AlliedSignal

ELECTRONIC AND AVIONICS SYSTEMS

# MAINTENANCE MANUAL

BENDIX/KING®

# KR 86

## AUTOMATIC DIRECTION FINDER

MANUAL NUMBER 006-05084-0001
REVISION 1 NOVEMBER, 1993

## WARNING

Information subject to the export control laws. This document, which includes any attachments and exhibits hereto, contains information subject to International Traffic in Arms Regulation (ITAR) or Export Administration Regulation (EAR) of 1979, which may not be exported, released or disclosed to foreign nationals inside or outside the U.S. without first obtaining an export license. Violators of ITAR or EAR may be subject to a penalty of 10 years imprisonment and a fine of $1,000,000 under 22 U.S.C. 2778 or Section 2410 of the Export Administration Act or 1979. Include this notice with any reproduced portion of this document.

## Comment Card

**Part Number/Revision:** ____________________

**Name:** ____________________

**Company:** ____________________

**Street Address:** ____________________

**City, State/Zip or Country:** ____________________

**Comments:** ____________________

____________________

____________________

____________________

____________________

## Subscription Card

Please complete and return this card to AlliedSignal, Inc., Technical Publications Department, to receive revisions for this publication.

**Publication Title:** ____________________

**Company:** ____________________

**Attn:** ____________________

**Street Address:** ____________________

**City, State:** ____________________

**Zip Code:** ____________________

**Country:** ____________________

NO POSTAGE
NECESSARY IF
MAILED IN THE
UNITED STATES

# BUSINESS REPLY MAIL

First Class Mail, Permit No. 121, Olathe, KS

POSTAGE WILL BE PAID BY THE ADDRESSEE

AlliedSignal, Inc.
Electronic and Avionics Systems
Attn:Technical Publications
P.O. Box 1950
Olathe, Kansas 66051-9930

NO POSTAGE
NECESSARY IF
MAILED IN THE
UNITED STATES

BUSINESS REPLY MAIL

First Class Mail, Permit No. 121, Olathe, KS

POSTAGE WILL BE PAID BY THE ADDRESSEE

AlliedSignal, Inc.
Electronic and Avionics Systems
Attn:Technical Publications
P.O. Box 1950
Olathe, Kansas 66051-9930

## AlliedSignal General Aviation Avionics

BENDIX/KING KR 86
AUTOMATIC DIRECTION FINDER

REVISION HISTORY AND INSTRUCTIONS

MANUAL: KR 86 Maintenance Manual
REVISION: 1, November, 1993
PART NUMBER: 006-05084-0001

Add, delete, or replace pages as indicated below and retain all tabs and dividers. Insert this page immediately behind the title page as a record of revisions.

| PAGE | ACTION |
|---|---|
| KR 86 MM Title Page | Remove and Replace |
| KR 86 Revision History | Insert Behind Title Page |
| KR 86 Installation Manual | Remove and Replace |

INSTALLATION MANUAL
SECTIONS I, II AND III

Sections I, II, and III have been deleted from the Maintenance-Overhaul Manual format. The Installation Manual, which covers the same information, should be placed behind this tab to complete your technical library for each unit. It is recommended that the entire Installation Manual be removed and replaced when a revision is issued. The revision number and date of revision are printed on each Installation Manual cover page

KPN 006-3001-01

AlliedSignal

ELECTRONIC AND AVIONICS SYSTEMS

# INSTALLATION MANUAL

# BENDIX/KING®

# KR 86

## AUTOMATIC DIRECTION FINDER

MANUAL NUMBER 006-00084-0004
REVISION 4 NOVEMBER, 1993

## WARNING

Information subject to the export control laws. This document, which includes any attachments and exhibits hereto, contains information subject to International Traffic in Arms Regulation (ITAR) or Export Administration Regulation (EAR) of 1979, which may not be exported, released or disclosed to foreign nationals inside or outside the U.S. without first obtaining an export license. Violators of ITAR or EAR may be subject to a penalty of 10 years imprisonment and a fine of $1,000,000 under 22 U.S.C. 2778 or Section 2410 of the Export Administration Act or 1979. Include this notice with any reproduced portion of this document.

# SECTION I
# GENERAL INFORMATION



# SECTION II
# INSTALLATION



# SECTION III
# OPERATION



# LIST OF ILLUSTRATIONS

# SECTION I
# GENERAL INFORMATION

## 1.1 INTRODUCTION

This manual contains information relative to the physical, mechanical, and electrical characteristics of the BENDIX/KING KR 86. Installation and operating procedures are also included. Information relative to the maintenance, alignment, and procurement of replacement parts may be found in the KR 86 Maintenance Manual, KPN 006-05084-0000.

## 1.2 DESCRIPTION OF EQUIPMENT

The KR 86 Automatic Direction Finder is a digitally tuned solid state receiver which provides an aural reception and bearing information capability within the frequency range of 200 KHz to 1750 KHz. The digitally selected channels may be selected in 1 KHz increments. Each channel is crystal controlled by a slaved master oscillator which employs capacitance-variable silicon diodes. The extensive use of Integrated Circuits in the digital circuitry has been primarily responsible for the ease and speed with which this receiver can be tuned. Tuning speed is typically 0.1 second from the time that a frequency is selected.

## 1.3 TECHNICAL CHARACTERISTICS

1.3.1 KR 86 Automatic Direction Finder

| SPECIFICATION | CHARACTERISTIC |
|---|---|
| APPLICABLE DOCUMENT: | FAA Minimum Operation Characteristics (MOC) RTCA Document DO-137. |
| PHYSICAL DIMENSIONS: (Inc. mounting racks) | |
| Depth (Behind Panel): | 9.05 inches (22.987 cm) |
| Width: | 6.25 inches (15.875 cm) |
| Height: | 2.60 inches ( 6.604 cm) |
| WEIGHT: | 3.1 lbs. without rack or connector (1.4 Kg)<br>3.9 lbs. with rack and connector (1.8 Kg) |
| DESIGN: | All solid state. Convection and radiation cooled. |
| ENVIRONMENTAL SPECIFICATIONS: | |
| Temperature: | -15°C to 55°C for continuous operation. |
| Altitude: | Up to 30,000 feet. |
| Humidity: | 95% - 100% R.H. at 50°C for 48 hours. |
| POWER REQUIREMENTS: | 13.75 VDC at 0.5 amps (ADF Mode) 0.35 amps (ANT Mode) |
| PANEL LAMP REQUIREMENTS: | 0.16 amps |
| FREQUENCY RANGE: | 200 KHz to 1750 KHz<br>Receiver employs digital tuning with 1 KHz channel spacing. All channels are crystal controlled. |
| RECEIVER SENSITIVITY: | |
| ADF Mode: | 100 uv/m maximum for s+n/n = 6 dB (AlliedSignal KA 42 Loop Antenna used) |
| Aural Receiver Mode: | 70 uv/m maximum for s+n/n = 6 dB (Sense Antenna with $H_e$ = .25m) |
| RECEIVER SELECTIVITY: | 6 dB bandwidth: ±1.0 KHz minimum<br>55 dB band width: ±6 KHz maximum |

| | |
|---|---|
| IMAGE REJECTION: | 200 KHz --- 80 dB Typical<br>400 KHz --- 70 dB Typical<br>800 KHz --- 60 dB Typical<br>1750 KHz --- 45 dB Typical |
| ADF BEARING ACCURACY: | +3° from 70 uv to 0.5 v/m rf input signal level . |
| ADF INDICATOR SPEED: | 6 seconds typical with indicator 175° off bearing and 70 uv/m to 0.5 v/m rf input signal level. |
| AUDIO OUTPUT: | |
| Frequency Response: | 350 Hz to 1400 Hz for 9 dB maximum variation. |
| Power Output: | 50 mw across 500 ohm load.<br>(500 ohm nominal source impedance). |

1.3.2 KA 42B Sense and Loop Antenna

| SPECIFICATION | CHARACTERISTIC |
|---|---|
| SENSE ANTENNA EFFECTIVE HEIGHT: | $H_E$ = .25M |
| PHYSICAL DIMENSIONS: (Inc. mounting racks) | |
| Length: | 11.6 inches (29.46 cm) |
| Width: | 6.0 inches (15.24 cm) |
| Height: | 1.87 inches (4.75 cm) |
| WEIGHT: | 2.4 lbs. (1.09 Kg) |
| SENSE ANTENNA SENSITIVITY: | Minimum 9 dB s+n/n for 70 uv/m field strength |
| POWER REQUIREMENTS: | Power supplied from KR 86 through sense cable. |

## 1.4 UNITS AND ACCESSORIES SUPPLIED

1.4.1 ADF Units And Antennas

The KR 86 ADF System is comprised of the KR 86 ADF Receiver, the KA 42 or KA 42A Loop Antenna, and a Wire or Whip Sense Antenna or KR 86 ADF Receiver and KA 42B Combination Sense and Loop Antenna. Part numbers are listed as follows:

066-1038-00 Standard KR 86 ADF Unit

066-1038-10 Crown Series KR 86 ADF Unit

071-1006-11 KA 42 Loop Antenna

071-1098-00 KA 42A Loop Antenna

071-1133-00 KA 42B Sense and Loop Antenna

1.4.2 KR 86 Installation Kit

The KR 86 Installation Kit, 050-01308-0000/0019 is shipped together with the system and includes the necessary unit connectors, cables and antennas. The KR 86 mounting rack is comprised of two sections, the basic mounting rack P/N 047-02510-0001 shipped with the KR 86 ADF and the rack rear cable plate which is shipped with the installation kit. A detailed listing of the items contained in each version of the kit is shown on the following pages.

<u>NOTE</u>: On versions using the KA 42A or KA 42B antennas, a 6-32X 2 1/2" screw (P/N 089-05907-0040) is supplied as part of the 155-02057-00XX cable assembly to attach the loop cable to the antenna. As it is included in the cable assembly, it is not listed individually in the parts lists that follow.

# AlliedSignal General Aviation Avionics

## BENDIX/KING KR 86
## AUTOMATIC DIRECTION FINDER

## INSTALLATION KITS P/N 050-01308-00XX

VERSION DESCRIPTION

| PART NUMBER | ANTENNA CONFIGURATION | VOLTAGE |
|---|---|---|
| 050-01308-0000 | 15' LOOP WITH WIRE SENSE | 14V |
| 050-01308-0001 | 15' LOOP WITH WHIP SENSE | 14V |
| 050-01308-0002 | 15' LOOP WITH WIRE SENSE | 28V |
| 050-01308-0003 | 15' LOOP WITH WHIP SENSE | 28V |
| 050-01308-0004 | 24' LOOP WITH WIRE SENSE | 14V |
| 050-01308-0005 | 24' LOOP WITH WHIP SENSE | 14V |
| 050-01308-0006 | 24' LOOP WITH WIRE SENSE | 28V |
| 050-01308-0007 | 24' LOOP WITH WHIP SENSE | 28V |
| 050-01308-0008 | 15' LOOP WITH WIRE SENSE | 14V |
| 050-01308-0009 | 15' LOOP WITH WHIP SENSE | 14V |
| 050-01308-0010 | 15' LOOP WITH WIRE SENSE | 28V |
| 050-01308-0011 | 15' LOOP WITH WHIP SENSE | 28V |
| 050-01308-0012 | 24' LOOP WITH WIRE SENSE | 14V |
| 050-01308-0013 | 24' LOOP WITH WHIP SENSE | 14V |
| 050-01308-0014 | 24' LOOP WITH WIRE SENSE | 28V |
| 050-01308-0015 | 24' LOOP WITH WHIP SENSE | 28V |
| 050-01308-0016 | 15' COMBINATION (KA 42B) | 14V |
| 050-01308-0017 | 15' COMBINATION (KA 42B) | 14V |
| 050-01308-0018 | 24' COMBINATION (KA 42B) | 14V |
| 050-01308-0019 | 24' COMBINATION (KA 42B) | 28V |

050-01308-0000/0006 PARTS LISTS

| PART NUMBER | DESCRIPTION | UM | 0000 | 0001 | 0002 | 0003 | 0004 | 0005 | 0006 |
|---|---|---|---|---|---|---|---|---|---|
| 030-01046-0008 | CONN 8 CONT | EA | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 047-01211-0003 | MTG PLT BCKUP | EA | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 047-02686-0002 | SHIELD W/TAPE | EA | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 050-01300-0000 | WIRE SENSE ANT KIT | EA | 1.00 | X | 1.00 | X | 1.00 | X | 1.00 |
| 071-01006-0011 | KA 42 ANTENNA | EA | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 071-01009-0000 | WHIP ANTENNA | EA | X | 1.00 | X | 1.00 | X | 1.00 | X |
| 089-05534-0020 | SCR FLHP 1/4-28 | EA | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| 089-05899-0003 | SCR PHP 2-56X3/16 | EA | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| 091-00128-0001 | STRAP CA SST1.5I | EA | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 155-02034-0000 | SENSE CABLE | EA | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 155-02035-0000 | LOOP CABLE | EA | 1.00 | 1.00 | 1.00 | 1.00 | X | X | X |
| 155-02035-0001 | LOOP CABLE | EA | X | X | X | X | 1.00 | 1.00 | 1.00 |
| 187-01052-0000 | GSKT RUBBER | EA | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 200-00523-0000 | RACK CABLE PLATE | EA | 1.00 | 1.00 | X | X | 1.00 | 1.00 | X |
| 200-00523-0001 | RACK CABLE PLATE | EA | X | X | 1.00 | 1.00 | X | X | 1.00 |

### 050-01308-0007/0013 PARTS LISTS

| PART NUMBER | DESCRIPTION | UM | 0007 | 0008 | 0009 | 0010 | 0011 | 0012 | 0013 |
|---|---|---|---|---|---|---|---|---|---|
| 030-01046-0008 | CONN 8 CONT | EA | 1.00 | X | X | X | X | X | X |
| 030-01046-0014 | CONTACT CONN | EA | X | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 047-01211-0003 | MTG PLT BCKUP | EA | 1.00 | X | X | X | X | X | X |
| 047-02686-0002 | SHIELD W/TAPE | EA | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 047-03793-0002 | PLT MTG W/F & HDW | EA | X | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 050-01300-0000 | WIRE SENSE ANT KIT | EA | X | 1.00 | X | 1.00 | X | 1.00 | X |
| 071-01006-0011 | KA 42 ANTENNA | EA | 1.00 | X | X | X | X | X | X |
| 071-01009-0000 | WHIP ANTENNA | EA | 1.00 | X | 1.00 | X | 1.00 | X | 1.00 |
| 071-01098-0000 | KA 42A ANTENNA | EA | X | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 089-05534-0020 | SCR FLHP 1/4-28 | EA | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | X |
| 089-05534-0036 | SCR FLHP 1/4-28 | EA | X | X | X | X | X | X | 2.00 |
| 089-05899-0003 | SCR PHP 2-56X3/16 | EA | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| 091-00128-0001 | STRAP CA SST1.5I | EA | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 150-00017-0010 | TUBING SHRINK 24G | IN | X | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 |
| 155-02034-0000 | SENSE CABLE | EA | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 155-02035-0001 | LOOP CABLE | EA | 1.00 | X | X | X | X | X | X |
| 155-02057-0000 | LOOP CBL 24' KR85 | EA | X | X | X | X | X | 1.00 | 1.00 |
| 155-02057-0002 | LOOP CBL 15' KR85 | EA | X | 1.00 | 1.00 | 1.00 | 1.00 | X | X |
| 187-01052-0000 | GSKT RUBBER | EA | 1.00 | X | X | X | X | X | X |
| 200-00523-0000 | RACK CABLE PLATE | EA | X | 1.00 | 1.00 | X | X | 1.00 | 1.00 |
| 200-00523-0001 | RACK CABLE PLATE | EA | 1.00 | X | X | 1.00 | 1.00 | X | X |

### 050-01308-0014/0019 PARTS LISTS

| PART NUMBER | DESCRIPTION | UM | 0014 | 0015 | 0016 | 0017 | 0018 | 0019 |
|---|---|---|---|---|---|---|---|---|
| 030-00005-0000 | CONN BNC CA RG142 | EA | . | . | 1.00 | 1.00 | 1.00 | 1.00 |
| 030-01046-0014 | CONTACT CONN | EA | 1.00 | 1.00 | . | . | . | . |
| 030-01046-0017 | CONTACT CONN | EA | . | . | 1.00 | 1.00 | 1.00 | 1.00 |
| 047-02686-0002 | SHIELD W/TAPE | EA | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 047-03793-0002 | PLT MTG W/F & HDW | EA | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 050-01300-0000 | WIRE SENSE ANT KIT | EA | 1.00 | . | . | . | . | . |
| 071-01009-0000 | WHIP ANTENNA | EA | . | 1.00 | . | . | . | . |
| 071-01098-0000 | KA 42A ANTENNA | EA | 1.00 | 1.00 | . | . | . | . |
| 071-01133-0000 | KA 42B ANTENNA | EA | . | . | 1.00 | 1.00 | 1.00 | 1.00 |
| 089-02140-0000 | NUT LOCK 4-40 | EA | . | . | 1.00 | 1.00 | 1.00 | 1.00 |
| 089-05534-0020 | SCR FLHP 1/4-28 | EA | 2.00 | 2.00 | . | . | . | . |
| 089-05534-0036 | SCR FLHP 1/4-28 | EA | . | . | 2.00 | 2.00 | 2.00 | 2.00 |
| 089-05666-0036 | SCR FLHP 1/4-28 | EA | . | 2.00 | . | . | . | . |
| 089-05899-0003 | SCR PHP 2-56X3/16 | EA | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| 089-05903-0004 | SCR PHP 4-40X1/4 | EA | . | . | 1.00 | 1.00 | 1.00 | 1.00 |
| 091-00128-0001 | STRAP CA SST1.5I | EA | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 150-00017-0010 | TUBING SHRINK 24G | IN | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 |
| 155-02034-0000 | SENSE CABLE | EA | 1.00 | 1.00 | . | . | . | . |
| 155-02057-0000 | LOOP CBL 24' KR85 | EA | 1.00 | 1.00 | . | . | 1.00 | 1.00 |
| 155-02057-0002 | LOOP CBL 15' KR85 | EA | . | . | 1.00 | 1.00 | . | . |
| 200-00523-0000 | RACK CABLE PLATE | EA | . | . | 1.00 | . | 1.00 | . |
| 200-00523-0001 | RACK CABLE PLATE | EA | 1.00 | 1.00 | . | 1.00 | . | 1.00 |
| 200-02104-0000 | MATCHING ASSY | EA | . | . | 1.00 | 1.00 | 1.00 | 1.00 |

# SECTION II

# INSTALLATION

## 2.1 GENERAL INFORMATION

This section contains general suggestions and information to consider before installation of the KR 86 ADF. Close adherence to these suggestions will assure optimum performance from the equipment.

## 2.2 UNPACKING AND INSPECTING EQUIPMENT

Exercise extreme care when unpacking the equipment. Make a visual inspection of the 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. The claim should be promptly filed with the transportation company. It would be advisable to retain the container and packaging material after all equipment has been removed in the event that equipment storage or reshipment should become necessary.

## 2.3 EQUIPMENT INSTALLATION

### 2.3.1 AVIONICS COOLING REQUIREMENTS FOR PANEL MOUNTED EQUIPMENT

The greatest single contributor to increased reliability of all modern day avionics is to limit the maximum operating temperature of the individual units whether panel mounted or remote mounted. While modern day individual circuit designs consume much less electrical energy, watts per cubic inch dissipated within the avionics unit remains much the same due to the high density packaging techniques utilized. Consequently, the importance of providing cooling to the avionics stack is still with us today.

While each individual unit may or may not require forced air cooling, the combined heat load of several units operating in a typical avionics location will significantly degrade the reliability of the avionics if provisions for cooling are not incorporated in the initial installation. Failure to provide cooling to the equipment will lead to increased avionics maintenance costs and may also void the AlliedSignal warranty.

In the case of the KR 86, installation of a KA 33, (P/N 071-4037-XX), or equivalent cooling system is required. Ram air cooling is not acceptable. For installation information on the KA 33 refer to the KA 33 installation manual, P/N 006-01069-XXXX and figures 2-14 and 2-15 in this manual.

### 2.3.2 KR 86 MECHANICAL INSTALLATION

The KR 86 installation will conform to standards designated by the customer, installing agency, and existing conditions as to the unit location and type of installation. However, the following suggestions will assure a more satisfactory performance from the equipment.

1. The KR 86 is mounted rigidly in the aircraft panel. Plan a location on the aircraft panel so that the KR 86 is plainly visible to the pilot and so that he has complete access to all front panel controls. Check to be sure that there is adequate depth behind the panel for the mounting rack and all the connectors and cabling. Be sure that the mounting location is not close to heater vents or other sources of high heat.
2. Refer to figure 2-3 for the panel cutout dimensions. Mark and cut the panel opening.

   NOTE: Mounting the KR 86 receiver any closer than 8" to a magnetic compass may cause a large compass error.

3. Select location for Loop and Sense Antenna's such that length of Loop and Sense Cables are adequate (See Antenna Installation Section).
4. Install shielded pair cable from the audio output terminals. Both audio output leads (Hi and Lo) should be routed from the KR 86 to an isolation amplifier or a headphone jack, is used. Do not route audio output leads with high level audio for long distances.
5. Route KR 86 cable harness away from pulse equipment harnesses.
6. Secure the mounting rack to instrument panel per figure 2-3.

7. Slide the KR 86 into the rack and secure by turning locking screw (3/32" Hex) on the front panel.

   CAUTION: DO NOT OVERTIGHTEN LOCKING SCREW.

8. On new aircraft, add filtering to alternator and regulator system per aircraft manufacturer's recommendation (refer to Service Memo 205 for part number information).

9. If a KA 42B Combination Sense and Loop Antenna is to be used, a Matching Assembly (200-02104-0000) must be installed in the Rack Cable Assembly (see figure 2-9 and 2-10).

### 2.3.3 KR 86 VOLTAGE CHANGEOVER

The KR 86 ADF requires the correct (14 or 28V) Installation Kit, and connecting the harness for parallel or series operation of the panel lamps.

1. For 14V operation ground Pin 5 of the connector and apply the 14V panel light power to Pin 4.
2. For 28V operation leave Pin 4 unconnected and apply the 28V panel lamp power to Pin 5.

### 2.3.4 ANTENNA INSTALLATION

The antenna installation will determine, to a large extent, whether the ADF will give optimum performance. The KR 86 employs both a loop and sense antenna. A loop antenna (figures 2-4, 2-5, and 2-6), loop antenna cable (figure 2-13), sense antenna cable and a sense antenna kit (figure 2-8) are supplied with the KR 86. It is important that the cables supplied be used, as they are designed particularly for the KR 86. The wire sense antenna as supplied with the KR 86 is designed to be anchored at the top of the aircraft cabin and near the tip of the vertical stabilizer. A special 54" whip sense antenna, KA 17 (figure 2-7) for mounting on top of aircraft is available on special order.

When a KA 42B Combination Sense and Loop Antenna is used, no separate sense antenna or sense cable is supplied. The KA 42B has internal sense and loop antennas and is supplied with loop cable and sense antenna connector. The sense cable length is not critical and should be made of 50 ohm coaxial cable such as RG-400 or equivalent. Several precautions should be considered in planning the installation of the KR 86 ADF.

1. Mount the sense antenna and loop antenna at least 3 feet from an L-Band Antenna to minimize interference.
2. Although a 10 foot 8 inch sense cable is supplied with the KA 42 and KA 42A, the sense antenna should be mounted within the reach of a 9 foot 9 inch sense cable, leaving an 11 inch service loop at the sense cable entry point to t he ADF rack to permit installation of the L-Band Filter if it becomes necessary. (See Installation of L-Band Filter P/N 050-01240-0001, figure 2-12 and I.B. 035).
3. It is recommended, if a bottom mounted sense antenna is to be used, that the L-Band Rejection Filter (P/N 050-01240-0001) be included in the installation.
4. L-Band Filter is not required when using KA 42B.
5. Do not route sense or loop cables with high level transmitting cables.
6. Do not route sense or loop cables with or near alternator or 400Hz cables.
7. Sleeving over contacts at end of sense and loop cables should be left on for protection in routing cables through aircraft. Remove sleeving when ready to insert contact terminals into connector P101 on rack cable plate. (Loop cable 155-02035-0000/0001 only. Contacts on Loop Cable 155-02057-0000/0002 are assembled at time of installation).
8. If the aircraft has a high frequency system, locate the sense antenna on the opposite side of the aircraft from the high frequency antenna and put a relay in the sense line to open the connection when the high frequency antenna is transmitting.

### 2.3.5 WIRE SENSE ANTENNA INSTALLATION

The KR 86 is designed to work with a 194pf sense antenna system. That is, a 144pf sense cable and a 50pf antenna. The effective height of the antenna should be 0.25 meters. The wire sense antenna kit supplied with the KR 86 is intended to be mounted on the top of the aircraft along the center line. Do not mount the sense antenna near antenna systems from other radios, especially transmitting antennas.

The necessary parts for the wire sense antenna are included in the wire sense antenna kit. The sense antenna cable supplied is cut for the 144pf required and therefore must not be altered. Tie any excess antenna cable length off in a convenient location.

Use Field Service Memo #75 Revised, as a guide for obtaining a 50pf and 0.25 meter sense antenna.

### 2.3.6 KA 17 WHIP SENSE ANTENNA INSTALLATION

The KA 17 Whip Sense Antenna Kit is intended to be mounted on the top of the aircraft along the centerline. Do not mount the whip sense antenna near antenna systems from other radios, especially transmitting antennas. The necessary parts for the whip sense antenna installation are included in the KA 17 whip antenna kit. The necessary cutouts and clearance area are shown in figure 2-7. Note installation of mounting base (088-00070-0000). The mounting base determines orientation of rod and adapter to aircraft. A 30pf Padder Capacitor is used with this antenna.

### 2.3.7 LOOP ANTENNA INSTALLATION

The loop antenna should be mounted as near as possible to the center line. The following information applied to KA 42 Loop Antennas (KPN 071-1006-10) manufactured before March, 1971. Choose a mounting location where 6° to 7° of quadrantal error exists due to the airframe. Additional amounts of correction can be realized by connecting the proper size of inductor across pins 4 and 9 of the antenna connect or of the loop cable. The maximum additional correction is 8°. The additional amounts of correction and the necessary inductances are given in the table below.

| Additional Correction | Inductance Pins 4-9 |
|---|---|
| 8° | #22 Buss Wire |
| 6° | .22uh (019-2082-02) |
| 4° | .47uh (019-2082-06) |
| 2° | 1.0uh (019-2082-13) |

It is also possible, with the KA 42 Loop Antenna, Part Number 071-1006-11 manufactured after March, 1971 and KA 42A Loop Antenna Part Number 071-1098-00 and KA 42B Combination Sense and Loop Part Number 071-1133-00 to reduce the amount of quadrantal error correction. This is done by connecting the proper size of inductor across pins 2 and 7 or terminals E6 and E8. The table below gives the value of inductance necessary for quadrantal error correction from 0° to 14.5°.

| Amount of Quadrantal Error Correction Necessary | Inductance (uh) 155-02035-0000/0001 | Inductance (uh) 155-02057-0000/0002 | Loop Cable (155-02035-0000/0001) Pins (figure 2-13) | Loop Cable (155-02057-0000/0002) Terminals (figure 2-5 or 2-6) |
|---|---|---|---|---|
| 0° | .09(019-02017-0000) | .09(019-02249-0000) | 2 to 7 | E6 to E8 |
| 2° | .22(019-02082-0002) | .22(019-02084-0005) | 2 to 1 | E6 to E8 |
| 4° | .47(019-02082-0006) | .47(019-02084-0013) | 2 to 7 | E6 to E8 |
| 6.5° | No Inductance Added | | | |
| 8.5° | 1.0(019-02082-0013) | 1.0(019-02084-0021) | 4 to 9 | E9 to E10 |
| 10.5° | .47(019-02082-0006) | .47(019-02084-0013) | 4 to 9 | E9 to E10 |
| 12.5° | .22(019-02082-0002) | .22(019-02084-0005) | 4 to 9 | E9 to E10 |
| 14.5° | #22 Buss Wire | #22 Buss Wire | 4 to 9 | E9 to E10 |

When the loop is bolted to the aircraft, take care to align the loop parallel with the center line of the aircraft. This will insure a 0° bearing reading when the aircraft is headed toward the station.

It is recommended that a small drain hole be drilled through the skin of the aircraft, in nonpressurized installations; at the low side of the loop antenna installation.

## 2.3.8 LOOP CABLE

The location (top or bottom mounting) of the loop and sense antennas will determine the proper loop cable wiring termination at connector P101, located on rack cable plate at rear of ADF mounting rack.

CAUTION: DO NOT ALTER THE LENGTH OF THE LOOP CABLE. TIE OFF ANY EXCESS CABLE IN A CONVENIENT LOCATION. THE LENGTH OF THE LOOP CABLE SUPPLIED IS 15 FEET.

## 2.3.9 LOOP ANTENNA PHASING FOR KR 86

If loop wiring correction is needed after testing ADF in aircraft, use a Molex ejector tool No. HT-1884 to remove contacts from the rack connector P101 and change termination as necessary, no desoldering or soldering is required.

The contact should be checked visually before reinstalling in connector, to be sure the retaining tab "A" extends as shown for retention in connector. (figure 2-2)

Use the following information for loop cable termination or reversal for the KR 86 ADF. The table below gives the wiring information for various combinations of loop and sense antenna installations using KA 42 or KA 42A Loop Antenna. Colors are loop cable leads. Wiring information is for P101 (18 pin connector) located at the rear of ADF mounting rack.

| Loop Location | Sense Location | Pin 17 | Pin 16 | Pin 15 | Pin 14 |
|---|---|---|---|---|---|
| *Bottom | *Top | Red | Black | White | Brown |
| Bottom | Bottom | Black | Red | Brown | White |
| Top | Top | Red | Black | Brown | White |
| Top | Bottom | Black | Red | White | Brown |

*This is the most common mounting configuration.

The table below gives the necessary connections for top and bottom mounting of the KA 42B Combination Sense and Loop Antenna.

| KA 42B Location | Pin 17 | Pin 16 | Pin 15 | Pin 14 |
|---|---|---|---|---|
| Bottom | Red | Black | White | Brown |
| Top | Black | Red | White | Brown |

All field wiring modifications as shown above shall be made at connector P101 at time of installation in aircraft.

## 2.3.10 ADF BEARING ADJUSTMENTS

Take bearing on known station and if error exists, note amount and direction. Remove ADF from aircraft mounting rack. Loosen the two socket head cap screws (approximately one turn) holding the goniometer shield. Rotate the goniometer shield (goniometer is keyed to shield) until the bearing (pointer) is within acceptable limits. Tighten the two socket head cap screws and reinstall ADF in aircraft.

## 2.3.11 CABLE HARNESS AND CONNECTOR ASSEMBLY

A. Fabrication of the External Cable

Proceed in accordance with the pinout diagram (figure 2-1), the interconnect diagram (figures 2-16 or 2-17) that most closely matches the application, and the rear plate assembly drawing (figure 2-11).

B. Contact Terminal Assembly using Molex Crimper (See figure 2-2)

The KA 134 uses a Molex connector that mates directly with the printed circuit board inside the unit. Assembly of this connector is as follows:

1. Strip each wire 5/32" for contact terminal, P/N 030-01107-00XX. Note: The last two digits of the part number indicates the number of terminals required.
2. Open the Molex HT 1921 hand crimper with the engraved side toward the operator. Place the conductor tab section of a contact terminal on Anvil A with the contact portion facing away from the operator. Close the crimper slightly until the contact tabs touch the female jaw.
3. Insert the stripped conductor until the insulation is even with the side of the crimper facing the operator. Crimp the conductor tabs by squeezing the handles together until the jaws are fully closed or a sufficient crimp is obtained.
4. Move the lead to Anvil A. Place the insulating tab section on Anvil A. Crimp again until the jaws are fully closed or until a sufficient crimp is obtained.

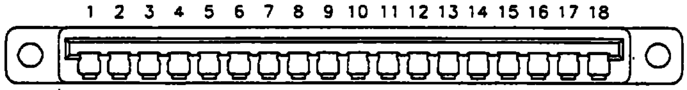
C. Contact Insertion into Molex Connector Housing

After the contact terminals have been installed on the wiring harness, the contact terminals can be inserted into the proper location in the connector housing. The terminal cannot be inserted upside down. Be sure to push the terminal all the way in until a click can be felt or heard. The self-locking feature can be tested by gently pulling on the wire.

D. Extraction of Contact from Molex Connector

1. Slip the flat narrow blade of a Molex HT-1884 contact ejector tool, P/N 047-05099-0001, under the contact on the mating side of the connector. By turning the connector upside down one can see the blade slide into the stop.
2. When the ejector is slid into place, the retaining tab of the contact is raised, allowing the contact to be removed by pulling moderately on the lead.
3. Neither the contact or position is damaged by removing a contact; however, the contact should be visually checked before reinstalling to be certain that retaining tab "A" extends as shown in figure 2-2 for retention in connector.

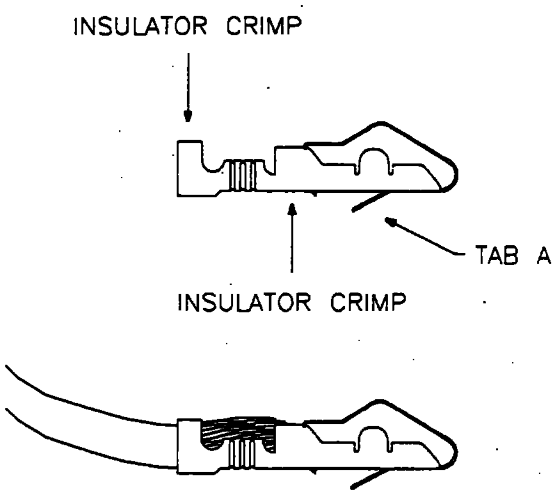
## P101



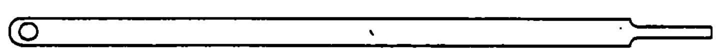

| Pin | Input | Output | Function |
|---|---|---|---|
| 1 | | | A/C GROUND |
| 2 | ← | | 13.75 V DC |
| 3 | | → | +8 V DC |
| 4 | ← | | +13.75 V DC LIGHTING DIMMER |
| 5 | ← | | +27.5 V DC LIGHTING DIMMER |
| 6 | | | GROUND |
| 7 | | → | SENSE CABLE (BLUE) |
| 8 | | → | SENSE CABLE (BLACK) |
| 9 | | | NOT CONNECTED |
| 10 | | → | 500 OHMS AUDIO HI |
| 11 | | → | 500 OHMS AUDIO LO |
| 12 | | | NOT USED |
| 13 | | | SHIELD GROUND |
| 14 | ← | | ANTENNA CONNECTION (BROWN) |
| 15 | ← | | ANTENNA CONNECTION (WHITE) |
| 16 | ← | | ANTENNA CONNECTION (BLACK) |
| 17 | ← | | ANTENNA CONNECTION (RED) |
| 18 | | | SHIELD GROUND |

← INPUTS    OUTPUTS →

FIGURE 2-1 KR 86 PIN FUNCTION AND LOCATION DIAGRAM



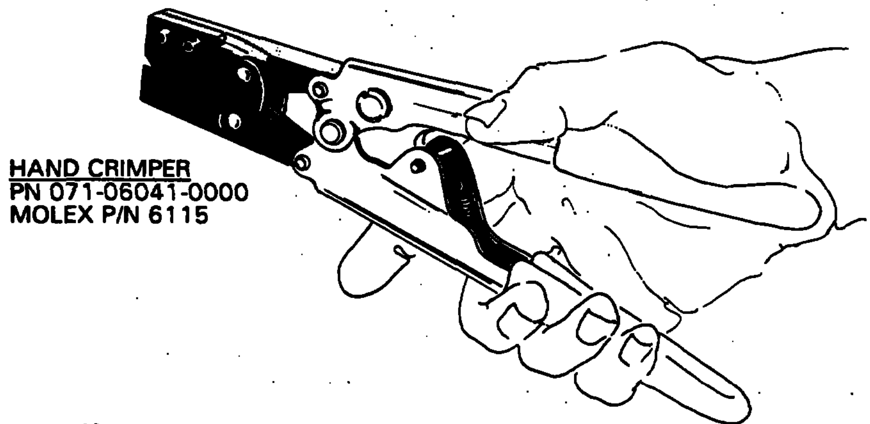

SOLDERLESS CONTACT TERMINAL
P/N 030-01107-0030



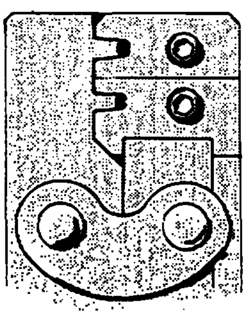
HAND EJECTOR
P/N 047-05099-0001
MOLEX P/N HT-1884

FIGURE 2-2. MOLEX TERMINAL AND TOOLS
(SHEET 1 OF 3)

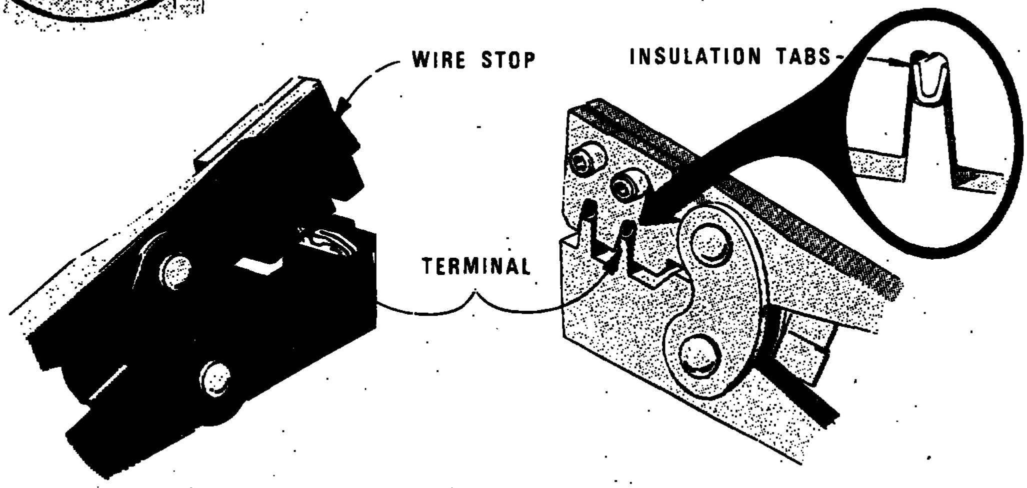
Holding the hand crimpers as shown, release the crimper's ratchet pawl and open by squeezing tightly on the handles, and then releasing pressure.




Close crimpers until ratchet begins to engage. Then insert the terminal into the jaws from the back side. (See Figures at bottom of page) For 24 to 30AWG wire, it will be necessary to start the crimp in jaw A and then complete it in jaw B.



| JAW | TERMINAL | WIRE SIZE | INSULATION RANGE |
|---|---|---|---|
| A | 030-01107-0030 | 18 TO 24 AWG | .110 TO .055 |
| B | 030-01107-0030 | 24 TO 30 AWG | .055 TO .030 |

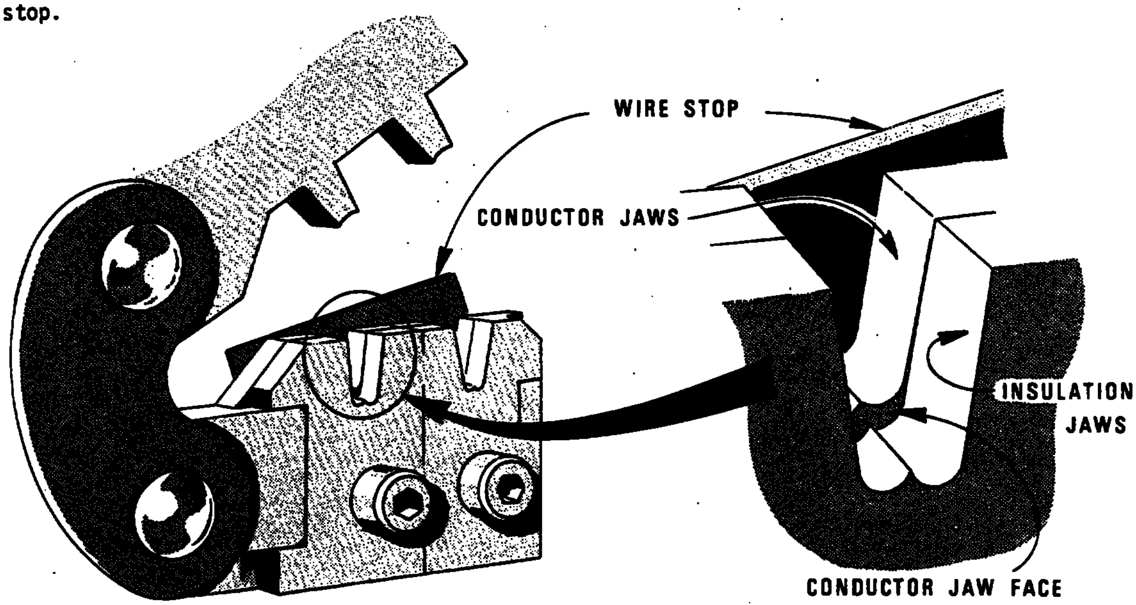



Terminal is in correct position when insulation tabs are flush with outside face of crimp jaws.

FIGURE 2-2 MOLEX TERMINAL AND TOOLS
(SHEET 2 OF 3)

Once the terminal is in the correct position, close the jaws gently until the terminal is held loosely in place. Push wire stop down so that it rests snugly behind the contact portion of the terminal.

Strip the wire insulation back 1/8 inch and insert the wire through the insulation tabs into the conductor tabs until the insulation hits the conductor jaw face or until the conductor touches the wire stop.




Squeeze the handles until the crimp jaws close and the ratchet releases.

Straighten the terminal if necessary, then release the plier grips and remove the crimped terminal.

CRIMPING PRESSURE ADJUSTMENT

If too much or too little pressure is needed to release the crimper's ratchet pawl at the end of the crimp stroke, the ratchet can be easily adjusted. A spanner wrench provided with the tool can be used to loosen the lock nut, and rotate the keyed stud clockwise for increased pressure and counter-clockwise for decreased pressure. Once the desired pressure has been set, the lock nut must be tightened again. Newer models may have a screwdriver adjustment.

