TM 11-6110-211-15

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

ORGANIZATIONAL, DIRECT SUPPORT, GENERAL SUPPORT AND DEPOT MAINTENANCE MANUAL

INCLUDING REPAIR PARTS AND SPECIAL TOOL LISTS

AMPLIFIER, ELECTRONIC CONTROL AM-3209/ASN

This copy is a reprint which includes current pages from Change 1.

HEADQUARTERS, DEPARTMENT OF THE ARMY
OCTOBER 1965

CAUTION

Before using any ohmmeter to test transistors or transistor circuits, check the open-circuit, voltage across the ohmmeter test leads. To prevent damage to the transistors because of excessive current drain, do not use the ohmmeter if the open-circuit voltage exceeds 1.5 volts. Also, since the Rx1 range normally connects the ohmmeter internal battery directly across the test leads, the comparatively high current (50 milliamperes or more) may damage the transistor under test. As a general rule, it is not recommended that the Rx1 range of any ohmmeter be used when testing transistors.

CHANGE
No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON D. C., 9 *June 1972*

Organizational Direct Support, General Support and Depot Maintenance Manual Including Repair Parts and Special Tool Lists

AMPLIFIER, ELECTRONIC CONTROL AM-3209/ASN

TM 11-6110-211-15, 27 October 1965, is changed as follows:

1. New or changed material is indicated by a vertical bar.

2. Remove old pages and insert new pages as indicated below.

Remove pages	*Insert pages*
i and ii	i and ii
. . . . .	4-1 through 4-7
AII-1 and AII-2	

3. File this change sheet in the front of the manual for reference purposes.

By Order of the Secretary of the Army:

W. C. WESTMORELAND,
General, United States Army,
Chief of Staff.

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The Adjutant General.

Distribution:

To be distributed in accordance with DA Form 12-36, Section I, (qty rqr block no. 1) organizational maintenance requirements for AM/3209/ASN.

TECHNICAL MANUAL
No. 11-6110-211-15

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., 27 *October 1965*

Organizational Direct Support, General Support and Depot Maintenance Manual Including Repair Parts and Special Tool Lists

AMPLIFIER, ELECTRONIC CONTROL AM-3209/ASN

			Paragraph	Page
CHAPTER 1.		INTRODUCTION		
Section I.		General		
		Scope	1-1	1-1
		Index of publications	1-2	1-2
		Forms and records	1-3	1-2
	II.	Description and Data		
		Purpose and use	1-4	1-2
		Technical characteristics	1-5	1-2
		Description	1-6	1-2
CHAPTER 2.		FUNCTIONING		
		General	2-1	2-1
		System application	2-2	2-1
		Block diagram analysis	2-3	2-1
		Push-pull voltage amplifier Q201 and Q202	2-4	2-1
		Push-pull power amplifier Q203 and Q204	2-5	2-3
		Power supply	2-6	2-3
CHAPTER 3.		TROUBLESHOOTING AND REPAIR		
Section I.		General Procedures		
		General	3-1	3-1
		General troubleshooting instructions	3-2	3-1
	II.	Troubleshooting Information		
		Troubleshooting procedures	3-3	3-1
		Test equipment required	3-4	3-2
		Troubleshooting	3-5	3-2
		Voltage and resistance measurements	3-6	3-3
		Additional troubleshooting data	3-7	3-3
		Testing.	3-8	3-3
	III.	Repairs		

CHAPTER 3. TROUBLESHOOTING AND REPAIR
Section III. -- Continued.

	Paragraph	*Page*
General parts replacement techniques	3-9	3-6
Servicing procedures.	3-10	3-6
Disassembly of AM-3209/ASN	3-11	3-6
Reassembly of AM-3209/ASN	3-12	3-7
CHAPTER 4. DEPOT OVERHAUL STANDARDS		
Purpose of final testing.	4-1	
Test facilities required	4-2	
Test requirements for AM-3209/ASN using the AM-3209/ASN test panel	4-3	
General test requirements for the AM-3209/ASN, without using AM-3209/ ASN test panel.	4-4	
APPENDIX I. REFERENCES	.....	AI-1
II. BASIC ISSUE ITEMS LIST	.....	Deleted
III. MAINTENANCE ALLOCATION	.....	AIII-1
IV. DIRECT AND GENERAL SUPPORT, AND DEPOT REPAIR PARTS LIST)	.....	AIV-1

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope

This manual contains instructions for organizational, direct and general support, and depot maintenance for Amplifier, Electronic Control AM-3209/ASN (fig. 1-1). It includes instructions appropriate to direct and general support and depot maintenance for troubleshooting, testing, repairing the equipment, and replacing maintenance parts. It also lists tools, materials, and test equipment required for maintenance. The manual also includes direct and general support and depot maintenance repair parts and special tool lists (appx IV).

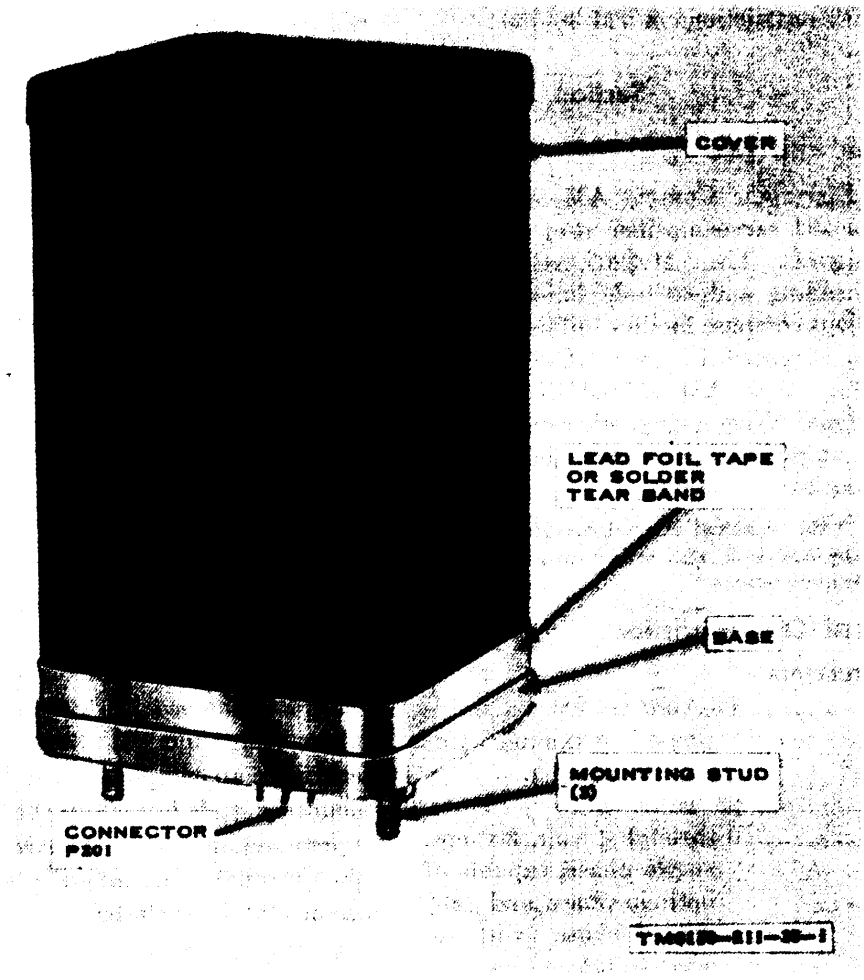


Figure 1-1. Amplifier, Electronic Control AM-3209/ASN.

1-2. Index of Publications

Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment. DA Pam 310-4 is an index of current technical manuals, technical bulletins, supply manuals (types 7, 8, and 9), supply bulletins, lubrication orders, and modification work orders that are available through publications supply channels. The index lists the individual parts (-10, -20, -35P, etc.) and the latest changes to and revisions of each equipment publication.

1-3. Forms and Records

a. Reports of Maintenance and Unsatisfactoy Equipment. Use equipment forms and records in accordance with instructions in TM 38-750.

b. Report of Damaged or Improper Shipment. Fill out and forward DD Form 6 (Report of Damaged or Improper Shipment) as prescribed in AR 700-58 (Army), NAVSANDA Publication 378 (Navy), and AFR 71-4 (Air Force).

c. *Reporting of Equipment Manual Improvements.* The direct reporting by the individual user, of errors, omissions, and recommendations for improving this equipment manual, is authorized and encouraged. DA Form 2028 (Recommended Changes to DA Publications) will be used for reporting these improvements. This form will be completed using pencil, pen, or typewriter and forwarded direct to Commanding General, U.S. Army Electronics Command, ATTN: AMSEL-MR-(NMP)-MA, Fort Monmouth, N.J., 07703.

Section II. DESCRIPTION AND DATA

1-4. Purpose and Use

Amplifier, Electronic Control AM-3209/ASN is a transistorized servoamplifier that amplifies servocontrol signals. The AM-3209/ASN is used to drive the heading and attitude functions displayed on various compass facility indicators (Indicator, Radio Magnetic Compass ID-998/ASN, or equivalent). The AM-3209/ASN receives servocontrol signals from a magnetic compass system indicator, amplifies these control signals, and applies them back to the indicator.

Note. Refer to the technical manual covering the aircraft in which the AM-3209/ASN is installed for details regarding specific applications,

1-5. Technical Characteristics

Volt age requirements:

Input _____	115 volts ac, 400 cps, single phase; maximum line current 210 ma.
Power _____	23 watts.
Input signal ---------	0 through 1 volt, 300 cps, single phase, capable of both in-phase and 180° out of phase (with respect to 115 ac line).
	Note. The signal source must be isolated from power ground for reversing purposes.
Output signal _____	50 mv to 1 volt, depending on input voltage.
Flag output voltage--	0.45 to 0.80 volt dc across 1,000-ohm load.
Fixed field output voltage.	26 volts, 400 cps, + 90° across servo load.

1-6. Description

a. The AM-3209/ASN (fig. 1-1) is a moisture-sealed, plug-in component. The internal components, transformers, fixed capacitors and resistors, germanium transistors, silicon diodes, and a thermistor are mounted on a circuit board (fig. 3-5 and 3-6) and protected by a snug-fitting cover (fig. 1-1). The cover (fig. 1-1) slides over the internal amplifier assembly circuit board and is secured to the base with either lead foil tape or a solder tear band seal. The AM-3209/ASN is secured to an equipment rack with three threaded mounting studs located on the base. All electrical inputs and outputs to the AM-3209/ASN are applied through a hermetically sealed electrical connector (P201) on the base.

b. The AM-3209/ASN is 4 1/8 inches long, 2 1/6 inches wide, and 2 5/32 inches high. The AM-3209/ASN weighs approximately 1 pound, is transistorized, and has a self-contained power supply.

CHAPTER 2

FUNCTIONING

2-1. General

The purpose, operation, and interoperation of the various electrical circuits of the AM-3209/ ASN are explained in this chapter. Familiarity with the equipment, how it works, and why it works that way are valuable tools in troubleshooting the equipment.

2-2. System Application

a. The AM-3209/ASN amplifies control signals from a navigation indicator to drive the navigation indicator directional mask, heading dial, or sphere, depending on the navigation indicator used. The amplified signal output is applied from the AM-3209/ASN to a motor-generator in the navigation indicator which, through gearing, drives the navigation indicator mask, dial, or sphere.

b. The AM-3209/ASN provides a corect-current (dc) voltage and two alternating-current (ac) voltages. The dc voltage may be used to drive the navigation indicator warning flag. The two ac voltages are used as fixed field voltages for the navigation indicator motor-generator.

