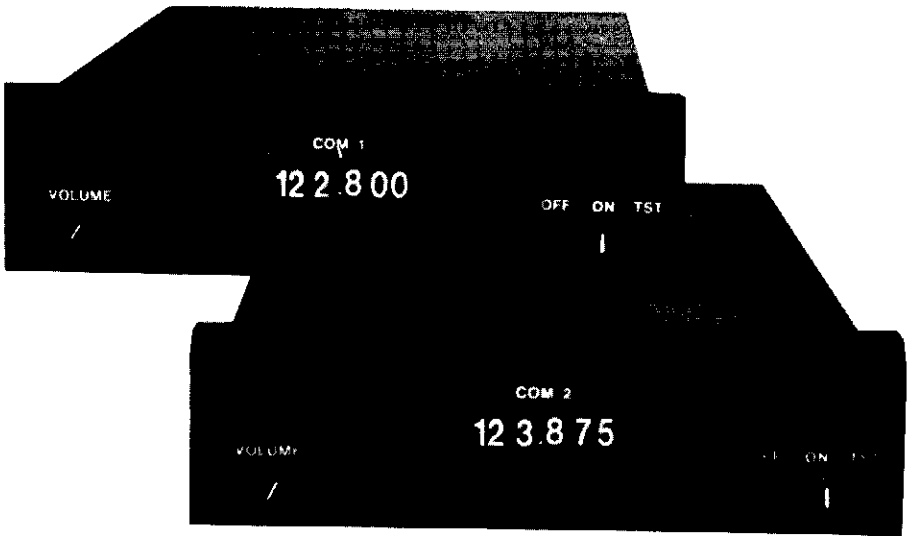
NARCO AVIONICS

COM 120 TSO
AND
COM 120/20 TSO
VHF TRANSCEIVERS



INSTALLATION MANUAL

03218-0621

NARCO AVIONICS
A DIVISION OF NARCO SCIENTIFIC
COMMERCE DRIVE, FORT WASHINGTON, PENNSYLVANIA 19034

Printed in U.S.A.

MARCH 1979
Reprint 2/80

1.1 GENERAL

In support of the Narco Avionics COM 120 TSO AND COM 120/20 TSO VHF communications transceiver, this manual provides detailed installation, operation, and maintenance procedures.

"This manual is intended for use by persons qualified to service equipment in this manual persuant to current regulatory requirements".

1.1.1 Manual Organization

Organized into six major sections the manual provides the following:

Section 1	Introduction	- general information required in planning the installation.
Section 2	Installation	- detailed procedures for performing the mechanical and electrical installation.
Section 3	Circuit Description	- technical description of all mechanical and electrical circuits.
Section 4	Maintenance	- provides test procedures and troubleshooting methods.
Section 5	Replacement Parts List	- provides exploded views of the Unit depicting the mechanical parts and certain electrical components. This Section also provides an alphanumerical listing of all the electrical components of the Unit.
Section 6	Schematics	- circuit schematics with voltages, test points, and component drawings.

Note: Installation Manuals consist of Sections 1 and 2, Maintenance Manuals contain Sections 1 through 6.

1.2 PRODUCT DESCRIPTION

The COM 120 TSO and COM 120/20 TSO are 720 channel transceivers which operate in the frequency range of 118.000 to 135.975 MHz. The COM 120 is completely interchangeable with a COM 111B as physical size and connector wiring are identical. The COM 120/20 nominal transmitter power output exceeds that of a COM 120 or COM 111B necessitating heavier gauge wire and circuit breaker requirements; otherwise, these units are interchangeable.

Designed for 14 Vdc operation, a COM 120 or COM 120/20 will require a separate voltage converter for use in aircraft with 28 Vdc power systems. A Narco MP 20 may be used with either COM unit; however, the Narco MP 10 may only be used with the COM 120.

1.3 DESIGN FEATURES

COM 120 and COM 120/20

- Meets or exceeds FAA TSO C-37b and C-38b.
- Meets or exceeds EUROCAE ED-23 and ED-24.
- 720 Channels 25 kHz spacing.
- 14/28 Vdc panel lamp changeover switch.
- Front panel transmit indicator light.
- Digital frequency synthesizer assures accurate channel lock on.
- Automatic squelch control.
- Interconnection between modules via plug in connectors.
- Front panel removable.
- Modular design for ease of servicing.
- Receive Audio Leveling.

COM 120 (Chassis ACGBF and later) and COM 120/20
All of the above plus-

- Consistent transmitter modulation assured by audio leveled microphone amplifier.
- Bass and Treble tone controls.

COM 120/20 Only
All of the above plus-

- 20 Watt transmitter power output (nominal)

1.4 PRODUCT SPECIFICATIONS

	COM 120	COM 120/20
Mechanical		
Exterior Dimensions and Mounting	Refer to Section 2.3	Refer to Section 2.3
Weight	3.5 lbs. (1.59 kgs)	4.0 lbs. (1.8 kgs)
Electrical		
Power Requirements		
Supply Voltage	13.75 Vdc*	13.75 Vdc*
Receive Current	0.8 Ampere	0.8 Ampere
Transmit Current (85% mod.)	3.5 Amperes	9 Amperes
Pilot Lamps	0.16 Ampere	0.16 Ampere
Frequency Range (MHz)	118.000 to 135.975	118.000 to 135.975
Channel Spacing	25 kHz	25 kHz
Number of Channels	720	720
Frequency Stability	0.003%	0.003%
Transmitter		
Power Output (minimum)	8 watts	16 watts
(nominal)	10 watts	20 watts
Modulation (minimum)	85% at 1 kHz	85% at 1 kHz
Duty Cycle (typical)	20%	20%
Microphone Input Voltage‡		
Voltage Range	0.1 to 3.0 Vrms	0.3 to 3.0 Vrms
Factory Set for 85% Mod.	0.2 Vrms (100 ohms)	----------
Audio Leveled For	----------	85% Modulation min.
Sidetone (85% Modulation)	12 mW across 300 ohms	12 mW across 300 ohms
Frequency Deviation (1 kHz, 50% Mod.)	±1 kHz maximum	±1 kHz maximum
Receiver		
Sensitivity (6 dB S+N/N)		
nominal	1.5 uV	1.5 uV
maximum	2.5 uV	2.5 uV
Spurious Image Rejection	70 dB or greater	70 dB or greater
Selectivity (Effective Bandwidth‡)		
nose, 6 dB	±8 kHz minimum	±8 kHz minimum
mid, 40 dB	±17 kHz maximum	±17 kHz maximum
skirt, 60 dB	±25 kHz maximum	±25 kHz maximum
Audio		
AVC Flatness (10 uv to 10,000 uv)	1 dB maximum	1 dB maximum
Audio Leveling (30% to 100% Mod.)	3 dB maximum	3 dB maximum
Speaker Power Output (4 ohm)	10 Watts minimum	10 Watts minimum
Audio Freq. Response (Ref. 1000 uv rf modulated 30% by 1 kHz)		
-6 dB	350 and 2500 Hz	350 and 2500 Hz
-18 dB	5000 Hz and above	5000 Hz and above
Headphone Power Output (300 ohms)		
Standard	50 mW minimum	50 mW minimum
Helicopter	150 mW minimum	150 mW minimum
Approvals		
FAA TSO-C37b and C38b	Yes	Yes
Environmental Categories	A2C1/A/PKS/XXXXXXZBBBA	A2C1/A/PKS/XXXXXXZBBBA
Eurocae ED-23 and ED-24	Yes	Yes

*For Operation from a 28 Vdc source, a voltage converter is required. Refer to Section 1.7. TP00170A

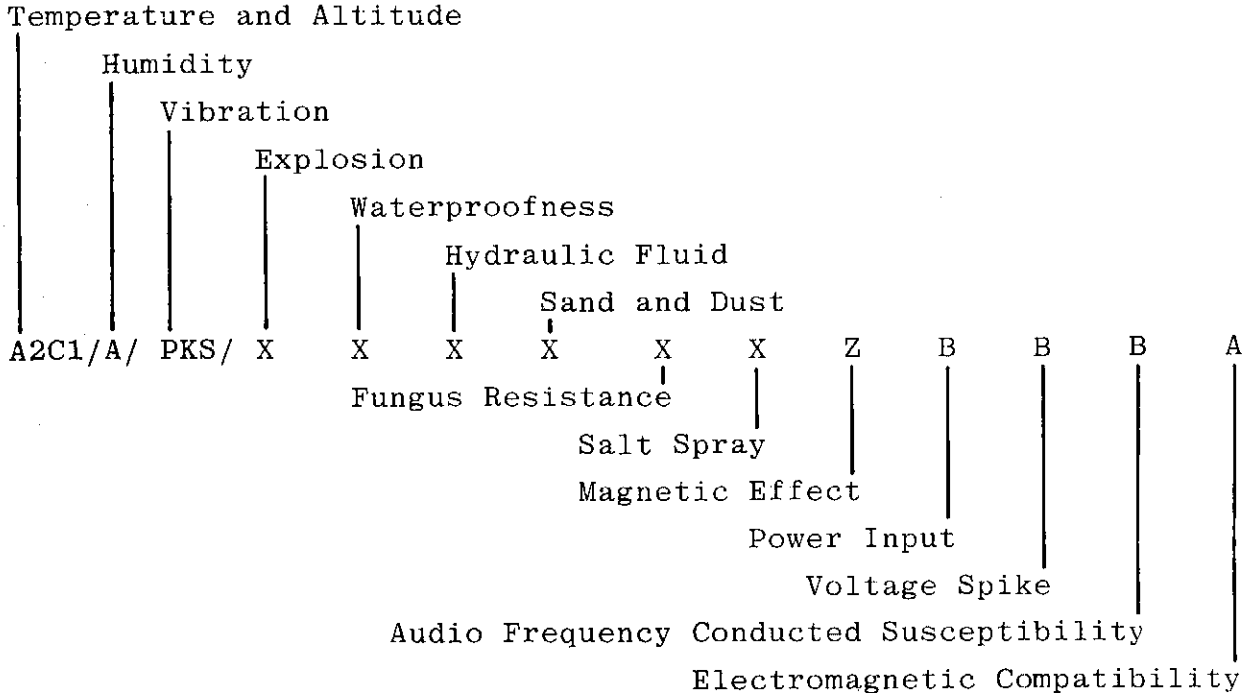
‡COM 120 Chassis AAAAA through ABGBE, use COM 120 microphone specifications
COM 120 Chassis ACGBF and later, use COM 120/20 microphone specifications.

‡Nominal LO stability over temperature range is 0.0015%.

1.5 TSO EXPLANATION

The COM 120* and COM 120/20 are designed to be instrument panel mounted within the cabin environment of fixed and rotary wing aircraft using piston or turbine engines, in single and multiengine configurations. They are designed for non-pressurized aircraft operating up to 35,000 feet as well as for pressurized aircraft. This equipment requires direct current power, but may be installed in aircraft having additional on-board alternating current sources.

There are fourteen Environment Test Procedures established in RTCA Document DO 160. These are identified on the TSO Nameplate(s). Following are the Environment Categories to which the Units are designed and an explanation of each category.



COM 120 TSO - C37b, Class IV
C38b, Class C

COM 120/20 TSO C37b, Class III
C38b, Class C

*Early COM 120s were TSO'd to RTCA Document DO 138. The requirements of the more stringent DO 160 were met without design changes. Refer to Field Service Bulletin COM 120-2 for details.

1.5 Continued

Temperature And Altitude - Category A2C1

Temperature, Operating:		
Low Operating Temperature	-20°C	(-4°F)
High Operating Temperature	+70°C	(+158°F)
Short Time Operating Temperature, High	+70°C	(+158°F)
Temperature, Non-Operating:		
Ground Survival Temperature, Low	-55°C	(-67°F)
Ground Survival Temperature, High	+85°C	(+185°F)
Altitude, Non-Pressurized:		
Maximum Operating Altitude	+11,000m	(+35,000 ft.)
Altitude, Pressurized:		
Not affected by decompression to	+12,000m	(+40,000 ft.)
Not affected by overpressurization to	-5,000m	(-15,000 ft.)

