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1 SEPTEMBER 1965
SUPERSEDING
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MILITARY SPECIFICATION

COMPUTER SET, LOFT BOMB RELEASE AN/AJB-3A

This specification has been approved by the
Bureau of Naval Weapons, Department of the Navy.

1. SCOPE

1.1 Scope - The equipment covered by this specification shall provide the functions of an all-attitude flight reference system plus a correlated loft bomb release system.

1.2 Classification - The AN/AJB-3A Loft Bomb Release Computer Set shall consist of the items listed in 6.9.

2. APPLICABLE DOCUMENTS

2.1 General - The documents listed in 6.11 of the issue in effect on the date of invitation for bids form a part of this specification to the extent specified herein.

3. REQUIREMENTS

*3.1 Preproduction - This specification makes provision for preproduction testing.

*3.2 Parts and Materials - In the selection of parts and materials, fulfillment of major design objectives shall be the prime consideration. In so doing the following shall govern:

(1) Microelectronic items shall conform to requirements specified herein.

(2) Other parts and materials requirements shall conform to Specification MIL-E-5400.

(3) Nonrepairable subassemblies, as outlined in Specification MIL-E-5400, shall be used when practicable. The general size of the subassembly and the amount of circuitry to be included therein shall be approved by the procuring activity. Nonrepairable subassemblies must be reliable. (See 6.4)

(4) When previously produced models of this equipment did not use nonrepairable subassemblies, the design shall not be changed to employ nonrepairable assemblies without the approval of the procuring activity.

3.2.1 Nonstandard Parts and Materials Approval - Approval for the use of nonstandard parts and materials shall be obtained as outlined in Specification MIL-E-5400.

3.2.2 Electron Devices - Electron tubes, transistors and diodes shall be chosen and applied as outlined in Specification MIL-E-4682.

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*3.2.3 Microelectronic Modular Assemblies - When used, Microelectronic Modular Assemblies shall be described by a contractor procurement specification and must be approved by the procuring agency. Microelectronic Modular Assemblies (Microelectronic Circuits) (MICS) shall be contained within Maintenance Modules (for example, on printed circuit cards). The choice of Microelectronic Modular Assemblies shall be based on at least two sources of supply, which can be used interchangeably.

*3.2.4 Modules, Maintenance - The electronic portions of the equipment shall be divided into maintenance modules (see Specification MIL-S-23603). Maintenance modules shall normally be considered repairable.

*3.2.5 Microelectronic Interchangeability - Microelectronic circuits (MICS) shall be interchangeable at the MIC level, or at the Maintenance module level when approved by the procuring activity. (See 6.13)

3.3 Design and Construction - The equipment shall conform with all the applicable requirements of Specification MIL-E-5400 for design, construction and workmanship, except as otherwise specified herein.

*3.3.1 Total Weight - The total weight of the equipment, excluding cables, shall be a minimum consistent with good design and shall not exceed 77.5 pounds.

3.3.2 Reliability

*3.3.2.1 Operational Stability - The equipment shall operate with satisfactory performance, continuously or intermittently for a period of at least 20 hours without the necessity for readjustment of any controls which are inaccessible to the operator during normal use.

*3.3.2.2 Operating Life - The equipment shall have a total operating life of 5000 hours with reasonable servicing and replacement of parts. Parts requiring scheduled replacement shall be specified by the contractor. No part shall have a life of less than 1000 hours.

*3.3.2.3 Reliability in Mean Time Between Failures (MTBF) - The equipment shall have 200 hours of mean (operating) time between failures when tested and accepted as outlined under the requirements of 4.4.3.

*3.3.2.4 Time Totalizing Meter - The equipment shall contain time totalizing meters in accordance with Specification MIL-M-7793. Meters shall be included in the following units:

(1) Adapter-Compensator, Compass MX-2826A/AJB
(2) Amplifier-Power Supply AM-1931/AJB-3
(3) Gyroscope Assembly, Displacement CN-494A/AJB-3
(4) Indicator, Attitude-Director ID-811/AJB-3A

3.3.3 Cabling and Connections

*3.3.3.1 Cables and Connectors - The equipment shall provide for the use of cables and connectors in accordance with Specification MIL-E-5400.

*3.3.3.2 Interconnection Cabling - The equipment shall be capable of satisfactory operation using external wiring in accordance with the applicable requirements of Specification MIL-W-5088. The external wiring shall be unshielded, except that a minimum number of the individual wires may be shielded when demonstrated as necessary to meet interference control requirements and provided the assembly of the cable to its plugs may be easily accomplished. External cables and that portion of the connectors attached to the cables shall not be supplied as part of the equipment.

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*3.3.4 Interchangeability of Reordered Equipment - For reordered equipment, interchangeability shall exist between units and all replaceable assemblies, subassemblies, and parts of a designated model of any previously manufactured equipment, supplied or designated by the procuring activity.

*3.3.5 Interference Control - The generation of radio interference by the equipment and the vulnerability of the equipment to radio interference shall be controlled within the limits of Specification MIL-I-6181.

*3.3.6 Maintenance Provisions and Field Testing - Provisions for maintenance shall be as specified in Specification MIL-E-5400. Specific test points and test facilities shall be provided to the greatest extent practicable for ease of field testing and maintenance.

3.3.7 Nomenclature and Nameplates - Nomenclature assignment and nameplate approval for equipment identification shall be in accordance with Specification MIL-N-18307.

*3.3.8 Standard Conditions - The following conditions shall be used to establish normal performance characteristics under standard conditions and for making laboratory bench tests.

Temperature	Room ambient (25°C ± 5°C)
Altitude	Normal Ground
Vibration	None
Humidity	Room ambient up to 90% relative humidity
Input power voltage	115 +1.0V AC, 400 ± 5 cps and 27.5 ± 0.5V DC

3.3.9 Service Conditions - The equipment shall operate satisfactorily under any of the environmental service conditions or reasonable combination of these conditions as specified in Specification MIL-E-5400 for Class 2 equipment, except as modified herein:

*3.3.9.1 Vibration - Each item of the equipment shall operate satisfactorily when subjected to the vibration requirements of Curves II and III of Specification MIL-E-5400, except the following items which shall operate satisfactorily when subjected to the vibration requirements specified.

Unit	Requirement
Indicator, Attitude-Director ID-811/AJB-3A	Proc. V, MIL-E-5272
Gyroscope Assembly, Displacement CN-494A/AJB-3	Curve II, MIL-E-5400

*3.3.10 Warm-Up Time - The time required for the equipment to warm-up prior to operation shall be kept to a minimum and shall not exceed 1 minute under standard conditions and 5 minutes at extreme service conditions.

*3.3.11 Primary Input Power Requirements - The equipment shall meet all applicable requirements of MIL-STD-704 and shall give specified performance from the following power sources with characteristics as defined in MIL-STD-704 having limits as specified therein. The power required shall not exceed the spedified amounts.

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(1) AC Power (Three Phase) 115/200V, Category "B", 200 VA
(2) DC Power 28V, Category "B", 1.5 Amps.

*3.3.11.1 Degraded Performance - Degraded performance will be permitted for voltage transients not exceeding 0.5 seconds during normal electric system operation. Operation shall be normal with no resulting damage to the equipment.

*3.3.12 Dielectric Strength - The materials used and the design shall be such that the resistance between isolated circuits and between each circuit and the case or connector shall be at least 50 megohms when a potential of 500V DC is applied for a period of 10 seconds.

*3.3.13 Control Panels - All rack or console mounted control panels shall conform to the applicable requirements of Specification MIL-C-6781. The configuration of all control panels must be approved by the procuring activity prior to preproduction testing.

3.4 Performance - Unless otherwise specified, values set forth to establish the requirements for satisfactory performance apply to performance under both standard and extreme service conditions. When reduced performance under the extreme conditions is acceptable, tolerance or values setting forth acceptable variations from the performance under the standard conditions will be specified.

*3.4.1 Operation - The Loft Bomb Release Computer Set shall provide the functions of an all-attitude flight reference system plus a correlated loft bomb release system. When operating as an all-attitude flight reference system, the system shall provide a continuous display of aircraft attitude through 360 degrees in roll, pitch and azimuth. A rate of turn display shall also be provided. Roll, pitch, and heading outputs shall also be provided for use by other systems.

The heading portion of the system shall have the following modes of operation:

(1) Slaved - providing gyro-stabilized heading referenced to magnetic north as established by the associated compass transmitter.

(2) Free - providing gyro-stabilized heading referenced to a grid system established by the operator.

(3) Compass - providing unstabilized heading referenced to magnetic north as established by the associated compass transmitter.

When operating in the loft bomb release mode, the system shall provide an additional display to direct the pilot through the proper maneuver. The display shall include an indication of roll correction necessary to correct for aircraft yaw or roll errors, and pitch steering commands to direct the pilot through a pull-up maneuver to a 4g loop up to the point of bomb release. The system shall also provide a signal to produce an aural warning tone and a tone indicating start of the pull-up maneuver, provide a signal to initiate bomb release at a preselected pitch angle, and cancel the bomb maneuver if excessive aircraft yaw occurs.

Means shall also be provided for the pilot to select the desired time delay between initiation of the bomb run and pull-up and to select either a preset low angle (less than 90°) or a preset high angle bomb release.

*3.4.1.1 Conditions - The system shall provide the performance specified when the components and associated equipment are interconnected and power is applied in accordance with Figure 1. Unless otherwise specified, the deviation compensation of the compass adapter shall be adjusted to compensate for heading errors and the roll and pitch trim of the attitude indicator shall be adjusted for zero trim.

*3.4.2 Erection and Synchronization - Within 88 seconds after initial application of power, the OFF flag in the attitude indicator shall disappear from view. Within 3.0 minutes after initial application of power, the pitch and roll indication shall be within ±2.0° of the position of the

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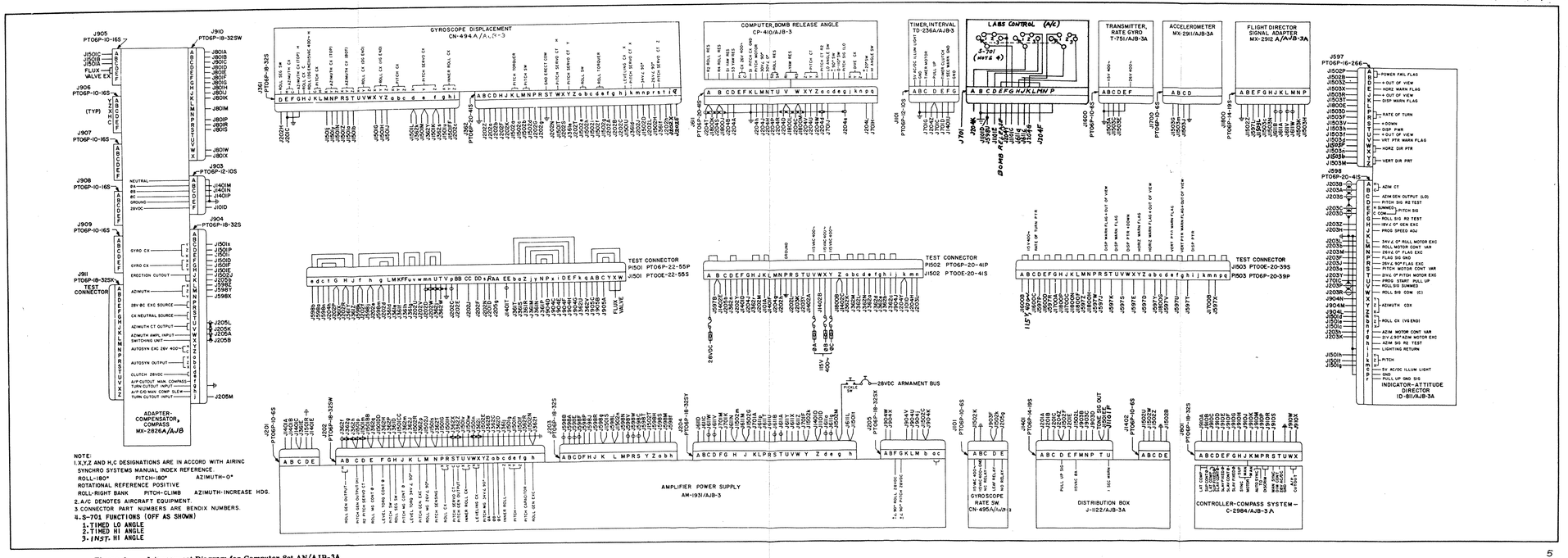

Figure 1. Interconnect Diagram for Computer Set AN/AJB-3A

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displacement gyroscope relative to local gravity vertical. Within 10 minutes after initial application of power and with the system operating in the SLAVED mode, the heading indication shall agree with the compass transmitter heading within ±3.5° and the needle of the SYNC IND on the controller shall be within 1/4 of the arc from the center to the end of the scale.

*3.4.2.1 Erection Rates - With the spin axis of the vertical gyro deflected 10° from local gravity vertical in roll, the low erection rate in roll shall be 1.3 ± 0.7 degrees per minute. With the spin axis of the vertical gyro deflected 20° from local gravity vertical in pitch, the low erection rate in pitch shall be 1.3 ± 0.7 degrees per minute.

*3.4.3 Azimuth Operation - Switching to the SLAVED mode or operating the PUSH TO SYNC button when in the SLAVED mode shall cause the heading indication to synchronize to within ±3.5° of the compass transmitter heading at a minimum rate of 20° per second. Within 5 seconds after the heading indication has stabilized, the needle of the SYNC IND meter shall be within 3/4 of the arc from the center to the end of the scale.

*3.4.3.1 Set Heading - With the system operating in the FREE mode, operation of the PUSH TO TURN control shall cause the heading indication to change at a rate approximately proportional to the degree of rotation of the control. Rotation to the right (R) shall cause the heading indication to increase and rotation to the left (L) shall cause the indication to decrease. When the PUSH TO TURN control is released, the heading indication shall stop changing.

*3.4.4 Attitude Indication - The attitude indicator sphere shall follow displacement gyro rotation through 360° in roll, pitch and azimuth smoothly and shall not jump greater than 0.5° in any axis except at 90° climb and 90° dive, a larger jump or transient in roll is permissible.

*3.4.4.1 Servo Sensitivity - Perceptible movement of the attitude indicator sphere in the corresponding axis shall result from displacement gyro movements of ±0.5° about each axis.

*3.4.5 Yaw Rate Switching - Within 35 seconds after a turn rate of 15° per minute is applied to the rate switching gyro, the synchronizing function shall become disabled and roll erection voltage to the displacement gyro shall be removed. Within 20 seconds after the turn rate is reduced to zero, the synchronizing function and roll erection voltage shall be restored.

*3.4.6 Turn Rate Indication - A clockwise turn rate of 6 ± 0.84° per second shall cause the turn rate indicator on the attitude indicator to align with the second index to the right of center. A counterclockwise turn rate of 6 ± 0.84° per second shall cause the indicator to align with the second index to the left of center.

*3.4.7 Latitude Compensation - With the system in FREE mode, the BIAS DEG./HR. dial in the compass adapter set to the value stenciled on the displacement gyro, and the LATITUDE setting on the controller set at the local latitude, the heading indication shall not change by more than 3° in one hour of operation.

*3.4.8 Bombing Functions

*3.4.8.1 Horizontal Pointer Adjustment - With 1g acceleration applied along the sensitive axis of the accelerometer, the system externally connected for LOW ANGLE bomb mode and a bomb run initiated, it shall be possible to adjust the CENTER potentiometer on the signal adapter to cause the horizontal pointer in the attitude indicator to align with the wings of the miniature airplane. This adjustment must be made before the end of the time set on the interval timer. At the end of the timer interval and with a 3g acceleration applied to the accelerometer, it shall be possible to adjust the SENS potentiometer to cause the horizontal pointer to deflect up 1 ± 1/16 inches from the wings of the miniature airplane.

*3.4.8.2 G Program Adjustment - With a 4g acceleration on the accelerometer and the system externally connected for LOW ANGLE bomb mode and a bomb run initiated, it shall be possible to adjust the PROG potentiometer, on the signal adapter, to obtain a 2 ± 0.1 second run-down time. The

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run-down cycle shall be measured from the end of the timer interval, until the horizontal pointer has aligned with the winds of the miniature airplane.

*3.4.8.3 Timed Low Angle Release - With the system externally connected for LOW ANGLE bomb mode, initiation of a bomb run shall cause a short duration audio signal to exist at the tone output 1 ± 0.1 seconds before the end of the timer interval. At the end of the timer interval, the tone output signal shall become continuous, the horizontal pointer on the attitude indicator shall start rundown (upward movement), and any pitch trim in the attitude indicator shall disappear. With these conditions existing, rotation of the displacement gyro in climb shall cause a bomb release within ±1° of the low release angle setting. Bomb release shall be evidenced by the appearance of a 28V DC release signal, the tone output shutting off, the horizontal pointer returning to its initial position, and indicator pitch trim reappearing.

*3.4.8.4 Timed High Angle Release - With the system externally connected for TIMED HIGH ANGLE bomb mode, the operation shall be the same as in 3.4.8.3 except that bomb release shall occur at the high release angle setting ±1.0°.

*3.4.8.5 Instantaneous High Angle Release - With the system externally connected for INSTANTANEOUS HIGH ANGLE, initiation of a bomb run shall immediately cause the steady tone signal to appear, the horizontal pointer on the attitude indicator to start rundown, and indicator pitch trim to disappear. With these conditions existing, rotation of the displacement gyro in climb shall cause bomb release within ±1° of the high release angle setting.

*3.4.8.6 Roll Error Signal - With the system externally connected for a bomb mode, a bomb run initiated, the displacement gyro at 0° pitch and the timer interval elapsed, it shall be possible to adjust the ROLL potentiometer in the amplifier-power supply such that a roll of the displacement gyro in either direction shall cause a corresponding amount of roll in the same direction to appear on the attitude indicator. The indicator roll in each direction shall be equal within 2.5 degrees for 10 degrees roll of the gyroscope.

*3.4.8.7 Yaw Error Signal - With the system externally connected for a bomb mode, a bomb run initiated, the displacement gyro at 0° pitch and the timer interval elapsed, it shall be possible to adjust the YAW potentiometer in the amplifier-power supply over a sufficient range such that 3° azimuth change of the displacement gyro in either direction shall cause the attitude indicator to show from 3° roll to 12° roll in the corresponding direction (e.g. right turn gives right roll). The amount of indicator roll shall be equal within 2.5° for the setting which gives a 12° indication for 3° gyro roll. With this setting on the YAW potentiometer, it shall be possible to adjust the YAW ADJ potentiometer in the signal adapter such that a 1° rotation of the displacement gyro in azimuth causes the vertical pointer on the attitude indicator to deflect 3/8" in the opposite direction (e.g. right turn causes left pointer movement). Reversing the direction of the gyro azimuth shall reverse the direction of pointer deflection and the amount of deflection for 1° rotation shall be 3/8" ± 3/64".

*3.4.8.8 Bomb Cancel - With the system externally connected for a bomb mode, a bomb run initiated, the displacement gyroscope at 0° pitch, and the timer interval elapsed, rotation of the displacement gyro in azimuth shall cause bomb cancel to be effected with less than 30° rotation. Bomb cancel shall be evidenced by shutting off the continuous tone signal, the horizontal pointer on the attitude indicator returning to its center position, pitch trim being reactivated, and the system returning to all-attitude mode.

*3.4.9 Performance at Temperature Extremes - The equipment shall perform as specified herein at temperature extremes except as follows:

*3.4.9.1 Erection and Synchronization - The OFF flag shall disappear from view within 114 seconds. Within 10 minutes the heading indication shall be within 4.5° of the compass transmitter heading.

*3.4.9.2 Erection Rates - The roll and pitch slow erection rates shall be 1.5 ± 1.0 degrees per minute.

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*3.4.9.3 Yaw Rate Switching - Within 25 seconds after the turn rate is reduced to zero, the synchronizing function and roll erection voltage shall be restored.

*3.4.9.4 Latitude Compensation - The heading indication shall not change more than 4° in one hour of operation.

*3.4.9.5 G Program Adjustment - The run-down time shall be 2.0 ± 0.2 seconds without readjusting the setting of 3.4.8.2.

*3.4.9.6 Bomb Release Angles - The low and high release angles shall be within ±2.0° of the release angle settings.

*3.4.9.7 Roll Error Signal - Roll indications shall be equal within 3.0 degrees for 10 degrees roll of the gyroscope. The vertical pointer deflections shall be equal within 1/8 inch at 4 degrees roll of the gyroscope.

*3.4.9.8 Yaw Error Signal - Roll indications shall be equal within 4.0 degrees for 12° yaw of the gyroscope. The vertical pointer deflections shall be equal within 3/32 inch for 1° yaw of the gyroscope.

*3.5 Detail Requirements -

*3.5.1 Accelerometer, Aircraft MX-2911/AJB-3A - The aircraft accelerometer shall meet the following requirements:

*3.5.1.1 Function - The aircraft accelerometer shall provide a damped potentiometer function proportional to the normal acceleration of an aircraft and is used to provide information for a programmed "pull-up" maneuver.

*3.5.1.2 Form Factor - The aircraft accelerometer shall be enclosed in a case conforming to the general requirements of MIL-C-172. The outline dimensions of the case shall conform to MS17389.

*3.5.1.3 Case - The case of the accelerometer shall be made of non-ferrous, low density metal, uniform in texture and shall have a smooth surface. The case shall be finished with a lusterless black material, Color No. 37038 of FED-STD-595. The sensitive axis shall be marked on the case as shown on MS17389.

*3.5.1.4 Electrical Connections - Connections to external circuits shall be provided as shown in Figure 1.

*3.5.1.5 Installation Mounting - Installation shall be with the sensitive axis vertical. Acceleration in an upward direction shall be defined as positive (+g's).

*3.5.1.6 Acceleration Range - The accelerometer shall be designed to respond to linear accelerations along the sensitive axis from 0g to +5g. The design shall be such that no electrical discontinuities result from accelerations up to +10g.

