

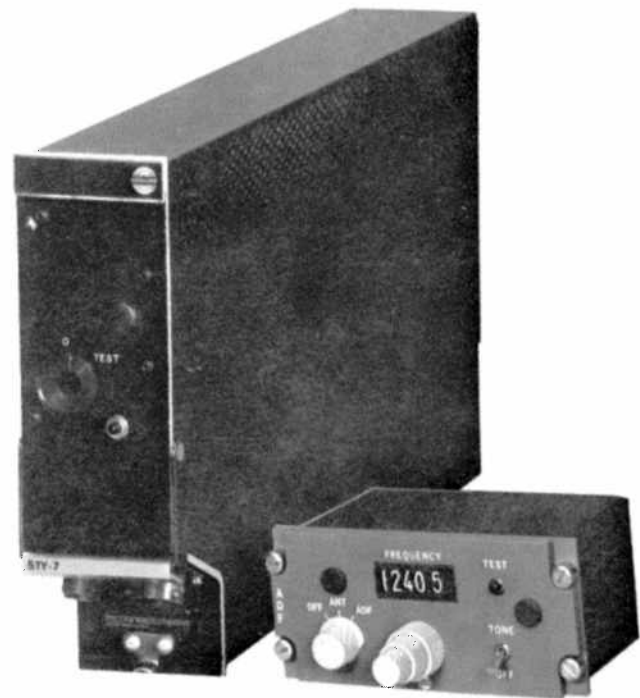
Collins Radio Company | Cedar Rapids, Iowa

product description

DF - 206 ADF System

Operational simplicity, reliability, and ease of maintenance highlight Collins new DF-206 ADF System.

The use of automatic fine tuning and automatic band selection simplifies operation. High reliability results from the use of solid-state switching techniques. Modern construction simplifies maintenance.



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Equipment specifications are subject to change without notice

product description

INTRODUCTION

Collins new ADF system, the DF-206, provides the simplified operating procedures and high reliability required for today's high-speed aircraft. The DF-206 is fully compatible with the new ARINC ADF Characteristic 570 as well as ARINC 550.

Digital frequency control and readout is provided in discrete 500-Hz steps. To conform to ARINC 570, the loop function and panel tuning meter of past generation ADF's have been eliminated. Automatic fine tuning is accomplished by internal circuits. ADF and ANT functions are available with volume control, on/off, and functional-test options.

The new components developed for the DF-206 System are the 51Y-7 Receiver and the 614L-11/12/13 Control Units. Standard ARINC 550 sense and loop antennas, cables, couplers, quadrantal error correctors (QEC), mounts, and bearing indicators currently used with the Collins DF-203 System make up the remainder of the ADF system. The 51Y-7 Receiver and 614L-11, 614L-12, or 614L-13 Control Units are directly interchangeable with last generation ADF systems in an aircraft containing full ARINC Characteristic 550 wiring. A retrofit of the 51Y-7 Receiver and the 614L-11, 614L-12, or 614L-13 Control Units will provide all the advantages of the new DF-206 System.

FEATURES

Frequency Range

- The 51Y-7 has a frequency range of 190 to 1750 kHz, tunable in 0.5-kHz steps, with digital frequency readout.

Digital Frequency Control

- Parallel bcd control logic is used in conjunction with a single loop phase-locked synthesizer. The operational frequencies are derived from a single crystal-controlled oscillator.

Phase Detection

- The 51Y-7 employs phase detection techniques for improved bearing stability in areas of high atmospheric noise.

Automatic Band Selection

- Automatic band selection is accomplished by logic circuits controlled by bcd logic generated in the 614L-11, 614L-12, or 614L-13 Control Unit.

Operational Simplicity

- Simplified control design permits easy selection of operating modes. The elimination of the tuning meter and the addition of digital techniques allow fast, automatic, fine tuning with a minimum of pilot effort.

ADF/ANT Functions

- The ADF function is used for navigational purposes and the ANT function for aural reception. A horizontal bearing indication is given when the mode switch is in the antenna position.

Functional-Test

- During functional-test, a signal from the synthesizer is applied to the sense and loop sections of the receiver. A 45-degree reading on the front panel test indicator indicates proper operation of the 51Y-7 Receiver.

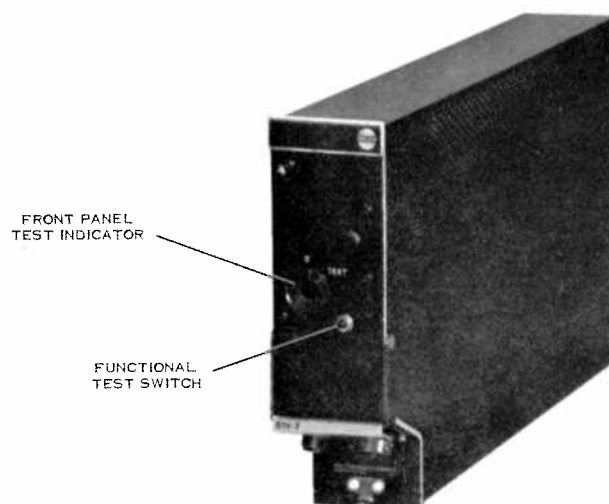


Figure 1. 51Y-7 ADF Receiver.

Modern Construction Techniques

- A combination of circuit boards, plug-in subassemblies, and point-to-point wiring minimizes aircraft downtime by simplifying testing and maintenance.

ARINC 570

- In accordance with ARINC Characteristic 570, the DF-206 ADF System features simplified operating controls, digital fre-

quency and tuning techniques, and improved operation in areas of high atmospheric noise. The requirements of RTCA Paper DO-138 have been incorporated.

ATE

- An ATE (automatic test equipment) connector is provided at the rear of the receiver for performance testing and fault isolation to the subassembly level.