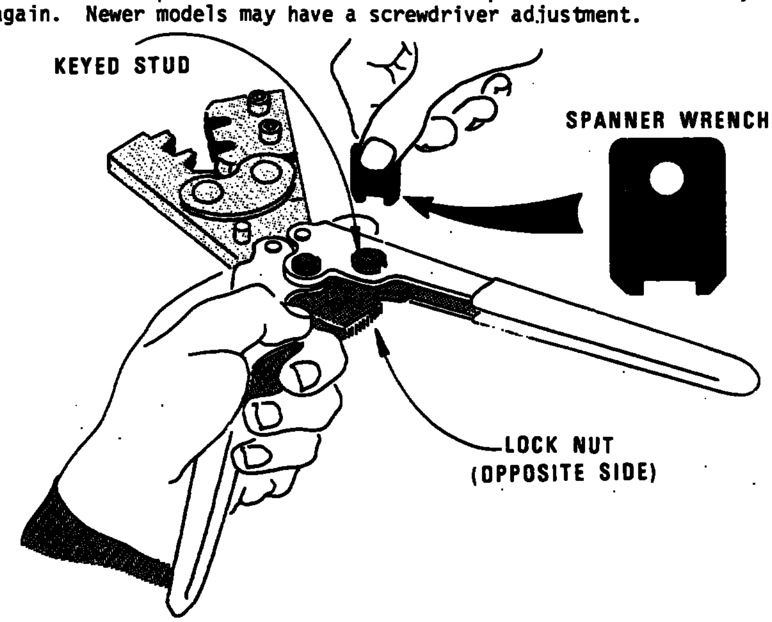
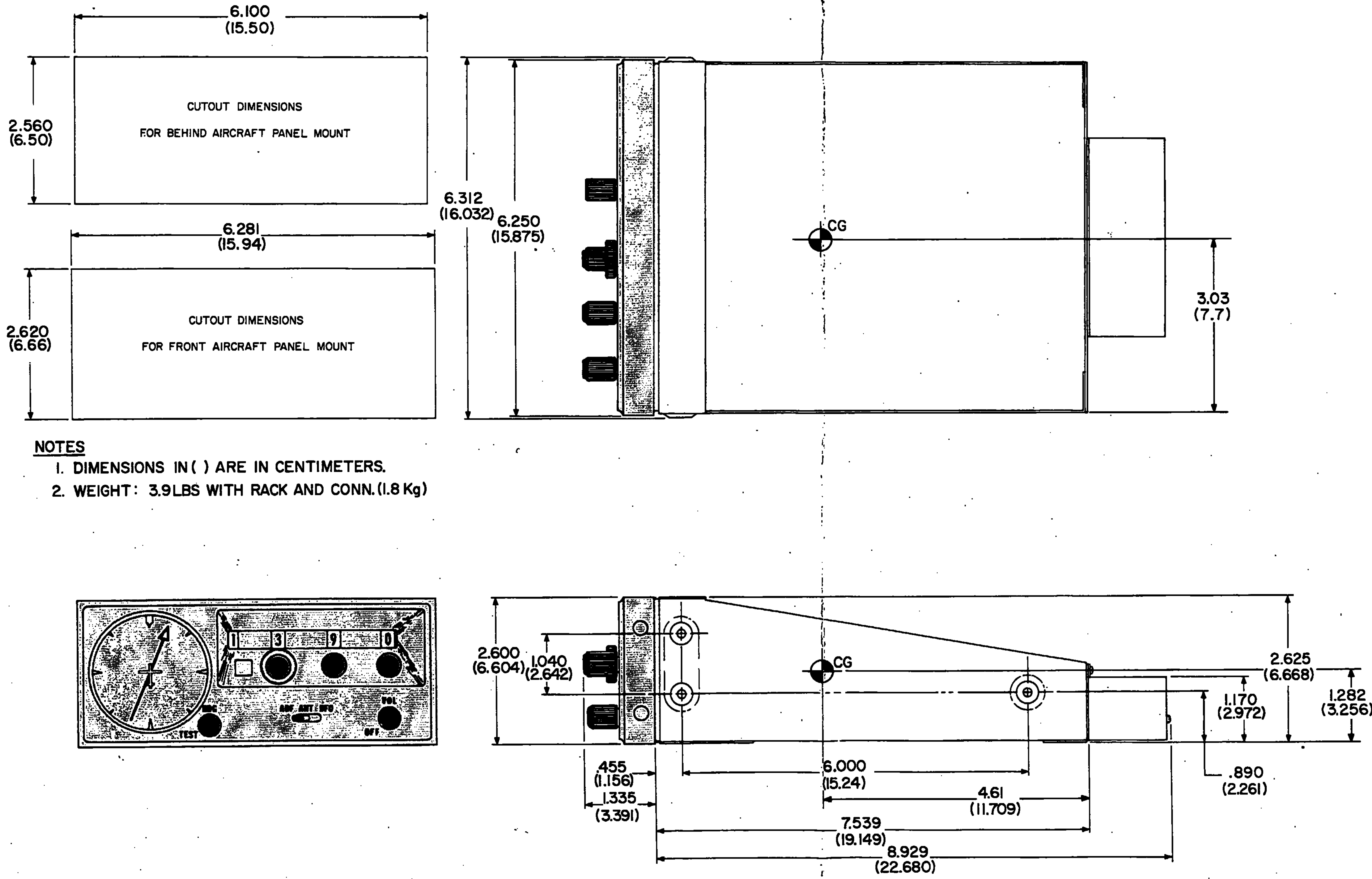



FIGURE 2-2 MOLEX TERMINAL AND TOOLS
(SHEET 3 OF 3)




NOTES
1. DIMENSIONS IN ( ) ARE IN CENTIMETERS.
2. WEIGHT: 3.9LBS WITH RACK AND CONN. (1.8 Kg)

FIGURE 2-3 KR 86 INSTALLATION DRAWING
(Dwg No 155-05101-0000 R-0)

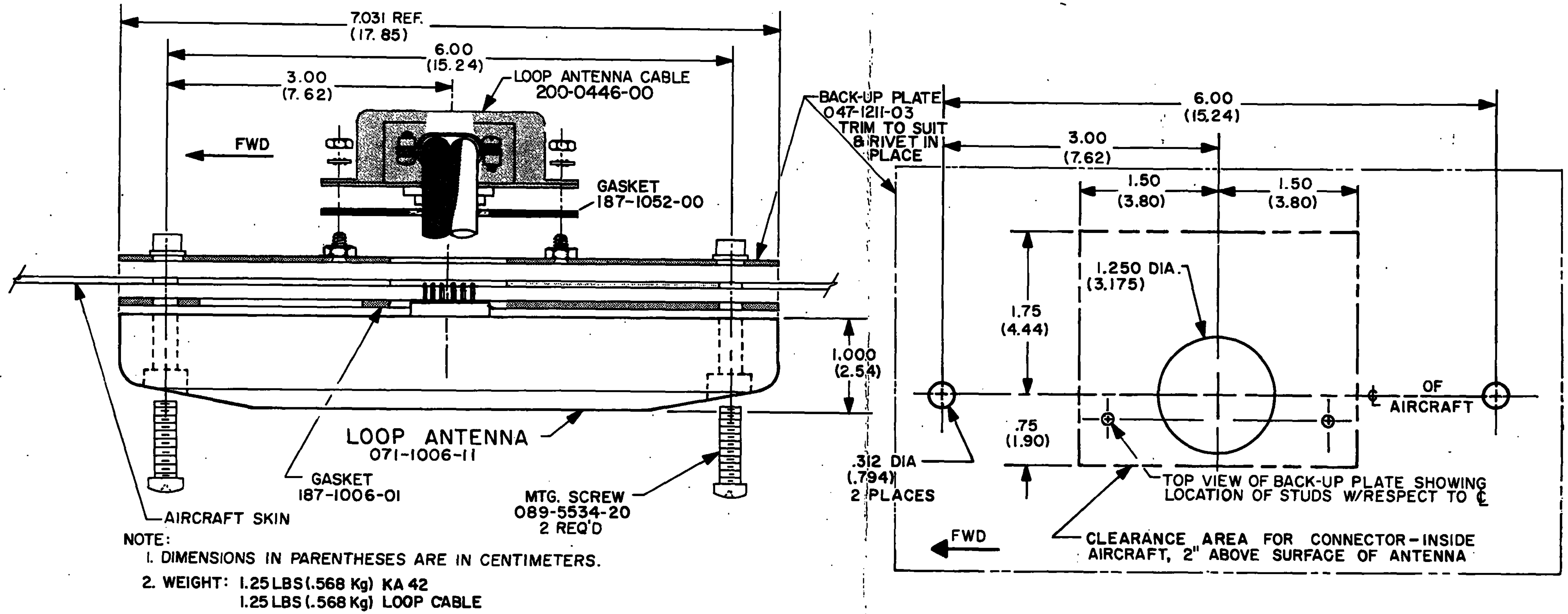



FIGURE 2-4 KA 42 LOOP ANTENNA INSTALLATION DRAWING
(Dwg No 155-05113-0000 R-3)

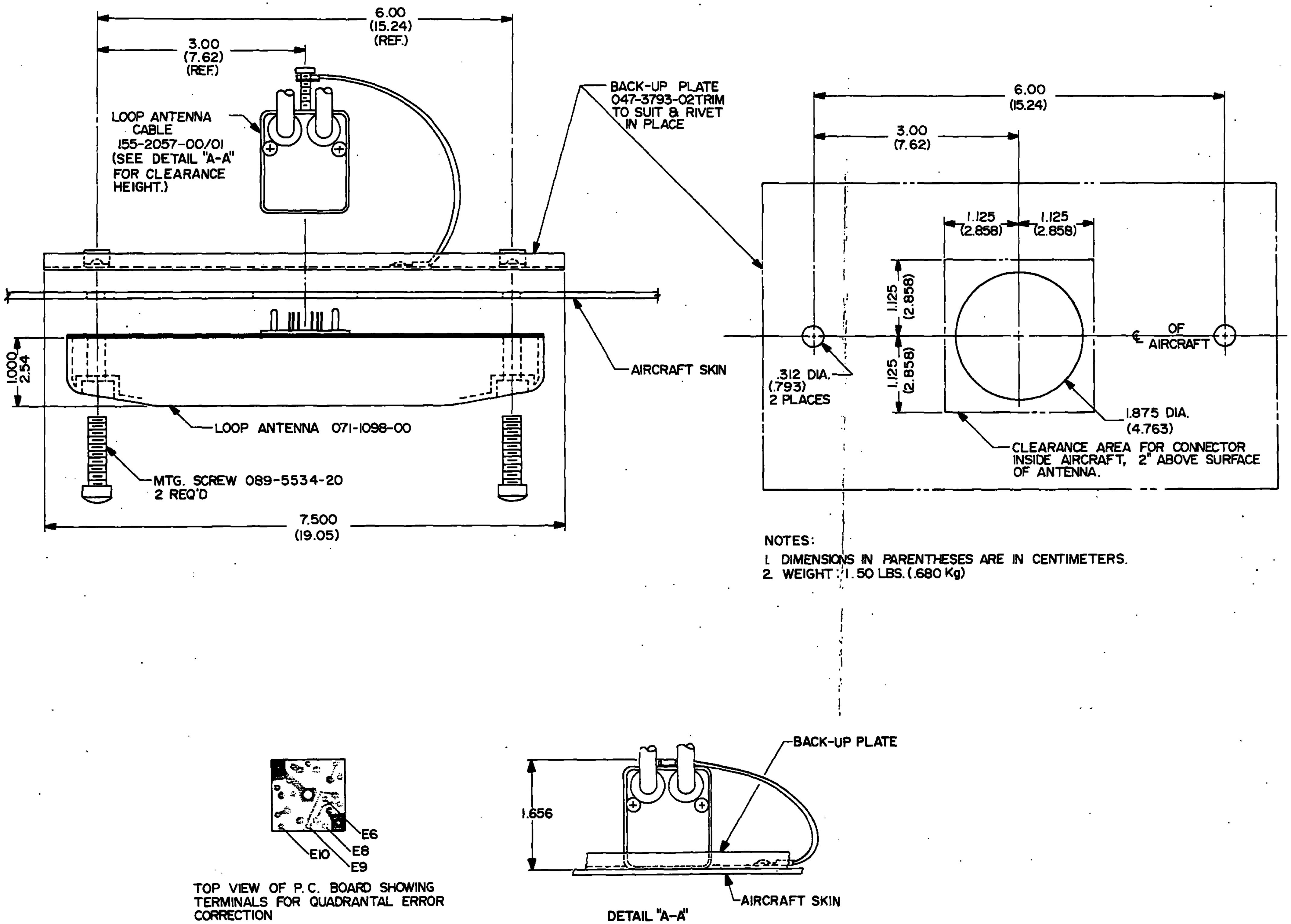



FIGURE 2-5 KA 42A LOOP ANTENNA INSTALLATION DRAWING
(Dwg No 155-05237-0000 R-2)

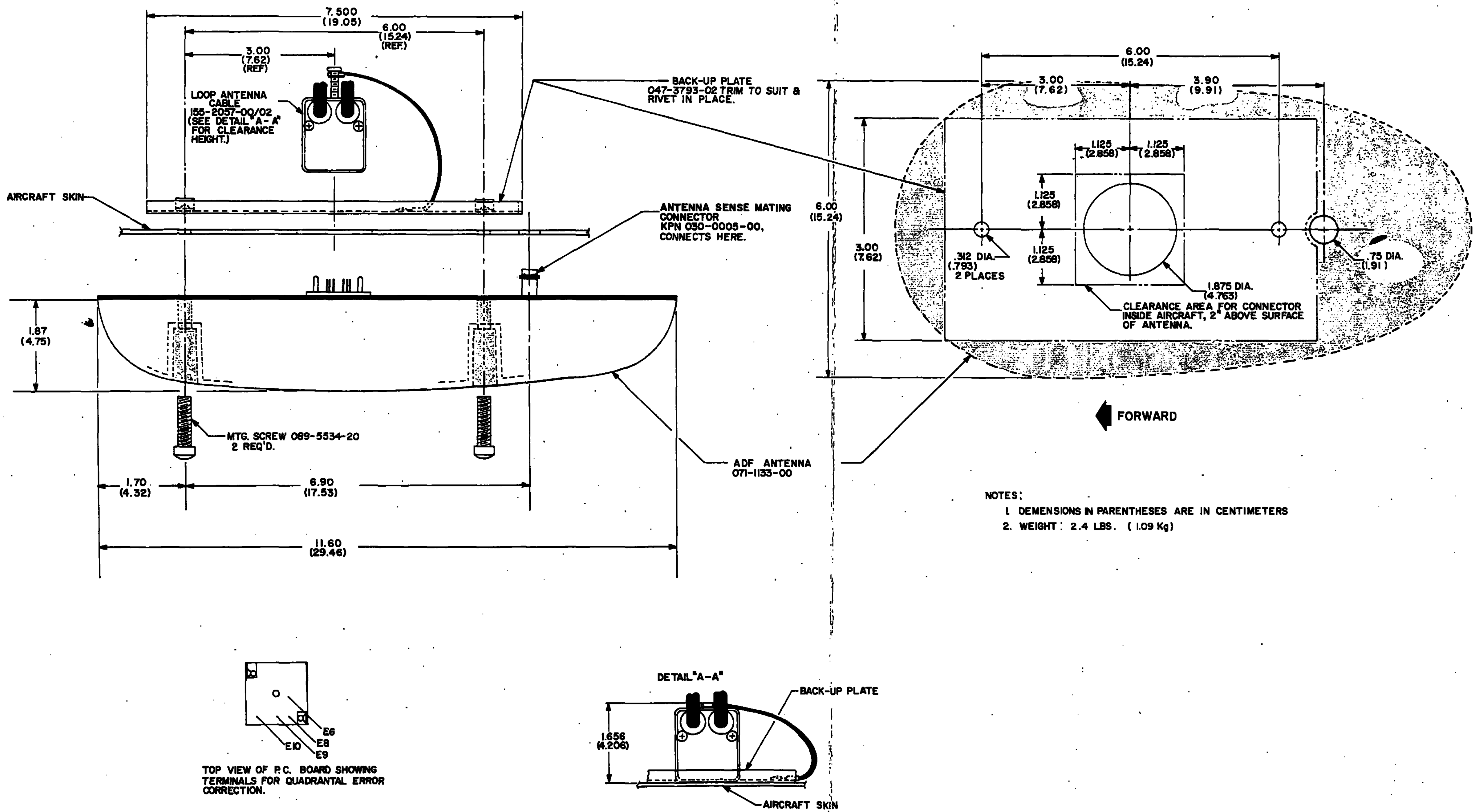



FIGURE 2-6 KA 42B LOOP ANTENNA INSTALLATION DRAWING
(Dwg No 155-05243-0000 R-3)

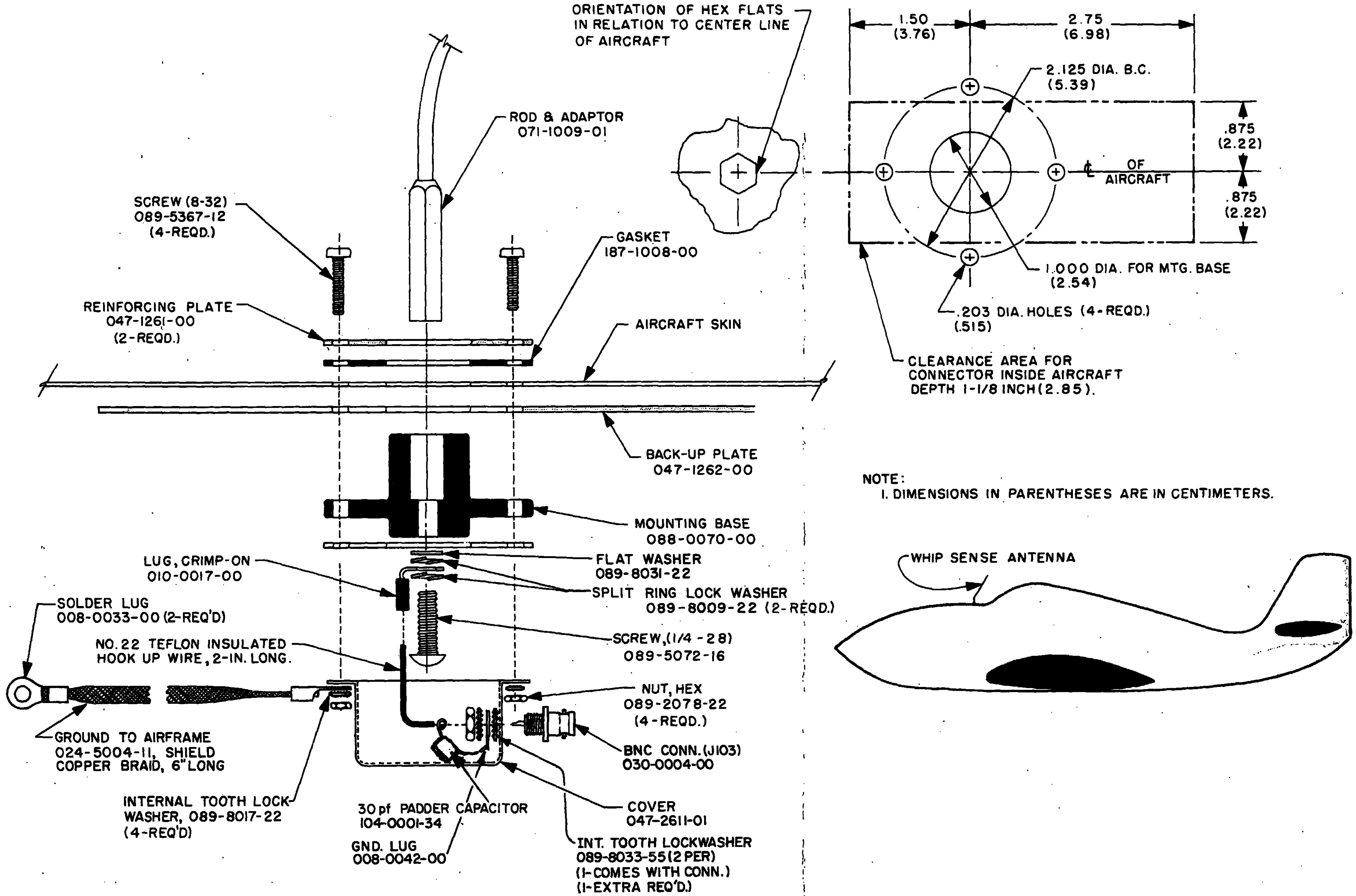
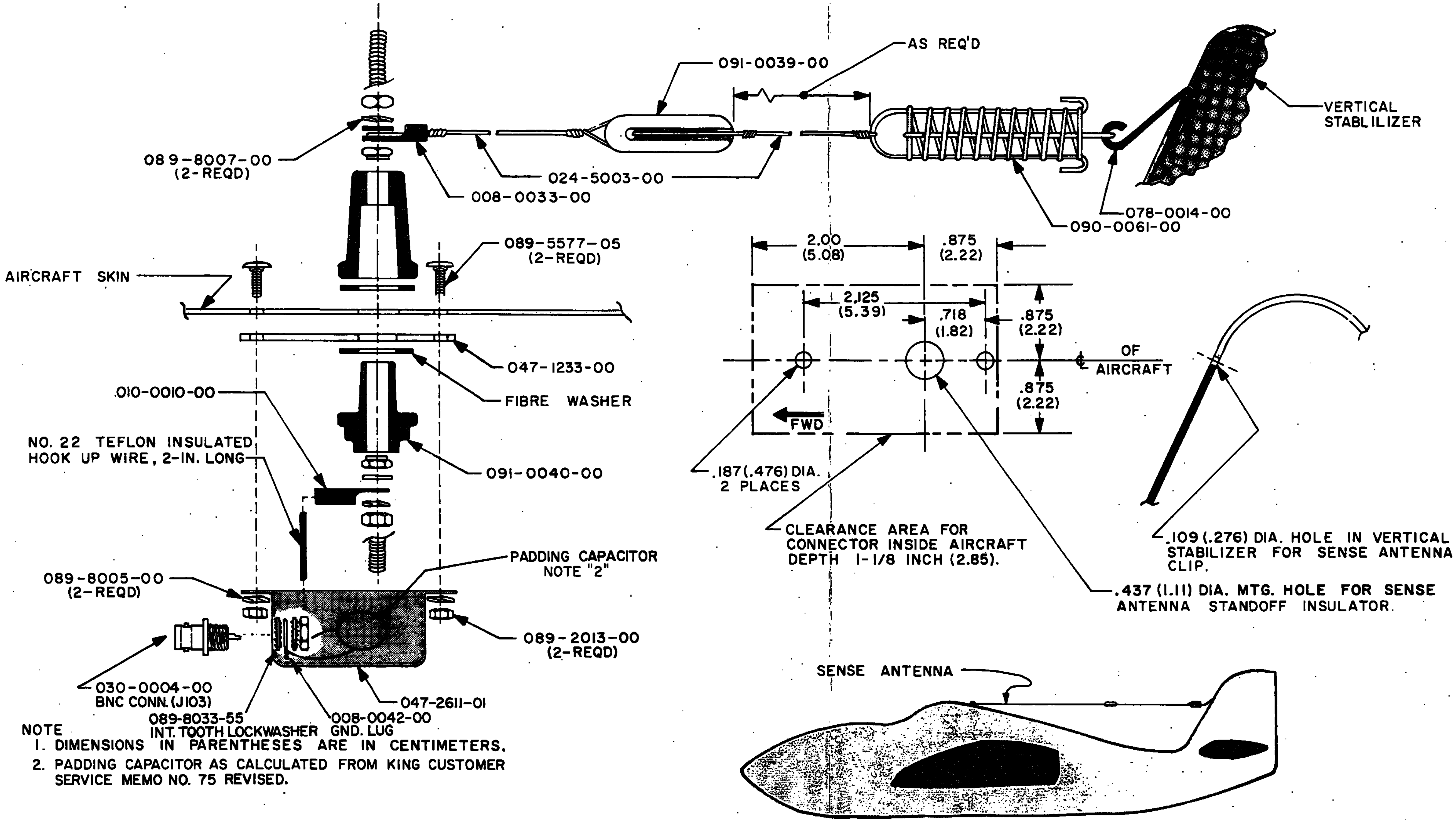



FIGURE 2-7 KA 17 WHIP SENSE ANTENNA INSTALLATION DRAWING
(Dwg No 155-05114-0000 R-0)




NOTE
1. DIMENSIONS IN PARENTHESES ARE IN CENTIMETERS.
2. PADDING CAPACITOR AS CALCULATED FROM KING CUSTOMER SERVICE MEMO NO. 75 REVISED.

FIGURE 2-8 KR 86 SENSE ANTENNA ASSEMBLY AND INSTALLATION DRAWING
(Dwg No 155-05115-0000 R-0)

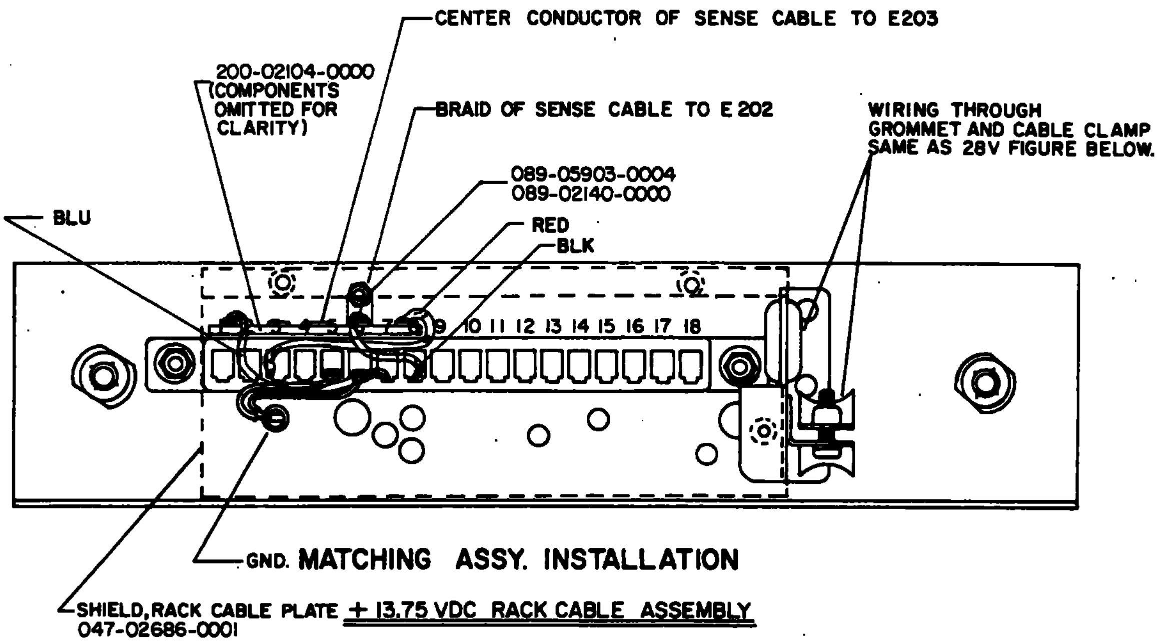



FIGURE 2-9 CONNECTOR PIN WIRING FOR KR 86 MATCHING ASSEMBLY

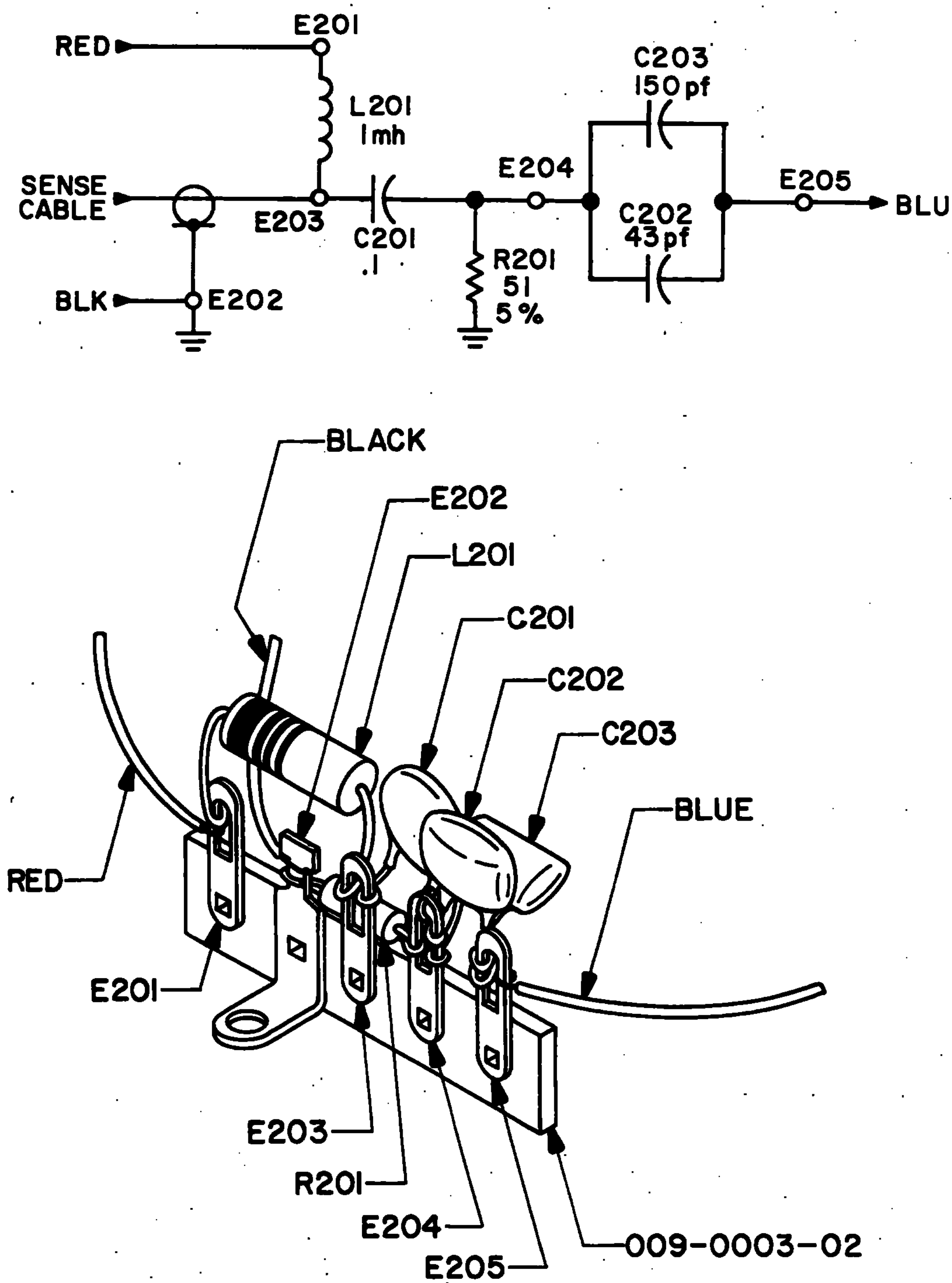
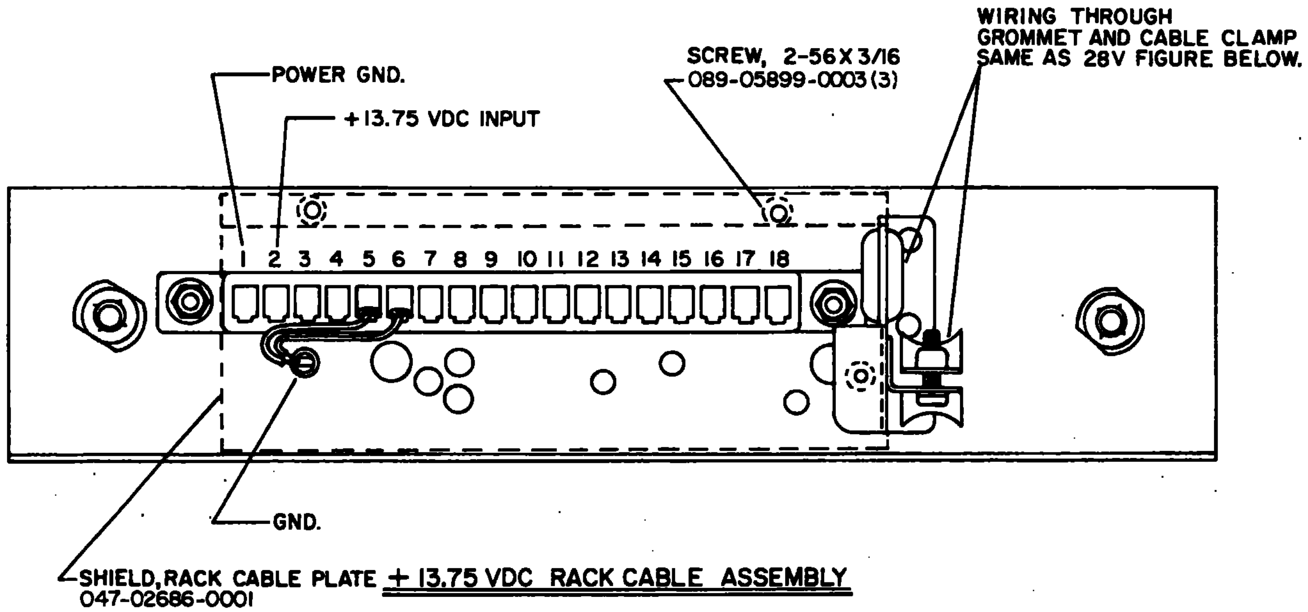
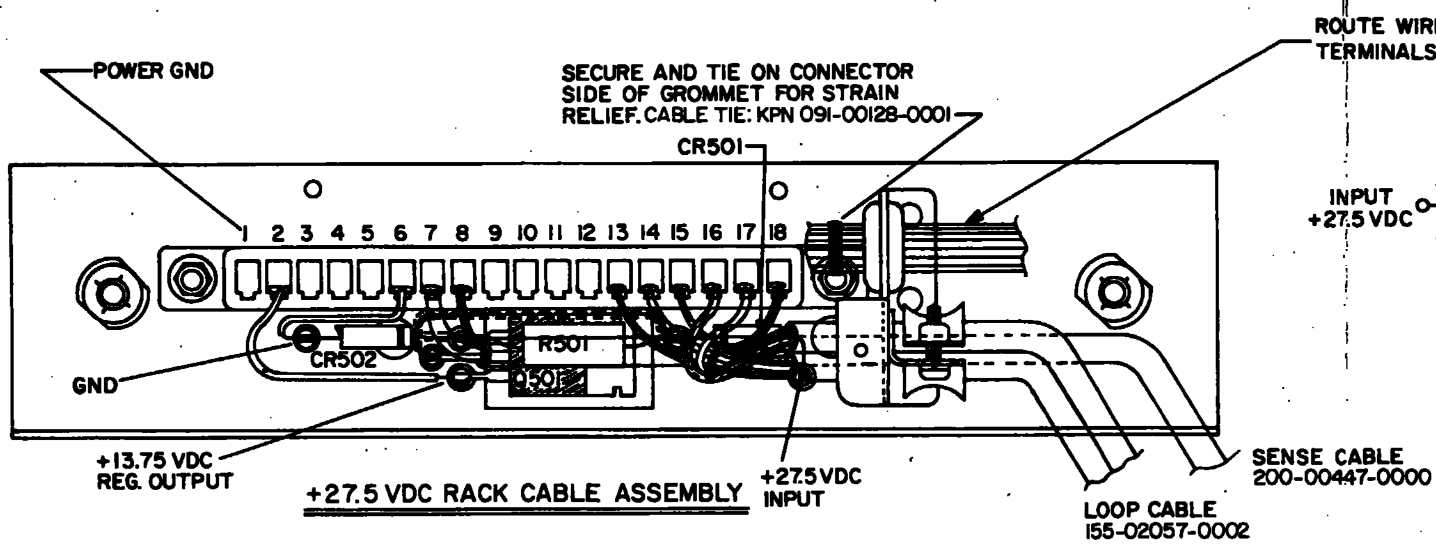
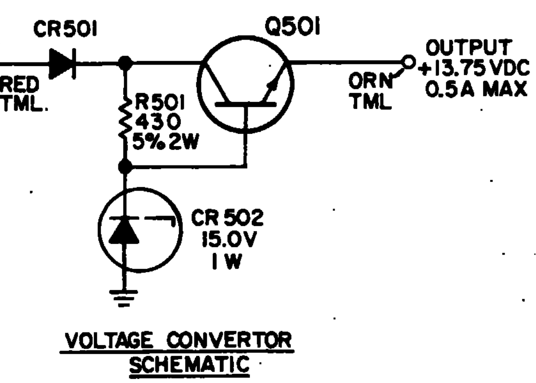



FIGURE 2-10 KA 42B MATCHING ASSEMBLY AND SCHEMATIC
(Dwg. Nos. 300-02104-0000 R-0 ; 002-00453-0002 R-0)



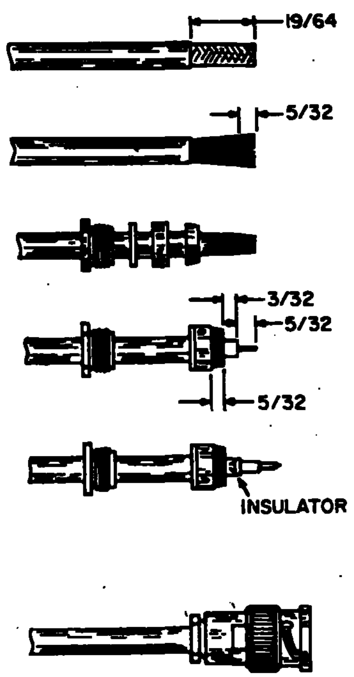

NOTES:

1. DO NOT ALTER LENGTH OF SENSE OR LOOP CABLES.
2. THE FOLLOWING TOOLS ARE REQUIRED FOR CONSTRUCTION AND MAINTENANCE OF WIRING AND CABLE HARNESS FOR CONN. P101.
   HAND CRIMPING TOOL - MOLEX HT-1921
   TERMINAL EXTRACTOR TOOL - MOLEX HT-1884

FIGURE 2-11 14/28 REAR PLATE ASSEMBLY DRAWING AND VOLTAGE CONVERTER SCHEMATIC

## INSTALLATION OF L-BAND REJECTION FILTER FOR THE KR 86 ADF

1. Remove Sense Antenna Cable - Use Molex contact terminal extractor tool No. HT-1884 to remove contact terminals #7 and #8 from connector P101.
2. Loosen clamp assembly and remove sense cable from clamp.
3. Cut 11 inches from the sense cable to compensate for the added filter capacity.
4. Cut approximately .8 inch from the 11 inch section removed from the sense antenna cable and using it for filler place under clamp with loop cables and tighten clamp.
5. Install the coax connector P105 (030-00096-0000) on this end of the sense cable.
6. Mount the L-Band filter in the "D" hole provided in the bracket on the rack cable plate.
7. Insert contact terminals into the connector, the shield braid contact into position 8, and the center conductor contact into position 7.
8. Connect sense cable connector P105 to J105 of L-Band filter.




Cut jacket to correct dimension

Fray shield and strip inner dielectric 5/32", tin center conductor

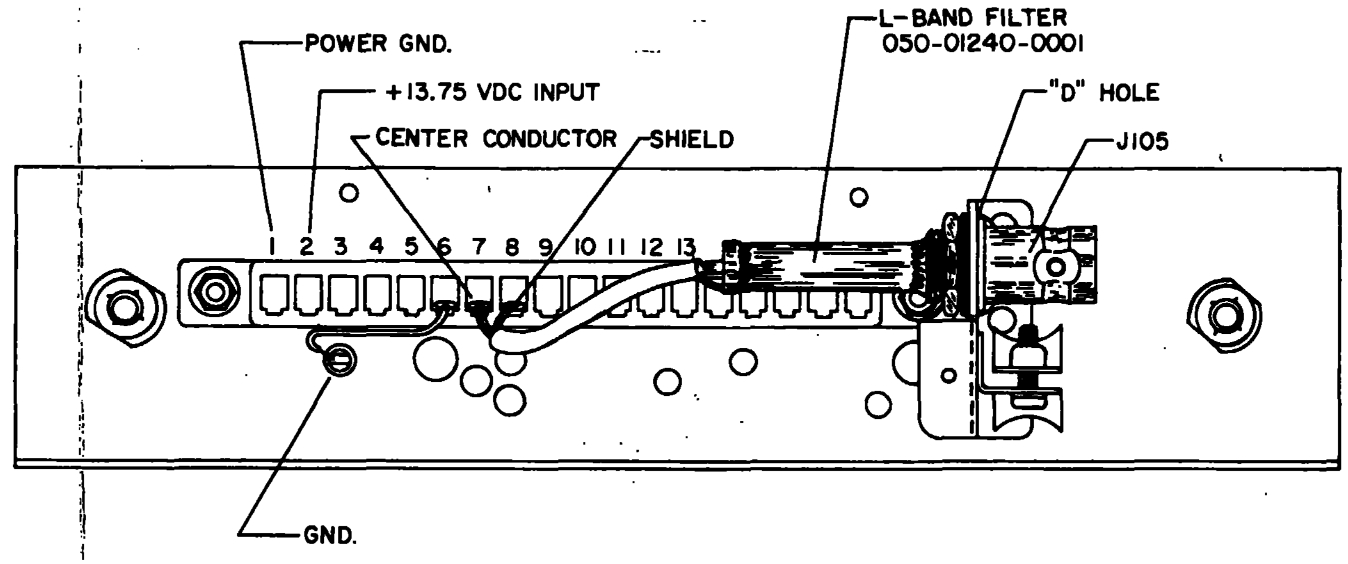
Taper braid and slide nut, washer, gasket and clamp over braid. clamp is inserted so that its inner shoulder fits squarely against end of cable jacket.

With clamp in place, comb out braid, fold back smooth as shown and trim 3/32" from end.

Place insulator against dielectric, slip contact in place; press against dielectric and solder. Remove excess solder from outside of contact. Be sure cable dielectric is not heated excessively and swollen so as to prevent dielectric from entering into conn.body.

Push assembly into body as far as it will go. Slide nut into body and screw in place with wrench until tight. For this operation, hold cable and shell rigid and rotate nut.

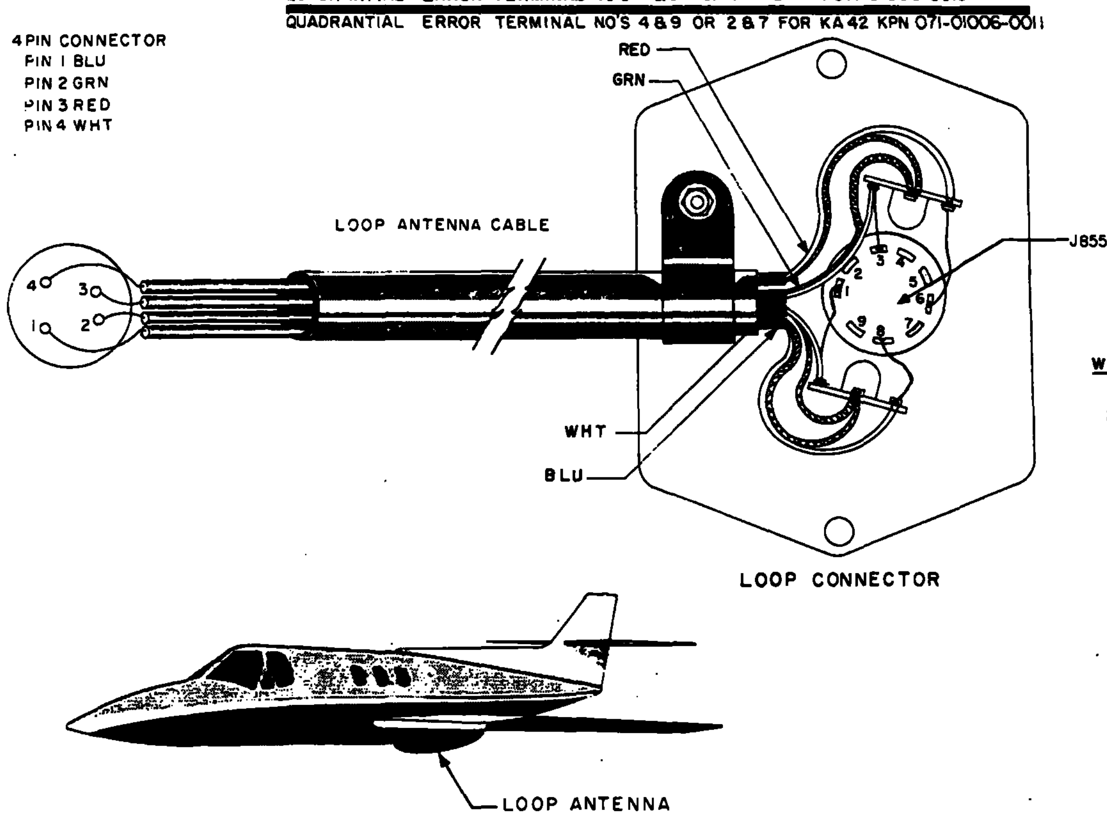
BNC CONNECTOR ASSEMBLY INSTRUCTIONS



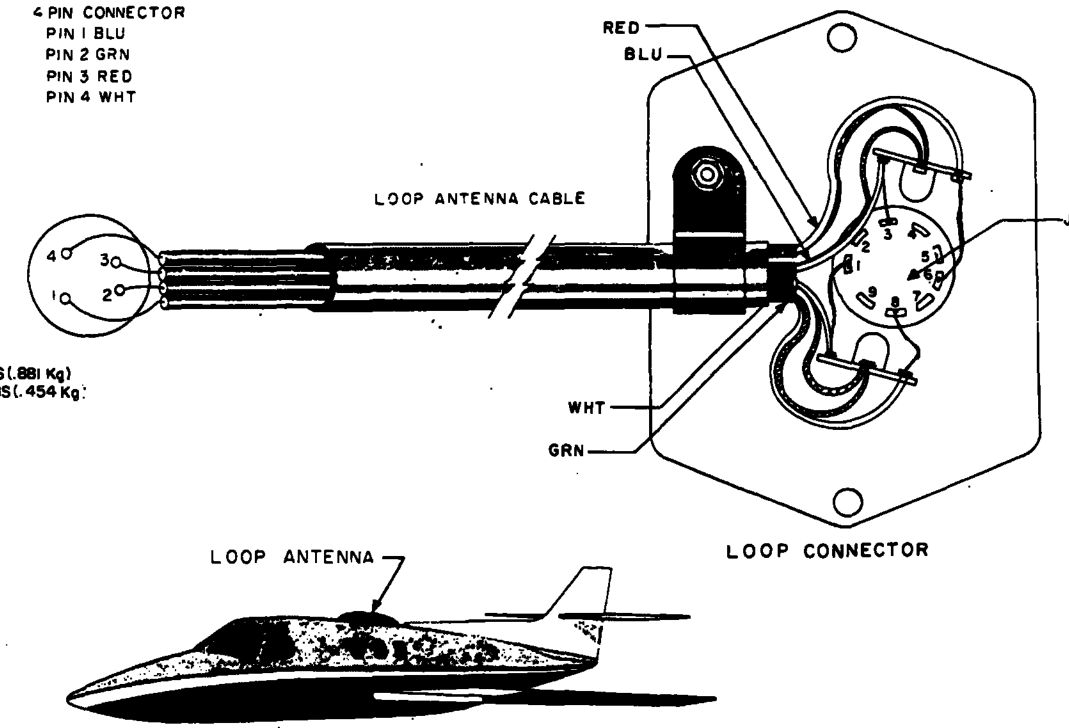

L-BAND FILTER INSTALLATION

FIGURE 2-12 L-BAND FILTER INSTALLATION DRAWING

NOTE.
QUADRANTIAL ERROR TERMINAL NO'S 4&9 FOR KA 42 KPN 071-01006-0010
QUADRANTIAL ERROR TERMINAL NO'S 4&9 OR 2&7 FOR KA 42 KPN 071-01006-0011



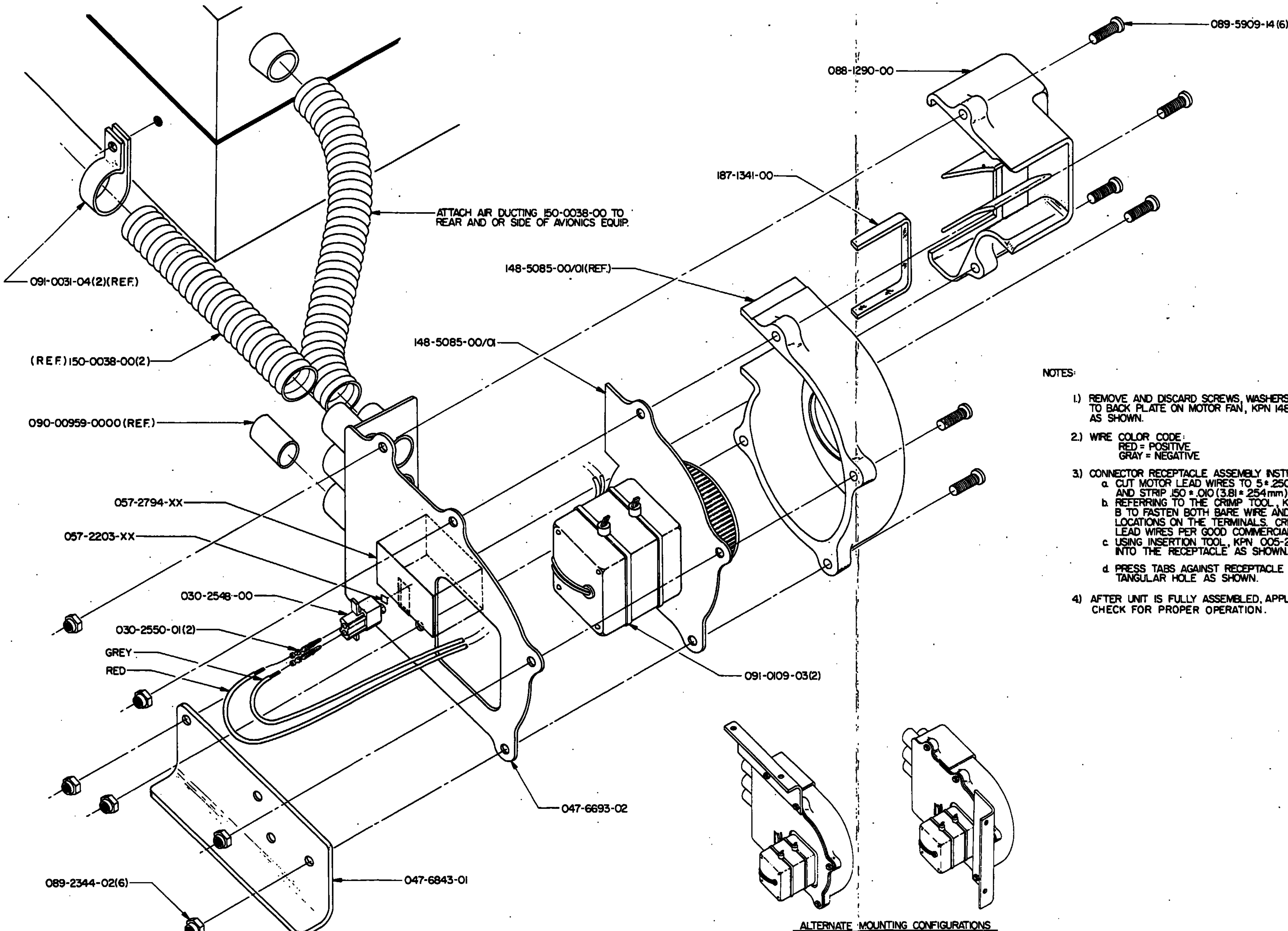

WEIGHT:
12 Ft. CABLE KPN 155-02008-0000 = 1.5 LBS (.881 Kg)
24 Ft. CABLE KPN 155-02008-0001 = 1.0 LBS (.454 Kg)




**(A) LOOP ANTENNA CABLE BOTTOM MOUNTING**

**(B) LOOP ANTENNA CABLE TOP MOUNTING**

FIGURE 2-13 LOOP ANTENNA CABLE MOUNTING DIAGRAM




NOTES:

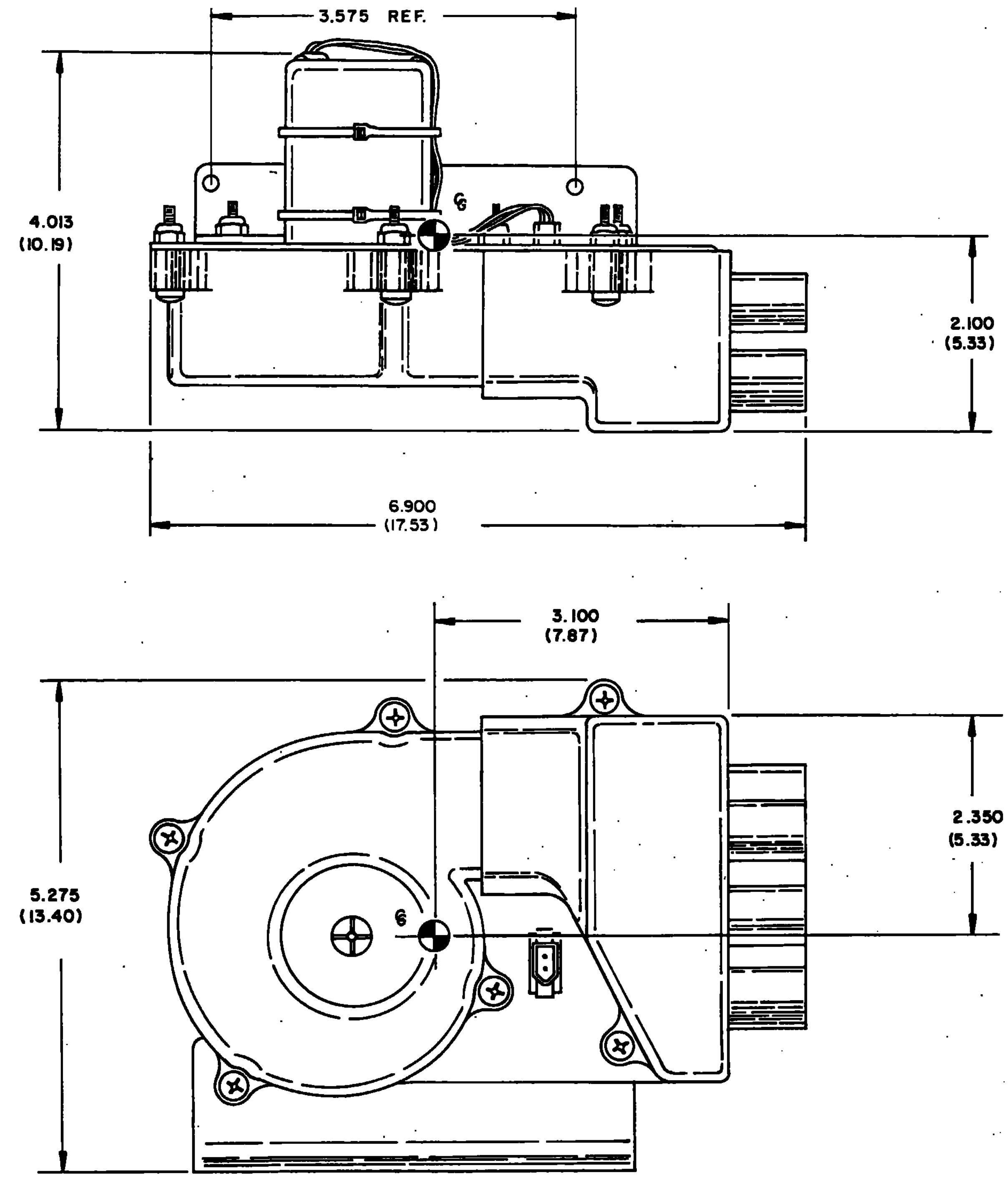
1.) REMOVE AND DISCARD SCREWS, WASHERS AND NUTS HOLDING FAN COVER TO BACK PLATE ON MOTOR FAN, KPN 148-5085-00/01. ASSEMBLE UNIT AS SHOWN.

2.) WIRE COLOR CODE:
RED = POSITIVE
GRAY = NEGATIVE

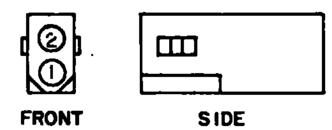
3.) CONNECTOR RECEPTACLE ASSEMBLY INSTRUCTIONS:
   a. CUT MOTOR LEAD WIRES TO 5 ± .250 INCHES (127 ± 6.35mm) IN LENGTH AND STRIP .150 ± .010 (3.81 ± 254mm) OF INSULATION FROM EACH END.
   b. REFERRING TO THE CRIMP TOOL, KPN 005-2012-10, USE CRIMP DIE B TO FASTEN BOTH BARE WIRE AND INSULATION IN THEIR PROPER LOCATIONS ON THE TERMINALS. CRIMP EACH TERMINAL ONTO MOTOR LEAD WIRES PER GOOD COMMERCIAL PRACTICE.
   c. USING INSERTION TOOL, KPN 005-2012-19, INSERT TERMINALS INTO THE RECEPTACLE AS SHOWN.
   d. PRESS TABS AGAINST RECEPTACLE HOUSING AND MOUNT INTO RECTANGULAR HOLE AS SHOWN.