Humidity - Category A

These units have been tested under the Standard Humidity Environment of +50°C (+122°F) at 95% relative humidity, reduced to +38°C (+100°F) with relative humidity maintained in excess of 85%.

This cycle was repeated twice for a total of 48 hours of exposure. Within 15 minutes after exposure, the units were operated and met all specifications.

*TSO requires that all specifications be met within 4 hours after exposure.

Vibration - Categories PKS

Maximum vibration limits are:
- 0.08" double amplitude from 5 Hz to 22 Hz.
- 2.0G constant acceleration from 22 Hz to 200 Hz.
- 1.5G constant acceleration from 200 Hz to 500 Hz.
- 0.25G constant acceleration from 500 Hz to 2000 Hz.

Not Applicable - Category X

The following six Environmental Conditions do not normally exist in Civil Aircraft, when recognized installation practices are adhered to, and are therefore not tested.

Explosion - Category X
Waterproofness - Category X
Hydraulic Fluid - Category X
Sand And Dust - Category X
Fungus Resistance - Category X
Salt Spray - Category X

1.5 Continued

Magnetic Effect - Category Z

With this equipment operating, it may be placed at a distance less than 0.3 meter from a free magnet with a 1^{o}, or less, deflection of the magnet.

Power Input - Category B

This equipment is designed for use in aircraft electrical systems supplied by an engine driven alternator/rectifier or DC generator with a battery of significant capacity floating in the DC bus at all times.

Normal Operating Conditions (Vdc) are:	28V System	14V System
Maximum	30.3	15.1
Nominal	27.5	13.8
Minimum	24.8	12.4
Emergency Operation	20.0	10.0

Voltage Spike - Category B

This equipment has been designed to withstand the transient voltage characteristics specified by RTCA Document DO 160.

Audio Frequency Conducted Susceptibility - Category B

This equipment has been designed and tested to assure compliance with the requirements of RTCA Document DO 160.

Electromagnetic Compatibility - Category A

Note: For this series of tests, equipment Interconnecting Cables and RF transmission lines were constructed in accordance with Section 2 of this manual.

1. Induced Signal Susceptibility - This equipment has been designed to withstand the effects of audio frequency electric and magnetic fields and induces voltage spikes as specified by Category A.
2. Radio Frequency Susceptibility - This equipment has been tested and is not affected by interference from other on board electronic equipment which meet Category A.
   Emission of Radio Frequency Energy Test of RTCA Document DO 160.
3. Emission of Radio Frequency Energy - This equipment has been tested and does not emit radio frequency energy in excess of that specified.

1.6 UNITS AND ACCESSORIES SUPPLIED

Tables 1.1 and 1.2 are used to order COM 120 and COM 120/20 systems respectively. Table 1.3 is used to order component parts of an Installation Kit for service replacement purposes.

All three Tables should also be used to check the contents of an order as soon after it is received as possible.

TABLE 1.1 COM 120 UNITS AND ACCESSORIES SUPPLIED

Item	Order Number	Description	Accessories Part No.
1	03218-0300	COM 120 TSO with: Tray Installation Kit	 55989-0101 03218-0500
2	03218-0301	COM 120 TSO, Helicopter version, with: Tray Installation Kit Installation Kit	 55980-0101 03218-0500 03218-0501
3	03218-0302	COM 120 TSO without tray or Installation Kit	
4	03218-0303	COM 120 TSO with: Tray (RF Cable installed) Interconnect Cable and Hardware	 90697-0101 03218-0504
5	03218-0305	COM 120 TSO with: Tray (removable rear plate) Installation Kit	 03218-0505 03218-0500

TABLE 1.2 COM 120/20 UNITS AND ACCESSORIES SUPPLIED

Item	Order Number	Description	Accessories Part No.
1	03222-0300	COM 120/20 TSO with: Tray Installation Kit	 55980-0101 03218-0500
2	03222-0301	COM 120/20 TSO, Helicopter version, with: Tray Installation Kit Installation Kit	 55980-0101 03218-0500 03218-0501
3	03222-0302	COM 120/20 TSO without Tray or Installation Kit	
4	03222-0303	COM 120/20 TSO with: Tray (RF Cable installed) Interconnect Cable and Hardware	 90697-0101 03218-0507
5	03222-0304	COM 120/20 TSO with: Tray (removable rear plate) Installation Kit	 03218-0505 03218-0500

TABLE 1.3 INSTALLATION KITS

Item	Part Number	Description	Quantities per Kit 03218-							
			0500	0501	0502	0503	0504	0505	0506	0507
1	55980-0101	Tray	-	-	1	-	-	-	-	-
2	90701-0101	RF Cable Ass'y	1	-	-	-	-	-	-	-
3	81307-0112	Washer, Flat, 9/16 OD x .438 ID x .020 thick	1	-	-	-	-	-	-	-
4	81192-0024	Ring, Retaining	1	-	-	-	-	-	-	-
5	90697-0101	Tray and RF Cable Ass'y	-	-	-	1	-	-	-	-
6	90695-0101	Interconnect Cable Ass'y, Com 120	-	-	-	-	1	-	-	-
7	82010-0014	Clamp, Cable	1	-	-	-	1	-	-	-
8	82815-0007	Screw, Mach, Bind Hd, Slotted, 6-32 x 1/2	1	-	-	-	1	-	-	1
9	81329-0006	Washer, Flat, 3/8 OD x 5/32 ID x 3/64 thick	1	-	-	-	1	-	-	1
10	81503-0004	Nut, "J", 6-32	1	-	-	-	1	-	-	1
11	41316-0007	Connector Housing, 15 pin (Molex)	1	1	-	-	-	-	-	-
12	41317-0001	Contact, Crimp type	15	6	-	-	-	-	-	-
13	82814-0008	Screw, Mach, Bind Hd, Slotted 4-40 x 5/16	2	-	-	-	-	-	-	-
14	82814-0004	Screw, Mach, Bind Hd, Slotted, 4-40 x 5/8	-	2	-	-	-	-	-	-
15	81324-0004	Washer, Lock, Split, No. 4	2	1	-	-	-	-	-	-
16	81213-0034	Spacer, General	-	1	-	-	-	-	-	-
17	81307-0119	Washer, Flat, Fiber	-	1	-	-	-	-	-	-
18	99090-0002	Pad, Spacer, 7/16 sq x 3/32 thick	4	-	-	-	-	-	-	-
19	04830-0001	Label, COM	1	-	-	-	-	-	-	-
20	56089-0001	Tray (Removable Rear Plate)	-	-	-	-	-	1	-	-
21	56088-0101	Rear Connector Plate	-	-	-	-	-	1	-	-
22	82956-0005	Screw, Mach, Bnd. SL #6-32 x 3/8"	-	-	-	-	-	2	-	-
23	82814-0007	Screw, Mach, Bnd. SL #4-40 x 1/2"	-	-	-	-	-	2	-	-
24	81213-0119	Spacer, 0.230	-	-	-	-	-	2	-	-
25	82814-0007	Screw, Mach, Bnd. SL #4-40 x 1/2"	-	-	-	-	-	2	-	-
26	90695-0102	Interconnect Cable Ass'y, COM 120/20	-	-	-	-	-	-	-	1

1.7 ACCESSORIES REQUIRED BUT NOT SUPPLIED

For proper operation of a COM 120 TSO or COM 120/20 TSO, the following accessories are required:

a. Antenna - Narco Avionics VCA-11 or equivalent.
To insure complete FAA Part 37 TSO compliance as applied to Air Carrier operation, these COM units must be used with an antenna meeting TSO C37b and C38b. Where Part 37 compliance is not required, a non-TSO'd antenna will suffice.

b. Loudspeaker/Headphones -
1. Loudspeaker - voice coil impedance, 4. ohms.
2. Headphones - high impedance type, 300 to 1000 ohms.
Headphones and Speaker may be used simultaneously.

c. Microphone - Narco Avionics M700B or equivalent.*

COM 120 - mike gain control has been factory set for the M700B. Most other carbon or dynamic noise canceling microphones may be used; however, the mike gain control may require readjustment.

COM 120/20 - it is important that the microphone have good noise canceling characteristics, as typified by the M700B.

d. Voltage Converter - required for installation in aircraft with 28 Vdc power systems.

COM 120 - Narco MP 10 or MP 20 or equivalent

COM 120/20 - Narco MP 20 or equivalent

1.7.1 Miscellaneous Items Required But Not Supplied

Refer to Installation Section for additional details.

a. Sufficient length of 22 AWG stranded hookup wire.
b. Sufficient length of RG-58 A/U coaxial cable.
c. Molex Hand Crimper HT-1921, Narco Part Number 41314-0001.
d. Molex Pin Ejector HT-1884, Narco Part Number 41314-0002.

*COM 120 Chassis AAAAA through ABGBE, use COM 120 microphone recommendations.
COM 120 Chassis ACGBF and later, use COM 120/20 microphone recommendations.

Refer to COM 120 Notice on page 2-1.

1.8 OPERATOR LICENSE REQUIREMENTS

The Federal Communications Commission requires that the operator of the transmitter in this equipment hold a Restricted Radio Telephone Operator Permit, or a license of a higher class. A permit may be obtained by any U.S. Citizen from the nearest field office of the FCC; no examination is required.

1.9 OPERATION

FIGURE 1-1. COM 120 TSO FRONT PANEL

The COM 120 and COM 120/20 operate identically. They are energized by turning the ON/OFF switch CW past the click to the ON position. Continued CW rotation to the TST position will deactivate the Unit's automatic squelch feature. In the ON position, the squelch will "break" at the RF level that produces a 6 dB S+N/N.

The transmit/receive frequency is selected by the three knobs located on either side of the transmit/receive frequency display window. The knob to the left of the display selects the MHz range (i.e. 124). The outer knob on the right selects the hundreds of kHz range (i.e. 0.900); the inner knob selects the tens of kHz range (i.e. 0.050).

The TRANSMIT LIGHT located under the frequency display window will light up when the transmitter is keyed by the push-to-talk switch on the microphone.

Turning the VOLUME control clockwise will increase the audio volume. Turning the VOLUME control counterclockwise will decrease the audio volume.

1.10 SYSTEMS

1.10.1 VCA-11 Antenna

To ensure complete FAA Part 37 compliance as applied to Air Carrier operation, the COM must be used with a communications antenna meeting TSO Categories C37b and C38b. Narco recommends the VCA-11 Antenna for this application.

It is possible in some type of aircraft to get satisfactory reception without special precautions. However, it is always advisable and frequently necessary to provide properly fitted ignition shielding. Experience has shown that such shielding, without clean and tight joints, etc., can be the cause of considerable noise, particularly at VHF. It is recommended that any ignition shielding in the aircraft in which the equipment is being installed be thoroughly inspected, and if necessary, be overhauled at the time of installation.

1.10.1.1 Mounting Locations And Ground Plane Considerations

Figure 1-2 provides the VCA-11 physical dimensions. The VCA-11 may be installed on either the top or, where ground clearance permits, bottom of the aircraft. The area surrounding the antenna location should be free of protrusions which could interfere with the line-of-sight characteristic of a VHF signal. The following rules should be observed with regard to the ground plane.

a. Metallic Mounting Surface
Mount the antenna in the center of a 9" (228.6 mm), minimum radius, ground plane. Antennas located near the edge of a ground plane may cause holes in the radiation and reception patterns.

b. Non-Metallic Mounting Surface
Aircraft with fabric, wood, or fiberglass fuselage covering must have a metal ground plane with a 9" (228.6 mm) minimum radius. This could be as simple as aluminum foil cemented inside wood or stiff fiberglass skin, or a doubler plate on a fabric covered aircraft. Such a ground plane should be either well bonded to the airframe, or well insulated from it, to prevent noise problems or erratic operation. Antenna mounting hardware must electrically connect the ground plane to the antenna.