2-3. Block Diagram Analysis

(fig. 2-1)

a. Primary Power. Primary power (115 volts, 400 cycles per second (cps)) is applied from the aircraft power distribution system to power transformer T202. The output of power transformer T202 drives a full-wave rectifier circuit consisting of diodes CR201 and CR202. The full-wave rectifier power supply provides voltages (22 and 27 volts) for operation of push-pull voltage amplifier Q201 and Q202 and push-pull power amplifier Q203 and Q204. In addition, the full-wave rectifier power supply provides a flag voltage to operate the flag alarm circuit in the associated navigation indicator. Transformer T202 also applies 26 volts ac to the navigation indicator generator fixed field winding and 115 volts ac, through phase-shift capacitor C204, to the navigation indicator motor fixed field winding.

b. Push-Pull Voltage and Power Amplifiers. Two inputs are applied to the amplifiers through calibrating resistors R201, R202, and R203. One input is the 400-cycle input voltage from the navigation indicator servo-synchro; the other is a 400-cycle feedback voltage from the navigation indicator motor-generator. Calibrating resistors R201, R202, R203 match the AM-3209/ASN to the various navigation indicators with which the AM-3209/ASN maybe used. The input and feedback voltages, applied from the calibrating resistors to transformer T201A, are out of phase and are added algebraically in transformer T201A. The algebraic sum of the input and feedback voltages is applied to push-pull voltage amplifier Q201 and Q202. The output of push-pull voltage amplifier Q201 and Q202 is applied to the input of push-pull power amplifier Q203 and Q204 The output from push-pull power amplifier Q203 and Q204 is applied to the control field of the navigation indicator motor-generator to drive the motor-generator. The direction of rotation for the motor-generator is dependent upon the output polarity of the voltage from push-pull power amplifier Q203 and Q204.

2-4. Push-Pull Voltage Amplifier Q201 and Q202

(fig. 2-2)

Input and feedback voltages (400~) from the navigation indicator are applied, as appropriate, through terminals 1, 3, 4, and 5 of P201, and through calibrating resistors R201, R202, and R203 to transformer T201A. The feedback voltage prevents excessive rapid rotation of the motor-generator rotor. The ground return of the primary winding of transformer T201A is completed through pin 6 of connector P201. The voltage developed across the secondary of transformer T201A is applied to the bases of push-pull voltage amplifier Q201 and Q202. A center tap on the secondary winding of transformer T201A assures that equal but opposite voltages are applied to Q201 and Q202. Forward bias to the emitters of

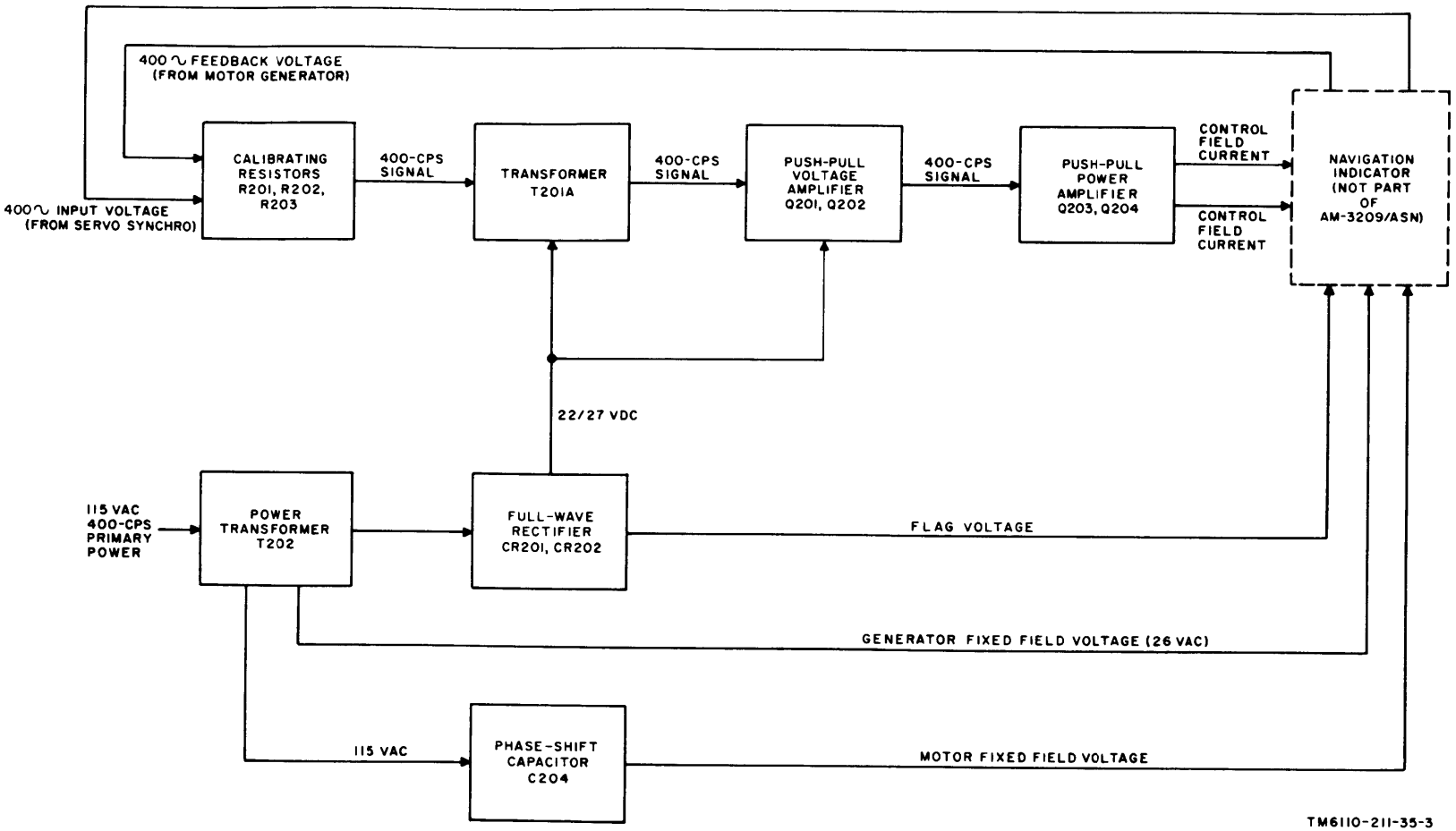


Figure 2-1. Amplifier, Electronic Control AM-3209/ASN, block diagram.

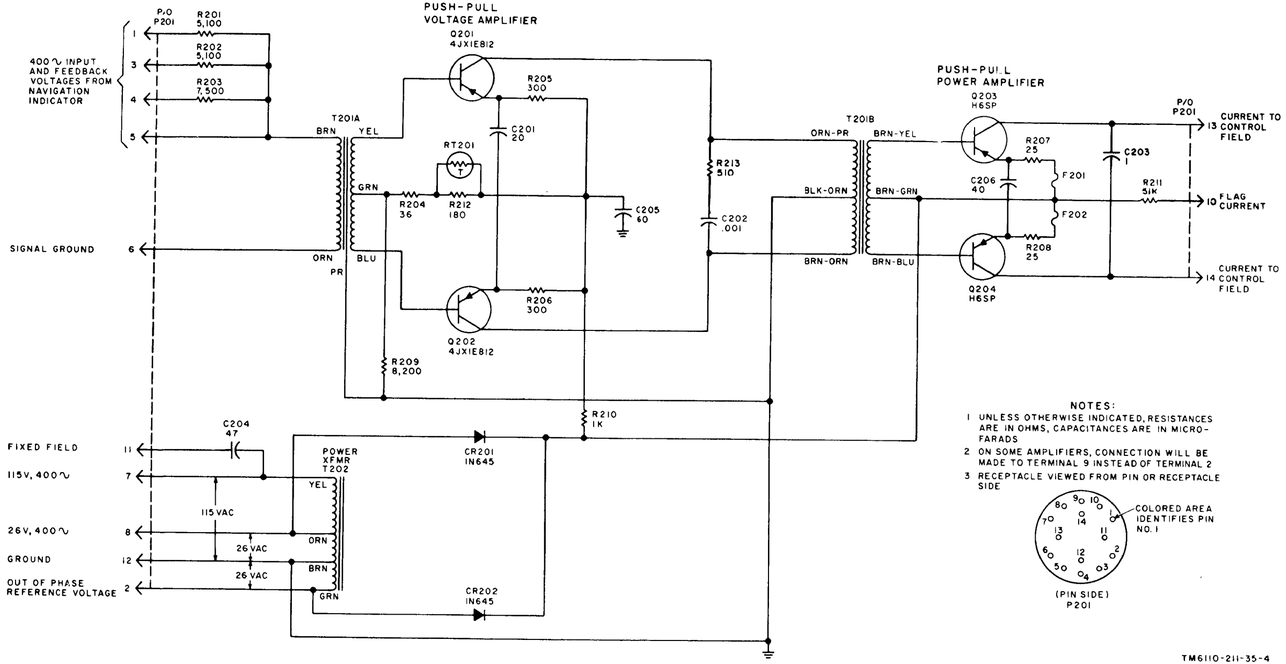


Figure 2-2 Amplifier, Electronic Control AM-3209/ASN, schematic diagram.

push-pull voltage amplifier Q201 and Q202 is provided by the voltage developed across mister R204 and the parallel arrangement of resistor R212 and thermistor RT201 (a negative temperature coefficient resistor which keeps the bias constant under varying temperature conditions). Resistors R209 and R204 and the parallel arrangement of resistor R212 and thermistor RT201 form a voltage divider network across power supply output filter capacitor C205. The voltage divider network provides the base-emitter bias voltage for Q201 and Q202. Resistors R205 and R206, in the emitter circuits, provide for dc bias and stability and prevent transistor thermal runaway. The output of push-pull voltage amplifier Q201 and Q202 is applied through coupling transformer T201B to push-pull power amplifier Q203 and Q204. The primary of transformer T201B is tuned to 400 cycles by capacitor C202 in series with resistor R213.

2-5. Push-Pull Power Amplifier Q203 and Q204

(fig. 2-2)

The output of coupling transformer T201B is applied to the bases of transistors Q203 and Q204, which form a push-pull power amplifier circuit. A center tap on the secondary winding of transformer T201B assures equal and opposite voltages and provides forward bias to the emitters of transistors Q203 and Q204. Operating bias for transistor Q203 is applied through resistor R207 and fuse F201. Operating bias for transistor Q204 is applied through resistor R208 and fuse F202. Resistors R207 and R208 and fuses F201 and F202 are in parallel with bypass capacitor C206. The output of push-pull power amplifier Q203 and Q204 is taken from the collectors and is applied through pins 13 and 14 of connector P201 to the motor control field of the motor-generator in the navigation indicator. The dc ground return for transistors Q203 and Q204 is through the control field of the navigation indicator motor-generator via terminals 13 and 14 of P201. Capacitor C203 is connected in parallel with the collectors and the output (control field of the motor) to present a nonreactive load to the push-pull power amplifier. Fuses F201 and F202 provide overload protection for transistors Q203 and Q204.

2-6. Power Supply

(fig. 2-2)

Ac power (115-volt, 400-cps) from the aircraft power supply is applied to the input section of power transformer T202 through pins 7 and 12 of connector P201. The ac voltage is also fed from pin 7 of connector P201 through phase-shifting capacitor C204 and pin 11 of connector P201 to the fixed field of the navigation indicator motor-generator. A tap on power transformer T202 supplies 26 volts ac, 400 cps, at 0° reference phase through pin 8 of connector P201 to energize the fixed field of the navigation indicator motor-generator. Full-wave rectification is accomplished by diodes CR201 and CR202. Resistor R210 and capacitor C205 filter the output of the full-wave rectifier. Unfiltered 27 volts dc from the junction of CR201 and R210 is applied as operating voltage for the push-pull power amplifier. The unfiltered 27 volts dc is also applied through dropping resistor R211 and pin 10 of connector P201 as flag current to control a warning flag in the navigation indicator. Filtered 22 volts dc from the junction of R210 and C205 is applied as operating and bias voltage for the push-pull voltage amplifier.

