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MILITARY SPECIFICATION

CONTROL SET, APPROACH POWER AN/ASN-54)(V)

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

1. SCOPE

1.1 Scope - This specification covers design and all performance requirements for the Approach Power Control Set AN/ASN-54 (V). This set shall be for use in the power approach configuration only.

1.2 Classification - The Approach Power Control (APC) Set shall consist of the following items: (See 6.5.)

Item	A/C	Designation	Paragraph
Computer, Throttle Control*	F-4B	CP-832/ASN-54(V)	3.5.1
	A-4E	CP-833/ASN-54(V)	
	RA-5C	CP-834/ASN-54(V)	
	A-6A	CP-(*)/ASN-54(V)	
	A-4C	CP-(*)/ASN-54(V)	
	A-3B	CP-(*)/ASN-54(V)	
Amplifier, Electronic (Single Engine)		AM-4377/ASN-54(V)	3.5.2.1
Amplifier, Electronic (Twin Engine)		AM-4376/ASN-54(V)	3.5.2.2
Servo Actuator, Electro-Mechanical, Rotary **		TG-155/ASN-54(V)	3.5.3
Accelerometer, Aircraft		MX-6320/ASN-54(V)	3.5.4

* Note: Computer circuitry will vary according to the class of aircraft as described in 3.5.1. (Classification of computers for aircraft other than those listed shall be made by the procuring activity at the time of procurement.)

** Note: (1 Per Engine)

FSC 5825

1.3 Associated equipment - The equipment shall operate with the following associated equipment which shall not be supplied as part of the equipment:

Transmitter, Angle of Attack

Control Panel

Elevator Position Transducer

2. APPLICABLE DOCUMENTS

2.1 General - The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

SPECIFICATIONS

Military

MIL-E-4682	Electron Tubes and Transistors, 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
MIL-I-6181	Interference Control Requirements, Aircraft Equipment
MIL-M-7793	Meter, Time Totalizing
MIL-E-17555	Electronic and Electrical Equipment and Associated Repair Parts, Preparation for Delivery of
MIL-T-18303	Test Procedures; Preproduction and Acceptance, For Aircraft Electronic Equipment, Format for
MIL-N-18307	Nomenclature and Nameplates for Aeronautical Electronic and Associated Equipment
MIL-T-19229	Transmitter, Angle of Attack or Sideslip, Local

Military (Continued)

MIL-R-22256	Reliability Requirements for Design of Electronic Equipment or Systems
MIL-R-23094	Reliability Assurance for Production Acceptance of Avionic Equipment, General Specification for

STANDARDS

Military

MIL-STD-415	Test Points and Test Facilities, Design Standard For
MIL-STD-704	Electric Power, Aircraft, Characteristics and Utilization of
MIL-STD-756	Reliability Prediction
MS 3116	Connectors, Plug, Electric, Solder Type, Straight, Bayonet Coupling (Navy)
MS 21083	Nut, Self-Locking, Hexagon, Non-Metallic Insert, Low Height, 250 Deg. F
MS 24693	Screw, Machine, Flat Countersunk Head, 100 Deg., Cross Recessed, UNC-2A and UNF-2A

Air Force - Navy Aeronautical

AN 960	Washer, Flat

2.2 Availability of documents - 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 DCS, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

2.3 Other publications - The following documents form a part of this specification. Unless otherwise indicated, the issue in effect on date of invitations for bids shall apply.

American Standards Association

ASA B5.15-1960

(Application for copies should be addressed to the American Standards Association, 10 East 40th Street, New York 16, N. Y.)

3. REQUIREMENTS

3.1 Preproduction - This specification make provisions for preproduction testing.

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

(a) Parts and materials requirements shall conform to MIL-E-5400.

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

3.2.1 Non-standard parts and materials approval - Approval for the use of non-standard parts and materials shall be obtained as outline in MIL-E-5400.

3.2.2 Electron devices - Transistors and diodes shall be chosen and applied, and the complements reported as outlined in MIL-E-4682. No electron tubes shall be used.

3.2.3 Non-magnetic materials - Non-magnetic materials shall be used for all parts except where magnetic materials are essential.

3.3 Design and construction - The equipment shall conform with all applicable requirements of MIL-E-5400 for design, construction, and workmanship except as otherwise specified herein. Modular construction and use of plug-in type assemblies shall be emphasized, in construction of the computer and amplifiers.

3.3.1 Provisions for maintenance testing -

3.3.1.1 Field testing - The set shall provide for connections to perform operational checkout of the installed equipment and shall be designed to be checked out by Test Set, Flight Control System TS-2451/ASW-54(V). These connections shall be accomplished through the functional connectors of the set. Separate external test connectors shall not be provided on the faces of the installed equipment.

3.3.1.2 Bench testing - The set shall be provided with internal and external test points in accordance with MIL-STD-415 and shall be designed to be checked out by "Test Set, Flight Control System TS-2452/ASW-54(V)." Test points shall provide for injection of all tests signals required during operation, adjustment and calibration, and for connections to all circuits required to isolate malfunctions to the smalles removable assembly.

3.3.1.3 Controls - All adjusting controls which must be adjusted after the set is installed in the airplane shall be accessible without disconnecting interconnecting cables or removal of units from installed location.

Space provisions for limited additions to these controls shall be included.

3.3.2 Cabling and connections -

3.3.2.1 Cables and connectors - The set shall provide for the use of cables and connectors in accordance with MIL-E-5400.

3.3.2.2 Interconnection cabling - The equipment shall be capable of satisfactory operation using external wiring in accordance with the applicable requirements of 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.

3.3.3 Interchangeability - The set shall meet the interchangeability requirements of MIL-E-5400 on an item basis.

3.3.4 Marking and identification -

3.3.4.1 Marking of parts and assemblies - Parts and assemblies shall be marked in accordance with MIL-E-5400.

3.3.4.2 Nomenclature and nameplates - Nomenclature assignment and nameplate approval for equipment identification shall be in accordance with MIL-N-18307.

3.3.5 Total weight - The set shall be designed to achieve the minimum weight feasible, consistent with the requirements for the components as stated in 3.5.

3.3.6 Reliability -

3.3.6.1 Operational stability - The set shall operate with satisfactory performance, continuously or intermittently, for a period of at least 200 hours without the necessity of readjustment of any controls which are inaccessible to the operator during normal use.

3.3.6.2 Operating life - The set shall have a minimum total operating life of 3000 hours with reasonable servicing and replacement of parts. Parts requiring scheduled replacement due to wear during the life of the set and the wearout life of such parts, shall be determined by the contractor and submitted to the procuring agency.

3.3.6.3 Reliability in mean time between failures (MTBF) - The set shall have a minimum of 1400 hours of mean (operating) time between failures when tested and accepted as outlined under the requirements of 4.4.3.

3.3.6.3.1 Reliability calculations - Calculated failure and reliability data in accordance with MIL-STD-756 and MIL-R-22256 shall be forwarded to the procuring activity for acceptance substantiating that the above requirement has

been met. These calculations shall be submitted to the procuring activity 90 days after award of the contract.

3.3.7 Interference control - The generation of radio interference by the set and the vulnerability of the set to radio interference shall be controlled within the limits of MIL-I-6181.

3.3.8 Standard conditions - To establish normal performance characteristics under standard conditions and for making laboratory bench tests, the conditions to be used are as follows:

Temperature	Room Ambient (25 ±5°C)
Altitude	Normal Ground
Vibration	None
Humidity	Room ambient up to 90 percent Relative Humidity
Input Voltage	115 ±1.0 VAC and 27.5 ±0.5 VDC

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

3.3.9.1 Servo actuator - The servo actuator shall withstand in a non-operating condition a temperature of 250° F for ten minutes with no degradation in performance. Reliability calculations and test of servo actuator shall include the 250° F environmental condition in meeting overall system reliability.

3.3.10 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 specified amounts.

(1) AC Power (Three Phase) 115/200 V, Category B

Single Engine	Twin Engine	Volt Amperes (VA)
	F-4B	13.5
	RA-5C	13.5
A-4E		45.0
A-4C		45.0
	A-6A	75.0

(2) DC Power 28 V, Category B

Single Engine	Twin Engine	Watts
	F-4B	1.0
	RA-5C	1.0
A-4E		35.0
A-4C		35.0
	A-6A	64.9

The input power requirements listed above include only the power consumed by the set covered by this specification. Power that is switched by the APCS but which is consumed by associated equipment is not included.

3.3.11 Time totalizing meter - The set shall include a digital nonresettable 10,000 hour elapsed time meter which will indicate unit "ON" time. The meter, conforming to MIL-M-7793, shall be located such that it may be read without removing a cover from the unit. The meter shall be included in the computer.

3.3.12 Warm-up time - The time required for the equipment to warm-up prior to operations shall be kept to a minimum and shall not exceed 60 seconds under standard and extreme service conditions.

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, tolerances or values setting forth acceptable variations from the performance under the standard conditions will be specified.

3.4.1 General - The AN/ASN-54(V) APC Set shall be used at all times in the landing pattern including all maneuvering normally encountered in the landing configuration such as descent, turns, and climbs. The APC Set, as shown in Figures 1 and 2, shall control angle of attack by adjusting the throttle in accordance with the angle of attack and normal acceleration inputs to the set and, when specified by the procuring activity, an elevator position input. Thus the angle of attack will be held constant throughout all maneuvers except for small momentary changes caused by vertical drafts or by vertical accelerations introduced by the pilot in order to change the flight path or bank angle. The APC Set shall take into account the relationship between thrust and throttle cross shaft angle, the effect of outside air temperature, the variation of aerodynamic drag as a function of airspeed, angle of attack, aircraft configuration, and the effect of the inclination of the flight path. The change in output of the APC computer shall be proportional to change in angle of attack, change in normal acceleration, the integral of angle of attack error and elevator position (see 3.4.10.4). The APC Set shall provide the performance specified below for the conditions indicated.

3.4.2 Airspeed command - In the normal landing mode, the APC Set shall be capable of maintaining an angle of attack such that airspeed shall be within one (1) percent of the referenced landing speed. The APC Set shall have the capability to decrease/increase the airspeed/angle of attack error caused by a step horizontal wind gust or pilot pitch input of a magnitude to upset the aircraft's angle of attack by ±2 units to 36.7 percent of the initial error within 4 seconds after the initial disturbance. A single overshoot shall be permitted during the correction, however it shall not exceed 20 percent of the initial error. The Set shall be able to quickly counteract any airspeed change which may result due to pitch maneuvers. This action may be checked by introducing an incremental pitch step command of 4 degrees up and 4 degrees down with respect to trim conditions. The airspeed change which results from either pitch command shall not exceed 1.5 percent of the reference value in the transient state. In returning to the reference landing speed only one overshoot in excess of one knot will be permitted.

