



*ELECTRONIC AND AVIONICS SYSTEMS*

***MAINTENANCE MANUAL***

***BENDIX/KING<sup>®</sup>***

***KI 208A/209A***

***NAVIGATION INDICATORS***

*MANUAL NUMBER 006-15543-0000*

*REVISION 0, DECEMBER, 1996*

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*ELECTRONIC AND AVIONICS SYSTEMS*

***INSTALLATION MANUAL***

***BENDIX/KING<sup>®</sup>***

***KI 208A/209A***  
***NAVIGATION INDICATORS***

*MANUAL NUMBER 006-10543-0000*

*REVISION 0 OCTOBER, 1996*

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**BENDIX/KING**  
**KI 208A/209A**  
**NAVIGATION INDICATORS**

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 KI 208A/209A  
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**SECTION I**  
**GENERAL INFORMATION**

**1.1 INTRODUCTION**

This manual contains information relative to the physical, mechanical and electrical characteristics of the Bendix/King Silver Crown, KI 208A and KI 209A.

**1.2 EQUIPMENT DESCRIPTION**

The Bendix/King KI 208A NAV Indicator is designed to operate with VHF, Loran-C and GPS navigational equipment (such as the KX 155/A, KLN 88 and KLN 89) to provide OMNI (VOR), GPS, Loran-C or LOCALIZER (LOC) information. An external selector switch determines which navigation information, GPS/Loran-C or VOR/LOC, is displayed on the indicator. When NAV is selected for display, the VHF navigational receiver receives and detects the omni or localizer information. The KI 208A converts this information to DC signals which drive the LEFT-RIGHT needle and the TO-OFF-FROM flag of the visual indicator. When LNAV is selected for display, the KI 208A receives inputs from compatible GPS/Loran-C receivers or Flight Management Systems to provide a visual presentation to the pilot.

The KI 209A NAV Indicator performs the same functions as the KI 208A. In addition, it contains an UP-DOWN needle with an OFF warning flag. The external selector switch determines whether information from an external glideslope receiver or vertical navigation information from a GPS or FMS is displayed.

The lateral and vertical deviation and flag signals that are selected for display on the indicator are output from the indicator for use by a flight control system. No course datum information is supplied by the indicator.

The KI 208A/209A OBS circuit is zeroed at 45°, as opposed to ORZ/EZ indicators which are typically zeroed at 300°. Because of this, any LNAV interfaced to the KI 208A/209A OBS resolver must have at least 110° of calibration range on its OBS resolver.

Three spare double throw relay contacts are provided by both the KI 208A and KI 209A. These relays are switched by the external selector switch that selects the indicator's displayed sensor.

**1.3 TECHNICAL CHARACTERISTICS**

SPECIFICATION	KI 208A	CHARACTERISTIC
GENERAL		
TSO COMPLIANCE:		C40a, C36c Class C Cat 2 DO-138 Environmental Cat. DAPAAAXXXXXX
SIZE:		See Figure 2-2
WEIGHT:		1.0 lbs (.45Kg) Nominal
POWER REQUIREMENTS:		14VDC                      28VDC
Indicator	50mA	50mA
Lighting	160mA	80mA

**BENDIX/KING**  
**KI 208A/209A**  
**NAVIGATION INDICATORS**

SPECIFICATION	KI 208A (Cont'd)	CHARACTERISTIC
<b>RELAY CHARACTERISTICS:</b>		
Total Energize Current	200mA Max.	100mA Max.
Resistive Load Current	1.0A Max.	1.0A Max.
Inductive Load Current	0.2A Max.	0.2A Max.
Incandescent Lamp Load Current	0.1A Max.	0.1A Max.
<b>NAV AND LNAV ANNUNCIATE:</b>		
Incandescent Lamp Load Current	0.1A Max.	0.1A Max.
<b>VOR/LOC</b>		
INPUT IMPEDANCE:	50K ohms, Nominal	
NOMINAL COMPOSITE INPUT LEVEL:	LOC: 0.33VRMS $\pm 10\%$ VOR: 0.50VRMS $\pm 10\%$ ARINC phased	
LOCALIZER SENSITIVITY:	4dB tone ratio will give 3 dot scale deflection	
OMNI ACCURACY:	$\pm 2^\circ$ Max Error, $\pm 1^\circ$ Typical	
OMNI SENSITIVITY:	$\pm 10^\circ$ off course gives full scale deflection	
EXTERNAL LOAD:	ARINC Autopilot Deviation (Two 1K loads)	
<b>LNAV LATERAL DEVIATION</b>		
INPUT IMPEDANCE:	1K ohms $\pm 5\%$	
DEFLECTION SENSITIVITY:	150 $\mu$ A $\pm 5\%$ for full scale deflection	
<b>LNAV LATERAL FLAG</b>		
INPUT IMPEDANCE:	1K ohms $\pm 5\%$ minimum	
DEFLECTION SENSITIVITY:	125 $\mu$ A for flag to leave stop 260 $\mu$ A maximum for fully concealed flag	
<b>LNAV OBS</b>		
Electrical Zero:	45 $^\circ$	
OBS Excitation Voltage:	2.0 - 7.2 V P-P, RMS or Square	
Input Impedance:	> 10K ohms	
Output Load Capability:	> 30K ohms	
<b>FLIGHT CONTROL SYSTEM OUTPUTS</b>		
Lateral Deviation Load Capability:	NAV Mode	LNAV Mode
	Two 1K ohm loads	Direct Relay Connection to LNAV



**BENDIX/KING**  
**KI 208A/209A**  
**NAVIGATION INDICATORS**

SPECIFICATION	KI 208A (Cont'd)	CHARACTERISTIC
Lateral Flag Load Capability:	NAV Mode	LNAV Mode
	Five 1K ohm loads	Direct Relay Connection to LNAV
FCS LOC Engage Load Capability:	NAV Mode	LNAV Mode
	Direct Relay Connection to VOR/LOC Receiver	Direct Relay Connection to LNAV

SPECIFICATION	KI 209A	CHARACTERISTIC
---------------	---------	----------------

GENERAL

TSO COMPLIANCE: C40a, C36c Class C Cat 2  
C34c Class D Cat 2  
DO-138 Environmental Cat. DAPAAAXXXXXX

SIZE: See Figure 2-2

WEIGHT: 1.2 lbs (.54Kg) Nominal

POWER REQUIREMENTS: 14VDC 28VDC

Indicator 50mA 50mA

Lighting 160mA 80mA

RELAY CHARACTERISTICS:

Total Energize Current 200mA Max. 100mA Max.

Resistive Load Current 1.0A Max. 1.0A Max.

Inductive Load Current 0.2A Max. 0.2A Max.

Incandescent Lamp Load Current 0.1A Max. 0.1A Max.

NAV AND LNAV ANNUNCIATE:

Incandescent Lamp Load Current 0.1A Max. 0.1A Max.

VOR/LOC

INPUT IMPEDANCE: 50K ohms, Nominal

NOMINAL COMPOSITE INPUT LEVEL: LOC: 0.33VRMS ±10%  
VOR: 0.50VRMS ±10% ARINC phased

LOCALIZER SENSITIVITY: 4dB tone ratio will give 3 dot scale deflection

OMNI ACCURACY: ±2° Max Error, ±1° Typical

OMNI SENSITIVITY: ±10° off course gives full scale deflection

EXTERNAL LOAD: ARINC Autopilot Deviation (Two 1K loads)

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 NAVIGATION INDICATORS

SPECIFICATION	KI 209A (Cont'd)	CHARACTERISTIC
<b>LNAV LATERAL AND VERTICAL DEVIATION</b>		
INPUT IMPEDANCE:	1K ohms ±5%	
DEFLECTION SENSITIVITY:	150µA ±5% for full scale deflection	
<b>LNAV LATERAL AND VERTICAL FLAG</b>		
INPUT IMPEDANCE:	1K ohms ±5% minimum	
DEFLECTION SENSITIVITY:	125µA for flag to leave stop 260µA maximum for fully concealed flag	
<b>LNAV OBS</b>		
Electrical Zero:	45°	
OBS Excitation Voltage:	2.0 - 7.2 V P-P, RMS or Square	
Input Impedance:	> 10K ohms	
Output Load Capability:	> 30K ohms	
<b>FLIGHT CONTROL SYSTEM OUTPUTS</b>		
Lateral Deviation Load Capability:	NAV Mode	LNAV Mode
	Two 1K ohm loads	Direct Relay Connection to LNAV
Lateral Flag Load Capability:	NAV Mode	LNAV Mode
	Five 1K ohm loads	Direct Relay Connection to LNAV
Vertical Deviation Load Capability:	NAV Mode	LNAV Mode
	Direct Relay Connection to Glideslope Receiver	Direct Relay Connection to LNAV
Vertical Flag Load Capability:	NAV Mode	LNAV Mode
	Direct Relay Connection to Glideslope Receiver	Direct Relay Connection to LNAV
FCS LOC Engage Load Capability:	NAV Mode	LNAV Mode
	Direct Relay Connection to VOR/LOC Receiver	Direct Relay Connection to LNAV
<b>GLIDESLOPE DEVIATION METER</b>		
INPUT IMPEDANCE:	1K ohms ±5%	
DEFLECTION SENSITIVITY:	150µA ±5% for full scale deflection	

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 KI 208A/209A  
 NAVIGATION INDICATORS

SPECIFICATION

KI 209A (Cont'd)

CHARACTERISTIC

GLIDESLOPE FLAG

INPUT IMPEDANCE: 1K ohms  $\pm 5\%$  minimum

DEFLECTION SENSITIVITY: 125 $\mu$ A for flag to leave stop  
 260 $\mu$ A maximum for fully concealed flag

**1.4 UNITS AND ACCESSORIES SUPPLIED**

- A. KI 208A NAV Indicator  
 066-3056-10
- B. KI 209A NAV Indicator  
 066-3056-11
- C. Bendix/King Equipment Installation Kit (050-01550-0001) which includes mating connectors, mounting hardware, etc., is as follows:

PART NUMBER	DESCRIPTION	VENDOR P/N	QUANTITY
030-01176-0000	Connector		1
030-02351-0004	Conn. Hood		1
030-02227-0023	Pin Female		50

**1.5 ACCESSORIES REQUIRED, BUT NOT SUPPLIED**

- A. Antenna
- B. Interconnecting Cables
- C. Receiver
- D. Switch/Annunciator (NAV/GPS)
 

	<u>Eaton Series 582</u>	<u>Eaton Series 584</u>
28 Volt	031-00785-0711	031-00763-0711
14 Volt	031-00785-0712	031-00763-0712
5 Volt	031-00785-0713	031-00763-0713
- E. Mooring Plate P/N 073-00044-0001
- F. Adapter Plate P/N 073-00045-0000 (Front mounting only)
- G. Punch P/N 071-06038-0000 or
- H. Filing Template P/N 071-06039-0000
- I. Crimp Tool P/N 005-02012-0021
- J. Positioner P/N 005-02012-0023
- K. Insertion/Extraction Tool P/N 005-02012-0025

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## 1.6 LICENSE REQUIREMENTS

None.

## 1.7 REQUIREMENTS FOR TSO'D VOR/ILS/GLIDESLOPE SYSTEM

Units used in conjunction with the KI 208A/209A must meet the specifications listed below to comprise a completely TSO'd navigation system.

### 1.7.1 NAVIGATION RECEIVER REQUIREMENTS FOR USE WITH KI 208A/209A:

- A. The Navigation Receiver shall be authorized to the standards of TSO C40a/b/c or TSO C36c/d/e.
- B. VOR phase error shall not exceed 1.5°.
- C. Variation in VOR composite output to not exceed  $\pm 3$ dB from .500VRMS as the RF input level of a Standard VOR Test Signal to the receiver is varied from 10 $\mu$ v to 10,000 $\mu$ v.
- D. Variation in the LOC composite output shall not exceed  $\pm 2$ dB from .333VRMS as the RF input level of a Standard Localizer Centering Signal is varied from 50 $\mu$ v to 10,000 $\mu$ v.
- E. A control line (ILS Energize) must be provided as a low impedance to ground when an ILS frequency is selected.

### 1.7.2 GLIDESLOPE RECEIVER/CONVERTER REQUIREMENTS FOR USE WITH KI 209A:

- A. The Glideslope Receiver/Converter shall be authorized to the standards of TSO C34c/d/e.
- B. Centering current to be 0  $\pm 7$  $\mu$ A into a 1000 ohm load with a 95% probability under all combinations of the service conditions listed in RTCA Paper DO-132, Minimum Performance Standards – Airborne ILS Glideslope Receiving Equipment paragraph 2.1 sub-paragraph b, Centering Accuracy.
- C. Deviation current with a 700 $\mu$ v Standard Glideslope Deviation Signal (.091  $\pm$  .001ddm tone ratio) applied to the receiver input shall be 78 $\mu$ A  $\pm 10$ % into a 1000 ohm load. Deviation current shall not change more than 15% as the RF input level of a Standard Glideslope Deviation Signal is varied from 100 to 10,000 $\mu$ v. Deviation Current shall be proportional within 5% to the difference in depth of modulation of the 90Hz and 150Hz tones.
- D. Warning signal output shall be a DC current less than 125 $\mu$ A into a 1000 ohm load for a warning flag to be fully visible. Warning signal for a fully concealed warning flag shall be a DC current of 260 $\mu$ A minimum into a 1000 ohm load.

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**SECTION II**  
**INSTALLATION**

**2.1 GENERAL**

This section contains suggestions and factors to consider before installing the KI 208A/209A Indicator. Close adherence to these suggestions will assure a more satisfactory performance from the equipment.

**2.2 UNPACKING AND INSPECTING EQUIPMENT**

Exercise extreme care when unpacking each unit. Make a visual inspection of each unit for evidence of damage incurred during shipment. If a claim for damage is to be made, save the shipping container to substantiate the claim. When all equipment is removed, place in the shipping container all packing materials for use in unit storage or reshipment. The KI 208A/209A installation will conform to standards designated by the customer, installing agency and existing conditions as to unit location and type of installation.

**NOTE**

This equipment has plastic lenses. Use extreme caution when cleaning.

**2.3 KI 208A/209A INSTALLATION**

**2.3.1 INSTALLATION PROCEDURE**

- A. Carefully select the KI 208A/209A panel location for unobstructed vision, minimum parallax and adequate clearance for the instrument case and installation of cables and connectors.
- B. Refer to Figure 2-2 for the KI 208A and KI 209A mounting dimensions.
- C. A standard 3 1/8" instrument hole is required. Use Hole Punch (P/N 071-06038-0000) or Filing Template (P/N 071-06039-0000).
- D. Secure the KI 208A/209A firmly in place using the mounting screws supplied. If the mounting screws supplied are not used, #6-32 screws that do not extend more than .625 (1.59cm) into the unit may be used.
- E. The installing agency will supply and fabricate the external cable. The plugs required are supplied by AlliedSignal.
- F. The KI 208A/209A will drive two external deflection indicator loads of 1000 ohms or greater impedance.
- G. An omni phase adjust potentiometer, R233, is accessible from the front of the indicator by removing the upper left mounting screw. The 2 1/2 inch long adjustment tool (P/N 088-00706-0000) is required to adjust the omni phase adjust potentiometer. This is for final calibration of the omni system after installation in the aircraft. The range of the error potentiometer is approximately  $\pm 25^\circ$ . It should be noted that this potentiometer does not affect localizer centering. The localizer centering potentiometer R227 is accessible from the front of the indicator by removing the upper right mounting screw. Again the 2 1/2 inch long adjustment tool is required.

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### 2.3.2 CABLING

- A. The length and routing of the external cables must be carefully studied and planned prior to the installation. Avoid sharp bends and placing cables too near the aircraft control cables.
- B. Fabricate the external cables in accordance with the installation drawing that fulfills the system requirement.
- C. Avoid running the interconnect harness between the KI 208A and navigation receiver too close to any transmitter antenna coax cable.
- D. Considerable savings of installation time can be realized by using the crimping tool shown in Figure 2-1.

### 2.3.3 PIN DESCRIPTIONS

- A. NAV 11-33 VDC A/C POWER and LNAV 11-33 VDC A/C POWER (Pins 40 and 41)

The KI 208A/209A will accept from 11 VDC to 33 VDC input power. Two separate pins are available so the KI 208A/209A is always powered by the displayed navigation data source. Pin 41 may be connected to the circuit breaker or switched power output of a NAV receiver or NAV/COM. If the switched power output is used, the KI 208A/209A draws current only when the power switch on the NAV or NAV/COM is ON (if NAV is selected on the NAV/LNAV switch). This is particularly helpful in aircraft where there is no avionics master switch. Generally, LNAV units are not equipped with switched power outputs, so pin 40 should be connected to the LNAV circuit breaker.

- B. A/C GROUND (Pin 34)

This pin is tied to aircraft ground. Wiring harness shields are not to be terminated on this pin. Refer to Figure 2-3.

- C. LIGHTING 14 V and LIGHTING 28 V / LO (Pins 4 and 5)

Used for the panel lighting. Refer to Figure 2-3 for the correct method of connecting these pins to the aircraft dimmer bus.

- D. VOR/LOC COMPOSITE (Pin 6)

VOR/LOC composite input from a NAV receiver. Nominal level: 500 mV VOR (ARINC phased), 350 mV LOC. Levels are as measured by an RMS-calibrated, peak detecting voltmeter.

- E. NAV VERTICAL +UP IN, NAV VERTICAL +DOWN IN, NAV VERTICAL +FLAG IN, and NAV VERTICAL -FLAG IN (Pins 29, 28, 25 and 24)(KI 209A only)

Meter-level vertical deviation and flag inputs from a NAV (glideslope) receiver.

- F. LNAV LATERAL DEV +LEFT IN, LNAV LATERAL DEV +RIGHT IN, LNAV +TO IN, LNAV +FROM IN, LNAV LATERAL +FLAG IN and LNAV LATERAL -FLAG IN (Pins 20, 21, 43, 42, 48 and 3)

Meter-level lateral deviation, TO/FROM, and flag inputs from an LNAV receiver.

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- G. LNAV VERTICAL +UP IN, LNAV VERTICAL +DOWN IN, LNAV VERTICAL +FLAG IN and LNAV VERTICAL -FLAG IN (Pins 27, 26, 23 and 22)(KI 209A only)

Meter-level vertical deviation and flag inputs from an LNAV receiver.

- H. LNAV OBS EXCITATION IN, LNAV OBS SIN OUT, LNAV OBS COS OUT, and OBS RETURN (Pins 2, 15, 14, and 50)

These pins form the OBS resolver interface. LNAV OBS EXCITATION IN is a typically 400-450 Hz excitation/reference signal. LNAV OBS SIN OUT and LNAV OBS COS OUT indicate the position of the OBS selection card on the KI 208A/209A. OBS RETURN is the low-side reference for all three signals. The KI 208A/209A OBS circuit is zeroed at 45°, as opposed to ORZ/EZ indicators which are typically zeroed at 300°. Because of this, any LNAV interfaced to the KI 208A/209A must have at least 110° of calibration range on its OBS resolver.

- I. LATERAL DEV +LEFT OUT, LATERAL DEV +RIGHT OUT, LATERAL +FLAG OUT and LATERAL -FLAG OUT (Pins 17, 16, 11 and 12)

Meter-level lateral deviation and flag outputs, typically to a flight control system. When LNAV is displayed on the KI 208A/209A, these signals are simply the LNAV deviation and flags switched through relay contacts. When NAV is displayed, these signals are the outputs of the VOR/LOC converter.

- J. VERTICAL +UP OUT, VERTICAL +DOWN OUT, VERTICAL +FLAG OUT, and VERTICAL -FLAG OUT (Pins 44, 45, 46, and 47)(KI 209A only)

Meter-level vertical deviation and flag outputs, typically to a flight control system. These signals are simply the NAV or LNAV deviation and flags switched through relay contacts, depending on which source is displayed on the KI 209A.

- K. RELAY 14 V POWER A and RELAY 14 V POWER B (Pins 35 and 37)

These pins are connected to the LNAV circuit breaker and provide the power for the KI 208A/209A's internal relays. Should a failure of LNAV power occur, the KI 208A/209A will automatically revert to displaying NAV data. These pins are connected differently, depending on the aircraft power voltage. The two banks are wired in series for 28 volt power, and in parallel for 14 volt power. Refer to Figure 2-3 for the proper connection to 14 volt and 28 volt power. The current draw is 58.5 mA when A/C POWER is 27.5 VDC, and 117 mA when A/C POWER is 14.75 VDC. Suppression diodes are contained within the KI 208A/209A.

- L. RELAY ENGAGE A and RELAY ENGAGE B (Pins 36 and 1)

These pins sense the position of the NAV/GPS switch. They are the low side of the relays, which complete the relay coil power circuit. In 28 volt aircraft, pin 36 is jumpered to pin 37, and pin 1 is connected to a NAV/GPS switch contact. In 14 volt aircraft, both pin 36 and pin 1 are connected to a NAV/GPS switch contact. Refer to Figure 2-3 for the proper connections in each case.

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M. LNAV ANNUNCIATE and NAV ANNUNCIATE (Pins 7 and 8)

Navigation source annunciator outputs. This output is tied to a remote annunciator lamp. When the line is pulled low the annunciator lamp will illuminate. The NAV ANNUNCIATE output will be active when the KI 208A/209A is in the NAV (VOR/LOC/GS) mode, and the LNAV ANNUNCIATE output will be active when the KI 208A/209A is in the LNAV (i.e. FMS, LORAN, or GPS) mode. The relay contacts that drive these outputs are rated at 100 mA maximum for an incandescent lamp load.

N. LNAV FCS LOC ENGAGE IN and NAV LOC ENGAGE IN (Pins 9 and 10)

NAV receivers and some LNAV receivers have localizer engage outputs which are connected to flight control systems so that their gain will be higher when tracking a localizer on the final approach course of a GPS approach. When a NAV receiver is the navigation source, NAV LOC ENGAGE IN is also used by the VOR/LOC converter to process the input composite signal as a localizer signal rather than a VOR signal. The KI 208A/209A accepts these discretes as inputs.

O. FCS LOC ENGAGE OUT (Pin 13)

The KI 208A/209A switches the appropriate localizer engage discrete (LNAV FCS LOC ENGAGE IN or NAV LOC ENGAGE IN) to a flight control system (FCS), based on the status of the external NAV/GPS switch. This ensures that the FCS only responds to the navigation source which is currently displayed on the KI 208A/209A. The FCS LOC ENGAGE logic from the LNAV should not drive the localizer energize input on an RMI or HSI as this could park the RMI pointer or remove the TO/FROM indicator when the LNAV is in Approach Active mode.

P. Spare relay contacts (Pins 18, 19, 30, 31, 32, 33, 38, 39, and 49)

There are three sets of spare relay contacts with three pins each (COMMON, NORMALLY CLOSED, and NORMALLY OPEN). When NAV is selected, COMMON is connected to NORMALLY CLOSED. When LNAV is selected, COMMON is connected to NORMALLY OPEN.

## 2.4 POST INSTALLATION CHECKOUT

An operational performance flight test is recommended after installation to insure satisfactory performance of the equipment in its normal environment.

To check the VOR/ILS System, select a VOR frequency within a forty nautical mile range. Listen to the VOR audio and insure that no electrical interference such as magneto noise is present. Check the tone identifier filter operation. Fly inbound or outbound on a selected VOR radial and check for proper LEFT-RIGHT and TO-FROM indications. Check the VOR accuracy.

### NOTE

VOR ground station scalloping may occur under weak signal conditions.

To check accuracy when installed with a GPS or Loran-C receiver, simply compare with the digital display on the receiver.

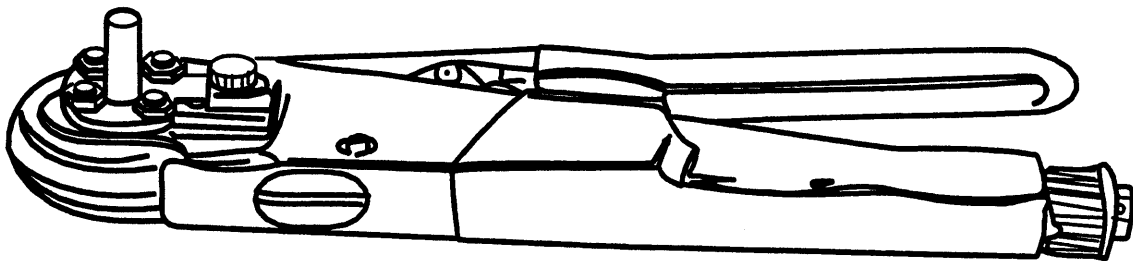
Flight test the ILS operation by flying a simulated ILS approach. Check localizer LEFT-RIGHT deflection and, if applicable, glideslope deflection. Check the localizer accuracy in relation to the ILS runway. Check the glideslope accuracy in relation to the published ILS approach altitude.



**BENDIX/KING**  
KI 208A/209A  
NAVIGATION INDICATORS

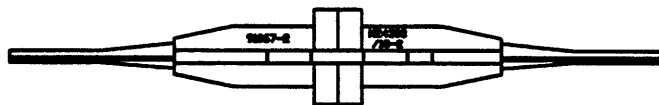
Check the operation of the OBS interface by selecting a course on the KI 208A/209A and verify it is displayed correctly on the LNAV. A calibration procedure must typically be performed on the LNAV for the selected course to be displayed correctly. Consult the installation literature for the interfaced LNAV.

If a flight control system is installed in the aircraft, verify that proper tracking occurs for both the NAV and LNAV display modes of the indicator.



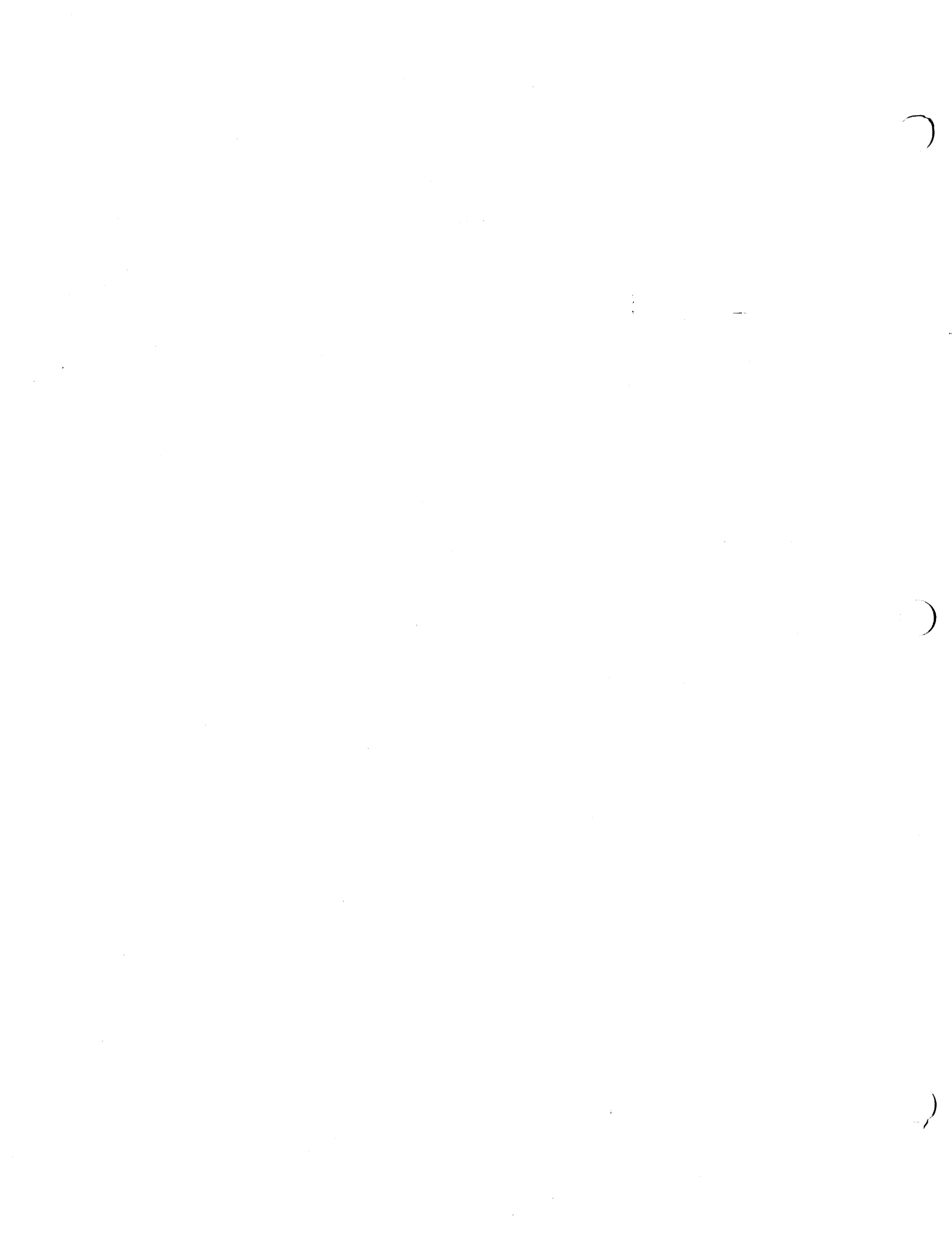
CRIMPING TOOL P/N: 005-02012-0021  
BUCHANAN P/N 612118  
POSITRONIC P/N: 9508

POSITIONER P/N: 005-02012-0023  
BUCHANAN P/N 612513  
POSITRONIC P/N: 9502-7

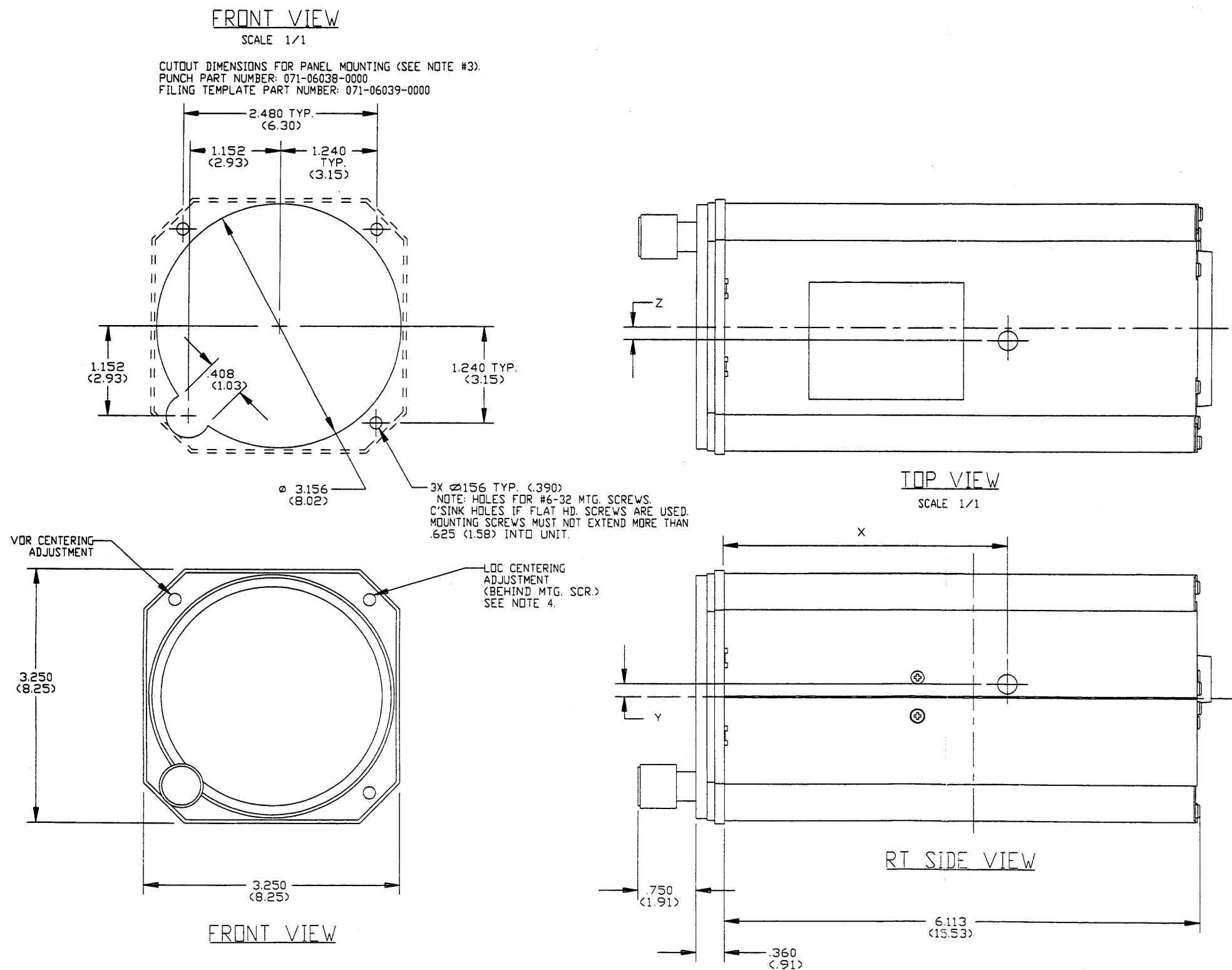


INSERTION/EXTRACTION TOOL P/N: 005-02012-0025  
AMP P/N 91067-2  
MIL SPEC P/N: M24308/18-12

FIGURE 2-1 KI 208A/209A CONNECTOR TOOLS



**BENDIX/KING**  
**KI 208A/209A**  
**NAVIGATION INDICATORS**



**NOTES:**

1. DIMENSIONS: IN(CM)
2. NOMINAL WEIGHT:  
 KI 208 A: 1.0 LBS/.45 KG  
 KI 209 A: 1.2 LBS/.54 KG
3. THIS UNIT MAY BE FRONT OR REAR MOUNTED. IN A STANDARD 3' A.T.I. OPENING. TO REAR MOUNT UNIT USE A STANDARD MOUNTING PLATE P/N 073-00044-0001. TO FRONT MOUNT UNIT USE A STANDARD BLACK ADAPTOR PLATE P/N 073-00045-0000 WITH A STANDARD MOUNTING PLATE P/N 073-00044-0001.
4. ADJUSTMENTS CAN ONLY BE MADE BY USING SPECIAL TUNING TOOL P/N 088-00706-0000.