CHAPTER 3

TROUBLESHOOTING AND REPAIR

Section I. GENERAL PROCEDURES

3-1. General

The organizational and direct and general support maintenance procedures in this manual supplement the troubleshooting procedure described in the technical manuals covering the aircraft in which the AM-3209/ASN is installed. The systematic troubleshooting procedure, which begins with the system and sectionalization checks that can be performed in the aircraft, is carried to a higher level in this manual. Troubleshooting and repair instructions contained within this manual are limited to the AM-3209/ASN; instructions relative to the application of the AM-3209/ASN in a complete navigation system will be found in the technical manual covering the aircraft in which the AM-3209/ASN is installed.

3-2. General Troubleshooting Instructions

General instructions arranged to reduce unnecessary work arid to aid in tracing trouble to a defective component are given below.

a. Visual. Inspection. The purpose of visual inspection is to locate faults without testing or measuring circuits. All voltage and resistance readings should be observed. A thorough and searching visual inspection of the internal components should also be made to detect failures.

b. Voltage Measurements. This equipment is transistorized. When measuring voltages, use tape or sleeving (spaghetti) to insulate the entire test prod, except for the extreme tip. A momentary short circuit can ruin the transistor. Use the same or equivalent electronic voltmeter specified in paragraph 3-4 and on the voltage and resistance diagrams (fig. 3-1 and 3-2).

c. Resistance Measurements. Make resistance measurements in this equipment only as directed on the voltage and resistance diagrams (fig. 3-1 and 3-2). Use the ohmmeter range specified on the diagrams, otherwise, the indications obtained will be inaccurate.

Caution: **Before using any ohmmeter to test transistors or transistor circuits, check the open-circuit voltage across the ohmmeter test leads. To prevent damage to the transistors because of excessive current drain, do not use the ohmmeter if the open-circuit voltage exceeds 1.5 volts. Also, since the Rx1 range normally connects the ohmmeter internal battery directly across the test leads, the comparatively high current (50 milliamperes (ma) or more) may damage the transistor under test. As a general rule, it is not recommended that the Rx1 range of any ohmmeter be used when testing transistors.**

d. Intermittent Troubles. In all of the tests, the possibility of intermittent troubles should not be overlooked. If present, this type of trouble often may be made to appear by tapping or jarring the AM-3209/ASN. Make a visual inspection of the wiring and connections at the base of the circuit boards and connector. Minute cracks in the circuit board can cause intermittent operation. A magnifying glass is often useful in locating defects in printed boards. Continuity measurements of printed conductors may be made by the use of the same technique ordinarily used on hidden conventional wiring; observe ohmmeter precautions discussed in c above.

e. Resistor and Capacitor Color Code Diagrams. The resistor and capacitor color code diagrams (fig. 3-7 and 3-8) aid maintenance personnel in determining the value, voltage rating, and tolerance of capacitors and resistors.

Section II. TROUBLESHOOTING INFORMATION

3-3. Troubleshooting Procedures

Operation failure and malfunctioning of the AM-3209/ASN are listed in the troubleshooting chart (para. 3-5). The information provided in the troubleshooting chart is based on the symptoms obtained when the AM-3209/ASN is connected into a complete servo loop system consisting of a signal source and the motor-generator and warn-

ing flag of an operable navigation indicator (ID-998/ASN, or equivalent). When using the troubleshooting chart, refer to the parts location diagrams (fig. 34, 3-5, and 3-6) and the overall schematic diagram (fig. 2-2).

3-4. Test Equipment Required

The following chart lists the test equipment required for troubleshooting the AM-3209/ASN. Also included are the associated technical manuals and assigned common names.

Test equipment	Technical manual	Common name
Voltmeter, Electronic ME–30B/U.	TM 11–6625–320–12.	Electronic voltmeter.
Multimeter TS–352(*)/U[a]	TM 11–5527	Multimeter.
Audio Oscillator TS–382(*)/U.[b]	TM 11–6625–261–12.	Signal generator.
Test Set, Transistor TS–1100/U.	TM 11–6625–343–15.	Transistor tester.

[a] Represents TS–352/U, TS–352A/U, and TS–352B/U.
[b] Represents TS–382/U, TS–382A/U, TS–382B/U, TS–382D/U, TS–382E/U, and TS–382F/U.

3-5. Troubleshooting

a. Gerund. Procedures are outlined in the following chart for localizing troubles within the various sections of the AM-3209/ASN. Parts location is indicated in figures 34, 3-5, and 3-6. Depending on the nature of the operational symptoms, one or more of the localizing procedures will be necessary.

b. *Use of Chart.* The troubleshooting chart is designed to supplement the operational and maintenance checks detailed in the electronic configuration manual covering the aircraft in which the AM-3209/ASN is installed. The information contained within the chart is based on symptoms obtained when the AM-3209/ASN is connected into a complete servo-loop system consisting of a signal source and the motor-generator and warning flag circuit of an operable navigation indicator (ID-998/ASN, or equivalent).

c. Troubleshooting Chart.

Symptom	Probable cause	Corrective action
Speed of motor-generator (in navigation indicator) is not constant or is too slow.	Open calibrating resistor R201, R202, or R203,	Check resistor values; replace faulty resistor.
Motor-generator inoperative due to lack of control f eld voltage. (No output at terminals 13 and 14 of connector P201.)	Open resistor R210 ____	Check for approximately 25 volts dc at junction of resistor R210 and capacitor C205. Troubleshoot power supply.
	Open winding on transformer T201A.	Check dc resistance of transformer windings (para. 3-7); replace defective transformer.
	Defective component in push-pull voltage amplifier.	Check resistors R204, R205, R206, and R212. Check voltages and resistances of transistors Q201 and Q202 (fig. 3-1 and 3-2). Check bypass capacitor C201 and resonant capacitor C202 for open or short circuit. Replace defective component.
	Open winding in transformer T201 B.	Check dc resistance of transformer windings (para. 3-7); replace defective transformer.
	Defective component in push-pull power amplifier.	Check resistors R207 and R208. Check fuses F201 and F202. Check voltages and resistances of transistors Q203 and Q204. Check bypass capacitor C206 and load capacitor C203 for open or short circuit. Replace defective component.
Warning flag circuit inoperative. (No dc output at terminal 10 of connector P201.)	Faulty power supply circuit.	Check resistor R211; check diodes CR201 and CR202; check dc resistance of windings of power transformer T202 (para. 3-7); check filter capacitor C205 for short circuit. Replace defective component.
No 26-volt ac at excitation winding of generator of navigation indicator motor-generator. (No ac output at terminal 8 of connector P201.)	Open winding in power transformer T202.	Check dc resistance of power transformer T202 (para. 3-7). Replace defective power transformer.

c. Troubleshooting Chart—Continued

Symptom	Probable cause	Corrective action
No 26-volt ac at fixed field of motor of navigation indicator motor-generator. (No output at terminal 11 of connector P201.)	Shorted winding in power transformer T202. Shorted or open capacitor C204.	Check dc resistances of power transformer T202 (para. 3-7). Replace defective power transformer. Check and, if necessary, replace defective capacitor.

3-6. Voltage and Resistance Measurements

The voltages and resistances at the contacts of each transistor are shown in figures 3-1 and 3-2. Figure 3-1 shows values for the transistor when it is connected in the circuit; figure 3-2 shows values for the circuit when the transistor is removed from the circuit. Voltage measurements shown in figures 3-1 and 3-2 are for AM-3209/ASN with a 0.1-volt, 400-cps input applied to terminals 5 and 6 of connector P201 and 115 ac applied to terminals 7 and 12 of connector P201.

3-7. Additional Troubleshooting Data

The following chart lists the normal dc resistances of the transformer windings in the AM-3209/ASN

Transformer	Measure between wires	Dc resistance (ohms)
T201	Brn and orn	2, 500+ 500
	Grn/pr and blk/brn	500 ±75
	Blk/orn and brn/orn	500 ±75
	Yel and grn	120±24
	Grn and blu	120±24
	Brn/yel and brn/grn	30±4. 5
	Brn/grn and brn/blu	30±4. 5
T202	Yel and orn	48±9. 6
	Orn and brn	8. 5±3.4
	Brn and grn	15±6

3-8. Testing

(fig. 3-3)

Procedures for testing the AM-3209/ASN are given below. The test setup required to test the amplifier is shown in figure 3-3.

a. Signal Requirements. A variable 0- to 1-volt, 400-cps, single-phase signal source (Audio Oscillator TS-382/U, or equivalent) is required. The signal source should be capable of supplying both in-phase and 180° out-of-phase signals, with respect to the 115-volt ac supply, and should be isolated from power ground for reversing purposes.

b. Test Requirements.

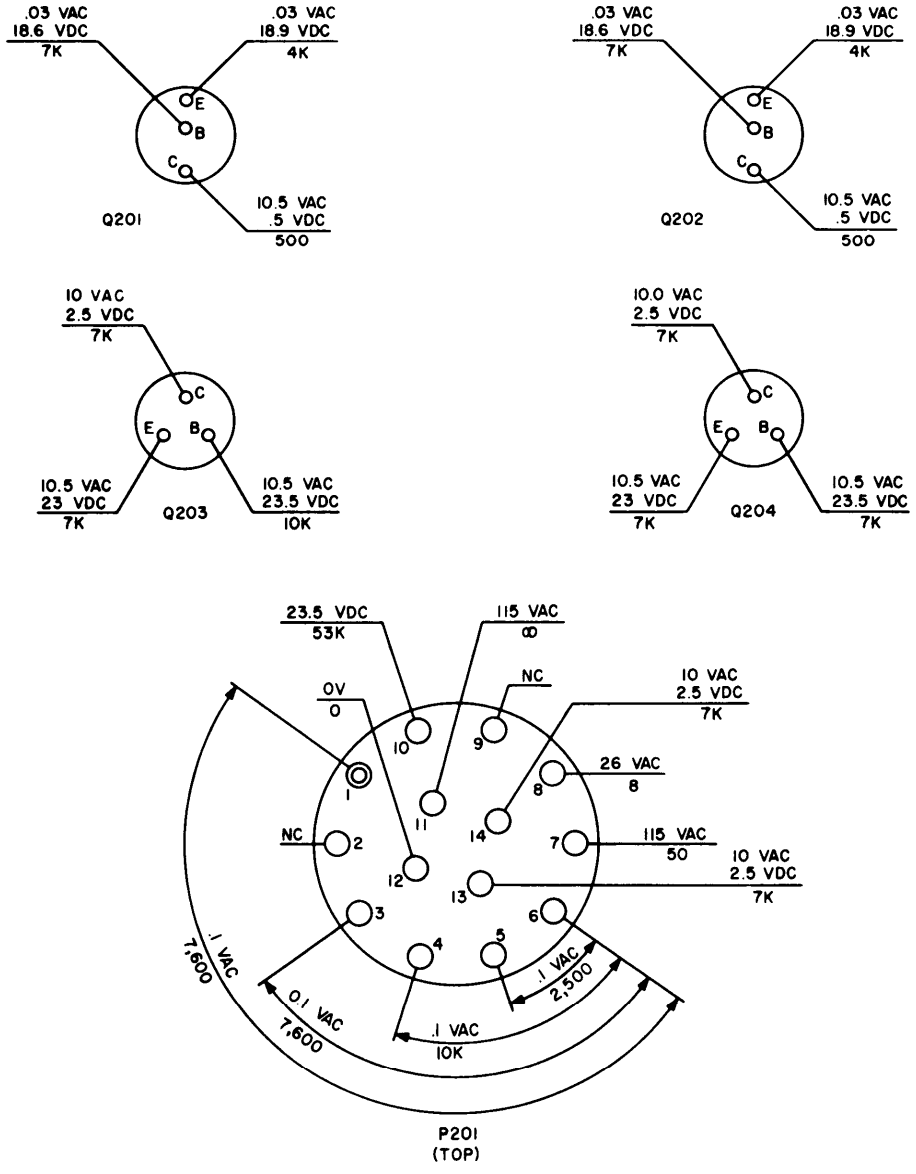
(1) If a pilot's navigation indicator is unavailable, the dummy loads listed in the following chart may be substituted.