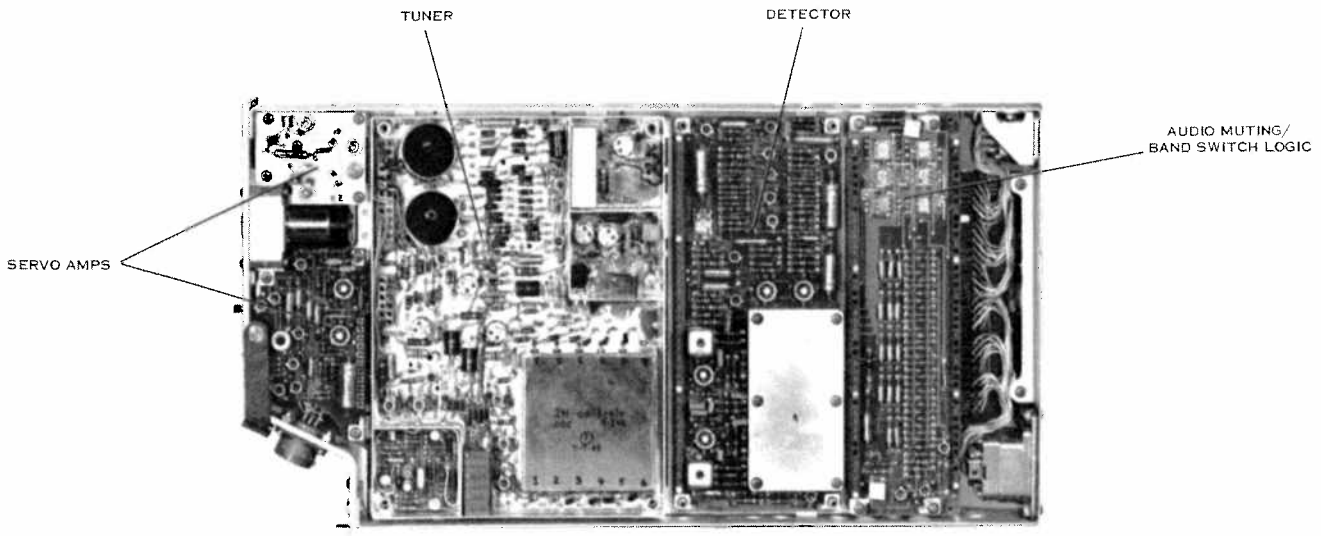
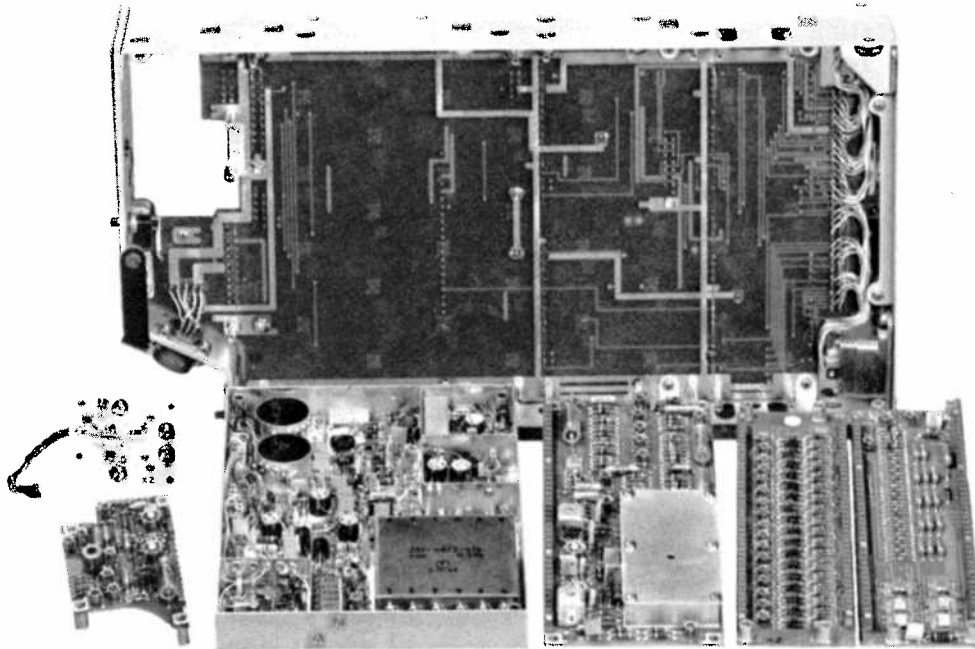


Figure 2. 51Y-7 ADF Receiver.

DESIGN CONCEPTS

Mechanical

51Y-7 ADF RECEIVER

The 51Y-7 Receiver is housed in a 1/4-ATR short box with a slide-on dust cover held by a single, captive, quarter-turn fastener. This unit is physically interchangeable with a 51Y-4 or 51Y-4A.

The receiver is constructed using a printed circuit center board with parallel-mounted plug-

in subassemblies located on either side. This center board provides all the necessary interconnect circuits between the subassemblies and the rear connectors, and provides a ground plane shield.

The plug-in subassemblies consist of a single circuit card with components on one side only for ease of maintenance. Both point-to-point wiring and printed circuits are employed on the subassemblies. Each subassembly can be easily detached.