1.10.1.2 Mounting

The VCA-11 installation manual provides a full scale mounting template. The aircraft should provide a flat stable base for the antenna. If adapter plates or shims are necessary, they must be metallic (free of paint or oxidation) and match the antenna mounting base to the aircraft contour. A doubler plate will be needed for an airworthy installation on most aircraft. Check the airworthiness regulations of the country of aircraft registry for acceptable mounting methods.

Remove all oxidation, paint, or other finish to permit good electrical contact between the antenna base and aircraft. Electrical ground will be carried by the mounting hardware. Install mounting hardware in a criss-cross pattern and then torque to 16 in/lb maximum. Use all mounting hardware. Application of a sealant or aerodynamic smoother must occur after final tightening of all antenna hardware.

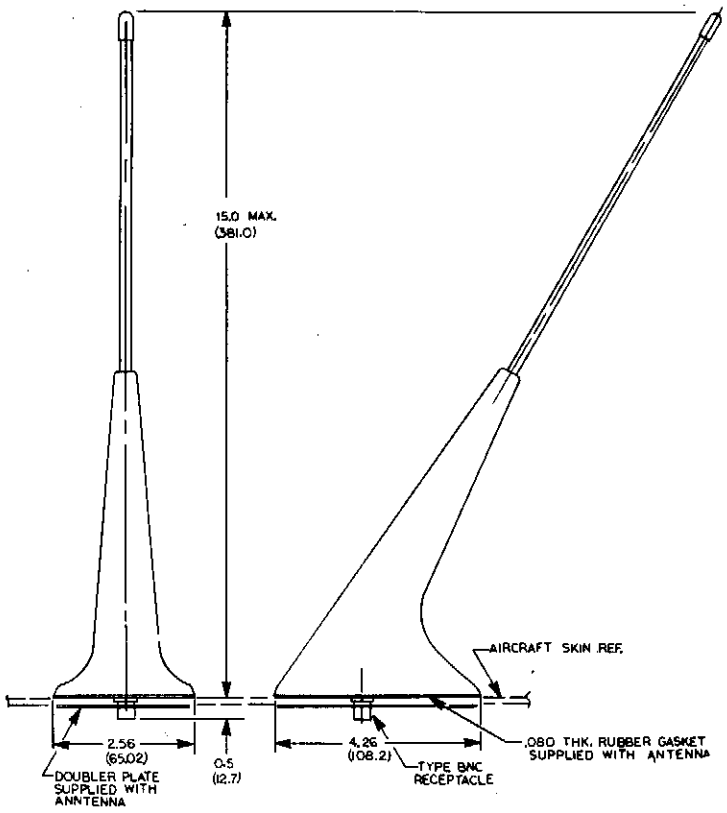


FIGURE 1-2. VCA-11 PHYSICAL DIMENSIONS

2.1 INTRODUCTION

This Section provides the necessary information for the installation of a COM 120 TSO or COM 120/20 TSO, and, where required, optional accessories.

Installation of a COM 120 or COM 120/20 in an aircraft with a 28 Vdc avionics bus will require the use of a 28 Vdc to 14 Vdc voltage converter. Recommended for use with the COM 120 is the Narco MP-10 or MP-20. The COM 120/20, because of its higher transmitter power output, requires an MP-20. If a COM/NAV system with either COM unit is being installed, the Narco MP-200 should be considered. Where another voltage converter is to be substituted, refer to Section 1.4 for the COM units power requirements.

COM 120 Notice

As part of our continuous improvement program, COM 120's with chassis ACGB (F) and later have COM 120/20 Bass, Treble, Sidetone, and Modulation circuitry and controls. When installing or adjusting a COM 120, check the chassis code on the bottom of the unit and if the code is ACGB (F) or later, use COM 120/20 procedures where so indicated in this manual. Otherwise, COM 120 procedures are to be used. In general, later COM 120's can also be identified by their top dust covers which are stamped to identify control access holes.

Chassis Codes are discussed in the COM 120 AND COM 120/20 Maintenance Manual. However, the fifth letter from the left indicates changes to the Modulator/Transmitter assembly.

2.2 PRELIMINARY INSPECTION

2.2.1 Unpacking

Carefully unpack the Unit and inspect for any damage that may have occured during shipment. Refer to Section 1.6, Units and Accessories Supplied, and inventory the contents of the Installation Kit. Refer to Section 1.7, Accessories Required but NOT Supplied for a listing of items and equipment needed for proper installation.

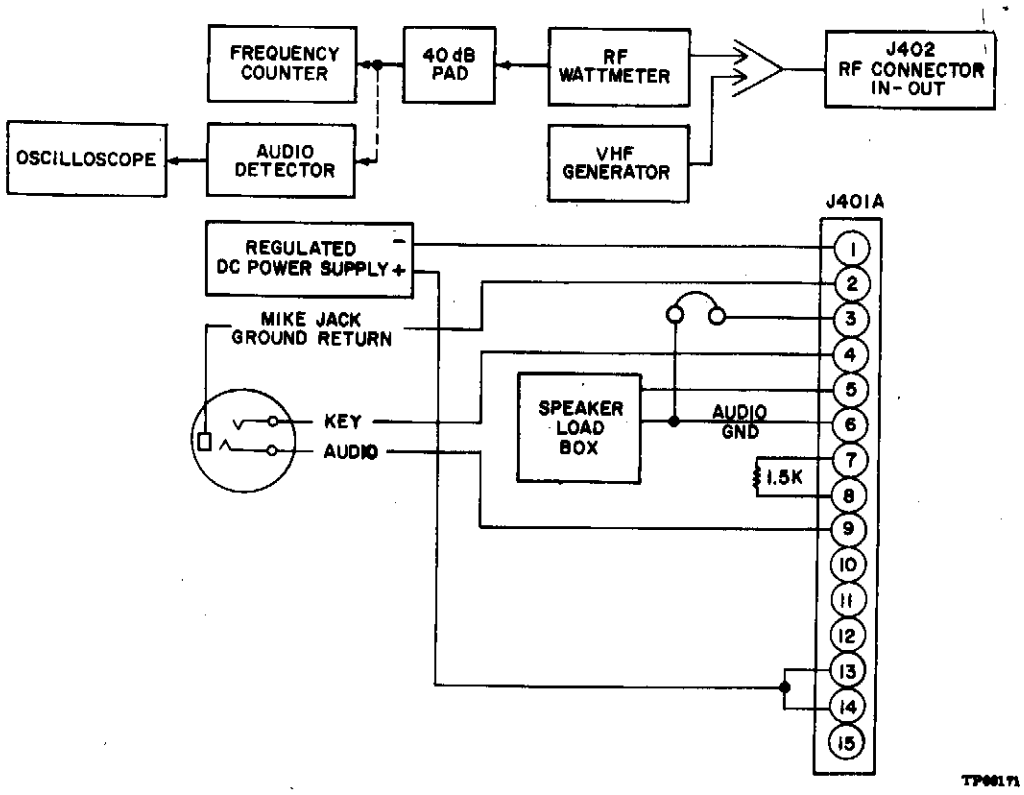


FIGURE 2-1. BENCH TEST SET-UP

2.2.2 Electrical Bench Test

2.2.2.1 Test Equipment Recommended

a. VHF Signal Generator: HP Model 608D or equivalent
b. RF Power Wattmeter: Bird Thruline, Model 43 or equivalent with 50 watt element.
c. Regulated DC Supply with 12 to 15 Vdc at 15 amperes capability: Deltron Inc. Model SP40-15 or equivalent.
d. Frequency Counter: HP Model 5246L equipped with prescaler Plug-In Model 5252A or equivalent.
e. Oscilloscope: Tektronix 535A or equivalent.
f. Speaker Load Box: with 15 watt capability.
g. 40 dB, 20 watt pad.
h. Audio Detector: Texscan Model DC-50 or equivalent.
i. Low Impedance microphone with a push-to-talk switch (preferably the microphone that will be used in the aircraft).
j. Narco Dealer Starter Kit: Required for construction of test set-up.

2.2.2.2 Test Procedure

a. Connect the COM Unit into the test set-up, diagramed in Figure 2-1, and set the DC supply for 13.75 Vdc.
b. Connect the VHF signal generator to J402; set the generator output level to 1.5 uv with 30%, 1 kHz modulation.
c. Set the COM VOLUME CONTROL for a 100 mW reading on the speaker load box meter.
d. Remove the modulation, look for a 6 dB decrease on the speaker load box meter.
e. Disconnect the signal generator. Connect the RF wattmeter and frequency counter as diagramed in Figure 2-1.
f. Connect the wattmeter to J402. Key the transmitter and talk into the microphone. The wattmeter indicator should react with a wiggle.
g. With the transmitter keyed, use the frequency counter to check the Unit's frequency programming. Set COM to 118.000 and check all kHz channels. Set COM to 118.000 and check all MHz channels.

2.2.2.3 Microphone Gain Adjustment (See COM 120 Notice on page 2-1)

2.2.2.3.1 COM 120

It is recommended that the microphone gain adjustment (see Figure 2-2) be performed while the COM 120 is on the bench using the aircraft's microphone(s). This adjustment can be made in the aircraft, since the MIKE GAIN control is located on the left side of the chassis. Should the aircraft be equipped with more than one microphone, the microphone gain should be adjusted with each microphone, and if necessary, the final setting should be a compromise for the multi-microphone application.

a. Connect the Unit into the test set-up diagramed in Figure 2-1.
b. Connect a 40 dB pad and audio detector to J402.
c. While monitoring the detector output on the oscilloscope, key the transmitter and talk into the microphone.
d. Adjust the MIKE GAIN control for an audio signal that is just beyond peak clipping.

2.2.2.3.2 COM 120 (ACGBF and later) and COM 120/20

Since the microphone amplifier incorporates audio leveling, there is no MIKE GAIN control. Refer to the Maintenance Manual to adjust the MOD. SET control if the microphone to be used produces an output voltage different from that specified in Section 1.4 under the sub-heading Transmitter.

2.2.2.4 Sidetone Adjustment (See COM 120 Notice on Page 2-1)

2.2.2.4.1 COM 120

a. Remove the top cover from the Unit by removing the four screws located on the sides of the chassis (Figure 2-2).
b. Connect the Unit into the test set-up diagramed in Figure 2-1.
c. Connect the RF wattmeter or a suitable dummy load to J402.
d. Key the transmitter and talk into the microphone.
e. Adjust SIDETONE control R448 for a comfortable listening level from the headphones.
f. Disconnect the Unit from the test set-up and replace the top cover.