4) AFTER UNIT IS FULLY ASSEMBLED, APPLY FULL RATED VOLTAGE AND CHECK FOR PROPER OPERATION.

FIGURE 2-14 KA 33 P/N 071-4037/00/01 FINAL ASSEMBLY
(Dwg. No. 300-03256-0000 R-6)



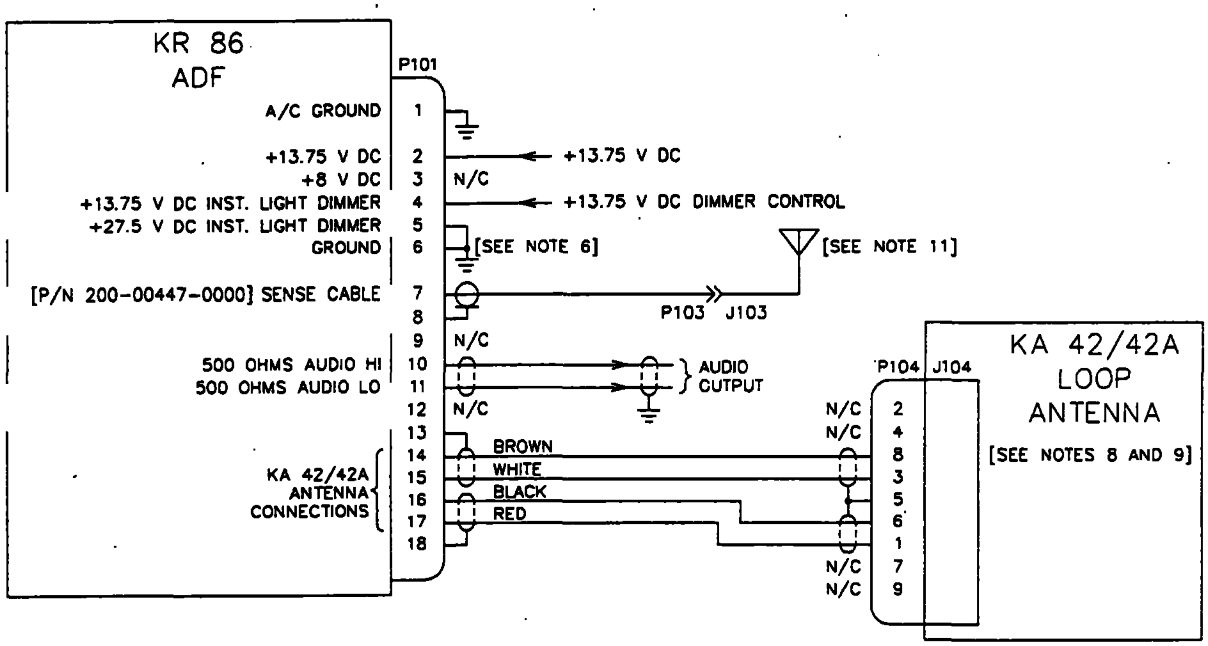

NOTES: 1. DIMENSIONS IN ( ) ARE IN CENTIMETERS.
2. USE KA33 BLOWER KIT, KPN 071-4037-00 FOR 14V AIRCRAFT AND KPN 071-4037-01 FOR 28V AIRCRAFT.
3. WEIGHT: 1.25 LBS. (0.57 KG.)




| | |
|---|---|
| PIN 2 | +14/28 VDC |
| PIN 1 | GROUND |

CONNECTOR PLUG
(KPN 030-2549-00)

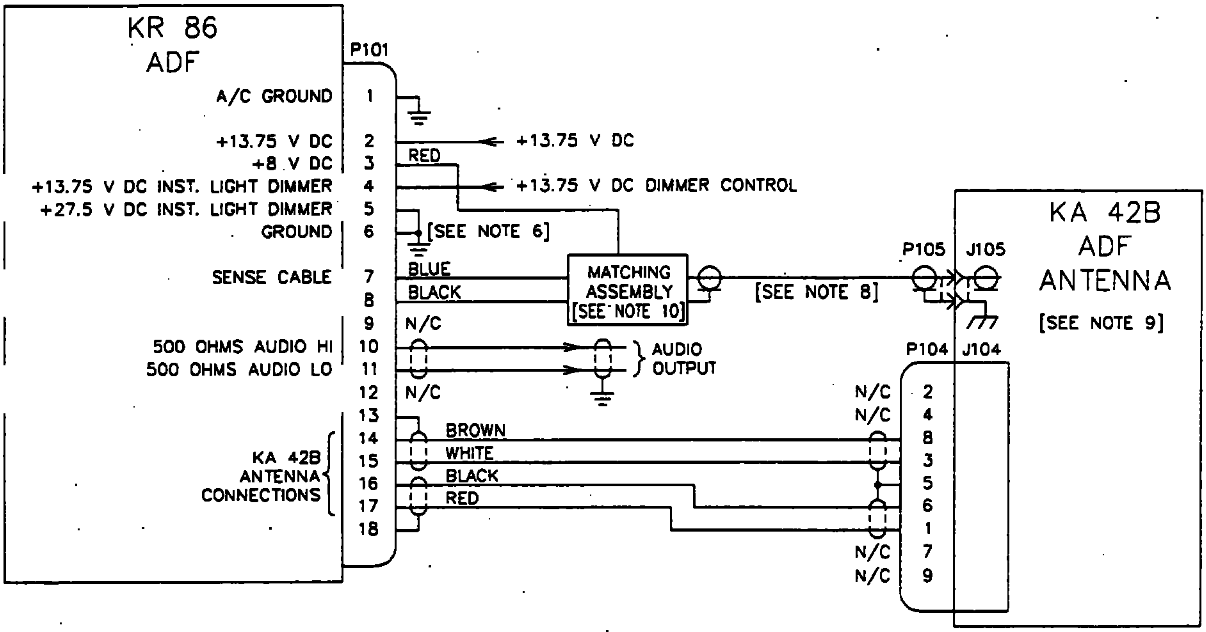
FIGURE 2-15 KA 33 INSTALLATION DRAWING
(Dwg. No. 155-05574-0000 R-5)




NOTES:

1. ANTENNA INSTALLATION IS SHOWN FOR BOTTOM MOUNTED LOOP AND TOP MOUNTED SENSE ANTENNAS.
2. DO NOT ALTER LENGTHS ON LOOP AND SENSE CABLES.
3. USE SHIELDED 2-CONDUCTOR CABLE WITH INSULATION JACKET OVERALL FOR AUDIO CABLE.
4. ALL WIRES ARE #22 AWG UNLESS OTHERWISE SPECIFIED.
5. FOR +27.5 VDC OPERATION:
   A. USE INSTALLATION KIT P/N 050-01308-0002/0003.
   B. FOR PANEL LIGHTS, CONNECT PIN 5 OF P101 TO +27.5 VDC DIMMER CONTROL; NO CONNECTION IS MADE TO PIN 4.
6. THIS CONNECTION IS MADE AT THE GROUND TERMINAL ON RACK CABLE PLATE.
7. FOR ADDITIONAL WIRING INFORMATION, REFER TO 14/28V REAR PLATE ASSEMBLY DRAWING AND VOLTAGE CONVERTER SCHEMATIC. A COPY MAY BE FOUND IN THE KR 86 INSTALLATION MANUAL.
8. KA 42 LOOP ANTENNA (P/N 071-1006-11) MUST MATE WITH 15 FT. LOOP CABLE ASSEMBLY (P/N 155-02035-0000) OR 24 FT. LOOP CABLE ASSEMBLY (P/N 155-02035-0001).
9. KA 42A LOOP ANTENNA (P/N 071-1098-00) MUST MATE WITH 15 FT. LOOP CABLE ASSEMBLY (P/N 155-02057-0002) OR 24 FT. LOOP CABLE ASSEMBLY (P/N 155-02057-0000).
10. P101 IS AN 18 PIN CONNECTOR (P/N 030-01045-0018). FOR CONTACTS, ORDER (P/N 030-01046-00XX) WHERE XX IS THE NUMBER OF CONTACTS REQUIRED.
11. UNIT IS A 50 PF SENSE ANTENNA.
12. N/C DENOTES A PIN THAT IS NOT CONNECTED.

**FIGURE 2-16 KR 86 INTERCONNECTION DIAGRAM**
**(Dwg. No. 155-01124-0000 R-2)**




NOTES:

1. THE ANTENNA INSTALLATION SHOWN IS FOR BOTTOM MOUNTED ANTENNA.
2. DO NOT ALTER THE LENGTHS ON LOOP CABLES.
3. USE SHIELDED 2-CONDUCTOR CABLE WITH INSULATION JACKET OVERALL FOR AUDIO CABLE.
4. ALL WIRES ARE #22 AWG UNLESS OTHERWISE SPECIFIED.
5. FOR +27.5 V DC OPERATION:
   A. USE INSTALLATION KIT P/N 050-01308-0017/0019.
   B. FOR PANEL LIGHTS, CONNECT PIN 5 OF P101 TO +27.5 V DC DIMMER CONTROL; NO CONNECTION IS MADE TO PIN 4.
6. THIS CONNECTION IS MADE AT THE GROUND TERMINAL ON RACK CABLE PLATE.
7. FOR ADDITIONAL WIRING INFORMATION, REFER TO 14/28 V REAR PLATE ASSEMBLY DRAWING AND VOLTAGE CONVERTER SCHEMATIC. A COPY MAY BE FOUND IN THE KR 86 INSTALLATION MANUAL.
8. FOR SENSE CABLE, USE RG-400, SUBMINIATURE RG-188, OR OTHER EQUIVALENT 50 OHMS COAXIAL CABLE. SENSE CABLE LENGTH IS NOT CRITICAL.
9. USE 15 FT. LOOP CABLE ASSEMBLY (P/N 155-02057-0002) OR 24 FT. LOOP CABLE ASSEMBLY (P/N 155-02057-0000).
10. MATCHING ASSEMBLY IS TO BE MOUNTED ON RACK CABLE ASSEMBLY. REFER TO KR 86 INSTALLATION MANUAL FOR DETAILS.
11. P101 IS AN 18 PIN CONNECTOR (P/N 030-01045-0018). FOR CONTACTS, ORDER (P/N 030-01046-00XX) WHERE XX IS THE NUMBER OF CONTACTS REQUIRED.
12. N/C DENOTES A PIN THAT IS NOT CONNECTED.

**FIGURE 2-17 INTERCONNECTION DIAGRAM**
**(Dwg. No. 155-01236-0000 R-1)**

# SECTION III
# OPERATION

To prevent excessive voltage transients from causing possible damage to the KR 86, it is recommended that the power switch be in the "OFF" position when the aircraft engine is started. Turn the unit "ON" by rotating the volume control knob clockwise. The frequency to which the receiver is tuned is displayed in the windows. The frequency may be changed by rotation of the three Frequency Control knobs and tuning is instantaneous. The Volume Control is adjusted for a comfortable listening level.

When a radio signal is being received, and the Function Selector Switch is in the ADF position, the ADF Indicator will display direction of the radio signal source relative to the heading of the aircraft. To assure that the ADF function is working properly, press the Heading/Test Knob. This will drive the ADF pointer in a clockwise direction. When the Heading/Test knob is released, the pointer will promptly return to its original position if the ADF system is functioning properly, and an adequate signal is being received. The Heading/Test knob also rotates the compass card enabling the pilot to set it for a selected bearing reference.

In various parts of the world, some radio range stations use an interrupted carrier for identification purposes. A Beat Frequency Oscillator (BFO) is provided to permit these stations to be more easily identified. The Function Selector Switch is simply placed in the BFO position and a 1000Hz tone will be heard while the transmitter carrier is on.

The KR 86 has an efficient Automatic Gain Control (AGC) circuit which holds the receiver audio output relatively constant over wide variations of rf signal input level. This circuitry is effective at all times. For this reason the KR 86 is not recommended for use with the four- course radio range stations (Aural Receiver Function).

Refer to figure 3-1 for KR 86 control functions.

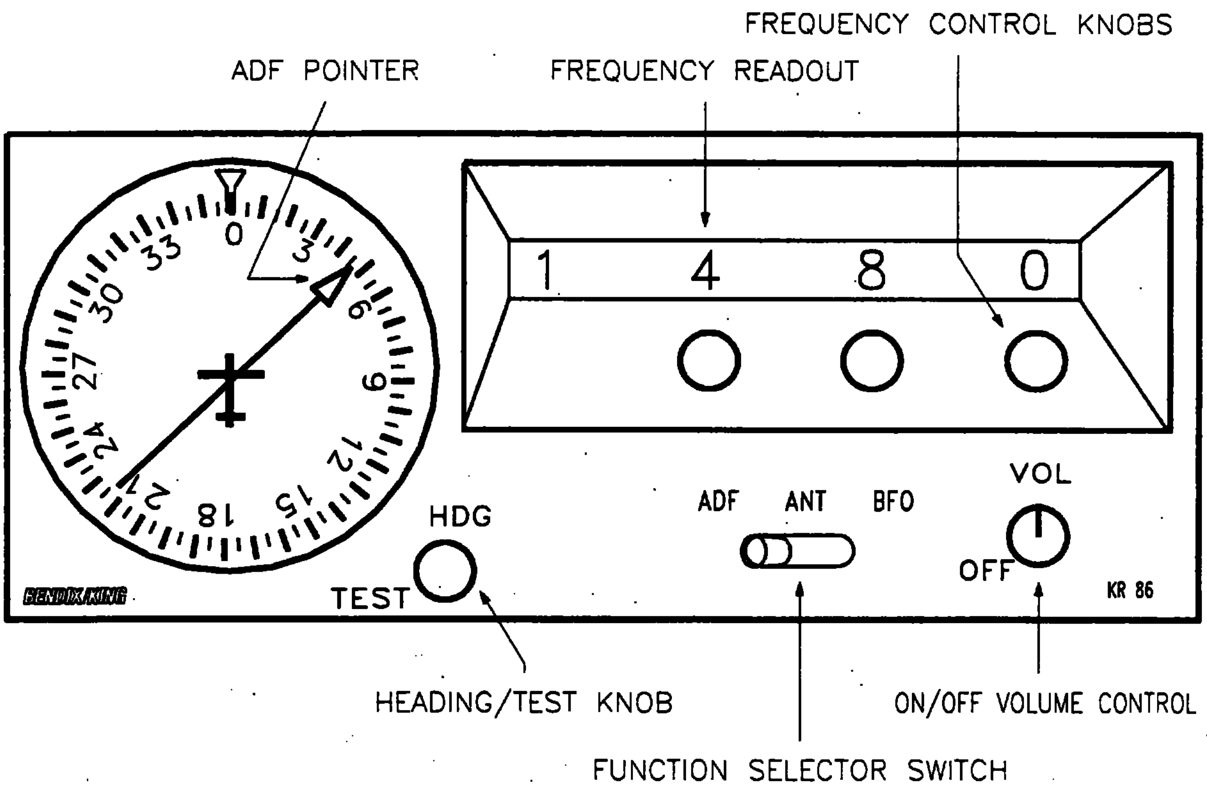



**FIGURE 3-1 KR 86 CONTROL FUNCTIONS**

Section I, II, and III have been deleted from the Maintenance-Overhaul Manual format. The Installation Manual, which covers the same installation information, should be added behind the red Installation Manual Tab provided in this binder.

MAINTENANCE/OVERHAUL MANUAL
SECTIONS IV, V AND VI

# TABLE OF CONTENTS

Paragraph | Page

## SECTION IV THEORY OF OPERATION



## SECTION V ILLUSTRATED PARTS LIST

Item | Page

# TABLE OF CONTENTS

# TABLE OF CONTENTS



# LIST OF DIAGRAMS AND ILLUSTRATIONS

# TABLE OF CONTENTS



## TABLES

# KING
## KR 86
## AUTOMATIC DIRECTION FINDER

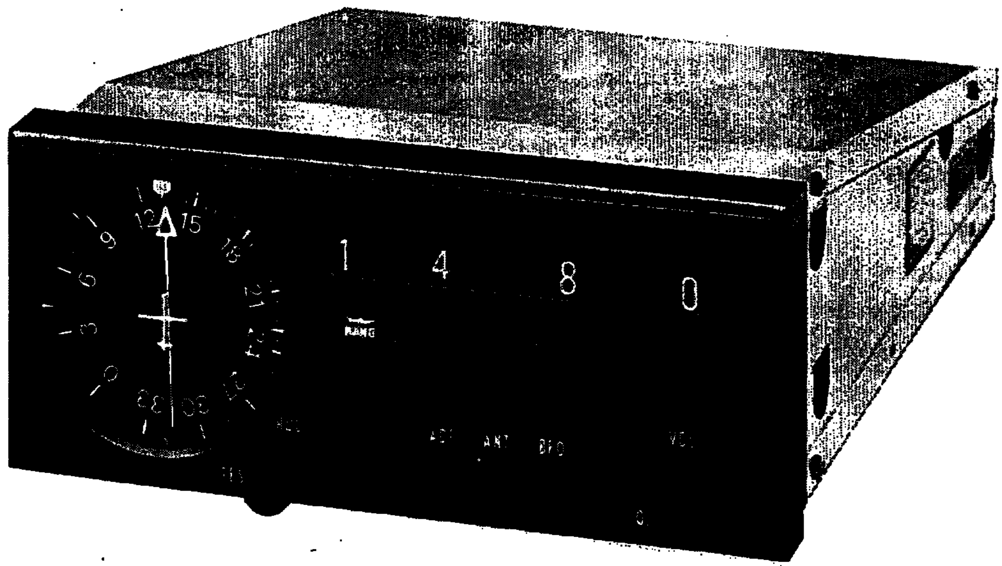



FIGURE i KR 86
(696-3204-00)

SECTION IV THEORY OF OPERATION

# SECTION IV

# THEORY OF OPERATION

## CONTENTS

# SECTION IV

# THEORY OF OPERATION

## 4.1 GENERAL PRINCIPLES OF OPERATION

The KR 86 is a single conversion superheterodyne receiver providing 1551 crystal controlled channels. These channels are spaced at 1KHz intervals over the range of 200KHz to 1750KHz. All (rf tank) L. C. circuits involved in tuning the receiver to frequency employ voltage variable capacitance silicon diodes (i. e. varactor diodes). Tuning voltage for the varactor diodes is generated in the digital circuitry and will be different for each different setting of the Frequency Selector.

### 4.1.1 OPERATION IN ADF MODE (Figure 4-1)

With the KR 86 operating in the ADF mode, the magnetic component of the intercepted radio waves induce voltages in the Loop Antenna windings. Voltages induced in the loop windings lead by 90° the voltage induced in the Sense Antenna. By connecting the loop antenna windings to corresponding stator windings in the goniometer, the current flow resulting from the induced voltage will cause the magnetic field to be reconstructed in the goniometer. The voltage induced in the rotor winding is the servo error signal, and will lead or lag the sense signal by 90° and have an amplitude dependent upon the relationship of the rotor position and the stator induced magnetic field. The rotor voltage nulls at the two positions where the rotor winding aperature is 90° to the magnetic field. The servo system is designed such that one null is stable and the other is unstable.

RF error signal developed across the rotor winding is applied to the Loop Amplifier input. Following amplification, the loop signal is applied to the Loop Modulator where the phase of the signal is alternately switched from -90° to +90° at an 83 1/3 Hz rate. A phase shift network retards the phase of the signal by 90° thus putting the loop signal alternately in phase and out of phase with the sense signal. This phase-switched loop signal is combined with the sense signal in the first RF sense stage. When the loop signal and the sense signal are in-phase, they will add; and when out-of-phase, they will subtract. The net effect is to produce an 83 1/3 Hz AM modulation of the signal. Any AM modulation of the original signal is, of course, still present.

The modulated signal is introduced into the Mixer stage along with the local oscillator voltage. The resulting difference frequency of 140KHz is passed through the 140KHz I. F. Amplifier where it is amplified to a suitable level for detection. The 83 1/3 Hz servo error signal and the normal audio is recovered at the Detector and then filtered in the 83 1/3 Hz selective servo amplifier. The output of the Servo Amplifier is connected to the Demodulator, which converts the error signal to an appropriate dc voltage to drive the dc motor and goniometer until the error signal is nulled. At this position the indicator points to the station.

### 4.1.2 OPERATION IN ANTENNA MODE

When the function switch on the KR 86 is set to "ANT" position the +8.0vdc regulated supply voltage is disconnected from the servo circuit, disabling the Loop Modulator and the Servo system. Incoming signals from the Sense Antenna only are utilized in producing a signal output, and the principle of operation is similar to that of any conventional single conversion superheterodyne receiver having an I. F. frequency of 140KHz.

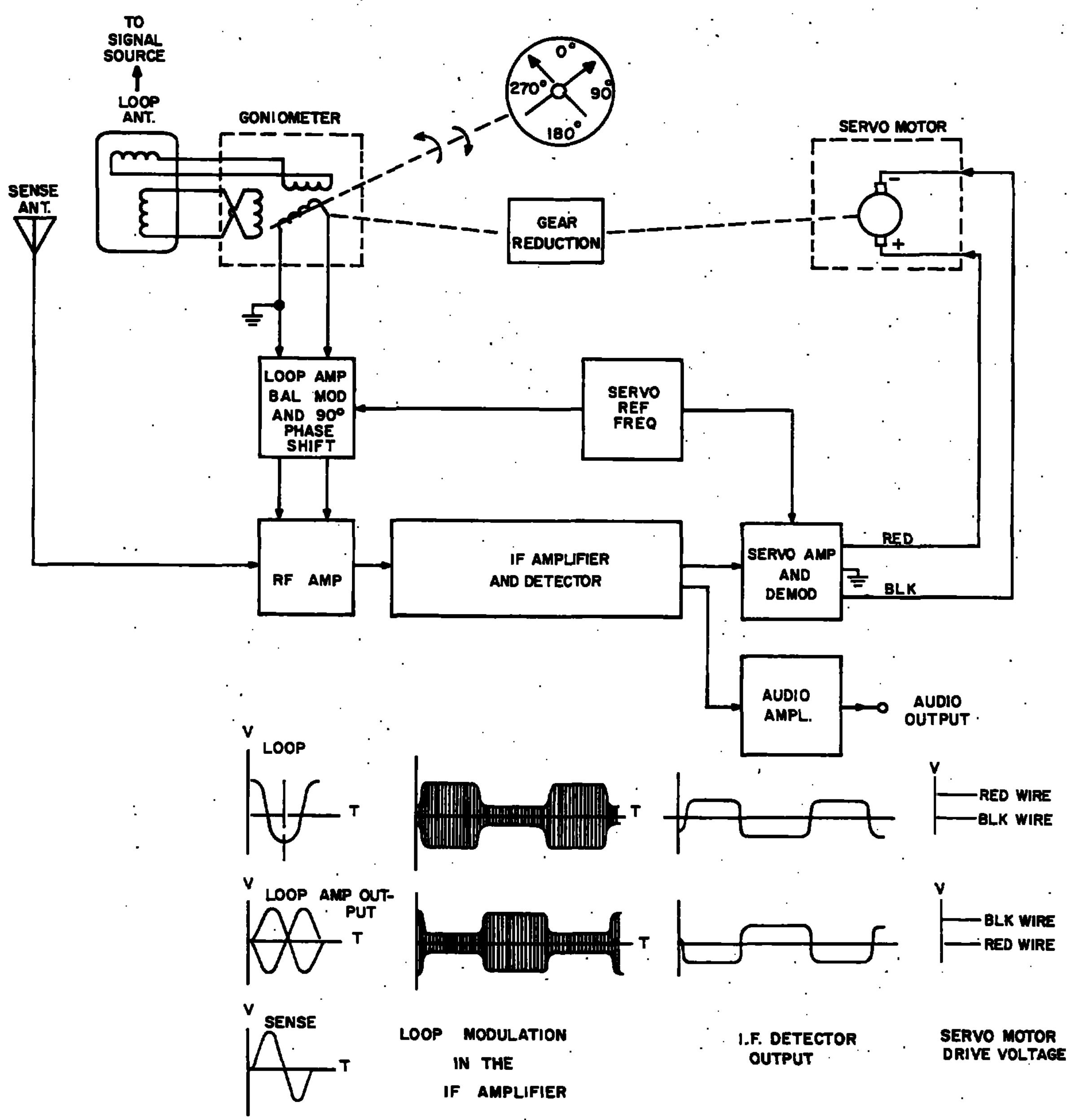



FIGURE 4-1 ADF OPERATION
(Dwg. No. 696-3205-00)

## 4.2 DETAILED THEORY OF OPERATION

The ADF block diagram in Figure 4-2 shows the interconnections of the functional parts of the KR 86. The ADF schematics are located in Section VI.

### 4.2.1 SENSE ANTENNA CIRCUIT

The RF signal picked by the Sense Antenna is fed to the primary windings of T206, T205 and T204, the low, mid and high band RF transformers. The sliding bandswitch S201 selects the correct RF transformer for each band and the primary winding is tuned by varactor diode CR202 to resonate at the receive frequency.

### 4.2.2 RF AMPLIFIER

The RF amplifier transistor Q202 amplifies the RF signal and its collector output is fed to the primary, input winding of RF transformers T209, T208 and T207. The tuned input and output stages of the RF Amplifier provide selectivity for image and spurious response rejection.

### 4.2.3 RF AGC

RF AGC is accomplished as the base of Q203 is turned on. Q203 acts as a variable shunt resistance lowering the input impedance at the base of RF amplifier transistor Q202 and reducing gain. As diode CR204 is turned off by AGC action the emitter and base impedance of RF amplifier Q202 increases further reducing RF gain and helping to maintain a constant input impedance and load for RF input transformers T206, T205 and T204.

### 4.2.4 BAND LEVELING FILTER

The broad RF tuning range of the ADF receiver requires compensation for tank impedance variations to provide a more constant RF signal amplitude level throughout the tuning range. This is accomplished by varying the impedance of the emitter circuit of the RF amplifier Q202 with the shunting impedance of inductance L208, L207 or L206. Capacitor C231 is used for dc decoupling.

### 4.2.5 INTERSTAGE TUNED CIRCUIT

The Interstage RF Tuned Circuit is composed of low, mid, and high band transformers T209, T208 and T207. The secondary output windings are shunted by resistors R231, R230 and R229 to stabilize the Q of the transformers and provide circuit stability. Varactor diode CR206 is used to provide tuning.

### 4.2.6 MIXER

The RF signal is coupled through capacitor C249 to the gate of FET mixer Q204. Local oscillator injection is applied to the source of the FET mixer through coupling capacitor C252.

### 4.2.7 I. F. AMPLIFIER

The I. F. amplifier consists of three double tuned stages T213-T214, T215-T216, T217-T218 and two stages of amplification I202 A and B. Each capacitor coupled double tuned stage is slightly over coupled and tuned to 140.00KHz. A gain controlled amplifier integrated circuit I202 sections A and B provide the two stages of amplification. Gain of both stages is reduced with the application of an increasing AGC voltage. In the BFO mode a 1KHz signal is applied to the AGC line to create 1KHz modulation for identification of keyed CW signals.

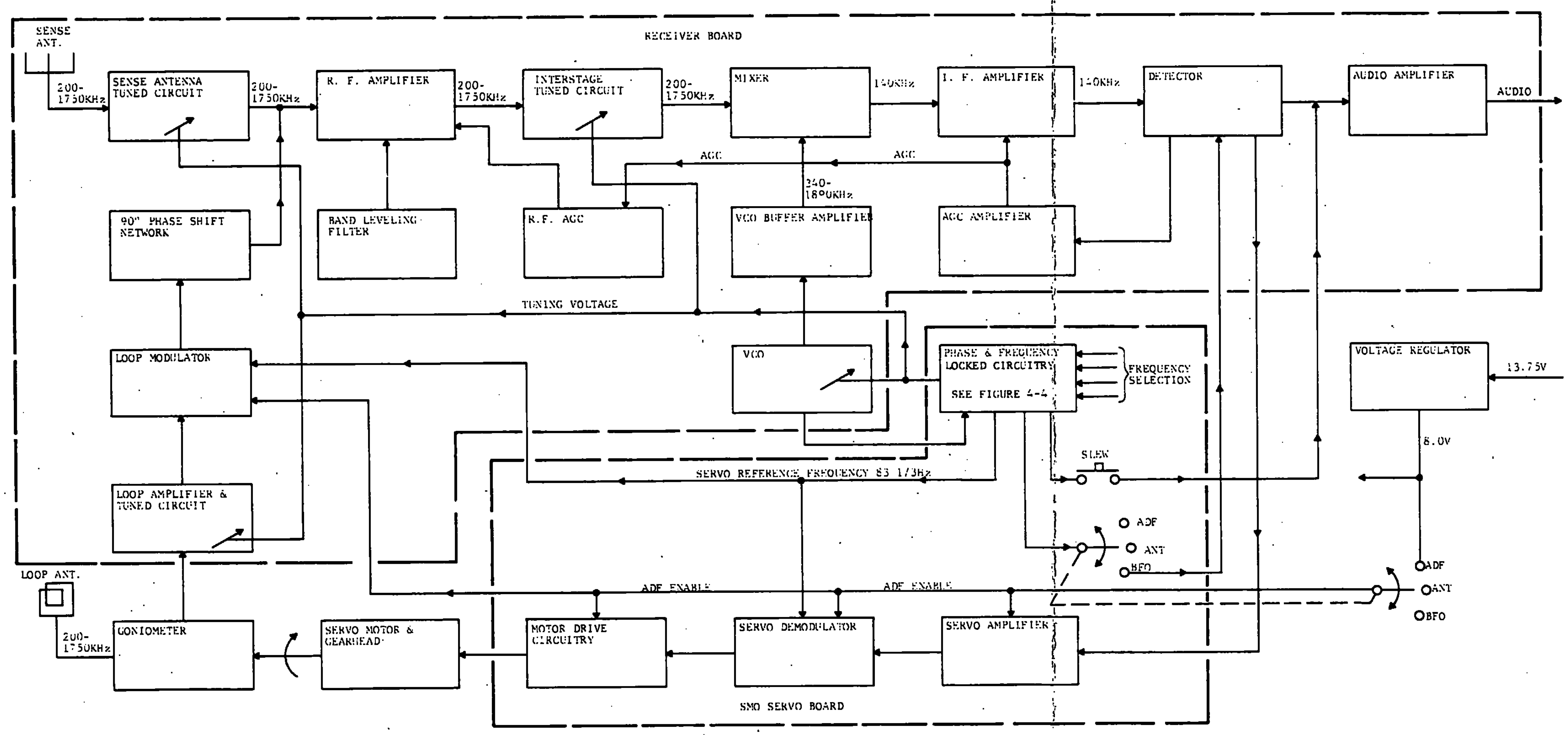



FIGURE 4-2 KR 86 ADF BLOCK DIAGRAM
(Dwg. No. 696-3206-00)

### 4.2.8 DETECTOR/SERVO GAIN CONTROL

Transistor Q207 serves as a linear detector. R261 (servo gain adj.) located in the collector circuit of Q207 provides a means for setting the signal level to the servo circuit. Transistor Q209 provides trickle bias for the linear detector.

### 4.2.9 AGC AMPLIFIER

Transistor Q208 serves as the AGC Amplifier. R264 and C286 filter the detector output and apply the resultant dc to the base of Q208. The dc voltage developed at the collector of Q208 serves as the AGC voltage for the I. F. amplifier I202 A and B and RF amplifier Q202. An increase in RF level causes the AGC voltage to go positive.

### 4.2.10 AUDIO AMPLIFIER

The audio signal is direct coupled from the detector transistor Q207 collector to the high impedance input of the Buffer Amplifier (Pin 10) of the integrated circuit amplifier I204. The Buffer Amplifier output (Pin 1) is fed to the volume control and back to the input (Pin 3) for final amplification. Transformer T219 transforms the output impedance of amplifier I204 to 500 ohms and provides 100mw audio output capability.

### 4.2.11 LOOP ANTENNA AND GONIOMETER (Figure 4-3)

The Loop Antenna consists of two windings wound at right angles on a ferrite core. The windings are symmetrical, with respect to ground, to prevent unwanted pickup. The magnetic field of the transmitted signal will induce a voltage in the windings of the Loop Antenna. The relative direction of the magnetic field will determine the relative amplitude of the induced voltage in each winding. If the plane of the coil is perpendicular to the field, maximum voltage is induced in the winding (i. e. maximum amount of magnetic flux linking the coil). If the plane of the coil is parallel to the field no voltage will be induced (i. e. no flux line linking the coil).

At 45° equal amounts of flux link both coils and thus the same voltage is induced in each coil. The voltages induced in the loop are transmitted to the Goniometer through the Loop Cable.

The loop cable capacitance is maintained constant because the entire circuit, goniometer, loop cable and antenna is tuned to the frequency set by the frequency selector.

The relative voltage induced in the two loop antenna coils depends upon the angle that the magnetic field enters the antenna. These induced voltages in the loop windings are applied to the goniometer stator windings. The voltage across the goniometer windings establishes a resultant magnetic field in the goniometer. Therefore the field in the goniometer has the same direction relative to the goniometer windings as the magnetic field that energizes the antenna winding. As the rotor of the goniometer is rotated it passes through minimum, maximum, or any intermediate value of coupling to the resultant magnetic field in the goniometer. As the rotor turns through any 180° the phase of the rotor voltage is reversed. The reversal occurs as the rotor passes through zero coupling (i. e. the nulls).

The amount of signal picked up by the Loop Antenna is dependent upon the frequency and strength of the magnetic field. The pick-up by the loop is proportional to the frequency which means that twice as much voltage is induced if the frequency is doubled. Therefore the loop antenna voltage will be 90° ahead of the sense antenna voltage.

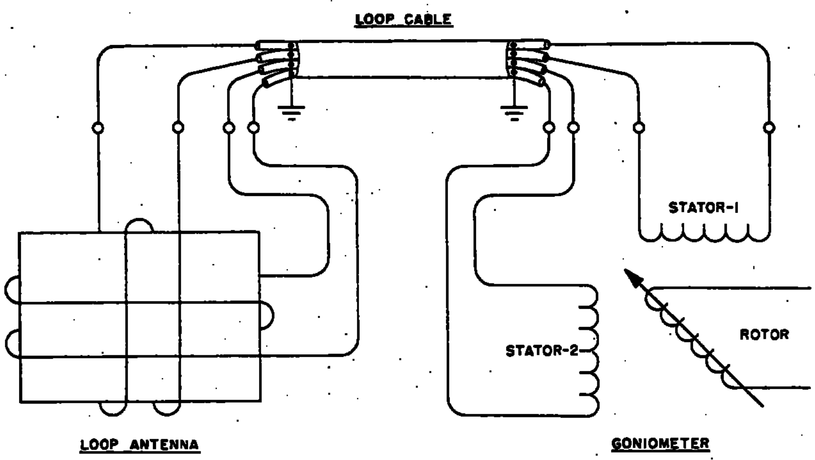



FIGURE 4-3 LOOP ANTENNA AND GONIOMETER
(Dwg. No. 696-3207-00)

### 4.2.12 LOOP AMPLIFIER AND TUNED CIRCUIT

The loop signal from the goniometer rotor is fed to the primary windings of loop transformers T203, T202 and T201. The secondary windings are varactor tuned by CR201 to resonate at the receive frequency. The tuned signal is link coupled to loop amplifier transistor Q201. The signal is amplified and applied to the Loop Modulator through coupling capacitor C211.

### 4.2.13 LOOP MODULATOR

A balanced modulator integrated circuit I201 serves as the loop signal modulator. R269 (loop balance adj.) is adjusted to balance the input of I201 thus providing a balanced output. R268 (loop gain adj.) provides an adjustment of loop modulator I201 gain to establish the required signal to noise ratio in ADF mode.

### 4.2.14 90° PHASE SHIFT NETWORK

The output signal from the loop modulator I201 passes through a 90° phase shift network consisting of inductance L204, L203 or L202 and capacitor C227 coupling to the base of RF amplifier transistor Q202.

4.2.15 SERVO AMPLIFIER

The receiver detector output signal is filtered by the servo amplifier circuit (I311A and B) to recover the 83 1/3 Hz error signal. R323 (phase adj.) provides the means for matching the phase of the I311 output with the 83 1/3 Hz servo reference frequency. The output from I311B is applied to the Demodulator through capacitor C317 and resistor R325.

4.2.16 SERVO DEMODULATOR

Integrated circuit I312 serves as a full wave demodulator for the servo signal. The amplified servo signal is applied to the balanced input (Pin 1) and the 83 1/3 Hz servo reference frequency to (Pin 8). The 83 1/3 Hz servo reference frequency is obtained by dividing the 1KHz SMO reference frequency by twelve. R330 provides Demodulator balance adjustment and establishes the minimum dead band characteristic. The unfiltered dc output level at (Pins 6 and 9) is dependent upon the phase and amplitude of the error signal received and controls the motor drive circuitry.

4.2.17 MOTOR DRIVE

Capacitors C324 and C325, resistors R340, R341, R342 and R343 provide a lead-lag network for servo compensation. R338 (dc balance adj.) is set for zero volts between test points TP317 and TP318 thus correcting for any dc unbalance in motor drive circuitry. Transistor Q308A used as a diode provides temperature compensation for transistors Q308B and Q308D. Q308C and Q308E provide appropriate voltage to the dc motor to drive the goniometer rotor to the stable null position.

4.2.18 STABILIZED MASTER OSCILLATOR (SMO) FREQUENCY SYNTHESIZER (Figure 4-4A & B)

The KR 86 Frequency Synthesizer utilizes a type II phase lock loop to stabilize a voltage controlled oscillator with a crystal reference frequency. Basically, the voltage controlled oscillator (VCO) tunes the range 340KHz to 1890KHz (RF + 140KHz IF) but is divided down to 1.0KHz by a Programmable Divider. Additionally, a 1.0KHz reference frequency is obtained by fixed division from a 128.00KHz crystal controlled oscillator. Both 1.0KHz signals are applied to a Phase-Frequency Comparator whose output is filtered and used as the tuning voltage for the VCO. This tuning voltage drives the VCO frequency to the condition where the 1.0KHz signals have the same frequency and phase and the loop is considered locked. By changing the Programmable Divider division ratio with front panel RF frequency selector switches, the VCO tunes the entire range from 340KHz to 1890KHz.

4.2.18.1 VCO

An emitter coupled oscillator integrated circuit (I203) in conjunction with the varactor diode (CR205), temperature compensating capacitor C232 and the tuned resonant circuit associated with T212, T211 and T210 serves as a voltage controlled oscillator. I203 supplies a square wave VCO output (Pin 3) to drive the SMO and sine wave output (Pin 12) to drive the VCO Buffer Amplifier.

4.2.18.2 VCO BUFFER AMPLIFIER

The buffer amplifier transistor Q205 represents a high load impedance to the VCO output tank and is directly coupled to transistor Q206. Q206 serves as an emitter follower providing a low impedance output for VCO injection to the Mixer.

## 4.2.18.3 PROGRAMMABLE DIVIDER

Schematics, logic and truth tables for all the integrated circuits are included in Section VI.

The Programmable Divider is a 2,000 state counter (10 states I303 × 10 states I302 × 10 states I301 × 2 states I305). The highest divide ratio employed in the KR 86 is 1939 (VCO = 1939 KHz) while the lowest divide ratio is 340 (VCO = 340KHz). To divide by 1939 it is necessary to make the counter skip 61 states in its count sequence. To divide by the minimum divide ratio (340) the counter must skip 1660 states. In the KR 86, the Load State (the state that initiates preset) is chosen 61 states from the maximum count available, which causes the counter to always skip over 61 states. The Preset State is selected according to the wafer switch positions to discard an additional 0 to 1599 states, to leave a wafer selectable 340 to 1939 state counter.

The receiver VCO input to the Programmable Divider is amplified by means of saturating amplifier Q301. The square wave output (CP) is applied to the counter circuit consisting of the three binary coded decimal (BCD) counters (I303, I302, I301) and the J-K flip-flop (I305).

By starting with the count state at preset, each BCD counter will advance one state (count enable) with the rising edge of each clock pulse if its respective CEP, CET, and $\overline{PE}$ inputs are high:

Count Enable = $CEP \cdot CET \cdot \overline{PE}$

The CEP and CET inputs of each counter stage are either held high or driven from preceeding stages. When the preceeding stage reaches its Terminal Count (TC) the following stage CEP and CET inputs go high. Terminal count (TC) is high when the decade counter is at the BCD nine state with its respective $Q_o$ high, $Q_1$ low, $Q_2$ low, $Q_3$ high and CET high.

$TC = CET \cdot Q_o \cdot \overline{Q_1} \cdot \overline{Q_2} \cdot Q_3$

The terminal counts for each of the BCD stages are as follows:

| | | | |
|---|---|---|---|
| I303 | TCW | = | $W_1 . W_8$ |
| I302 | TCX | = | $W_1 . X_1 . X_8$ |
| I301 | TCY | = | $W_8 . Y_1 . Y_8$ |

The outputs from the three BCD counters I303, I302 and I301 drive the J-K flip-flop I305 whose output Z goes positive when J is high and K is low (see truth table in Section VI, Figure 6-6). The J and K inputs are as follows:

$J = W_1 . W_8 . X_1 . X_8 . Y_1 . Y_8$

$K = W_8 . X_1 . X_2 . Y_1 . Y_8 . Z . D$

Where D = A function of slide switch S201B which is low for the low and middle RF band and high for the high RF band.

Outputs from I303, I302, I301 and I305 also drive the two 3-input NAND gates (I304) and a 2-input NOR gate (I306). The output from I306 is $\overline{PE}$ and is high when BCD counters I301 $Y_1 \cdot Y_8$; I302 $X_1 \cdot X_2$; I303 $W_8$; and I305 Z are all high in the Load State. The next falling edge of the Clock Pulse (CP) will send $\overline{PE}$ low overriding CEP and CET inputs and presetting the four parallel inputs to each BCD counter. The rising edge of the CP occuring at this preset state transfers

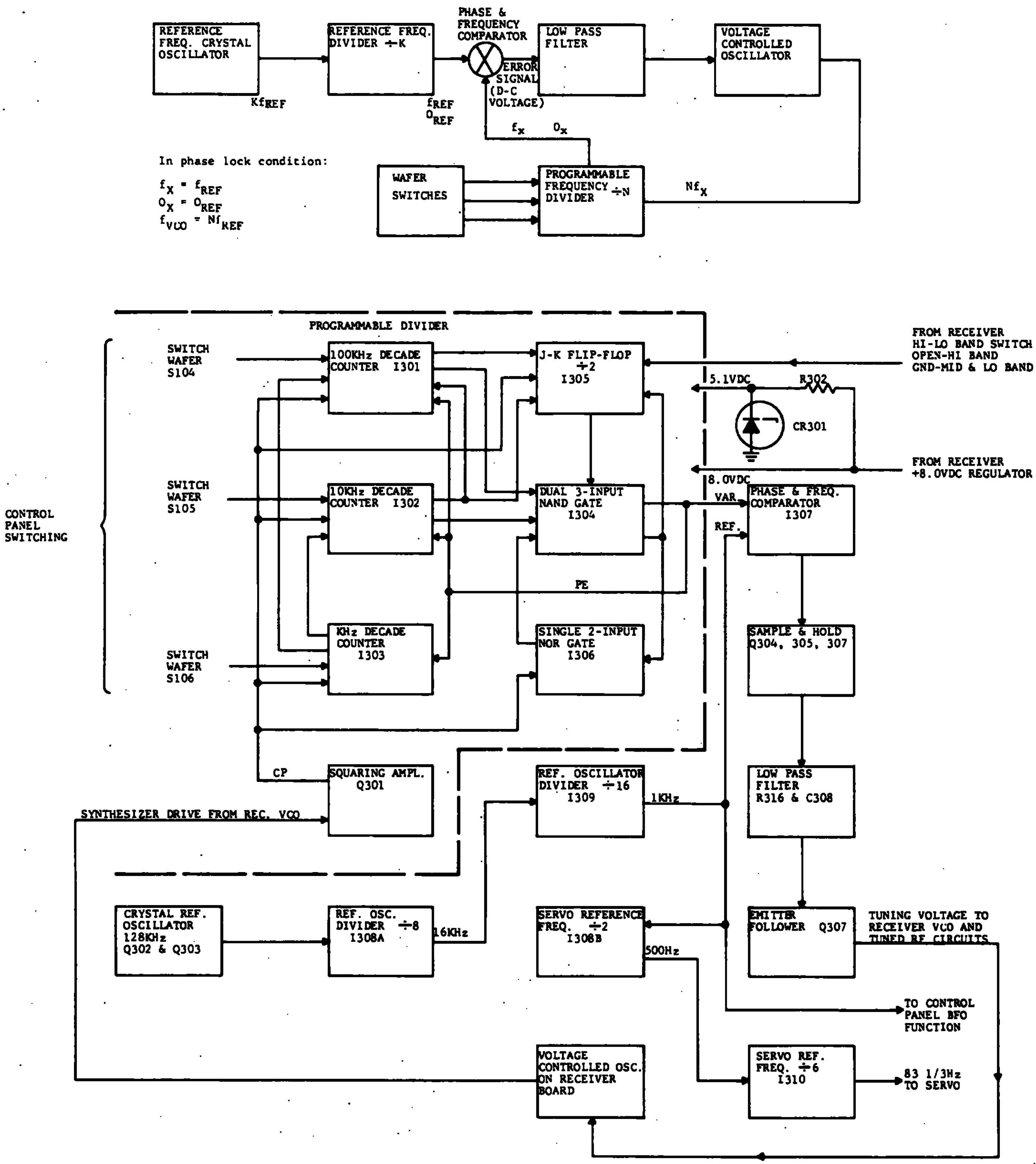



FIGURE 4-4A and B KR 86 STABILIZED MASTER OSCILLATOR (SMO) FREQUENCY SYNTHESIZER
(Dwg. No. 696-3208-00)

the condition of the four parallel inputs to the four parallel outputs of each stage, the counters are reset and the sequence is repeated.

$\overline{PE} = CP \cdot W_8 \cdot X_0 \cdot X_2 \cdot Y_0 \cdot Y_8 \cdot Z$

The following two examples are presented as an aid to understanding the operation of the Programmable Divider. In the discussion to follow reference is made to the Programmable Divider Switching Chart (Figure 4-5). ADF frequency selection is set up by S104 (hundreds), S105 (tens) and S106 (ones) switch wafers. In the low and mid band position S201 B supplies a low input to $K_2$ on flip-flop I305. This causes I305 output to be high limiting the maximum count capability to 1,000.

Let us consider the operation of the Programmable Divider as similar to the odometer (mileage traveled readout) in your automobile. I303 serves as the ones decade counter, I302 as the tens decade counter and I301 the hundreds decade counter. Our first example will be with the ADF RF frequency selector controls set at 200KHz and in the Preset State shown by the dashed line on the Programmable Divider switching chart.

We will follow the action from the Preset State to the Load State. With the rising edge of the Clock Pulse, I303 the ones counter and I302 the tens counter will reset to zero and I301 the hundreds counter advances from BCD five to BCD six (storing a one count). Thus we have used one CP; remember the action of each CP equals one count. With each succeeding CP I303 will advance one state, requiring nine clock pulses to reach BCD nine terminal count (TC). The next CP will reset I303 to zero and I302 will advance from BCD zero to BCD one (storing a ten count). I303 will continue to advance with each CP and after each terminal count (TC) will reset storing a ten count in I302 until it reaches BCD nine (TC). I303 continues to count until reaching TC, the next CP resets I303 and I302 to zero and advances I301 to BCD seven. One hundred and one counts have now been stored in I301. This sequence continues until I301 has advanced to BCD eight and then BCD nine (TC) and Load State. I301 has stored a total of three hundred and one counts upon reaching its Load State(maximum count).

I303 continues to count and store each TC in I302 which reaches BCD three its load state with thirty counts. The next CP resets I303 to zero. I203 continues to count until reaching BCD eight its load state with nine counts. Add up the three hundred and one counts stored in I301, 30 counts in I302, and the nine counts stored in I303. This gives us a total of 340 counts.

The frequency set by the ADF RF frequency selector of 200KHz plus 140KHz (I. F. frequency) equals 340KHz the VCO frequency required for high side injection to the Mixer. If we divide the VCO frequency of 340KHz by 340 (the number of counts stored by the counter) we have a frequency of 1KHz which is equal to the 1KHz reference frequency which is required for a lockup condition.