Connect between servoamplifier pins	Dc resistance (ohms) of dummy inductance	Inductance (millihenrys)	Replaces
11 and 12	135	31	Fixed field of motor.
13 and 12	90	37	Control field of motor.
14 and 12	90	37	Control field of motor.
8 and 12	190	71	Generator field of excitation.

(2) Connect a jumper wire between terminals A and J of the test terminal board (zero input signal). Voltages at the terminals should be as indicated in the following chart:

Measure between terminals	Multimeter indication (volts ac)
D and I	0 to 0.9
E and I	0 to 0.9
G and I	19 to 31
F and I	19 to 31

(3) Remove the jumper wire between terminals A and J.



NOTES:

1. VOLTAGE READINGS ARE ABOVE LINE, RESISTANCE READINGS BELOW LINE.
2. UNLESS OTHERWISE SHOWN, VOLTAGES AND RESISTANCES ARE MEASURED TO CHASSIS GROUND. DC VOLTAGE READINGS TAKEN WITH 20,000 OHMS-PER-VOLT VOLTMETER. AC VOLTAGE READINGS TAKEN WITH VTVM. ALL VOLTAGE READINGS SHOWN ARE WITH 0.IV, 400CPS INPUT ACROSS 5 AND 6 OF P201.
3. NC INDICATES NO CONNECTION.
4. NEGATIVE SIDE OF OHMMETER SHOULD BE CHASSIS GROUND. OHMMETER OUTPUT VOLTAGE MUST NOT EXCEED 2. VOLTS TO PREVENT TRANSISTOR DAMAGE DUE TO EXCESSIVE CURRENT.
5. TRANSISTORS Q201 AND Q202 ARE SHOWN VIEWED FROM BOTTOM. VOLTAGES AND RESISTANCES SHOWN ARE FOR THE CONDITION WHERE ALL THE TRANSISTORS ARE CONNECTED TO CIRCUIT.
6. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS.

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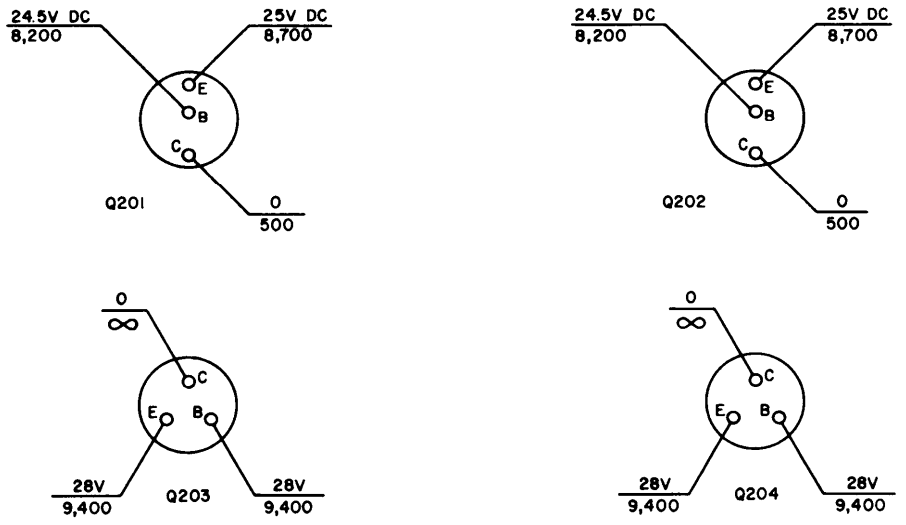
Figure 3-1. Amplifier, Electronic Control AM-3209/ASN voltage and resistance measurements, transistors connected.



NOTES:

1. VOLTAGE AND RESISTANCE MEASUREMENTS ARE SHOWN FOR EXTERNAL CIRCUIT POINTS WHICH ARE NORMALLY CONNECTED TO THE TRANSISTORS BUT WITH ALL TRANSISTORS REMOVED FROM CIRCUIT.
2. VOLTAGE READINGS ARE ABOVE LINE, RESISTANCE READINGS BELOW LINE. READINGS MEASURED TO GROUND. VOLTAGE READINGS WITH 20,000 OHMS-PER-VOLT METER.
3. RESISTANCES ARE GIVEN IN OHMS.

TM6110-211-35-5

Figure 3-2. Amplifier, Electronic Control AM-3209/ASN voltage and resistance measurements, transistors disconnected

c. Performance Test.

(1) Vary the 400-cps input between terminals A and J to the values shown in the following chart and use the voltmeter to check the output voltages measured between terminals D and E.

400-cps input between terminals A and J (millivolts)	400-cps output between terminals D and E (volts)
50	3 to 18
100	9 to 30
150	14 to 36
300	20 to 39
500	22 to 38
1,000	22 to 39

(2) The minimum direct current between terminals H and I with an input signal of 1 volt should be 0.45 ma.

(3) The maximum line current drawn from the 115-volt power source must not exceed 200 ma during the entire test.

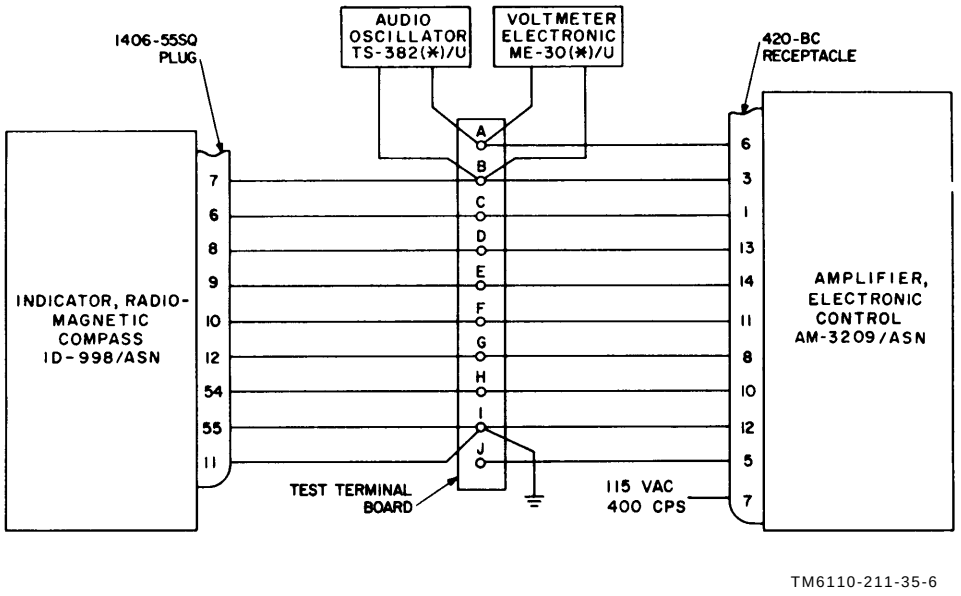


Figure 3-3. Amplifier, Electronic Control AM-3209/ASN, test setup.

Section III. REPAIRS

3-9. General Parts Replacement Techniques

This section contains servicing, disassembly, and reassembly procedures for the AM-3209/ASN. Most of the components can be reached easily and replaced without special procedures. The following general precautions should be observed during repair:

a. Before removing a component of the amplifier, note its position; install the replacement part as close to the same position as possible.

b. Use a pencil-type soldering iron with a 25-watt maximum capacity. If an ac-operated soldering iron is used, use an isolating transformer. Do not use a soldering gun; damaging voltages can be induced in the transistorized circuits.

c. When soldering transistor leads, use a heat sink between the solder joint and the transistor and retain the heat sink until the soldered joint has cooled. Use approximately the same length and dress of transistor leads as used originally.

3-10. Servicing Procedures

a. Clean the AM-3209/ASN as follows:

(1) Remove dust from the amplifier assembly with low-pressure (20 pounds per square inch (psi) maximum) air.

(2) Wash the cover and case assembly with cleaning compound or equivalent.

(3) Remove excess solder flux with a small brush dipped in alcohol.

b. Inspect the servoamplifier as follows:

(1) Examine all wiring for worn insulation; check to see that all soldered connections are intact.

Caution: **Wires are easily broken; avoid bending.**

(2) Examine connector P201 for bent or broken pins.

Caution: **When using a pin straightener to repair bent pins, do not apply a wobbling motion; pull straight up to avoid cracking glass insulation around connector pins.**

(3) Examine all resistors and capacitors for discoloration and blistering.

(4) Check straightness of positioning studs.

(5) Check tightness of mounting clips on main amplifier assembly and subassembly.

3-11. Disassembly of AM-3209/ASN (fig. 3-4)

The disassembly procedures for the AM-3209/ASN given below are required only to perform cleaning, inspection, and troubleshooting.

a. Peel off and discard the lead foil tape (2) that seals the cover and case assembly (1) to the main amplifier assembly (8). (Some units are provided with a solder tear band.)

b. Rock the tightly fitted cover and case assembly (1) to free it from the amplifier subassembly (9).

c. Remove the four flathead screws (3) and cone-shaped lockwashers (4) which secure the amplifier subassembly (9) to the main amplifier assembly (8).

d. Carefully tilt the amplifier subassembly (9) away from the main amplifier assembly (8).

Caution: **Do not allow the amplifier subassembly (9) to hang by the interconnecting leads, because the leads may become damaged.**

e. Disassemble the assemblies only to the extent necessary to unsolder and replace damaged or malfunctioning parts.

Note. To simplify handling while troubleshooting, connect the amplifier subassembly (9) to the main amplifier assembly (8) with two of the four flathead screws (3).

Caution: **When replacing a transistor, diode, or thermistor, avoid overheating the part.**

3-12. Reassembly of AM-3209/ASN (fig. 3-4)