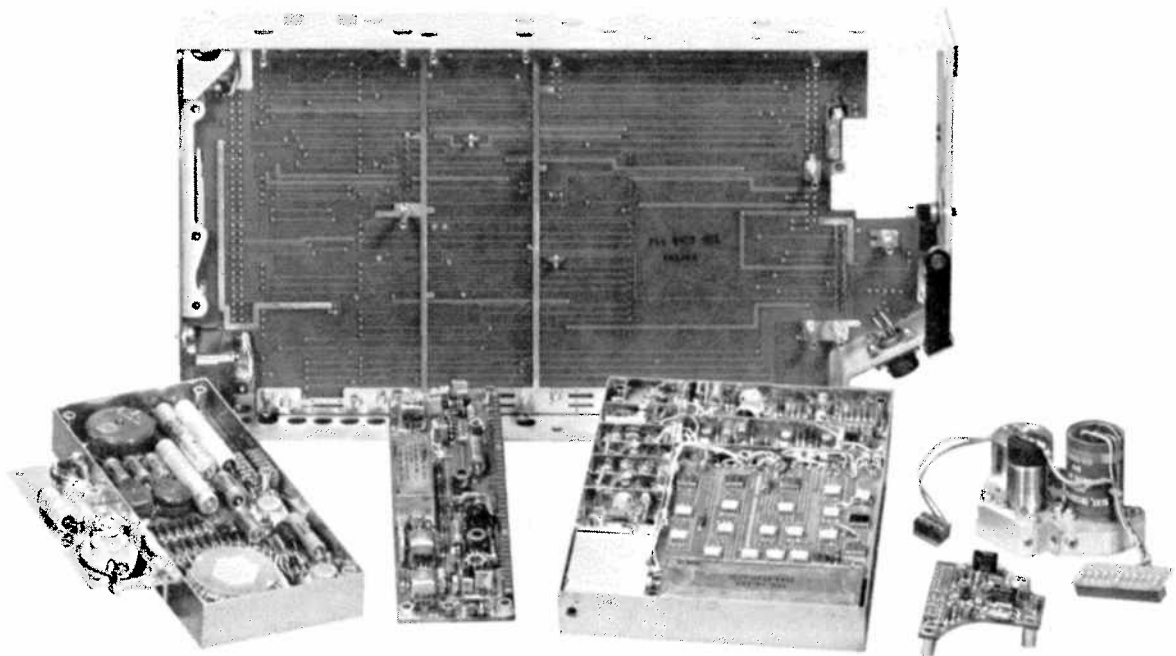
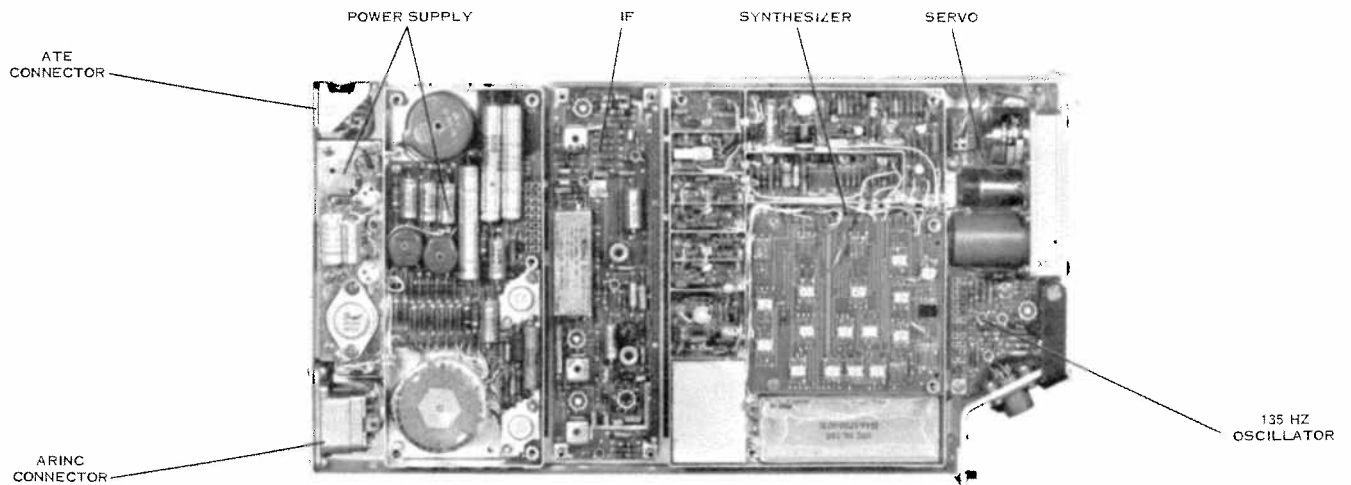


Figure 3. 51Y-7 ADF Receiver.

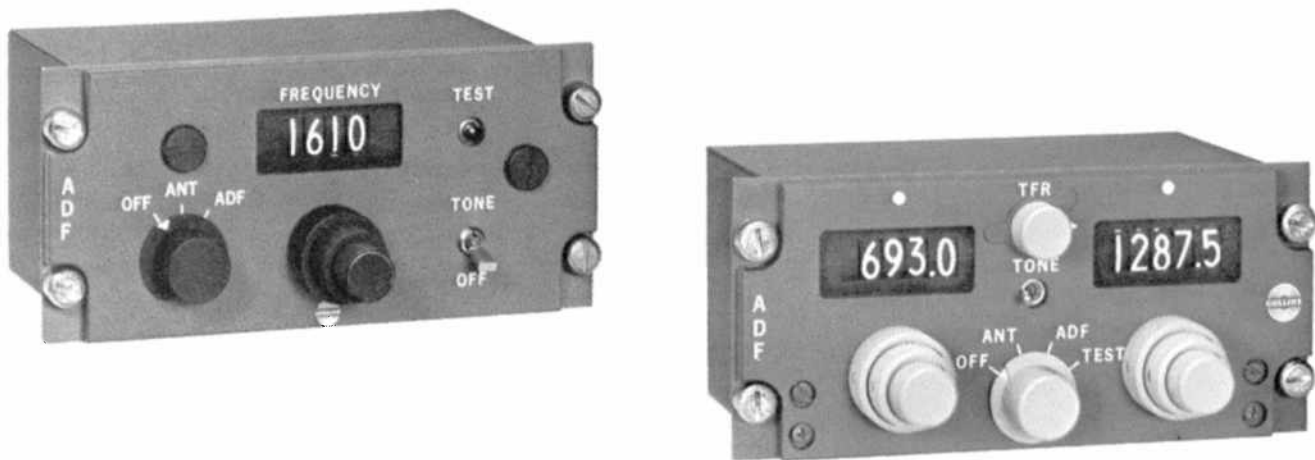


Figure 4. 614L-11 and 614L-12 ADF Control Units.