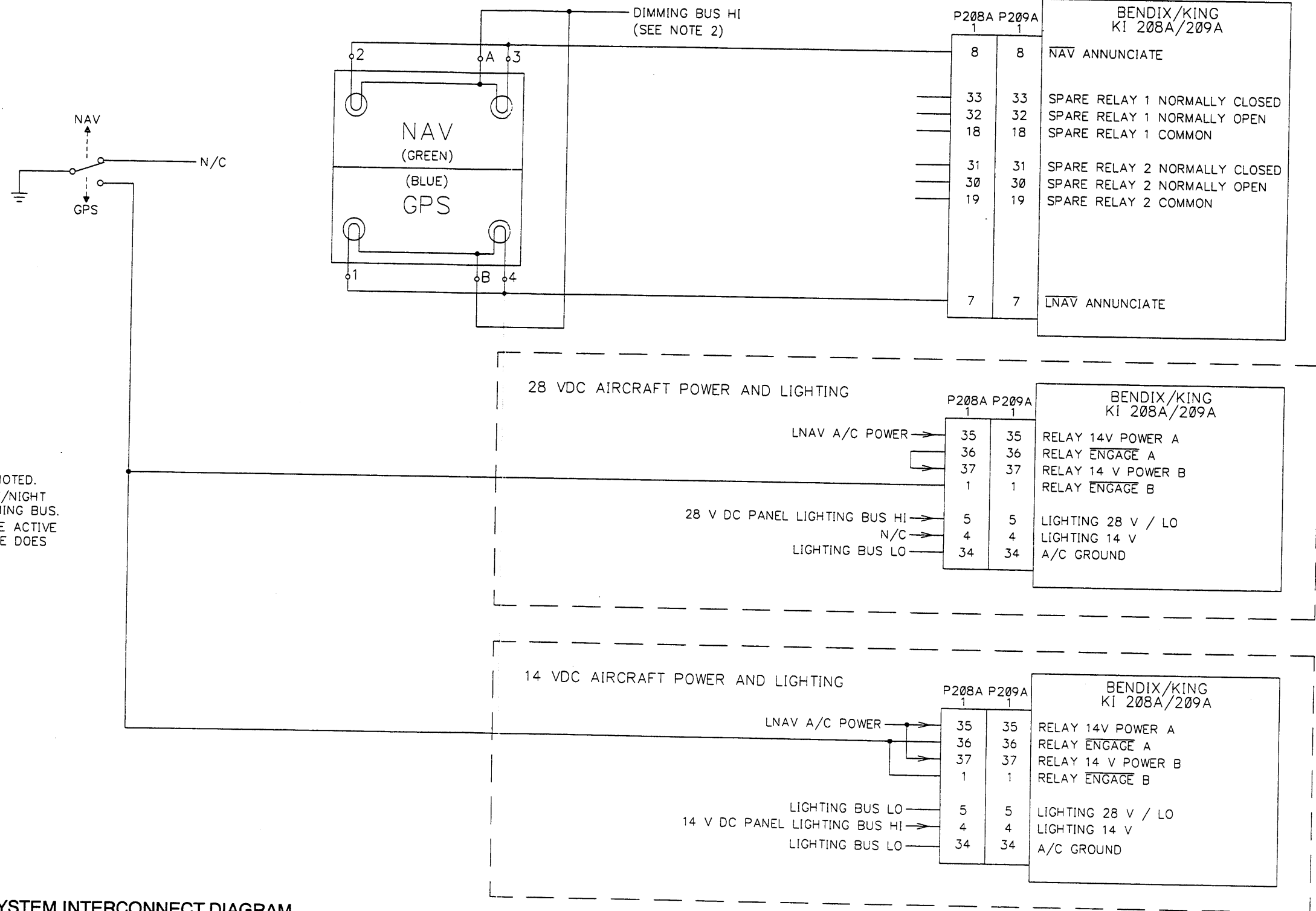
C.G. DIMENSION TABLE

AXIS	KI 208 A	KI 209 A
X	2.875 (7.303)	2.850 (7.239)
Y	.100 (.254)	.000 (.000)
Z	.060 (.152)	.000 (.000)

**FIGURE 2-2 KI 208A/209A OUTLINE AND MOUNTING DIAGRAM**

(Dwg. No. 155-06038-0000, R-2)

**BENDIX/KING**  
**KI 208A/209A**  
**NAVIGATION INDICATORS**



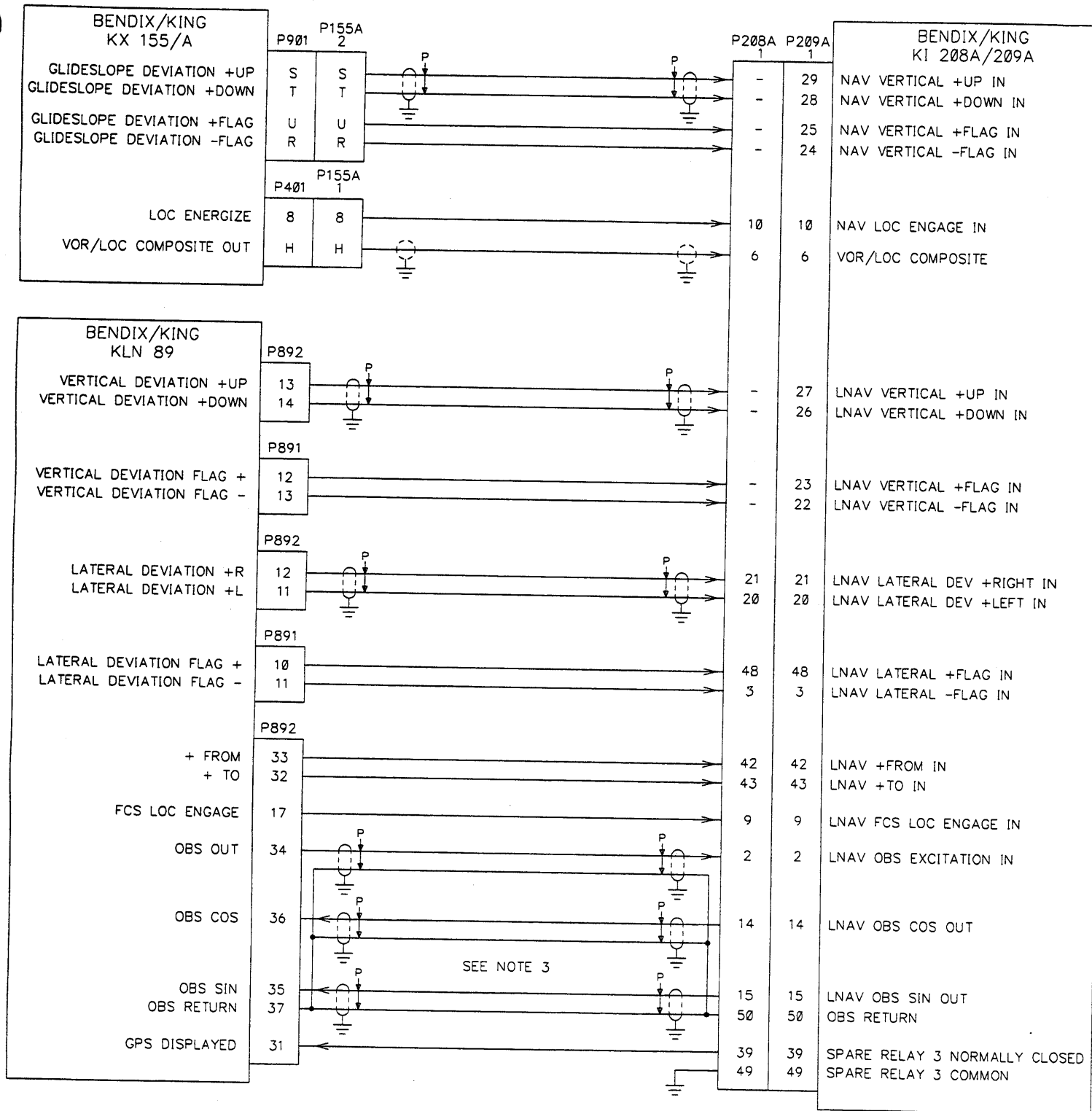
**NOTES:**

1. ALL WIRES ARE 24 AWG MINIMUM UNLESS OTHERWISE NOTED.
2. ANNUNCIATOR DIMMING MAY BE BY PHOTOCELL OR DAY/NIGHT SWITCH. DO NOT USE PANEL LIGHTING RHEOSTAT DIMMING BUS.
3. OVERLINED PIN NAMES, SUCH NAV, GENERALLY INDICATE ACTIVE LOW SIGNALS, ALTHOUGH THE ABSENCE OF AN OVERLINE DOES NOT NECESSARILY INDICATE AN ACTIVE HIGH SIGNAL.

155-01650-0000R051

**FIGURE 2-3 TYPICAL KI 208A/209A SYSTEM INTERCONNECT DIAGRAM**  
 (Dwg. No. 155-01650-0000, R-0)  
 (Sheet 1 of 3)

**BENDIX/KING**  
**KI 208A/209A**  
**NAVIGATION INDICATORS**



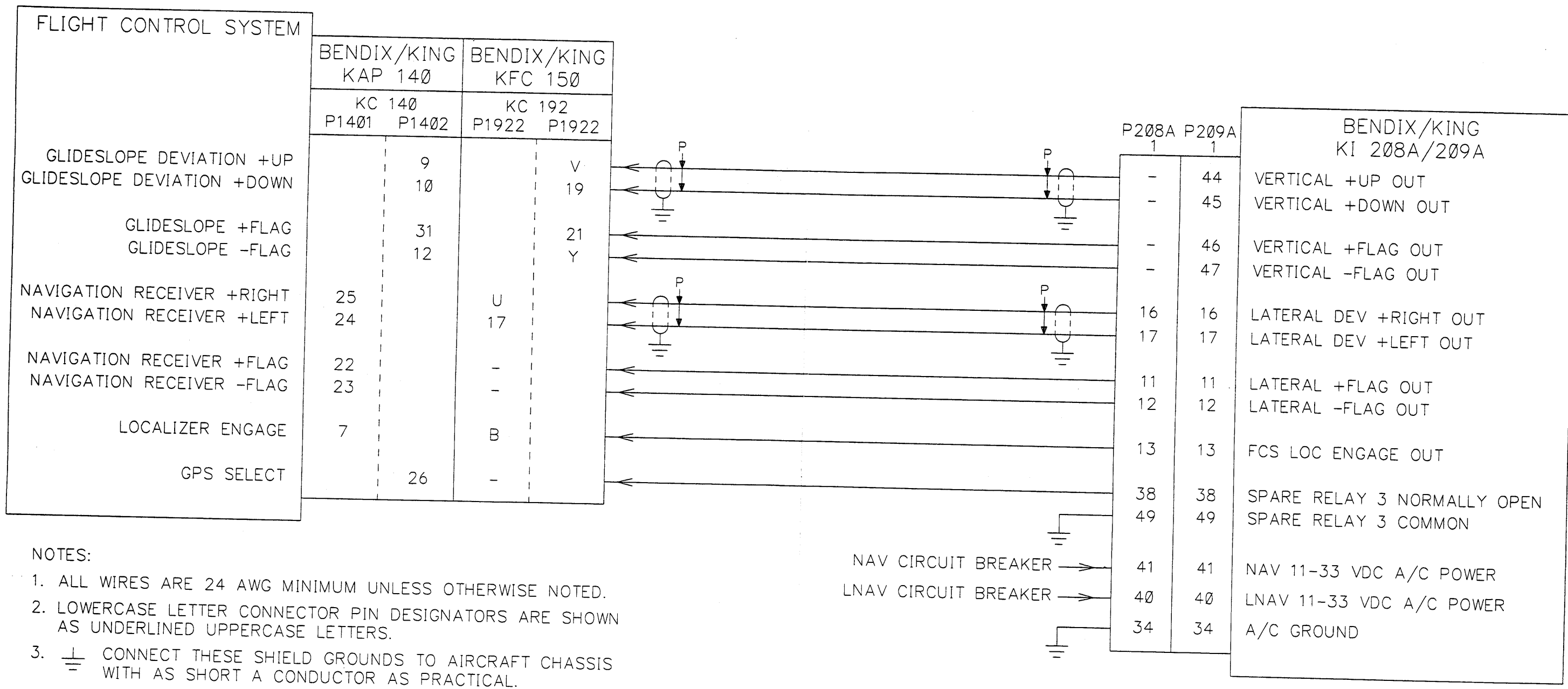
NOTES:

1. ALL WIRES ARE 24 AWG MINIMUM UNLESS OTHERWISE NOTED.
2. LOWERCASE LETTER CONNECTOR PIN DESIGNATORS ARE SHOWN AS UNDERLINED UPPERCASE LETTERS.
3. THE KI 208A/209A OBS CIRCUIT IS ZEROED AT 45°, AS OPPOSED TO ORZ/EZ INDICATORS WHICH ARE TYPICALLY ZEROED AT 300°. BECAUSE OF THIS, ANY LNAV INTERFACED TO THE KI 208A/209A MUST HAVE AT LEAST 110° OF CALIBRATION ON ITS OBS RESOLVER.
4. CONNECT THESE SHIELD GROUNDS TO AIRCRAFT CHASSIS WITH AS SHORT A CONDUCTOR AS PRACTICAL.

**FIGURE 2-3 TYPICAL KI 208A/209A SYSTEM INTERCONNECT DIAGRAM**  
 (Dwg. No. 155-01650-0000, R-0)  
 (Sheet 2 of 3)

155-01650-0000R0S2

**BENDIX/KING**  
**KI 208A/209A**  
**NAVIGATION INDICATORS**



**NOTES:**

1. ALL WIRES ARE 24 AWG MINIMUM UNLESS OTHERWISE NOTED.
2. LOWERCASE LETTER CONNECTOR PIN DESIGNATORS ARE SHOWN AS UNDERLINED UPPERCASE LETTERS.
3. CONNECT THESE SHIELD GROUNDS TO AIRCRAFT CHASSIS WITH AS SHORT A CONDUCTOR AS PRACTICAL.

155-01650-0000R0S3

**FIGURE 2-3 TYPICAL KI 208A/209A SYSTEM INTERCONNECT DIAGRAM**  
 (Dwg. No. 155-01650-0000, R-0)  
 (Sheet 3 of 3)

**BENDIX/KING**  
 KI 208A/209A  
 NAVIGATION INDICATORS

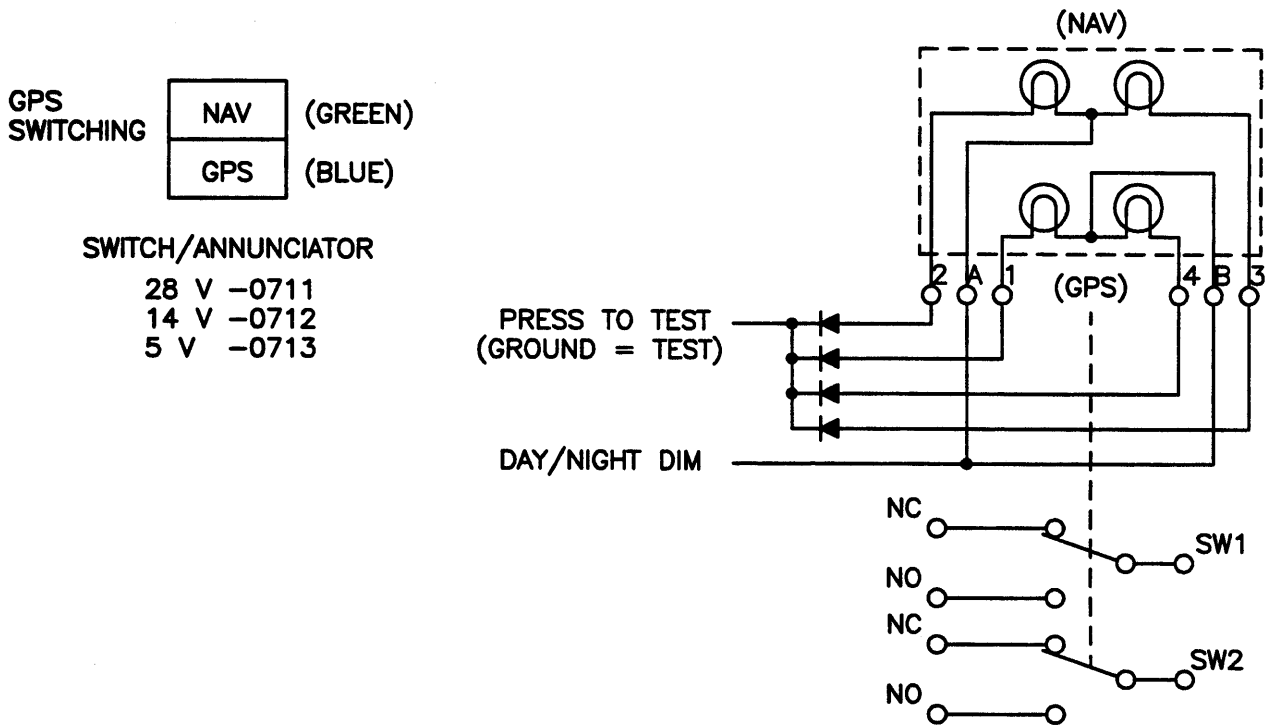


FIGURE 2-4 INTERNAL SWITCH SCHEMATIC (031-00785-XXXX)

**BENDIX/KING**  
 KI 208A/209A  
 NAVIGATION INDICATORS

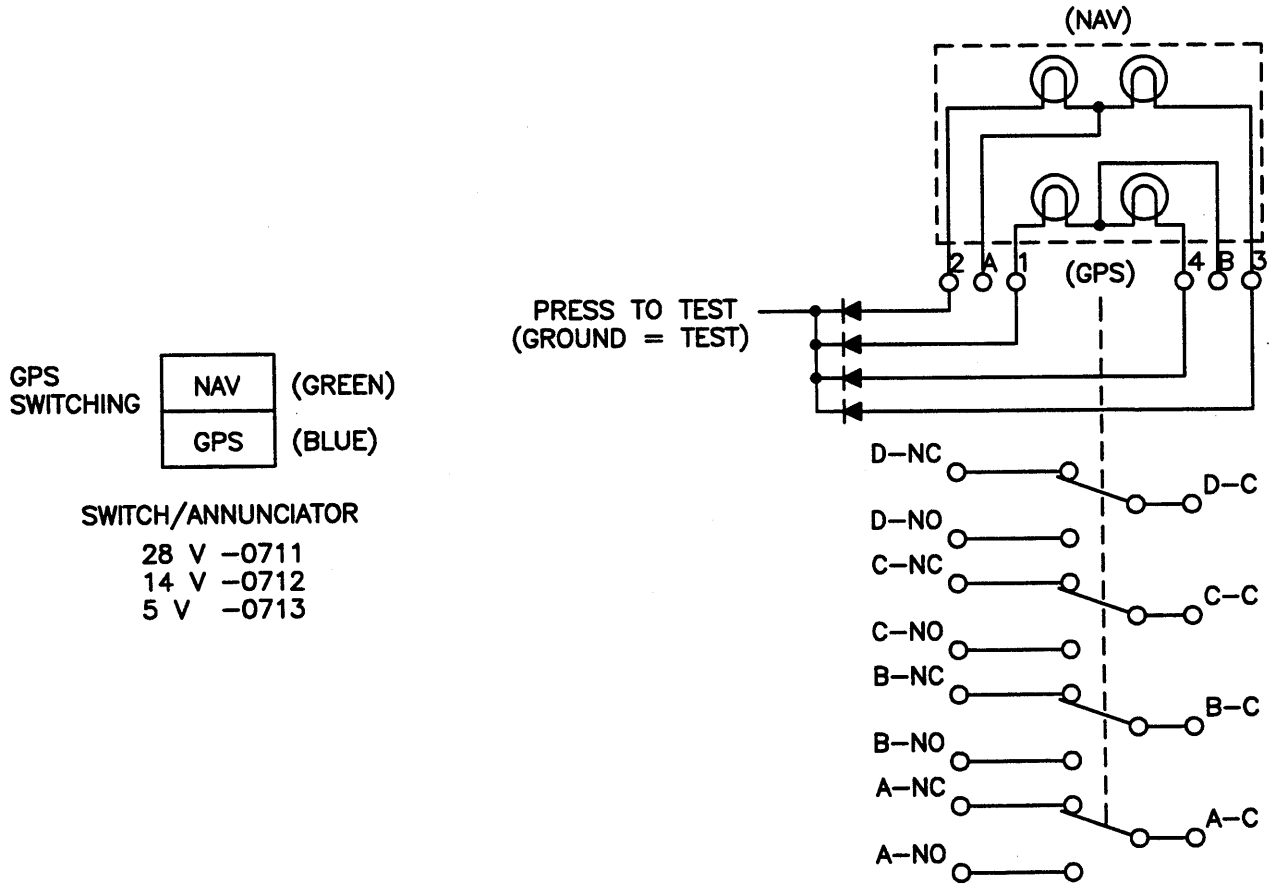


FIGURE 2-5 INTERNAL SWITCH SCHEMATIC (031-00763-XXXX)



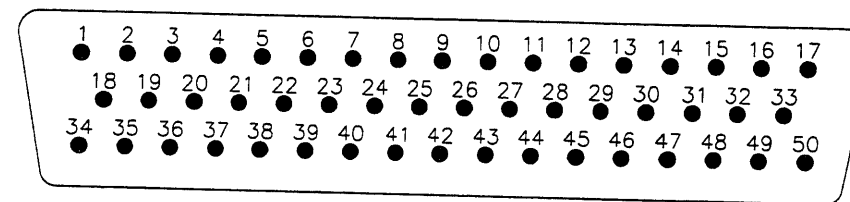
**BENDIX/KING**  
**KI 208A/209A**  
**NAVIGATION INDICATORS**

P208A		DESCRIPTION
1	←	RELAY ENGAGE B
2	←	LNAV OBS EXCITATION IN
3	←	LNAV LATERAL -FLAG IN
4	←	14 VOLT LIGHTING
5	←	28 VOLT/LO LIGHTING
6	←	VOR/LOC COMPOSITE
7	→	LNAV ANNUNCIATE
8	→	NAV ANNUNCIATE
9	←	LNAV FCS LOC ENGAGE IN
10	←	NAV LOC ENGAGE IN
11	→	LATERAL +FLAG OUT
12	→	LATERAL -FLAG OUT
13	→	FCS LOC ENGAGE OUT
14	→	LNAV OBS COS OUT
15	→	LNAV OBS SIN OUT
16	→	LATERAL DEVIATION +RIGHT OUT
17	→	LATERAL DEVIATION +LEFT OUT
18		SPARE RELAY 1 COMMON
19		SPARE RELAY 2 COMMON
20	←	LNAV LATERAL DEVIATION +LEFT IN
21	←	LNAV LATERAL DEVIATION +RIGHT IN
22		NO CONNECTION
23		NO CONNECTION
24		NO CONNECTION
25		NO CONNECTION

← INPUT    OUTPUT →

P208A		DESCRIPTION
26		NO CONNECTION
27		NO CONNECTION
28		NO CONNECTION
29		NO CONNECTION
30		SPARE RELAY 2 NORMALLY OPEN
31		SPARE RELAY 2 NORMALLY CLOSED
32		SPARE RELAY 1 NORMALLY OPEN
33		SPARE RELAY 1 NORMALLY CLOSED
34		AIRCRAFT GROUND
35	←	LNAV RELAY 14 VOLT POWER A
36	←	RELAY ENGAGE A
37	←	LNAV RELAY 14 VOLT POWER B
38		SPARE RELAY 3 NORMALLY OPEN
39		SPARE RELAY 3 NORMALLY CLOSED
40	←	LNAV 11-33 VDC AIRCRAFT POWER
41	←	NAV 11-33 VDC AIRCRAFT POWER
42	←	LNAV +FROM IN
43	←	LNAV +TO IN
44		NO CONNECTION
45		NO CONNECTION
46		NO CONNECTION
47		NO CONNECTION
48	←	LNAV LATERAL +FLAG IN
49		SPARE RELAY 3 COMMON
50		OBS RETURN

← INPUT    OUTPUT →

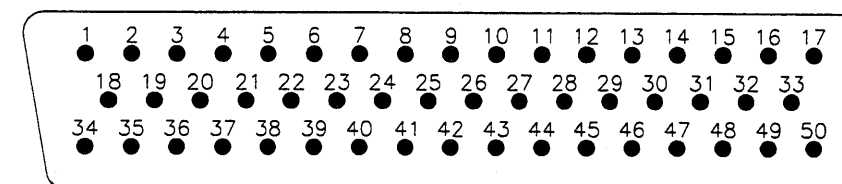


CABLE END VIEW

FIGURE 2-6 KI 208A PINOUT LIST

**BENDIX/KING**  
**KI 208A/209A**  
**NAVIGATION INDICATORS**

P209A	DESCRIPTION	P209A	DESCRIPTION
1 ←	RELAY ENGAGE B	26 ←	LNAV VERTICAL +DOWN IN
2 ←	LNAV OBS EXCITATION IN	27 ←	LNAV VERTICAL +UP IN
3 ←	LNAV LATERAL -FLAG IN	28 ←	NAV VERTICAL +DOWN IN
4 ←	14 VOLT LIGHTING	29 ←	NAV VERTICAL +UP IN
5 ←	28 VOLT/LO LIGHTING	30	SPARE RELAY 2 NORMALLY OPEN
6 ←	VOR/LOC COMPOSITE	31	SPARE RELAY 2 NORMALLY CLOSED
7	→ LNAV ANNUNCIATE	32	SPARE RELAY 1 NORMALLY OPEN
8	→ NAV ANNUNCIATE	33	SPARE RELAY 1 NORMALLY CLOSED
9 ←	LNAV FCS LOC ENGAGE IN	34	AIRCRAFT GROUND
10 ←	NAV LOC ENGAGE IN	35 ←	LNAV RELAY 14 VOLT POWER A
11	→ LATERAL +FLAG OUT	36 ←	RELAY ENGAGE A
12	→ LATERAL -FLAG OUT	37 ←	LNAV RELAY 14 VOLT POWER B
13	→ FCS LOC ENGAGE OUT	38	SPARE RELAY 3 NORMALLY OPEN
14	→ LNAV OBS COS OUT	39	SPARE RELAY 3 NORMALLY CLOSED
15	→ LNAV OBS SIN OUT	40 ←	LNAV 11-33 VDC AIRCRAFT POWER
16	→ LATERAL DEVIATION +RIGHT OUT	41 ←	NAV 11-33 VDC AIRCRAFT POWER
17	→ LATERAL DEVIATION +LEFT OUT	42 ←	LNAV +FROM IN
18	SPARE RELAY 1 COMMON	43 ←	LNAV +TO IN
19	SPARE RELAY 2 COMMON	44	→ VERTICAL +UP OUT
20 ←	LNAV LATERAL DEVIATION +LEFT IN	45	→ VERTICAL +DOWN OUT
21 ←	LNAV LATERAL DEVIATION +RIGHT IN	46	→ VERTICAL +FLAG OUT
22 ←	LNAV VERTICAL -FLAG IN	47	→ VERTICAL -FLAG OUT
23 ←	LNAV VERTICAL +FLAG IN	48 ←	LNAV LATERAL +FLAG IN
24 ←	NAV VERTICAL -FLAG IN	49	SPARE RELAY 3 COMMON
25 ←	NAV VERTICAL +FLAG IN	50	OBS RETURN



CABLE END VIEW

← INPUT    OUTPUT →

← INPUT    OUTPUT →

FIGURE 2-7 KI 209A PINOUT LIST

**BENDIX/KING**  
KI 208A/209A  
NAVIGATION INDICATORS

**SECTION III**  
**OPERATION**

**3.1 GENERAL**

All controls required to operate the KI 208A/209A are located on the unit's front panel and on the front panel of the related navigation receivers. A panel mounted switch is needed to select NAV or LNAV to be displayed on the KI 208A/209A.

**3.1.1 KI 208A/209A VOR OPERATION**

Select the desired VOR station frequency with the NAV frequency controls. The NAV receiver volume control can then be adjusted to positively identify the station or listen to FSS reports.

To intercept a selected VOR radial (from the station) and fly outbound, turn the OBS control to set the desired radial under the top indicator index. Maneuver the aircraft to fly the selected radial magnetic heading plus a 45° intercept angle which will provide a sufficient intercept angle. The intercept angle should be reduced as the deviation needle approaches an on course condition (center) to prevent excessive course bracketing.

To determine the bearing and fly "to" a selected VOR station, turn the OBS control until the "To-From" flag resembles a white arrow pointing up and the deviation needle is centered. Read the "To" bearing under the top indicator index and maneuver the aircraft to approximately fly the magnetic course "To" the station. If the deviation needle moves to the right, the aircraft course must be adjusted 5 or 10 degrees to the right. Similarly, if the deviation needle goes to the left, the aircraft course must be adjusted to the left. Maintaining a centered deviation needle will provide automatic course compensation for wind drift.

**3.1.2 KI 208A/209A LNAV OPERATION**

If the KI 208A/209A OBS lines are connected to the LNAV the course to the active waypoint is selected using the OBS knob on the KI 208A/209A. When the LNAV is in LEG mode, course selection is automatically done by the LNAV. To intercept an LNAV course, maneuver the aircraft to fly a course heading which establishes a 45° intercept angle to the LNAV course. The intercept angle should be reduced as the deviation needle approaches an on course condition (center) to prevent excessive course bracketing. The deviation scale depends on the present LNAV mode. Crosstrack deviation is linear during LNAV operation rather than angular as in VOR operation.

The KI 209A is GPS precision approach ready. It is capable of displaying the vertical guidance information when these GPS approaches become operational.

**3.1.3 KI 208A/209A LOCALIZER OPERATION**

Localizer circuits are automatically energized when an ILS frequency is selected on the KX 155/A. By adjusting the NAV volume level, the localizer station can be identified and in some cases, ATIS information received. The localizer flag should disappear from view into the "To" condition indicating the signal is reliable.

Maneuver the aircraft to fly on course centered needle. While flying a front course approach or outbound on the back course approach, magnetic heading corrections are made toward the needle deflection. Similarly, while flying the back course approach or outbound on the front course approach, corrections are made away from the needle deflection.

**BENDIX/KING**  
KI 208A/209A  
NAVIGATION INDICATORS

The localizer course width is narrow compared to VOR course width and requires much smaller course corrections to center the deviation needle. When intercepting the localizer course, the aircraft turn into the localizer course should be started when the needle moves off the meter stop.

A helpful quick reference reminder of the localizer course is to set the course on the Omni bearing readout.

### 3.1.4 KI 209A GLIDESLOPE OPERATION

The glideslope (horizontal) needle provides the pilot with vertical steering information during ILS approaches. The glideslope circuitry may be energized independently or when the associated localizer frequency is selected on the navigation receiver. Observe that the glideslope warning flag is concealed. The glideslope needle deflects toward the direction the pilot must fly to remain on the glideslope path. If the glideslope needle deflects upward, the aircraft is below the glideslope and must climb to center the needle. If the needle deflects downward, the aircraft is above the glide path and must descend to remain on the glide path. When the needle is centered the aircraft is on the glide path.

## 3.2 KI 208A/209A INDICATOR CONTROL FUNCTIONS

### 3.2.1 OMNI BEARING SELECTOR (OBS)

The OMNI Bearing Selector knob rotates the azimuth card on which the desired course is selected. The reciprocal course is identified under the bottom course indice.

### 3.2.2 VOR/LOC/LNAV DEVIATION INDICATOR

The VOR/LOC/LNAV needle deflection indicates the amount of deviation from the selected VOR/LNAV course or localizer path. The indicated deviation is toward the proper flight path in normal operation. Crosstrack deviation is linear during LNAV operation, not angular as in VOR operation.

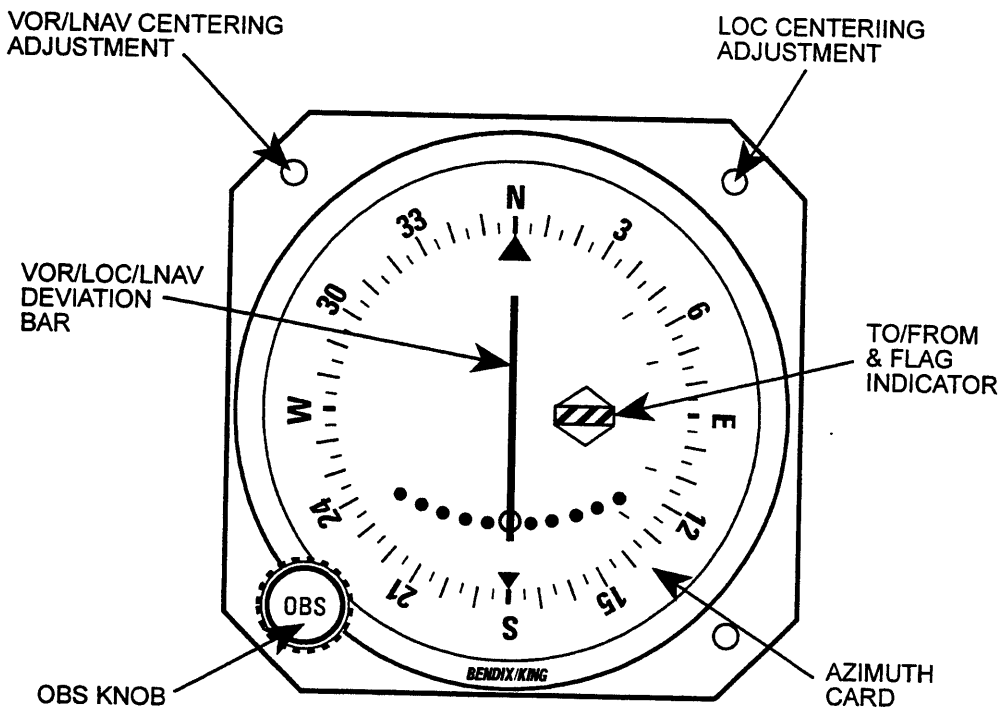
The VOR/LOC/LNAV warning flag is fully visible when the VOR, LNAV or LOC signal is unreliable. The VOR/LNAV TO/FROM flag indicates the direction "To" or "From" the VOR station or LNAV waypoint.