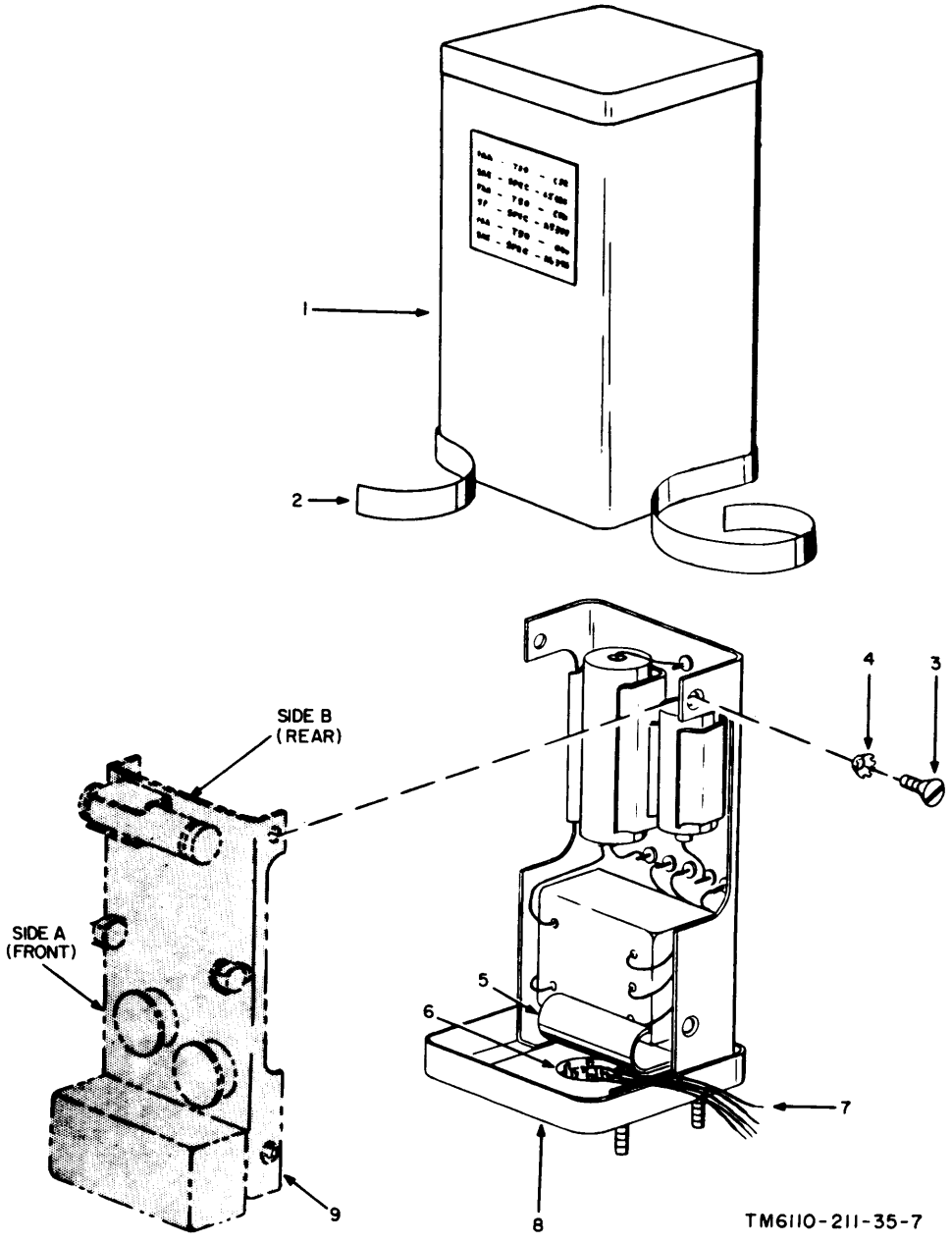
Follow the reassembly procedures for the AM-3209/ASN given below after completion of cleaning, inspection, or troubleshooting.

a. Connect the amplifier subassembly (9) to the main amplifier assembly (8) by replacing the four cone-shaped lockwashers (4) and flathead screws (3).

b. Press the cover and case assembly (1) and the main amplifier assembly (8) together until a firm fit is secured.

c. Cut new lead tape (Minnesota Mining and Manufacturing Co. No. 420 or equivalent) to the proper length.

d. Press the lead foil tape (2) around the junction of the mated cover and case assembly (1) and the main amplifier assembly (8).



1 Cover and case assembly
2 Lead foil tape
3 Flathead screw (4)
4 Lockwasher (4)
5 Electrical insulation sheets
6 14-contact connector
7 Electrical leads
8 Main amplifier assembly
9 Amplifier subassembly

Figure 3-4. Amplifier, Electronic Control AM-3209/ASN, disassembled view.

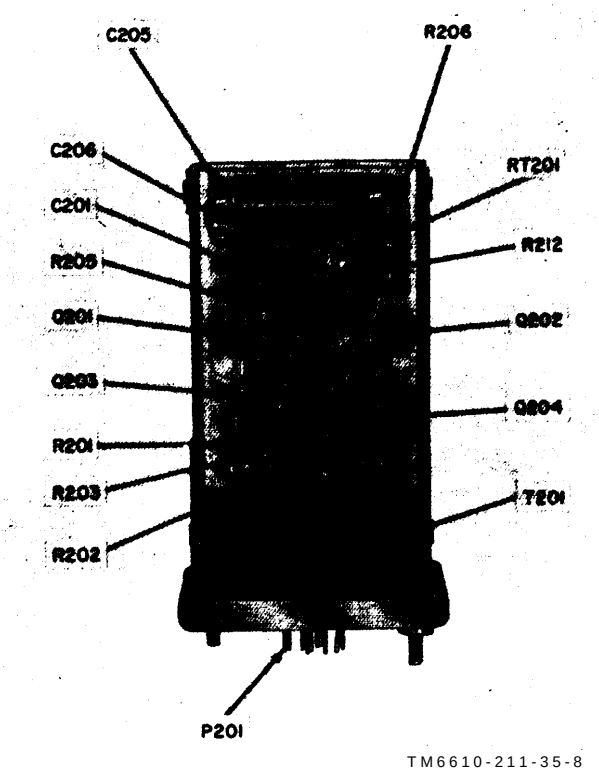


Figure 3-5. Amplifier, Electronic Control AM-3209/ASN, interior front view.

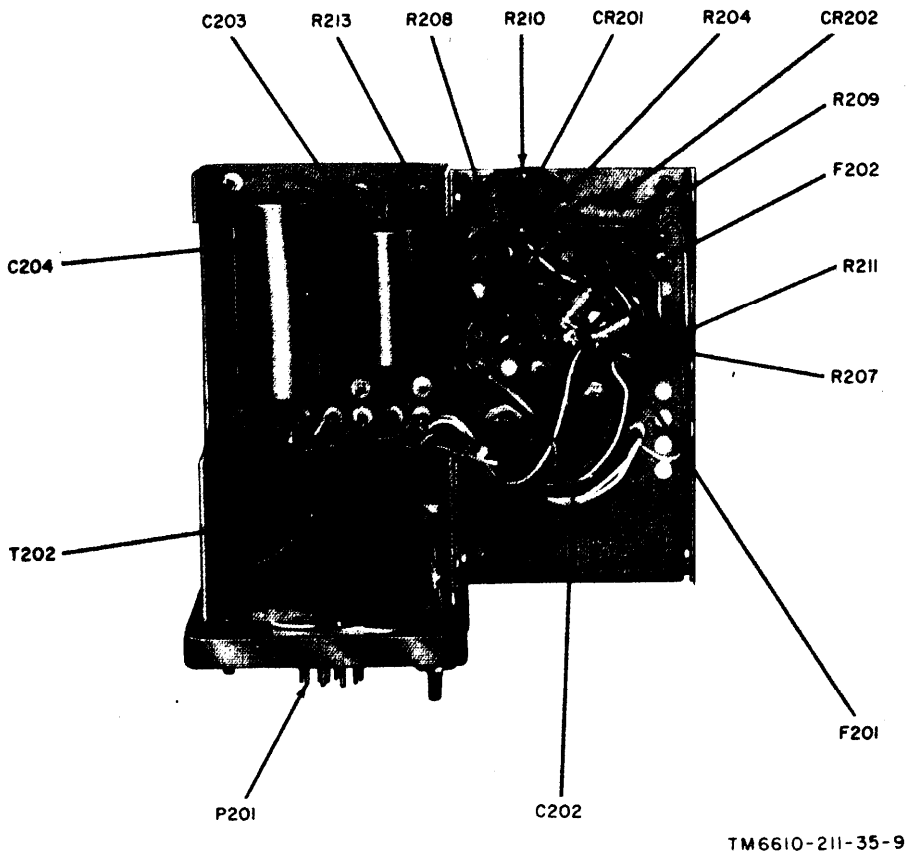
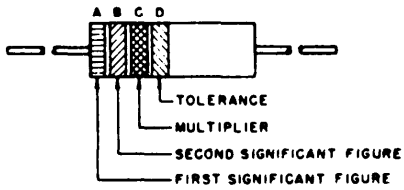


Figure 3-6. Amplifier, Electronic Control AM-3209/ASN, interior rear view.

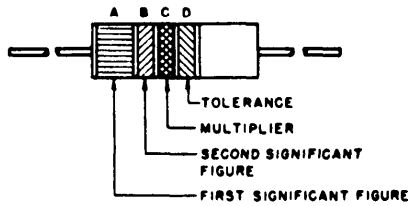
COLOR CODE MARKING FOR MILITARY STANDARD RESISTORS

COMPOSITION-TYPE RESISTORS



BAND A— Equal Width Band Signifies Composition-Type

WIREWOUND-TYPE RESISTORS

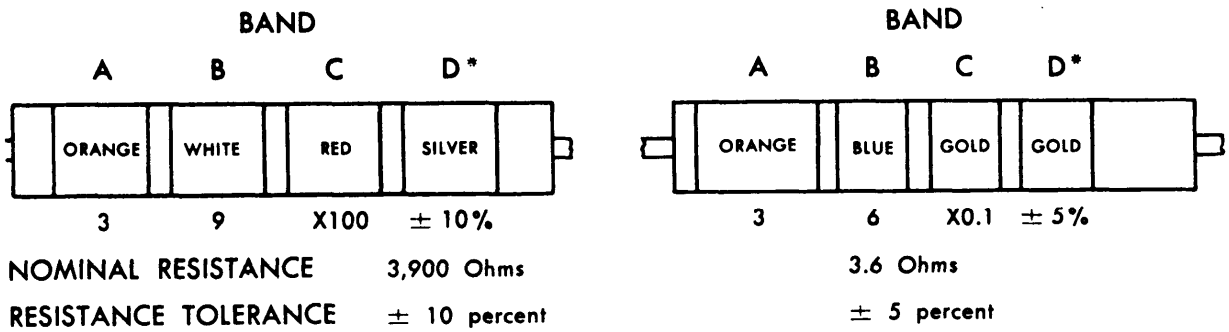


BAND A— Double Width Signifies Wire-wound Resistor

COLOR CODE TABLE

BAND A		BAND B		BAND C		BAND D*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1		
BROWN	1	BROWN	1	BROWN	10		
RED	2	RED	2	RED	100		
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000	SILVER	± 10
GREEN	5	GREEN	5	GREEN	100,000	GOLD	± 5
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	SILVER	0.01		
WHITE	9	WHITE	9	GOLD	0.1		

EXAMPLES OF COLOR CODING

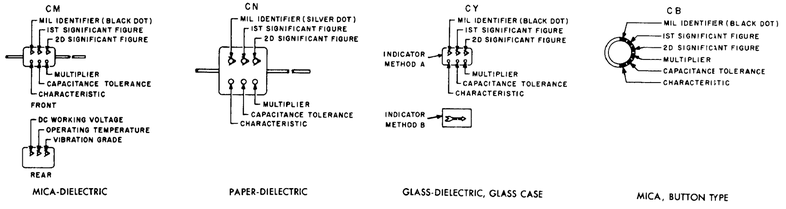


*If Band D is omitted, the resistor tolerance is ±20%, and the resistor is not Mil-Std.

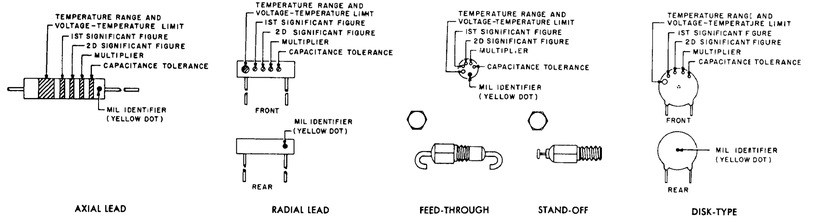
Figure 3-7. Color code marking for MIL-STD resistors.

COLOR CODE MARKING FOR MILITARY STANDARD CAPACITORS

GROUP I Capacitors, Fixed, Various-Dielectrics, Styles CM, CN, CY, and CB



GROUP II Capacitors, Fixed Ceramic-Dielectric (General Purpose) Style CK



GROUP III Capacitors, Fixed, Ceramic-Dielectric (Temperature Compensating) Style CC

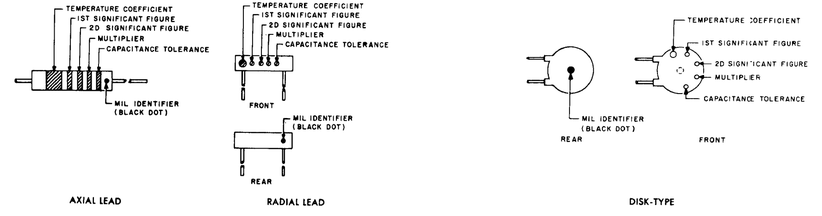


Figure 3-8. Color code marking for MIL-STD capacitors.