3.4.3 Transient response - Transients due to switching within the

set, whether automatic or due to mode switching by the operator, shall be minimized by good design including adequate fading of signals. The set performance shall meet specification requirements after switching. The set design shall minimize transients in all system outputs and visual readouts and the design shall also make adequate allowance for reasonable transients in the inputs to the equipment. It shall not be necessary to manually synchronize the aircraft throttle(s) with the APC Set servo actuator(s) for engagement.

3.4.4 Performance in turns - In steady state coordinated turns the APC set shall adjust thrust to maintain a relatively constant airspeed in accordance with the inherent error signal generated in measured angle of attack in the turn.

3.4.5 Throttle control - The APC Set shall be adjusted as required by the particular aircraft engine installation. When engaged, the set shall smoothly move the throttle(s) to the position required to establish the airspeed that will result in the correct angle of attack, except that the throttle shall not at any time be retarded beyond a minimum allowable position consistent with an engine(s) rpm of approximately 75 percent; nor advanced beyond the military power setting.

3.4.6 Effect of flight path control - It shall be possible for the pilot or Automatic Flight Control System (AFCS) while on AN/SPN-10 automatic landing system to maneuver the airplane as required to maintain the proper flight path during final approach, with the APC Set engaged.

3.4.7 Throttle damping - The set shall be damped to prevent excessive throttle movement when flying through turbulence.

3.4.8 Engage and disengage transients - The set shall provide suitable output signal control to prevent excessive engage and disengage transients under all conditions under which the set could be automatically or manually engaged or disengaged.

3.4.9 Free air temperature range - The set shall be able to provide proper compensation for a free air temperature range of -53°C (-63°F) to 54°C (130°F). See paragraph 3.4.10.3.

3.4.10 Control functions of set - The APC Set shall be constructed so as to provide the functional inputs and outputs as shown in Figures 3 through 6 and as described in 3.4.10.1 through 3.4.10.5. These outputs will be used to provide signals to the items in the set and to the associated equipment.

3.4.10.1 Pilot's control switch - The APC Set shall provide outputs such that either one of the two following switching arrangements may be used on the control panel. The preferred switching arrangement will provide a three-position ENGAGE-STANDBY-OFF Switch. When the switch is in the OFF position all AC and DC power to the APC Set will be de-energized. When the switch is placed in the STANDBY position, the system shall be energized with AC power and is ready for engagement at the end of the warm-up period. This warm-up period shall not exceed sixty (60) seconds under any combination of service conditions. When the switch is in the ENGAGE position DC power to the system shall be energized. The system will then be engaged and operating. The ENGAGE switch will be solenoid held to the ENGAGE position and will revert

to the STANDBY position if the holding coil current is momentarily interrupted. This pilot's control function may also be fulfilled by use of two switches; an OFF-ON toggle switch for the system AC power, and a STANDBY-ENGAGE solenoid held switch for the system DC power.

3.4.10.2 Weight-on-wheels-switch - The APC Set shall provide outputs such that the following switching arrangement will operate properly. A switch which is normally closed and which will open when weight is applied to the main landing gear will be provided. This switch will be used to automatically switch the set from ENGAGE to STANDBY condition on touchdown.

3.4.10.3 Free air temperature switch - The APC computer shall provide outputs such that a three position (HOT-STANDBY-COLD) switch can be inserted to give free air temperature compensation in the computer. Recommendations relative to operating procedures for the free air temperature switch shall be provided by the APC manufacturer.

3.4.10.4 Elevator position transducer - When specified by the procuring activity, provisions for utilizing this input shall be provided within the logic circuits of the computer and the control functions of the set. Recommendations relative to transducer design and operating procedures shall be provided by the APC manufacturer. This signal shall be utilized to provide a lead term to the computer indicating that a change in thrust is required. The design shall be such as to minimize pilot control stick inputs to maintain flight path.

3.4.10.5 Angle of attack transmitter - The APC Set shall utilize a signal from an angle of attack transmitter as specified by MIL-T-19229A(WEP). Excitation for the angle of attack signal potentiometer shall be provided by the APC Set.

3.5 Detail requirements -

3.5.1 Computer, Throttle Control, CP-(*)/ASN-54(V) - The computer shall be made up of electronic and mechanical components suitably mounted in a protective case. The computer shall contain its own power supply. The outline dimensions of the computer case shall conform to Figure 7. The weight of the computer shall not exceed 5 pounds. By using angle of attack and normal acceleration inputs, the computer shall determine throttle position necessary to control angle of attack, and hence airspeed, and shall express the results of this determination as a direct current voltage. This voltage will then be used to control the throttle servo unit. In order to obtain set response consistent with the performance requirements of 3.4 for the designated class of aircraft, the computer must be constructed so as to be able to easily adapt the electronic circuitry. This must be accomplished through the use of one adapter module which will incorporate all necessary changes in computer circuitry, to calibrate the set to the designated aircraft. This plug-in adapter module must be an integral part of the computer. The computer adapter module shall include provisions for acceptance of an additional signal from the elevator position transducer.

3.5.2 Amplifiers, Electronic - The servo amplifiers shall be made up of electronic components suitably mounted in a protective case. The servo amplifiers shall contain a power supply and all equipment required for control of the servo unit and shall supply all power required by the servo unit. The procuring activity will indicate at the time of procurement which servo amplifier(s) will be used in the APC Set configuration(s). (See 6.5.)

3.5.2.1 Servo Amplifier (Single Engine), AM-4377/ASN-54(V) - The outline dimensions of the single engine servo amplifier case shall conform to Figure 8. The weight of the single engine servo amplifier shall not exceed 2 pounds. The single engine servo amplifier shall receive DC inputs of required throttle position from the computer and AC inputs of actual throttle position from the servo actuator. (See 3.5.3.) The single engine servo amplifier shall compare the required throttle position with the actual throttle position and command the throttle movement required to maintain the preset angle of attack. The single engine servo amplifier output shall be an analog AC signal and shall vary in accordance with changing thrust requirements. Under worst transient conditions maximum allowable current shall be 1.2-1.5 amps AC. Nominal current at output shall be 0.5-0.75 amps AC.

3.5.2.2 Servo Amplifier (Twin Engine), AM-4376/ASN-54(V) - The outline dimensions of the twin engine servo amplifier case shall conform to Figure 9. The weight of the twin engine servo amplifier shall not exceed 2 pounds. The twin engine servo amplifier shall be a dual channel amplifier and shall drive two independent electro-hydraulic servo units. The twin engine servo amplifier shall receive DC inputs of required throttle position from the computer and AC inputs of actual throttle positions from the servo units. Each channel of the twin engine servo amplifier shall compare the required throttle position with the actual throttle position and command the required throttle movement to maintain the preset angle of attack. The twin engine servo amplifier outputs shall be analog DC signals and shall vary in accordance with changing thrust requirements. Signals from the twin engine servo amplifier to the servo units shall cause the electrical servo motor armatures to deflect and move the electrical servo valves. With no input for computer or actuator the quiescent current shall be 70 milliamps. The maximum differential current shall be 150-160 milliamps and differential current output shall be linear from 100 to 140 milliamps.

3.5.3 Servo Actuator, Electro-Mechanical, Rotary, TG-155/ASN-54(V) - The servo actuator shall be made up of an AC servo motor, a linear transducer, an electro-magnetic clutch, a switch which is actuated when the servo is manually overpowered, adjustable clockwise and counterclockwise limit switches, circuitry for the foregoing components, and gearing. The servo actuator shall have minimum backlash and torsional resilience between the output shaft, linear transducer, and servo motor and may be connected to the airplane throttle system by means of a sheave and cable, a drive shaft or a crank arm and push rod as specified by the procuring activity. In an emergency it shall be possible to mechanically override the servo actuator such that a mechanical slippage within the unit will occur in the event that the electrical disconnect switch does not remove power from the electro-magnetic clutch. Shear pins shall not be used. The servo actuator shall be capable of moving the

throttle from military power setting to the minimum allowable power setting (see 3.4.5) for a cold day (see 3.4.10.3) by rotating through an angle of 60 degrees. The output shaft of the servo shall rotate at half speed of the follow-up linear transducer and shall produce a minimum output torque of 50 pound inches. The servo shall be capable of accelerating to an output shaft speed of 20 degrees per second within 0.1 second. The linear transducer shall be attached to the servo actuator output such that it will not become mechanically disengaged at any time other than for maintenance. The linear transducer shall be excited by the throttle control computer. Electrical limit switches shall be dual redundant and connected in series between the electrical disengaging switch and power ground and shall be actuated in the ranges of 31-35 degrees and 325-329 degrees for clockwise and counterclockwise rotations of the output shaft respectively. The limit switches shall have a minimum mechanical life of 100,000 cycles where opening and closing of contacts constitutes one cycle. The electrical disengaging switch shall be actuated when the servo is overpowered by the pilot with a force which produces a torque of 60-90 pound inches at the output shaft. This switch shall be connected to the engage switch for the APC Set and it, in turn, shall supply power to the electro-magnetic clutch in the servo actuator. Thus the clutch will drop out and remain disengaged until the engage switch is reset by the pilot. The mechanical override shall enable the pilot to manually control the throttle by applying a force which produces a torque of 100-170 pound-inches at the output shaft until such time as he could cut the APC Set engage switch. These upper limits are required as maximum under extreme operating conditions. When the servo actuator is disengaged, it shall be possible to rotate the output shaft with a torque equal to or less than 5.0 pound-inches. The outline dimensions and external wiring of the servo actuator shall conform to Figure 10. The weight of the servo actuator shall not exceed 4.0 pounds.

3.5.4 Accelerometer, Aircraft, MX-6320/ASN-54(V) -- At the normal approach angle-of-attack, the accelerometer shall provide an electrical output that shall vary linearly with the acceleration normal to the flight path and perpendicular to the pitch axis. The weight of the accelerometer shall not exceed 1.6 pounds. The outline dimensions of the accelerometer shall conform to Figure 11. The accelerometer shall consist of a mass supported in equilibrium by a spring against the attraction of gravity. The mass shall be restrained from rapid motion by a dashpot. Thus in the presence of an acceleration along the sensitive axis, the mass will be displaced to a new equilibrium position at which the spring force balances the net force due to gravity and acceleration. The dashpot shall damp the spring-mass combination to prevent oscillation and shall introduce a time constant or response delay of one second. A resistance element shall be used to provide an electrica output directly proportional to acceleration.