A self-test button is provided on the front panel of the receiver for ground maintenance purposes. The goniometer synchro system provides a 45-degree bearing indication on the front panel of the receiver. A rear test connector is provided for ATE compatibility.

CONTROL UNITS

Three control units, the 614L-11, 614L-12, and 614L-13, are available with the DF-206. The 614L-11, 614L-12, and 614L-13 Controls are mechanically interchangeable with the 614L-8 of the DF-203 System and other ARINC 550 controls. The 614L-12 provides complete control functions, as well as a preset frequency capability. The 614L-13 is used in dual receiver applications.

Either 5- or 28-volt, red or white lighting is available in the 614L-11, 614L-12, and 614L-13 Control Units. Self-test switches, on/off, and volume controls are optional on all control units. Panel and knob color options are also available.

51Y-7, Electrical Description

GENERAL

The 51Y-7 Receiver is a dual conversion receiver operating in the frequency range of 190 to 1750 kHz. Integrated circuits are used ex-

tensively throughout the receiver. Injection frequencies are developed in 500-Hz increments by a digital stabilized frequency synthesizer containing only one crystal. A single phase-locked loop assures accuracy of the injection frequency. The synthesizer is controlled by bcd information provided by the 614L-11, 614L-12, or 614L-13 Control Unit.

The receiver contains solid-state band switching circuits. Selective filtering and phase detection improve noise rejection to provide reliable ADF operation under conditions of high precipitation static and atmospheric noise.

Parallel bcd control logic is used for frequency selection. Automatic band selection is accomplished in the receiver. Serial control is available as a growth capability.

The standard receiver has a 3000-pF sense antenna input; however, a low capacitance sense input version is also available.

RF TUNER

Solid-state amplifiers and electronic selection of fixed-tuned, bandpass filters provide faster, simplified tuning.

Automatic band selection is accomplished by logic from the receiver control bcd frequency input.

The loop amplifier and associated broadband circuits provide gain characteristics to the signal from the loop antenna. The amplified signal is modulated at an audio switching rate in the balanced modulator, so that a phase reversal of the rf output occurs on each half-cycle of the switching frequency. The balanced modulator output is combined with the sense signal. This phase modulates the received signal at the balanced modulator switching frequency.

The combined sense and loop signals are selected by bandpass filters and processed in the first mixer. The resulting if is 15 MHz.

INTERMEDIATE FREQUENCY (IF)

The 15-MHz composite signal from the first mixer is amplified and converted to 3.6 MHz in the second mixer. A crystal filter provides 15-MHz selectivity to prevent first injection feedthrough and to provide image rejection. Selectivity in the 3.6-MHz stages is also provided by a crystal filter that rejects adjacent channel and other undesired responses.

DETECTOR

The 3.6-MHz if signal is amplified and demodulated by a dual detector consisting of a phase detector and an AM detector. The phase detector furnishes bearing information and the AM detector provides aural, agc, sweep, and loop enable control voltage outputs.

The phase detector includes a 3.6-MHz voltage-controlled crystal oscillator (VCXO) that is controlled by the sweep circuit. The sweep circuit causes the detector to "search" through a 250-Hz range on each side of the 3.6-MHz if output to "capture" a station that may be slightly off frequency. When the incoming phase-modulated signal and VCXO are in phase, a lock circuit stops the sweep, and the detected bearing information is processed and applied to the servo system.

The AM detector provides an aural output and a dc voltage that operates the agc. The dc voltage output is also coupled to an AND function that activates the loop circuit when a signal is being received and when the 614L-11/12/13 mode control is in the ADF position.

The if portion of the 51Y-7 Receiver also contains a 1020-Hz tone generator. The tone generator permits aural reception of an unmodulated (CW) rf carrier. The 1020-Hz tone modulates the if and is available only when the tone switch is on.

FREQUENCY SYNTHESIZER

A single phase-locked loop locks a master oscillator to a 500-Hz reference frequency. The reference frequency is derived from a single crystal oscillator in the synthesizer. The master oscillator provides a first injection frequency in 500-Hz increments from 15.19 to 16.75 MHz, and a second injection frequency of 18.6 MHz. The synthesizer is controlled by parallel bcd logic information from the control unit. The highly stable output from the frequency synthesizer assures accurate injection frequencies.

SERVO SYSTEM

The servo system consists of a polarity sensing phase detector, servo amplifier, dc motor, and loop switching oscillator. The excellent damping characteristics of the dc motor are used to reduce noise susceptibility and hunting of the ADF indicator. Circuits are provided that cause the bearing indicator to assume a horizontal position when the receiver is in the ANT mode or when a receiver fault is detected.

POWER SUPPLY

The internal power supply provides all the necessary dc voltages for tuning, switching, and operating the DF-206 System from the 27.5-Vdc aircraft supply. The supply consists of a series preregulator and a multiple output dc-to-dc converter. A 26-Vac supply is available from the receiver for driving the indicator synchro system.

FUNCTIONAL-TEST

The functional-test feature of the DF-206 allows complete on-channel testing. Proper operation is indicated when the front-panel indicator moves to a 45-degree position.

The functional-test signal is obtained from the frequency synthesizer and applied to the stator windings of the loop antenna resolver to the sense antenna input circuits. The sense rf amplifier is disabled to prevent sense antenna signals from interfering with the functional-test.

SPECIFICATIONS

General

Temperature -54 to +55 °C continuous operation; +71 °C short-time operation (30 minutes).

Altitude Sea level to +55,000 feet.