In our second example the ADF RF frequency selector controls are set at 1750KHz and again shown in the Preset State by the dotted line on the Programmable Divider switching chart. We will again follow the action from the Preset State to the Load State. With the rising edge of CP, I303 the ones counter having been preset in the BCD nine state terminal count (TC) will reset to zero and simultaneously advance I302 from BCD four to BCD five (storing a one count). I301 the hundreds counter remains at BCD zero. With each succeeding CP I303 will advance one state until it reaches BCD nine (TC). The next CP resets I303 to zero and I302 will advance to BCD six. I303 will continue to advance with each CP and each time upon reaching TC will advance I302 one state until I302 reaches BCD nine (TC). I303 continues to count until it again reaches BCD nine (TC). With I302 at its TC and I303 at its TC the next CP will reset both I303 and I302 to zero simultaneously advancing I301 from BCD zero to the BCD one state storing the fifty one counts. Each time that I302 and I303 reach TC, I301 will advance one state (storing one hundred

| FREQ. SEL. DIAL | BAND SW. S101B "D" | I301(100's) COUNTER $C_8$ / $Y_8$ | $C_4$ / $Y_4$ | $C_2$ / $Y_2$ | $C_1$ / $Y_1$ | INPUT / OUTPUT |
|---|---|---|---|---|---|---|
| 17 | 1 | 0 | 0 | 0 | 0 | 0 |
| 16 | 1 | 0 | 0 | 0 | 1 | 1 |
| 15 | 1 | 0 | 0 | 1 | 0 | 2 |
| 14 | 1 | 0 | 0 | 1 | 1 | 3 |
| 13 | 1 | 0 | 1 | 0 | 0 | 4 |
| 12 | 1 | 0 | 1 | 0 | 1 | 5 |
| 11 | 1 | 0 | 1 | 1 | 0 | 6 |
| 10 | 1 | 0 | 1 | 1 | 1 | 7 |
| 9 | 1 | 1 | 0 | 0 | 0 | 8 |
| 8 | 1 | 1 | 0 | 0 | 1 | ●9 |
| 7 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 0 | 0 | 0 | 0 | 1 | 1 |
| 5 | 0 | 0 | 0 | 1 | 0 | 2 |
| 4 | 0 | 0 | 0 | 1 | 1 | 3 |
| 3 | 0 | 0 | 1 | 0 | 0 | 4 |
| 2 | 0 | 0 | 1 | 0 | 1 | 5 |
| | 0 | 0 | 1 | 1 | 0 | 6 |
| | 0 | 0 | 1 | 1 | 1 | 7 |
| | 0 | 1 | 0 | 0 | 0 | 8 |
| | 0 | 1 | 0 | 0 | 1 | 9 |

LOAD STATE

| FREQ. SEL. DIAL | I302(10's) COUNTER $B_8$ / $X_8$ | $B_4$ / $X_4$ | $B_2$ / $X_2$ | $B_1$ / $X_1$ | INPUT / OUTPUT |
|---|---|---|---|---|---|
| 9 | 0 | 0 | 0 | 0 | 0 |
| 8 | 0 | 0 | 0 | 1 | 1 |
| 7 | 0 | 0 | 1 | 0 | 2 |
| 6 | 0 | 0 | 1 | 1 | 3 |
| 5 | 0 | 1 | 0 | 0 | 4 |
| 4 | 0 | 1 | 0 | 1 | 5 |
| 3 | 0 | 1 | 1 | 0 | 6 |
| 2 | 0 | 1 | 1 | 1 | 7 |
| 1 | 1 | 0 | 0 | 0 | 8 |
| 0 | 1 | 0 | 0 | 1 | 9 |

| FREQ. SEL. DIAL | I303(1's) COUNTER $A_8$ / $W_8$ | $A_4$ / $W_4$ | $A_2$ / $W_2$ | $A_1$ / $W_1$ | INPUT / OUTPUT | NOTE DIRECTION OF ACTION |
|---|---|---|---|---|---|---|
| 9 | 0 | 0 | 0 | 0 | 0 | ADVANCE ↑ / RESET ↓ |
| 8 | 0 | 0 | 0 | 1 | 1 | |
| 7 | 0 | 0 | 1 | 0 | 2 | |
| 6 | 0 | 0 | 1 | 1 | 3 | |
| 5 | 0 | 1 | 0 | 0 | 4 | |
| 4 | 0 | 1 | 0 | 1 | 5 | |
| 3 | 0 | 1 | 1 | 0 | 6 | |
| 2 | 0 | 1 | 1 | 1 | 7 | |
| 1 | 1 | 0 | 0 | 0 | 8 | |
| 0 | 1 | 0 | 0 | 1 | 9 | |

NOTES:

1. Low State=0.0V=Gnd. High State=+0.5V.
2. Load State and Preset State are shown on chart.
3. Total count possible = 2x10x10x10 = 2,000 (0→1999). Counts required = 1940 (0→1939).

FIGURE 4-5 PROGRAMMABLE DIVIDER SWITCHING CHART
(Dwg. No. 696-3209-00)

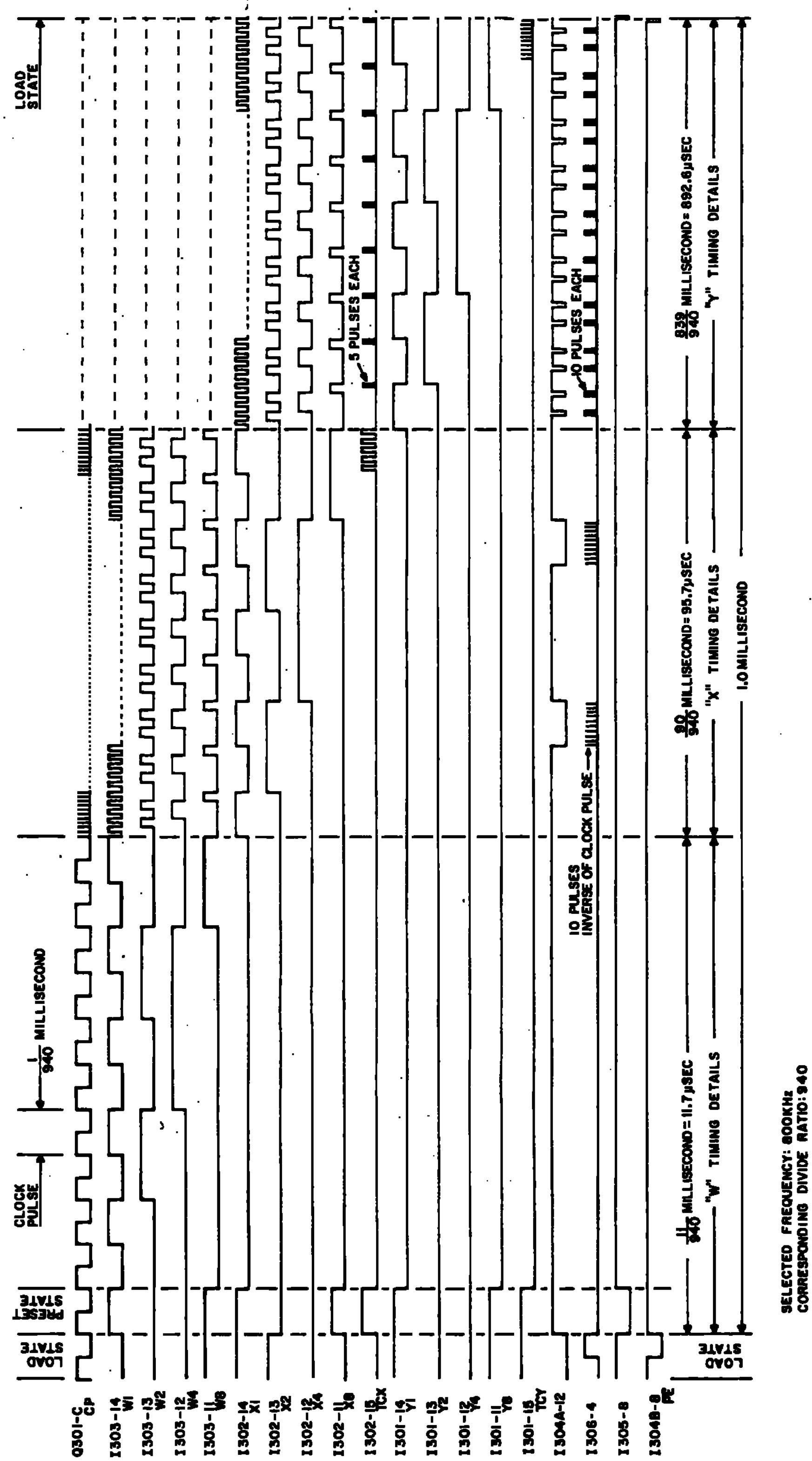
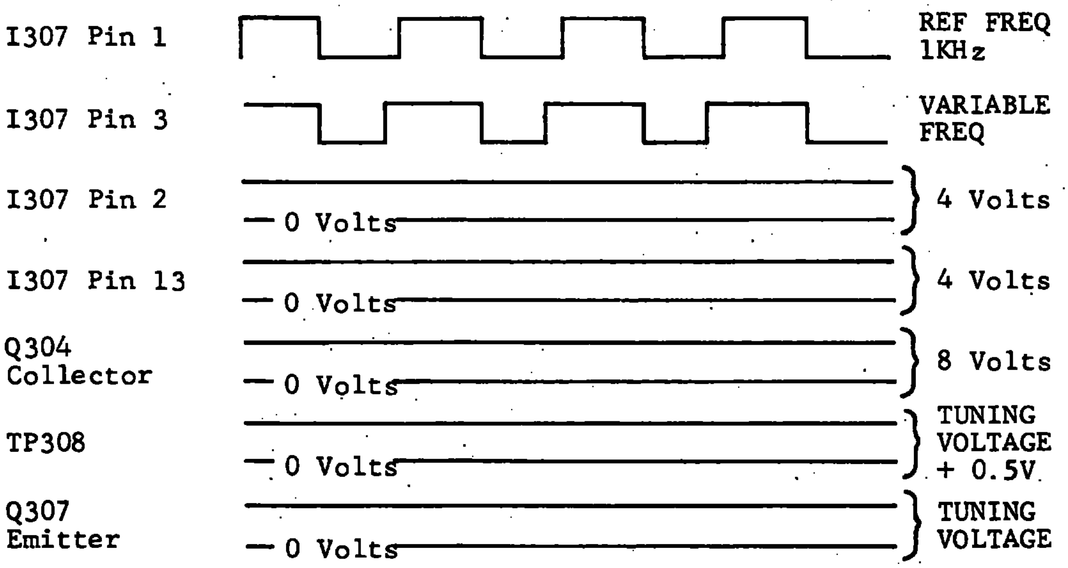



FIGURE 4-6 PROGRAMMABLE DIVIDER TIMING DIAGRAM
(Dwg. No. 696-3210-00)

Negative transitions of the Reference and Variable inputs are equal in phase and frequency when the lock condition is established.




The DC Tuning Voltage drives $F_{vco}$ to maintain phase and frequency lock.

FIGURE 4-7 PHASE AND FREQUENCY COMPARATOR DIAGRAM
(Dwg. No. 696-3211-00)

counts) until I301 reaches BCD nine (TC) marked by an asterisk. I303 continues counting and storing counts in I302. I302 reaches BCD three and I303 reaches BCD eight and I301 is waiting at BCD nine *(TC). We have all the requirements for the parallel enable (PE) to preset the counters with the next CP, dependent only upon the state (low or high) of I305 output Z. If Z is high I303, I302 and I301 will preset, if Z is low no preset can take place. The state of I305 output Z is dependent upon the input to I304$K_2$ which is determined by the output of sliding bandswitch S201 B. With S201 B providing a high output D to I305$K_2$ in the high band position, the result is a low output from I305Z, thus retaining the counter in the count mode and enabling a possible count of nineteen hundred and thirty nine. Counting continues until I301 advances to BCD nine (TC). I301 has stored eighteen hundred and fifty one counts upon reaching its load state. I303 and I302 continue to count until I302 advances to BCD three its load state with 30 counts. I303 advances until reaching BCD eight its load state with nine counts. To find the total counts (CP) required to reach the Load State, we add the eighteen hundred and fifty one counts stored in I301, the thirty counts in I302 and the nine counts stored in I303. This gives us a total of eighteen hundred and ninety counts (CP).

The total number of counts (CP) can be again compared to the frequency set by the ADF RF frequency selector controls as 1750KHz + 140KHz. The 1750KHz + 140KHz equals the VCO frequency (For high side injection) required for an I. F. frequency of 140KHz.

A timing diagram of the Programmable Divider (ADF RF frequency selector set at 800KHz) is illustrated in Figure 4-6.

4.2.18.4 PHASE AND FREQUENCY COMPARATOR (Figure 4-7)

The Phase and Frequency Comparator consists of the integrated circuit I307. The phase-frequency detector is locked in (indicated by both outputs high, approximately 4 vdc) when the negative transitions of the variable input (Pin 3) and reference input (Pin 1) are equal in frequency and phase. If the variable input is lower in frequency or lags in phase, the (Pin 13) output goes low; conversely the (Pin 2) output goes low when the variable input is higher in frequency or leads the reference input in phase. It is important to note that the duty cycles of the variable input and the reference input are not important since only negative transitions control circuit operation.

4.2.18.5 SAMPLE AND HOLD

The Sample and Hold Circuit consists basically of transistors Q304, Q305, Q306, Resistor R315 and capacitor C307. Q304, Q305 and Q306 are normally dc biased in the off state. When in phase and frequency locked condition occasional negative pulses from I307 (Pin 13) activates Q304 and in turn Q305 supplying a charging pulse to and maintaining a constant voltage at C307. Contingent with the phase or frequency error at the variable input of I307 the output from (Pin 13 is approximately 4 vdc and, or containing negative pulses (duty cycle varies with amount of error) biasing on Q304 and in turn Q305 producing charging pulses for the purpose of increasing and/or maintaining a voltage charge on C307. The output from I307(Pin 2) is approximately 4vdc and/ or containing negative pulses (duty cycle varies with amount of error biasing on Q306 producing pulses for the purpose of decreasing and/or maintaining a voltage charge on C307. The voltage at TP308 is essentially the value of the required tuning voltage plus the base to emitter voltage on Q307 of 0.5 volt.

4.2.18.6 1KHz REFERENCE FREQUENCY GENERATOR

The reference oscillator for the phase and frequency locked loop consists of a 128.00KHz crystal oscillator. Transistors Q302 and Q303 are connected as an astable multivibrator. Crystal Y301 acts as a series resonant element controlling the oscillation of the multivibrator. The 128KHz oscillator output is divided by eight in I308A and its 16KHz output divided by sixteen in I309. The 1KHz square wave output from I309 provides the reference frequency for the Phase and Frequency Comparator I307.

4.2.18.7 LOW PASS FILTER AND EMITTER FOLLOWER

Components R316 and C308 compose a low pass RC filter. Its purpose is to remove any ac component from the output of the Sample and Hold Circuit and provide a clean dc voltage to the base of Q307. The purpose of emitter follower Q307 is to serve as a low output impedance and provide the VCO and RF varactor tuning voltage.

4.2.18.8 BFO SOURCE

The 1KHz square wave reference for the Phase and Frequency Comparator is filtered by resistor R310 and capacitor C306 and serves as the RF injection signal for the BFO function.

4.2.18.9 SERVO REFERENCE FREQUENCY

The 1KHz square wave reference is divided by two in I308B and its 500Hz output divided by six in I310 with its 83 1/3Hz square wave output serving as the servo reference frequency.

4.2.19 VOLTAGE REGULATOR

The Voltage Regulator I401 is an integrated circuit providing a regulated 8 vdc output with an input of 11.0 to 16.0 vdc. Voltage Regulator I401 has internal thermal overload protection and short circuit current limiting.

# SECTION V ILLUSTRATED PARTS LIST

# SECTION V
# ILLUSTRATED PARTS LIST
## CONTENTS

| NAME | | ASS'Y. NO. | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Final Assembly KR 86, ADF | | 066-1038-00 | | | | | | |

**KING RADIO CORP. PARTS LISTING**

| SYMBOL | PART NUMBER | DESCRIPTION | CODE | QUANTITY -00 | -01 | -02 | -03 | -04 |
|---|---|---|---|---|---|---|---|---|
| | 016-1033-00 | Adhesive Activator | | ar | | | | |
| | 047-2510-01 | Rack, Unit Mounting | | 1 | | | | |
| | 057-1442-01 | Serial No. Tag, Stamped with Mod Status | | 1 | | | | |
| | 057-1044-00 | Decal, FCC Tag | | 1 | | | | |
| | 057-1374-00 | Label, Patent | | 1 | | | | |
| | 200-0434-00 | Unit Sub-Assembly | | 1 | | | | |

| PARTS LIST REVISION HISTORY | | ENGR. APPROVAL Burrell | |
|---|---|---|---|
| NAME Final Assembly | | ASS'Y. NO. 066-1038-00 | |
| ASS'Y. DWG. NONE | UNIT KR 86 | USED ON Top B/M | |

| REV | CHANGE | SYMBOL | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|
| 1 | 10417 | | | |
| 2 | 10492 | | | |
| 3 | 10803 | | | |
| | | | | KR 86 Maintenance Manual<br>Rev. 0, April, 1973 |



K-1650 3/73

| NAME | ASS'Y. NO. |
| --- | --- |
| Unit Sub-Assembly KR 86, ADF | 200-0434-00 |

KING RADIO CORP. PARTS LISTING

| SYMBOL | PART NUMBER | DESCRIPTION | CODE | QUANTITY -00 | -01 | -02 | -03 | -04 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | 012-1002-00 | Tape Thermosetting (Loop Shld.) | | .3 | | | | |
| | 012-1066-00 | Insul. Fish paper (SEN Shld) | | 1 | | | | |
| | 012-1069-00 | Tape, Adh. Blk Mystic #770 (Smo. Shld.) | | .3 | | | | |
| | 012-1071-00 | Insul. Fish paper (Top cover) | | 1 | | | | |
| | 016-1004-00 | Thrm. Compound (For I401) | | AR | | | | |
| | 016-1038-00 | Spray Adh. #77 | | AR | | | | |
| | 026-0001-00 | Wire, Tnd, Cop #26 AWG (For Freq. Sel. SW) | | .5 | | | | |
| | 026-0003-00 | Wire, Tnd. Cop #22 AWG (For shld gnd loop on Goni Cables) | | .2 | | | | |
| | 047-2507-01 | Rear Plt. | | 1 | | | | |
| | 047-2508-02 | Cover, Top | | 1 | | | | |
| | 047-2509-03 | Cover, Bottom | | 1 | | | | |
| | 047-2512-01 | Side Rail, Left | | 1 | | | | |
| | 047-2513-01 | Side Rail, Right | | 1 | | | | |
| | 047-2554-01 | Shld. Smo Bd. | | 1 | | | | |
| | 047-2571-01 | Shld. Sense | | 1 | | | | |
| | 047-2599-02 | Shld. Loop | | 1 | | | | |
| | 073-0191-04 | Knob (Heading) | | 1 | | | | |
| | 073-0191-05 | Knob (Vol.) | | 1 | | | | |
| | 073-0200-03 | Knobs (Freq.) | | 2 | | | | |
| | 073-0201-03 | Knob (Step Freq.) | | 1 | | | | |
| | 076-0583-00 | Hold Down Scr. | | 1 | | | | |
| | 076-0639-00 | Spacer, Sl. Sw. | | 1 | | | | |
| | 088-0277-00 | Hold Down Unit | | 1 | | | | |
| | 088-0305-03 | Front Panel | | 1 | | | | |
| | 088-0319-01 | Wedge, Lighting | | 1 | | | | |
| | 089-2005-37 | Nut, Hex #6-32 (Sl. Sw.) | | 1 | | | | |
| | 089-2030-30 | Nut, Hex #6-32 (rgltr. mtg.) | | 1 | | | | |
| | 089-2322-00 | Speed Nut, Push-on type (Wedge Mtg.) | | 3 | | | | |
| | 089-5899-06 | Scr. #2-56X3/8, LG PHP (Sl. Sw.) | | 1 | | | | |
| | 089-5907-05 | Scr. #6-32X3/16, LG, PHP (Rgltr. Mtg.) | | 1 | | | | |
| | 089-6204-03 | Set Scr. #4-40X3/32, LG Blk. (Vol & Hd. Knob) | | 3 | | | | |
| | 089-6204-04 | Set Scr. #4-40X1/8 LG Blk. (Freq. Knobs) | | 3 | | | | |
| | 089-6293-03 | Scr. Taptight #3-48X3/16 LG (Casting Covers) | | 16 | | | | |

| NAME | ASS'Y. NO. |
|---|---|
| Unit Sub-Assembly KR 86 ADF | 200-0434-00 |

KING RADIO CORP. PARTS LISTING

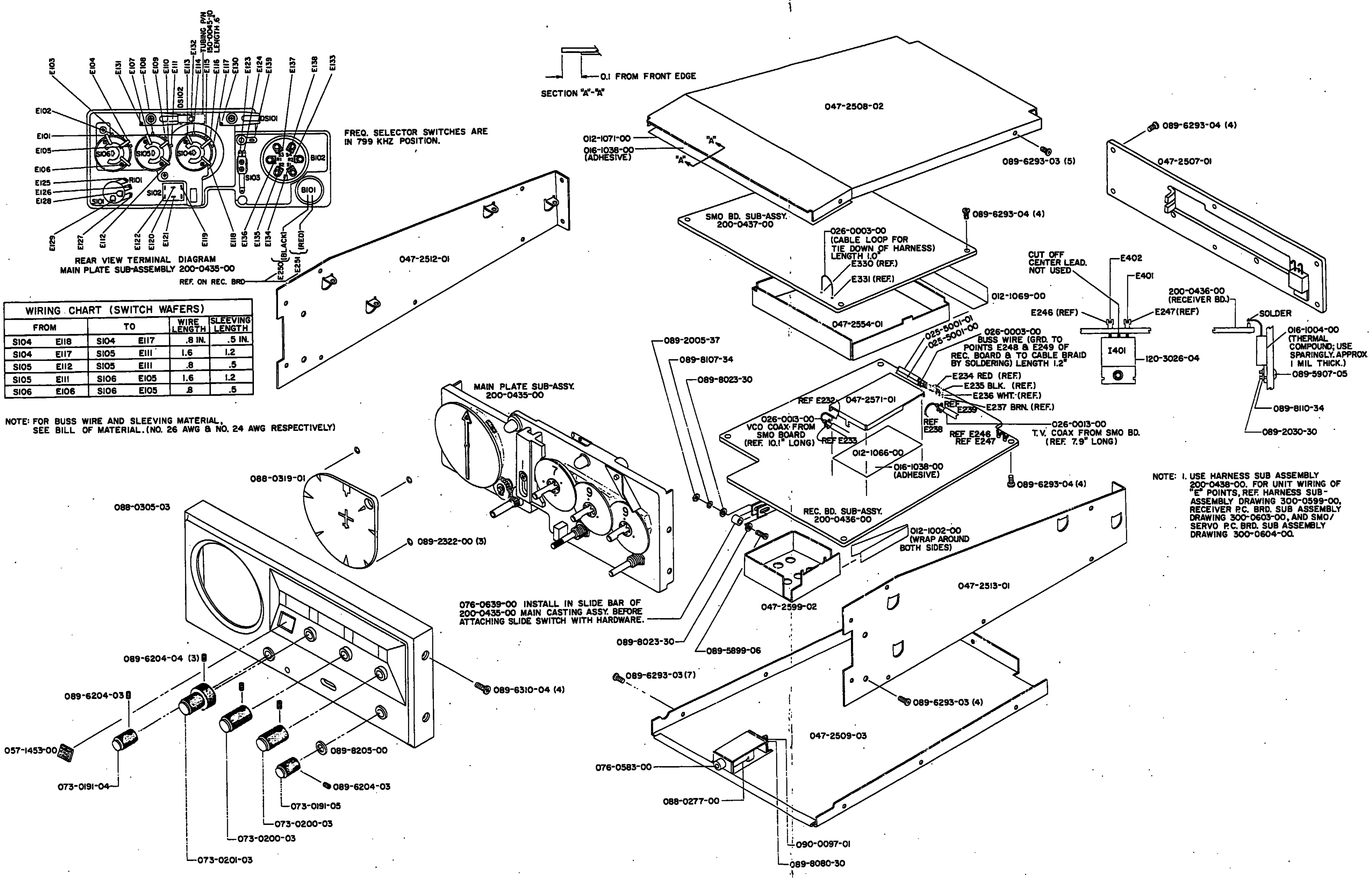
| SYMBOL | PART NUMBER | DESCRIPTION | CODE | QUANTITY -00 | -01 | -02 | -03 | -04 |
|---|---|---|---|---|---|---|---|---|
| | 089-6293-04 | Scr. Taptight #3-48X1/4 (Rear Pl. & P.C. Bds.) | | 12 | | | | |
| | 089-6310-04 | Scr. Taptight Blk. Hd. #3-48X1/4, LG. (Frt. Panel) | | 4 | | | | |
| | 089-8023-30 | Washer, #2 Flat (Sl. Sw.) | | 2 | | | | |
| | 089-8080-30 | Washer, Hold Down | | 1 | | | | |
| | 089-8107-34 | Washer, #2 Splitlock (sl. sw) | | 1 | | | | |
| | 089-8110-34 | Washer, #6 Splitlock (Rgltr. Mtg.) | | 1 | | | | |
| | 089-8205-00 | Washer, Felt (For VOL cont knob) | | 1 | | | | |
| | 090-0097-01 | Scroll Pin, Hold Down | | 1 | | | | |
| I401 | 120-3026-04 | Rgltr. 8V (T0220) | | 1 | | | | |
| | 150-0003-10 | Tubing, Teflon #24 AWG | | .4 | | | | |
| | 150-0045-10 | Tubing, Teflon #8 AWG (For Panel Lamp Terminal) | | .1 | | | | |
| | 200-0435-00 | Main Plt. Sub-Ass'y. | | 1 | | | | |
| | 200-0436-00 | Rec. Bd. Sub-Ass'y. | | 1 | | | | |
| | 200-0437-00 | SMO/Servo Bd. Sub-Ass'y. | | 1 | | | | |
| | 200-0438-00 | Harness Sub-Ass'y. | | 1 | | | | |

| PARTS LIST REVISION HISTORY | | | | ENGR. APPROVAL Burrell |
|---|---|---|---|---|
| NAME Unit Sub-Assembly | | | | ASS'Y. NO. 200-0434-00 |
| ASS'Y. DWG. 300-0601-00 | | UNIT KR 86 | | USED ON 066-1038-00 |

| REV | CHANGE | SYMBOL | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|
| 1 | 10226 | | | |
| 2 | 10367 | | | |
| 3 | 10417 | | | |
| 4 | 10492 | | | |
| 5 | 10635 | | | |
| 6 | 10649 | | | |
| 7 | 10712 | | | |
| 8 | 11093 | | | |
| 9 | 11911 | | | |
| | | | | KR 86 Maintenance Manual<br>Rev. 0, April, 1973 |



K-1650 3/73




| WIRING CHART (SWITCH WAFERS) | | | | | |
|---|---|---|---|---|---|
| FROM | | TO | | WIRE LENGTH | SLEEVING LENGTH |
| S104 | E118 | S104 | E117 | .8 IN. | .5 IN. |
| S104 | E117 | S105 | E111 | 1.6 | 1.2 |
| S105 | E112 | S105 | E111 | .8 | .5 |
| S105 | E111 | S106 | E105 | 1.6 | 1.2 |
| S106 | E106 | S106 | E105 | .8 | .5 |

NOTE: FOR BUSS WIRE AND SLEEVING MATERIAL, SEE BILL OF MATERIAL. (NO. 26 AWG & NO. 24 AWG RESPECTIVELY)

FIGURE 5-1 UNIT SUB-ASSEMBLY
(Dwg. No. 300-0601-00, R-0)

| NAME Main Plate Sub-Assembly KR 86 | | ASS'Y. NO. 200-0435-00 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| KING RADIO CORP. PARTS LISTING | | | CODE | QUANTITY | | | | |
| SYMBOL | PART NUMBER | DESCRIPTION | | -00 | -01 | -02 | -03 | -04 |
| | 008-0018-00 | Ground Lug, Lamp | | 1 | | | | |
| | 008-0022-00 | Lug, Ground | | 1 | | | | |
| | 008-0048-01 | Receptacle, Solderless | | 2 | | | | |
| | 012-1063-00 | Reflector, Light | | 1 | | | | |
| | 012-1065-00 | Insl. Test Sw. (Fish paper) | | 1 | | | | |
| | 012-1067-00 | Insl. Motor Term. | | 1 | | | | |
| | 016-1013-00 | Lub Cmpd. (See Ass'y. dwg.) | | ar | | | | |
| | 029-0222-01 | Pinion & Shaft | | 1 | | | | |
| | 029-0223-00 | Gear, Pointer | | 1 | | | | |
| | 029-0224-00 | Gear, Motor | | 1 | | | | |
| | 029-0225-00 | Gear, Hdg. Idler | | 1 | | | | |
| | 029-0231-00 | Gearhead, Reduction | | 1 | | | | |
| S103 | 031-0047-00 | Sw. Test | | 1 | | | | |
| | 047-1173-00 | Contact Spring, Lamp | | 2 | | | | |
| | 047-2505-02 | Spring, Detent | | 2 | | | | |
| | 047-2511-01 | Pointer | | 1 | | | | |
| | 047-2526-01 | Sw. Mtg. Plt. | | 1 | | | | |
| | 047-2555-01 | Retainer, Motor Gear | | 1 | | | | |
| | 047-2600-01 | Shld. Motor | | 1 | | | | |
| | 047-2604-00 | Spring, Detent Doubler | | 1 | | | | |
| | 047-2605-02 | Spring, Slide Detent | | 1 | | | | |
| | 057-1429-00 | Light Fil. Dial | | 1 | | | | |
| | 057-1430-00 | Unit Dial, Decal | | 1 | | | | |
| | 057-1434-00 | Dial | | 3 | | | | |
| | 073-0179-03 | Casting, Main Plt. | | 1 | | | | |
| | 073-0180-02 | Plunger, Sw. | | 1 | | | | |
| | 073-0204-02 | Shld. Goniometer | | 1 | | | | |
| | 078-0019-03 | Spg. Cprsn. (Push to test) | | 1 | | | | |
| | 088-0136-00 | Fil. Lamp Blu | | 2 | | | | |
| | 088-0168-01 | Bushing Lamp | | 1 | | | | |
| | 088-0306-00 | Cam | | 1 | | | | |
| | 088-0307-01 | Bar, Cam Follower | | 1 | | | | |
| | 088-0309-01 | Shaft & Transfer Dial | | 1 | | | | |
| | 088-0310-01 | Shaft & Dial | | 2 | | | | |
| | 088-0311-00 | Digit Sl. | | 1 | | | | |
| | 088-0314-01 | Compass Card | | 1 | | | | |
| | 089-2106-30 | Nut, Hex 1/4-32 (Vol. cont.) | | 1 | | | | |
| | 089-2322-00 | SP Nut, Push-on type (Lt. Refl. Mtg. Spg. rtng.) | | 5 | | | | |

| NAME | ASS'Y. NO. |
|---|---|
| Main Plate Sub-Assembly KR 86 | 200-0435-00 |

KING RADIO CORP. PARTS LISTING

| SYMBOL | PART NUMBER | DESCRIPTION | CODE | QUANTITY -00 | -01 | -02 | -03 | -04 |
|---|---|---|---|---|---|---|---|---|
| | 089-5853-04 | Set Scr. #2-56X1/8 LG (Pointer Gear) | | 2 | | | | |
| | 089-5857-06 | Set Scr. #4-40X3/16 LG (cam) | | 2 | | | | |
| | 089-6024-05 | Scr. #4-40X5/16 LG Socket Hed Cap Scr. (mtg. Goni. Shld.) | | 2 | | | | |
| | 089-6039-04 | Scr. #2-56X1/4 PHP Thd. Ctg. (Mtr. Shld. Mtg.) | | 2 | | | | |
| | 089-6039-06 | Scr. #2-56X3/8 LG PHP Thd. Ctg. (Test Sw. Mtg.) | | 2 | | | | |
| | 089-6039-01 | Scr. #2-56X5/8 PHP Thd ctg. (Sw. Mtg.) | | 6 | | | | |
| | 089-6293-03 | Scr. Taptight #3-48X3/16 LG (swt. pl. Sl. & G. Lug) | | 4 | | | | |
| | 089-6293-04 | Scr. Taptight # 3-48X1/4 LG (Lamp Contact Mtg.) | | 2 | | | | |
| | 089-8020-37 | Lock Washer 1/4" Intl. Multi-Tooth (Vol. Cont.) | | 1 | | | | |
| | 089-8107-34 | Lock Washer, #2 Spitlock (Test Sw. & 10 Pos. Sw. Mtg.) 2 for Motor Shld. Mtg. | | 10 | | | | |
| | 089-8109-34 | Lockwasher, Spitlock #4 (Goni. Mtg.) | | 2 | | | | |
| | 089-8205-01 | Washer, Frict. (Mtg. Idler Gear) | | 1 | | | | |
| | 090-0019-00 | Rtng. Ring (1/8" Axially Applied, Mtg. Idler Gear) | | 1 | | | | |
| | 090-0074-00 | Rtng. Ring (3/32 Radially Applied, Mtg. Pinion W/Shaft) | | 1 | | | | |
| | 090-0176-07 | Rtng. Ring (5/16" Radially Applied) (dial shafts) | | 3 | | | | |
| | 090-0196-00 | Spacer, Sw. (Sw. Mtg.) | | 6 | | | | |
| | 090-0198-00 | Rtng. Ring, Push-on (5/16 Shaft) | | 3 | | | | |
| | 091-0033-00 | Washer, Flat Fibre (Lamp) | | 2 | | | | |
| | 091-0068-04 | Washer, Extruded Phenolic (Lamps) | | 2 | | | | |
| R101/S101 | 133-0097-00 | Cont. On-Off Volume 1K, | | 1 | | | | |
| | 187-1066-00 | "O" Ring (Mtg. Goni.) | | 1 | | | | |

NAME Main Plate Sub-Assembly KR 86

ASS'Y. NO. 200-0435-00

KING RADIO CORP. PARTS LISTING

| SYMBOL | PART NUMBER | DESCRIPTION | CODE | QUANTITY -00 | -01 | -02 | -03 | -04 |
|---|---|---|---|---|---|---|---|---|
| S102 | 031-0206-00 | Sw. 3 Pos. Toggle | | 2 | | | | |
| S104 | 031-0182-00 | Sw. 10 Pos | | 3 | | | | |
| S105 | 031-0182-00 | Sw. 10 Pos | | | | | | |
| S106 | 031-0182-00 | Sw. 10 Pos | | | | | | |
| DS101 | 037-0007-01 | Lamp, T 1 3/4 - 14V | | 2 | | | | |
| DS102 | 037-0007-01 | Lamp, T 1 3/4 - 14V | | | | | | |
| B101 | 148-5022-00 | Motor | | 1 | | | | |
| B102 | 148-0024-00 | Goniometer | | 1 | | | | |

| PARTS LIST REVISION HISTORY | | | ENGR. APPROVAL Burrell | |
|---|---|---|---|---|
| NAME Main Plate Sub-Assembly | | | ASS'Y. NO. 200-0435-00 | |
| ASS'Y. DWG. 300-0602-00 | | UNIT KR 86 | USED ON 200-0434-00 | |

| REV | CHANGE | SYMBOL | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|
| 1 | 10226 | | | |
| 2 | 10367 | | | |
| 3 | 10417 | | | |
| 4 | 10484 | | | |
| 5 | 10526 | | | |
| 6 | 10587 | | | |
| 7 | 10552 | | | |
| 8 | 10649 | | | |
| 9 | 10733 | | | |
| 10 | 10948 | | | |
| 11 | 11223 | | | |
| | | | | KR 86 Maintenance Manual<br>Rev. 0, April, 1973 |



K-1650 3/73

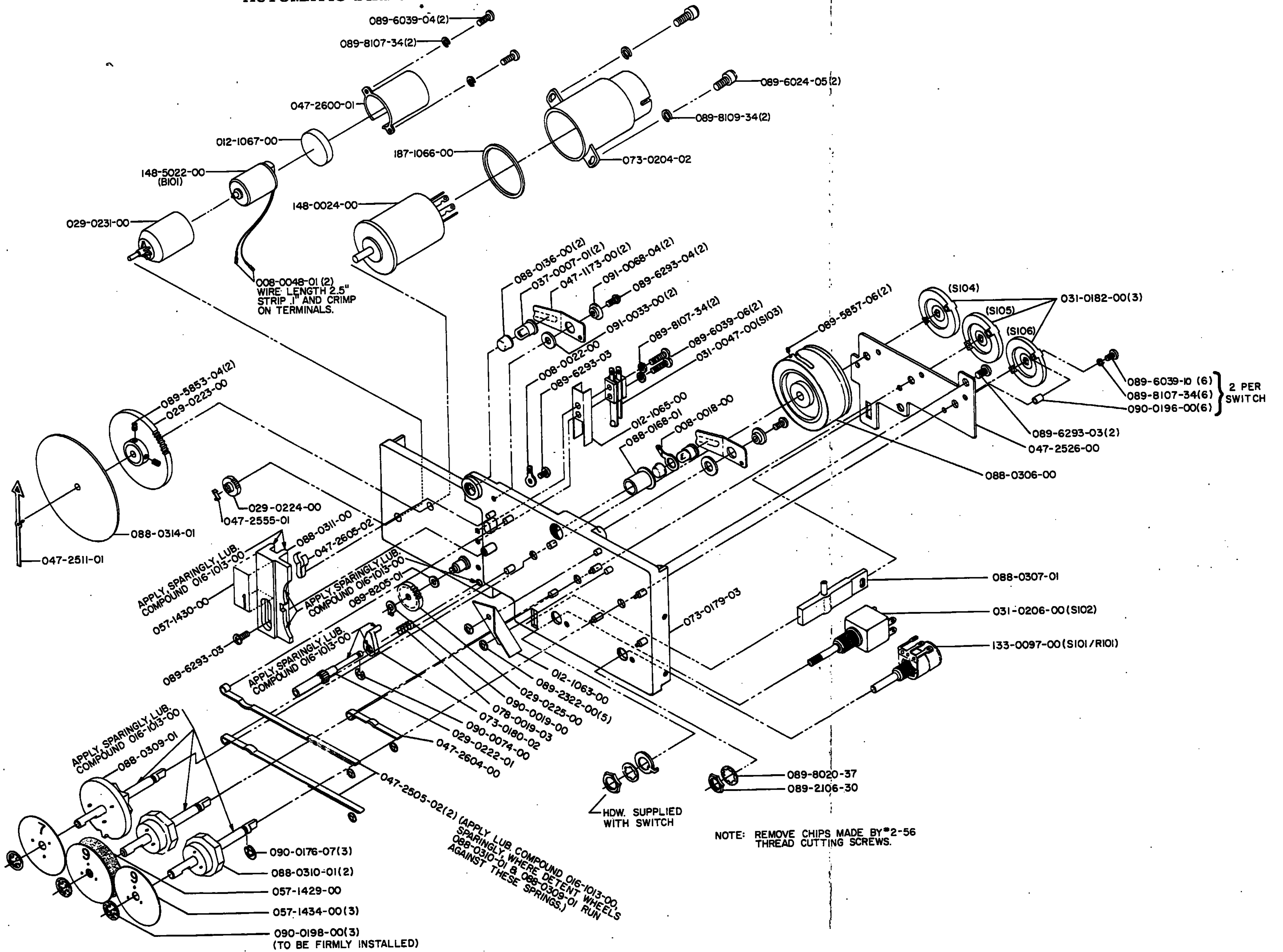



FIGURE 5-2 MAIN PLATE SUB-ASSEMBLY
(Dwg. No. 300-0602-00, R-0)

NAME Receiver Board Sub-Assembly | ASS'Y. NO. 200-0436-00

KING RADIO CORP. PARTS LISTING

| SYMBOL | PART NUMBER | DESCRIPTION | CODE | QUANTITY -00 | -01 | -02 | -03 | -04 |
|---|---|---|---|---|---|---|---|---|
| | 009-5244-01 | Rcvr. Bd. P.C. | | 1 | | | | |
| Q201 | 007-0226-00 | Tstr. MPSH04 | | 3 | | | | |
| Q202 | 007-0226-00 | Tstr. MPSH04 | | | | | | |
| Q203 | 007-0226-00 | Tstr. MPSH04 | | | | | | |
| Q204 | 007-0214-00 | Tstr. MSPF846 | | 1 | | | | |
| Q205 | 007-0187-00 | Tstr. 2N5089 | | 2 | | | | |
| Q206 | 007-0187-00 | Tstr. 2N5089 | | | | | | |
| Q207 | 007-0078-00 | Tstr. 2N3415 | | 2 | | | | |
| Q208 | 007-0078-00 | Tstr. 2N5086 | | 1 | | | | |
| Q209 | 007-0078-00 | Tstr. 2N3415 | | | | | | |
| CR201 | 007-4015-00 | DIO, Vctr. Kit | | 4 | | | | |
| CR202 | 007-4015-00 | DIO, Vctr. Kit | | | | | | |
| CR203 | 007-5016-00 | DIO, Zen. 5.1V, 1W | | 1 | | | | |
| CR204 | 007-6067-00 | DIO, MBD101 | | 1 | | | | |
| CR205 | 007-4015-00 | DIO, Vctr. Kit | | | | | | |
| CR206 | 007-4015-00 | DIO, Vctr. Kit | | | | | | |
| L201 | 019-2082-21 | Choke, Mld, 2.2µh, 10% | | 1 | | | | |
| L202 | 019-2176-01 | Inductor, 650µh Blu | | 1 | | | | |
| L203 | 019-2176-00 | Inductor, 1mh Red | | 1 | | | | |
| L204 | 019-2175-00 | Inductor, 3mh Blk | | 1 | | | | |
| L205 | 019-2174-00 | Choke, 1mh | | 1 | | | | |
| L206 | 019-2084-73 | Choke, dipped 150µh, 10% | | 1 | | | | |
| L207 | 019-2084-65 | Choke, dipped 68µh, 10% | | 1 | | | | |
| L208 | 019-2084-57 | Choke, dipped 33µh, 10% | | 1 | | | | |
| T201 | 019-3051-02 | XFMR Loop Blue | | 1 | | | | |
| T202 | 019-3051-01 | XFMR Loop Red | | 1 | | | | |
| T203 | 019-3051-00 | XFMR Loop Blk | | 1 | | | | |
| T204 | 019-3053-02 | XFMR R. F. Blue | | 1 | | | | |
| T205 | 019-3053-01 | XFMR R. F. Red | | 1 | | | | |
| T206 | 019-3053-00 | XFMR R. F. Blk | | 1 | | | | |
| T207 | 019-3054-02 | XFMR Intrstg. Blue | | 1 | | | | |
| T208 | 019-3054-01 | XFMR Intrstg. Red | | 1 | | | | |
| T209 | 019-3054-00 | XFMR Intrstg. Blk | | 1 | | | | |

| NAME Receiver Board Sub-Assembly | | ASS'Y. NO. 200-0436-00 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| KING RADIO CORP. PARTS LISTING | | | CODE | QUANTITY | | | | |
| SYMBOL | PART NUMBER | DESCRIPTION | | -00 | -01 | -02 | -03 | -04 |
| T210 | 019-3052-02 | XFMR V.C.O. Grn | | 1 | | | | |
| T211 | 019-3052-01 | XFMR V.C.O. Yel | | 1 | | | | |
| T212 | 019-3052-00 | XFMR V.C.O. Orn | | 1 | | | | |
| T213 | 019-8074-00 | XFMR I. F. Wht | | 3 | | | | |
| T214 | 019-8049-00 | XFMR I. F. Brn | | 3 | | | | |
| T215 | 019-8049-00 | XFMR I. F. Brn | | | | | | |
| T216 | 019-8049-00 | XFMR I. F. Brn | | | | | | |
| T217 | 019-8048-00 | XFMR I. F. Wht | | | | | | |
| T218 | 019-8048-00 | XFMR I. F. Wht | | | | | | |
| T219 | 019-5064-00 | XFMR Audio | | | | | | |
| CJ201 | 026-0018-00 | Ckt. Jumper | | 1 | | | | |
| S201 | 031-0178-00 | Sl. Bandsw. | | 1 | | | | |
| F201 | 036-0025-00 | Fuse 1 Amp. Type AGC | | 1 | | | | |
| C201 | 104-0001-55 | Cap. Mica. 15pf, SCDM | | 3 | | | | |
| C202 | 104-0001-51 | Cap. Mica. 47pf, SCDM | | 5 | | | | |
| C203 | 014-0001-51 | Cap. Mica. 47pf, SCDM | | | | | | |
| C204 | 096-1030-17 | Cap. Tant. 6.8μf, 15V | | 8 | | | | |
| C205 | 096-1030-17 | Cap. Tant. 6.8μf, 15V | | | | | | |
| C206 | 102-0037-02 | Cap. Trim. 1.5-20pf | | 12 | | | | |
| C207 | 102-0037-02 | Cap. Trim. 1.5-20pf | | | | | | |
| C208 | 102-0037-02 | Cap. Trim. 1.5-20pf | | | | | | |
| C209 | 114-7104-00 | Cap. D/C 1μf, X5R, 12V | | 22 | | | | |
| C210 | 114-7104-00 | Cap. D/C 1μf, X5R, 12V | | | | | | |
| C211 | 114-7104-00 | Cap. D/C 1μf, X5R, 12V | | | | | | |
| C212 | 114-7104-00 | Cap. D/C 1μf, X5R, 12V | | | | | | |
| C213 | 114-7104-00 | Cap. D/C. 1μf X5R, 12V | | | | | | |
| C214 | 096-1030-23 | Cap. Tant. 39μf, 10V | | 1 | | | | |
| C215 | 114-7104-00 | Cap. D/C 1μf, X5R, 12V | | | | | | |
| C216 | 114-7104-00 | Cap. D/C 1μf, X5R, 12V | | | | | | |
| C217 | 114-7104-00 | Cap. D/C 1μf, X5R, 12V | | | | | | |
| C218 | 113-3033-00 | Cap. D/C 3.3pf ±.25pf 500V | | 1 | | | | |
| C219 | 102-0037-02 | Cap. Trim. 1.5-20pf | | | | | | |
| C220 | 104-0001-55 | Cap. Mica. 15pf, SCDM | | | | | | |
| C221 | 102-0037-02 | Cap. Trim. 1.5-20pf | | | | | | |

| NAME | | ASS'Y. NO. |
|---|---|---|
| Receiver Board Sub-Assembly | | 200-0436-00 |