3.6 Design data - No design 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 6.7).

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 - The items covered by this specification shall be subjected to the following tests to determine compliance with all applicable requirements:

(a) Preproduction Tests
(b) Production Sample Tests
(c) Acceptance Tests
(d) Life Tests

4.2 Preproduction tests - Preproduction tests shall be made on equipments representative of the production equipments to be supplied under the contract. Preproduction tests shall consist of the following:

(1) Contractor Demonstration Tests
(2) Service Approval Tests

4.2.1 Preproduction test sample - Preproduction samples shall consist of three Approach Power Control Sets manufactured in accordance with this specification. The Approach Power Control Sets submitted for preproduction inspection shall have been previously subjected only to the individual inspections. Service approval samples shall be forwarded, at the contractor's expense, to the laboratory designated.

4.2.1.1 Preproduction test sample identification - The preproduction test samples shall be plainly identified by durable tags, securely attached, and marked with the following information:

Sample for Preproduction Inspection
CONTROL SET, APPROACH POWER AN/ASN-54(V)
Submitted by (Manufacturer's name, date)

4.2.1.2 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 MIL-T-5422 and interference tests in accordance with MIL-I-6181. Preproduction tests shall include as a minimum the tests specified under test methods (4.7).

4.2.1.3 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.

4.2.2 Contractor demonstration tests - Contractor demonstration 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.

4.2.2.1 Demonstration 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, 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 operation condition. Such data on parts may be included as part of the preliminary parts list.

4.2.3 Service approval tests - At the completion of the contractor demonstration tests and when requested by the procuring activity, the equipment shall be delivered at the contractor's expense to a specified government laboratory for additional testing. This additional testing may consist of duplicating tests previously conducted and such other tests as are deemed necessary to determine compliance with all applicable design and performance requirements. Service approval tests shall also include a Navy conducted flight program of a preproduction sample for each aircraft type to demonstrate satisfactory performance. This includes successful flight test aboard an aircraft carrier. Based on the results of flight tests, the manufacturer will be responsible for all engineering changes to the APC Set necessary for satisfactory performance of the installed APC system at no cost to the Government.

4.2.3.1 Accessory material - In addition to the complete equipment submitted for service approval tests the contractor shall also submit the accessory material and design and test data specified in MIL-E-5400. This information shall indicate the physical and electrical characteristics of the equipment and establish the equipment's compliance with applicable requirements.

4.2.4 Production equipments - Equipments supplied under the contract shall in all respects, including design, construction, workmanship, performance and quality, be identical 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 Production sample tests - When requested by the procuring activity, one equipment shall be selected from the first 10 production equipments submitted for acceptance and sent at the contractor's expense to a designated government laboratory for tests. This equipment shall be selected by the government inspector after the equipment has successfully passed all individual tests. The preproduction sample shall not be selected for this test.

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 qualification sample in design, construction, workmanship, performance and quality and that it meets all applicable requirements.

4.3.2 Production sample approval - Approval of the 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 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.

4.3.3 Reconditioning of production test sample - On completion of the production sample test the equipment shall be reworked by the contractor by replacing all worn 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:

(a) Individual Tests

(b) Sampling Tests

(c) Reliability Assurance Tests

(d) 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:

(a) Examination of Product

(b) Operational Test

(c) 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. These characteristics shall be chosen from the characteristics established in 4.7.3.

4.4.1.3 Manufacturing run-in test - Each set 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.

Temperature	Ambient room
Humidity	Ambient room
Vibration	Any selected frequency within the range of 20 to 30 cps (excluding resonant points) and a minimum amplitude of ±3 g's

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 that 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 once each hour for the equivalent of 10 full cycles of the servo actuator 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 that 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	1
Next 50	1
Next 75	1
Next 100	1
	1 for each additional 200 or fraction thereof

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

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

(b) Operational test at certain environmental conditions. The conditions may vary for each equipment tested and should be based on results of the Qualification, Production and Special tests.

(c) Manufacturing run-in test specified in 4.4.1.3, except that the test duration shall be 120 hours with no restriction on the number of failures and the 10 minute vibration test shall run only at the beginning and end of that 120 hour test. However, each failure shall be analyzed as to cause and remedial action necessary to reduce the possibility of its recurrence in future equipment shall be taken.

4.4.3 Reliability assurance tests - Reliability assurance tests shall be conducted as required by MIL-R-23094 and MIL-R-22256. Equipments selected for reliability assurance tests shall first have passed the individual tests.

4.4.3.1 Reliability procedure - Reliability Procedure I from MIL-R-23094 shall be used. A lot shall be one month's production quantity.

4.4.3.2 Test level - Test Level IV from Table I of MIL-R-23094 shall be used. During each cycle the equipment shall be operated from time "A" through time "B" of the chart accompanying the table.

4.4.3.3 Accept-reject criteria - Figure 15 of MIL-R-23094 shall be used to determine the accept-reject criteria for the Reliability Qualification Test Plan. Figure 16 of MIL-R-23094 shall be used to determine the accept-reject criteria for the Reliability Sampling Test Plan.

4.4.3.4 Length of heat portion of cycle - After stabilization at the high temperature limit required by the test level, the equipment shall be operated 1 hour during each cycle.

4.4.3.5 Performance characteristics to be measured - The performance characteristics to be measured in the reliability tests shall be taken from those determined in 4.7.3. These characteristics shall be submitted for approval by the procuring activity.

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

(a) Whenever performance characteristics fall below the Acceptance requirement (see 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.

4.4.3.7 Preventive maintenance - During the period of the tests no preventive measures may be performed on the equipment.

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:

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

(b) 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:

(a) Determine the cause of failure.

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

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

(d) 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 and 4.5.2. The life test sample shall be selected by the government inspector in accordance with the following; except that when a production sample equipment is requested and submitted to the procuring activity for test then the first equipment specified below need not be selected or subjected to this test. (Equipments which have successfully passed the sampling tests or special tests may be selected for life tests.)

Quantity of Equipments Offered for Acceptance	Quantity to be Selected For Life Test
First 25	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 Set configuration for life test - The set shall be connected together as it would be in an airplane and a 50 inch pound friction load attached to the servo output shaft. A signal simulating an error in angle of attack shall be fed into the system. When the servo reaches a limit switch, the simulated angle of attack signal shall be changed to make the servo run in the opposite direction. The set shall be cycled at the rate of one complete cycle in 30 seconds for a period of 1000 hours.

4.5.3 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. Once during each 6 hours of operation, the equipment shall be turned on and off several times and put through its various phases of operation.

4.5.4 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, and will constitute the Failure Criteria for the Life Test.

4.5.5 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:

(a) Part type number

(b) The circuit reference symbol number

(c) The part function

(d) Name of the manufacturer

(e) Nature of the failure

(f) The number of hours which the part operated prior to failure.

4.5.5.1 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.

4.5.6 Reconditioning of life test samples - An equipment which has been subjected to the life test shall be reconditioned as follows:

(a) 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.

(b) 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, 90 days after contract award. 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. MIL-T-18303 shall be used as a guide for preparation of test procedures. When test procedures are available from previous contracts such procedures may be used when approved by the procuring activity. As a minimum test procedures must include individual tests (4.4.1) and test methods (4.7).

4.7 Test methods -

4.7.1 Electrical tests -

4.7.1.1 Dielectric strength tests - Each circuit of electrical and electronic components shall be subjected to a test equivalent to the application of a root mean square test voltage of three times (3X) the maximum (but not less than 500 V) surge D.C. or maximum surge peak A.C. voltage to which the circuit will be subjected under service conditions. The test voltage shall be of commercial frequency and shall be applied between ungrounded terminals and ground, and between terminals insulated from each other. The test duration shall be for a period of one minute for all items of the set except the accelerometer. The test duration for the accelerometer shall be 10 seconds. Leakage shall not exceed 0.5 ma. The test shall be accomplished at normal ground barometric pressure. No breakdown of insulation or air gap shall occur. Circuits containing capacitors or other similar electronic parts which may be subject to damage by application of above voltages shall be subjected to twice the surge peak (but no less than 100V) operating voltage for the specified period. If the maximum peak operating voltage is greater than 700 V, the rms value of the test voltage shall be 1050 V greater than 1.5 times the maximum peak operating voltage. Electrical and electronic components shall also be tested for resistance to air gap breakdown at the maximum altitude specified in the altitude test.

4.7.1.1.1 Computer - The dielectric strength tests shall be performed on connector 1J1 between the following points:

Pin A to Chassis ground 500 VAC rms

Pin C to Chassis ground 500 VAC rms

Pin a to Chassis ground 500 VAC rms

Pin b to Chassis ground 500 VAC rms

Pin c to Chassis ground 500 VAC rms

4.7.1.1.2 Servo amplifier, single engine - The dielectric strength tests shall be performed on connector 3J1 between the following points:

Pin C to Pin T 500 VAC rms

4.7.1.1.3 Servo amplifier, twin engine - The dielectric strength tests shall be performed on connector 3J1 between the following points:

Pin S to Pin d 500 VAC rms

4.7.1.1.4 Servo actuator - The dielectric strength tests shall be performed between the following points:

Pin b to Pins A and B connected together, 500 VAC rms

Pin b to Pins K and M connected together, 500 VAC rms

Pin b to Pins T and U connected together, 500 VAC rms

Pin b to Pins W and X connected together, 500 VAC rms

Pin b to Pins Z and a connected together, 500 VAC rms

Pin b to Pins C,E and G connected together, 500 VAC rms

4.7.1.1.5 Accelerometer - The dielectric strength test shall be performed between the shell of connector 2J1 and pins B, D, and F connected together.

4.7.1.2 Continuity tests - The applicable assemblies of the set shall be subjected to continuity tests. These tests are to be performed with all external connections removed. The resistance of the circuits shall be as specified below. (Resistance readings shall be ±10 percent.)

4.7.1.2.1 Computer - Continuity tests shall be performed with the adapter module installed and the reference angle of attack adjustment set for the particular aircraft reference value. Continuity between the shell of connector 1J1 and pins H, V, d, h, and j of connector 1J1 shall be zero ohms. Tests between pins of connector 1J1 shall be in accordance with Table I.

TABLE I

Pins	A-4E	F-4B	RA-5C	A-4C	A-6A
P-R	17	17	17	17	17
L-H	690	690	690	690	690
M-H	690	690	690	690	690
S-H	690	690	690	690	690
A-C	27	27	27	27	27
X-Z	580	580	580	580	580
E-F	580	580	580	580	580
f-Y	530K	345K	*	*	*
c-a	0	0	0	0	0
c-b	∞	∞	∞	∞	∞
G-d	90K	51K	*	*	*
N-d	*	*	*	*	*
J-H	∞	6.8K	*	∞	∞
J-g	15.9K	5.2K	*	*	*

(*) Indicates that values will be provided when known.