### 3.2.3 GLIDESLOPE DEVIATION INDICATOR (KI 209A ONLY)

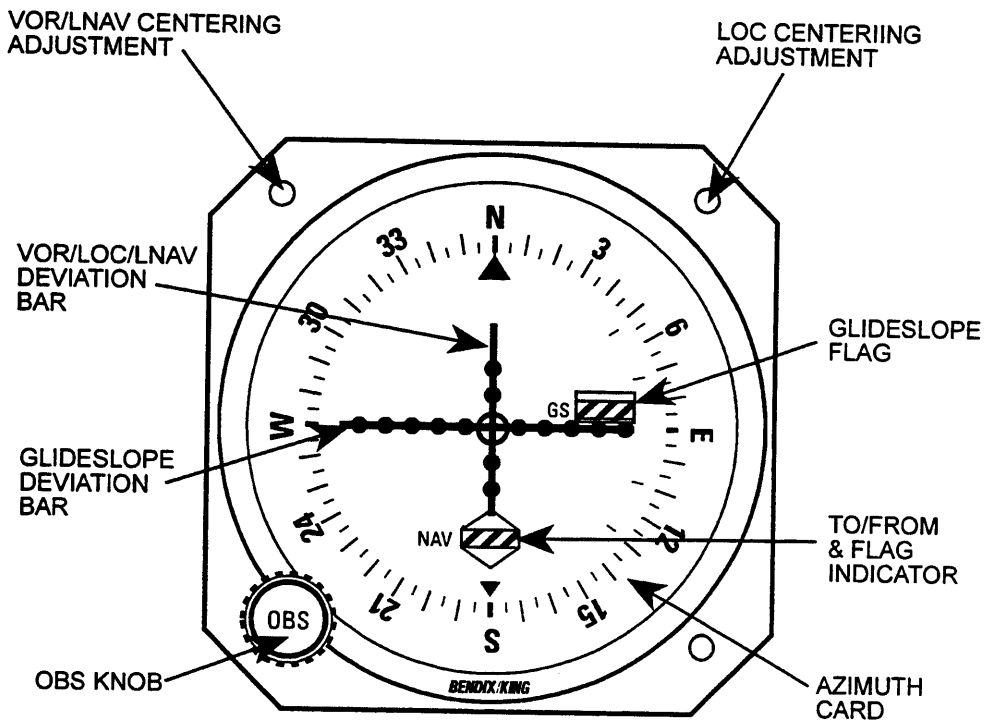
The glideslope deviation needle deflection indicates the amount of deviation from the glide path. The deflection is toward the direction of flight required to maintain the proper descent path. The glideslope warning flag is visible when the glideslope signal is unreliable or the receiver has malfunctioned.

When GPS precision approaches become operational, the glideslope deviation needle and flag may be used for the vertical guidance portion of these approaches.

**BENDIX/KING**  
 KI 208A/209A  
 NAVIGATION INDICATORS



**FIGURE 3-1 KI 208A CONTROL FUNCTIONS**



**FIGURE 3-2 KI 209A CONTROL FUNCTIONS**





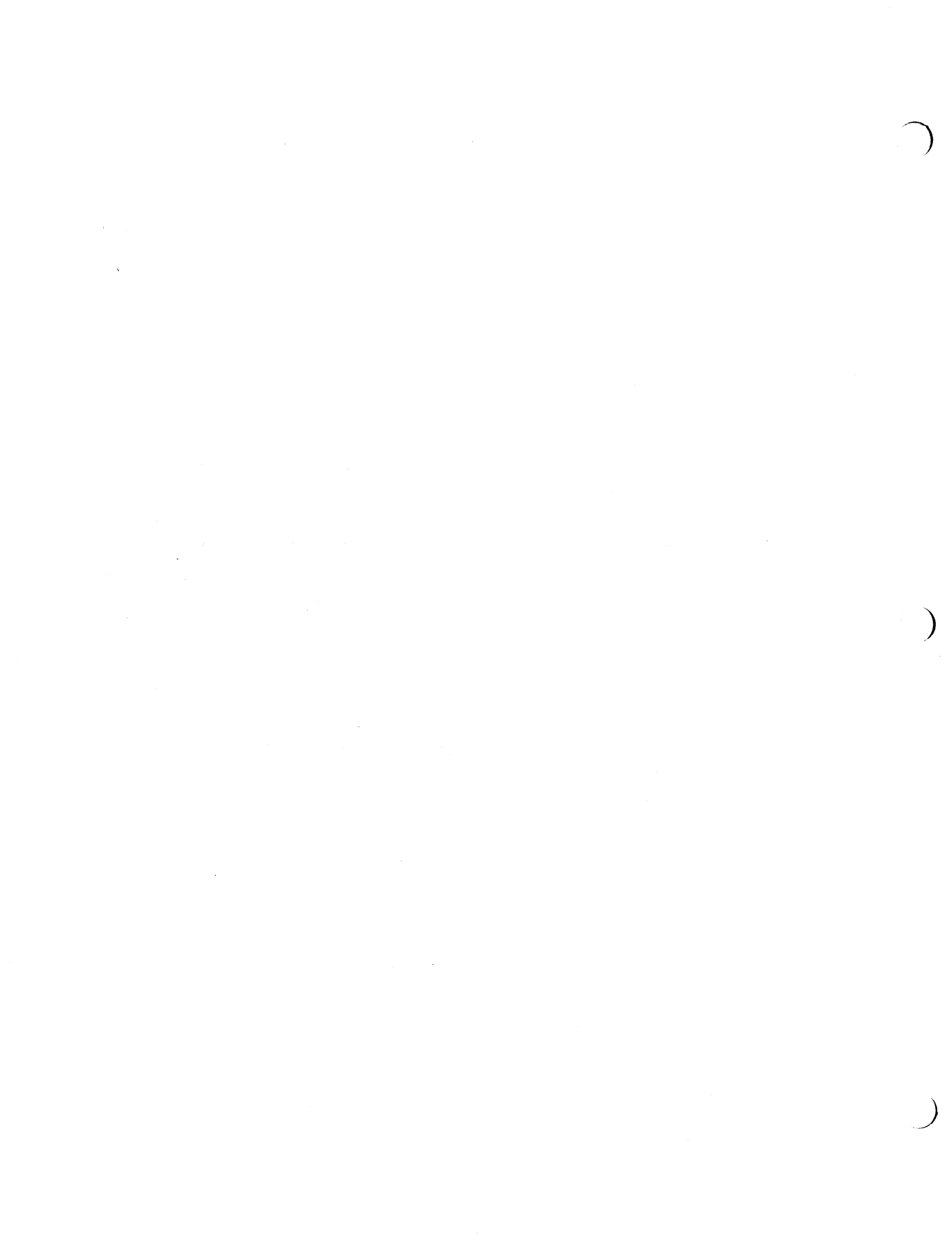
*ELECTRONIC AND AVIONICS SYSTEMS*

*MAINTENANCE MANUAL*

***BENDIX/KING<sup>®</sup>***

***KI 208A/209A***

***NAVIGATION INDICATORS***





**BENDIX/KING**  
KI 208A/209A  
INDICATORS

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**BENDIX/KING**

KI 208A/209A

INDICATORS

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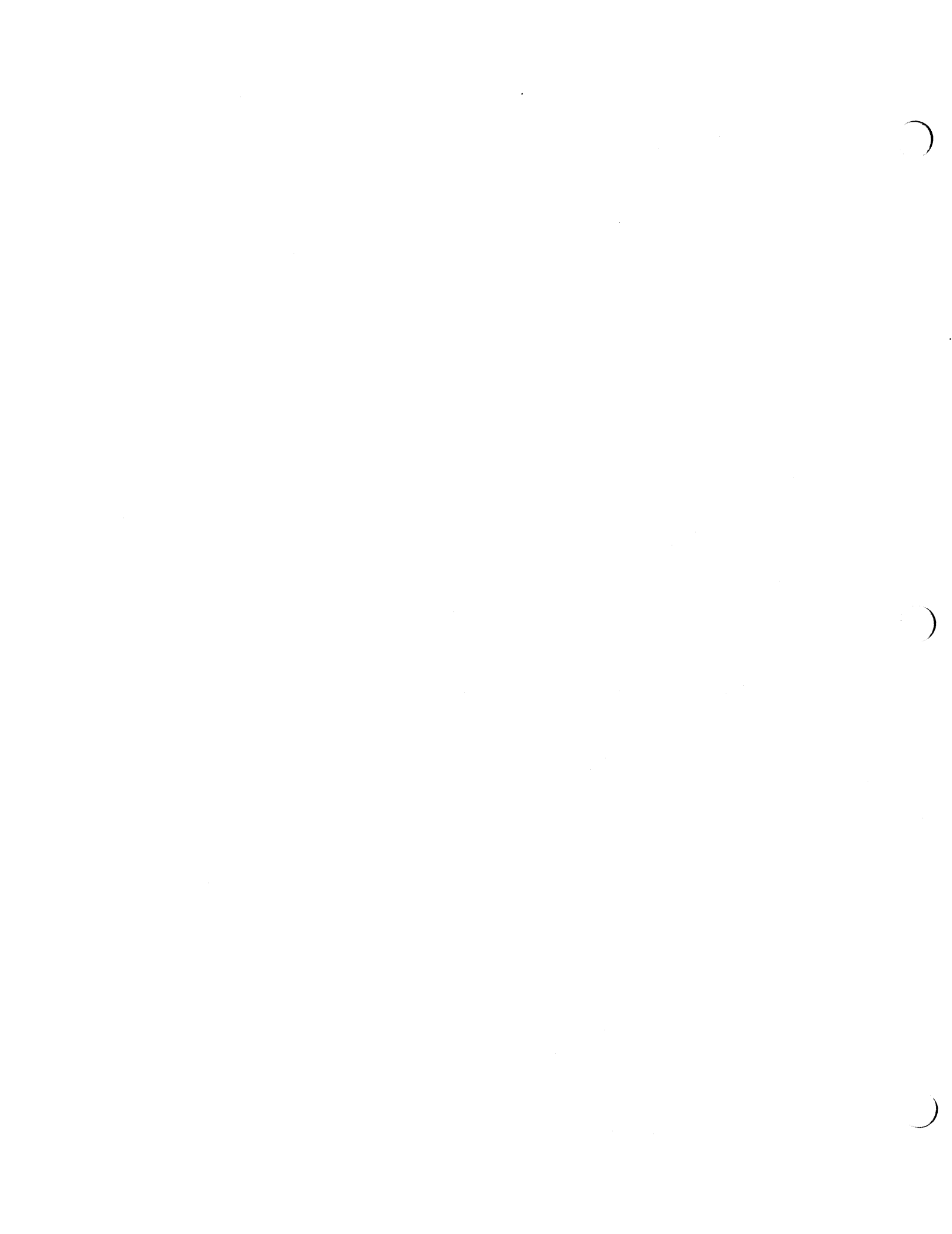
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**BENDIX/KING**  
KI 208A/209A  
INDICATORS

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**BENDIX/KING**  
KI 208A/209A  
INDICATORS

**SECTION IV**  
**THEORY OF OPERATION**

**4.1 GENERAL**

The KI 208A and KI 209A Indicators contain the same VOR/LOC converter. However, the KI 209A Indicator contains additional meters to provide glideslope information.

**4.2 PRINCIPLES OF VOR SYSTEM**

**4.2.1 GENERAL**

The basic function of VOR is to provide a means to determine an aircraft's position with reference to a VOR ground station and also to follow a certain path toward or away from the station. This is accomplished by indicating when the aircraft is on a selected VOR station radial or by determining which radial the aircraft is on. A means to differentiate between radials and identify them is necessary. For this purpose, advantage is taken of the fact that the phase difference between two signals can be accurately determined. The phase difference between two signals which are generated by the VOR station is varied as the direction relative to the station changes so that a particular radial is represented by a particular phase difference. Refer to **Figure 4-3**. One non-directional reference signal is generated with a phase that at any instant is different in all directions. A second signal is generated with a phase that at any instant is the same in different directions. The phase of the variable phase signal is the same as the phase of the reference signal only at the 0° radial (North). As the angle measured from the 0° radial increases, the phase of the variable phase signal lags the phase of the reference signal by the number of degrees of the angle from 0°. The reference and variable phase signals, which are 30Hz voltages, are carried by rf to make radio transmission and reception possible. The VOR receiving equipment must separate the 30Hz reference and variable phase signals from the rf carrier and compare the phase of the two signals. The phase difference is indicated on a course indicator or RMI.

**4.2.2 VOR GENERATION**

The VOR electromagnetic field is composed of the radiation from two ground based antennas radiating at the same carrier frequency. The first is a non-directional antenna radiating an amplitude modulated carrier. The frequency of the modulating signal varies from 9,480Hz to 10,440Hz back to 9,480Hz 30 times per second. That is, a 9,960Hz subcarrier amplitude modulates the rf carrier and is frequency modulated by 30Hz.

The second antenna is a horizontal dipole which rotates at the rate of 30 revolutions per second. The dipole produces a figure 8 field pattern. The rf voltages within the two lobes are 180° out of phase with each other. The rf within one of the lobes is exactly in phase with the rf radiated from the non-directional antenna and the rf within the other lobe is 180° out of phase with the non-directional field. The rotating figure 8 pattern reinforces the non-directional pattern on the in phase side of the dipole and subtracts from the non-directional pattern on the out of phase side. See **Figure 4-3** This results in a cardioid field pattern which rotates at the rate of 30 revolutions per second, the rate at which the dipole antenna rotates.

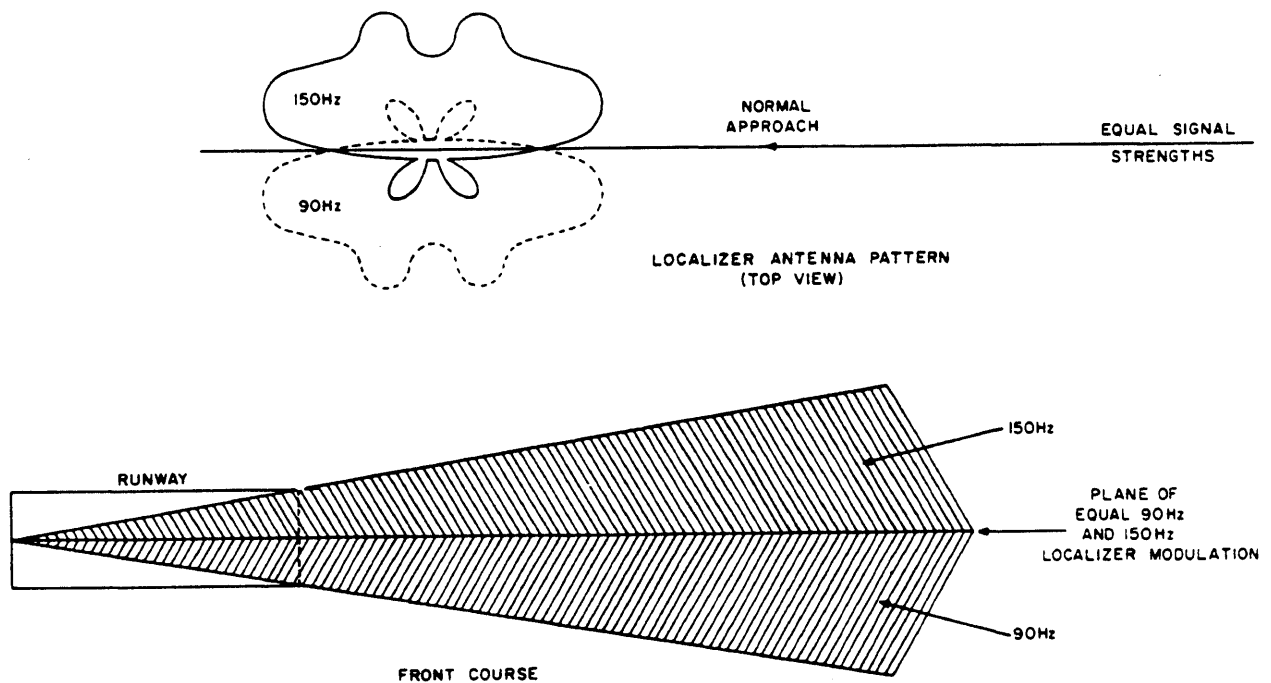
The signal at an aircraft within radio range of the VOR station is an rf carrier with amplitude varying at the rate of 30Hz because of the rotation of the cardioid pattern. The carrier is also amplitude modulated at the station by the 9,960Hz signal which is, in turn, frequency modulated on a sub-carrier so that it may be separated from the 30Hz variable phase signal.

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### 4.3 PRINCIPLES OF LOCALIZER SYSTEM

The localizer facility provides a visual display of the aircraft's position relative to a straight approach line to the runway. The ground based localizer antenna system generates two patterns. Refer to **Figure 4-1**. One pattern is directed toward the right side of the runway, the second to the left. The two patterns have the same carrier frequency but different audio modulating signals. The pattern to the left of the runway (in normal approach) is 90Hz amplitude modulated while the pattern to the right is 150Hz amplitude modulated.

The ration of 90Hz to 150Hz audio, after demodulation, is dependent only upon the position of the aircraft within the patterns. The patterns are adjusted so they are of equal strength on a vertical plane extending out from the runway centerline. When the aircraft is on this plane, the 90Hz and 150Hz voltages will be equal.

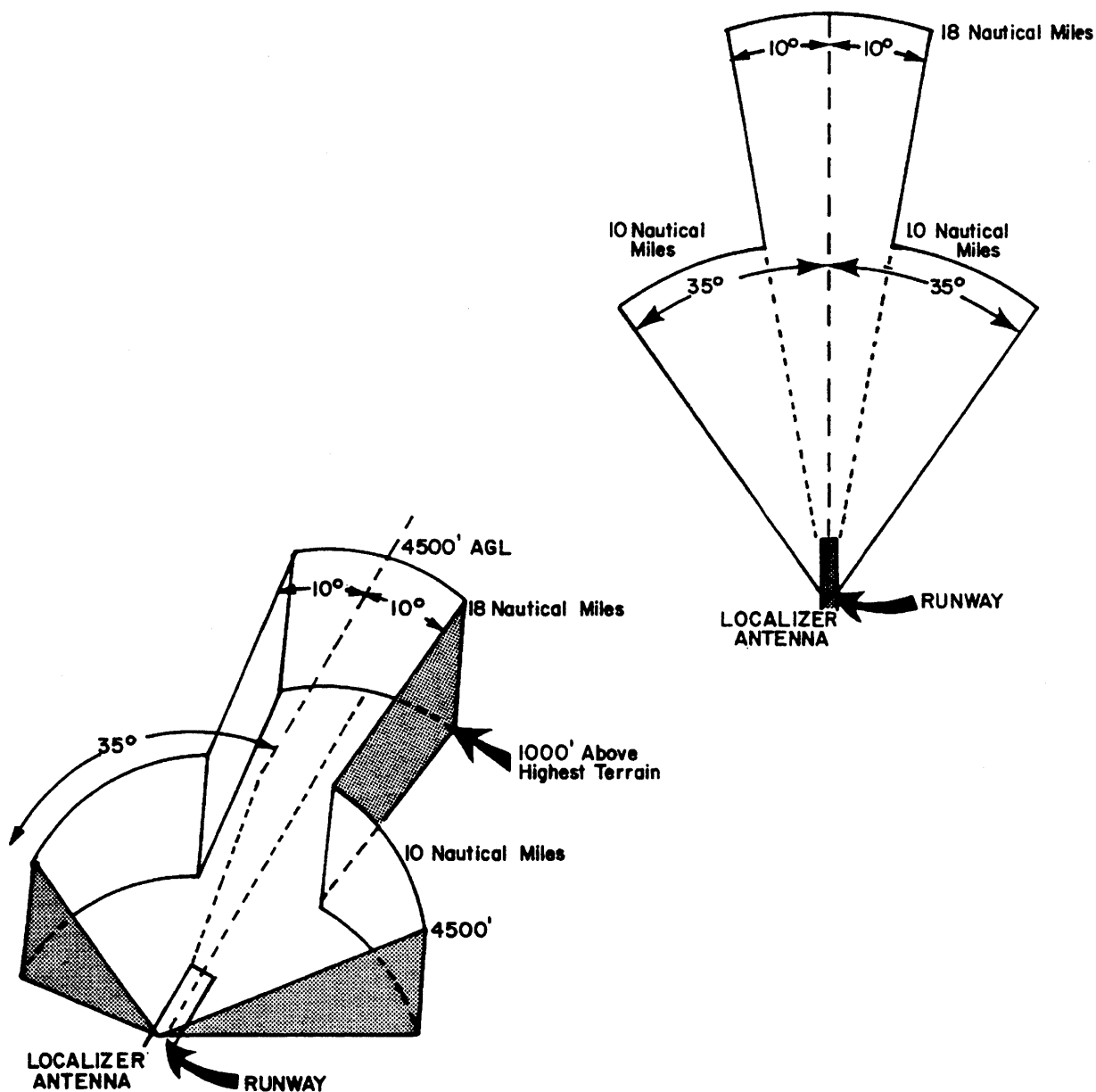


**FIGURE 4-1 LOCALIZER SIGNAL GENERATION**

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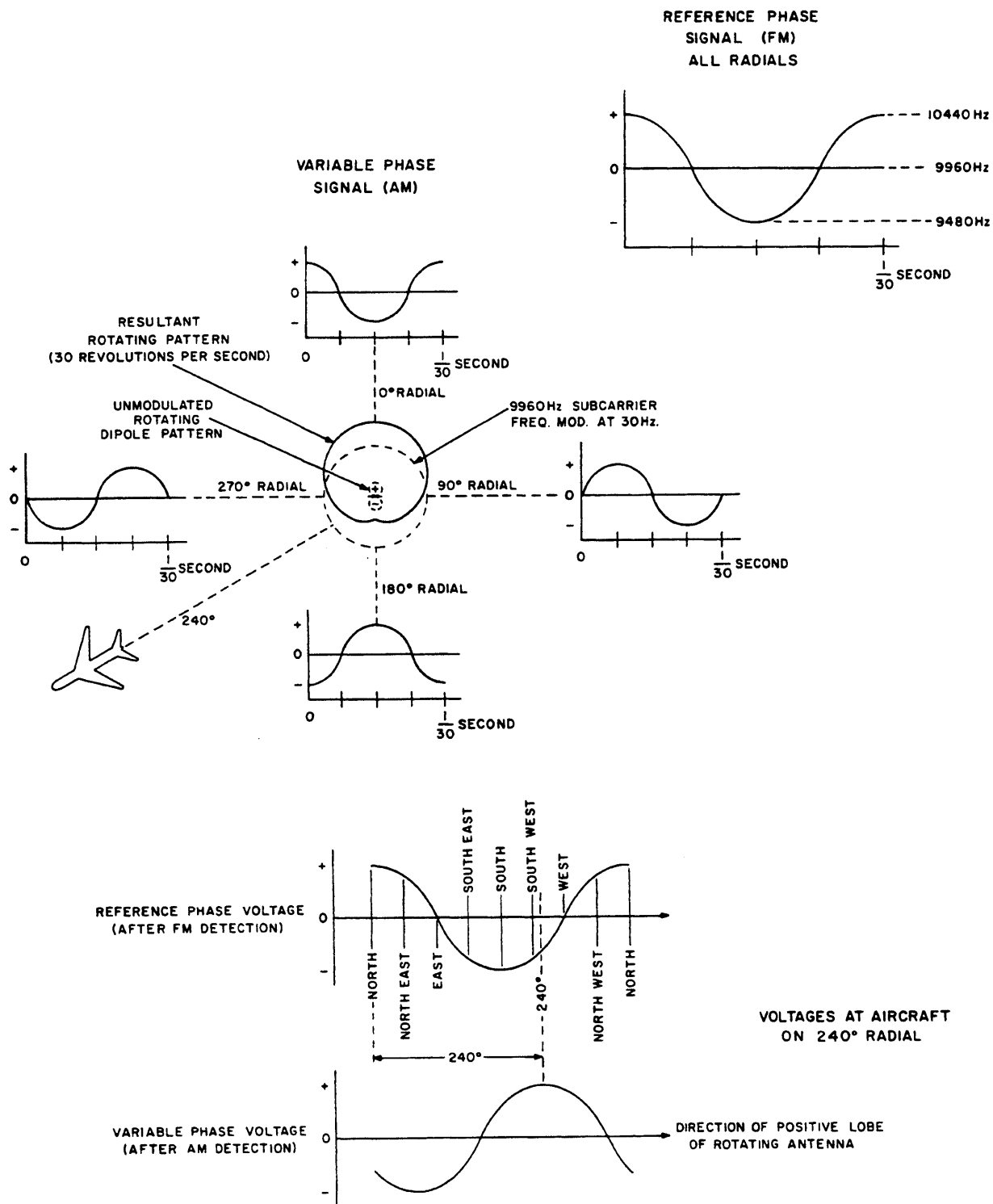
A new type of instrument landings systems antenna is being deployed by the FAA. While previous ILS antennas provided a clearance signal throughout 360 degrees, the new antennas provide more accurate course guidance only within a narrow area of reception. The new antennas have no **usable** signal radiating beyond 35 degrees from the on-course indication. Pilots should be cautioned against relying on localizer signals to provide guidance outside the 35 degree sector of the localizer or beyond any extremities shown below. Extended coverage of this area can be recognized by an flight procedure being predicated on the use of localizer guidance beyond the normal service volume shown below:

(For further information, refer to FAA AIR CARRIER OPERATIONS BULLETIN, No. 75-98-4-75)



**FIGURE 4-2 LOC COVERAGE**

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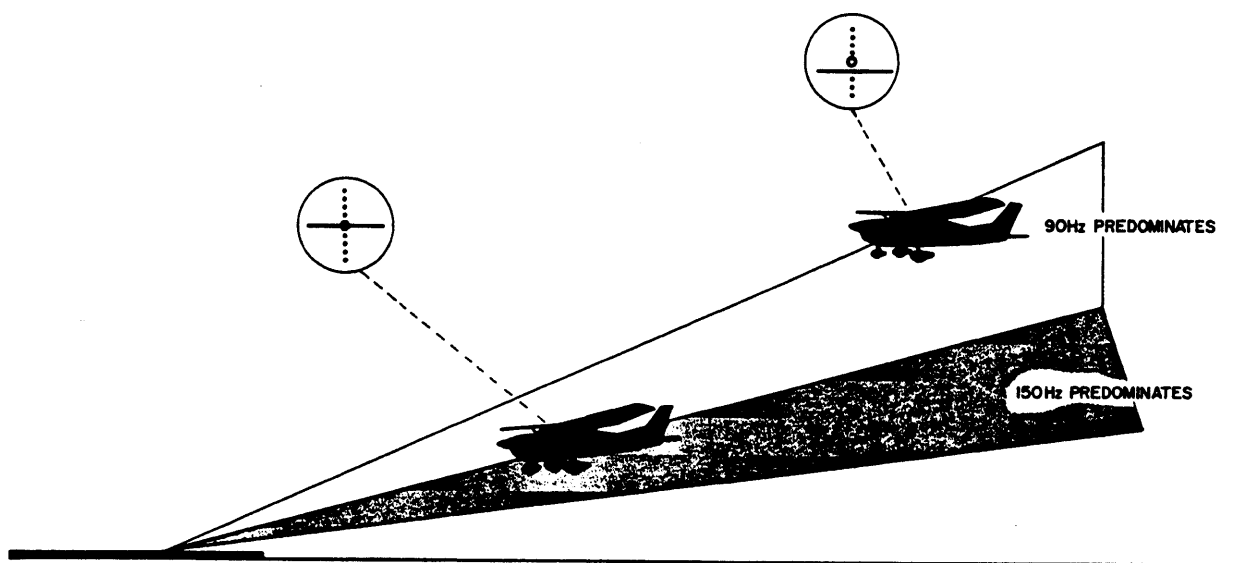
**FIGURE 4-3 VOR SIGNAL GENERATION**



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#### 4.4 PRINCIPLES OF GLIDESLOPE SYSTEM

The glideslope signal is radiated by a directional antenna array located near the approach end of the runway. The signal consists of two intersecting lobes of RF energy. The upper lobe contains 90Hz modulation and the lower lobe contains 150Hz modulation. The equal tone amplitude intersection of these two lobes forms the glide path. A typical glide angle is 2.5 degrees. If the aircraft is on the glide path, equal amplitudes of both tones will be received and the deviation bar will be centered. If the aircraft is above the glide path, 90Hz modulation predominates and the visual display is displaced downward. If below the glide path, 150Hz predominates and the display is displaced upward.



**FIGURE 4-4 GLIDE PATH**

#### 4.5 KI 208A/209A VOR OPERATION

##### 4.5.1 INPUT BUFFER

Transistor Q201, capacitors C201, C213 and associated resistors R201, 202, 203 on Converter Board 1, comprise the input buffer stage for the indicator. This stage is set up as an emitter follower to provide high input resistance and low output resistance. High input impedance is necessary to prevent loading of the NAV receiver. The low output impedance allows the output signal (wiper of R203) to be varied, without significantly changing the impedance at TP202. If this impedance changed greatly, the center frequency of the two active filters would be effected. R203 is adjusted to obtain proper VOR course width.

##### 4.5.2 VOR LIMITER/DISCRIMINATOR

The VOR composite signal is coupled to the limiter stage by C202. The limiter, which consists of Q202, CR201 and R204, effectively removes any amplitude modulation on the composite signal.

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This stage supplies "clean" 9960Hz FM of significant amplitude to drive the phase locked loop PLL discriminator I201. The limiter output couples to the PLL via C203.

Without an FM signal into Pin 14 of the PLL, the voltage controlled oscillator (VCO) within I201 will not be changing frequency. If no signal is applied, the VCO frequency on either Pins 3 or 4 should be equal to 9960Hz. This frequency is established by R205, 206, 207 and C204. When FM is applied the VCO is forced to sweep the FM deviation, i.e.,  $\pm 480\text{Hz}$  for VOR. The output of the phase detector then samples the difference in phase of the input FM signal and the internal VCO. After this difference signal is filtered by R208 and C205 a 30Hz reference signal is produced. This 30Hz signal is accessible at TP203. Pin 5 of I201 performs an enable/disable function. It must be less than .5 volt to enable the PLL in VOR. Pin 5 will be a logic high (approximately 9V) when in LOC.

#### 4.5.3 30HZ BANDPASS FILTERS

By following the signal flow lines it can be seen that the input to the 30Hz reference filter in the VOR mode is through R209 since Q204 is off. The gain of the reference filter from TP203 to TP204 is equal to  $1/2$  (R235 divided by R209) or 2.11. The center frequency (phase) is predominately set by the value of R232 and R233. The "active" components in the VOR mode for the reference filter are R209, R232, R233, R235, capacitors C208 and C209, and I202A.

The above statements for gain and phase on the reference 30Hz filter also hold for the 30Hz variable filter. On the 30Hz variable filter, the gain from TP202 to TP205 is equal to  $1/2$  (R223 divided by R220) or 5. The fixed center frequency of the filter is predominately set by R221. The "active" components in the 30Hz variable filter in the VOR mode are R220, R221, R223, capacitors C206 and C207 and I202B. The phase shift of the variable channel is matched by adjusting R233 in the reference channel to exactly balance the two phase shifts.

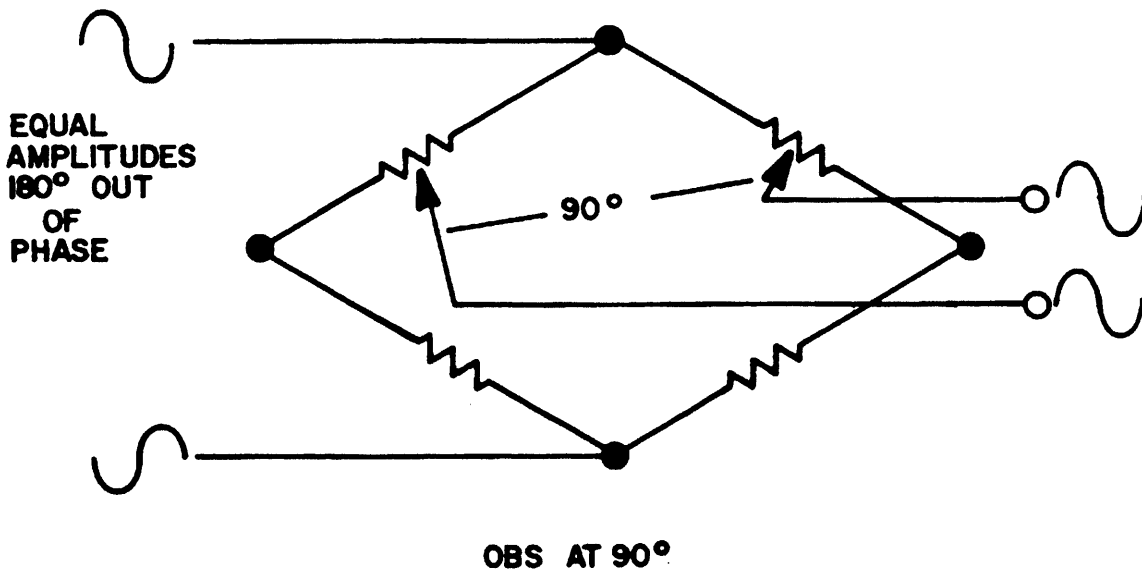
Bias voltage (4.16V) is supplied to the non-inverting terminals of the op amps via R222 and R234. The values of 430K and 270K were chosen to keep the output offsets a minimum in LOC mode.

Transistors Q204 through Q207 are used to reconfigure the 30Hz filters to either 90Hz or 150Hz filters when the LOC enable line goes low. (TP201 goes high). In VOR operation all of these transistors are cut off; therefore, R213, R216, R218, R219 and R231 do not effect the VOR operation of the filters.