COLOR CODE TABLES

TABLE I – For use with Group I, Styles CM, CN, CY and CB

COLOR	MIL ID	1st SIG FIG	2nd SIG FIG	MULTIPLIER[1]	CAPACITANCE TOLERANCE				CHARACTERISTIC[2]				DC WORKING VOLTAGE	OPERATING TEMP. RANGE	VIBRATION GRADE
					CM	CN	CY	CB	CM	CN	CY	CB	CM	CM	CM
BLACK	CM, CY CB	0	0	1			± 20%	± 20%		A				− 55° to + 70°C	10–55 cps
BROWN		1	1	10					B	E		B			
RED		2	2	100	± 2%		± 2%	± 2%	C		C			− 55° to + 85°C	
ORANGE		3	3	1,000		± 30%			D			D	300		
YELLOW		4	4	10,000					E					− 55° to + 125°C	10–2,000 cps
GREEN		5	5		± 5%				F				500		
BLUE		6	6											− 55° to + 150°C	
PURPLE (VIOLET)		7	7												
GREY		8	8												
WHITE		9	9												
GOLD				0.1			± 5%	± 5%							
SILVER	CN				± 10%	± 10%	± 10%	± 10%							

TABLE II – For use with Group II, General Purpose, Style CK

COLOR	TEMP. RANGE AND VOLTAGE – TEMP. LIMITS[3]	1st SIG FIG	2nd SIG FIG	MULTIPLIER[1]	CAPACITANCE TOLERANCE	MIL ID
BLACK		0	0	1	± 20%	
BROWN	AW	1	1	10	± 10%	
RED	AX	2	2	100		
ORANGE	BX	3	3	1,000		
YELLOW	AV	4	4	10,000		CK
GREEN	CZ	5	5			
BLUE	BV	6	6			
PURPLE (VIOLET)		7	7			
GREY		8	8			
WHITE		9	9			
GOLD						
SILVER						

TABLE III – For use with Group III, Temperature Compensating, Style CC

COLOR	TEMPERATURE COEFFICIENT[4]	1st SIG FIG	2nd SIG FIG	MULTIPLIER[1]	CAPACITANCE TOLERANCE		MIL ID
					Capacitances over 10uuf	Capacitances 10uuf or less	
BLACK	0	0	0	1		± 2.0uuf	CC
BROWN	− 30	1	1	10	± 1%		
RED	− 80	2	2	100	± 2%	± 0.25uuf	
ORANGE	− 150	3	3	1,000			
YELLOW	− 220	4	4				
GREEN	− 330	5	5		± 5%	± 0.5uuf	
BLUE	470	6	6				
PURPLE (VIOLET)	− 750	7	7				
GREY		8	8	0.01			
WHITE		9	9	0.1	± 10%		
GOLD	+ 100					± 1.0uuf	
SILVER							

1. The multiplier is the number by which the two significant (SIG) figures are multiplied to obtain the capacitance in uuf.
2. Letters indicate the Characteristics designated in applicable specifications: MIL–C–5, MIL–C–91, MIL–C–11272, and MIL–C–10950 respectively.
3. Letters indicate the temperature range and voltage-temperature limits designated in MIL–C–11015.
4. Temperature coefficient in parts per million per degree centigrade.

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CHAPTER 4

DEPOT OVERHAUL STANDARDS

4-1. Purpose of Final Testing

The tests outlined in this chapter are designed to measure the performance capability of repaired equipment. Equipment that meets the minimum standards stated in the tests will furnish satisfactory operation equivalent to that of new equipment.

4-2. Test Facilities Required

a. Test Equipment. The following equipment, or suitable equivalents, will be employed in determining compliance with the requirements of this manual:

Equipment	Federal stock No.	Qty req'd	Applicable literature
Motor-Tachometer	6105-806-8614	1	
Resistor, Composition, 1000 ohms, 5 percent, 1/2 watt.	5905-195-6806	1	
*Voltmeter ME-30B/U.	.....	2	TM 11-6625-320-12
Transformer, Step Down.	5950-042-6449		
Resistor, Variable, 1000 ohms, 5 percent, 5 watts, 3600-degree rotation.			
*Phase Angle Voltmeter AN/USM-223 (*)/U.	6625-999-7465	1	TM 11-6625-525-12-1
Multimeter ME-26D/U.	6625-913-9781	1	TM 11-6625-200-15
*AM-3209/ASN Test Panel.	.....	1	
*Multimeter TS-352B/U.	6635-553-0142	1	TM 11-6625-366-15
PL55 Phone Plug.	5935-192-4753	1	
Ammeter ME-65/U, ME-65A/U, or ME-156/U.	.....	1	
115.0 ±2.0 volts, 400 ±2 cycle, single-phase source.	.....	1	

*Equipment used when testing with AM-3209/ASN test panel.

b. AM-3209/ASN Test Panel. The following list of parts or suitable equivalents are required to fabricate the AM-3209/ASN test panel.

Symbol	*Parts description list*
F-101	Fuse, 2 amp 3AG
J-116	Connector-Bendix PT02E 14-18S (SR)
P-216	Connector-Bendix PT06W 14-18P
B-101	Motor Generator Bendix FV-110-12-A1
J-201	Relay Socket AMPHENOL type 59-106
M-101	Voltmeter AC 0-50 v Scale Simpson model 1347
M102	Milliammeter DC 0-1 ma Scale Simpson model 1327
TB-101	Terminal Strip CINCH-JONES type 14-140Y
TB-102	Terminal Strip CINCH-JONES type 14-140Y
J-101	Tip Jacks Delux E. F. Johnson
J-115	Red type 1-5-607
S-103	Switch Rotary Centralab type 25-13
R-102	Resistor, Metal Film 200K ±1% IRC type MEC T-O
R-103	Resistor, Metal Film 1 ohm ±1% IRC type MEC T-O
J-120	Jack, Phone H. H. Smith type 275
S-101	Switch Toggle DPST Cutler-Hammer type 7321K2
S-102	Switch Toggle DPDT Off Cntr, Cutler-Hammer type 8820-K10.
T-101	Transformer, Variable Superior type 1HS01UK
T-102	Transformer, Filament HS Triad type HS438
R-101	Rheostat, 100 ohms 4 watt IRC-CTS type 25
	Cabinet Shadow, Bud SB 2142
	Minibox Bud CU-210SA
	Lampholder Dialco Wht 81 0B-435
LM-101	Lamp, Neon NE 59
TP-1	Tip Jack, E. F. Johnson type 105-607 (Blue)
TP-2	Tip Jack, E. F. Johnson type 105-607
TP-2	Tip Jack, E. F. Johnson type 105-607 (Yel)
BP-101	Binding Post, Hex nut Superior DF 30 RC
BP-102	Binding Post, Hex nut Superior DF 30 BC

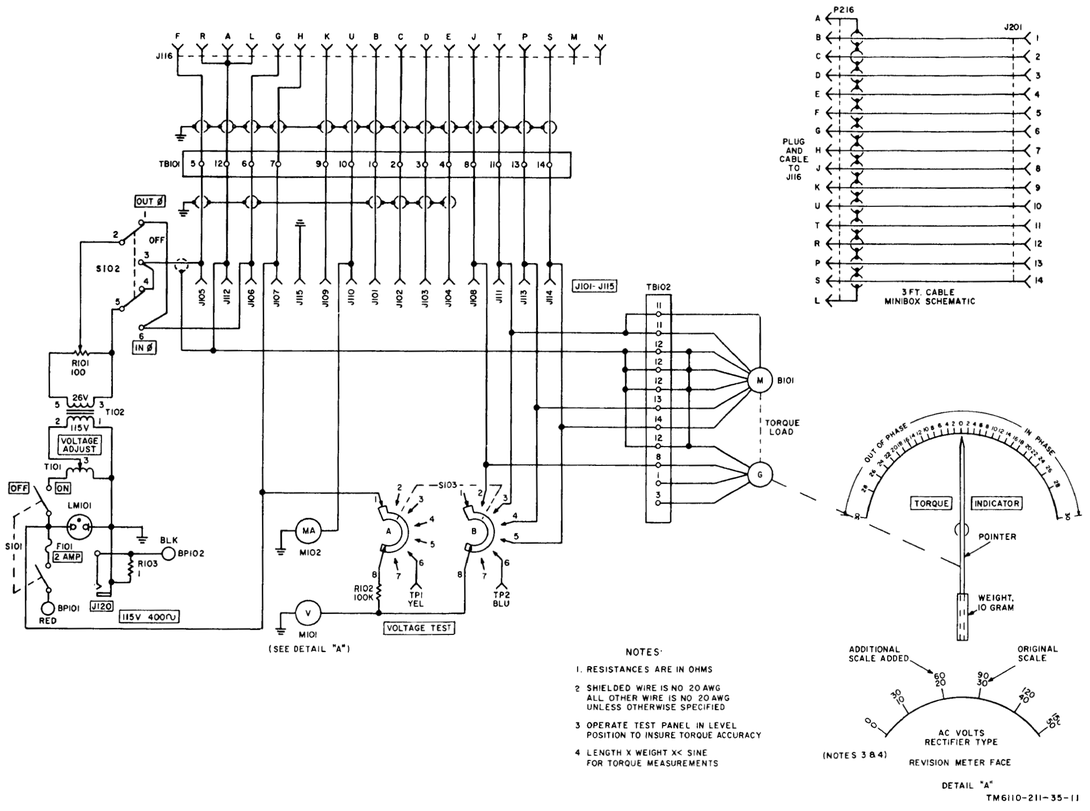

Figure 4-1. Schematic drawing for AM-3209/ASN test panel.

4-3. Test Requirements for AM-3209/ASN Using the AM-3209/ASN Test Panel

a. Resistance Test.

(1) Set test panel switches as follows: S-101 ON-OFF to OFF, S-102 IN 0-OUT 0 to middle position, and S-103 VOLTAGE TEST to 7.

(2) Connect AM-3209/ASN to test panel.

(3) Measure resistance according to the following chart using TS-352B/U.

TS-352B/U connection		*Corresponding pin*	*Resistance*
From —	*To —*		
J103	J106	3 and 6	6K to 9K
J104	J106	4 and 6	8K to 12K
J101	J106	1 and 6	6K to 9K
J105	J106	5 and 6	1K to 3K
J107	J112	7 and 12	35 to 70
J108	J112	8 and 12	2 to 12

B. Zero Signal Voltage Test.

(1) Set S-102 IN O-OUT to IN O.

(2) Rotate T-101 VOLTAGE ADJUST and R-101 POWERSTAT controls fully counterclockwise.

(3) Set S-101 ON-OFF to ON.

(4) Rotate S-103 VOLTAGE TEST and observe ac voltmeter M-101. Voltage readings shall conform to the following chart.

S-103 VOLTAGE TEST switch position	*Measurement*	*M-101 (volts ac)*
1	Line voltage	113 to 117
2	Generator excitation	19 to 31
3	Motor fixed field	19 to 31
4	½ Motor control field	0 to 0.9
5	½ Motor control field	0 to 0.9

c. In-Phase Torque Test.

(1) Connect ME-30B/U No. 1 to J-120 using a PL-55 phone plug (ground side to sleeve).

(2) Connect AN/USM-223 between J-113 and J-114.

(3) Connect ME-30B/U No. 2 between J-105 and J-106 (ground side to J-106).

(4) Set S-102 IN 0-OUT 0 to IN 0.

(5) Rotate AN/USM-223 FUNCTION selector to TOTAL.