Vibration Shockmount: 0.8 in DA, 5 to 10 Hz; 0.42 g, 10 to 15 Hz; 0.036 in DA, 15 to 65 Hz; 8 g, 65 to 500 Hz.

Rigid mount: 0.02 in DA with 3 g max, 5 to 55 Hz; 1.5 g, 55 to 500 Hz.

Shock Shockmount: 15 g operational, 30 g impact.

Rigid mount: 6 g operational, 15 g impact.
Note: Shock duration -10 ms.

Size Receiver: 1/4-ATR short. Control: 2.65 by 5.75 by 3.0 in per ARINC Characteristic 570.

Weight..... 51Y-7 Receiver: 8.9 lb. 614L-11 Control: 1.2 lb. 614L-12 Control: 2.8 lb.

Power requirement 27.5 Vdc - 1.2 A. 26 V, 400 Hz, 0.6 A, 0.29 power factor (27.5 Vdc only option available).

Frequency control Bcd per ARINC Characteristic 570.

Electrical Characteristics

Frequency range 190 to 1750 kHz.

Channel increments.....0.5 kHz.

Operating modes ANT - aural receiver, CW/MCW. ADF - navigation receiver, CW/MCW.

Sensitivity.....ANT - 30 μ V/m for 6 dB (s+n)/n. ADF - 50 μ V/m for 6 dB (s+n)/n. Lock threshold for ± 2 -degree error, 15 μ V/m.

Selectivity.....2.5 kHz at 6 dB; 6.5 kHz at 60 dB.

Spurious response.....80 dB.

Aural output Level: 100 mV into 600-ohm load.

Aural frequency response..... ± 4.5 dB, 350 to 1400 Hz, decreases below 350 Hz and above 1400 Hz.

Navigation output.....Synchro transmitter output to two ID-250 indicators or equivalent pointers 11.8 V 400 Hz line-to-line.

Synthesizer frequency stability.....0.003 percent.

Agc.....Not more than 3-dB rise signal strengths of 50 to 500,000 μ V/m:

Bearing speed.....25 degrees per second for 20 μ V/m or greater input.

Bearing accuracy.....2 degrees max error for 30 μ V/m or greater input excluding quadrantal error.

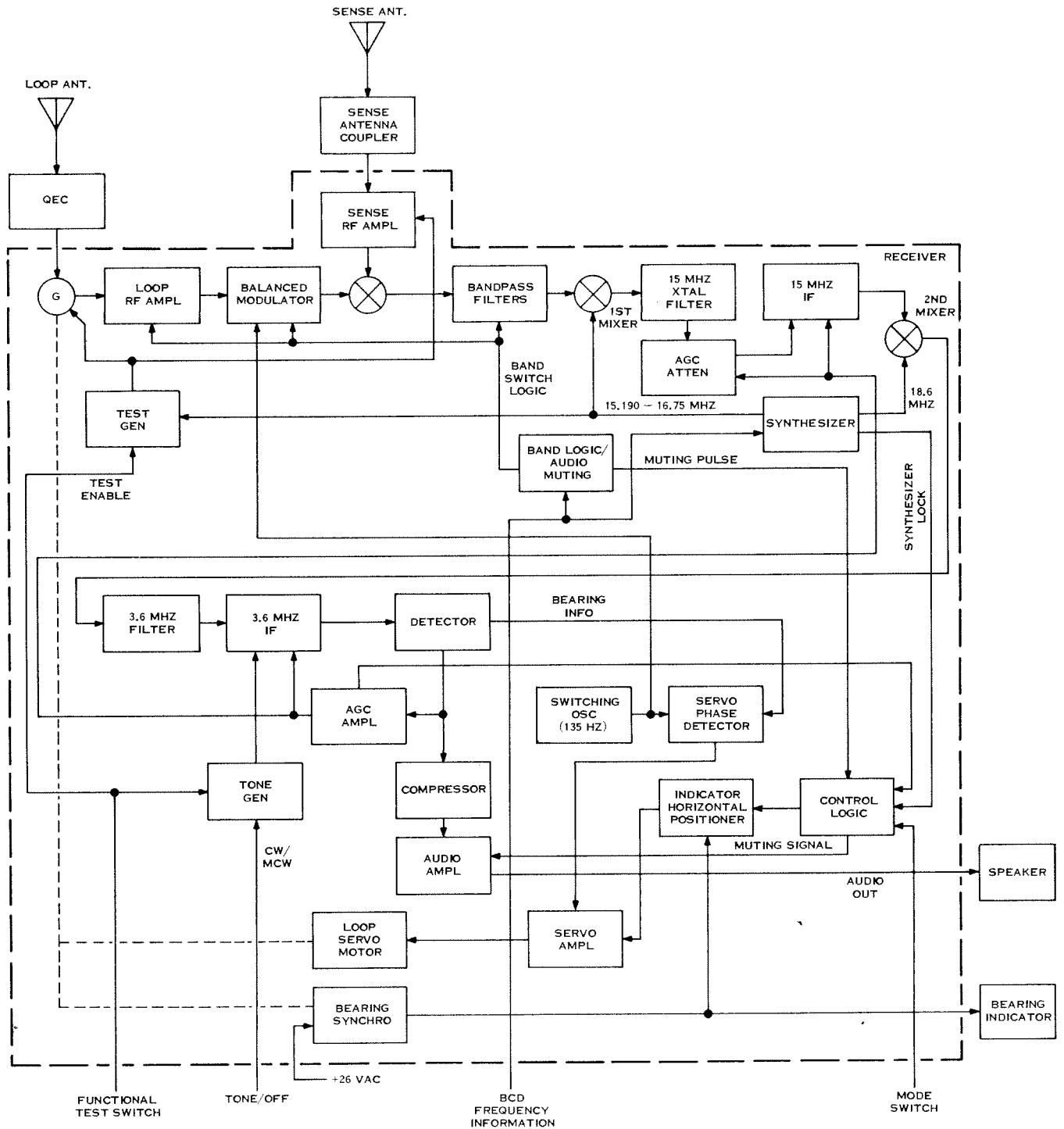


Figure 5. DF-206 ADF System, Block Diagram.