4.7.1.2.2 Single engine amplifier - Continuity between the shell of connector 3J1 and pins H, V, and U of connector 3J1 shall be zero ohms. Tests between pins of connector 3J1 shall be performed as specified below.

Pins	Resistance (ohms)
A to C	480
A to B	480
A to D	0
B to C	0
B to D	480
C to D	480
E to F	85,000
J to H	580,000
L to M	3,100

4.7.1.2.3 Twin engine amplifier - Continuity between the shell of connector 3J1 and pins E, N, and d of connector 3J1 shall be zero ohms. Tests

between pins of connector 3J1 shall be performed as specified below.

Pins	Resistance (ohms)
A to S	100
F to G	31,000
L to M	31,000
J to R	Infinite
X to Z	Infinite
a to c	Infinite

4.7.1.2.4 Servo actuator - Continuity between the shell of the servo actuator connector and pin b of the servo actuator connector shall be zero ohms. With the output shaft of the servo actuator in the reference position (0 degrees) and with no load or override forces applied, tests between pins of the servo actuator connector shall be performed as specified below.

Pins	Resistance (ohms)
A to B	130
C to D	42
K to L	85
M to N	85
S to T	0
S to U	Infinite
T to U	Infinite
V to W	0
V to X	Infinite
W to X	Infinite
Y to Z	0
Y to a	Infinite
Z to a	Infinite
E to H (F and G jumpered)	2

With overpower forces (60-90 pound inches torque) applied to the output shaft of the servo actuator in both clockwise and counterclockwise directions, tests between pins of the servo actuator connector shall be performed. For these tests the servo actuator clutch shall be energized as shown in Figure 15. Tests shall be performed as specified below.

Pins	Resistance (ohms)
S to T	Infinite
S to U	Infinite
T to U	0

With the servo actuator connected as specified in 4.7.4.4.5, tests between pins of the servo actuator connector shall be performed as specified below.

(a) Clockwise Limit Setting

Pins	Resistance (ohms)
V to W	Infinite
V to X	Infinite
W to X	0

(b) Counterclockwise Limit Setting

Pins	Resistance (ohms)
Y to Z	Infinite
Y to a	Infinite
Z to a	0

4.7.1.2.5 Accelerometer -

Connector	Pin to Connector Pin		Resistance (ohms)
2J1	B	F	2250-2750
2J1	H	shell	0

4.7.2 Environmental tests - The applicable assemblies of the set shall be subjected to environmental tests in accordance with the tests and procedures in MIL-T-5422 as specified herein. (See 3.3.9.1.)

4.7.2.1 Temperature - altitude test - The equipment shall operate under the applicable temperature-altitude combinations for Class 2 equipment during intermittent operations. The operational tests in 4.7.3 shall be conducted as required to assure satisfactory equipment operation.

4.7.2.2 Vibration tests - The equipment shall withstand, without damage, vibration within the frequency range and amplitude of Curve I as shown in Figure 2. The operational tests in 4.7.3 shall be conducted as required to assure satisfactory equipment operation.

4.7.2.3 Shock test - The equipment shall not suffer damage or subsequently fail to provide required performance due to applied shocks. The operational tests in 4.7.3 shall be conducted as required to assure satisfactory equipment operation.

4.7.2.4 Humidity test - The equipment shall withstand the effects of humidities up to 100 percent, including conditions wherein condensation takes place in and on the equipment. The equipment shall withstand the above conditions during exposure in a nonoperating condition. At the completion of this test the equipment shall be subjected to the operational tests in 4.7.3 as required to assure satisfactory operation.

4.7.2.5 Salt spray test - The equipment shall withstand, in a nonoperating condition, exposure to salt-sea atmospheres. At the completion of this test the equipment shall be subjected to the operational tests in 4.7.3 as required to assure satisfactory operation.

4.7.2.6 Explosion test - The equipment shall not cause ignition of an ambient-explosive-gaseous mixture with air when operating in such an atmosphere. Procedure I shall be used.

4.7.2.7 Sand and dust test - The equipment shall withstand, in a nonoperating condition, exposure to sand and dust particles as encountered in desert areas. At the completion of this test, the operational tests in 4.7.3 shall be conducted as required to assure satisfactory equipment operation.

4.7.2.8 Fungus test - The equipment shall withstand in a nonoperating condition, exposure to fungus growth as encountered in tropical climates. At the completion of this test the operational tests in 4.7.3 shall be conducted as required to assure satisfactory equipment operation.

4.7.3 Functional characteristics - To assure satisfactory equipment operation, under standard operating conditions, the following operating characteristics for each item in the set shall be determined using the test methods and test equipment specified in 4.7.4 and 4.7.5.

4.7.3.1 Computer -

(a) Reference angle of attack range and adjustment

(b) Regulated AC and DC voltages

(c) Gain measurement

4.7.3.2 Twin engine servo amplifier -

(a) Quiescent current

(b) Off-set voltage

(c) Gain measurement

(d) DC input null

(e) Differential output current

4.7.3.3 Single engine servo amplifier -

(a) Off-set voltage

(b) Transient response

(c) Gain measurement

(d) Null adjust with two inputs

(e) Maximum output voltage

4.7.3.4 Servo actuator -

(a) Static torque

(b) Electrical disconnect and mechanical override torque

(c) Output speed under load

(d) Limit switches

4.7.3.5 Accelerometer -

(a) Calibration

(b) Damping ratio

4.7.4 Functional tests -

4.7.4.1 Computer - The computer shall be connected to the test circuit shown in Figure 12 or its equivalent for the following tests.

4.7.4.1.1 Reference angle of attack range and adjustment - Set the angle of attack adjustment potentiometer on the front of the computer to its maximum CW position, and engage the computer. With R2 set at the value specified in step 8 of Table II, the computer output should go to its maximum positive output as specified in Table II. Set the angle of attack adjustment potentiometer to its maximum CCW position. With R2 set at the value specified in step 10 of Table II, the computer output should go to its maximum negative output as specified in Table II. Set R2 to the value specified in step 11 of Table II, and adjust the angle of attack adjustment potentiometer for constant computer output. The output may be considered constant when it is changing at a rate of less than 0.1 volts per minute; however, it is possible to make this adjustment more exact, and a good adjustment here will aid further testing.

4.7.4.1.2 Regulated AC and DC voltages - Measure the regulated AC and DC voltages as specified in steps 12 - 15 of Table II. The voltages shall be within the limits specified in the table.

4.7.4.1.3 Gain checks - Operate the test set switches and potentiometers in accordance with the sequence details in steps 16 - 48 of Table II, and observe the computer output voltage (V_{j-g}) to see that it is within the limits given. (Note: The limits given are based on a computer regulated DC voltage of exactly 30 volts. Thus 5 volts in the table actually means 5/30 times the regulated DC voltage. In most cases, the difference between the absolute value of the output voltage, and the value of the output voltage as a percentage of the regulated voltage is small, however, it should be considered in cases of borderline readings. In such cases, the voltage limits calculated by taking the appropriate percentage of the supply voltage shall be considered the proper limits. Also, the limits given for output voltages measured immediately after changes in the position of R1 and R3 are based on the output voltages measured immediately before the change in potentiometer

positions being exactly at the nominal value. Since the important considerat in these cases is the changes in output due to the change in input, further calculations should be made to determine whether or not the equipment operati is satisfactory when either the starting voltage or the final voltage is near a borderline. In such cases, the change in the output voltage shall be the criterion for determining proper operation.)

TABLE II

Step No.	Switch or Potentiometer Switch	Readings				
		F-4B	RA-5C	A-4E	A-4C	A-6A
(1)	Set R1 to	500 HPD*	500	500	**	**
(2)	Set R3 to	500	500	500		
(3)	Set S2 to	Standard	Standard	Standard		
(4)	Set S3 to	Dual	Dual	Omit		
(5)	Set S4 to	P	P	P		
(6)	Set S5 to	Accelerometer	Accelerometer	Accelerometer		
(7)	Set S6 to	Normal	Normal	Normal		
(8)	Set R2 to	575	560	575		
(9)	Set S1 to	Engage	Engage	Engage		
	With A/A Adj. at Max. CW position, Output should go to	+6.0V to +6.8V	+5.4V to +6.4V	+9.2V to +9.7V		
(10)	Set R2 to	425	360	425		
	With A/A Adj. at Max. CCW position, Output should go to	-9.6V to -10.4 V	-9.6V to -10.4V	-9.1V to -9.6V		
(11)	Set R2 to	500	500	500		
	And set A/A Adj. for constant output					
(12)	Set S1 to	Standby	Standby	Standby		

* All resistance readings are in Helipot Position Divisions (HPD).
** Values will be supplied when known.

TABLE II (Continued)

Step No.	Switch or Potentiometer Switch	Readings					
		F-4B	RA-5C	A-4E	A-4C	A-6A	
(13)	Set R2 to	Omit	422	469.5			
(14)	Set S6 to	F-4B	RA-5C	A-4E			
	V_{EF} should be	29 V to 31 V for all types					
	V_{P-H} should be	18.9/30 to 19.5/30 times V_{EF} for all types					A
(15)	Set S4 to R						
	V_{R-H} should be	18.9/30 to 19.5/30 times V_{EF} for all types					A
(16)	Set S6 to	Normal	Normal	Normal			
(17)	Set R2 to	Omit	460	500			
(18)	Set S2 to	Cold	Cold	Cold			
	Output should go to	+2.0 V to +2.8 V	+0.4 V to +1.2 V	-0.4 V to +0.4 V			
(19)	Set S2 to	Hot	Hot	Hot			
	Output should go to	-1.8 V to -2.6 V	-5.1 V to -5.9 V	-5.1 V to -5.9 V			
(20)	Set S2 to	Standard	Standard	Standard			
	Output should go to	-0.4 V to +0.4 V	-1.5 V to -2.3 V	-1.3 V to -2.1 V			
(21)	Set S1 to	Engage	Engage	Engage			
(22)	Set R1 to	605	612.6	657			
	Output should go to	-5.1 V to -6.2 V	-6.9 V to -8.1 V	-7.2 V to -8.4 V			A
(23)	Set R1 to	500	500	500			
(24)	Set S1 to	Standby	Standby	Standby			
	Output should go to	-0.4 V to +0.4 V	-1.5 V to -2.3 V	-1.3 V to -2.1 V			
(25)	Set S1 to	Engage	Engage	Engage			

TABLE II (Continued)

Step No.	Switch or Potentiometer Switch	Readings				
		F-4B	RA-5C	A-4E	A-4C	A-6A
(26)	Set R3 to	700	650	800		
	Output should go to	-6.7 V to -8.1 V	-8.0 V to -9.4 V	-7.4 V to -8.6 V		
(27)	Set S1 to	Standby	Omit	Omit		
(28)	Set R3 to	300	Omit	Omit		
	Output should go to	-0.4 V to +0.4 V	Omit	Omit		
(29)	Set S1 to	Engage	Omit	Omit		
(30)	Set R3 to	100	Omit	Omit		
	Output should go to	+5.7 V to +6.9 V	Omit	Omit		
(31)	Set R3 to	500	500	500		
(32)	Set R2 to	395	347.4	437.2		
(33)	Set S2 to	Cold	Cold	Cold		
	Output should go to	+7.1 V to +7.9 V	+6.1 V to +6.9 V	+9.7 V to +10.2 V		
(34)	Set S2 to	Hot	Hot	Hot		
	Output should go to	+5.3 V to +6.1 V	+4.4 V to +5.2 V	+8.5 V to +9.0 V		
(35)	Set S2 to	Standard	Standard	Standard		
	Output should go to	+6.0 V to +6.8 V	+5.4 V to +6.4 V	+9.2 V to +9.7 V		
(36)	Set R2 to	605	572.6	562.8		
	Output should change to at a rate of 10 volts in	-9.6 V to -10.4 V 14.1 to 17.3 sec.	-9.6 V to -10.4 V 10.4 to 12.7 sec.	-9.1 V to -9.6 V 13.2 to 16.2 sec.		

