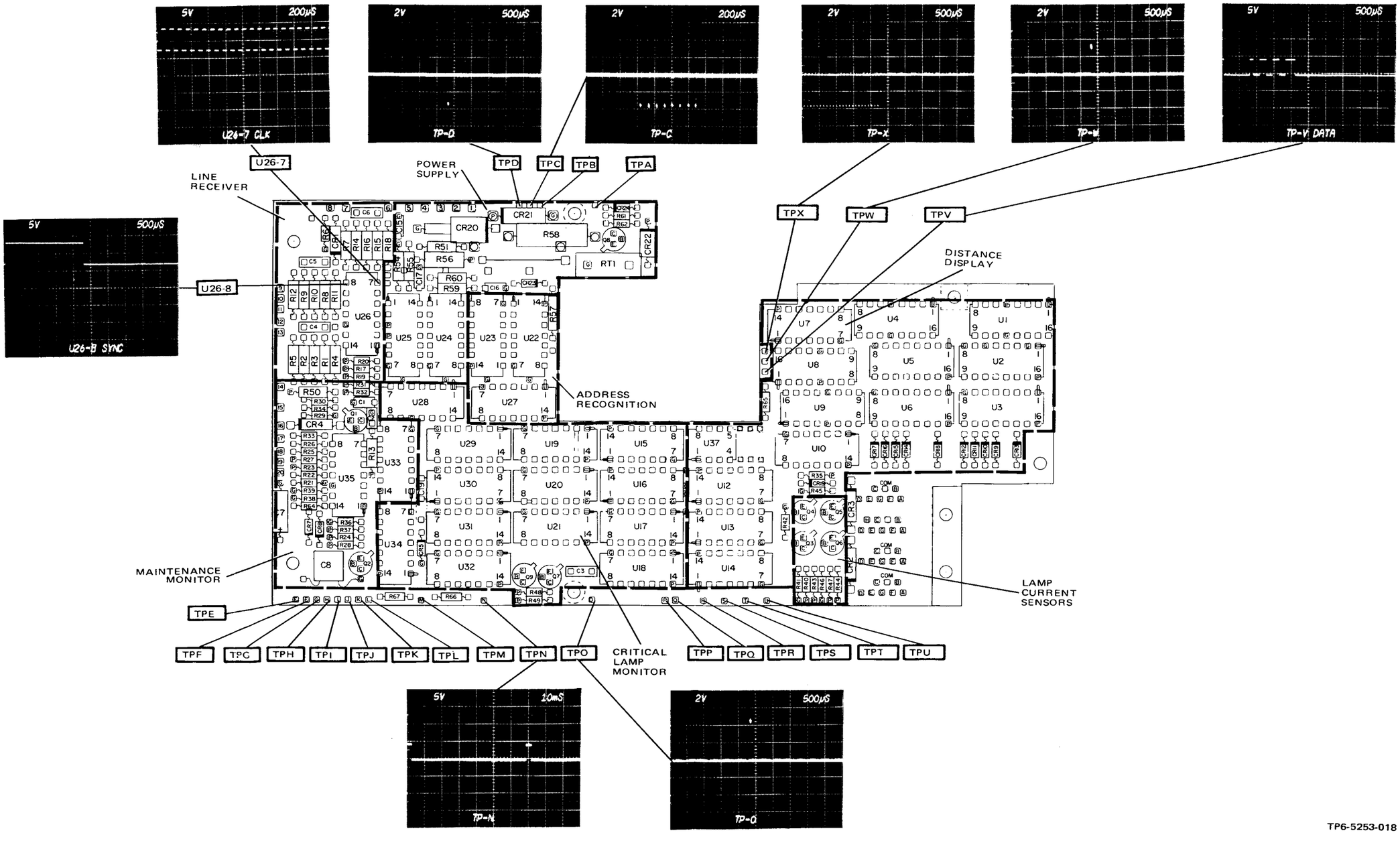
Modification history for the HSI-45 Horizontal Situation Indicator is presented in figure 203. This history is provided to aid the technician in understanding why a service bulletin was issued, and to describe the change to the equipment

MODIFICATION HISTORY

SERVICE BULLETIN	REASON/DESCRIPTION
1	Service Bulletin No 1 superseded by Service Bulletin No 2.
2	This modification replaces servo-amplifier modules with discrete components on electronic component assembly A6 to eliminate availability and cost problems. Zener diodes are added to servo power supply card A3 to improve supply regulation.
3	Incorrect display driver integrated circuit devices (A1U2, A1U3, A1U5, and A1U6) are replaced with the same display drivers devices (CPN 351-7528-030) utilized prior to July 1983.
A4	The pins in certain gear assemblies are inspected for proper installation and gears are replaced as required. Installation of this modification eliminates the possibility of gear pins coming loose causing gear slippage thus resulting in erroneous displays.
5	Lamp voltage reduction. On circuit card A1, the values of two resistors are changed and one jumper wire and one circuit cut added. Installation of this modification reduces maximum lamp voltage, increasing lamp life. NOTE: This service bulletin is only applicable for aircraft installations that provide +5 V dc at HSI-45 connector pin J1-54. The DME displays will not be lighted if this SB is performed and then installed in aircraft without external +5 V dc at J1-54.
6	Circuit board A6 (CPN 652-0037-001) is replaced with a new A6 circuit board (CPN 652-0037-002) which has zener diodes installed to reduce the voltage on the input windings of the drive motors. Installation of this modification will eliminate premature failure of the drive motors thus ensuring reliable operation of the compass card.

SCHEMATIC CHANGES

SHEET	REV IDENT	DESCRIPTION OF REVISION AND REASON FOR CHANGE	SERVICE BULLETIN	EFFECTIVITY
2	A1	Changed values of R1, R2, R4, R5, R7, R8, R9, R11, R12, R14, R15, and R18 to correct schematic errors		
1	A2	Interchanged yellow and blue leads of B2 to correct schematic error		
1A	A3	Replaced circuit card A6, containing servo-amplifier modules, with circuit cards A6 and A7 containing discrete components. Add VR1 and VR2 and change the value of R2 and R4 on servo power supply card A3 to improve power supply regulation	SB 2	Serno 1022 and above
3, 5	A4	Replaced type 9317 7-segment decoder/driver, which is an obsolete part, with type 5447 7-segment decoder/driver		
1	B1	Deleted capacitor C1 from circuit; revised note 1 for applicability to service bulletins 1 or 2.		All units with SB 1 or 2 only
1A	B2	Changed resistors R9, R20, R31, and R42 from 86.6 to 205 kΩ to meet servo sensitivity specifications.		A7 card CPN 647-6816-001 REV B and above
1A	B3	Changed resistors R50, R52, R48, R46, R54, R56, R58, and R60 from 1200 to 150 Ω; changed transistors Q1 through Q8 from 2N2222A to 2N3700 to eliminate high failure rate of Q1 through Q8 due to over potential during operation.		A7 card CPN 647-6816-001 REV C and above
1A	B4	Added zener diodes VR1 and VR2 to A6 card to reduce voltage to servo motors increasing reliability. Created new A6 card CPN 652-0037-002.	SB 6	A6 card CPN 652-0037-002
5	B5	Revised note 6.		All



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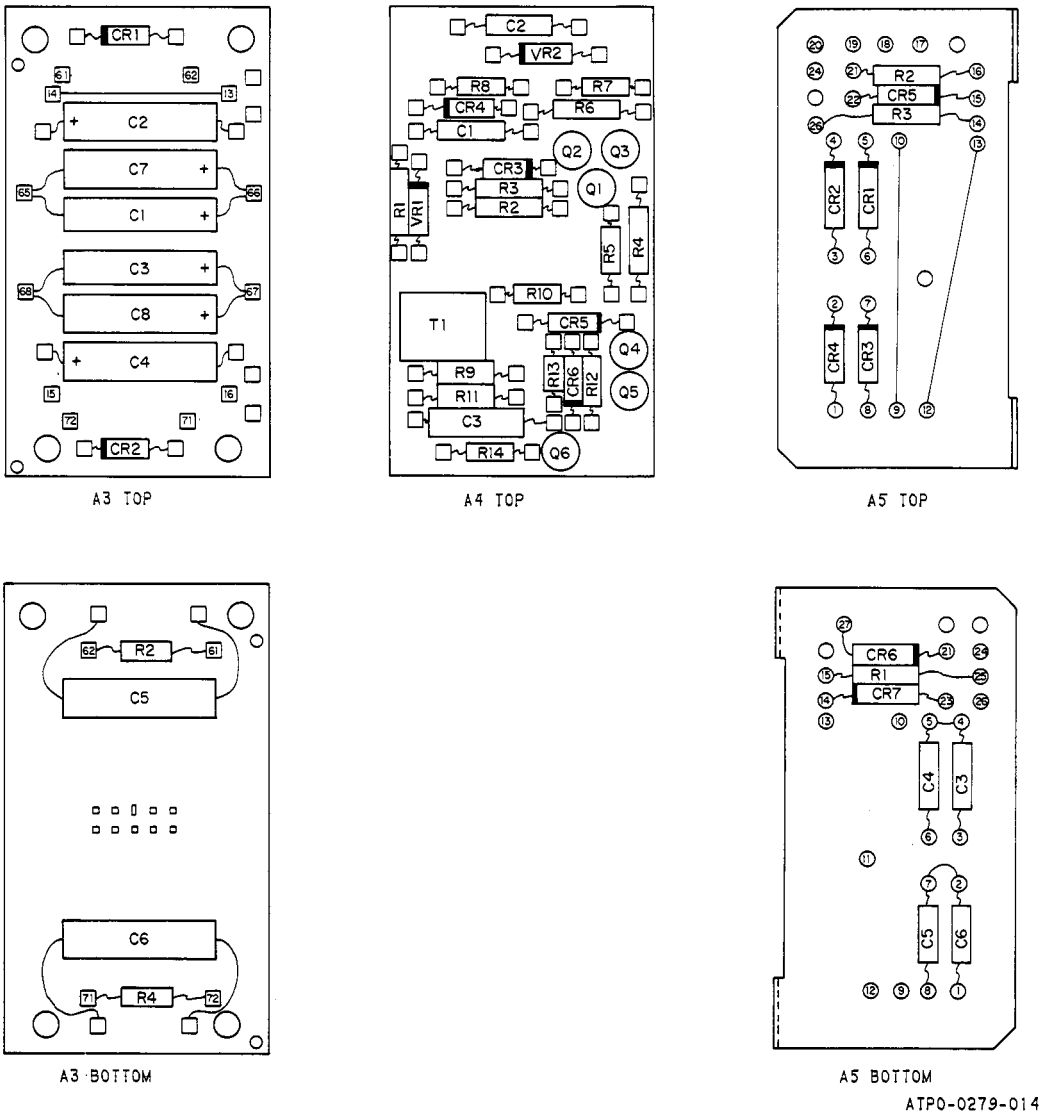
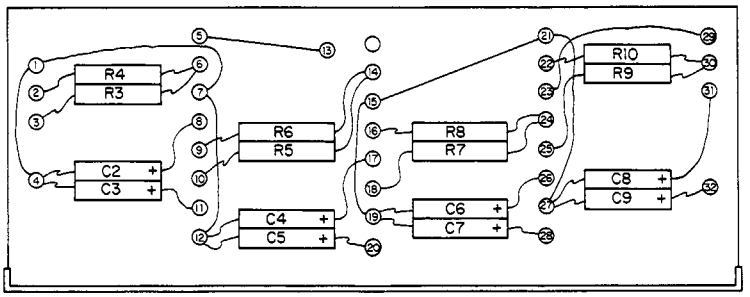
Distance Readout Card A1 (CPN 638-2777-001), Maintenance Aid Diagram
Figure 205

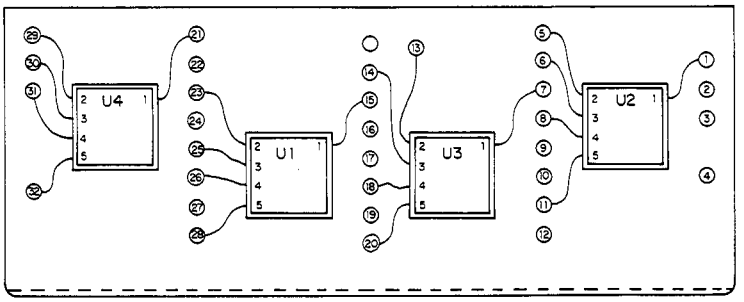


Cards A3, A4, and A5, Maintenance Aid Diagram
Figure 206

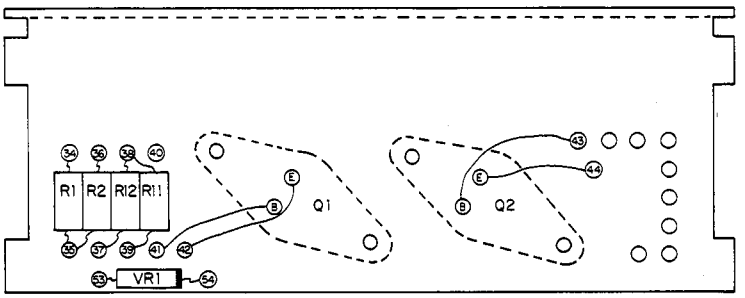
A6 FRONT (1)



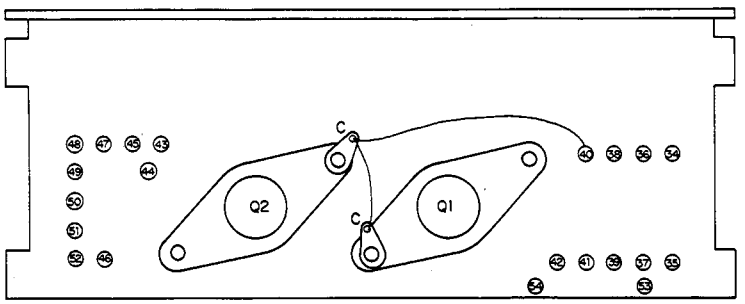
A6 REAR (1)



A6 TOP (1)



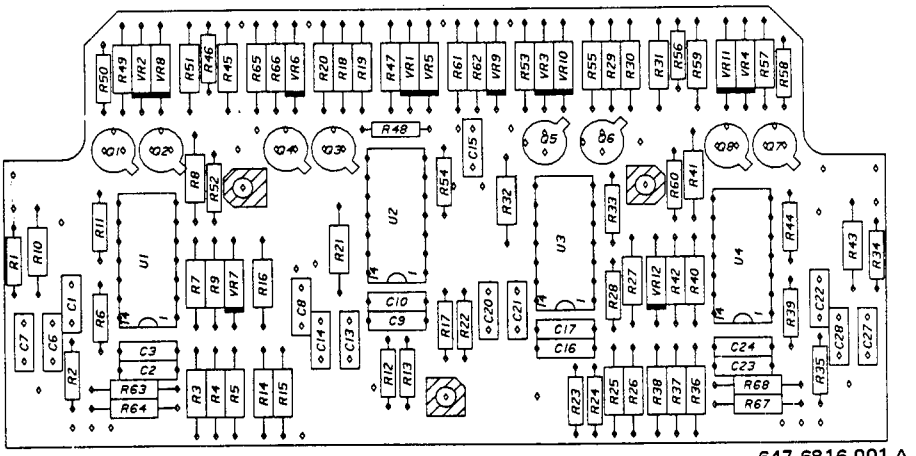
A6 BOTTOM (1)

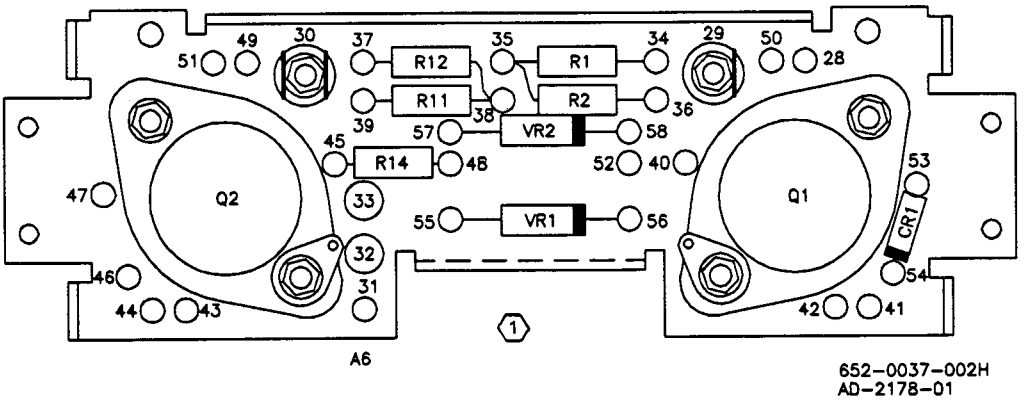


NOTE: (1) APPLICABLE TO CPN 622-4298-001 WITH SB2.

TP6-5131-014

Card A6, Maintenance Aid Diagram
Figure 206A

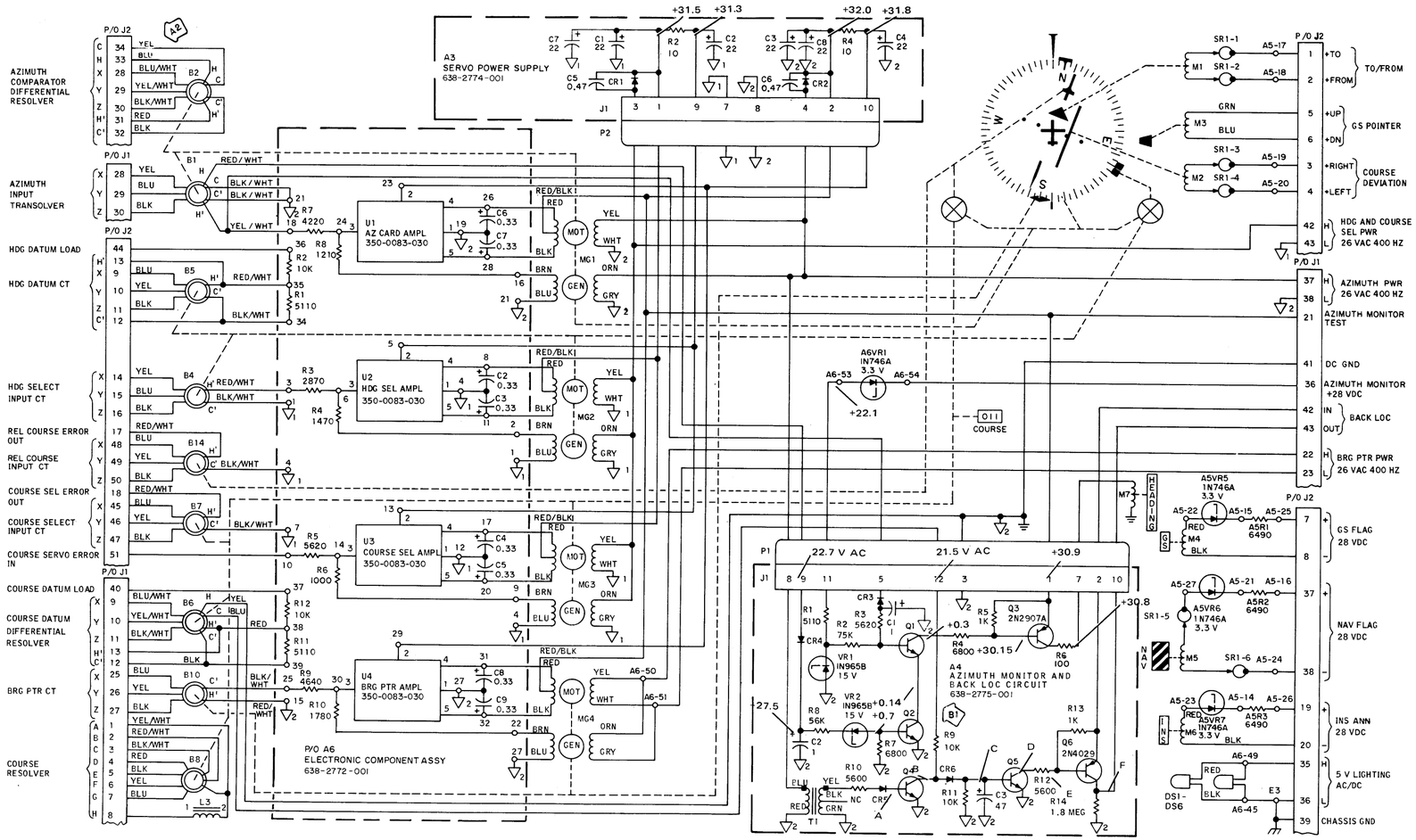




1 APPLICABLE TO CPN 622-4298-001 WITH SB 1.

ATPO-0282-017

Cards A6 and A7, Maintenance Aid Diagram
Figure 206B



TO VERIFY THE SCHEMATIC VOLTAGE READINGS MAKE THE INITIAL CONNECTIONS OUTLINED IN THE TESTING SECTION.

SYNCHRO 2 IS CONNECTED TO COURSE DATUM DIFFERENTIAL RESOLVER INPUT.

SYNCHRO 1 AND SYNCHRO 2 ARE SET TO 0.0° UNLESS OTHERWISE NOTED.

CONNECT J1-54 TO +5.0 V DC.

CONNECT J1-51 AND J1-53 TO GROUND.

DATA BITS 1, 8 AND 31 TO LOGIC 1 (SETS DISTANCE DISPLAY TO 888.8).

SET SYNCHRO 2 TO 0° FOR BACK LOC OFF AND 180° FOR BACK LOC ON.

MEASURE AT	BACK LOC MODE	
	ON	OFF
A	−0.1	−2.5
B	+0.55	−2.9
C	+0.7	+0.15
D	0	+28.0
E	+27.3	+28.1
F	+28.0	0

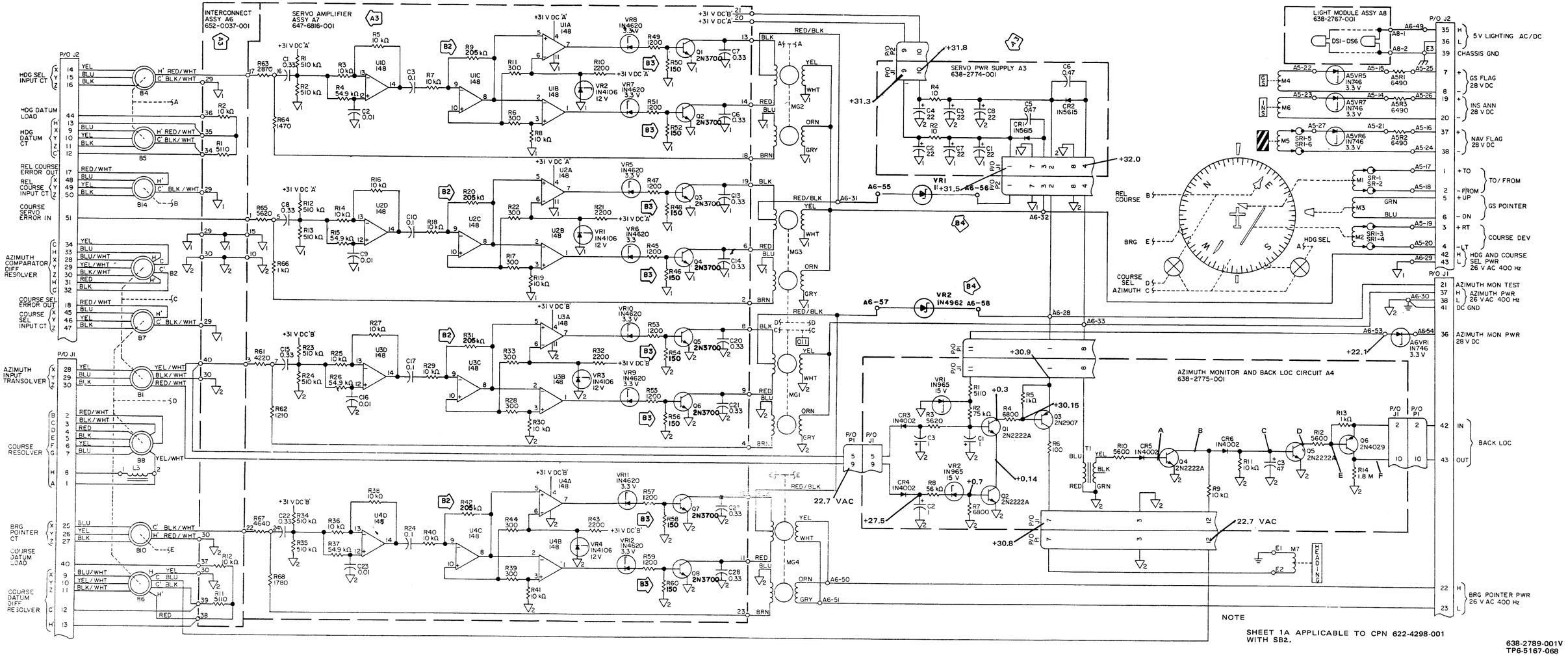
ALL MEASUREMENTS ARE NOMINAL VALUES (V DC UNLESS OTHERWISE NOTED).

SET DATA BITS 1, 8, 17, 20, 21, 24, 25, 28, 29, AND 30 TO LOGIC 1 TO CREATE THE PROPER CONDITIONS FOR THE RED LOGIC INDICATIONS ON THE SCHEMATIC.

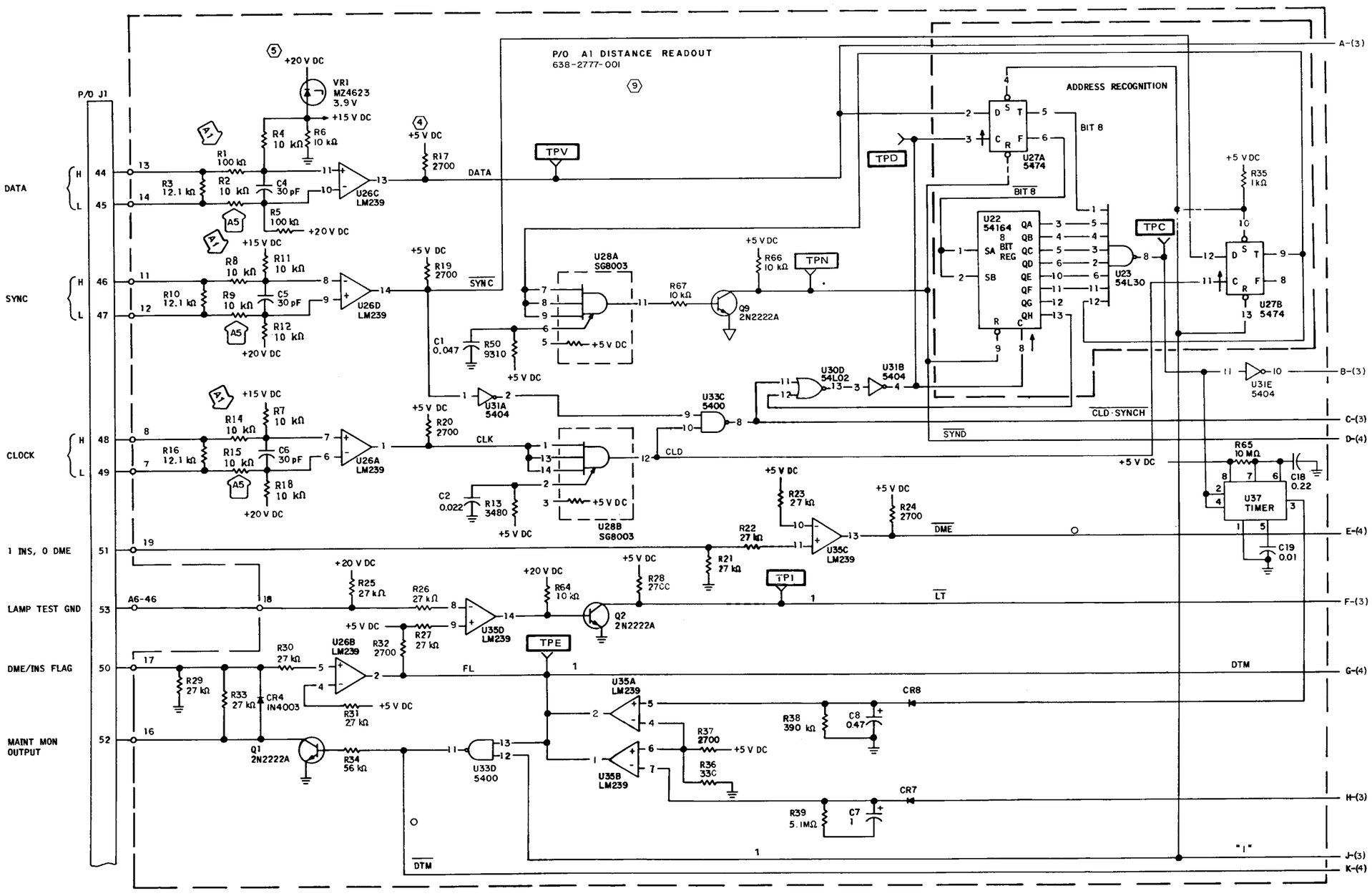
NOTE:

BI (1) SHEET 1 APPLICABLE TO UNITS WITHOUT SERVICE BULLETINS 1 OR 2.

638-2789-001F
TP6-5167-068

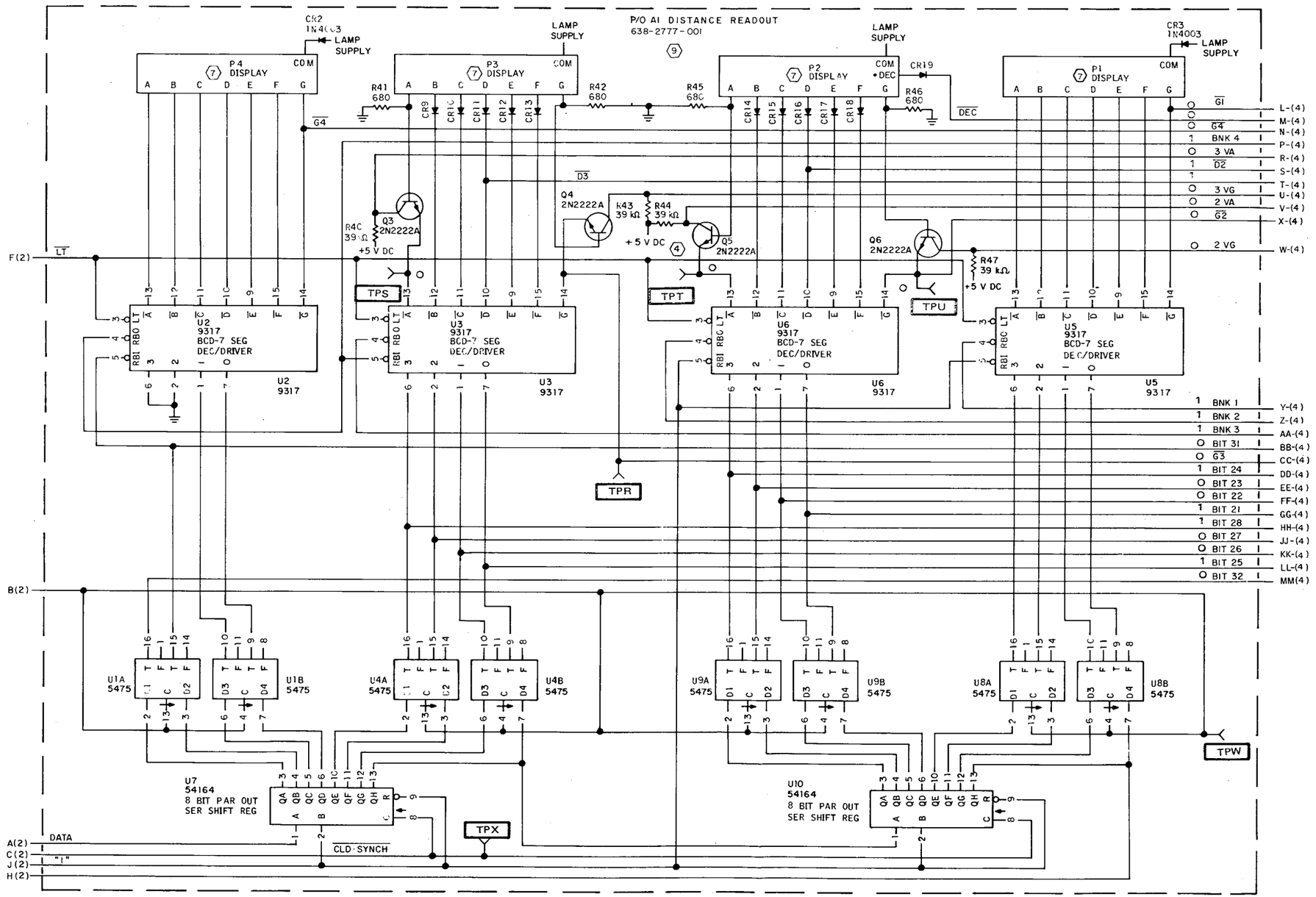


HSI-45 Horizontal Situation Indicator (CPN 622-4298-001), Schematic Diagram
Figure 207 (Sheet 1A)



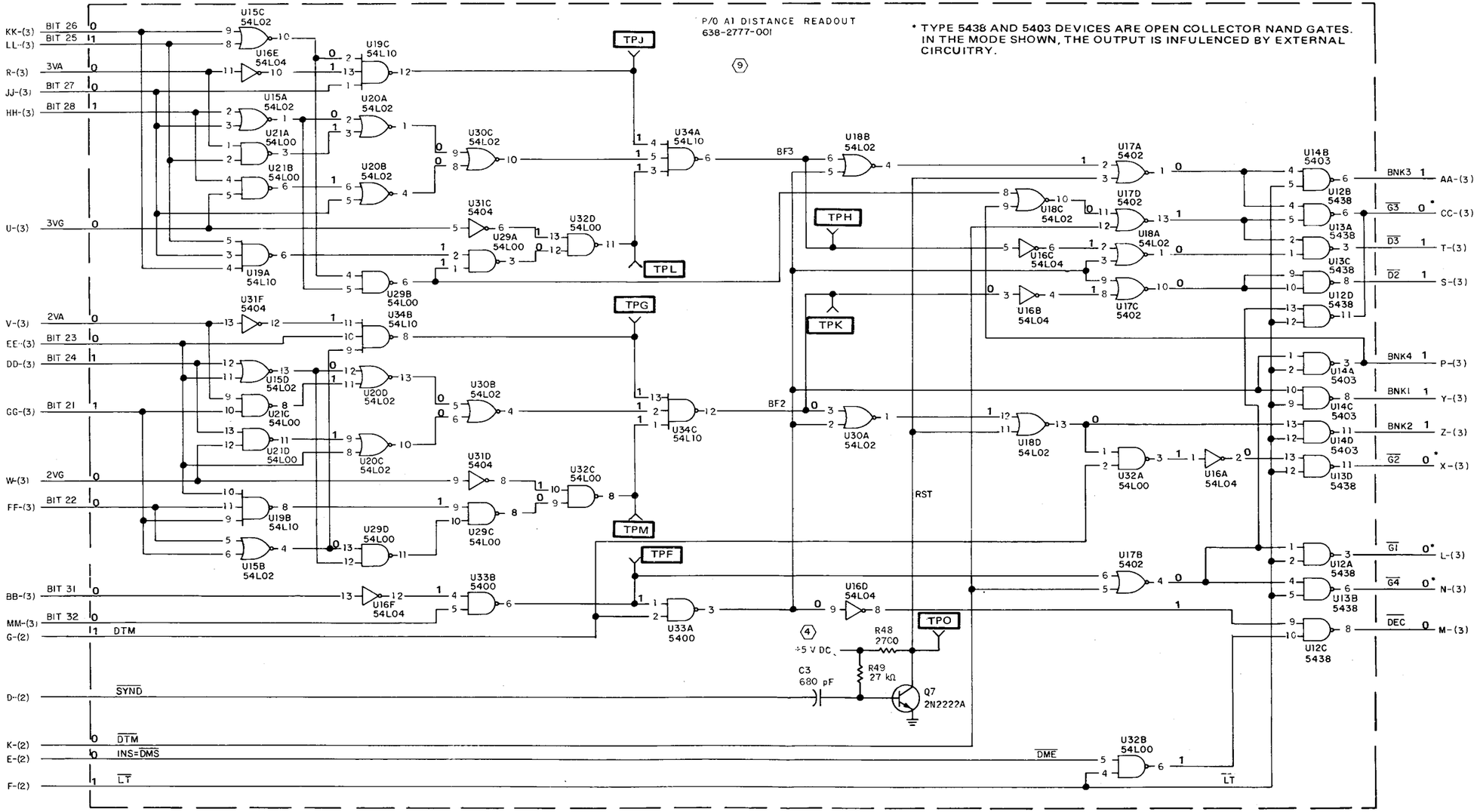
638-2789-001H
TP6-5167-068

HSI-45 Horizontal Situation Indicator (CPN 622-4298-001), Schematic Diagram
Figure 207 (Sheet 2)



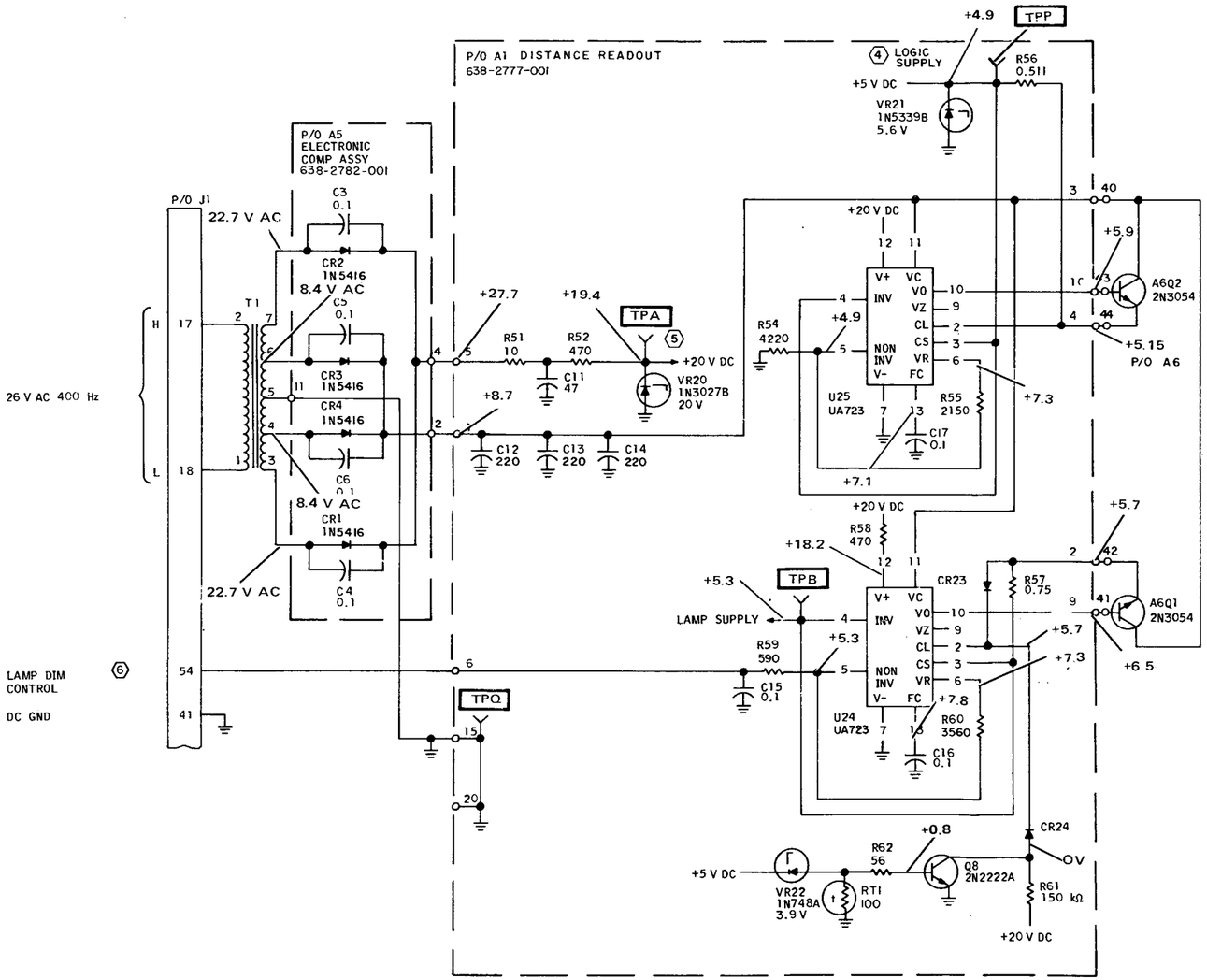
638-2789
TP6-5167-058

HSI-45 Horizontal Situation Indicator (CPN 622-4298-001), Schematic Diagram
Figure 207 (Sheet 3)



638-2789
TP6-5167-058

HSI-45 Horizontal Situation Indicator (CPN 622-4298-001), Schematic Diagram
Figure 207 (Sheet 4)



NOTES:

1. UNLESS OTHERISE SPECIFIED RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS AND INDUCTANCE VALUES ARE IN MICROHENRYS.
2. UNLESS OTHERWISE SPECIFIED, TRANSISTORS ARE 2N2222 AND DIODES ARE 1N4454.
3. DELETED
4. LOGIC SUPPLY VOLTAGE (5 V DC) IS 4.6 V DC NOMINAL.
5. BUS COUPLER SUPPLY (20 V DC) IS 19 4 V DC NOMINAL
6. B5 DME DISPLAY DIMMING INPUT, 0-5 V DC FROM AIRCRAFT.
7. DISPLAY FOR P1 THRU P4 IS SHOWN BELOW:

8. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION, PREFIX WITH UNIT AND/OR ASSEMBLY DESIGNATION.
9. MICROCIRCUIT POWER AND GROUND PIN TABLE FOR A1 638-2777-001

TYPE	POWER PIN	POWER VOLT	GND
5400 5403 5404 5438 5474 54L00 54L02 54L04 54L10 54L30	14	+5	7

TYPE	POWER PIN	POWER VOLT	GND
54164 UA723	14	+5	7
LM239	3	+20	12
SG8003	4	+5	10
9317	16	+5	8
5475	5	+5	12

A4

638-2789-001H
TP6-5167-068

DISASSEMBLY

1. General

Do not disassemble indicator unless absolutely necessary, and only to the extent required for repair or testing. Procedures are in order of disassembly from highest to the lowest subassembly.