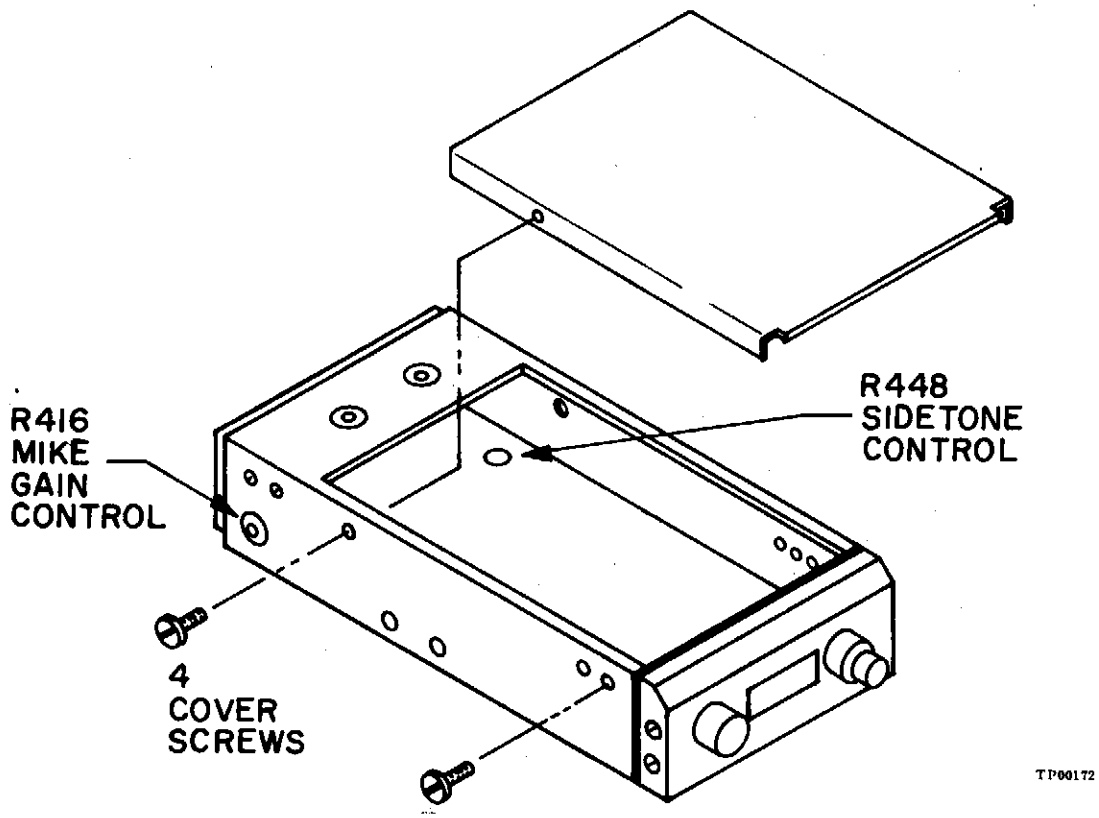


FIGURE 2-2. EARLY COM 120 MIKE GAIN AND SIDETONE CONTROLS

2.2.2.4.2 COM 120 (ACGBF and later) and COM 120/20

a. Connect the Unit into the test set-up diagramed in Figure 2-1.
b. Connect the RF wattmeter or a suitable dummy load to J402.
c. Key the transmitter and talk into the microphone.
d. Insert a straight slot screwdriver thru the COM's top dust cover and adjust for a comfortable headphone listening level.

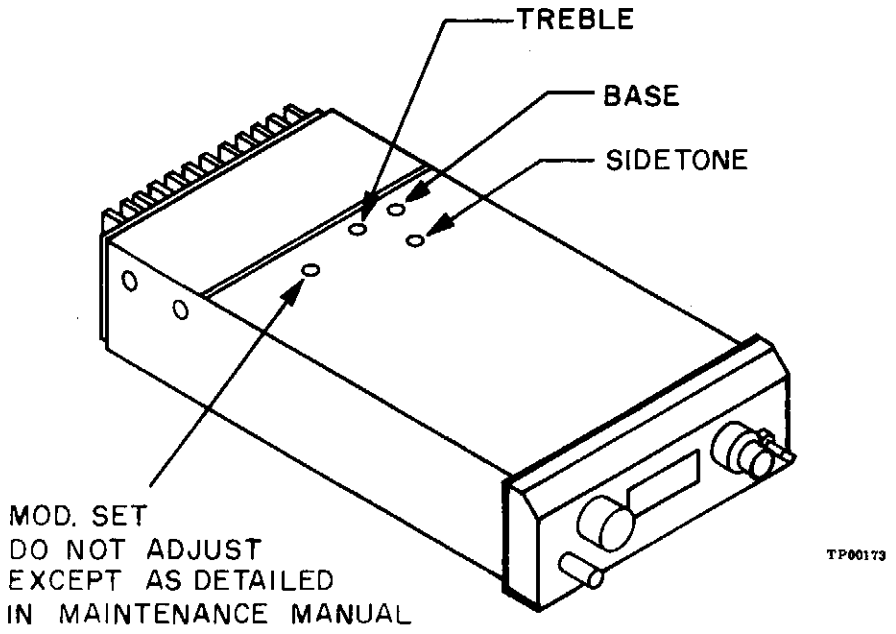


FIGURE 2-3. LATER COM 120 AND COM 120/20 SIDETONE CONTROL

2.2.2.5 Tone Control Adjustment

Base and treble controls should be adjusted in the aircraft with the aircraft's speaker (and speaker baffle), headphone, and microphone. Refer to Section 2.5.1.2 for an adjustment procedure. These controls are factory set for flat audio response.

2.3 MECHANICAL INSTALLATION

2.3.1 Mounting Tray

COM's are supplied with a mounting tray which is designed to be mounted behind the aircraft instrument panel using four No. 6 binding head screws. Figures 2-4, 2-5, and 2-6 provide a detailed drawing of the trays and the parts of the Installation Kit. These figures also provide all the necessary dimensions for panel cutout as well as dimensions for the mounting bracket locations. A full scale panel cutout template is also provided.

Mounting brackets (4) are not supplied due to the wide range in mounting requirements. Suitable mounting brackets may be fabricated from ordinary sheet metal or angle stock.

The tray must be provided with a good electrical ground. A ground strap can be attached to a rear, side mounting screw.

It is recommended that the COM be provided with ram air cooling.

2.3.2 Insertion And Removal

CAUTION

Always check the position of the 14/28V pilot light switch before inserting the Unit into the tray or prior to checking pilot light operation. The switch should be set to aircraft bus voltage.

COM's contain a locking screw (located on the front panel below the kHz knob) which should be turned full CCW before sliding the Unit into the tray. After the Unit is in the tray, the locking screw should be turned CW, this draws the Unit into the tray and engages the mating connectors.

DO NOT RAM THE UNIT INTO THE TRAY

To remove the Unit, turn the locking screw full CCW and pull the Unit straight out.

Item	Part Number	Description	Quantities per Kit 03218-							
			0500	0501	0502	0503	0504	0505	0506	0507
1	55980-0101	Tray	-	-	1	-	-	-	-	-
2	90701-0101	RF Cable Ass'y	1	-	-	-	-	-	-	-
3	81307-0112	Washer, Flat, 9/16 OD x .438 ID x .020 thick	1	-	-	-	-	-	-	-
4	81192-0024	Ring, Retaining	1	-	-	-	-	-	-	-
5	90697-0101	Tray and RF Cable Ass'y	-	-	-	1	-	-	-	-
6	90695-0101	Interconnect Cable Ass'y, Com 120	-	-	-	-	1	-	-	-
7	82016-0014	Clamp, Cable	1	-	-	-	1	-	-	-
8	82815-0007	Screw, Mach, Bind Hd, Slotted, 6-32 x 1/2	1	-	-	-	1	-	-	1
9	81329-0006	Washer, Flat, 3/8 OD x 5/32 ID x 3/64 thick	1	-	-	-	1	-	-	1
10	81503-0004	Nut, "J", 6-32	1	-	-	-	1	-	-	1
11	41316-0007	Connector Housing, 15 pin (Molex)	1	1	-	-	-	-	-	-
12	41317-0001	Contact, Crimp type	15	6	-	-	-	-	-	-
13	82814-0008	Screw, Mach, Bind Hd, Slotted 4-40 x 5/16	2	-	-	-	-	-	-	-
14	82814-0004	Screw, Mach, Bind Hd, Slotted, 4-40 x 5/8	-	2	-	-	-	-	-	-
15	81324-0004	Washer, Lock, Split, No. 4	2	1	-	-	-	-	-	-
16	81213-0034	Spacer, General	-	1	-	-	-	-	-	-
17	81307-0119	Washer, Flat, Fiber	-	1	-	-	-	-	-	-
18	99090-0002	Pad, Spacer, 7/16 sq x 3/32 thick	4	-	-	-	-	-	-	-
19	04830-0001	Label, COM	1	-	-	-	-	-	-	-
20	56089-0001	Tray (Removable Rear Plate)	-	-	-	-	-	1	-	-
21	56088-0101	Rear Connector Plate	-	-	-	-	-	1	-	-
22	82956-0005	Screw, Mach, Bnd. SL #6-32 x 3/8"	-	-	-	-	-	2	-	-
23	82814-0007	Screw, Mach, Bnd. SL #4-40 x 1/2"	-	-	-	-	-	2	-	-
24	81213-0119	Spacer, 0.230	-	-	-	-	-	2	-	-
25	82814-0007	Screw, Mach, Bnd. SL #4-40 x 1/2"	-	-	-	-	-	2	-	-
26	90695-0102	Interconnect Cable Ass'y, COM 120/20	-	-	-	-	-	-	-	1