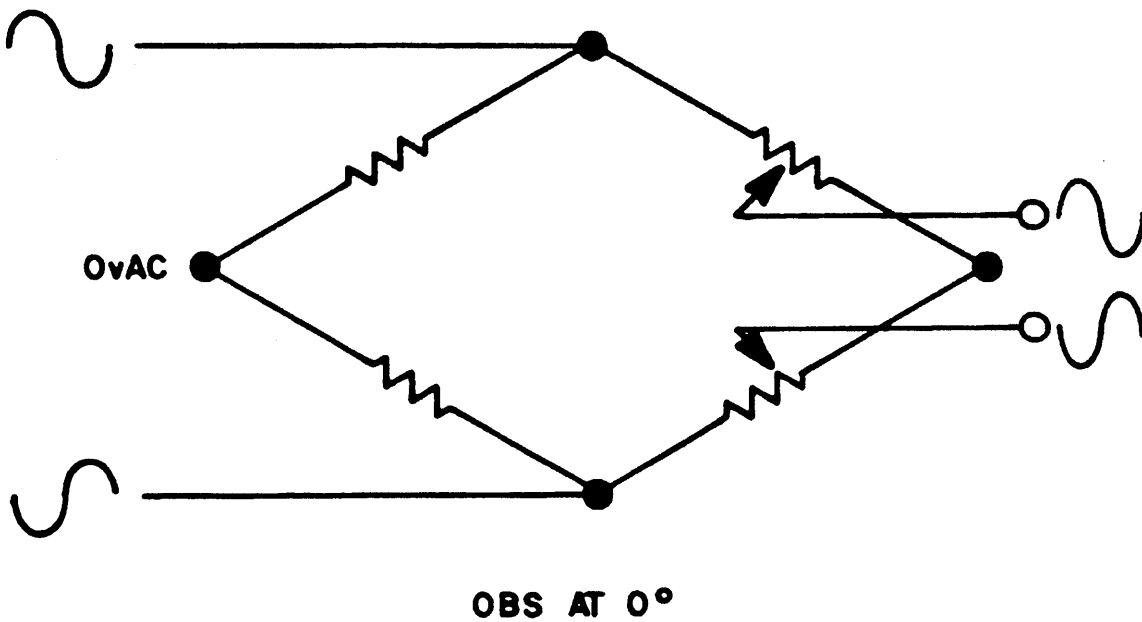
#### 4.5.4 SIN-COS POT INTERFACE

In VOR, the output of I202A drives a unity gain inverter stage I202C and one branch of the Sin-Cos pot. The inverter, composed of I202C and R236 and R238 drives the opposite branch of the pot as shown below.

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**FIGURE 4-5 OBS AT 90°**



**FIGURE 4-6 OBS AT 0°**

With the pot set as shown in Figure 4-5 (OBS at 90°) the signals at the wipers will be .707 the amplitude of the top signal. These wipers are connected to high impedance emitter followers Q208

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and Q209 to prevent loading of the pot. Their outputs then drive an RC network comprised of C210 and R241 and 242. The resistance of R241 is adjusted so the total resistance of R241 plus R242 is equal to the reactance of C210 at 30Hz. Since at the 90° position (**Figure 4-5**) the signals applied to the RC network are equal in amplitude and in phase there is no resultant phase shift in the output signal at TP206. When the OBS is rotated to 0° as shown in **Figure 4-6**, then the signal on the wipers are equal in amplitude but 180° out of phase. Applying two signals 180° out of phase to the RC network produces an output signal which is shifted 90°. The examples shown above were for only two discrete positions but the phase shift is continuously variable as the wipers rotate 360° in position.

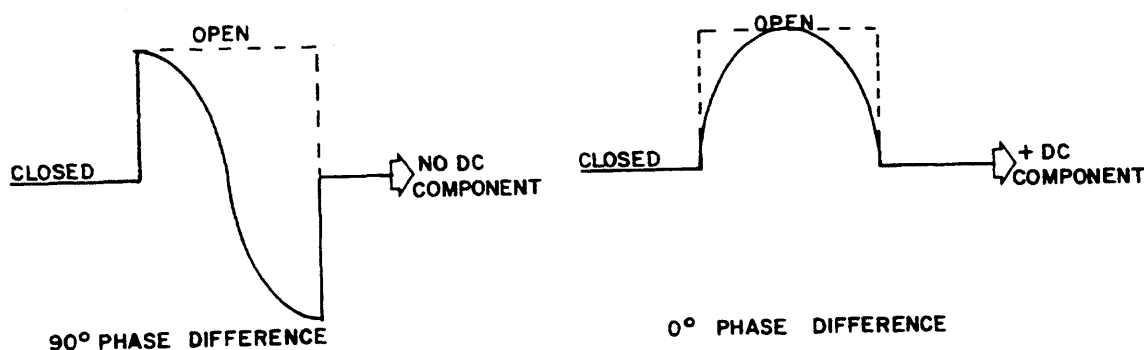
As was mentioned R241 is adjusted so that the total resistance equaled the reactance of C210 at 30Hz. In actual practice this is accomplished by placing the OBS and VOR generator to 0° and adjusting R241 for a 90° phase shift as noted by a null on the indicator meter.

#### 4.5.5 SQUARING AMPLIFIER

The output from the Sin-Cos Interface Circuit drives I202D via C211. The op amp is configured as an open loop amplifier thus is quickly driven between saturation and cutoff. An offset threshold voltage 275mv higher than the voltage on the non-inverting terminal is used to reject noise. This noise threshold keeps the needle steady when the NAV receiver is tuned off channel. The threshold for the op amp is produced by the voltage divider action of R244 and R245. Resistors R247 and R248 supply the bias for the inverting input. When the indicator is in LOC mode Q211 becomes saturated taking the inverting input low. The inverting input going low causes the op amps output (TP301) to go high. This then causes the chopper switches I301C and D to be closed (shorted) when in LOC.

#### 4.5.6 VOR PHASE DETECTION AND OUTPUT DRIVE

The 30Hz variable sine wave is coupled to the chopper phase detector I301C by C303 and R311. The chopper acts as a switch which is controlled by the reference 30Hz square wave. If the two 30Hz signals are 90° out of phase there will not be any resultant dc voltage produced. If the signal are in phase, however, a maximum dc voltage is produced. This is shown below (**Figure 4-7**):



**FIGURE 4-7 PHASE DIFFERENCE**

As the signals vary from the 90° nulled position, a resultant dc voltage is produced whose polarity indicates the direction of variation. The resultant half waves are filtered by R312 and C306 to produce a 3 second needle speed in VOR. Since the output is dc coupled to the meter any excessive leakage in capacitors C303 or C306 will be observed as a variation from the nulled

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position. Nulling the meter by changing the VOR phase shift via R233 only compounds this problem since when the OBS is rotated 180° the needle will now be twice as far from center. If the capacitors are leaky it can sometimes be noticed as a change in needle position when the unit is powered up with no input signal. Output offset voltages that exceed the LM324's spec. can also cause this problem.

Since I301A is "open" in VOR, R313 does not have any effect on VOR needle deflection. Also with I301A being open, the output op amp I302B is configured as a voltage follower. It should be noted that this type of output is a voltage drive amplifier as opposed to a more typical current drive output.

R315, CR303, CR304 are output protection components. R315 limits the output current that I302B can deliver. CR303 and CR304 limit the output voltages to less than .65 volts to protect the meter package.

#### 4.5.7 VOR FLAG

The 30Hz variable sinewave from I202B is coupled to a 90° fixed phase shift stage composed of R305, R306, C301 and I302D. The 90° phase shift can be observed by checking TP204 to TP303. This signal then feeds another chopper phase detector as described in the previous paragraph. The flag drive is smoothed by R308 and C304. The same comments on leaky capacitors apply to this output stage. If the TO-FROM changeover is greatly different from 90° off course, or is biased toward either a TO or FROM with no composite input, leaky capacitors or excessive output offset voltage should be investigated.

As with the needle drive circuit, I302A is configured as a voltage follower in VOR mode. This is true since I301B is open. R309 and CR301, CR302 are circuit protection components as described previously.

## 4.6 KI 208A/209A LOC OPERATION

### 4.6.1 INPUT BUFFER

The input stage performs the same function in LOC as it did in VOR. R203 should not be adjusted for LOC deflection since its function is solely VOR course width. LOC deflection is controlled by R313. Both the 90Hz and 150Hz LOC modulation tones pass through the wiper of R203 enroute to the bandpass filters.

### 4.6.2 VOR/LOC SWITCHING

When J2081 Pin 4 is grounded (LOC Mode) CR207 becomes forward biased and causes a voltage divider action between R215 and R210. This causes Q203's base to become negative with respect to its emitter and enough base current flows to saturate the transistor. TP201 then goes to 9 volts. When that occurs Q204, Q205, Q206, Q207 and Q211 are driven into saturation. The PLL is disabled by the action of I201 Pin 5 going high in LOC. The VOR squaring amplifier output is also driven high by this action, which in turn, causes the two VOR choppers to be shorted. Finally, LOC Enable closes I301A and B to allow the LOC signals to be passed to the output stages.

### 4.6.3 90 AND 150HZ BANDPASS FILTERS

The saturation of transistors Q205 and Q206 place an additional resistor (R216 or R219) in parallel with the frequency determining resistor (R232 or R221) of each of the two bandpass filters. This paralleling of resistors causes the center frequency of the filter to be changed to either 150Hz or 90Hz. Saturation of Q207 causes the feedback resistance of the 150Hz filter to be changed to the parallel combination of R231 and R235. This change is necessary to keep the Q of the two filters

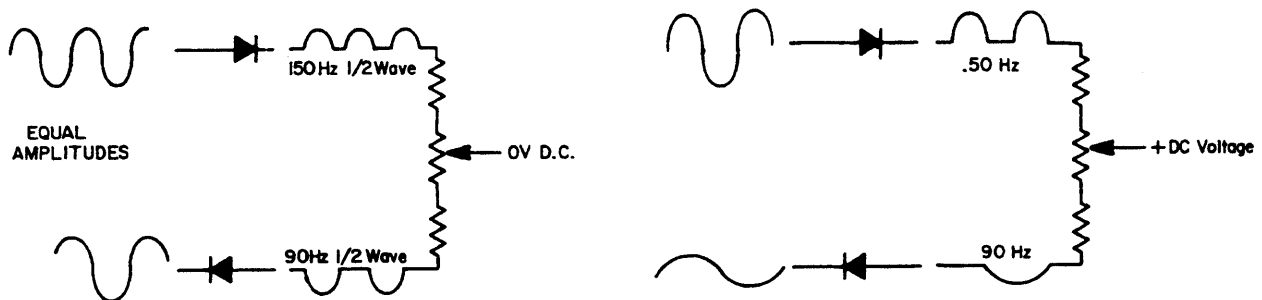
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the same. If Q207 were not in the circuit the 90Hz filter would have a Q of 12 and the 150Hz filter a Q of 20. Since Q207 is in the circuit both filters have a Q of 12.

Since Q204 is saturated, the LOC signal input to the 150Hz filter is through R213. The input to the 90Hz filter is through R220. The phase of the two filters are matched much the same as in VOR. The phase matching is necessary to achieve proper temperature tracking of the filters. In this case, the input (TP202) to output (TP204) phase of the 150Hz filter is recorded and then the input (TP202) to output (TP205) phase of the 90Hz filter is adjusted with R218 to match the recorded data. Both filters have a gain of 5 in LOC.

#### 4.6.4 LOC DEFLECTION AND FLAG SUMMATION

The resistor–diode network of CR203, CR204, R226 through R228 performs the LOC deflection summation. Since CR203 and CR204 are installed opposite, equal 90Hz and 150Hz signals will cancel at the center of R227. This is symbolically shown below (Figure 4–8):



**FIGURE 4–8 LOC DEFLECTION SUMMATION**

Ignoring the fact that the 90 and 150Hz tones are riding on a 4.16 volt dc level, if the 150Hz tone is greater, a positive dc voltage is produced. If the 90Hz tone is greater a negative dc voltage is produced. This bipolar signal then drives R313 and the output op amp I302B through the closed I301A switch.

As mentioned, the above discussion ignored the fact that the two tones were riding on a 4.16VDC level. This is a valid analytical statement however, since the non–inverting terminal of I302B is also at this 4.16VDC potential. If the 90Hz tone predominates then the output of R227 will be negative with respect to this 4.16 volt level.

R227 is used to balance or center the needle when equal 90 and 150Hz tones are present. R313 is used to control the amount of LOC deflection. This should be set to produce 4 dots deflection for a 4db tone ratio.

The LOC flag summation network is composed of CR202, CR205, R224 and R225. Since CR202 and CR205 are installed in the same direction, their output amplitudes sum directly to produce a TO indication. If one tone is absent then the output dc is 1/2 its normal value. This causes a 1/2 flag condition.

#### 4.6.5 LOC OUTPUT STAGES

In LOC I302B is configured as an inverting amplifier stage. R314 and C307 provide the filtering to produce the 0.6 second needle speed in LOC. Bias for the non–inverting terminal is produced by connecting R312 to the 4.16 volt line through the shorted I301C switch.

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The same statements are true for the LOC flag output stage. R310 and C305 provide the filtering and R308 provides the bias through shorted I301D switch.

#### 4.7 VOLTAGE REGULATOR

The Voltage Regulator portion consists of I303, Q101, C308 through C313, R317 through R321 and CR305, CR306. This regulator was chosen due to its low input to output voltage, as well as excellent regulation. This regulator should be capable of holding 9.2 output with an input as low as 10 volts. R321 is the voltage adjustment control. C308 reduces the noise on the reference voltage of the IC regulator.

C309 is the high frequency compensation for the IC and C311 reduces the high frequency response of the pass transistor Q101. C312 and C313 are used to keep a low source impedance at high frequencies. R317 establishes the short circuit protection limits for the IC. (Q101 is only protected by limiting the base current. This will not usually allow its collector to be shorted without destroying the transistor). R318 is a bias resistor for CR305 and 306. These diodes are used to keep the differential amplifier inside the IC operating in its linear region. R319, R320, R321 establish the voltage applied to the input of the regulator. CR307 and C310 are transient protection for the regulator.

Associated circuitry involves R301, R302, R303 and I302C. The R301-302 voltage divider drives I302C. The op amp is configured as a voltage follower to produce a very low source impedance for the 4.16 reference voltage. R303 will prevent blowing the input stage of the IC under short circuited conditions.

#### 4.8 GLIDESLOPE OPERATION [KI 209A ONLY]

The KI 209A only contains the glideslope meter packages. The applicable glideslope receiver that is used to drive the meters should be consulted for theory of operation.

#### 4.9 COMP/RELAY BOARD

The performance of the KI208A and KI209A retain the NAV features of the KI208 and KI209 respectively. By incorporating assembly 200-09091-0000, the units are able to switch between the conventional NAV operation and LNAV operation. This permits access to the 'D-Bar' and 'FLAG' movements and, on the KI209A, vertical 'D-Bar' and vertical 'FLAG' movements. In addition, the OBS is available for LNAV use.

Performance in NAV mode is the same as for the KI208 & KI209.

The following 10 relays switch these signals:

RELAY	INPUT FUNCTIONS	OUTPUT FUNCTIONS
K401	SPARE 1 NC / SPARE 1 NO SPARE 2 NC / SPARE 2 NO	SPARE 1 COMMON SPARE 2 COMMON
K402	NAV VERT +UP IN / LNAV VERT +UP IN NAV VERT +DOWN IN / LNAV VERT +DOWN IN	VERT +UP METER OUT VERT +DOWN METER OUT
K403	NAV VERT +FLAG IN / LNAV VERT +FLAG IN NAV VERT -FLAG IN / LNAV VERT -FLAG IN	VERT +FLAG OUT VERT -FLAG OUT
K404	NAV A/C POWER / LNAV A/C POWER SPARE 3 NC / SPARE 3 NO	UNIT POWER OUT SPARE 3 COMMON

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RELAY	INPUT FUNCTIONS	OUTPUT FUNCTIONS
K405	NAV LOC ENGAGE IN / LNAV FCS LOC ENGAGE IN NAV ANNUNCIATE / LNAV ANNUNCIATE	LOC ENGAGE OUT GROUND
K406	NAV +TO IN / LNAV +TO IN NAV +FROM IN / LNAV +FROM IN	+TO METER OUT +FROM METER OUT
K407	NAV FLAG OUT / LNAV +FLAG OUT GROUND / LNAV -FLAG OUT	LATERAL +FLAG OUT LATERAL -FLAG OUT
K408	NAV LATERAL DEV +RIGHT IN / LNAV LATERAL DEV +RIGHT IN NAV LATERAL DEV +LEFT IN / LNAV LATERAL DEV +LEFT IN	LAT. DEV. +RIGHT MTR OUT LAT. DEV. +LEFT MTR OUT
K409	NAV HI IN / LNAV OBS EXCITE IN NAV LO IN / LNAV OBS	OBS SIN/COS POT HI OUT OBS SIN/COS POT LO OUT
K410	NAV OBS COS OUT / LNAV OBS COS OUT NAV OBS SIN OUT / LNAV OBS SIN OUT	NAV OBS COS OUT NAV OBS SIN OUT

I401A and I401B provide amplified LNAV OBS COS & SIN outputs.

I401C AND I401D amplify the OBS drive signal.

I402A and I402B are or'd together so either polarity will give a non-polarized NAV FLAG output at the emitter of Q401.



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**SECTION V**  
**MAINTENANCE**

**5.1 GENERAL INFORMATION**

**5.1.1 SEMICONDUCTOR REPLACEMENT**

It is recommended that semiconductors not be tested or replaced until unsatisfactory performance is observed.

**5.1.2 SEMICONDUCTOR MAINTENANCE**

**5.1.2.1 GENERAL**

Due to the wide utilization of semiconductors in this electronic equipment, somewhat different techniques are necessary in maintenance procedures. In solid state circuits the impedance and resistances encountered are of much lower values than those encountered in vacuum-tube circuits. Therefore, a few ohms discrepancy can greatly affect the performance of the equipment. Also, coupling and filter capacitors are of larger values and usually are of the tantalum type. Hence, when measuring resistances, an instrument accurate in the high ranges must be employed. Capacitor polarity must be observed when measuring resistance.

**5.1.2.2 SEMICONDUCTOR TEST EQUIPMENT**

Damage to semiconductors by test equipment is usually the result of accidentally applying too much current or voltage to the elements. Common causes of damage from test equipment are discussed in the following paragraphs.

**5.1.2.2.1 TRANSFORMERLESS POWER SUPPLIES**

Test equipment with transformerless power supplies is one source of high current. However, this type of test equipment can be used by employing an isolation transformer in the AC power line.

**5.1.2.2.2 LINE FILTER**

It is still possible to damage semiconductors from line current, even though the test equipment has a power transformer in the power supply, if the test equipment is provided with a line filter. This filter may function as a voltage divider and apply half voltage to the semiconductor. To eliminate this condition, connect a ground wire from the chassis of the equipment under test before making any other connections.

**5.1.2.2.3 LOW-SENSITIVITY MULTIMETERS**

Another cause of semiconductor damage is a multimeter that requires excessive current to provide adequate indications. Multimeters with sensitivities of less than 20,000 ohms-per-volt should not be used on semiconductors. A multimeter with low sensitivity will draw too much current through many types of small semiconductors, causing damage. When in doubt as to the amount of current supplied by a multimeter, check the multimeter circuits on all scales with an external,

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low-resistance multimeter connected in series with the multimeter leads. If more than one milliampere is drawn by the multimeter on any range, this range cannot be safely used on small semiconductors.

#### 5.1.2.2.4 POWER SUPPLY

When using a battery-type power supply, always use fresh batteries of the proper value. Make certain that the polarity of the power supply is correct for the equipment under test. Do not use power supplies having poor voltage regulation.

#### 5.1.2.3 SEMICONDUCTOR VOLTAGE AND RESISTANCE MEASUREMENTS

When measuring voltage or resistances in circuits containing semiconductor devices, remember that these components are polarity and voltage conscious. Since the values of capacitors used in semiconductor circuits are usually large (especially in audio, servo, or power circuits) time is required to charge these capacitors when an ohmmeter is connected to a circuit in which they appear. Thus, any reading obtained is subjected to error if sufficient time is not allowed for the capacitor to fully charge. When in doubt it may be best in some cases to isolate the components in question and measure them individually.

#### 5.1.2.4 TESTING OF TRANSISTORS

A transistor check should be used to properly evaluate transistors. If a transistor tester is not available, a good multimeter may be used. Make sure that the multimeter meets the requirements outlined in preceding paragraph 5.1.2.3. Always check the value of the bias resistors in series with the various transistor elements. A transistor is very sensitive to improper bias voltage therefore a short or open circuit in the bias resistance may damage the transistor. For this reason, do not troubleshoot by shorting the various points in the circuit to ground and listening for clicks.

#### **CAUTION**

IF A TRANSISTOR IS FOUND TO BE DEFECTIVE, MAKE CERTAIN THAT THE CIRCUIT IS IN GOOD OPERATING ORDER BEFORE INSTALLING A REPLACEMENT TRANSISTOR. IF A SHORT CIRCUIT EXISTS IN THE CIRCUIT, PUTTING IN ANOTHER TRANSISTOR WILL MOST LIKELY RESULT IN BURNING OUT THE NEW COMPONENT. DO NOT DEPEND UPON FUSES TO PROTECT TRANSISTORS.

#### 5.1.2.4.2 PNP TRANSISTOR

To check a PNP transistor, connect the positive lead of the multimeter to the base of the transistor and the negative lead to the emitter. Generally, a resistance reading of 50,000 ohms or more should be obtained. Reconnect the multimeter with the negative lead to the base. With the positive lead connected to the emitter, a resistance value of 500 ohms or less should be obtained. When the positive lead is connected to the collector a value of 500 ohms or less should be likewise obtained.

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#### 5.1.2.4.3 NPN TRANSISTOR

Similar tests made on an NPN transistor should produce the following results: With the negative lead of the multimeter connected to the base of the transistor the value of resistance between the base and the collector should be high. With the positive lead of the multimeter connected to the base, the value of resistance between the base and the collector should be low. If these results are not obtained, the transistor is probably defective and should be replaced.

#### 5.1.2.5 REPLACING SEMICONDUCTORS

Never remove or replace a plug-in semiconductor with the supply voltage turned on. Transients thus produced may damage the semiconductor or others remaining in the circuit. If a semiconductor is to be evaluated in an external test circuit, be sure that no more voltage is applied to the semiconductor than normally is used in the circuit from which it came.

Use only a low heat soldering iron when installing or removing soldered-in parts. Use care in the handling of printed circuit boards. When removing a part from a printed circuit board, first unbend the crimped leads. Use only the necessary amount of heat to unsolder the part. Clear excess solder from mounting eyelets, making sure that mounting holes are clear before installing new parts. When removing a transformer or other part having a multiple number of leads, straighten (unbend) all leads first and then heat leads one at a time, working around the part, until the part can be gently "rocked out".

When installing or removing a soldered-in semiconductor grasp the lead to which heat is applied between the solder joint and the semiconductor with long-nosed pliers. This will dissipate some of the heat that would otherwise conduct into the semiconductor from the soldering iron. Make certain that all wires soldered to semiconductor terminals have first been properly tinned so that the necessary connection can be made quickly. Excessive heat will permanently damage a semiconductor.

When soldering is required to remove a component from a semiconductor socket, remove the semiconductor to prevent damage to the semiconductor.

In some cases, power transistors are mounted on heat sinks that are designed to dissipate heat away from them. In some power circuits, the transistor must also be insulated from them. In some power circuits, the transistor must also be insulated from ground. Often, this insulating is accomplished by means of insulating washers made of fiber and mica. When replacing transistors mounted in this manner, be sure that the insulating washers are replaced in proper order. Before installing the mica washers treat them with a film of silicone grease. This treatment helps in the transfer of heat. After the transistor is mounted, and before making any connections, check from the case of the transistor to ground with a multimeter to see that the insulation is effective.

## 5.2 TEST ALIGNMENT

### 5.2.1 GENERAL INFORMATION

The following is an alignment procedure for aligning the VOR/LOC portion of the KI 208A and KI 209A indicators. Successful completion of this alignment procedure will enable the unit to meet

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its Minimum Performance Specification. All tests are conducted with the KI 208A/209A indicator connected to a KX 155/A series navigation receiver (200uV RF input level) or directly to a VOR/LOC generator such as the Collins 479S-3 or Tel-Instrument T-20A. The alignment assumes that the Azimuth Dial Card and the Sin-Cos pot R101 has been properly set. If this is not true, or if in doubt, Paragraph 5.2.3. has a method for quickly setting the card.

#### **5.2.2 TEST EQUIPMENT**

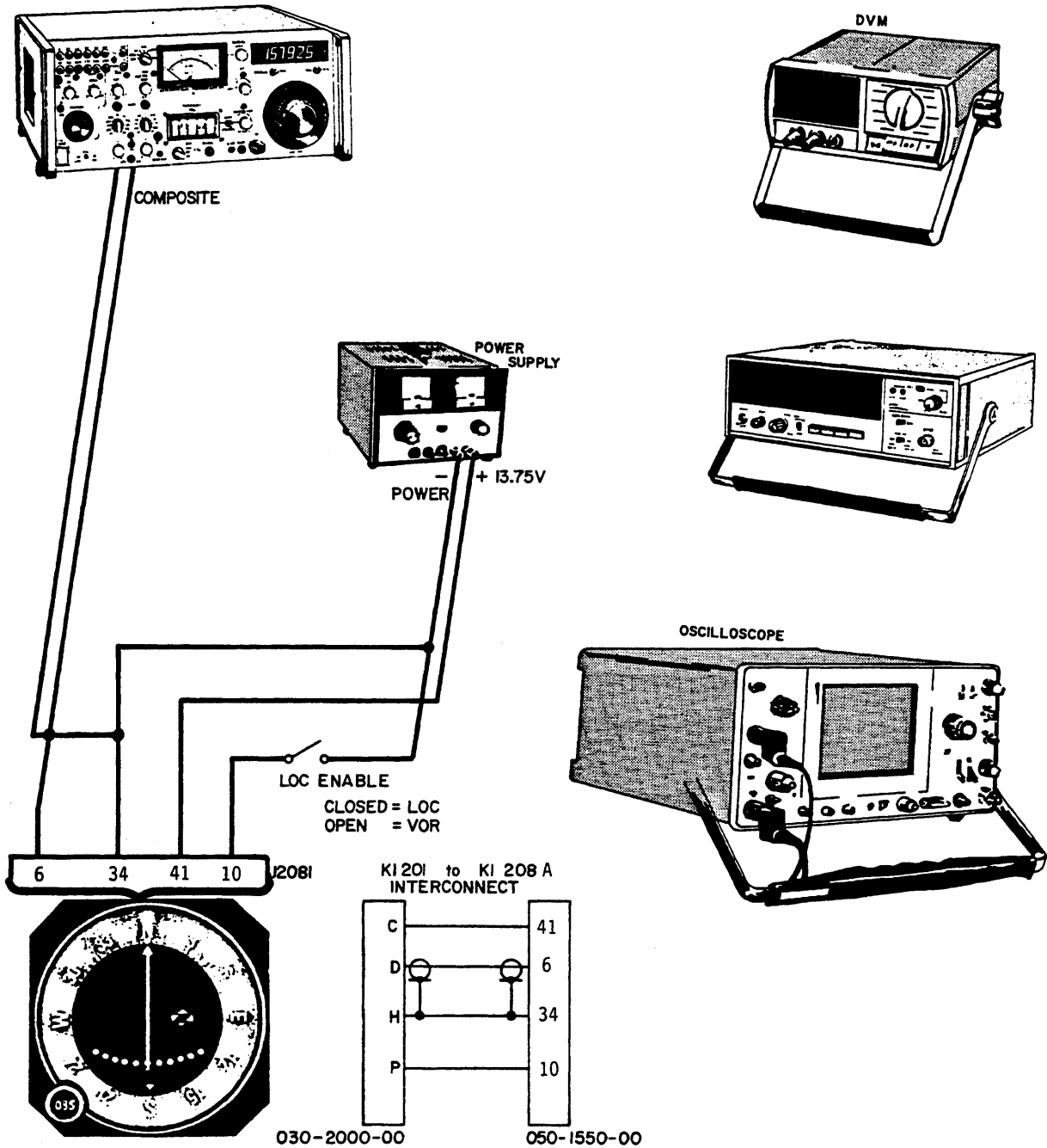
The following test equipment, or equivalent, is required to properly align and test the KI 208A/209A indicators. All test equipment must be properly calibrated before attempting alignment.

- A. Power Supply: Heath Model IP-20 or equivalent
- B. Digital Multimeter: Fairchild 7050 multimeter or equivalent
- C. Frequency Counter: CMC 616A or equivalent
- D. Oscilloscope (Dual Trace): Tektronix Model 453 or equivalent
- E. VOR/LOC Generator: Collins 479S-3 or equivalent
- F. KI 208A/209A Bench Interconnect: See Figure 5-1.

The following pieces of equipment are optional. They are used to align the KI 208A/209A indicators with the mating NAV receiver. The only exception to this is the phase meter, which makes LOC alignment easier.

- 1. NAV Receiver: KX 155/A Series Receiver
- 2. VHF Signal Generator: Boonton Model 211A or equivalent
- 3. Digital Phase Meter: Dranetz 305 with PA-3001 plug-in
- 4. KX 155/A, KI 208A Bench Interconnect: See Figure 5-2.

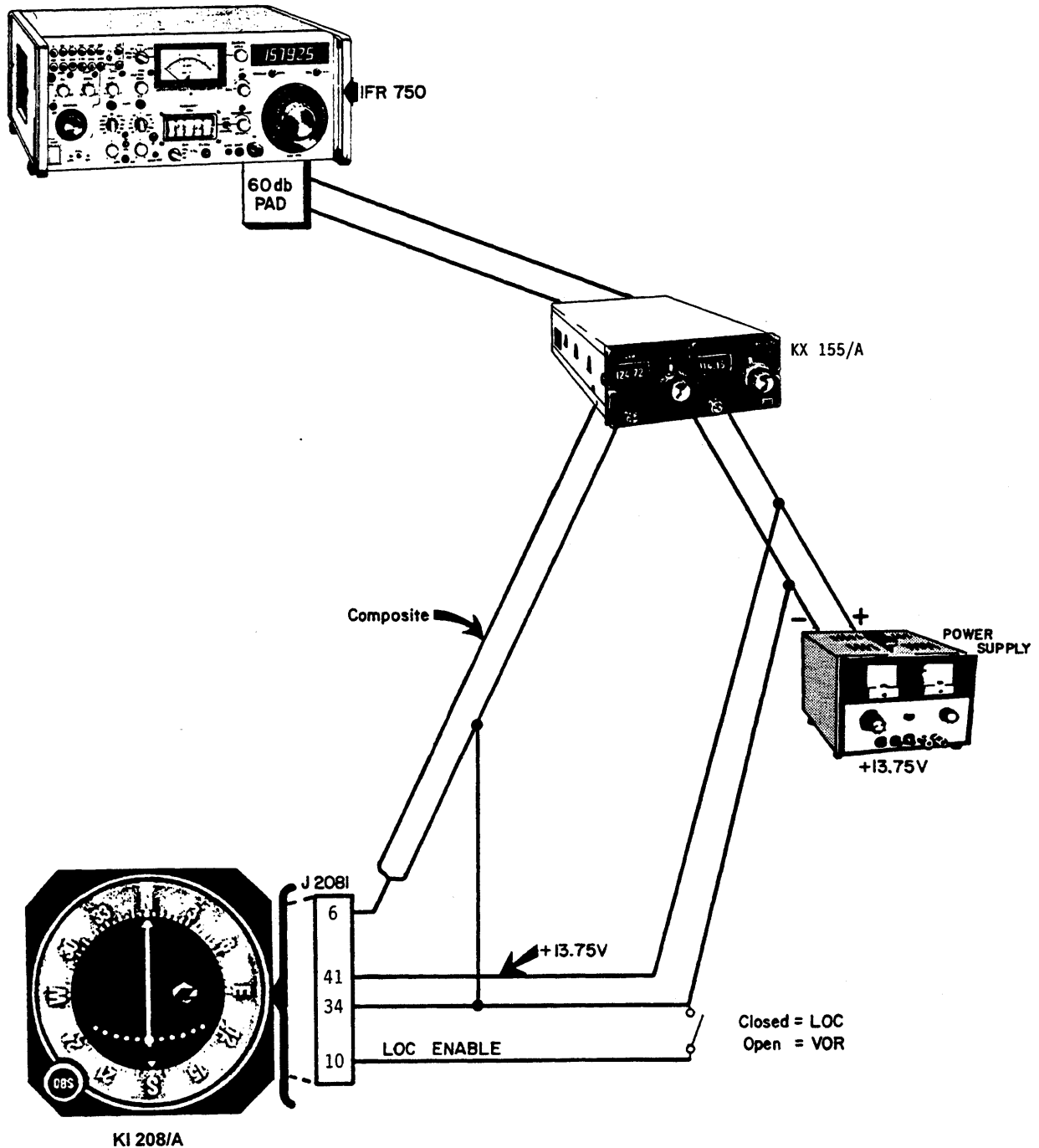
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- note:
1. The top board of the KI 208A/209A is hinged for easier access to the test points of both boards. See 6.3.4.1 for instructions.
  2. An interconnect harness using KI 201 KPN 030-2000-00 and P2081 KPN 050-1550-01 may be used with existing bench test sets.
  3. A 2½ inch long adjustment tool KPN 088-0706-00 is required to adjust VOR & LOC centering.

**FIGURE 5-1 KI 208A/209A BENCH TEST SET (MODULATOR)**

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- NOTE**
1. The top board of the KI 208A/209A is hinged for easier access to the test points. See 6.3.4.1 for instructions.
  2. A 2½ inch long adjustment tool KPN 088-0706-00 is required to adjust VOR & LOC centering.

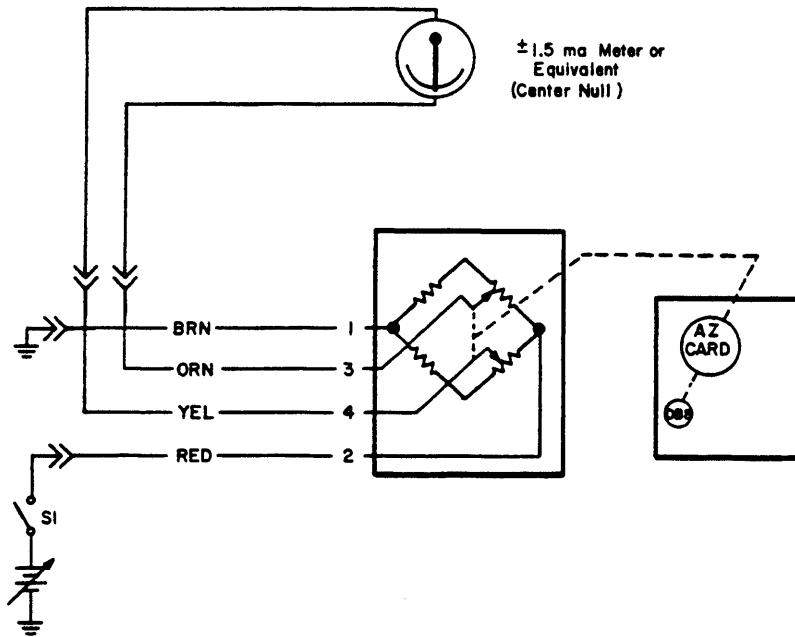
**FIGURE 5-2 KI 208A/209A BENCH TEST SET (NAV RECEIVER)**

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**5.2.3 SIN-COS POT/AZIMUTH CARD CALIBRATION**

The KI 208A/209A Overall Performance tests can be completed without any disassembly of the unit. In order to carry out the alignment procedures of the individual subassemblies, only the dust covers need be removed.