*3.5.1.7 Signal Pickoff - The signal pickoff shall consist of a 2000 ohms +10%, -0% potentiometer padded on each end with an additional resistance of 500 to 515 ohms. The resistance of the padding resistors shall be equally matched within 1% and have a temperature coefficient equal to the potentiometer within 10%. The maximum resistance variation of the pickoff through the applicable temperature range shall be 6%.

*3.5.1.7.1 Pickoff Rating - The signal pickoff shall operate with 30V DC applied and shall be capable of carrying a continuous duty current of 15 milliamperes.

*3.5.1.8 Performance Characteristics - The performance characteristics shall be as follows under standard conditions (3.2.8).

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*3.5.1.8.1 Natural Frequency - The accelerometer shall have a natural resonant frequency of 11.0 cps ± 10%.

*3.5.1.8.2 Damping - The accelerometer shall have a damping ratio of 0.34 to 1.5 over the temperature range of -54°C to +71°C.

*3.5.1.8.3 Resolution - The average increment of voltage ratio (output voltage to input voltage) within the range of the instrument shall be 0.004 maximum.

*3.5.1.8.4 Static Friction - The maximum acceleration required to overcome friction under static conditions (no vibration) shall be 0.03g.

*3.5.1.8.5 Hysteresis - The maximum difference between the voltage ratio at any g value during increasing acceleration and the voltage ratio at the same g value during decreasing acceleration shall be 0.01.

*3.5.1.8.6 Cross Talk - The output signal variation with acceleration perpendicular to the sensitive axis shall be less than 3% of that value which would be realized if the acceleration were applied to the sensitive axis.

*3.5.1.8.7 Output Sensitivity - The output sensitivity of the accelerometer shall be as follows with an input voltage of 30 ± 0.5V DC applied between connector terminals A and C with C positive and the output measured between terminals A and B.

Acceleration	Voltage Ratio
0.0 g	0.138 to 0.198
+0.5	0.204 to 0.264
+1.0	0.271 to 0.331
+1.5	0.337 to 0.397
+2.0	0.404 to 0.464
+2.5	0.470 to 0.530
+3.0	0.536 to 0.596
+3.5	0.602 to 0.662
+4.0	0.669 to 0.729
+4.5	0.735 to 0.795
+5.0	0.802 to 0.862

NOTE:

Zero Acceleration - Zero acceleration is the condition of the unit being at rest with the plane of the mounting surface perpendicular to the pull of gravity.

Voltage Ratio - Voltage ratio is the ratio of output voltage to input voltage.

*3.5.1.8.7.1 Slope - The difference in voltage ratio between 1g and 4g shall be 0.398 ± 0.012.

*3.5.1.9 Performance at Temperature Extremes - The accelerometer shall perform as specified herein at temperature extremes except as follows:

*3.5.1.9.1 Slope - The tolerance shall be ±0.036 in lieu of ±0.012.

*3.5.2 Adapter-Compensator, Compass MX-2826A/AJB - The Compass Adapter-Compensator shall meet the following requirements:

*3.5.2.1 Function - The Compass Adapter-Compensator shall provide azimuth heading outputs using basic input signals from a ML-1 Compass Transmitter per MIL-T-19576, a Displacement Gyroscope Assembly CN-494A/AJB-3 and a Compass System Controller C-2984/AJB-3A or equals. It shall

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operate in the slaved, free, or compass mode to develop gyro stabilized magnetic, free gyro, and magnetic heading data for navigation, radar, fire control, autopilot and related equipment.

*3.5.2.2 Form Factor - The Compass Adapter-Compensator shall be enclosed in a case conforming to the general requirements of MIL-C-172. The outline dimensions of the case shall conform to MS17390.

*3.5.2.3 Case - The case of the Compass Adapter-Compensator shall be made of non-ferrous, low density metal, uniform in texture and having a smooth surface. The case shall be finished with a lusterless black material, Color No. 37038 of FED-STD-595.

*3.5.2.4 Contents - The Compass Adapter-Compensator shall contain the following circuits and components:

*3.5.2.4.1 Azimuth Servo (DG Follow-Up) - The azimuth follow-up shall repeat the directional gyro heading output with high response and accuracy. This shall be a direct output from the compass adapter. The azimuth servo system shall provide the following performance:

Static Accuracy	0° 15' RMS (B202) or 0° 30' max.
Null Repeatability	0° 20'
Follow-Up Rate, Minimum	180°/sec.
Follow-Up Lag, Maximum	0.2°/RPM to 5 RPM
Natural Frequency, Undamped	5 CPS min.

*3.5.2.4.1.1 Dynamic Accuracy - The heading output shall not change more than 0.25° when operating with the compass transmitter oscillating up to ±5° at 6 cpm.

*3.5.2.4.1.2 Reversing Azimuth Servo Null - Reversal of the gyro CT output leads to the azimuth amplifier shall cause a 180° rotation of the 4-power and 20-power CX's but shall not reverse the differential synchro output.

*3.5.2.4.2 Correction and Slaving Servo - The correction and slaving servo shall perform the functions of slaving the outputs of the compass adapter to the magnetic compass transmitter and provide correction signals for the heading outputs corresponding to earth's rate (latitude) and directional gyro drift bias.

*3.5.2.4.2.1 Magnetic Slaving - Magnetic slaving shall slave the output of the compass adapter to the compass transmitter. The slaving signals shall provide the following performance:

Static Accuracy	0° 30' max. (B202)
Follow-Up Rate	0.7 to 1.5° per min.

*3.5.2.4.2.2 Deviation Compensation - A 24 point electrical deviation compensator shall be provided to minimize errors of the remote compass transmitter and its associated control system. It shall only be effective when the compass transmitter signal is being utilized. The 24 point deviation compensator shall provide compensation with a minimum range of ±3.5 degrees at each adjustment point.

The deviation compensator shall be a plug-in module and be easily accessible. The compass adapter-compensator shall contain provisions which will permit elimination of the deviation compensation signal from the slaving signal as an aid in magnetic compass compensation.

*3.5.2.4.2.3 Automatic Gain Control - The compass adapter shall contain an automatic gain control to maintain slaving accuracy, slaving rate, and synchronizing meter output requirements when supplied with a signal from an ML-1 compass transmitter operating in a magnetic field with the horizontal component varying between 0.08 and 0.40 oersteds.

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*3.5.2.4.2.4 Heading Corrections - Signals shall be available in slaved and free modes to compensate for the DG mean drift up to 5° per hour and for the apparent DG drift caused by earth's rotation up to 15° per hour. The correction servo shall integrate these signals and provide a controlled rate of correction under standard conditions as follws:

Range - 0.5° to 20° per hour minimum
Random Error - ± 0.15° per hour rms
Maximum Error - ± 0.3° per hour

*3.5.2.4.3 Synchronization - Means shall be provided to automatically synchronize the directional gyro input signal to the compass transmitter input at a fast rate during an intial power application (DC power to be applied after AC power is applied), during switching to the slaved mode, or by manually depressing the push-to-sync button on the controller. Synchronization shall be at a minimum rate of 20° per second and shall be accurate to ± 2°.

*3.5.2.4.3.1 Indicator Signal - A synchronization signal shall be provided for driving the compass controller synchronizing indicator meter. This signal shall provide a current of 10 ± 3 microamperes per degree (1100 ohm load) and shall be limited to a maximum of 250 microamperes. Polarity of the signal shall indicate the direction of the error. The signal at null shall not exceed ± 5 microamperes.

*3.5.2.4.4 Set Heading Control - The compass adapter in combination with the controller shall provide for the setting of heading while in the "FREE" mode of operation. The output data transmitter of the compass adapter shall increase (+) when the knob of the controller is rotated clockwise. Speed of this rotation shall be adjustable from 1 to 9 RPM as determined by how far the Set Heading Knob is rotated.

*3.5.2.4.5 Data Transmitting Synchros - The outputs of the compass adapter shall be obtained from the following:

a. One 20-power transmitter
b. Three 4-power transmitters
c. One differential transmitter
d. One clutched synchro

Items a, b, d. shall be driven by the azimuth servo, and item c. shall be driven by the correction and slaving servo.

*3.5.2.4.6 Synchro Requirements - Each 4-power transmitter shall be capable of driving two receiver synchros each having input impedance of 45 ± 3 ohms +j255 ±13 ohms, or four control transformers each having input impedance of 220 ± 11 ohms +j470 ±24 ohms. The synchros shall have a nominal no load line-to-line output of 11.8 ± 0.35V and phase shift of not more than 11.5 degrees. When loaded with 4 CT's, the line-to-line output voltage shall not be less than 10.6V and the phase shift shall not be more than 17 degrees. Each 4-power synchro shall have a transmission accuracy of ±7' or less. The 20-power transmitter shall be capable of supplying 10 receivers or 20 control transformers under the foregoing condition.

*3.5.2.4.6.1 Clutched Synchro - The clutched synchro shall be excited through a fixed resistor in series with the rotor. Synchro and resistor shall be such that, when the output from 2 stator leads (blue to blk or yel to blk) are loaded with 5000 ± 10% ohms and the synchro rotor (with resistor) is excited with 26 ± 0.5V, 400 ± 8 cps; the maximum output shall be 10.2 ± 1.2 volts at a phase angle of 30° ±2° lead.

*3.5.2.4.7 Synchro Zeroing - The output synchros shall be set at electrical zero for north (0°) heading output. The differential synchro shall be zeroed such that when the rotor is excited by a synchro transmitter operating at its electrical zero, the stator output will be at its electrical zero +180 degrees.

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*3.5.2.4.7.1 With the B202 (J908) at 0° and the transmitter at 0° ± 0.5° and slaving cutout, the output of the CX's (J909 and J902) shall be 0° ± 12', and the output of the CX's (J906 and J907) shall be 0° ± 18'. The output of the CDX shall be 180° ± 30'.

NOTE: The heading synchro is adjusted for zero when the voltage from X to Y is at a minimum and the dial reading is 0° (NORTH), and with rotor lead C connected to stator lead Z the voltage from H to X shall be greater than the voltage from H to C. The voltage between X and Z shall increase before decreasing for a rotation of the dial in increasing heading direction. For decreasing heading rotation of the dial, the voltage between X and Z shall decrease before increasing.

*3.5.2.4.7.2 Clutched Synchro Zero - The output of the clutched synchro shall be 0° ± 1° with the clutch de-energized. With the clutch energized by 28V DC the output shall increase for increasing heading and decrease for decreasing heading change up to ±25°.

*3.5.2.4.8 Compass Mode Operation - In the compass mode operation, the output data transmitters follow the compass transmitter input. (No directional gyro stabilization.) The compass mode shall be initiated by an external signal from the mode selector switch. Static accuracy in the compass mode shall be ±1° 30'.

*3.5.2.4.9 Excitation Voltage Output - The compass adapter shall provide the following excitation voltages:

(1) 26V, 400 cps for excitation of synchro transmitters. The output shall be capable of simultaneously exciting the transmitters of 3.5.2.4.5 at room temperatures.

(2) 23.5V, 400 cps for excitation of the type ML-1 magnetic compass transmitter.

(3) 26V, 400 cps for excitation of the latitude compensation resolver in the compass controller.

(4) 3 - gnd - 3V, 400 cps for excitation of the heading set potentiometer in the compass controller.

*3.5.2.4.10 Cutout Relay - A 28V DC relay shall be provided which, when energized, will interrupt the slaving operation of 3.5.2.4.2.1. The relay shall also interrupt a gyro erection circuit routed through the compass adapter.

*3.5.2.4.11 Autopilot Decoupling - A circuit routed through the compass adapter shall be interrupted whenever either manual or automatic synchronization occurs. The interruption shall occur prior to the start of synchronization.

*3.5.2.5 Performance of Environmental Extremes - When tested at environmental extremes, the compass adapter shall meet the positioning accuracy, rate, and synchronizing requirements specified except as indicated below. Adjustment of deviation potentiometers shall not be required during environmental tests.

*3.5.2.5.1 Azimuth Servo - The positional tolerances shall be increased from ±30' max. to ±45' max. and dead zone from 20' to 30'.

*3.5.2.5.2 Compass Mode - The positional tolerances shall be increased from 1° 30' to 2°.

*3.5.2.5.3 Magnetic Slaving - The rate shall be increased from 3.5 and 7.5 degrees in 5 minutes to 2.5 and 8.5 degrees in 5 minutes. The positional accuracy shall be increased from 30' to 1.0°.

*3.5.2.5.4 Synchronization - The positional tolerances shall increase from ±2° to ±2.5°.

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*3.5.2.5.5 Synchronizing Indicator - The current through the 1100 ohm resistor shall increase from 5 microamperes or less to 8 microamperes or less. The current through the 1100 ohm resistor shall increase from 10 ± 3 microamperes per degree to 10 ± 4 microamperes per degree.

*3.5.2.5.6 Set Heading Control - The minimum speed of 9 RPM shall be decreased to 8 RPM.

*3.5.2.5.7 Correction Servo - The requirements of para. 3.5.1.4.2.4 shall apply except that the random error tolerance shall be ±0.20° per hour rms and the maximum error shall be ±0.5° per hour.

*3.5.2.6 Electrical Connections - Connections to external circuits shall be provided as shown in Figure 1.

*3.5.3 Adapter, Flight Director Signal MX-2912A/AJB-3A. The flight director signal adapter shall meet the following requirements:

*3.5.3.1 Function - The flight director signal adapter shall provide aircraft steering information by providing a DC signal proportional to roll/yaw information received to drive the vertical needle of an indicator and by providing a DC signal proportional to the difference between "g" information received from an accelerometer and the desired "g" as programmed by the signal adapter to drive the horizontal needle of an indicator.

*3.5.3.2 Form Factor - The flight director signal adapter shall be enclosed in a case conforming to the general requirements of MIL-C-172. The outline dimensions of the case shall conform to MS17391.

*3.5.3.3 Case - The case of the flight director signal adapter shall be made of non-ferrous, low density metal, uniform in texture and shall have a smooth surface. The case shall be finished with a lusterless black materail, Color No. 37038 of FED-STD-595.

*3.5.3.4 Contents - The flight director signal adapter shall consist of a roll/yaw signal section consisting of a mixer network, an amplifier and associated discriminator and a "G" programmer section consisting of a power supply, and an electronic programmer.

*3.5.3.4.1 Roll/Yaw Section -

*3.5.3.4.1.1 General - The mixing network shall be designed to total roll and yaw signals received from the resolver in a Bomb Release Angle Computer CP-410/AJB-3. The roll/yaw signal shall be amplified and then converted to DC by a phase sensitive discriminator. The output signal shall be capable of driving a 1000 ohm resistive load as specified herein. Input connections shall be as specified in Figure 1.

*3.5.3.4.1.2 Mixing Network - The roll/yaw mixing network, in connection with the amplifier and the discriminator, shall be designed to proportion the roll/yaw section output signal so that: with a roll input of 0.040V, the output shall be adjustable to provide from less than 0.100V to greater than 0.550V across a 1000 ohm resistive load; with a yaw input of 0.040V, the output shall be adjustable to provide from less than 0.314V to greater than 1.20V across a 1000 ohm resistive load. The ratio shall be controlled by means of two potentiometers adjustable from the exterior of the unit.

*3.5.3.4.1.3 Amplifier - The amplifier shall be designed to amplify the roll/yaw signal from the mixing network. The output circuitry shall be compatible with the input circuitry of the discriminator. The gain characteristic shall be such as to furnish the specified final output signal for the 1000 ohm resistive load.

*3.5.3.4.1.4 Discriminator - The discriminator shall be designed to operate from the amplifier output signal. The output shall be a DC voltage whose polarity is controlled by the phase of the amplifier output and whose amplitude is controlled by the amplitude of the amplifier output. The polarity of the output and the output connections shall be as specified in Figure 1.

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*3.5.3.4.2 "G" Programmer Section -

*3.5.3.4.2.1 General - The function of the "g" programmer section is the development of a dc output signal whose amplitude is directly proportioned to the difference between the "g" force applied to the Aircraft Accelerometer MX-2911/AJB-3A and an internally programmed signal representing the desired "g" load. The accelerometer shall complete a bridge network whose other parameter, the programmed signal, is developed by the signal adapter. The network shall be energized from a dc power supply in the signal adapter.

*3.5.3.4.2.2 Output Signal - The output signal of the bridge network shall be capable of driving a 1000 ohm resistive load such that a 1/2 "g" error shall provide a 1.25V across the load.

*3.5.3.4.2.3 Programming - The "g" values commanded by the programmer shall change from 1g to 4g when initiated by application of a 28V DC signal. The 3g change shall be adjustable to 2 seconds.

*3.5.3.4 Controls - The following controls shall be externally adjustable and of the screwdriver type:

Identification	Function
(1) CENTER	1 g adjustment
(2) PROG	"g" programmer time
(3) SENS	"g" programmer output
(4) ROLL	Roll output sensitivity
(5) YAW	Yaw output sensitivity

*3.5.3.5.1 Roll and Yaw Dials - Dials bearing positional graduations or markings shall be provided for the Roll and Yaw controls. The graduations shall provide 10 equal, within 10%, divisions of the nominal adjustment shaft rotation. The graduations need not be identified as to angular position. Markings may be stnecilled directly on the painted exterior of the case.

*3.5.3.6 Electrical Connections - Connections to external circuits shall be provided as shown in Figure 1.

*3.5.3.7 Performance at Temperature Extremes - The flight director signal adapter shall perform as specified herein at temperature extremes except as follows:

*3.5.3.7.1 Output Voltage - Without readjustment, the output voltages shall be within ±15% of the values obtained under standard conditions (3.3.8).

*3.5.3.7.2 Program Time - Without readjustment, the program time shall be within ±10% of the value obtained under standard conditions (3.3.8).

*3.5.4 Amplifier-Power Supply AM-1931/AJB-3 - The amplifier power supply shall meet the following requirements:

*3.5.4.1 Function - The amplifier-power supply shall provide amplifiers, power supply, switching, and controls for the operation of associated displacement gyroscope, attitude indicator, and bomb release angle computer in the AN/AJB-3 and AN/AJB-3A Loft Bomb Release Computer Set.

*3.5.4.2 Form Factor - The amplifier-power supply shall be enclosed in a case conforming to the general requirements of MIL-C-172. The outline dimensions of the case shall conform to MS17378.

*3.5.4.3 Case - The case of the amplifier-power supply shall be made of non-ferrous, low density metal, uniform in texture and shall have a smooth surface. The case shall be finished with a lusterless black material, Color No. 37038 of FED-STD-595.

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*3.5.4.4 Contents - The amplifier-power supply shall contain the following circuits and controls.

(1) Power Supply - Develop power for motor and generator excitation, gyro erection systems, etc., incorporate the system start relay, gyro start relay and 12 and 60 sec. time delay relays.

(2) Servo Amplifier - Displacement gyro roll servo.

(3) Servo Amplifier - Displacement gyro pitch follow-up servo.

(4) Servo Amplifier - Displacement gyro leveling servo.

(5) Servo Amplifier - Bomb release angle computer servo.

(6) Servo Amplifier - Attitude indicator pitch servo.

(7) Servo Amplifier - Attitude indicator roll servo.

(8) Servo Amplifier - Attitude indicator azimuth servo.

(9) Relay Module - System switching relays.

(10) Controls - Roll/yaw signal mixing and "g" programmer speed adjust.

*3.5.4.4.1 Power Supply - The power supply shall perform as follows:

(1) Voltages - The following AC voltages shall be supplied and shall be within 9% of the nominal values with the specified loads.

60V, 0.3 amp.	Roll erection (12 to 60 sec.) Pitch erection (1st 60 sec.)
34V, 0.55 amp.	Indicator Roll motor fixed Ø Gyro leveling torquer fixed Ø (after 12 sec.)
30V, 0.2 amp.	Bomb rel. angle computer gen. excitation Bomb rel. angle computer motor fixed Ø
26V, 0.6 amp.	Indicator power failure flag motor excitation Gyro roll gen. excitation Gyro roll motor fixed Ø
21V, 0.3 amp.	Indicator pitch motor fixed Ø Indicator azimuth motor fixed Ø
18V, 0.85 amp.	Roll erection (after 60 sec.) Pitch erection (after 60 sec.) Indicator gen. excitation Gyro pitch follow-up gen. excitation

(2) Relays - The 12 second and 60 second time delay relays shall accomplish the following system switching:

(a) 12 second relay - The relay contacts shall cause the operation of the gyro start relay during the first 12 seconds after system power is applied. The gyro start relay removes roll erection, opens the fixed phase to the leveling torquer and the indicator roll motor, opens phase A to the gyro rotor and

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adds 500 ohms in series with phase B to the gyro rotor. The tolerance for the 12 second period shall be ±5 seconds as the input voltage varies from 25 to 29VDC.

(b) 60 second relay - The relay contacts shall cause the energizing of the system start relay coil and the 12 second time delay relay coil during the first 60 seconds after system power is applied. Operation of the system start relay shall remove ground from the indicator power failure flag, energize the cage relay, and increase the pitch and roll erection voltage to 60 VAC. The tolerance for the 60 second period shall be +12, -15 seconds as the input voltage varies from 25 to 29VDC.

*3.5.4.4.2 Displacement Gyro Roll Servo Amplifier - This amplifier shall have the following nominal characteristics and shall provide the performance specified when connected in an AN/AJB-3 system.

(1) Characteristics:

Input impedance	15K ohms minimum
Load impedance	43 +j63 ohms
Input (displacement)	0.1V AC, ØC
Output (displacement input)	15V, leading gyro motor fixed Ø by 90°
Input (rate)	0.1V AC, ØC
Output (rate input)	11V, leading gyro motor fixed Ø by 90°
Null output	3.0V AC maximum

(2) Performance:

Follow-up rate	225°/sec. minimum
Follow-up lag	0.5°/10°/sec. maximum
Positional accuracy	Roll angle ±1°
Hunting and jumping	±0.5° maximum at maximum rate

*3.5.4.4.3 Displacement Gyro Pitch Follow-up Servo Amplifier - This amplifier shall have the following nominal characteristics and shall provide the performance specified when connected in an AN/AJB-3 system.