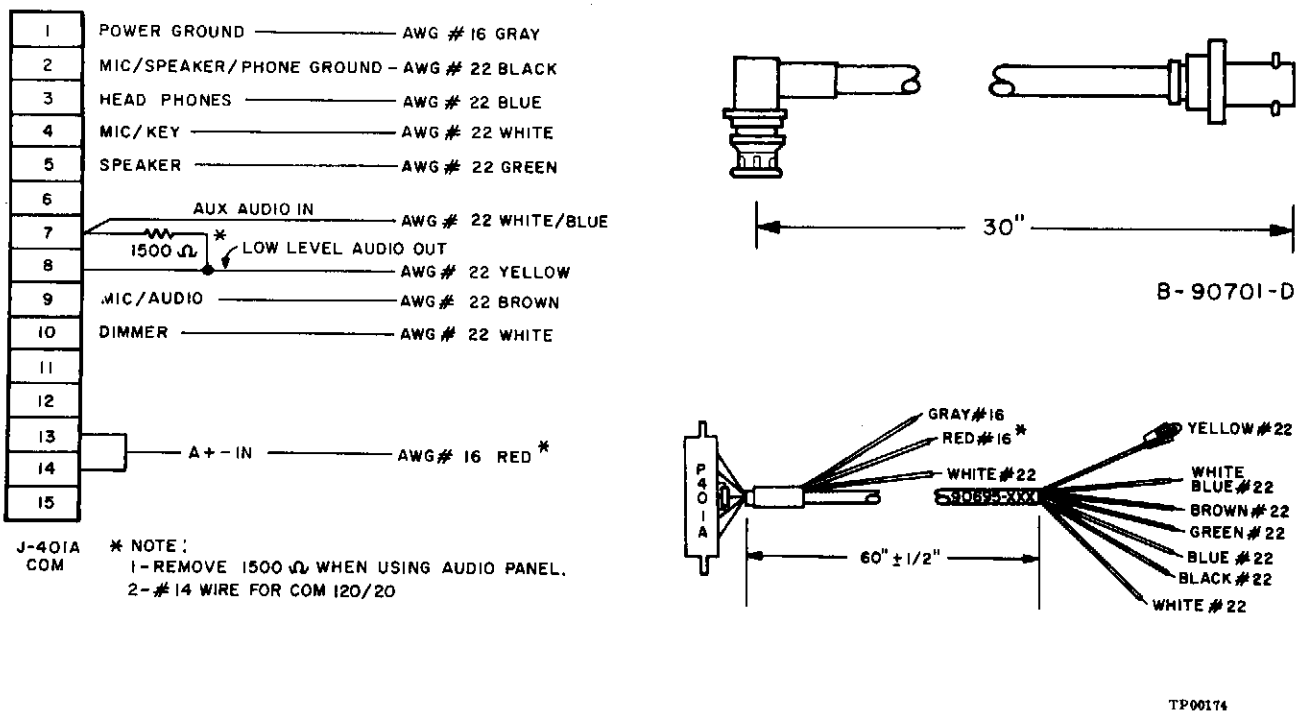
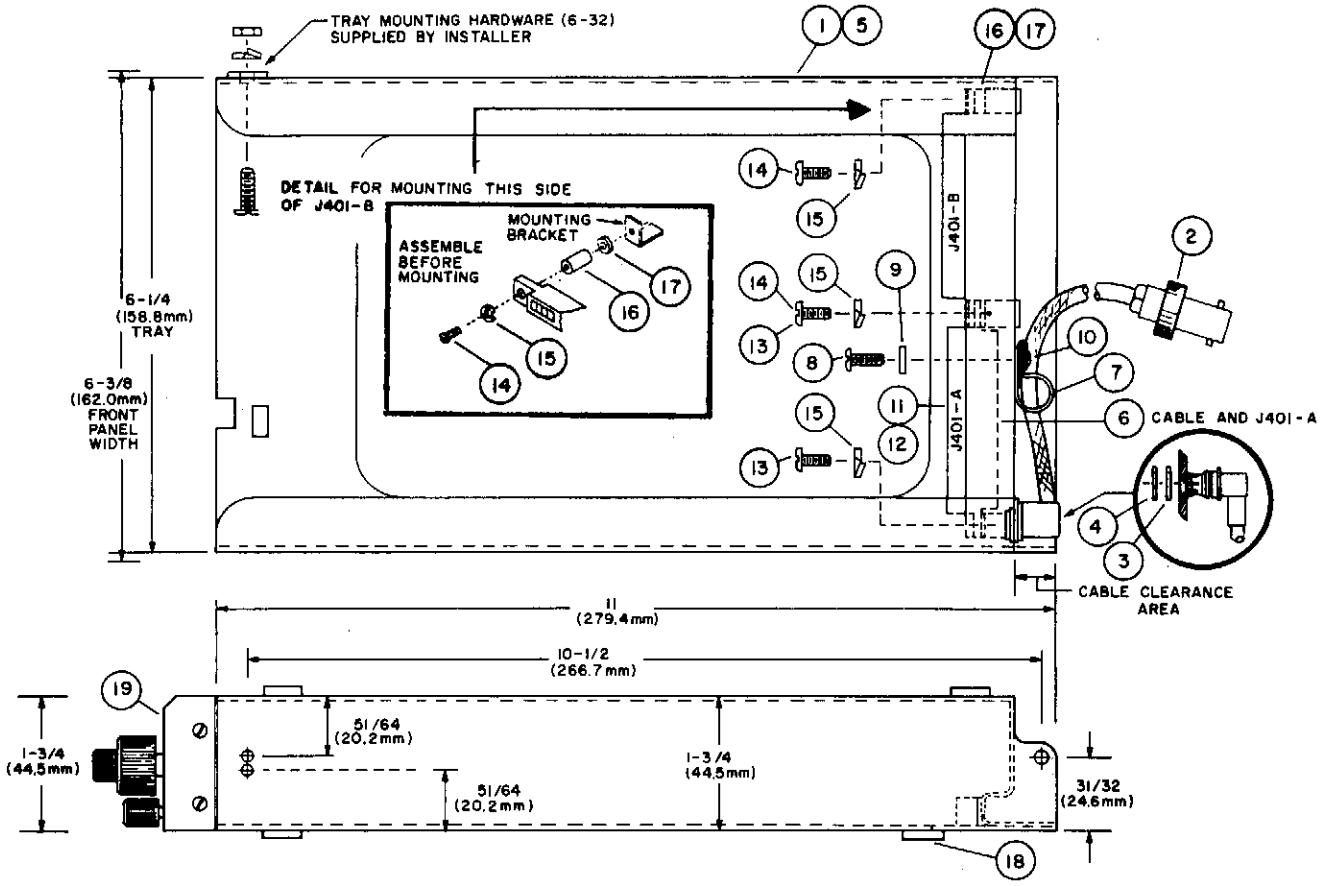
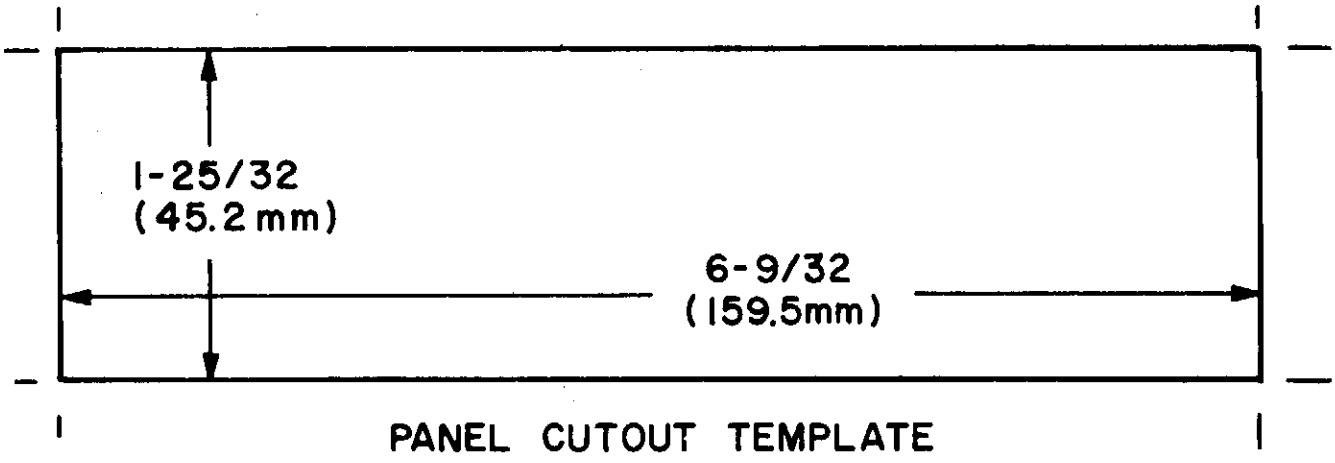


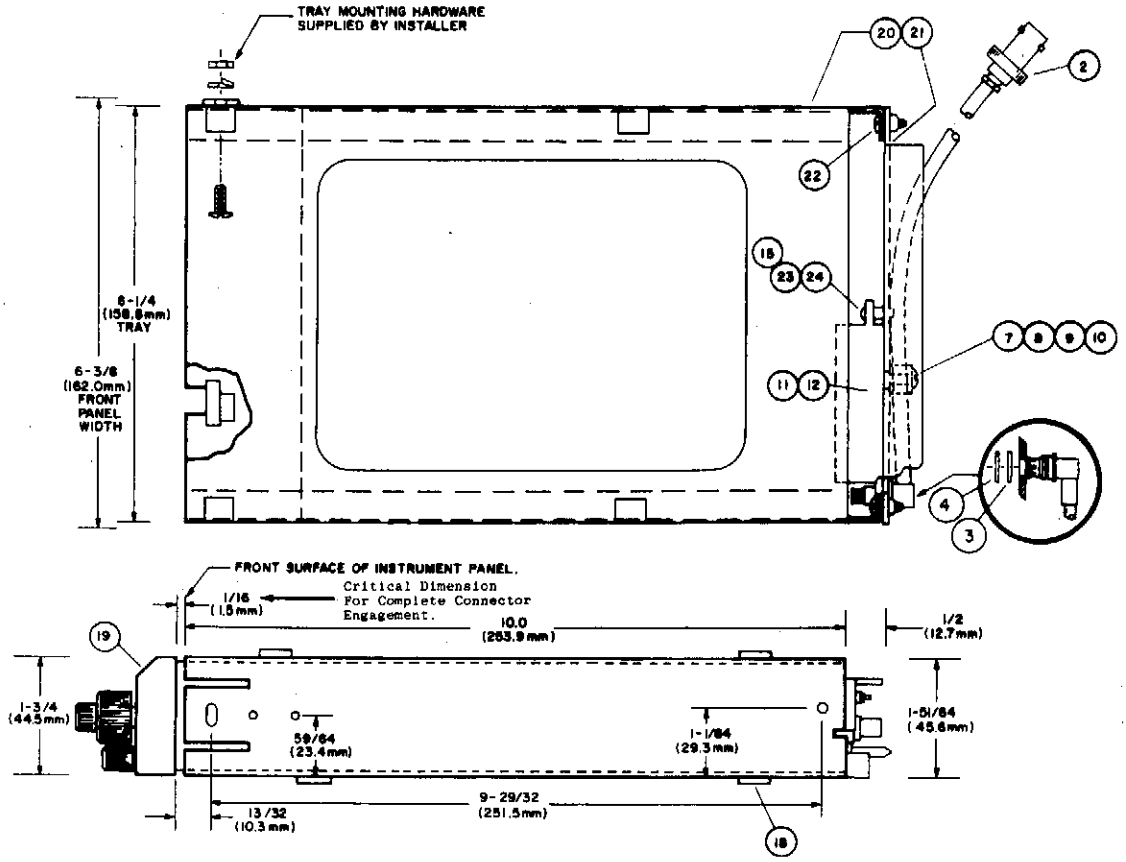
FIGURE 2-4. INTERCONNECT CABLE ASS'Y





PANEL CUTOUT TEMPLATE

FIGURE 2-5. INSTALLATION DRAWING



ITEM 13 OF INSTALLATION KIT 03218-555 NOT REQUIRED.

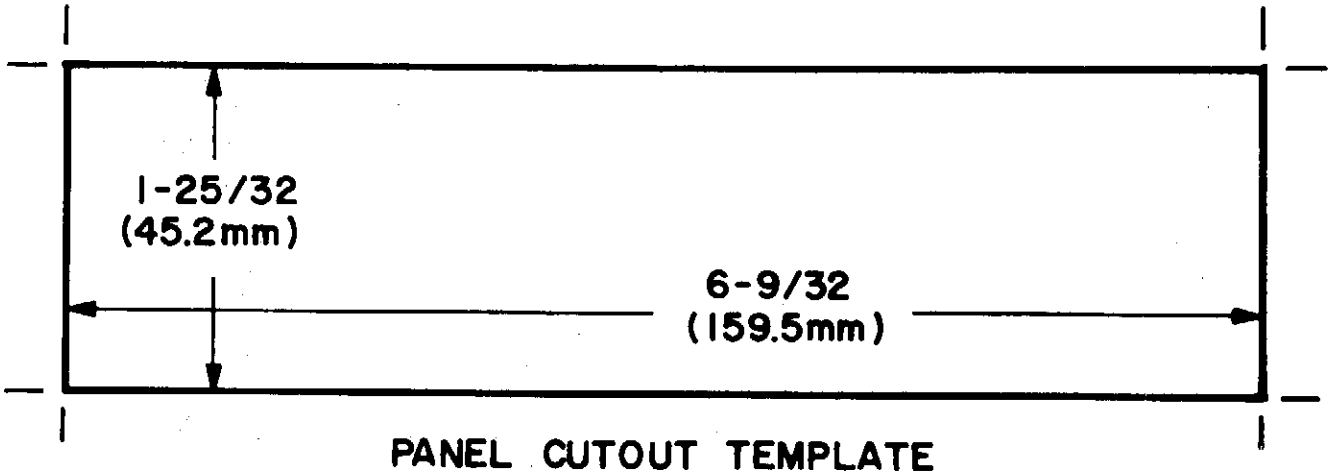


FIGURE 2-6. INSTALLATION DRAWING (TRAY WITH REMOVABLE REAR).

2.3.3 Tray With Removable Rear Plate

A complete tray assembly consists of a rear plate and a mounting tray. Wiring of the rear plate is covered in the Electrical Installation Section.

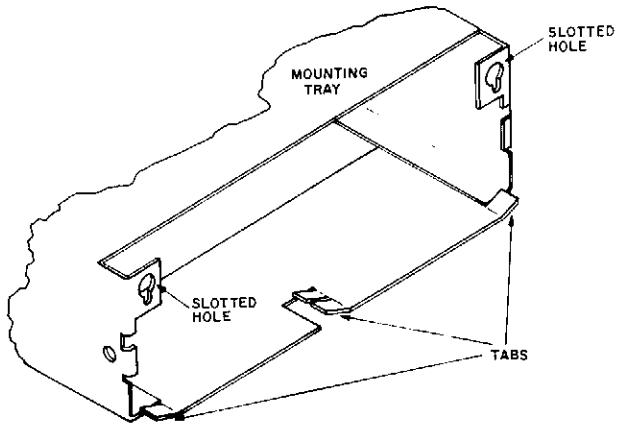


FIGURE 2-7. MOUNTING TRAY, REAR VIEW

Tray Assembly Installation Procedure:

1. Secure mounting tray to the instrument panel and support rear of tray.
2. Loosen two 6-32 screws at the Rear Plate Assemblies upper corners.
3. Partially insert the Rear Plate into tray tabs and push the heads of the 6-32 screws through the tray's slotted holes.
4. Pull down on the Rear Plate, to seat the Assembly, and tighten the 6-32 screws (a screwdriver with a 12-inch shank is handy for this operation).