NOTE: All item numbers in parentheses refer to figures in the Illustrated Parts List section.

2. Precautions and General Techniques

CAUTION: WHEN REMOVING A SOLID-STATE DEVICE, USE A HEAT SINK ON THE LEADS TO PREVENT DAMAGE TO THE COMPONENT.

TO PROCEED WITH DISASSEMBLY WHILE POWER CABLE IS CONNECTED MAY CAUSE VOLTAGE TRANSIENTS THAT WILL DESTROY SEMICONDUCTORS.

CAUTION:

REFER TO ESDS HANDLING CAUTION AND WARNING IN ADVISORIES PARAGRAPH OF INTRODUCTION TO MANUAL.

NOTE: Loosen staking compound with thinner (CPN 005-0164-000).

When disconnecting electrical leads, mark or otherwise identify for color coding, placement, and method of insulation (if any) before unsoldering or removing components.

3. Procedure

A. HSI-45 Horizontal Situation Indicator (IPL, fig 1)

(1) Remove case (7, 10) attached by four screws (8).

(1A) Remove two screws (16), two lockwashers (17), and two flat washers (18) and unplug display indicator (20).

(2) Remove distance readout circuit card assembly A1 (13) attached by two screws (14), one washer (18), two screws (15, 16A), four screws (16, 16B), and one flat washer (18).

(3) Remove rear cover (53) attached by four screws (54) and one screw (45).

(4) Remove power supply circuit card A3 (34) and azimuth circuit card assembly A4 (35) attached by seven screws (36).

(5) Remove coil L3 (41) attached by screw (42) and lockwasher (43) and remove bracket (47).

(6) Remove electronic component assembly A5 (23) attached by two screws (24) and two lockwashers (25).

NOTE: Step (7) applicable to CPN 622-4298-001 without SB 2.

(7) Remove electronic components assembly A6 (37) and three posts (38) attached by six screws (39) and six lockwashers (40).

NOTE: Steps (8) thru (9B) are applicable to CPN 622-4298-001 with SB 2.

(8) Tag, label, or note the position of wires soldered to servo-amplifier card A7 (37C) and remove wires.

(9) Remove three screws (39), three lockwashers (40), and remove servo-amplifier card A7 (37C).

(9A) Tag, label, or note position of wires soldered to electronic component assembly A6 (37), and remove wires.

(9B) Remove four screws (36B), four lockwashers (36C), and four flat washers (36D) and remove electronic component assembly A6 (37).

(10) Remove connectors J2 (48), J1 (49) attached by eight nuts (50), eight lockwashers (51), and eight screws (52).

(11) Remove meter frame (55) (refer to paragraph B for disassembly of meter frame).

(12) Remove two clips (56), lighting board cover (57), and lighting board (61) attached by two screws (58), two lockwashers (59), and two flat washers (60).

(13) Remove plate (64) attached by two screws (65).

(14) Remove airplane symbol (66), index tube (67), and lubber line wire (68) attached by two screws (69) and two flat washers (70).

(15) Remove two supports (71), mask (72, 76), and four sleeves (77) attached by two screws (78) and two screws (79).

(16) Remove dial (80) attached by two screws (81).

(17) Remove ring (82, 84) attached by four screws (83) and cursor (85, 87) attached by two pins (86).

(18) Remove meter M3 (88) attached by two screws (89) and two flat washers (90).

(19) Remove plate (91) attached by two screws (92), two flat washers (93), and shims (94).

(20) Remove meter M4 (95) attached by two screws (96).

(21) Remove bracket (97) attached by two screws (98) and two flat washers (99).

(22) Remove scale (100) attached by two screws (101).

(23) Remove meter M6 (102) attached by two screws (103) and two flat washers (104).

(24) Remove bracket (105) attached by two screws (106) and two flat washers (107).

(25) Remove two brackets (108, 113) attached by two screws (109), two screws (110), and four lockwashers (111).

(26) Remove rotating counter (114) attached by three screws (115), three lockwashers (116), three flat washers (117), and shims (118).

(27) Remove meter M7 (119).

(28) Remove bracket (120) and meter movement (119) attached by screw (121) and mounting block (122) attached by two screws (123) and two lockwashers (124).

(29) Remove the following piece parts consisting of thirty-two bearings (126), sixteen supports (127), and four spacers (128) attached by four rings (129) and plate (125) assembled on four shafts (130) attached by four screws (131).

(30) Remove display plate (132) attached by three screws (133), three lockwashers (135), and three flat washers (136).

(31) Remove three spacers (137) and three shafts (138) attached by screw (133), lockwasher (135), and flat washer (136).

(32) Remove points (140, 141) and (143) attached to ring (146) by two screws (142) and two screws (144).

(33) Remove gears (145) and (146) from the hub of gear (147). Remove gear (148) from the back side of (147).

(34) Remove gearshaft (150), bearing (149), and collar (151) attached by two setscrews (152).

(35) Remove gearshaft (154) and collar (155) attached by two setscrews (156).

(36) Remove shaft (157) attached by two setscrews (158) in collar (163) and remove bearing (159).

(37) Remove gear cluster (160) and collar (163)..

(38) Remove spider (165, 170), gear (171), and gear (168) attached by two setscrews (167), tapered pin (169), and ring (166). Remove bearings (164) and (172).

(39) Remove spider (174, 179), gear (180), and gear (177) attached by two setscrews (176), tapered pin (178), and ring (175). Remove bearings (173) and (181).

(40) Remove gearshaft (183) attached by four setscrews (184). Remove bearing (182).

(41) Remove collar (185), bearing (186), gearshaft (187), bearing (188), gearshaft (189), collar (190), and bearing (191).

(42) Remove gearshaft (193) attached by two setscrews (194) in collar (195) and remove bearing (192).

(43) Remove collar (195), bearing (196), gearshaft (197), and bearings (198) and (199).

(44) Remove gear assembly (200) attached by two rings (201), two setscrews (202), and one pin (205).

(45) Remove shaft (206), gears (204) and (207), shim (203), and two bearings (208).

B. Meter Frame (IPL, fig 7)

(1) Remove mask (4) by removing arrow pointer (2) and tail pointer (3) from two pins (29) on frame (27, 30).

(2) Remove two meters, 5 (M5), 6 (M1), and plate (7) attached by four screws (8) and four screws (9).

(3) Remove meter M2 (11) attached by two screws (12) and two flat washers (13).

(4) Remove plate (14) and brush (15) attached by two nuts (16), four flat washers (17), and two screws (18) and two screws (19).

(5) Remove plate (20) and clamp (21) attached by four screws (22) and three washers (23).

(6) Remove ring assembly (24) and two bearings (26) from frame (27, 30) attached by two rings (25).

C. Motor-Synchronizer Assembly (IPL, fig 8)

(1) Remove motor assembly (2) attached by four screws (24), two lockwashers (25), and two flat washers (26).

(2) Remove gear (124) attached by one pin (125) and remove ring (121).

(3) Remove bearing (129) from plate (113), gear (128) secured by collar (127) fastened by four setscrews (122), two washers (123), ring (121), and bearing (129) from plate (258).

(4) Remove plate (139, 142, 146) from plate (113) with screw (140), lockwasher (141), and pin (145).

(5) Remove plate (114, 118, 119) from plate (113) with screw (115), lockwasher (116), flat washer (116A), and pin (117).

(6) Remove servo mechanism (52) attached by two screws (53), two lockwashers (54), and one flat washer (55).

(7) Remove motor-generator MG4 (59) attached by two clamps (56), two screws (57), and two lockwashers (58).

(8) Remove two posts (64) from plate (71) attached by two screws (65).

(9) Remove two bearings (69) and one bearing (70) from plate (71).

(10) Remove three gear shafts (66, 67, 68).

(11) Remove three bearings (63) and two posts (61) from plate (60, 62)

(12) Remove collar (110) and gear (112) attached by two setscrews (111).

(13) Remove gearshaft (32) and bearing (31) from plate (113).

(14) Remove collet (28) attached by three screws (29) and three washers (30).

(15) Remove gear assembly (8) attached by one screw (9), one lockwasher (10), and one flat washer (11).

(16) Remove ring (16) from shaft (15). Remove gears (18, 19), spring (12), gear (13), and shims (14).

(17) Remove servo mechanism (33) attached by two screws (34) and one lockwasher (35).

(18) Remove motor-generator MG1 (39) attached by two clamps (36), two screws (37), and two lockwashers (38).

(19) Remove two posts (44) attached by two screws (45).

(20) Remove two bearings (50) and one bearing (49) from plate (51).

(21) Remove three gearshafts (46, 47, 48).

(22) Remove three bearings (43) and two posts (41) from plate (40, 42).

(23) Remove servo mechanism (72) attached by two screws (73) and two lockwashers (74).

(24) Remove motor-generator MG3 (78) attached by two clamps (75), two screws (76), and two lockwashers (77).

(25) Remove two posts (83) attached by two screws (84).

(26) Remove two bearings (89) and one bearing (88) from plate (90).

(27) Remove three gearshafts (85, 86, 87).

(28) Remove three bearings (82) and two posts (80) from plate (79, 81).

(29) Remove servo mechanism (91) attached by two screws (92) and two lockwashers (93).

(30) Remove motor-generator MG2 (97) attached by two clamps (94), two screws (95), and two lockwashers (96).

(31) Remove two posts (102) attached by two screws (103).

(32) Remove two bearings (108) and one bearing (107) from plate (109).

(33) Remove three gearshafts (104, 105, 106).

(34) Remove three bearings (101) and two posts (99) from plate (98, 100).

(35) Remove two plates (3), two spacers (6), and two spacers (7) attached by eight screws (4) and eight washers (5).

(36) Remove gearshaft (130), two rings (131) and two bearings (132).

(37) Remove gear (137) from shaft (20) attached by ring (138) and ring (22). Secure by screw (21).

(38) Remove gearshaft (133), ring (134), bearing (135), and bearing (136).

(39) Remove rings (156, 157), gear (155), spring (158), gear (160), and gear (161) from shaft (162). Remove shaft (162) from plate (258) secured by screw (152), lockwasher (153), and flat washer (154).

(40) Remove rings (229, 230), gear (228), spring (231), gear (233), and gear (234) from shaft (235). Remove shaft (235) from plate (258) secured by screw (225), lockwasher (226), and flat washer (227).

(41) Remove gear (178) attached by setscrew (177), and gear (179), shims (180), and ring (181) from shaft of B1 (250).

(42) Remove gear (184) attached by setscrew (183), and gear (185), shims (186), and ring (187) from shaft of B5 (254).

(43) Remove gear (196) attached by setscrew (195), and spring (197), gear (198), shims (199), and ring (200) from shaft of B2 (246).

(44) Remove gear (190) attached by setscrew (189), gear (191), shims (192), and ring (193) from shaft of B7 (247).

(45) Remove gear (203) attached by setscrew (202), spring (204), gear (205), shims (206), and ring (207) from shaft of B4 (253).

(46) Remove gear (218) attached by setscrew (217), spring (219), gear (220), shims (221, 222), and ring (223) from shaft of B14 (251).

(47) Remove gear (210) attached by screw (209), spring (211), gear (212), shims (213, 214), and ring (215) from shaft of B10 (246).

(48) Remove gear (171) attached by setscrew (170), spring (172), gear (173), shims (174), and ring (175) from shaft of B8 (249).

(49) Remove gear (165) attached by setscrew (164), gear (166), shims (167), and ring (168) from shaft of B6 (252).

(50) Remove four posts (23) attached by screw (245), three screws (24), three lockwashers (25), and three flat washers (26).

(51) Remove two posts (239) attached by one screw (240), one screw (241), one lockwasher (242), and one terminal lug (243).

(52) Remove two posts (244) attached by one screw (240), one screw (241), and one lockwasher (242).

(53) Remove synchros attached by clamps (236), screws (237), and lockwashers (238).

(54) Remove synchro B8 (249) attached by three clamps (255), three screws (256), and three lockwashers (257).

CLEANING

1. Introduction

This section presents the special instructions necessary for cleaning parts and disassembled assemblies of this equipment. For standard cleaning instructions, the technician should follow the instructions outlined in the Collins Avionics Standard Shop Practices manual, Collins part number 523-0768039.

2. Cleaning Materials

No special materials are required to clean this equipment.

3. Procedures

WARNING: OBSERVE ALL WARNINGS AND CAUTIONS LISTED IN THE ADVISORIES PARAGRAPH OF THIS MANUAL AND THE COLLINS AVIONICS STANDARD SHOP PRACTICES MANUAL.

No special instructions are required to clean this equipment.

(Figure 401 deleted)
(Pages 403 through 406 deleted)

CHECK

1. Introduction

This section presents the unique instructions necessary to verify the condition of disassembled and cleaned assemblies of this equipment. For standard equipment checks, the technician should follow the instructions outlined in the Collins Avionics Standard Shop Practices manual, Collins part number 523-0768039.

2. Procedures

WARNING: OBSERVE ALL WARNINGS AND CAUTIONS LISTED IN THE ADVISORIES PARAGRAPH OF THIS MANUAL AND THE COLLINS AVIONICS STANDARD SHOP PRACTICES MANUAL.

This equipment does not require any special check procedure.

(Figures 501 and 502 deleted)
(Pages 503 and 504 deleted)

HSI-45 Horizontal Situation Indicator

COMPONENT MAINTENANCE MANUAL with IPL (523-0768607)

TEMPORARY REVISION NO. 34-28-25-23

Insert facing page 601, 34-28-25.

This temporary revision supersedes Temporary Revision 34-28-25-07.

Subject: Revise Detailed Parts List.

Change paragraph 3.A. to read:

A. To prevent damage to the insulator (CPN 352-9570-020) when changing Q1 or Q2 on the Electronic Component Assembly A6 (CPN 652-0037-001), torque rating on the screws (CPN 343-0135-000) shall not exceed 4.4 – 5.6 in/lbs.

REPAIR

1. Introduction

This section presents special instructions necessary for the repair of disassembled assemblies of this equipment. For standard repair procedures, the technician should follow the instructions outlined in the Collins Avionics Standard Shop Practices manual, Collins part number 523-0768039.

2. Repair Tools and Supplies

No special supplies are required to repair this equipment.

3. Repair and Replacement Procedures

WARNING: OBSERVE ALL WARNINGS AND CAUTIONS LISTED IN THE ADVISORIES PARAGRAPH OF THIS MANUAL AND THE COLLINS AVIONICS STANDARD SHOP PRACTICES MANUAL.

A. (Deleted)

B. (Deleted)

C. (Deleted)

D. (Deleted)

E. Meter Movements

CAUTION: METER MOVEMENTS ARE EXTREMELY DELICATE; HANDLE GENTLY. DO NOT BEND METER STRUTS.

(1) Unbalanced meters will not maintain their position when the horizontal situation indicator is turned or set on end. Rebalance meters by repositioning the small nuts on the meter shafts.

(2) Adjust meter clearance as necessary by adding or removing meter shims.

NOTE: Sticking of meters is usually caused by foreign matter on the meter stops. If too much cement is used to secure the ceramic stop to its supporting wire, the meter will stick if its shaft touches cement rather than ceramic.

(3) Use cleaning procedure listed in standard shop practices manual, to clean meter stops. Twist or reposition the meter stop slightly to assure that the shaft touches clean ceramic.

NOTE: For specific meter movement overhaul manuals, refer to figure 603.

(Figures 601 and 602 deleted)

METER	MFR AND P/N	CPN	MANUAL	CHAPTER
To-from pointer (M1)	Weston 9833-98	482-5084-010	523-0763365	39-234-8
Deviation pointer (M2)	Weston 520465	482-5083-020	NA	
Glideslope pointer (M3)	Weston 9880-29	482-5085-010	523-0763259	39-224-8
Glideslope flag (M4)	International Weston Sun	482-5131-010	NA	
NAV flag (M5)	Weston Phaostron	482-5107-020	NA	
INS annunciator flag (M6)	Weston	482-5130-010	NA	
Heading flag (M7)	Weston	482-5129-010	NA	

HSI-45 Meter Movements
Figure 603

(Paragraphs F through N deleted)

O. Servos and Motor-Generators

Replace defective servos and motor-generators. Clean connections and apply new solder. Refer to figure 604 for specific servo and motor-generator overhaul manuals.

SERVO MOTOR-GENERATOR	MFR AND P/N	CPN	MANUAL	CHAPTER
Azimuth card (B1)	Clifton CSDH8BQ2L607, Kearfott CM41005008	229-6026-030	523-0762171 523-0763334	39-190-0 39-231-1
Azimuth comparator (B2) (Cont)	Kearfott CM41005012,	229-7031-010	NA	

HSI-45 Servos and Motor-Generators
Figure 604 (Sheet 1 of 2)

SERVO MOTOR-GENERATOR	MFR AND P/N	CPN	MANUAL	CHAPTER
(Cont)	McGraw-Edison 4255-15-01, Clifton CDSH8BQ4AQ13 Harowe 8CRD300B34		523-0762649 523-0762605 523-0762605	39-211-2 39-210-0 39-210-0
Heading select (B4), Heading datum (B5), Course select (B7)	McGraw-Edison 4277-31-01, Clifton CTH8BQ4A005, Kearfott CM41004100	229-5022-010	523-0763158 523-0762216 NA	39-218-2 39-194-0
Course datum (B6)	Clifton CDSH8DZ2L503, Kearfott CM41005016	229-0097-010	523-0761791	39-175-0
Course resolver (B8)	Clifton TSH11F08A049, Kearfott R931-017	229-0178-000	523-0755767 523-0763458	22-10-14 22-10-15
Bearing pointer (B10), Relative course (B14)	McGraw-Edison 4277-01-05, Clifton CTH8A4L906, Kearfott CM01004908, Control Data	229-0194-000	523-0757352 523-0757272 523-0762500 NA	39-55-02 35-55-00 39-207-1
Azimuth card MG1, Heading select MG2, Course select MG3, Bearing pointer MG4	Control Data ST8111	229-2050-020	523-0760588	39-136-6

HSI-45 Servos and Motor-Generators
Figure 604 (Sheet 2)

(Pages 605 through 614 deleted)

ASSEMBLY (INCLUDING STORAGE)

1. General

This section presents instructions for assembling the indicator. Procedures are in order of the lowest major part of subassembly and proceed to a completely assembled unit. All necessary repairs or replacements should be made before beginning assembly procedures.

NOTE: Item numbers in parentheses refer to the exploded views in the Illustrated Parts List section.

2. Precautions and General Techniques

CAUTION: ASSEMBLE EQUIPMENT IN A DUST-FREE AREA.

ALWAYS USE A HEAT SINK WHEN SOLDERING A SOLID-STATE DEVICE.

CAUTION:

REFER TO ESDS HANDLING CAUTION IN ADVISORIES PARAGRAPH OF INTRODUCTION TO MANUAL.

A. Wiring

NOTE: Before soldering any part, refer to notes on color coding, placement of leads, and wire insulation made during disassembly. If not available, determine by examining a unit known to be correct.

(1) All wire connections are to be soldered as specified in MIL-S-6872 using rosin-core solder, Federal Specification QQ-S-5716, composition Sn60.

(2) Replace electrical wiring with wire of the same size and color code as that removed.

(3) Lace all electrical harness and tie at all breakouts. Lace ties should be approximately 1/2 inch apart. Use Dacron lacing cord, nonwaxed lacing cord, or Tyraps.

B. Hardware

CAUTION: DO NOT ALLOW LIQUID STAKE TO COME INTO CONTACT WITH BEARING OR GEAR SURFACES.

(1) Liquid-stake all screws indicated with retaining compound. Refer to figure 701. Unless otherwise specified, the notation "liquid stake " signifies that General Electric Co. retaining compound (005-0133-0XX) is to be used.

(2) Retaining rings and washers are to be installed with the burr side away from bearing surfaces.

MANUFACTURER	MANUFACTURER'S DESIGNATION	USE	QTY	COLLINS PART NUMBER
General Electric Co., Insulating Materials Product Section, 1 Campbell Rd., Schenectady, NY 12306	Retaining compound, blue	Retaining compound	Gal Pint Quart	005-0133-000 -010 -020
General Electric Co., Silicone Products Dept., Waterford, NY 12188	Versilube G-322L	Silicone grease	2 oz	005-2444-010
General Electric Co., Silicone Products Dept., Distributed by Panef Mfg. Waterford, NY 12188	General Electric Co. SF-1147	Silicone oil	0.5 oz	838-6000-010
Loctite Corp., 705 N. Mountain Rd., Newington, CT 06111	Loctite sealant Grade E	Sealant	10 cc	005-0550-000
Dow Chemical Co. 2030 Dow Center Midland, MI 48640	Chlorothene® SM (1, 1, 1, Trichlorothane) 005-1182-010	Cleaner	Gal	005-1185-000
Connecticut Hard Rubber Co. 407 East St., New Haven, CT 06509	Thermal curing Teflon tape	Insulating	1/4 in x 18 yd	014-0581-000

Lubricants and Sealants
Figure 701

3. Lubrication Data

Major contamination problems arise between some silicon-base and oil-base lubricants, or hydraulic fluids as a result of additives (oxidation inhibitors, corrosion inhibitors, etc) used in these fluids. Do not mix lubricants unless specifically directed to do so. Many of the additives will precipitate as gummy or crystalline sludges when the fluids are mixed. The result may be high torques, sticking mechanisms, lubrication failure, and ultimate failure of the equipment.

4. Detailed Assembly Procedures

All index numbers in parentheses represent the index numbers in the IPL and on the IPL exploded views.

A. Assembly of Motor Synchronizer Assembly (IPL, fig 8)

(1) Assemble synchro assembly (150) as follows:

(a) Apply a light coating of G-322L grease to all synchro seating surfaces and pilot holes in plate (258).

(b) Mount synchros B1 (250), B2 (246), B5 (254), B6 (252), and B10 (246) to plate (258) with 10 screws (237), 10 lockwashers (238), and 10 clamps (236).

(c) Mount synchros B4 (253), B7 (247), and B14 (251) to plate (258) with six screws (237), six lockwashers (238), and six clamps (236).

(d) Mount resolver B8 (249) to plate (258) with three screws (256), three lockwashers (257), and three clamps (255).

(e) Attach two hexposts (239) to plate (258) with one screw (240), one screw (241), one lockwasher (242), and one terminal lug (243).

(f) Attach two hexposts (244) to plate (258) with one screw (240), one screw (241), and one lockwasher (242).

(g) Attach three posts (23) to plate (258) with three screws (24), three lockwashers (25), and three flat washers (26).

(h) Attach one post (23) to plate (258) with one liquid-staked (005-0133-000) screw (245).

(i) Assemble gear assemblies (208, 216) as follows:

1. Apply a minimum amount of G-322L grease to mating surfaces of gears (210, 218, 212, 220). Remove excess grease.

2. Insert end of spring (211, 219) into counterbore of gear (210, 218).

3. Place gear (212, 220) over hub of gear (210, 218) and insert opposite end of spring into hole. Secure with retaining ring (215, 223). Use shims (213, 214, 221, 222) as required between gear and retaining ring to obtain 0.002- to 0.005-inch (0.0508- to 0.1270-mm) end play.

4. Mark two teeth on each gear, directly across from each other, with a felt-tip pen for reference when loading.

(j) Load two gears (216, 208) three to five teeth and mount on synchro B10 (246) and B14 (251) shaft with hub up. Secure with two setscrews (217, 209).

(k) Assemble gear assemblies (194, 201) as follows:

1. Apply a minimum amount of G-322L grease to mating surfaces of gears (196, 203, 198, 205). Remove excess grease.

2. Insert end of spring (197, 204) into counterbore of gear (196, 203).

3. Place gear (198, 205) over hub of gear (196, 203) and insert opposite end of spring into hole. Secure with retaining ring (200, 207). Use shims (199, 206) as required between gear and retaining ring to obtain 0.002- to 0.005-inch (0.0508- to 0.1270-mm) end play.

4. Mark two teeth on each gear, directly across from each other, with a felt-tip pen for reference when loading.

(l) Mount gear assemblies (194, 201) on synchro B2 (246) and B4 (253) shafts with hub down. Secure with two setscrews (195, 202).

(m) Assemble gear assemblies (176, 182, 188).

1. Apply a minimum amount of G-322L grease to mating surfaces of gears (178, 184, 190, 179, 185, and 191). Remove excess grease.

2. Place gear (179, 185, 191) over hub of gear (178, 184, 190) and secure with retaining ring (181, 187, 193). Use shims (180, 186, 192) as required to obtain 0.002- to 0.005-inch (0.0508- to 0.1270-mm) end play.

(n) Mount gear assemblies (176, 182, 188) on synchro B1 (250), B5 (254), and B7 (247) shafts with hub down. Secure with setscrews (177, 183, 189).

(o) Assemble gear assembly (169) as follows:

1. Apply a small amount of G-322L grease to mating surfaces of gears (171, 173). Remove excess grease.

2. Insert end of spring (172) into counterbore of gear (171).

3. Place gear (173) over hub of gear (171) and insert opposite end of spring into hole. Secure with retaining ring (175). Use shims (174) as required between gear and retaining ring to obtain 0.002- to 0.005-inch (0.0508- to 0.1270-mm) end play.

4. Mark two teeth on each gear, directly across from each other, with a felt-tip pen for reference when loading.

(p) Mount gear assembly (169) to synchro B8 (249) shaft with hub down. Secure with liquid-staked setscrew (170).

(q) Assemble gear assembly (163) as follows:

1. Apply a small amount of G-322L grease to mating surfaces of gears (165, 166). Remove excess grease.

2. Mount gear (166) over hub of gear (165) and secure with retaining ring (168). Use shims (167) as required to obtain 0.002- to 0.005-inch (0.0508- to 0.1270-mm) end play.

(r) Mount gear assembly (163) to synchro B6 (252) shaft with hub down. Secure with liquid-staked setscrew (164).

(s) Assemble gear assemblies (151, 224) as follows:

NOTE: If it is necessary to replace gear (160, 223) or gearshaft (161, 234) separately, proceed to step 1 or 2. If gear (156, 232) is not disassembled, proceed to step 3.

1. Replace gear (160, 223) as follows:

   a. Remove gear (160, 223) from gearshaft (161, 234).

   b. Press gear (160, 233) onto gearshaft (161, 234) ensuring that gear does not protrude beyond shoulder of gearshaft.

2. Replace gearshaft (161, 234) as follows:

   a. Remove gear (160, 233) from gearshaft (161, 234).

   b. Press gear (160, 233) onto gearshaft (161, 234) ensuring that gear does not protrude beyond shoulder of gearshaft.

   c. Ream inside diameter of gearshaft to 0.1250 to 0.1255 inch (3.175 to 3.188 mm).

3. Insert one end of spring (158, 231) into hole in gear (159, 232).

4. Mount gear (155, 228) over end of gear (159, 232) and insert spring into hole, and secure with retaining ring (157, 229).

5. Apply a minimum amount of G-322L grease to gearshaft (162, 235) and insert gearshaft through gear (159, 232). Secure with retaining ring (156, 230).

6. Mark two teeth on each load gear, directly across from each other, with a felt-tip pen for reference when loading.

7. Mount gears (151, 224) to plate (258) with two flat washers (154, 227), two lockwashers (153, 226), and two screws (152, 225).

B. Assembly of Motor Assembly (2, IPL, fig 8)

(1) Assemble servo mechanism MG2 (91) as follows:

(a) Mount two posts (102) to plate (109) with two liquid-staked screws (103).

(b) Insert two bearings (108) and one bearing (107) into plate (109).

(c) Insert three gearshafts (104, 105, 106) into bearings in plate (109).

(d) Insert three bearings (101) and two posts (99) into plate (98, 100).

(e) Align plate (98, 100) (with bearings) over gearshafts and insert posts into holes in plate (109).

(f) Mount motor (97) on plate (98, 100) and mesh motor shaft with mating gear. Secure motor to plate with two screws (95), two lockwashers (96), and two clamps (94).

(2) Assemble servo mechanism MG3 (72) as follows:

(a) Mount two posts (83) to plate (90) with two liquid-staked screws (84).

(b) Insert two bearings (89) and one bearing (88) into plate (90).

(c) Insert three gearshafts (85, 86, 87) into bearings in plate (90).

(d) Insert three bearings (82) and two posts (80) into plate (79, 81).

(e) Align plate (79, 81) over gearshafts and insert posts into holes of plate (90).

(f) Mount motor (78) on plate (79, 81) and mesh motor shaft with mating gear. Secure motor to plate with two screws (76), two lockwashers (77), and two clamps (75).

(3) Assemble servo mechanism MG1 (33) as follows:

(a) Mount two posts (44) to plate (51) with two liquid-staked screws (45).

(b) Insert two bearings (50) and one bearing (49) into plate (51).

(c) Insert three gearshafts (46, 47, 48) into bearings in plate (51).

(d) Insert three bearings (43) and 2 posts (41) into plate (40, 42).

(e) Align plate (40, 42) over gearshafts and insert posts into holes of plate (51).

(f) Mount motor (39) on plate (40, 42) and mesh motor shaft with mating gear. Secure motor to plate with two screws (37), two lockwashers (38), and two clamps (36).

(4) Assemble servo mechanism MG4 (52) as follows:

(a) Mount two posts (64) to plate (71) with two liquid-staked screws (65).

(b) Insert two bearings (69) and one bearing (70) into plate (71).

(c) Insert three gearshafts (66, 67, 68) into bearings in plate (71).

(d) Insert three bearings (63) and two posts (61) into plate (60, 62).

(e) Align plate (60, 62) over gearshaft and insert posts into holes in plate (71).

(f) Mount motor (59) on plate (60, 62) and mesh motor shaft with mating gear. Secure motor to plate with two screws (51), two lockwashers (58), and two clamps (56).

(5) Assemble gear assembly (8) as follows:

NOTE: If it is necessary to replace gear (19) or gearshaft (18) separately, proceed to step (a) or (b). If gear assembly (17) is not disassembled, proceed to step (c).

(a) Replace gear (19) as follows:

1. Remove gear (19) from gearshaft (18).

2. Press gear (19) onto gearshaft (18).

(b) Replace gearshaft (18) as follows:

1. Remove gear (19) from gearshaft (18).

2. Press gear (19) onto gearshaft (18).

3. Ream inside diameter of gearshaft (18) to 0.1250- to 0.1255-inch (3.175- to 3.188-mm) diameter.

(c) Insert one end of spring (12) into hole in gear (13). Apply a minimum amount of G-322L grease to top of gear shoulders.

(d) Mount gear (13) over end of gear assembly (17) and insert free end of spring into hole.

(e) Apply a minimum amount of G-322L grease to gearshaft (15) and insert gearshaft through gear assembly. Secure with retaining ring (16). Use shims (14) as required to obtain 0.002- to 0.005-inch (0.0508- to 0.1270-mm) end play.

(f) Mark two teeth on each load gear, directly across from each other, with a felt-tip pen for reference when loading.

(6) Mount two retaining plates (3) to motor plate (113) with two spacers (7), two spacers (6), eight flat washers (5), and eight liquid-staked screws (4).

(7) Mount gear assembly (8) to motor plate (113) with flat washer (11), lockwasher (10), and screw (9).

(8) Mount post (20) to motor plate (113) with liquid-staked screw (21).

(9) Press retaining ring (22) on post (20).

(10) Mount collet (28) on motor plate (113) with three lockwashers (30) and three screws (29). Ensure tapped hole in collet is toward top of motor plate (113).

(11) Install bearing (31) into motor plate (113) and insert gearshaft (32) into bearing.

(12) Mount servo mechanism MG1 (33) to motor plate (113) with two lockwashers (35) and two liquid-staked screws (34).

(13) Mount servo mechanism MG4 (52) to motor plate (113) with two lockwashers (54), one flat washer (55), and two liquid-staked screws (53).

(14) Mount servo mechanism MG3 (72) to motor plate (113) with two lockwashers (74) and two liquid-staked screws (73).

(15) Mount servo mechanism MG2 (91) to motor plate (113) with two lockwashers (93) and two liquid-staked screws (92).

(16) Mount gear (112) on gearshaft (66) and secure with collar (110) and two liquid-staked setscrews (111).

(17) Mount retaining plate (114, 118, 119) to motor plate (113) with pin (117), flat washer (116A), lockwasher (116), and screw (115).

(18) Insert one each bearings (129, 132, 136) into holes in gear side of motor plate (113).

(19) Mount two retaining rings (131) on gearshaft (130) and insert large gear end of shaft into bearing (132).

(20) Mount retaining ring (134) on gearshaft (133) and insert large gear end of shaft into bearing (136). Insert bearing (135) into plate (258).

(21) Mount gear (137) small end down on post (20) and secure with retaining ring (138).

(22) Mount ring (121) onto shaft (126).

(23) Place gear (124) onto shaft (126). Secure with pin (125) and liquid stake.

(24) Insert shaft (126) through bearing (129) in plate (113).

(25) Place gear (128) on shaft (126) and secure with collar (127) held by four setscrews (122).

(26) Use shims (123) as required to obtain minimum end play and secure gear assembly to shaft (126) with ring (121).

(27) Secure mounting plate (139, 142, 146) to motor plate (113) with pin (145), screw (140), and lockwasher (141).

(28) Insert bearings (129, 132) and bearing (135) into gear side of synchro assembly (150).

(29) Place gear sides of synchro assembly (150) and motor assembly (2) together. Align two motor plate (113) gears with mating synchro gears and insert three gearshaft ends into bearings in synchro plate (258).

(30) Secure motor assembly (2) to synchro assembly (150) with two screws (24), two lockwashers (25), and two flat washers (26).

(31) Center spur gear (128) on bevel gearshaft (126) and snug tighten four set-screws (122).

C. Assembly of Meter Frame (IPL, fig 7)

(1) Mount to-from meter M1 (6) to plate (7) with two liquid-staked screws (9).

(2) Mount NAV flag meter M5 (5) to plate (7) with two liquid-staked screws (9).

(3) Mount plate (7) to frame (27, 30) with three liquid-staked screws (8).

(4) Mount two bearings (26) into frame (27, 30).

(5) Install retaining ring (25) in wire end of slipring (24), and insert slipring through bearings (26). Secure with retaining ring (25).

(6) Mount plate (20) to frame (27, 30) with one clamp (21), three flat washers (23), and four liquid-staked screws (22).

(7) Mount deviation meter M2 (11) to plate (20) with two flat washers (13) and two screws (12). Center deviation bar in 0 position, in line with arrow and tail mounting pins (29). Tighten screws (12) and liquid-stake.

(8) Mount brush block (15) to plate (14) with two nuts (16), two flat washers (17), and two liquid-staked screws (18).

(9) Slide brushes over slipring (24) and secure plate (14) to frame (27, 30) with two flat washers (17) and two liquid-staked screws (19).

(10) Move slipring (24) back and forth to ensure that each brush is centered between slipring spacers.

(11) Insert deviation bar through slot in mask (4) and align holes in mask over pins (29) in frame (27, 30).

(12) Secure mask (4) to frame (27, 30) by mounting tail pointer (3) and arrow pointer (2) over pins (29). Liquid-stake pointers to pins.

(13) Align to-from meter M1 (6) to obtain the following clearances:

(a) To-from pointer and arm must clear all parts of the unit by 0.015 inch (0.381 mm) at all points of travel.

(b) With to-from pointer against the stop, tip of pointer must align with center line of the course arrow and tail pointer within 0.0313 inch (0.794 mm). Repeat for opposite stop.

(14) Align deviation meter M2 (11) to obtain the following clearances:

(a) Meter arm and deviation bar must clear all parts by 0.015 inch (0.381 mm).

(b) Clearance between ends of deviation bar and arrow and tail pointers shall be 0.020 to 0.055 inch (0.508 to 1.397 mm).

(c) With deviation bar against the stop, the distance between the inner edge of the second dot and the inner edge of the bar shall be 0.015 to 0.045 inch (0.508 to 1.143 mm). Repeat for opposite stop.

(15) Align NAV flag meter M5 (5) to obtain the following clearances. Use shims (10) as required.

(a) NAV flag meter and arm must clear all parts of the unit by 0.015 inch (0.381 mm) at all points of travel.

(b) Clearance between NAV flag and side mask must be 0.015 inch (0.381 mm) minimum.

D. Assembly of Indicator Subassembly (12, IPL, fig 1)

(1) Install bearings (191, 199) into motor plate (113, IPL, fig 8) of motor synchronizer assembly (212).

(2) Install bearings (172, 181) into plates 3, IPL, fig 8) on motor synchronizer assembly (212).

(3) Install three shafts (138) into motor plate on motor synchronizer assembly (212).

(4) Install three spacers (137) over three shafts (138) and attach with three rings (139).

(5) Insert bearing (196) into gearshaft (197) and insert bearing (198) on opposite end.

(6) Slide collar (195) with two setscrews (194) over shaft (193) and insert shaft (193) through gearshaft (197) into bearing (199).

(7) Install bearing (192) on shaft (193).

(8) Insert bearing (186) into gearshaft (187) and insert bearing (188) on opposite end.

(9) Slide collar (185) with two setscrews (184) over shaft (183) and insert shaft (183) through gearshaft (187) into bearing (191).

(10) Install bearing (182) on shaft (183).

(11) Install gearshaft (189) and collar (190) on gearshaft end protruding through motor plate (113, IPL, fig 8) with collar toward plate. Secure with two setscrews (184). Liquid-stake.

(12) Install collar (151) over gearshaft (150) and mount gearshaft over shaft (32, IPL, fig 8) protruding through motor plate.

NOTE: Ensure that gear mating with shaft (32, IPL, fig 8) is loaded three to five teeth cw.

(13) Install bearing (149), hub down, on gearshaft (165, 170).

(14) Install collar (155) on shaft (157) and install gearshaft (154), longer end first, into shaft (157). Loosely tighten setscrews (156).

(15) Install bearing (159) into motor plate and install shaft (157) into bearing.

(16) Install cluster gear (160) and collar (163) on shaft (157) with collar toward motor plate. Load mating gear three to five teeth cw and secure with setscrews (158). Liquid-stake.

(17) Install bearing (153) over gearshaft (154).

(18) Install bearing (208) into plate (139, 142, 146, IPL, fig 8) and install gear assembly (200) through bearing (208).

(19) Install bevel gear (207) on shaft (206) with setscrews (202) away from plate (139, 142, 146, IPL, fig 8) and slide shaft (206) through bearing (208) in plate (114, 118, 119, IPL, fig 8). Secure with retaining rings (201). Use shims (203) as required to obtain 0.002- to 0.005-inch (0.0508- to 0.1270-mm) end play.

(20) Adjust bevel gear (207) for minimum backlash and no toothiness. Tighten setscrews (202). Liquid-stake.

(21) Install two retaining rings (166) on shaft of differential spider (165, 170) and retaining ring (175) on shaft of differential spider (174, 179).

(22) Install differential spiders (165, 170 and 174, 179) into bearings (172, 181) and install gears (168, 177) on shafts of differential spiders. Liquid-stake and tighten two setscrews (169) and two setscrews (178).

(23) Install bearings (164, 173) on shafts of differential spiders (165, 170) and (174, 179).

(24) Assemble parts to four shafts (130) as follows:

Install bearing (126), support (127), two bearings (126), support (127), two bearings (126), support (127), bearing (126), spacer (128), bearing (126), support (127), bearing (126), and retaining ring (129).

(25) Mount plate (64) to display plate (132) with two screws (65). Liquid-stake.

(26) Mount three shafts (130) from step (24) to display plate (132), two at lower side of display plate and one at upper right corner of display plate. Secure with three screws (131). Liquid-stake.

(27) Mount cursor indicator (85, 87) to ring (82, 84) with liquid stake.

(28) Mount heading ring (82, 84) to heading gear (145) and secure with four screws (83). Liquid-stake.

(29) Slide bearing gear (146), heading ring (82, 84), and heading gear (145) over azimuth gear (147) and install on supports (127).

(30) Install select course gear (148) on supports (127).

(31) Mount support (127) to display plate (132) with screw (131). Liquid-stake.

(32) Remove four retaining rings (129) and install retaining plate (125) over shafts (130). Replace retaining rings.

(33) Rotate heading (145), bearing (146), azimuth (147), and course (148) gears to ensure they rotate smoothly.

(34) Align display plate (132) over gearshafts in motor synchronizer assembly (212). Ensure pin in bracket (139, 142, 146, IPL, fig 8) is aligned with hole in display plate. Secure display plate to shafts (138) with three screws (133), three lockwashers (135), and three flat washers (136).

(35) Secure display plate (132) to plate (139, 142, 146, IPL, fig 8) with screw (134) and lockwasher (135).

(36) Loosen setscrews (152, 156, 184, 194) in collars (151, 155, 185, 195) and adjust gears for proper mesh with 0.002- to 0.005-inch (0.0508- to 0.1270-mm) end play for shafts (150, 157, 183, 193). Liquid-stake and tighten setscrews.

(37) Mount bracket (108, 113) to unit with two screws (110), two screws (109), and four lockwashers (111).

(38) Loosen setscrew (195, IPL, fig 8) in synchro B2 gear (194, IPL, fig 8) and load B2 gear three to five teeth ccw (from synchro plate side). Center B2 gear on mating gear and tighten setscrew. Liquid-stake.

(39) Loosen setscrew (202, IPL, fig 8) in synchro B4 gear (201, IPL, fig 8) and load B4 gear three to five teeth ccw (from synchro plate side). Tighten setscrew in B4 gear. Loosen setscrew (183, IPL, fig 8) in synchro B5 gear (182, IPL, fig 8) and setscrews in mating differential gear. Ensure B5 gear remains loaded and align B4, B5, and differential gears. Tighten all setscrews and liquid-stake.