(1) Characteristics:

Input impedance	15K ohms minimum
Load impedance	100 +j95 ohms
Input at saturation	0.15V AC, ØC
Output at saturation	15V, leading gyro motor fixed Ø by 90°
Null output	3.0V AC maximum

(2) Performance:

Follow-up rate	200°/sec. minimum
Follow-up lag	1°/10°/sec. maximum
Positional accuracy	Pitch angle ±1.25°
Hunting or jumping	±0.5° maximum at maximum rate

*3.5.4.4.4 Displacement Gyro Leveling Servo Amplifier - This amplifier shall have the following nominal characteristics and shall provide the performance specified when connected in an AN/AJB-3 system.

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(1) Characteristics:

Input impedance	15K ohms minimum
Load impedance	530 +j700 ohms
Input at saturation	0.15V AC, ØC
Output at saturation	41V, lagging torquer fixed phase by 90°
Null output	4V AC maximum

(2) Performance:

Leveling rate	
Initial	Shall level the gyro to within 1-1/2 minutes after start
Normal	2° to 10°/minute
Level accuracy	The gyro spin axis shall be perpendicular to the azimuth axis within ±0.5°

*3.5.4.4.5 Bomb Release Angle Computer Servo Amplifier - This amplifier shall have the following nominal characteristics and shall provide the performance specified when connected in an AN/AJB-3 system.

(1) Characteristics:

Input impedance	15K ohms minimum
Load impedance	82 +j143 ohms
Input at saturation	0.15V AC ØC
Output at saturation	20V AC leading motor fixed phase by 90°
Null output	3V AC maximum

(2) Performance:

Follow-up rate	300°/sec. minimum
Follow-up lag	0.4°/10°/sec. maximum
Positional accuracy	Pitch input signal ±0.5°
Hunting and jumping	±0.5° maximum at maximum rate
Damping factor	0.7

*3.5.4.4.6 Attitude Indicator Pitch Servo Amplifier - This amplifier shall have the following nominal characteristics and shall provide the performance specified when connected in an AN/AJB-3 system.

(1) Characteristics:

Input impedance	1K ohms minimum
Load impedance	158 +j104 ohms
Input at saturation	0.6V AC ØC in series with 20K ohms
Output at saturation	16V AC leading motor fixed phase by 90°
Null output	3V AC maximum

(2) Performance:

Follow-up rate	300°/sec. minimum
Follow-up lag	0.5°/10°/sec. maximum
Positional accuracy	Pitch input signal ±1°
Hunting and jumping	±0.4° maximum at maximum rate
Damping factor	0.7

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*3.5.4.4.7 Attitude Indicator Roll Servo Amplifier - This amplifier shall have the following nominal characteristics and shall provide the performance specified when connected in an AN/AJB-3 system.

(1) Characteristics:

Input impedance	1K ohms minimum
Load impedance	87 +j109 ohms
Input at saturation	0.60V AC ØC in series with 20K ohms
Output at saturation	15V AC leading motor fixed phase by 90°
Null output	3V AC maximum

(2) Performance:

Follow-up rate	300°/sec. minimum
Follow-up lag	0.5°/10°/sec. maximum
Positional accuracy	Roll input signal ±1°
Hunting and jumping	±0.5° maximum at maximum rate
Damping factor	0.7

*3.5.4.4.8 Attitude Indicator Azimuth Servo Amplifier - This amplifier shall have the following nominal characteristics and shall provide the performance specified when connected in an AN/AJB-3 system.

(1) Characteristics:

Input impedance	15K ohms minimum
Load impedance	158 +j104 ohms
Input at saturation	0.15V AC ØC
Output at saturation	16V AC leading motor fixed phase by 90°
Null output	3V AC maximum

(2) Performance:

Follow-up rate	300°/sec. minimum
Follow-up lag	0.4°/10°/sec. maximum
Positional accuracy	Azimuth input signal ±1°
Hunting and jumping	±0.5° maximum at maximum rate
Damping factor	0.7

*3.5.4.4.9 Relay Module - The relay module shall provide the following:

*3.5.4.4.9.1 Continuity - Continuity as specified by Table I shall exist between designated pins. No power shall be applied.

*3.5.4.4.9.2 Yaw Cancel - With a pickle signal applied, a yaw resolver signal of 0.75V shall cause yaw cancel to occur. This opens the bomb release signal circuit and reverts the system to all attitude. Cancel shall remain until the pickle voltage is interrupted.

*3.5.4.4.9.3 Pull Up - Application of a pull up signal shall provide the following functions:

a) Pitch erection cutout

b) Roll erection cutout

c) Leveling cutout

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TABLE I

FROM PIN NO.	TO PIN NO.	FROM PIN NO.	TO PIN NO.
J201-A	J202-Z	J202-S	J202-T
J201-B	J202-a	J202-P	J202-V
J201-C	J202-b	J202-U	J204-P
J201-D	J203-E	J203-B	J204-A
J201-E	J204-Y	J203-D	J203-R
J201-E	J205-F	J203-S	J204-D
J202-B	J202-U	J203-S	J204-S
J202-e	J204-W	J204-g	J204-K
J202-d	J204-U	J204-Z	J205-a
J202-f	J204-V	J204-Z	J205-c
J202-g	J202-G	J205-A	J205-L
J202-g	J205-b	J205-B	J205-K
J202-h	J203-M	J205-F	J205-G
J201-D	J202-X	J205-g	J205-M
J202-L	J203-Z	J202-M	J202-H
J202-V	J204-R		

d) Cage relay operated - This switches the displacement gyro roll servo amplifier input from inner roll to outer roll.

e) Locks the Indicator Azimuth servo loop.

f) Sums the yaw and roll resolver signal with indicator roll signal and displays the sum on the indicator roll axis. It shall always be possible to override the summed yaw-roll resolver signal with the indicator roll input signal.

*3.5.4.4.9.4 System Switching - The relay modules shall provide the following switching logic.

*3.5.4.4.9.4.1 Apply +28V DC to J205-c and J201-E. Continuity shall exist between the following pairs of pins:

(1) J204-W and J202-d
(2) J204-U and J202-e
(3) J204-A and J203-A
(4) J204-B and J203-B

*3.5.4.4.9.4.2 The open circuits described in 3.5.4.4.9.4.1 shall remain through the following sequence of operations.

(1) Connect J202-N to ground
(2) Move ground from J202-N to J202-H
(3) Move ground from J202-H to J204-L
(4) Connect J202-H and J204-L to ground
(5) Move ground from J204-L to J202-N
(6) Move ground from J202-H to J204-L

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*3.5.4.4.9.4.3 The open circuits described in 3.5.4.4.9.4.1 shall become short circuits upon simultaneously grounding J202-H, J204-L and J202-N. These short circuits shall remain through the following sequences of operations.

(1) Remove ground from J204-L
(2) Remove ground from J202-N
(3) Remove ground from J202-H

*3.5.4.4.9.4.4 Simultaneously grounding J202-N, J202-H and J204-L shall produce the closed circuits of paragraph 3.5.4.4.9.4.3. These closed circuits shall remain after removing the ground from J202-N. The closed circuits shall remain after replacing the ground on J202-N and removing the ground from J202-H. Once again remove the ground from J202-N and with J204-L, only, grounded the closed circuits shall become open.

*3.5.4.4.9.4.5 Apply +28V DC to J204-g. Short pin J205-a to J204-K. Applied voltage shall not appear at J204-F. Ground pin J204-G. The applied DC voltage shall disappear at J204-K and shall appear at J204-F. Remove the ground connection to J204-G. The applied DC voltage shall remain at J204-F. Remove the short between J205-a and J204-K. The applied voltage shall remain at J204-F. Remove the power to J204-g. The DC voltage shall disappear at J204-F.

*3.5.4.4.9.4.6 Apply +28V DC to pin J205-a and ground J204-G. There shall be zero volts at J204-F. Remove ground from J204-G. There shall be continuity between J202-R and B.

*3.5.4.5 Controls - The amplifier-power supply shall contain "ROLL", "YAW", and "PROG SPEED" controls of the screwdriver adjustment type. When connected to an AN/AJB-3 system, they shall function as follows:

(1) Roll - It shall be possible to adjust the roll portion of the roll/yaw signal to obtain a 0.5° to 2° roll deflection on the indicator for a 1° roll attitude change.

(2) Yaw - It shall be possible to adjust the yaw portion of the roll/yaw signal to obtain a 2° to 6° roll deflection on the indicator for a 1° yaw attitude change.

(3) Programmer Speed - A resistor variable from 0 to 250 ohms shall be provided for control of programmer speed.

*3.5.4.6 Performance at Temperature Extremes - The amplifier-power supply shall perform as specified herein at temperature extremes.

*3.5.4.7 Electrical Connections - Connections to external circuits shall be provided as shown in Figure 1.

*3.5.5 Computer, Bomb Release Angle CP-410/AJB-3 - The bomb release angle computer shall meet the following requirements:

*3.5.5.1 Function - The bomb release angle computer shall receive pitch attitude signals from a displacement gyroscope and shall develop bomb release signals at preselected pitch angles, shall resolve gyro roll and yaw signals about pitch to provide aircraft roll and yaw signals, shall develop relay switching signals at preselected pitch angles, and shall develop a signal proportional to the error between aircraft dive angle and a preselected dive angle.

*3.5.5.2 Form Factor - The bomb release angle computer shall be enclosed in a case conforming to the general requirements of MIL-C-172. The outline dimensions of the case and mounting bracket shall conform to MS17379.

*3.5.5.3 Case - The case and mounting bracket shall be made of non-ferrous, low density metal, uniform in texture, and having a smooth surface. The case and mounting bracket shall be

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finished with a lusterless black material, Color No. 37038 of FED-STD-595. The case shall be pivoted in the mounting bracket so it may be positioned to facilitate adjustment and viewing of the dials.

*3.5.5.4 Contents - The bomb release angle computer shall contain the following:

*3.5.5.4.1 Servo Mechanism - The servo mechanism shall consist of a synchro control transformer, a servo motor-generator, and a gear train. The servo mechanism shall operate in conjunction with an external amplifier. Its components shall have the following characteristics:

(1) Control Transformer - The control transformer shall have the following nominal characteristics:

DC rotor resistance	347 ohms
DC stator resistance	64 ohms, line to line
Input voltage	11.8V, line to line
Input current	33 ma, max.
Output voltage	26V, open circuit
Impedance	
Output Z_{RO}	470 +j1860 ohms
Input, Z_{SO}	78 +j346 ohms
Accuracy	±7 minutes

(2) Motor-Generator - The motor-generator shall have the following nominal characteristics:

Motor -	
Input voltage	
Fixed phase	26V, 400 cps
Control phase	33V, 400 cps
Current	
Fixed phase	95 ma, max.
Control phase	72 ma, max.
Impedance	
Fixed phase	270 +j195
Control phase	460 +j320
Generator -	
Voltage	
Input	30V, 400 cps
Output	0.2V/1000 rpm
Impedance	
Input	1450 +j950 ohms
Output	650 +j416 ohms
Input current	22 ma, max.
Null voltage	30 mv, max.

(3) Gear Train - The gear train shall be designed to provide the specified follow-up rate and accuracy. The gear design shall eliminate detrimental play and backlash.

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*3.5.5.4.2 Angle Data Shaft - The angle data shaft shall be driven by the servo gear train and shall drive the control transformer rotor, the dive synchro transmitter rotor, the resolver rotor, and the switch assembly. The design of the system shall be such that the shaft repeats the pitch attitude of the aircraft when the control transformer is driven by the pitch synchro transmitter in the CN-494A/AJB-3 Displacement Gyroscope Assembly.

*3.5.5.4.3 Resolver - The resolver shall consist of two stator windings and two rotor windings. The nominal electrical characteristics of the resolver shall be as follows:

(1) Stator, per winding -

Input voltage	26V, max.
Input current	14 ma, max.
Impedance, Z_{SO}	475 +j2170
Input power	0.12 watt max.

(2) Rotor, per winding -

Impedance, Z_{RO}	595 +j1900
Null voltage	50 mv, max. open circuit

The two stator and two rotor windings shall be positioned 90 degrees in respect to each other.

(3) Output Voltages -

(a) From electrical 0° to 180° and CW rotation, the resolver output voltages shall vary in accordance with the following equations:

$$E_R\ 13 = 0.843\ E_S\ 42 \cos\theta$$

$$E_R\ 24 = 0.843\ E_S\ 42 \sin\theta$$

or

$$E_R 31 = 0.843\ E_S\ 31 \sin\theta$$

$$E_R 34 = 0.843\ E_S\ 31 \cos\theta$$

(b) From 180° to 360° the output voltages shall be equal to those specified in (a) above, but of reverse phase.

(c) With both stator windings excited, the output voltages shall vary in accordance with the following equations:

$$E_R\ 13 = 0.843\ E_S\ 42 \cos\theta - 8.843\ E_S\ 31 \sin\theta$$

$$E_R\ 24 = 0.843\ E_S 31 \cos\theta + 0.843\ E_S\ 42 \sin\theta$$

NOTE: θ = stator to rotor displacement angle. Unit observations are made from the lead side.

*3.5.5.4.4 Dive Transmitter - The dive transmitter shall have the following nominal electrical characteristics. The stator shall be adjustable from 0° to -100°.

DC rotor resistance	24 ohms
DC stator resistance, line to line	7.5 ohms
Input voltage	26V, 400 cps, 1 Ø
Input current	200 ma, max.

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Impedance	
Input, Z_{RO}	32 +j150 ohms
Output, Z_{SO}	7.3 +j26 ohms
Output voltage, line to line	11.8V, max.
Null voltage	30 mv, max.
Accuracy	±7 minutes

*3.5.5.4.5 Switch Assembly - The switch assembly shall be designed to provide the following control signals:

(1) Low Angle Release - The low angle release switch shall be adjustable to produce continuity to DC ground at angles of 0° to 80°. The continuity shall remain through 10°. The same condition shall prevail at the selected angle plus 180°.

(2) High Angle Release - The high angle release switch shall be adjustable to produce continuity to DC ground at angles of 80° to 170°. The continuity shall remain through 10°. The same condition shall prevail at the selected angle plus 180°.

(3) ±20° Switch - The ±20° switch shall produce continuity to DC ground from 340° through 20° and from 160° through 200°.

*3.5.5.4.6 Dials - Precision dials shall be provided to enable accurate setting of the low and high bomb release angle switches and the dive synchro transmitter stator. A vernier scale shall be provided for each dial so that each dial may be adjusted to 0.1° setting.

*3.5.5.4.6.1 Dial Adjustment - The dials shall be settable by adjustment screws available from the exterior of the case and shall not lose adjustment or change setting during or after exposure to any of the specified environmental requirements.

*3.5.5.5 Performance - The equipment shall meet the detail performance requirements specified when connected to a test synchro transmitter and amplifier as specified below.

*3.5.5.5.1 Test Synchro Transmitter - The test synchro transmitter shall be a Kearfott type R510-1A or equivalent and shall be connected as indicated below:

Synchro Transmitter	Connector Pins (J611)
X	Y
Z	X
Y	Z
H, C	26V AC - 400 cps

The rotor and stator leads H, C, X, Y, and Z shall be designated for 180° index reference and positive rotational reference per ARinc Synchro Manual. Positive rotation is designated as climb.

*3.5.5.5.2 Test Amplifier - The test amplifier shall have the nominal characteristics and shall be connected as specified below:

(1)	Input impedance	15K ohms min.
(2)	Load impedance	82 +j143 ohms
(3)	Input saturation E	0.15V AC, ØC
(4)	Output E at saturation	20V AC, leading motor fixed phase by 90°

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(5)	Null output	3V rms, max.
(6)	Connections:	
	Input, low	pin g
	Input, high	pin a
	Output, high	pin L
	Output, low (case gnd) ..	pin K

*3.5.5.5.3 Servo - The servo performance shall be as follows:

(1)	Follow-up rate	150°/sec. min.
(2)	Follow-up error	-0.1°/10°/sec.
(3)	Overshooting	None at rates up to 150°/sec.
(4)	Static positional accuracy	±0.3°

*3.5.5.5.4 Resolver - The voltage output across pins A and B shall be at a minimum and less than 130 mv with the synchro test transmitter set at 30° ± 5° climb. The voltage output across pins V to W shall be 980 mv ± 10% and shall be in phase with the input to T to U. As the synchro test transmitter is advanced in climb, the voltage output across pins A to B shall increase and be in phase with the input to pins T to U. The voltage output across pins A and B shall be at a maximum and more than 550 mv with the synchro test transmitter set at 120° ± 5°. The A-B voltage shall be in phase with the input to T to U. Also, the output voltage across pins V to W shall be less than 130 mv. As the synchro test transmitter is advanced, the voltage output across V to W shall be out of phase with the input voltage to T to U.

*3.5.5.5.5 Dive Transmitter - Electrical zero as described in MIL-S-16892 shall occur within ±1.5° of any dive angle set on the dive angle dial as the rotor is moved by the servo and synchro transmitter.

*3.5.5.5.6 Switching - The performance of the switches shall be as specified below:

(1) Low Angle Release Switch - Continuity to DC ground shall occur when the synchro transmitter is within +0.1° -0.6° of the preset release angle and is being advanced from 0° at a rate equal to or less than 1 RPM.

(2) High Angle Release Switch - Performance shall be as specified for the low angle release switch.

(3) ±20° Switch - Continuity to DC ground shall exist from 340 ± 2° through 20 ± 2° and from 160 ± 2° through 200 ± 2°.

*3.5.5.5.7 Dials - The setting accuracy of the high and low angle release dials shall be ±0.1° and that of the dive transmitter dial shall be ±1.0°.

*3.5.5.6 Performance at Temperature Extremes - The bomb release angle computer shall perform as specified herein at temperature extremes except as follows:

*3.5.5.6.1 Servo Follow-Up Error - The follow-up error shall not exceed 0.15°/10°/second in lieu of 0.1°/10°/second.

*3.5.5.6.2 Resolver - The resolver null shall not exceed 150 mv in lieu of 130 mv.

*3.5.5.7 Electrical Connections - Connections to external circuits shall be provided as shown in Figure 1.

*3.5.6 Controller, Compass System C-2984/AJB-3A - The compass system controller shall meet the following requirements:

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*3.5.6.1 Function - The compass system controller shall provide the mode selection and controls for the operation of a directional gyro-magnetic compass heading system. It shall operate with the following items:

Adapter-Compensator, Compass MX-2826A/AJB

*3.5.6.2 Form Factor - The compass system controller shall be enclosed in a case conforming to the general requirements of MIL-C-172. The outline dimensions of the case including the control knobs, shall conform to MS17392.

*3.5.6.3 Case - The case of the controller shall be made of non-ferrous, low density metal, uniform in texture, having a smooth surface. The case shall be finished with a lusterless black material, Color No. 37038 of FED-STD-595. Panel markings shall be in accordance with MS17392.

*3.5.6.4 Controls - The compass system controller shall provide the following controls as shown on MS17392:

*3.5.6.4.1 Mode Selector Switch - The mode selector switch shall provide for the selection of "SLAVED" directional gyro mode of operation, "FREE" directional gyro mode of operation, or "COMPASS" mode of operation.

*3.5.6.4.2 Set Heading Control - The set heading control shall be labeled "PUSH TO TURN", shall provide switching to de-couple the autopilot and to control the direction and rate of slewing the system to an azimuth heading when operating in the "FREE" mode.

*3.5.6.4.3 Synchronizing Switch - The synchronizing switch shall be labeled "PUSH TO SYNC" and shall provide for synchronization of the azimuth heading output to the magnetic compass when operating in the "SLAVED" mode.

*3.5.6.4.4 Latitude Control - The latitude control shall provide means to compensate for apparent drift of the gyroscope resulting from rotation of the earth.

*3.5.6.4.5 Hemisphere Switch - The hemisphere switch shall enable selection of the hemisphere in which latitude correction is to be applied.

*3.5.6.5 Synchronizing Indicator - The compass system controller shall include a synchronizing indicator to provide a visual indication of synchronization between the azimuth heading output and the magnetic compass.

*3.5.6.5.1 Dial Marking - The synchronizing indicator dial shall be marked as shown on MS17392. The "L" and "R" and zero index markings shall be lusterless black, Color No. 37038 of FED-STD-595 and the scale shall be lusterless white, Color No. 37875 of FED-STD-595.

*3.5.6.6 Electrical Connections - Connections to external circuits shall be provided as shown in Figure 1.

*3.5.6.7 Panel Illumination and Marking - The compass system controller shall contain a lighting plate conforming to Specification MIL-P-7788. The plate shall be marked in accordance with Specification MIL-C-18012.

*3.5.6.8 Performance Characteristics - The performance characteristics shall be as follows under standard conditions (3.3.8).

*3.5.6.8.1 Synchronizing Indicator - With the mode selector in the "SLAVED" or "COMPASS" position, 45 microamperes DC from pins P to R shall cause a minimum pointer deflection of 2/3 of full scale from its center position. Deflection shall be to the left when pin P is positive and to the right when pin R is positive.

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*3.5.6.8.2 Mode Selector Switch - The specified resistance shall exist between the specified pins for the three switch positions.

CONNECTOR PINS (J801)	SLAVED	FREE	COMPASS
C - G	Over 50 Megohms	Over 50 Megohms	2 ohms max.
C - H	Over 50 Megohms	Over 50 Megohms	20 ohms max.
C - S	Over 50 Megohms	Over 50 Megohms	Over 50 Megohms
C - K	Over 50 Megohms	Over 50 Megohms	500 ± 12% ohms
C - J	Over 50 Megohms	Over 50 Megohms	500 ± 12% ohms
C - M	Over 50 Megohms	Over 50 Megohms	Over 50 Megohms
D - G	2 ohms max.	Over 50 Megohms	Over 50 Megohms
D - H	20 ohms max.	Over 50 Megohms	Over 50 Megohms
D - S	Over 50 Megohms	Over 50 Megohms	Over 50 Megohms
D - K	500 ± 12% ohms	Over 50 Megohms	Over 50 Megohms
D - J	500 ± 12% ohms	Over 50 Megohms	Over 50 Megohms
D - M	Over 50 Megohms	Over 50 Megohms	Over 50 Megohms
c - b	Over 50 Megohms	2 ohms max.	Over 50 Megohms

*3.5.6.8.3 Set Heading Control - The specified resistance shall exist between the specified connector pins for the two switch positions. The "PUSH TO TURN" knob shall not be rotated and the mode selector switch shall be in the "SLAVED" position.