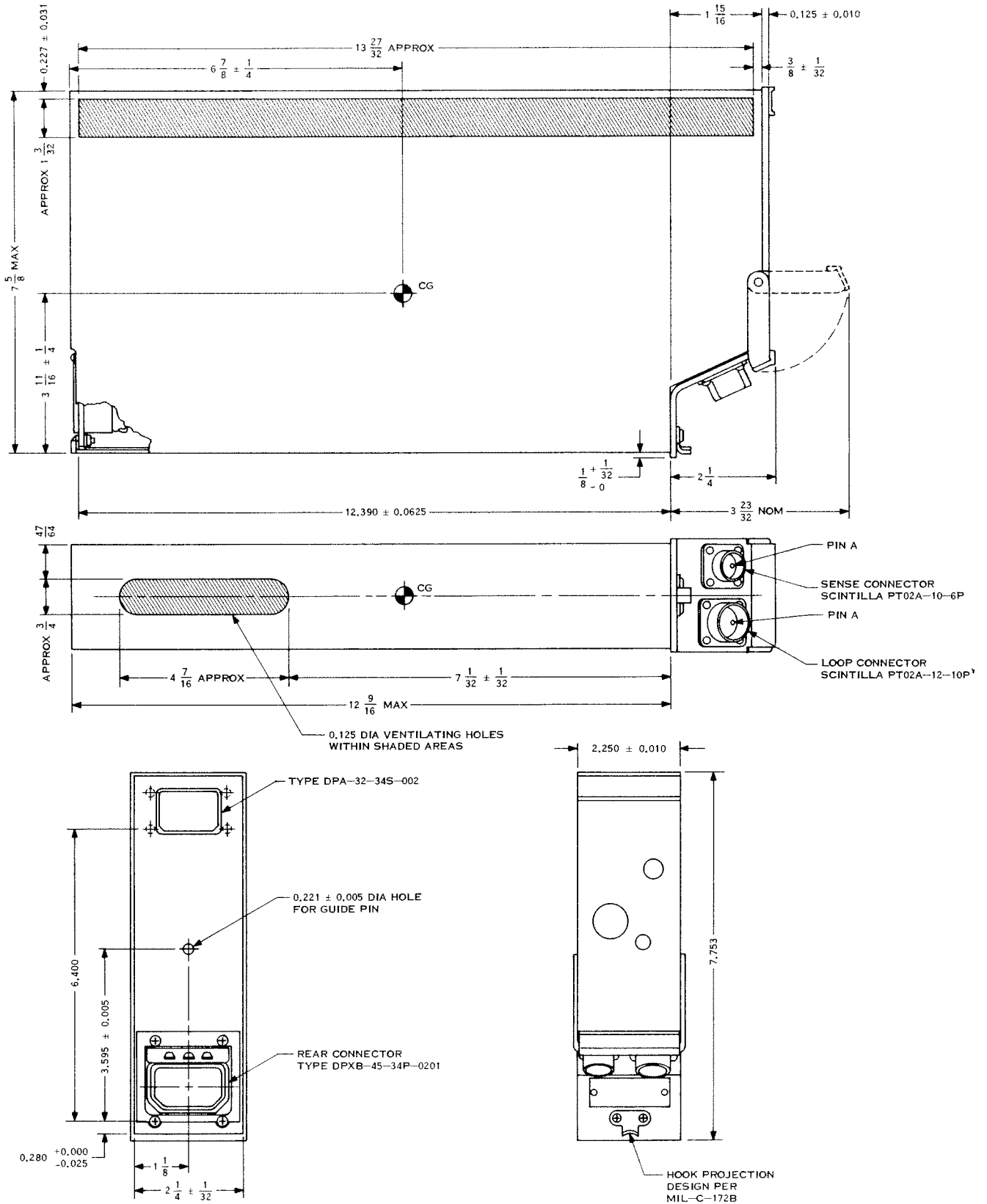


Figure 6. 51Y-7 ADF Receiver, Outline and Mounting Dimensions.