(40) Loosen setscrew (170, IPL, fig 8) in synchro B8 gear (169, IPL, fig 9) and load B8 gear three to five teeth ccw (from synchro plate side). Align B8 gear with B6 gear (163, IPL, fig 8). Liquid-stake and tighten setscrew.

(41) Loosen setscrew (189, IPL, fig 8) in synchro B7 gear (188, IPL, fig 8) and align gear with B8 gear (169, IPL, fig 8). Liquid-stake and tighten setscrew.

(42) Carefully install meter frame (55) into unit, and install setscrew (56A) in collet (28, IPL, fig 8). Ensure sliprings (24, IPL, fig 7) and brush block (15, IPL, fig 7) are properly aligned. Liquid-stake and tighten setscrew (56A).

NOTE: Steps (43) and (44) are applicable to CPN 622-4298-001 without SB 2.

(43) Mount three posts (38) to electronic component assembly A6 (37) with three screws (39) and three lockwashers (40).

NOTE: Steps (43A) and (43B) applicable to CPN 622-4298-001 with SB 2.

(43A) Mount three posts (38) to servo-amplifier card A7 (37C), three screws (39), and three lockwashers (40), and mount to rear cover (53) with three screws (39). Liquid-stake three screws.

(43B) Mount electronic component assembly A6 (37) to two posts (244) (refer to IPL, fig 8) with four screws (36B), four lockwashers (36C), and four flat washers (36D).

(44) Mount A6 (37) to rear cover (53) with three screws (39) and three lockwashers (40).

(45) Mount electronic component assembly A5 (23) to synchro plate (258, IPL, fig 8) with two screws (24) and two lockwashers (25).

(46) Mount power supply A3 (34) and azimuth monitor and back LOC A4 (35) to electronic component assembly A6 (37) with four screws (36). Liquid-stake.

(47) Mount bracket (44, 47) to A3 (34) and A4 (35) with four screws (36). Liquid-stake.

(48) Mount rear cover (53) to four hexposts (239, IPL, fig 8) with four screws (54).

(49) Mount course counter (114) to unit with three screws (115), three lockwashers (116), and three flat washers (117).

(50) Ensure that all gear teeth have a thin film of G-322L grease.

(51) Apply a strip of electrical tape (014-0581-000) on top of lighting board (61). Mount lighting board (61) and cover (57) to display plate (132) with two screws (58), two lockwashers (59), two flat washers (60), and two clips (56).

(52) Mount glideslope scale (100) to bracket (108, 113) with two screws (101). Liquid-stake.

(53) Mount pointer support (141), pointer (140) and pointer (143) to bearing gear (146) with two screws (142) and two screws (144). Liquid-stake.

(54) Secure dial scale (80) to unit with four screws (81). Liquid stake.

(55) Mount bracket (120) to mounting block (122) with screw (121). Liquid-stake.

(56) Mount HEADING flag M7 (119) to bracket (120) and secure mounting block (122) to display plate (132) with two screws (123) and two lockwashers (124).

(57) Mount main mask (72, 76) to unit with four spacers (77), two prism supports (71), two screws (78), and two screws (79).

(58) Check for proper gear mesh between gear on course counter (114) and mating gear on unit. Check for 0.015-inch (0.381-mm) minimum clearance between course counter and main mask (72, 76). Reposition course counter as required, and use shims (118) as required to obtain clearance and proper gear mesh.

(59) Insert tabs on top index (63) into slots in main mask (72, 76). Fold tabs over and liquid-stake.

(60) Mount and align airplane symbol (66) as follows:

(a) Install screw (69) and flat washer (70) to rear of display plate (132).

(b) Bend airplane tabs down. Thread lubber line wire (68) through hole in top of main mask (72, 76) and tie a knot in lubber line wire. Cut wire 1/32 inch (0.9938 mm) from end of knot. Thread airplane symbol (66) and index tube (67) on wire and route wire in notches at top and bottom

of main mask and in groove of screw (69). Tighten screw (69) and liquid-stake. Cut off excess wire. Liquid-stake index tube to wire to obtain maximum clearance from main mask.

(c) Align airplane symbol wings so they center with dots on deviation scale with deviation scale in horizontal position. Bend end tabs over to capture wire. Liquid-stake tabs to wire on underside, in the out-of-view area.

(d) Paint lubber line wire (68), top index (63), and index tube (67) with black lacquer.

(61) Loosen setscrews in gear that meshes with course counter gear. Align course counter (114) so 000 is in view when course arrow points to north (N). Liquid-stake and tighten setscrews.

(62) Mount GS flag meter M4 (95) to bracket (97) with two screws (96). Liquid-stake.

(63) Mount bracket (97) to bracket (112) with two screws (98) and two flat washers (99).

(64) Align GS flag meter M4 (95) to obtain the following clearances.

(a) GS flag and arm must clear all parts of the unit by 0.015 inch (0.381 mm) minimum at all points of travel.

(b) With GS flag in full in-view position, the left edge of the flag must clear the edge of the side mask by 0.0469 to 0.0781 inch (1.191 to 1.984 mm) and be parallel to the vertical edge of the side mask.

(c) Tighten meter mounting screws (98).

(65) Mount INS annunciator meter M6 (102) to bracket (105) with two screws (103) and two lockwashers (104).

(66) Mount bracket (105) to bracket (108, 113) with two screws (106) and two flat washers (107). Snug tighten screws.

(67) Align INS annunciator meter to obtain the following clearances.

(a) INS annunciator and arm must clear all parts of the unit by 0.015 inch (0.381 mm) minimum at all points of travel.

(b) With INS annunciator in full in-view position, the right edge of the annunciator must clear the edge of the side mask by 0.0469 to 0.0781 inch (1.919 to 1.984 mm) and be parallel to the vertical edge of the side mask.

(c) Tighten meter mounting screws (107).

(68) Mount GS pointer meter M3 (88) to plate (91) with two screws (89) and two flat washers (90). Snug tighten screws.

(69) Mount plate (91) to motor synchronizer assembly (212) with two screws (92) and two flat washers (93).

(70) Align GS pointer meter to obtain the following clearances. Use shims (94) as required.

(a) Clearance between GS pointer and raised GS scale reference marks is 0.015 inch (0.381 mm) minimum.

(b) With the GS pointer in 0 position, the pointer must be aligned with the center of the GS scale reference bar 0.010 inch (0.254 mm) either side of center.

(c) GS pointer tip must center on the four scale reference dots within 0.020 inch (0.508 mm).

(d) Clearance between GS flag and GS pointer is 0.010 inch (0.254 mm) minimum.

(e) Liquid-stake and tighten meter mounting screws.

(f) Adjust GS pointer meter balance nuts, as required, until the pointer deviation is NMT 0.030 inch (0.762 mm) either side of center with the instrument in the following positions: face vertical, top up; face vertical, top right; face vertical, top left; face vertical, top down; and face horizontal, face up.

(71) Plug distance readout (20) into distance readout assembly A1 (13), and secure to bracket with two screws (16), two lockwashers (17), and two flat washers (18).

(72) Secure distance readout assembly A1 (13) with two screws (14), one lockwasher (18), four screws (16, 16A), and two screws (15, 16A).

NOTE: Adjust bracket so digital readout (20) is within 0.050 inch (1.270 mm) of, to flush against rear of main mask, and centered in opening in mask. A gap is permissible between edge of digital readout and mask.

E. Synchro and Resolver Zeroing

(1) Remove four screws (54) securing rear cover (53) to unit. Carefully fold rear cover away from unit to gain access to synchro clamps.

(2) Azimuth Input Transolver B1 (250, IPL, fig 8)

(a) Apply 26 V, 400 Hz to J1-37 (H) and J1-38 (L).

(b) Connect a synchro simulator (0.0°) to J1-28 (X), J1-29 (Y), J1-30 (Z).

(c) Loosen B1 clamps (236, IPL, fig 8) and rotate B1 case until the 0° index (N) on the azimuth card is precisely aligned with the tip of the lubber line. Tighten clamps.

(d) Remove 26 V and synchro simulator from steps (a) and (b).

(3) Azimuth Comparator Differential Resolver B2 (246, IPL, fig 8).

(a) Apply 26 V, 400 Hz to J2-33 (H) and J2-34 (L). Connect J2-30 to J2-34.

(b) Connect a synchro simulator (0.0°) to J1-28 (X), J1-29 (Y), and J1-30 (Z), and adjust simulator to precisely align the 0° index (N) on the azimuth card with the tip of the lubber line.

(c) Connect a dvm between J2-33 and J2-28. Loosen B2 clamps (236, IPL, fig 8) and rotate B2 case to obtain 34 to 38 V ac. With simulator at 0°, adjust simulator in the direction of increasing numbers (cw). Dvm reading should increase before decreasing. If not, rotate B2 case 180° and repeat this step.

(d) Connect the dvm between J2-28 and J2-29. Return simulator to 0.0°. Carefully rotate B2 case for a null of 50 mV ac maximum. Tighten clamps.

(e) Remove 26 V ac, simulator, and jumper from steps (a) and (b).

(4) Heading Datum Control Transformer B5 (254, IPL, fig 8)

(a) Apply 26 V, 400 Hz to J2-42/J2-13 (H), J2-43/J2-12 (L). Connect J2-11 to J2-12.

NOTE: Synchro simulator 2 is required.

(b) Connect synchro simulator 1 (0.0°) to J1-28 (X), J1-29 (Y), and J1-30 (Z) and synchro simulator 2 to J2-14 (X), J2-15 (Y), and J2-16 (Z). Adjust simulator 2 or HDG knob until the heading marker is precisely aligned with the 270° index mark on the azimuth card.

(c) Connect a dvm between J2-13 and J2-9. Loosen B5 clamps (236, IPL, fig 8) and rotate B5 case to obtain 34 to 38 V ac. Starting at 270°, adjust simulator 2 or HDG knob in the direction of increasing numbers (cw). Dvm reading should increase before decreasing. If not, rotate B5 case 180° and repeat this step.

(d) Connect the dvm between J2-9 and J2-10. Adjust simulator 2 or HDG knob until the heading marker is precisely aligned with the 270° index

mark on the azimuth card. Carefully rotate B5 case for a null of 50 mV dc maximum. Tighten clamps.

(e) Remove 25 V ac, simulators, and jumper connected in steps (a) and (b).

(5) Heading Select Control Transformer B4 (253, IPL, fig 8)

(a) Apply 26 V, 400 Hz to J2-42 (H) and J2-43 (L).

(b) Connect synchro simulator 1 to J1-28 (X), J1-29 (Y), and J1-30 (Z) and simulator 2 (0.0°) to J2-14 (X), J2-15 (Y), and J2-16 (Z). Adjust simulator 1 to precisely align the 0° index (N) of the azimuth card under the lubber line.

(c) Loosen B4 clamps (236, IPL, fig 8) and rotate B4 case until the heading marker is precisely aligned with the 0° index on the azimuth card.

(d) Remove 26 V ac and simulator from steps (a) and (b).

(6) Course Select Input Control Transformer B7 (247, IPL, fig 8).

(a) Apply 26 V, 400 Hz to J2-42 (H) and J2-43 (L).

(b) Connect synchro simulator 1 to J1-28 (X), J1-29 (Y), and J1-30 (Z) and synchro simulator 2 to J2-45 (X), J2-46 (Y), and J2-47 (Z). Connect J2-51 to J2-18.

(c) Adjust simulator 2 to 0.0°; adjust simulator 1 to precisely align the 0° index (N) on the azimuth card with the lubber line.

(d) Loosen B7 clamps (236, IPL, fig 8) and rotate B7 case until the selected course arrow pointer is precisely aligned with the 0° index on the azimuth card. Tighten clamps.

(e) Remove simulator, 26 V ac, and connections from steps (a) and (b).

(7) Relative Course Input Control Transformer B14 (251, IPL, fig 8)

(a) Apply 26 V, 400 Hz to J2-42 (H) and J2-43 (L).

(b) Connect synchro simulator 1 to J1-28 (X), J1-29 (Y), and J1-30 (Z) and synchro simulator 2 to J2-48 (X), J2-49 (Y), and J2-50 (Z). Connect J2-51 to J2-17.

(c) Adjust simulator 2 to 0.0°; adjust simulator 1 to precisely align the 0° index (N) on the azimuth card with the lubber line.

(d) Loosen B14 clamps (236, IPL, fig 8) and rotate B14 case until the course arrow pointer is precisely aligned with the lubber line.

(e) Remove simulator, 26 V ac, and connections from steps (a) and (b).

(8) Course Datum Differential Resolver B6 (252, IPL, fig 8)

(a) Apply 26 V, 400 Hz to J2-42/J1-13 (H) and J2-43/J1-12 (L).

(b) Connect synchro simulator 1 to J1-28 (X), J1-29 (Y), and J1-30 (Z) and simulator 2 to J2-45 (X), J2-46 (Y), and J2-47 (Z). Connect J1-11 to J1-12. Adjust simulator 1 to 0.0°; adjust simulator 2 until the course arrow is precisely aligned with the 270° mark on the azimuth card.

(c) Connect a dvm between J1-13 and J1-9. Loosen B6 clamps (236, IPL, fig 8) and rotate B6 case to obtain 34 to 38 V ac. Starting at 270°, adjust simulator 2 in the direction of increasing numbers (cw). Dvm reading should increase before decreasing. If not, rotate B6 case 180° and repeat this step.

(d) Return simulator 2 to 270°. Connect the dvm between J1-9 and J1-10. Carefully rotate B6 case for a null of 50 mV ac maximum. Tighten clamps.

(e) Remove the simulators, 26 V ac, and connections from steps (a) and (b).

(9) Bearing Pointer Control Transformer B10 (246, IPL, fig 8)

(a) Apply 26 V, 400 Hz to J1-22 (H) and J1-23 (L).

(b) Connect synchro simulator 1 to J1-28 (X), J1-29 (Y), and J1-30 (Z) and simulator 2 to J1-25 (X), J1-26 (Y), and J1-27 (Z).

(c) Adjust simulator 1 to precisely align the 0.0° index (N) on the azimuth card with the lubber line. Adjust simulator 2 to 0.0°.

(d) Loosen B10 clamps (236, IPL, fig 8) and rotate case until the desired track symbol is precisely aligned under the lubber line. Tighten clamps.

(e) Remove the simulators and 26 V ac from steps (a) and (b).

(10) Course Resolver B8 (249, IPL, fig 8)

NOTE: Course select input control transformer B7 must be zeroed before course resolver B8 can be zeroed.

(a) Apply 26 V, 400 Hz to J1-1 (H) and J1-3 (L).

(b) Connect a synchro simulator to J2-45 (X), J2-46 (Y), and J2-47 (Z). Adjust simulator to 300°.

(c) Connect a dvm between J1-4 and J1-5. Loosen B8 clamps (249, IPL, fig 8) and rotate B8 case for maximum dvm reading (22 V ac minimum).

(d) Connect J1-3 to J1-4. Connect the dvm between J1-5 and J1-1. Dvm reading should be 40 V ac minimum. If not, check B8 wiring and stator winding 1.

(e) Adjust simulator to 30°. Remove 26 V from J1-1 (H), and connect to J1-2. Open J1-3, J1-4. Connect the dvm between J1-4 and J1-5. Dvm reading should be 22 V ac minimum. If not, check B8 wiring and rotor winding 2.

(f) Adjust simulator to 300°. Connect J1-3 to J1-6. Connect dvm between J1-2 and J1-7. Dvm reading should be 40 V ac minimum. If not, check B8 wiring and stator winding 2.

(g) Open J1-3, J1-6. Ensure course arrow is at 300.0°. Connect dvm between J1-4 and J1-5. Record dvm reading. Slowly adjust simulator cw and ccw, and note if dvm reading changes to less than the recorded value. If a lower reading is obtained, adjust simulator to 300.0°. Carefully rotate B8 case until the null is obtained. Tighten clamps.

(h) If compensation choke L3 (41, IPL, fig 1) was changed, the EZ-ORZ procedure must be performed to select the proper value for L3. Refer to figure 102, test 15 in the Testing section of this manual for the selection procedure.

(i) Remove simulator, 26 V ac, and connections from steps (a) through (g).

(11) Secure rear cover (53) to unit with four screws (54).

F. HSI-45 Horizontal Situation Indicator (IPL, fig 1)

(1) Clean inside of indicator case (7, 10) with a vacuum hose to remove all foreign material.

(2) Clean lighting wedge according to instructions contained in the Cleaning section of this manual.

(3) Loosen screws (58) securing lighting cover (57) to display plate (132). Install bottom edge of lighting wedge (11) into supports (71). Place lighting cover over lighting wedge and tighten screws (58). Bend spring clips (56) as required to hold wedge securely. Adjust lighting wedge to obtain 0.005- to 0.010-inch (0.0508- to 0.254-mm) clearance between lighting wedge and lubber line index (63).

(4) The instrument should now be tested completely in accordance with the Testing section of this manual. After completion of the test procedures, return to this section to complete the assembly procedures.

(5) Carefully slide indicator subassembly (12) into case (7, 10) and secure with four screws (8). Do not force subassembly into case.

(6) Using tape, seal case (7, 10) to rear cover completely around the unit.

5. Storage After Assembly

Ensure that all assemblies are secured to the chassis and that the equipment is installed in the dust cover. Place the equipment in the original shipping container, if available. Before storing the equipment, include sufficient desiccant to absorb any moisture and seal with tape.

At no time should the ambient temperature of the storage area fall outside the limits set forth in the equipment specification.

CAUTION: THE CONDUCTIVE CONNECTOR CAPS SHOULD BE INSTALLED WHENEVER THE UNITS ARE NOT IN USE; IE, IN STORAGE OR DURING SHIPMENT. WITHOUT CAPS, POSSIBLE ELECTROSTATIC DISCHARGE DAMAGE MAY OCCUR TO THE UNIT.

NOTE: To replace lost or misplaced caps, refer to illustrated parts list or ALL AIR TRANSPORT AVIONICS EQUIPMENT SIL 1-88 for Collins and other vendor part numbers.

FITS AND CLEARANCES

The fits and clearances to be observed for this equipment are indicated where applicable in the Assembly section of this manual.

SPECIAL TOOLS, FIXTURES, AND EQUIPMENT

Figure 901 lists the equipment used to test, troubleshoot, and overhaul the equipment. The figure is divided into two sections: standard equipment and special equipment. A representative type of each piece of standard equipment is listed. Special equipment includes that specifically designed for testing the HSI-45.

NOTE: Figure 906 lists the addresses for the manufacturers of the representative type test equipment specified in figure 901.

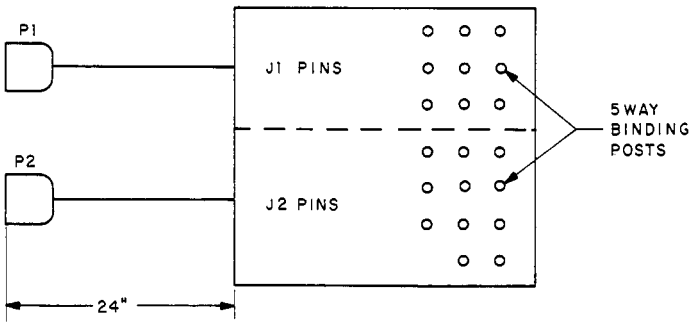
ITEM	APPLICABLE CHARACTERISTICS	REPRESENTATIVE TYPE
Digital voltmeter	31 V dc, 40 V ac	Fairchild 7000A or Fluke 8050
Ac vtvm (2 are needed, vtvm 1 and vtvm 2)	10 V ac. Must have an amplified ac output.	Ballantine 310
Ac power supply	26 V, 400 Hz, fixed	Invertron 351
Dc power supply (3 are needed)	0 to ±35 V, 0.3 A, variable	Kepco ABC-30-0.3M
Dc ammeter	0 to 5 mA	Any
Oscillator	30-Hz output	*Collins 479S-3 (CPN 505-4070-005)
Serial data bit generator	Conforms to ARINC Characteristics 561 and 568	*Collins 331A-8D BCD Distance Generator (CPN 779-6852-003)
Resolver zeroing panel	Compatible with resolvers in the HSI-45	*Collins 479X-2 (CPN 522-0167-001)
Synchro transmitter (3 are needed; synchro 1, syncrho 2, synchro 3)	Simulate gyro-compass signals (ARINC zeroed for zero index reference and positive rotation reference with dial resolution to 0.1°) NOTE: Excitation for the 978F-2S is 26 V ac, 400 Hz < 0 connected to the H and C jacks.	Collins 978F-2S (CPN 522-3498-000)

*ARINC zeroed for zero index reference and positive rotation reference with dial resolution to 0.1°.

Tools, Fixtures and Equipment
Figure 901 (Sheet 1 of 2)

ITEM	APPLICABLE CHARACTERISTICS	REPRESENTATIVE TYPE
Oscilloscope	Audio type, 10-V ac vertical input	Dumont 304
Meter tester	Compatible with HSI-45 meters and is adjustable ±250 μA	Minneapolis-Honeywell M2
Resistor	270Ω, 5W, 1%	Any
980L-1/1A	Universal test set	
440Y-23	Adapter for universal test set	
SPECIAL EQUIPMENT		
One-to-one breakout box	Provides a one-to-one connection with the pins of the HSI-45 J1 and J2	Fabricate per figure 902
Bcd distance generator cable	Connects the distance generator to the one-to-one breakout box	Fabricate per figure 903
Adapter box (used with 980L-1A/ 440Y-23 test set)	Connects the HSI-45 to the 440Y-23 test set	Fabricate per figures 904 and 905

Tools, Fixtures and Equipment
Figure 901 (Sheet 2)

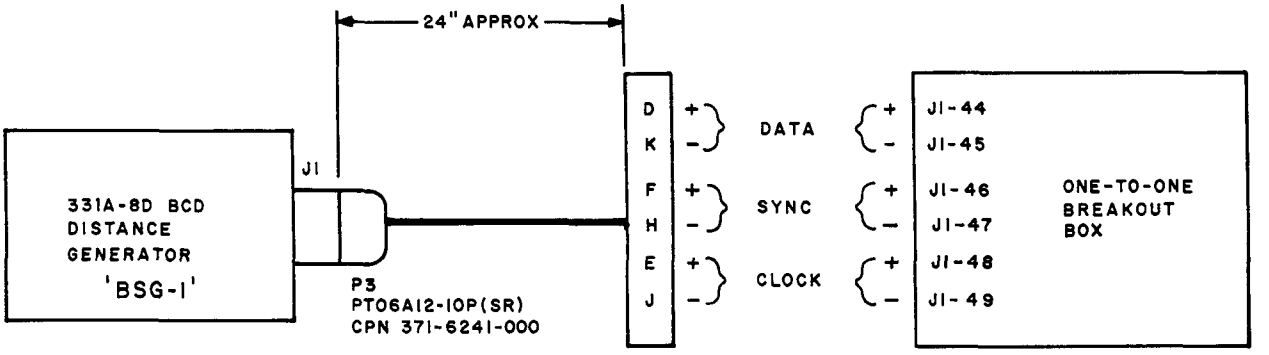


TP2-9317-012

Breakout Box
Figure 902 (Sheet 1 of 2)

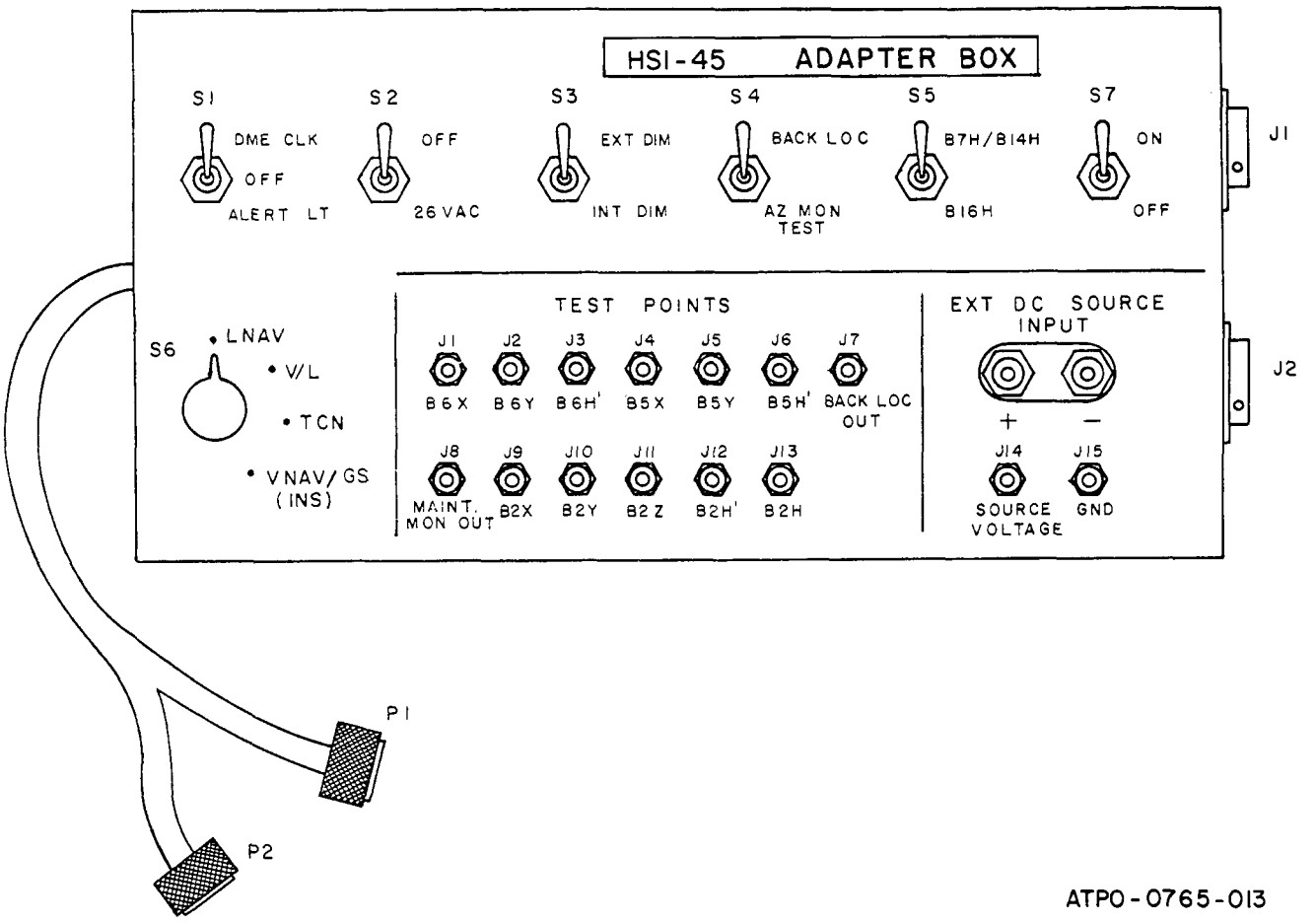
COMPONENT	QTY REQD	COLLINS PART NO	REMARKS
Connector, P2	1	359-4020-000	MS-24266R-22-B-55S9
Connector, P1	1	359-4019-000	MS-24266R-22-B-55S8
Chassis, aluminum	1		2 in h by 8 in w by 18 in l (approx)
5-way binding posts	110	372-1061-000	Mount in chassis on 1 in centers
Wire, #22 AWG	100 ft	Various	Wire from posts to P1 and P2 on a one-to-one basis. Mark corresponding connector pin on chassis.

Breakout Box
Figure 902 (Sheet 2)



TP3-2355-012

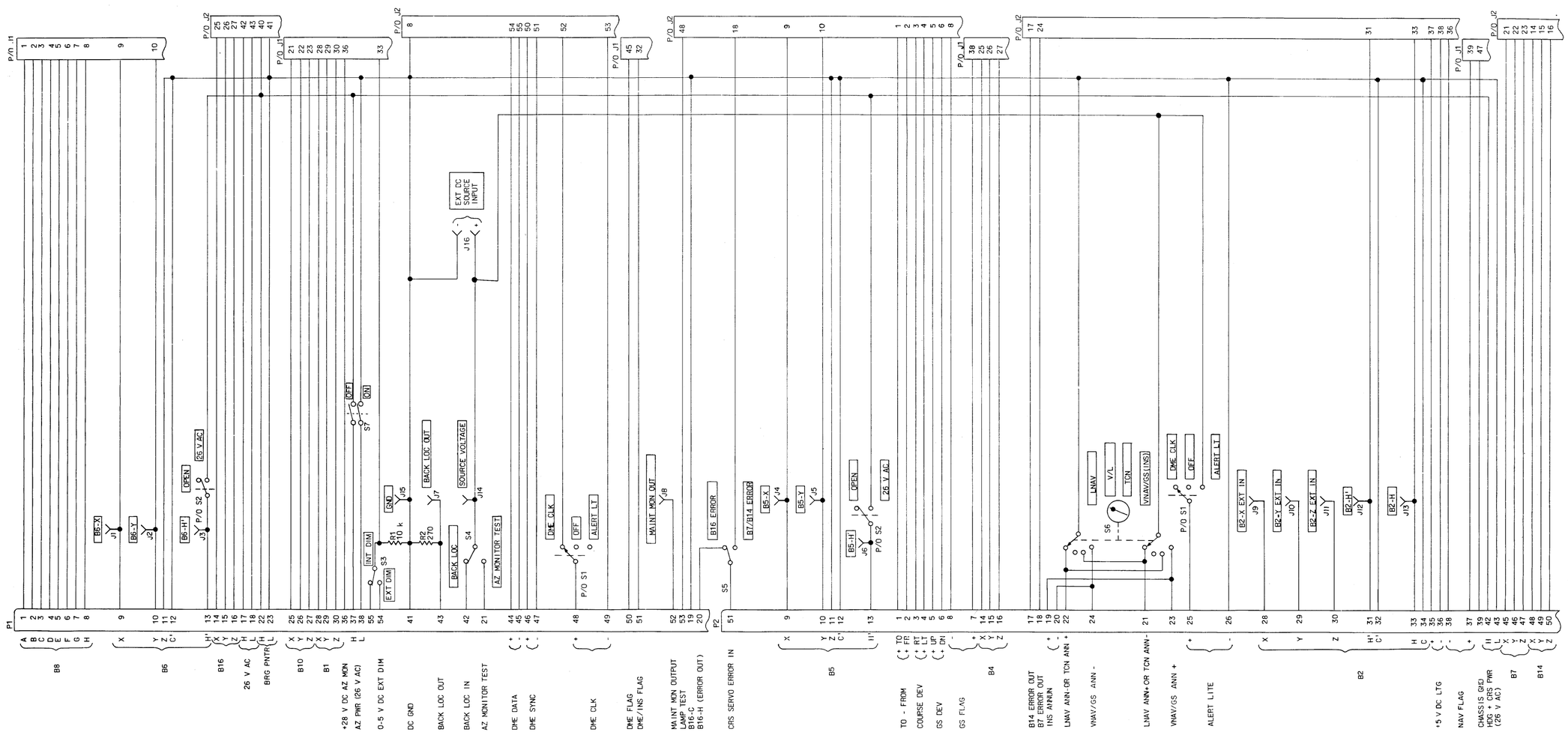
BCD Distance Generator Cable
Figure 903



ATPO-0765-013

SYMBOL	DESCRIPTION	PART NUMBER	QTY
J1-J13, J15	Jack, pin, black	360-0150-000	14
J14	Jack, pin, red	360-0150-000	1
J6	Jack, double-banana	360-2240-010	1
P1	Connector, 55-socket	359-4019-000 or 359-4095-940	1
P2	Connector, 55-socket	359-4020-000 or 359-4095-950	1
J1	Connector, 55-pin	359-4118-020	1
J2	Connector, 55-pin	359-4118-030	1
R1	Resistor, carbon, 10 kΩ, 10%, 1/2 W	745-1349-000	1
R2	Resistor, wire wound, 270 Ω 5%, 3W	747-5349-000	1
S1	Switch, 1P2T (with center off)	266-5321-160	1
S2, S7	Switch, 2P2T	266-5321-200	2
S3, S4, S5	Switch, 1P2T	266-5321-150	3
S6	Switch, rotary, 2 poles, 5 positions	259-9628-060	1

HSI-45 Adapter Box, Suggested Panel Layout and Parts List
Figure 904



NOTES:

1. P1 AND P2 MATE RESPECTIVELY WITH J1 AND J2 ON THE HSI-45
   J1 AND J2 MATE RESPECTIVELY WITH P1 AND P2 ON THE 4407-23 ADAPTER.
2. CONNECTOR P/N J1 359-4110-020, P1 359-4095-940.
   J2 359-4110-030, P2 359-4095-950.
3. WIRE SIZE: ALL WIRES ARE 20 AMG.

ATPO-0766-015

HSI-45 Adapter Box, Wiring Diagram
Figure 905

MANUFACTURER	
NAME	ADDRESS
Ballantine	Ballantine Laboratories, Inc. 9 Saddle Road Cedar Knolls, NJ 07927 TEL: (201) 984-1900 FAX: (201) 984-1479
Collins Air Transport Division	Rockwell International Corporation 400 Collins Road NE Cedar Rapids, IA 52498 TEL: (319) 395-5000
Dumont	Dumont Oscilloscopes E & R Electronics Inc. 40 Fairfield Place West Caldwell, NJ 07006 TEL: (201) 575-8666 TWX: 710-734-4308
Fluke	John Fluke Mfg. Company, Inc. P.O. Box 43210 Mount Lake, WA 98043 TEL: (206) 774-2211 TWX: 910-449-2850
Invertron	Invertron Inc. 23630 Industrial Park Dr. Farmington Hills, MI 48024 TEL: (303) 473-9250 FAX: (313) 473-9255
Kepco	Kepco Inc. 131-38 Sanford Ave. Flushing, NY 11352 TEL: (718) 461-7000 FAX: (718) 767-1102
Honeywell	Honeywell Test Instruments Div. P.O. Box 5227 Denver, CO 80217 TEL: (303) 773-4700

Test Equipment Manufacturers
Figure 906

ILLUSTRATED PARTS LIST

1. Introduction

The purpose of this parts list, prepared by Collins Air Transport Division of Rockwell International, is for identification, requisition, and issuance of parts. Parts listed meet critical equipment design specification requirements. Use only part numbers specified in this parts list for replacement of parts.

A. How To Use This Illustrated Parts List

To locate the illustration for a part if the equipment designator is known, refer to the Equipment Designator Index and find the equipment designator; turn to the Detailed Parts List and find the figure and index number indicated in the index.

To locate the illustration for a part if the part number is known, refer to the Numerical Index and find the part number. Turn to the Detailed Parts List and find the first figure and index number indicated in the Numerical Index for that part. If this figure shows the part in a section or system of the equipment other than the one desired, refer to the other figure numbers listed in the Numerical Index.

To locate a part number if the assembly in which the part is used is known, identify the illustration showing the breakdown of the assembly. Locate the part and its index number on the illustration and find the index number on the Detailed Parts List page to determine its description and part number.

B. Equipment Designator Index

EQUIPMENT DESIGNATOR Column — Equipment designators are listed in alphanumeric sequence.

FIG-ITEM Column — Digits preceding the dash refer to figure numbers. Digits following the dash are item numbers.

C. Numerical Index

PART NUMBER Column — Part numbers are listed in alphanumeric sequence.

AIRLINE PART NO Column — Part numbers will be included by the airlines as applicable.

FIG-ITEM Column — Digits preceding the dash refer to figure numbers. Digits following the dash are item numbers.

TTL REQ Column — Listed is the total quantity of parts or assemblies covered in the Detailed Parts List.

D. Detailed Parts List

FIG-ITEM Column — Digits preceding the dash refer to figure numbers. Digits following the dash are item numbers assigned in sequence to correspond with item numbers on the illustration.

PART NO Column — Listed are MIL standard, vendor, or Collins part numbers. Collins part numbering system consists of 10 digits as follows: a 3-digit family number, a 4-digit serial number, and a 3-digit dash number.

AIRLINE PART NO Column - Part numbers will be included by the airlines as applicable.

INDENT Column — Items are coded 1, 2, 3, etc, to indicate the relationship to the next higher assembly.

NOMENCLATURE Column — Listed are the noun name, modifier, descriptive information, federal manufacturer's code, attaching part, reference to other figures, and effectivities. Effectivities are identified by the following methods: MCN (Manufacturer Control Number) 101 and up; CI (Configuration Identifier) 5-digit number; REV (Revision Identifier) dash (—) denotes original, letter A first change, letter B second change, etc. One of the above identifiers is listed on each chassis and/or replaceable assembly. Service Bulletins are identified by SB 1, SB 2, etc.

EFFECT CODE Column — Part variations within a group of equipment are indicated by a letter code (A, B, C, etc). Absence of a code indicates part applies to all models.

UNITS PER ASSY Column — Quantities specified are per item number. Letters AR denote the selection of parts as required. Letters RF refer to an assembly completely assembled on a preceding figure and illustration.