The calibration of a KI 208A or 209A Azimuth card and sin-cos pot can be done quickly by using the test circuit shown in Figure 5-3.



**CAUTION**

1. Do not increase voltage beyond 15V until the OBS is rotated so as to null the indicator.
2. Open S1 prior to checking the reciprocal heading.

**FIGURE 5-3 AZIMUTH CARD CALIBRATION**

**Alignment**

1. First check the resistance between pins 1 (Brn) and 2 (Red) of R101. A reading of 6.5K ohm  $\pm 975$  ohms should be obtained.
2. Rotate the OBS knob until a balanced resistance reading of approximately 2.1K ohm is obtained between pins 1 and 3 (Orn) and pins 1 and 4 (Yel) of R101.
3. After obtaining the balanced resistance ( 2.3K) between 1-3 and 1-4, loosen the allen screw on the sin-cos pot's gear so the pot's shaft does not turn when the OBS knob is rotated. Once that has been done, rotate the Azimuth card until 90° is under the top vertical tick mark. Retighten the gear on the shaft.

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4. The final alignment of an azimuth card is done using the test circuit shown in Figure 5-3. Connect the power supply and jumpers as shown in Figure 5-3. Close S1 and slowly increase the voltage while turning the OBS to null the meter. 33 volts can safely be applied with the meter nulled. This voltage allows sufficient sensitivity to balance out small errors. While 50 volts can be applied while the meter is nulled **do not** allow this voltage to remain on when the OBS is rotated between 270° and 90°, or whenever the meter is pegged.
5. With the meter nulled (close to 90° bearing) loosen the allen screw on the sin-cos pot's gear so the pot's shaft does not turn. Rotate OBS to exactly 90° and tighten the gear on the shaft.
6. Open S1 and then rotate the azimuth card to 270°. Close S1 and check for nulled condition. If any error is present, first rotate the OBS to halve the error, and then loosen the large gear so it does not turn the sin-cos pot. Turn the OBS to exactly 270°. Tighten the card on the shaft.
7. Open S1, rotate azimuth card to 90°. Close S1 and check that the error does not exceed that noted at 270°. Repeat step 6 if necessary and **align for minimum centering error** at 90° and 270°. The error shall not exceed 1° at either position.
8. To assure that the pot is not set 180° out of position check the resistances between pins 1 and 3 and between pins 1 and 4 with the OBS set to 90°. The resistances should be balanced and approximately equal to 2.3K.

Rotate the OBS to 270° and the resistances between pins 2 and 3 and between pins 2 and 4 should be balanced and approximately equal to 2.1K.

#### 5.2.4 VOR/LOC ALIGNMENT PROCEDURE

##### 5.2.4.1 GENERAL

###### 5.2.4.1.1 Standard VOR Test Signal

A signal consisting of two equal amplitude components:

1. A 9960 Hz signal frequency modulated at a 30 Hz rate with a deviation ratio of 16 by a reference phase signal. Set this tone to .39 V RMS.
2. A 30 Hz signal "variable phase signal" which can be varied in phase with respect to the reference phase signal. Set this tone to .39 V RMS.

###### 5.2.4.1.2 Standard Localizer Test Signals

A signal consisting of two components, 90 Hz and 150 Hz combined as described in RTCA Paper 208-53/DO-52 "Calibration Procedures for Signal Generators Used in the Testing of VOR and ILS Receivers". The amplitude ratio of the 90/150 Hz tones (tone ratio) must be adjustable. Unless specified, the level of the Localizer Test Signal with equal amplitude components of 90 Hz and 150 Hz (0.00 DDM) shall be .27 V RMS for each tone with the other tone removed.



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Prior to starting the alignment one of the two possible bench interconnects should be chosen. If Figure 5-1 is chosen assure that the modulator levels are set correctly. The following alignment will only call out "VOR or LOC" test signals. The full title "standard VOR modulator test signal" or "standard VOR test signal" will depend on which bench interconnect is chosen; i.e., figure 5-1 or Figure 5-2, respectively. Millivolt levels within parenthesis in the alignment are measured from pin 11 to pin 10 on the rear connector. The test setup of figure 5-1 and 5-2 does not test LNAV capability and there is no alignment for LNAV.

#### 5.2.4.2 INITIAL CHECK

- A. Prior to turning on the unit assure that no shorts exist on the 9.2 volt output (TP308). Resistance between TP308 and ground should be greater than 100 ohms.
- B. Preset all variable resistors to the center of their range unless the unit has been previously aligned.

#### 5.2.4.3 REGULATOR ADJUSTMENTS

- A. Apply input power (13.75VDC) to unit. Current drain should be less than 250mA with dial light on.
- B. Monitor TP308 with a digital voltmeter and adjust R321 on bottom board for 9.2VDC  $\pm 0.1$ VDC.

#### 5.2.4.4 PHASE LOCKED LOOP ADJUSTMENTS

- A. With no composite signal applied (remove modulation from VHF generator or short out composite input) check that pin 14 of I201 on the top board does not change logic status.
- B. Monitor either pin 3 or 4 of I201 with a frequency counter and adjust R207 to obtain 9960  $\pm 10$ Hz.

#### 5.2.4.5 VOR ALIGNMENT

- A. With no composite signal applied, note the position of the needle. It should be centered within 1/2 needle's width.
- B. Apply a VOR Test Signal with both the VOR generator and the unit's OBS set to 90° (FROM indication).
- C. Adjust R233 on the top board (accessible from the left front) to place the needle in the same position as noted in Step A.
- D. Rotate the VOR generator to 270°. If necessary slightly readjust R233 until the needle is midway between this reading and the position set in the previous step. If a greater than 2

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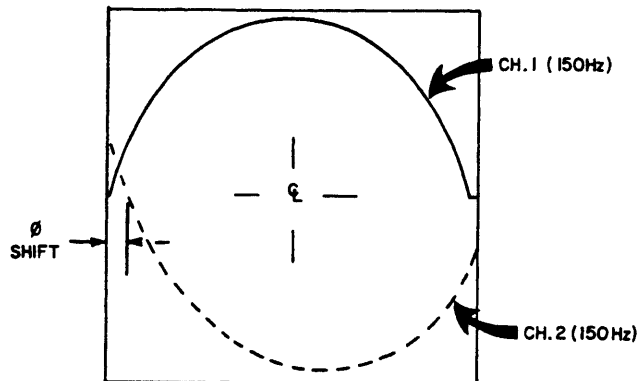
degree readjustment is required, this will usually signify a bad output stage or incorrectly set azimuth card.

- E. Shift the VOR generator to 280° and adjust R203 on the top board to produce 5 dots (150mV) right deflection. Rotate the generator to 260° and check that 5 dots (150mV) left deflection is recorded. If necessary readjust R203 to balance any error between the two deflections. Example, if 5 dots right deflection is recorded, but only 4 1/2 dots left deflection, then R203 should be readjust to produce 5 1/4 dots right deflection and 4- 3/4 dots left deflection.
- F. Repeat C and D and align for minimum centering error at both 90° TO and FROM. The majority of units will be capable of being nulled to less than 0.5° (6.8mV) difference. If the error cannot be reduced to less than 1° (13.5mV) difference, then troubleshoot the VOR converter.
- G. Change the VOR generator to 0° and set the unit's OBS to 0° (FROM indication). Adjust R241 to center the needle.
- H. Rotate the VOR generator to 180° (TO indication) and readjust R241 to halve any error that is present.
- I. Repeat G and H to balance or equalize any error at the two headings. **Align for minimum error.** Troubleshoot VOR converter if the error cannot be reduced to less than 1.5° total difference in the readings (less than 20.4mV)
- J. Set the 479T to 80° (the needle should deflect 5 dots to the right) and lower the composite input signal so that the needle deflects only 2-1/2 dots.
- K. Adjust R323 so that the RED/WHITE striped flag is in view only in the top 1/3 of the window.
- L. Return the composite input to 0.5VRMS.

#### 5.2.4.6 LOC ALIGNMENT

- A. To match the bandpass of the two LOC filters in the unit, first configure the LOC generator to produce 150Hz only.
- B. Measure and record the phase shift from TP202 and TP204. Either the phase meter or oscilloscope can be used for this measurement. If a scope is used, it is recommended that the variable time base control be used to expand 1/2 the wave to occupy the entire scope display as shown in Figure 5-4. Use AC coupling and adjust the two channels vertical position controls so their grounds are coincident and are at the center of the display. Check that the phase shifts of the two scope channels are equivalent by placing both probes on one 150Hz signal.

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**FIGURE 5-4 PHASE SHIFT**

- C. Reconfigure the LOC generator to produce only 90Hz. Monitor the phase shift between TP202 and TP205. If using the scope method, readjust the variable time base to reduce the 1/2 waveform to full horizontal display as shown above. Adjust R128 on the top board to match the phase shift recorded in B.

**CAUTION**

DO NOT SWITCH REFERENCE WAVEFORMS BETWEEN THE TWO MEASUREMENTS. THAT IS, IF TP202 WAS THE #1 INPUT TO THE PHASE METER (OR SCOPE) IN STEP B, DO NOT CHANGE IT TO THE #2 INPUT WHEN PERFORMING STEP C.

- D. Once the phase shifts are matched, the two active filters are equivalent. Any drift due to temperature will affect both of them equally and will not produce an offset condition that could have occurred if they were not matched.
- E. Set the LOC generator to produce equal 90 and 150Hz tones. Refer to LOC test signals for amplitudes.
- F. Adjust R227 (accessible from the top right of unit) to center the needle.
- G. Set the Tone Localizer switch of the LOC generator to 4db (.093ddm) on each side and adjust R313 on bottom board for 3 dots (90.0mv) deflection.
- H. Return the generator to 0db and switch the generator between CAL 90 and CAL 150 while observing the flag. Leave the generator at the setting that has the least amount of flag in view.
- I. Adjust R310 so that the flag is in view in the bottom 1/3 of the window.

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J. This completes the alignment of the KI 208A/209A.

## 5.2.5 MINIMUM PERFORMANCE SPECIFICATIONS

### 5.2.5.1 PURPOSE

The following specifications establish the Minimum Performance Standards for the KI 208A and KI 209A Indicators. All indicators must meet the specifications preceded by an asterisk (\*).

### 5.2.5.2 MINIMUM PERFORMANCE UNDER STANDARD CONDITIONS

#### A. VOR

**FLAG:** With a VOR test signal of 0.5V RMS applied, there shall be no warning flag showing up to 60° off the bearing set on the OBS. When either the reference or the variable modulation is removed from the VOR test signal the alarm flag shall appear.

**COURSE ACCURACY:**  $\pm 2^\circ$  maximum with .5VRMS signal. Measured on the 12 radials specified.

**COURSE WIDTH:** 20° +4° with .5V RMS signal input.

**TO-FROM:** The To-From changeover (centered flag condition) shall be 90°  $\pm 10^\circ$  from an On course heading.

**POLARITY:** With the generator and unit set for 0° "FROM" heading, rotating the bearing on the generator +10° shall cause the needle to deflect to the left.

**AUTOPILOT DRIVE:** With the conditions of paragraph 2.1.5, readjust if necessary the bearing on the VOR generator so as to produce 5 dots left deflection. J2031 Pin 10 should be positive with respect to pin 11 and 150mV  $\pm 30$ mV should be recorded.

**REFERENCE VOLTAGE:** J2081 pin 10 should be at +4.15V  $\pm 0.15$ V with respect to ground.

#### B. LOCALIZER

**FLAG:** With a 0.3V RMS LOC test signal applied, there shall be a full "TO" indication with no warning flag showing. When both the 90Hz or the 150Hz tone are removed from the LOC test signal, the alarm flag shall appear.

**CENTERING ACCURACY:** Needle shall be centered within  $\pm 1/2$  dot, with a 0.3V RMS input and an Odb tone ratio.

**DEFLECTION CHARACTERISTIC:** With 0.35V RMS input and a 4db tone ratio, the needle shall deflect to the third dot  $\pm 1/2$  dot.

**POLARITY:** With the tone ratio set in the 90 Hz side the needle shall deflect to the right and when set in the 150Hz side the needle shall deflect to the left.

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C. GLIDESLOPE METERS (KI 209A ONLY)

INPUT IMPEDANCE: 1K ohm  $\pm$ 5%, both flag and needle.

POLARITY: A +100mV DC voltage on J101 pin 3 with pin 6 being the return shall produce an upward movement of the GS needle. Conversely, a -100mV DC on J2081 pin 3 with pin 6 common shall produce a downward movement of the GS needle.

FLAG: A 250mV DC voltage on J2081 pin 9 with pin 12 the return shall remove the GS warning from view.

D. EXTERNAL LOADING

VOR-LOC: With one ARINC Autopilot load (1K ohm) connected across the deflection meter through J2081 pins 10 and 11, all the requirements of parts 2.1 and 2.2 shall be met.

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5.2.6 KI 208A/209A TEST DATA SHEET

I. VOR

A. FLAG \_\_\_\_\_ (OK) \_\_\_\_\_ (OK) \_\_\_\_\_ (OK)  
Composite On 30Hz Var. Off 9960Hz Off

B. LATERAL FLAG ON \_\_\_\_\_ (OK) \_\_\_\_\_ (OK) \_\_\_\_\_ (OK)  
Composite On 30Hz Var. Off 9960Hz Off

C. COURSE ACCURACY ( $\pm 2^\circ$  MAX ERROR)

	TO	FROM		TO	FROM
0°	_____	_____	180°	_____	_____
30°	_____	_____	210°	_____	_____
60°	_____	_____	240°	_____	_____
90°	_____	_____	270°	_____	_____
120°	_____	_____	300°	_____	_____
150°	_____	_____	330°	_____	_____

D. COURSE WIDTH ( $20^\circ \pm 4^\circ$ ) \_\_\_\_\_  
DATA

E. TO FROM CHANGEOVER ( $90^\circ \pm 10^\circ$ ) \_\_\_\_\_  
DATA

F. POLARITY (Incr. Genr. Angel = Lf. Defl.) \_\_\_\_\_ (OK)

G. AUTOPILOT DRIVE (5 dots LF. Deflection = 150mV  $\pm$  30Mv)  
\_\_\_\_\_ (OK)

H. REFERENCE VOLTAGE (4.15V  $\pm$ .15V) \_\_\_\_\_  
DATA

II. LOC

A. FLAG \_\_\_\_\_ (OK) \_\_\_\_\_ (OK)  
Composite On Composite Off

B. CENTERING (with  $\pm 1/2$  Dot) \_\_\_\_\_ (OK)

C. DEFLECTION for 4db = 3 dots  $\pm 1/2$  Dot \_\_\_\_\_ Right 90Hz (OK)



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C. VERTICAL DEVIATION (KI 209A)

Centered \_\_\_\_\_ (0 mV)

Up 2 Marks \_\_\_\_\_ (+150 mV)

Down 2 Marks \_\_\_\_\_ (-150 mV)

D. VERTICAL FLAG (KI 209A)

Flag \_\_\_\_\_ (129 mV)

No Flag \_\_\_\_\_ (260 mV)

E. OBS

0° \_\_\_\_\_ (<± 2°)

90° \_\_\_\_\_ (<± 2°)

180° \_\_\_\_\_ (<± 2°)

270° \_\_\_\_\_ (<± 2°)

F. SPARE RELAYS

Spare Relay 1

NO \_\_\_\_\_ NC \_\_\_\_\_

Spare Relay 2

NO \_\_\_\_\_ NC \_\_\_\_\_

Spare Relay 3

NO \_\_\_\_\_ NC \_\_\_\_\_



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## 5.3 OVERHAUL

### 5.3.1 GENERAL

Maintenance information contained in this section includes inspection procedures, cleaning, semiconductor replacement, and troubleshooting procedures.

### 5.3.2 VISUAL INSPECTION

The following visual inspection procedures should be performed during the course of maintenance operations.

- a. Inspect all wiring for frayed, loose, or burned wires.
- b. Check cable connections, making sure the plugs are free from corrosion and are properly soldered.
- c. Check all components for evidence of overheating, breakage, vibration, corrosion, or loose connections.

### 5.3.3 CLEANING

- a. Using a clean lint-free cloth, lightly moistened with an approved cleaning solvent remove the foreign matter from the equipment case and unit front panels. Wipe dry using a clean, dry, lint-free cloth.
- b. Using a hand controlled dry air jet (not more than 15 psi), blow the dust from inaccessible areas. Care should be taken to prevent damage by the air blast.
- c. Clean electrical contacts with a burnishing tool or cloth lightly moistened with an approved contact cleaner.
- d. Clean the receptacles and plugs with a hand controlled dry jet (not more than 25 psi) and a clean lint-free cloth lightly moistened with an approved cleaning solvent. Wipe dry with a clean, dry, lint-free cloth.

### 5.3.4 DISASSEMBLY PROCEDURES

The following instructions include procedures that are necessary to remove and disassemble the subassemblies of the KI 208A/209A. Before disassembly, verify that the power is removed and disassemble only to the extent necessary to effect test, alignment and repair. Tag or in some means, identify all disconnected wires.

#### 5.3.4.1 KI 208A/209A DISASSEMBLY PROCEDURES

The KI 208A/209A Overall Performance tests can be completed without any disassembly of the unit. In order to carry out the alignment procedures of the individual subassemblies, only the dust covers need be removed.

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The support framework of the KI 208A/209A consists of the mounting chassis, rear plate and printed circuit board (PC) Carriers.

The KI 208A/209A Converter #1 Board is secured to the top printed circuit board carrier. A ribbon cable connects between the converter #1 board and the converter #2 board. Also, four wires connect the Sine/Cosine variable resistor to the Relay Board.

The KI 208A/209A Converter #2 Board is secured to the bottom printed circuit board carrier. The ribbon cable, as mentioned above, connects to the converter #1 board. Also, six wires connect to the meter package and light, and six wires connect to the Relay Board.

The KI 209A has four additional wires from the meter package that connect to the Relay Board.

The meter assembly and Sine/Cosine variable resistor of the KI 208A/209A are attached to the front gear plate and mounting chassis respectively. The meter assembly and Sine/Cosine variable resistor removal is facilitated by separating the mounting chassis from the bezel and removing the respective wires from the printed circuit boards. The KI 209A has four wires of the meter assembly connected to the Relay Board.

The following procedures describe how the Indicator can be disassembled so that alignment or troubleshooting can be performed on a given subassembly. They also describe how that subassembly can be completely removed from the Indicator in the event it is replaced by a new module. This assumes the dust covers have been separated from the unit after removing the eight screws which hold them in place.

**A. KI 208A/209A Converter #1 Board**

1. Unscrew and remove the two screws on the left side (as viewed from the front of the unit) used to mount the top printed circuit board carrier to the mounting chassis and rear plate respectively. Also, unscrew approximately a quarter turn the remaining two mounting screws.
2. Rotate the printed circuit board and carrier approximately 90°R and retighten the two screws used for hinging.

At this point, the component side of the Converter #1 Board is exposed and the Converter #2 Board component side is exposed to facilitate the major amount of troubleshooting required.

3. Unscrew and remove the two screws used as the hinge.
4. Unscrew and remove the four board mounting screws.
5. Desolder each wire and tag it for identification.

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**B. KI 208A/209A Converter #2 Board**

1. Unscrew and remove the screw used to mount transistor Q101 to the rear plate.
2. Unscrew and remove the four screws used to mount the bottom printed circuit board carrier to the mounting chassis and rear plate respectively. Unscrew and remove two long screws and spacers that hold the Relay Board and Converter board #2 to the mounting chassis.
3. Rotate the printed circuit board and carrier until the component side of the board is accessible.
4. Unscrew and remove the two board mounting screws.
5. Desolder each wire and tag it for identification.

**C. KI 208A/209A Sine/Cosine Variable Resistor**

1. Unscrew and remove the four screws used to mount the mounting chassis to the front gear plate and bezel.
2. Rotate bezel, gear plate and meter assembly over the top of the unit to expose the Sine/Cosine variable resistor gear.
3. Unscrew about two turns of the capscrew on the gear clamp.
4. Remove gear from the Sine/Cosine variable resistor shaft.
5. Unscrew and remove the three screws used to mount the Sine/Cosine variable resistor body to the mounting chassis.
6. Desolder each wire and tag it for identification.

**D. KI 208A Meter Assembly Package**

1. Unscrew and remove the four screws used to mount the mounting chassis to the front gear plate and bezel.
2. Rotate bezel, gear plate, and meter assembly over the top of the unit to expose the mounting screws.
3. Unscrew and remove the three mounting screws.

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4. Desolder each meter assembly wire from the Converter #2 Board and tag it for identification.

E. KI 209A Meter Assembly Package

1. Unscrew and remove the four screws used to mount the mounting chassis to the front gear plate and bezel.
2. Rotate bezel, gear plate and meter assembly over the top of the unit to expose the mounting screws.
3. Unscrew and remove the three mounting screws.
4. Desolder each meter assembly wire from the Relay Board and Converter #2 Board and tag it for identification.

F. KI 208A/209A Relay Board

1. The rear connector, J2081/2091 is soldered to the Relay Board and held to the rear plate by two screws.
2. The Relay Board is completely exposed when the other boards are removed.

A. KI 208A/209A Subassemblies

1. In general, the assembly procedures for each of the subassemblies are the reverse of the disassembly procedures.

## 5.4 TROUBLESHOOTING

### 5.4.1 TROUBLESHOOTING THE KI 208A/209A

Various customer complaints can be resolved by using troubleshooting chart. When a circuit failure is suspected the troubleshooting flow chart should be used to quickly isolate the problem area. Once the decision blocks have isolated the area, the theory of operation for that area should be reviewed. After reviewing how the particular circuit works, then the detailed troubleshooting procedures can be used in conjunction with the photographs to isolate the defective component.

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**5.4.2 TROUBLESHOOTING FLOW CHART**

INDICATION	PROBABLE CAUSE
1) VOR inaccurate	1) R233 not balanced on TO-FROM. 2) R241 not adjusted properly at 0°. 3) Leaky capacitors in output stage. 4) Ring clamp on sin/cos pot has slipped. 5) Bad op amp (high offset voltage).
2) VOR insensitive	1) VOR sig. from NAV receiver less than .5VRMS at 200uv RF level input, or is distorted. 2) Phase locked loop center frequency. not 9960Hz ±25Hz. 3) Op amp gains not correct.
3) VOR accurate at long range but inaccurate close to station	1) NAV receivers output greater than .6VRMS at 200uV RF level input. 2) R203 set incorrectly. 3) NAV receivers AGC is poor which allows its output to increase until I202B is overdriven.
4) VOR needle unstable oscillates side to side)	1) Prop modulation. 2) VOR scalloping. 3) Output stage filtering is bad.
5) Not enough L-R VOR deflection	1) VOR signal from NAV receiver less than .5VRMS. 2) R203 set incorrectly.
6) Needle wiggles when audio level of NAV receiver is high	1) Insufficient size wire on NAV receivers power lines. 2) Very low voltage to receiver and indicator. 3) Bad regulator in the KI 208A/209A.
7) Needle kicks when transmitter is keyed	1) Indicator not grounded per installation drawing (Remember the #16 wire and shielded composite?). 2) Transmitter coax paralleled with indicator cabling.
8) LOC centering incorrect	1) R227 set incorrectly. 2) R218 set incorrectly. 3) Q205 or Q206 not switching.
9) Not enough L-R LOC deflection	1) LOC signal from NAV receiver less than .35VRMS. 2) R313 set incorrectly.

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10) LOC inaccurate over the transmitter	1) LOC signal from NAV receiver greater than .5VRMS at 200uV RF input. 2) R203 set incorrectly. 3) NAV receivers AGC is poor, which causes I202A and B to be overdriven with the strong input signal.
11) OBS error in LNAV	1) If VOR operation is okay, then the error is external.
12) No deviation in LNAV	1) check relay activation. 2) Check LNAV receiver/converter.
<b>NOTE:</b> The KI 208/209 has the greatest capability for handling variations of input amplitude of any of the new generation indicators but can be overdriven if the amplitude of the signal increases approximately 5db over the amplitude at which the indicator was aligned.	

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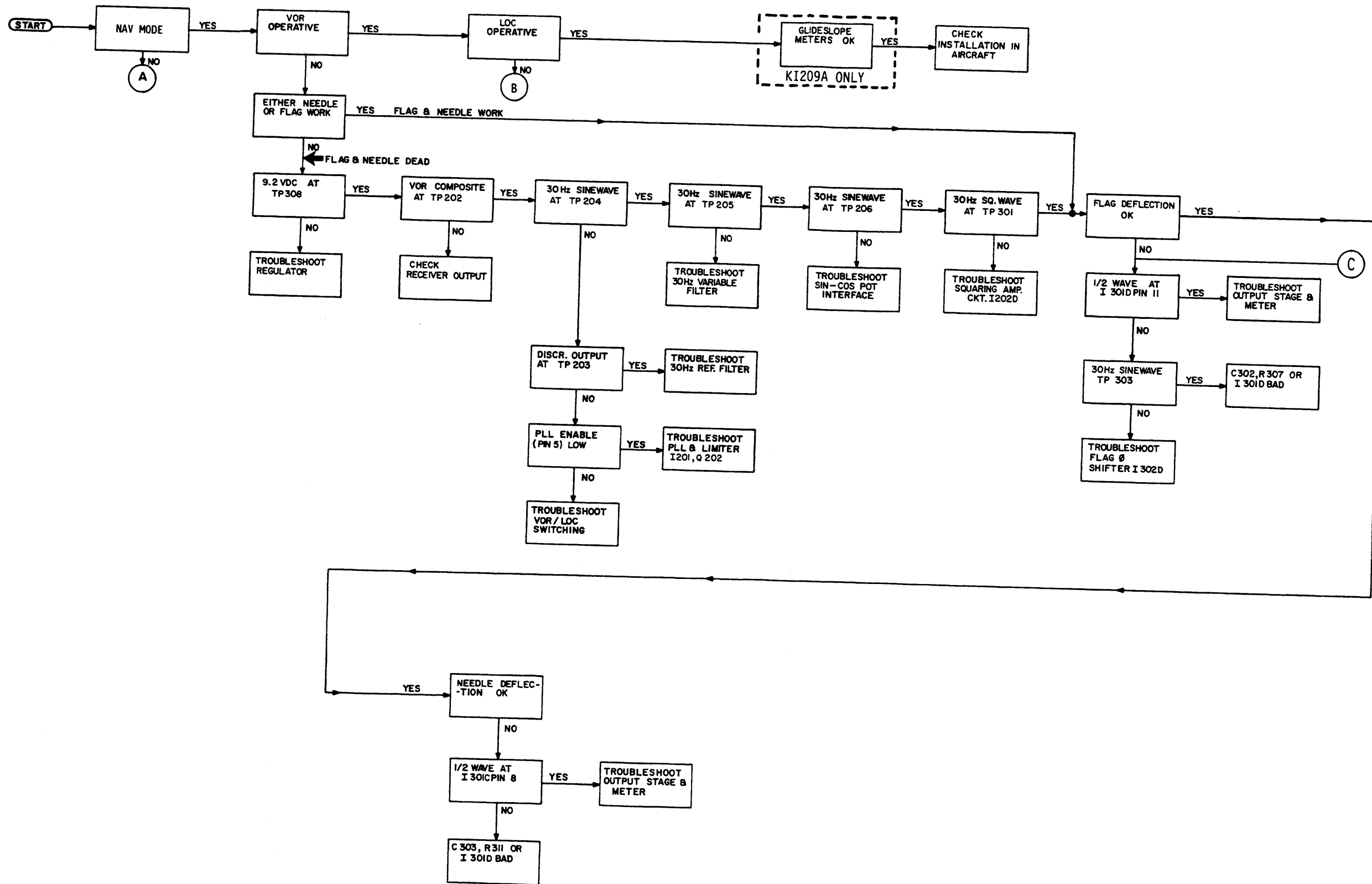
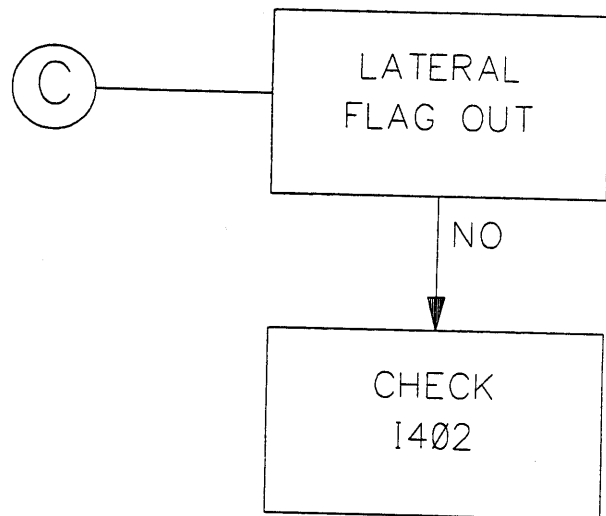
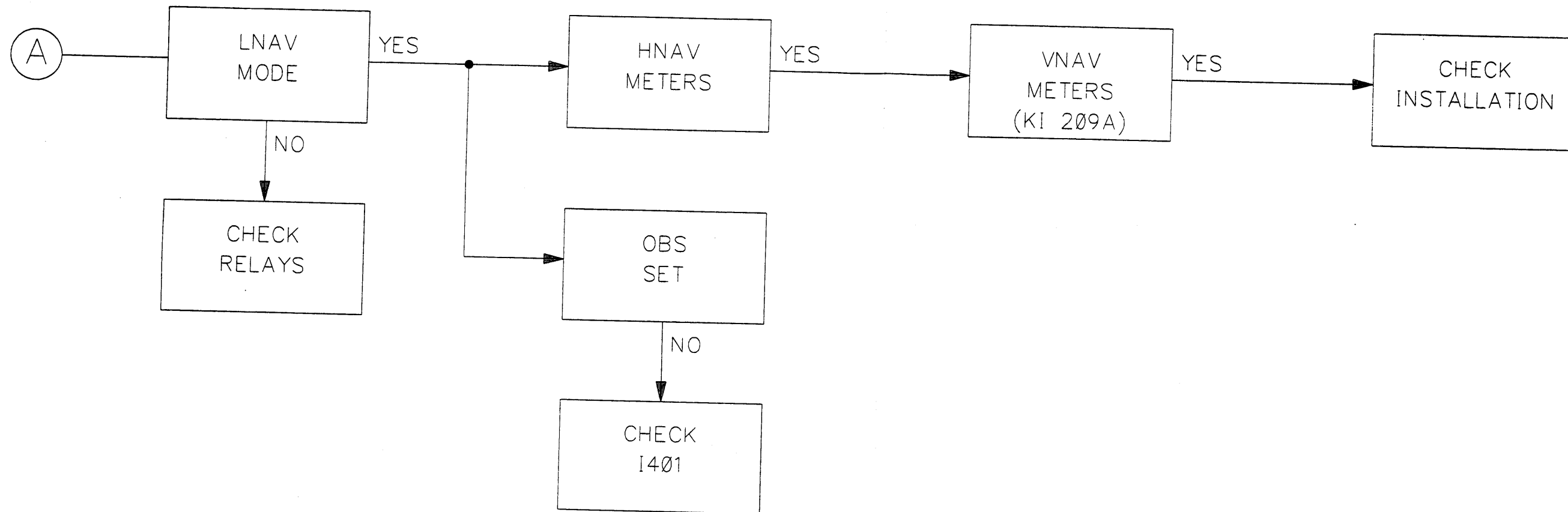


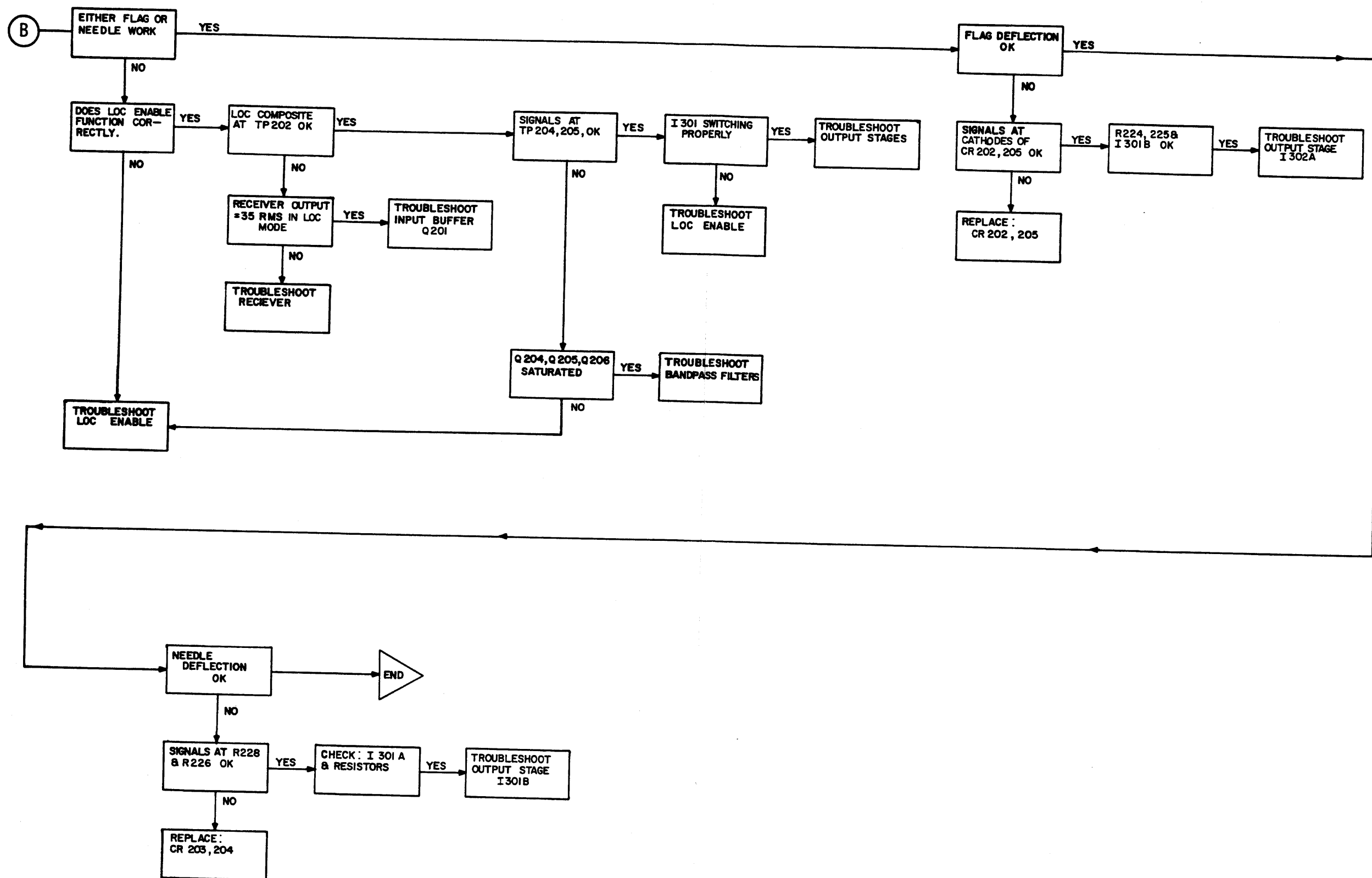
FIGURE 5-5A TROUBLESHOOTING FLOW CHART



**FIGURE 5-5B TROUBLESHOOTING FLOW CHART**



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**FIGURE 5-5C TROUBLESHOOTING FLOW CHART**

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**Troubleshooting Regulator:**

This circuit consists of a high gain amplifier (I303) and pass transistor Q101. A circuit jumper has been installed so the regulator can be isolated from the rest of the circuitry. If the 9.2V line has been shorted Q101 will usually be blown with no damage to I303. The reference voltage for the regulator (approx. 1.6V) should be checked on pin 5 to assure that it is present. The input voltage on pin 6 should be very close to the voltage measured on pin 5. Pin 7 must be more positive than pin 6, if it is not check CR305 and CR306. If CR307 has been overheated it will usually fail in a shorted condition.