KING RADIO CORP. PARTS LISTING

| SYMBOL | PART NUMBER | DESCRIPTION | CODE | QUANTITY -00 | -01 | -02 | -03 | -04 |
|---|---|---|---|---|---|---|---|---|
| C221 | 102-0037-02 | Cap, Trim. 1.5-20pf | | | | | | |
| C222 | 104-0001-49 | Cap. Mica. 33pf SCDM | | 3 | | | | |
| C223 | 102-0037-02 | Cap. Trim. 1.5-20pf | | | | | | |
| C224 | 104-0001-49 | Cap. Mica. 33pf SCDM | | | | | | |
| C225 | 097-0062-12 | Cap. 4.7µf, 10V | | | | | | |
| C226 | 114-7104-00 | Cap. D/C 1µf, X5R, 12V | | | | | | |
| C227 | 114-7104-00 | Cap. D/C 1µf, X5R, 12V | | | | | | |
| C228 | 104-0001-18 | Cap. Mica. 2000pf, SCDM | | 1 | | | | |
| C229 | 104-0001-10 | Cap. Mica. 750pf, SCDM | | 1 | | | | |
| C230 | 096-1030-21 | Cap. Tant. 12µf, 10V | | 2 | | | | |
| C231 | 114-7104-00 | Cap. D/C 1µf, X5R, 12V | | | | | | |
| C232 | 109-0005-01 | Cap. D/C 910pf, 100V | | 1 | | | | |
| C233 | 096-1030-17 | Cap. Tant. 6.8µf, 15V | | | | | | |
| C234 | 104-0001-55 | Cap. Mica. 15pf, SCDM | | | | | | |
| C235 | 102-0037-02 | Cap. Trim. 1.5-20pf | | | | | | |
| C236 | 104-0001-51 | Cap. Mica. 47pf, SCDM | | | | | | |
| C237 | 102-0037-02 | Cap. Trim. 1.5-20pf | | | | | | |
| C238 | 104-0001-51 | Cap. Mica. 47pf, SCDM | | | | | | |
| C239 | 102-0037-02 | Cap. Trim. 1.5-20pf | | | | | | |
| C240 | 102-0037-02 | Cap. Trim. 1.5-20pf | | | | | | |
| C241 | 104-0001-46 | Cap. Mica. 10pf, SCDM | | 1 | | | | |
| C242 | 102-0037-02 | Cap. Trim. 1.5-20pf | | | | | | |
| C243 | 104-0001-49 | Cap. Mica. 33pf SCDM | | | | | | |
| C244 | 102-0037-02 | Cap. Trim. 1.5-20pf | | | | | | |
| C245 | 104-0001-51 | Cap. Mica. 47pf SCDM | | | | | | |
| C246 | 096-1030-17 | Cap. Tant. 6.8µf, 15V | | | | | | |
| C247 | 114-7104-00 | Cap. D/C, 1µf, X5R, 12V | | | | | | |
| C248 | 097-0062-12 | Cap. 4.7µf, 10V | | | | | | |
| C249 | 114-7104-00 | Cap. D/C, 1µf, X5R, 12V | | | | | | |
| C250 | 096-1030-17 | Cap. Tant. 6.8µf, 15V | | | | | | |
| C251 | 096-1030-17 | Cap. Tant. 6.8µf, 15V | | | | | | |
| C242 | 114-7104-00 | Cap. D/C, 1µf, X5R, 12V | | | | | | |
| C253 | 104-0001-21 | Cap. Mica. 390pf. SCDM | | 6 | | | | |
| C254 | 109-0009-00 | Cap. D/C, 170pf, 1000V | | 6 | | | | |
| C255 | 097-0062-12 | Cap. 4.7µf, 10V | | | | | | |
| C256 | 096-1030-17 | Cap. Tant. 6.8µf, 15V | | | | | | |
| C257 | 113-3120-00 | Cap. D/C, 12pf, 500V | | 3 | | | | |
| C258 | 109-0009-00 | Cap. D/C, 170pf, 1000V | | | | | | |
| C259 | 104-0001-21 | Cap. Mica. 390pf, SCDM | | | | | | |
| C260 | 114-7104-00 | Cap. D/C. .1µf, X5R, 12V | | | | | | |
| C261 | 097-0062-04 | Cap. .47µf, 25V | | 1 | | | | |
| C262 | 114-7104-00 | Cap. D/C .1µf, X5R, 12V | | | | | | |
| C263 | 113-5102-00 | Cap, D/C, 1000pf, X5F, 500V | | 2 | | | | |
| C264 | 113-5102-00 | Cap. D/C, 1000pf, X5F, 500V | | | | | | |
| C265 | 114-7104-00 | Cap. D/C, 1µf, X5R, 12V | | | | | | |
| C266 | 114-7104-00 | Cap. D/C, 1µf, X5R, 12V | | | | | | |

| NAME Receiver Board Sub-Assembly | | | ASS'Y. NO. 200-0436-00 | | | | | |
|---|---|---|---|---|---|---|---|---|
| KING RADIO CORP. PARTS LISTING | | | CODE | QUANTITY | | | | |
| SYMBOL | PART NUMBER | DESCRIPTION | | -00 | -01 | -02 | -03 | -04 |
| C267 | 097-0062-06 | Cap. 1μf, 25V | | 2 | | | | |
| C268 | 097-0062-06 | Cap. 1μf, 25V | | | | | | |
| C269 | 104-0001-21 | Cap. Mica. 390pf, SCDM | | | | | | |
| C270 | 109-0009-00 | Cap. D/C, 170pf, 1000V | | | | | | |
| C271 | 113-3120-00 | Cap. D/C, 12pf, 500 V | | | | | | |
| C272 | 109-0009-00 | Cap. D/C, 170pf, 1000V | | | | | | |
| C273 | 104-0001-21 | Cap. Mica. 390pf, SCDM | | | | | | |
| C274 | 114-7104-00 | Cap. D/C, 1μf, X5R, 12V | | | | | | |
| C275 | 097-0062-12 | Cap. 4.7μf 10V | | | | | | |
| C276 | 096-1030-17 | Cap. Tant. 6.8μf, 15V | | | | | | |
| C277 | 104-0001-21 | Cap. Mica. 390pf, SCDM | | | | | | |
| C278 | 109-0009-00 | Cap. D/C, 170pf, 1000V | | | | | | |
| C279 | 097-0062-12 | Cap. 4.7μf, 10V | | | | | | |
| C280 | 113-3120-00 | Cap. D/C, 12pf, 500V | | | | | | |
| C281 | 109-0009-00 | Cap. D/C, 170pf, 1000V | | | | | | |
| C282 | 104-0001-21 | Cap. Mica. 390pf, SCDM | | | | | | |
| C283 | 114-7104-00 | Cap. D/C, 1μf, X5R, 12V | | | | | | |
| C284 | 113-7503-00 | Cap. D/C, .05μf, X5R, 12V | | 1 | | | | |
| C286 | 096-1030-21 | Cap. Tant. 12μf, 10V | | | | | | |
| C288 | 097-0057-35 | Cap. Al. 680μf, 25V | | 1 | | | | |
| C289 | 097-0062-12 | Cap. 4.7μf, 10V | | | | | | |
| C290 | 114-7104-00 | Cap. D/C, 1μf, X5R, 12V | | | | | | |
| C291 | 114-7104-00 | Cap. D/C, 1μf, X5R, 12V | | | | | | |
| I201 | 120-3027-00 | I.C. MC1496G | | 1 | | | | |
| I202 | 120-3028-00 | I.C. μA757C | | 1 | | | | |
| I203 | 120-4004-00 | I.C. MC1648P | | 1 | | | | |
| I204 | 120-3006-00 | I.C. CA3020 | | 1 | | | | |
| R201 | 130-0302-23 | Res. F/C, 3K, QW, 5% | | 2 | | | | |
| R202 | 130-0113-23 | Res. F/C, 11K, QW, 5% | | 1 | | | | |
| R203 | 130-0471-25 | Res. F/C, 470, QW, 10% | | 3 | | | | |
| R204 | 130-0471-25 | Res. F/C, 470, QW, 10% | | | | | | |
| R205 | 130-0152-25 | Res. F/C, 1.5K, QW, 10% | | 2 | | | | |
| R206 | 130-0104-25 | Res. F/C, 100, QW, 10% | | 6 | | | | |
| R207 | 130-0104-25 | Res. F/C, 100, QW, 10% | | | | | | |
| R208 | 130-0102-25 | Res. F/C, 1K, QW, 10% | | 9 | | | | |
| R210 | 130-0681-25 | Res. F/C, 680, QW, 10% | | 1 | | | | |
| R211 | 130-0821-25 | Res. F/C, 820, QW, 10% | | 1 | | | | |
| R212 | 130-0102-25 | Res. F/C, 1K, QW, 10% | | | | | | |
| R213 | 130-0102-25 | Res. F/C, 1K, QW, 10% | | | | | | |

| NAME Receiver Board Sub-Assembly | | ASS'Y. NO. 200-0436-00 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| KING RADIO CORP. PARTS LISTING | | | CODE | QUANTITY | | | | |
| SYMBOL | PART NUMBER | DESCRIPTION | | -00 | -01 | -02 | -03 | -04 |
| R214 | 130-0102-25 | Res. F/C, 1K, QW, 10% | | | | | | |
| R215 | 130-0101-25 | Res. F/C, 100, QW, 10% | | 1 | | | | |
| R216 | 130-0102-25 | Res. F/C, 1K, QW, 10% | | | | | | |
| R217 | 130-0151-25 | Res. F/C, 150, QW, 10% | | 3 | | | | |
| R218 | 130-0182-25 | Res. F/C, 1.8K, QW, 10% | | 1 | | | | |
| R219 | 130-0153-23 | Res. F/C, 15K, QW, 5% | | 1 | | | | |
| R220 | 130-0104-25 | Res. F/C, 100K, QW, 10% | | | | | | |
| R221 | 130-0222-25 | Res. F/C, 2.2K, QW, 10% | | 2 | | | | |
| R222 | 130-0430-23 | Res. F/C, 43, QW, 5% | | 1 | | | | |
| R223 | 130-0331-23 | Res. F/C, 330, QW, 5% | | 1 | | | | |
| R224 | 130-0391-25 | Res. F/C, 390, QW, 10% | | 1 | | | | |
| R225 | 130-0750-23 | Res. F/C, 75, QW, 5% | | 1 | | | | |
| R226 | 130-1022-23 | Res. F/C, 1.2K, Qw, 5% | | 1 | | | | |
| R227 | 130-0431-23 | Res. F/C, 430, QW, 5% | | 2 | | | | |
| R228 | 130-0473-25 | Res. F/C, 47K, QW, 10% | | 1 | | | | |
| R229 | 130-0154-25 | Res. F/C, 150K, QW, 10% | | 1 | | | | |
| R230 | 130-0394-25 | Res. F/C, 390K, QW, 10% | | 4 | | | | |
| R231 | 130-0624-23 | Res. F/C, 620K, QW, 5% | | 1 | | | | |
| R232 | 130-0434-23 | Res. F/C, 430K, QW, 5% | | 1 | | | | |
| R233 | 130-0104-25 | Res. F/C, 100K, QW, 10% | | | | | | |
| R234 | 130-0125-25 | Res. F/C, 1.2Meg. QW, 10% | | 1 | | | | |
| R235 | 130-0431-23 | Res. F/C, 430, QW, 5% | | | | | | |
| R236 | 130-0471-25 | Res. F/C, QW, 10% | | | | | | |
| R237 | 130-0151-25 | Res. F/C, 150, QW, 10% | | | | | | |
| R238 | 130-0912-23 | Res. F/C, 9.1K, QW, 5% | | 2 | | | | |
| R239 | 130-0152-25 | Res. F/C, 1.5K, QW, 10% | | | | | | |
| R240 | 130-0221-25 | Res. F/C, 220, QW, 10% | | 1 | | | | |
| R241 | 130-0102-25 | Res. F/C, 1K, QW, 10% | | | | | | |
| R242 | 130-0151-25 | Res. F/C, 150, QW, 10% | | | | | | |
| R243 | 130-0394-25 | Res. F/C, 390K, QW, 10% | | | | | | |
| R244 | 130-0334-25 | Res. F/C, 330K, QW, 10% | | 3 | | | | |
| R245 | 130-0512-23 | Res. F/C, 5.1K, QW, 5% | | 1 | | | | |
| R246 | 130-0102-25 | Res. F/C, 1K, QW, 10% | | | | | | |
| R247 | 130-0394-25 | Res. F/C, 390K, QW, 10% | | | | | | |
| R248 | 130-0104-25 | Res. F/C, 100K, QW, 10% | | | | | | |
| R249 | 130-0912-23 | Res. F/C, 9.1K, QW, 5% | | | | | | |
| R250 | 130-0102-25 | Res. F/C, 1K, QW, 10% | | | | | | |
| R251 | 130-0302-23 | Res. F/C, 3K, QW, 5% | | | | | | |
| R252 | 130-0364-23 | Res. F/C, 360K, QW, 5% | | | | | | |
| R253 | 130-0394-25 | Res. F/C, 390K, QW, 10% | | | | | | |
| R254 | 130-0220-25 | Res. F/C, 22, QW, 10% | | 3 | | | | |
| R255 | 130-0220-25 | Res. F/C, 22, QW, 10% | | | | | | |
| R256 | 130-0220-25 | Res. F/C, 22, QW, 10% | | | | | | |
| R258 | 130-0334-25 | Res. F/C, 330K, QW, 10% | | | | | | |
| R259 | 130-0334-25 | Res. F/C, 330K, QW, 10% | | | | | | |
| R260 | 130-0104-25 | Res. F/C, 100K, QW, 10% | | | | | | |

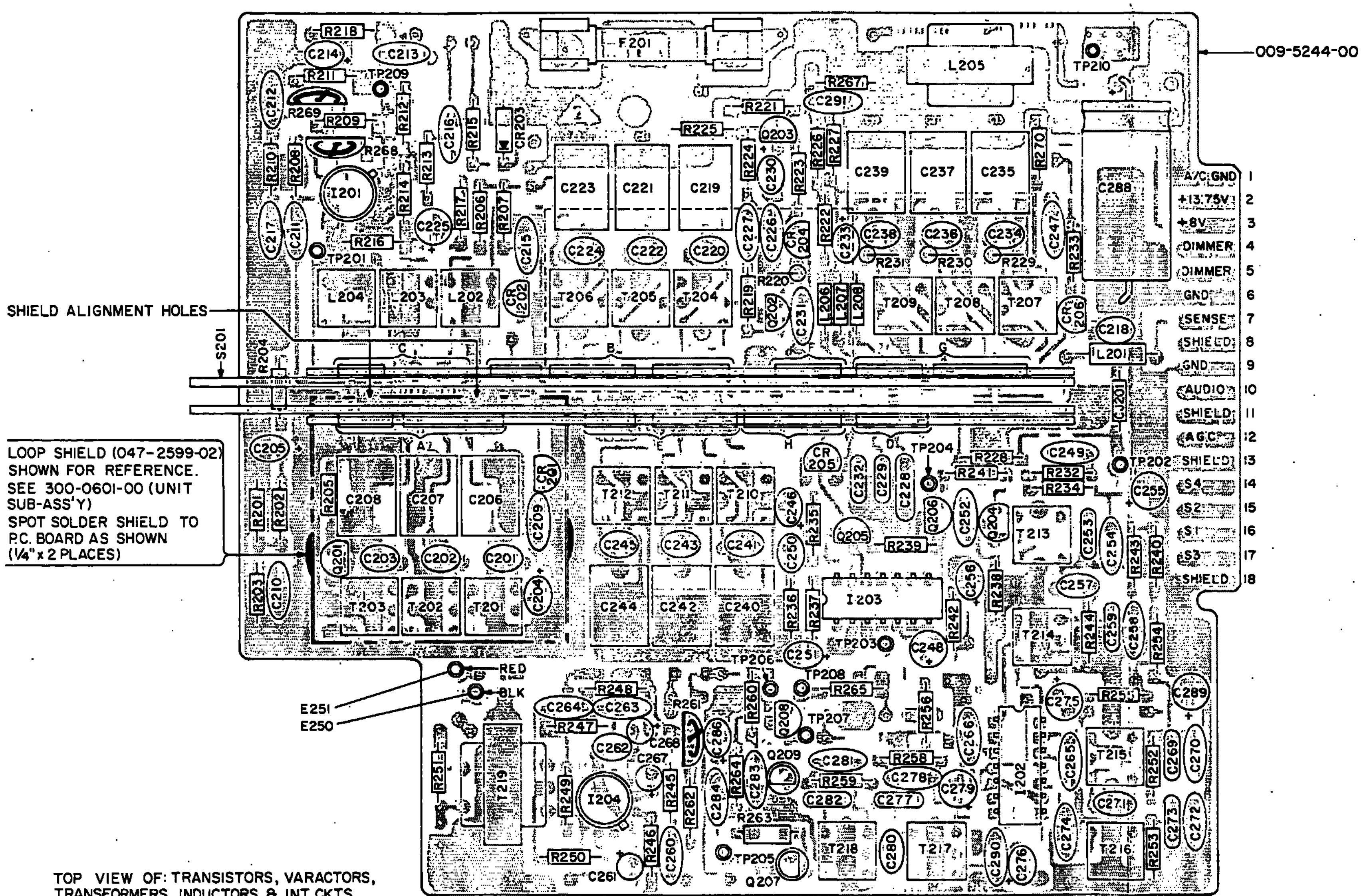
| NAME | ASS'Y. NO. |
| --- | --- |
| Receiver Board Sub-Assembly | 200-0436-00 |

KING RADIO CORP. PARTS LISTING

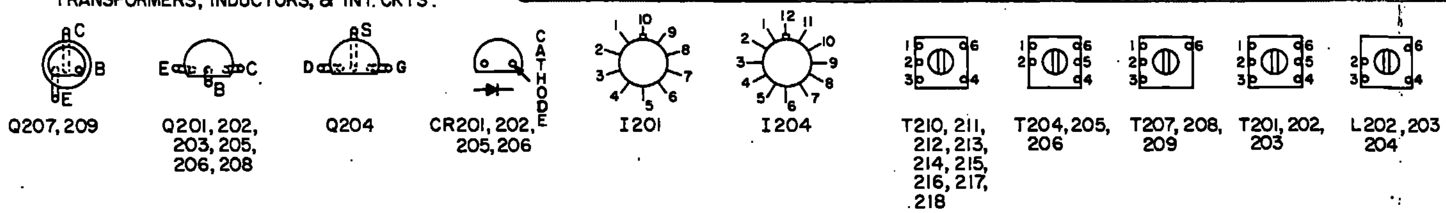
| SYMBOL | PART NUMBER | DESCRIPTION | CODE | QUANTITY -00 | -01 | -02 | -03 | -04 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| R261 | 133-0016-02 | Res. Vari. 1K | | 1 | | | | |
| R262 | 130-0222-25 | Res. F/C, 2.2K, QW, 10% | | | | | | |
| R263 | 130-0390-23 | Res. F/C, 39, QW, 5% | | 1 | | | | |
| R264 | 130-0223-25 | Res. F/C, 22K, QW, 10% | | 1 | | | | |
| R265 | 130-0161-23 | Res. F/C, 160, QW, 5% | | 1 | | | | |
| R267 | 133-0201-23 | Res. F/C, 200, QW, 5% | | 1 | | | | |
| R268 | 133-0016-03 | Res. Vari. 10K | | 2 | | | | |
| R269 | 130-0016-03 | Res. Vari. 10K | | | | | | |
| R270 | 130-0470-23 | Res. F/C, 47, QW, 5% | | 1 | | | | |

| PARTS LIST REVISION HISTORY | | | ENGR. APPROVAL Burrell | |
|---|---|---|---|---|
| NAME Receiver Bd. Sub-Ass'y. | | | ASS'Y. NO. 200-0436-00 | |
| ASS'Y. DWG. 300-0603-00 | | UNIT KR 86 | USED ON 200-0434-00 | |

| REV | CHANGE | SYMBOL | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|
| 1 | 10217 | | | |
| 2 | 10367 | | | |
| 3 | 10417 | | | |
| 4 | 10491 | | | |
| 5 | 10649 | | | |
| 6 | 11093 | | | |
| 7 | 11249 | | | |
| 8 | 11368 | | | |
| 9 | 11629 | | | |
| 10 | 11691 | | | |
| | | | | KR 86 Maintenance Manual<br>Rev. 0, April, 1973 |

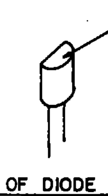



TOP VIEW OF: TRANSISTORS, VARACTORS, TRANSFORMERS, INDUCTORS, & INT. CKTS.




| DIODE | INSTALLATION | |
|---|---|---|
| POSITION | COLOR | COMPUTER SY |
| CR 201 | BLUE | BLU |
| CR 202 | BLACK | (NONE) |
| CR 205 | RED | RED |
| CR 206 | YELLOW | YEL |

SEE NOTES 1, 2 & 3




DETAIL OF DIODE MARKING
SEE NOTE 2

NOTES:

1. THE FOUR DIODES USED ON THIS ASSEMBLY ARE MATCHED BY COMPUTER. IF ONE DIODE IS LOST OR MIXED WITH DIODES FROM ANOTHER SET, THE DIODES AND THE DATA PROCESSING CARD ARE TO BE RETURNED TO RECEIVE INSPECTION VIA PRODUCTION CONTROL DEPARTMENT.
2. THE COLOR MARKING ON THE DIODE MUST BE PLACED IN THE CORRECT LOCATION ON THE P.C. BOARD.
3. THE "DATA PROCESSING CARD" WITH EACH SET OF DIODES CONTAINS INFORMATION FOR TEST AND ALIGNMENT. THE CARD FROM EACH SET MUST BE ATTACHED TO THE P.C. BOARD WITH THOSE DIODES INSTALLED ON IT TO BE REMOVED ONLY BY TEST DEPARTMENT. IF A CARD IS LOST, A NEW SET OF DIODES WILL HAVE TO BE INSTALLED.
4. WHEN SOLDERING THE SLIDE SWITCH TO P.C. BOARD USE A MIN. AMOUNT OF SOLDER. THIS WILL LIMIT THE AMOUNT OF SOLDER WICKING UP INTO THE SWITCH CONTACT.

FIGURE 5-3 RECEIVER BOARD SUB-ASSEMBLY
(Dwg. No. 300-0603-00, R-0)

| NAME | | | ASS'Y. NO. | | | | | |
|---|---|---|---|---|---|---|---|---|
| SMO/Servo Board Sub-Assembly KR86 | | | 200-0437-00 | | | | | |

KING RADIO CORP. PARTS LISTING

| SYMBOL | PART NUMBER | DESCRIPTION | CODE | QUANTITY -00 | -01 | -02 | -03 | -04 |
|---|---|---|---|---|---|---|---|---|
| | 009-5237-01 | SMO Servo P. C. Bd. | | 1 | | | | |
| | 026-0003-00 | Wire, Cop. Tnd. #22 AWG | | .2 | | | | |
| | 016-1040-00 | Seal Coat, Clear Urethane | | AR | | | | |
| Q301 | 007-0078-00 | Tstr, 2N3415 | | 3 | | | | |
| Q302 | 007-0078-00 | Tstr, 2N3415 | | | | | | |
| Q303 | 007-0078-00 | Tstr, 2N3415 | | | | | | |
| Q304 | 007-0046-00 | Tstr, 2N3605A | | 2 | | | | |
| Q305 | 007-0238-00 | Tstr, FPN4917 | | 1 | | | | |
| Q306 | 007-0046-00 | Tstr, 2N3605A | | | | | | |
| Q307 | 007-0187-00 | Tstr, 2N5089 | | 1 | | | | |
| Q308 | 120-3032-00 | Tstr Array, CA3083 | | 1 | | | | |
| CR301 | 007-5016-00 | DIO, Zen. 5.1V, 1W | | 1 | | | | |
| CR302 | 007-5011-12 | DIO, Zen. 4.3V, 1W | | 1 | | | | |
| CR303 | 007-6029-00 | DIO, 1N457 | | 1 | | | | |
| L301 | 019-2057-30 | Choke, R.F. 27μh, 5% | | 2 | | | | |
| L302 | 019-2057-00 | Choke, R.F. 27μh, 5% | | | | | | |
| | 026-0013-00 | Co-ax Cable RG178 | | 1.7 | | | | |
| CJ302 | 026-0018-00 | Circuit Jumper | | 2 | | | | |
| CJ303 | 026-0018-00 | Circuit Jumper | | | | | | |
| C301 | 096-1030-22 | Cap. Tant. 22μf, 10V | | 5 | | | | |
| C302 | 113-7503-00 | Cap. D/C, .05μf, X5R, 12V | | 4 | | | | |
| C303 | 096-1030-22 | Cap. Tant. 22μf, 10V | | | | | | |
| C304 | 097-0062-02 | Cap. .22μf, 25V | | 1 | | | | |
| C305 | 113-7503-00 | Cap. D/C, .05μf, X5R, 12V | | | | | | |
| C306 | 096-1030-17 | Cap. Tant, 6.8μf, 15V | | 1 | | | | |
| C307 | 096-1030-21 | Cap. Tant, 12μf, 10V | | 1 | | | | |
| C308 | 113-7503-00 | Cap. D/C, .05μf, X5R, 12V | | | | | | |
| C309 | 096-1030-22 | Cap. Tant, 22μf, 10V | | | | | | |

| NAME | ASS'Y. NO. |
|---|---|
| SMO/Servo Board Sub-Assembly KR86 | 200-0437-00 |

KING RADIO CORP. PARTS LISTING

| SYMBOL | PART NUMBER | DESCRIPTION | CODE | QUANTITY -00 | -01 | -02 | -03 | -04 |
|---|---|---|---|---|---|---|---|---|
| C310 | 109-0007-00 | Cap. D/C, .01$\mu$f, 25V | | 1 | | | | |
| C311 | 113-5151-01 | Cap. D/C, 150pf, X5F, 500V | | 1 | | | | |
| C312 | 105-0033-51 | Cap. MYL. .12$\mu$f, 50V | | 2 | | | | |
| C313 | 097-0062-06 | Cap. 1$\mu$f, 25V | | 1 | | | | |
| C314 | 113-5681-00 | Cap. D/C, 680pf, X5F, 500V | | 1 | | | | |
| C315 | 096-1030-22 | Cap. Tant, 22$\mu$f, 10V | | | | | | |
| C316 | 113-7503-00 | Cap. D/C, .05$\mu$f, X5R, 12V | | | | | | |
| C317 | 096-1030-24 | Cap. Tant, 68$\mu$f, 10V | | 1 | | | | |
| C318 | 105-0033-51 | Cap. MYL. .12$\mu$f, 50V | | | | | | |
| C319 | 096-1030-22 | Cap. Tant, 22$\mu$f, 10V | | | | | | |
| C320 | 114-7104-00 | Cap. D/C, .1$\mu$f, X5R, 12V | | 2 | | | | |
| C321 | 114-7104-00 | Cap. D/C, .1$\mu$f, X5R, 12V | | | | | | |
| C322 | 096-1030-11 | Cap. Tant, 4.7$\mu$f, 20V | | 1 | | | | |
| C323 | 114-5157-00 | Cap. D/C, 1500pf, X5F | | 1 | | | | |
| C324 | 096-1030-17 | Cap. Tant, 6.8$\mu$f, 15V | | 3 | | | | |
| C325 | 096-1030-17 | Cap. Tant, 6.8$\mu$f, 15V | | | | | | |
| C326 | 105-0033-37 | Cap. MYL. .033$\mu$f, 50V | | 2 | | | | |
| C327 | 105-0033-37 | Cap. MYL. .033$\mu$f, 50V | | | | | | |
| I301 | 120-0050-01 | I.C. U6M93L1059X or DM86L75N | | 3 | | | | |
| I302 | 120-0050-01 | I.C. U6M93L1059X or DM86L75N | | | | | | |
| I303 | 120-0050-01 | I.C. U6M93L1059X or DM86L75N | | | | | | |
| I304 | 120-0003-00 | I.C. SN7410N | | 1 | | | | |
| I305 | 120-0051-00 | I.C. SN7470N | | 1 | | | | |
| I306 | 120-0002-00 | I.C. SN7402N | | 1 | | | | |
| I307 | 120-0049-00 | I.C. MC4044P | | 1 | | | | |
| I308 | 120-0011-00 | I.C. SN7493N | | 2 | | | | |
| I309 | 120-0011-00 | I.C. SN7493N | | | | | | |
| I310 | 120-0010-00 | I.C. SN7492N | | 1 | | | | |
| I311 | 120-3022-03 | I.C. MC1458P | | 1 | | | | |
| I312 | 120-3027-00 | I.C. MC1496G | | 1 | | | | |
| R301 | 015-0023-00 | Res. Module, 12 at 4.7K | | 1 | | | | |
| R302 | 132-0107-30 | Res. W/W, 12, 3 QW, 5% | | 1 | | | | |
| R303 | 130-0563-23 | Res. F/C, 56K, QW, 5% | | 1 | | | | |
| R304 | 130-0820-25 | Res. F/C, 82, QW, 10% | | 1 | | | | |

| NAME | ASS'Y. NO. |
|---|---|
| SMO/Servo Board Sub-Assembly KR 86 | 200-0437-00 |

KING RADIO CORP. PARTS LISTING

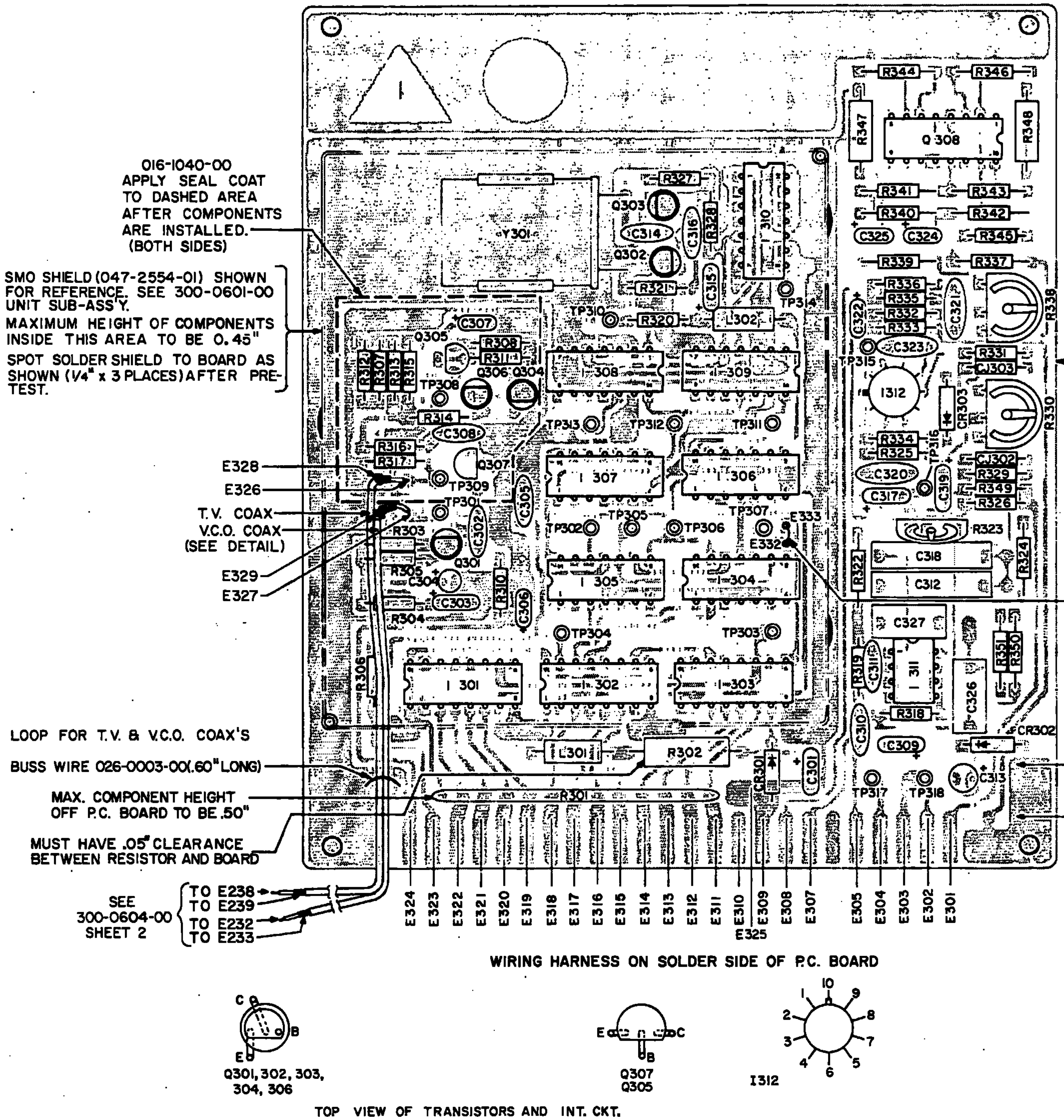
| SYMBOL | PART NUMBER | DESCRIPTION | CODE | QUANTITY -00 | -01 | -02 | -03 | -04 |
|---|---|---|---|---|---|---|---|---|
| R305 | 130-0391-25 | Res. F/C, 390, QW, 10% | | 1 | | | | |
| R306 | 130-0472-25 | Res. F/C, 7K, QW, 10% | | 1 | | | | |
| R307 | 130-0362-23 | Res. F/C, 3.6K, QW, 5% | | 1 | | | | |
| R308 | 130-0102-25 | Res. F/C, 1K, QW, 10% | | 4 | | | | |
| R310 | 130-0222-23 | Res. F/C, 2.2K, QW, 5% | | 2 | | | | |
| R311 | 130-0102-25 | Res. F/C, 1K, QW, 10% | | | | | | |
| R312 | 130-0621-23 | Res. F/C, 620, QW, 5% | | 1 | | | | |
| R313 | 130-0821-23 | Res. F/C, 820, QW, 5% | | 3 | | | | |
| R314 | 130-0821-23 | Res. F/C, 820, QW, 5% | | | | | | |
| R315 | 130-0271-23 | Res. F/C, 270, QW, 5% | | | | | | |
| R316 | 130-0103-23 | Res. F/C, 10K, QW, 5% | | 1 | | | | |
| R317 | 130-0104-25 | Res. F/C, 100K, QW, 10% | | 1 | | | | |
| R318 | 130-0910-23 | Res. F/C, 91, QW, 5% | | 1 | | | | |
| R319 | 130-0243-23 | Res. F/C, 24K, QW, 5% | | 3 | | | | |
| R320 | 130-0242-23 | Res. F/C, 2.4K, QW, 5% | | 2 | | | | |
| R321 | 130-0243-23 | Res. F/C, 2.4K, QW, 5% | | | | | | |
| R322 | 130-2373-22 | Res. M/F, 237K, 1% | | 2 | | | | |
| R323 | 133-0016-05 | Res. Pot. 500, 20% | | 1 | | | | |
| R324 | 136-7500-22 | Res. M/F, 750, 1% | | 3 | | | | |
| R325 | 130-0471-23 | Res. F/C, 470, QW, 5% | | 1 | | | | |
| R326 | 130-0222-23 | Res. F/C, 2.2K, QW, 5% | | | | | | |
| R327 | 130-0243-23 | Res. F/C, 24K, QW, 5% | | | | | | |
| R328 | 130-0242-23 | Res. F/C, 2.4K, QW, 5% | | | | | | |
| R329 | 130-0272-23 | Res. F/C, 2.7K, QW, 5% | | 1 | | | | |
| R330 | 133-0016-03 | Res. Vari. 10K, 20% | | 1 | | | | |
| R331 | 130-0511-23 | Res. F/C, 510, QW, 5% | | 1 | | | | |
| R332 | 130-0562-23 | Res. F/C, 5.6K, QW, 5% | | 2 | | | | |
| R333 | 130-0562-23 | Res. F/C, 5.6K, QW, 5% | | | | | | |
| R334 | 130-0470-23 | Res. F/C, 47, QW, 5% | | 1 | | | | |
| R335 | 130-0102-25 | Res. F/C, 1K, QW, 10% | | | | | | |
| R336 | 130-0102-25 | Res. F/C, 1K, QW, 10% | | | | | | |
| R337 | 136-7500-22 | Res. M/F, 750, 1% | | | | | | |
| R338 | 133-0016-07 | Res. Vari. 150, 20% | | 1 | | | | |
| R339 | 136-7500-22 | Res. M/F, 750, 1% | | | | | | |
| R340 | 136-2212-22 | Res. M/F, 22.1K, 1% | | 2 | | | | |
| R341 | 136-2212-22 | Res. M/F, 22.1K, 1% | | | | | | |
| R342 | 136-6811-22 | Res. M/F, 6810, 1% | | 2 | | | | |
| R343 | 136-6811-22 | Res. M/F, 6810, 1% | | | | | | |
| R344 | 136-1001-22 | Res. M/F, 1000, 1% | | 2 | | | | |
| R345 | 130-0151-23 | Res. F/C, 150, QW, 5% | | 1 | | | | |
| R346 | 136-1001-22 | Res. M/F, 1000, 1% | | | | | | |
| R347 | 130-0151-33 | Res. F/C, 150, QW, 5% | | 2 | | | | |
| R348 | 130-0151-33 | Res. F/C, 150, QW, 5% | | | | | | |
| R349 | 130-0821-23 | Res. F/C, 820, QW, 5% | | | | | | |
| R350 | 136-2373-22 | Res. M/F, 237K, 1% | | | | | | |
| R351 | 136-1502-22 | Res. M/F, 15K, 1% | | 1 | | | | |

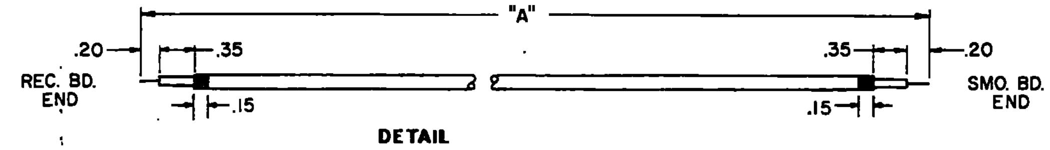
| PARTS LIST REVISION HISTORY | | | | ENGR. APPROVAL Burrell |
|---|---|---|---|---|
| NAME SMO/Servo Bd. Sub-Assembly | | | | ASS'Y. NO. 200-0437-00 |
| ASS'Y. DWG. 300-0604-00 | | UNIT KR 86 | | USED ON 200-0434-00 |

| REV | CHANGE | SYMBOL | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|
| 1 | 10367 | | | |
| 2 | 10417 | | | |
| 3 | 10442 | | | |
| 4 | 10478 | | | |
| 5 | 10491 | | | |
| 6 | 10649 | | | |
| 7 | 10803 | | | |
| 8 | 11112 | | | |
| 9 | 11629 | | | |
| | | | | KR 86 Maintenance Manual<br>Rev. 0, April, 1973 |



K-1650 3/73




| NAME | MATERIAL | DIM. "A" |
|---|---|---|
| TUNING VOLTAGE COAX | 026-0013-00 | 7.9" |
| V.C.O. COAX | 026-0013-00 | 10.1" |

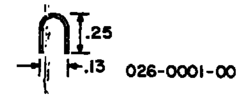



FIGURE 5-4 SMO/SERVO BOARD SUB-ASSEMBLY
(Dwg. No. 300-0604-00, R-0)

| NAME | ASS'Y. NO. |
| --- | --- |
| Harness Sub-Assembly KR 86 | 200-0438-00 |

KING RADIO CORP. PARTS LISTING

| SYMBOL | PART NUMBER | DESCRIPTION | CODE | QUANTITY -00 | -01 | -02 | -03 | -04 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | 012-1006-00 | Nylon Lacing Tape .090 Nat | | AR | | | | |
| | 025-0003-12 | W. Teflon #22 AWG (Red) | | 1.1 | | | | |
| | 025-0003-12 | W. Teflon #22 AWG (Red/Wht) | | .7 | | | | |
| | 025-0018-00 | W. Teflon #22 (Blk) | | 2.0 | | | | |
| | 025-0018-09 | W. Teflon #26 (Blk/Wht) | | .7 | | | | |
| | 025-0018-10 | W. Teflon #26 (Brn/Blk) | | 1.1 | | | | |
| | 025-0018-11 | W. Teflon #26 (Brn) | | .5 | | | | |
| | 025-0018-12 | W. Teflon #26 (Brn/Red) | | 1.1 | | | | |
| | 025-0018-14 | W. Teflon #26 (Brn/Yel) | | 1.6 | | | | |
| | 025-0018-19 | W. Teflon #26 (Brn/Wht) | | .6 | | | | |
| | 025-0018-22 | W. Teflon #26 (Red) | | .5 | | | | |
| | 025-0018-28 | W. Teflon #26 (Red/Gry) | | 1.2 | | | | |
| | 025-0018-29 | W. Teflon #26 (Red/Wht) | | .8 | | | | |
| | 025-0018-30 | W. Teflon #26 (Orn/Blk) | | .8 | | | | |
| | 025-0018-39 | W. Teflon #26 (Orn/Wht) | | 1.1 | | | | |
| | 025-0018-40 | W. Teflon #26 (Yel/Blk) | | 1.0 | | | | |
| | 025-0018-44 | W. Teflon #26 (Yel) | | .5 | | | | |
| | 025-0018-49 | W. Teflon #26 (Yel/Wht) | | .6 | | | | |
| | 025-0018-50 | W. Teflon #26 (Grn/Blk) | | .6 | | | | |
| | 025-0018-54 | W. Teflon #26 (Grn/Yel) | | .6 | | | | |
| | 025-0018-55 | W. Teflon #26 (Grn) | | 2.2 | | | | |
| | 025-0018-59 | W. Teflon #26 (Grn/Wht) | | .5 | | | | |
| | 025-0018-63 | W. Teflon #26 (Blu/Orn) | | .9. | | | | |
| | 025-0018-64 | W. Teflon #26 (Blu/Yel) | | .9 | | | | |
| | 025-0018-66 | W. Teflon #26 (Blu) | | .9 | | | | |
| | 025-0018-69 | W. Teflon #26 (Blu/Wht) | | 1.5 | | | | |
| | 025-0018-77 | W. Teflon #26 (Vio) | | 1.2 | | | | |
| | 025-0018-79 | W. Teflon #26 (Vio/Wht) | | 1.2 | | | | |
| | 025-0018-88 | W. Teflon #26 (Gray) | | .5 | | | | |
| | 025-0018-89 | W. Teflon #26 (Gray/Wht) | | .6 | | | | |
| | 025-0018-91 | W. Teflon #26 (Wht/Brn) | | .8 | | | | |
| | 025-0018-92 | W. Teflon #26 (Wht/Red) | | .8 | | | | |
| | 025-0018-93 | W. Teflon #26 (Wht/Orn) | | .6 | | | | |
| | 025-0018-94 | W. Teflon #26 (Wht/Yel) | | .8 | | | | |
| | 025-0018-97 | W. Teflon #26 (Wht/Vio) | | .7 | | | | |
| | 025-0018-98 | W. Teflon #26 (Wht/Gry) | | .8 | | | | |
| | 025-0018-99 | W. Teflon #26 (Wht) | | 4.4 | | | | |
| | 025-5001-00 | Cable, 2 Cndct. (Shld. Pr.) (Red/Blk) | | .9 | | | | |
| | 025-5001-01 | Cable, 2 Cndct. (Shld. Pr.) (Brn/Wht) | | .9 | | | | |
| | 150-0042-10 | Tubing, Shrinkable | | .1 | | | | |

| PARTS LIST REVISION HISTORY | | | ENGR. APPROVAL Burrell | |
|---|---|---|---|---|
| NAME Harness Sub-Assembly | | | ASS'Y. NO. 200-0438-00 | |
| ASS'Y. DWG. 300-0599-00 | | UNIT KR 86 | USED ON 200-0434-00 | |

| REV | CHANGE | SYMBOL | PART NUMBER | DESCRIPTION |
|---|---|---|---|---|
| 1 | 10367 | | | |
| 2 | 10417 | | | |
| 3 | 10491 | | | |
| 4 | 10649 | | | |
| 5 | 11093 | | | |
| | | | | KR 86 Maintenance Manual<br>Rev. 0, April, 1973 |


K-1650 3/73

| NAME | ASS'Y. NO. |
|---|---|
| Rack Cable Plate Sub-Ass'y. | 200-0523-01 |

KING RADIO CORP. PARTS LISTING

| SYMBOL | PART NUMBER | DESCRIPTION | CODE | QUANTITY -00 | -01 | -02 | -03 | -04 |
|---|---|---|---|---|---|---|---|---|
| C501 | 007-0112-06 | Tstr NPN | | 1 | | | | |
| CR501 | 007-6021-00 | Diode, Rect | | 1 | | | | |
| CR502 | 007-5011-18 | Diode, Zen 15V, 5%, 1W | | 1 | | | | |
| | 010-0019-20 | Term, S/O, Tef, Red | | 1 | | | | |
| | 010-0019-30 | Term, S/O, Tef, Orn | | 1 | | | | |
| | 010-0019-90 | Term, S/O, Tef, Wht | | 3 | | | | |
| | 016-1004-00 | Thml. Cmpd. | | AR | | | | |
| | 025-0003-00 | Wire, Tef, #22AWG Blk | | .2 | | | | |
| | 025-0003-02 | Wire, Tef, #22AWG Red | | .2 | | | | |
| | 026-0003-00 | Wire, Tef, #22AWG Tinned | | .2 | | | | |
| P101 | 030-1045-18 | Conn, Molex, 18 contact | | 1 | | | | |
| | 030-1046-01 | Conn Contact, Molex | | 2 | | | | |
| | 047-2603-03 | Rack Cable Plate | | 1 | | | | |
| | 089-5436-05 | Scr, 4-40 x 5/16 FHP | | 2 | | | | |
| | 089-5878-06 | Scr, 4-40 x 3/8 ST | | 2 | | | | |
| | 089-5903-04 | Scr, 4-40 x 1/4 PHP | | 1 | | | | |
| | 089-5907-05 | Scr, 6-32 x 5/16 PHP | | 2 | | | | |
| | 089-8003-34 | Washer, SL#4 | | 3 | | | | |
| | 089-8024-30 | Washer, Flat, .250OD | | 1 | | | | |
| | 089-8025-30 | Washer, Flat #4 .281OD | | 2 | | | | |
| | 091-0015-11 | Grommet 5/16 ID | | 1 | | | | |
| R501 | 132-5037-00 | Res, WW, 430, 5%, 2W | | 1 | | | | |
| | 150-0005-10 | Tubing, Tef, #20AWG | | .2 | | | | |

| PARTS LIST REVISION HISTORY | | | | ENGR. APPROVAL |
|---|---|---|---|---|
| NAME Rack Cable Plate Sub-Ass'y. | | | | ASS'Y. NO. 200-0523-01 |
| ASS'Y. DWG. 300-0724-00 | | | UNIT KR 86 | USED ON |
| REV | CHANGE | SYMBOL | PART NUMBER | DESCRIPTION |
| 1 | 11093 | | | |
| | | | | KR 86 Maintenance Manual<br>Rev. 0, April, 1973 |



K-1650 3/73

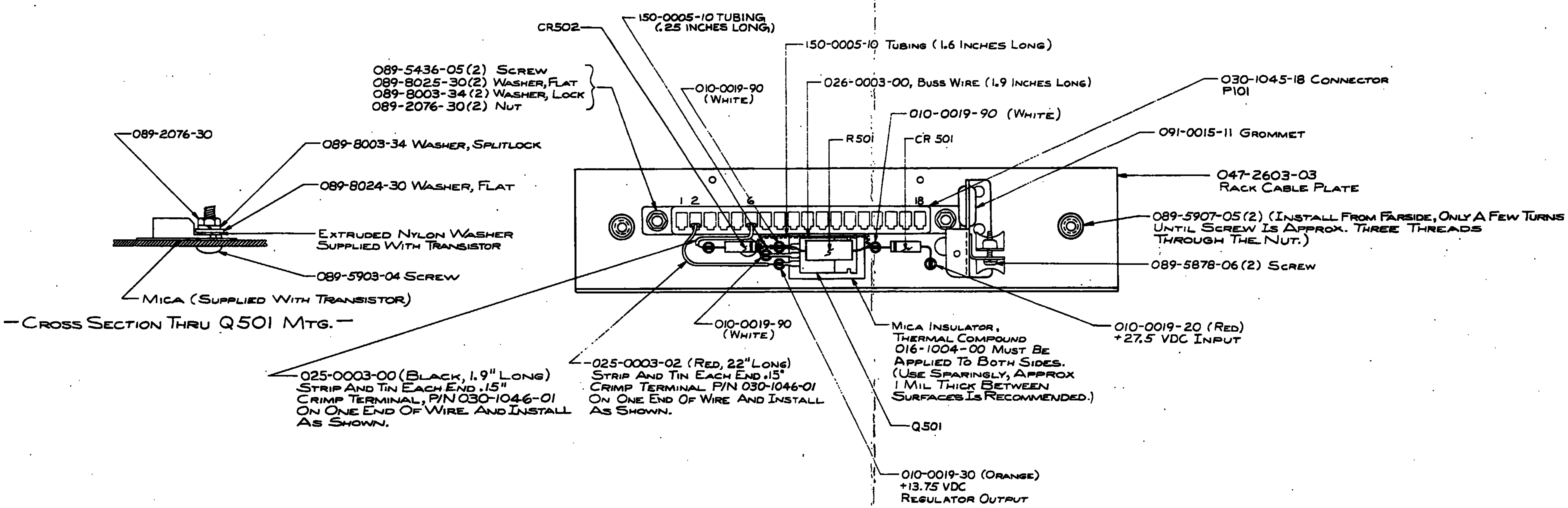



FIGURE 5-5 RACK CABLE PLATE SUB-ASSEMBLY
(Dwg. No. P/O 300-0724-00 R-0)

SECTION VI MAINTENANCE

# SECTION VI
# MAINTENANCE
## CONTENTS

# CONTENTS

# SECTION VI
# MAINTENANCE

## 6.1 GENERAL INFORMATION

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

### 6.1.1 SEMICONDUCTOR MAINTENANCE

#### 6.1.1.1 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 impedances 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 values of capacitors, an instrument accurate in the high ranges must be employed. Capacitor polarity must be observed when measuring resistance. Usually more accurate measurements can be obtained if the semi-conductors are removed or disconnected from the circuit.

#### 6.1.1.2 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 paragraph.

(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.

(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 test equipment to the chassis of the equipment under test before making any other connections.

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

(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.

### 6.1.1.3 SEMICONDUCTOR VOLTAGE AND RESISTANCE MEASUREMENTS

When measuring voltage or resistance 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, time is required to charge these capacitors when they appear. Thus, any reading obtained is subject 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.

### 6.1.1.4 TESTING OF TRANSISTORS

A transistor checker 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 the preceding paragraph.

(1) 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.

(2) 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.

**— 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.

(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.

### 6.1.1.5 REPLACING SEMICONDUCTORS

Never remove or replace a 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.

(1) Use only a low heat soldering iron when installing or removing soldered-in parts.

(2) 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.

(3) 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 ground. Often, this insulating is accomplished by means of insulating washers made of 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 thermal compound (King Part Number 016-1004-00). 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.

## 6.1.2 INTEGRATED CIRCUIT (I.C.) MAINTENANCE

### 6.1.2.1 GENERAL

A knowledge of integrated circuit fundamentals is as necessary in testing digital logic circuits involving I.C.'s as a knowledge of rectification fundamentals is needed to test a power supply.

### 6.1.2.2 TERMINOLOGY

Several terms are used whenever logic circuits are discussed:

(1) A logic state is defined as a high or low level voltage applied to the input or seen at the output of a device. A high level voltage is called a logic "1". A low level voltage is called a logic "0".

(2) A truth table is a list of input logic states that will yield certain output logic states. A digital logic element should be thought of as a circuit element with its output level being either HI or LO as programmed by the levels present on its inputs. A logic element may be tested by verifying that it is performing per the Truth Table of that logic element.

(3) Logic elements which have multiple inputs and a single output are known as gates. The OR gate produces a HI output when one OR more of the inputs are HI. With all inputs LO, the output is LO. The AND gate produces a HI output only when all inputs are HI. When any input is LO the output is LO. A small circle at the output of a gate on the schematics indicates "negation", which means that the sense of the gate logic is reversed. An OR gate with negation is called a NOR gate and an AND gate with negation is called a NAND gate. A NOR gate produces a LO output when one or more of the inputs are HI and a NAND gate produces a LO output only when all inputs are HI.

(4) The Flip-Flop logic element is the basic data storage element of digital logic.

It has two outputs that are always at opposite logic levels that is, when one output is HI the other is LO. The flip-flop will remain in a particular state until that state is changed by an input signal.

The operation of these flip-flops is controlled by the signals on their inputs, and is best understood by a careful study of their Truth Tables. It should be kept in mind that the small circle on either the input or output indicates negation. Also, a circle on a clock input indicates that a HI to LO transition causes the flip-flop to function.

(5) Two types of logic circuitry are used in the KR 86. These are Transistor-Transistor-Logic (TTL) and Current Mode Logic (MECL). Typical supply voltage is +5.2VDC. Typical gate schematics are shown in Figure 6-1. Basic gates, and JK flip-flops are defined symbolically and functionally in Figure 6-2.

6.1.2.3 SPECIAL LOGIC CIRCUITS

(1) A counter is used to provide one output pulse for every N input pulses. This means F(out) = F(in)/N. In a programmable counter N may be selected from any one of several choices. Programmable counters are divided into two classifications: reset counters and preset counters. The reset counter uses the principle that when the counter reaches a selected load state it sets to a fixed reset state and then recycles. The preset counter reaches a fixed load state, sets to a selected preset state and recycles.

Counters are further specified on the basis of the count method employed. The most common method used is to establish a decimal weighted code for each flip-flop and to gate the respective outputs accordingly. Typical of this method would be a binary counter. The KR-86 incorporates a programmable shift-counter. In this system, the information is shifted from left to right through the register giving a cyclical code.

(2) A Phase-Frequency Detector is used to develop UP-DOWN pulses for driving the sample and Hold circuit. The UP and DOWN pulse widths are dependent on the phase relationship of the variable to the reference input and are equal only when the variable input phase is equal to the reference input phase.