E. Manufacturer's Code, Name, and Address

MFR CODE	MANUFACTURER'S NAME AND ADDRESS
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP 13500 N CENTRAL EXPRESSWAY P O BOX 225012 M/S 49 DALLAS TX 75265
02660	BUNKER RAMO CORP AMPHENOL NORTH AMERICA DIV 2801 S 25TH AVE BROADVIEW IL 60153
02995	OPPENHEIMER PRECISION PRODUCTS INC 2475 WYANDOTTE RD WILLOW GROVE PA 19090
03998	CONTROL DATA CORP MAGNETIC CONDUCTOR PRODUCTS DEPT 7801 COMPUTER AVE S MINNEAPOLIS, MN 55435
04099	CAPCO INC FORESIGHT INDUSTRIAL PARK P O BOX 2164 GRAND JUNCTION CO 81501
04713	MOTOROLA INC SEMICONDUCTOR GROUP 5005 E MCDOWELL RD PHOENIX AZ 85008
05411	DU PAGE MFG CO 2250 CURTISS AVE DOWNERS GROVE IL 60515

MFR CODE	MANUFACTURER'S NAME AND ADDRESS
05464	INDUSTRIAL ELECTRONIC ENGINEERS INC 7720 LEMONA AVE VAN NUYS CA 91405
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIV SUB OF SCHLUMBERGER LTD NORTH AMERICAN SALES MAIL STOP 14-1053 401 ELLIS ST P O DRAWER 7284 MOUNTAIN VIEW CA 94042
07388	TOROTEL PRODUCTS INC 13402 S 71 HWY GRANDVIEW MO 64030
08289	BLINN DELBERT CO INC THE 1678 E MISSION BLVD P O BOX 2007 POMONA CA 91766
08664	ACCO INDUSTRIES INC BRISTOL-BABCOCK DIV 40 BRISTOL ST WATERBURY CT 06708
10646	CARBORUNDUM CO THE P O BOX 337 NIAGARA FALLS NY 14302
12954	SIEMENS CORP COMPONENTS GROUP 8700 E THOMAS RD P O BOX 1390 SCOTTSDALE AZ 85252
13499	ROCKWELL INTERNATIONAL CORP COLLINS AIR TRANSPORT DIV 400 COLLINS ROAD NE CEDAR RAPIDS IA 52498
14099	SEMTECH CORP 652 MITCHELL ROAD NEWBURY PARK CA 91320
14433	ITT SEMICONDUCTOR DIV WEST PALM BEACH FL
18324	SIGNETICS CORP 811 E ARQUES SUNNYVALE CA 94086
21845	SOLITRON DEVICES INC SEMICONDUCTOR GROUP FLORIDA OPERS 1177 BLUE HERON BLVD RIVIERA BEACH FL 33404
26769	MEPCO/ELECTRA INC A NORTH AMERICAN PHILIPS COMPANY 5900 AUSTRALIAN AVE WEST PALM BEACH FL 33407
27014	NATIONAL SEMICONDUCTOR CORP 2900 SEMICONDUCTOR DR SANTA CLARA CA 95051
30464	GENERAL ELECTRIC CO LARGE STEAM TURBINE-GENERATOR DEPT 1 RIVER RD SCHENECTADY NY 12345
31433	UNION CARBIDE CORP ELECTRONICS DIV HWY 276 SE P O BOX 5928 GREENVILLE SC 29606
33005	AMERICAN GAGE AND MACHINE CO JEWELL ELECTRICAL INSTRUMENTS INC DIV GRENIER FIELD INDUSTRIAL PK MANCHESTER NH 03105
34333	SILICON GENERAL INC 11651 MONARCH ST GARDEN GROVE CA 92641
34335	ADVANCED MICRO DEVICES 901 THOMPSON PL SUNNYVALE CA 94086
40920	MINIATURE BEARING DIV MPB CORP OPTICAL AVE PRECISION PARK KEENE NH 03431
43334	GENERAL MOTORS CORP NEW DEPARTURE-HYATT BEARINGS DIV 2509 HAYES AVE SANDUSKY OH 44870
49956	RAYTHEON CO EXECUTIVE OFFICES 141 SPRING ST LEXINGTON MA 02173
51642	CENTRE ENGINEERING INC 2820 E COLLEGE AVE STATE COLLEGE PA 16801
54572	MONTEVIDEO TECHNOLOGY INC 204 N 4TH ST P O BOX 16 A MONTEVIDEO MN 56265
56289	SPRAGUE ELECTRIC CO 87 MARSHALL ST NORTH ADAMS MA 01247
57863	NORTH AMERICAN SPECIALTIES CORP 120-12 28TH AVE FLUSHING NY 11354

MFR CODE	MANUFACTURER'S NAME AND ADDRESS
65092	WESTON INSTRUMENTS DIV SANGAMO WESTON INC 614 FRELINGHUYSEN AVE NEWARK NJ 07114
70318	ALLMETAL SCREW PRODUCTS CO INC 821 STEWART AVE GARDEN CITY NY 11530
70674	ADC PRODUCTS DIV MAGNETIC CONTROLS CO 4900 WEST 78TH STREET MINNEAPOLIS MN 55435
71468	ITT CANNON ELECTRIC DIV OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORP 10550 TALBERT AVE P O BOX 8040 FOUNTAIN VALLEY CA 92708
72962	ESNA DIV OF AMERACE CORP 2330 VAUXHALL ROAD UNION NJ 07083
73957	GROOV-PIN CORP 1125 HENDRICKS CAUSEWAY RIDGEFIELD NJ 07657
74445	HOLO-KROME CO 31 BROOK ST WEST HARTFORD CT 06110
77147	PATTON-MACGUYER CO DIV OF AVID CORP 17 VIRGINIA AVE PROVIDENCE RI 02905
77250	ALLIED PRODUCTS CORP PHEOLL MFG CO DIV 5700 W ROOSEVELT RD CHICAGO IL 60650
79136	WALDES KOHINOOR INC 47-16 AUSTEL PLACE LONG ISLAND CITY NY 11101
79807	WROUGHT WASHER MFG INC 2100 S BAY ST MILWAUKEE WI 53207
79963	ZIERICK MFG CO RADIO CIRCLE MT KISCO NY 10549
80205	NATIONAL AEROSPACE STANDARD
80223	TRW INC TRW UNITED TRANSFORMER DIV 150 VARICK ST NEW YORK NY 10013
81030	INTERNATIONAL INSTRUMENTS DIVISION SIGMA INSTRUMENTS INC 88 MARSH HILL RD ORANGE CT 06477
81349	MILITARY SPECIFICATIONS
81350	JOINT ARMY NAVY
81483	INTERNATIONAL RECTIFIER 9220 SUNSET BLVD P O BOX 2321 TERMINAL ANNEX LOS ANGELES CA 90054
82386	SUN ELECTRIC CORP 6323 AVONDALE AVE CHICAGO IL 60631
82686	TRANSICOIL INC TROOPER RD WORCESTER PA 19490
83086	NEW HAMPSHIRE BALL BEARINGS INC RT 202 PETERBOROUGH NH 03458
83718	NATIONAL-STANDARD CO 601 N 8TH ST NILES MI 49120
86197	CLIFTON PRECISION DIV LITTON SYSTEMS INC MARPLE AT BROADWAY CLIFTON HEIGHTS PA 19018
88044	AERONAUTICAL STANDARD
88818	SINGER CO THE KEARFOTT DIV 1150 MCBRIDE AVE LITTLE FALLS NJ 07424
90123	ITT HARPER INC 8200 LEHIGH AVE MORTON GROVE IL 60053
91637	DALE ELECTRONICS INC P O BOX 609 COLUMBUS NE 68601
93108	DURALITH CORP 525 ORANGE ST MILLVILLE NJ 08332
93790	CORNELL-DUBILIER ELECTRONICS DIV FEDERAL PACIFIC ELECTRIC CO 1605 RODNEY FRENCH BLVD NEW BEDFORD MA 02741
96733	SAN FERNANDO ELECTRIC MFG CO 1501 FIRST ST SAN FERNANDO CA 91341

MFR CODE	MANUFACTURER'S NAME AND ADDRESS
96906	MILITARY STANDARD
98291	SEALECTRO CORP 225 HOYT MAMARONECK NY 10544
99932	POLY-SCIENTIFIC DIV LITTON SYSTEMS INC 1213 MAIN N BLACKSBURG VA 24060
A0473	AVERY LABEL COMPANY INC DIVISION OF AVERY PRODUCTS INC PEORIA IL 61611

F. Equipment Designator Prefixes

PREFIX	UNIT PART NUMBER	FIG-ITEM
A1	638-2777-001	2-1
A3	638-2774-001	4-1
A4	638-2775-001	5-1
A5	638-2782-001	3-1
A6	638-2772-001	6-1
A6	652-0037-001	9-1
A7	647-6816-001	10-1

G. Configuration Identifiers

CI/REV LTR	UNIT PART NUMBER	FIG-ITEM
D	622-4298-001	1-1
L	638-2788-001	1-12
F	638-2777-001	2-1
—	638-2782-001	3-1
C	638-2774-001	4-1
B	638-2775-001	5-1
B	638-2772-001	6-1
B	638-2786-001	7-1
—	638-2785-001	8-1
C	652-0037-001	9-1
B	647-6816-001	10-1

H. Service Bulletins

SB NUMBER	SIL NUMBER
SB 1 (Superseded by SB 2)	
SB 2	

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A1CR10	2-126	A1R12	2-56	A1R59	2-78
A1CR11	2-127	A1R13	2-18	A1R6	2-62
A1CR12	2-128	A1R14	2-65	A1R60	2-77
A1CR13	2-124	A1R15	2-68	A1R61	2-84
A1CR14	2-130	A1R16	2-67	A1R62	2-85
A1CR15	2-131	A1R17	2-48	A1R64	2-5
A1CR16	2-132	A1R18	2-69	A1R65	2-114
A1CR17	2-133	A1R19	2-47	A1R66	2-43
A1CR18	2-129	A1R2	2-50	A1R67	2-42
A1CR19	2-112	A1R20	2-55	A1R7	2-64
A1CR2	2-137	A1R21	2-9	A1R8	2-59
A1CR20	2-75	A1R22	2-10	A1R9	2-57
A1CR21	2-79	A1R23	2-11	A1U1	2-122
A1CR22	2-86	A1R24	2-40	A1U10	2-113
A1CR23	2-82	A1R25	2-13	A1U12	2-107
A1CR24	2-83	A1R26	2-14	A1U13	2-105
A1CR3	2-134	A1R27	2-12	A1U14	2-148
A1CR4	2-16	A1R28	2-39	A1U15	2-109
A1CR7	2-4	A1R29	2-102	A1U16	2-108
A1CR8	2-3	A1R3	2-51	A1U17	2-106
A1CR9	2-125	A1R30	2-44	A1U18	2-104
A1C1	2-100	A1R31	2-46	A1U19	2-25
A1C11	2-98	A1R32	2-101	A1U2	2-121
A1C12	2-91	A1R33	2-15	A1U2	2-121
A1C13	2-94	A1R34	2-103	A1U20	2-27
A1C14	2-96	A1R35	2-135	A1U21	2-28
A1C15	2-70	A1R36	2-2	A1U22	2-90
A1C16	2-92	A1R37	2-41	A1U23	2-93
A1C17	2-73	A1R38	2-7	A1U24	2-95
A1C19	2-158	A1R39	2-8	A1U25	2-97
A1C2	2-20	A1R4	2-53	A1U26	2-99
A1C3	2-30	A1R40	2-143	A1U27	2-24
A1C4	2-54	A1R41	2-144	A1U28	2-22
A1C5	2-60	A1R42	2-147	A1U29	2-23
A1C6	2-66	A1R43	2-142	A1U3	2-123
A1C7	2-6	A1R44	2-139	A1U3	2-123
A1C8	2-38	A1R45	2-111	A1U30	2-26
A1Q1	2-19	A1R46	2-141	A1U31	2-29
A1Q2	2-37	A1R47	2-140	A1U32	2-35
A1Q3	2-145	A1R48	2-32	A1U33	2-21
A1Q4	2-146	A1R49	2-33	A1U34	2-36
A1Q5	2-136	A1R5	2-49	A1U35	2-17
A1Q6	2-138	A1R50	2-45	A1U37	2-110
A1Q7	2-31	A1R51	2-74	A1U4	2-119
A1Q8	2-87	A1R52	2-80	A1U5	2-120
A1Q9	2-34	A1R54	2-71	A1U5	2-120
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A1U9	2-115	A5CR2	3-8	A6U4	6-6
A3	1-34	A5CR3	3-5	A6VR1	6-50
A3	4-1	A5CR4	3-6	A7	1-37C
A3CR1	4-9	A5CR5	3-3	A7	10-1
A3CR2	4-2	A5CR6	3-9	A7C1	10-5
A3C1	4-6	A5CR7	3-11	A7C10	10-31
A3C2	4-8	A5C3	3-12	A7C13	10-5
A3C3	4-5	A5C4	3-13	A7C14	10-5
A3C4	4-3	A5C5	3-15	A7C15	10-5
A3C5	4-11	A5C6	3-14	A7C16	10-33
A3C6	4-12	A5R1	3-10	A7C17	10-31
A3C7	4-7	A5R2	3-2	A7C2	10-33
A3C8	4-4	A5R3	3-4	A7C20	10-5
A3R2	4-10	A6	1-37	A7C21	10-5
A3R4	4-13	A6	1-37	A7C22	10-5
A4	1-35	A6	6-1	A7C23	10-33
A4	5-1	A6	9-1	A7C24	10-31
A4CR3	5-12	A6CR1	9-34	A7C27	10-5
A4CR4	5-14	A6C2	6-40	A7C28	10-5
A4CR5	5-26	A6C3	6-41	A7C3	10-31
A4CR6	5-31	A6C4	6-39	A7C6	10-5
A4C1	5-13	A6C5	6-30	A7C7	10-5
A4C2	5-16	A6C6	6-29	A7C8	10-5
A4C3	5-3	A6C7	6-28	A7C9	10-33
A4Q1	5-22	A6C8	6-19	A7Q1	10-13
A4Q2	5-20	A6C9	6-18	A7Q2	10-13
A4Q3	5-21	A6Q1	6-20	A7Q3	10-13
A4Q4	5-27	A6Q1	9-3	A7Q4	10-13
A4Q5	5-29	A6Q2	6-31	A7Q5	10-13
A4Q6	5-32	A6Q2	9-3	A7Q6	10-13
A4R1	5-9	A6R1	6-2	A7Q7	10-13
A4R10	5-7	A6R1	9-33	A7Q8	10-13
A4R11	5-4	A6R10	6-48	A7R1	10-3
A4R12	5-28	A6R11	6-5	A7R10	10-7
A4R13	5-30	A6R11	9-33	A7R11	10-9
A4R14	5-2	A6R12	6-4	A7R12	10-3
A4R2	5-10	A6R12	9-31	A7R13	10-3
A4R3	5-11	A6R14	9-33	A7R14	10-11
A4R4	5-23	A6R2	6-3	A7R15	10-35
A4R5	5-24	A6R2	9-31	A7R16	10-11
A4R6	5-19	A6R3	6-43	A7R17	10-9
A4R7	5-18	A6R4	6-42	A7R18	10-11
A4R8	5-15	A6R5	6-45	A7R19	10-11
A4R9	5-5	A6R6	6-44	A7R2	10-3
A4T1	5-6	A6R7	6-47	A7R20	10-27
A4VR1	5-8	A6R8	6-46	A7R21	10-7
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A7R25	10-11	A7R9	10-47	T2	1-209
A7R26	10-35	A7U1	10-47	T2	1-209
A7R27	10-11	A7U2	10-47	T2	1-209
A7R28	10-9	A7U3	10-47	T2	1-209
A7R29	10-11	A7U4	10-47	T2	1-209
A7R3	10-11	A7VR1	10-47	T2	1-209
A7R30	10-11	A7VR10	10-47	T2	1-209
A7R31	10-27	A7VR11	10-47	T2	1-209
A7R32	10-7	A7VR12	10-47	T2	1-209
A7R33	10-9	A7VR2	10-47	T2	1-209
A7R34	10-3	A7VR3	10-47	T2	1-209
A7R35	10-3	A7VR4	10-47	T2	1-209
A7R36	10-11	A7VR5	10-47	T2	1-209
A7R37	10-35	A7VR6	10-47	T2	1-209
A7R38	10-11	A7VR7	10-47	T2	1-209
A7R39	10-9	A7VR8	10-47	T2	1-209
A7R4	10-35	A7VR9	10-47	T2	1-209
A7R40	10-11	A8	1-47	T2	1-209
A7R41	10-11	B1	8-47	T2	1-209
A7R42	10-27	B10	8-246	T2	1-209
A7R43	10-7	B14	8-251	T2	1-209
A7R44	10-9	B2	8-248	T2	1-209
A7R45	10-17	B4	8-253	A7R39	10-9
A7R46	10-15	B5	8-254	A7R39	10-9
A7R47	10-17	B6	8-252	A7R39	10-9
A7R48	10-15	B7	8-247	A7R39	10-9
A7R49	10-17	B8	8-249	A7R39	10-9
A7R5	10-11	DS1-DS6	1-62	A7R39	10-9
A7R50	10-15	E1	7-15	A7R39	10-9
A7R51	10-17	J1	1-49	A7R39	10-9
A7R52	10-15	J2	1-48	A7R39	10-9
A7R53	10-17	L3	1-41	A7R39	10-9
A7R54	10-15	L3	1-41A	A7R39	10-9
A7R55	10-17	L3	1-41B	A7R39	10-9
A7R56	10-15	L3	1-41C	A7R39	10-9
A7R57	10-17	L3	1-41D	A7R39	10-9
A7R58	10-15	MG1	8-33	A7R39	10-9
A7R59	10-17	MG2	8-91	A7R39	10-9
A7R6	10-9	MG3	8-72	A7R39	10-9
A7R60	10-15	MG4	8-52	A7R39	10-9
A7R61	10-41	M1	7-6	A7R39	10-9
A7R62	10-43	M2	7-11	A7R39	10-9
A7R63	10-37	M3	1-88	A7R39	10-9
A7R64	10-39	M3	1-88	A7R39	10-9
A7R65	10-23	M4	1-95	A7R39	10-9
A7R66	10-25	M5	7-5	A7R39	10-9
A7R67	10-47	M6	1-102	A7R39	10-9
A7R68	10-47	P1	1-26	A7R39	10-9

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A7R39	10-9				
A7R39	10-9				
A7R39	10-9				
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AN565D4L2		1-167	2
		1-176	2
CDSH8DZ2L503		8-252	1
CD5EY300J0		2-54	1
		2-60	1
		2-66	1
CK05BX103K		2-158	1
CK05BX104K		2-70	1
		2-73	1
		2-92	1
CK05BX223K		2-20	1
CK05BX473K		2-100	1
CK05BX681K		2-30	1
CK06BX334K		10-5	12
CM41005012		8-248	1
CRC-1-530		4-11	1
		4-12	1
CSDH8BQ2L607		8-250	1
DM54164J		2-90	1
		2-113	1
		2-117	1
DM74126N		2-118	1
		2-120	1
		2-121	1
		2-123	1
DR230		5-6	1
IEE715ASP15PCTM1 5PCT		1-62	6
JAN1N3027B		2-75	1
JAN1N748A		2-86	1
LM148J		10-29	4
LM3302N		2-17	1
		2-99	1
MC5438L		2-105	1
		2-107	1
MD1-9SH001		1-19D	4
		2-152	4
MS16555-601		7-28	1
		8-117	1
		8-145	2
MS16624-5018		8-215	1
		8-223	1
MS16624-5021		8-168	1
		8-175	AR
		8-181	1
		8-187	1
		8-193	1
		8-200	1
		8-207	1
MS16632-1012		1-201	2
		8-16	1
		8-22	1
		8-121	2
		8-131	2
		8-134	
		8-138	1
		8-156	1
		8-229	1
MS16632-1018		1-166	2
		1-175	1
		8-157	1
MS16632-1018		8-230	1
MS16632-1025		7-25	2
MS16633-1006		1-19C	2
		2-150	2
MS16997-3		1-19J	2
		2-157	2
MS20426AD2-5		8-143	2
MS35198-9		1-79	2
MS35215-3		7-12	2
MS35338-134		1-6	2
		1-17	2
		1-25	2
		1-36C	2
		1-37B	4
		1-40	3
		1-59	2
		1-111	4
		1-116	3
		1-124	2
		1-135	4
		1-139A	3
		8-10	1
		8-25	2
		8-30	3
		8-35	2
		8-38	2
		8-54	2
		8-58	2
		8-74	2
		8-77	2
		8-93	2
		8-96	2
		8-116	1
		8-141	1
		8-153	1
		8-226	1
		8-238	16
		8-257	3
MS35338-135		8-242	2
		9-7	4
		9-23	2
MS35649-224		6-7	1
		6-10	1
MS51923-112		8-125	1
MS51923-113		1-205	1
MS51957-13		1-54	4
MS51957-14		1-52	8
		1-210	2
		8-241	2
		9-29	2
MS51957-15		9-17	4
MS51957-2		1-16	4
		1-39	6
		1-58	2
		1-109	8
		1-133	3
		1-139	3
		8-4	8
		8-152	1
		8-225	1
MS51957-3		1-5	2
		1-14	2

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		1-36	7
		1-36B	2
		1-37A	4
		1-45	1
		1-92	2
		1-123	2
		1-134	1
		8-9	1
		8-24	4
		8-115	1
		8-140	1
MS51957-4		1-16B	2
		1-97B	2
		1-105A	2
		8-29	3
MS51957-6B		1-78	2
MS51957-82		6-26	1
		6-37	1
MS51957-9		8-34	2
		8-53	2
		8-73	2
		8-92	2
MS51959-13		8-240	2
		8-245	2
MS51959-2		1-8	4
		1-98	2
		1-106	2
		1-131	4
		8-21	1
		8-45	2
		8-65	2
		8-84	2
		8-103	2
MW-375-118		9-25	2
M39003-01-2117		2-6	1
M39003-01-2217		6-18	1
		6-19	1
		6-28	1
		6-29	1
		6-30	1
		6-39	1
		6-40	1
		6-41	1
M39006-21-0043		2-91	1
		2-94	1
		2-96	1
M39006/09-8118		2-98	1
M39014/22-0176		10-33	4
M39014/22-0194		10-31	4
M45938/5-1		1-21	1
		1-46	4
		6-53	6
		8-144	1
		9-43	4
M45938/5-2		1-112	2
NAS620C4L		9-15	6
NAS67C4		9-5	4
		9-21	2
P313-0050-000		7-16	2
P313-0132-000		1-50	8
		6-13	1
P313-0132-000		6-16	1
		6-23	2
		6-34	2
P320-0010-000		7-8	4
		7-22	4
P321-0289-00		1-16A	1
		1-69	2
		1-142	2
		1-144	2
P321-0292-000		1-15	1
P322-0149-000		1-65	2
P322-0151-000		7-9	4
P322-0159-000		1-96	2
		1-103	2
P322-0161-000		1-81	4
		1-83	1
P323-0124-00		1-20B	1
P330-2284-000		8-27	2
P330-5003-010		1-83A	3
P343-0287-000		6-27	1
		6-38	1
P343-0299-000		1-89	2
		7-19	2
P343-0300-000		7-18	2
P343-0330-000		1-42	1
P347-0006-000		1-121	1
P347-0022-000		8-237	16
P347-0023-000		1-115	3
P347-0024-000		8-37	2
		8-57	2
		8-76	2
		8-95	2
		8-256	3
RCR05G102JS		5-24	1
		5-30	1
RCR05G102KS		2-135	1
RCR05G103KS		2-5	1
		2-42	1
		2-43	1
		2-62	1
RCR05G106KS		2-114	1
RCR05G122KS		10-15	8
RCR05G154KS		2-84	1
RCR05G185KS		5-2	1
RCR05G272KS		2-32	1
		2-39	1
		2-40	1
		2-41	1
		2-47	1
		2-48	1
		2-55	1
		2-101	1
RCR05G273KS		2-9	1
		2-10	1
		2-11	1
		2-12	1
		2-14	1
		2-15	1
		2-33	1
		2-44	1
		2-46	1
		2-102	1

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RCR05G331KS		2-2	1
RCR05G393KS		2-139	1
		2-140	1
		2-142	1
		2-143	1
RCR05G394KS		2-7	1
RCR05G471KS		2-81	1
RCR05G514JS		10-3	8
RCR05G515JS		2-8	1
RCR05G560KS		2-85	1
RCR05G563JS		5-15	1
RCR05G563KS		2-103	1
RCR05G681KS		2-111	1
		2-141	1
		2-144	1
		2-147	1
RCR05G682JS		5-18	1
RCR07G100KS		2-74	1
RCR07G101KS		5-19	1
RCR07G122KS		10-17	8
RCR07G222KS		10-7	4
RCR07G562KS		5-7	1
		5-28	1
RCR07G682KS		5-23	1
RCR20G100KS		4-10	1
		4-13	1
RCR32G390JS		2-13	1
RCR32G471KS		2-80	1
RG80D		2-22	1
RNF-100 3/16IN B LK		8-148	1
RN55D1001F		6-44	1
		10-25	1
RN55D1002F		2-49	1
		2-50	1
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		2-53	1
		2-56	1
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		2-65	1
		2-68	1
		2-69	1
		5-4	1
		5-5	1
		6-3	1
		6-4	1
		9-31	2
		10-11	16
RN55D1211F		6-46	1
		10-43	1
RN55D1212F		2-51	1
		2-58	1
		2-67	1
RN55D1471F		6-42	1
		10-39	1
RN55D1781F		6-48	1
		10-45	1
RN55D2151F		2-72	1
RN55D2871F		6-43	1
		10-37	1
RN55D3481F		2-18	1
RN55D3651F		2-77	1
RN55D4221F		2-71	1
		6-47	1
		10-41	1
RN55D4641F		6-49	1
		10-47	1
RN55D5111F		2-45	1
		5-9	1
RN55D5492F		10-35	4
RN55D5621F		5-11	1
		6-45	1
		10-23	1
RN55D5900F		2-78	1
RN55D7502F		5-10	1
RN55D8662F		10-27	4
RN60D5111F		6-2	1
		6-5	1
		9-33	3
RN60D6491F		3-2	1
		3-4	1
		3-10	1
RS12X000ER7500H		2-89	1
RS1887		2-31	1
		2-34	1
RW70UR511F		2-76	1
R1363-010		3-12	1
		3-13	1
		3-14	1
		3-15	1
SC12240P		2-110	1
SC5615		4-2	1
		4-9	1
SFR1PPK25-26		8-49	1
		8-88	1
		8-107	1
SFR1445K25-26		8-129	1
		8-132	2
		8-136	1
SG723J		2-95	1
		2-97	1
SK086925-3		1-20	1
SN54L00J		2-23	1
		2-28	1
		2-35	1
SN54L02J		2-26	1
		2-27	1
		2-104	1
		2-109	1
SN54L04J		2-108	1
SN54L10J		2-25	1
		2-36	1
SN54L30J		2-93	1
SN5402J		2-106	1
SN5474J		2-24	1
SN5475J		2-115	1
		2-116	1
		2-119	1
		2-122	1
S3FC3P15LY5		8-43	3

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		8-63	3
		8-69	2
		8-82	3
		8-89	2
		8-101	3
		8-108	2
S3332FCE3P25LY5		1-126	32
S3332FCP25LY5		8-135	1
S4FCHH3P15LY5		1-149	1
		1-153	1
		1-159	1
S418CE3P25LY5		1-188	1
		1-198	1
S418C3P15LY5		1-186	1
		1-196	1
S418FCHH3P15LY5		1-182	1
		1-191	1
		1-192	1
		1-199	1
S418FC3P15LY5		1-208	2
S5400F/883C		2-21	1
S5632FC3P15LY5		1-164	1
		1-172	1
		1-173	1
		1-181	1
S614FC3P15LY5		7-26	2
		8-31	1
TA-2402-A		6-25	1
		6-36	1
		9-11	2
TSH11F08A049		8-249	1
U216505		8-39	1
		8-59	1
		8-78	1
		8-97	1
002-3402-000599		3-17	15
		6-52	47
		9-41	4
004-3401-000599		3-18	12
		6-54	6
		8-118	2
		9-39	19
014-2402-000599		9-37	2
015-1812-000		7-15	1
015-3196-010		7-24	1
0550F5-256		2-88	1
1N4002		5-12	1
		5-14	1
		5-26	1
		5-31	1
1N4003		2-16	1
		2-134	1
		2-137	1
1N4106		10-19	4
1N4454-1		2-3	1
		2-4	1
		2-82	1
		2-83	1
		2-112	1
		2-124	1
		2-125	1
1N4454-1		2-126	1
		2-127	1
		2-128	1
		2-129	1
		2-130	1
		2-131	1
		2-132	1
		2-133	1
1N4620		10-21	8
1N4622		2-63	1
1N5339B		2-79	1
1N5415		3-5	1
		3-6	1
		3-7	1
		3-8	1
1N746A		3-3	1
		3-9	1
		3-11	1
1N753A		6-50	1
		9-34	1
1N965B		5-8	1
		5-17	1
12393B		1-41	1
12395B		1-41A	1
12398B		1-41B	1
12399B		1-41C	1
12408B		1-41D	1
152-3583-000		8-148	1
183-1277-020		4-3	1
		4-4	1
		4-5	1
		4-6	1
		4-7	1
		4-8	1
184-7398-000		5-13	1
		5-16	1
184-7401-000		5-3	1
184-9084-440		2-6	1
184-9085-760		6-18	1
		6-19	1
		6-28	1
		6-29	1
		6-30	1
		6-39	1
		6-40	1
		6-41	1
184-9103-830		2-98	1
184-9116-050		2-91	1
		2-94	1
		2-96	1
2N2222A		2-19	1
		2-37	1
		2-87	1
		2-136	1
		2-138	1
		2-145	1
		2-146	1
		5-20	1
		5-22	1
		5-27	1
		5-29	1
		10-13	8

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2N2907A		5-21	1
2N3054-122		6-20	1
		6-31	1
		9-3	2
2N4029		5-32	1
229-0091-010		8-252	1
229-0178-000		8-249	1
229-0194-000		8-246	1
		8-251	1
229-2050-010		8-39	1
		8-59	1
		8-78	1
		8-97	1
229-5022-010		8-247	1
		8-253	1
		8-254	1
229-6026-030		8-250	1
229-7031-010		8-248	1
240-0279-000		1-41	1
240-0281-000		1-41A	1
240-0284-000		1-41B	1
240-0285-000		1-41C	1
240-0294-000		1-41D	1
262-1095-000		1-62	6
262-1302-010		1-20	1
280-3441-000		1-3	1
280-3778-010		1-2	1
3-18514		1-209	1
300-050-601-474M		2-38	1
302-0640-080		9-25	2
304-0015-000		6-22	1
		6-33	1
		9-9	2
304-1089-000		8-243	1
		9-19	3
305-1354-000		8-143	2
306-0788-010		9-37	2
306-2222-100		3-18	12
		6-54	6
		8-118	2
		9-39	19
306-2474-010		3-17	15
		6-52	47
		9-41	4
309-0003-010		1-126	32
309-0783-000		8-49	1
		8-88	1
		8-107	1
309-0832-000		8-129	1
		8-132	2
		8-136	1
309-1216-020		1-188	1
		1-198	1
309-1557-000		8-43	3
		8-50	3
		8-63	3
		8-69	2
		8-82	3
		8-89	2
		8-101	3
		8-108	2
309-1561-000		1-208	2
309-1563-000		1-164	1
		1-172	1
		1-173	1
		1-181	1
309-1565-000		7-26	2
		8-31	1
309-1846-000		1-186	1
		1-196	1
309-1856-000		8-70	1
309-1859-000		8-135	1
309-1977-030		1-149	1
		1-153	1
		1-159	1
309-1977-050		1-182	1
		1-191	1
		1-192	1
		1-199	1
310-0078-000		1-43	1
310-0129-000		1-36D	2
		1-90	2
		7-13	2
		7-17	4
310-0275-000		1-6	2
		1-17	2
		1-25	2
		1-36C	2
		1-37B	4
		1-40	3
		1-59	2
		1-111	4
		1-116	3
		1-124	2
		1-135	4
		1-139A	3
		8-10	1
		8-25	2
		8-30	3
		8-35	2
		8-38	2
		8-54	2
		8-58	2
		8-74	2
		8-77	2
		8-93	2
		8-96	2
		8-116	1
		8-141	1
		8-153	1
		8-226	1
		8-238	16
		8-257	3
310-0278-000		6-8	1
		6-11	1
		6-14	1
		6-17	1
		6-24	2
		6-35	2
310-0279-000		8-242	2
		9-7	4
		9-23	2
310-0297-000		1-51	8
		1-211	2

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PART NUMBER	AIRLINE PART NO	FIG-ITEM	TTL REQ	PART NUMBER	AIRLINE PART NO	FIG-ITEM	TTL REQ
310-0550-000		1-70	2	333-0837-000		1-21	1
310-0740-200		9-15	6			1-46	4
310-6320-000		1-18	3			6-53	6
		1-19H	4			8-144	1
		1-60	2			9-43	4
		1-93	2	333-0838-000		1-112	2
		1-99	2	335-0120-000		8-164	1
		1-107	2			8-170	1
		1-117	3			8-177	1
		1-136	3			8-183	1
		1-139B	3			8-189	1
		2-156	4			8-195	1
		8-5	8			8-202	1
		8-11	1			8-217	1
		8-26	2	335-0121-000		1-152	2
		8-116A	1			1-156	2
		8-154	1			1-158	2
		8-227	1			1-184	4
311-0261-000		1-169	1			1-194	2
		1-178	1			8-112	2
311-0431-000		8-125	1	340-0004-000		8-215	1
311-0432-000		1-205	1			8-223	1
311-1624-000		7-28	1	340-0098-000		1-19C	2
		8-117	1			2-150	2
		8-145	2	340-0112-000		1-201	2
313-0037-000		6-7	1			8-16	1
		6-10	1			8-22	1
313-0050-000		7-16	2			8-121	2
313-0132-000		1-50	8			8-131	2
		6-13	1			8-134	
		6-16	1			8-138	1
		6-23	2			8-156	1
		6-34	2			8-229	1
		9-5	4	340-0113-000		1-166	2
		9-21	2			1-175	1
320-0010-000		7-8	4			8-157	1
		7-22	4			8-230	1
321-0289-000		1-16A	1	340-0114-000		7-25	2
		1-69	2	340-0275-000		1-129	4
		1-142	2	340-0504-000		8-168	1
		1-144	2			8-175	AR
321-0292-000		1-15	1			8-181	1
321-0413-000		1-101	2			8-187	1
322-0149-000		1-65	2			8-193	1
322-0151-000		7-9	4			8-200	1
322-0159-000		1-96	2			8-207	1
		1-103	2	342-0044-000		8-240	2
322-0161-000		1-81	4			8-245	2
		1-83	1	342-0132-000		1-8	4
323-0124-000		1-20B	1			1-98	2
324-2601-000		1-19J	2			1-106	2
		2-157	2			1-131	4
328-0368-000		8-122	4			8-21	1
328-0369-000		1-202	2			8-45	2
328-0371-000		1-167	2			8-65	2
		1-176	2			8-84	2
330-2284-000		8-27	2			8-103	2
330-5003-010		1-83A	3	342-0866-000		1-79	2
333-0347-000		6-27A	1	343-0123-000		1-16	4
		6-38A	1			1-39	6
333-0604-000		1-19G	2			1-58	2
		2-155	2			1-109	8

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343-0123-000		1-133	3	351-7365-140		2-23	1
		1-139	3			2-28	1
		8-4	8			2-35	1
		8-152	1	351-7365-170		2-108	1
		8-225	1	351-7365-180		2-25	1
343-0124-000		1-5	2			2-36	1
		1-14	2	351-7365-200		2-93	1
		1-24	2	351-7389-020		2-21	1
		1-36	7	351-7490-010		2-90	1
		1-36B	2			2-113	1
		1-37A	4			2-117	1
		1-45	1	351-7528-030		2-118	1
		1-92	2			2-120	1
		1-123	2			2-121	1
		1-134	1			2-123	1
		8-9	1	351-7606-020		2-24	1
		8-24	4	351-7678-010		2-106	1
		8-115	1	351-7679-010		2-148	1
		8-140	1	351-7680-010		2-115	1
343-0125-000		1-16B	2			2-116	1
		1-97B	2			2-119	1
		1-105A	2			2-122	1
		8-29	3	351-7686-020		2-26	1
343-0129-000		8-34	2			2-27	1
		8-53	2			2-104	1
		8-73	2			2-109	1
		8-92	2	351-7689-010		2-29	1
343-0133-000		1-54	4	351-7728-010		2-118	1
343-0134-000		1-52	8			2-120	1
		1-210	2			2-121	1
		8-241	2			2-123	1
		9-29	2	351-7748-030		2-105	1
343-0135-000		9-17	4			2-107	1
343-0268-000		6-26	1	352-0551-010		5-21	1
		6-37	1	352-0581-010		6-20	1
343-0287-000		6-27	1			6-31	1
		6-38	1			9-3	2
343-0299-000		1-89	2	352-0661-020		2-19	1
		7-19	2			2-37	1
343-0300-000		7-18	2			2-87	1
343-0330-000		1-42	1			2-136	1
343-0676-000		1-78	2			2-138	1
343-0731-000		7-12	2			2-145	1
347-0006-000		1-121	1			2-146	1
347-0022-000		8-237	16			5-20	1
347-0023-000		1-115	3			5-22	1
347-0024-000		8-37	2			5-27	1
		8-57	2			5-29	1
		8-76	2			10-13	8
		8-95	2	352-0661-040		2-31	1
		8-256	3			2-34	1
350-0083-030		6-6	1	352-0754-040		5-32	1
		6-9	1	352-9570-020		6-25	1
		6-12	1			6-36	1
		6-15	1			9-11	2
351-1035-040		2-95	1	353-0120-000		8-209	1
		2-97	1	353-2714-000		6-50	1
351-1122-040		2-17	1			9-34	1
		2-99	1	353-2938-000		3-3	1
351-1137-010		2-110	1			3-9	1
351-1262-020		10-29	4			3-11	1
351-7307-030		2-22	1	353-2975-000		2-86	1

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353-3057-000		2-75	1
353-3176-000		5-8	1
		5-17	1
353-3591-080		10-19	4
353-3591-440		10-21	8
353-3591-460		2-63	1
353-3644-010		2-3	1
		2-4	1
		2-82	1
		2-83	1
		2-112	1
		2-124	1
		2-125	1
		2-126	1
		2-127	1
		2-128	1
		2-129	1
		2-130	1
		2-131	1
		2-132	1
		2-133	1
353-6442-020		5-12	1
		5-14	1
		5-26	1
		5-31	1
353-6442-030		2-16	1
		2-134	1
		2-137	1
353-6496-020		4-2	1
		4-9	1
353-6550-070		2-79	1
353-6558-010		3-5	1
		3-6	1
		3-7	1
		3-8	1
359-4118-040		1-49	1
359-4118-050		1-48	1
371-7042-100		1-19D	4
		2-152	4
372-2236-010		1-28	1
		1-31	9
372-2252-010		1-27	11
		1-32	9
372-2253-010		1-29	1
		1-33	1
40SS105A035M1A		5-13	1
		5-16	1
40SS476B006M1A		5-3	1
4007-4HT		6-22	1
		6-33	1
4007-4HTD		9-9	2
403		8-243	1
		9-19	3
4277-01-05		8-246	1
		8-251	1
4277-31-01		8-247	1
		8-253	1
		8-254	1
431-0469-000		1-68	1
48-7127-8		1-49	1
48-7127-9		1-48	1
482-5083-020		7-11	1
482-5084-010		7-6	1
482-5085-010		1-88	1
482-5107-020		7-5	1
482-5129-010		1-119	1
482-5130-010		1-102	1
482-5131-010		1-95	1
482-5205-010		1-88	1
500-1128-003		8-14	AR
		8-123	AR
503-0634-001		7-23	3
506-8392-001		7-10	AR
540-9004-003		1-38	3
540-9006-003		1-36A	2
		1-38	3
540-9007-003		1-36A	2
540-9010-003		1-38	3
5403J		2-148	1
5404DM		2-29	1
542-4176-002		8-12	1
		8-158	1
		8-172	1
		8-197	1
		8-204	1
		8-231	1
542-4177-002		8-211	1
		8-219	1
542-7481-003		1-94	AR
		8-55	1
542-7499-003		1-118	AR
		7-10	AR
542-7501-003		8-214	AR
		8-222	AR
542-7502-003		8-213	AR
		8-221	AR
543-5320-002		7-21	1
544-3521-002		1-151	1
		1-155	1
544-3643-002		8-36	2
		8-56	2
		8-75	2
		8-94	2
		8-236	
544-3733-004		1-66	1
545-7501-003		1-203	AR
547-8177-003		6-21	2
		6-32	2
		9-13	4
547-8177-016		9-27	2
548-9534-003		8-167	AR
		8-174	AR
		8-180	AR
		8-186	AR
		8-192	AR
553-5080-003		8-199	1
		8-206	1
554-1447-002		8-127	1
554-1453-002		8-255	3
554-1495-003		8-128	1
5555G9MD		1-129	4
6RS25PB2BA4		8-209	1
600D226G050KD5		4-3	1
		4-4	1

NUMERICAL INDEX

PART NUMBER	AIRLINE PART NO	FIG-ITEM	TTL REQ
600D226G050KD5		4-5	1
		4-6	1
		4-7	1
		4-8	1
618-5295-001		8-28	1
622-4298-001		1-1	RF
629-8060-001		1-19E	1
		2-153	1
629-8061-001		1-132	1
629-8062-001		1-73	1
629-8063-001		1-19F	1
		2-154	1
629-8065-001		1-125	1
629-8263-001		1-71	2
629-8511-001		8-142	1
634-0403-001		1-97A	1
		1-105	1
634-0404-001		1-97C	1
		1-105B	1
634-3881-001		9-35	1
634-3881-002		9-45	1
635-2287-000		1-4	1
635-6370-001		1-13	1
638-2762-001		8-17	1
638-2763-001		8-8	1
638-2764-001		8-60	1
		8-79	1
		8-98	1
638-2765-001		8-114	1
638-2766-001		1-108	2
638-2767-001		1-61	1
638-2768-001		1-200	1
638-2769-001		8-120	1
638-2770-000		8-232	1
638-2770-001		8-159	1
638-2771-000		8-224	1
638-2771-001		8-151	1
638-2772-001		1-37	1
		6-1	RF
638-2773-001		6-51	1
638-2774-001		1-34	1
		4-1	RF
638-2775-001		1-35	1
		5-1	RF
638-2776-001		1-30	1
638-2777-001		1-19K	1
		2-1	RF
638-2778-001		1-26	1
638-2779-001		1-44	1
638-2780-001		1-72	1
638-2781-001		3-16	1
638-2782-001		1-23	1
		3-1	RF
638-2783-001		8-150	1
638-2784-001		8-2	1
638-2785-001		1-212	1
		8-1	RF
638-2786-001		1-55	1
		7-1	RF
638-2787-001		7-27	1
638-2788-001		1-12	1
638-2791-001		8-139	1
638-2792-001		1-20A	1
638-2792-002		1-22	1
638-2793-001		1-174	1
638-2793-002		1-165	1
638-2794-001		8-52	1
638-2795-001		8-33	1
638-2796-001		8-72	1
		8-91	1
638-2797-001		8-194	1
		8-201	1
638-2798-001		8-169	1
638-2799-001		8-176	1
		8-182	1
		8-188	1
638-2800-001		7-3	1
638-2801-001		7-2	1
638-2802-001		8-208	1
		8-216	1
638-2803-001		1-85	1
638-2804-001		1-82	1
638-2805-001		1-160	1
638-2806-001		1-7	1
638-2807-001		8-163	1
641-0751-001		7-20	1
642-9679-001		1-138A	3
647-6816-001		1-37C	1
		10-1	RF
652-0037-001		1-37	1
		9-1	RF
652-0039-001		8-239	2
662-0518-010		1-209	1
677-1412-000		5-6	1
68-1660-26		1-19G	2
		2-155	2
68NM40		6-27A	1
		6-38A	1
705-0985-000		2-78	1
705-0996-000		10-25	1
705-1000-000		6-46	1
		10-43	1
705-1004-000		6-42	1
		10-39	1
705-1008-000		6-48	1
		10-45	1
705-1012-000		2-72	1
705-1018-000		6-43	1
		10-37	1
705-1022-000		2-18	1
705-1023-000		2-77	1
705-1026-000		2-71	1
		6-47	1
		10-41	1
705-1028-000		6-49	1
		10-47	1
705-1030-000		2-45	1
		5-9	1
705-1032-000		10-23	1
705-1044-000		2-49	1
		2-50	1
		2-52	1
		2-53	1
		2-56	1

NUMERICAL INDEX

PART NUMBER	AIRLINE PART NO	FIG-ITEM	TTL REQ
705-1044-000		2-57	1
		2-59	1
		2-61	1
		2-64	1
		2-65	1
		2-68	1
		2-69	1
		5-4	1
		5-5	1
		9-31	2
		10-11	16
705-1048-000		2-51	1
		2-58	1
		2-67	1
705-1086-000		5-10	1
705-1089-000		10-27	4
705-1454-390		6-44	1
705-1454-570		5-11	1
		6-45	1
705-1454-630		6-3	1
		6-4	1
705-3605-830		10-35	4
705-6630-000		6-2	1
		6-5	1
		9-33	3
705-6635-000		3-2	1
		3-4	1
		3-10	1
714-1730-000		2-88	1
745-0677-000		2-74	1
745-0713-000		5-19	1
745-0752-000		10-17	8
745-0761-000		10-7	4
745-0776-000		5-7	1
		5-28	1
745-0779-000		5-23	1
745-1268-000		4-10	1
		4-13	1
745-1863-360		10-9	8
745-1863-490		5-24	1
		5-30	1
745-1863-690		5-18	1
745-1863-910		5-15	1
745-1864-180		10-3	8
745-1864-420		2-8	1
745-1864-760		5-2	1
745-1864-850		2-114	1
745-2295-000		2-85	1
745-2323-000		2-2	1
745-2329-000		2-81	1
745-2335-000		2-111	1
		2-141	1
		2-144	1
		2-147	1
745-2341-000		2-135	1
745-2344-000		10-15	8
745-2356-000		2-32	1
		2-39	1
		2-40	1
		2-41	1
		2-47	1
		2-48	1
745-2356-000		2-55	1
		2-101	1
745-2377-000		2-5	1
		2-42	1
		2-43	1
		2-62	1
745-2392-000		2-9	1
		2-10	1
		2-11	1
		2-12	1
		2-14	1
		2-15	1
		2-33	1
		2-44	1
		2-46	1
		2-102	1
745-2398-000		2-139	1
		2-140	1
		2-142	1
		2-143	1
745-2404-000		2-103	1
745-2419-000		2-84	1
745-2434-000		2-7	1
745-3292-000		2-13	1
745-3338-000		2-80	1
747-1499-300		2-76	1
747-1862-000		2-89	1
757-0269-001		8-149	1
763-5530-001		1-120	1
768-1636-001		8-147	1
768-5919-003		4-14	1
		5-25	1
77NM0612ZJ5FM1		8-70	1
775-5019-001		8-19	1
775-5020-001		8-13	1
		8-155	1
		8-228	1
775-5031-001		7-14	1
775-5034-001		1-171	1
		1-180	1
775-5035-001		8-178	1
		8-184	1
		8-190	1
		8-196	1
		8-203	1
775-5035-002		8-171	1
775-5040-001		8-7	2
775-5040-002		8-6	2
775-5042-001		8-20	1
775-5044-001		8-166	1
		8-173	
		8-179	1
		8-185	1
		8-191	1
		8-198	1
		8-205	1
775-5051-001		1-127	16
775-5068-001		8-44	2
		8-64	2
		8-83	2
		8-102	2
775-5069-001		8-41	2