**Troubleshooting VOR-LOC Switching:**

When J2081 pin 4 goes low Q203 must saturate. When this happens the collector should be to approximately 9V. If that does not happen and if the base goes low, Q203 is bad. All transistors connected to Q203's collector; i.e. Q204, Q205, Q206, Q207 and Q211 should saturate when it goes high. Q203's collector also controls enable/disable of I201 and I301A and B.

**Troubleshooting PLL and Limiter:**

With no signal into the phase locked loop, the internal voltage controlled oscillator (VCO) should be free running at  $9960 \pm 10\text{Hz}$ . This frequency can be measured at pin 4 and adjusted by R207. To check the internal phase detector, check for a square wave at pin 2. Remember to check pin 5.

The limiter should provide FM Square waves of 1 volt amplitude. The voltage at the base of Q202 should be clamped at .6 volt by Q202's base to emitter junction.

**Troubleshooting 30Hz Variable Filter:**

Check that Q204, Q205, Q207 are shut off. Gain from TP203 to TP204 should equal 2.1. Q of filter should = 4. Check that bias is at 4.16 volts at non-inverting terminal of I202A.

**Troubleshooting 30Hz Reference Filter:**

Check that Q206 is shut off. Gain from TP202 to TP205 should equal 5. Q of filter should = 4. Check that bias is at 4.16 volts at non-inverting terminal of I202B.

**Troubleshooting Sin-Cos Pot Interface:**

The 30Hz signals on brown and red leads must be equal in amplitude and  $180^\circ$  out of phase. When OBS is at  $90^\circ$ , the signal on orange and yellow leads must be equal in amplitude (.707 amplitude of brown and red) and in phase. Signal at TP206 should stay approximately the same amplitude and appear to shift continuously as the OBS is rotated. If Q208 or Q209 are shorted then there will be a greater amplitude change at TP206 as the OBS is rotated.

**Troubleshooting Squaring Amplifier:**

Check that approximately a 275mV threshold exists between the DC voltage on pin 13 to pin 12 of I202D. If it does not exist, check that Q211 is off.

**Troubleshooting Flag Phase Shifter:**

Check for a  $90^\circ \pm 10^\circ$  phase shift between TP205 and TP303. Input to output amplitude change equals slightly less than one-third; i.e., gain = 0.35. Check for 4.16V bias at non-inverting terminal of I302D.

**Troubleshooting VOR Output Stage:**

Check that I301A and B are open, so signals at input to the I301 CMOS switch do not pass to the inverting terminal of either I302A and B. The output stage itself can be checked by monitoring the

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output test points for differential voltages up to  $\pm 65$  volt as the OBS is rotated from  $90^\circ$  off course to  $-90^\circ$  off course.

**Troubleshooting LOC Bandpass Filters:**

Check that Q204, Q205, Q206 and Q207 are saturated. The gains should be 5 for both the 150Hz and 90Hz filters and the Q's should also be equal to 12. The phase shifts ( $180^\circ$ ) should be equal for the two filters by adjusting R218. This phase shift adjustment was set at the factory and should not be readjusted unless there is a significant difference between the two filters. Check for bias at non-inverting terminal.

**Troubleshooting LOC Output Stages:**

Check that I301C and D are closed when in LOC mode. This enables an input bias voltage to be applied to the non-inverting input of the output op amps. Also check that I301A and B are shorted to enable transmission of LOC DC voltage to the output stages. Check that the feedback resistors (R314 or R310) are of correct values.

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**SECTION VI**

**ILLUSTRATED PARTS LIST**

**6.1 INTRODUCTION**

The Illustrated Parts List (IPL) is a complete list of assemblies and parts required for the unit. The IPL also provides for the proper identification of replacement parts. Individual Bills of Material (BOM) within this IPL are arranged in numerical sequence starting with the top assembly and continuing with the sub-assemblies. All mechanical parts will be separated from the electrical parts used on the sub-assembly. Each BOM is followed by the Assembly Drawing and Schematic Diagram for that assembly.

Parts identified in this IPL by AlliedSignal Part Number meet design specifications for this equipment and are the recommended replacement parts. Warranty information concerning AlliedSignal replacement parts is contained in Service Memo #1, P/N 600-08001-00XX.

This section describes the various items that appear on the Bills of Material. A sample BOM is included in this section as Figure 6-1.

**A. BOM Number**

The Bill of Material Number appears at the top of the BOM as a 12-digit number which is also the AlliedSignal Part Number for the assembly. The BOM Number is followed by the assembly description and the revision level of the BOM.

**B. Symbol Column**

This column contains the Reference Designators of the electrical components of the assembly. Mechanical parts are not assigned Reference Designators; however, they may be assigned item numbers to assist in locating the part on an assembly drawing. The Reference Designator consists of a letter abbreviation which indicates the type of component followed by the number assigned to that part (C101, Q101, etc). Common Reference Designator abbreviations are listed below.

B	Motor or Synchro	Q	Transistor
C	Capacitor	P	Plug
CJ	Circuit Jumper	R	Resistor
CR	Diode	RT	Thermistor
DS	Lamp	S	Switch
F	Fuse	T	Transformer
FL	Filter	TP	Test Point
I	Integrated Circuit	U	Resistor/Capacitor Network/Integrated Circuit
J	Jack	V	Photocell/Vacuum Tube
L	Inductor	WG	Waveguide
M	Meter	Y	Crystal

**C. Part Number Column**

This column contains the AlliedSignal Part Number for each part. Special purpose 999-09999-00XX series part numbers may appear in the BOM and are described below.

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(1) CR401 999-09999-0096 RESERVED

The Reference Designator CR401 has been reserved for future use; the assembly does not currently include a CR401.

(2) CR401 999-09999-0097 SEE NEXT ASSEMBLY

CR401 is a part of the electrical circuit but due to assembly or testing requirements is actually part of a different assembly.

(3) CR401 999-09999-0098 NOT USED

The Reference Designator CR401 is available for future assignment. The assembly does not currently include a CR401.

(4) CR401 999-09999-0099 DO NOT USE

The Reference Designator CR401 has been previously used for this assembly and later deleted. It may not be reassigned on this assembly.

(5) I401 999-09999-0090 REF SFTWARE SET

I401 is a programmed memory device. Refer to Section H, Software Documentation in this introduction for a description of the software documentation system being used at the time of publication of this manual.

D. Description Column

This column contains the description of each part in the assembly. Common abbreviations which may appear in this column are listed below.

AL	Aluminum	MY	Mylar
ASSY	Assembly	PC	Polycarbonate
BIFLR	Bifilar	PF	Precision Film
BOM	Bill of Material	PP	Paper
CAP	Capacitor	PS	Polystrene
CC	Carbon Composite	QW	Quarter Watt
CF	Carbon Film	RES	Resistor
CH	Choke	S	Silicon
CR	Ceramic	SCR	Screw
CRT	Cathode Ray Tube	SM	Silver Mica
DC	Disc Ceramic	STDF	Standoff
DIO	Diode	SW	Switch
EL	Electrolytic	TERM	Terminal
EW	Eighth Watt	TN	Tantalum
FC	Fixed Composition	TST PT	Test Point
FERR	Ferrite	TW	Tenth Watt
FLTR	Filter	U	Integrated Circuit
FT	Feedthru	VA	Variable
HV	High Voltage	WW	Wire Wound
HVXFMR	High Voltage XFMR	XFMR	Transformer
HW	Half Watt	XSTR	Transistor Ceramic
MC	Monolithic	XTAL	Crystal

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E. Assembly (A) Column

An "A" in this column indicates that the part indicated is an assembly. If the P/N and description reads "200-0XXXX-0099 COMMON BOM" or "200-XXXX-99 COMMON BOM" the parts for that assembly are included in the same BOM. The parts breakdown for an assembly with any other P/N will be found in the BOM with the same number.

F. Unit of Measure (UM) Column

This column indicates the Unit of Measure for each part. Common abbreviations found in this column are listed below.

EA	Each	RF	For Reference Only
FT	Foot	IN	Inch
AR	As Required		

G. Quantity and Flavor Columns

Individual flavors of an assembly are identified by the last four digits of the P/N. Part quantities for each flavor will be indicated under headings numbered 0000 through 9900 as required. The parts indicated in the 9900 Column are common to all other flavors of the assembly and are considered the Common Bill of Material for the assembly.

H. Software Documentation

The documentation of software involves the use of several unique types of part numbers. The following subsections list these part numbers with their description. In some cases, some specific versions of hardware must be used with specific versions of software. To determine the correct P/N for ordering the programmed device, you will need to know the part number of and the software revision level of the unit.

The last two digits of all software related P/N's, designated in the following text as -RN, indicate the revision number or level of the related software. This number is incremented with each revision of software. For example, -01 is revision 0, -02 is revision 1, and so on. When ordering specific integrated circuits or devices, the applicable 122-XXXXX-XXRN P/N is used. When ordering a circuit board which contains software, the applicable 205X-XXXX-XXRN P/N is used. Applicable assembly drawings and schematic diagrams will then follow in order.

(1) General Information

The part number of the unit, typically the 065-, 066- or 071-top assembly part number, contains a 206- item in its bill of materials. This 206- item is the configuration control mechanism for programmable electronic devices of the unit. Two different means exist to label the hardware/software configuration of the unit depending on the the part number of the unit:

- (a) When the part number of the unit is a 9-digit part as represented on the TSO label, the last 2 digits of the 206-item are the digits of the Software Identification (SW ID) tag that appears on the unit.

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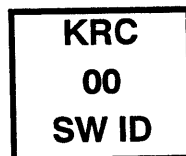
- (b) When the part number of the unit is a 12-digit part as represented on the TSO label, the last 4 digits of the 206- item are the digits of the Software Modification (SW MOD) tag that appears on the unit. In the example shown in figure 6-1, sheet 1 the 206- item is flagged with an "A" in the right hand margin.

(2) Definition of a Hardware/Software System

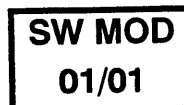
The 206- item represents the collection of all boards in the unit which contain electronic programmable devices (software). The hardware/software system (206-) bill of materials contains two categories of items:

- (a) The part number of the unit label, i.e. the SOFT ID or SOFT MOD tag.

- 1) In the case of the 9-digit TSOed unit the unit label part number 057-03284-00XX where XX is the last two digits of the 206- number. The software identification tag is illustrated below.



- 2) In the case of the 12-digit TSOed unit the unit label part number is 057-05287-YYYY where YYYY is the last four digits of the 206- number. This number is also referred to as the software mod level of the unit. The software mod tag is illustrated below.



- (b) The 205- hardware/software board assemblies constitute all the hardware/software boards which this unit contains. In the example, the item marked "B" is the 205- hardware/software board used in the rest of the example.

(3) Definition of a Hardware/Software Board

The hardware/software board (205-) bill of materials contains four categories of items:

- (a) The part numbers of the board label:

- 1) For 12-digit 205-0XXXX-00YY board labels, the first 10 digits are contained on a label part number of 057-05252-XXXX and the last two digits are specified by 057-05335-00YY.

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- 2) For 9-digit 205-WWWW-ZZ board labels, the first 7 digits are contained on a label part number of 057-050WW-00WW and the last two digits are specified by 057-05252-00ZZ.

The 205-0XXXX-00YY and the 057-05252-00YY P/N is incremented whenever the revision number of any one or more of the 125-0XXXX-XXRN P/N's is incremented. This means that the -RN part of the P/N's for the 057-05252-XXRN and the 205-0XXXX-XXRN will be the same. A circuit board identification tag is illustrated below.

205-06616-	0000
------------	------

- (b) The software programmable device set assemblies (125-):

Each 125- programmable device set constitutes all the software for a unique microprocessor on the hardware board. The group of 125- programmable device sets constitutes all of the software for all of the microprocessors.

- 1) 125-0XXXX-XXRN AlliedSignal Part Numbers

The 125-0XXXX-XXRN P/N is a BOM which lists all the 122-0XXXX-XXRN programmed devices in a software set for a given circuit board. There may be only one 122-0XXXX-XXRN P/N listed or there may be several. Whenever the revision number (RN) of any one or more of the 122-0XXX-XXRN programmed devices is incremented in a new software release, the -XXRN part of the 125-0XXXX-RN P/N is also incremented. This 125-0XXXX-XXRN BOM also identifies the "U" or "I" circuit designators used to identify the programmed devices on assembly drawings and schematic diagrams.

- 2) The 122-0XXXX-XXRN P/N is used to identify an individual integrated circuit or other device containing software.

- (c) The non-software programmable device set assemblies (126-) which fulfill software requirements.

- (d) The specification of the hardware board (200-).

In the example, the items marked "C" in the right margin are all the programmable device assemblies which fulfill the software requirements.

- (4) Definition of a Hardware Board

The hardware board (200-) bill of materials contains two categories of items that relate to programmable devices:



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- (a) The non-software programmable device sets (126s) that fulfill hardware requirements. (Items D1 thru D4 in the example).
- (b) The references to all of the programmable devices (122-) on the board. These references resolve device location on the board in that they use the SYMBOL field of the bill of materials to specify component location. These 122-numbers are of the form 122-3XXXX-9999 or 122-0YYYY-9999.

The 122- numbers of the form 122-3XXXX-9999 are used for non-software programmable devices (126-) that fulfill hardware requirements and therefore these programmable device sets appear on the hardware board (200-) bill of materials. (Items D5 thru D10 in the example).

The 122- numbers of the form 122-0YYYY-9999 are used for both software programmable devices (125-) (items D12 thru D15 in the example) and non-software programmable devices (126-) (item D11 in the example) that fulfill software requirements.

These programmable device sets appear on the hardware/software board (205-) bill of materials.

The exact programmable device (the resolution of the -9999 in the above items) is specified by the respective software programmable device set (125-) or the non-software programmable device set (126-) bill of materials.

Using the SYMBOL field as specified above would discourage the use of the SYMBOL field for this purpose in the programmable device sets (125- and 126-) bill of materials. This would then permit the specification of the same programmable device sets in different boards, hence different component designers.

In the example, **Figure 6-1**:

- the items flagged D1 thru D4 in the right margin are non-software programmable device sets,
- the items flagged D5 thru D10 in the right margin are non-software programmable device designers that fulfill hardware requirements,
- the item flagged D11 in the right margin is a non-software programmable device designer that fulfills software requirements,
- the items flagged D12 thru D15 in the right margin are software programmable device designers that fulfill software requirements,

**Figure 6-1**, while closely related to a specific product, does not represent an exact configuration in use by that product. This example has been modified to clarify certain points.

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Assy: 066-04020-0203 SG464 HSI W/O WX

Symbol	Part Number	Rev	Description	UM	Quantity	BxItm
	016-01008-0004	3	GLYPTAL 7526 BL	AR	1.00	
	016-01131-0000	1	CNTCT CMT BND 1055	AR	1.00	
	047-02579-0002	2	HANDLE ASSEMBLY	EA	1.00	
	047-09392-0001	0	SPACER RT W/FIN	EA	1.00	
	057-02203-0002	3	FLAVOR STCKR	EA	1.00	
	057-02203-0003	3	FLAVOR STCKR	EA	1.00	
	057-05286-0000	0	SERIAL TAG SG 464	EA	1.00	
	075-05082-0002	0	GUIDE PLATE TOP	EA	1.00	
	090-00277-0000	1	HOLD DOWN BRACKET	EA	1.00	
	155-02536-0001	1	CABLE ASSY	EA	1.00	
	200-07703-0000	2	DPX CONN BD ASSY	EA	1.00	
	200-07704-0000	8	LV PS BD ASSY	EA	1.00	
	206-00118-0301	0	EFS40/50 HSI SET	EA	1.00	<--- A

Assy: 206-00118-0301 EFS40/50 HSI SET

Symbol	Part Number	Rev	Description	UM	Quantity	BxItm
	057-05287-0301	0	SW MOD TAG	EA	1.00	
	205-00564-0002	0	EFIS 40/50 I/O PBS	EA	1.00	
	205-00565-0004	0	E40/50 HSI P/D PBS	EA	1.00	<--- B

Assy: 205-00565-0004 E40/50 HSI P/D PBS

Symbol	Part Number	Rev	Description	UM	Quantity	BxItm
	057-02241-0016	1	IDENT LABEL	EA	1.00	
	057-05252-0565	1	IDT 205-00565-0000	EA	1.00	
	125-00602-0004	0	EFIS 40/50 NAV SDS	EA	1.00	<--- C1
	125-00603-0002	0	EFIS40/50 DSPL SDS	EA	1.00	<--- C2
	126-00019-0000	1	EFS40/50 CLIPPER	EA	1.00	<--- C3
	200-07706-0000	1	PRCSR/DSPL BD ASSY	EA	1.00	

**FIGURE 6-1 TYPICAL BILL OF MATERIAL**  
**(Sheet 1 of 4)**

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Assy: 200-07706-0000 PRCSR/DSPL BD ASSY

Symbol	Part Number	Rev	Description	UM	Quantity	BxItm
	009-07706-0000	0	PC BD PRCSR/DSPL	EA	1.00	
	.					
	150-00004-0010	3	TUBING TFLN 22AWG	IN	2.00	
	200-04969-0000	0	EXT BD PRCSR/ADI A	RF	0.00	
	126-00005-0000	1	EFS40/50 INT LOGIC	EA	1.00	<--- D1
	126-00006-0000	1	EFS40/50 VIDEO MUX	EA	1.00	<--- D2
	126-00017-0000	1	EFS40/50 SM SET	EA	1.00	<--- D3
	126-00018-0000	1	EFS40/50 SINE SET	EA	1.00	<--- D4
C 5001	111-02104-0042	26	CAP MC100KPF50V20%	EA	1.00	
	.					
I 5005	122-30001-9999	0	EFS40/50 VIDEO MUX	RF	0.00	<--- D5
I 5008	122-30002-9999	0	EFS40/50 INT LOGIC	RF	0.00	<--- D6
	.					
I 5036	122-30003-9999	0	EFS40/50 SM HIGH	RF	0.00	<--- D7
I 5037	122-30004-9999	0	EFS40/50 SM LOW	RF	0.00	<--- D8
I 5038	122-30005-9999	0	EFS40/50 SINE HIGH	RF	0.00	<--- D9
I 5039	122-30006-9999	0	EFS40/50 SINE LOW	RF	0.00	<--- D10
	.					
I 5075	122-00958-9999	0	EFS40/50 CLIPPER	RF	0.00	<--- D11
	.					
I 5138	122-00918-9999	0	EFS40/50 HSI NAV-E	RF	0.00	<--- D12
I 5139	122-00919-9999	0	EFS40/50 HSI NAV-O	RF	0.00	<--- D13
	.					
I 5158	122-00920-9999	0	EFS40/50 HSI DSP-E	RF	0.00	<--- D14
I 5159	122-00921-9999	0	EFS40/50 HSI DSP-O	RF	0.00	<--- D15

Assy: 126-00005-0000 EFS40/50 INT LOGIC

Symbol	Part Number	Rev	Description	UM	Quantity	BxItm
	122-30002-0000	0	EFS40/50 INT LOGIC	EA	1.00	

Assy: 122-30002-0000 EFS40/50 INT LOGIC

Symbol	Part Number	Rev	Description	UM	Quantity	BxItm
	120-02376-0000	1	EPLD EP320 (OTP)	EA	1.00	

**FIGURE 6-1 TYPICAL BILL OF MATERIAL**  
**(Sheet 2 of 4)**

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Assy: 125-00602-0004 EFIS 40/50 NAV SDS

Symbol	Part Number	Rev	Description	UM	Quantity	BxItm
	122-00918-0004	0	EFS40/50 HSI NAV-E	EA	1.00	
	122-00919-0004	0	EFS40/50 HSI NAV-O	EA	1.00	

Assy: 125-00603-0002 EFIS40/50 DSPL SDS

Symbol	Part Number	Rev	Description	UM	Quantity	BxItm
	122-00920-0002	0	EFS40/50 HSI DSP-E	EA	1.00	
	122-00921-0002	0	EFS40/50 HSI DSP-O	EA	1.00	

**FIGURE 6-1 TYPICAL BILL OF MATERIAL**  
(Sheet 3 of 4)

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BOM NUMBER	200-08366-0000	MST67 IOP/DLP	R: 2	MST0067A					ASSEMBLY VERSION
	200-08366-0000	MST67 IOP/DLP	R: 2	MST0067A					
	SYMBOL	PART NUMBER	DESCRIPTION	A	UM	0000	9900		
		009-08366-0000	PC BD IOP/DLP	A	EA	1.00	1.00		
		016-01040-0000	COATING TYPE AR		AR	1.00	1.00		
		033-00114-0021	SOCKET IC DIP 28C	A	EA	3.00	3.00		
		047-09680-0001	KEYING BRACKET	A	EA	3.00	3.00		
		090-00087-0000	CLIP CRYSTAL		EA	1.00	1.00		
		092-05003-0015	EYELET .049		EA	2.00	2.00		
PROGRAMMABLE DEVICE SET		126-00030-0000	MST67A ASIC SFTWR	A	EA	1.00	1.00		
	C 9001	106-04104-0047	CH 100KX7R/50V		EA	1.00	1.00		
	C 9002	106-04104-0047	CH 100KX7R/50V		EA	1.00	1.00		
	C 9003	106-04104-0047	CH 100KX7R/50V		EA	1.00	1.00		
	CR 9001	007-06180-0000	DIO SW MMBD6050		EA	1.00	1.00		
	CR 9002	007-08092-0000	QUAD SD DIODE		EA	1.00	1.00		
	CR 9003	007-08092-0000	QUAD SD DIODE		EA	1.00	1.00		
	DS 9001	007-06408-0000	COM CATH 7 SEG LED		EA	1.00	1.00		
	J 9002	030-02174-0000	PIN CONT		EA	50.00	1.00		
	P 9003	155-02688-0003	RIBBON CABLE ASSY	A	EA	1.00	1.00		UNIT OF MEASURE
	Q 9003	007-00065-0001	XSTR 2N3906 (SDT)		EA	1.00	1.00		
	Q 9006	007-00383-0004	SDT-23 2N2222A XST		EA	1.00	1.00		
	Q 9011	007-00530-0000	XSTR NPN MMBT3903	A	EA	1.00	1.00		
	R 9001	130-05104-0023	RES CH 100K EW 5%		EA	1.00	1.00		
REFERENCE DESIGNATOR	R 9002	015-00207-0020	DUCTAL SD RESISTOR		EA	1.00	1.00		QUANTITY
	R 9003	130-05472-0023	RES CHIP 4.7KEW5%		EA	1.00	1.00		
	R 9004	130-05471-0023	RES CHIP 470EWS%		EA	1.00	1.00		
	R 9005	130-05104-0023	RES CH 100K EW 5%		EA	1.00	1.00		
	R 9006	130-05104-0023	RES CH 100K EW 5%		EA	1.00	1.00		
	R 9007	130-05000-0025	RES CHIP 0 EW CJ		EA	1.00	1.00		
	TP 9001	008-00096-0001	TERMINAL TEST PNT		EA	1.00	1.00		
	TP 9002	008-00096-0001	TERMINAL TEST PNT		EA	1.00	1.00		
PART NUMBER	U 9001	120-02208-0004	UPRGSSR 10MHZ16B.T	A	EA	1.00	1.00		
	U 9002	120-06129-0009	6264-15 8K X 8 RAM		EA	1.00	1.00		
	U 9003	120-06129-0009	6264-15 8K X 8 RAM		EA	1.00	1.00		
	U 9004	122-01195-9999	*MST67 PRGMD ODD	A	RF	X.			
	U 9005	122-01194-9999	*MST67 PRGMD EVEN	A	RF	X.			
	U 9006	124-00574-0003	IC 74HCT574		EA	1.00	1.00		
	U 9007	123-00138-0003	74HC138 SD PKG		EA	1.00	1.00		
	Y 9001	044-00009-0019	XTAL 14.75MHZ		EA	1.00	1.00		
DESCRIPTION	Y 9002	044-00293-0000	20 MHZ OSC		EA	1.00	1.00		

**FIGURE 6-1 TYPICAL BILL OF MATERIAL**  
**(Sheet 4 of 4)**

**BENDIX/KING**  
**KI 208A/209A**  
**INDICATORS**

6.2      066-03056-0010    Rev. 1    KI 208A INDICATOR ASSEMBLY  
           066-03056-0011    Rev. 1    KI 209A INDICATOR ASSEMBLY  
           066-03056-0098    Rev. 2    COMMON BOARD

SYMBOL	PART NUMBER	DESCRIPTION	[UM]	QUANTITY		
				-0010	-0011	-0098
	012-01021-0006	TAPE ELEC 3/8 WD	[AR]		1	
	016-01015-0000	IND ADH 3M 4475	[AR]		1	
	016-01068-0000	ANTI STATIC CRM	[AR]		1	
	016-01082-0000	DC RTV 3145	[AR]		1	
	025-00003-0002	WIRE 22 RED	[IN]		4.5	
	025-00018-0000	WIRE 26 BLK	[IN]		11.5	
	025-00018-0003	WIRE 26 BK/OR	[IN]			
	025-00018-0009	WIRE 26 BK/WH	[IN]		4.5	
	025-00018-0011	WIRE 26 BRN	[IN]		15	
	025-00018-0019	WIRE 26 BN/WH	[IN]		4.5	
	025-00018-0022	WIRE 26 RED	[IN]		9.5	
	025-00018-0023	WIRE 26 RD/OR	[IN]			
	025-00018-0029	WIRE 26 RD/WH	[IN]		4.5	
	025-00018-0033	WIRE 26 ORG	[IN]		9.5	
	025-00018-0039	WIRE 26 OR/WH	[IN]		4.5	
	025-00018-0044	WIRE 26 YEL	[IN]		9.5	
	025-00018-0055	WIRE 26 GRN	[IN]		5	
	025-00018-0059	WIRE 26 GN/WH	[IN]		9.5	
	025-00018-0088	WIRE 26 GRY	[IN]		7	
	025-00018-0089	WIRE 26 GY/WH	[IN]		7	
	025-00018-0090	WIRE 26 WH/BK	[IN]		4.5	
	025-00018-0092	WIRE 26 WH/RD	[IN]		4.5	
	025-00018-0099	WIRE 26 WHT	[IN]		7	
	025-00025-0012	CA RBN 28G 12C	[IN]		3.6	
	029-00022-0000	GEAR CLMP	[EA]		1	
	029-00287-0001	GEAR RING 64P	[EA]		1	
	029-00288-0000	GEAR IDLR 24T/64DP	[EA]		1	
	029-00289-0000	GEAR DRVR 24T	[EA]		1	
	029-00290-0000	GEAR SPUR 165T	[EA]		1	
	030-01099-0000	PIN CONTACT	[EA]			
	030-02227-0015	CONNECTOR	[EA]			
	035-01361-0006	PROTECTIVE CVR	[EA]		1	
	047-04090-0004	SHLD RF ASSY	[EA]			
	047-04090-0005	SHLD RF ASSY	[EA]			

**BENDIX/KING**  
**KI 208A/209A**  
**INDICATORS**

SYMBOL	PART NUMBER	DESCRIPTION	[UM]	QUANTITY		
				-0010	-0011	-0098
	047-04091-0001	CVR DUST	[EA]			2
	047-04151-0001	STRAP GROUND W/F	[EA]			2
	047-04152-0001	REAR PLATE W/F	[EA]			
	047-12117-0001	REAR PLATE	[EA]			1
	057-01199-0002	MOD TAG	[EA]			1
	057-01831-0000	CAUTION TAG	[EA]			1
	057-01879-0002	SERIAL TAG KI208	[EA]			
	057-01880-0002	SERIAL TAG KI209	[EA]			
	057-02203-0000	FLAVOR STCKR	[EA]			
	057-02203-0001	FLAVOR STCKR	[EA]			
	057-02203-0002	FLAVOR STCKR	[EA]			
	057-02203-0003	FLAVOR STCKR	[EA]			
	057-03511-0001	DECAL_ CAUTION	[EA]			1
	057-05839-0001	MADE IN SINGAPORE / KI 208A	[EA]	1		
	057-05840-0001	MADE IN SOFTWARE / KI 209A	[EA]		1	
	066-03056-0098	COMMON BOM	[EA]	1	1	
	076-00727-0000	POST IDLER	[EA]			1
	076-02958-0000	BOARD SPACER	[EA]			2
	088-00193-0004	FLTR LMP LGT BLU	[EA]			1
	088-00480-0002	BEZEL	[EA]			1
	088-00481-0002	FRONT MTG PLATE	[EA]			1
	088-00695-0005	AZ DIAL CRD W/PHS	[EA]			1
	088-00697-0001	KNOB W/F - OBS	[EA]			1
	088-00698-0000	CARRIER PC BRD	[EA]			2
	088-00699-0000	COVER CONN BCK	[EA]			
	088-00700-0000	CHASSIS MNTG	[EA]			1
	088-00701-0000	WEDGE LIG	[EA]			
	088-00701-0001	WEDGE LIGHTING	[EA]			1
	089-02076-0030	NUT FLAT 4-40	[EA]			4
	089-02322-0000	NUT SPD PUSH-ON	[EA]			1
	089-02357-0000	NUT TORQUE 4-40	[EA]			3
	089-05436-0012	SCR FHP 4-40X3/4	[EA]			3
	089-05878-0006	SCR PHP 4-40X3/8	[EA]			5
	089-05903-0004	SCR PHP 4-40X1/4	[EA]			4
	089-06022-0006	SCR SHC 2-56X3/8	[EA]			1
	089-06167-0012	SCR FHP 6-32X3/4	[EA]			3

**BENDIX/KING**  
**KI 208A/209A**  
**INDICATORS**

SYMBOL	PART NUMBER	DESCRIPTION	[UM]	QUANTITY		
				-0010	-0011	-0098
	089-06218-0006	SCR SET 4-40X3/32	[EA]			2
	089-06292-0004	SCR PHP 2-56X1/4	[EA]			4
	089-06293-0003	SCR PHP 3-48X3/16	[EA]			
	089-06414-0004	SCR PHP 2-28X1/4	[EA]			9
	089-06414-0005	SCR PHP 2-28X5/16	[EA]			8
	089-06414-0020	SCREW_ PAN HEAD PLASTITE	[EA]			2
	089-06484-0004	SCR FHP 2-28X1/4	[EA]			4
	089-08003-0034	WSHR SPLT LK #4	[EA]			3
	089-08018-0037	WSHR INTL LK #10	[EA]			1
	089-08023-0030	WSHR FLT STD #2	[EA]	3		
	089-08024-0030	WSHR FLT STD #3	[EA]			1
	089-08074-0030	WSHR FLT STD .106	[EA]			3
	089-08105-0004	WSHR SPR 2.500	[EA]			1
	090-00038-0000	SPRING WSHR .240	[EA]			1
	090-00160-0000	SCKT LAMP INSUL	[EA]			1
	090-00990-0009	CONDUCTIVE DP COVER	[EA]			1
	091-00033-0004	WASHER FLAT .228	[EA]			3
	091-00109-0000	CABLE TIE .234	[AR]			1
	091-00156-0000	BUSHING	[EA]			1
	091-00203-0003	SCR FHS 0-80X.187	[EA]			3
	091-00286-0002	INSUL XSTR .687	[EA]			1
	150-00020-0010	TUBING SHRINK 18G	[IN]			7.2
	187-01060-0001	GSKT LGT WEDGE	[EA]			1
	200-05848-0000	CONVERTER BD #1	[EA]			1
	200-05849-0000	CONVERTER BD #2	[EA]			1
	200-09091-0000	COMP/RELAY BOARD	[EA]			1
DS 101	037-00007-0016	LMP 336 T1-3/4 14	[EA]			1
DS 102	037-00032-0009	LMP 646E T1-1/4 14	[EA]			1
J 2081	030-02227-0001	CONN SMS12R-1	[EA]			
L 102	013-00006-0000	FERR BEAD	[EA]			
L 103	013-00006-0000	FERR BEAD	[EA]			
L 104	013-00006-0000	FERR BEAD	[EA]			
L 105	013-00006-0000	FERR BEAD	[EA]			
L 106	013-00006-0000	FERR BEAD	[EA]			
L 107	013-00006-0000	FERR BEAD	[EA]			
L 108	013-00006-0000	FERR BEAD	[EA]			



**BENDIX/KING**  
**KI 208A/209A**  
**INDICATORS**

SYMBOL	PART NUMBER	DESCRIPTION	[UM]	QUANTITY
				-0010 -0011 -0098
L 109	013-00006-0000	FERR BEAD	[EA]	
L 110	013-00006-0000	FERR BEAD	[EA]	
L 111	013-00006-0000	FERR BEAD	[EA]	
L 112	013-00006-0000	FERR BEAD	[EA]	
M 101	023-00098-0000	MTR FLAG	[EA]	1
M 101	023-00125-0000	MTR ASSY	[EA]	1
M 101	023-00098-0000	MTR FLAG	[EA]	
Q 101	007-00930-0000	XSTR S PNPJJE15029	[EA]	1
R 101	133-00111-0000	RES VA 100M .5W	[EA]	1