(3) The Emitter-coupled Oscillator, used in conjunction with the external parallel tuned circuit, provides the local oscillator signal for the KR 86.

6.1.2.4 LINEAR INTEGRATED CIRCUITS

(a) A dual operational amplifier is used in the KR 86 as a two section active filter circuit.

(b) A Balanced Modulator/Demodulator (MC 1496) is designed for use where the output voltage is a product of an input voltage and a switching function. In the KR 86, it is used as a Phase Modulator/Demodulator where the input signal is switching at an 83 1/3 Hz rate.

Figures 6-1 thru 6-13 show the graphical representations and pin configurations for the integrated circuits used in the KR 86.

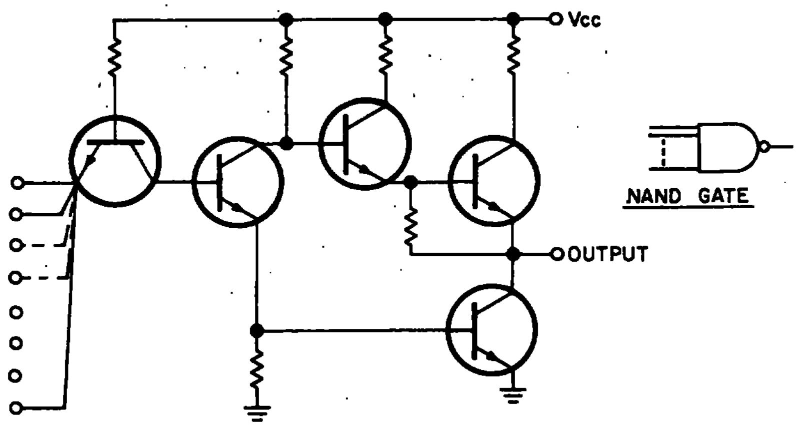
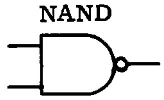
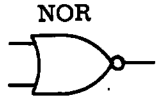



FIGURE 6-1 TYPICAL TTL GATE CIRCUIT
(Dwg. No. 696-3212-00)

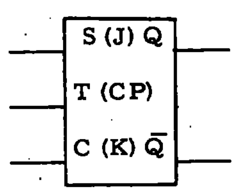
I. GATES

| | | Inputs | Outputs |
|---|---|---|---|
| A. | NAND  | All high (1)<br>Any low (0) | Low (0)<br>High (1) |
| B. | NOR  | All low (0)<br>Any high (1) | High (1)<br>Low (0) |

II. CLOCKED J-K FLIP FLOPS

TTL

| J | K | $\bar{K}$ | Q After Next Clock Pulse |
|---|---|---|---|
| 0 | 0 | 1 | Output unchanged |
| 0 | 1 | 0 | 0 |
| 1 | 1 | 0 | Output changes state |
| 1 | 0 | 1 | 1 |




TTL Change of state caused by clock pulse positive transition.

In a J-K flip-flop, output changes are initiated by the clock pulse according to the state of the J-K inputs at the time of the clock pulse transition.

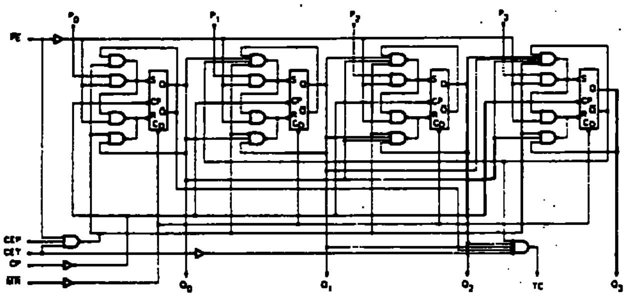
FIGURE 6-2 BASIC LOGIC FUNCTIONS
(Dwg. No. 696-3213-00)

**DESCRIPTION –**

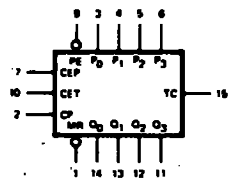
93L10 is a High Speed Synchronous BCD Decade Counter synchronously presetable, multifunctional MSI building blocks useful in a large number of counting, digital integration and conversion applications. Several stages of synchronous operation are obtainable with no external gating packages required through an internal carry lookahead counting technique.

**LOGIC DIAGRAMS**

93L10



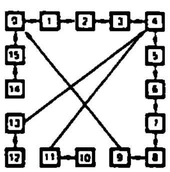
**LOGIC SYMBOL**



$V_{CC}$ = Pin 16
GND = Pin 8

**STATE DIAGRAM**

93L10



**LOGIC EQUATIONS**

Count Enable = CEP · CET · PE
TC for 93L10 = CET · $Q_0 \cdot \overline{Q_1} \cdot \overline{Q_2} \cdot Q_3$
Preset = $\overline{PE}$ · CP+ (rising clock edge)
Reset = $\overline{MR}$

**PIN NAMES**

| | |
|---|---|
| $\overline{PE}$ | Parallel Enable (Active LOW) Input |
| $P_0, P_1, P_2, P_3$ | Parallel Inputs |
| CEP | Count Enable Parallel Input |
| CET | Count Enable Trickle Input |
| CP | Clock (Active HIGH Going Edge) Input |
| $\overline{MR}$ | Master Reset (Active LOW) Input |
| $Q_0, Q_1, Q_2, Q_3$ | Parallel Outputs |
| TC | Terminal Count Outputs |

NOTE:
The 93L10 can be preset to any state, but will not count beyond 9. If preset to state 10, 11, 12, 13, 14, or 15, it will return to its normal sequence within two clock pulses.

**TERMINAL COUNT GENERATION**

| CET | 93L10 ($Q_0 \bullet \overline{Q}_1 \bullet \overline{Q}_2 \bullet Q_3$) | TC |
|---|---|---|
| L | L | L |
| L | H | L |
| H | L | L |
| H | H | H |

TC = CET $\bullet Q_0 \bullet \overline{Q}_1 \bullet \overline{Q}_2 \bullet Q_3$

POSITIVE LOGIC H HIGH Voltage Level
L LOW Voltage Level

**MODE SELECTION**

| $\overline{PE}$ | CEP | CET | MODE |
|---|---|---|---|
| L | L | L | Preset |
| L | L | H | Preset |
| L | H | L | Preset |
| L | H | H | Preset |
| H | L | L | No Change |
| H | L | H | No Change |
| H | H | L | No Change |
| H | H | H | Count |

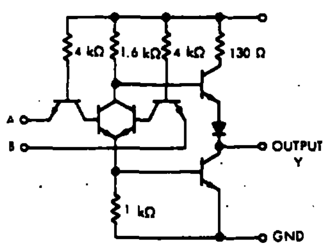
($\overline{MR}$ = HIGH)

FIGURE 6-3 93L10/86L75
(Dwg. No. 696-3216-00)

***description***

**Series 54/74 integrated circuits are designed and characterized for high-speed, general-purpose digital applications where high d-c noise margin and relatively low power dissipation are important system considerations. This logic series includes the basic gates, flip-flop elements, and complex logic and storage elements needed to perform all functions of general-purpose digital systems.**

**schematic (each gate)**




NOTE: *Component values shown are nominal.*

**J OR N-DUAL-IN-LINE PACKAGE (TOP VIEW)**

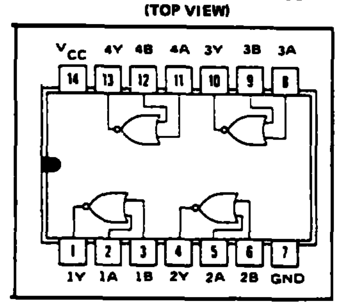
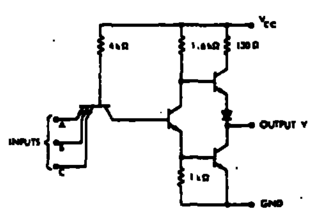



FIGURE 6-4 SN7402
(Dwg. No. 696-3215-00)

**schematic (each gate)**




**NOTE: Component values shown are nominal.**

**J OR N DUAL-IN-LINE PACKAGE (TOP VIEW)**

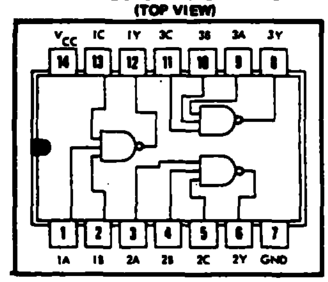



FIGURE 6-5 SN7410
(Dwg. No. 696-3216-00)

**description**

These monolithic, edge-triggered J-K flip-flops feature gated inputs, direct clear and preset inputs, and complementary Q and $\bar{Q}$ outputs. Input information is transferred to the outputs on the positive edge of the clock pulse.

Direct-coupled clock triggering occurs at a specific voltage level of the clock pulse, and after the clock input threshold voltage has been passed, the gated inputs are locked out.

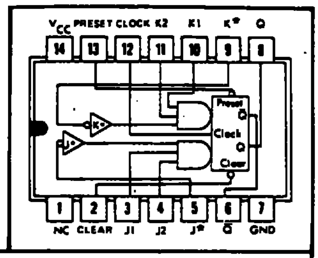
**logic**

TRUTH TABLE

| $t_n$ | | $t_{n+1}$ |
|---|---|---|
| J | K | Q |
| 0 | 0 | $Q_n$ |
| 0 | 1 | 0 |
| 1 | 0 | 1 |
| 1 | 1 | $\bar{Q}_n$ |

NOTES:
1. $J = J1 \cdot J2 \cdot \overline{J^*}$
2. $K = K1 \cdot K2 \cdot \overline{K^*}$.
3. $t_n$ = Bit time before clock pulse.
4. $t_{n+1}$ = Bit time after clock pulse.
5. If inputs J* or K* are not used they must be grounded.
6. NC - No Internal Connection

J OR N DUAL-IN-LINE PACKAGE (TOP VIEW)




**positive logic:** Low input to preset sets Q to logical 1
Low input to clear sets Q to logical 0
Preset or clear function can occur only when clock input is low.

FIGURE 6-6 SN7470
(Dwg. No. 696-3217-00)

**description**

These high-speed, monolithic 4-bit binary counters consist of four master slave flip-flops which are internally interconnected to provide a divide-by-two counter and a divide-by-six counter. A gated direct reset line is provided which inhibits the count inputs and simultaneously returns the four flip-flop outputs to a logical 0. As the output from flip-flop A is not internally connected to the succeeding flip-flops, the counter may be operated in two independent modes:

1. When used as a divide-by-twelve counter, output A must be externally connected to input BC. The input count pulses are applied to input A. Simultaneous divisions of 2, 6, and 12 are performed at the A, C, and D outputs as shown in the truth table.

2. When used as a divide-by-six counter, the input count pulses are applied to input BC. Simultaneously, frequency divisions of 3 and 6 are available at the C and D outputs. Independent use of flip-flop A is available if the reset function coincides with reset of the divide-by-six counter.

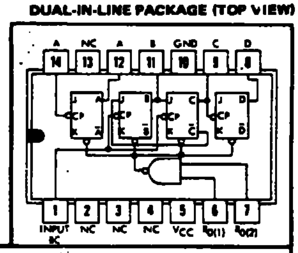
**logic**

TRUTH TABLE (See Notes 1, 2, and 3)

| COUNT | OUTPUT | | | |
|---|---|---|---|---|
| | D | C | B | A |
| 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 1 |
| 2 | 0 | 0 | 1 | 0 |
| 3 | 0 | 0 | 1 | 1 |
| 4 | 0 | 1 | 0 | 0 |
| 5 | 0 | 1 | 0 | 1 |
| 6 | 1 | 0 | 0 | 0 |
| 7 | 1 | 0 | 0 | 1 |
| 8 | 1 | 0 | 1 | 0 |
| 9 | 1 | 0 | 1 | 1 |
| 10 | 1 | 1 | 0 | 0 |
| 11 | 1 | 1 | 0 | 1 |

NOTES:
1. Output A connected to input B
2. To reset all outputs to logical 0 both $R_{0(1)}$ and $R_{0(2)}$ inputs must be at logical 1.
3. Either (or both) reset inputs $R_{0(1)}$ and $R_{0(2)}$ must be at a logical 0 to count.

J OR N
DUAL-IN-LINE PACKAGE (TOP VIEW)




**positive logic:** see truth table

NC—No Internal Connection

FIGURE 6-7 SN7492
(Dwg. No. 696-3218-00)

**description**

These high-speed, monolithic 4-bit binary counters consist of four master-slave flip-flops which are internally interconnected to provide a divide-by-two counter and a divide-by-eight counter. A gated direct reset line is provided which inhibits the count inputs and simultaneously returns the four flip-flop outputs to a logical 0. As the output from flip-flop A is not internally connected to the succeeding flip-flops the counter may be operated in two independent modes:

1. When used as a 4-bit ripple-through counter, output A must be externally connected to input B. The input count pulses are applied to input A. Simultaneous divisions of 2, 4, 8, and 16 are performed at the A, B, C, and D outputs as shown in the truth table above.

2. When used as a 3-bit ripple-through counter, the input count pulses are applied to input B. Simultaneous frequency divisions of 2, 4, and 8 are available at the B, C, and D outputs. Independent use of flip-flop A is available if the reset function coincides with reset of the 3-bit ripple-through counter.

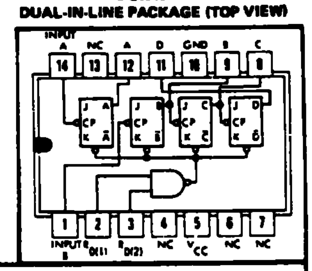
**logic**

TRUTH TABLE (See Notes 1, 2, and 3)

| COUNT | OUTPUT D | C | B | A |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 1 |
| 2 | 0 | 0 | 1 | 0 |
| 3 | 0 | 0 | 1 | 1 |
| 4 | 0 | 1 | 0 | 0 |
| 5 | 0 | 1 | 0 | 1 |
| 6 | 0 | 1 | 1 | 0 |
| 7 | 0 | 1 | 1 | 1 |
| 8 | 1 | 0 | 0 | 0 |
| 9 | 1 | 0 | 0 | 1 |
| 10 | 1 | 0 | 1 | 0 |
| 11 | 1 | 0 | 1 | 1 |
| 12 | 1 | 1 | 0 | 0 |
| 13 | 1 | 1 | 0 | 1 |
| 14 | 1 | 1 | 1 | 0 |
| 15 | 1 | 1 | 1 | 1 |

NOTES: 1. Output A connected to input B
2. To reset all outputs to logical 0 both $R_{0(1)}$ and $R_{0(2)}$ inputs must be at logical 1.
3. Either (or both) reset inputs $R_{0(1)}$ and $R_{0(2)}$ must be at a logical 0 to count.

J OR N
DUAL-IN-LINE PACKAGE (TOP VIEW)




positive logic: see truth table

NC—No Internal Connection

FIGURE 6-8 SN7493
(Dwg. No. 696-3219-00)

This device contains two digital phase detectors for use in frequency discrimination and phase-locked-loop applications.

The two phase detectors have common inputs. Phase-frequency detector 1 is locked in (indicated by both outputs high) when the negative transitions of the variable input (VI) and reference input (RI) are equal in frequency and phase. If the variable input is lower in frequency or lags in phase, the U1 (up) output goes low; conversely the D1 (down) output goes low when the variable input is higher in frequency or leads the reference input in phase. It is important to note that the duty cycles of the variable input and the reference input are not important since negative transitions control system operation.

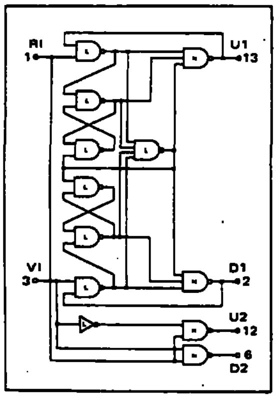
Phase detector 2, on the other hand, is locked in when the variable input phase lags the reference phase by 90° (indicated by the U2 and D2 outputs alternately going low with equal pulse widths). If the variable input phase lags by more than 90°, U2 will remain low longer than D2, and, conversely, if the variable input phase lags the reference phase by less than 90°, D2 remains low longer. In this phase detector the variable input and the reference must have 50% duty cycles.

| INPUT STATE | INPUT | | OUTPUT | | | |
|---|---|---|---|---|---|---|
| | RI | VI | U1 | D1 | U2 | D2 |
| 1 | 0 | 0 | X | X | 1 | 1 |
| 2 | 1 | 0 | X | X | 0 | 1 |
| 3 | 1 | 1 | X | X | 1 | 0 |
| 4 | 1 | 0 | X | X | 0 | 1 |
| 5 | 0 | 0 | X | X | 1 | 1 |
| 6 | 1 | 0 | X | X | 0 | 1 |
| 7 | 0 | 0 | X | X | 1 | 1 |
| 8 | 1 | 0 | X | X | 0 | 1 |
| 9 | 0 | 0 | 0 | 1 | 1 | 1 |
| 10 | 0 | 1 | 0 | 1 | 1 | 1 |
| 11 | 0 | 0 | 1 | 1 | 1 | 1 |
| 12 | 0 | 1 | 1 | 1 | 1 | 1 |
| 13 | 0 | 0 | 1 | 0 | 1 | 1 |
| 14 | 0 | 1 | 1 | 0 | 1 | 1 |
| 15 | 0 | 0 | 1 | 0 | 1 | 1 |
| 16 | 1 | 0 | 1 | 0 | 0 | 1 |
| 17 | 0 | 0 | 1 | 1 | 1 | 1 |

**TRUTH TABLE**

This is not strictly a functional truth table; i.e., it does not show all possible modes of operation. It is useful for dc testing.

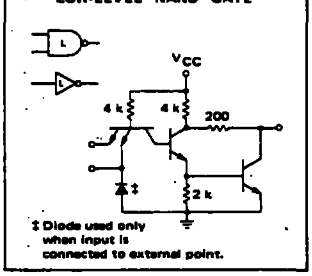
1. X indicates output state unknown.
2. U1 and D1 outputs are sequential; i.e., they must be sequenced in order shown.
3. U2 and D2 outputs are combinational; i.e., they need only inputs shown to obtain outputs.




**PHASE DETECTOR**

The phase detector portion of this device is constructed using low and high-level gates interconnected as shown by the logic diagram.

**LOW-LEVEL "NAND" GATE**




**HIGH-LEVEL "NAND" GATE**

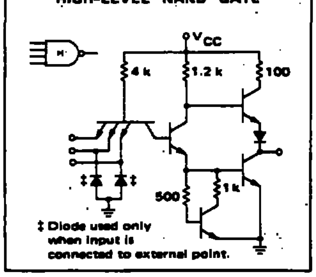
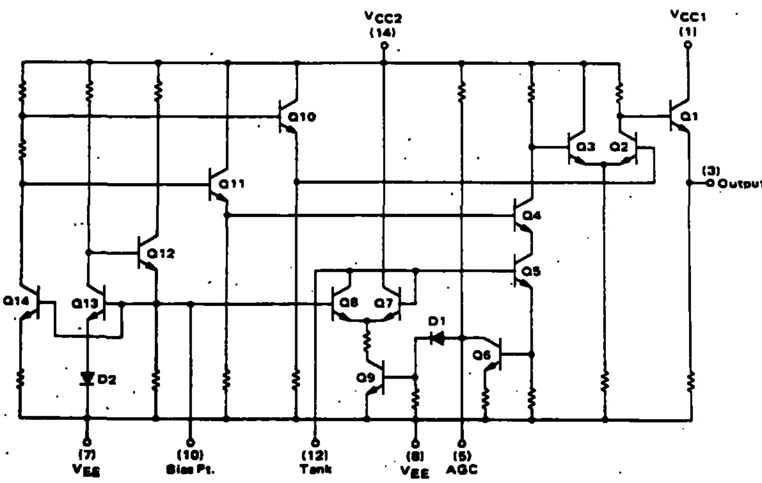



FIGURE 6-9 MC4044P
(Dwg. No. 696-3220-00)

The MC1648 is an emitter-coupled oscillator, constructed on a single monolithic silicon chip. Output levels are compatible with MECL III logic levels. The oscillator requires an external parallel tank circuit consisting of the inductor (L) and capacitor (C).

A varactor diode may be incorporated into the tank circuit to provide a voltage variable input for the oscillator (VCO). This device may be used in many applications requiring a fixed or variable frequency clock source of high spectral purity.




Numbers in parenthesis denote pin number for F package (Case 607), L package (Case 632), and P package (Case 646).

FIGURE 6-10 MC1648
(Dwg. No. 696-3221-00)

**MONOLITHIC BALANCED
MODULATOR – DEMODULATOR**

. . . designed for use where the output voltage is a product of an input voltage (signal) and a switching function (carrier): Typical applications include suppressed carrier and amplitude modulation, synchronous detection, FM detection, phase detection, and chopper applications.

CIRCUIT SCHEMATIC

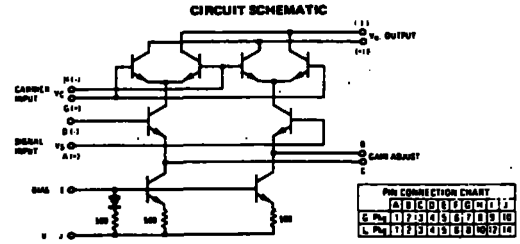
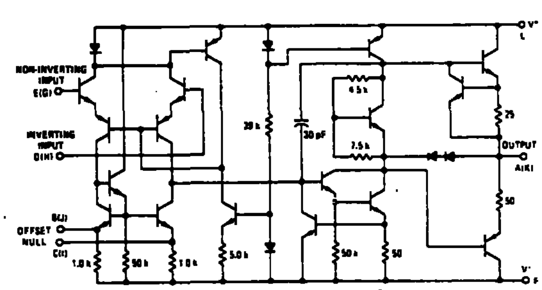


FIGURE 6-11 MC1496G
(Dwg. No. 696-3222-00)

. . . designed for use as a summing amplifier, integrator, or amplifier with operating characteristics as a function of the external feedback components.

CIRCUIT SCHEMATIC



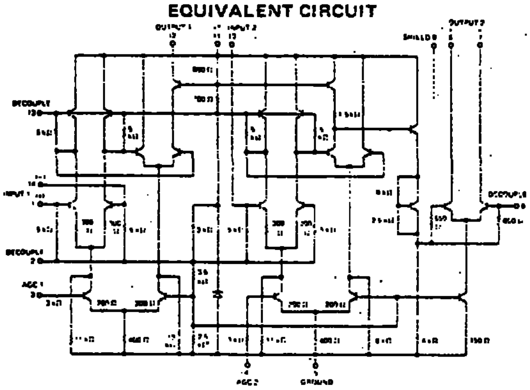

PIN CONNECTIONS

| Schematic | A | B | C | D | E | F | G | H | I | J | K | L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| G & P1 Packages | 1 | – | – | 2 | 3 | 4 | 5 | 6 | – | – | 7 | 8 |
| L & P2 Packages | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 14 |

FIGURE 6-12 MC1458P
(Dwg. No. 696-3223-00)

**GENERAL DESCRIPTION** – The μA757 is a high performance, gain-controlled IF amplifier constructed on a silicon chip using the Fairchild Planar* epitaxial process. The amplifier contains two sections which may be operated independently, or in cascade, from audio frequencies to 25 MHz. The μA757 is intended primarily as a gain-controlled, intermediate-frequency amplifier in AM and FM communications receivers. It also has excellent performance when operated in FM receivers as a limiting-amplifier.

**EQUIVALENT CIRCUIT**



**CONNECTION DIAGRAM**
**(TOP VIEW)**

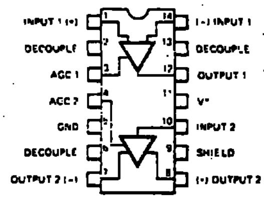



FIGURE 6-13 μA757
(Dwg. No. 696-3224-00)

## 6.1.2.5 TESTING OF DIGITAL INTEGRATED CIRCUITS

Precision voltage measurements are not needed in testing digital I.C.'s other than to see that the voltage is a HI level or a LO level. An oscilloscope with a calibrated vertical and horizontal axis is normally used in order to measure voltages of short duration or to measure the relationship of two voltage pulses.

(a) A Truth Table of the logic element under question is the primary tool to be used. When checking input and output levels of a logic element under question, it should be remembered that an input or output may not agree with its truth table not because it has malfunctioned but because some other component connected to the same point has shorted to ground or to $V_{CC}$. This is not uncommon when an output of one element is connected to an input or output of another. It may be necessary to isolate the gate under question by unsoldering the necessary I.C. pins. A majority of digital I.C. failures can be grouped into three categories.

(1) Input(s) or output shorted to ground pin of I.C.
(2) Input(s) or output shorted to $V_{CC}$ pin of I.C.
(3) Open input(s) or output.

An input or output shorted to ground would be a constant LO and an input or output shorted to $V_{CC}$ would be a constant HI. An open input would not cause any change in the output state. An open output would be less than 0.5VDC.

(b) Other failures common in digital I.C.'s are:

(4) Ground pin open.
(5) $V_{cc}$ pin open.
(6) Inputs shorted together.

An open ground pin would not allow a LO on the output.
An open $V_{cc}$ pin would not allow a HI on the output.
(Remember to isolate the device from other components connected to it). Two or more inputs shorted together can be checked by grounding one of the inputs under question. If the other input also goes to ground they are probably shorted.

6.1.2.6 TESTING OF LINEAR INTEGRATED CIRCUITS

An oscilloscope with a calibrated vertical and horizontal axis is normally used in order to measure the signals associated with linear I.C.'s. Precision DC voltage measurements should be made with a digital voltmeter with a floating ground.

(a) Possible Problems With Operational Amplifiers

1. Wrong DC voltages on input terminals. This problem is generally caused by excess leakage in a bypass or coupling capacitor. If the voltage returns to normal when the capacitor is disconnected, the capacitor is leaky. If the voltage does not return to normal then the op amp is most likely at fault.

2. The input terminals are normal while the output terminal is at $+V_{cc}$. This problem is generally caused by an open feedback loop.

3. The DVM, connected across the input terminals of the op amp indicate in excess of 6.0MV. This condition, called excess offset, indicates a defective op amp.

(b) Possible Problems with Balanced Modulators

1. The carrier input cannot be nulled at the output. This indicates a defective balanced modulator.

6.1.2.7 REPLACING INTEGRATED CIRCUITS

If an I.C. is known to be defective, the easiest way to remove it is to cut off each of its pins, remove the case, and then unsolder the remaining pins from the printed circuit board one by one. This is preferable over removing the I.C. intact because attempts to remove the I.C. intanct may result in damage to the printed circuit board. If it is desired to remove an I.C. intanct, a soldering iron with a special tip may be used that will heat all the pins on the backside of the board at the same time. After removal the holes of the board should be cleaned of solder so that the replacement I.C. may be installed. Note the marking identation of the I.C. before removal, and replace the new one with the same orientation as the one removed.

**—CAUTION—**

If an I.C. is found to be defective, verify that there is no greater than $V_{cc}$ +10% on any of the I.C. holes on the board or a ground on an I.C. hole that should not be grounded, before installating a replacement I.C.

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

## 6.2 TEST AND ALIGNMENT

The following is an Alignment Procedure for adjusting the KR 86 so it will meet its minimum performance specifications.

### 6.2.1 REQUIRED TEST EQUIPMENT

A. Primary Power Supply, Heath IP-27 or equivalent. (+13.75V at 0.5A).
B. Digital Voltmeter, Digitec 211 or equivalent.
C. VTVM, Heath IM-13 or equivalent.
D. Audio Wattmeter, EICO 261 or equivalent.
E. Frequency Counter. Monsanto 100A or equivalent.
F. Signal Generator, HP606A or equivalent.
G. Oscilloscope, Tektronix 454 or equivalent.
H. ADF Signal Simulator, TIC CES-116A
I. Sense Antenna simulator, See Figure 6-14
J. KR 86 Bench Test Set, See Figure 6-15, 6-16.

### 6.2.2 KR 86 ALIGNMENT PROCEDURES

A. The following procedures outline the steps necessary to properly align the KR 86. Refer to assembly drawing and schematic diagrams for location of components and test points (TP).

B. In no event should alignment be attempted without first insuring that the proper DC voltages are present within the unit.

C. The loop, sense and SMO covers should be in place before final alignment.

D. Refer to Figure 6-15 for the ADF test setup.

#### 6.2.2.1 PRELIMINARY

A.
1. Set loop gain (R268) to mid-range.
2. Set loop balance (R269) to mid-range.
3. Set function switch (S102) to Ant. Mode.
4. Adjust L204 maximum counterclockwise.
5. Disconnect motor leads.

B. Apply input power (13.75V) to unit. Current drain should be approximately 0.340 amp (0.450 amp - ADF mode) plus .120 amp with lamps.

C. Monitor TP210 or E206 with a DVM. 8.0 ±0.4 VDC must be obtained.

#### 6.2.2.2 SMO ALIGNMENT

A. Determine the tuning voltages at which the VCO will be aligned. These voltages will be supplied with each varactor kit.

**—NOTE—**

Varactors must be replaced as a set. List the correct tuning voltage on the tuning voltage decal.

B. Monitor the tuning voltage (TP202) with a DVM and the VCO frequency (TP204) with a frequency counter.

C. Set frequency selector to 200KHz and adjust T212 (orange core) for the low value tuning voltage found in step A. VCO frequency must remain stable at 340KHz ±68Hz.

D. Set frequency selector to 399KHz and adjust C244 for the high value tuning voltage found in step A. VCO frequency must remain stable at 539KHz ±108Hz.

E. Repeat steps C and D until no further change in tuning voltage is observed.

F. Set frequency selector to 400KHz and adjust T211 (yellow core) for the low value tuning voltage found in step A. VCO frequency must remain stable at 540KHz ±108Hz.

G. Set frequency selector to 799KHz and adjust C242 for the high value tuning voltage found in step A. VCO frequency must remain stable at 939KHz ±188Hz.

H. Repeat steps F and G until no further change in tuning voltage is observed.

I. Set frequency selector to 800KHz and adjust T210 (green core) for the low value tuning voltage found in step A. VCO frequency must remain stable at 940KHz ±188Hz.

J. Set frequency selector to 1750KHz and adjust C240 for the high value tuning voltage found in step A. VCO frequency must remain stable at 1890KHz ±380Hz.

K. Repeat Steps I and J until no further change is observed.

6.2.2.3 I. F. ALIGNMENT

A. Monitor the AGC Voltage (TP207 or Pin # 12 of J101) with a DVM and the detector output (TP205) with a scope. Set the frequency selector and signal generator to 1666.200KHz.

**—NOTE—**

During receiver alignment, keep the signal generator level sufficient for 15db S+N/N.

B. Preliminary alignment - adjust C219, C235 and all I.F. tranformers for maximum AGC voltage.

**—NOTE—**

If the receiver is badly out of alignment, it may be necessary to inject a 140KHz signal at points C, G, or K (Figure 6-17) and tune succeeding I. F. stages in order to get the I. F. amplifier into approximate alignment. (Use 0.001μf disc capacitor in series with signal generator lead). (Fig. 6-27)

C. Load and tune following steps (D thru I) using a 33KΩ resistor. (Refer to Figure 6-17).

D. Load T217 (point C to D) and tune T218 for maximum AGC.

E. Load T218 (point A to B) and tune T217 for maximum AGC.

F. Load T215 (point G to H) and tune T216 for maximum AGC.

G. Load T216 (point E to F) and tune T215 for maximum AGC.

H. Load T213 (point K to L) and tune T214 for maximum AGC.

I. Load T214 (point I to J) and tune T213 for maximum AGC.

6.2.2.4 RF ALIGNMENT

A. Check SMO Alignment per step 6. 2. 2. 2.

B. Set frequency selector and signal generator to 200KHz. Adjust T206 and T209 for maximum AGC.

C. Set frequency selector and signal generator to 399KHz. Adjust C223 and C239 for maximum AGC.

D. Repeat Steps B and C until no further change is observed.

E. Set frequency selector and signal generator to 400KHz. Adjust T205 and T208 for maximum AGC.

F. Set frequency selector and signal generator to 799KHz. Adjust C221 and C237 for maximum AGC.

G. Repeat steps F and G until no further change is observed.

H. Set frequency selector and signal generator to 800KHz. Adjust T204 and T207 for maximum AGC.

I. Set frequency selector and signal generator to 1750KHz. Adjust C219 and C235 for maximum AGC.

J. Repeat steps H and I until no further change is observed.

6.2.2.5 LOOP ALIGNMENT AND GAIN ADJUSTMENT

A. Set frequency selector and signal generator to 200KHz. Set signal generator level to 5mv/M. Set ADF function switch to the ADF mode. Sync scope from

from TP209 and turn simulator bearing dial to obtain maximum loop modulation at TP205 (motor disconnected). Adjust T203 for maximum modulation.

B. Set frequency selector and signal generator to 399KHz. Adjust C208 for maximum modulation.

C. Repeat steps A and B until no further change is observed.

D. Set frequency selector and signal generator to 400KHz. Adjust T202 for maximum modulation.

E. Set frequency selector and signal generator to 799KHz. Adjust C207 for maximum modulation.

F. Repeat steps D and E until no further change is observed.

G. Set frequency selector and signal generator to 800KHz. Adjust T201 for maximum modulation.

H. Set frequency selector and signal generator to 1750KHz. Adjust C206 for maximum modulation.

I. Repeat steps G and H until no further change is observed.

J. Set frequency selector and signal generator to 200KHz, 30% 1KHz modulation and the R. F. level for 100$\mu$v/m. Set simulator bearing selector for minimum modulation (TP205). Adjust R268 for 6db s+n/n.

K. Remove modulation from signal generator and set RF level for 0.01v/m. Adjust R269 for minimum square wave at TP201.

L. Recheck step J.

6.2.2.6 SERVO ALIGNMENT

A. Monitor and sync scope at TP315. Monitor TP316 with other scope channel. Set simulator bearing dial for an undistorted error signal at TP316 and adjust R323 for maximum output. (The sinewave zero crossing should correspond to the square wave zero crossing.)

B. Turn simulator bearing dial 5° off null. Adjust R261 on receiver board for 1.25V peak-to-peak at TP316. Reconnect motor.

C. Jumper the junction of R319 and C310 to ground. Monitor TP317 or TP318 on scope and adjust R330 for minimum square wave.

D. Monitor voltage between TP317 and TP318 and adjust R338 for 0.0VDC output. Remove jumper from junction of R319 and C310.

E. Turn simulator bearing dial to 0° and set pointer on ADF to 0°.

## 6.2.3 27.5VDC TO 13.75VDC CONVERTOR TEST PROCEDURE

Refer to Figure 6-18 for test setup.

A. Connect a 0.5amp load to the convertor output (orange terminal).

B. Apply power to the input (red terminal) and vary from 22.0VDC to 33.0VDC. The output must maintain 13.75 ±2.0VDC.

C. Momentarily short circuit (2 sec) the output terminal, the converter must not destroy itself.

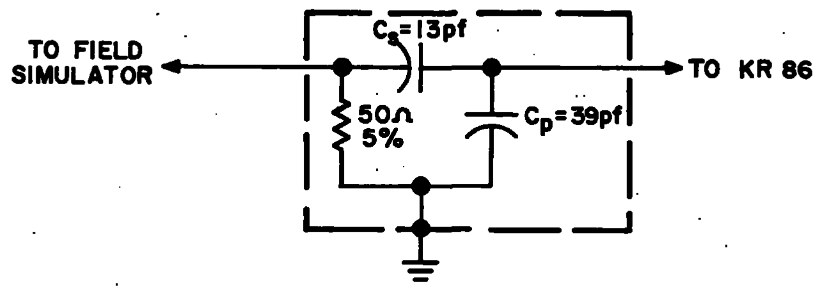



FIGURE 6-14 SENSE ANTENNA SIMULATOR
(Dwg. No. 696-3225-00)

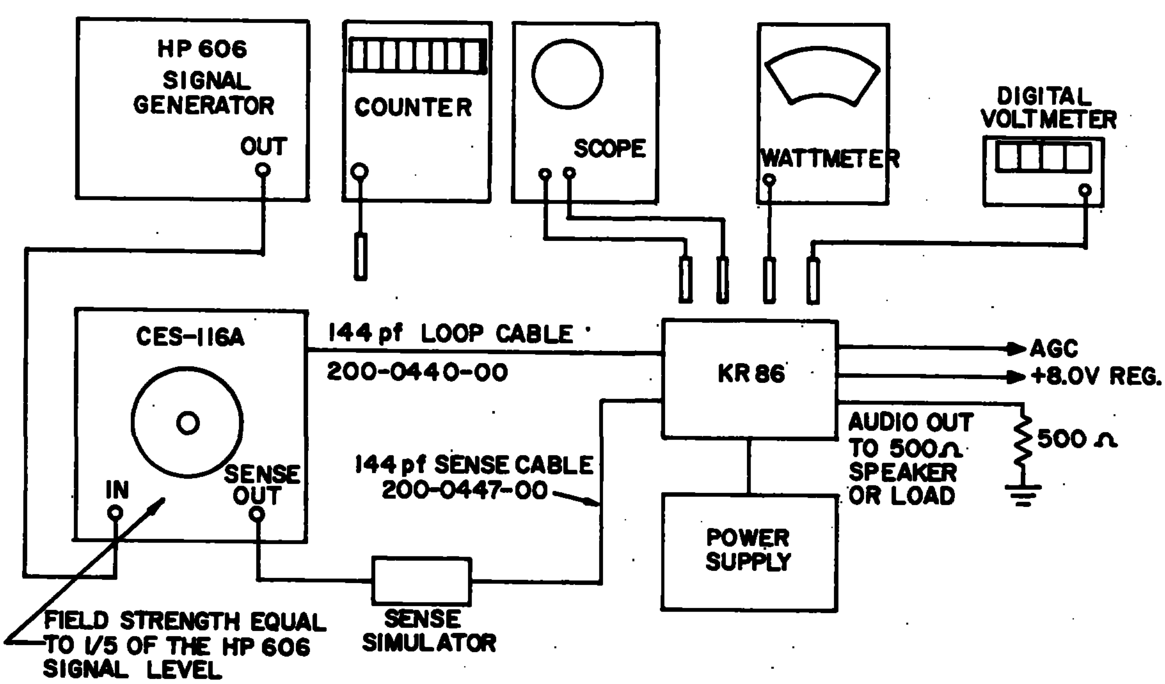
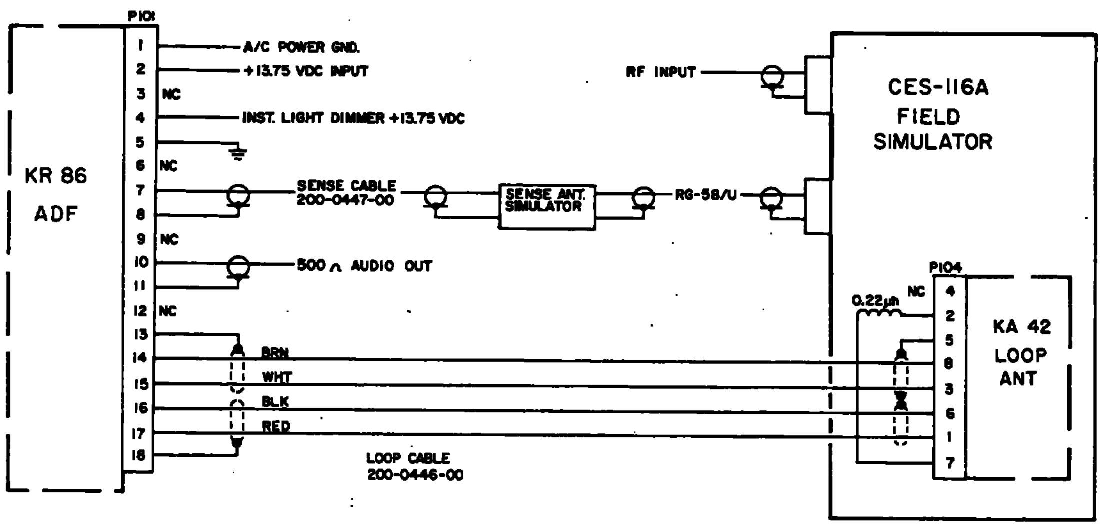



FIGURE 6-15 KR 86 TEST SETUP
(Dwg. No. 696-3226-00)




NOTES:

1. LOOP AND SENSE CABLE LENGTHS MUST NOT BE ALTERED.
2. WIRE SIZE MUST BE #18 TO #22AWG.
3. ADD 0.22μh CHOKE BETWEEN PINS 2 AND 7 OF P104 TO CORRECT FOR QUADRANTAL ERROR.
4. SEE FIG. 6-14 FOR SENSE ANTENNA SIMULATOR SCHEMATIC DIAGRAM.

FIGURE 6-16 KR 86 TEST SET INTERCONNECT
(Dwg. No. 696-3227-00)

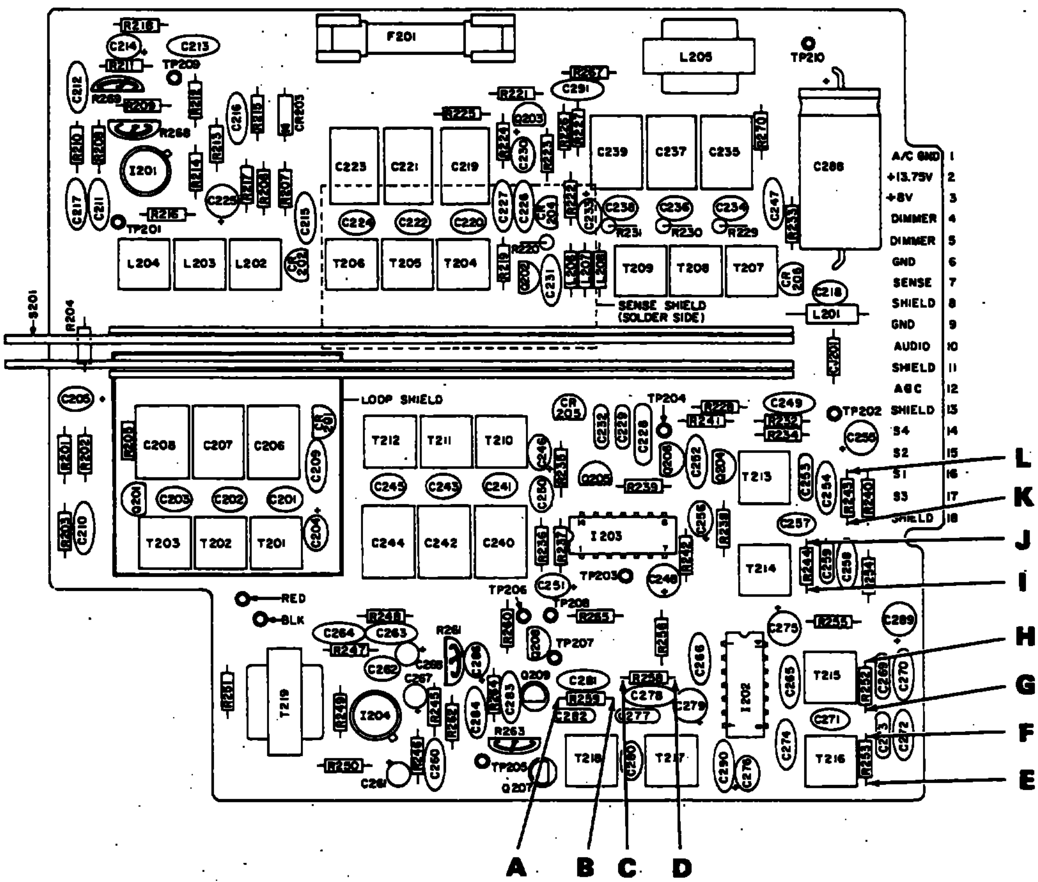



FIGURE 6-17 RECEIVER ALIGNMENT LOADING POINTS
(Dwg. No. 696-3228-00)

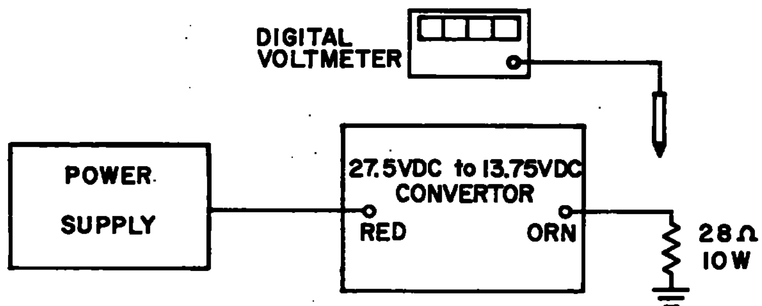



FIGURE 6-18 27.5VDC to 13.75VDC CONVERTOR TEST SETUP
(Dwg. No. 696-3229-00)

### 6.2.4 KR 86 AUTOMATIC DIRECTION FINDER FINAL TEST DATA  Serial No. ____________

1. Regulated Voltage: (8.0 ±0.4VDC)
   Input 16.50 Volts Output __________ Volts
   13.75 Volts Output __________ Volts
   11.00 Volts Output __________ Volts

2. Current Drain at 13.75V:  ADF Mode __________ amps. (0.5A. Max)

3. VCO frequency. Sensitivity (1000Hz at 30%). Bearing Accuracy. Pointer speed and Image rejection.

| Rec. Freq. (kHz) | VCO Rec. Freq. +140kHz (±.02%) | ANT Sensitivity MCW at 70$\mu$v/m (6db s+n/n min) | ADF Sensitivity MCW at 100$\mu$v/m (6db s+n/n Min) | BFO Sensitivity CW at 70$\mu$v/m (6db s+n/n Min) |
|---|---|---|---|---|
| 200 | ________ | ________ | ________ | ________ |
| 300 | | | ________ | |
| 399 | ________ | | ________ | |
| 411 | ________ | | ________ | |
| 577 | ________ | | ________ | |
| 788 | ________ | | ________ | ________ |
| 822 | ________ | | ________ | |
| 933 | ________ | ________ | | |
| 1044 | ________ | | | |
| 1155 | ________ | | ________ | |
| 1666 | ________ | | ________ | ________ |

| Rec. Freq. (kHz) | ADF Bearing Error 70$\mu$v/m 0° Simulator (3° Max) | ADF Bearing Error 0.5v/m 0° Simulator (3° Max) | ADF Pointer Speed 70$\mu$v/m 175° Rotation (7 sec. Max) | Image Rejection Rec. Freq. +280kHz |
|---|---|---|---|---|
| 200 | ________ | ________ | ________ | ________ (70 db min) |
| 300 | | | ________ | |
| 399 | | | ________ | ________ (60 db min) |
| 411 | ________ | ________ | ________ | |
| 577 | | | ________ | |
| 788 | | | ________ | ________ (50 db min) |
| 822 | ________ | ________ | ________ | |

| Rec. Freq. (kHz) | ADF Bearing Error 70μv/m 0° Simulator (3° Max) | ADF Bearing Error 0.5v/m 0° Simulator (3° Max) | ADF Pointer Speed 70μv/m 175° Rotation (7 sec. Max) | Image Rejection Rec. Freq. +280kHz |
|---|---|---|---|---|
| 1155 | | | ________ | |
| 1666 | ________ | ________ | ________ | ________(40 db min) |

Bearing Accuracy at 45° Incremental Headings

R. F. Input Signal - 1000μv/m
Frequency - 300kHz

| F. S. Bearing 300 kHz | Indicator Bearing with Q. E. Correction | Measured Indicator Bearing |
|---|---|---|
| 0° | 0° ±3° | ________° |
| 45° | 52° ±3° | ________° |
| 90° | 90° ±3° | ________° |
| 135° | 128° ±3° | ________° |
| 180° | 180° ±3° | ________° |
| 225° | 232° ±3° | ________° |
| 270° | 270° ±3° | ________° |
| 315° | 308° ±3° | ________° |

4. Selectivity at 1666kHz (Aural Receive Mode).

6db - ________KHz, + ________KHz (± 1KHz Min)
55db - ________KHz, + ________KHz (± 6KHz Max)

5. Audio and AGC characteristics; ANT mode, 1666kHz, 30% AM modulation.

a. 1000μv/m, 1,000Hz modulation.

Maximum undistorted audio ________Vrms (5v min)
Minimum audio ________Vrms (0.1v max)

b. 1000 μv/m, audio level adjusted for 3.3Vrms with 1kHz 30% modulation

Total audio variation 350 Hz - 1400Hz ________db (9 db Max)

c. 1000Hz modulation, audio level adjusted for 3.3Vrms with 100μv/meter.

Audio Variation 100$\mu$v/m to 0.5v/m.
Max ______________ db (12db)

7. Indicator Rotation

CW ________________ (ok) CCW ______________ (ok)

6.2.5 KR 86 27.5VDC to 13.75VDC VOLTAGE CONVERTER FINAL TEST DATA

1.1 Current Output = .5 amps

| Voltage In | Voltage Out (13.75 ±15%) |
|---|---|
| 22.00 volts | ________________ volts |
| 27.50 volts | ________________ volts |
| 33.00 volts | ________________ volts |

1.2 Output Terminal Short Circuit (2 sec) ________________ ok.

## 6.3 OVERHAUL

### 6.3.1 VISUAL INSPECTION

This section contains instructions to assist in determining, by inspection, the condition of the KR 86. Defects resulting from wear, physical damage, deterioration, or other causes can be found by these inspection procedures.

a. Inspect all wiring and coax cables for damaged insulation and proper termination (broken strands and solder joint).

b. Check connector cable connections, making sure they are free from corrosion and are properly secured.

c. Check all components for evidence of overheating, discoloration, bulges or cracked housing.

d. Check all components for evidence of vibration, lead breakage and broken or insecure mounting.

e. Inspect switch contacts for pits or arcing.

### 6.3.2 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 15psi), blow the dust from inaccessible areas. Care should be taken to prevent damage by the air blast.

c. Clean electrical contacts with cloth lightly moistened with an approved contact cleaner.

d. Clean the receptacle and plugs with a hand controlled dry air jet (not more than 25psi), and a clean lint-free cloth lightly moistened with an approved cleaning solvent. Wipe dry with a clean, dry, lint-free cloth.