(6) Adjust input voltage as shown in the following chart with R-101 POWERSTAT and T-101 VOLTAGE ADJUST. Torque indicator and AN/USM-223 shall indicate as shown*

CAUTION

Do not apply voltage too fast or damage to torque indicator may result.

ME-30B/U No. 2 input reading (millivolts)	*Torque indicator reading (minimum) (gram-centimeters)*	*AN/USM-223 output reading (volts)*
50	1.8	3 to 18
100	4.7	9 to 30
150	7.5	14 to 36
300	10.5	20 to 38
500	11.5	22 to 39
1000	11.5	22 to 39

(7) The line current shall not exceed 210 ma at any time during the test (210-millivolt indication on ME-30B/U No. 1).

(8) Maximum torque shall be obtained with an input signal between 150 and 4000 millivolts.

(9) With an input signal of 1000 millivolts, M-102 shall indicate 0.45 ma or more.

(10) Rotate T-101 VOLTAGE ADJUST and R-101 POWERSTAT fully counterclockwise.

d. Out-Phase Torque Test.

(1) Set S-102 IN 0-OUT 0 to IN 0.

(2) Repeat c(6) and (7) above.

(3) Rotate T-101 VOLTAGE ADJUST and R-101 POWERSTAT fully clockwise.

e. Null Error Test.

(1) Set S-102 IN 0-OUT 0 to OUT 0.

(2) Rotate S-103 VOLTAGE TEST to 1.

(3) Connect AN/USM-223 between J-113 and J-114.

(4) Rotate AN/USM-223 FUNCTION selector to FUNDAMENTAL.

(5) The 400-cycle voltage shall not exceed 1800 millivolts.

NOTE

Test procedure in paragraph 4-4 is an alternate procedure. If AM-3209 /ASN test panel is available, perform only the procedure in this paragraph.

4-4. General Test Requirements for the AM-3209/ASN, without using AM-3209/ASN Test Panel

a. Test Setup. Connect the AM-3209/ ASN to the test setup as shown in figure 4-2. During the following tests, the ammeter shall be monitored to insure that the line current does not exceed 210 ma.

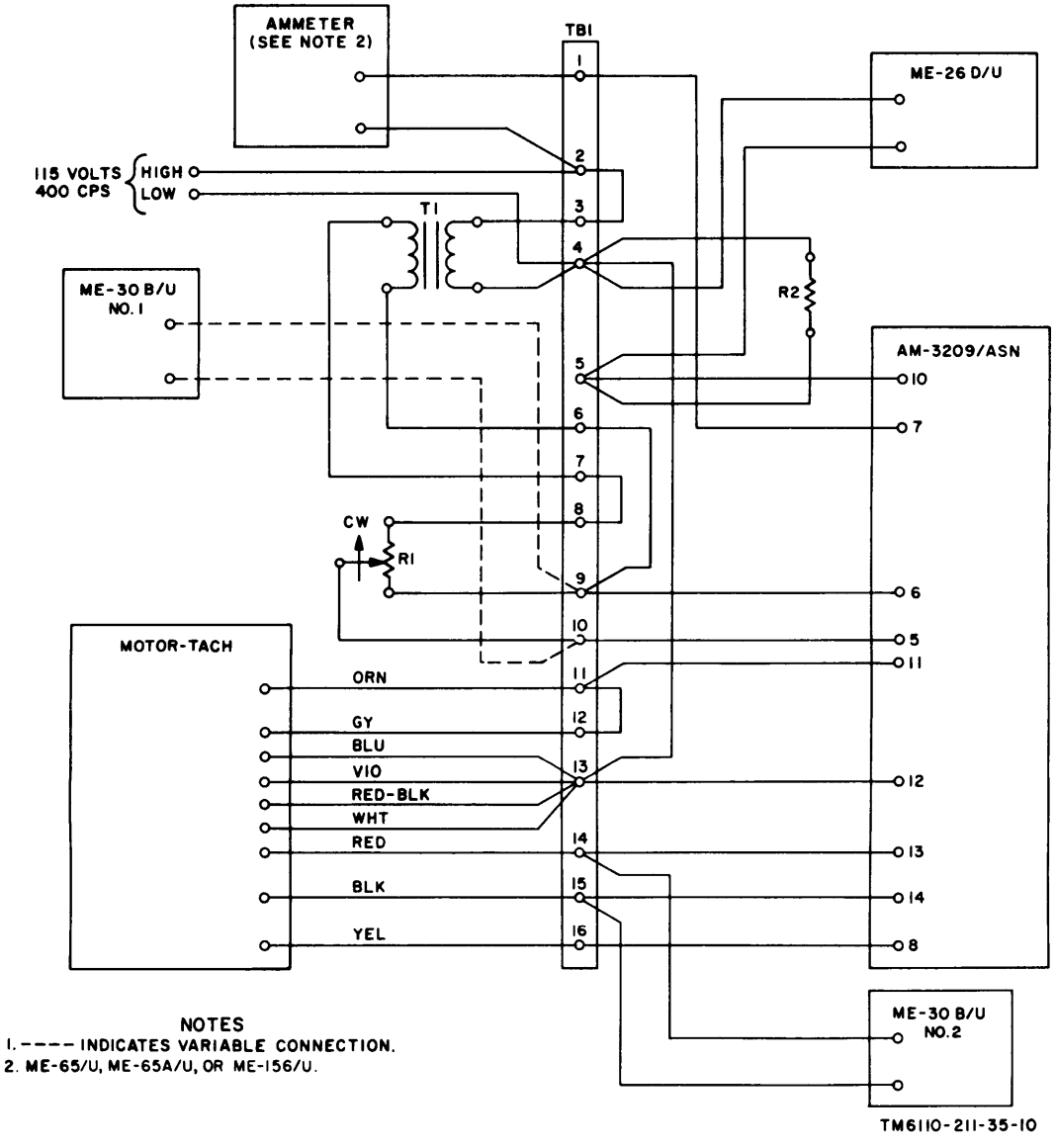

Figure 4-2. AM-3209/ASN test setup.

b. Tests of Output Voltages.

(1) Adjust R1 until 0 volts ac appears across terminals 5 and 6 of AM-3209/ASN. Use ME-30B/U No. 1 to check for the voltages listed below.

AM-3209/ASN Terminals (grd)	*ME-30B/U No. 1 Indication (volts)*
13 and 12	0 to 0.9
14 and 12	0 to 0.9
8 and 12	19 to 31
11 and 12	19 to 31

(2) Connect ME-30B/U No. 1 between AM-3209/ASN terminals 5 and 6. Adjust R1 for each of the ME-30B/U No. 1 indications listed below. For each setting of R1, ME-30B/U No. 2 shall indicate as listed and ME-26D/U shall indicate between 0.45 and 0.80-volt dc flag voltage across R2.

ME-30B/U No. 1 (volts)	*ME-30B/U No. 2 (volts)*
0.050	3 to 18
0.100	9 to 30
0.150	14 to 36
0.300	20 to 39
0.500	22 to 39
1.000	22 to 39

(3) Reverse the input connections to AM-3209/ASN terminals 5 and 6 and repeat (2) above.

APPENDIX I

REFERENCES

Following is a list of applicable references available to organizational, direct and general support, and depot maintenance personnel of Amplifier, Electronic Control AM-3209/ASN.

DA PAM 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (Types 7, 8, and 9), Supply Bulletins, Lubrication Orders, and Modification Work Orders.
TA 11-17	Signal Field Maintenance Shops.
TA 11-100(11-17)	Allowances of Signal Corps Expendable Supplies for Signal Field Maintenance Shops.
TM 11-5527	Multimeters TS-352/U, TS-352A/U, and TS-352B/U.
TM 11-6625-261-12	Operator's and Organizational Maintenance Manual: Audio Oscillators TS-382A/U, TS-382B/U, TS-382D/U, TS-382E/U, and TS-382F/U.
TM 11-6625-320-12	Organizational Maintenance Manual: Voltmeter, Meter ME-30A/U and Voltmeters, Electronic ME-30B/U, ME-30C/U, and ME-30E/U.
TM 11-6625-343-15	Operator, Organizational, Field, and Depot Maintenance Manual: Test Set, Transistor TS-1100/U.
TM 38-750	Army Equipment Record Procedures.

APPENDIX III

MAINTENANCE ALLOCATION

Section I. INTRODUCTION

1. General

a. This appendix assigns maintenance functions to be performed on components, assemblies, and subassemblies by the lowest appropriate maintenance category.

b. Columns in the maintenance allocation chart are as follows:

(1) *Part or component.* This column shows only the nomenclature or standard item name. Additional descriptive data are included only where clarification is necessary to identify the component. Components, assemblies, and subassemblies are listed in top-down order. That is, the assemblies which are part of a component are listed immediately below that component, and subassemblies which are part of an assembly are listed immediately below that assembly. Each generation breakdown (components, assemblies, or subassemblies) is listed in disassembly order or alphabetical order.

(2) *Maintenance function.* This column indicates the various maintenance functions allocated to the categories.

(a) Service. To clean, to preserve, and to replenish lubricants.

(b) Adjust. To regulate periodically to prevent, malfunction.

(c) Inspect. To verify serviceability and detect incipient electrical or mechanical failure by scrutiny.

(d) Test. To verify serviceability and to detect incipient electrical or mechanical failure by use of special equipment such as gages, meters, and other test devices.

(e) Replace. To substitute serviceable components, assemblies, or subassemblies, for unserviceable components, assemblies, or subassemblies.

(f) Repair. To restore an item to serviceable condition through correction of a specific failure or unserviceable condition. This function includes but is not limited to welding, grinding, riveting, straightening, and replacement of parts other than the trial and error replacement of running spare type items such as fuses, lamps, or electron tubes.

(g) Align. To adjust two or more components of an electrical system so that their functions are properly synchronized.

(h) Calibrate. To determine, check, or rectify the graduation of an instrument, weapon, or weapons system, or components of a weapons system.

(i) Overhaul. To restore an item to completely serviceable condition as prescribed by serviceability standards. This is accomplished through employment of the technique of "inspect and repair only as necessary" (IROAN). Maximum utilization of diagnostic and test equipment is combined with minimum disassembly of the item during the overhaul process.

(j) Rebuild. To restore an item to a standard as near as possible to original or new condition in appearance, performance and life expectancy. This is accomplished through the maintenance technique of complete disassembly of the item, inspection of all parts or components, repair or replacement of worn or unserviceable elements using original manufacturing tolerances and/or specifications and subsequent reassembly of the item.

(3) *Operator, organization, direct support, general support, and depot.* The symbol

X indicates the, categories responsible for performing that particular maintenance operation, but does not necessarily indicate that repair parts will be stocked at that level. Categories higher than those marked by X are authorized t o perform the indicated operatin.

(4) *Tools required.* This column indicates codes assigned to each individual tool equipment, test equipment, and maintenance equipment referenced. The grouping of codes in this column of the maintenance allocation chart indicates the tool, test, and maintenance equipment required to perform the maintenance function.

(5) *Remarks.* Entries in this column will be utilized when necessary to clarify any of the data cited in the preceding column.

c. Columns in the allocation of tools for maintenance functions are as follows:

(1) *Tools required for maintenance functions.* This column lists tools, test, and maintenance equipment required to perform the maintenance functions.

(2) *Operator, organization, direct support, general support, and depot.* The dagger (†) symbol indicates the categories normally allocated the facility.

(3) *Tool code.* This column lists the tool code assigned.

2. Maintenance by Using Organizations

When this equipment is used by signal services organizations organic to theater headquarters or communication zones to provide theater communications, those maintenance functions allocated up to and including genera] support are authorized to the organization operating this equipment.