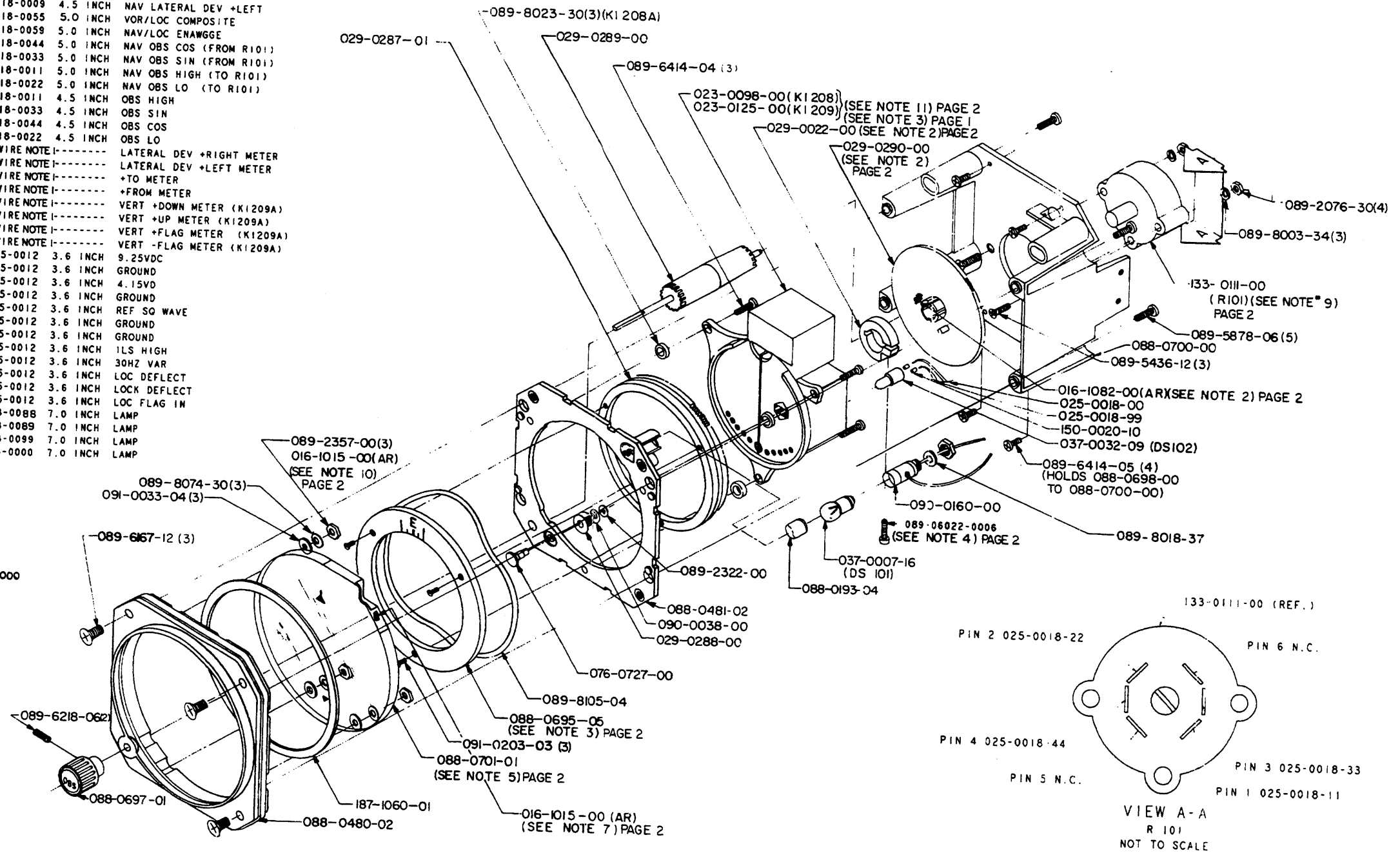
**BENDIX/KING**  
**KI 208A/209A**  
**INDICATORS**

**WIRING INFORMATION**

FROM	TO	DESCRIPTION	PART NUMBER	LENGTH	REMARKS
E401	E324	#22 AWG. RED	025-00003-0002	4.5 INCH	+9.25 VDC
E402	TP8(E301)	#26 GA. BRN	025-00018-0011	5.5 INCH	+9.25 VDC
E403	TP305	#26 AWG GRN/WHT	025-00018-0059	4.5 INCH	+14.5VDC
E404	E320	#26 AWG BRN/WHT	025-00018-0019	4.5 INCH	LIGHTING +14V
E405	E319	#26 AWG ORN/WHT	025-00018-0039	4.5 INCH	LIGHTING 28V
E428	E323	#26 AWG BLK	025-00018-0000	4.5 INCH	GROUND
E406	E316	#26 AWG WHT/RED	025-00018-0092	4.5 INCH	NAV +TO IN
E407	E318	#26 AWG WHT/BLK	025-00018-0090	4.5 INCH	NAV +FROM IN
E408	E315	#26 AWG RED/WHT	025-00018-0029	4.5 INCH	NAV LATERAL DEV +RIGHT
E409	E314	#26 AWG BLK/WHT	025-00018-0009	4.5 INCH	NAV LATERAL DEV +LEFT
E410	E213	#26 AWG GRN	025-00018-0055	5.0 INCH	VOR/LOC COMPOSITE
E411	E214	#26 AWG GRN/WHT	025-00018-0059	5.0 INCH	NAV/LOC ENAWGGE
E412	E215	#26 AWG YEL	025-00018-0044	5.0 INCH	NAV OBS COS (FROM R101)
E413	E217	#26 AWG ORN	025-00018-0033	5.0 INCH	NAV OBS SIN (FROM R101)
E414	E216	#26 AWG BRN	025-00018-0011	5.0 INCH	NAV OBS HIGH (TO R101)
E415	E218	#26 AWG RED	025-00018-0022	5.0 INCH	NAV OBS LO (TO R101)
E418	R101-1	#26 AWG BRN	025-00018-0011	4.5 INCH	OBS HIGH
E417	R101-3	#26 AWG ORN	025-00018-0033	4.5 INCH	OBS SIN
E418	R101-4	#26 AWG YEL	025-00018-0044	4.5 INCH	OBS COS
E419	R101-2	#26 AWG RED	025-00018-0022	4.5 INCH	OBS LO
E424	M101	#26 AWG RED/WHT	METER WIRE NOTE 1		LATERAL DEV +RIGHT METER
E425	M101	#26 AWG BLK/WHT	METER WIRE NOTE 1		LATERAL DEV +LEFT METER
E426	M102	#26 AWG WHT/RED	METER WIRE NOTE 1		+TO METER
E427	M102	#26 AWG WHT/BLK	METER WIRE NOTE 1		+FROM METER
E420	M103	#26 AWG RED/YEL	METER WIRE NOTE 1		VERT +DOWN METER (KI209A)
E421	M103	#26 AWG BLK/YEL	METER WIRE NOTE 1		VERT +UP METER (KI209A)
E422	M104	#26 AWG YEL/RED	METER WIRE NOTE 1		VERT +FLAG METER (KI209A)
E423	M104	#26 AWG YEL/BLK	METER WIRE NOTE 1		VERT -FLAG METER (KI209A)
E301	E201	BRN 28 AWG RIBBON	025-00025-0012	3.6 INCH	9.25VDC
E302	E202	RED 28 AWG RIBBON	025-00025-0012	3.6 INCH	GROUND
E303	E203	ORN 28 AWG RIBBON	025-00025-0012	3.6 INCH	4.15VD
E304	E204	YEL 28 AWG RIBBON	025-00025-0012	3.6 INCH	GROUND
E305	E205	GRN 28 AWG RIBBON	025-00025-0012	3.6 INCH	REF SQ WAVE
E306	E206	BLU 28 AWG RIBBON	025-00025-0012	3.6 INCH	GROUND
E307	E207	VIO 28 AWG RIBBON	025-00025-0012	3.6 INCH	GROUND
E308	E208	GRY 28 AWG RIBBON	025-00025-0012	3.6 INCH	ILS HIGH
E309	E209	WHT 28 AWG RIBBON	025-00025-0012	3.6 INCH	30HZ VAR
E310	E210	BLK 28 AWG RIBBON	025-00025-0012	3.6 INCH	LOC DEFLECT
E311	E211	BRN 28 AWG RIBBON	025-00025-0012	3.6 INCH	LOCK DEFLECT
E312	E212	RED 28 AWG RIBBON	025-00025-0012	3.6 INCH	LOC FLAG IN
DS102	E325	#26 AWG GRAY	025-00018-0088	7.0 INCH	LAMP
DS102	E326	#26 AWG GRAY/WHT	025-00018-0089	7.0 INCH	LAMP
DS101	E317	#26 AWG WHT NOTE 2	025-00018-0099	7.0 INCH	LAMP
DS101	E313	#26 AWG BLK NOTE 2	025-00018-0000	7.0 INCH	LAMP

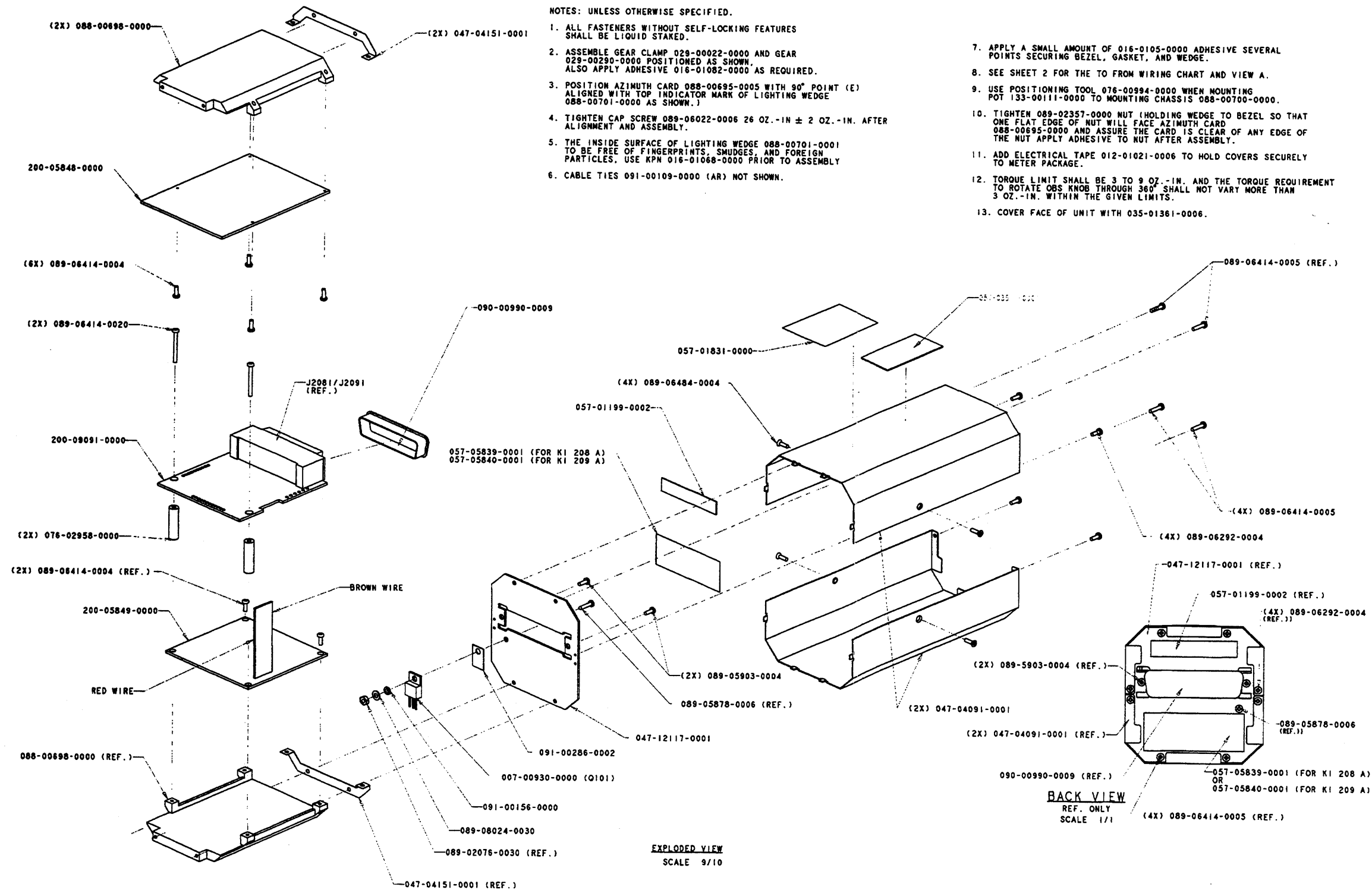
**NOTES**

1. METER WIRE PART OF ASSEMBLY 023-00098-0000 (KI 208A), 023-00125-0000 (KI 209A).
2. PART OF 090-00160-0000.
3. M102 - M104 ARE PART OF M101 ASSEMBLY (023-00098-0000 OR 023-00125-0000)



**FIGURE 6-2 KI208A/209A FINAL ASSEMBLY**  
**(Dwg. No. 300-02030-0010 R-4, Sheet 1 of 2)**

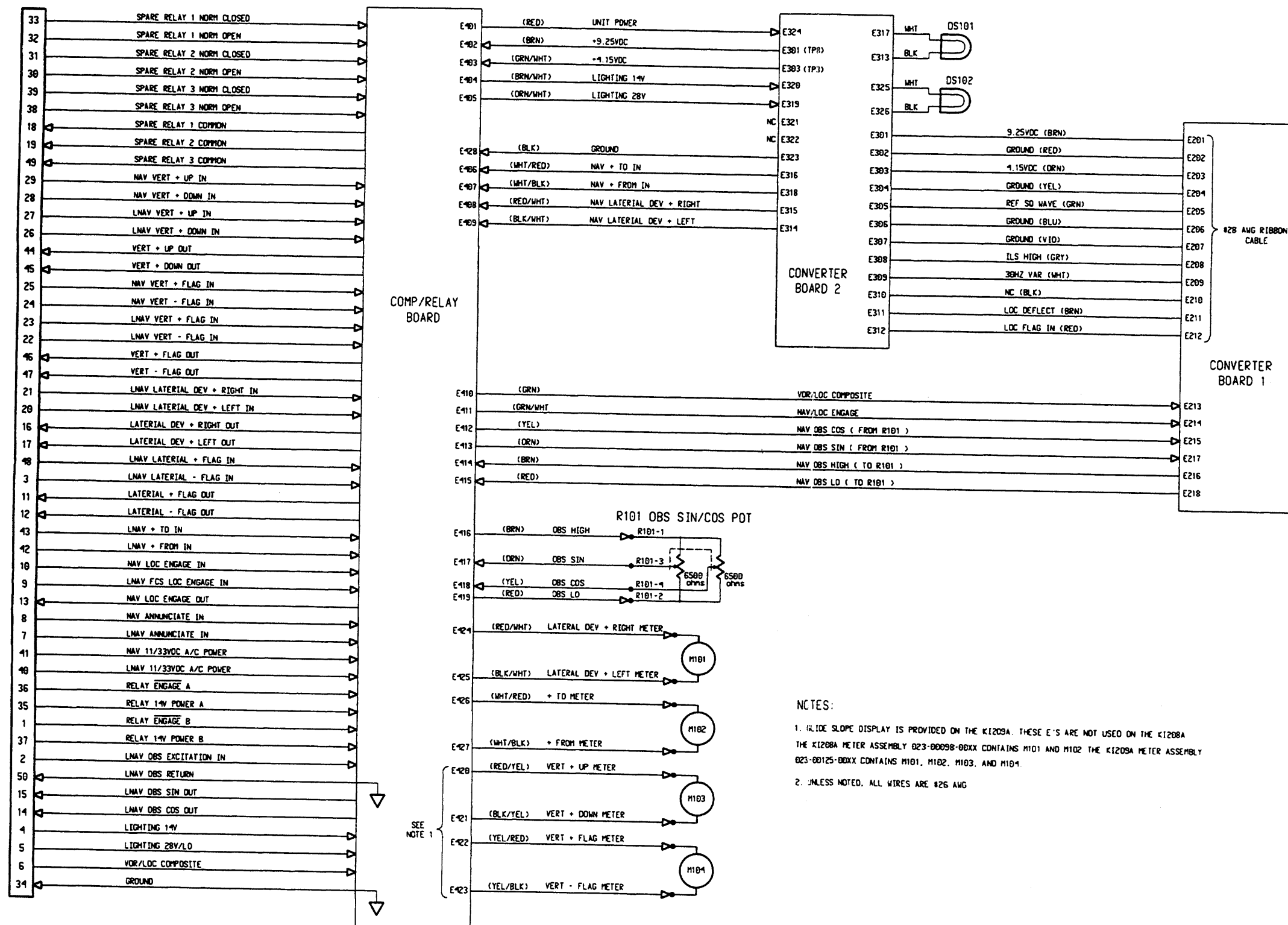
**BENDIX/KING**  
**KI 208A/209A**  
**INDICATORS**



**FIGURE 6-2 KI208A/209A FINAL ASSEMBLY**  
**(Dwg. No. 300-02030-0010 R-4, Sheet 2 of 2)**

**BENDIX/KING**  
**KI 208A/209A**  
**INDICATORS**

J208A/209A



**FIGURE 6-3 KI208A/209A INTERCONNECTION DIAGRAM**  
 (Dwg. No. 002-00438-0004 R-0)

**BENDIX/KING**  
**KI 208A/209A**  
**INDICATORS**

6.3 200-05848-0000 Rev. 28 Converter Bd #1

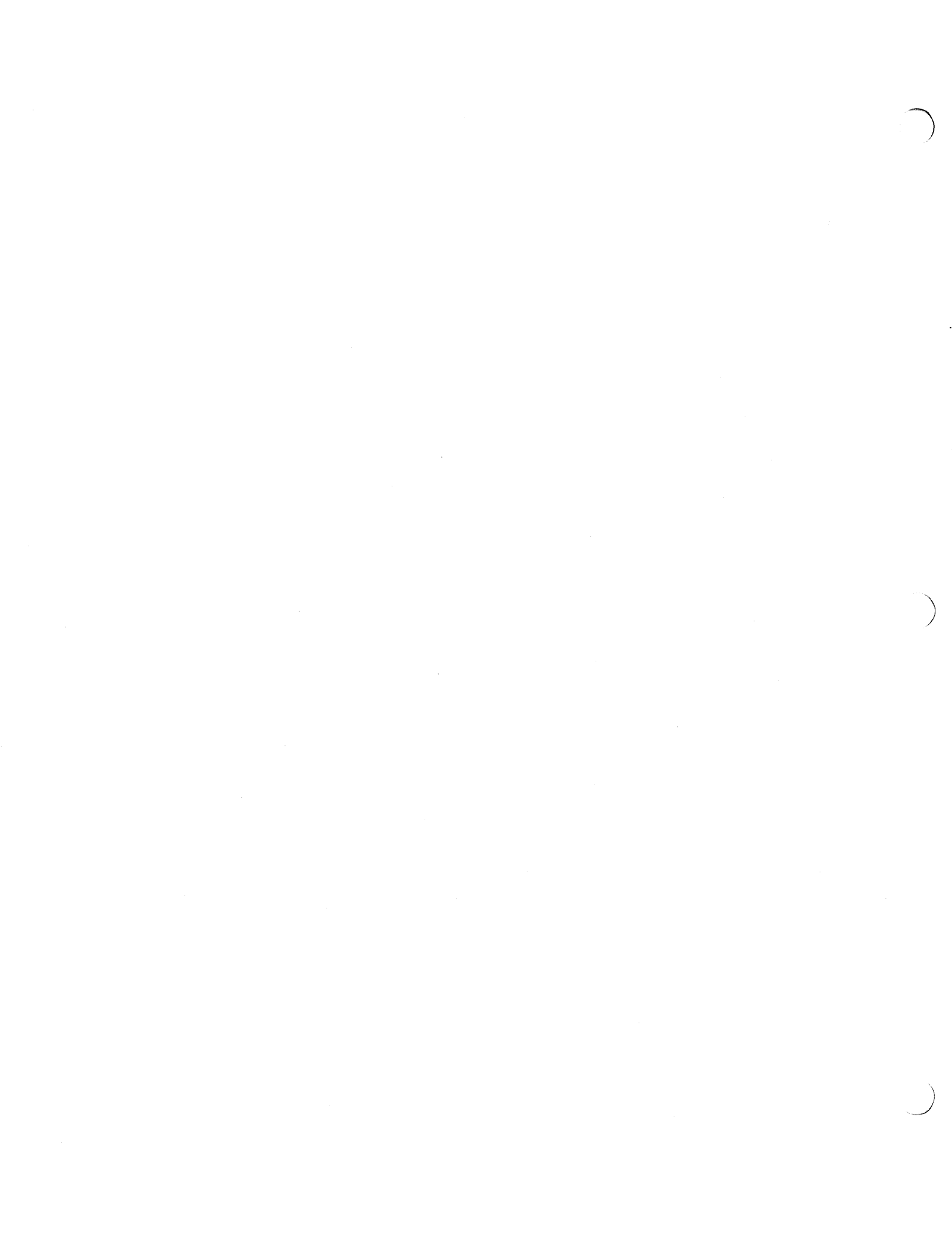
SYMBOL	PART NUMBER	DESCRIPTION	[UM]	QUANTITY
				-0000
	009-05848-0000	PC BD #1 CONV	[EA]	1
	016-01040-0000	COATING TYPE AR	[AR]	1
C 201	096-01014-0000	CAP TN 40UF 10V	[EA]	1
C 203	111-00001-0003	CAP CR .22UF 50V	[EA]	1
C 204	104-00001-0018	CAP SM 2KPF 100V	[EA]	1
C 205	104-00001-0018	CAP SM 2KPF 100V	[EA]	1
C 206	108-06005-0012	CAP TRKG SET/4 1%	[EA]	1
C 207	108-06005-0012	CAP TRKG SET/4 1%	[RF]	0
C 208	108-06005-0012	CAP TRKG SET/4 1%	[RF]	0
C 209	108-06005-0012	CAP TRKG SET/4 1%	[RF]	0
C 210	108-06005-0000	CAP MPC .10UF50V5%	[EA]	1
C 211	096-01014-0000	CAP TN 40UF 10V	[EA]	1
C 212	113-05471-0000	CAP DC 470PF 500V	[EA]	1
C 213	113-03121-0000	CAP DC 120PF 500V	[EA]	1
C 214	118-00015-0000	CAP DC 27PF 500V	[EA]	1
C 215	113-03121-0000	CAP DC 120PF 500V	[EA]	1
C 216	113-03121-0000	CAP DC 120PF 500V	[EA]	1
C 217	113-03121-0000	CAP DC 120PF 500V	[EA]	1
C 219	111-00001-0000	CAP CR .01UF 50V	[EA]	1
CR 202	007-06016-0000	DIO S 1N4154	[EA]	1
CR 203	007-06016-0000	DIO S 1N4154	[EA]	1
CR 204	007-06016-0000	DIO S 1N4154	[EA]	1
CR 205	007-06016-0000	DIO S 1N4154	[EA]	1
CR 206	007-06016-0000	DIO S 1N4154	[EA]	1
CR 207	007-06016-0000	DIO S 1N4154	[EA]	1
CR 208	007-06016-0000	DIO S 1N4154	[EA]	1
CR 209	007-06016-0000	DIO S 1N4154	[EA]	1
I 201	120-06038-0012	SCREENED 02 GREEN	[EA]	1
I 202	120-03052-0005	IC LM224N	[EA]	1
L 201	019-02129-0024	COIL RF 27MH 10%	[EA]	1
Q 201	007-00078-0000	XSTR S NPN 2N3415	[EA]	1
Q 203	007-00238-0000	XSTR S PNP FPN4917	[EA]	1
Q 204	007-00078-0000	XSTR S NPN 2N3415	[EA]	1
Q 205	007-00078-0000	XSTR S NPN 2N3415	[EA]	1
Q 206	007-00078-0000	XSTR S NPN 2N3415	[EA]	1
Q 207	007-00078-0000	XSTR S NPN 2N3415	[EA]	1
Q 208	007-00078-0000	XSTR S NPN 2N3415	[EA]	1

**BENDIX/KING**  
**KI 208A/209A**  
**INDICATORS**

SYMBOL	PART NUMBER	DESCRIPTION	[UM]	QUANTITY
				-0000
Q 209	007-00078-0000	XSTR S NPN 2N3415	[EA]	1
Q 210	007-00187-0000	XSTR S NPN 2N5089	[EA]	1
Q 211	007-00383-0001	XSTR S NPN 2N2222A	[EA]	1
R 201	131-00104-0023	RES CF 100K QW 5%	[EA]	1
R 202	131-00104-0023	RES CF 100K QW 5%	[EA]	1
R 203	133-00113-0015	RES VA 2K 20% B	[EA]	1
R 204	131-00472-0023	RES CF 4.7K QW 5%	[EA]	1
R 205	131-00154-0023	RES CF 150K QW 5%	[EA]	1
R 206	136-06812-0072	RES PF 68.1K QW 1%	[EA]	1
R 207	133-00096-0037	RES VA 200K HW 10%	[EA]	1
R 208	131-00124-0023	RES CF 120K QW 5%	[EA]	1
R 209	136-01003-0072	RES PF 100K QW 1%	[EA]	1
R 210	131-00472-0023	RES CF 4.7K QW 5%	[EA]	1
R 211	131-00122-0023	RES CF 1.2K QW 5%	[EA]	1
R 212	131-00472-0023	RES CF 4.7K QW 5%	[EA]	1
R 213	136-02552-0072	RES PF 25.5K QW 1%	[EA]	1
R 214	131-00472-0023	RES CF 4.7K QW 5%	[EA]	1
R 215	131-00472-0023	RES CF 4.7K QW 5%	[EA]	1
R 216	136-04640-0072	RES PF 464 QW 1%	[EA]	1
R 217	131-00472-0023	RES CF 4.7K QW 5%	[EA]	1
R 218	133-00122-0000	RES VA 200 HW 20%	[EA]	1
R 219	136-07320-0072	RES PF 732 QW 1%	[EA]	1
R 220	136-04222-0072	RES PF 42.2K QW 1%	[EA]	1
R 221	136-08061-0072	RES PF 8.06K QW 1%	[EA]	1
R 222	131-00434-0023	RES CF 430K QW 5%	[EA]	1
R 223	136-04223-0072	RES PF 422K QW 1%	[EA]	1
R 224	131-00623-0023	RES CF 62K QW 5%	[EA]	1
R 225	131-00623-0023	RES CF 62K QW 5%	[EA]	1
R 226	131-00243-0023	RES CF 24K QW 5%	[EA]	1
R 227	133-00122-0003	RES VA 50K HW 20%	[EA]	1
R 228	131-00243-0023	RES CF 24K QW 5%	[EA]	1
R 229	131-00472-0023	RES CF 4.7K QW 5%	[EA]	1
R 230	131-00153-0023	RES CF 15K QW 5%	[EA]	1
R 231	136-06343-0072	RES PF 634K QW 1%	[EA]	1
R 232	136-06191-0072	RES PF 6.19K QW 1%	[EA]	1
R 233	133-00122-0001	RES VA 2K HW 20%	[EA]	1
R 234	131-00274-0023	RES CF 270K QW 5%	[EA]	1
R 235	136-04223-0072	RES PF 422K QW 1%	[EA]	1

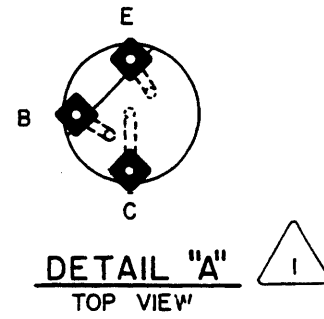
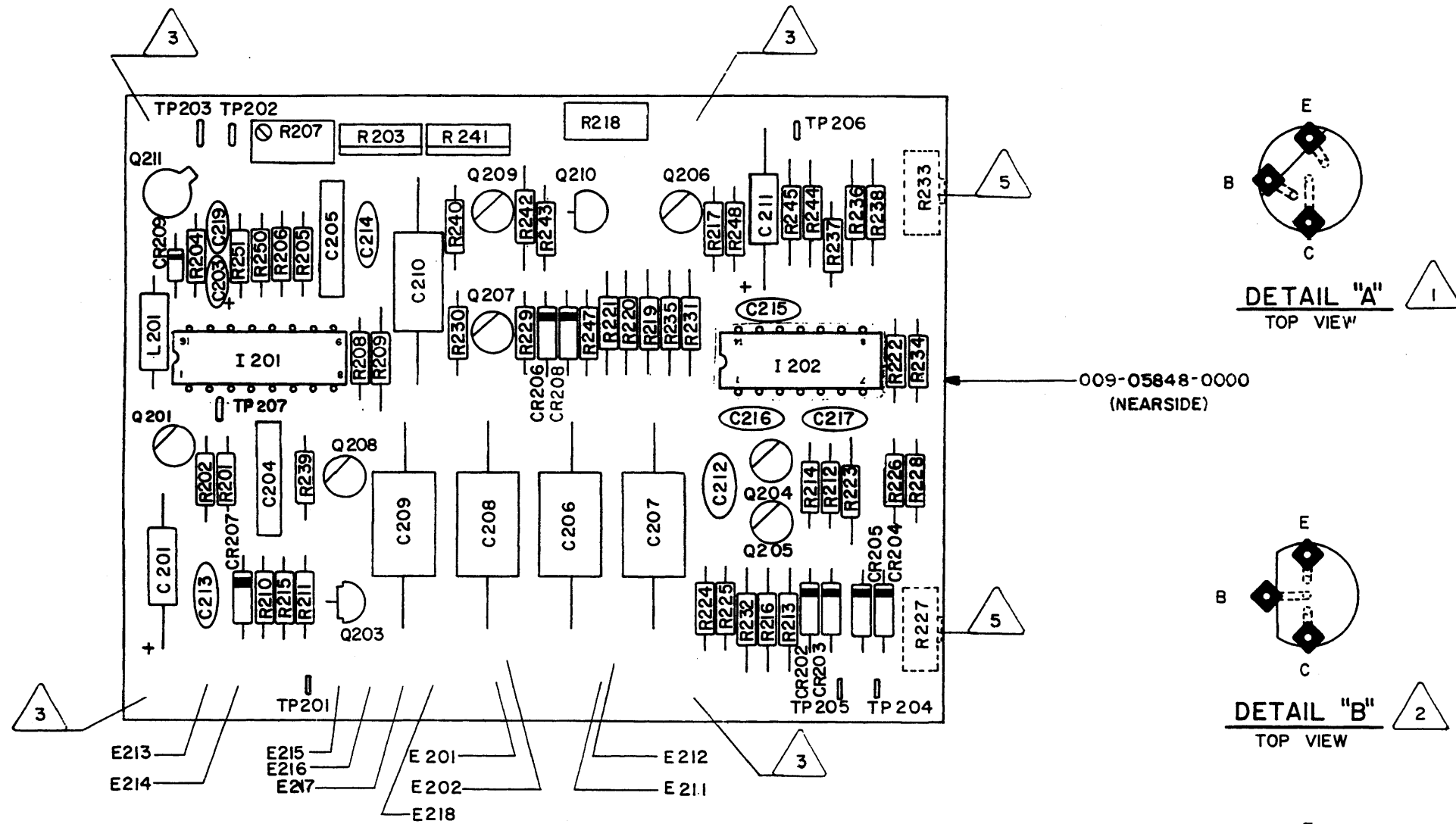
**BENDIX/KING**  
**KI 208A/209A**  
**INDICATORS**

SYMBOL	PART NUMBER	DESCRIPTION	[UM]	QUANTITY
				-0000
R 236	136-01333-0071	RES PF 133K QW .5%	[EA]	1
R 237	131-00683-0023	RES CF 68K QW 5%	[EA]	1
R 238	136-01333-0071	RES PF 133K QW .5%	[EA]	1
R 239	131-00472-0023	RES CF 4.7K QW 5%	[EA]	1
R 240	131-00472-0023	RES CF 4.7K QW 5%	[EA]	1
R 241	133-00113-0019	RES VA 10K 20% B	[EA]	1
R 242	136-04872-0072	RES PF 48.7K QW 1%	[EA]	1
R 243	131-00562-0023	RES CF 5.6K QW 5%	[EA]	1
R 244	136-04992-0072	RES PF 49.9K QW 1%	[EA]	1
R 245	136-05362-0072	RES PF 53.6K QW 1%	[EA]	1
R 247	131-00163-0023	RES CF 16K QW 5%	[EA]	1
R 248	131-00912-0023	RES CF 9.1K QW 5%	[EA]	1
R 250	131-00203-0023	RES CF 20K QW 5%	[EA]	1
R 251	131-00511-0023	RES CF 510 QW 5%	[EA]	1
TP 201	008-00096-0001	TERMINAL TEST PNT	[EA]	1
TP 202	008-00096-0001	TERMINAL TEST PNT	[EA]	1
TP 203	008-00096-0001	TERMINAL TEST PNT	[EA]	1
TP 204	008-00096-0001	TERMINAL TEST PNT	[EA]	1
TP 205	008-00096-0001	TERMINAL TEST PNT	[EA]	1
TP 206	008-00096-0001	TERMINAL TEST PNT	[EA]	1
TP 207	008-00096-0001	TERMINAL TEST PNT	[EA]	1

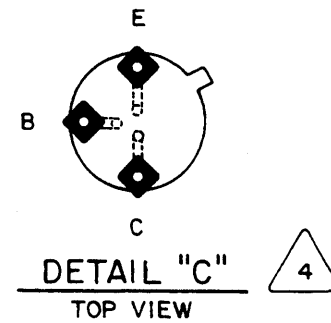
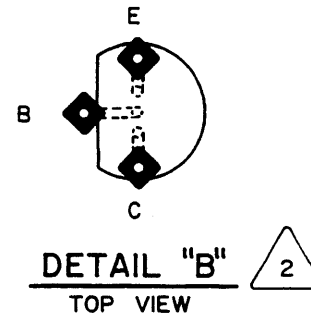




**BENDIX/KING**  
KI 208A/209A  
INDICATORS



009-05848-0000  
(NEAR SIDE)



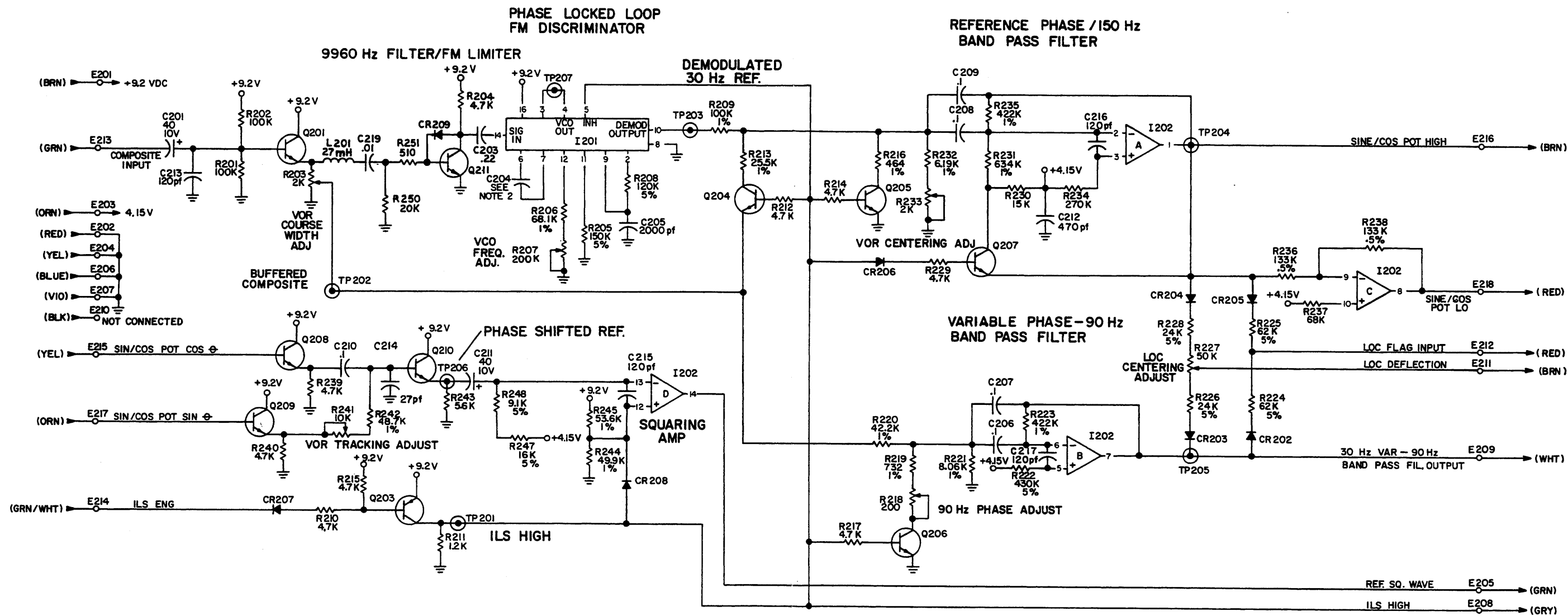
NOTES:

1. TRANSISTORS Q201, Q204, Q205, Q206, Q207, Q208, & Q209, SEE DETAIL "A".
2. TRANSISTORS Q203, & Q210, SEE DETAIL "B".
3. MASK OFF TEST POINTS (7), ALL PADS WITH "E" NO'S (18), R203, R207, R218, R223, R227, R241, & FOUR MOUNTING AREAS, THEN POST COAT BOTH SIDES OF ASSEMBLY WITH CLEAR URETHANE COATING (P/N 016-1040-00).
4. TRANSISTOR Q211, SEE DETAIL "C".
5. POTS R227 AND R233 MOUNT ON FAR SIDE. ADJUSTOR TO FACE AWAY FROM P.C. BOARD.