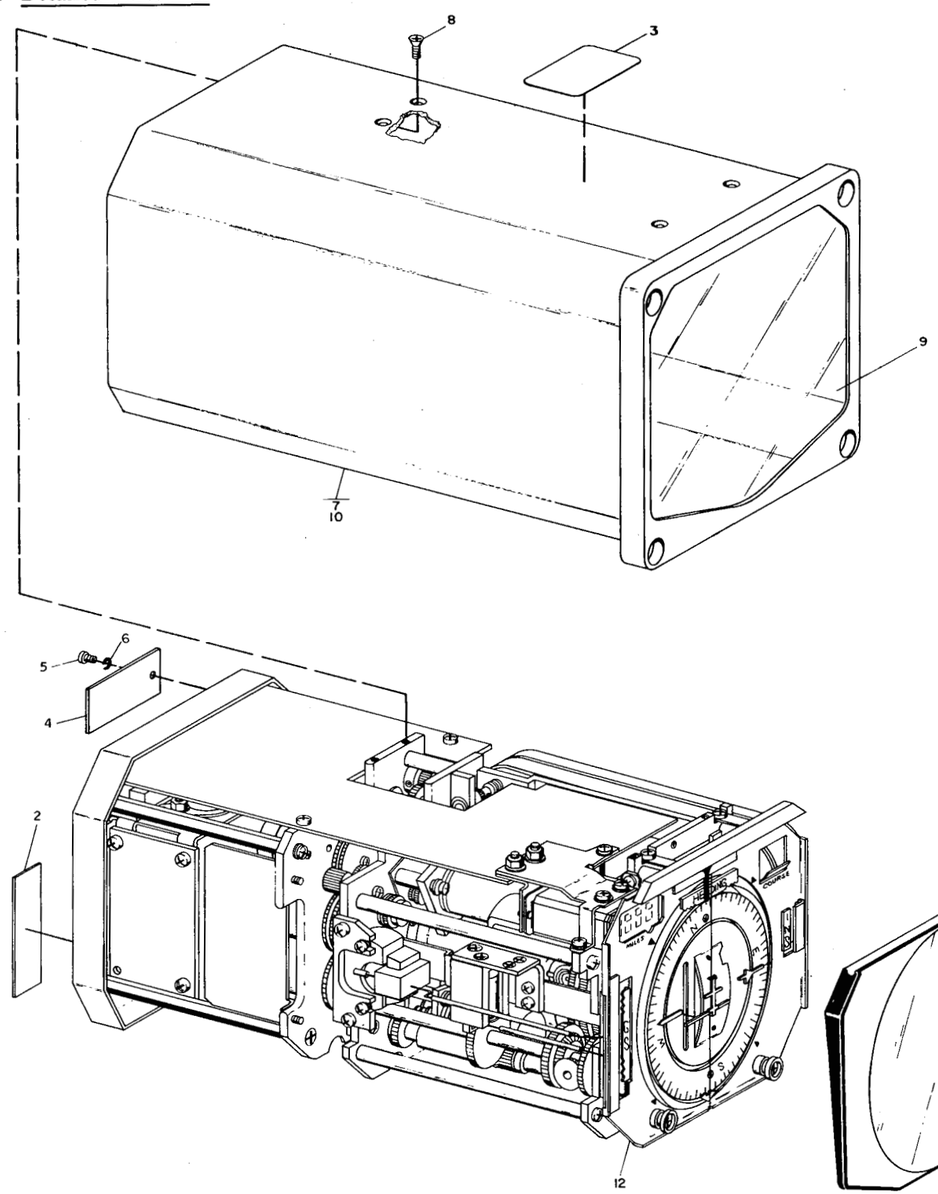
NUMERICAL INDEX

PART NUMBER	AIRLINE PART NO	FIG-ITEM	TTL REQ
775-5069-001		8-61	2
		8-80	2
		8-99	2
775-5074-001		7-29	2
775-5075-001		8-126	1
775-5076-001		1-206	1
775-5078-001		1-204	1
775-5079-001		1-64	1
775-5087-001		7-20	1
775-5090-001		1-11	1
775-5094-002		1-57	1
775-5095-001		1-145	1
775-5097-001		8-119	1
775-5098-001		1-122	1
775-5099-001		1-113	
775-5100-001		1-97	1
775-5102-001		1-91	1
775-5103-001		1-100	1
775-5104-001		1-63	1
775-5105-001		1-137	3
775-5106-001		1-138	3
775-5107-001		8-23	4
775-5109-001		8-15	1
		8-162	1
		8-235	1
775-5112-001		8-18	1
775-5117-001		8-42	1
		8-62	2
		8-81	1
		8-100	1
775-5118-001		8-51	1
		8-71	1
		8-90	1
		8-109	1
775-5119-001		8-48	
		8-68	1
		8-87	1
		8-106	1
775-5120-001		8-47	1
		8-67	1
		8-86	1
		8-105	1
775-5121-001		8-46	1
775-5124-001		1-207	1
775-5125-001		8-124	1
775-5132-001		1-104	1
775-5136-001		1-147	1
775-5137-001		1-148	1
775-5139-002		1-170	1
		1-179	1
775-5187-001		8-130	1
775-5189-001		8-137	1
775-5191-001		8-133	1
775-5199-001		8-40	1
775-5263-001		1-130	4
777-2581-001		1-67	1
778-0168-001		1-56	2
779-3254-001		1-77	4
779-3790-001		8-212	1
		8-220	1
779-3791-001		1-161	1
		1-189	1
779-3791-001		8-110	1
779-3792-001		1-162	1
779-3793-001		1-157	1
779-3794-001		1-143	1
779-3798-001		8-210	1
		8-218	1
779-3799-001		1-80	1
779-3800-002		1-84	1
779-3801-001		8-66	1
779-3803-001		1-154	1
779-3807-001		8-161	1
		8-234	1
779-3808-001		1-146	1
779-3816-001		1-163	1
		1-190	1
		8-111	1
779-5019-001		8-160	1
		8-233	1
791-2292-001		1-86	2
791-2293-001		187	1
791-2433-001		1185	1
		1-195	1
791-2434-002		1-168	1
		1-177	1
791-2436-001		1-193	1
791-2485-001		8-3	1
792-1053-002		1-114	1
792-1073-001		1-75	1
792-1434-001		1-74	1
792-1435-001		8-32	1
792-1436-001		8-85	1
		8-104	1
792-1437-001		1-150	1
792-1438-001		1-187	1
		1-197	1
792-1439-001		1-47	1
792-1440-001		1-10	1
792-1441-001		6-55	1
792-1459-001		7-4	1
797-6629-001		1-76	1
797-6721-001		3-19	1
797-6747-001		8-113	1
797-6813-001		1-53	1
797-6835-001		8-258	1
797-6865-001		1-128	4
797-6899-001		1-141	1
797-6904-001		1-9	1
797-6909-001		8-244	2
797-6983-001		7-30	1
797-6985-001		7-7	1
797-7038-001		1-19A	1
		2-149	1
797-7039-001		1-19B	2
		2-151	2
797-7166-001		1-183	1
797-7266-001		1-140	1
797-7276-001		8-165	1
797-7747-001		8-146	1
912-4141-200		2-54	1
		2-60	1
		2-66	1
913-3279-250		2-38	1

NUMERICAL INDEX

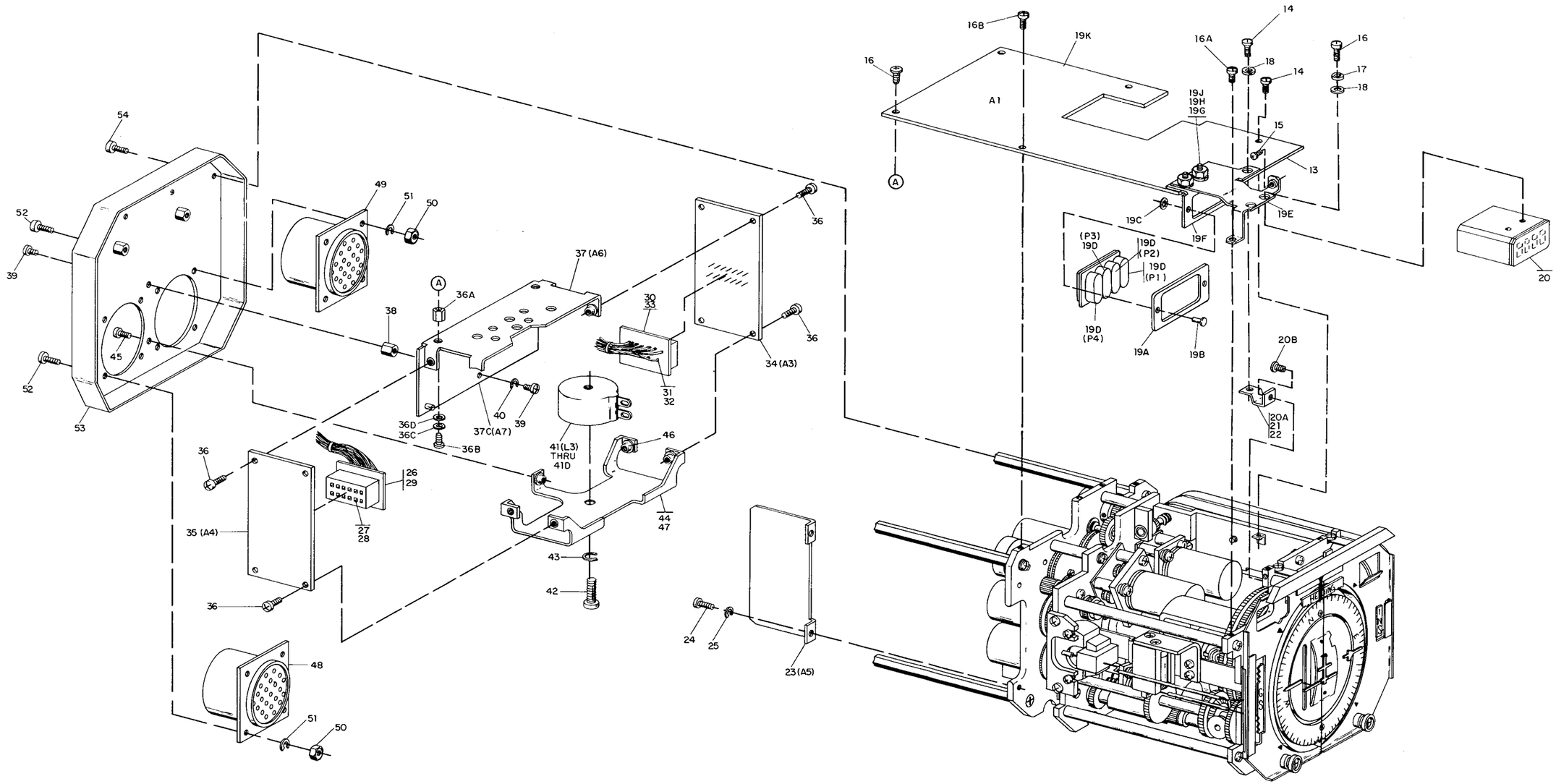
PART NUMBER	AIRLINE PART NO	FIG-ITEM	TTL REQ	PART NUMBER	AIRLINE PART NO	FIG-ITEM	TTL REQ
913-3665-380		10-33	4				
913-3665-430		10-31	4				
913-4016-000		2-30	1				
913-4496-010		3-12	1				
		3-13	1				
		3-14	1				
		3-15	1				
913-5019-200		2-158	1				
913-5019-240		2-20	1				
913-5019-280		2-100	1				
913-5019-320		2-70	1				
		2-73	1				
		2-92	1				
913-5019-500		10-5	12				
9317CDM		2-118	1				
		2-120	1				
		2-121	1				
		2-123	1				
933-1081-530		4-11	1				
		4-12	1				

4. Detailed Parts List



HSI-45 Horizontal Situation Indicator
Figure 1 (Sheet 1 of 4)

DETAILED PARTS LIST



THIS SHEET EFFECTIVE TO SERVICE BULLETIN 2

TP6-5106-044

HSI-45 Horizontal Situation Indicator
Figure 1 (Sheet 2 of 4)

HSI-45 Horizontal Situation Indicator

COMPONENT MAINTENANCE MANUAL with IPL (523-0768607)

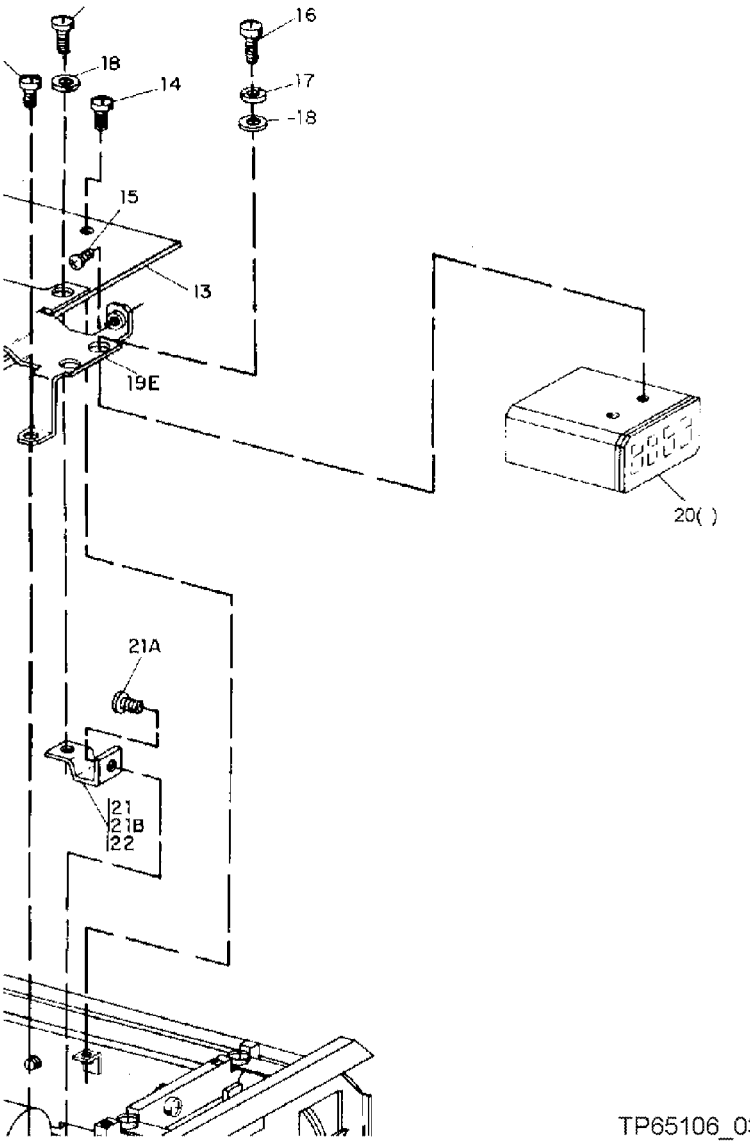
TEMPORARY REVISION NO. 34-28-25-23

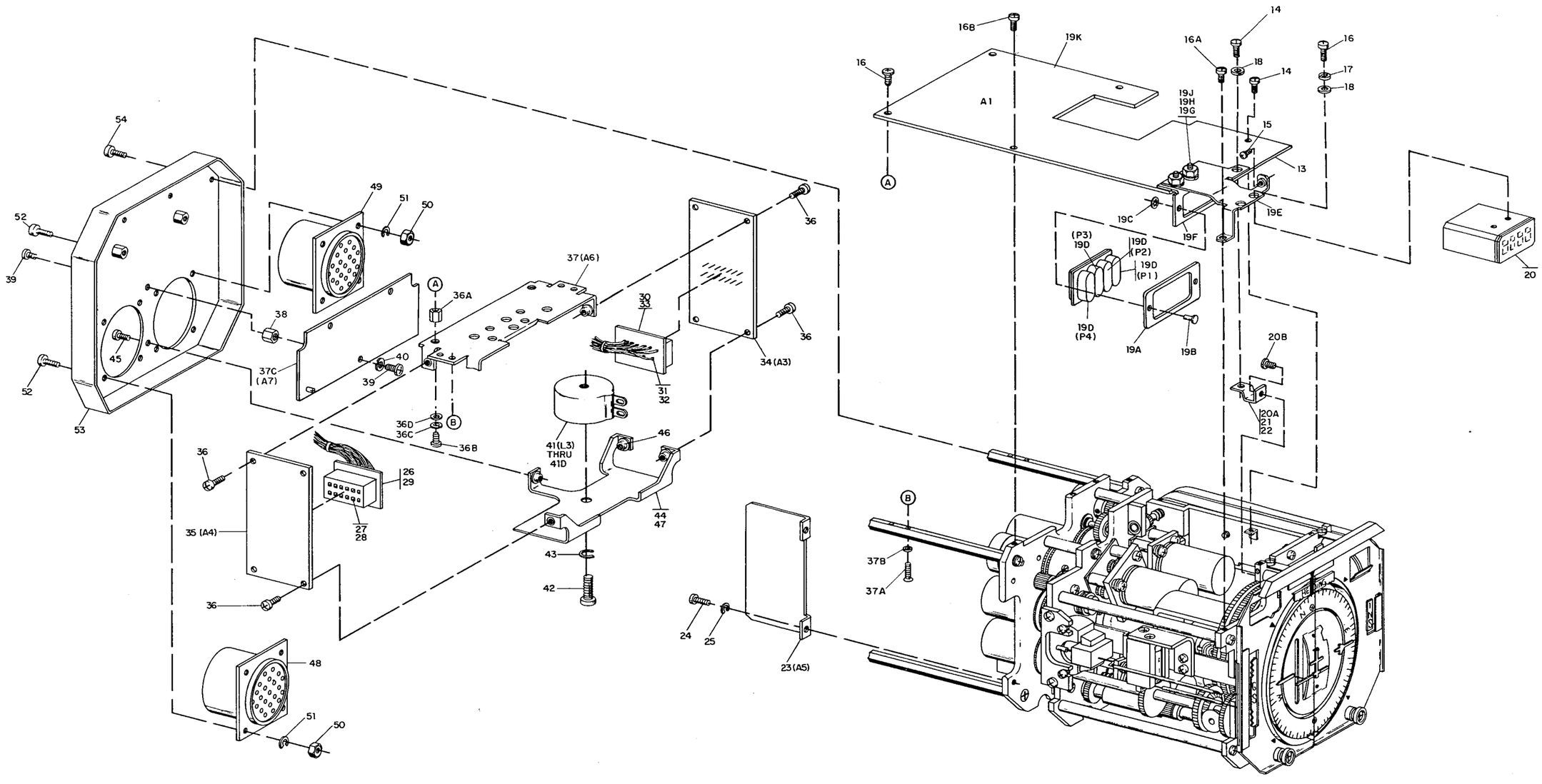
Insert facing page 1024, 34-28-25.

This temporary revision supersedes Temporary Revision 34-28-25-07.

Subject: Revise Detailed Parts List.

Change Fig 1, Sheet 2 as shown below.



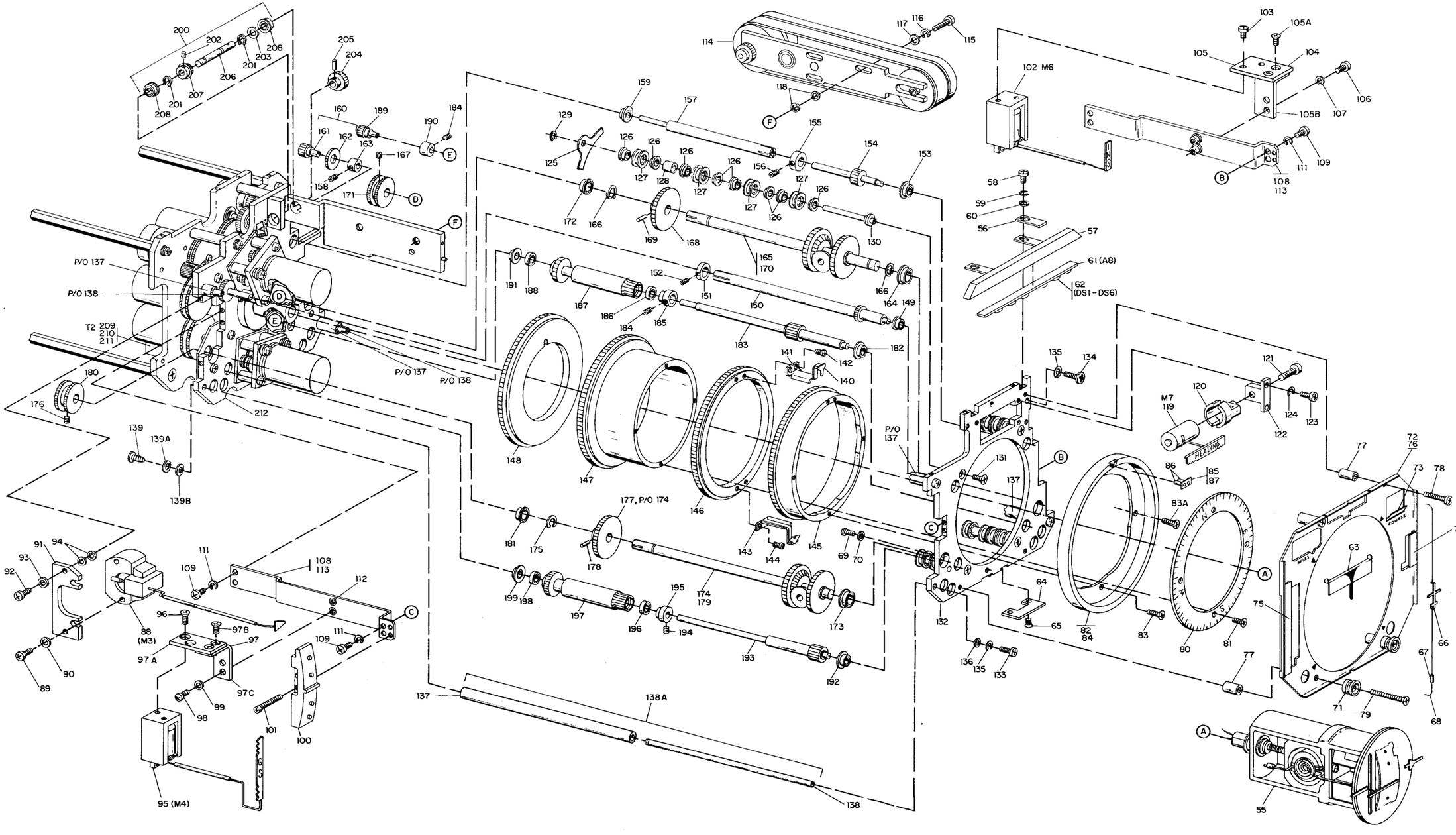


THIS SHEET EFFECTIVE SERVICE BULLETIN 2

TP6-5106-044

HSI-45 Horizontal Situation Indicator
Figure 1 (Sheet 3 of 4)

DETAILED PARTS LIST



TP6-5106-044

HSI-45 Horizontal Situation Indicator
Figure 1 (Sheet 4 of 4)

HSI-45 Horizontal Situation Indicator

COMPONENT MAINTENANCE MANUAL with IPL (523-0768607)

TEMPORARY REVISION NO. 34-28-25-23

Insert facing page 1027, 34-28-25.

This temporary revision supersedes Temporary Revision 34-28-25-07.

Subject: Revise Detailed Parts List.

Change the parts list as follows:

DETAILED PARTS LIST

FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDENT	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
1-20	CR70018-2		3	INDICATOR, DSPL (V02995) 262-1302-010 (REPLACEMENT BULB P/N LA-72-001-6)		1
20	CR700018-3		3	INDICATOR, DSPL (V02995) 262-1302-040 (REPLACEMENT BULB P/N LA-72-001-6) (SUPSD 262-1302-010)		1
				OR		
-20			3	INDICATOR KIT 983-8111-001 (CONTAINS LAMPS)		1
-20C	LA72-001-6		4	LAMP, INCA (V02995) 262-1302-030 (SUPSD BY 262-1104-010)		AR
-20D	062401BPAS15		4	LAMP, INCA (AV 1654) 262-1104-010 (SUPSDS 262-1302-030)		AR

DETAILED PARTS LIST

	FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDEX	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
	1-1	622-4298-001		1	INDICATOR, HORIZONTAL SITUATION HSI-45		RF
	2	280-3778-010		2	CHART,INFORMATION (V93108)		1
	3	280-3441-000		2	PLATE,INSTRUCTION (VA0473)		1
	4	635-2287-000		2	PLATE, IDENT		1
R	5	MS51957-3		2	SCREW,MACH CD PL STL, 2-56 X 1/4 (V96906) 343-0124-000 (AP)		2
	6	MS35338-134		2	WASHER,LOCK SST, 0.088 ID X 0.172 0D (V96906) 310-0275-000 (AP)		2
	7	638-2806-001		2	CASE, INDICATOR-BONDED		1
	8	MS51959-2		2	SCREW,MACH SST, 2-56 X 3/16 (V96906) 342-0132-000 (AP)		4
	9	797-6904-001		3	WINDOW DIAL		1
	10	792-1440-001		3	CASE, INDICATOR		1
	11	775-5090-001		2	PRISM LIGHTING		1
	12	638-2788-001		2	INDICATOR SUBASSEMBLY		1
R	13	635-6370-001		3	DISPLAY ASSEMBLY-DME		1
R	14	MS51957-3		3	SCREW,MACH CD PL STL, 2-56 X 1/4 (V96906) 343-0124-000 (AP)		2
R	15	P321-0292-000		3	SCREW,MACH NP BRS, 0-80 X 1/4 (V77250) 321-0292-000 (AP)		1
R	16	MS51957-2		3	SCREW,MACH SST, 2-56 X 3/16 (V96906) 343-0123-000 (AP)		4
R	16A	P321-0289-00		3	SCREW,MACH NP BRS, 0-80 X 1/8 (V77250) 321-0289-000 (AP)		1
R	16B	MS51957-4		3	SCREW,MACH CD PL STL, 2-56 X 5/16 (V96906) 343-0125-000 (AP)		2
R	17	MS35338-134		3	WASHER,LOCK SST, 0.088 ID X 0.172 0D (V96906) 310-0275-000 (AP)		2
R	18	310-6320-000		3	WASHER,FLAT SST, 0.092 X 0.219 OD (V79807) (AP)		3
R	-19				NOT USED		
R	19A	797-7038-001		4	PLATE, RETAINING		1
R	19B	797-7039-001		4	PIN		2
R	19C	MS16633-1006		4	RING,RTNG (V96906) 340-0098-000 (AP)		2
R	19D	MD1-9SH001		4	CONNECTOR,RCPT ELEC (V71468) 371-7042-100		4
R	19E	629-8060-001		4	BRACKET, READOUT		1
R	19F	629-8063-001		4	BRACKET, CONN		1
R	19G	68-1660-26		4	NUT,SLFLKG,HEX AL, 2-56 (V72962) 333-0604-000 (AP FOR 19E AND 19F)		2
R	19H	310-6320-000		4	WASHER,FLAT SST, 0.092 X 0.219 OD (V79807) (AP FOR 19E AND 19F)		4
R	19J	MS16997-3		4	SCREW,CAP,SCH CD PL STL, 2-56 X 3/8 (V96906) 324-2601-000 (AP FOR 19E AND 19F)		2
R	19K	638-2777-001		4	CIRCUIT CARD ASSEMBLY, DISTANCE READOUT A1 (SEE FIG 2)		1
	20	SK086925-3		3	INDICATOR,DSPL (V02995) 262-1302-010 (REPLACEMENT BULB P/N LA-72-001-6)		1
	20A	638-2792-001		3	BRACKET, PRSD		1
R	20B	P323-0124-00		3	SCREW,MACH NP STL, 6-32 X 1/8 (V77250) 323-0124-000 (AP)		1
R	21	M45938/5-1		4	NUT,SLFLKG,CLINCH CD PL STL, 2-56 (V81349) 333-0837-000		1
R	22	638-2792-002		4	BRACKET, CIRCUIT CARD (AP)		1
	23	638-2782-001		3	ELECTRONIC COMPONENT ASSEMBLY A5 (SEE FIG 3)		1
	24	MS51957-3		3	SCREW,MACH CD PL STL, 2-56 X 1/4 (V96906) 343-0124-000 (AP)		2

- ITEM NOT ILLUSTRATED

DETAILED PARTS LIST

	FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDENT	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
	1 25	MS35338-134		3	WASHER,LOCK SST, 0.088 ID X 0.172 0D (V96906) 310-0275-000 (AP)		2
	26	638-2778-001		3	BOARD, CONNECTOR P1		1
R	27	372-2252-010		4	CONTACT,ELECTRICAL (V57863)		11
R	28	372-2236-010		4	CONTACT,ELEC		1
	29	372-2253-010		4	HOUSING,CONNECTOR		1
	30	638-2776-001		3	ELECT COMP ASSY P2		1
	31	372-2236-010		4	CONTACT,ELEC		9
R	32	372-2252-010		4	CONTACT,ELECTRICAL (V57863)		9
	33	372-2253-010		4	HOUSING,CONNECTOR		1
	34	638-2774-001		3	CIRCUIT CARD ASSEMBLY, POWER SUPPLY A3 (SEE FIG 4)		1
	35	638-2775-001		3	CIRCUIT CARD ASSEMBLY, AZIMUTH MON AND BACK LOC A4 (SEE FIG 5)		1
R	36	MS51957-3		3	SCREW,MACH CD PL STL, 2-56 X 1/4 (V96906) 343-0124-000 (AP FOR 34 AND 35)		7
R	36A	540-9006-003		3	POST (EFF REV G TO REV K)		2
R	36A	540-9007-003		3	POST (EFF REV K)SB2		2
R	36B	MS51957-3		3	SCREW,MACH CD PL STL, 2-56 X 1/4 (V96906) 343-0124-000 (AP)		2
R	36C	MS35338-134		3	WASHER,LOCK SST, 0.088 ID X 0.172 0D (V96906) 310-0275-000 (AP)		2
R	36D	310-0129-000		3	WASHER,FLAT BRS, 0.089 ID X 0.188 0D (V05411) (AP)		2
R	37	638-2772-001		3	ELECTRONIC COMPONENT ASSEMBLY A6 (SEE FIG 6)		1
R	37	652-0037-001		3	ELECTRONIC COMPONENT ASSEMBLY A6 (SEE FIG 9)		1
R	37A	MS51957-3		3	SCREW,MACH CD PL STL, 2-56 X 1/4 (V96906) 343-0124-000 (AP)		4
R	37B	MS35338-134		3	WASHER,LOCK SST, 0.088 ID X 0.172 0D (V96906) 310-0275-000 (AP)		4
R	37C	647-6816-001		3	CIRCUIT CARD ASSEMBLY, SERVO AMP A7 (SEE FIG 10) (EFF SB2)		1
R	38	540-9010-003		3	POST (EFF TO REV G)		3
R	38	540-9006-003		3	POST (EFF REV G TO REV K)		3
R	38	540-9004-003		3	POST,ELEC-MECH (EFF REV K)SB2		3
R	39	MS51957-2		3	SCREW,MACH SST, 2-56 X 3/16 (V96906) 343-0123-000 (AP FOR 37C AND 38)		6
R	40	MS35338-134		3	WASHER,LOCK SST, 0.088 ID X 0.172 0D (V96906) 310-0275-000 (AP FOR 37C AND 38)		3
R	41	12393B		3	COIL,RF 240MH (V07388) 240-0279-000 L3 OR		1
R	41A	12395B		3	COIL,RF 360MH (V07388) 240-0281-000 L3 OR		1
R	41B	12398B		3	COIL,RF 600MH (V07388) 240-0284-000 L3 OR		1
R	41C	12399B		3	COIL,RF 720MH (V07388) 240-0285-000 L3 OR		1
R	41D	12408B		3	COIL,RF 470MH (V07388) 240-0294-000 L3		1
	42	P343-0330-000		3	SCREW,MACH NP BRS, 6-32 X 3/8 (V77250) 343-0330-000 (AP)		1
	43	310-0078-000		3	WASHER,LOCK BRZ, 0.141 ID X 0.239 OD (V79807) (AP)		1
	44	638-2779-001		3	BRACKET		1
	45	MS51957-3		3	SCREW,MACH CD PL STL, 2-56 X 1/4 (V96906) 343-0124-000 (AP)		1
R	46	M45938/5-1		4	NUT,SLFLKG,CLINCH CD PL STL, 2-56 (V81349) 333-0837-000		4

DETAILED PARTS LIST

	FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDENT	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
	1 47	792-1439-001		4	BRACKET, ELECTRICAL		1
	48	48-7127-9		3	CONNECTOR,RCPT ELEC (V02660) 359-4118-050 J2		1
	49	48-7127-8		3	CONNECTOR,RCPT ELEC (V02660) 359-4118-040 J1		1
	50	P313-0132-000		3	NUT,PLAIN,HEX SST, 4-40 (V77250) 313-0132-000 (AP FOR 48-49)		8
R	51	310-0297-000		3	WASHER,LOCK SST, 0.573 ID X 0.975 0D (V70318) (AP FOR 48-49)		8
	52	MS51957-14		3	SCREW,MACH SST, 4-40 X 5/16 (V96906) 343-0134-000 (AP FOR 48-49)		8
	53	797-6813-001		3	COVER, INDICATOR		1
	54	MS51957-13		3	SCREW,MACH STL, 4-40 X 1/4 (V96906) 343-0133-000 (AP)		4
	55	638-2786-001		3	FRAME, METER (SEE FIG 7)		1
	56	778-0168-001		3	CLIP, SPRING TENSION		2
	57	775-5094-002		3	COVER, LIGHTING MODULE		1
R	58	MS51957-2		3	SCREW,MACH SST, 2-56 X 3/16 (V96906) 343-0123-000 (AP FOR 56-57)		2
	59	MS35338-134		3	WASHER,LOCK SST, 0.088 ID X 0.172 0D (V96906) 310-0275-000 (AP FOR 56-57)		2
	60	310-6320-000		3	WASHER,FLAT SST, 0.092 X 0.219 OD (V79807) (AP FOR 56-57)		2
	61	638-2767-001		3	CIRCUIT BOARD, LIGHTING WEDGE A8		1
R	62	IEE715ASP15PCTM1 5PCT		4	LAMP,INCANDESCENT (V05464) 262-1095-000 DS1-DS6		6
	63	775-5104-001		3	INDEX TOP		1
	64	775-5079-001		3	PLATE, SUPPORT MASK		1
	65	P322-0149-000		3	SCREW,MACHINE NP BRS, 0.060-80X1/8IN (V77250) 322-0149-000 (AP)		2
	66	544-3733-004		3	SYMBOL, AIRPLANE		1
	67	777-2581-001		3	TUBE INDEX		1
	68	431-0469-000		3	WIRE,STEEL (V83718)		1
	69	P321-0289-00		3	SCREW,MACH NP BRS, 0-80 X 1/8 (V77250) 321-0289-000 (AP FOR 67-68)		2
	70	310-0550-000		3	WASHER,FLAT SST, 0.062 ID X 5/32 OD (V79807) (AP FOR 67-68)		2
	71	629-8263-001		3	SUPPORT, PRISM		2
	72	638-2780-001		3	MASK, MAIN CEMENTED		1
R	73	629-8062-001		4	MASK, SCALE, DIAL		1
	74	792-1434-001		4	MASK, SIDESHIELD RH		1
	75	792-1073-001		4	MASK, SIDESHIELD LH		1
R	76	797-6629-001		4	MASK, MAIN		1
	77	779-3254-001		3	SLEEVE SPACING		4
	78	MS51957-6B		3	SCREW,MACH SST, 2-56 X 7/16 (V96906) 343-0676-000 (AP)		2
	79	MS35198-9		3	SCREW,MACH BRS, 2-56 X 3/4 (V96906) 342-0866-000 (AP)		2
R	80	779-3799-001		3	DAIL SCALE		1
R	81	P322-0161-000		3	SCREW,MACHINE BL CHEM BRS, 0.060-80X3/16IN (V77250) 322-0161-000 (AP)		4
	82	638-2804-001		3	RING, HEADING		1
R	83	P322-0161-000		3	SCREW,MACHINE BL CHEM BRS, 0.060-80X3/16IN (V77250) 322-0161-000 (AP)		1
R	83A	P330-5003-010		3	SCREW,MACH STL, 0-80 X 1/8 (V77250) 330-5003-010 (AP)		3
R	84	779-3800-002		4	RING, INDICATOR		1
	85	638-2803-001		4	CURSOR, INDICATOR		1
	86	791-2292-001		5	PIN, STRAIGHT		2

HSI-45 Horizontal Situation Indicator

COMPONENT MAINTENANCE MANUAL with IPL (523-0768607)

TEMPORARY REVISION NO. 34-28-25-23

Insert facing page 1030, 34-28-25.

This temporary revision supersedes Temporary Revision 34-28-25-07.

Subject: Revise Detailed Parts List.

Add to the parts list as follows:

DETAILED PARTS LIST

FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDENT	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
1-						
-114A	458-9014-010		4	BVR TAPE, TENS AND HUNDREDS, BVR P/N 273565*		1
				OR		
-114A	458-9014-030		4	PRECIPART TAPE, TENS AND HUNDREDS, PRECIPART P/N 3001-117*		1
-114B	458-9014-020		4	BVR TAPE, UNITS, BVR P/N 273564*		1
				OR		
-114B	458-9014-040		4	PRECIPART TAPE, UNITS, PRECIPART P/N 3001-116*		1

* BVR and Precipart tapes are not interchangeable. Ensure that the correct supplier is chosen when ordering replacement parts.