Section II. MAINTENANCE ALLOCATION CHART

PART OR COMPONENT	MAINTENANCE FUNCTION	ECHELON O/C	ECHELON O	ECHELON DS	ECHELON GS	ECHELON D	TOOLS REQUIRED	REMARKS
AMPLIFIER, ELECTRONIC CONTROL AM-3209/ASN	inspect		X				2	
	repair		X				6	Replace black box.
CHASSIS ASSEMBLY (AM-3209/ASN)	inspect			X				
	test			X			1,3,4,7	
	overhaul			X			1,3,4,5,7	Replace piece parts

Section III. ALLOCATION OF TOOLS FOR MAINTENANCE FUNCTIONS

TOOLS REQUIRED FOR MAINTENANCE FUNCTIONS	ECHELON O/C	O	DS	GS	D	TOOL CODE	REMARKS
AM-3209/ASN (continued)							
AUDIO OSCILLATOR TS-382/U			†	†	†	1	
MULTIMETER AN/URM-105		†				2	
MULTIMETER TS-352/U			†	†	†	3	
TEST SET TRANSISTOR TS-1836/U			†	†	†	4	
TOOL KIT, ELEC EQUIP TK-100/G			†	†	†	5	
TOOL KIT, ELEC EQUIP TK-105/G		†				6	
VOLTMETER, METER ME-30/U			†	†	†	7	
NOTE: Indicator Radio Magnetic Compass ID-998/ASN is required for testing this Servo Amplifier							

APPENDIX IV

DIRECT AND GENERAL SUPPORT, AND DEPOT REPAIR PARTS LIST

Section I. INTRODUCTION

1. General

a. This appendix lists the quantities of repair parts for direct support, general support, and depot maintenance and is a basis for requisitioning authorized parts. It is also a guide for depot maintenance in establishing initial levels of spare parts.

b. Columns are as follows:

(1) *Source, maintenance, and recoverability code.* Source, maintenance, and recoverability codes indicate the commodity command responsible for supply, the maintenance category at which an item is stocked, categories at which an item is installed or repaired, and whether an item is repairable or salvageable. The source code column is divided into four parts.

(a) Column A. This column indicates the materiel code and designates the area of responsibility for supply. AR 310-1 defines the basic members used to identify the materiel code. If the part is Signal materiel responsibility, the column is blank.

(b) Column B. This column indicates the point within the maintenance system where the part is available. P indicates that the repair part is a high mortality part; procured by commodity command, stocked in and supplied from the commodity command depot system, and authorized for use at indicated maintenance categories. P1 indicates that the repair part is a low mortality part; procured by commodity commands, stocked only in and supplied from commodity command key depots, and authorized for installation at indicated maintenance categories. MD applies to repair parts which are not Procured or stocked but are to be fabricated by using units at depot. X2 applies to repair parts which are not stocked. The indicated maintenance category requiring such repair parts will attempt, to obtain from salvage; if not obtainable from salvage, such repair parts will be requisitioned with supporting justification through normal supply channels. Code A applies to assemblies which are not procured or stocked as such but are made up of two or more units, each of which carries individual stock numbers and descriptions and is procured and stocked and can be assembled by units at indicated maintenance category. Repair parts requiring manufacture, assembly, or test at a level higher than that authorized to replace the part are indicated by AH.

(c) Column C. This column indicates the lowest maintenance category authorized to install the part.

F—Direct support maintenance.
H—General support maintenance.

(d) Column D. The symbols in this column indicate whether the item is repairable or salvageable, as follows:

R—indicates that the part or assembly is economically repairable and is supplied, when abailable, on an exchange basis.

(2) *Federal stock number.* This column lists the 11-digit Federal stock number.

(3) *Designation by model.* Not used.

(4) *Description.* Nomenclature or the standard item name and brief identifying data for each item are listed in this column. When requisitioning, enter the nomenclature and description.

(5) *Unit of issue.* The unit of issue is each unless otherwise indicated and is the supply term by which the individual item is counted for procurement, storage, requisitioning, allowances, and issue purposes.

(6) *Expendability.* Nonexpendable items are indicated by NX. Expendable items are not annotated.

(7) *Quantity incorporated in unit.* This column lists the quantity of each part found in a given assembly, component, or equipment.

(8) *Direct support.* This column indicates quantities of repair parts authorized for initial stockage for use in the direct support maintenance and in supply support to organization. The quantities are based on 100 equipments to be maintained for a 15-day period.

(9) *General support.* The numbers in this column indicate quantities of repair parts authorized for initial stocks.ge for use in general support maintenance. The quantities are based on 100 equipments to be maintained for a 15-day period.

(10) *Depot.* The numbers in this column indicate quantities of repair parts authorized for depot maintenance and for initial stockage for maintenance, and for supply support to lower categories. The entries are based on the quantity required for rebuild of 100 equipments.

(11) *Illustration.* The "item No." column lists the reference designations that appear on the part in the equipment. These same designations are also used on any illustrations of the equipment. The numbers in the "Figure No." column refer to the illustrations where the part is shown.

2. Parts for Maintenance

When this equipment is used by signal service organizations organic to theater headquarters or communications zones to provide theater communications, those repair parts authorized up to and including general support are authorized for stockage by the organization operating this equipment.

3. Stockage

No parts authorized for stockage at organizational level.

4. Requisitioning Information

a. The allowance factors are based on 100 equipments. In order to determine the number of parts authorized for initial stockage for the specific number of equipments supported, the following formula will be used and carried out to two decimal places.

$$\text{Specific number of equipments support} \times \frac{\text{allowance factor}}{100} = \text{Number of parts authorized for initial stockage.}$$

b. Fractional values obtained from above computation will be rounded to whole numbers as follows :

(1) When the total number of parts authorized is less than 0.5, the quantity authorized will be zero.

(2) When the total number of parts authorized is between 0.5 and 1.0, the quantity authorized will be one.

(3) For all values above one, fractional values below 0.5 will revert to the next lower whole number and fractional value 0.5 and above will advance to the next higher whole number.

(4) Parentheses ( ) around the allowance factor listed in the third echelon column indicates that the item is combat essential and that a minimum quantity of one is authorized for initial stockage even though tile computed quantity is less than 0.5.

c. The quantities determined in accordance with the above computation represent the initial stockage for a 15-day period.

Section II. DIRECT AND GENERAL SUPPORT FUNCTIONAL PARTS LIST

SOURCE CODE A	B	C	D	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	MAINTENANCE ALLOWANCE DIRECT SUPPORT	GENERAL SUPPORT	DEPOT	ILLUSTRATION FIG. NO.	ITEM NO.
				6110-678-8507		AMPLIFIER, ELECTRONIC CONTROL AM-3209/ASN: power rating 23W; input signal channel data: 1 ea Resolver Sig; output sig channel		NX						
						data; 1 ea Exciter Sig; oper power regt: AC: 115V, 400 cyc, 1 ph; 4-1/8 in. lg X 2-9/64 in. w X 2-5/32 in. h; rack mtd; Sperry Gyro								
						pt #1783867-1								
		H		5910-959-0018		CAPACITOR: 50 mmf, +75 -15%; Sprague pt #112D607C7050J0			1		0.3	20.0		
		H		5910-666-7156		CAPACITOR, FIXED, CERAMIC DIELECTRIC: 1000 mmf, +100 -20%; 500 vdcw; MIL type CK61Y102Z			1		0.3	10.0		
		H		5910-809-0809		CAPACITOR, FIXED, ELECTROLYTIC: 20 mf, +75 -15%; 25 vdcw; GE pt #29F662G4			1		0.5	20.0		
		H		5910-814-9906		CAPACITOR, FIXED, ELECTROLYTIC: GE pt #29F652G4			1		0.5	20.0		
		H		5910-833-5539		CAPACITOR, FIXED, PAPER DIELECTRIC: 1 uf; 200 vdcw; Astron Co part #MQLF-2-1M			1		0.4	15.0		
		H		5910-820-6308		CAPACITOR, FIXED, PAPER DIELECTRIC: 470,000 mmf; Sprague pt #118P474S4S2			1		0.4	15.0		
		H		5935-721-2683		CONNECTOR, RECEPTACLE, ELECTRICAL: Sperry Gyro pt #742181			1		0.4	20.0		
		H		5325-985-6612		GROMMET, PLASTIC: Monadnock Mills pt #295202-6A			1		0.3	10.0		
		H		5995-226-1709		LEAD ASSEMBLY, ELECTRICAL: Sperry Gyro pt #1755363			1		0.3	10.0		
		H		5905-279-3514		RESISTOR, FIXED, COMPOSITION: 180 ohm ±5%; 1/2 w; MIL type RC20GF181J			1		0.3	10.0		
		H		5905-299-1965		RESISTOR, FIXED, COMPOSITION: Allen Bradley pt #EB3015			2		0.5	20.0		
		H		5905-279-2019		RESISTOR, FIXED, COMPOSITION: 5100 ohm ±5%; 2/2 w; MIL type RC20GF512J			2		0.5	20.0		
		H		5905-249-4195		RESISTOR, FIXED, COMPOSITION: 7500 ohm ±5%; 1/2 w; MIL type RC20GF752J			1		0.3	10.0		
		H		5905-195-6806		RESISTOR, FIXED, COMPOSITION: 1000 ohm ±5%; 1/2 w; MIL type RC20GF102J			1		0.3	10.0		
		H		5905-279-1885		RESISTOR, FIXED, COMPOSITION: 36 ohm ±5%; 1/2 w; MIL type RC20GF360J			1		0.3	10.0		
		H		5905-279-3511		RESISTOR, FIXED, COMPOSITION: 510 ohm ±5%; 1/2 w; MIL type RC20GF511J			1		0.3	10.0		
		H		5905-299-1971		RESISTOR, FIXED, COMPOSITION: 8200 ohm ±5%; 1/2 w; MIL type RC20GF822J			1		0.3	10.0		

SMR CODE A	B	C	D	FEDERAL STOCK NUMBER	DESIGNATION BY MODEL	DESCRIPTION	UNIT OF ISSUE	EXP	QTY IN UNIT	MAINTENANCE ALLOWANCE: DIRECT SUPPORT	GENERAL SUPPORT	DEPOT	ILLUSTRATION: FIG. NO.	ITEM NO.
						AM-3209/ASN (continued)								
		H		5905-279-3498		RESISTOR, FIXED, COMPOSITION: 43,000 ohm ±5%; 1/2 w; MIL type RC20GF433J			1		0.3	10.0		
		H		5920-042-9807		RESISTOR, FUSE: Bussman pt #GLX2-10			2		0.8	20.0		
		H		5905-810-2845		RESISTOR, THERMAL: 295 ohm at 0.003 amp; 6000 ohm at 0.275 amp;;Victory Engineering Corp pt #23D7			1		0.5	20.0		
		H				RESISTOR, FIXED, WIRE WOUND: Daven Co. part #R985 L4Aa48-A029			2		0.7	20.0		
		H		5960-617-4347		SEMICONDUCTOR DEVICE, DIODE: IN645			2		0.7	20.0		
		H		5940-881-9396		TERMINAL, FEEDTHRU, INSULATED: Metron, Inc pt SFU-6			6		0.7	5.0		
		H		5940-665-9165		TERMINAL STUD: Sealectro Corp pt #STSM2C2P16			23		2.0	100.0		
		H		5940-630-1985		TERMINAL STUD: Sealectro Corp pt #RSTSM1			15		1.3	50.0		
		H		5950-226-1691		TRANSFORMER, POWER, STEP DOWN: Sperry Gyro pt #1784751			1		0.4	10.0		
		H		5950-657-7708		TRANSFORMER: Sperry Gyro pt #618506			1		0.4	10.0		
		H		5960-226-1693		TRANSISTOR: Minneapolis-Honeywell pt #H6SP			2		0.7	20.0		
		H		5960-275-2427		TRANSISTOR: GE pt #4JX1E812			2		0.7	20.0		

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