TABLE II (Continued)

Step No.	Switch or Potentiometer Switch	Readings				
		F-4B	RA-5C	A-4E	A-4C	A-6A
(37)	Set R2 to	395	347.4	437.2		
	Output should change to at a rate of 10 volts in	+6.0 V to +6.8 V 14.1 to 17.3 sec.	+5.4 V to +6.4 V 10.4 to 12.7 sec.	+9.2 V to +9.7 V 13.3 to 16.2 sec.		
(38)	Set S1 to	Omit	Standby	Omit		
(39)	Set R2 to	Omit	460	Omit		
(40)	Set S5 to	Omit	Elevator	Omit		
	Output should go to	Omit	-1.7 V to -2.1 V	Omit		
(41)	Set S1 to	Omit	Engage	Omit		
(42)	Set R3 to	Omit	568.5	Omit		
	Output should go to	Omit	-7.6 V to -8.9 V	Omit		
(43)	Set R3 to	Omit	500	Omit		
(44)	Set S1 to	Standby	Standby	Omit		
(45)	Set S3 to	Single	Single	Omit		
(46)	Set R2 to	500	409.4	Omit		
	Output should go to	-0.4 V to +0.4 V	-1.7 V to -2.1 V	Omit		
(47)	Set S1 to	Engage	Engage	Omit		
(48)	Set R1 to	552.5	556.3	Omit		
	Output should go to	-5.1 V to -6.2 V	-6.9 V to -8.1 V	Omit		

4.7.4.2 Twin engine servo amplifier - The twin engine servo amplifier shall be connected to the test circuit shown in Figure 13 or its equivalent. The test circuit shall generate the necessary input voltages to the twin engine servo amplifier in order to simulate actual system operating conditions.

The twin engine servo amplifier is a dual channel amplifier and each of the following tests must be repeated for each channel.

4.7.4.2.1 Quiescent current - Balance the amplifier by turning the computer input potentiometer P_1 until the differential output voltage is 0.00 volts ±50 MV DC. Record the quiescent current as indicated by meters M_1 and M_2. Note that the LVDT input switch S_3 and the computer AC input switch S_2 are in the OFF position during this measurement. The quiescent current shall be between 60 and 80 MA.

4.7.4.2.2 Off-set voltage - With the computer AC input switch S_2 and the LVDT input switch S_3 in the OFF position balance the amplifier with the computer DC potentiometer P_1 until the output voltage is 0.00 volts ±50 MV DC. Record the computer input helipot setting which shall be between 485 and 515.

4.7.4.2.3 Gain - Balance the amplifier with the computer DC input potentiometer P_1. Place the computer AC input switch S_2 in the OFF position; apply a 1 volt ±50 MV peak-to-peak sinusoidal input voltage at the LVDT input by turning the LVDT select switch S_4 to the 1 volt peak-to-peak position and LVDT input switch to the ON position. The differential output current as indicated by the difference between M_1 and M_2 shall be between 85 and 120 MA. The gain is the differential output current divided by the LVDT peak-to-peak input voltage.

4.7.4.2.4 DC input null - With the computer AC input switch S_2 in the OFF position apply 3.92 ±.039 volts AC rms at the LVDT input in the following manner:

(a) Place the LVDT phase select switch S_5 in the 0 degrees position.

(b) Turn the LVDT select switch S_4 to the 3.92 volt position.

(c) Place the LVDT input switch S_3 in the ON position.

(d) Place the computer DC input switch S_1 in the ON position and balance the amplifier for 0.00 ±50 MV differential output voltage. The computer DC input potentiometer P_1 setting shall be between 950 and 980.

4.7.4.2.5 Differential output current - This test determines the maximum differential output current that the amplifier is capable of supplying.

(a) Place the computer AC input switch S_2 in the OFF position.

(b) Place the computer DC input switch S_1 in the OFF position.

(c) Turn the LVDT select switch S_4 in the 3.92 volt position.

(d) Place the LVDT phase select switch S_5 in the 0 degrees position.

(e) Place the LVDT input switch S_3 in the ON position.

The minimum differential output current which is the difference between M_1 and M_2 shall be 100 milliamperes.

4.7.4.3 Single engine servo amplifier - The single engine servo amplifier shall be connected to the test circuit shown in Figure 14 or its equivalent. The test circuit shall generate the necessary input voltages to the single engine servo amplifier in order to simulate actual system operating conditions.

4.7.4.3.1 Offset voltage - The offset voltage is the DC voltage at the computer input necessary to give minimum amplifier output voltage. The following test method is used:

(a) Place the fixed phase input select switch S_4 in the OFF position.

(b) Place the actuator input switch S_2 in the OFF position.

(c) Place computer input potentiometer P_1 at a dial reading of 500.

(d) Return the error select switch S_3 to the OFF position.

(e) Apply both the 115 volts 400 cycles and 28 VDC power to the test set.

(f) With an average sensitive AC rms meter connected across the amplifier output (across pins L and N), place the computer input switch S_1 in the ON position and adjust the computer input potentiometer P_1 for minimum amplifier output voltage (5 +1 -5 volts AC rms). The AC null shall occur when the computer input potentiometer setting is between 495 and 505.

4.7.4.3.2 Transient response - The amplifier when operated as part of a closed loop servo shall provide appropriate compensation for proper damping of the servo.

4.7.4.3.2.1 Response to step input under no-load conditions -

(a) Remove the 50 inch-pound friction load.

(b) Place the AC feedback switch S_5 in the actuator select position.

(c) Place the fixed phase switch S_4 in the ON position.

(d) Return the actuator input switch S_2 to the ON position.

(e) Place the error select switch S_3 in the OFF position.

(f) Position the computer input potentiometer P_1 to a dial reading of 525.

(g) Connect a Brush Instruments Mark 200 recorder demodulator signal input High to pin E and the signal input Low to pin F of the single engine servo amplifier. The demodulator reference input is available at test points 51 and 25 of the test set.

(h) Apply both the 115 volts 400 cycles and 28 VDC power to the test set.

(i) Apply a step input to the servo amplifier by placing the computer input switch S_1 in the ON position.

(j) The leading edge of the response curve shall rise to 63 percent of its final value within 0.2 second.

4.7.4.3.2.2 Response to a step input under rated load conditions -

(a) Apply a 50 inch-pound friction load to the actuator output shaft.

(b) Repeat steps 4.7.4.3.2.1 (b) through 4.7.4.3.2.1 (i).

(c) The leading edge of the response curve shall rise to 63 percent of its final value within 0.25 second.

4.7.4.3.3 Gain of amplifier with reference to the computer input -

(a) Return the fixed phase input switch S_4 to the OFF position.

(b) Place the error signal select switch S_3 in the OFF position.

(c) Place the actuator input switch S_2 in the OFF position.

(d) Connect an average sensitive AC rms voltmeter across pins L and N of the amplifier output.

(e) Apply both 400 cycles and 28 VDC power to the test set.

(f) Place the computer input switch S_1 in the ON position and record the amplifier AC output voltage with the computer input dial at: (1) 495, (2) 505.

(g) The gain which is AC rms output voltage for 5 helipot divisions of computer input signal is found by adding

the two AC voltages measured in 1.3 (f) (1) (2) and divide by two. The gain shall be a minimum of 10 volts AC rms for a computer input of 5 helipot divisions.

4.7.4.3.4 Amplifier null with two inputs -

(a) Return the fixed phase input switch S_4 to the OFF position.

(b) Place the error signal select switch S_3 in the OFF position.

(c) Place the AC feedback switch S_5 in the AC internal position.

(d) Return the actuator input switch S_2 to the ON position.

(e) Place the computer input switch S_1 in the ON position.

(f) Return the computer input helipot P_1 to a dial reading of 1000.

(g) Apply both 115 volts 400 cycles and 28 VDC to the test set.

(h) Position the AC internal helipot P_2 for minimum AC output voltage. The null voltage should be 5 + 1 -5 volts rms and the AC internal helipot P_2 dial reading shall be between 925 and 975.

4.7.4.3.5 Maximum output voltage -

(a) Place the actuator input switch S_2 in the OFF position.

(b) Position the computer input helipot P_1 to a dial reading of 750.

(c) Return the fixed phase input switch S_4 to the OFF position.

(d) Place the computer input switch S_1 in the ON position.

The output voltage as indicated on an average sensitive AC rms voltmeter shall be a minimum of 34 VAC.

4.7.4.4 Servo actuator -

4.7.4.4.1 Static torque - With all electrical power disconnected and no load on the output shaft, the torque required to turn the output shaft clockwise and counterclockwise shall be less than 5 pound-inches.

4.7.4.4.2 Electrical disconnect torque - With the servo actuator connected to the circuits shown in Figures 15, 16, and 17, the torque required to electrically disconnect the servo actuator shall be between 60 and 90 pound-inches. For this test, the servo motor control phase voltage shall be 18 volts AC.

4.7.4.4.3 Mechanical override torque - With the servo actuator connected as in 4.7.4.4.2, the torque required to mechanically override the servo actuator shall be between 100 and 200 pound-inches. For this test, the electrical disconnect bypass switch shall be closed.

4.7.4.4.4 Output speed under load - With the servo actuator connected to the circuits shown in Figures 15, 16, 17, and 18, the servo actuator shall drive a 50 pound-inch torque friction load at a speed of 30 degrees per second or greater.