CONNECTOR PINS (J801)	NORMAL	DEPRESSED
H - K	500 ± 12% ohms	500 ± 12% ohms
H - J	500 ± 12% ohms	500 ± 12% ohms
H - M	Over 50 Megohms	20 ohms max.
H - G	20 ohms max.	20 ohms max.
X - W	Less than 2 ohms	Over 50 Megohms
M - G	Over 50 Megohms	Less than 2 ohms

*3.5.6.8.3.1 With "PUSH TO TURN" knob depressed; the resistance between J and H and K and H shall be equal within 80 ohms and rotation to full CW position shall increase the resistance between H and K to 1000 ± 6% ohms. Rotation to full CCW position shall decrease the resistance between H and K to 5 ohms or less. In full CW position the resistance between J and H shall be less than 5 ohms.

*3.5.6.8.3.2 With the "PUSH TO TURN" knob at its maximum CW or CCW position and with no axial pressure on the knob, the following resistances shall exist:

CONNECTOR PINS (J801)	RESISTANCE
X - W	Over 50 Megohms
M - G	Less than 2 ohms

*3.5.6.8.4 Synchronizing Switch - With the synchronizing switch in its normal position and the mode selector in the "SLAVED" position, the resistance between pins S and D of J801 shall be over 50 megohms. With the switch depressed, the resistance shall be less than 2 ohms.

*3.5.6.8.5 Latitude Control - With 26 ± 2.6V AC applied between pins A and B (gnd) and a load of 17.5K ohms ±1% between pins E and F of J801, the ratios between the in-phase component of the voltage between pins E and F and the excitation voltage shall be as specified below for each latitude setting:

LATITUDE SETTING	VOLTAGE RATIO
90°	0.777 ± 1%
75°	0.750 ± 1%
60°	0.672 ± 1%

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45°	0.549 ± 1%
30°	0.388 ± 1%
15°	0.201 ± 1%
0°	0.005 (max.)

For the "N" position of the hemisphere switch, the voltages between pins E and F (common) shall lead the excitation voltage by 8° ± 3° and lag by 172° ± 3° for the "S" position of the hemisphere switch.

*3.5.6.9 Performance at Temperature Extremes - The compass system controller shall perform as specified herein at temperature extremes except as follows:

*3.5.6.9.1 Resistance - The resistance tolerances of ± 12% in paragraphs 3.5.6.8.2 and 3.5.6.8.3 shall be ± 16%. The resistance tolerance of ± 6% in paragraph 3.5.6.8.3.1 shall be ± 10%.

*3.5.6.9.2 Voltage Ratio - The voltage ratio tolerances of ±1% in paragraph 3.5.6.8.5 shall be ±2%.

*3.5.6.9.3 Phase Angle - The phase angle tolerances of ±3% in paragraph 3.5.6.8.5 shall be ±5%.

*3.5.7 Distribution Box J-1122/AJB-3A - The ditribution box shall meet the following requirements:

*3.5.7.1 Function - The distribution box shall provide two functions, an AC-DC interlock and an aural tone generator. The AC-DC interlock shall interrupt both AC and DC power when the DC and/or one, two, or all three phases of the AC power is interrupted or drops below predetermined values. The aural tone generator shall generate a 400 cps warning burst when triggered by a DC ground signal pulse and shall generate a 400 cps steady tone when triggered by 28V DC.

*3.5.7.2 Form Factor - The distribution box shall be enclosed in a case conforming to the general requirements of MIL-C-172. The outline dimensions of the case shall conform to MS17381.

*3.5.7.3 Case - The case of the distribution box shall be made of non-ferrous, low density metal, uniform in texture and shall have a smooth surface. The case shall be finished with a lusterless black material, Color No. 37038 of FED-STD-595.

*3.5.7.4 Contents - The distribution box shall contain the following circuits:

*3.5.7.4.1 AC-DC Interlock -

*3.5.7.4.1.1 Operation - With 115V ± 3%, 400 cps ± 2% from pins A to D, B to D and C to D of J1402 and 28 ± 1V DC from E to D (-DC to D) of J1402, input AC power shall appear at pins A, B, and C of J1401 in respect to pin G.

*3.5.7.4.1.2 Drop-Out - Removal of AC power from A, B, or C of J1402 or removal of DC power from pin E of J1402 shall cause the output power at pins A, B, and C of J1401 to disappear within 7 seconds.

Reduction of the AC power to pins A, B, or C of J1402 to 70V shall cause the output power at pins A, B, and C of J1401 to disappear within 25 seconds.

*3.5.7.4.2 Tone Generator - The following performance requirements shall be met with 115V ± 3%, 400 cps ± 2%, 1 Ø AC power applied between B and G of J1401 and a 600 ohm ± 5%, 5W resistance load across T and G of J1401.

*3.5.7.4.2.1 Warning Tone Burst - With the volume control at maximum CW position, grounding of pin U of J1401 shall cause a 0.25 to 0.5 second, 400 cps ± 2% signal burst of 100 mw minimum across pins G and T. With the volume control at maximum CCW position, the power of the burst shall be 10 mw maximum.

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*3.5.7.4.2.2 Continuous Tone - With the volume control at maximum CW position, application of 28 ± 1V DC to pin D with respect to pin G of J1401 shall cause a steady, 400 cps ± 2% signal of 50 mw minimum across pins G and T. With the volume control at maximum CCW position, the signal power shall be 5 mw maximum. The tone shall remain until the DC power is removed from pin D.

*3.5.7.4.2.3 Power Ratio - For a given setting of the volume control, the power level of the warning tone burst shall be approximately twice that of the continuous tone.

*3.5.7.4.2.4 Tone Content - The tone generator shall utilize the 400 cps aircraft power as a tone source but shall introduce sufficient harmonic to distinguish the tone from normal 400 cps hum.

*3.5.7.5 Controls - A screwdriver adjustable AURAL TONE VOLUME control shall be externally accessible.

*3.5.7.6 Electrical Connections - Connections to external circuits shall be provided as shown in Figure 1.

*3.5.7.7 Performance at Temperature Extremes - The performance of the distribution box shall be as specified herein at temperature extremes except as follows:

*3.5.7.7.1 Tone Level - Without readjustment, the output power of the tone generator shall be within ± 3 db of the value obtained under standard conditions (3.3.8).

*3.5.8 Gyroscope Assembly, Displacement CN-494A/AJB-3 - The displacement gyroscope assembly shall meet the following requirements:

*3.5.8.1 Function - The displacement gyroscope assembly shall provide electrical signals representative of aircraft attitude through 360° of pitch, roll, and yaw. It shall consist of a vertical gyro and a directional gyro mounted in multiple gimbals with a common outer gimbal as described herein. The gimbal arrangement shall prevent gimbal lock and, with proper correction for signal phasing, the unit shall meet the detail performance requirements with the outer gimbal in its normal attitude or in a position 180° from the normal attitude.

*3.5.8.2 Form Factor - The displacement gyroscope assembly shall be enclosed in a case conforming to the general requirements of MIL-C-172. The outline dimensions of the case shall conform to MS17382.

*3.5.8.3 Case - The case of the gyroscope shall be made of non-ferrous, low density metal, uniform in texture, having a smooth surface and shall be hermetically sealed. The case shall be finished with a lusterless black material, Color No. 37038 of FED-STD-595. A white arrow labeled "direction of flight" shall be painted on the case as shown on MS17382.

*3.5.8.3.1 Hermetic Sealing - The case shall provide a hermetically sealed enclosure for all of the mechanism. The case shall be so constructed that it may be opened, the mechanism removed and replaced and the case re-sealed at least three times. This shall be possible without the use of any special tool, jig or fixture, unless such device is specifically approved by the procuring activitiy. The sealing of the case shall not be dependent upon any material which will be adversely affected by any atmosphere to which the instrument may be subjected in normal use in military aircraft.

*3.5.8.3.2 Filling Medium - The filling medium shall be either a mixture of 90% nitrogen and 10% helium or 95% helium and 5% carbon dioxide. The nitrogen used shall be in accordance with Specification BB-N-411, Type I, Class I, Grade C. The filling medium shall contain not more than 0.006 milligram of water vapor per liter (dew point -65°C) at the filling pressure. The absolute pressure of the filling medium in the case shall be 1 ± 0.1 atmosphere.

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*3.5.8.3.3 Leak Rate - The gas or mixture of gases in the case, adjusted to a pressure differential of one atmosphere, shall not have a leakage from the case that would permit more than 10 percent contamination of the filling medium after 1000 hours.

*3.5.8.4 Electrical Connections - Connections to external circuits shall be provided as shown in Figure 1.

*3.5.8.5 Installation Mounting - Installation shall be with the mounting feet down and with the "direction of flight" arrow pointing forward.

*3.5.8.6 Contents - The displacement gyroscope assembly shall consist of a vertical gyro and a directional gyro mounted in multiple gimbals with a common outer gimbal.

*3.5.8.6.1 Vertical Gyro - The vertical gyro shall have sufficient angular momentum and be of such design so as to provide the performance specified herein when operated throughout the temperature, vibration, and acceleration ranges specified.

*3.5.8.6.1.1 Gimbal System - The vertical gyro shall be suspended in a gimbal system which has two free inner gimbals and a servo driven outer gimbal to eliminate gimbal lock of the gyro. The outer gimbal shall be used in common with the directional gyro.

*3.5.8.6.1.1.1 First Gimbal - The first gimbal shall be the gyro rotor housing. It shall be stabilized by the inertia of the gyro.

*3.5.8.6.1.1.2 Second Gimbal - The second gimbal shall be the next gimbal outward from the first gimbal. It shall be stabilized in pitch by the gyro.

*3.5.8.6.1.1.3 Third Gimbal - The third gimbal shall be the outer gimbal. It shall be servo driven to maintain a fixed relation between the first and second gimbal except for certain conditions specified herein.

*3.5.8.6.1.2 Axes of Freedom - The vertical gyro shall have three axes of freedom. Each axis shall be a signal axis.

*3.5.8.6.1.2.1 First Axis of Freedom - The first axis of freedom shall be between the first and second gimbal. This axis shall be maintained in the horizontal plane and be aligned with the orthogonal horizontal projection of the fore and aft axis of the gyroscope under normal conditions. A minimum freedom of ±80 degrees shall be provided about this axis. An angular displacement about this axis shall provide an indication which changes from roll to yaw as the pitch angle changes from zero pitch to ±90 degrees pitch. Stops shall be incorporated on this axis which produce a pitch precession when the freedom is exceeded and no damage shall result under this condition.

*3.5.8.6.1.2.2 Second Axis of Freedom - The second axis of freedom shall be between the second gimbal and the third (servo driven) gimbal. This axis shall be perpendicular to the first axis of freedom and shall be maintained in the horizontal plane under normal conditions. Unlimited freedom shall be provided about this axis. An angular displacement about this axis shall be a measurement of the pitch angle.

*3.5.8.6.1.2.3 Third Axis of Freedom - The third axis of freedom shall be between the third gimbal and the instrument frame or case. This axis shall be perpendicular to the second axis of freedom and shall coincide with the fore and aft axis of the instrument. Unlimited freedom shall be provided about this axis. An angular displacement about this axis shall be a measurement of the roll angle. This axis shall have a preassembled slip ring and brush-block capsule having redundant circuits for all output signal leads. Individual slip ring circuit assignments shall be made to minimize the voltage differential between adjacent slip rings.

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*3.5.8.6.1.3 Gimbal Actuation - The inner two gimbals are maintained in a fixed relation to the apparent gravity vertical by the erection system. The outer gimbal is actuated by a servo mechanism and is driven so as to maintain the spin axis of the vertical gyro and the pitch axis in a 90-degree relation to each other except for certain transient conditions. The response of the servo of the outer gimbal shall be such that this 90-degree relation will be maintained during roll rates from zero through 360 degrees per second with no lag, overshooting, oscillation, hunting, or jumping or such a magnitude and frequency which will effect the performance of a high performance autopilot. The servo loop shall be sufficiently tight such that in normal operation during loop maneuvers, the third gimbal is rotated when the third gimbal axis passes through the vertical in order to keep proper sensing of the servo drive. The servomechanism shall be designed to meet specified performance requirements when connected to a servo amplifier as specified in paragraph 3.5.8.7.3 (c).

*3.5.8.6.1.4 Erection - Means shall be incorporated for erection of the gyro to apparent gravity vertical from any attitude. The pitch and bank erection systems shall be separate and controllable individually.

*3.5.8.6.1.5 Synchro Outputs - Two transmitting synchros shall be mounted on the outer roll and on the pitch gimbals. One transmitting synchro shall be mounted on the inner roll gimbal. The inner roll synchro and one each of the two pitch and outer roll synchros shall be excited internally. The rotor leads of the other synchros shall be brought out to the connector for external excitation. The stator leads of all five synchros shall be brought out to the connector. The output signal from each synchro shall have a one-to-one ratio with the movement of the corresponding gimbal.

*3.5.8.6.1.5.1 Synchro Characteristics - The synchros shall have the following characteristics:

(1)	Input voltage	115V, 400 cps, 1 Ø
(2)	Input current, open stator	38 ma
(3)	Input power, open stator	0.90 watt
(4)	Input impedance, open stator	810 +j3500
(5)	Rotor resistance, dc	235 ohms
(6)	Stator output voltage, line-to-line	11.8 ± 0.25V
(7)	Stator resistance, dc, between leads	4.5 ohms
(8)	Null voltage	25 mv maximum
(9)	Accuracy	±8 minutes (1 pitch, 2 azimuth) ±15 minutes (2 roll, 1 pitch)

Each synchro shall be capable of operating up to eight high impedance control transformers of the Eclipse-Pioneer AY500-5 type or equal simultaneously when the control transformers are loaded with 10,000 ohm loads.

*3.5.8.6.1.6 Roll Switch - A segment switch shall be incorporated to sense an inverted outer roll gimbal condition.

*3.5.8.6.1.7 Pitch Switch - A segment switch shall be incorporated to sense the relation between the pitch gimbal and outer roll gimbal positions.

*3.5.8.6.1.8 Power-Off Freedom - When power is removed momentarily, the vertical gyro shall still have freedom about its first and second gimbal axes and shall not be displaced from the vertical at ±70° pitch and bank angles.

*3.5.8.6.2 Directional Gyro - The directional gyro shall have sufficient angular momentum and be of such design so as to provide the performance specified herein when operated throughout the temperature, vibration, and acceleration ranges specified herein.

*3.5.8.6.2.1 Gimbal System - The directional gyro shall be suspended in a gimbal system of which the outer gimbal is the third (servoed) gimbal of the vertical gyro. The directional gyro shall have three other gimbals contained in the outer gimbal.

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*3.5.8.6.2.1.1 First Gimbal - The first (inner) directional gyro gimbal (gyro wheel housing) shall be stabilized by the inertia of the gyro. Its pivot axis shall be the first directional gyro axis of freedom and shall be perpendicular to the spin axis of the gyro and shall normally lie in the horizontal plane. The slaving torquer shall be mounted on this axis. This gimbal shall have a minimum of ±80 degrees of freedom from normal.

*3.5.8.6.2.1.2 Second Gimbal - The second directional gyro gimbal shall be stabilized by the inertia of the gyro. Its pivot axis shall be the second directional gyro axis of freedom and shall be normally aligned with the vertical. The azimuth output synchros and the leveling torquer shall be mounted on this axis. This gimbal shall be capable of continuous rotation about its axis.

*3.5.8.6.2.1.3 Third Gimbal - The third directional gyro gimbal (pitch) shall be servo driven such that it follows the vertical gyro second gimbal (pitch) at a maximum rate of not less than 200° per second. Its pivot axis shall be the third directional gyro axis of freedom and shall be parallel to the vertical gyro second axis (pitch) of freedom. This gimbal shall be capable of continuous rotation about its axis. The servo mechanism shall be designed to meet specified performance requirements when connected to the servo amplifier specified in paragraph 3.5.8.7.3 (a). This axis shall have a preassembled slip ring and brushblock capsule having redundant circuits for all output signal leads. Individual slip ring circuit assignments shall be made to minimize the voltage differential between adjacent slip rings.

*3.5.8.6.2.2 Leveling - Means shall be incorporated to maintain the spin axis perpendicular to the azimuth axis. The leveling shall be controlled by a non-pendulous sensor and shall utilize the amplifier specified in paragraph 3.5.8.7.3 (b).

*3.5.8.6.2.3 Slaving - Means shall be incorporated to slave the azimuth gimbal to any desired heading.

*3.5.8.6.2.4 Latitude Compensation Calibration - Data necessary to provide compensation for directional gyro drift shall be provided as follows:

(a) Bias and trim voltages, necessary to compensate for directional gyro drift due to random drift and earth's rate, shall be calibrated for each gyro assembly and shall be displayed (in voltage values) on the connector end of the case. These voltages shall determine the "Bias" and "Trim" potentiometer settings on the Specification MIL-A-23717, Compass Adapter-Compensator MX-2488A/AJB-3 (or equal) only, as used in the Loft Bomb Release Computer Set AN/AJB-3 only.

(b) Also, the directional gyro random drift in degrees per hour shall be displayed on the connector end of the case. This value shall determine the setting of the "bias/deg/hr" potentiometer on the Compass Adapter-Compensator MX-2826A/AJB-3A only, as used in the Loft Bomb Release Computer Set AN/AJB-3A only.

*3.5.8.6.2.5 Synchro Outputs - Two transmitting synchros shall be mounted on the azimuth gimbal. The rotor leads of both synchros shall be brought out to the connector for external excitation (however, one synchro may have one lead tied to AC neutral internally). The stator leads of both synchros shall be brought out to the connector. The output signal from each synchro shall have a one-to-one ratio with the movement of the gimbal.

*3.5.8.6.2.5.1 Synchro Characteristics - The synchro characteristics shall be identical to those of the vertical gyro synchros. See paragraph 3.5.8.6.1.5.1.

*3.5.8.7 Performance Characteristics - The performance characteristics shall be as follows under standard conditions (3.3.8).

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*3.5.8.7.1 Vertical Gyro

*3.5.8.7.1.1 Erection - When the gyro is displaced about one axis but erected in the other, the gyro shall not deviate more than 1.5° from the erected position while the displaced gimbal is being erected. Application of 60V rms to both the pitch and roll erection systems shall cause erection of the gimbals at a minimum rate of 15° per minute. Application of 18V rms to both the pitch and roll erection systems shall cause erection of the gimbals at a rate of 0.8 to 1.8° per minute.

*3.5.8.7.1.1.1 Initial Erection - With the gyro rotor at a standstill and the spin axis in any rancom position, application of rotor power and high erection voltage to both the pitch and roll erection systems shall cause erection of the gyro to a position within 1° of apparent gravity vertical in 1 minute or less.

*3.5.8.7.1.1.2 Final Erection - After completion of the initial erection cycle, application of low erection voltage shall cause erection of the gyro to a position within 0.25° of vertical in 2 minutes or less.

*3.5.7.7.1.2 Synchro Outputs

*3.5.8.7.1.2.1 Outer Roll - The phase of the outer roll synchro output signals shall be as specified below:

(a) Externally Excited Synchro - When terminals W and H are connected to AC neutral and terminal J to ØC, the voltage measured across U and V shall be at a minimum and the voltage measured between U or V and J shall be less than the excitation voltage when the gimbal is at zero displacement. Applying right roll to the reference shall cause the voltage across U and W to increase before decreasing and the voltage across V and W to decrease before increasing. Referenced terminals are on J361.

(b) Internally Excited Synchro - When terminal Z is connected to AC neutral, the voltage measured across X and Y shall be at minimum and the voltage measured between X or Y and D of J362 shall be less than the excitation voltage when the gimbal is at zero displacement. Applying right roll to the reference shall cause the voltage across X and Z to increase before decreasing and the voltage across Y and Z to decrease before increasing. Referenced terminals are on J361.

(c) In each of the above, the outer roll gimbal shall be stabilized as the reference is rolled.

*3.5.8.7.1.2.2 Pitch - The outputs of the pitch synchros shall be as specified below.

(a) Externally Excited Synchro - When terminals c and K are connected to AC neutral and terminal L to ØC, the voltage measured across a and b shall be at minimum and the voltage measured between a or b and L shall be less than the excitation voltage when the gimbal is at zero displacement. Applying climb to the reference shall cause the voltage a and c to increase before decreasing and the voltage across b and c to decrease before increasing. Terminals are on J361.

(b) Internally Excited Synchro - When terminal f is connected to AC neutral, the voltage across d and e shall be at minimum and the voltage measured between d or e and D of J362 shall be less than the excitation voltage when the gimbal is at zero displacement. Applying climb to the reference shall cause the voltage across d and f to increase before decreasing and the voltage across e and f to decrease before increasing. Referenced terminals are on J361. The maximum

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tracking and alignment error spread shall be 1° and the difference between the errors at identical angles as the gyro is rotated from 0° to 180° in climb with the outer roll gimbal inverted and normal shall not exceed 0.4°.

*3.5.8.7.1.2.2.1 Pitch Synchro Correction Chart - A pitch synchro correction chart shall be derived from the synchro error data taken between 0° and 180° climb at pins d, e, and f of J361 in 5° steps. This chart shall be found on the side of the unit.

*3.5.8.7.1.2.3 Inner Roll - The output of the inner roll synchro shall be as specified below.

When terminal j is connected to AC neutral, the voltage across g and h shall be a minimum and the voltage measured between g or h and D of J362 shall be less than the excitation voltage when the gimbal is at zero displacement. Applying right roll to the reference shall cause the voltage across g and j to increase before decreasing the voltage across h and j to decrease before increasing. Referenced terminals are J361.

*3.5.8.7.1.2.4 Electrical Zero Accuracy - With the gimbals fully erected, the synchro signals shall be at electrical zero within the tolerences specified below:

(a) Outer Roll - ± 0.75°
(b) Pitch - ± 0.5°
(c) Inner Roll - ± 0.5°

*3.5.8.7.1.3 Drift - The maximum free drift, noted after compensation for earth's rotation effect, shall not be greater than 0.25° per minute with the gyro spin axis either tilted 20° or vertical.