Unit Installation:

1. Using an allen wrench, turn the front panel locking screw CCW.
2. Slide the Unit into the mounting tray.
3. Turn locking screw CW to pull Unit into tray - do not over tighten.

Unit and Rear Plate Assembly Removal:

1. Using an allen wrench, turn the front panel locking screw CCW; this will partially remove the Unit from the tray.
2. Pull Unit from tray.
3. Rear Plate Assembly removal is eased if a screwdriver with a 12-inch shank is available. Looking into the tray from the cockpit, locate and loosen (about 4 turns) the two screws.
4. Grasp the Rear Plate Assembly and pull it rearward from the tray, first horizontally, then vertically (out and up).

2.4 ELECTRICAL INSTALLATION

The installing agency can fabricate their own interconnect cable or order an assembled 60-inch long cable. COM 120 cable connections are shown in Figure 2-8 and COM 120/20 cable connections are shown in Figure 2-9. Check that cable length is sufficient to allow for proper dressing and clamping.

2.4.1 Antenna Cable RF Connector Assembly

The Antenna Cable Assembly is 30 inches long. It is installed on the tray using a flat washer and a retaining ring (refer to Figure 2-5). The installing agency must provide a cable between the Antenna Cable Assembly and the Antenna. This coaxial cable should be 50 ohm, RG-58 A/U.

2.4.2 Interconnect Cable

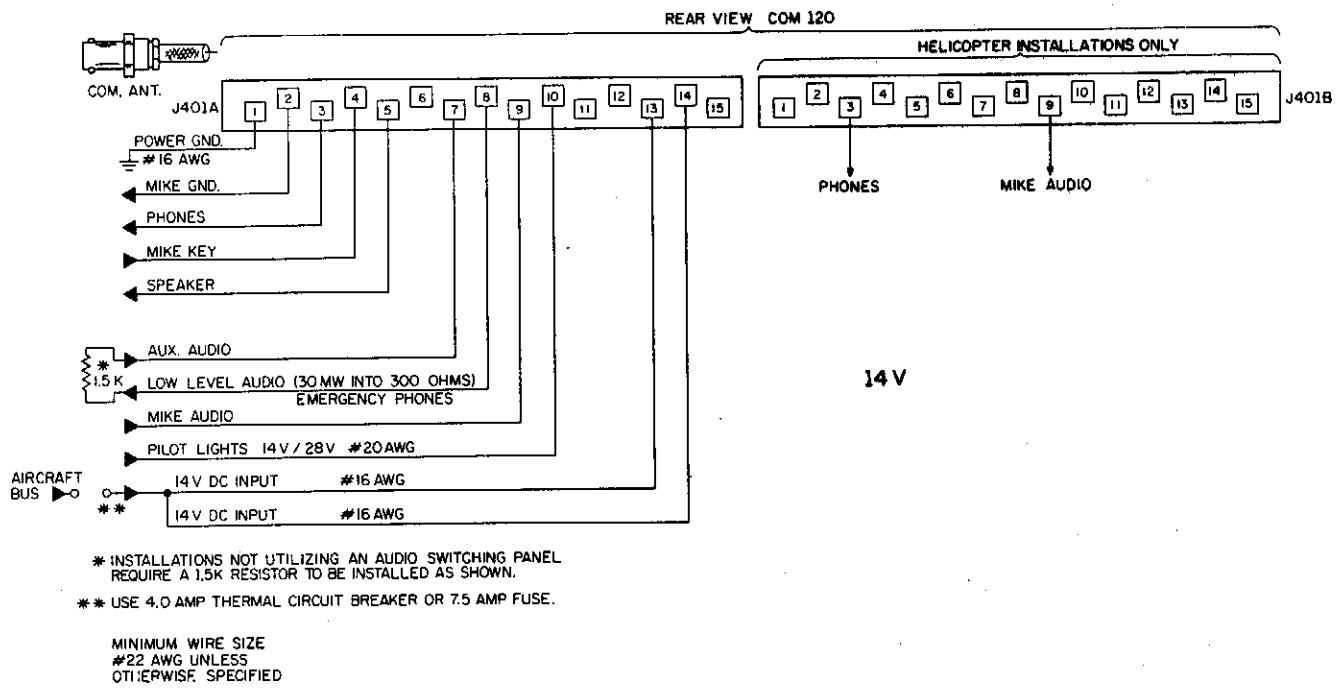
COMs have three ground connections; J401A-1 Power Ground, J401A-2 Microphone Ground, and J401A-6. The only terminal that should be connected to airframe ground is pin 1. Pin 6 should not be used as an airframe ground; it should only be used as a ground for a "floating" Speaker, Headphones, or Microhpone circuits in those installations where remote grounding of these units or their associated panel jacks induces noise into the transmitter carrier and/or noise in the headphone/speaker system.

A thermal circuit breaker or fuse must be provided by the installing agency and connected between the COM and the aircraft power bus. Refer to the Table for recommended ratings.

COM 120/20 installations may require in-line splices in the 14 and 28 Vdc wiring (refer to Figure 2-9). J401A will not accept a wire size larger than #16 AWG and where the total cable run (refer to Figure 2-7) necessitates larger gauge wire, in-line splices are necessary. FAA Advisory Circular 43.13-1 discusses the installation of in-line splices.

Unit	Circuit Breaker	Fuse
COM 120	4.0 Ampere	7.5 Ampere
COM 120/20	10 Ampere	15 Ampere

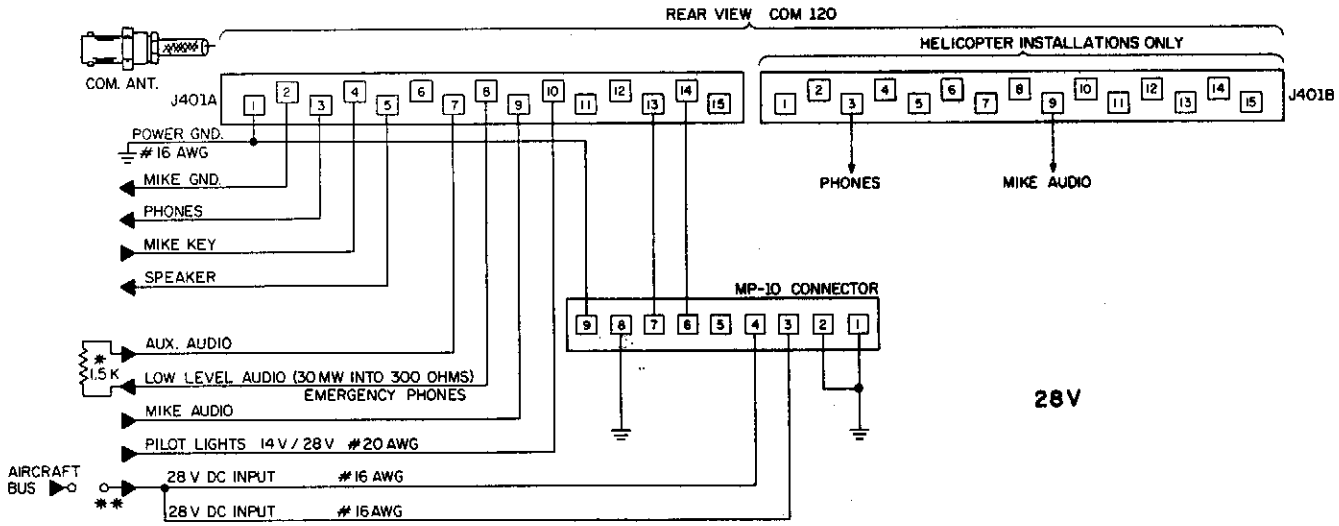
Be sure to observe wire size requirements.



* INSTALLATIONS NOT UTILIZING AN AUDIO SWITCHING PANEL REQUIRE A 1.5K RESISTOR TO BE INSTALLED AS SHOWN.

** USE 4.0 AMP THERMAL CIRCUIT BREAKER OR 7.5 AMP FUSE.

MINIMUM WIRE SIZE
#22 AWG UNLESS
OTHERWISE SPECIFIED



* INSTALLATIONS NOT UTILIZING AN AUDIO SWITCHING PANEL CONTAINING AN ISOLATION AMPLIFIER REQUIRE A 1.5K RESISTOR TO BE INSTALLED AS SHOWN.

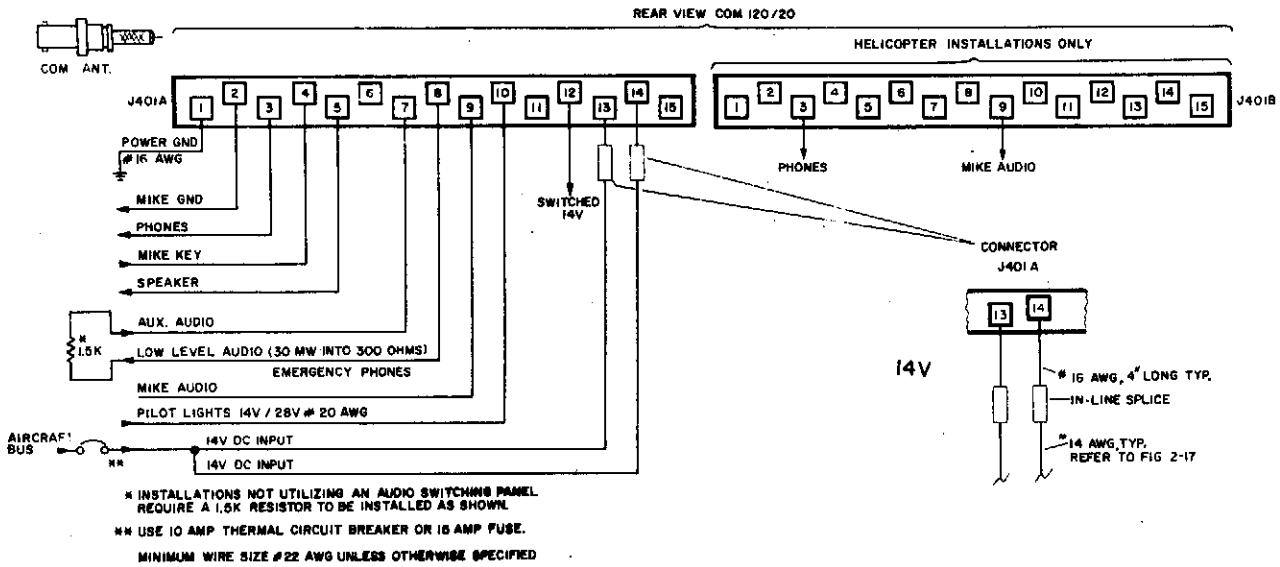
** USE 4.0 AMP THERMAL CIRCUIT BREAKER SUPPLIED WITH MP 10 OR 7.5 AMP FUSE

MINIMUM WIRE SIZE
#22 AWG UNLESS
OTHERWISE SPECIFIED

SWITCH PILOT LIGHT SWITCH (ON BOTTOM OF UNIT) TO THE 28 V POSITION.