4.7.4.4.5 Limit switch settings - With the servo actuator connected as shown in Figures 15 and 19, the clockwise and counterclockwise limit switch shall operate when the output shaft is rotated to dial readings of 31-35 degrees and 325-329 degrees respectively.

4.7.4.5 Accelerometer -

4.7.4.5.1 Calibration test - The accelerometer shall be calibrated using either the beam-balance method as shown in Figure 20 or the rate table method as shown in Figure 21. Electrical measurements shall be made using the circuit of Figure 22.

4.7.4.5.1.1 Beam balance method - With the front cone of the accelerometer removed, the accelerometer shall be mounted on the beam balance and test at values of 1.0g, 0.8g, 1.2g and 1.4g. At each step, the test weight shall be placed at the proper position on the balance beam. The potentiometer shall then be adjusted until VI indicates zero volts DC. Light tapping or vibration shall be applied to the accelerometer before each reading.

4.7.4.5.1.2 Rate table method - The accelerometer shall be mounted on the rate table and the speed of rotation adjusted to each value shown in Table III. At each step, the potentiometer dial shall be adjusted until VI indicates zero volts DC.

TABLE III

Rate Table Speed Degrees per Second (±1%)	g Value	T10 Dial
0	0.8	---
206	1.0	480-520
291	1.2	---
356	1.4	---

The tolerances for other values of "g" are based on the test potentiometer reading obtained at one "g".

4.7.4.5.2 Damping ratio test - The accelerometer shall be mounted on the accelerometer dynamic tester as shown in Figure 23, or equivalent mechanical oscillator. The frequency shall be set to 5 ±0.05 cycles per second and the total displacement to .100 ±.005 inches. The accelerometer shall be connected to the circuit shown in Figure 24. The test shall be performed in the following steps: (A Dumont 304A or approved equivalent oscilliscope shall be used).

(a) With the switch set for natural undamped frequency, run the mechanical oscillator at the frequency and total displacement specified.

(b) Adjust the oscilloscope horizontal gain to give approximately 3 inches total horizontal deflection.

(c) Adjust the oscilloscope vertical gain to give approximately 3 inches total vertical deflection.

(d) Turn the switch to the damping ratio position.

(e) An increase in the vertical height of the oscilloscope pattern shall indicate that the requirement for a damping ratio greater than 4 is being met.

4.7.5 Miscellaneous tests - The applicable components of the set shall be tested to determine compliance with all test requirements in this specification and in all other detail specifications, that are not covered in 4.7.4.

4.7.6 Test equipment - In addition to the test equipment required in 4.7.4, the following instruments and equipment, or their equivalents, shall be used.

4.7.6.1 Electronic control amplifiers -

(a) Digital voltmeter - The digital voltmeter shall have an absolute accuracy of 10 millivolts when measuring either 10 volts DC or 10 volts AC with a resolution in both cases of 1 millivolt. The digital voltmeter shall be utilized to calibrate the electronic control amplifier test sets.

(b) DC voltmeter, pointer type - The DC voltmeter shall be used in testing the twin engine electronic control amplifier and shall have an input impedance greater than 1 megohm and a minimum accuracy of 3 percent of full scale. Full scale capability of 300 millivolts, 1 volt, 3 volts, 10 volts, and 30 volts is required.

(c) AC rms voltmeter, pointer type - The AC voltmeter shall be used in testing the single engine electronic control amplifier and shall be of the average sensitive variety having an input impedence minimum of 5000 ohms per volt and an accuracy of 3 percent of full scale. Scales of 3, 12, 30, and 120 volts rms are required.

(d) DC voltmeter, 10-0-10 volts, 20,000 ohms per volt, ±1 percent accuracy - The DC voltmeter shall be used in testing the throttle control computer. A scale of 1-0-1 volts or less is required for making the angle of attack adjustment.

(e) Voltmeter, AC, 0-30 volts, 5,000 ohms per volt, half wave copper oxide rectifier type, ±1 percent accuracy - The AC voltmeter shall be used in testing the throttle control computer. (Note: If an AC meter other than th specified type is used, the reading at the test voltage should be correlated with a meter of the specified type. This is necessary because the waveform being measured is not a pure sine wave, and the voltage value specified is as measured with a 5,000 ohms per volt, half wave copper oxide rectifier meter.)

(f) Voltmeter 0-50 volts DC - This DC voltmeter shall be used in testing the throttle control computer.

(g) The following equipment shall be used in testing the electromechanical servo actuator:

(1) Motor locking pin

(2) Torque wrench, 0-5 pound-inches

(3) Torque wrench, 0-200 pound-inches

(4) Torque wrench adapter, 1/4 inch square to female spline

(5) Torque wrench adapter, 3/8 inch square to female spline

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 MIL-E-17555.

6. NOTES

6.1 Intended use - The sets covered by this specification are intended for use in aircraft to control angle of attack, and hence air speed, in the landing mode.

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 acceptable standard 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 MIL-E-5400, it is desired their use 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.

6.4 Non-repairable subassembly configuration - 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 than that of a similar repairable one. The non-repairable subassembly shall evidence a Mean-time-to-failure greater than 5000 hours.

6.5 Set configuration - The procuring activity shall indicate at the time of procurement, which items in the set as listed in 1.2 and shown in Figures 7 through 11, and which items of associated equipment as listed in 1.3, will make up the configuration of the APC Set.

6.6 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 subsidiar 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.

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

(a) Title, number, and date of specification.

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

(c) Amplifier; Single engine, Twin engine.

(d) Elevator position input signal requirement.

(e) Data requirements. (See 3.6)

(f) Delivery requirements.

6.8 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 3.3.4.2. The complete type number shall be used on nameplates, shipping records and instruction books, as applicable.

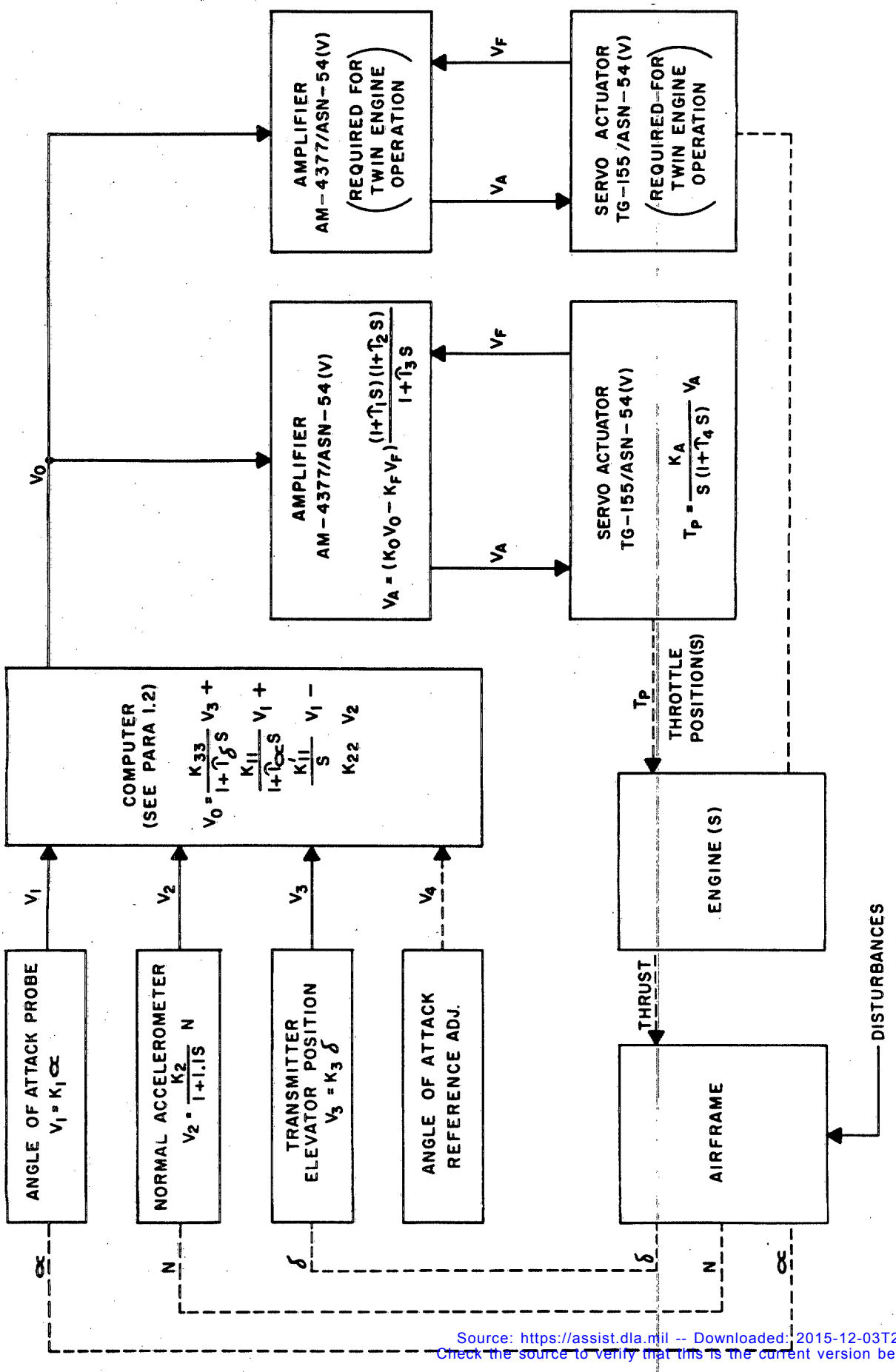


Figure 1. AN/ASN-54(V) APC Set - Functional Diagram
Typical Configuration(s) (A-4E, A-4C, A-6A)