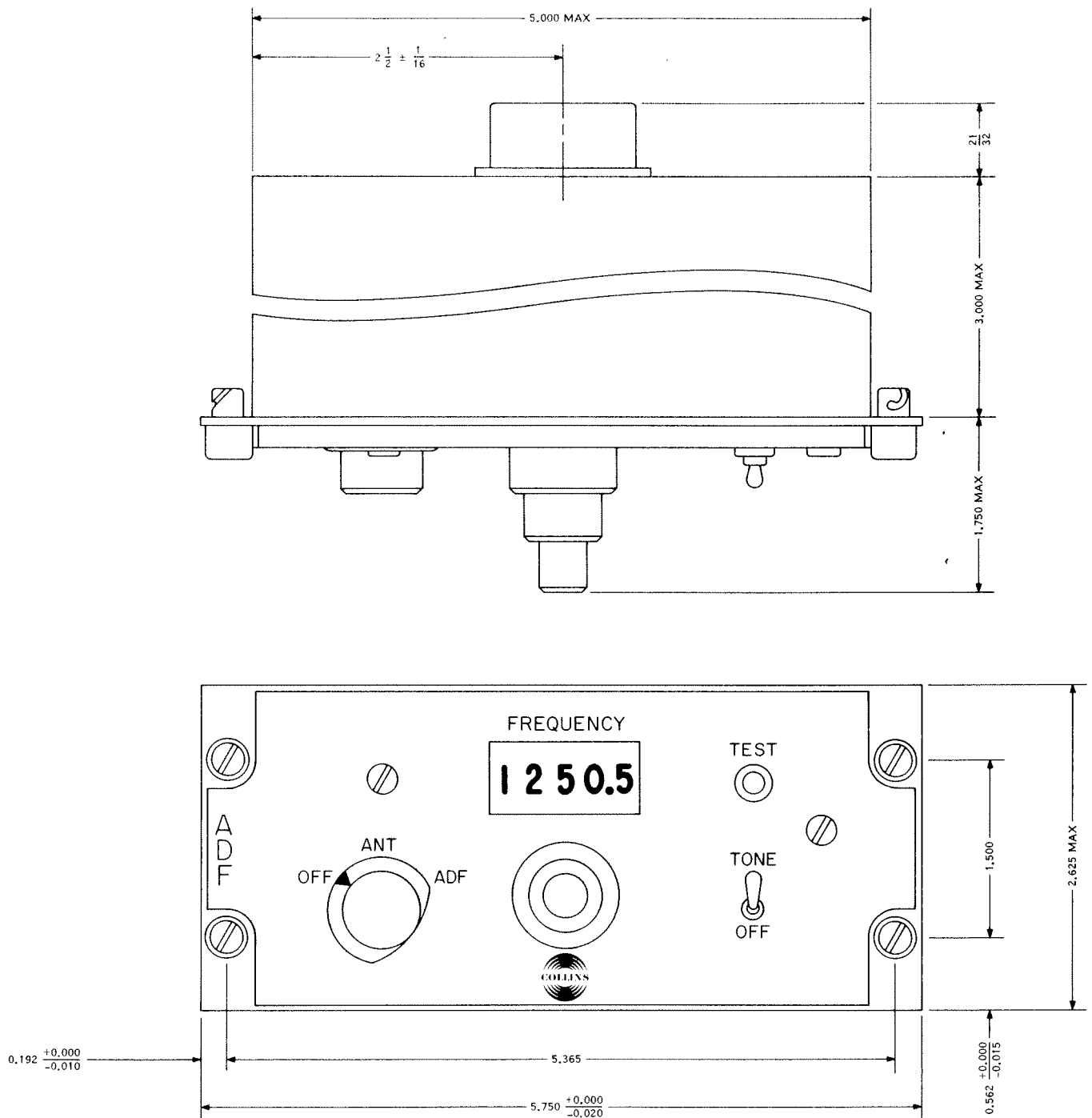


Figure 7. 614L-11 ADF Control Unit, Outline and Mounting Dimensions.

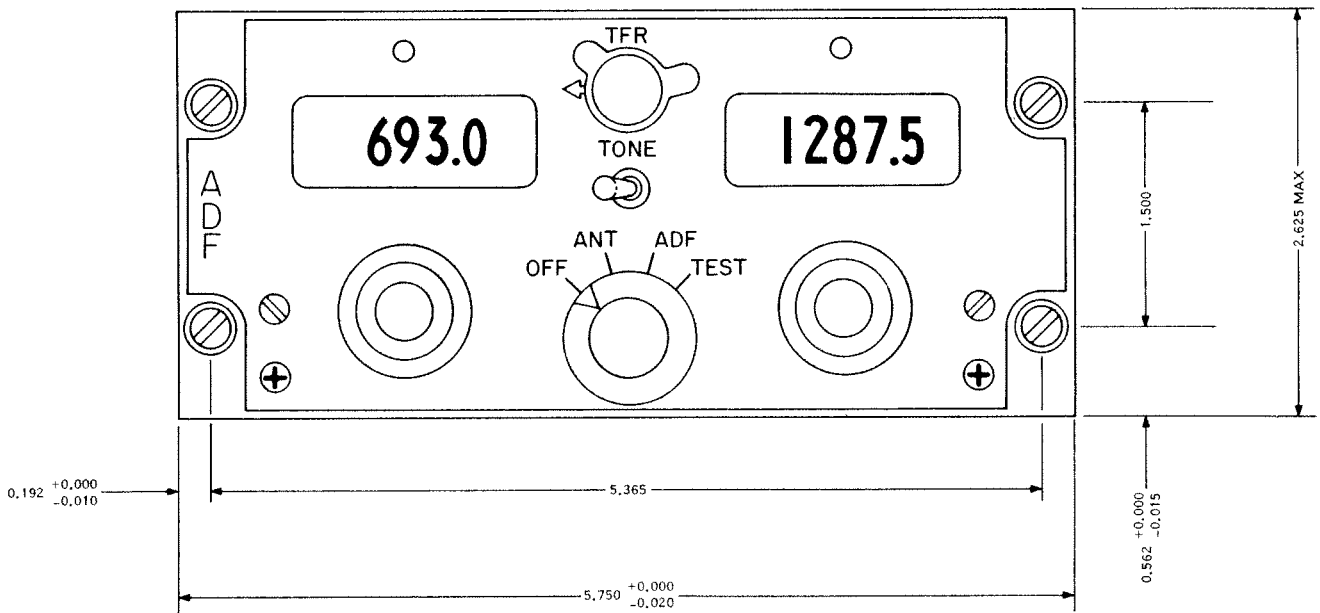
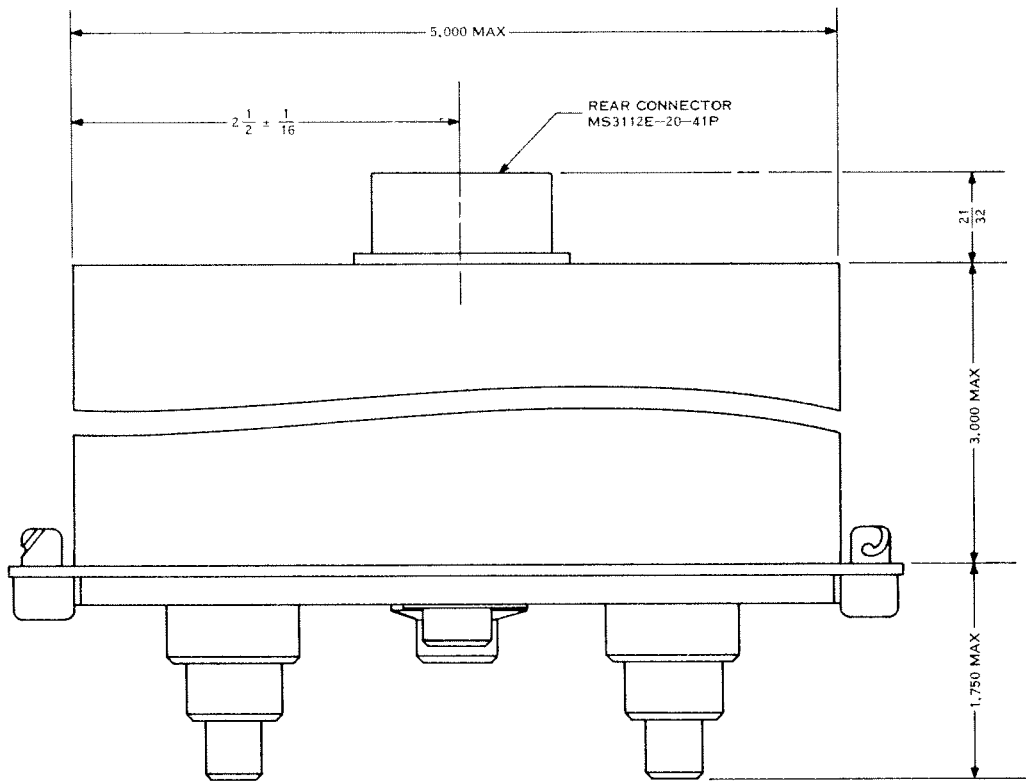