*3.5.8.7.1.4 Roll Switch - The roll switch shall connect terminal D to AC neutral from ±90° through 180° to 270° where zero roll is the initial zero position as defined in paragraph 3.5.8.7.1.2.1. The circuit shall be open for the remaining 180° of roll. Referenced terminals are on J361.

*3.5.8.7.1.5 Outer Roll Servo - The performance of the roll servo shall satisfy the design requirements as specified in paragraph 3.5.8.6.1.3 when connected to an amplifier whose characteristics are equal to those of the roll servo test amplifier as specified in 3.5.8.7.3 (c).

*3.5.8.7.2 Directional Gyro

*3.5.8.7.2.1 Leveling - Using an amplifier whose characteristics are equal to those of the leveling test amplifier as specified in 3.5.8.7.3 (b) and a fixed phase voltage of 30V rms on the torquer, the leveling rate shall be 2 to 10° per minute. The leveling system shall level the gyro within 1-1/2 minutes after application of starting power.

*3.5.8.7.2.2 Slaving - Application of 5.6V rms of slaving power to the slaving torquer shall torque the gyro about its azimuth axis at a rate of 1 to 2 degrees per minute.

*3.5.8.7.2.3 Pitch Follow-Up - The pitch follow-up servo shall drive the pitch follow-up gimbal at a mazimum rate of not less than 200°/sec when connected to an amplifier whose characteristics are equal to those of the pitch follow-up test amplifier as specified in 3.5.8.7.3 (a).

*3.5.8.7.2.4 Synchro Outputs - The outputs of the azimuth synchros shall be as specified below:

(a) Internally Excited Synchro - When terminal T is connected to AC neutral, the voltage across R and S shall be a minimum and the voltage measured

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between R or S and E shall be greater than excitation voltage when the spin axis is aligned with the fore and aft axis of the reference. Applying right turn to the reference shall cause the voltage across R and T to increase before decreasing and the voltage across S and T to decrease before increasing. Connect E to ØC for this test. Referenced terminals are on J361.

(b) Externally Excited Synchro - When terminals P and F are connected to AC neutral and G is connected to ØC, the voltage across M and N shall be at minimum and the voltage measured between M or N and G shall be greater than the excitation voltage when the spin axis is aligned with the fore and aft axis of the reference. Applying right turn to the reference shall cause the voltage across M and P to increase before decreasing and the voltage across N and P to decrease before increasing. Referenced terminals are on J361.

*3.5.8.7.2.5 Random Drift - The random drift, noted after compensation for earth's rotation effect, shall not exceed 4° per hour.

*3.5.8.7.3 Test Amplifiers - Amplifiers with the following characteristics shall be connected to the pins indicated during all performance tests. The amplifiers shall be energized with ØC power.

(a) Pitch Follow-Up Servo Amplifier

J362-h	input, low
J362-W	input, high
J362-m	output

Connect

J361-e to J362-Y
J361-d to J362-k
J361-f to J362-s
J362-X to J362-Z

Amplifier Characteristics Nominal

Input impedance	25K ohms
Load impedance	100 + j95 ohms
Input saturation E	0.15 VAC
Output E at saturation	15 ± 2 VAC, 180° out-of-phase
Null output	3.0V rms, Maximum

(b) Leveling Amplifier

J362-i	input, low
J362-j	input, high
J362-H	output

Amplifier Characteristics, Nominal

Input impedance	25K ohms
Load impedance	530 ± j700 ohms
Input saturation E	0.51 VAC
Output E at saturation	41 ± 4 VAC, 180° out-of-phase
Null output	4.5V rms, Maximum

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(c) Roll Servo Amplifier

J361-g	input, high
J362-g	rate, input, low
J362-f	rate, input, high
J361-h	input, low
J362-q	output

Amplifier Characteristics, Nominal

Input impedance	25K ohms
Load impedance	43 +j63 ohms
Input saturation E	0.1 VAC
Output E at saturation	15 ± 2 VAC, 180° out-of-phase with input to J361-g 11 ± 2 VAC, 180° out-of-phase, with input to J362-f
Null output	2.0V rms, Maximum

(d) When specified, J361-Y shall be connected to the input, high, in place of J361-g and J361-X shall be connected to the input, low, in place of J361-h in Section (c) above.

*3.5.9 Gyroscope, Rate Switching CN-495A/AJB-3 - The rate switching gyroscope shall meet the following requirements.

*3.5.9.1 Function - The rate switching gyroscope shall provide a single pole, double throw switching function within specified time intervals both after application of specified turn rates and after the return to zero turn rate from specified turn rates.

*3.5.9.2 Form Factor - The rate switching gyroscope shall be enclosed in a case conforming to the general requirements of MIL-C-172. The outline dimensions of the case shall conform to MS-17384.

*3.5.9.3 Case - The case of the gyroscope shall be made of non-ferrous, low density metal, uniform in texture, having a smooth surface and shall be hermetically sealed. The case shall be finished with a lusterless black material, Color No. 37038 of FED-STD-595. A white line labeled "line of flight" shall be painted on the case as shown on MS-17384.

*3.5.9.3.1 Hermetic Sealing - The case shall provide a hermetically sealed enclosure for all of the mechanism. The case shall be so constructed that it may be opened, the mechanism removed and replaced and the rate switching gyroscope case resealed at least three times. This shall be possible without the use of any special tool, jig or fixture, unless such device is specifically approved by the procuring activity. The sealing of the case shall not be dependent upon any material which will be adversely affected by any atmosphere to which the instrument may be subjected in normal use in military aircraft.

*3.5.9.3.2 Filling Medium - The filling medium shall be either a mixture of 90% nitrogen and 10% helium or 95% helium and 5% carbon dioxide. The nitrogen used shall be in accordance with Specification BB-N-411, Type I, Class I, Grade C. The filling medium shall contain not more than 0.006 milligram of water vapor per liter (dew point -65°C) at the filling pressure. The absolute pressure of the filling medium in the case shall be 1 ± 0.1 atmosphere.

*3.5.9.3.3 Leak Rate - The gas or mixture of gases in the case, adjusted to a pressure differential of one atmosphere, shall not have a leakage from the case that would permit more than 10 percent contamination of the filling medium after 1000 hours.

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*3.5.9.4 Electrical Connections - Connections to external circuits shall be provided as shown in Figure 1.

*3.5.9.5 Installation Mounting - Installation shall be with the mounting feet down and the "line of flight" line on the case parallel to the longitudinal axis of the aircraft.

*3.5.9.6 Contact Rating - The rating of the switching contacts shall not be less than 2 amps at 115V when operating into a resistive load.

3.5.9.7 Performance Characteristics - The performance characteristics shall be as follows under standard conditions (3.3.8).

*3.5.9.7.1 Switching - The rate switching gyroscope shall operate to close the internal circuit between terminals D and E and to open the circuit between terminals C and D within the time specified after application of the following turn rates about the axis perpendicular to the plane of the mounting feet.

Turn Rate	Time	Turn Rate	Time
180° per minute	4 seconds	20° per minute	20 seconds
45° per minute	8 seconds	15° per minute	35 seconds

When the turn rate is reduced to zero, the circuit between terminals D and E shall open and the circuit between terminals C and D shall close within 20 seconds.

*3.5.9.7.2 Yaw Oscillation - With zero turn rate applied, yaw oscillations of plus and minus one degree with a 2 second period and yaw oscillations of plus and minus 2 degrees with an 8 second period shall not cause switching to occur. With the one degree oscillation superimposed on a 30 degree per minute rate of turn, switching shall occur within 30 seconds.

*3.5.9.7.3 Power Failure - Removal of power from the gyroscope shall immediately cause the circuit between terminals D and E to open and remain open and the circuit between terminals E and D to close and remain closed.

*3.5.9.8 Performance at Temperature Extremes - The rate switching gyroscope shall perform as specified herein at temperature extremes except as follows:

*3.5.9.8.1 Switching - When the turn rate is reduced to zero, the circuit between terminals D and E shall open and the circuit between terminals C and D shall close within 25 seconds.

*3.5.10 Indicator, Attitude-Director ID811/AJB-3A - The attitude-director indicator shall meet the following requirements:

*3.5.10.1 Function - The attitude-director indicator shall provide a continuous and unambiguous display of aircraft attitude for 360° of roll, pitch, and azimuth plus horizontal and vertical flight director pointers, a turn and bank display, a vertical displacement display, and power failure indication.

*3.5.10.2 Form Factor - The attitude-director indicator shall be enclosed in a case conforming to the general requirements of MIL-C-172. The outline dimensions of the case shall conform to MS17393.

*3.5.10.3 Case - The case of the indicator shall be made of non-ferrous, low density metal, uniform in texture, having a smooth surface and shall be hermetically sealed. The case shall be finished with a lusterless black material, Color No. 37038 of FED-STD-595.

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*3.5.10.3.1 Hermetic Sealing - The case shall provide a hermetically sealed enclosure for all of the mechanism. The case shall be so constructed that it may be opened, the mechanism removed and replaced and the indicator case resealed at least three times. This shall be possible without the use of any special tool, jig or fixture, unless such device is specifically approved by the procuring activity. The sealing of the case shall not be dependent upon any material which will be adversely affected by any atmosphere to which the instrument may be subjected in normal use in military aircraft.

*3.5.10.3.2 Filling Medium - The filling medium shall be either a mixture of 90% nitrogen and 10% helium or 95% helium and 5% carbon dioxide. The nitrogen used shall be in accordance with Specification BB-N-411, Type I, Class I, Grade C. The filling medium shall contain not more than 0.006 milligram of water vapor per liter (dew point -65°C) at the filling pressure. The absolute pressure of the filling medium in the case shall be 1 ± 0.1 atmosphere.

*3.5.10.3.3 Leak Rate - The gas or mixture of gases in the case, adjusted to a pressure differential of one atmosphere, shall not have a leakage from the case that would permit more than 10 percent contamination of the filling medium after 1000 hours.

*3.5.10.3.4 Mounting - A flange shall be provided for panel mounting. The flange and panel cutout dimensions shall be in accordance with MS-33545 (ASG).

*3.5.10.4 Contents - The attitude-director indicator shall contain assemblies, subassemblies, and circuits to provide the following displays.

*3.5.10.4.1 Attitude Display - The attitude display shall basically consist of a bank angle dial and scale, dial masks, mechanism mask, bank indices, a miniature airplane, and a sphere background which is supported and rotated about three servo driven gimbal axes. The overall arrangement of the attitude display shall be in accordance with Figure 2.

*3.5.10.4.1.1 Bank Angle Dial and Scale - The bank angle dial and scale presentation shall be in accordance with Figure 3.

*3.5.10.4.1.2 Dial Masks - A mask shall be attached to each side of the bank angle dial and scale in accordance with Figure 2. The mask on the left shall also be the scale for the displacement pointer. The surface of the scale shall follow the arc of the pointer movement. The mask shall be designed so that the pointer can be driven out of view to the top as shown in Figure 2. The right mask shall be the shield behind which the vertical pointer can be driven.

*3.5.10.4.1.3 Mechanism Mask - A mask which is attached to the roll gimbal and extends essentially from the bank dial to the sphere shall be incorporated. The visible surface of this mask shall be shaped as the surface of a frustrum of a cone. The large diameter shall be forward. The edge of the mask shall be hidden by the inner diameter of the bank scale. The small diameter shall be toward the rear.

*3.5.10.4.1.4 Bank Indices - Bank indices shall be fixed to and rotate with the roll gimbal. At zero roll indication, one shall be adjacent to and aligned with the zero roll marking on the bank angle dial. The other index shall be at the 180 degree roll position.

*3.5.10.4.1.5 Miniature Airplane - The miniature airplane may be attached to either the light wedge or the bank angle dial at the zero pitch position. The wings of the miniature airplane shall be curved such that they follow the swing radius of the vertical pointer. The markings and coloring on the miniature airplane shall be in accordance with Figure 3.

*3.5.10.4.1.6 Gimbal System - The gimbal system shall consist of the following:

*3.5.10.4.1.6.1 Roll Gimbal - The roll gimbal shall be the outer gimbal and shall be capable of rotating 360°. The axis of the gimbal shall be perpendicular to the face of the indicator and in line

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with the center of the sphere. The gimbal shall be driven by the roll servo mechanism. The gimbal shall be designed to mount the bank indices and the pitch gimbal.

*3.5.10.4.1.6.1.1 Roll Trim - Means shall be incorporated to adjust the roll gimbal ± 3° minimum. The adjustment shall be located on the rear of the indicator case.

*3.5.10.4.1.6.2 Pitch Gimbal - The pitch gimbal shall be suspended in the roll gimbal and shall be capable of rotating 360°. The axis of the gimbal shall be at right angles to the roll gimbal axis and in line with the roll axis. The gimbal shall be driven by the pitch servo mechanism. The azimuth mechanism shall be mounted on the pitch gimbal.

*3.5.10.4.1.6.2.1 Pitch Trim - Means shall be incorporated to adjust the position of sphere in pitch by means of a pitch trim knob mounted on the lower right hand side of the face of the indicator. The knob shall have approximately one-fourth turn of freedom in the counterclockwise direction from the zero pitch trim position. The freedom in each direction shall be limited by a positive stop. When the knob is rotated to the stop in the clockwide direction one-half turn, the sphere shall rotate to deflect the horizon line upward to indicate between 10° and 20° dive. When the knob is rotated to the stop in the counterclockwise direction the sphere shall rotate to deflect the horizon line downward to indicate between 5° and 10° climb. The servo system shall operate properly for any pitch trim adjustment. The knob shall have sufficient friction to remain fixed when set but it shall move smoothly without evidence of binding or erratic movement. The internal design of the indicator shall be such that any pitch trim input is automatically faded out as the sphere is driven to the extreme pitch indications and the sensing of the trim signal reversed so as to correspond to the side of the sphere showing when the sphere is driven through the 90 degree pitch positions. The fade-out shall occur as the sphere is driven from the 20 degree to 75 degree pitch indications and shall fade-in as the indicated pitch angle changes from 75 to 20 degrees. It shall occur on both sides of the sphere for both climb and dive indications.

*3.5.10.4.1.6.3 Azimuth Mechanism - The azimuth mechanism shall consist of a shaft and the azimuth servo mechanism and shall be capable of rotating 360°. The shaft shall be mounted so that it is perpendicular to the pitch gimbal axis and, at zero pitch attitude, perpendicular to the roll gimbal axis. The shaft shall support the two sphere halves at their centers. The shaft shall be driven by the azimuth servo mechanism.

*3.5.10.4.1.6.4 Sphere - The sphere which forms the background of the display shall consist of two half spheres. The half spheres shall be fastened to the end of the azimuth shaft. The sphere shall rotate with the roll gimbal for roll indications, rotate in relation to the roll gimbal about the pitch axis for pitch indication and rotate in relation to the pitch and roll axes about the azimuth axis for azimuth indications. The sphere shall be driven in pitch such that the horizon line goes above the miniature airplane for dive maneuvers and below for climb maneuvers and shall be driven in azimuth so that it moves to the left for right turns. The gimbal shall rotate CCW for right banks.

*3.5.10.4.1.6.4.1 Sphere Marking and Coloring - All marking and coloring of the sphere presentation shall be in accordance with Figure 4.

*3.5.10.4.2 Power Failure Indicator - A power failure warning flag and the associated meter movement shall be incorporated in the lower left corner of the indicator as shown in Figures 2 and 3. The meter and its associated circuitry shall be designed to move the flag from view when 25 to 29 volts DC is applied.

*3.5.10.4.3 Inclinometer - The inclinometer shall be incorporated into the display in accordance with Figure 2.

*3.5.10.4.3.1 Tube - The glass of the inclinometer tube shall be made of clear annealed glass tubing free from any flaws that will seriously affect the readability of the inclinometer. The inside of the tube shall be smooth and uniform so that the ball may roll freely except for the damping of the liquid. The arc length of the visible portion of the tube shall be approximately 1-1/4 inches.

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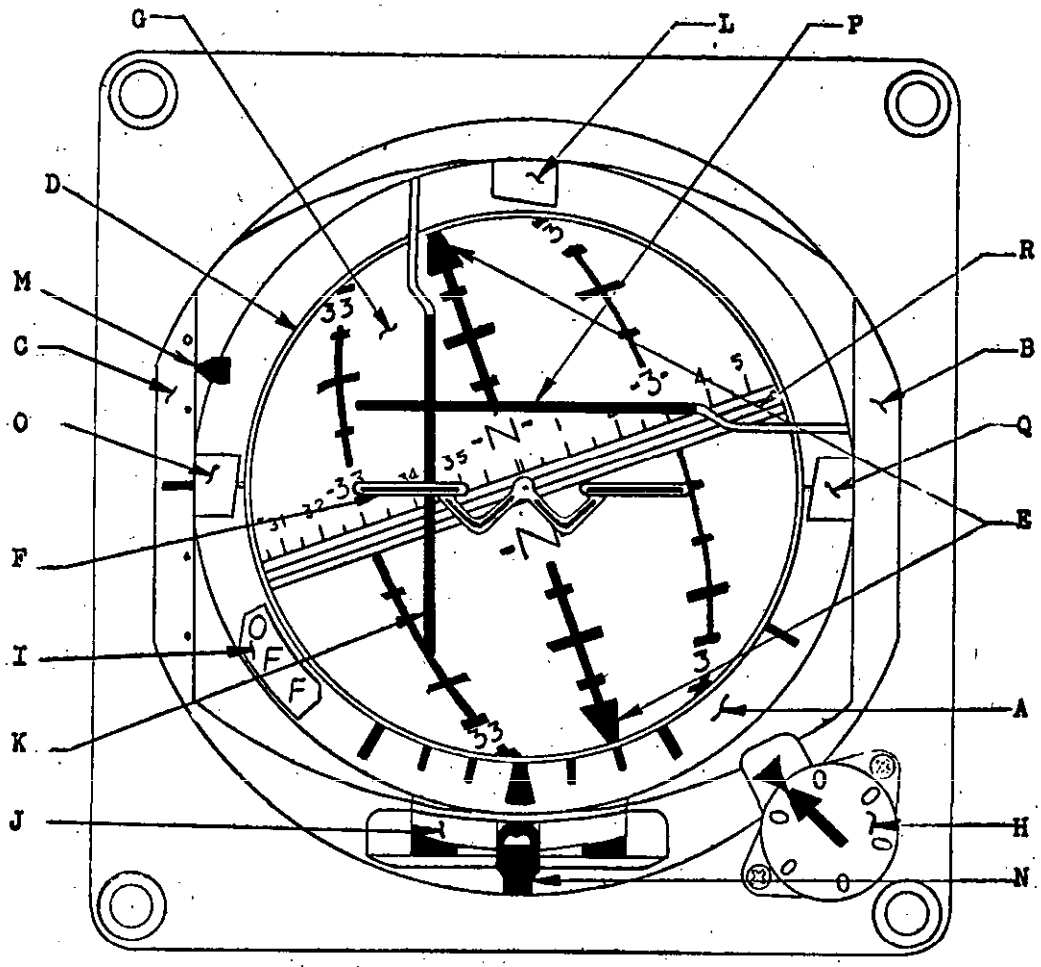

A. BANK ANGLE DIAL AND SCALE
B. DIAL MASK AND VERTICAL POINTER SHIELD
C. DIAL MASK AND DISPLACEMENT POINTER SCALE
D. MECHANISM MASK
E. BANK ANGLE INDICES
F. MINIATURE AIRPLANE
G. SPHERE
H. PITCH TRIM KNOB
I. POWER FAILURE INDICATOR
J. INCLINOMETER
K. VERTICAL POINTER
L. VERTICAL POINTER ALARM FLAG
M. DISPLACEMENT POINTER
N. RATE OF TURN
O. DISPLACEMENT POINTER ALARM FLAG
P. HORIZONTAL POINTER
Q. HORIZONTAL POINTER ALARM FLAG
R. HORIZON BAR

FIGURE 2

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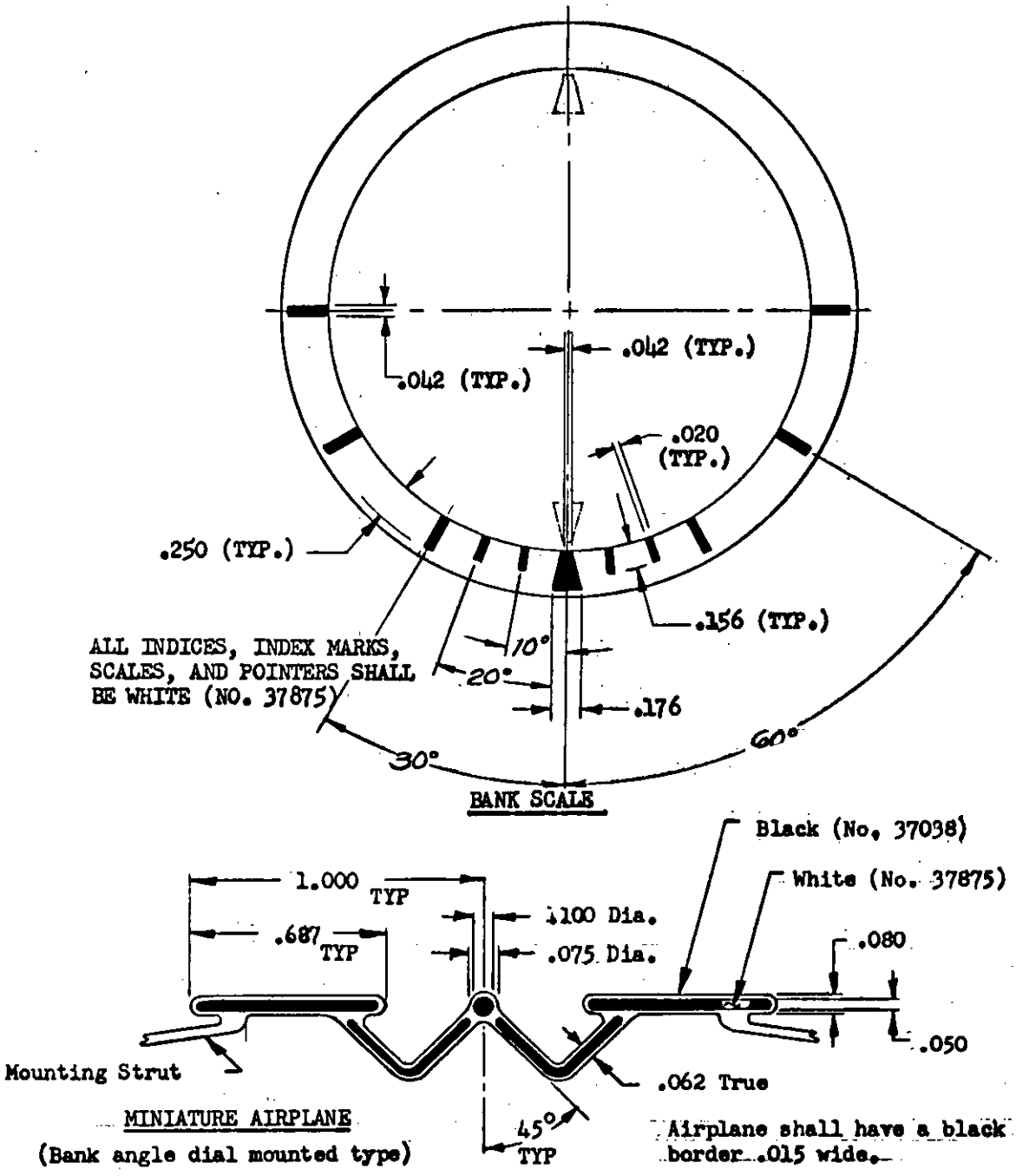