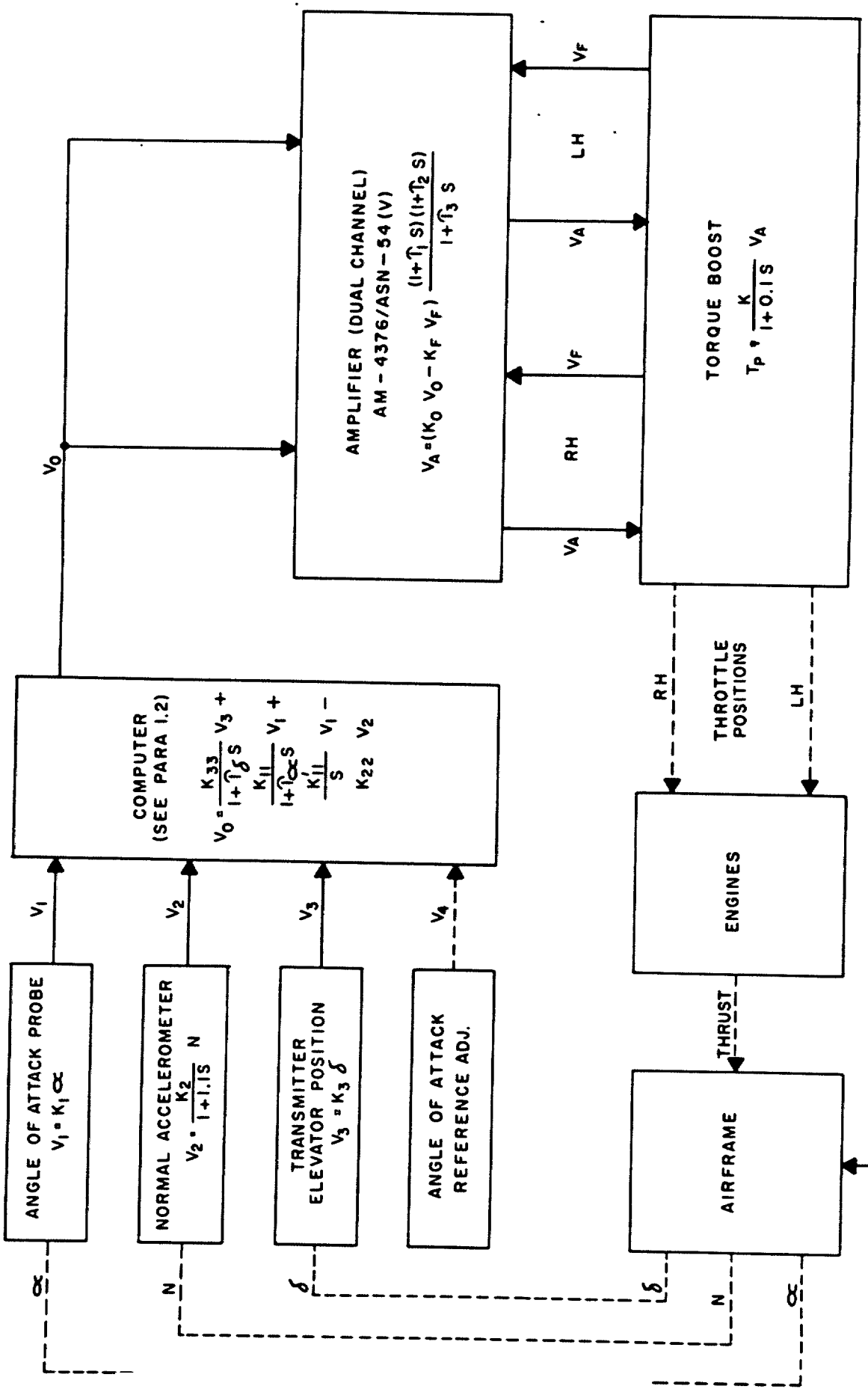
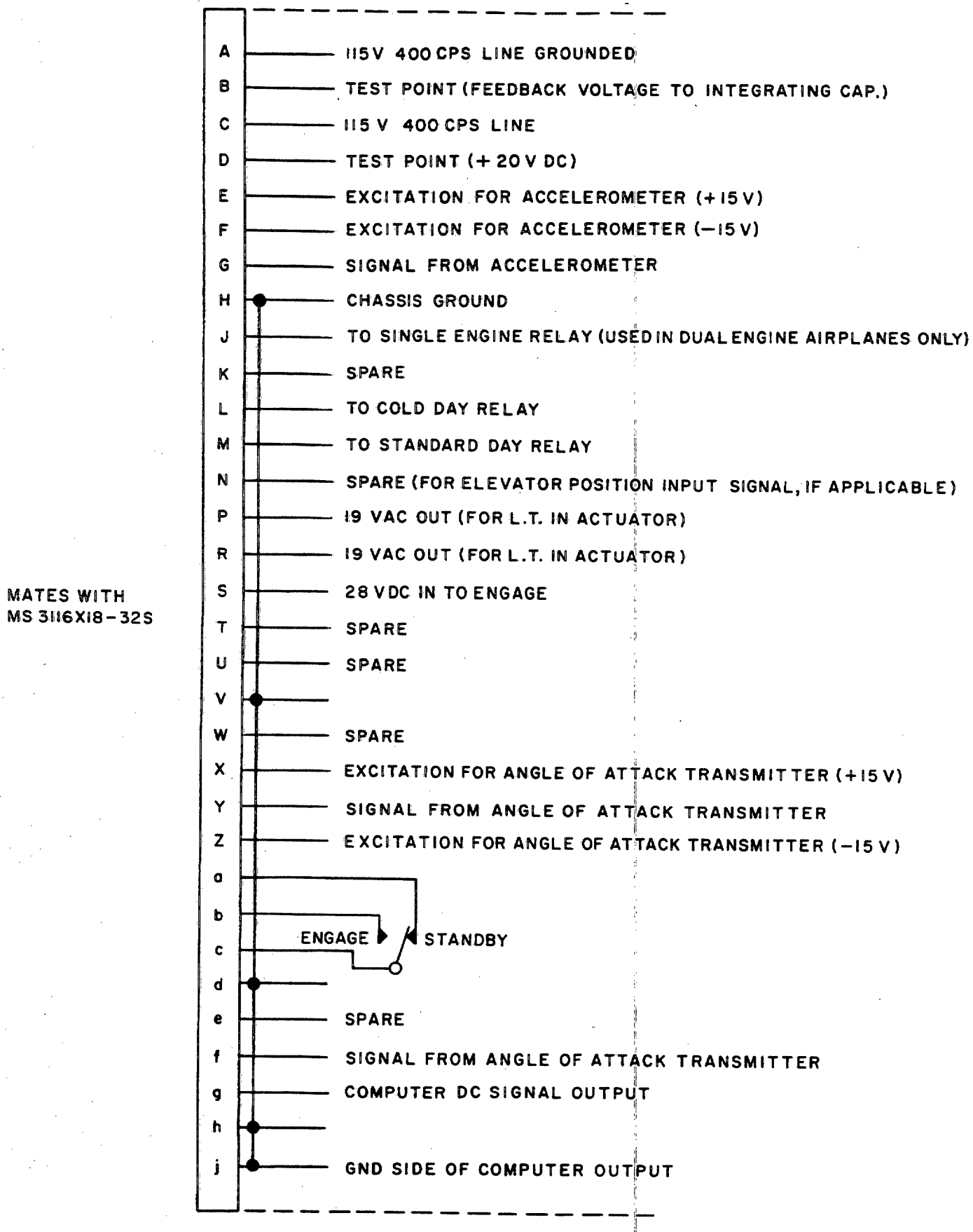


Figure 2. AN/ASN-54(V) APC Set - Functional Diagram Twin Engine Configuration (F-4B, RA-5C)



MATES WITH
MS 3116X18-32S

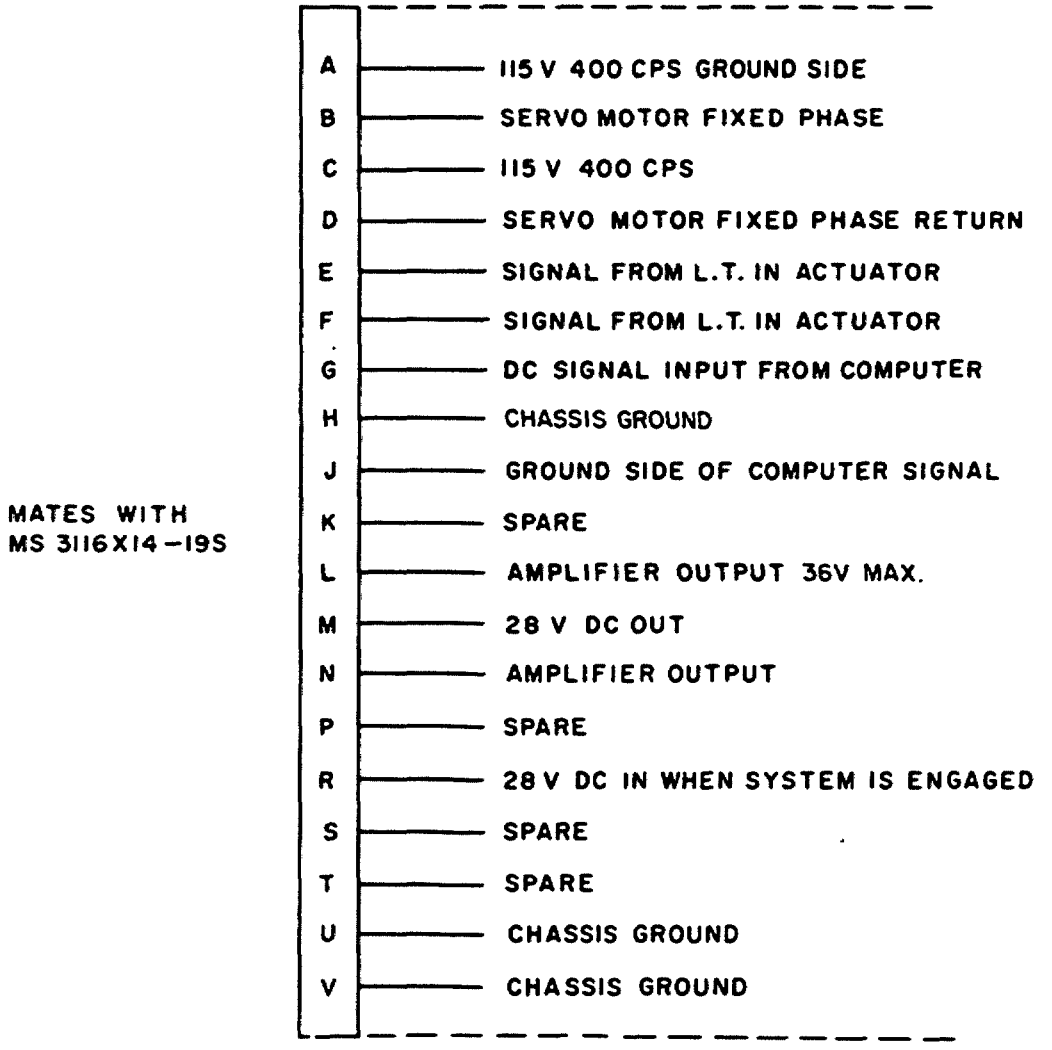
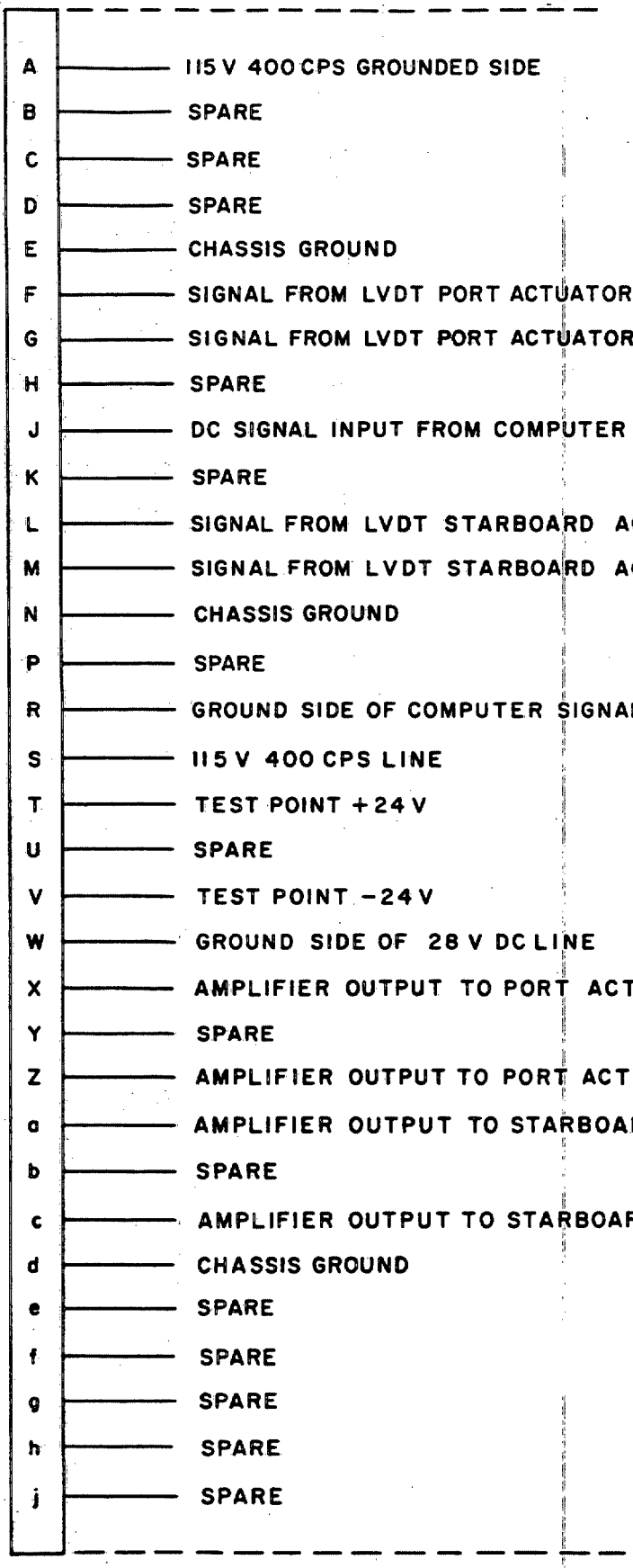