### 6.3.3 REPAIR

This section describes the procedure, along with any special techniques, for replacing damaged or defective components of the KR 86 ADF.

a. CRYSTALS

When replacing the crystal in the KR 86 use a heat sink, such as a pair of long nose pliers, between the crystal and the lead being soldered. Verify that the crystal is firmly seated in its holder after replacement. Use of other than King crystals is considered an unauthorized modification.

b. DIODES

Diodes used in the KR 86 are Silicon. Use long nose pliers as a heat sink under normal soldering conditions. Note the diode polarity before removal.

c. INTEGRATED CIRCUITS

Refer to INTEGRATED CIRCUIT MAINTENANCE (6.1.2.7) for removal and replacement instructions. A path that has opened up on the top or bottom of a card can be replaced with insulated hookup wire.

d. TRANSISTORS

Refer to SEMICONDUCTOR MAINTENANCE (6.1.1.5) for removal and replacement instructions.

e. WIRING

When repairing a wire that has broken from its terminal, remove all old solder and pieces of wire from the terminal, restrip the wire to the necessary length and resolder the wire to the terminal. Replace the damaged wire with wire of the same size and color coding.

## 6.3.4 DISASSEMBLY PROCEDURES (Figure 6-19)

The following instructions include procedures that are necessary to remove and disassemble the KR 86. 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 or coaxial cables.

a. The KR 86 performance tests can be completed without any disassembly of the unit except for measuring the VCO frequency which does require that the bottom cover be removed temporarily.

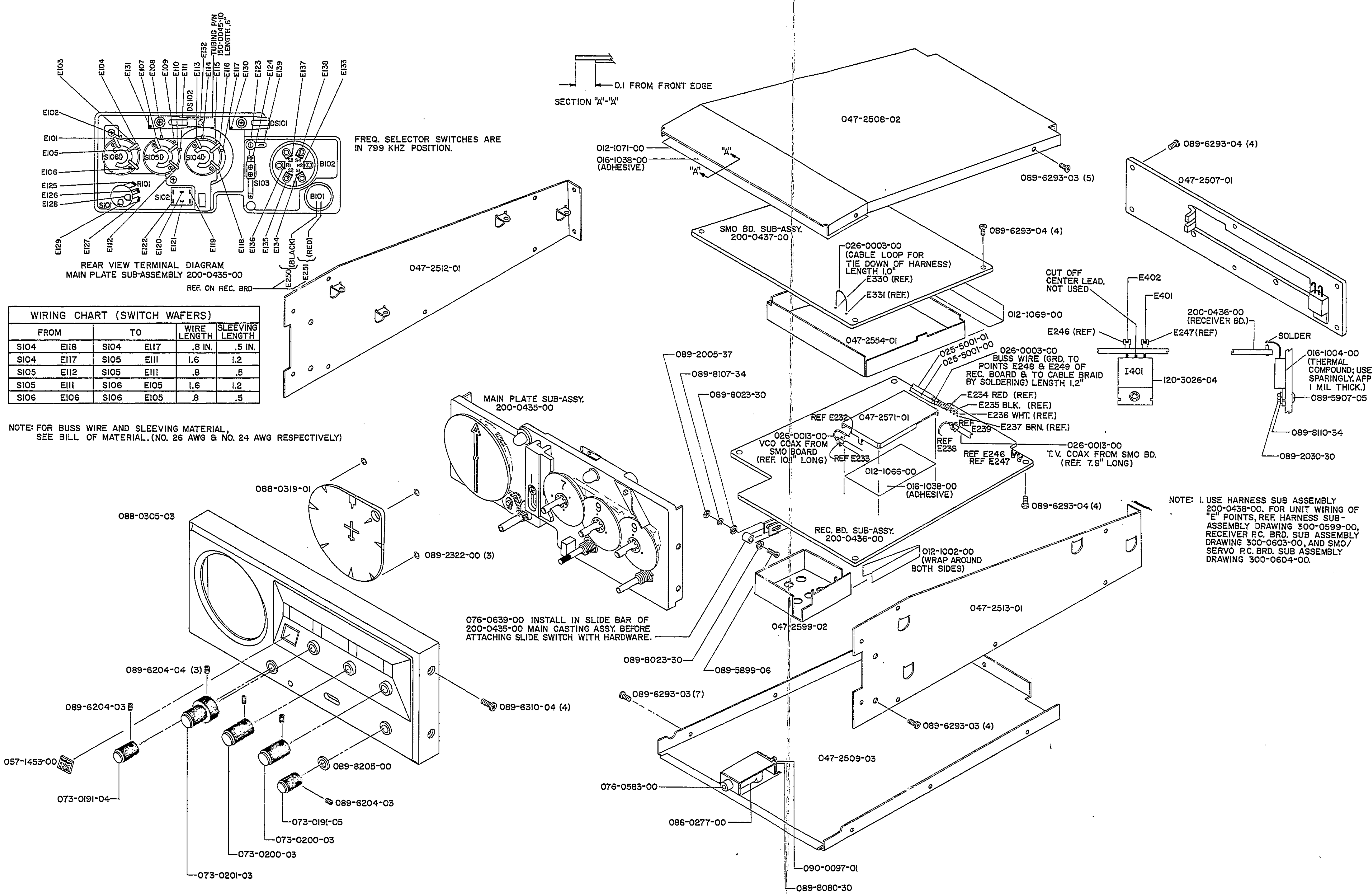
b. The receiver P.C. Board is mounted component side out on the bottom side of the radio. It is held in place by a screw in each corner.

c. The SMO/Servo P.C. Board is mounted component side in on the top side of the radio. This board is wired such that by removing the four mounting screws, the board can be swung out for servicing.

d. The receiver board has a loop cover and a sense cover which are held in place by two solder tacks each and the SMO/Servo Board has a SMO cover which is also solder tacked in place. Refer to Board Assembly drawings for mounting procedure for the covers.

## 6.3.5 ASSEMBLY PROCEDURES

In general the assembly procedures for each of the subassemblies are the reverse of the disassembly procedures. Therefore no specific assembly procedures are given in this manual.




| WIRING CHART (SWITCH WAFERS) | | | | | |
|---|---|---|---|---|---|
| FROM | | TO | | WIRE LENGTH | SLEEVING LENGTH |
| S104 | E118 | S104 | E117 | .8 IN. | .5 IN. |
| S104 | E117 | S105 | E111 | 1.6 | 1.2 |
| S105 | E112 | S105 | E111 | .8 | .5 |
| S105 | E111 | S106 | E105 | 1.6 | 1.2 |
| S106 | E106 | S106 | E105 | .8 | .5 |

NOTE: FOR BUSS WIRE AND SLEEVING MATERIAL, SEE BILL OF MATERIAL. (NO. 26 AWG & NO. 24 AWG RESPECTIVELY)

FIGURE 6-19 UNIT SUB-ASSEMBLY
(Dwg. No. 300-0601-00, R-0)

## 6.4 TROUBLESHOOTING

This section is intended for use as a guide in isolating unit malfunctions. The guidance presented here and the figures referenced by no means profess to include all possible causes of failure, but are presented as a guide line to be used in locating the approximate area of the unit that has failed.

### 6.4.1 GENERAL

Procedures followed when troubleshooting differ slightly from the procedures followed when aligning the unit. Therefore, after the troubleshooting procedures have been completed, the units must be checked or aligned by the procedures outlined in section 6.2. Contained within this section are Troubleshooting Flow Charts, Troubleshooting Sequence Charts, Detailed Troubleshooting Procedures, Waveforms, and Schematics. The charts and procedures are arranged in the most logical troubleshooting order and will help in locating why the unit failed a specific test. They assume that the portions of the Performance Test which preceed the test which was not passed have been checked and found satisfactory.

### 6.4.2 KR 86 TROUBLESHOOTING FLOW CHART AND SEQUENCE CHART

Figure 6-20 is the KR 86 Troubleshooting Flow Chart and is arranged in a manner that will expedite finding the general area of a failure. Table 6-1 is the KR 86 Troubleshooting Sequence Chart and is arranged in a manner that will expedite finding the specific area or component of a failure.

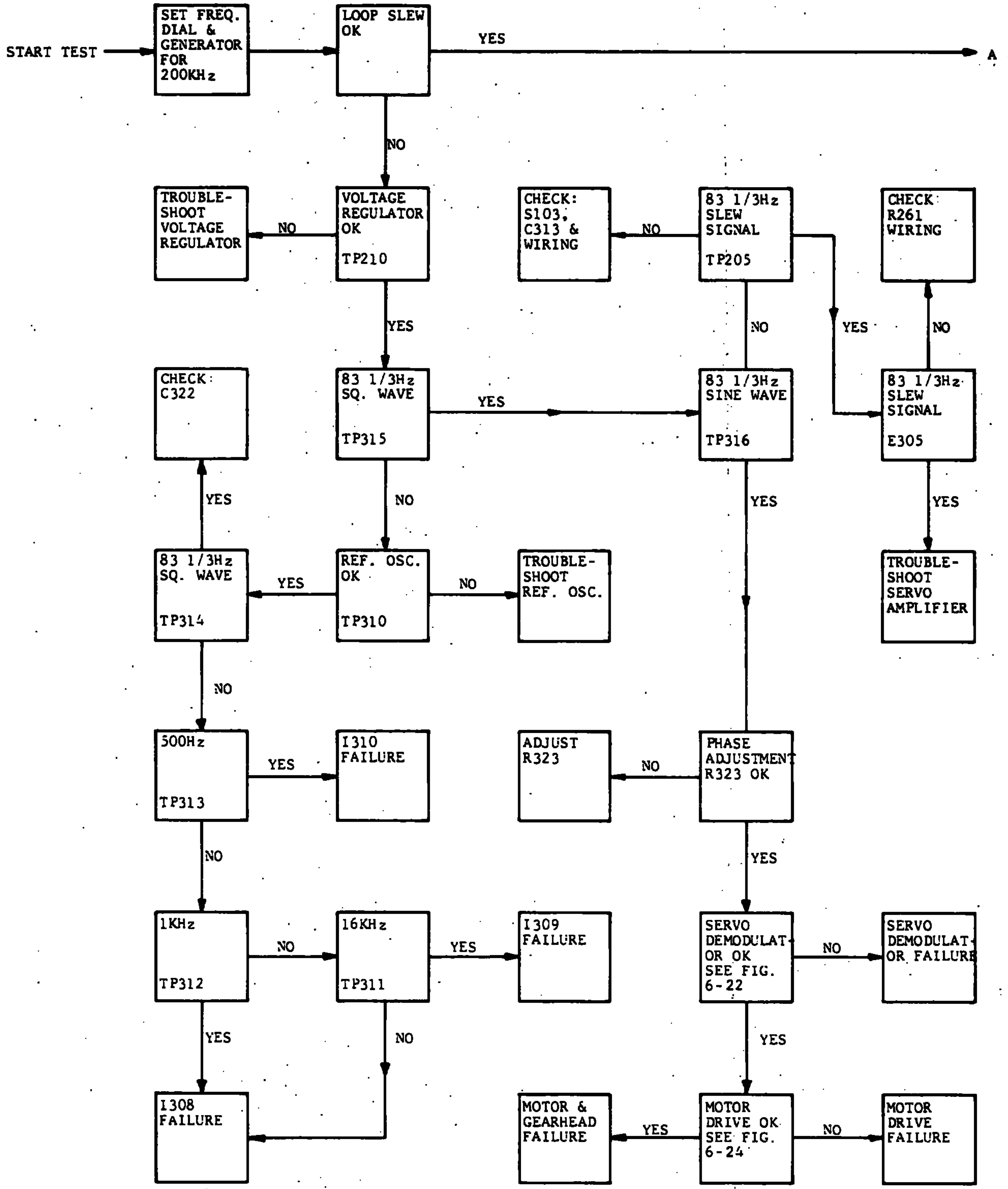



FIGURE 6-20 A KR 86 TROUBLESHOOTING FLOW CHART
(Dwg. No. 696-3230-01)

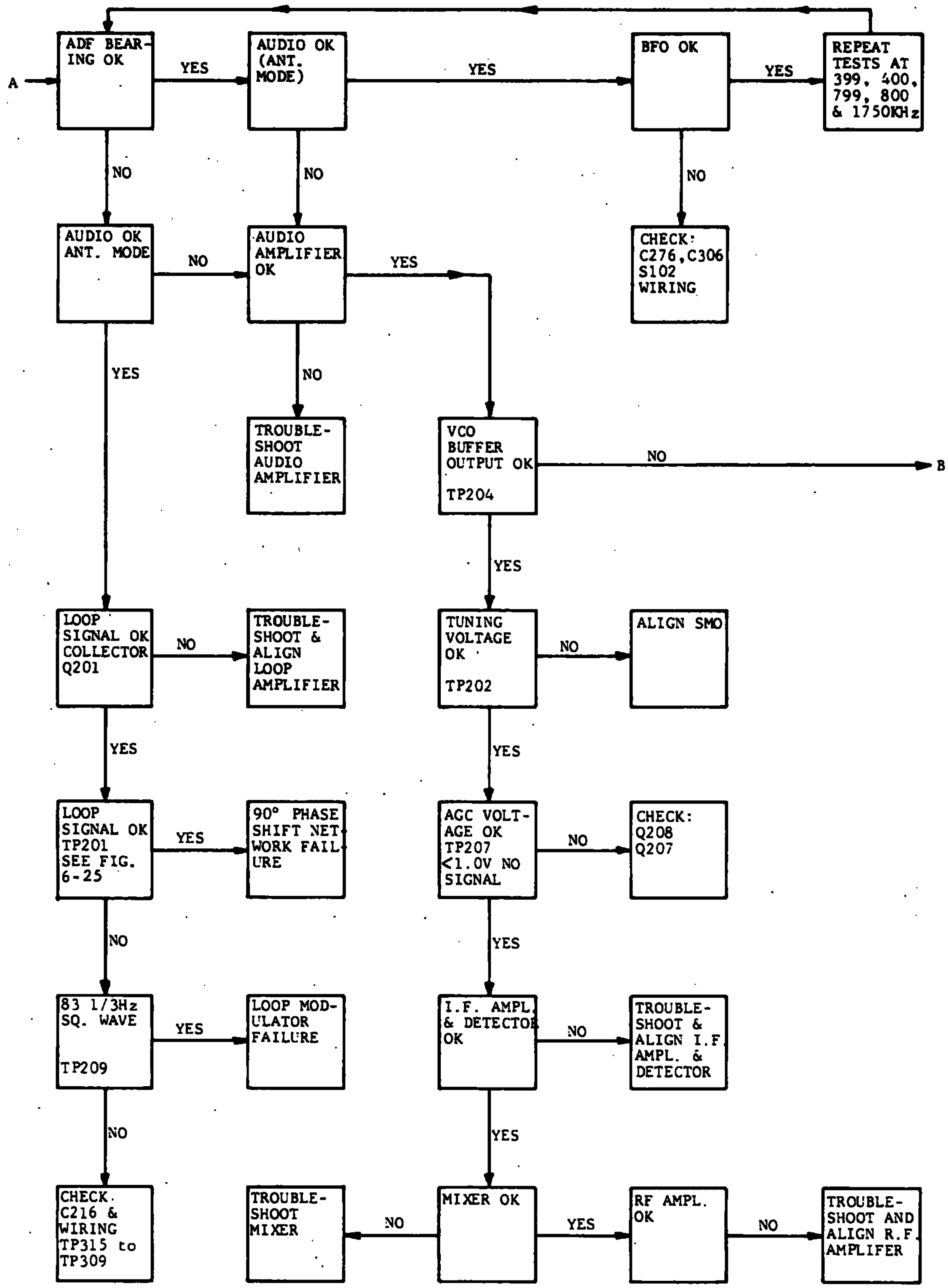



FIGURE 6-20 B KR 86 TROUBLESHOOTING FLOW CHART
(Dwg. No. 696-3230-02)

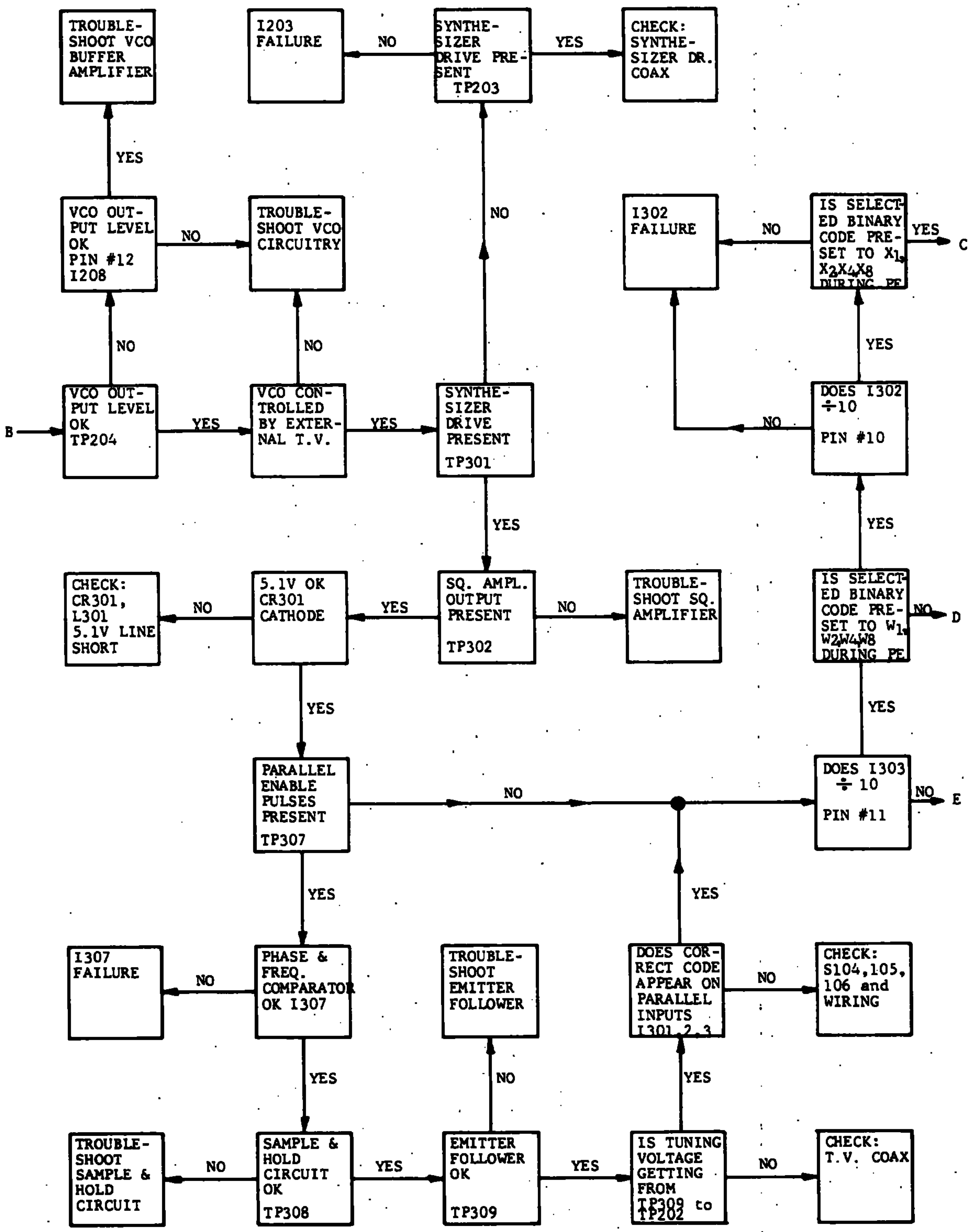



FIGURE 6-20 C KR 86 TROUBLESHOOTING FLOW CHART
(Dwg. No. 696-3230-03)

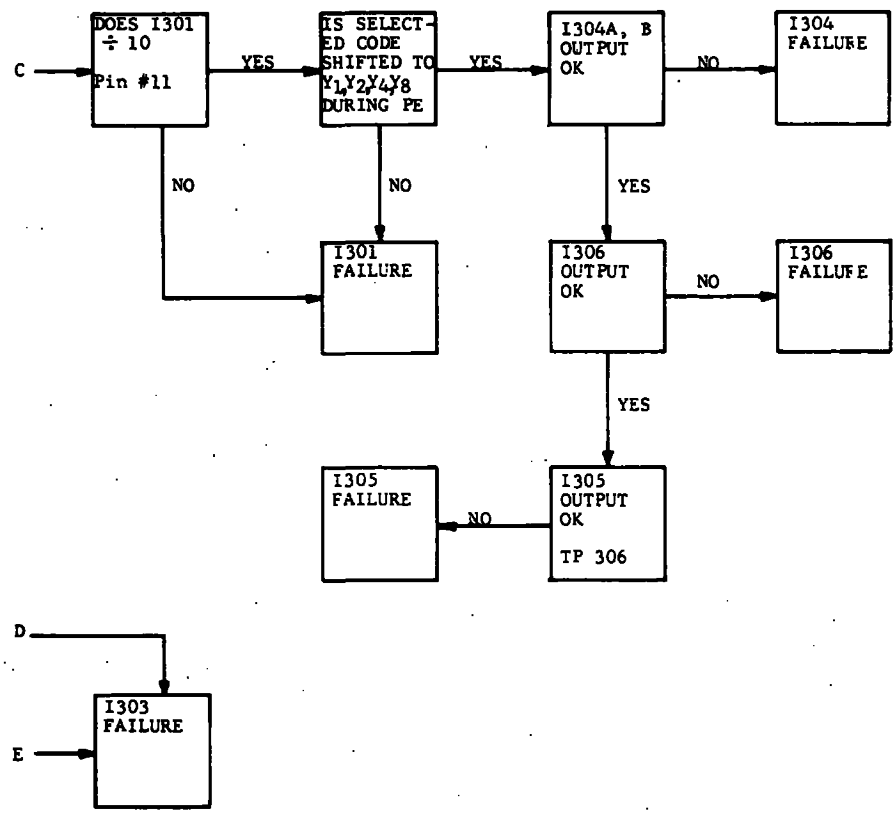



FIGURE 6-20 D KR 86 TROUBLESHOOTING FLOW CHART
(Dwg. No. 696-3230-04)

TABLE 6-1 TROUBLESHOOTING SEQUENCE

| SECTION | SYMPTOM | POSSIBLE CAUSE |
|---|---|---|
| Voltage Regulator | +8.0VDC missing or low (TP210) | Short on +8.0VDC line<br>C288 shorted<br>Fuse (F201) open<br>L205 open<br>S101 faulty<br>13.75VDC line faulty<br>I401 faulty |
| Reference Oscillator | No output TP310 | +5.0VDC missing<br>Q302, 303 faulty<br>C316 faulty<br>C314 open<br>Y301 faulty |
| Servo Amplifier | Output faulty TP316 | +8.0VDC missing<br>I311 faulty<br>CR302 faulty<br>C309 shorted<br>C317 faulty<br>R323 faulty<br>C310 faulty<br>C312, 318 faulty<br>C326, 327 faulty<br>C311 shorted |
| Servo Demodulator | Output faulty<br>Pin #6 or #9 of I312 | +8.0VDC missing<br>CR203 faulty<br>C225 shorted<br>C321 shorted<br>R330 faulty<br>C320, 319 shorted<br>CR303 shorted<br>I312 faulty |
| Motor Drive | Output faulty<br>TP317 or TP318 | +8.0VDC missing<br>Q308 faulty<br>C324, 325 faulty<br>R338 faulty |
| Audio Amplifier | No output | Short on output line<br>+8.0v missing<br>T219 faulty<br>C261, 260 open<br>C262 shorted<br>Audio input line faulty |

TABLE 6-1. TROUBLESHOOTING SEQUENCE

| SECTION | SYMPTOM | POSSIBLE CAUSE |
|---|---|---|
| | | I204 faulty<br>R101 faulty |
| Audio Amplifier | Distorted or low output | T219 faulty<br>C267 faulty<br>C268 faulty<br>C263, C264 faulty<br>C261, C260 shorted<br>I204 faulty<br>R101 faulty |
| Voltage Controlled Oscillator (VCO) | No output (Pin #12, I208) | +8. 0VDC missing<br>S201 faulty<br>I203 faulty<br>Faulty tuned circuit<br>C246 faulty |
| VCO Buffer Amplifier | Output faulty TP204 | Q206 faulty<br>Q205 faulty<br>C250 faulty<br>+8. 0VDC missing<br>C256 faulty |
| Squaring Amplifier | No output (TP302) | +5. 1VDC missing<br>Q301 faulty<br>C302 faulty<br>C304 shorted |
| Sample & Hold Circuit | Output Faulty (TP308) | +8V missing<br>Q304 faulty<br>Q305 faulty<br>Q306 faulty<br>C307 shorted |
| Emitter Follower | No output (TP309) | +8. 0VDC missing<br>Q307 defective<br>Tuning volts line shorted<br>C308 shorted |
| AGC Amplifier | AGC voltage high | C286 leaky<br>C284 shorted<br>Q208 faulty<br>Q207 shorted<br>R261 open<br>Orn/Blk wire shorted |
| AGC Amplifier | AGC voltage inoperative | Q208 open |
| Detector | Output faulty | Q207 faulty<br>Q209 faulty<br>C283 shorted |

| SECTION | SYMPTOM | POSSIBLE CAUSE |
|---|---|---|
| | | T218 open<br>+8.0VDC missing<br>R261 open<br>Orn/Blk wire shorted |
| Intermediate Frequency Amplifier | No output | +8.0VDC missing<br>I202 faulty<br>Shorted by-pass capacitor<br>Open coupling capacitor<br>Faulty tuned-circuit |
| Mixer | Output faulty | Q204 faulty<br>C252 open or shorted<br>C249 open or shorted |
| RF Amplifier | No output | Q202 faulty<br>Faulty tuned-circuit<br>C227 shorted<br>+8.0VDC missing<br>Shorted by-pass capacitor<br>Faulty antenna system |
| RF Amplifier | Output low | Tuned Circuit misaligned<br>CR204 open<br>L206, 207 or 208 open<br>Q203 shorted<br>Tuning voltage faulty |
| Loop Amplifier | No output collector Q201 | +8.0VDC missing<br>Q201 faulty<br>C204 shorted<br>Faulty tuned-circuit<br>Faulty antenna system<br>C205 shorted |
| Loop Amplifier | Output low | Tuned circuit misaligned<br>Tuning voltage faulty<br>C204 open<br>C210 open |
| 83 1/3Hz REF TP209 | Missing | C322 open<br>Grn/wht wire faulty<br>C216 shorted |
| Loop Modulator | No output TP201 | +8VDC missing<br>CR203 faulty |

| SECTION | SYMPTOM | POSSIBLE CAUSE |
|---|---|---|
| | | C225 shorted<br>C217 shorted<br>C211 open<br>R269, R268 faulty<br>C212 shorted |
| 90° Phase Shift Network | Output faulty | L202, 203 or 204 open<br>C227 open<br>S201D faulty |
| BFO | No output | C276 open<br>S102 defective<br>C306 shorted<br>BFO line faulty |

## 6.4.3 KR 86 TROUBLESHOOTING PROCEDURES

This section discusses an overall approach to troubleshooting and troubleshooting techniques. It is arranged in the same logical troubleshooting order as the troubleshooting flow chart and gives helpful repair hints to the service technician. For a further breakdown on individual component failures, refer to the troubleshooting sequence chart, Table 6-1.

### 6.4.3.1 VOLTAGE REGULATOR

a. Apply the correct operating voltage and turn the ADF on. The correct current drain should be less than .500 amp in ADF mode.

b. Check the voltage at TP210. It should be +8.0 ±0.4VDC.

c. Check the voltage at cathode of CR301. It should be +5.1 ±0.25VDC.

### 6.4.3.2 83 1/3Hz SQUARE WAVE, TP315

a. Use oscilloscope to verify.

### 6.4.3.3 83 1/3Hz SINE WAVE, TP316

a. Depress test button

b. Use oscilloscope to verify.

### 6.4.3.4 PHASE ADJUSTMENT R323

a. Monitor and sync one scope channel at TP315

b. Use other channel to monitor TP316.

c. Depress test button.

d. The sinewave zero crossing should correspond to the squarewave zero crossing with R323 adjusted for approximately maximum sinewave output.

6.4.3.5 SERVO DEMODULATOR

a. Monitor pin #6, I312 with one scope channel and pin #9, I312 with other scope channel.

b. Sync scope from TP315.

c. Verify proper operation per following figures.

| | | |
|---|---|---|
| TP | Pin 6, I312 | Pin 9, I312 |
| VERT | 2V/Div | 2V/Div |
| HORIZ | 2mSec/Div | |
| COUPLING | DC | |
| SYNC | TP315 | |
| FREQ | 200KHz | |
| SIGNAL LEVEL | 5K$\mu$v/m | |
| MODE | ADF | |
| ERROR | Zero | |

Pin 6
Pin 9

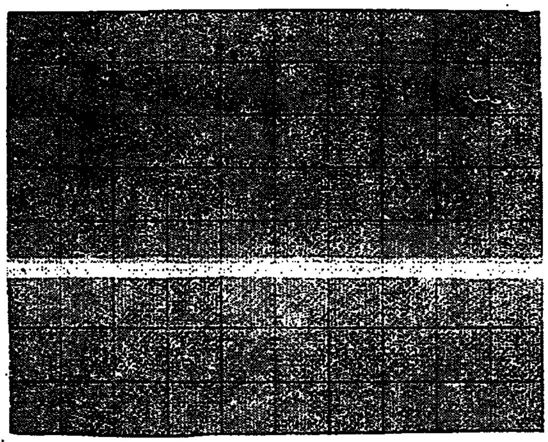


FIGURE 6-21 SERVO DEMODULATOR, NULLED INPUT
(Dwg. No. 696-3232-00)

| | | |
|---|---|---|
| TP | Pin 6, I312 | Pin 9, I312 |
| VERT | 2V/Div | 2V/Div |
| HORIZ | 2mSec/Div | |
| COUPLING | DC | |
| SYNC | TP315 | |
| FREQ | 200KHz | |
| SIGNAL LEVEL | 5K$\mu$v/m | |
| MODE | ADF | |

Pin 6
Pin 9

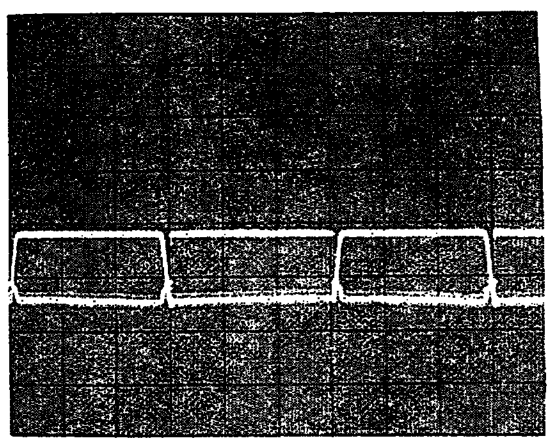


FIGURE 6-22 SERVO DEMODULATOR, TEST BUTTON DEPRESSED
(Dwg. No. 696-3233-00)

6.4.3.6 MOTOR DRIVE

a. Monitor TP317 with one scope channel and TP318 with the other scope channel.

b. Sync scope from TP315.

c. Verify proper operation per following figures.

| | | |
|---|---|---|
| TP | TP317 | TP318 |
| VERT | 2V/Div | 2V/Div |
| HORIZ | 2mSec/Div | |
| COUPLING | DC | |
| SYNC | TP315 | |
| FREQ | 200KHz | |
| SIGNAL LEVEL | 5Kμv/m | |
| MODE | ADF | |
| ERROR | Zero | |

317
318

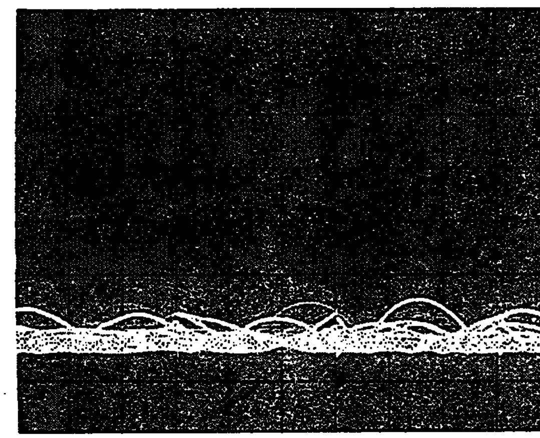


FIGURE 6-23 MOTOR DRIVE, NORMAL
(Dwg. No. 696-3234-00)

| | | |
|---|---|---|
| TP | TP317 | TP318 |
| VERT | 2V/Div | 2V/Div |
| HORIZ | 2mSec/Div | |
| COUPLING | DC | |
| SYNC | TP315 | |
| MODE | ADF | |
| ERROR | Test Pressed | |

317
318

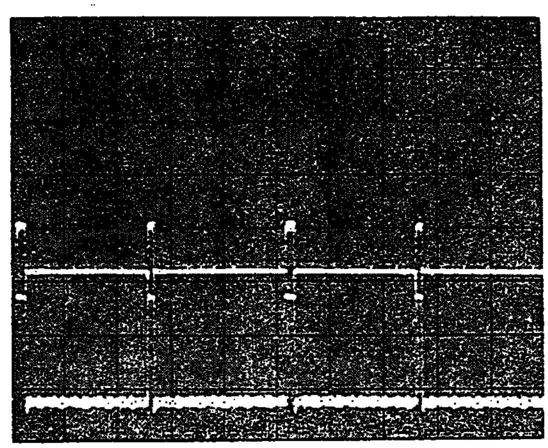


FIGURE 6-24 MOTOR DRIVE, TEST BUTTON DEPRESSED
(Dwg. No. 696-3235-00)

6.4.3.7 MOTOR AND GEARHEAD

a. Disconnect motor leads from Receiver Board and apply 6VDC across motor.

b. The pointer should rotate smoothly at approximately 12 seconds per revolution.

6.4.3.8 83 1/3Hz SLEW SIGNAL TP205

a. Depress test button.

b. Use oscilloscope to verify.

6.4.3.9 83 1/3Hz SLEW SIGNAL E305

a. Depress test button.

b. Use oscilloscope to verify.

6.4.3.10 REFERENCE OSCILLATOR TP310

a. Use oscilloscope to verify.

6.4.3.11 83 1/3Hz SQUARE WAVE TP314

a. Use oscilloscope to verify.

6.4.3.12 500KHz TP313

a. Use oscilloscope to verify.

6.4.3.13 1KHz TP312

a. Use oscilloscope to verify.

6.4.3.14 6KHz TP311

a. Use oscilloscope to verify.

6.4.3.15 LOOP SIGNAL AT COLLECTOR Q201

a. Monitor the collector of Q201 with oscilloscope.

b. Function switch in ADF mode.

c. Frequency selector and Signal Generator per Table 6-2.

d. Signal level, unmodulated, per Table 6-2.

e. Rotate signal simulator bearing for maximum indication.

f. Consult gain chart Table 6-2 for proper indication.

6.4.3.16 LOOP SIGNAL TP201

a. Monitor TP201 with oscilloscope.

b. Function switch in ADF mode.

c. Frequency selector and Signal Generator 200KHz.

d. Signal level 0. 6v/m unmodulated.

e. Rotate signal simulator bearing dial for maximum indication.

f. Verify proper operation per Figure 6-25.

| | |
|---|---|
| TP | 201 |
| VERT | 50mv/Div |
| HORIZ | 20μs/Div (Delayed Sweep) |
| COUPLING | AC |
| SYNC | TP209 |
| FREQ | 200KHz |
| SIGNAL LEVEL | 3. 0V/m 15 |
| MODE | ADF |
| ERROR | Max. |

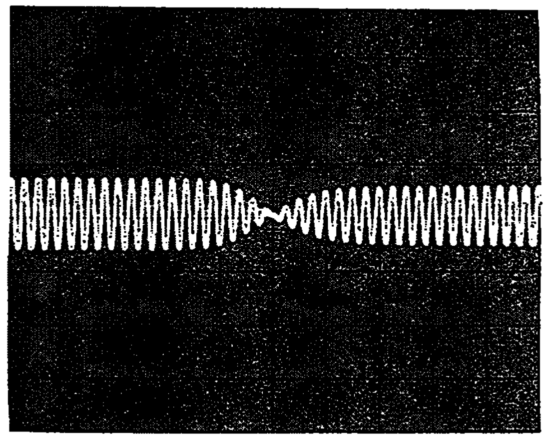


FIGURE 6-25 LOOP SIGNAL (TP 201)
(Dwg. No. 696-3236-00)

6.4.3.17 83 1/3Hz SQUARE WAVE TP209

a. Use oscilloscope to verify.

6.4.3.18 VCO BUFFER OUTPUT TP204

a. Monitor TP204 with oscilloscope and frequency counter.

b. The output frequency must be 140KHz ±0. 02% above the dial frequency.

c. The output level must be approximately 1. 5 V p-p and steady.

6.4.3.19 TUNING VOLTAGE TP202

a. Monitor TP202 with a DVM

b. Verify that the tuning voltage is accurate at 200, 399, 400, 799, 800 and 1750KHz.

6.4.3.20 AGC Voltage TP207

a. Monitor TP202 with a DVM

b. Verify that with no input signal, the AGC voltage is below 1. 0VDC. (0. 4VDC typical).

c. Connect a variable D-C power supply to TP205 through a 1KΩ resistor and compare the input to output voltage relationships with the typical data of Figure 6-26.

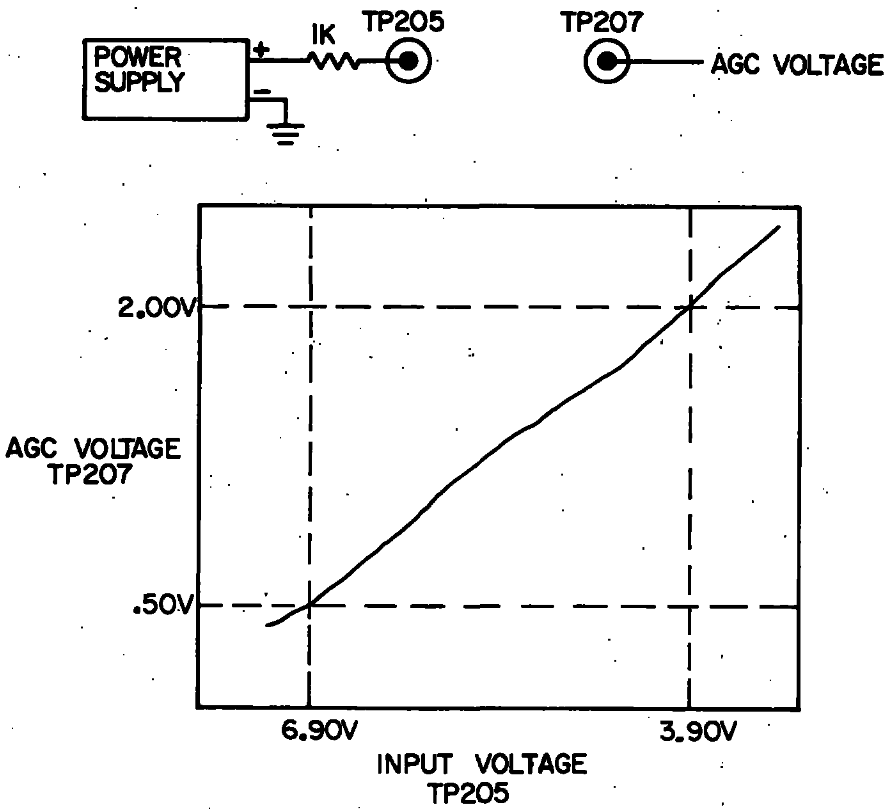



FIGURE 6-26 AGC VOLTAGE
(Dwg. No. 696-3237-00)

6.4.3.21 IF AMPLIFIER AND DETECTOR

a. Monitor TP205 with a scope and TP207 with a DVM.

b. Inject a 140KHz signal mod. 1000Hz, 30% thru a .001μf capacitor (Fig. 6-27) to various points in IF Ampl. as indicated by Table 6-3.

c. Verify that the approximate signal input level is required for AGC threshold.

—NOTE—

AGC threshold is reached when the signal input level is increased just enough to cause the AGC voltage to begin to increase.

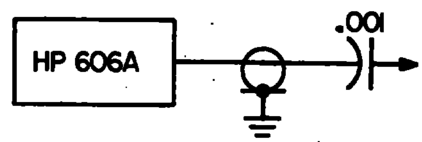



FIGURE 6-27 IF SIGNAL INPUT
(Dwg. No. 696-3238-00)

6.4.3.22 MIXER

a. Verify correct LO injection at TP204.

b. Monitor TP205 with a scope and TP207 with a DVM.

c. Set frequency dial and signal generator 200KHz.

d. Inject required signal, modulated 1000Hz, 30%, thru a .001$\mu$f capacitor to gate of Q204.

e. Verify that the approximate signal input level is required for AGC threshold. Table 6-3.

6.4.3.23 RF AMPLIFIER

a. Monitor TP205 with a scope and TP207 with a DVM.

b. Set frequency dial and signal generator per Table 6-3.

c. Apply required signal, modulated 1000Hz; 30%, to sense antenna input.

d. Verify that the approximate signal input level is required for AGC threshold per Table 6-3.

6.4.3.24 VCO CONTROLLED BY EXTERNAL TUNING VOLTAGE

a. Monitor TP204 with oscilloscope and counter.

b. Open the loop by grounding TP308.

c. Apply an external D. C. tuning voltage to TP202.

d. Verify that with the low value tuning voltage applied, the VCO can be adjusted for the correct frequency at the low end of each band.

e. Verify that with the high value tuning voltage applied, the VCO can be adjusted for the correct frequency at the high end of each band.

**—NOTE—**

The correct tuning voltages are listed on the tuning voltage decal.

6.4.3.25 SYNTHESIZER DRIVE TP301

a. Monitor TP301 with oscilloscope.

b. Verify presence of a 0.750 V p-p square wave.

6.4.3.26 SQUARING AMPLIFIER OUTPUT TP302

a. Monitor TP302 with oscilloscope.

b. Verify presense of a 4.5V p-p square wave.

6.4.3.27 5.1V CR301 CATHODE

a. Verify presence of 5.1 ±0.25VDC at cathode of CR301.

6.4.3.28 PARALLEL ENABLE PULSES TP307

a. Use oscilloscope to verify.

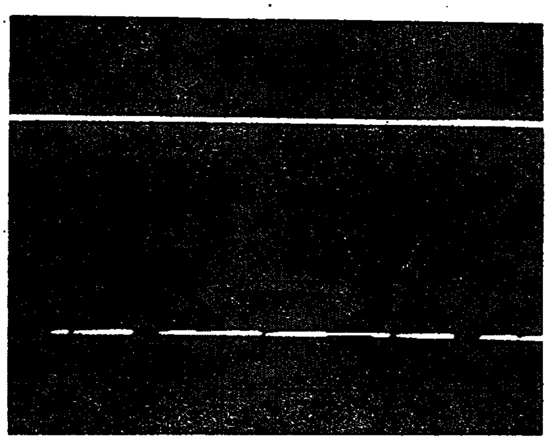
6.4.3.29 PHASE AND FREQUENCY COMPARATOR

a. Monitor pin 13, I307 with one scope channel.
Monitor pin 2, I307 with other scope channel.

b. Apply an external tuning voltage to TP202 to control the VCO frequency. Verify proper operation per Figure 6-28.

| | | |
|---|---|---|
| TP | Pin 2, I307 | Pin 13, I307 |
| VERT | 2.0V/Div | 2.0V/Div |
| HORIZ | .5mSec/Div | |
| COUPLING | DC | |
| SYNC | INT. | |
| VARIABLE | | |
| INPUT FREQ. | Ref | |

Pin 13



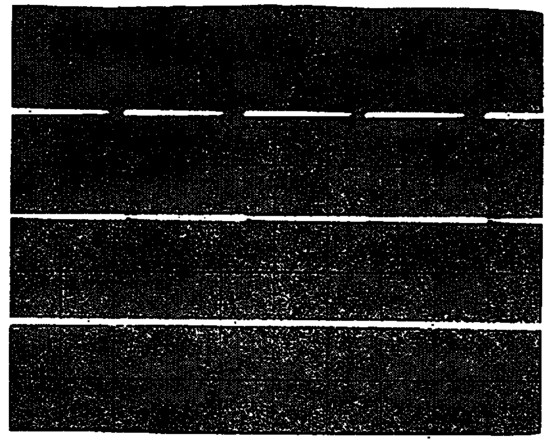
Pin 2

6-28A VARI INPUT FREQUENCY HIGH
(Dwg. No. 696-3239-00)

| | | |
|---|---|---|
| TP | Pin 2, I307 | Pin 13, I307 |
| VERT | 2. 0V/Div | 2. 0/Div |
| HORIZ | . 5mSec/Div | |
| COUPLING | DC | |
| SYNC | INT. | |
| VARI INPUT FREQ. | Ref Freq. | |

Pin 13

Pin 2



6-28B VARIABLE INPUT FREQUENCY LOW
(Dwg. No. 696-3240-00)

6.4.3.30 SAMPLE AND HOLD CIRCUIT

a. Monitor TP308 with DVM.

b. Apply an external tuning voltage to TP202.

c. Apply the high value tuning voltage (Approx. 5. 5VDC). The TP308 voltage must go low.

d. Apply the low value tuning voltage (Approx. 1. 0VDC). The TP308 voltage must go high.

6.4.3.31 EMITTER FOLLOWER TP309

a. Monitor TP309 with a DVM.

b. Apply a variable DC voltage to TP308.

c. Verify that the TP309 voltage is approximately 0. 6V lower than the TP308 voltage at any setting of the variable power supply between 1. 0VDC and 6. 0VDC.

6.4.3.32 DIVIDE BY TEN FUNCTION OF I301, I302, I303

—NOTE—

This step requires that the Parallel Enable (PE) line be disabled and grounded. This is accomplished by removing the #26 Buss wire jumper near TP307.
Do Not Ground TP307.

a. Monitor and sync one scope channel from Pin #11, I303. Monitor TP302 with other scope channel.

1. Verify a divide ratio of ten.

b. Monitor and sync one scope channel from Pin #11 I302. Monitor TP303 with other scope channel.

1. Verify a divide ratio of ten.

c. Monitor and sync one scope channel from Pin #11 I301. Monitor Pin #11 I302 with other scope channel.

1. Verify a divide ratio of ten.

6.4.3.33 PRESET FUNCTION OF I301, I302, I303

—NOTE—

This step requires that the parallel enable ($\overline{PE}$) line be disabled and grounded. This is accomplished by removing the #26 Buss wire jumper near TP307 and grounding Pin #9, I303. Do Not Ground TP307.

a. Use a DC coupled scope to verify that the selected binary code that is present on the parallel input terminals is transferred to the corresponding output terminals.

6.4.3.34 I304 and I306

a. I304 and I306 gates can be checked by using one scope channel to monitor and sync to any active gate input and use the other scope channel to compare the output $V_S$ input per common NAND-NOR gate logic.

6.4.3.35 I305 (TP306)

—NOTE—

This step requires that the Parallel Enable ($\overline{PE}$) line be disabled. This is accomplished by removing the #26 Buss wire jumper from E332 and E333.

a. Dial any low band frequency. Monitor TP306 with a DC coupled scope.

b. Momentarily ground Pin #9, I303. TP306 must stay in the high state.

c. Dial 861KHz. Momentarily ground Pin #9, I303. TP306 must switch to the low state while Pin #9 is grounded.

6.4.3.36 BFO

a. The BFO audio output should be clear and undistorted at approximately the same level as 1000Hz, 30% modulation.

6.4.4 KR 86 STAGE GAIN AND PERCENT OF MODULATION

Tables 6-2 thru 6-4 contain stage gain information which should expedite determining satisfactory operation of each gain stage.

6.4.4.1 MEASURING THE PERCENTAGE OF LOOP MODULATION

a. Monitor TP205 with oscilloscope.

b. Function switch in ADF mode.

c. Frequency selector and signal generator per Table 6-4.

d. Signal level 5K $\mu$v/m unmodulated.

e. Rotate the signal simulator bearing for maximum error.

f. Consult Table 6-4 for typical percentage of loop modulation.

g. Refer to Figure 6-29 for procedure to determine percent of loop modulation.