TP06175

FIGURE 2-8. COM 120 INTERCONNECTION DIAGRAMS, 14 AND 28V



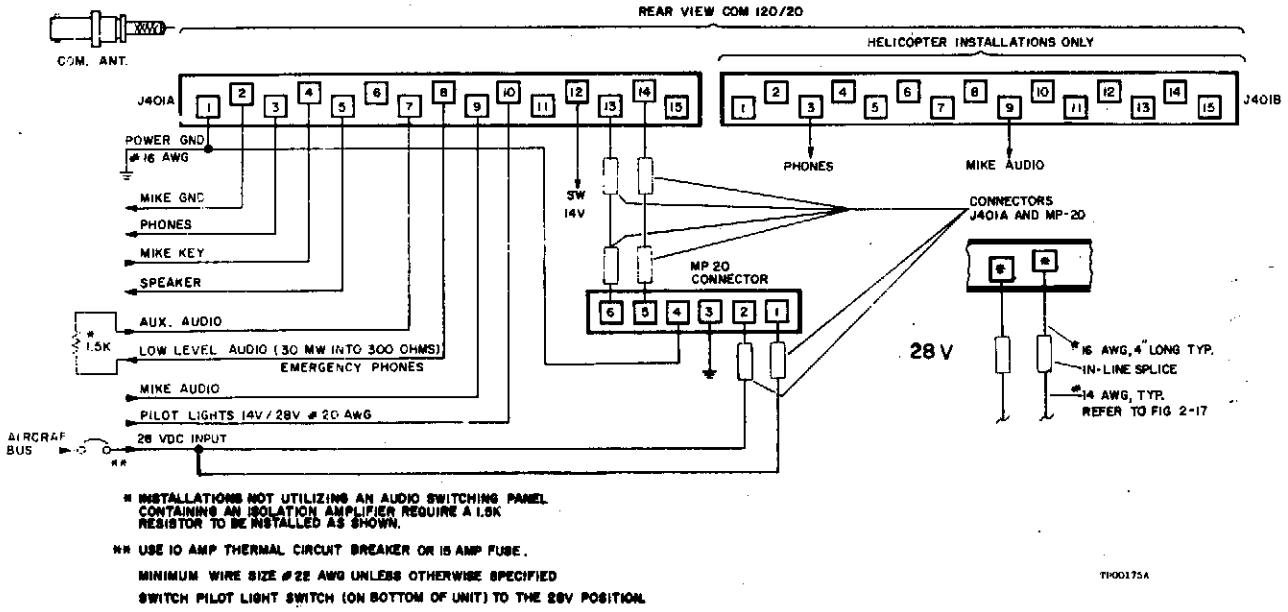


FIGURE 2-9. COM 120/20 INTERCONNECT DIAGRAMS, 14 AND 28V

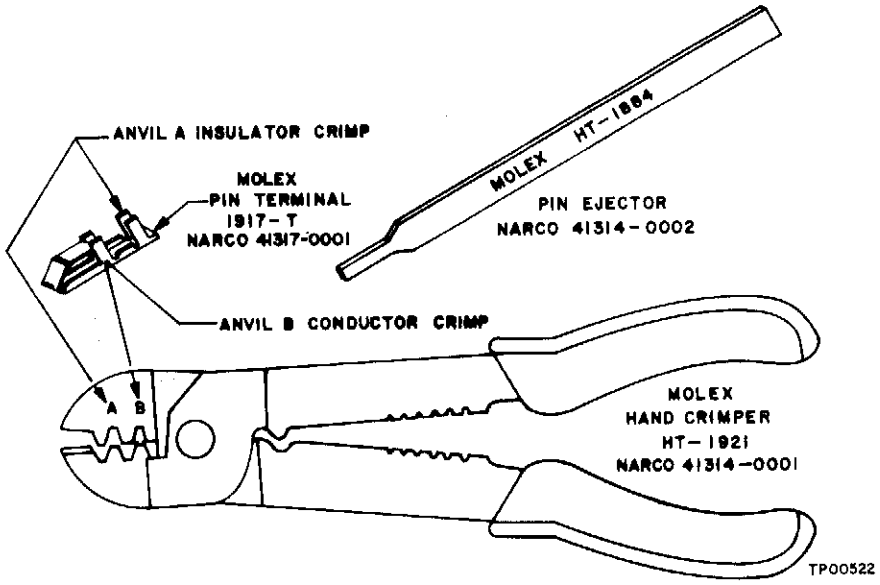


FIGURE 2-10. CRIMPING TOOL

2.4.3 Cable Fabrication

1. Strip wire 5/32" for PIN Terminal No. 1917-T.
2. Open tool (engraved side toward you), from the opposite side, place the conductor tab section of the pin on Anvil B. Close tool slightly (until tabs touch the female jaw).
3. Insert stripped conductor until insulation is level with outside of jaw. Crimp by squeezing handles together until jaws are fully closed or sufficient crimp is made.
4. Move leads and pin to Anvil A. Crimp again until jaws are closed or sufficient crimp is made.
5. If necessary, straighten pin while still being held in the jaw.

Insertion

1. The PIN terminal may now be inserted into the desired pin location in the translucent connector housing. The pin cannot be inserted upside down. Right-side-up it slides in effortlessly. Be sure to push it all the way in, until a "click" can be felt, heard, or even seen (by turning the translucent housing over).
2. There is no necessity to pull back on the lead itself except to test for the "locking feature", and then only with a moderate pull.

2.4.3 Continued

Extraction

1. If a pin is erroneously inserted into the wrong housing position, or if at some later time a circuit change is desired, the pin can be removed easily. Slip the flat narrow blade portion of the tool into the mating side of the housing, under the pin. By holding the housing upside down one can see the blade slide in, up to the stop. This action picks up the locking key and allows the lead and pin to slip out of its position using a light pulling action in the lead. Neither pin nor position has been damaged allowing re-insertion in the same or another position.

Crimping with Pliers

The lead PIN Terminal connection using the Molex hand crimper provides a superior connection than with pliers. However, with care, a satisfactory connection can be made without the crimper.

1. Strip wire 5/32" for PIN Terminal 1917-T.
2. Using needle nose pliers, fold over conductor tabs firmly onto the conductor, one side then the other.
3. Repeat step 2 for the insulator tabs.

2.4.4 Pilot Light Control

There are two common methods of pilot light control: (1) a constant brilliance, using the unit's ON/OFF switch; or (2) a variable brilliance method whereby the lamps are controlled by the aircraft's master dimmer switch.

The first method requires that the PILOT LIGHT 14/28V switch be set to 14V, and pin 10 of J401A be jumpered to pin 12 (switched A+, 14V).

The second method requires that the PILOT LIGHT 14/28V switch be set to the appropriate bus voltage and that the dimmer lead be connected to pin 10 of J401A.

2.4.5 Audio Input Connections

Figures 2-8 and 2-9 show a 1.5K resistor between J401A pin 7 and pin 8. This resistor is required when an installation does NOT use an audio switching panel. When an audio switching panel with an isolation amplifier is used, the resistor is removed.

In installations where several switched receive audio inputs are desired for the COM system and an isolation amplifier is not used, an audio summing network must be utilized for optimum performance. The following diagram shows an example of such a network. In all installations, terminal 3 can be used for headphone connection. The mute relay is controlled by the microphone key.

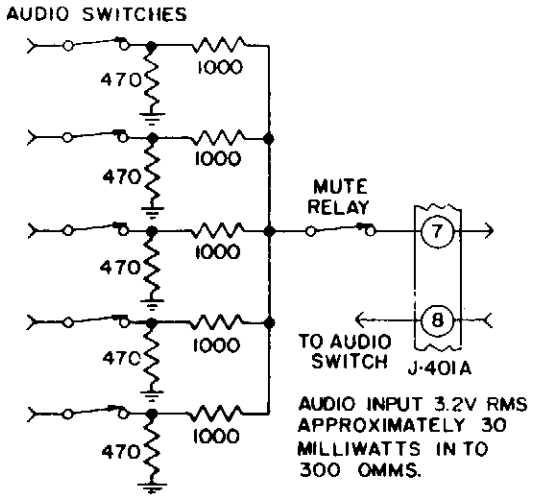


FIGURE 2-11. SUMMING NETWORK

2.4.6 Cabin Speaker Amplifier (See COM 120 Notice on page 2-1)

Either model Com may serve as the cabin speaker amplifier for other avionics equipments, such as ADF, MKR, and NAV receivers, while performing its normal functions (Refer to Section 2.4.5).

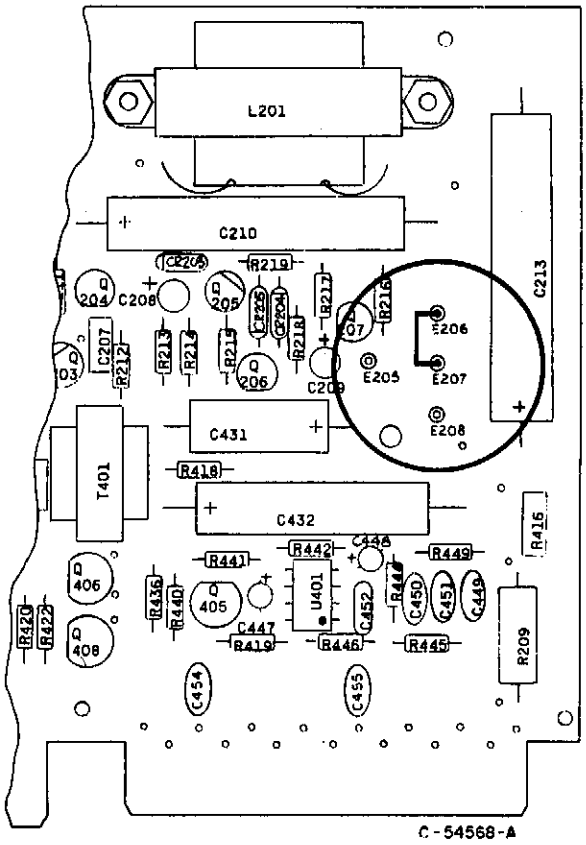
As shipped, the Com's audio amplifier will operate only when the Com is turned ON. When the Com's audio amplifier is serving as the cabin speaker amplifier and a failure occurs requiring that the Com be turned OFF, all audio routed through the Com will be lost. This may be prevented by the changing of a jumper to route A+ (J401A-14) directly to the amplifier thus bypassing the Com's ON-OFF switch. The Com's receiver and transmitter will be controlled by the Com's ON-OFF switch while the audio amplifier will be turned ON and OFF by the aircraft master switch or avionics master switch.

2.4.6.1 Com 120

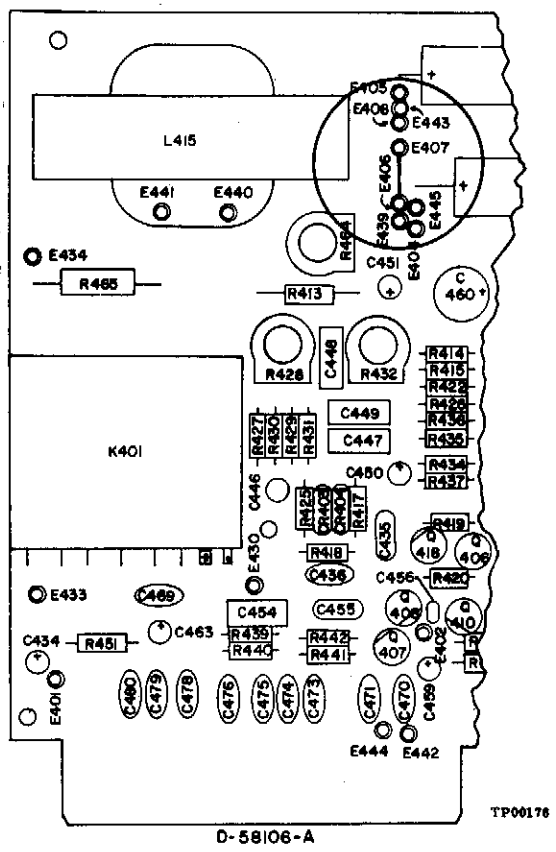
1. Remove the units top dust cover.
2. Refer to Figure 2-12 and locate E206, E207, and E208.
3. Unsolder jumper between E206 and E207.
4. Solder jumper from E207 to E208.
5. Install dust cover.