DETAILED PARTS LIST

	FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDENT	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
	1 87	791-2293-001		5	PLATE, INDICATOR		1
	88	482-5085-010		3	METER MOVEMENT (V81030) M3		1
					OR		
R	88	482-5205-010		3	METER MOVEMENT (V54572) M3		1
	89	P343-0299-000		3	SCREW,MACH NP BRS, 2-56 X 1/4 (V77250) 343-0299-000 (AP)		2
	90	310-0129-000		3	WASHER,FLAT BRS, 0.089 ID X 0.188 0D (V05411) (AP)		2
	91	775-5102-001		3	PLATE, MOUNTING GS METER		1
	92	MS51957-3		3	SCREW,MACH CD PL STL, 2-56 X 1/4 (V96906) 343-0124-000 (AP)		2
	93	310-6320-000		3	WASHER,FLAT SST, 0.092 X 0.219 OD (V79807) (AP)		2
	94	542-7481-003		3	SHIM		AR
R	95	482-5131-010		3	METER MOVEMENT (V82386) M4		1
R	96	P322-0159-000		3	SCREW,MACHINE BRS, 0.086-64X1/8IN (V77250) 322-0159-000 (AP)		2
R	97	775-5100-001		3	BRACKET, METER (EFF TO REV H)		1
R	97A	634-0403-001		3	PLATE, METER MOUNTING (EFF REV H)		1
R	97B	MS51957-4		3	SCREW,MACH CD PL STL, 2-56 X 5/16 (V96906) 343-0125-000 (AP)		2
R	97C	634-0404-001		3	BRACKET, METER (EFF REV H)		1
R	98	MS51959-2		3	SCREW,MACH SST, 2-56 X 3/16 (V96906) 342-0132-000 (AP)		2
	99	310-6320-000		3	WASHER,FLAT SST, 0.092 X 0.219 OD (V79807) (AP)		2
	100	775-5103-001		3	SCALE, GLIDESLOPE		1
R	101	321-0413-000		3	SCREW,MACHINE SST, 0-80 X 3/8 (V90123) (AP)		2
	102	482-5130-010		3	METER MOVEMENT (V65092) M6		1
R	103	P322-0159-000		3	SCREW,MACHINE BRS, 0.086-64X1/8IN (V77250) 322-0159-000 (AP)		2
R	104	775-5132-001		3	BRACKET, METER (EFF TO REV H)		1
R	105	634-0403-001		3	PLATE, METER MOUNTING (EFF REV H)		1
R	105A	MS51957-4		3	SCREW,MACH CD PL STL, 2-56 X 5/16 (V96906) 343-0125-000 (AP)		2
R	105B	634-0404-001		3	BRACKET, METER (EFF REV H)		1
R	106	MS51959-2		3	SCREW,MACH SST, 2-56 X 3/16 (V96906) 342-0132-000 (AP)		2
R	107	310-6320-000		3	WASHER,FLAT SST, 0.092 X 0.219 OD (V79807) (AP)		2
	108	638-2766-001		3	BRACKET		2
R	109	MS51957-2		3	SCREW,MACH SST, 2-56 X 3/16 (V96906) 343-0123-000 (AP)		8
R	-110				NOT USED		
	111	MS35338-134		3	WASHER,LOCK SST, 0.088 ID X 0.172 0D (V96906) 310-0275-000 (AP)		4
R	112	M45938/5-2		4	NUT,SLFLKG,CLINCH CD PL STL, 2-56 (V81349) 333-0838-000 (AP)		2
	113	775-5099-001		4	BRACKET		
	114	792-1053-002		3	COUNTER, ROTATING		1
	115	P347-0023-000		3	SCREW,MACH SST, 2-56 X 5/16 (V77250) 347-0023-000 (AP)		3
	116	MS35338-134		3	WASHER,LOCK SST, 0.088 ID X 0.172 0D (V96906) 310-0275-000 (AP)		3
	117	310-6320-000		3	WASHER,FLAT SST, 0.092 X 0.219 OD (V79807) (AP)		3
	118	542-7499-003		3	SHIM		AR
	119	482-5129-010		3	METER MOVEMENT (V65092)		1
	120	763-5530-001		3	BRACKET, FLAG		1

- ITEM NOT ILLUSTRATED

DETAILED PARTS LIST

	FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDENT	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
	1 121	P347-0006-000		3	SCREW,MACH SST, 4-40 X 1/4 (V77250) 347-0006-000 (AP FOR 119-120)		1
	122	775-5098-001		3	BLOCK, MOUNTING		1
	123	MS51957-3		3	SCREW,MACH CD PL STL, 2-56 X 1/4 (V96906) 343-0124-000 (AP)		2
	124	MS35338-134		3	WASHER,LOCK SST, 0.088 ID X 0.172 0D (V96906) 310-0275-000 (AP)		2
	125	629-8065-001		3	PLATE, RETAINING		1
	126	S3332FCE3P25LY5		3	BEARING,BALL,AN (V40920) 309-0003-010		32
	127	775-5051-001		3	SUPPORT		16
	128	797-6865-001		3	SPACER		4
	129	5555G9MD		3	RING,RTNG (V79136) 340-0275-000 (AP FOR 125-128)		4
	130	775-5263-001		3	SHAFT		4
	131	MS51959-2		3	SCREW,MACH SST, 2-56 X 3/16 (V96906) 342-0132-000 (AP)		4
	132	629-8061-001		3	PLATE, DISPLAY		1
	133	MS51957-2		3	SCREW,MACH SST, 2-56 X 3/16 (V96906) 343-0123-000 (AP)		3
	134	MS51957-3		3	SCREW,MACH CD PL STL, 2-56 X 1/4 (V96906) 343-0124-000 (AP)		1
	135	MS35338-134		3	WASHER,LOCK SST, 0.088 ID X 0.172 0D (V96906) 310-0275-000 (AP)		4
	136	310-6320-000		3	WASHER,FLAT SST, 0.092 X 0.219 OD (V79807) (AP)		3
R	137	775-5105-001		3	SPACER (EFF TO REV D)		3
R	138	775-5106-001		3	SHAFT (EFF TO REV D)		3
R	138A	642-9679-001		3	SHAFT, SPACER (EFF REV D)		3
R	139	MS51957-2		3	SCREW,MACH SST, 2-56 X 3/16 (V96906) 343-0123-000 (AP)		3
R	139A	MS35338-134		3	WASHER,LOCK SST, 0.088 ID X 0.172 0D (V96906) 310-0275-000 (AP)		3
R	139B	310-6320-000		3	WASHER,FLAT SST, 0.092 X 0.219 OD (V79807) (AP)		3
	140	797-7266-001		3	POINTER, TRACK		1
	141	797-6899-001		3	SUPPORT, POINTER TRACK		1
	142	P321-0289-00		3	SCREW,MACH NP BRS, 0-80 X 1/8 (V77250) 321-0289-000 (AP)		2
	143	779-3794-001		3	POINTER, BRG NO1		1
	144	P321-0289-00		3	SCREW,MACH NP BRS, 0-80 X 1/8 (V77250) 321-0289-000 (AP)		2
	145	775-5095-001		3	GEAR, SPUR-HDG, 216T		1
	146	779-3808-001		3	GEAR, SPUR-216T		1
	147	775-5136-001		3	GEAR, SPUR-AZ, 216T		1
	148	775-5137-001		3	GEAR, SPUR COURSE, 216T		1
	149	S4FCHH3P15LY5		3	BEARING,BALL,AN (V40920) 309-1977-030		1
	150	792-1437-001		3	GEARSHAFT, SPUR 24T		1
	151	544-3521-002		3	COLLAR		1
R	152	335-0121-000		3	SETSCREW CD PL STL, 2-56 X 1/16 (V74445) (AP FOR 150-151)		2
	153	S4FCHH3P15LY5		3	BEARING,BALL,AN (V40920) 309-1977-030		1
	154	779-3803-001		3	GEARSHAFT		1
	155	544-3521-002		3	COLLAR		1
R	156	335-0121-000		3	SETSCREW CD PL STL, 2-56 X 1/16 (V74445) (AP FOR 154-155)		2
	157	779-3793-001		3	SHAFT,SHOLDERED		1
R	158	335-0121-000		3	SETSCREW CD PL STL, 2-56 X 1/16 (V74445) (AP)		2
	159	S4FCHH3P15LY5		3	BEARING,BALL,AN (V40920) 309-1977-030		1
	160	638-2805-001		3	GEAR CLUSTER		1
	161	779-3791-001		4	GEARSHAFT		1

DETAILED PARTS LIST

	FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDENT	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
	1 162	779-3792-001		4	GEAR		1
	163	779-3816-001		3	COLLAR		1
	164	S5632FC3P15LY5		3	BEARING,BALL,AN (V40920) 309-1563-000		1
	165	638-2793-002		3	SPIDER, DIFFERENTIAL-PRSD		1
	166	MS16632-1018		3	RING,RTNG (V96906) 340-0113-000 (AP)		2
	167	AN565D4L2		3	SETSCREW CD PL STL, 4-40 X 1/8 (V88044) 328-0371-000 (AP)		2
	168	791-2434-002		4	GEAR, SPUR-72 - 80		1
	169	311-0261-000		4	PIN,TAPERED,PL SST, 0.0625 X 5/16 (V73957)		1
	170	775-5139-002		4	SPIDER		1
	171	775-5034-001		3	GEAR, SPUR-60T		1
	172	S5632FC3P15LY5		3	BEARING,BALL,AN (V40920) 309-1563-000		1
	173	S5632FC3P15LY5		3	BEARING,BALL,AN (V40920) 309-1563-000		1
	174	638-2793-001		3	SPIDER		1
	175	MS16632-1018		3	RING,RTNG (V96906) 340-0113-000 (AP)		1
R	176	AN565D4L2		3	SETSCREW CD PL STL, 4-40 X 1/8 (V88044) 328-0371-000 (AP)		2
	177	791-2434-002		4	GEAR		1
	178	311-0261-000		4	PIN,TAPERED,PL SST, 0.0625 X 5/16 (V73957)		1
	179	775-5139-002		4	SPIDER		1
	180	775-5034-001		3	GEAR		1
	181	S5632FC3P15LY5		3	BEARING,BALL,AN (V40920) 309-1563-000		1
	182	S418FCHH3P15LY5		3	BEARING,BALL,AN (V40920) 309-1977-050		1
	183	797-7166-001		3	GEARSHAFT		1
R	184	335-0121-000		3	SETSCREW CD PL STL, 2-56 X 1/16 (V74445) (AP)		4
	185	791-2433-001		3	COLLAR		1
	186	S418C3P15LY5		3	BEARING,BALL,AN (V40920) 309-1846-000		1
	187	792-1438-001		3	GEARSHAFT		1
	188	S418CE3P25LY5		3	BEARING,BALL (V40920) 309-1216-020		1
	189	779-3791-001		3	GEARSHAFT		1
	190	779-3816-001		3	COLLAR		1
	191	S418FCHH3P15LY5		3	BEARING,BALL,AN (V40920) 309-1977-050		1
	192	S418FCHH3P15LY5		3	BEARING,BALL,AN (V40920) 309-1977-050		1
	193	791-2436-001		3	GEARSHAFT		1
R	194	335-0121-000		3	SETSCREW CD PL STL, 2-56 X 1/16 (V74445)		2
	195	791-2433-001		3	COLLAR		1
	196	S418C3P15LY5		3	BEARING,BALL,AN (V40920) 309-1846-000		1
	197	792-1438-001		3	GEARSHAFT		1
	198	S418CE3P25LY5		3	BEARING,BALL (V40920) 309-1216-020		1
	199	S418FCHH3P15LY5		3	BEARING,BALL,AN (V40920) 309-1977-050		1
	200	638-2768-001		3	GEAR		1
	201	MS16632-1012		3	RING,RTNG (V96906) 340-0112-000 (AP)		2
	202	AN565D2L2		3	SETSCREW CD PL STL, 2-56 X 1/8 (V88044) 328-0369-000 (AP)		2
	203	545-7501-003		3	SHIM (AP)		AR
	204	775-5078-001		4	GEAR, SPUR COUNTER		1
	205	MS51923-113		4	PIN,SPRING SST, 0.031 DIA X 1/4 (V96906) 311-0432-000		1
	206	775-5076-001		4	SHAFT, STRAIGHT		1
	207	775-5124-001		3	GEAR		1
	208	S418FC3P15LY5		3	BEARING,BALL,AN (V40920) 309-1561-000		2
	209	3-18514		3	TRANSFORMER,PWR (V70674) 662-0518-010 T2		1
R	210	MS51957-14		3	SCREW,MACH SST, 4-40 X 5/16 (V96906) 343-0134-000 (AP)		2
R	211	310-0297-000		3	WASHER,LOCK SST, 0.573 ID X 0.975 OD (V70318) (AP)		2
R	212	638-2785-001		3	MOTOR SYNCHRONIZER (SEE FIG 8)		1

HSI-45 HORIZONTAL SITUATION INDICATOR

COMPONENT MAINTENANCE MANUAL (523-0768607)

TEMPORARY REVISION NO 34-28-25-10

Insert facing page 1032, 34-28-25

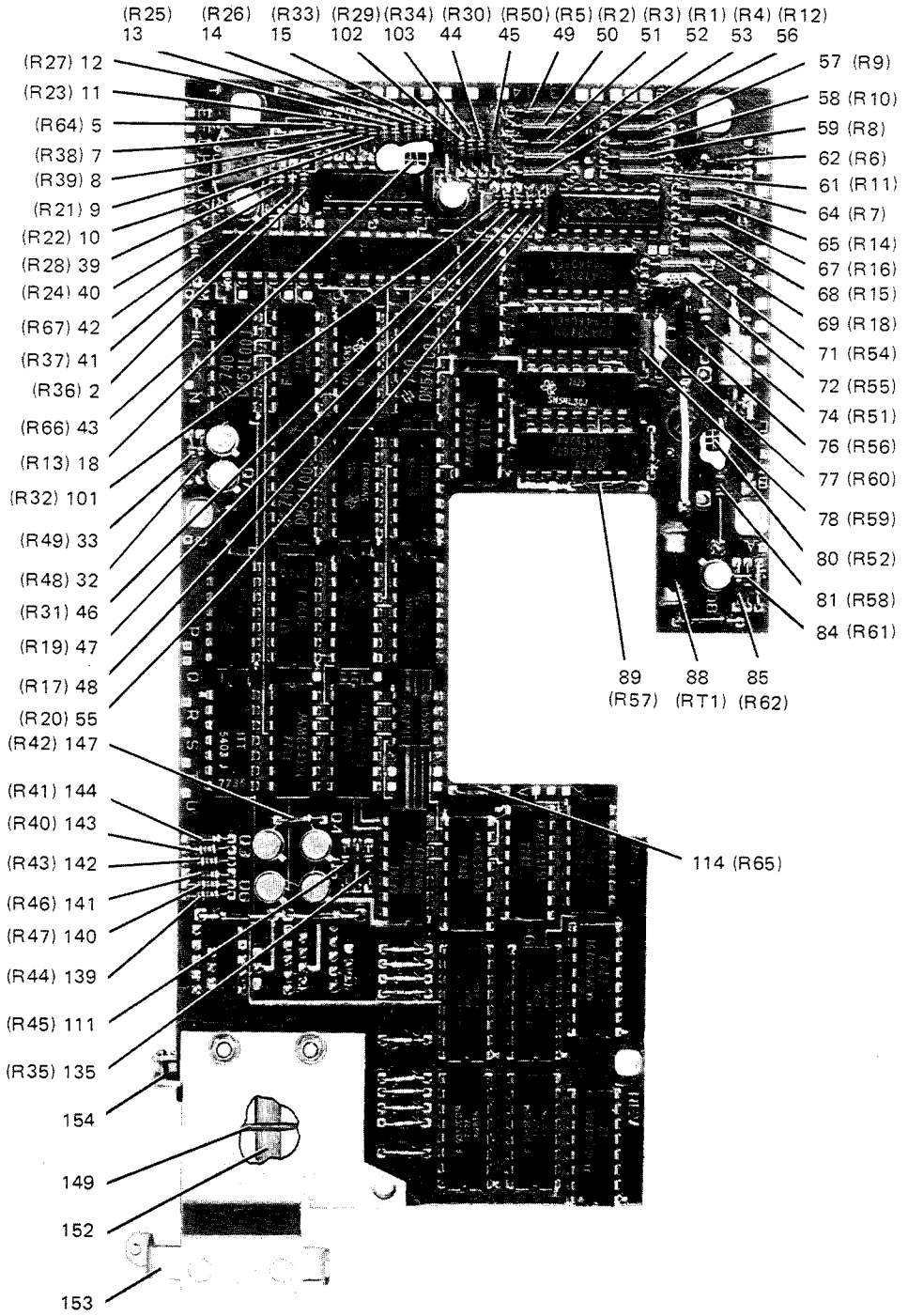
This temporary revision supersedes temporary revision number 9

Subject: Illustrated Parts List

Correct the parts list as follows:

170	775-5138-002	4	SPIDER	1

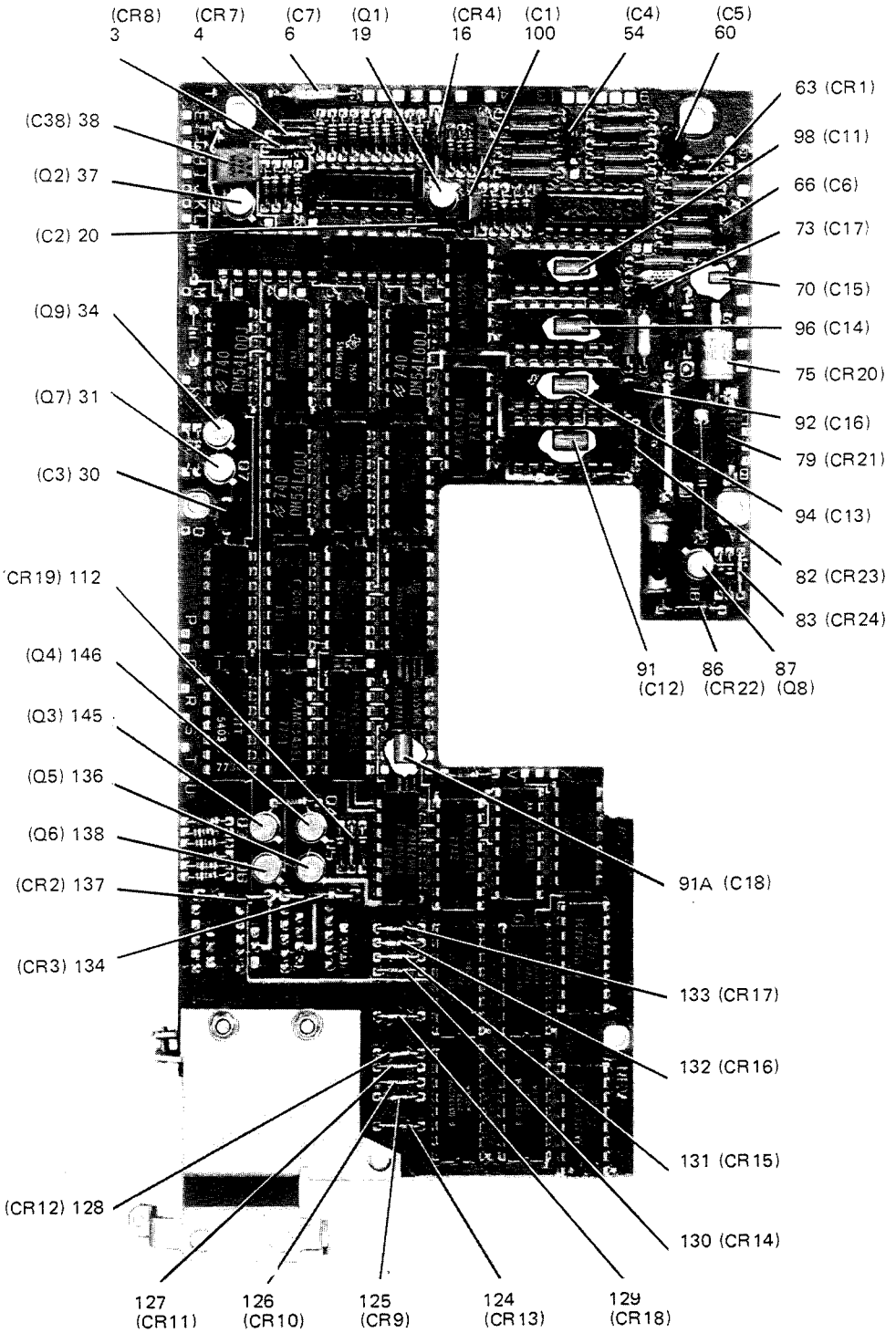
DETAILED PARTS LIST



TP6-5222-037

Distance Readout, Circuit Card Assembly A1
Figure 2 (Sheet 1 of 3)

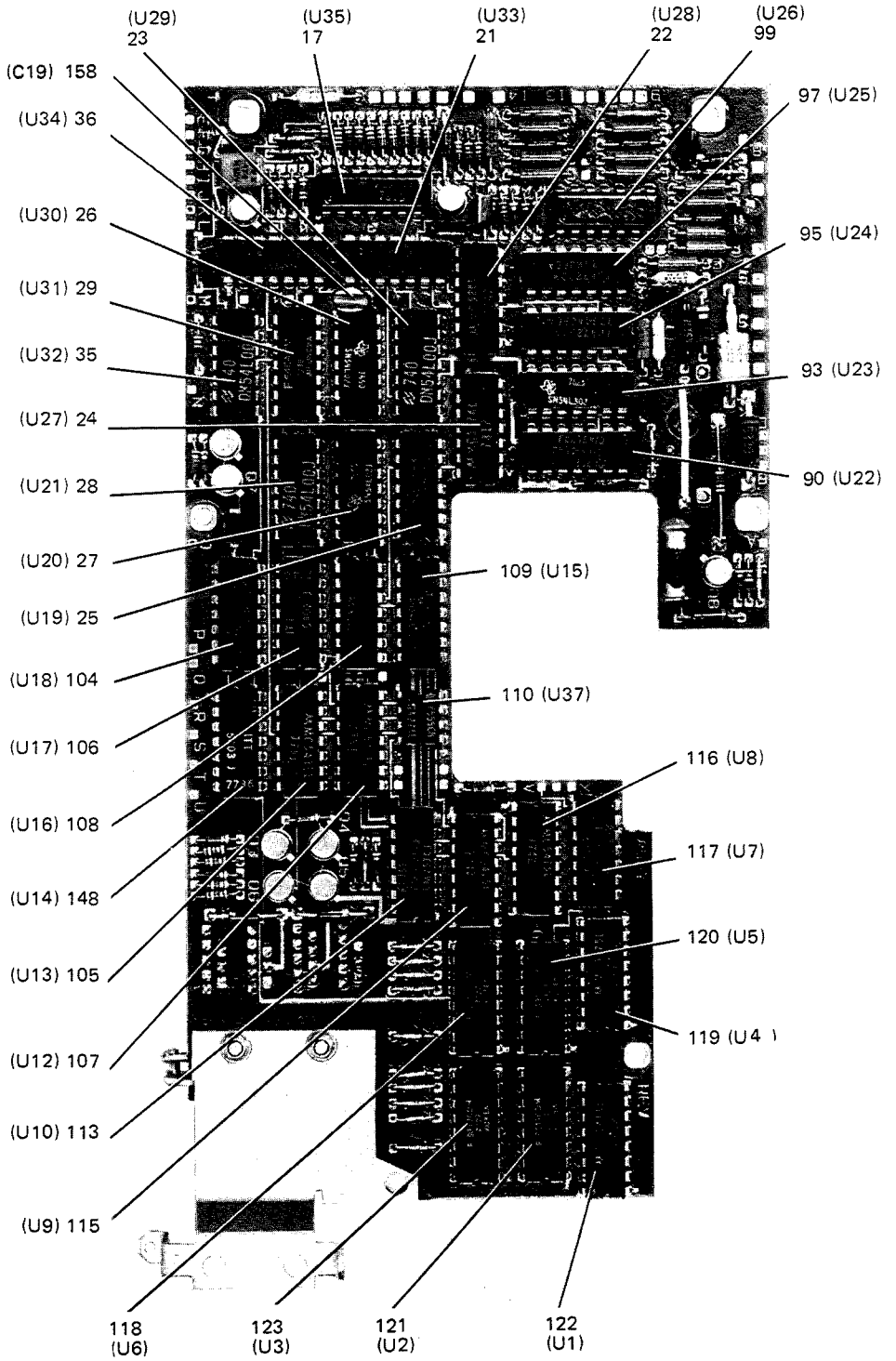
DETAILED PARTS LIST



TP6-5222-037

Distance Readout, Circuit Card Assembly A1
Figure 2 (Sheet 2 of 3)

DETAILED PARTS LIST



TP6-5222-037

Distance Readout, Circuit Card Assembly A1
Figure 2 (Sheet 3 of 3)

DETAILED PARTS LIST

	FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDENT	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
R	2-1	638-2777-001		1	CIRCUIT CARD ASSY, DISTANCE READOUT A1 (SEE FIG 1-19K FOR NHA)		RF
	2	RCR05G331KS		2	RESISTOR,FIXED CMPSN, 330 OHMS, 10%, 1/8W (V81349) 745-2323-000 A1R36		1
R	3	1N4454-1		2	SEMICOND DEVICE (V31433) 353-3644-010 A1CR8		1
R	4	1N4454-1		2	SEMICOND DEVICE (V31433) 353-3644-010 A1CR7		1
	5	RCR05G103KS		2	RESISTOR,FIXED CMPSN, 10K, 10%, 1/8W (V81349) 745-2377-000 A1R64		1
	6	M39003-01-2117		2	CAPACITOR,FXD ELCTLT, 1UF, 20%, 50V (V81349) 184-9084-440 A1C7		1
R	7	RCR05G394KS		2	RESISTOR,FIXED CMPSN, 390K, 10%, 1/8W (V81349) 745-2434-000 A1R38		1
	8	RCR05G515JS		2	RESISTOR,FIXED CMPSN, 5.1MEGO, 5%, 1/8W (V81349) 745-1864-420 A1R39		1
	9	RCR05G273KS		2	RESISTOR,FIXED CMPSN, 27K, 10%, 1/8W (V81349) 745-2392-000 A1R21		1
	10	RCR05G273KS		2	RESISTOR,FIXED CMPSN, 27K, 10%, 1/8W (V81349) 745-2392-000 A1R22		1
	11	RCR05G273KS		2	RESISTOR,FIXED CMPSN, 27K, 10%, 1/8W (V81349) 745-2392-000 A1R23		1
	12	RCR05G273KS		2	RESISTOR,FIXED CMPSN, 27K, 10%, 1/8W (V81349) 745-2392-000 A1R27		1
	13	RCR32G390JS		2	RESISTOR,FXD CMPSN, 39 OHMS, 5%, 1W (V81349) 745-3292-000 A1R25		1
	14	RCR05G273KS		2	RESISTOR,FIXED CMPSN, 27K, 10%, 1/8W (V81349) 745-2392-000 A1R26		1
	15	RCR05G273KS		2	RESISTOR,FIXED CMPSN, 27K, 10%, 1/8W (V81349) 745-2392-000 A1R33		1
R	16	1N4003		2	SEMICOND DEVICE (V14433) 353-6442-030 A1CR4		1
R	17	LM3302N		2	INTEGRATED CIRCUIT COMPARATOR (V34335) 351-1122-040 A1U35		1
	18	RN55D3481F		2	RESISTOR,FIXED FILM, 3.48K, 1%, 1/8W (V81349) 705-1022-000 A1R13		1
R	19	2N2222A		2	TRANSISTOR (V49956) 352-0661-020 A1Q1		1
	20	CK05BX223K		2	CAPACITOR,FIXED CER DIEL, 0.022UF, 10%, 50VDC (V81349) 913-5019-240 A1C2		1
R	21	S5400F/883C		2	INTEGRATED CIRCUIT LOGIC GATE (V18324) 351-7389-020 A1U33		1
	22	RG80D		2	INTEGRATED CIRCUIT LOGIC GATE (V49956) 351-7307-030 A1U28		1
	23	SN54L00J		2	INTEGRATED CIRCUIT LOW PWR XSTR-TTL (V01295) 351-7365-140 A1U29		1
	24	SN5474J		2	INTEGRATED CIRCUIT FLIP-FLOP (V01295) 351-7606-020 A1U27		1
	25	SN54L10J		2	INTEGRATED CIRCUIT LOW PWR XSTR-TTL (V01295) 351-7365-180 A1U19		1
	26	SN54L02J		2	INTEGRATED CIRCUIT (V01295) 351-7686-020 A1U30		1
	27	SN54L02J		2	INTEGRATED CIRCUIT (V01295) 351-7686-020 A1U20		1
	28	SN54L00J		2	INTEGRATED CIRCUIT LOW PWR XSTR-TTL (V01295) 351-7365-140 A1U21		1
R	29	5404DM		2	INTEGRATED CIRCUIT INVERTER (V07263) 351-7689-010 A1U31		1
	30	CK05BX681K		2	CAPACITOR,FIXED CER DIEL, 680PF, 10%, 200V (V81349) 913-4016-000 A1C3		1
R	31	RS1887		2	TRANSISTOR (V49956) 352-0661-040 A1Q7		1

- ITEM NOT ILLUSTRATED

DETAILED PARTS LIST

	FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDENTURE	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
	2 32	RCR05G272KS		2	RESISTOR,FIXED CMPSN, 2.7K, 10%, 1/8W (V81349) 745-2356-000 A1R48		1
	33	RCR05G273KS		2	RESISTOR,FIXED CMPSN, 27K, 10%, 1/8W (V81349) 745-2392-000 A1R49		1
R	34	RS1887		2	TRANSISTOR (V49956) 352-0661-040 A1Q9		1
	35	SN54L00J		2	INTEGRATED CIRCUIT LOW PWR XSTR-TTL (V01295) 351-7365-140 A1U32		1
	36	SN54L10J		2	INTEGRATED CIRCUIT LOW PWR XSTR-TTL (V01295) 351-7365-180 A1U34		1
R	37	2N2222A		2	TRANSISTOR (V49956) 352-0661-020 A1Q2		1
R	38	300-050-601-474M		2	CAPACITOR,FIXED CER DIEL, 0.47UF, 20%, 50V (V51642) 913-3279-250 A1C8		1
	39	RCR05G272KS		2	RESISTOR,FIXED CMPSN, 2.7K, 10%, 1/8W (V81349) 745-2356-000 A1R28		1
	40	RCR05G272KS		2	RESISTOR,FIXED CMPSN, 2.7K, 10%, 1/8W (V81349) 745-2356-000 A1R24		1
	41	RCR05G272KS		2	RESISTOR,FIXED CMPSN, 2.7K, 10%, 1/8W (V81349) 745-2356-000 A1R37		1
	42	RCR05G103KS		2	RESISTOR,FIXED CMPSN, 10K, 10%, 1/8W (V81349) 745-2377-000 A1R67		1
	43	RCR05G103KS		2	RESISTOR,FIXED CMPSN, 10K, 10%, 1/8W (V81349) 745-2377-000 A1R66		1
	44	RCR05G273KS		2	RESISTOR,FIXED CMPSN, 27K, 10%, 1/8W (V81349) 745-2392-000 A1R30		1
	45	RN55D5111F		2	RESISTOR,FIXED FILM, 5.11K, 1%, 1/8W (V81349) 705-1030-000 A1R50		1
	46	RCR05G273KS		2	RESISTOR,FIXED CMPSN, 27K, 10%, 1/8W (V81349) 745-2392-000 A1R31		1
	47	RCR05G272KS		2	RESISTOR,FIXED CMPSN, 2.7K, 10%, 1/8W (V81349) 745-2356-000 A1R19		1
	48	RCR05G272KS		2	RESISTOR,FIXED CMPSN, 2.7K, 10%, 1/8W (V81349) 745-2356-000 A1R17		1
	49	RN55D1002F		2	RESISTOR,FIXED FILM, 10K, 1%, 1/8W (V81349) 705-1044-000 A1R5		1
	50	RN55D1002F		2	RESISTOR,FIXED FILM, 10K, 1%, 1/8W (V81349) 705-1044-000 A1R2		1
	51	RN55D1212F		2	RESISTOR,FXD FILM, 12.1K, 1%, 1/8W (V81349) 705-1048-000 A1R3		1
	52	RN55D1002F		2	RESISTOR,FIXED FILM, 10K, 1%, 1/8W (V81349) 705-1044-000 A1R1		1
	53	RN55D1002F		2	RESISTOR,FIXED FILM, 10K, 1%, 1/8W (V81349) 705-1044-000 A1R4		1
R	54	CD5EY300J0		2	CAPACITOR,FIXED MICA DIEL, 30PF, 5%, 50V (V93790) 912-4141-200 A1C4		1
	55	RCR05G272KS		2	RESISTOR,FIXED CMPSN, 2.7K, 10%, 1/8W (V81349) 745-2356-000 A1R20		1
	56	RN55D1002F		2	RESISTOR,FIXED FILM, 10K, 1%, 1/8W (V81349) 705-1044-000 A1R12		1
	57	RN55D1002F		2	RESISTOR,FIXED FILM, 10K, 1%, 1/8W (V81349) 705-1044-000 A1R9		1
	58	RN55D1212F		2	RESISTOR,FXD FILM, 12.1K, 1%, 1/8W (V81349) 705-1048-000 A1R10		1
	59	RN55D1002F		2	RESISTOR,FIXED FILM, 10K, 1%, 1/8W (V81349) 705-1044-000 A1R8		1
R	60	CD5EY300J0		2	CAPACITOR,FIXED MICA DIEL, 30PF, 5%, 50V (V93790) 912-4141-200 A1C5		1
	61	RN55D1002F		2	RESISTOR,FIXED FILM, 10K, 1%, 1/8W (V81349) 705-1044-000 A1R11		1
	62	RCR05G103KS		2	RESISTOR,FIXED CMPSN, 10K, 10%, 1/8W (V81349) 745-2377-000 A1R6		1

DETAILED PARTS LIST

	FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDEX	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
R	2 63	1N4622		2	SEMICOND DEVICE (V04713) 353-3591-460 A1CR1		1
	64	RN55D1002F		2	RESISTOR,FIXED FILM, 10K, 1%, 1/8W (V81349) 705-1044-000 A1R7		1
	65	RN55D1002F		2	RESISTOR,FIXED FILM, 10K, 1%, 1/8W (V81349) 705-1044-000 A1R14		1
R	66	CD5EY300J0		2	CAPACITOR,FIXED MICA DIEL, 30PF, 5%, 50V (V93790) 912-4141-200 A1C6		1
	67	RN55D1212F		2	RESISTOR,FXD FILM, 12.1K, 1%, 1/8W (V81349) 705-1048-000 A1R16		1
	68	RN55D1002F		2	RESISTOR,FIXED FILM, 10K, 1%, 1/8W (V81349) 705-1044-000 A1R15		1
	69	RN55D1002F		2	RESISTOR,FIXED FILM, 10K, 1%, 1/8W (V81349) 705-1044-000 A1R18		1
	70	CK05BX104K		2	CAPACITOR,FIXED CER DIEL, 0.1UF, 10%, 50VDC (V81349) 913-5019-320 A1C15		1
	71	RN55D4221F		2	RESISTOR,FIXED FILM, 4.22K, 1%, 1/8W (V81349) 705-1026-000 A1R54		1
	72	RN55D2151F		2	RESISTOR,FXD FILM, 2.15K, 1%, 1/8W (V81349) 705-1012-000 A1R55		1
	73	CK05BX104K		2	CAPACITOR,FIXED CER DIEL, 0.1UF, 10%, 50VDC (V81349) 913-5019-320 A1C17		1
	74	RCR07G100KS		2	RESISTOR,FIXED CMPSN, 10 OHMS, 10%, 1/4W (V81349) 745-0677-000 A1R51		1
R	75	JAN1N3027B		2	SEMICOND DEVICE (V81349) 353-3057-000 A1CR20		1
	76	RW70UR511F		2	RESISTOR,FXD WW, 0.511 OHMS, 1%, 1W (V81349) 747-1499-300 A1R56		1
	77	RN55D3651F		2	RESISTOR,FXD FILM, 3.65K, 1%, 1/8W (V81349) 705-1023-000 A1R60		1
	78	RN55D5900F		2	RESISTOR,FXD FILM, 590 OHMS, 1%, 1/8W (V81349) 705-0985-000 A1R59		1
	79	1N5339B		2	SEMICOND DEVICE (V04713) 353-6550-070 A1CR21		1
	80	RCR32G471KS		2	RESISTOR,FXD CMPSN, 470 OHMS, 10%, 1W (V81349) 745-3338-000 A1R52		1
	81	RCR05G471KS		2	RESISTOR,FIXED CMPSN, 470 OHMS, 10%, 1/8W (V81349) 745-2329-000 A1R58		1
R	82	1N4454-1		2	SEMICOND DEVICE (V31433) 353-3644-010 A1CR23		1
R	83	1N4454-1		2	SEMICOND DEVICE (V31433) 353-3644-010 A1CR24		1
	84	RCR05G154KS		2	RESISTOR,FIXED CMPSN, 150K, 10%, 1/8W (V81349) 745-2419-000 A1R61		1
	85	RCR05G560KS		2	RESISTOR,FIXED CMPSN, 56 OHMS, 10%, 1/8W (V81349) 745-2295-000 A1R62		1
	86	JAN1N748A		2	SEMICOND DEVICE (V81350) 353-2975-000 A1CR22		1
R	87	2N2222A		2	TRANSISTOR (V49956) 352-0661-020 A1Q8		1
	88	0550F5-256		2	RESISTOR,THERMAL 100 OHMS, 10%, 1W (V10646) 714-1730-000 A1RT1		1
	89	RS12X000ER7500H		2	RESISTOR,FIXED WW, 0.75 OHMS, 3%, 1/2W (V91637) 747-1862-000 A1R57		1
	90	DM54164J		2	INTEGRATED CIRCUIT SHIFT REGISTER (V27014) 351-7490-010 A1U22		1
	91	M39006-21-0043		2	CAPACITOR,FIXED ELCTLT, 220UF, PORM20%, 30V (V81349) 184-9116-050 A1C12		1
	92	CK05BX104K		2	CAPACITOR,FIXED CER DIEL, 0.1UF, 10%, 50VDC (V81349) 913-5019-320 A1C16		1
	93	SN54L30J		2	INTEGRATED CIRCUIT LOW PWR XSTR-TTL (V01295) 351-7365-200 A1U23		1

DETAILED PARTS LIST

	FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDEX	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
	2 94	M39006-21-0043		2	CAPACITOR,FIXED ELCTLT, 220UF, PORM20%, 30V (V81349) 184-9116-050 A1C13		1
R	95	SG723J		2	INTEGRATED CIRCUIT V RGLTR (V34333) 351-1035-040 A1U24		1
	96	M39006-21-0043		2	CAPACITOR,FIXED ELCTLT, 220UF, PORM20%, 30V (V81349) 184-9116-050 A1C14		1
R	97	SG723J		2	INTEGRATED CIRCUIT V RGLTR (V34333) 351-1035-040 A1U25		1
R	98	M39006/09-8118		2	CAPACITOR,FIXED ELCTLT, 47UF, 20%, 50V (V81349) 184-9103-830 A1C11		1
R	99	LM3302N		2	INTEGRATED CIRCUIT COMPARATOR (V34335) 351-1122-040 A1U26		1
	100	CK05BX473K		2	CAPACITOR,FIXED CER DIEL, 0.047UF, 10%, 50VDC (V81349) 913-5019-280 A1C1		1
	101	RCR05G272KS		2	RESISTOR,FIXED CMPSN, 2.7K, 10%, 1/8W (V81349) 745-2356-000 A1R32		1
	102	RCR05G273KS		2	RESISTOR,FIXED CMPSN, 27K, 10%, 1/8W (V81349) 745-2392-000 A1R29		1
	103	RCR05G563KS		2	RESISTOR,FIXED CMPSN, 56K, 10%, 1/8W (V81349) 745-2404-000 A1R34		1
	104	SN54L02J		2	INTEGRATED CIRCUIT (V01295) 351-7686-020 A1U18		1
	105	MC5438L		2	INTEGRATED CIRCUIT LOGIC GATE (V04713) 351-7748-030 A1U13		1
	106	SN5402J		2	INTEGRATED CIRCUIT LOGIC GATE (V01295) 351-7678-010 A1U17		1
	107	MC5438L		2	INTEGRATED CIRCUIT LOGIC GATE (V04713) 351-7748-030 A1U12		1
	108	SN54L04J		2	INTEGRATED CIRCUIT LOW PWR XSTR-TTL (V01295) 351-7365-170 A1U16		1
	109	SN54L02J		2	INTEGRATED CIRCUIT (V01295) 351-7686-020 A1U15		1
R	110	SC12240P		2	INTEGRATED CIRCUIT TIMER (V04713) 351-1137-010 A1U37		1
	111	RCR05G681KS		2	RESISTOR,FIXED CMPSN, 680 OHMS, 10%, 1/8W (V81349) 745-2335-000 A1R45		1
R	112	1N4454-1		2	SEMICOND DEVICE (V31433) 353-3644-010 A1CR19		1
	113	DM54164J		2	INTEGRATED CIRCUIT SHIFT REGISTER (V27014) 351-7490-010 A1U10		1
	114	RCR05G106KS		2	RESISTOR,FXD CMPSN, 10MEGO, 10%, 1/8W (V81349) 745-1864-850 A1R65		1
	115	SN5475J		2	INTEGRATED CIRCUIT (V01295) 351-7680-010 A1U9		1
	116	SN5475J		2	INTEGRATED CIRCUIT (V01295) 351-7680-010 A1U8		1
	117	DM54164J		2	INTEGRATED CIRCUIT SHIFT REGISTER (V27014) 351-7490-010 A1U7		1
R	118	9317CDM		2	INTEGRATED CIRCUIT (V07263) 351-7528-030 A1U6 (EFF TO REV F) (OBSOLETE)		1
R	118	DM74126N		2	INTEGRATED CIRCUIT (V27014) 351-7728-010 A1U6 (EFF REV F) (REPLACEMENT)		1
	119	SN5475J		2	INTEGRATED CIRCUIT (V01295) 351-7680-010 A1U4		1
R	120	9317CDM		2	INTEGRATED CIRCUIT (V07263) 351-7528-030 A1U5 (EFF TO REV F) (OBSOLETE)		1
R	120	DM74126N		2	INTEGRATED CIRCUIT (V27014) 351-7728-010 A1U5 (EFF REV F) (REPLACEMENT)		1
R	121	9317CDM		2	INTEGRATED CIRCUIT (V07263) 351-7528-030 A1U2 (EFF TO REV F) (OBSOLETE)		1

HSI-45 HORIZONTAL SITUATION INDICATOR

COMPONENT MAINTENANCE MANUAL (523-0768607)

TEMPORARY REVISION NO 34-28-25-12

Insert facing page 1040, 34-28-25

This temporary revision supersedes temporary revison number 11

Subject: Illustrated Parts List

Change figure 2 as follows:

118	9317CDM	2	INTEGRATED CIRCUIT (V07263) 351-7528-030	A1U6	1
118	DM74126N	2	A1U6 (DELETED)		
120	9317CDM	2	INTEGRATED CIRCUIT (V07263) 351-7528-030	A1U5	1
120	DM74126N	2	A1U5 (DELETED)		
121	9317CDM	2	INTEGRATED CIRCUIT (V07263) 351-7528-030	A1U2	1

HSI-45 HORIZONTAL SITUATION INDICATOR

COMPONENT MAINTENANCE MANUAL (523-0768607)

TEMPORARY REVISION NO 34-28-25-12

Insert facing page 1041, 34-28-25

This temporary revision supersedes temporary revision number 11

Subject: Illustrated Parts List

Change figure 2 as follows:

121	DM74126N	2	A1U2 (DELETED)
123	9317CDM	2	INTEGRATED CIRCUIT (V07263) 351-7528-030 A1U3 1
123	DM74126N	2	A1U3 (DELETED)