Figure 8. 614L-12 ADF Control Unit, Outline and Mounting Dimensions.

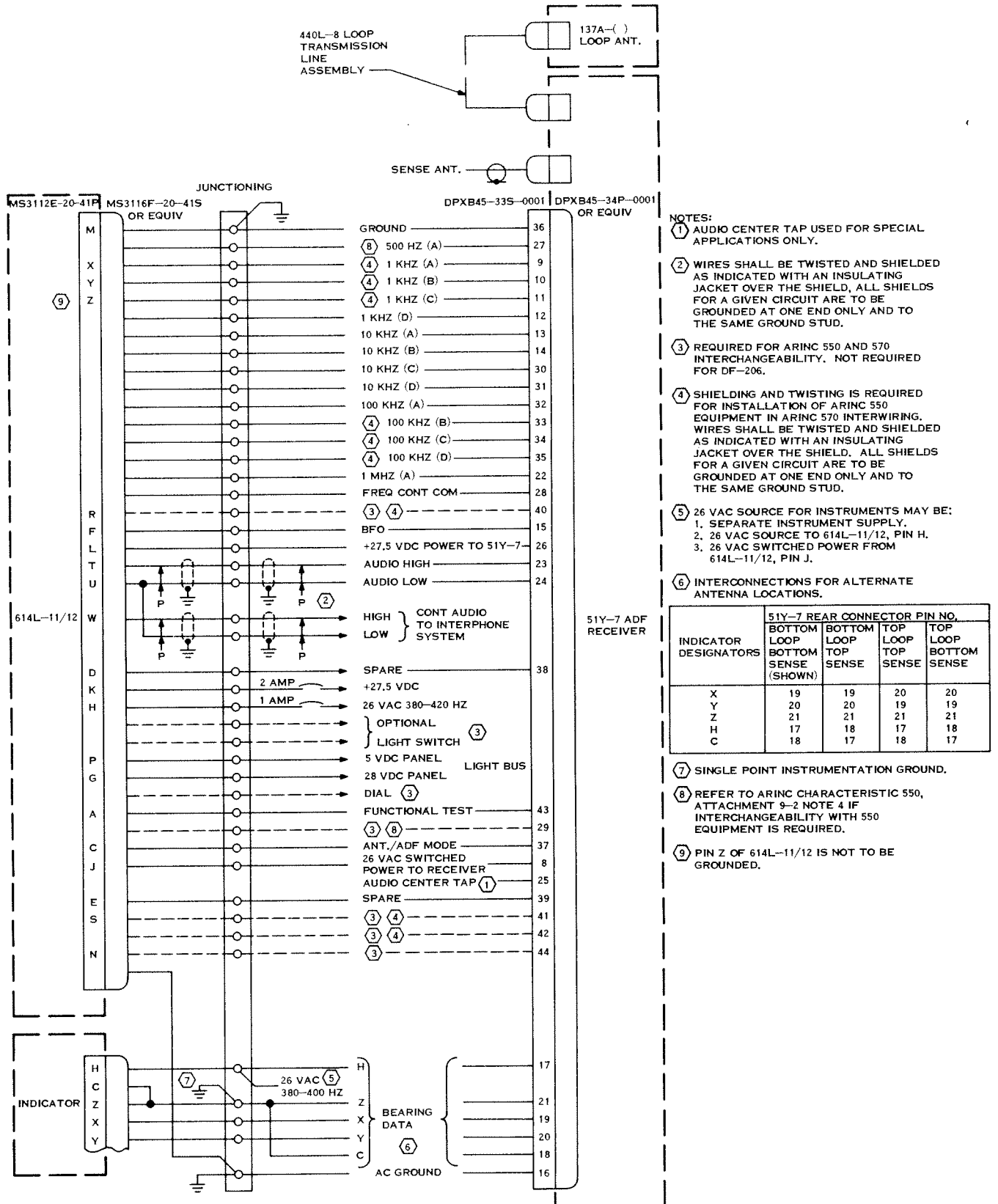


Figure 9. DF-206 ADF System, Interconnect Diagram.