REF

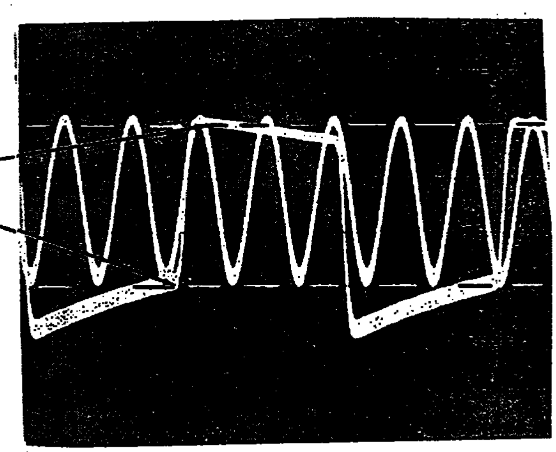


FIGURE 6-29 LOOP MODULATION
(Dwg. No. 696-3241-00)

Establish loop modulation reference level per Figure 6-29, then change to ANT mode and apply 400Hz modulation. Adjust percent of modulation control for same reference then read % of modulation direct from meter.

| FREQ. | INJECTION POINT | INJECTION LEVEL | MEASUREMENT POINT | MEASUREMENT CONDITION | REMARKS |
|---|---|---|---|---|---|
| 200KHz | Antenna | 2v/m/5 | col. Q201 | 50mVRMS | ADF mode max. bearing error |
| 399KHz | Antenna | .76v/m/5 | col. Q201 | 50mVRMS | ADF mode max. bearing error |
| 400KHz | Antenna | 1.25v/m/5 | col. Q201 | 50mVRMS | ADF mode max. bearing error |
| 799KHz | Antenna | .65v/m/5 | col. Q201 | 50mVRMS | ADF mode max. bearing error |
| 800KHz | Antenna | .76v/m/5 | col. Q201 | 50mVRMS | ADF mode max. bearing error |
| 1750KHz | Antenna | .55v/m/5 | col. Q201 | 50mVRMS | ADF mode max. bearing error |

TABLE 6-2 LOOP AMPLIFIER GAIN
(Dwg. No. 696-3242-00)

| FREQ. | INJECTION POINT | INJECTION LEVEL | MEASUREMENT POINT | MEASUREMENT CONDITION | REMARKS |
|---|---|---|---|---|---|
| 140KHz | Base Q207 | .056v/m | TP205 & TP207 | AGC Threshold | Isolate injection probe with .001μf |
| 140KHz | Pin 8, I202 | .057v/m | TP205 & TP207 | AGC Threshold | Isolate injection probe with .001μf |
| 140KHz | Pin 10, I202 | 775μv/m | TP205 & TP207 | AGC Threshold | Isolate injection probe with .001μf |
| 140KHz | Pin 12, I202 | 950μv/m | TP205 & TP207 | AGC Threshold | Isolate injection probe with .001μf |
| 140KHz | Pin 1, I202 | 140μv/m | TP205 & TP207 | AGC Threshold | Isolate injection probe with .001μf |
| 140KHz | Gate Q204 | 260μv/m | TP205 & TP207 | AGC Threshold | Isolate injection probe with .001μf |
| 200KHz | Gate Q204 | 23μv/m | TP205 & TP207 | AGC Threshold | Isolate injection probe with .001μf |
| 200KHz | Antenna | 100μv/m/5 | TP205 & TP207 | AGC Threshold | |
| 399KHz | Antenna | 21μv/m/5 | TP205 & TP207 | AGC Threshold | |
| 400KHz | Antenna | 130μv/m/5 | TP205 & TP207 | AGC Threshold | |
| 799KHz | Antenna | 25μv/m/5 | TP205 & TP207 | AGC Threshold | |
| 800KHz | Antenna | 170μv/m/5 | TP205 & TP207 | AGC Threshold | |
| 1750KHz | Antenna | 26μv/m/5 | TP205 & TP207 | AGC Threshold | |

TABLE 6-3 RECEIVER GAINS (ANT. MODE)
(Dwg. No. 696-3243-00)

| FREQ. | INJECTION POINT | INJECTION LEVEL | MEASUREMENT POINT | TYPICAL PERCENT OF LOOP MOD. | REMARKS |
|---|---|---|---|---|---|
| 200KHz | Antenna | 25Kμv/m/5 | TP205 | 28% | ADF Mode max. bearing error |
| 399KHz | Antenna | 25Kμv/m/5 | TP205 | 17% | ADF Mode max. bearing error |
| 400KHz | Antenna | 25Kμv/m/5 | TP205 | 22% | ADF Mode max. bearing error |
| 799KHz | Antenna | 25Kμv/m/5 | TP205 | 12% | ADF Mode max. bearing error |
| 800KHz | Antenna | 25Kμv/m/5 | TP205 | 32% | ADF Mode max. bearing error |
| 1750KHz | Antenna | 25Kμv/m/5 | TP205 | 10% | ADF Mode max. bearing error |

TABLE 6-4 PERCENT OF LOOP MODULATION
(Dwg. No. 696-3244-00)

### 6.4.5 KR 86 WAVEFORMS

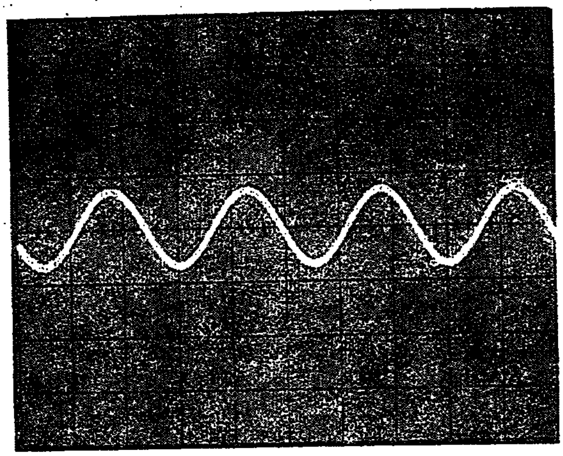
Figures 6-21 thru 6-29 contain voltage waveforms for strategic points within the KR 86. All waveforms are photgraphed under the conditions indicated beside the waveform. All photographs were made using a Hewlett-Packard 198 A Oscilloscope Camera and a 180 A Oscilloscope.

### 6.4.6 SCHEMATICS AND VOLTAGES

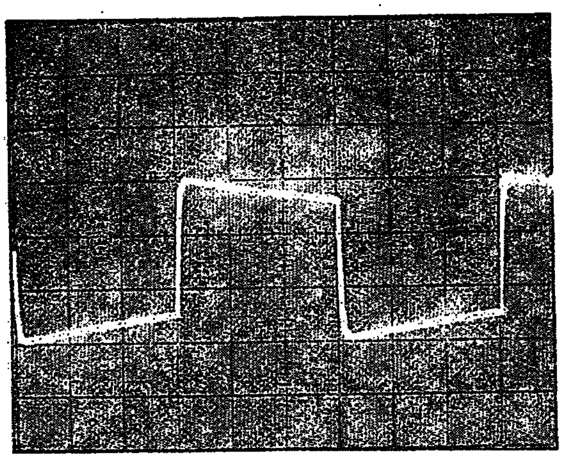
The DC voltages which are shown on the schematics are also an aid to troubleshooting. These voltages were recorded,using the unit operating conditions indicated by the schematics,with a Digitec Model 211 Digital Voltmeter on a scale which was best suited to make the measurement.

The voltages shown are constant under the conditions indicated. They are nominal voltages and can vary slightly from unit to unit and with power supply regulator variations. It should be noted that for some of the points in the circuit AC waveforms exist on top of the DC voltage. These waveforms will significantly modify the DC voltage measured by the meter and should be taken into account when making judgement on the circuits involved.

| | |
|---|---|
| TP | Col. Q201 |
| VERT | 50mv/Div |
| HORIZ | 2μs/Div |
| COUPLING | AC |
| SYNC | INT. |
| FREQ | 200KHz |
| SIGNAL LEVEL | 1.0V/M/5 |
| MODE | ADF |
| ERROR | Max. |



| | |
|---|---|
| TP | 209 |
| VERT | 0.2V/Div |
| HORIZ | 2ms/Div |
| COUPLING | DC |
| SYNC | INT. |



| | |
|---|---|
| TP | 205 |
| VERT | .5V/Div |
| HORIZ | .5mSec/Div |
| COUPLING | AC |
| SYNC | INT. |
| FREQ | 200KHz |
| SIGNAL LEVEL | .01V/m |
| MODE | ANT |
| MODULATION | 1000Hz, 30% |

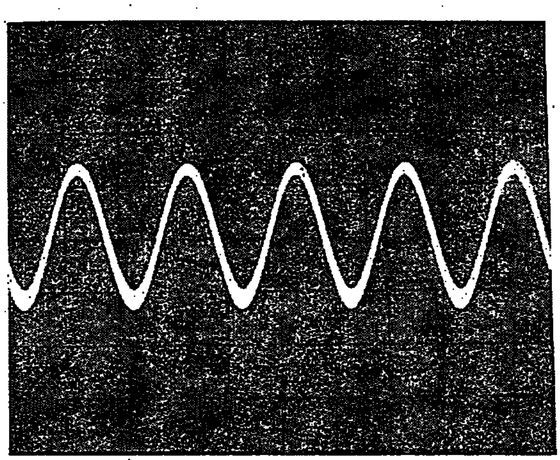
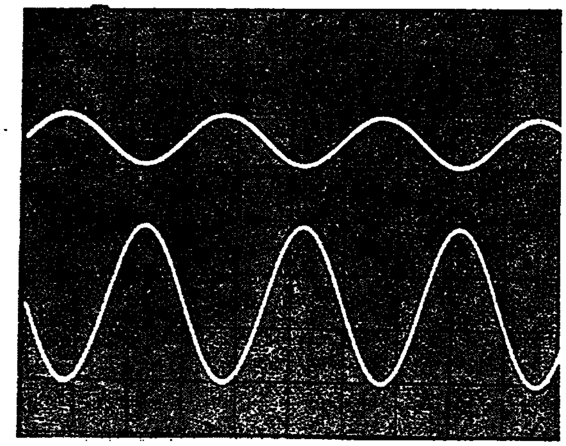


FIGURE 6-30 KR 86 TEST POINT WAVEFORMS
(Dwg. No. 696-3245-00)

| | | |
|---|---|---|
| TP | 204 | Base Q205 |
| VERT | 0. 5V/Div | 0. 5V/Div |
| HORIZ | 1μs/Div | |
| COUPLING | AC | AC |
| SYNC | INT. | |
| FREQ | 200KHz | |

B Q205

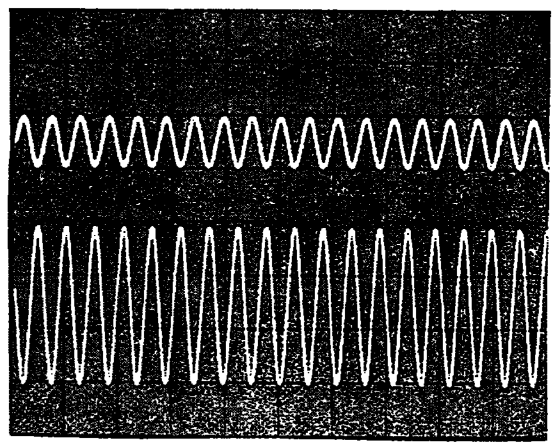
TP204



| | | |
|---|---|---|
| TP | 204 | Base Q205 |
| VERT | 0. 5V/Div | 0. 5V/Div |
| HORIZ | 1μs | |
| COUPLING | AC | AC |
| SYNC | INT. | |
| FREQ | 1750KHz | |

B Q205

TP204



| | | |
|---|---|---|
| TP | 301 | 302 |
| VERT | 0. 5V/Div | 2V/Div |
| HORIZ | 1μs/Div | |
| COUPLING | AC | AC |
| SYNC | INT | |
| FREQ | 200KHz | |

301

302

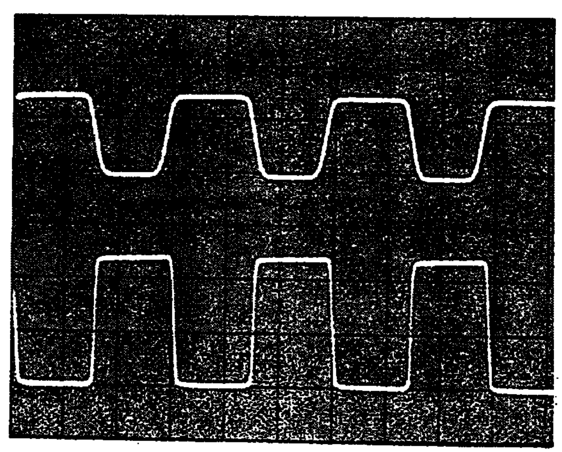
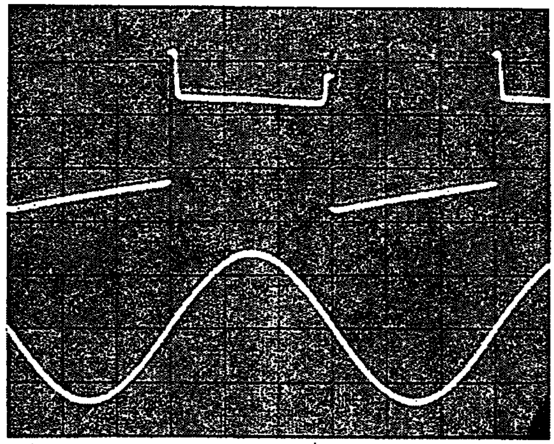


FIGURE 6-30 KR 86 TEST POINT WAVEFORMS (cont'd)

| | | |
|---|---|---|
| TP | 315 | 316 |
| VERT | 0. 2V/Div | 2. 0V/Div |
| HORIZ | 2ms/Div | |
| COUPLING | AC | |
| SYNC | TP315 | |
| FREQ | 200KHz | |
| SIGNAL LEVEL | 5Kμv | |
| ERROR | Max. Undistorted | |

315

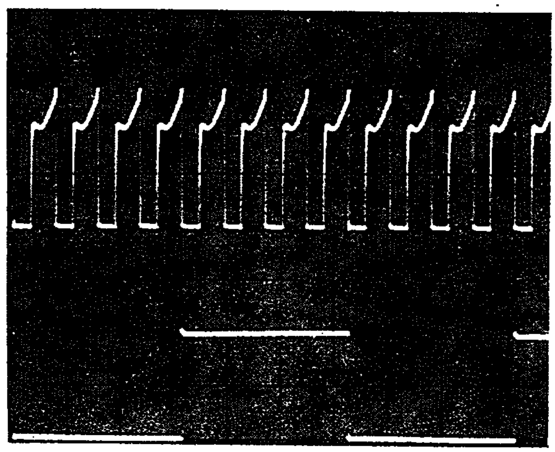
316



| | | |
|---|---|---|
| TP | 310 | 311 |
| VERT | 2V/Div | 2V/Div |
| HORIZ | 10μs/Div | |
| COUPLING | DC | |
| SYNC | TP311 | |

310

311



| | | |
|---|---|---|
| TP | 313 | 314 |
| VERT | 2V/Div | 2V/Div |
| HORIZ | 2ms/Div | |
| COUPLING | DC | |
| SYNC | TP314 | |

313

314

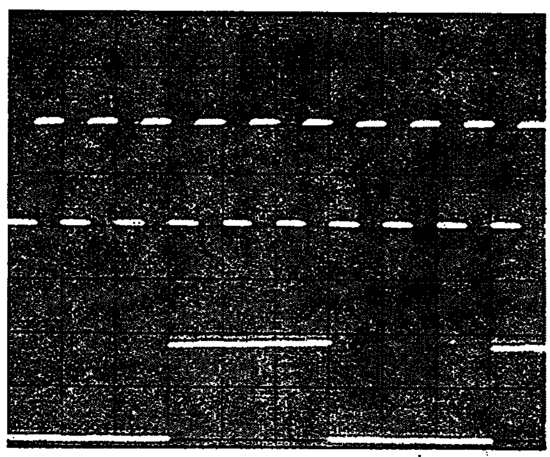
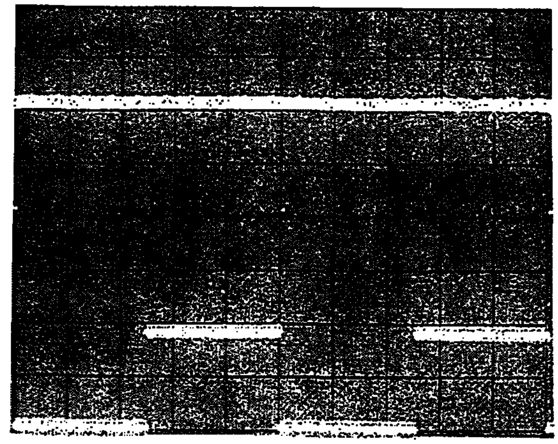
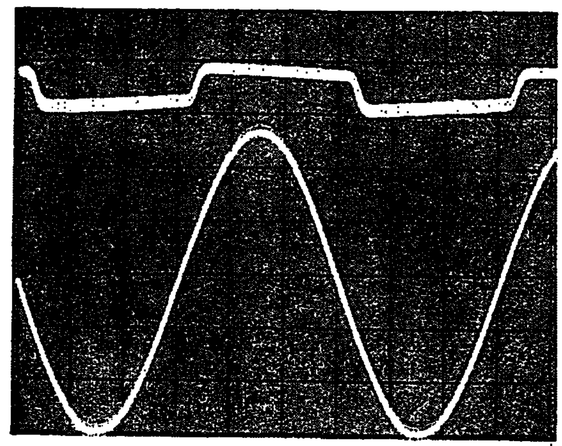


FIGURE 6-30 KR 86 TEST POINT WAVEFORMS (cont'd)

| | | |
|---|---|---|
| TP | 312 | 307 |
| VERT | 2V/Div | 2V/Div |
| HORIZ | 0. 1ms/Div | |
| COUPLING | DC | |
| SYNC | TP312 | |




| | | |
|---|---|---|
| TP | 316 | E305 |
| VERT | 1V/Div | 1V/Div |
| HORIZ | 2ms/Div | |
| COUPLING | AC | |
| SYNC | TP315 | |
| FREQ | 200KHz | |
| SIGNAL LEVEL | 5Kμv/m | |
| MODE | ADF | |
| ERROR | Max. Undistorted | |




| | | |
|---|---|---|
| TP | TP317 | TP318 |
| VERT | 2V/Div | 2V/Div |
| HORIZ | 2mSec/Div | |
| COUPLING | DC | |
| SYNC | TP315 | |
| FREQ | 200KHz | |
| SIGNAL LEVEL | 5Kμv/m | |
| MODE | ADF | |
| ERROR | 5° | |

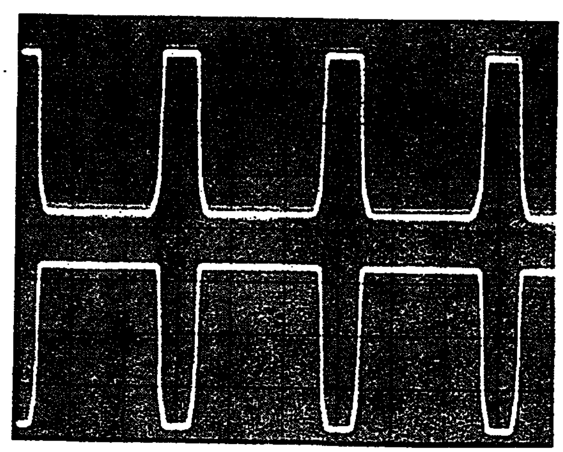
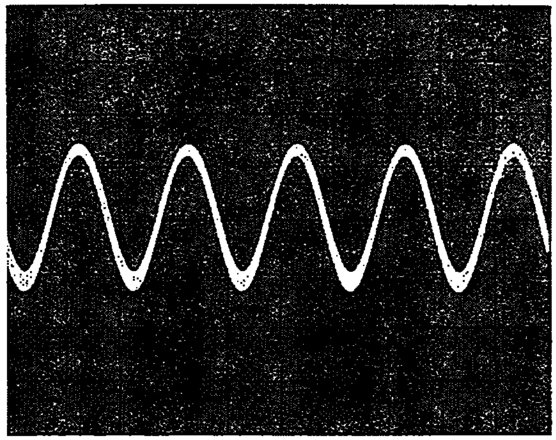



FIGURE 6-30 KR 86 TEST POINT WAVEFORMS (cont'd)

| | |
|---|---|
| TP | 205 |
| VERT | .5V/Div |
| HORIZ | .5mSec/Div |
| COUPLING | AC |
| SYNC | INT. |
| FREQ | 200KHz |
| SIGNAL LEVEL | .01V/m |
| MODE | BFO |
| MODULATION | None |



| | |
|---|---|
| TP | 205 |
| VERT | .5V/Div |
| HORIZ | 2.0ms/Div |
| COUPLING | AC |
| SYNC | TP209 |
| FREQ | 200KHz |
| SIGNAL LEVEL | .01V/m |
| MODE | ADF |
| ERROR | Max. |

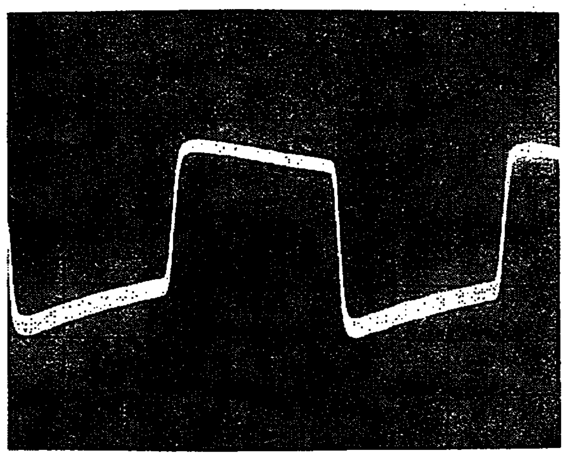
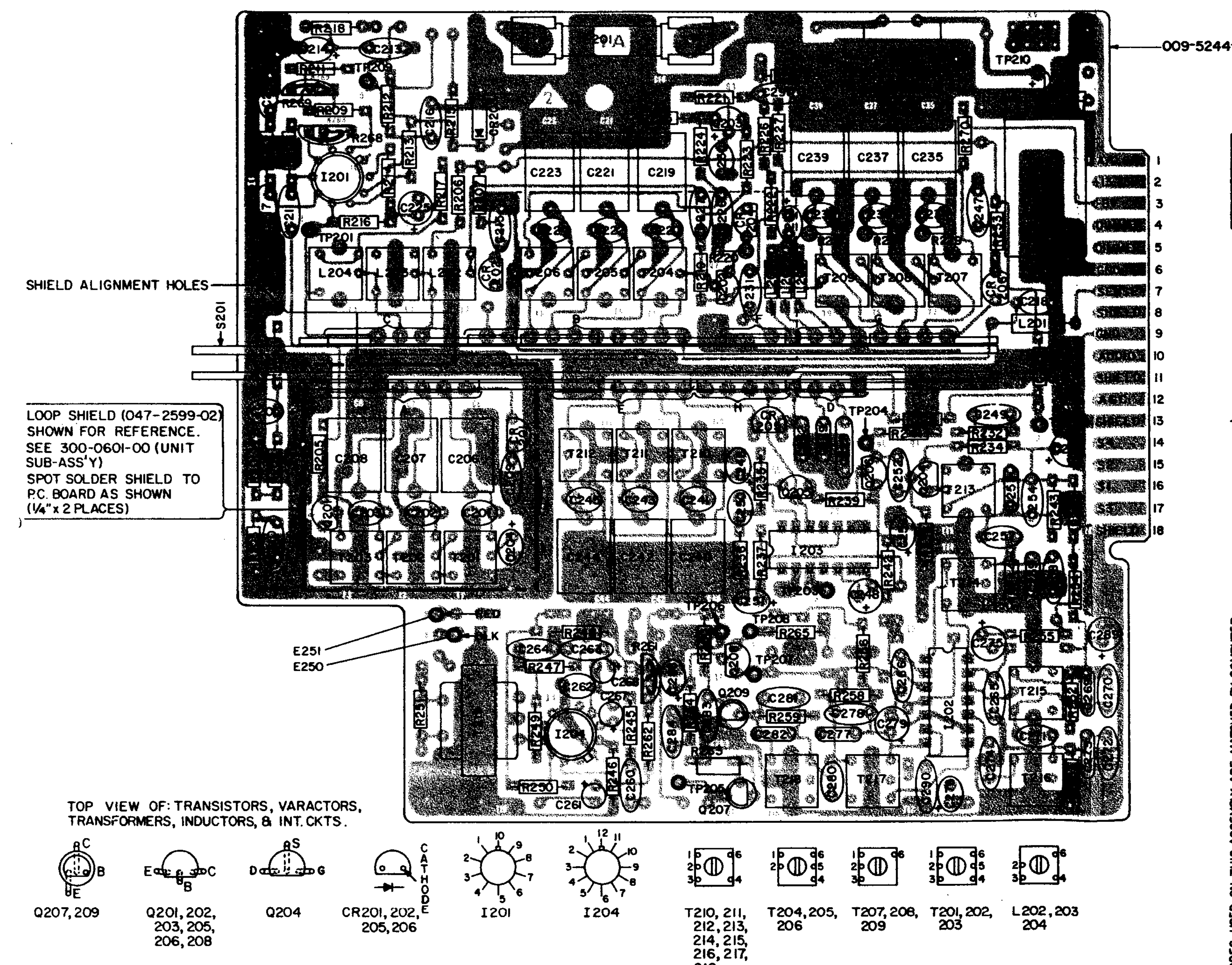


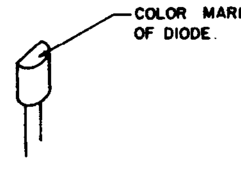
FIGURE 6-30 KR 86 TEST POINT WAVEFORMS (cont'd)

**KING**
KR 86
AUTOMATIC DIRECTION FINDER




| DIODE INSTALLATION | | |
|---|---|---|
| POSITION | COLOR | COMPUTER SY. |
| CR 201 | BLUE | BLU |
| CR 202 | BLACK | (NONE) |
| CR 205 | RED | RED |
| CR 206 | YELLOW | YEL |

SEE NOTES 1, 2 & 3




DETAIL OF DIODE MARKING
SEE NOTE 2

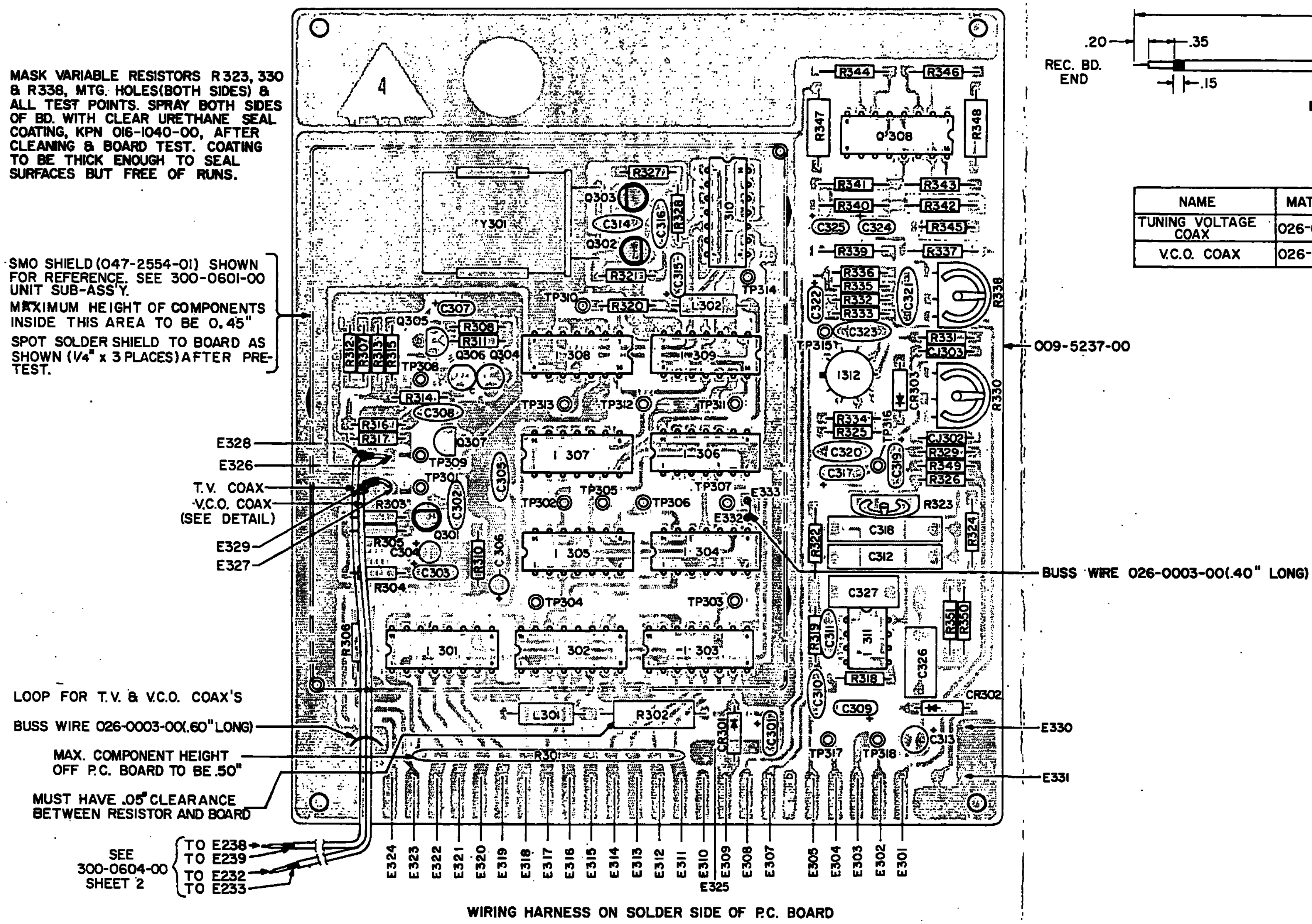
NOTES:

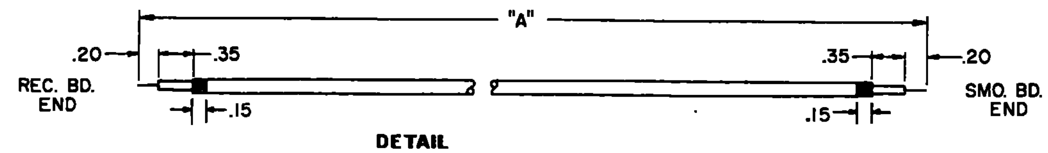
1. THE FOUR DIODES USED ON THIS ASSEMBLY ARE MATCHED BY COMPUTER. IF ONE DIODE IS LOST OR MIXED WITH DIODES FROM ANOTHER SET, THE DIODES AND THE DATA PROCESSING CARD ARE TO BE RETURNED TO RECEIVE INSPECTION VIA PRODUCTION CONTROL DEPARTMENT.
2. THE COLOR MARKING ON THE DIODE MUST BE PLACED IN THE CORRECT LOCATION ON THE P.C. BOARD.
3. THE "DATA PROCESSING CARD" WITH EACH SET OF DIODES CONTAINS INFORMATION FOR TEST AND ALIGNMENT. THE CARD FROM EACH SET MUST BE ATTACHED TO THE P.C. BOARD WITH THOSE DIODES INSTALLED ON IT TO BE REMOVED ONLY BY TEST DEPARTMENT. IF A CARD IS LOST, A NEW SET OF DIODES WILL HAVE TO BE INSTALLED.
4. WHEN SOLDERING THE SLIDE SWITCH TO P.C. BOARD USE A MIN. AMOUNT OF SOLDER. THIS WILL LIMIT THE AMOUNT OF SOLDER WICKING UP INTO THE SWITCH CONTACT.


NOTES:

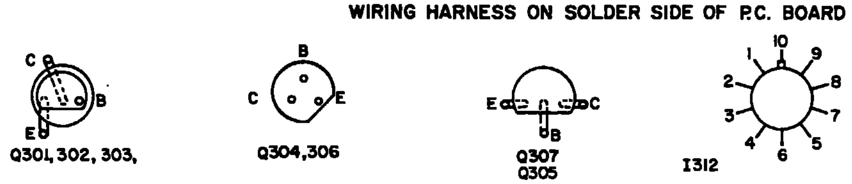
1. UNLESS NOTED, RESISTANCE VALUES ARE IN OHMS, 1/4W, 10%. CAPACITANCE VALUES ARE IN PICOFARADS (pf).
2. DIODE SYMBOLS:
   SILICON ZENER VARACTOR
3. VOLTAGE MEASUREMENT CONDITIONS:
   ABOVE LINE – 200KHZ, ADF MODE, NO SIGNAL INPUT, MINIMUM VOLUME.
   BELOW LINE – 200KHZ, ANT MODE, 0.01 V/M INPUT SIGNAL.

FIGURE 6-31 RECEIVER BOARD ASSEMBLY AND SCHEMATIC
(Dwg. No's. 300-0603-00, R-0; 002-0233-01, R-1)



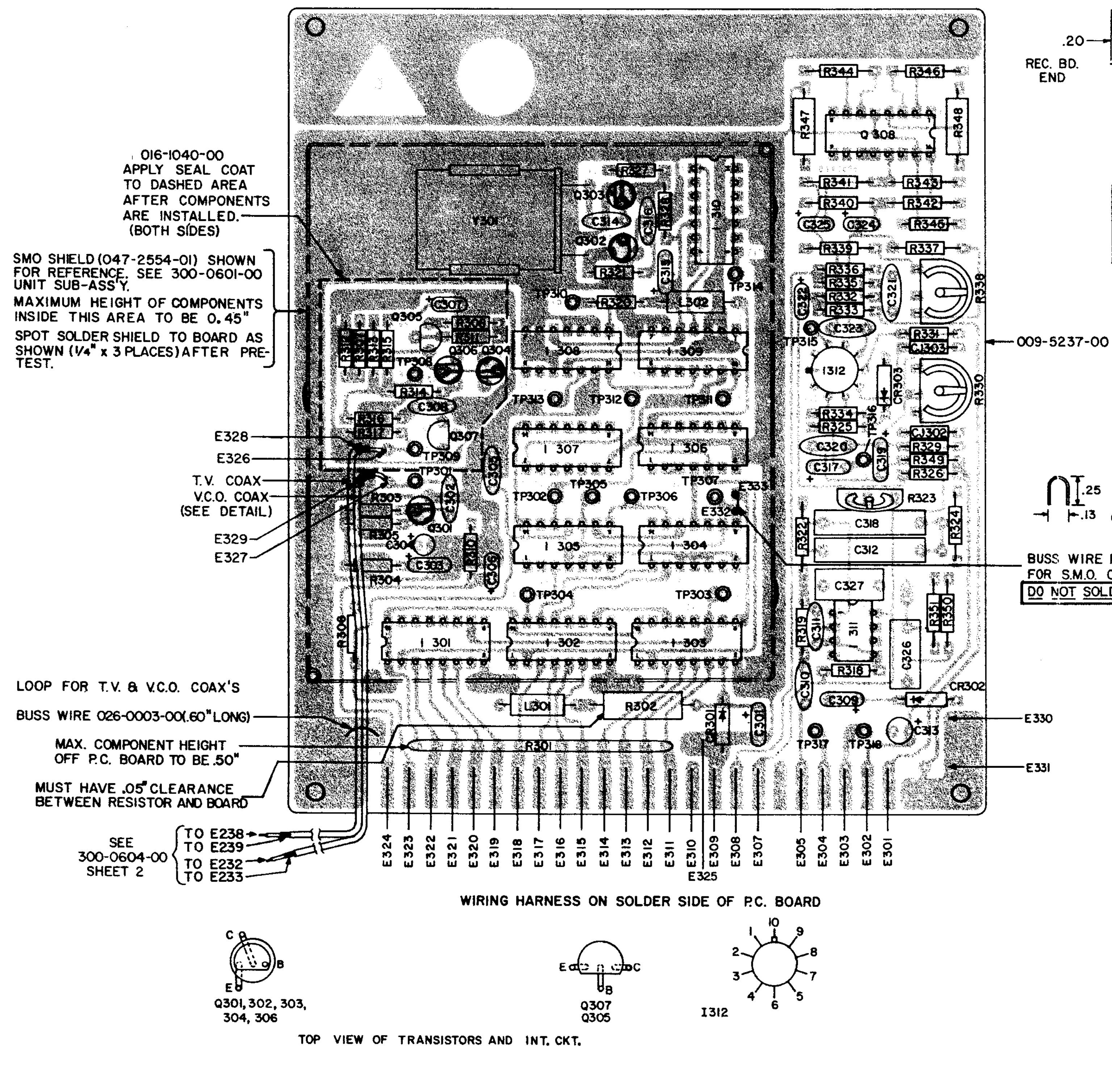




| NAME | MATERIAL | DIM. "A" |
|---|---|---|
| TUNING VOLTAGE COAX | 026-0013-00 | 7.9" |
| V.C.O. COAX | 026-0013-00 | 10.1" |




TOP VIEW OF TRANSISTORS AND INT. CKT.

FIGURE 6-32 SMO/SERVO BOARD ASSEMBLY (SOLDER SIDE)
(Dwg. No. 300-0604-00, R-0 )




| NAME | MATERIAL | DIM. "A" |
|---|---|---|
| TUNING VOLTAGE COAX | 026-0013-00 | 7.9" |
| V.C.O. COAX | 026-0013-00 | 10.1" |

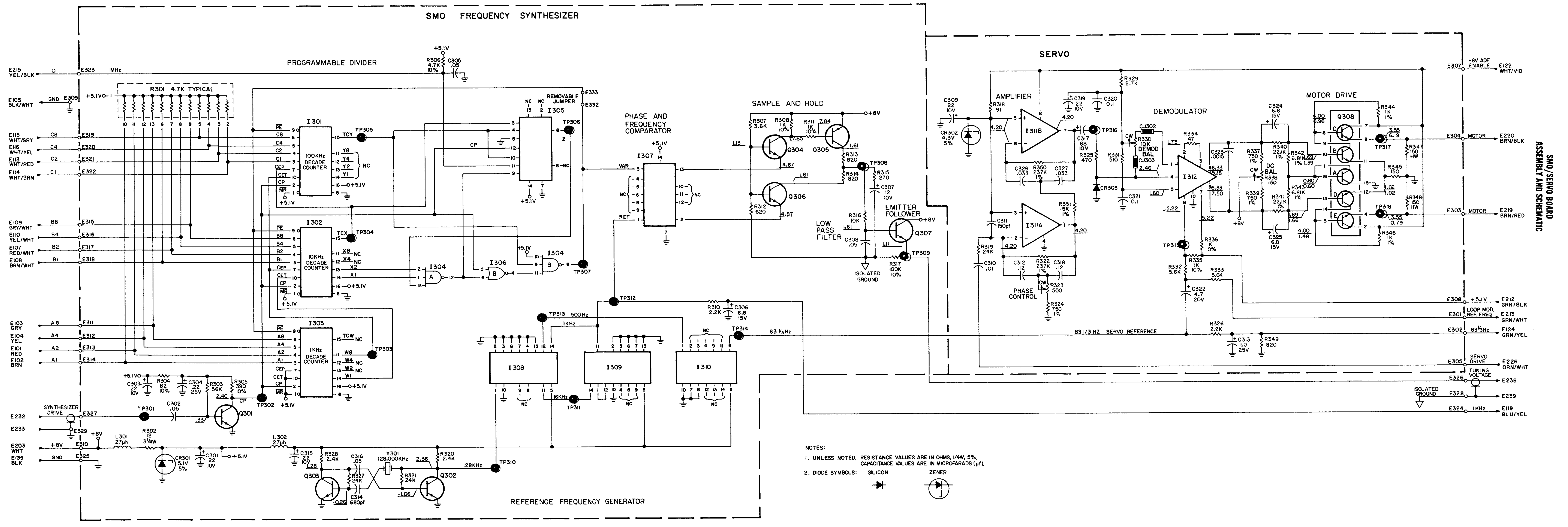
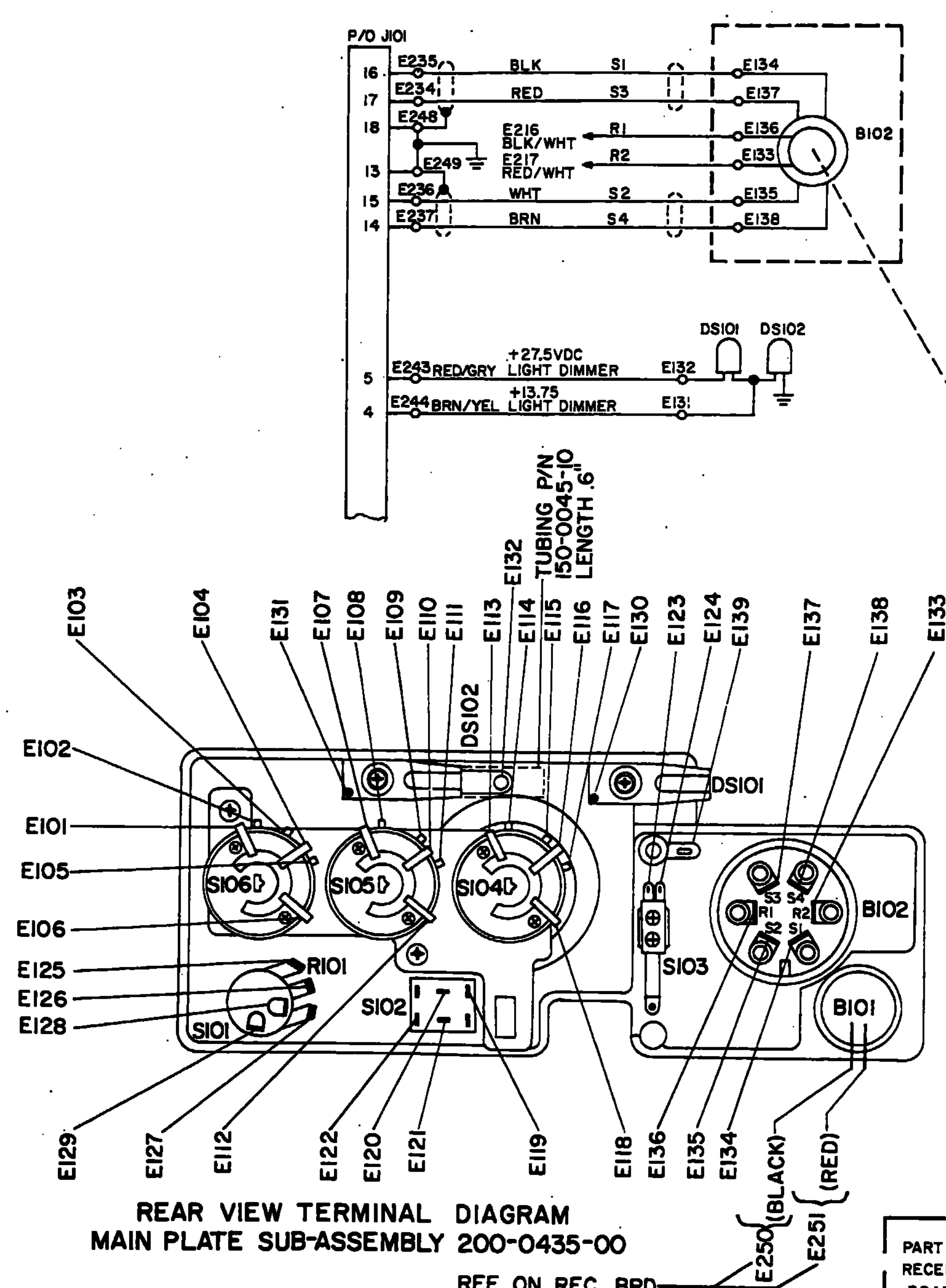
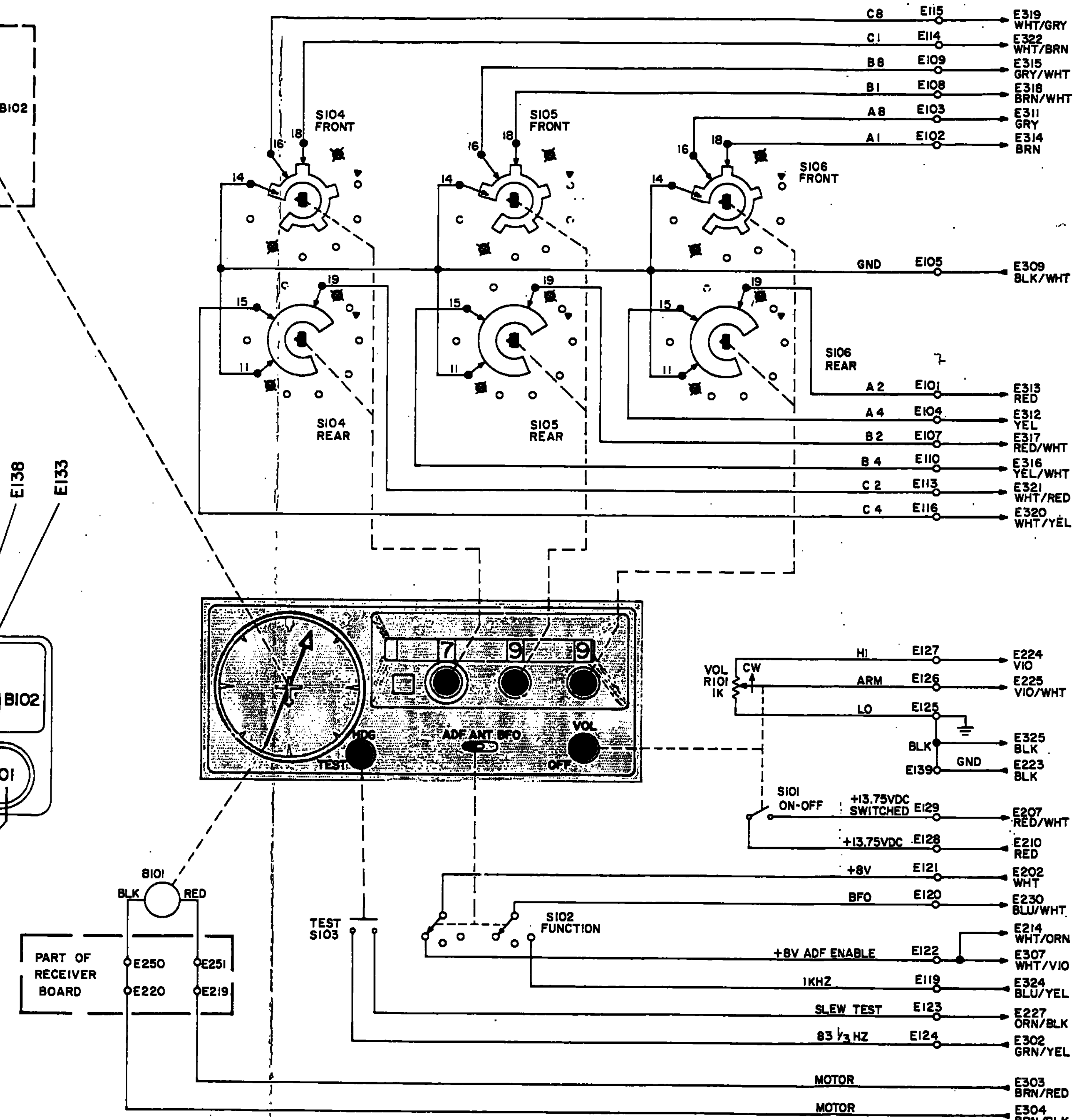


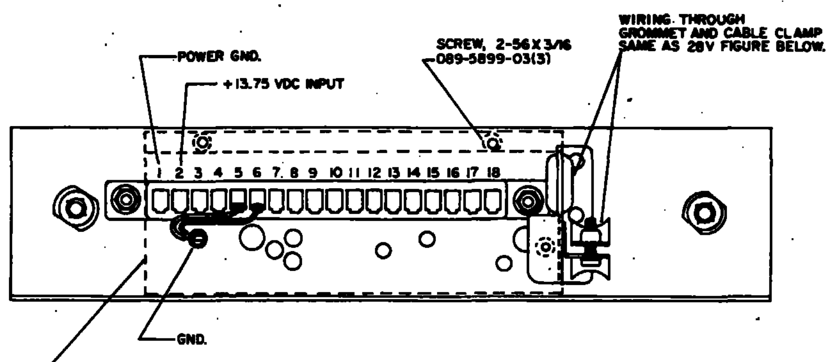

FIGURE 6-33 SMO/SERVO BOARD ASSEMBLY AND SCHEMATIC
(Dwg. No's. 300-0604-00, R-0 ; 002-0233-02, R-0)



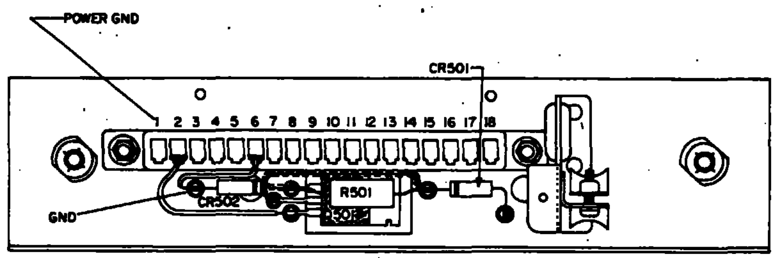




| WIRING CHART (SWITCH WAFERS) | | | | | |
|---|---|---|---|---|---|
| FROM | | TO | | WIRE LENGTH | SLEEVING LENGTH |
| S104 | E118 | S104 | E117 | .8 IN. | .5 IN. |
| S104 | E117 | S105 | E111 | 1.6 | 1.2 |
| S105 | E112 | S105 | E111 | .8 | .5 |
| S105 | E111 | S106 | E105 | 1.6 | 1.2 |
| S106 | E106 | S106 | E105 | .8 | .5 |

FIGURE 6-34 SWITCHING AND CONTROL HEAD ASSEMBLY AND SCHEMATIC
(Dwg. No's. P/O 300-0602-00, R-0 ; 002-0233-03, R-0)



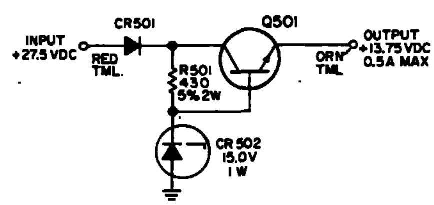

+13.75 VDC RACK CABLE ASSEMBLY




+27.5 VDC RACK CABLE ASSEMBLY

NOTES:

1. DO NOT ALTER LENGTH OF SENSE OR LOOP CABLES.
2. THE FOLLOWING TOOLS ARE REQUIRED FOR CONSTRUCTION AND MAINTENANCE OF WIRING AND CABLE HARNESS FOR CONN. P101.
   HAND CRIMPING TOOL - MOLEX HT-1921
   TERMINAL EXTRACTOR TOOL - MOLEX HT-1884




VOLTAGE CONVERTOR SCHEMATIC

FIGURE 6-35 27.5 to 13.75VDC VOLTAGE REGULATOR ASSEMBLY AND SCHEMATIC
(Dwg. No's. P/O 696-3201-00, R-0; 002-0277-00, R-0)