DETAILED PARTS LIST

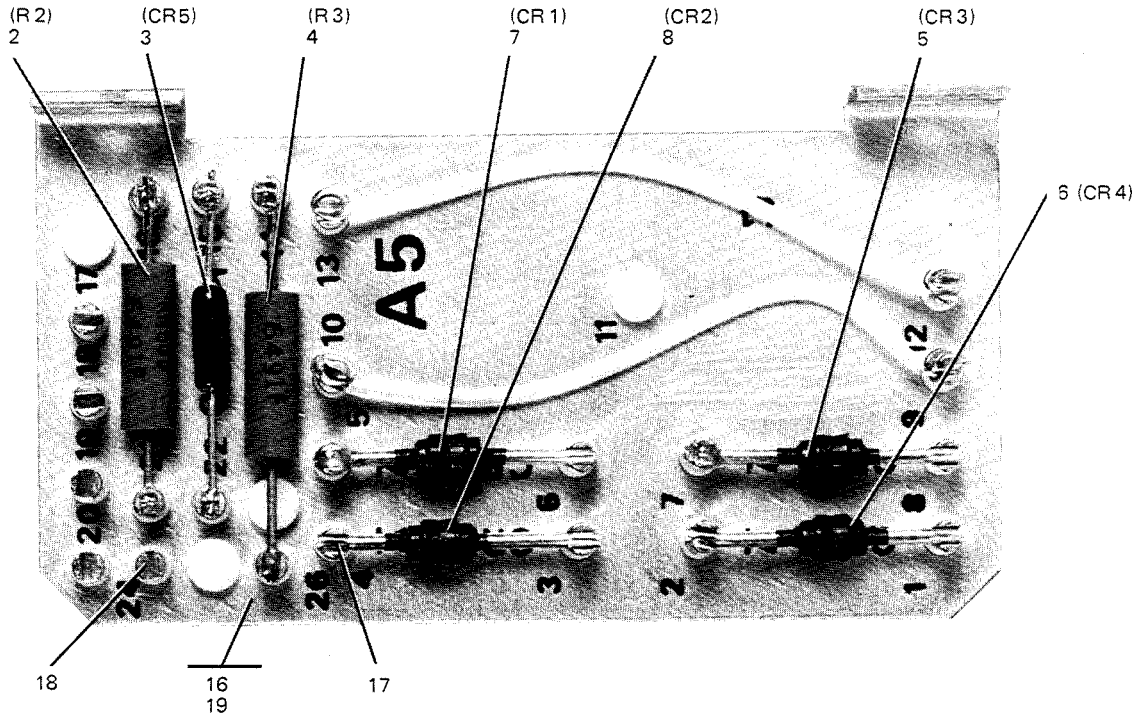
	FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDENT	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
R	2 121	DM74126N		2	INTEGRATED CIRCUIT (V27014) 351-7728-010 A1U2 (EFF REV F) (REPLACEMENT)		1
	122	SN5475J		2	INTEGRATED CIRCUIT (V01295) 351-7680-010 A1U1		1
R	123	9317CDM		2	INTEGRATED CIRCUIT (V07263) 351-7528-030 A1U3 (EFF TO REV F) (OBSOLETE)		1
R	123	DM74126N		2	INTEGRATED CIRCUIT (V27014) 351-7728-010 A1U3 (EFF REV F) (REPLACEMENT)		1
R	124	1N4454-1		2	SEMICOND DEVICE (V31433) 353-3644-010 A1CR13		1
R	125	1N4454-1		2	SEMICOND DEVICE (V31433) 353-3644-010 A1CR9		1
R	126	1N4454-1		2	SEMICOND DEVICE (V31433) 353-3644-010 A1CR10		1
R	127	1N4454-1		2	SEMICOND DEVICE (V31433) 353-3644-010 A1CR11		1
R	128	1N4454-1		2	SEMICOND DEVICE (V31433) 353-3644-010 A1CR12		1
R	129	1N4454-1		2	SEMICOND DEVICE (V31433) 353-3644-010 A1CR18		1
R	130	1N4454-1		2	SEMICOND DEVICE (V31433) 353-3644-010 A1CR14		1
R	131	1N4454-1		2	SEMICOND DEVICE (V31433) 353-3644-010 A1CR15		1
R	132	1N4454-1		2	SEMICOND DEVICE (V31433) 353-3644-010 A1CR16		1
R	133	1N4454-1		2	SEMICOND DEVICE (V31433) 353-3644-010 A1CR17		1
R	134	1N4003		2	SEMICOND DEVICE (V14433) 353-6442-030 A1CR3		1
	135	RCR05G102KS		2	RESISTOR,FIXED CMPSN, 1K, 10%, 1/8W (V81349) 745-2341-000 A1R35		1
R	136	2N2222A		2	TRANSISTOR (V49956) 352-0661-020 A1Q5		1
R	137	1N4003		2	SEMICOND DEVICE (V14433) 353-6442-030 A1CR2		1
R	138	2N2222A		2	TRANSISTOR (V49956) 352-0661-020 A1Q6		1
	139	RCR05G393KS		2	RESISTOR,FIXED CMPSN, 39K, 10%, 1/8W (V81349) 745-2398-000 A1R44		1
	140	RCR05G393KS		2	RESISTOR,FIXED CMPSN, 39K, 10%, 1/8W (V81349) 745-2398-000 A1R47		1
	141	RCR05G681KS		2	RESISTOR,FIXED CMPSN, 680 OHMS, 10%, 1/8W (V81349) 745-2335-000 A1R46		1
	142	RCR05G393KS		2	RESISTOR,FIXED CMPSN, 39K, 10%, 1/8W (V81349) 745-2398-000 A1R43		1
	143	RCR05G393KS		2	RESISTOR,FIXED CMPSN, 39K, 10%, 1/8W (V81349) 745-2398-000 A1R40		1
	144	RCR05G681KS		2	RESISTOR,FIXED CMPSN, 680 OHMS, 10%, 1/8W (V81349) 745-2335-000 A1R41		1
R	145	2N2222A		2	TRANSISTOR (V49956) 352-0661-020 A1Q3		1
R	146	2N2222A		2	TRANSISTOR (V49956) 352-0661-020 A1Q4		1
	147	RCR05G681KS		2	RESISTOR,FIXED CMPSN, 680 OHMS, 10%, 1/8W (V81349) 745-2335-000 A1R42		1
	148	5403J		2	INTEGRATED CIRCUIT LOGIC GATE (V14433) 351-7679-010 A1U14		1
R	149	797-7038-001		2	PLATE (EFF TO REV A)		1
R	-150	MS16633-1006		2	RING,RTNG (V96906) 340-0098-000 (AP) (EFF TO REV A)		2
R	-151	797-7039-001		2	PIN (AP) (EFF TO REV A)		2
R	152	MD1-9SH001		2	CONNECTOR,RCPT ELEC (V71468) 371-7042-100 (EFF TO REV A)		4
R	153	629-8060-001		2	BRACKET (EFF TO REV A)		1

- ITEM NOT ILLUSTRATED

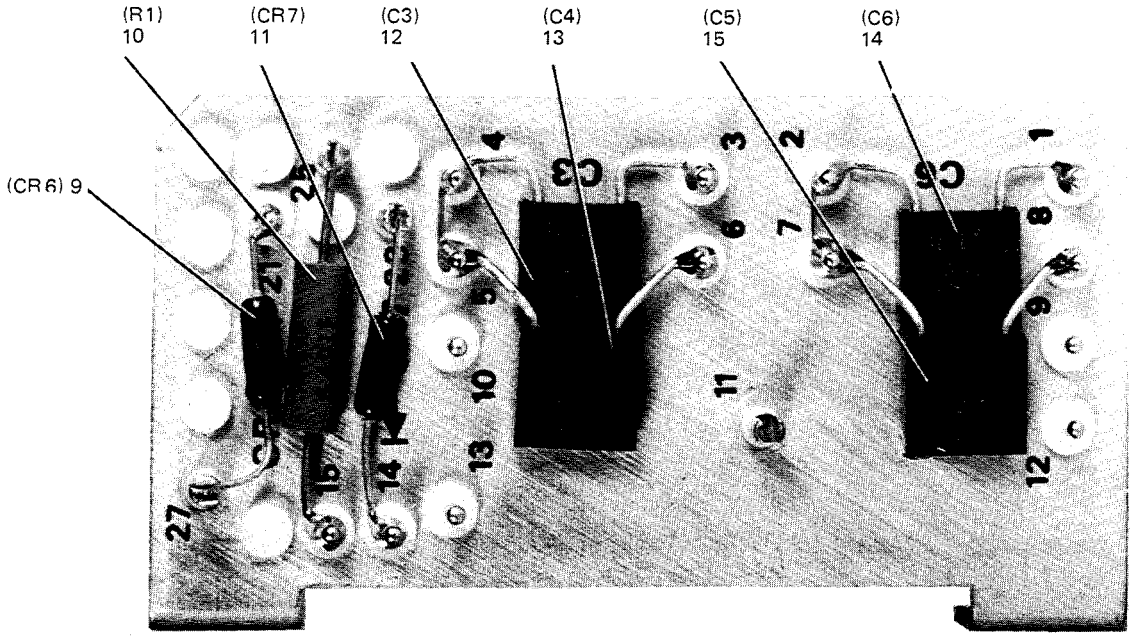
DETAILED PARTS LIST

	FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDENT	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
R	2 154	629-8063-001		2	BRACKET (EFF TO REV A)		1
R	-155	68-1660-26		2	NUT,SLFLKG,HEX AL, 2-56 (V72962) 333-0604-000 (AP FOR 153-154) (EFF TO REV A)		2
R	-156	310-6320-000		2	WASHER,FLAT SST, 0.092 X 0.219 OD (V79807) (AP FOR 153-154) (EFF TO REV A)		4
R	-157	MS16997-3		2	SCREW,CAP,SCH CD PL STL, 2-56 X 3/8 (V96906) 324-2601-000 (AP FOR 153-154) (EFF TO REV A)		2
R	158	CK05BX103K		2	CAPACITOR,FIXED CER DIEL, 0.01UF, 10%, 100VDC (V81349) 913-5019-200 A1C19		1

- ITEM NOT ILLUSTRATED



FRONT VIEW



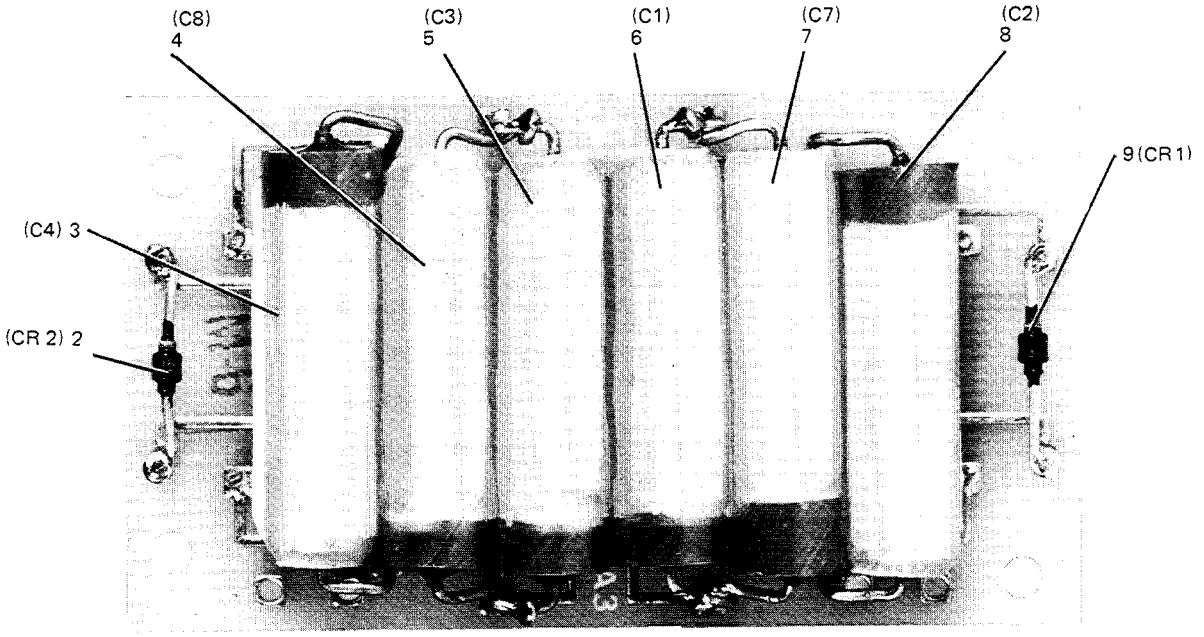
REAR VIEW

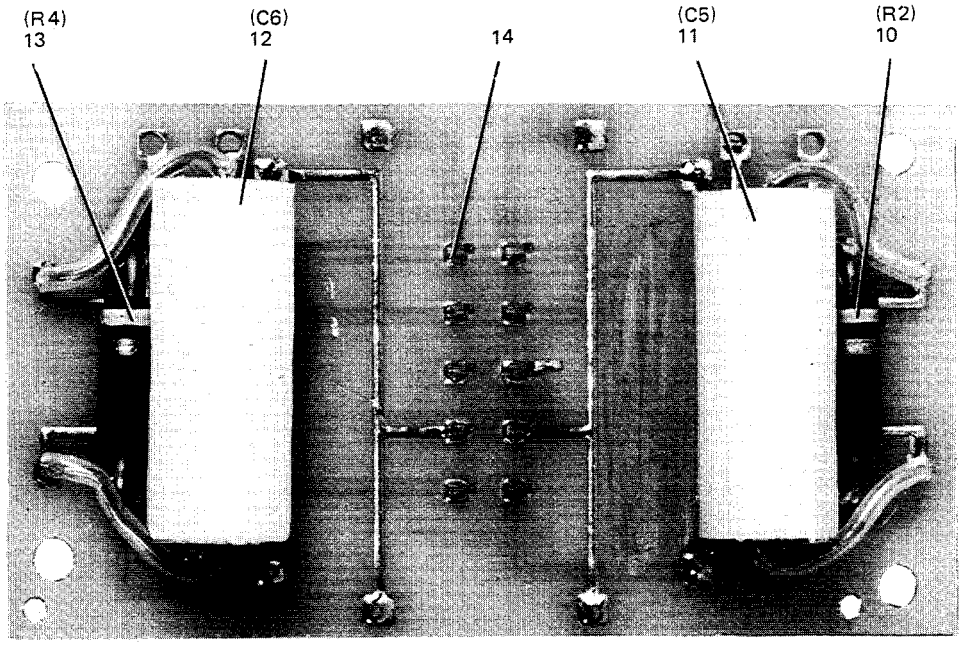
Electronic Components Assembly A5
Figure 3

DETAILED PARTS LIST

	FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDENT	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
	3-1	638-2782-001		1	ELECTRONIC COMPONENT ASSEMBLY A5 (SEE FIG 1-23 FOR NHA)		RF
	2	RN60D6491F		2	RESISTOR,FXD FILM, 6.49K, 1%, 1/4W (V81349) 705-6635-000 A5R2		1
R	3	1N746A		2	SEMICOND DEVICE (V12954) 353-2938-000 A5CR5		1
	4	RN60D6491F		2	RESISTOR,FXD FILM, 6.49K, 1%, 1/4W (V81349) 705-6635-000 A5R3		1
	5	1N5415		2	SEMICOND DEVICE (V14099) 353-6558-010 A5CR3		1
	6	1N5415		2	SEMICOND DEVICE (V14099) 353-6558-010 A5CR4		1
	7	1N5415		2	SEMICOND DEVICE (V14099) 353-6558-010 A5CR1		1
	8	1N5415		2	SEMICOND DEVICE (V14099) 353-6558-010 A5CR2		1
R	9	1N746A		2	SEMICOND DEVICE (V12954) 353-2938-000 A5CR6		1
	10	RN60D6491F		2	RESISTOR,FXD FILM, 6.49K, 1%, 1/4W (V81349) 705-6635-000 A5R1		1
R	11	1N746A		2	SEMICOND DEVICE (V12954) 353-2938-000 A5CR7		1
R	12	R1363-010		2	CAPACITOR,FIXED CER DIEL, 100,000PF, PORM20%, 50V OR 75V OR 100V (V96733) 913-4496-010 A5C3		1
R	13	R1363-010		2	CAPACITOR,FIXED CER DIEL, 100,000PF, PORM20%, 50V OR 75V OR 100V (V96733) 913-4496-010 A5C4		1
R	14	R1363-010		2	CAPACITOR,FIXED CER DIEL, 100,000PF, PORM20%, 50V OR 75V OR 100V (V96733) 913-4496-010 A5C6		1
R	15	R1363-010		2	CAPACITOR,FIXED CER DIEL, 100,000PF, PORM20%, 50V OR 75V OR 100V (V96733) 913-4496-010 A5C5		1
	16	638-2781-001		2	TERMINAL BOARD		1
R	17	002-3402-000599		3	TERMINAL,FEEDTHRU (V98291) 306-2474-010		15
R	18	004-3401-000599		3	TERMINAL,STANDOFF (V98291) 306-2222-100		12
	19	797-6721-001		3	TERMINAL BOARD		1

- ITEM NOT ILLUSTRATED





TP6-5160-017

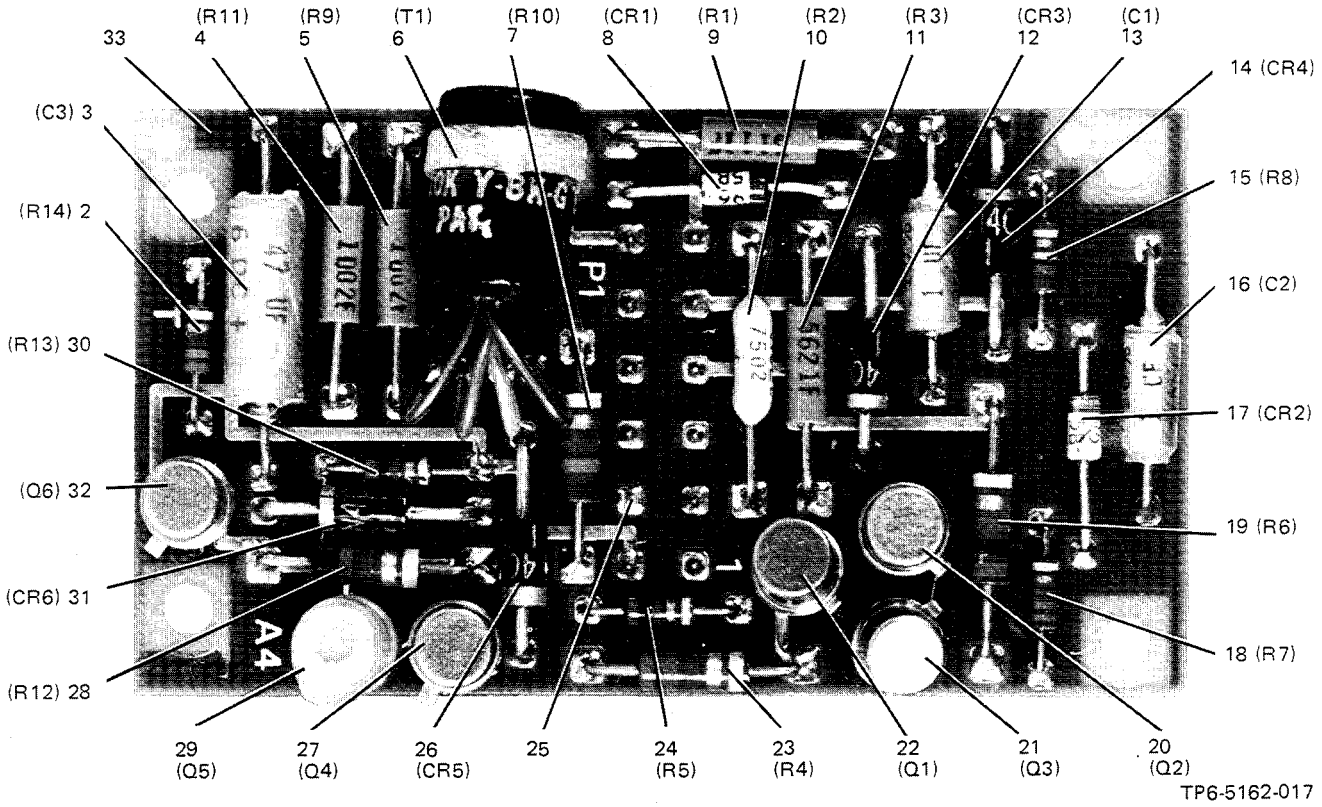
Power Supply Circuit Card Assembly A3
Figure 4

DETAILED PARTS LIST

	FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDENT	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
	4-1	638-2774-001		1	CIRCUIT CARD ASSY, POWER SUPPLY A3 (SEE FIG 1-34 FOR NHA)		RF
	2	SC5615		2	SEMICOND DEVICE (V14099) 353-6496-020 A3CR2		1
	3	600D226G050KD5		2	CAPACITOR,FXD ELCTLT, 22UF, P75%M10%, 50V (V56289) 183-1277-020 A3C4		1
	4	600D226G050KD5		2	CAPACITOR,FXD ELCTLT, 22UF, P75%M10%, 50V (V56289) 183-1277-020 A3C8		1
	5	600D226G050KD5		2	CAPACITOR,FXD ELCTLT, 22UF, P75%M10%, 50V (V56289) 183-1277-020 A3C3		1
	6	600D226G050KD5		2	CAPACITOR,FXD ELCTLT, 22UF, P75%M10%, 50V (V56289) 183-1277-020 A3C1		1
	7	600D226G050KD5		2	CAPACITOR,FXD ELCTLT, 22UF, P75%M10%, 50V (V56289) 183-1277-020 A3C7		1
	8	600D226G050KD5		2	CAPACITOR,FXD ELCTLT, 22UF, P75%M10%, 50V (V56289) 183-1277-020 A3C2		1
	9	SC5615		2	SEMICOND DEVICE (V14099) 353-6496-020 A3CR1		1
R	10	RCR20G100KS		2	RESISTOR,FXD CMPSN, 10 OHMS, 10%, 1/2W (V81349) 745-1268-000 A3R2		1
R	11	CRC-1-530		2	CAPACITOR,FIXED PLSTC DIEL, 0.47UF, 10%, 150V (V04099) 933-1081-530 A3C5		1
R	12	CRC-1-530		2	CAPACITOR,FIXED PLSTC DIEL, 0.47UF, 10%, 150V (V04099) 933-1081-530 A3C6		1
R	13	RCR20G100KS		2	RESISTOR,FXD CMPSN, 10 OHMS, 10%, 1/2W (V81349) 745-1268-000 A3R4		1
	14	768-5919-003		2	KEY, INDEX		1

- ITEM NOT ILLUSTRATED

DETAILED PARTS LIST



Azimuth Card and Back LOC Circuit Card Assembly A4
Figure 5

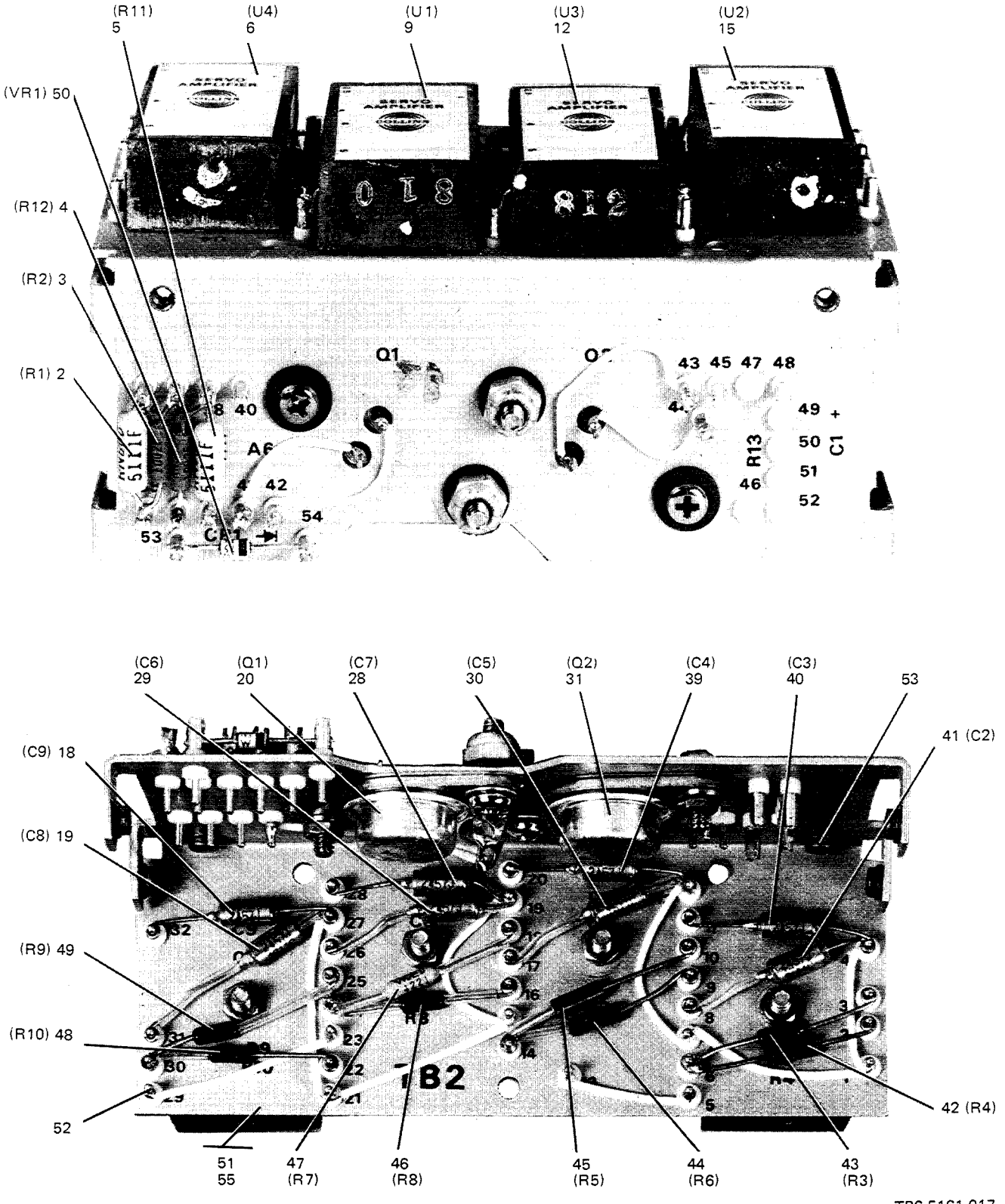
	FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDENT	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
	5-1	638-2775-001		1	CIRCUIT CARD ASSY,AZIMUTH MON-BACK LOC A4 (SEE FIG 1-35 FOR NHA)		RF
	2	RCR05G185KS		2	RESISTOR,FXD CMPSN, 1.8MEGO, 10%, 1/8W (V81349) 745-1864-760 A4R14		1
R	3	40SS476B006M1A		2	CAPACITOR,FIXED ELCTLT, 47UF, 20%, 6V (V26769) 184-7401-000 A4C3		1
	4	RN55D1002F		2	RESISTOR,FIXED FILM, 10K, 1%, 1/8W (V81349) 705-1044-000 A4R11		1
	5	RN55D1002F		2	RESISTOR,FIXED FILM, 10K, 1%, 1/8W (V81349) 705-1044-000 A4R9		1
	6	DR230		2	TRANSFORMER,AF (V80223) 677-1412-000 A4T1		1
	7	RCR07G562KS		2	RESISTOR,FIXED CMPSN, 5.6K, 10%, 1/4W (V81349) 745-0776-000 A4R10		1
	8	1N965B		2	SEMICOND DEVICE (V04713) 353-3176-000 A4VR1		1
	9	RN55D5111F		2	RESISTOR,FIXED FILM, 5.11K, 1%, 1/8W (V81349) 705-1030-000 A4R1		1
	10	RN55D7502F		2	RESISTOR,FXD FILM, 75K, 1%, 1/8W (V81349) 705-1086-000 A4R2		1
	11	RN55D5621F		2	RESISTOR,FIXED FILM, 5.62K, 1%, 1/8W (V81349) 705-1454-570 A4R3		1

- ITEM NOT ILLUSTRATED

DETAILED PARTS LIST

	FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDENT	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
R	5 12	1N4002		2	SEMICOND DEVICE (V14433) 353-6442-020 A4CR3		1
R	13	40SS105A035M1A		2	CAPACITOR,FIXED ELCTLT, 1UF, 20%, 35V (V26769) 184-7398-000 A4C1		1
R	14	1N4002		2	SEMICOND DEVICE (V14433) 353-6442-020 A4CR4		1
	15	RCR05G563JS		2	RESISTOR,FIXED CMPSN, 56K, 5%, 1/8W (V81349) 745-1863-910 A4R8		1
R	16	40SS105A035M1A		2	CAPACITOR,FIXED ELCTLT, 1UF, 20%, 35V (V26769) 184-7398-000 A4C2		1
	17	1N965B		2	SEMICOND DEVICE (V04713) 353-3176-000 A4VR2		1
	18	RCR05G682JS		2	RESISTOR,FIXED CMPSN, 6.8K, 5%, 1/8W (V81349) 745-1863-690 A4R7		1
	19	RCR07G101KS		2	RESISTOR,FIXED CMPSN, 100 OHMS, 10%, 1/4W (V81349) 745-0713-000 A4R6		1
R	20	2N2222A		2	TRANSISTOR (V49956) 352-0661-020 A4Q2		1
	21	2N2907A		2	TRANSISTOR (V04713) 352-0551-010 A4Q3		1
R	22	2N2222A		2	TRANSISTOR (V49956) 352-0661-020 A4Q1		1
	23	RCR07G682KS		2	RESISTOR,FIXED CMPSN, 6.8K, 10%, 1/4W (V81349) 745-0779-000 A4R4		1
	24	RCR05G102JS		2	RESISTOR,FIXED CMPSN, 1K, 5%, 1/8W (V81349) 745-1863-490 A4R5		1
	25	768-5919-003		2	KEY, INDEX		1
R	26	1N4002		2	SEMICOND DEVICE (V14433) 353-6442-020 A4CR5		1
R	27	2N2222A		2	TRANSISTOR (V49956) 352-0661-020 A4Q4		1
	28	RCR07G562KS		2	RESISTOR,FIXED CMPSN, 5.6K, 10%, 1/4W (V81349) 745-0776-000 A4R12		1
R	29	2N2222A		2	TRANSISTOR (V49956) 352-0661-020 A4Q5		1
	30	RCR05G102JS		2	RESISTOR,FIXED CMPSN, 1K, 5%, 1/8W (V81349) 745-1863-490 A4R13		1
R	31	1N4002		2	SEMICOND DEVICE (V14433) 353-6442-020 A4CR6		1
R	32	2N4029		2	TRANSISTOR (V49956) 352-0754-040 A4Q6		1

DETAILED PARTS LIST



TP6-5161-017

Electronic Components Assembly A6
Figure 6

DETAILED PARTS LIST

	FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDENT	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
R	6-1	638-2772-001		1	ELECTRONIC COMPONENTS ASSEMBLY A6 (SEE FIG 1-37 FOR NHA) (EFF TO SB2)		RF
	2	RN60D5111F		2	RESISTOR,FXD FILM, 5.11K, 1%, 1/4W (V81349) 705-6630-000 A6R1		1
	3	RN55D1002F		2	RESISTOR,FIXED FILM, 10K, 1%, 1/8W (V81349) 705-1454-630 A6R2		1
	4	RN55D1002F		2	RESISTOR,FIXED FILM, 10K, 1%, 1/8W (V81349) 705-1454-630 A6R12		1
	5	RN60D5111F		2	RESISTOR,FXD FILM, 5.11K, 1%, 1/4W (V81349) 705-6630-000 A6R11		1
	6	350-0083-030		2	AMPLIFIER,ELEC A6U4		1
	-7	MS35649-224		2	NUT,PLAIN,HEX SST, 2-56 (V96906) 313-0037-000 (AP)		1
	-8	310-0278-000		2	WASHER,LOCK SST, 0.115 ID X 0.202 OD (V70318) (AP)		1
	9	350-0083-030		2	AMPLIFIER,ELEC A6U1		1
	-10	MS35649-224		2	NUT,PLAIN,HEX SST, 2-56 (V96906) 313-0037-000 (AP)		1
	-11	310-0278-000		2	WASHER,LOCK SST, 0.115 ID X 0.202 OD (V70318) (AP)		1
	12	350-0083-030		2	AMPLIFIER,ELEC A6U3		1
	-13	P313-0132-000		2	NUT,PLAIN,HEX SST, 4-40 (V77250) 313-0132-000 (AP)		1
	-14	310-0278-000		2	WASHER,LOCK SST, 0.115 ID X 0.202 OD (V70318) (AP)		1
	15	350-0083-030		2	AMPLIFIER,ELEC A6U2		1
	-16	P313-0132-000		2	NUT,PLAIN,HEX SST, 4-40 (V77250) 313-0132-000 (AP)		1
	-17	310-0278-000		2	WASHER,LOCK SST, 0.115 ID X 0.202 OD (V70318) (AP)		1
	18	M39003-01-2217		2	CAPACITOR,FIXED ELCTLT, 0.33UF, 10%, 100V (V81349) 184-9085-760 A6C9		1
	19	M39003-01-2217		2	CAPACITOR,FIXED ELCTLT, 0.33UF, 10%, 100V (V81349) 184-9085-760 A6C8		1
R	20	2N3054-122		2	TRANSISTOR (V21845) 352-0581-010 A6Q1		1
	-21	547-8177-003		2	BUSHING (AP)		2
	-22	4007-4HT		2	TERMINAL,LUG (V77147) 304-0015-000 (AP)		1
	-23	P313-0132-000		2	NUT,PLAIN,HEX SST, 4-40 (V77250) 313-0132-000 (AP)		2
	-24	310-0278-000		2	WASHER,LOCK SST, 0.115 ID X 0.202 OD (V70318) (AP)		2
R	-25	TA-2402-A		2	INSULATOR,PLATE (V08289) 352-9570-020 (AP)		1
	-26	MS51957-82		2	SCREW,MACH SST, 1/4-20 X 7/8 (V96906) 343-0268-000 (AP)		1
	-27	P343-0287-000		2	SCREW,MACH NP BRS, 4-40 X 3/8 (V77250) 343-0287-000 (AP)		1
	-27A	68NM40		2	NUT,SLFLKG,HEX AL, 4-40 (V72962) 333-0347-000 (AP)		1
	28	M39003-01-2217		2	CAPACITOR,FIXED ELCTLT, 0.33UF, 10%, 100V (V81349) 184-9085-760 A6C7		1
	29	M39003-01-2217		2	CAPACITOR,FIXED ELCTLT, 0.33UF, 10%, 100V (V81349) 184-9085-760 A6C6		1
	30	M39003-01-2217		2	CAPACITOR,FIXED ELCTLT, 0.33UF, 10%, 100V (V81349) 184-9085-760 A6C5		1
R	31	2N3054-122		2	TRANSISTOR (V21845) 352-0581-010 A6Q2		1
	-32	547-8177-003		2	BUSHING (AP)		2
	-33	4007-4HT		2	TERMINAL,LUG (V77147) 304-0015-000 (AP FOR 15-16)		1
	-34	P313-0132-000		2	NUT,PLAIN,HEX SST, 4-40 (V77250) 313-0132-000 (AP) (AP FOR 15-16)		2

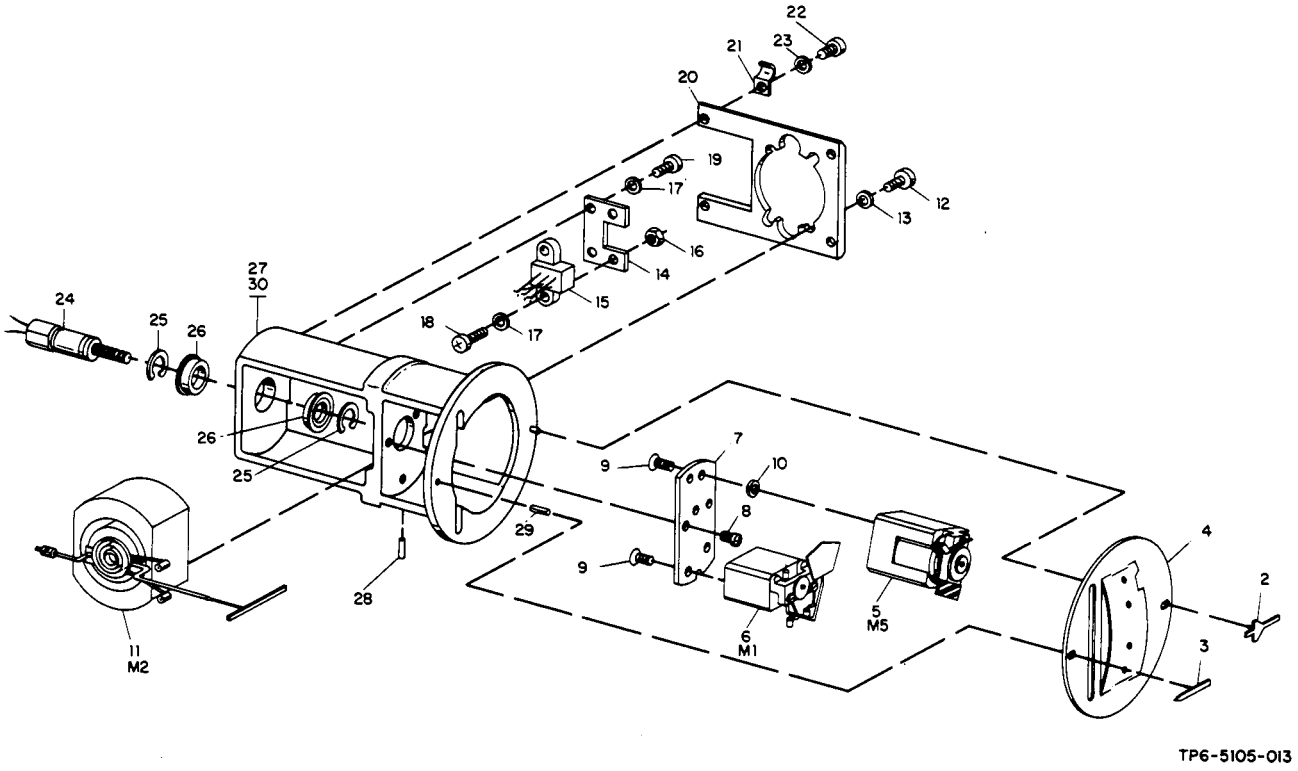
- ITEM NOT ILLUSTRATED

DETAILED PARTS LIST

	FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDEX	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
	6-35	310-0278-000		2	WASHER,LOCK SST, 0.115 ID X 0.202 0D (V70318) (AP)		2
R	-36	TA-2402-A		2	INSULATOR,PLATE (V08289) 352-9570-020 (AP)		1
	-37	MS51957-82		2	SCREW,MACH SST, 1/4-20 X 7/8 (V96906) 343-0268-000 (AP)		1
	-38	P343-0287-000		2	SCREW,MACH NP BRS, 4-40 X 3/8 (V77250) 343-0287-000 (AP)		1
	-38A	68NM40		2	NUT,SLFLKG,HEX AL, 4-40 (V72962) 333-0347-000 (AP)		1
	39	M39003-01-2217		2	CAPACITOR,FIXED ELCTLT, 0.33UF, 10%, 100V (V81349) 184-9085-760 A6C4		1
	40	M39003-01-2217		2	CAPACITOR,FIXED ELCTLT, 0.33UF, 10%, 100V (V81349) 184-9085-760 A6C2		1
	41	M39003-01-2217		2	CAPACITOR,FIXED ELCTLT, 0.33UF, 10%, 100V (V81349) 184-9085-760 A6C3		1
	42	RN55D1471F		2	RESISTOR,FIXED FILM, 1.47K, 1%, 1/8W (V81349) 705-1004-000 A6R4		1
	43	RN55D2871F		2	RESISTOR,FXD FILM, 2.87K, 1%, 1/8W (V81349) 705-1018-000 A6R3		1
	44	RN55D1001F		2	RESISTOR,FIXED FILM, 1K, 1%, 1/8W (V81349) 705-1454-390 A6R6		1
	45	RN55D5621F		2	RESISTOR,FIXED FILM, 5.62K, 1%, 1/8W (V81349) 705-1454-570 A6R5		1
	46	RN55D1211F		2	RESISTOR,FXD FILM, 1.21K, 1%, 1/8W (V81349) 705-1000-000 A6R8		1
	47	RN55D4221F		2	RESISTOR,FIXED FILM, 4.22K, 1%, 1/8W (V81349) 705-1026-000 A6R7		1
	48	RN55D1781F		2	RESISTOR,FIXED FILM, 1.78K, 1%, 1/8W (V81349) 705-1008-000 A6R10		1
	49	RN55D4641F		2	RESISTOR,FIXED FILM, 4.64K, 1%, 1/8W (V81349) 705-1028-000 A6R9		1
	50	1N753A		2	SEMICOND DEVICE (V81483) 353-2714-000 A6VR1		1
	51	638-2773-001		2	CHASSIS		1
R	52	002-3402-000599		3	TERMINAL,FEEDTHRU (V98291) 306-2474-010		47
R	53	M45938/5-1		3	NUT,SLFLKG,CLINCH CD PL STL, 2-56 (V81349) 333-0837-000		6
R	-54	004-3401-000599		3	TERMINAL,STANDOFF (V98291) 306-2222-100		6
	55	792-1441-001		3	CHASSIS		1

- ITEM NOT ILLUSTRATED

DETAILED PARTS LIST



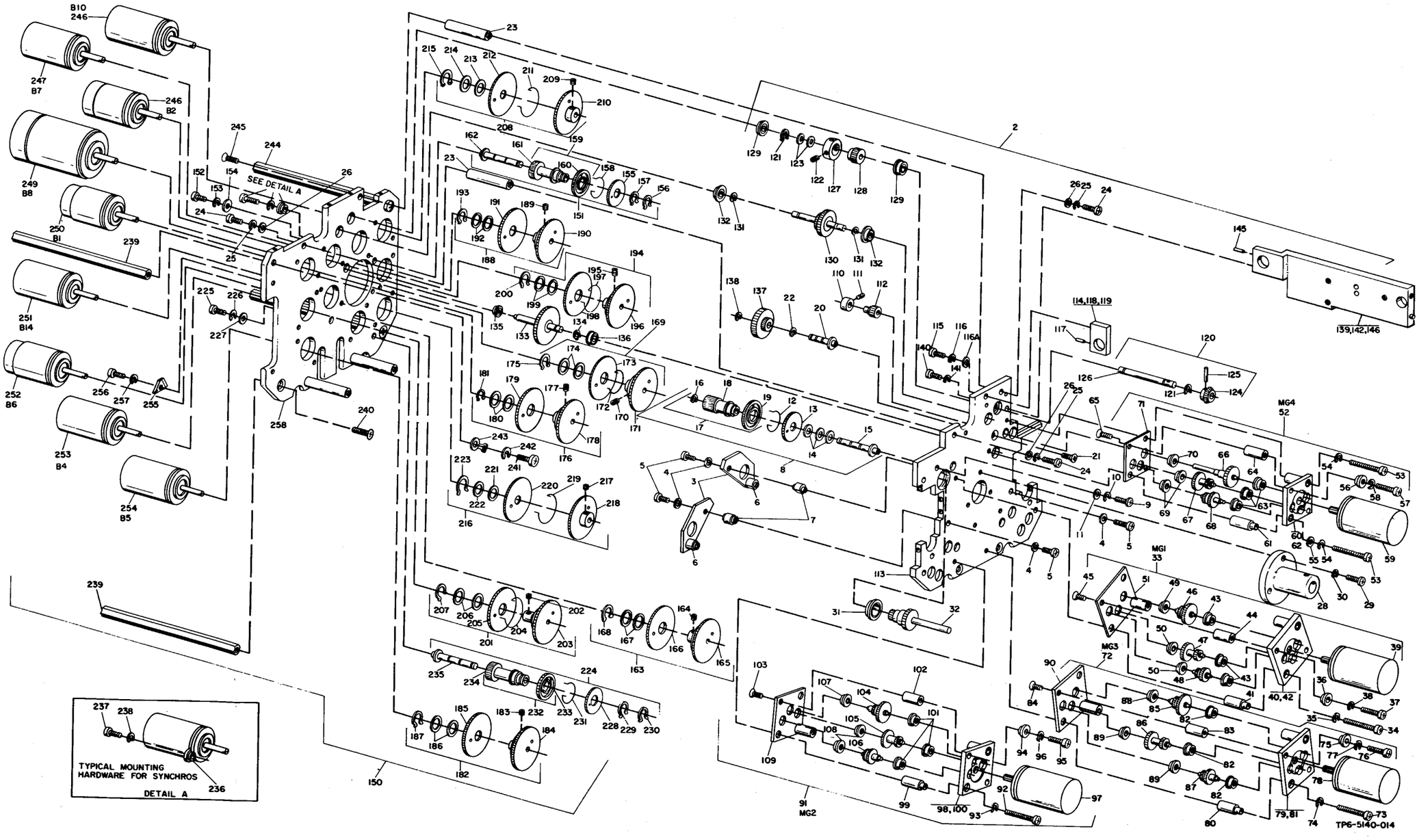
Meter Frame Assembly
Figure 7

	FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDENT	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
	7-1	638-2786-001		1	FRAME, METER (SEE FIG 1-55 FOR NHA)		RF
	2	638-2801-001		2	POINTER, DIAL, ARROW		1
	3	638-2800-001		2	POINTER, DIAL, TAIL		1
	4	792-1459-001		2	MASK		1
R	5	482-5107-020		2	METER MOVEMENT (V33005) M5		1
	6	482-5084-010		2	METER MOVEMENT (V81030) M1		1
	7	797-6985-001		2	PLATE		1
	8	P320-0010-000		2	SCREW,MACH NP BRS, 0-80 X 3/16 (V77250) 320-0010-000 (AP FOR 5-7)		4
	9	P322-0151-000		2	SCREW,MACHINE NP BRS, 0.086-64X3/16IN (V77250) 322-0151-000 (AP FOR 5-7)		4
	10	506-8392-001		2	SHIM (AP FOR 5-7)		AR
					OR		
	10	542-7499-003		2	SHIM (AP FOR 5-7)		AR
	11	482-5083-020		2	METER MOVEMENT (V82386) M2		1
R	12	MS35215-3		2	SCREW,MACHINE BRS, 2-64 X 1/4 (V96906) 343-0731-000 (AP)		2
	13	310-0129-000		2	WASHER,FLAT BRS, 0.089 ID X 0.188 0D (V05411) (AP)		2
	14	775-5031-001		2	PLATE		1
	15	015-1812-000		2	BRUSH,ELEC (V99932) E1		1

- ITEM NOT ILLUSTRATED

DETAILED PARTS LIST

	FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDENT	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
	7 16	P313-0050-000		2	NUT,PLAIN,HEX NP BRS, 2-56 (V77250) 313-0050-000 (AP FOR 14-15)		2
	17	310-0129-000		2	WASHER,FLAT BRS, 0.089 ID X 0.188 0D (V05411) (AP FOR 14-15)		4
	18	P343-0300-000		2	SCREW,MACH NP BRS, 2-56 X 5/16 (V77250) 343-0300-000 (AP FOR 14-15)		2
	19	P343-0299-000		2	SCREW,MACH NP BRS, 2-56 X 1/4 (V77250) 343-0299-000 (AP FOR 14-15)		2
R	20	775-5087-001		2	PLATE (EFF TO REV B)		1
R	20	641-0751-001		2	PLATE, DEVIATION METER (EFF REV B)		1
	21	543-5320-002		2	CLAMP		1
	22	P320-0010-000		2	SCREW,MACH NP BRS, 0-80 X 3/16 (V77250) 320-0010-000 (AP FOR 20-21)		4
	23	503-0634-001		2	WASHER (AP FOR 20-21)		3
	24	015-3196-010		2	RING ASSY,ELEC (V99932)		1
	25	MS16632-1025		2	RING,RTNG (V96906) 340-0114-000 (AP)		2
	26	S614FC3P15LY5		2	BEARING,BALL,AN (V40920) 309-1565-000		2
	27	638-2787-001		2	FRAME		1
	28	MS16555-601		3	PIN,STR HDLS SST, 1/16 DIA X 3/16 (V96906) 311-1624-000		1
	29	775-5074-001		3	PIN		2
	30	797-6983-001		3	FRAME		1



Motor Synchronizer Assembly
Figure 8

HSI-45 HORIZONTAL SITUATION INDICATOR

COMPONENT MAINTENANCE MANUAL (523-0768607)

TEMPORARY REVISION NO 34-28-25-17

Insert facing page 1056, 34-28-25

This temporary revision supersedes temporary revision no 34-28-25-16

Subject: Motor Synchronizer Assembly, Figure 8

In upper left hand corner, change item number of B2 from 246 to 248.