2.4.6.2 Com 120 (ACGBF and later) and Com 120/20

1. Remove the units top dust cover.
2. Refer to Figure 2-12 and locate E406, E407, and E408.
3. Unsolder jumper between E406 and E407.
4. Solder jumper from E407 to E408.
5. Install dust cover.



EARLY COM 120



LATER COM 120
AND COM 120/20

FIGURE 2-12. CABIN AMPLIFIER MODIFICATION

2.4.7 General Recommendations For Helicopters

1. Do not connect microphones in PARALLEL! The impedance of microphone varies greatly between models and between units of the same type. It is impossible to get a balance between levels of two microphones in parallel and sometimes one microphone will completely swamp out the other. In addition, one does not want to add the noise that the unused microphone will pick up into the audio system.

   Relays should be used so that only the desired microphone is feeding the microphone input.
2. It is possible with some types of control stick switches to eliminate the intercom relays by having the control stick switch be the ground connection for the microphone. Great care must be taken to avoid sneak paths and prevent noise pickup on the microphone lead with this system. For this reason it is NOT RECOMMENDED - Relays should be used.
3. The COM unit is capable of 10 watts of audio. The audio system produces approximately 20 volts p-p at full output at the speaker and the headphone lead from a very low impedance source.

   Because of higher noise levels in most helicopters, a high audio output level is required. When a COM unit is to be installed in a helicopter, it is shipped with an extra connector which, when installed, connects the PHONES output directly to the audio output transistors.

   If because of a high noise level environment more headphone audio is desired, one can add a transformer to step-up the audio voltage.

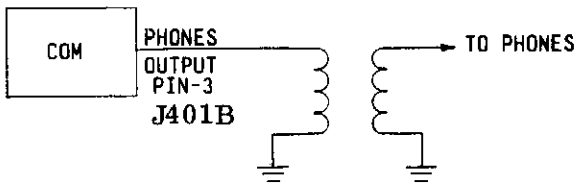


FIGURE 2-13. METHOD TO INCREASE PHONE AUDIO OUTPUT

4. Because of the usually long leads and high audio level requirements in the helicopter, it is recommended that shielded wire be used for at least the microphone and auxiliary audio lead, if it is used.

2.4.7 Continued

5. MIKE GAIN ADJUSTMENT, COM 120* only - The mike gain control will affect both transmitter operation and intercom level. The mike gain should be adjusted for full modulation of the transmitter with normal talking into the microphone.

   DO NOT USE THE MIKE GAIN TO ADJUST INTERCOM LEVEL.

6. To adjust intercom level, an L-pad should be wired in series with J401B-3 for COM 120*. The volume control adjusts intercom level in the COM 120 (chassis code ACGBF and later) and COM 120/20.

7. If speaker operation is desired, a switch should be provided to turn the speaker OFF when headphones are used.

   This is necessary with intercoms to prevent audio feedback and is desirable even when one is not using intercom because with the receiver set for a comfortable headphone level, the speaker would be blasting.

*Chassis codes AAAAA through ABGBE.

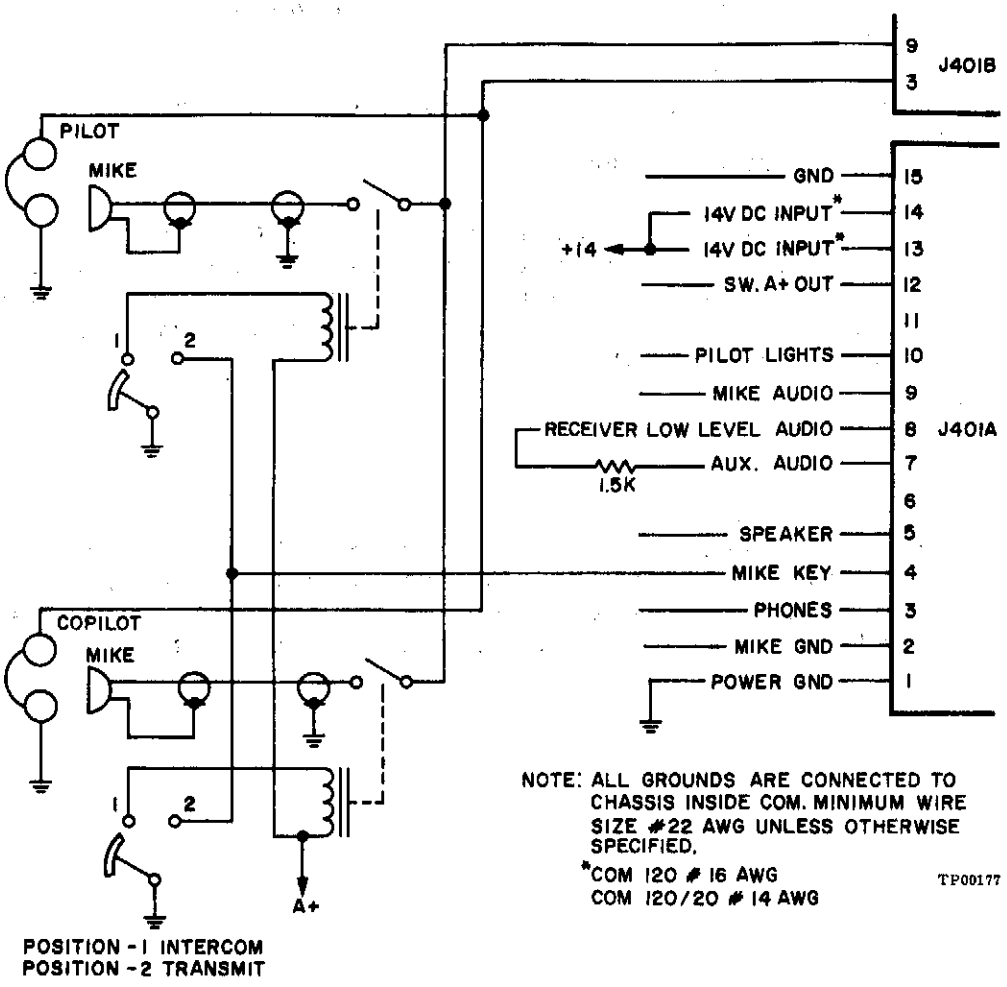


FIGURE 2-14. BASIC COM UNIT HELICOPTER INTERCOM WIRING

2.4.8 Helicopter External Wiring

For helicopter installations, the COM Unit has an alternate high audio output capability which facilitates the use of an intercom system. To obtain this higher audio output, connector J401B must be installed along with connector J401A on the rear of the COM Unit. Figure 2-14 presents a basic helicopter intercom system. Where systems of greater complexity are involved, the 4 ohm output impedance of J401B pin 3 should be taken into consideration.

The switching system shown in Figure 2-15 is for an intercom system that uses a two position switch which grounds a wire in the 1st position and grounds both 1 and 2 in the 2nd position.

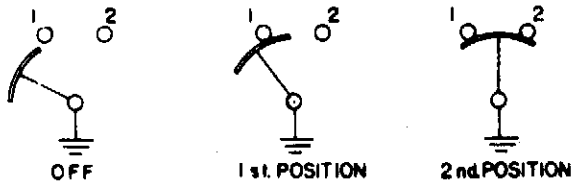


FIGURE 2-15. TYPICAL STICK CONTROL SWITCH

2.5 POST INSTALLATION TESTS

To certify the installation FAA Form 337 must be completed. In addition, weight and balance or any operating limitations must be entered into the aircraft logbook. Refer to the current Federal Aviation Regulations for any additional requirements. Equipment weight and power requirements are listed in Section 1.4.

2.5.1 Pre Flight Test

2.5.1.1 General

With the aircraft engines, aircraft equipment, and other on board electronic equipment operating, transmit and receive on several different frequencies. There should be no excessive interference and intelligible two-way communications should be demonstrated.

2.5.1.2 Tone Control Adjustment (See Com 120 Notice on page 2-1)

A. Com 120

Not Applicable

B. Com 120 (ACGBF and later) and Com 120/20

These Coms are shipped with the base and treble controls set to provide a balanced audio response which, in most installations, will provide the best overall listening quality and intelligibility. Since these controls will affect both receive audio and the microphone audio modulating the transmitter, their adjustment must be very carefully accomplished. Do not attempt to use these controls to compensate for a poor quality microphone or speaker.

To set the tone controls:

1. Listen to a variety of communications to determine how the audio response should be changed (i.e., more base, less treble, etc.).
2. Remove unit from instrument panel.
3. Peel forward the tape on the Com's top dust cover to expose the base and treble control's access holes.

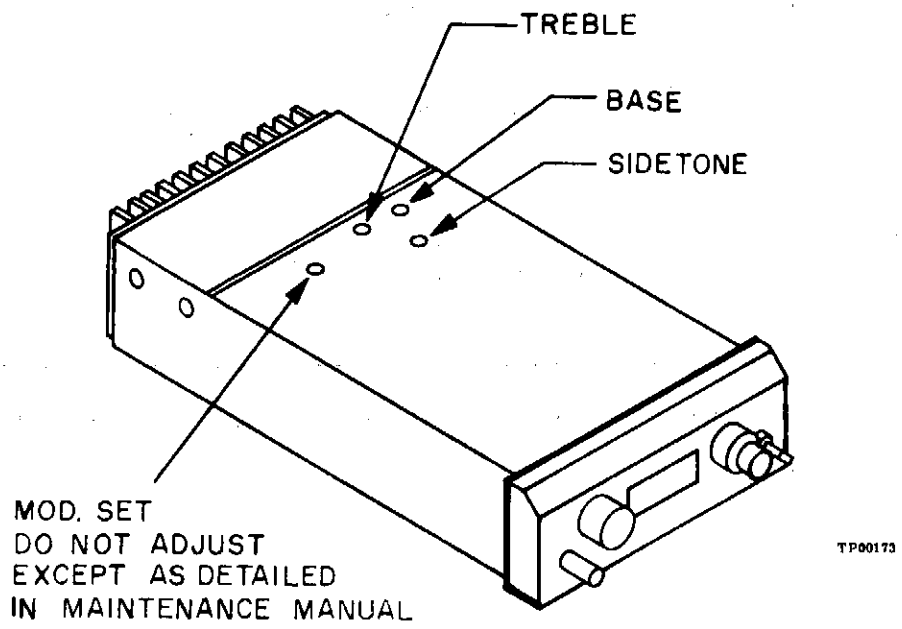


FIGURE 2-16. TONE CONTROL LOCATION

2.5.1.2 Continued

4. Insert a small straight blade screwdriver (blade width 3/32" max., thickness 1/64" max.) through the appropriate opening and rotate the screwdriver clockwise to boost either base or treble, or counterclockwise to cut either base or treble.
5. Install unit and if necessary, repeat steps 2 through 4.
6. Communicate with the tower or unicom and request an appraisal of the transmitted audio quality.

2.5.2 Flight Test

After installation of the COM Unit a flight test should be performed to check the antenna pattern and system compatibility.

a. Flying at an altitude of 6000 feet establish two-way communications with a ground station facility at least 50 NM away.
b. With the aircraft flying at 6000 feet in right and left banks (up to 10^{O}) at 10 of 12 equally spaced headings establish two-way communication with a ground station at least 50 NM away.
c. At an altitude of 6000 feet and at a distance of 20 NM from the ground facility, fly directly toward the facility and for 20 NM beyond.
d. At a distance of 10 NM from the ground station put the landing gear and the aircraft in the approach configuration.

2.6 AIRCRAFT LICENSE REQUIREMENTS

These Units, as installed in the aircraft, require an Aircraft Radio Station License. This license may be obtained by filing FCC form 404. The unit may be operated for up to 30 days after filing the FCC form 404 providing a copy of the FCC form 404 is kept in the aircraft.

This equipment has been type accepted by the FCC and entered in their list of type accepted equipments as "NARCO COM 120 TSO" or "NARCO COM 120/20 TSO" as applicable.

CAUTION

The VHF transmitter contained in this equipment is guaranteed to meet FCC approval only when Narco Crystals are used. The use of other than Narco Crystals will void the manufacturer's warranty.