FIGURE 3

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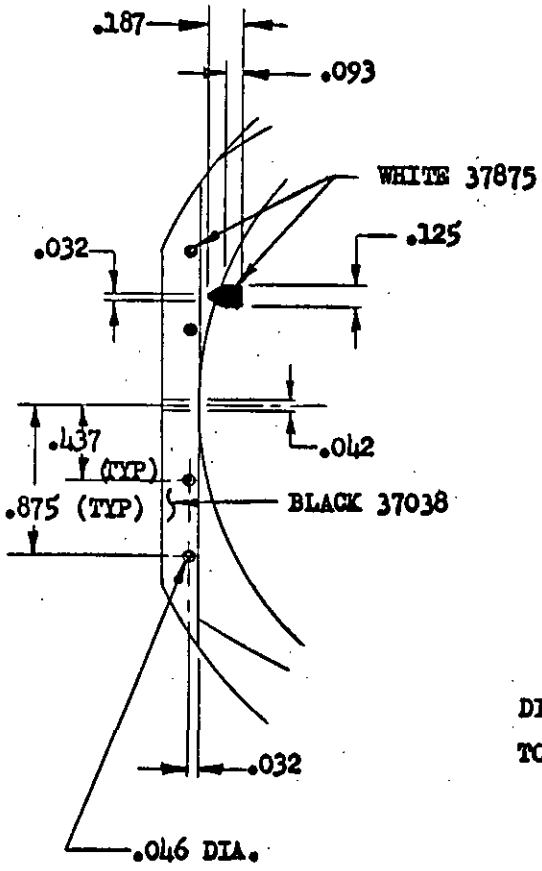
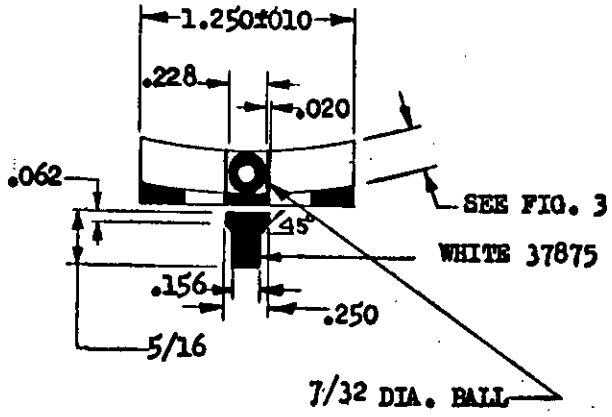
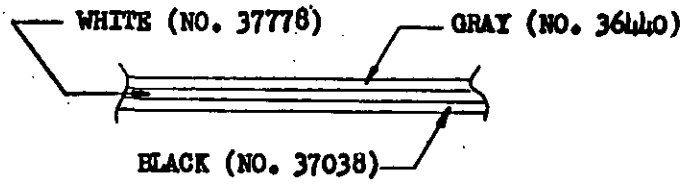
PITCH TRIM KNOB





DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED.
TOLERANCES: FRACTIONS ± 1/64
DECIMALS ± .005



HORIZON BAR

FIGURE 3 CONTINUED

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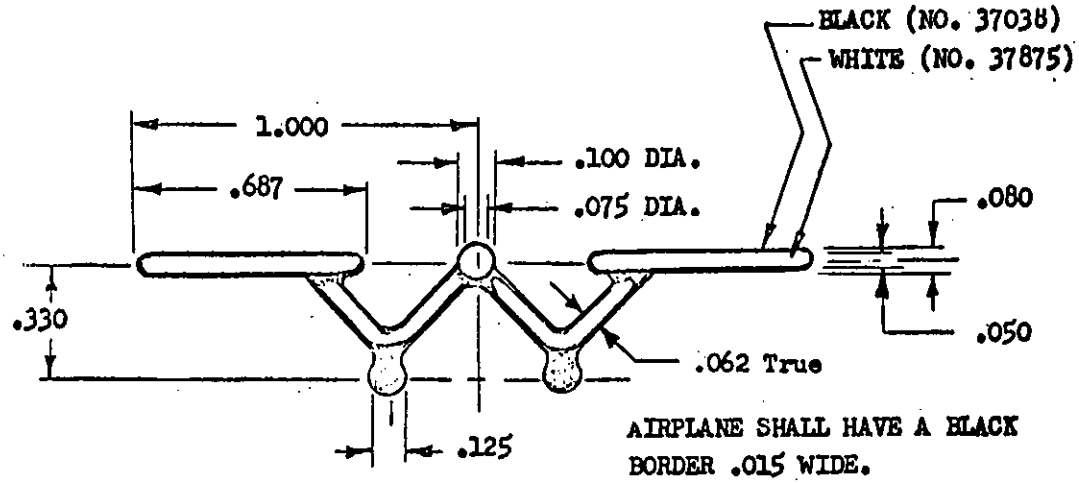
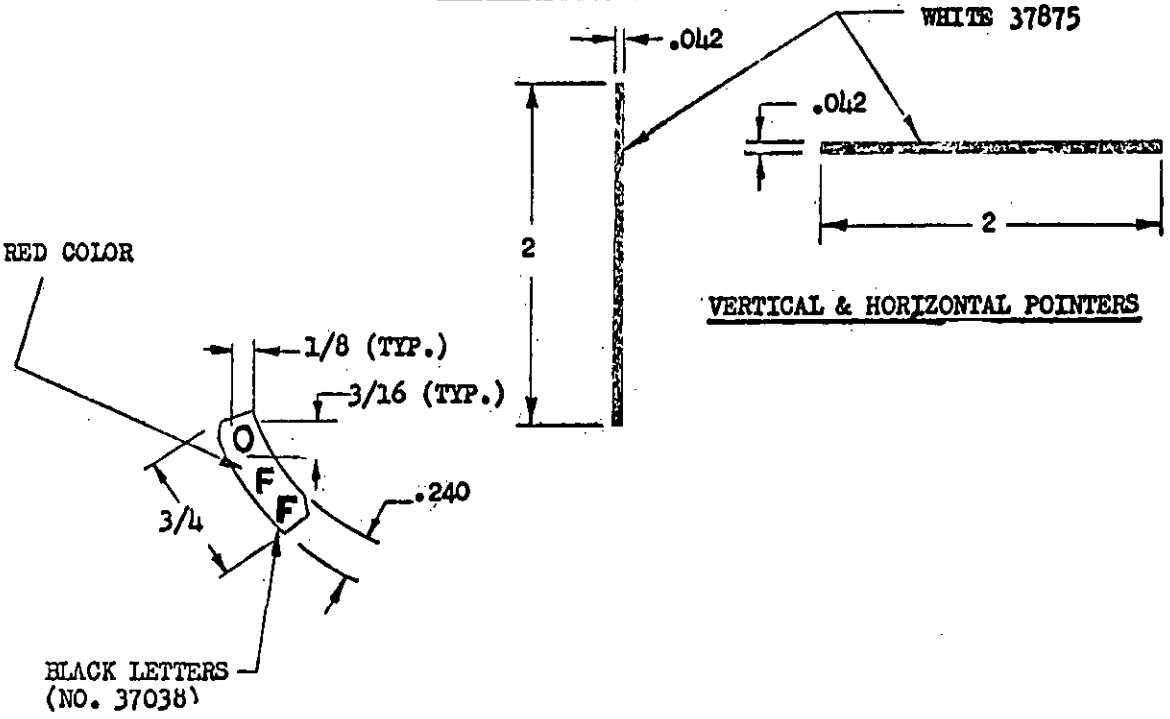


MINIATURE AIRPLANE (Wedge Mounted Type)



VERTICAL & HORIZONTAL POINTERS

FIGURE 3 CONTINUED

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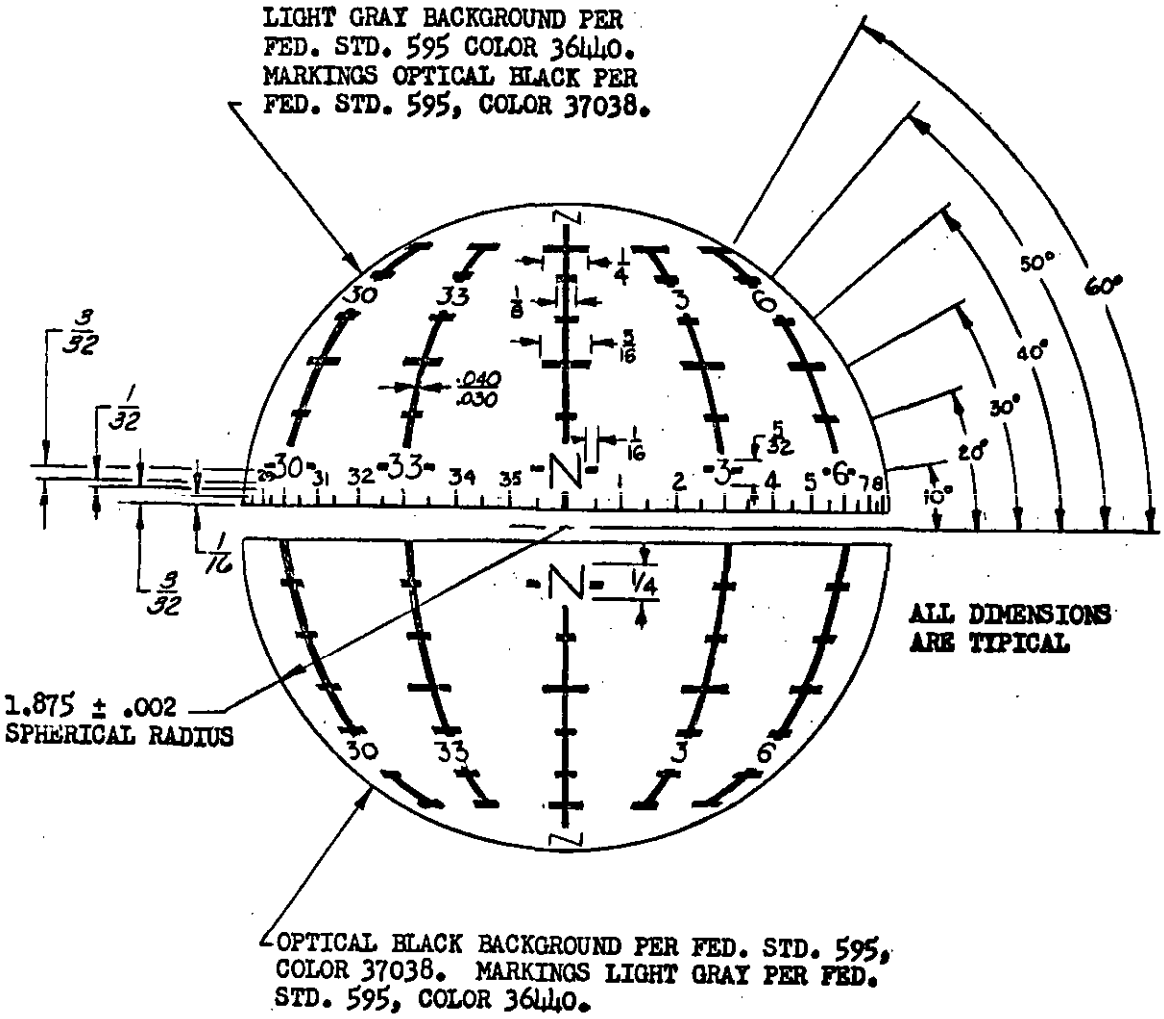

NUMBERS AND LETTERS TO CONFORM WITH MS 33558.

DIMENSIONS IN INCHES, UNLESS OTHERWISE SPECIFIED.
TOLERANCES: FRACTIONS ± 1/64
DECIMALS ± .005
ANGLES ± 15'

FIGURE 4

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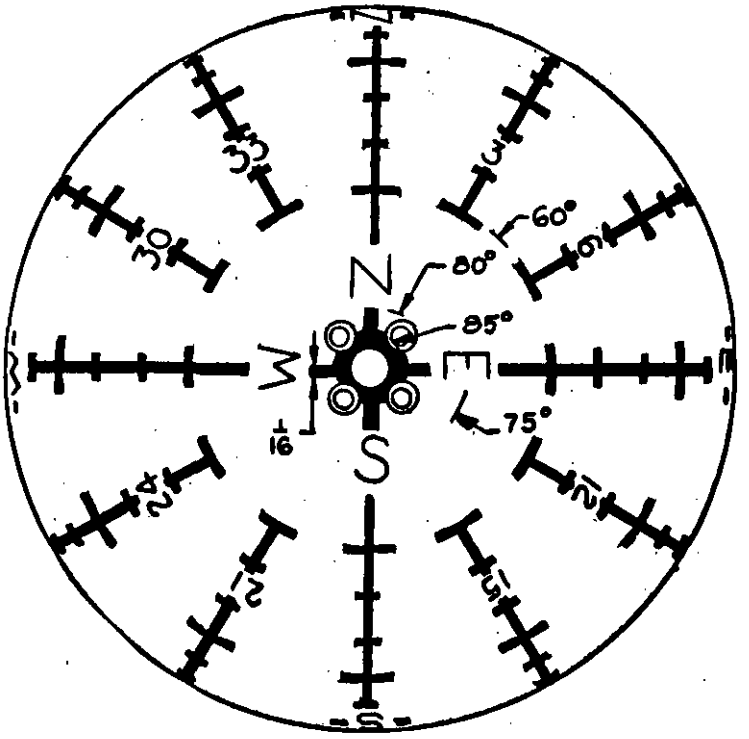

SPHERE - BOTTOM VIEW

FIGURE 4 CONTINUED

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*3.5.10.4.3.2 Ball - The ball shall be a 7/32 inch black sphere. A minimum of 2/3 of the ball shall remain in view at either extreme of the tube, when viewed from 12 inches in front of the zero mark of the slip indicator at an angle of 30 degrees with the horizontal plane prescribed by the base of the indicator.

*3.5.10.4.3.3 Damping Liquid - The damping liquid used shall be sufficiently colorless to preclude interference with the visibility of the ball under day light and night lighting conditions and under normal and temperature extremes.

*3.5.10.4.3.4 Sensitivity - The sensitivity of the inclinometer shall be such that the ball reaches its limit of travel when the indicator is rotated right or left 10 ± 2 degrees about the roll axis with the face of the indicator vertical.

*3.5.10.4.4 Flight Director Display - The flight director display shall consist of a vertical pointer, a horizontal pointer, a pointer to show displacement from commanded flight path, and 3 signal level flag alarms. These pointers and flags shall be driven by meter movements and shall be in accordance with Figures 2 and 3. The design of the pointer meter movements shall be such that when not energized these pointers are maintained as near as practicable to their adjusted zero positions while under all flight conditions including rough air. All meter movement leads shall be electrically isolated from each other, from other circuitry in the case and from the case.

*3.5.10.4.4.1 Vertical Pointer - The vertical pointer shall be positioned directly in front of the horizontal pointer. With the indicator in normal operating position, the vertical pointer shall be mounted on a meter movement which is pivoted at a point behind the pointer in a manner that the pointer shall remain vertical at zero center or at any point of deflection to the right or left of center, and shall deflect right or left in agreement with the polarity of direct current received from the flight director computer. An external mechanical zero adjustment shall be provided.

*3.5.10.4.4.1.1 Deflection - The design shall be such that the deflection of the pointer to the left of the center position is limited to one inch by a physical stop and the maximum deflection to the right will carry the pointer behind the mask on the right side of the display. The direction of deflection for given input signal shall be as specified in Table I.

*3.5.10.4.4.1.2 Response - The vertical pointer response shall be linear in degrees with respect to current within 7.5% of the proportionate full scale value. A deflection of 7/8 of an inch measured from the center of the dial to the pointer along the horizontal line shall require 2.2 ma, ± 7.5%. An application of 10 ma of the proper polarity shall drive the pointer from view behind shield to the right. The 10 to 13.5 ma shall be applied as a step input, without damaging the meter movement.

*3.5.10.4.4.1.3 Resistance - The resistance across the vertical pointer input terminals shall be 1000 ohms ± 3% at 25°C.

*3.5.10.4.4.1.4 Damping - The pointer mechanism shall be damped such that there is no more than 1-1/2% overshoot.

*3.5.10.4.4.1.5 Response Time - Response time of the vertical pointer shall be a maximum of 1/3 second. Response time is defined as the time required for the pointer to reach 90% of its final indication, and time is counted from the instant of application of the current. The pointer shall be considered as having come to apparent rest when it has reached within ± 1% of the scale length of the actual rest point.

*3.5.10.4.4.2 Vertical Pointer Flag Alarm - The vertical pointer flag alarm shall be operated by a suppressed zero type of mechanism, which shall hold the flag against a stop in the position shown in Figure 2 in the absence of current, or when the current application is below a predetermined value as specified below.

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*3.5.10.4.4.2.1 Deflection - The vertical flag alarm shall be designed to deflect out of view with the input signal polarity of Figure 1 connected to a voltage which is polarized plus and minus, respectively.

*3.5.10.4.4.2.2 Response - The alarm flag shall leave its visible-position stop with a current application of 180 microamperes or more. The flag alarm shall disappear from view with a current application of 245 microamperes. The application of 380 microamperes as a step input shall not damage the meter movement.

*3.5.10.4.4.2.3 Resistance - The resistance across the vertical pointer flag alarm input shall be 1000 ohms ± 3% at 25°C.

*3.5.10.4.4.3 Horizontal Pointer - The horizontal pointer shall be positioned directly behind and as near as practicable to the vertical pointer. The horizontal pointer shall be mounted on a meter movement which is pivoted at a point approximately 4-1/2 inches behind the pointer. With the indicator in normal operating position, the pointer shall move in such a manner that it remains horizontal at zero center or up or down in agreement with the polarity of direct current received from the flight director computer. An external mechanical zero adjustment shall be provided.

*3.5.10.4.4.3.1 Deflection - The maximum deflection downward shall not exceed 1-1/16 inch. The design shall be such that the pointer can be deflected up until it disappears from view behind a mask. This direction of deflection for a given input signal shall be specified in Figure 1.

*3.5.10.4.4.3.2 Response - A deflection of 7/8 inch measured from the center of the dial to the pointer along a vertical line shall require 2.2 ma, ± 7.5%. The horizontal pointer response shall be linear in degrees with respect to current to within 7.5% of the proportionate full scale value.

An application of 10 ma of the proper polarity shall drive the pointer from view behind its mask at the top of the display. The application of 13.5 ma as a step input to drive the pointer from view shall not damage the meter movement.

*3.5.10.4.4.3.3 Resistance - The resistance across the horizontal point input terminals shall be 1,000 ohms, ± 3%, at 25°C.

*3.5.10.4.4.3.4 Damping - The pointer mechanism shall be damped such that there is no more than 1-1/2% overshoot.

*3.5.10.4.4.3.5 Response Time - Response time of the indicating pointer shall be a maximum of 1/3 second. Response time is defined as in paragraph 3.5.10.4.4.1.5.

*3.5.10.4.4.4 Horizontal Pointer Flag Alarm - The design of the indicator shall be such that a horizontal pointer flag alarm can be provided on the right side of the display as shown in Figure 1. The horizontal flag alarm shall be in accordance with Figure 3. Its characteristics shall be the same as those specified for the vertical pointer flag alarm per paragraphs 3.5.10.4.4.2.1, 3.5.10.4.4.2.2, 3.5.10.4.4.2.3.

*3.5.10.4.4.5 Displacement Pointer - The displacement pointer and scale shall be in accordance with Figure 3. The pointer shall be mounted on a meter movement which is pivoted at a point behind the pointer. With the indicator in normal operating position, the pointer shall move in such a manner that it remains horizontal at zero center or at any point of deflection up or down from center, and shall deflect up or down in agreement with the polarity of direct current received from the flight director computer. An external mechanical zero adjustment shall be provided. The pointer shall run adjacent to the displacement scale as shown in Figure 2. The design of the displacement pointer shall be such that an application of 500 microamperes of the proper polarity applied as a step input shall drive the displacement pointer up out of view. The application of 750 microamperes to drive the pointer out of view shall not damage the meter movement.

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*3.5.10.4.4.5.1 Deflection - The direction of deflection for a given input shall be as specified in Figure 1.

*3.5.10.4.4.5.2 Response - The displacement pointer response shall be linear in degree with respect to current to within 7.5% of the proportionate full scale value. A deflection 7/8 inch measured from the zero position of the scale to the center line of the pointer shall require 150 microamperes, ± 7.5%.