DETAILED PARTS LIST

	FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDENT	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
R	8-1	638-2785-001		1	MOTOR SYNCHRONIZER ASSEMBLY (SEE FIG 1-212 FOR NHA)		RF
	2	638-2784-001		2	MOTOR PLATE ASSEMBLY		1
	3	791-2485-001		3	PLATE, RETAININ		1
	4	MS51957-2		3	SCREW,MACH SST, 2-56 X 3/16 (V96906) 343-0123-000 (AP)		8
	5	310-6320-000		3	WASHER,FLAT SST, 0.092 X 0.219 OD (V79807) (AP)		8
	6	775-5040-002		3	SPACER (AP)		2
	7	775-5040-001		3	SPACER (AP)		2
	8	638-2763-001		3	GEAR		1
	9	MS51957-3		3	SCREW,MACH CD PL STL, 2-56 X 1/4 (V96906) 343-0124-000 (AP)		1
	10	MS35338-134		3	WASHER,LOCK SST, 0.088 ID X 0.172 0D (V96906) 310-0275-000 (AP)		1
	11	310-6320-000		3	WASHER,FLAT SST, 0.092 X 0.219 OD (V79807) (AP)		1
	12	542-4176-002		4	SPRING		1
	13	775-5020-001		4	GEAR 48 T		1
	14	500-1128-003		4	SHIM		AR
	15	775-5109-001		4	POST		1
	16	MS16632-1012		4	RING,RTNG (V96906) 340-0112-000 (AP)		1
	17	638-2762-001		4	GEAR 48 T		1
	18	775-5112-001		5	GEAR 30 T		1
R	19	775-5019-001		5	GEAR 48T		1
	20	775-5042-001		3	POST		1
	21	MS51959-2		3	SCREW,MACH SST, 2-56 X 3/16 (V96906) 342-0132-000 (AP)		1
	22	MS16632-1012		3	RING,RTNG (V96906) 340-0112-000 (AP)		1
	23	775-5107-001		3	POST		4
	24	MS51957-3		3	SCREW,MACH CD PL STL, 2-56 X 1/4 (V96906) 343-0124-000 (AP)		4
	25	MS35338-134		3	WASHER,LOCK SST, 0.088 ID X 0.172 0D (V96906) 310-0275-000 (AP)		2
	26	310-6320-000		3	WASHER,FLAT SST, 0.092 X 0.219 OD (V79807) (AP)		2
	-27	P330-2284-000		3	SCREW,MACHINE SST, 2-56X3/16IN (V77250) 330-2284-000 (AP)		2
	28	618-5295-001		3	COLLET		1
	29	MS51957-4		3	SCREW,MACH CD PL STL, 2-56 X 5/16 (V96906) 343-0125-000 (AP)		3
	30	MS35338-134		3	WASHER,LOCK SST, 0.088 ID X 0.172 0D (V96906) 310-0275-000 (AP)		3
	31	S614FC3P15LY5		3	BEARING,BALL,AN (V40920) 309-1565-000		1
	32	792-1435-001		3	GEARSHAFT		1
	33	638-2795-001		3	SERVO, MECH-NO1 MG1		1
	34	MS51957-9		3	SCREW,MACH SST, 2-56 X 3/4 (V96906) 343-0129-000 (AP)		2
	35	MS35338-134		3	WASHER,LOCK SST, 0.088 ID X 0.172 0D (V96906) 310-0275-000 (AP)		2
	36	544-3643-002		4	CLAMP		2
	37	P347-0024-000		4	SCREW,MACH SST, 2-56 X 3/8 (V77250) 347-0024-000 (AP)		2
	38	MS35338-134		4	WASHER,LOCK SST, 0.088 ID X 0.172 0D (V96906) 310-0275-000 (AP)		2
R	39	U216505		4	MOTOR-TACH GEN (V82686) 229-2050-010 (REF 39-136-6 523-0760588)		1
	40	775-5199-001		4	PLATE		1
	41	775-5069-001		5	SPACER		2
	42	775-5117-001		5	PLATE		1
	43	S3FC3P15LY5		4	BEARING,BALL,AN (V40920) 309-1557-000		3

- ITEM NOT ILLUSTRATED

DETAILED PARTS LIST

	FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDEX	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
	8 44	775-5068-001		4	SPACER		2
	45	MS51959-2		4	SCREW,MACH SST, 2-56 X 3/16 (V96906) 342-0132-000 (AP)		2
	46	775-5121-001		4	GEARSHAFT		1
	47	775-5120-001		4	GEARSHAFT		1
	48	775-5119-001		4	GEARSHAFT		
	49	SFR1PPK25-26		4	BEARING,BALL,AN (V83086) 309-0783-000		1
	50	S3FC3P15LY5		4	BEARING,BALL,AN (V40920) 309-1557-000		3
	51	775-5118-001		4	PLATE		1
	52	638-2794-001		3	SERVO, MECH NO3 MG4		1
	53	MS51957-9		3	SCREW,MACH SST, 2-56 X 3/4 (V96906) 343-0129-000 (AP)		2
	54	MS35338-134		3	WASHER,LOCK SST, 0.088 ID X 0.172 0D (V96906) 310-0275-000 (AP)		2
	55	542-7481-003		3	WASHER		1
	56	544-3643-002		4	CLAMP		2
	57	P347-0024-000		4	SCREW,MACH SST, 2-56 X 3/8 (V77250) 347-0024-000 (AP)		2
	58	MS35338-134		4	WASHER,LOCK SST, 0.088 ID X 0.172 0D (V96906) 310-0275-000 (AP)		2
R	59	U216505		4	MOTOR-TACH GEN (V82686) 229-2050-010 (REF 39-136-6 523-0760588)		1
	60	638-2764-001		4	PLATE		1
	61	775-5069-001		5	SPACER		2
	62	775-5117-001		5	PLATE		2
	63	S3FC3P15LY5		4	BEARING,BALL,AN (V40920) 309-1557-000		3
	64	775-5068-001		4	POST		2
	65	MS51959-2		4	SCREW,MACH SST, 2-56 X 3/16 (V96906) 342-0132-000 (AP)		2
	66	779-3801-001		4	GEARSHAFT		1
	67	775-5120-001		4	GEARSHAFT		1
	68	775-5119-001		4	GEARSHAFT		1
	69	S3FC3P15LY5		4	BEARING,BALL,AN (V40920) 309-1557-000		2
	70	77NM0612ZJ5FM1		4	BEARING,BALL,AN (V43334) 309-1856-000		1
	71	775-5118-001		4	PLATE		1
	72	638-2796-001		3	SERVO,MECH NO 2 MG3		1
	73	MS51957-9		3	SCREW,MACH SST, 2-56 X 3/4 (V96906) 343-0129-000 (AP)		2
	74	MS35338-134		3	WASHER,LOCK SST, 0.088 ID X 0.172 0D (V96906) 310-0275-000 (AP)		2
	75	544-3643-002		4	CLAMP		2
	76	P347-0024-000		4	SCREW,MACH SST, 2-56 X 3/8 (V77250) 347-0024-000 (AP)		2
	77	MS35338-134		4	WASHER,LOCK SST, 0.088 ID X 0.172 0D (V96906) 310-0275-000 (AP)		2
R	78	U216505		4	MOTOR-TACH GEN (V03998) 229-2050-010 (REF 39-136-6 523-0760588)		1
	79	638-2764-001		4	PLATE		1
	80	775-5069-001		5	SPACER		2
	81	775-5117-001		5	PLATE		1
	82	S3FC3P15LY5		4	BEARING,BALL,AN (V40920) 309-1557-000		3
	83	775-5068-001		4	POST		2
	84	MS51959-2		4	SCREW,MACH SST, 2-56 X 3/16 (V96906) 342-0132-000 (AP)		2
	85	792-1436-001		4	GEARSHAFT		1
	86	775-5120-001		4	GEARSHAFT		1
	87	775-5119-001		4	GEARSHAFT		1
	88	SFR1PPK25-26		4	BEARING,BALL,AN (V83086) 309-0783-000		1
	89	S3FC3P15LY5		4	BEARING,BALL,AN (V40920) 309-1557-000		2
	90	775-5118-001		4	PLATE		1
	91	638-2796-001		3	SERVO,MECH NO MG2		1

HSI-45 HORIZONTAL SITUATION INDICATOR

COMPONENT MAINTENANCE MANUAL (523-0768607)

TEMPORARY REVISION NO 34-28-25-19

Insert facing page 1059, 34-28-25

Subject: Illustrated Parts List

This temporary revision changes the part number of items 110, 111 and 112 as follows:

110	779-3816-001	3	COLLAR	1
111	335-0121-000	3	SETSCREW CD PL STL, 2-56 X 1/16 (V74445)(AP)	1
112	779-3791-001	3	GEAR	1

DETAILED PARTS LIST

	FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDENT	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
	8 92	MS51957-9		3	SCREW,MACH SST, 2-56 X 3/4 (V96906) 343-0129-000 (AP)		2
	93	MS35338-134		3	WASHER,LOCK SST, 0.088 ID X 0.172 0D (V96906) 310-0275-000 (AP)		2
	94	544-3643-002		4	CLAMP		2
	95	P347-0024-000		4	SCREW,MACH SST, 2-56 X 3/8 (V77250) 347-0024-000 (AP)		2
	96	MS35338-134		4	WASHER,LOCK SST, 0.088 ID X 0.172 0D (V96906) 310-0275-000 (AP)		2
R	97	U216505		4	MOTOR-TACH GEN (V82686) 229-2050-010		1
	98	638-2764-001		4	PLATE		1
	99	775-5069-001		5	SPACER		2
	100	775-5117-001		5	PLATE		1
	101	S3FC3P15LY5		4	BEARING,BALL,AN (V40920) 309-1557-000		3
	102	775-5068-001		4	POST		2
	103	MS51959-2		4	SCREW,MACH SST, 2-56 X 3/16 (V96906) 342-0132-000 (AP)		2
	104	792-1436-001		4	GEARSHAFT		1
	105	775-5120-001		4	GEARSHAFT		1
	106	775-5119-001		4	GEARSHAFT		1
	107	SFR1PPK25-26		4	BEARING,BALL,AN (V83086) 309-0783-000		1
	108	S3FC3P15LY5		4	BEARING,BALL,AN (V40920) 309-1557-000		2
	109	775-5118-001		4	PLATE		1
	110	779-3791-001		3	GEAR		1
	111	779-3816-001		3	COLLAR		1
R	112	335-0121-000		3	SETSCREW CD PL STL, 2-56 X 1/16 (V74445) (AP)		2
	113	797-6747-001		3	PLATE		1
	114	638-2765-001		2	PLATE		1
	115	MS51957-3		2	SCREW,MACH CD PL STL, 2-56 X 1/4 (V96906) 343-0124-000 (AP)		1
	116	MS35338-134		2	WASHER,LOCK SST, 0.088 ID X 0.172 0D (V96906) 310-0275-000 (AP)		1
	116A	310-6320-000		2	WASHER,FLAT SST, 0.092 X 0.219 OD (V79807) (AP)		1
	117	MS16555-601		3	PIN,STR HDLS SST, 1/16 DIA X 3/16 (V96906) 311-1624-000		1
R	118	004-3401-000599		3	TERMINAL,STANDOFF (V98291) 306-2222-100		2
	119	775-5097-001		3	PLATE		1
	120	638-2769-001		2	GEAR		1
	121	MS16632-1012		2	RING,RTNG (V96906) 340-0112-000 (AP)		2
	122	328-0368-000		2	SETSCREW CD PL STL, 2-56 X 3/32 (V08664) (AP)		4
	123	500-1128-003		2	SHIM		AR
	124	775-5125-001		3	GEAR		1
	125	MS51923-112		3	PIN,SPRING SST, 0.031 DIA X 3/16 (V96906) 311-0431-000		1
	126	775-5075-001		3	SHAFT		1
	127	554-1447-002		2	COLLAR		1
	128	554-1495-003		2	GEAR		1
	129	SFR1445K25-26		2	BEARING,BALL,AN (V83086) 309-0832-000		1
	130	775-5187-001		2	GEARSHAFT		1
	131	MS16632-1012		2	RING,RTNG (V96906) 340-0112-000 (AP)		2
	132	SFR1445K25-26		2	BEARING,BALL,AN (V83086) 309-0832-000		2
	133	775-5191-001		2	GEAR		1
	134	MS16632-1012		2	RING,RTNG (V96906) 340-0112-000 (AP)		
	135	S3332FCP25LY5		2	BEARING,BALL,AN (V40920) 309-1859-000		1
	136	SFR1445K25-26		2	BEARING,BALL,AN (V83086) 309-0832-000		1
	137	775-5189-001		2	GEAR		1
	138	MS16632-1012		2	RING,RTNG (V96906) 340-0112-000 (AP)		1
	139	638-2791-001		2	PLATE		1

DETAILED PARTS LIST

	FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDENT	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
	8 140	MS51957-3		2	SCREW,MACH CD PL STL, 2-56 X 1/4 (V96906) 343-0124-000 (AP)		1
	141	MS35338-134		2	WASHER,LOCK SST, 0.088 ID X 0.172 0D (V96906) 310-0275-000 (AP)		1
	142	629-8511-001		3	BRACKET		1
	-143	MS20426AD2-5		3	RIVET,SOLID AL, 0.062 DIA X 5/16 (V96906) 305-1354-000 (AP)		2
R	-144	M45938/5-1		3	NUT,SLFLKG,CLINCH CD PL STL, 2-56 (V81349) 333-0837-000 (AP)		1
	145	MS16555-601		3	PIN,STR HDLS SST, 1/16 DIA X 3/16 (V96906) 311-1624-000		2
	146	797-7747-001		3	PLATE, MOUNTING		1
	147	768-1636-001		2	CLAMP		1
R	148	RNF-100 3/16IN B LK		2	SLEEVING,INSUL (V81349) 152-3583-000		1
	149	757-0269-001		2	CLAMP		1
	150	638-2783-001		2	SYNCHRO ASSY		1
	151	638-2771-001		3	GEAR		1
	152	MS51957-2		3	SCREW,MACH SST, 2-56 X 3/16 (V96906) 343-0123-000 (AP)		1
	153	MS35338-134		3	WASHER,LOCK SST, 0.088 ID X 0.172 0D (V96906) 310-0275-000 (AP)		1
	154	310-6320-000		3	WASHER,FLAT SST, 0.092 X 0.219 OD (V79807) (AP)		1
	155	775-5020-001		3	GEAR		1
	156	MS16632-1012		4	RING,RTNG (V96906) 340-0112-000 (AP)		1
	157	MS16632-1018		4	RING,RTNG (V96906) 340-0113-000 (AP)		1
	158	542-4176-002		4	SPRING		1
	159	638-2770-001		4	GEAR		1
	160	779-5019-001		5	GEAR		1
	161	779-3807-001		5	GEAR		1
	162	775-5109-001		4	POST		1
	163	638-2807-001		3	GEAR		1
R	164	335-0120-000		3	SETSCREW CD PL STL, 2-56 X 3/32 (V74445)		1
	165	797-7276-001		4	GEAR		1
	166	775-5044-001		4	GEAR		1
	167	548-9534-003		4	SHIM (AP)		AR
	168	MS16624-5021		4	RING,RTNG (V96906) 340-0504-000 (AP)		1
	169	638-2798-001		3	GEAR		1
R	170	335-0120-000		4	SETSCREW CD PL STL, 2-56 X 3/32 (V74445) (AP)		1
	171	775-5035-002		4	GEAR		1
	172	542-4176-002		4	SPRING		1
	173	775-5044-001		4	GEAR		
	174	548-9534-003		4	SHIM (AP)		AR
	175	MS16624-5021		4	RING,RTNG (V96906) 340-0504-000 (AP)		AR
	176	638-2799-001		3	GEAR		1
R	177	335-0120-000		3	SETSCREW CD PL STL, 2-56 X 3/32 (V74445) (AP)		1
	178	775-5035-001		4	GEAR		1
	179	775-5044-001		4	GEAR		1
	180	548-9534-003		4	SHIM (AP)		AR
	181	MS16624-5021		4	RING,RTNG (V96906) 340-0504-000 (AP)		1
	182	638-2799-001		3	GEAR		1
R	183	335-0120-000		3	SETSCREW CD PL STL, 2-56 X 3/32 (V74445) (AP)		1
	184	775-5035-001		4	GEAR		1
	185	775-5044-001		4	GEAR		1
	186	548-9534-003		4	SHIM (AP)		AR
	187	MS16624-5021		4	RING,RTNG (V96906) 340-0504-000 (AP)		1
	188	638-2799-001		3	GEAR		1

- ITEM NOT ILLUSTRATED

DETAILED PARTS LIST

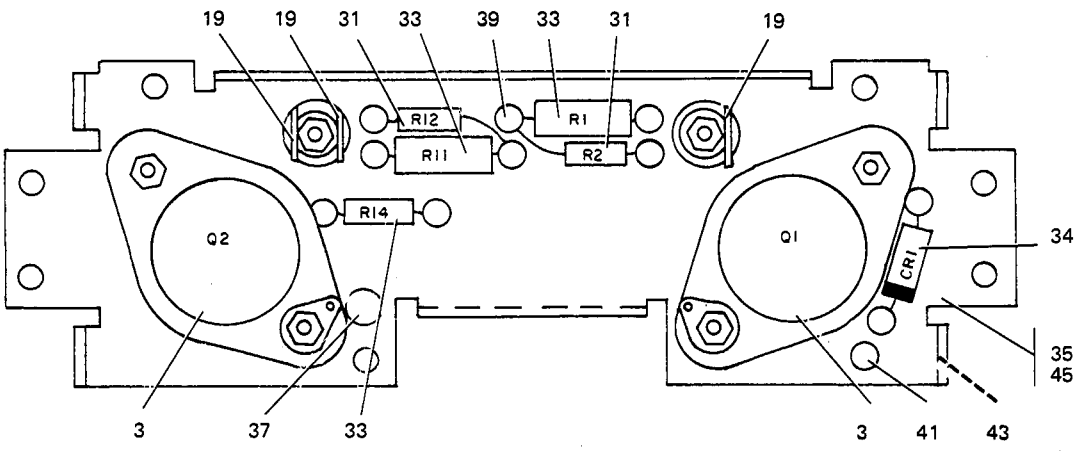
	FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDENT	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
R	8 189	335-0120-000		3	SETSCREW CD PL STL, 2-56 X 3/32 (V74445) (AP)		1
	190	775-5035-001		4	GEAR		1
	191	775-5044-001		4	GEAR		1
	192	548-9534-003		4	SHIM		AR
	193	MS16624-5021		4	RING,RTNG (V96906) 340-0504-000		1
	194	638-2797-001		3	GEAR		1
R	195	335-0120-000		3	SETSCREW CD PL STL, 2-56 X 3/32 (V74445) (AP)		1
	196	775-5035-001		4	GEAR		1
	197	542-4176-002		4	SPRING		1
	198	775-5044-001		4	GEAR		1
	199	553-5080-003		4	SHIM (AP)		1
	200	MS16624-5021		4	RING,RTNG (V96906) 340-0504-000 (AP)		1
	201	638-2797-001		3	GEAR		1
R	202	335-0120-000		3	SETSCREW CD PL STL, 2-56 X 3/32 (V74445)		1
	203	775-5035-001		4	GEAR		1
	204	542-4176-002		4	SPRING		1
	205	775-5044-001		4	GEAR		1
	206	553-5080-003		4	SHIM (AP)		1
	207	MS16624-5021		4	RING,RTNG (V96906) 340-0504-000 (AP)		1
	208	638-2802-001		3	GEAR		1
	209	6RS25PB2BA4		3	RECTIFIER,MTLC (V30464) 353-0120-000 (AP)		1
	210	779-3798-001		4	GEAR		1
	211	542-4177-002		4	SPRING		1
	212	779-3790-001		4	GEAR		1
	213	542-7502-003		4	SHIM (AP)		AR
	214	542-7501-003		4	SHIM (AP)		AR
	215	MS16624-5018		4	RING,RTNG (V96906) 340-0004-000 (AP)		1
	216	638-2802-001		3	GEAR		1
R	217	335-0120-000		3	SETSCREW CD PL STL, 2-56 X 3/32 (V74445) (AP)		1
	218	779-3798-001		4	GEAR		1
	219	542-4177-002		4	SPRING		1
	220	779-3790-001		4	GEAR		1
	221	542-7502-003		4	SHIM (AP)		AR
	222	542-7501-003		4	SHIM (AP)		AR
	223	MS16624-5018		4	RING,RTNG (V96906) 340-0004-000 (AP)		1
	224	638-2771-000		3	GEAR		1
	225	MS51957-2		3	SCREW,MACH SST, 2-56 X 3/16 (V96906) 343-0123-000 (AP)		1
	226	MS35338-134		3	WASHER,LOCK SST, 0.088 ID X 0.172 OD (V96906) 310-0275-000 (AP)		1
	227	310-6320-000		3	WASHER,FLAT SST, 0.092 X 0.219 OD (V79807) (AP)		1
	228	775-5020-001		4	GEAR		1
	229	MS16632-1012		4	RING,RTNG (V96906) 340-0112-000 (AP)		1
	230	MS16632-1018		4	RING,RTNG (V96906) 340-0113-000 (AP)		1
	231	542-4176-002		4	SPRING		1
	232	638-2770-000		4	GEAR		1
	233	779-5019-001		5	GEAR		1
	234	779-3807-001		5	GEAR		1
	235	775-5109-001		4	POST		1
	236	544-3643-002			CLAMP		
	237	P347-0022-000		3	SCREW,MACH SST, 2-56 X 1/4 (V77250) 347-0022-000 (AP)		16
	238	MS35338-134		3	WASHER,LOCK SST, 0.088 ID X 0.172 OD (V96906) 310-0275-000 (AP)		16
R	239	652-0039-001		3	POST (SB2)		2

- ITEM NOT ILLUSTRATED

DETAILED PARTS LIST

	FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDENT	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
	8 240	MS51959-13		3	SCREW,MACH SST, 4-40 X 1/4 (V96906) 342-0044-000 (AP)		2
	241	MS51957-14		3	SCREW,MACH SST, 4-40 X 5/16 (V96906) 343-0134-000 (AP)		2
	242	MS35338-135		3	WASHER,LOCK SST, 0.115 ID X 0.209 OD (V96906) 310-0279-000 (AP)		2
	243	403		3	TERMINAL,LUG (V79963) 304-1089-000		1
	244	797-6909-001		3	POST		2
	245	MS51959-13		3	SCREW,MACH SST, 4-40 X 1/4 (V96906) 342-0044-000		2
R	246	4277-01-05		3	SYNCHRO (V86197) 229-0194-000 B10		1
R	247	4277-31-01		3	SYNCHRO (V86197) 229-5022-010 B7		1
	248	CM41005012		3	SYNCHRO (V88818) 229-7031-010 B2		1
	249	TSH11F08A049		3	SYNCHRO (V86197) 229-0178-000 B8		1
	250	CSDH8BQ2L607		3	SYNCHRO (V86197) 229-6026-030 B1		1
R	251	4277-01-05		3	SYNCHRO (V86197) 229-0194-000 B14		1
	252	CDSH8DZ2L503		3	SYNCHRO (V86197) 229-0091-010 B6		1
R	253	4277-31-01		3	SYNCHRO (V86197) 229-5022-010 B4		1
	254	4277-31-01		3	SYNCHRO (V86197) 229-5022-010 B5		1
	255	554-1453-002		3	CLAMP		3
	256	P347-0024-000		3	SCREW,MACH SST, 2-56 X 3/8 (V77250) 347-0024-000 (AP)		3
	257	MS35338-134		3	WASHER,LOCK SST, 0.088 ID X 0.172 OD (V96906) 310-0275-000 (AP)		3
	258	797-6835-001		3	PLATE, MOUNTING		1

DETAILED PARTS LIST



TP6-9030-017

Electronic Component Assembly A6
Figure 9

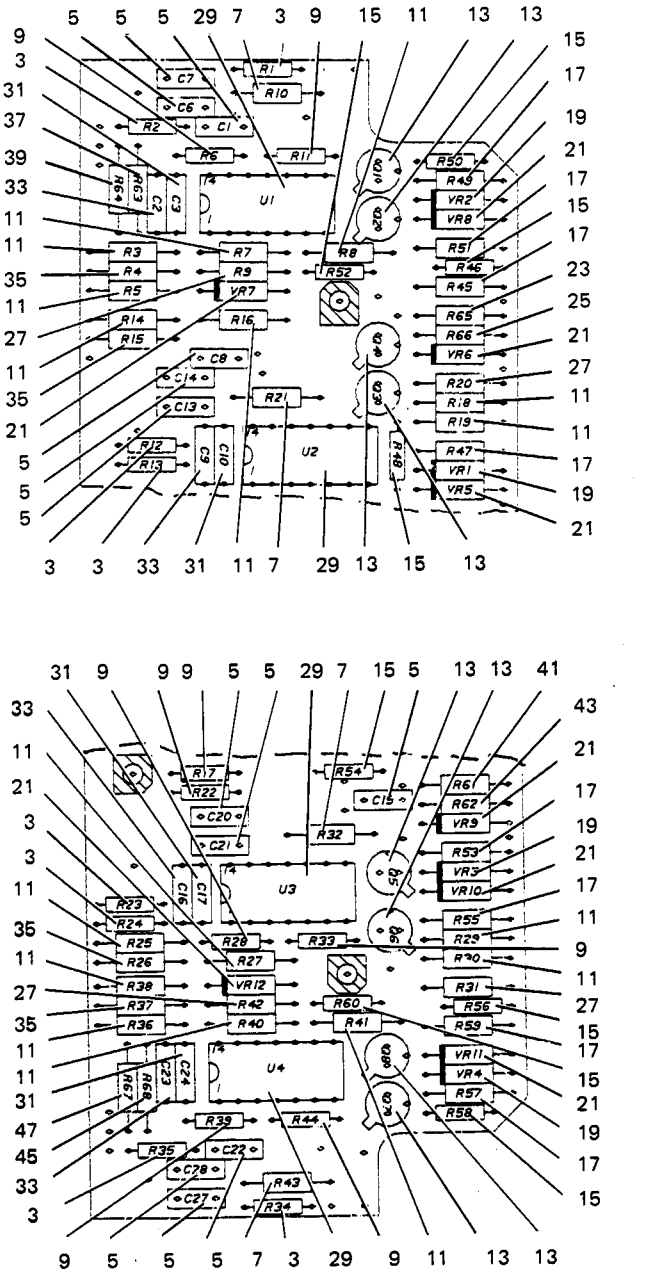
	FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDENT	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
R	9-1	652-0037-001		1	ELECTRONIC COMPONENT ASSEMBLY A6 (SEE FIG 1-37 FOR NHA)SB2		RF
R	3	2N3054-122		2	TRANSISTOR (V21845) 352-0581-010 A6Q1 A6Q2		2
					ATTACHING PARTS		
R	-5	NAS67C4		2	NUT,PLAIN,HEXAGON CD PL STL, 0.112-40 (V80205) 313-0132-000		4
R	-7	MS35338-135		2	WASHER,LOCK SST, 0.115 ID X 0.209 OD (V96906) 310-0279-000		4
R	-9	4007-4HTD		2	TERMINAL,LUG (V77147) 304-0015-000		2
R	-11	TA-2402-A		2	WASHER (V08289) 352-9570-020		2
R	-13	547-8177-003		2	BUSHING		4
R	-15	NAS620C4L		2	WASHER,FLAT PSVT CRES, 0.115 ID X 0.209 OD (V80205) 310-0740-200		6
R	-17	MS51957-15		2	SCREW,MACH STL, 4-40 X 3/8 (V96906) 343-0135-000		4
					—*—		
R	19	403		2	TERMINAL,LUG (V79963) 304-1089-000		3
					ATTACHING PARTS		
R	-21	NAS67C4		2	NUT,PLAIN,HEXAGON CD PL STL, 0.112-40 (V80205) 313-0132-000		2

- ITEM NOT ILLUSTRATED

DETAILED PARTS LIST

	FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDENT	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
R	9-23	MS35338-135		2	WASHER,LOCK SST, 0.115 ID X 0.209 OD (V96906) 310-0279-000		2
R	-25	MW-375-118		2	INSULATOR,WASHER MICA, 0.118 ID X 0.375 OD (V08289) 302-0640-080		2
R	-27	547-8177-016		2	BUSHING		2
R	-29	MS51957-14		2	SCREW,MACH SST, 4-40 X 5/16 (V96906) 343-0134-000		2
					---*---		
R	31	RN55D1002F		2	RESISTOR,FIXED FILM, 10K, 1%, 1/8W (V81349) 705-1044-000 A6R12 A6R2		2
R	33	RN60D5111F		2	RESISTOR,FIXED FILM, 5.11K, 1%, 1/4W (V81349) 705-6630-000 A6R1 A6R11 A6R14		3
R	34	1N753A		2	SEMICOND DEVICE (V07263) 353-2714-000 A6CR1		1
R	35	634-3881-001		2	TERMINAL BOARD		1
R	37	014-2402-000599		3	TERMINAL,STUD (V98291) 306-0788-010		2
R	39	004-3401-000599		3	TERMINAL,STANDOFF (V98291) 306-2222-100		19
R	41	002-3402-000599		3	TERMINAL,FEEDTHRU (V98291) 306-2474-010		4
R	43	M45938/5-1		3	NUT,SLFLKG,CLINCH CD PL STL, 2-56 (V81349) 333-0837-000		4
R	45	634-3881-002		3	TERMINAL BOARD		1

- ITEM NOT ILLUSTRATED



TP6-9031-017

Servo Amplifier Circuit Card Assembly A7
Figure 10

HSI-45 HORIZONTAL SITUATION INDICATOR

COMPONENT MAINTENANCE MANUAL (523-0768607)

TEMPORARY REVISION NO 34-28-25-18

Insert facing page 1067, 34-28-25

This temporay revision supersedes temporary revision number 13.

Subject: Illustrated Parts List

This temporary revision changes the part number of items 13, 15 and 27. Change figure 10 as follows:

13	2N222A	2	TRANSISTOR (V49956) 352-0661-020 A7Q1 A7Q2 A7Q3 A7Q4 A7Q5 A7Q6 A7Q7 A7Q8 (SUPSD BY 13A)	8
-13A	2N3700	2	TRANSISTOR (V49956) 352-0734-020 (SUPSDS 13)	8
15	RCR05G122KS	2	RESISTOR, FIXED CMPSN, 1.2K, 10%, 1/8W (V81349) 745-2344-000 A7R46 A7R48 A7R50 A7R52 A7R54 A7R56 A7R58 A7R60 (SUPSD BY 15A)	8
-15A	RCR05G151KS	2	RESISTOR, FIXED CMPSN, 150OHMS , 10%, 1/8W (V81349) 745-2311-000 (SUPSDS 15)	8
27	RN55D8662F	2	RESISTOR, FIXED CMPSN, 86.6K, 1%, 1/8W (V81349) 705-1089-000 A7R20 A7R31 A7R42 A7R9 (SUPSD BY 27A)	8
-27A	RN55D2053F	2	RESISTOR, FIXED CMPSN, 205K, 1%, 1/8W (V81349) 705-1107-000 (SUPSDS 27)	8

DETAILED PARTS LIST

	FIG-ITEM	PART NUMBER	AIRLINE PART NO	INDENT	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
R	10-1	647-6816-001		1	CIRCUIT CARD ASSEMBLY, SERVO AMP A7 (SEE FIG 1-37C FOR NHA)		RF
R	3	RCR05G514JS		2	RESISTOR,FIXED CMPSN, 510K, 5%, 1/8W (V81349) 745-1864-180 A7R1 A7R12 A7R13 A7R2 A7R23 A7R24 A7R34 A7R35		8
R	5	CK06BX334K		2	CAPACITOR,FIXED CER DIEL, 0.33UF, 10%, 50VDC (V81349) 913-5019-500 A7C1 A7C13 A7C14 A7C15 A7C20 A7C21 A7C22 A7C27 A7C28 A7C6 A7C7 A7C8		12
R	7	RCR07G222KS		2	RESISTOR,FIXED CMPSN, 2.2K, 10%, 1/4W (V81349) 745-0761-000 A7R10 A7R21 A7R32 A7R43		4
R	9	RCR05G301JS		2	RESISTOR,FIXED CMPSN, 300 OHMS, 5%, 1/8W (V81349) 745-1863-360 A7R11 A7R17 A7R22 A7R28 A7R33 A7R39 A7R44 A7R6		8
R	11	RN55D1002F		2	RESISTOR,FIXED FILM, 10K, 1%, 1/8W (V81349) 705-1044-000 A7R14 A7R16 A7R18 A7R19 A7R25 A7R27 A7R29 A7R3 A7R30 A7R36 A7R38 A7R40 A7R41 A7R5 A7R7 A7R8		16
R	13	2N2222A		2	TRANSISTOR (V49956) 352-0661-020 A7Q1 A7Q2 A7Q3 A7Q4 A7Q5 A7Q6 A7Q7 A7Q8		8
R	15	RCR05G122KS		2	RESISTOR,FIXED CMPSN, 1.2K, 10%, 1/8W (V81349) 745-2344-000 A7R46 A7R48 A7R50 A7R52 A7R54 A7R56 A7R58 A7R60		8
R	17	RCR07G122KS		2	RESISTOR,FIXED CMPSN, 1.2K, 10%, 1/4W (V81349) 745-0752-000 A7R45 A7R47 A7R49 A7R51 A7R53 A7R55 A7R57 A7R59		8
R	19	1N4106		2	SEMICOND DEVICE (V04713) 353-3591-080 A7VR1 A7VR2 A7VR3 A7VR4		4
R	21	1N4620		2	SEMICOND DEVICE (V04713) 353-3591-440 A7VR10 A7VR11 A7VR12 A7VR5 A7VR6 A7VR7 A7VR8 A7VR9		8
R	23	RN55D5621F		2	RESISTOR,FIXED FILM, 5.62K, 1%, 1/8W (V81349) 705-1032-000 A7R65		1
R	25	RN55D1001F		2	RESISTOR,FIXED FILM, 1K, 1%, 1/8W (V81349) 705-0996-000 A7R66		1
R	27	RN55D8662F		2	RESISTOR,FIXED FILM, 86.6K, 1%, 1/8W (V81349) 705-1089-000 A7R20 A7R31 A7R42 A7R9		4
R	29	LM148J		2	INTEGRATED CIRCUIT OPRTNL AMPLIFIER (V27014) 351-1262-020 A7U1 A7U2 A7U3 A7U4		4
R	31	M39014/22-0194		2	CAPACITOR,FIXED CER DIEL, 0.1UF, 10%, 50VDC (V81349) 913-3665-430 A7C10 A7C17 A7C24 A7C3		4
R	33	M39014/22-0176		2	CAPACITOR,FIXED CER DIEL, 10,000PF, 10%, 100VDC (V81349) 913-3665-380 A7C16 A7C2 A7C23 A7C9		4
R	35	RN55D5492F		2	RESISTOR,FIXED FILM, 54.9K, 1%, 1/8W (V81349) 705-3605-830 A7R15 A7R26 A7R37 A7R4		4
R	37	RN55D2871F		2	RESISTOR,FIXED FILM, 2.87K, 1%, 1/8W (V81349) 705-1018-000 A7R63		1
R	39	RN55D1471F		2	RESISTOR,FIXED FILM, 1.47K, 1%, 1/8W (V81349) 705-1004-000 A7R64		1
R	41	RN55D4221F		2	RESISTOR,FIXED FILM, 4.22K, 1%, 1/8W (V81349) 705-1026-000 A7R61		1
R	43	RN55D1211F		2	RESISTOR,FIXED FILM, 1.21K, 1%, 1/8W (V81349) 705-1000-000 A7R62		1

- ITEM NOT ILLUSTRATED

DETAILED PARTS LIST

	FIG-ITEM	PART NUMBER	AIRLINE PART NO	I-D-U-Z-H	NOMENCLATURE	EFFECT CODE	UNITS PER ASSY
R	10 45	RN55D1781F		2	RESISTOR,FIXED FILM, 1.78K, 1%, 1/8W (V81349) 705-1008-000 A7R68		1
R	47	RN55D4641F		2	RESISTOR,FIXED FILM, 4.64K, 1%, 1/8W (V81349) 705-1028-000 A7R67		1

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