**FIGURE 6-4 KI208A/209A CONVERTER BOARD #1**  
(Dwg. No. 300-05848-0000 R-12)

REF: B/M 200-05848-XXXX

**BENDIX/KING**  
**KI 208A/209A**  
**INDICATORS**



NOTE: 1. UNLESS NOTED: ALL RESISTANCE VALUES ARE IN OHMS, QW, 10%.  
 ALL CAPACITANCE VALUES ARE IN MICROFARADS (µf).  
 2. USE EITHER 2000pF OR 3300pF FOR C204. SEE I95-00099-0000.

**FIGURE 6-5 KI208A/209A CONVERTER BOARD #1 SCHEMATIC**  
 (Dwg. No. 002-00438-0002 R-14)

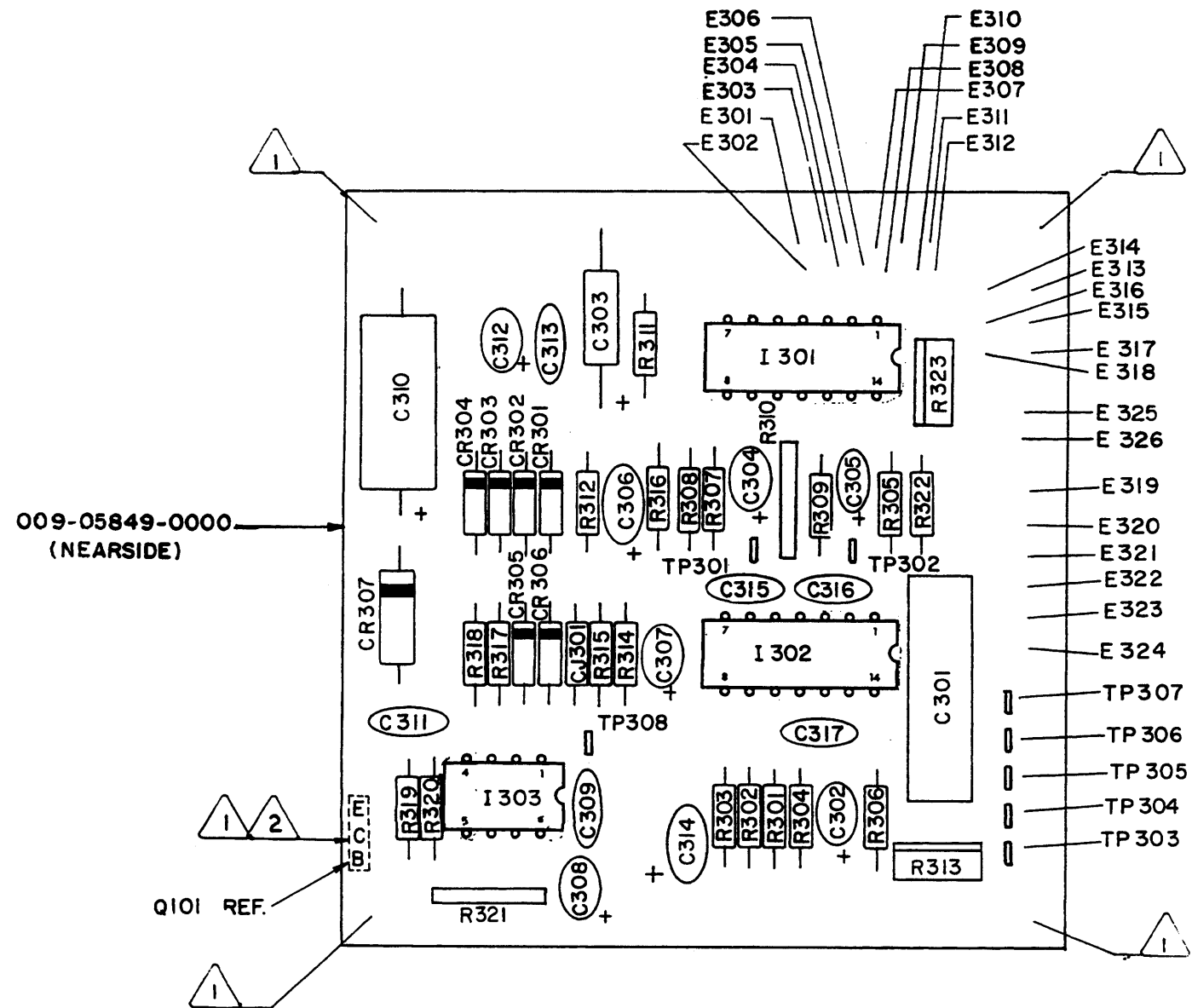
**BENDIX/KING**  
**KI 208A/209A**  
**INDICATORS**

6.4 200-05849-0000 Rev. 21 Converter Bd #2			
SYMBOL	PART NUMBER	DESCRIPTION	[UM] QUANTITY
			-0000
	009-05849-0000	PC BD #2 CONV	[EA] 1
	016-01040-0000	COATING TYPE AR	[AR] 1
C 301	105-00032-0053	CAP MY .15UF5%200V	[EA] 1
C 302	096-01030-0021	CAP TN 12UF20%10V	[EA] 1
C 303	096-01014-0000	CAP TN 40UF 10V	[EA] 1
C 304	096-01030-0011	CAP TN 4.7UF20%20V	[EA] 1
C 305	096-01030-0011	CAP TN 4.7UF20%20V	[EA] 1
C 306	096-01082-0054	CAP TN 15UF 20V	[EA] 1
C 307	096-01030-0034	CAP TN 4.7UF5%20V	[EA] 1
C 308	097-00068-0002	CAP AL 47UF 6.3V	[EA] 1
C 309	109-00007-0000	CAP DC .01UF 25V	[EA] 1
C 310	097-00056-0065	CAP AL 47UF 63V	[EA] 1
C 311	113-05221-0001	CAP DC 220PF 500V	[EA] 1
C 312	096-01030-0011	CAP TN 4.7UF20%20V	[EA] 1
C 313	113-05471-0000	CAP DC 470PF 500V	[EA] 1
C 314	096-01030-0005	CAP TN 10UF 10%20V	[EA] 1
C 315	113-03121-0000	CAP DC 120PF 500V	[EA] 1
C 316	113-03121-0000	CAP DC 120PF 500V	[EA] 1
C 317	113-03121-0000	CAP DC 120PF 500V	[EA] 1
CJ 301	026-00018-0000	WIRE CKTJMPR 22AWG	[EA] 1
CR 301	007-06016-0000	DIO S 1N4154	[EA] 1
CR 302	007-06016-0000	DIO S 1N4154	[EA] 1
CR 303	007-06016-0000	DIO S 1N4154	[EA] 1
CR 304	007-06016-0000	DIO S 1N4154	[EA] 1
CR 305	007-06016-0000	DIO S 1N4154	[EA] 1
CR 306	007-06016-0000	DIO S 1N4154	[EA] 1
CR 307	007-05032-0066	DIO Z 1N5365B	[EA] 1
I 301	120-06083-0001	IC SCL4066BC	[EA] 1
I 302	120-03052-0005	IC LM224N	[EA] 1
I 303	120-03060-0000	IC CA3085AE	[EA] 1
R 301	136-01001-0072	RES PF 1K QW 1%	[EA] 1
R 302	136-01211-0072	RES PF 1.21K QW 1%	[EA] 1
R 303	131-00102-0023	RES CF 1K QW 5%	[EA] 1
R 304	131-00913-0023	RES CF 91K QW 5%	[EA] 1
R 305	131-00753-0023	RES CF 75K QW 5%	[EA] 1
R 306	131-00105-0023	RES CF 1M QW 5%	[EA] 1
R 307	131-00103-0023	RES CF 10K QW 5%	[EA] 1
R 308	131-00333-0023	RES CF 33K QW 5%	[EA] 1

**BENDIX/KING**  
**KI 208A/209A**  
**INDICATORS**

SYMBOL	PART NUMBER	DESCRIPTION	[UM]	QUANTITY
				-0000
R 309	131-00102-0023	RES CF 1K QW 5%	[EA]	1
R 310	133-00113-0025	RES VA 100K 20% B	[EA]	1
R 311	131-00103-0023	RES CF 10K QW 5%	[EA]	1
R 312	131-00104-0023	RES CF 100K QW 5%	[EA]	1
R 313	133-00113-0027	RES VA 200K 20% B	[EA]	1
R 314	131-00104-0023	RES CF 100K QW 5%	[EA]	1
R 315	131-00102-0023	RES CF 1K QW 5%	[EA]	1
R 316	131-00103-0023	RES CF 10K QW 5%	[EA]	1
R 317	131-00220-0023	RES CF 22 QW 5%	[EA]	1
R 318	131-00103-0023	RES CF 10K QW 5%	[EA]	1
R 319	131-00162-0023	RES CF 1.6K QW 5%	[EA]	1
R 320	131-00271-0023	RES CF 270 QW 5%	[EA]	1
R 321	133-00113-0009	RES VA 200 20% B	[EA]	1
R 322	131-00103-0023	RES CF 10K QW 5%	[EA]	1
R 323	133-00113-0027	RES VA 200K 20% B	[EA]	1
TP 301	008-00096-0001	TERMINAL TEST PNT	[EA]	1
TP 302	008-00096-0001	TERMINAL TEST PNT	[EA]	1
TP 303	008-00096-0001	TERMINAL TEST PNT	[EA]	1
TP 304	008-00096-0001	TERMINAL TEST PNT	[EA]	1
TP 305	008-00096-0001	TERMINAL TEST PNT	[EA]	1
TP 306	008-00096-0001	TERMINAL TEST PNT	[EA]	1
TP 307	008-00096-0001	TERMINAL TEST PNT	[EA]	1
TP 308	008-00096-0001	TERMINAL TEST PNT	[EA]	1

**BENDIX/KING**  
KI 208A/209A  
INDICATORS



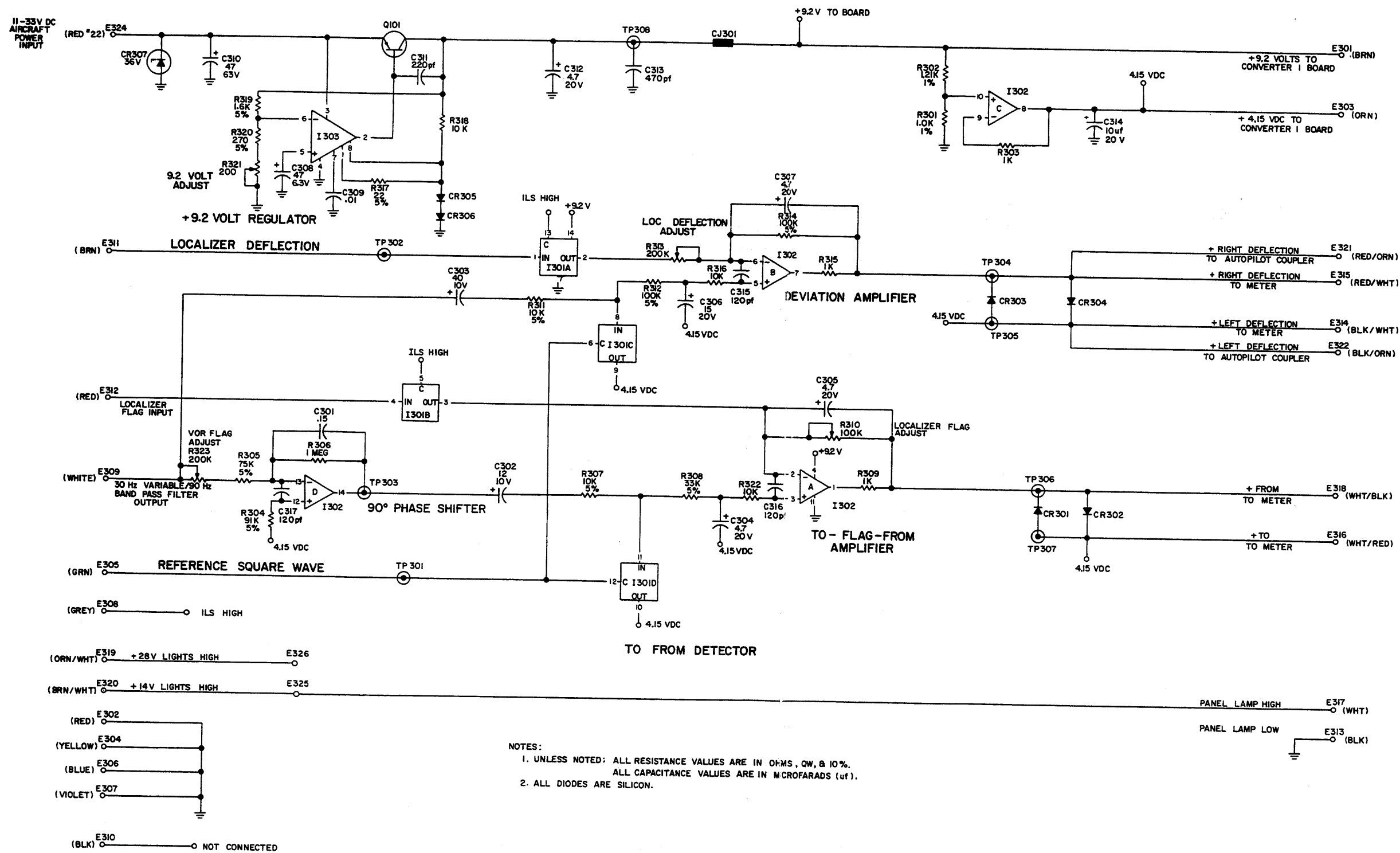
NOTES:

1. MASK OFF TEST POINTS (8), ALL PADS WITH "E" NO'S (26), R310, R323, R321, R313, PADS IN DASHED AREA, & FOUR MOUNTING AREAS, THEN POST COAT BOTH SIDES OF ASSEMBLY WITH (P/N 016-1040-00).
2. Q101 IS ON FINAL ASSEMBLY.

REF: B/M 200-5849-XX

**FIGURE 6-6 KI208A/209A CONVERTER BOARD #2**  
(Dwg. No. 300-05849-0000 R-10)

**BENDIX/KING**  
KI 208A/209A  
INDICATORS



**FIGURE 6-7 KI208A/209A CONVERTER BOARD #2 SCHEMATIC**  
(Dwg. No. 002-00438-0003 R-10)

**BENDIX/KING**  
**KI 208A/209A**  
**INDICATORS**

6.5		200-09091-0000	Rev. 0	Comp/Relay Bd.		
SYMBOL	PART NUMBER	DESCRIPTION	[UM]	QUANTITY		
						-0000
	009-09091-0000	COMP / RELAY BOARD	[EA]	1		
C 401	096-01186-0014	CAP 10.0UF 16V 10%	[EA]	1		
C 402	106-04104-0047	CH 100KX7R/50V	[EA]	1		
C 403	096-01186-0014	CAP 10.0UF 16V 10%	[EA]	1		
C 404	096-01186-0014	CAP 10.0UF 16V 10%	[EA]	1		
C 405	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 406	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 407	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 408	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 409	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 410	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 411	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 412	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 413	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 414	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 415	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 416	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 417	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 418	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 419	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 420	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 421	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 422	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 423	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 424	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 425	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 426	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 427	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 428	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 429	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 430	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 431	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 432	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 433	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 434	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 435	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 436	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		
C 437	106-05221-0026	CAP CH220PFNPO/100	[EA]	1		

**BENDIX/KING**  
**KI 208A/209A**  
**INDICATORS**

SYMBOL	PART NUMBER	DESCRIPTION	[UM]	QUANTITY
				-0000
C 438	106-05221-0026	CAP CH220PFNPO/100	[EA]	1
C 439	106-05221-0026	CAP CH220PFNPO/100	[EA]	1
C 440	106-05221-0026	CAP CH220PFNPO/100	[EA]	1
C 441	106-05221-0026	CAP CH220PFNPO/100	[EA]	1
C 442	106-05221-0026	CAP CH220PFNPO/100	[EA]	1
C 443	106-05221-0026	CAP CH220PFNPO/100	[EA]	1
C 444	106-05221-0026	CAP CH220PFNPO/100	[EA]	1
C 445	106-05221-0026	CAP CH220PFNPO/100	[EA]	1
C 446	106-05221-0026	CAP CH220PFNPO/100	[EA]	1
C 447	106-05221-0026	CAP CH220PFNPO/100	[EA]	1
C 448	106-05221-0026	CAP CH220PFNPO/100	[EA]	1
C 449	106-05221-0026	CAP CH220PFNPO/100	[EA]	1
C 450	106-05221-0026	CAP CH220PFNPO/100	[EA]	1
C 451	106-05221-0026	CAP CH220PFNPO/100	[EA]	1
C 452	106-05221-0026	CAP CH220PFNPO/100	[EA]	1
C 453	106-05221-0026	CAP CH220PFNPO/100	[EA]	1
CR 401	007-06180-0000	DIO SW MMBD6050	[EA]	1
CR 402	007-06180-0000	DIO SW MMBD6050	[EA]	1
CR 403	007-06180-0000	DIO SW MMBD6050	[EA]	1
CR 404	007-06180-0000	DIO SW MMBD6050	[EA]	1
CR 405	007-06180-0000	DIO SW MMBD6050	[EA]	1
CR 406	007-06180-0000	DIO SW MMBD6050	[EA]	1
CR 407	007-06180-0000	DIO SW MMBD6050	[EA]	1
CR 408	007-06180-0000	DIO SW MMBD6050	[EA]	1
CR 409	007-06180-0000	DIO SW MMBD6050	[EA]	1
CR 410	007-06180-0000	DIO SW MMBD6050	[EA]	1
CR 411	007-06180-0000	DIO SW MMBD6050	[EA]	1
I 401	120-03196-0000	IC LM2902D	[EA]	1
I 402	120-03127-0011	IC LM2903 SO PKG	[EA]	1
J 608A	030-03322-0001	50P MALE D SUB W/ FERRITE	[EA]	1
K 401	032-00156-0001	RELAY 12VDC DPDT SMD	[EA]	1
K 402	032-00156-0001	RELAY 12VDC DPDT SMD	[EA]	1
K 403	032-00156-0001	RELAY 12VDC DPDT SMD	[EA]	1
K 404	032-00156-0001	RELAY 12VDC DPDT SMD	[EA]	1
K 405	032-00156-0001	RELAY 12VDC DPDT SMD	[EA]	1
K 406	032-00156-0001	RELAY 12VDC DPDT SMD	[EA]	1
K 407	032-00156-0001	RELAY 12VDC DPDT SMD	[EA]	1
K 408	032-00156-0001	RELAY 12VDC DPDT SMD	[EA]	1



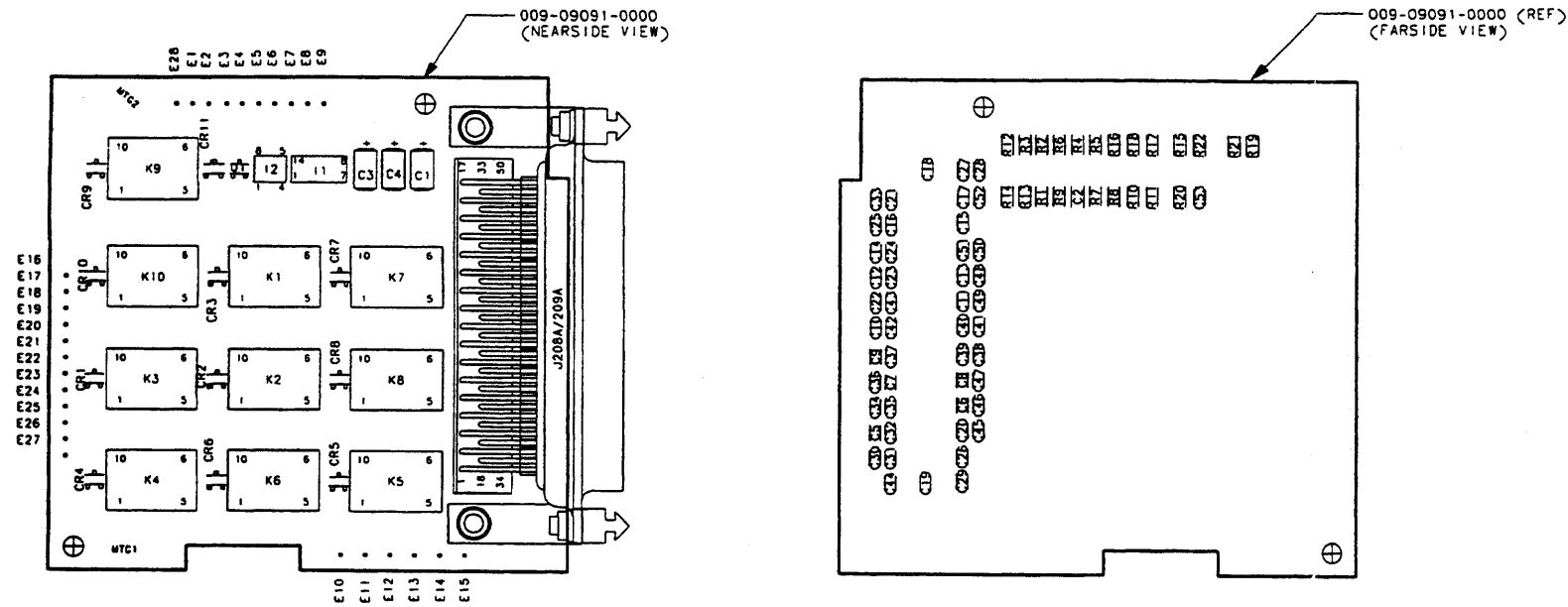
**BENDIX/KING**  
**KI 208A/209A**  
**INDICATORS**

SYMBOL	PART NUMBER	DESCRIPTION	[UM]	QUANTITY
				-0000
K 409	032-00156-0001	RELAY 12VDC DPDT SMD	[EA]	1
K 410	032-00156-0001	RELAY 12VDC DPDT SMD	[EA]	1
Q 401	007-00065-0001	XSTR 2N3906 (SOT)	[EA]	1
R 401	139-01002-0000	RES CHIP 10K EW 1%	[EA]	1
R 402	139-01002-0000	RES CHIP 10K EW 1%	[EA]	1
R 403	139-01002-0000	RES CHIP 10K EW 1%	[EA]	1
R 404	139-01003-0003	RES CH 100K EW .1%	[EA]	1
R 405	139-01003-0003	RES CH 100K EW .1%	[EA]	1
R 406	139-04992-0000	RES CH 49.9K EW 1%	[EA]	1
R 407	139-02002-0000	RES CHIP 20.0KEW1%	[EA]	1
R 408	139-02740-0000	RES CH 274 EW 1%	[EA]	1
R 409	139-01001-0003	RES CH 1K EW 1%	[EA]	1
R 410	139-01003-0003	RES CH 100K EW .1%	[EA]	1
R 411	139-02002-0000	RES CHIP 20.0KEW1%	[EA]	1
R 412	139-01003-0003	RES CH 100K EW .1%	[EA]	1
R 413	139-02740-0000	RES CH 274 EW 1%	[EA]	1
R 414	139-01001-0003	RES CH 1K EW 1%	[EA]	1
R 415	139-02212-0000	RES CHIP 22.1KEW1%	[EA]	1
R 416	139-06040-0000	RES CHIP 604 EW 1%	[EA]	1
R 417	139-06040-0000	RES CHIP 604 EW 1%	[EA]	1
R 418	139-04642-0000	RES CHIP 46.4KEW1%	[EA]	1
R 419	139-01002-0000	RES CHIP 10K EW 1%	[EA]	1
R 420	139-01002-0000	RES CHIP 10K EW 1%	[EA]	1
R 421	139-01001-0000	RES CHIP 1K EW 1%	[EA]	1
R 422	139-01501-0000	RES CH 1.5K EW 1%	[EA]	1



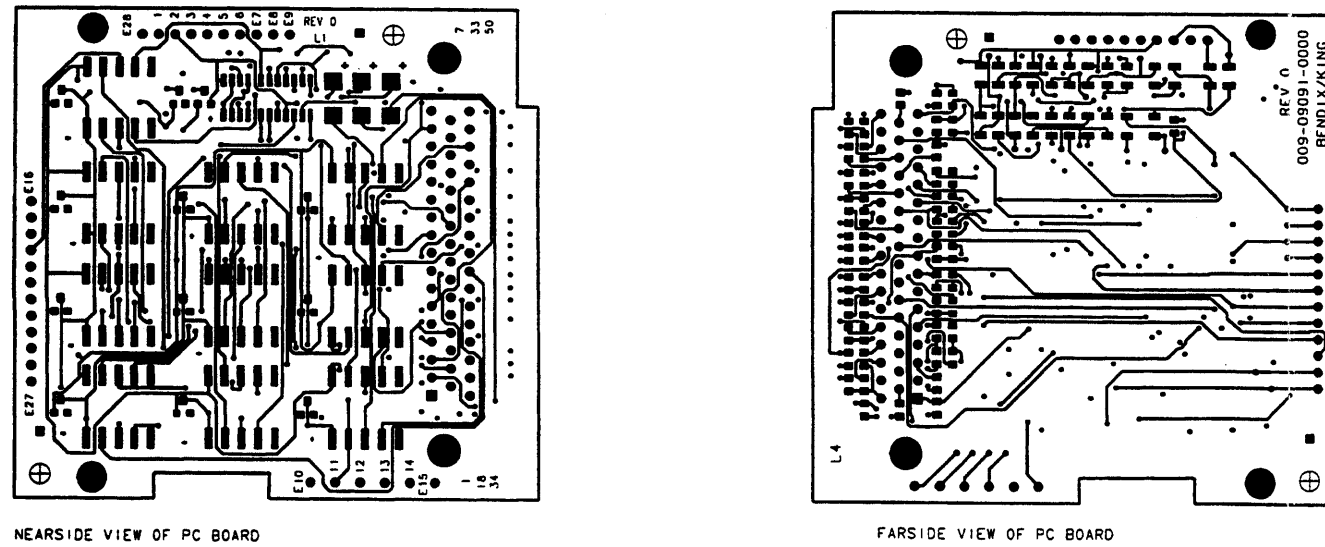
**BENDIX/KING**  
**KI 208A/209A**  
**INDICATORS**

NOTE: ADD 400 TO ALL REFERENCE DESIGNATORS, EXCEPT J208A/209A.

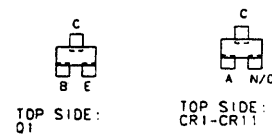


NOTES:

1. POST COATING NOT REQUIRED.
2. PRINTED CIRCUIT ASSEMBLY IDENTIFICATION MUST BE IN ACCORDANCE WITH SPEC. 001-01101-0000.
3. LIQUID STAKE ALL FASTENERS PER SPEC. 001-01080-0000



THIS DRAWING IS NOT COMPLETE WITHOUT PARTS LIST 200-09091-0000

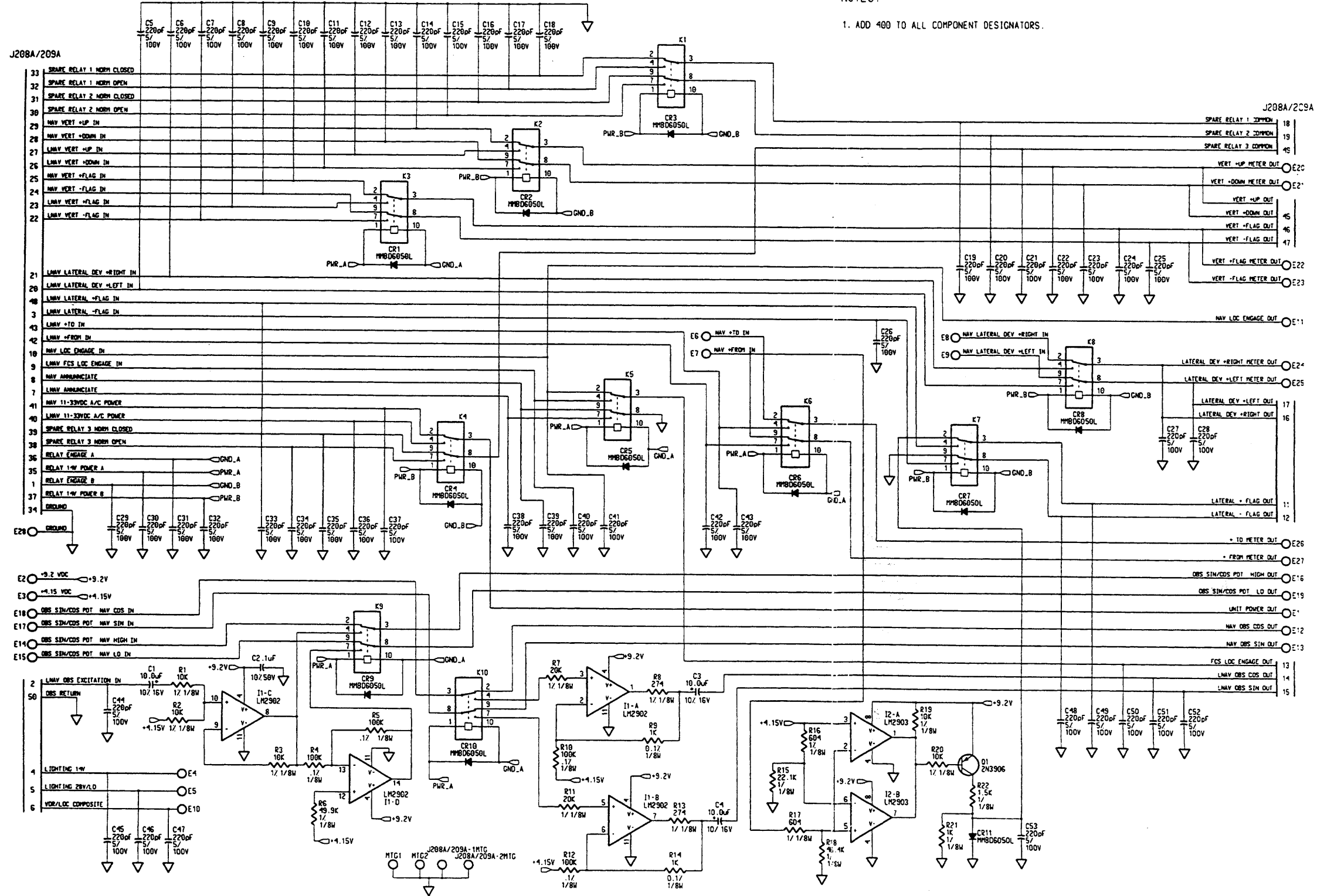


**FIGURE 6-8 KI208A/209A COMP/RELAY BOARD**  
**(Dwg. No. 300-09091-0000 R-0)**

**BENDIX/KING**  
**KI 208A/209A**  
**INDICATORS**

NOTES:

1. ADD 400 TO ALL COMPONENT DESIGNATORS.



**FIGURE 6-9 KI208A/209A COMP/RELAY BOARD SCHEMATIC**  
 (Dwg. No. 002-09091-0000 R-0)