*3.5.10.4.4.5.3 Resistance - The resistance across the displacement pointer input terminals shall be 1,000 ohms, ± 3% at 25°C.

*3.5.10.4.4.5.4 Damping - The pointer mechanism shall be overdamped (no overswing).

*3.5.10.4.4.5.5 Response Time - Response time of the indicating pointer shall be a minimum of 1.15 seconds and a maximum of 2 seconds. Response time is defined as in paragraph 3.5.10.4.4.1.5.

*3.5.10.4.4.6 Displacement Pointer Flag - The displacement pointer flag shall be in accordance with Figures 2 and 3. Its characteristics shall be the same as those specified for the vertical pointer flag alarm as per paragraphs 3.5.10.4.4.2.1, 3.5.10.4.4.2.2 and 3.5.10.4.4.2.3.

*3.5.10.4.4.7 Rate of Turn - The rate of turn display shall be in accordance with Figures 1 and 2. The moving index shall be mounted as a meter movement which is pivoted at a point behind the pointer. The design shall be such that the pointer is stable under rough air conditions. Within normal operating position, the index shall move left or right in agreement with the polarity of the direct current received from the remote rate of turn sensor. An external mechanical zero adjustment shall be provided. The scale shall be made to conform to the path of the index such that there is the minimum of parallax. The front surface of the scale and index shall be within 1/4 inch of the cover glass at zero displacement. The index deflection to either side of the center zero position shall be limited to 5/8. At each of the fully deflected positions, a minimum of 1/2 of the index shall be in view when viewed at a horizontal distance of 2 feet from the center dot of the display.

*3.5.10.4.4.7.1 Deflection - The direction of deflection for a given input shall be as specified in Figure 1.

*3.5.10.4.4.7.2 Response - The index response shall be linear in degree with respect to current to within 7.5% of the proportionate full scale value. A deflection of one index width from the zero position shall require 0.5 ma ± 7.5%. A deflection of two index widths such that the index aligns with appropriate outer scale mark shall require 1.0 ma ± 7.5%.

*3.5.10.4.4.7.3 Resistance - The resistance across Rate of Turn input terminals shall be 1,000 ohms, ± 3%, at 25°C.

*3.5.10.4.4.7.4 Damping - The pointer mechanism shall be damped such that there is no more than 1-1/2% overshoot.

*3.5.10.4.4.7.5 Response Time - Response time of the rate of turn index shall be a maximum of 1/3 second. Response time is defined as in paragraph 3.5.10.4.4.1.5.

*3.5.10.4.5 Attitude Display Servo Characteristics - The performance of the attitude display (sphere) shall be as specified when operated with the input power, servo amplifiers, and test transmitters specified.

*3.5.10.4.5.1 Input Power - Input power shall be as follows:

(1) Generator Excitation - 18V ± 1V, 400 cps, ØC from J598-H to J598-K with AC neutral to K.

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(2) Roll-Motor Excitation - 34V ± 2V, 400 cps, ØC from J598-L to J598-K with AC neutral to K.

(3) Pitch Motor Excitation - 21V ± 1V, 400 cps, ØC from J598-T to J598-K with AC neutral to K.

(4) Azimuth Motor Excitation - 21V ± 1V, 400 cps, ØC +90° from J598-g to J598-K with AC neutral to K.

NOTE: ØC refers to ØC of 115/200V, 400 cps, 3 Ø, 4 wire wye, grounded neutral power per MIL-STD-704.

*3.5.10.4.5.2 Roll, Pitch, and Azimuth Servo Amplifiers - The roll, pitch, and azimuth servo amplifiers shall be equivalent to those in Amplifier-Power Supply AM-1931/AJB-3 and shall be connected to J598 of the attitude-director indicator as follows:

	Input	Common	Output
Roll Servo Amplifier	V	W	M
Pitch Servo Amplifier	E	F	S
Azimuth Servo Amplifier	B	C	f

*3.5.10.4.5.3 Signal Source - Roll, pitch and azimuth servo control signals shall be supplied by Kearfott type R510-1A synchro transmitters or equivalent. The transmitter rotors shall be excited with 26V ± 1 volt, 400 cps from the same power supply voltage which operates the indicator. It shall be applied such that the voltage from rotor lead "C" to rotor lead "H" is in phase with the voltage from pin K to pin H (J598) of the indicator with lead "C" and pin K (J598) common.

(1) Roll - 180° index reference, positive rotational reference.
(2) Pitch - 180° index reference, positive rotational reference.
(3) Azimuth - 0° index reference, positive rotational reference.

The index reference nulls shall correspond to 0° roll, 0° pitch, and 0° azimuth respectively. Positive rotational reference signals shall result in right bank, climb and right turn displays.

The synchro transmitters shall be connected as follows:

(1) Roll -

CX Stator	Connected to J598
X	n
Y	a
Z	b

(2) Pitch -

CX Stator	Connected to J598
X	m
Y	j
Z	k

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(3) Azimuth -

CX Stator	Connected to CDX	CDX Stator	Connected to J598
X	Yellow	Yellow	X
Y	Blue	Blue	Z
Z	Black	Black	Y

CDX shall be Eclipse-Pioneer Type AY533-25 or equivalent.

*3.5.10.4.5.4 Servo Performance - The roll, pitch, and azimuth follow-up rates shall not be less than 300°/sec. with an allowable follow-up lag of 20°, 15°, and 15°, respectively at a rate of 300°/sec. The servo operation in all axes shall be visually smooth without hunting or jumping greater than 0.5° total at any rate up to the maximum specified. With a step input equal to the maximum follow-up lag, the overshoot shall not exceed 3°.

*3.5.10.4.5.4.1 Static Positional Accuracy - The static positional accuracy shall be ± 0.5° for pitch and roll at 0° and 180° and ± 1.0° at all other attitudes. The positional accuracy for azimuth shall be ± 1.0° at any heading. Zero trim shall be applied during this test.

*3.5.10.4.5.4.2 Sensitivity - With zero trim applied, displacement of the input signals 0.25° in right and left bank, climb and dive, and right and left turn shall result in a perceptible movement of the sphere in the proper direction for each displacement. With maximum roll and pitch trim applied perceptible movement shall occur with a 0.5° displacement of the input signal.

*3.5.10.4.6 Integral Lighting - The attitude-director indicator shall contain integral lighting in accordance with MIL-L-25467.

*3.5.10.4.6.1 Lighting Power - The lighting power shall be as follows:

Operating Voltage Limits	4.9 to 5.1 volts
Operating Frequency Limits	0 to 420 cps
Reduced Performance Voltage Limits	3.0 to 4.9 volts
Current	2 amps, max.

*3.5.10.4.7 Cover Glass - The cover glass shall be free from defects which interfere with normal reading of the indicator.

*3.5.10.4.7.1 Anti-Reflection Coatings - A magnesium fluoride coating in accordance with JAN-F-675 shall be applied to each surface of the cover-glass and of the lighting wedge. Coated surfaces shall not chip, scale, peel, flake, dissolve, discolor or otherwise be adversely affected by the environmental tests specified herein or in normal service use. The coating on the outer surface of the cover glass shall be capable of withstanding abrasion incident to normal service usage.

*3.5.10.4.8 Bomb Mode Relay - A DPDT, 28 volt DC relay shall be incorporated to cut-off pitch trim and to develop a ground signal upon receipt of a DC bomb mode signal.

*3.5.10.5 Controls - An operational type "PITCH TRIM" control shall be accessible from the front of the indicator. Screwdriver adjustment controls for "ROLL TRIM" and centering of the meter mechanisms shall be accessible from the rear of the indicator.

*3.5.10.6 Performance at Temperature Extremes - Performance of the attitude-director indicator at temperature extremes shall be as specified herein except as follows:

*3.5.10.6.1 Servo Operation - The maximum follow-up lag of 3.5.10.4.5.4 shall be 25°, 20°, and 20° instead of 20°, 15°, and 15° respectively.

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*3.5.10.6.2 Sensitivity - The input displacements of 3.5.10.4.5.4.2 shall be 0.5° and 1.0° instead of 0.25° and 0.5° respectively.

*3.5.10.7 Electrical Connections - Connections to external circuits shall be provided as shown in Figure 1.

*3.5.11 Timer, Interval TD-236A/AJB-3 - The interval timer shall meet the following requirements:

*3.5.11.1 Function - The interval timer shall provide a speed governed 28 volt DC motor, associated switching mechanisms, a digital time display, and a knob for setting time intervals in flight and shall provide accurately timed electrical signals for the AN/AJB-3 or AN/AJB-3A Loft Bomb Release Computer Set.

*3.5.11.2 Form Factor - The interval timer shall be enclosed in a case conforming to the general requirements of MIL-C-172. The outline dimensions of the case shall conform to MS-17388.

*3.5.11.3 Case - The case of the interval timer shall be made of non-ferrous, low density metal, uniform in texture, having a smooth surface and shall be hermetically sealed. The case shall be finished with a lusterless black material, Color No. 37038 of FED-STD-595.

*3.5.11.3.1 Hermetic Sealing - The case shall provide a hermetically sealed enclosure for all of the mechanism. The case shall be so constructed that it may be opened, the mechanism removed and replaced and the interval timer case resealed at least three times. This shall be possible without the use of any special tool, jig or fixture, unless such device is specifically approved by the procuring activity. The sealing of the case shall not be dependent upon any material which will be adversely affected by any atmosphere to which the instrument may be subjected in normal use in military aircraft.

*3.5.11.3.2 Filling Medium - The filling medium shall be either a mixture of 90% nitrogen and 10% helium or 95% helium and 5% carbon dioxide. The nitrogen used shall be in accordance with Specification BB-N-411, Type I, Class I, Grand C. The filling medium shall contain not more than 0.006 milligram of water vapor per liter (dew point -65°C) at the filling pressure. The absolute pressure of the filling medium in the case shall be 1 ± 0.1 atmosphere.

*3.5.11.3.3 Leak Rate - The gas or mixture of gases in the case, adjusted to a pressure differential of one atmosphere, shall not have a leakage from the case that would permit more than 10 percent contamination of the filling medium after 1000 hours.

*3.5.11.4 Contents - The interval timer shall contain a speed governed DC motor, associated switching mechanisms, a digital time display and a control knob.

*3.5.11.4.1 Output Signals - The unit shall provide output signals as follows:

*3.5.11.4.1.1 One Second Warning - The one second warning signal shall consist of a DC ground occuring 1.0 ± 0.2 seconds before the end of the selected time cycle. The signal shall remain until the unit is reset.

*3.5.11.4.1.2 Time-Out - The time-out signal shall be the input DC voltage occuring at the end of the selected interval within ± 0.1 second or 1% of the interval, whichever is greater. The signal shall remain until the unit is reset.

*3.5.11.4.1.3 Circuit Loads - The output signal circuits shall be capable of supplying a minimum of 1 ampere to a resistive load.

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*3.5.11.4.2 Function Initiation - The time interval shall be initiated by the application of 25-29 volts DC. The motor shall stop at the end of the time interval and the timing mechanism shall reset upon removal of time interval initiation DC.

*3.5.11.4.3 Range of Operation - The time interval shall be settable to time intervals of 0.1 to 30 seconds in 0.1 second increments. The time settable shall not be greater than 30.9 seconds and not less than 0.1 second.

*3.5.11.4.3.1 Time Interval Selection - A control knob which can be adjusted in flight shall be provided to select the time interval. Positive detent action shall be provided at the 0.1 second increments throughout the adjustment range.

*3.5.11.4.4 Interval Display - The interval display shall be digital and shall display all intervals specified in 3.5.11.4.3. The display shall be visible from any point within the frustum of a cone whose side makes an angle of 30° with a perpendicular to the dial and whose small diameter is the aperture of the case.

*3.5.11.4.4.1 Integral Lighting - The interval timer shall be provided with integral lighting in accordance with MIL-L-25467.

*3.5.11.4.4.2 Dial Marking - The dial shall be marked as shown on MS-17388. All visible portions of the dial shall be lusterless black; Color No. 37038 of FED-STD-595, and all markings on the dial shall be lusterless white; Color No. 37875 of FED-STD-595.

*3.5.11.5 Performance At Temperature Extremes - The performance of the interval timer at temperature extremes shall be as specified herein.

*3.5.11.6 Electrical Connections - Connections to external circuits shall be provided as shown in Figure 1.

*3.5.12 Transmitter, Rate Gyroscope T-751/AJB-3A - The rate gyroscope transmitter shall meet the following requirements:

*3.5.12.1 Function - The function of the rate gyroscope transmitter is to provide a DC current having a polarity and magnitude proportional to the direction and rate of turn about the input axis. This current is used to operate a meter mechanism displaying aircraft rate-of-turn information to the pilot.

*3.5.12.2 Form Factor - The rate gyroscope transmitter shall be enclosed in a case conforming to the general requirements of MIL-C-172. The outline dimensions of the case shall conform to MS-17394.

*3.5.12.3 Case - The case of the gyroscope shall be made of non-ferrous, low density metal, uniform in texture, having a smooth surface and shall be hermetically sealed. The case shall be finished with a lusterless black material, Color No. 37038 of FED-STD-595. Marking on the case shall be as shown on MS-17394.

*3.5.12.3.1 Hermetic Sealing - The case shall provide a hermetically sealed enclosure for all of the mechanism. The case shall be so constructed that it may be opened, the mechanism removed and replaced and the rate gyroscope transmitter case resealed at least three times. This shall be possible without the use of any special tool, jig or fixture, unless such device is specifically approved by the procuring activity. The sealing of the case shall not be dependent upon any material which will be adversely affected by any atmosphere to which the instrument may be subjected in normal use in military aircraft.

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*3.5.12.3.2 Filling Medium - The filling medium shall be either a mixture of 90% nitrogen and 10% helium or 95% helium and 5% carbon dioxide. The netrogen used shall be in accordance with Specification BB-N-411, Type I, Class I, Grade C. The filling medium shall contain not more than 0.006 milligram of water vapor per liter (dew point -65°C) at the filling pressure. The absolute pressure of the filling medium in the case shall be 1 ± 0.1 atmosphere.

*3.5.12.3.3 Leak Rate - The gas or mixture of gases in the case, adjusted to a pressure differential of one atmosphere, shall not have a leakage from the case that would permit more than 10 percent contamination of the filling medium after 1000 hours.

*3.5.12.4 Electrical Connections - Connections to external circuits shall be provided as shown in Figure 1.

*3.5.12.5 Installation Mounting - Installation shall be with the connector end of the equipment facing forward in the aircraft.

*3.5.12.6 Undervoltage Protection - The equipment shall not be damaged by voltages below the minimum specified herein and shall automatically resume normal operation when the voltage returns within the specified limits.

*3.5.12.7 Signal Source Impedance - The signal source impedance shall be approximately 1,000 ohms.

*3.5.12.8 Operating Range - The rate gyroscope transmitter shall have an operating range ± 360 degrees per minute. Suitable stops shall be provided to limit the output and to prevent damage to the equipment when the operating range is exceeded.

*3.5.12.9 Natural Frequency - The rate gyroscope transmitter shall have a minimum undamped natural frequency of 5 cps.

3.5.12.10 Performance Characteristics - The performance characteristics of the rate gyroscope transmitter shall be as follows under standard conditions (3.3.8), and with a 1000 ohm ± 1% resistive load across the output terminals.

*3.5.12.10.1 Null Limits - With the rate ghroscope transmitter at rest, the output shall not exceed ± 7.5 micro-amperes.

*3.5.12.10.2 Output Signal - The output shall be as follows for rotation in either direction about the input axis.

Input	Output Milliamperes
360°/minute	1.000 ± 6-1/2%
180°/minute	0.500 ± 8%
90°/minute	0.250 ± 9-1/2%
45°/minute	0.125 ± 12-1/2%

The output tolerances shall be proportional to these values at all intermediate input rates.

*3.5.12.10.3 Signal Polarity - Pin C shall be positive with respect to Pin D for clockwise (right turn) input rates. Pin d shall be positive with respect to Pin C for counterclockwise (left turn) input rates.

*3.5.12.10.4 Damping Ratio - The damping ratio shall be between 8 and 12.

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*3.5.12.10.5 Cross Coupling - When rotated about axes perpendicular to the input axis, the output shall be less than 1% of the value obtained when rotated at the same rate about the input axis.

*3.5.12.10.6 Resolution and Threshold - Both the resolution and the threshold shall be less than 0.015 degrees per second.

*3.5.12.10.7 Hysteresis and Friction - The hysteresis and friction shall not exceed 1% of the maximum operating rate.

*3.5.12.11 Performance at Temperature Extremes - The rate gyroscope transmitter shall perform as specified herein at temperature extremes except as follows:

*3.5.12.11.1 Null Limits - The output shall not exceed ± 14 microamperes.

*3.5.12.11.2 Output Signal - An additional ± 3-1/2% shall be applied to the output signal tolerances.

*3.6 Design Data - No data is required by this specification (other than reports accompanying samples submitted for testing) or by applicable documents, unless specified in the contract or order (See paragraph 6.7).

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4. QUALITY ASSURANCE PROVISIONS

*4.1 Responsibility for Inspection - Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

*4.1.1 Classification of Tests - Items covered by this specification shall be subjected to the following tests to determine compliance with all applicable requirements:

(1) Preproduction Tests
(2) Initial Production Tests
(3) Acceptance Tests
(4) Life Tests

*4.2 Preproduction Tests - Preproduction tests shall be made on an equipment representative of the production equipments to be supplied under the contract. Preproduction tests shall be accomplished under the responsibility of the contractor and shall be conducted in accordance with the approved test procedure of 4.6. The government inspector and the procuring activity shall be advised when tests are to be conducted so that a representative may be designated to witness or supervise the tests when so desired. Contractors not having adequate facilities to conduct all required tests shall obtain the services of a commercial testing laboratory acceptable to the Government.

*4.2.1 Preproduction Test Data - The contractor shall submit all data collected in conducting these tests to the procuring agency for review and approval. On first production contracts this data shall include a list of all electrical and electronic parts giving their specified voltage, current and temperature rating and the applied circuit voltage, current and ambient and surface temperatures. The ambient and surface temperature shall be obtained under the extreme high temperature operating condition.

*4.2.2 Scope of Tests - Preproduction tests shall include all tests deemed necessary by the procuring activity to determine that the equipment meets all the requirements of this specification and the contract. Preproduction tests shall include environmental tests in accordance with the procedures of Specification MIL-T-5422 and interference tests in accordance with Specification MIL-I-6181.

*4.2.3 Preproduction Approval - Approval of the preproduction sample shall be by the procuring activity upon satisfactory completion of all tests. No production equipments shall be delivered prior to the approval of the preproduction sample. Prefabrication of production equipment prior to the approval of the preproduction sample is at the contractor's own risk. The approved preproduction sample shall be retained by the contractor for his use in the fabrication and testing of equipment to be submitted for acceptance. The preproduction sample shall not be considered as one of the equipments under the contract.

*4.2.4 Production Equipments - Equipments supplied under the contract shall in all respects, including design, construction, workmanship, performance and quality, be equivalent to the approved preproduction sample. Each equipment shall be capable of successfully passing the same tests as imposed on the preproduction sample. Evidence of non-compliance with the above shall constitute cause for rejection, and for equipment already accepted by the Government, it shall be the obligation of the contractor to make necessary corrections as approved by the procuring activity.

*4.3 Initial Production Tests - One of the first ten production equipments shall be selected and sent at the contractor's expense to a designated Government laboratory for tests. This equipment shall be selected by the procuring activity after the equipment has successfully passed all individual tests. The preproduction sample shall not be selected for this test.

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*4.3.1 Scope of Tests - This equipment may be subjected to any and all tests the procuring activity deems necessary to assure that the production equipment is equivalent to the previously approved preproduction sample in design, construction, workmanship, performance and quality and that it meets all applicable requirements.

*4.3.2 Accessory Material - In addition to the complete equipment submitted for Initial Production Tests the contractor shall also submit such accessory material and data necessary to test the equipment.

*4.3.3 Initial Production Sample Approval - Approval of the Initial Production Sample shall be by the procuring activity upon satisfactory completion of all tests. Any design, material or performance defect made evident during this test shall be corrected by the contractor to the satisfaction of the procuring activity. Failure of the Initial Production Sample to pass any of the tests shall be cause for deliveries of equipment under the contract to cease until proper corrective action is approved and accomplished. Corrective action shall also be accomplished on equipment previously accepted when requested by the procuring activity.

*4.3.4 Reconditioning of Initial Production Test Sample - On completion of the initial production test the equipment shall be reworked by the contractor by replacing all wear or damaged items. After reworking, the contractor shall resubmit the equipment for acceptance.

*4.4 Acceptance Tests - The contractor shall furnish all samples and shall be responsible for accomplishing the acceptance tests. All inspection and testing shall be under the supervision of the government inspector. Contractors not having testing facilities satisfactory to the procuring activity shall engage the service of a commercial testing laboratory acceptable to the procuring activity. The contractor shall furnish test reports showing quantitative results for all acceptance tests. Such reports shall be signed by an authorized representative of the contractor or laboratory, as applicable. Acceptance or approval of material during the course of manufacture shall not be construed as a guarantee of the acceptance of the finished product. Acceptance tests shall consist of the following:

(1) Individual Tests
(2) Sampling Tests
(3) Reliability Assurance Tests
(4) Special Tests

*4.4.1 Individual Tests - Each equipment submitted for acceptance shall be subjected to the individual tests. These tests shall be adequate to determine compliance with the requirements of material, workmanship, operational adequacy and reliability. As a minimum, each equipment accepted shall have passed the following tests:

(1) Examination of Product
(2) Operational Test
(3) Manufacturing Run-In Test

4.4.1.1 Examination of Product - Each equipment shall be examined carefully to determine that the material and workmanship requirements have been met.

*4.4.1.2 Operational Test - Each equipment shall be operated long enough to permit the equipment temperature to stabilize and to check sufficient characteristics and record adequate data to assure satisfactory equipment operation.

*4.4.1.3 Manufacturing Run-In Test - Each equipment shall be operated under the conditions specified herein for a period of 6 hours without failure. A failure shall be defined as anything which causes malfunctioning of the equipment. Only those adjustments will be permitted which can be made by using such controls and adjustments that are accessible to the operator during the normal use of the equipment.

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Temperature	Ambient room
Humidity	Ambient room
Vibration	Any selected frequency within the range of 20 to 30 cps (excluding resonant points) and a amplitude of ±3 g's except the Displacement Gyroscope Assembly and the Attitude-Director Indicator which shall be at a minimum amplitude of 0.5 g's and 1.0 g's respectively.

The equipment shall be vibrated (without vibration isolators) for a period of 10 minutes prior to the beginning of the 6-hour period of operation. Where feasible, the equipment shall be operated during this vibration period for the purpose of detecting flaws and imperfect workmanship. Operation within the specified limits of satisfactory performance is not necessarily required during the vibration period. The direction of vibration should be vertical to the normal mounting plane for 5 minutes and lateral to the plane for 5 minutes. Where it is not feasible to vibrate the equipment in 2 directions the vertical direction shall be used. During the 6-hour period of operation following the 10-minute vibration period, the equipment shall be mechanically cycled periodically through its various phases of operation. Should a failure occur, it should be repaired and the test started over, except that the 10-minute vibration period need not be repeated when it is certain the failure was not a result of the vibration. Should repetitive failures occur, corrective action shall be taken to eliminate this defect from future equipment. A record shall be kept of all failures. The 6-hour period specified above may be composed of two 3-hour periods to conform with standard working hours.

*4.4.2 Sampling Tests - Equipments selected for sampling tests shall first have passed the individual tests. Equipments shall be selected for sampling tests by the government inspector in accordance with the following: (Sampling tests shall not be conducted unless Reliability Assurance Tests of 4.4.3 are deleted by contractual action.)

Quantity of Equipments Offered for Acceptance	Quantity to be Selected For Sampling Test
First 10	0*
Next 50	1
Next 75	1
Next 100	1
1 for each additional 200 or fraction thereof	

*NOTE: If by contract action the Initial Production Test (4.3) is deleted, then a Sample Test shall be conducted on one equipment from the first 10 produced.

*4.4.2.1 Scope of Tests - As a minimum, each equipment selected for sampling tests shall be subjected to the following tests:

(1) Complete operational test at ambient room conditions, making all necessary measurements to assure that all applicable specification requirements have been met.

(2) Operational test at certain environmental conditions. The conditions may vary for each equipment tested and should be based on results of the preproduction, initial production, individual and special tests.

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(3) Manufacturing run in test specified in paragraph 4.4.1.3 except that the test duration shall be 120 hours with no restriction on the number of failures. However, each failure shall be analyzed as to cause and remedial action necessary to reduce the possibility of its recurrence in future equipment.

*4.4.3 Reliability Assurance Tests - Reliability assurance tests shall be conducted as required by Specification MIL-R-23094. Equipments selected for reliability assurance tests shall first have passed the individual tests.

*4.4.3.1 Reliability Procedure - For the Reliability Qualification Plan, as outlined in Specification MIL-R-23094, Procedure I shall be used. For the Reliability Sampling Plan Procedure I shall be used.

*4.4.3.2 Test Level - The test shall be as follows:

Except for the initial temperature cycle of +71°C (+160°F) followed by -54°C (-65°F), the high temperature shall be +55°C (+130°F) and the low temperature shall be -40°C (-40°F). The initial temperature cycle shall be conducted at the start of each system and on each unit thereafter upon repair or replacement. The length of each cycle shall not exceed 24 hours nor shall either of the high or low temperature conditions be less than 4 hours. The equipment shall be vibrated at 1/2 g at a non-resonant frequency between 20 and 60 cps for 10 minutes at each extreme temperature. No unit shall be subjected to temperature or vibration conditions exceeding the unit specification requirements.

*4.4.3.3 Duty Cycle - Upon receipt of the equipment, following operational tests (or debugging) the system shall be placed in a chamber at +71°C (+160°F) and operated for 4 hours using nominal voltage. The system shall be tested by Scorsby motion during this test (at least ±5°). The system shall then be tested at -54°C (-65°F) after a 4-hour soak at -54°C (-65°F). The system shall then be tested as follows:

The system shall be operated for 2-1/2 hours at nominal voltage and shall be de-energized for 1/2 hour. This duty cycle shall be conducted at least eight times each day. Time counted toward the reliability test shall be the sum of all 2-1/2 hour running periods.

Following the initial hot and cold tests of the one temperature cycle (see 4.4.3.2), the tests shall continue at -40°C (-40°F) to +55°C (+130°F). At all times when power is applied during the Reliability test, including heat and cold (except for a period including the starting cycle on each start and not to exceed 5 minutes) the displacement gyro, the rate switching gyro, and the proportional rate gyro shall be on a Scorsby table operating at between 5 and 7 cycles per minute and at an angle sufficient to cause positive switching of the rate switching gyro.

*4.4.3.4 Accept-Reject Criteria - Figure 13 of Specification MIL-R-23094 shall be used to determine the accept-reject criteria for the Reliability Qualification Test Plan. Figure 14 of Specification MIL-R-23094 shall be used to determine the accept-reject criteria for the Reliability Sampling Test Plan.

*4.4.3.5 Performance Characteristics to be Measured - The performance characteristics to be measured shall be as specified in 6.10.

*4.4.3.6 Failure Criteria - In addition to the requirements of Specification MIL-R-23094, the following requirements shall be used to determine when a failure has occurred during the test:

(1) Whenever performance characteristics fall below the Acceptance requirement (paragraph 4.4.3.5) at least one failure has occurred. If subsequent analysis reveals that several parts have deteriorated, each shall be counted a failure, unless one caused the other parts to fail.

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*4.4.3.7 Preventive Maintenance - During the test no preventive maintenance, other than simple adjustments normally performed on the equipment by the operator, shall be permitted. However, a log of all such adjustments shall be kept. The procuring activity may weight these adjustments and if it feels justified assign excessive ones as failures.

*4.4.3.8 Additional Requirements - The procedure set forth herein requires a complete system or a suitable simulation of the system loads and sequencing when the test is applied for the item specified.

*4.4.4 Special Tests - Special tests shall be conducted on a quantity of equipments for the purpose of checking the effect of any design or material change on the performance of the equipment and to assure adequate quality control. The equipment selected for special tests may be selected from equipments previously subjected to the sampling or reliability assurance tests.

*4.4.4.1 Special Test Schedule - Selection of equipments for special tests shall be made as follows:

(1) On an early equipment after an engineering or material change.

(2) Whenever failure reports or other information indicate additional tests are required. (This will be determined by the procuring activity.)

*4.4.4.2 Scope of Tests - Special tests shall consist of such tests as approved by the procuring activity. Test procedures previously approved for the preproduction tests shall be used where applicable. When not applicable, the contractor shall prepare a test procedure and submit it to the procuring activity for approval prior to conducting the tests.

*4.4.5 Equipment Failure - Should a failure occur during either the sampling, reliability assurance or special tests, the following action shall be taken:

(1) Determine the cause of failure.

(2) Determine if the failure is an isolated case or design defect.

(3) Submit to the procuring activity for approval, proposed corrective action intended to reduce the possibility of the same failure(s) occurring in future tests.

(4) Where practical, include a test in the individual test to check all equipment for this requirement until reasonable assurance is obtained that the defect has been satisfactorily corrected.

*4.5 Life Test - The contractor shall furnish all samples and shall be responsible for accomplishing the life test. The test shall be of 1000 hours duration and shall be conducted on equipments that have passed the individual test. The life test shall be performed under the conditions specified in 4.5.1. The life test sample shall be selected by the government inspector in accordance with the following. (Equipments which have successfully passed the Initial Production Test, Sampling Tests, Reliability Tests, or Special Tests may be selected for life tests.) When reliability tests are conducted, the life test may be omitted if, during the reliability tests, a quantity of equipments equal to, or more than, that listed below receive at least 1000 hours each of test time.

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Quantity of Equipments Offered for Acceptance	Quantity to be Selected for Life Test
First 10	1
Next 175	1
Next 300	1
	1 for each additional 500 or fraction thereof

*4.5.1 Test Conditions - The life test shall be conducted under the following simulated service conditions:

Temperature	Normal room
Altitude	Normal ground (0 - 5000 ft.)
Humidity	Room ambient
A.C. Voltage	115 ± 5 volts (at lowest applicable frequency)
D.C. Voltage	27.0 ± 2.0 volts

*4.5.2 Test Periods - The test may be run continuously or intermittently. Any period of operation shall be of sufficient duration to permit the equipment temperature to stabilize. Periodically, the equipment shall be turned on and off several times and put through its various phases of operation.

*4.5.3 Performance Check - At approximately 8-hour intervals during the test, a limited performance check shall be made. The performance check proposed by the contractor shall be subject to approval by the procuring activity.

*4.5.4 Test Data - The contractor shall keep a daily record of the performance of the equipment, making particular note of any deficiencies or failures. In the event of part failures, the defective part shall be replaced and the operation resumed for the balance of the test period. A record shall be kept of all failures throughout the test, including all tube failures. This record shall indicate the following:

(1) Part type number
(2) The circuit reference symbol number
(3) The part function
(4) Name of the manufacturer
(5) Nature of the failure
(6) The number of hours which the part operated prior to failure

*4.5.4.1 Failure Report - In the event of a failure, the government inspector shall be notified immediately. A report shall be submitted to the procuring activity upon completion of the test. In this report, the contractor shall propose suitable and adequate design or material corrections for all failures which occurred. The procuring activity will review such proposals and determine whether they are acceptable.

*4.5.5 Reconditioning of Life Test Samples - An equipment which has been subjected to the life test shall be reconditioned as follows:

(1) On completion of the life test, the equipment shall be reworked by the contractor by replacing all "wear" items. The "wear" items shall be determined by agreement between the contractor and the procuring activity.

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(2) After reworking, the contractor shall resubmit the equipment for acceptance.

*4.6 Test Procedures - The procedures used for conducting preproduction tests, acceptance tests and life tests shall be prepared by the contractor and submitted to the procuring activity for review and approval. The right is reserved by the procuring activity or the government inspector to modify the tests or require any additional tests deemed necessary to determine compliance with the requirements of this specification or the contract. Specification MIL-R-18303 shall be used as a guide for preparation of test procedures. When approved test procedures are available from previous contracts such procedures will be provided and may be used when their use is approved by the procuring activity. However, the right is reserved by the procuring activity to require modification of such procedures, including additional tests, when deemed necessary.

*4.7 Reconditioning of Tested Equipment - Equipment which has been subjected to acceptance and life tests shall be reconditioned by the contractor by replacing all wear or damaged items. After reworking the contractor shall resubmit the equipment for acceptance.

*4.8 Presubmission Testing - No item, part or complete equipment shall be submitted by the contractor until it has been previously tested and inspected by the contractor and found to comply, to the best of his knowledge and belief, with all applicable requirements.

*4.9 Rejection and Retest - Equipment which has been rejected may be reworked or have parts replaced to correct the defects and resubmitted for acceptance. Before resubmitting, full particulars concerning previous rejection and the action taken to correct the defects found in the original shall be furnished the government inspector.

5. PREPARATION FOR DELIVERY

*5.1 General - All major units and parts of the equipment shall be preserved, packaged, packed and marked for the level of shipment specified in the contract or order in accordance with Specification MIL-E-17555.

6. NOTES

*6.1 Intended Use - The equipment covered by this specification is intended for use in aircraft to provide an all-attitude flight reference system plus a correlated loft bomb release system providing flight director and bomb release information for either high or low angle loft bomb release maneuvers.

*6.2 Test Values - Normal and limiting values of performance data shall be determined at input voltages of 27.5 ± 0.5 V DC and 115 ± 1.0 V AC as applicable. These data are to be used in testing the equipment at installation points for compliance with minimum acceptance standard of performance.

*6.3 Performance Objectives - Minimum size and weight, simplicity of operation, ease of maintenance, and an improvement in the performance and reliability of the specific functions beyond the requirements of this specification are objectives which shall be considered in the production of this equipment. Where it appears a substantial reduction in size and weight or improvement in simplicity of design, performance, ease of maintenance or reliability will result from the use of materials, parts and processes other than those specified in Specification MIL-E-5400, it is desired their use to be investigated. When investigation shows advantages can be realized, a request for approval shall be submitted to the procuring activity for consideration. Each request shall be accompanied by complete supporting information.

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*6.4 As a general rule non-repairable subassemblies should be encapsulated or hermetically-sealed. The number of connections internal to the subassembly should be held to a minimum. Detail parts tolerances and ratings should be so selected that the life of the subassembly is greater then that of a similar repairable one. With few exceptions (such as high voltage power supplies), the non-repairable subassembly should evidence a Mean-Time-to-Failure greater than 5000 hours, and for many applications this figure must be nearer 50,000 hours.

*6.5 Precedence of Documents - When the requirements of the contract, this specification, or applicable subsidiary specifications are in conflict, the following precedence shall apply:

(1) Contract - The contract shall have precedence over any specification.

(2) This Specification - This specification shall have precedence over all applicable subsidiary specifications. Any deviation from this specification, or from subsidiary specifications where applicable, shall be specifically approved in writing by the procuring activity.

(3) Referenced Specifications - Any referenced specification shall have precedence over all applicable subsidiary specifications referenced therein. All referenced specifications shall apply to the extent specified.

*6.6 The parentheses (*), when used in the type designation, will be deleted or replaced by either a number or letter furnished by the procuring activity upon application by the contractor for assignment of nomenclature in accordance with 3.3.7. The complete type number shall be used on nameplates, shipping records and instruction books, as applicable.

*6.7 Ordering Data - Purchasers should exercise any desired options offered herein, and procurement documents should specify the following:

(1) Title, number, and date of this specification.

(2) Selection of applicable levels of packaging and packing (see 5.1).

(3) Data requirements (see 3.6).

6.8 Asterisk - In specification revisions and superseding amendments an asterisk "" preceding a paragraph number denotes paragraphs in which changes have been made from the previous issue. This has been done as a convenience only and the government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content as written, irrespective of the asterisk notations and relationship to the last previous issue.

*6.9 Items of Equipment - The equipment covered by this specification shall consist of the following items:

Item	Type Designation	Applicable Paragraph
Accelerometer, Aircraft	MX-2911/AJB-3A	3.5.1
Adapter-Compensator, Compass	MS-2826A/AJB	3.5.2
Adapter, Flight Director Signal	MX-2912A/AJB-3A	3.5.3
Amplifier-Power Supply	AM-1931/AJB-3	3.5.4
Computer, Bomb Release, Angle	CP-410/AJB-3	3.5.5
Controller, Compass System	C-2984/AJB-3A	3.5.6
Distribution Box	J-1122/AJB-3A	3.5.7
Gyroscope Assembly, Displacement	CN-494A/AJB-3	3.5.8
Gyroscope, Rate Switching	CN-495A/AJB-3	3.5.9
Indicator, Attitude-Director	ID-811/AJB-3A	3.5.10
Timer, Interval	TD-236A/AJB-3	3.5.11
Transmitter, Rate Gyroscope	T-751/AJB-3A	3.5.12

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*6.9.1 Associated Equipment - The equipment shall operate with the following associated equipment:

Equipment

Transmitter, Remote Compass, Thin Wing, Type ML-1 (unstabilized)

*6.10 Performance Characteristics to be Measured - Tests necessary to determine failures in performance characteristics (listed below) shall be conducted at least once every 24 hours. If operation is extended over a weekend, the tests may be conducted on the day prior to and the day following the weekend in lieu of the 24-hour tests for the weekend. A failure shall be defined to be any of the following conditions:

(1) Any failure which prevents the presentation of accurate roll, pitch, or azimuth information (± 2 degrees) to the observer.

(2) Any intermittent condition which causes jumping in the roll, pitch, or azimuth indication. Disqualifying jumping shall be jumping of 3 degrees or more.

(3) Any failure which interferes with the ability to "drop" bombs in the normal manner.

(4) Any drift rate of the vertical gyro which exceeds 45 degrees per hour, when the erection circuits are de-energized.

(5) Any azimuth drift which exceeds 12 degrees per hour, after correction for earth rate effects. Azimuth compensating circuits are to be ineffective during this test.

(6) Any azimuth drift exceeding 9 degrees per hour, uncorrected for earth rate effects and compensated by the proper compensating circuits.

*6.11 Applicable Documents

SPECIFICATIONS

Federal

BB-N411	Nitrogen

Military

MIL-C-172	Cases; Bases, Mounting; and Mounts, Vibration (for use with Electronic Equipment in aircraft)
MIL-E-4682	Electron Tubes and Transsitors, Choice and Application of
MIL-W-5088	Wiring; Aircraft, Installation of
MIL-E-5400	Electronic Equipment, Aircraft, General Specification for
MIL-T-5422	Testing, Environmental, Aircraft Electronic Equipment

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MIL-I-6181	Interference Control Requirements, Aircraft Equipment
MIL-C-6781	Control Panel: Aircraft Equipment, Rack or Console Mounted
MIL-P-7788	Plate, Plastic Lighting
MIL-M-7793	Meter; Time Totalizing
MIL-S-16892	Synchros, 400 Cycle
MIL-E-17555	Electronic and Electrical Equipment and Associated Repair Parts, Preparation for Delivery of
MIL-T-18303	Test Procedures; Preproduction and Inspection, For Aircraft Electronic Equipment, Format for
MIL-N-18307	Nomenclature and Nameplates for Aeronautical Electronic and Associated Equipment
MIL-T-19576	Transmitter, Remote Compass, Thin Wing, Type ML-1 (unstabilized)
MIL-R-23094	Reliability Assurance for Production Acceptance of Avionics Equipment, General Specification for
MIL-S-23603	System Readiness/Maintainability; Avionic Systems Design, General Specification for
MIL-L-25467	Lighting, Integral, Instrument, General Specification for
JAN-F-675	Anti-Reflective Coatings

STANDARDS

Federal

FED-STD-595	Colors

Military

MIL-STD-704	Electric Power, Aircraft, Characteristics and Utilization of
MS-17378	Amplifier-Power Supply AM-1931/AJB-3
MS-17379	Computer, Bomb Release, Angle CP-410/AJB-3
MS-17381	Distribution Box J-1122/AJB-3A
MS-17382	Gyroscope Assembly, Displacement CN-494A/AJB-3
MS-17384	Gyroscope, Rate Switching CN-495A/AJB-3

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MS-17388	Timer, Interval TD-236A/AJB-3
MS-17389	Accelerometer, Aircraft MX-2911/AJB-3A
MS-17390	Adapter-Compensator, Compass MX-2826A/AJB
MS-17391	Adapter, Flight Director Signal MX-2912A/AJB-3
MS-17392	Controller, Compass System C-2984/AJB-3A
MS-17393	Indicator, Attitude-Director ID-811/AJB-3A
MS-17394	Transmitter, Rate Gyroscope T-751/AJB-3A
MS-33545	Case - Instrument, 5 x 5-1/4, Standard Dimensions for
MS-33558	Numerals and Letters, Aircraft Instrument Dial, Standard Form of

*6.11.1 Availability of Documents -

(1) When requesting specifications, standards, drawings, and publications refer to both title and number. Copies of this specification and applicable specifications required by contractors in connection with specific procurement functions may be obtained upon application to the Commanding Officer, Naval Supply Depot, Code 105, 5801 Tabor Avenue, Philadelphia, Pennsylvania.

*6.12 Criteria for Multiple Source - The criteria of this paragraph shall be used for determining the extent to which the requirement for multiple independent source availability of microcircuits is satisfied. For interchangeability at the MIC level, multiple source availability exists if the devices from the different sources may be used interchangeably, device by device, in the final equipment without any need for mechanical or electrical changes. For interchangeability at the card level, multiple source availability exists if a card composed of MICS from one source is mechanically and electrically interchangeable with another card composed of MICS from another source. Numerous aspects need be considered to arrive at the independence of sources; these involve production independence, corporate (or firm) and financial independence, and geographical separation. The production independence of one source of another is determined by the extent to which the one source is independent of the other for manufacture; and by the lack of common original suppliers of raw or processed materials. Design, process information, technology, and diffusion masks may be derived from a common source. However, in such a case, each device source shall have a demonstrated capability of originating these items. The corporate (or firm) and financial independence of one source of another is determined by the absence of common directors, common officers, or holders of large common financial interests. Geographical separation is simply the distance between the locations where principal manufacture takes place by two sources.

*6.13 Microelectronic Interchangeability Demonstration - Interchangeability of microelectronic elements shall be demonstrated as follows:

(1) For the interchangeability at the MIC level, it shall be demonstrated for each type of functional MIC from one source, as used in the system, that it is mechanically and electrically interchangeable with that from another source (see paragraph 6.12).

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(2) For the interchangeability at the Maintenance module level, it shall be demonstrated that modules typical of those to be used in the system composed of MICS from one source are mechanically and electrically interchangeable with modules composed of MICS from another source.

(3) For the completed equipment, it shall be demonstrated that modules composed of MICS from one source are interchangeable with corresponding modules composed of MICS from another source. When interchange has been effected, no degradation shall take place in system and subsystem performance.

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SPECIFICATION ANALYSIS SHEET

Form Approved
Budget Bureau No. 119-R004

INSTRUCTIONS

This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity (as indicated on reverse hereof).

SPECIFICATION

MIL-C-23717A(WP) COMPUTER SET, LOFT BOMB RELEASE AN/AJB-3A

ORGANIZATION *(Of submitter)*

CITY AND STATE

CONTRACT NO.

QUANTITY OF ITEMS PROCURED

DOLLAR AMOUNT

$

MATERIAL PROCURED UNDER A

☐ DIRECT GOVERNMENT CONTRACT ☐ SUBCONTRACT

1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?

A. GIVE PARAGRAPH NUMBER AND WORDING.

B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES.

2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID

3. IS THE SPECIFICATION RESTRICTIVE?

☐ YES ☐ NO IF "YES", IN WHAT WAY?

4. REMARKS *(Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)*

SUBMITTED BY *(Printed or typed name and activity)*

DATE

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