Figure 4. Pin Wiring for Single Engine Amplifier



MATES WITH
MS 3116P18-32SW

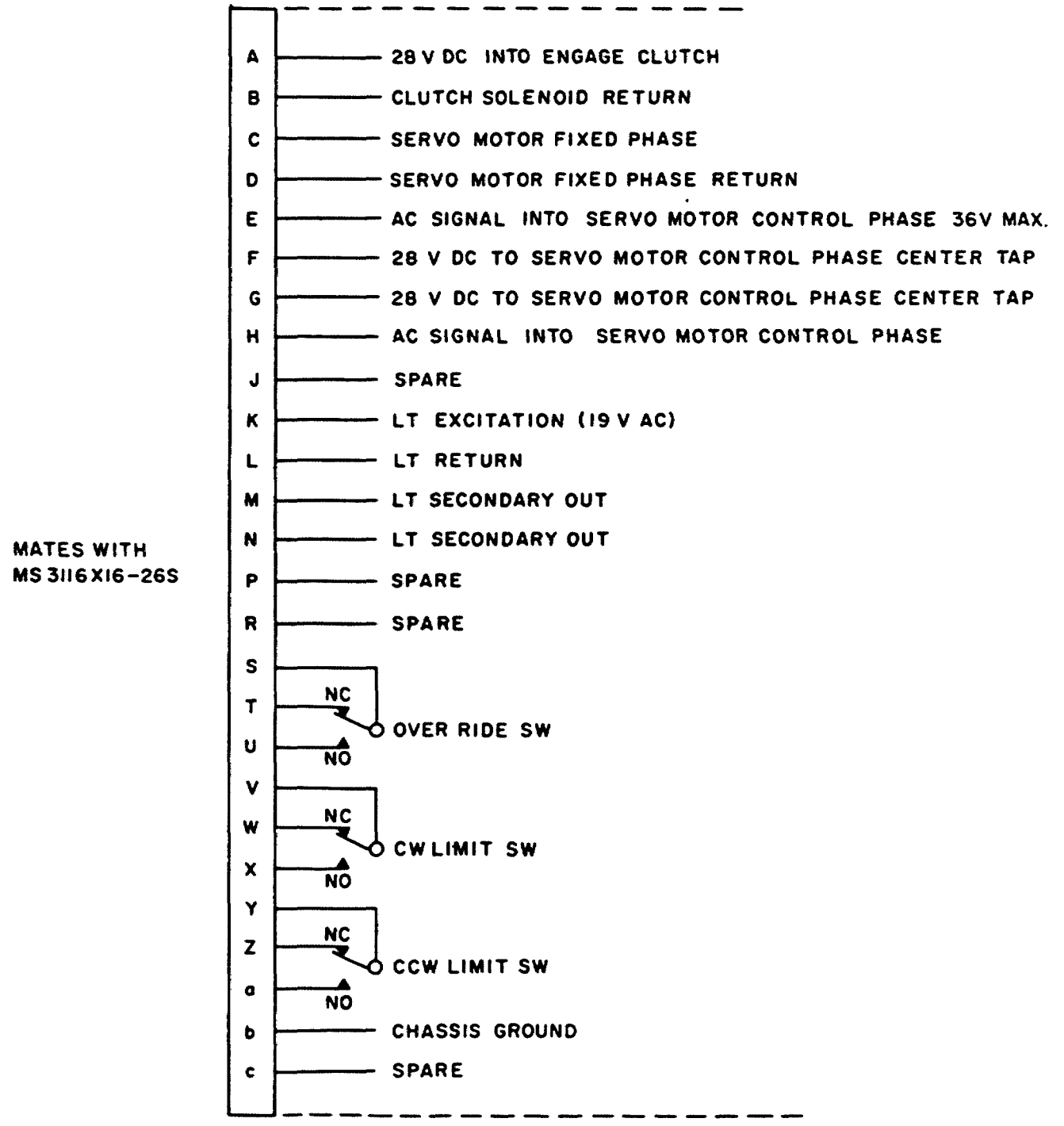
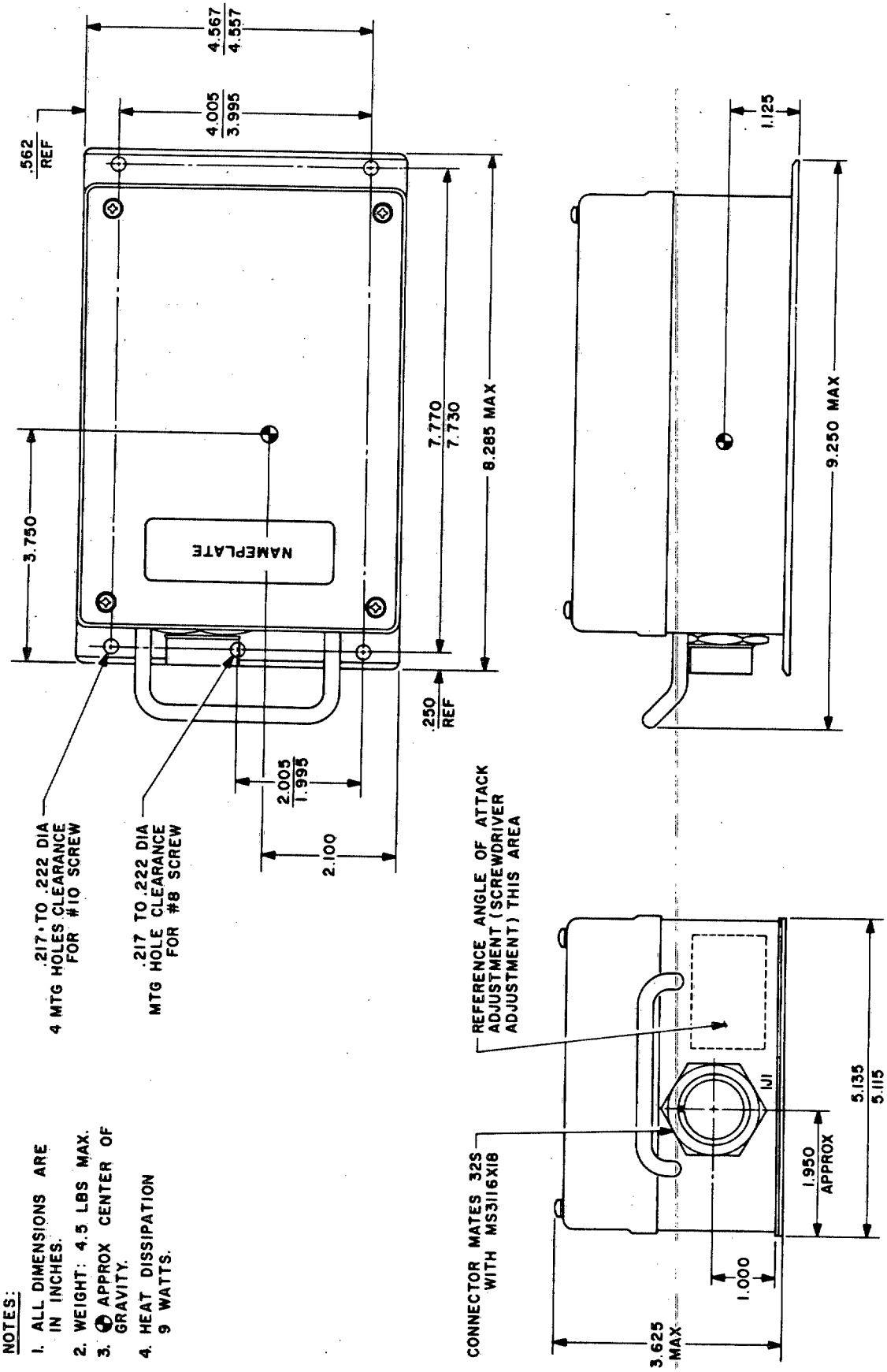


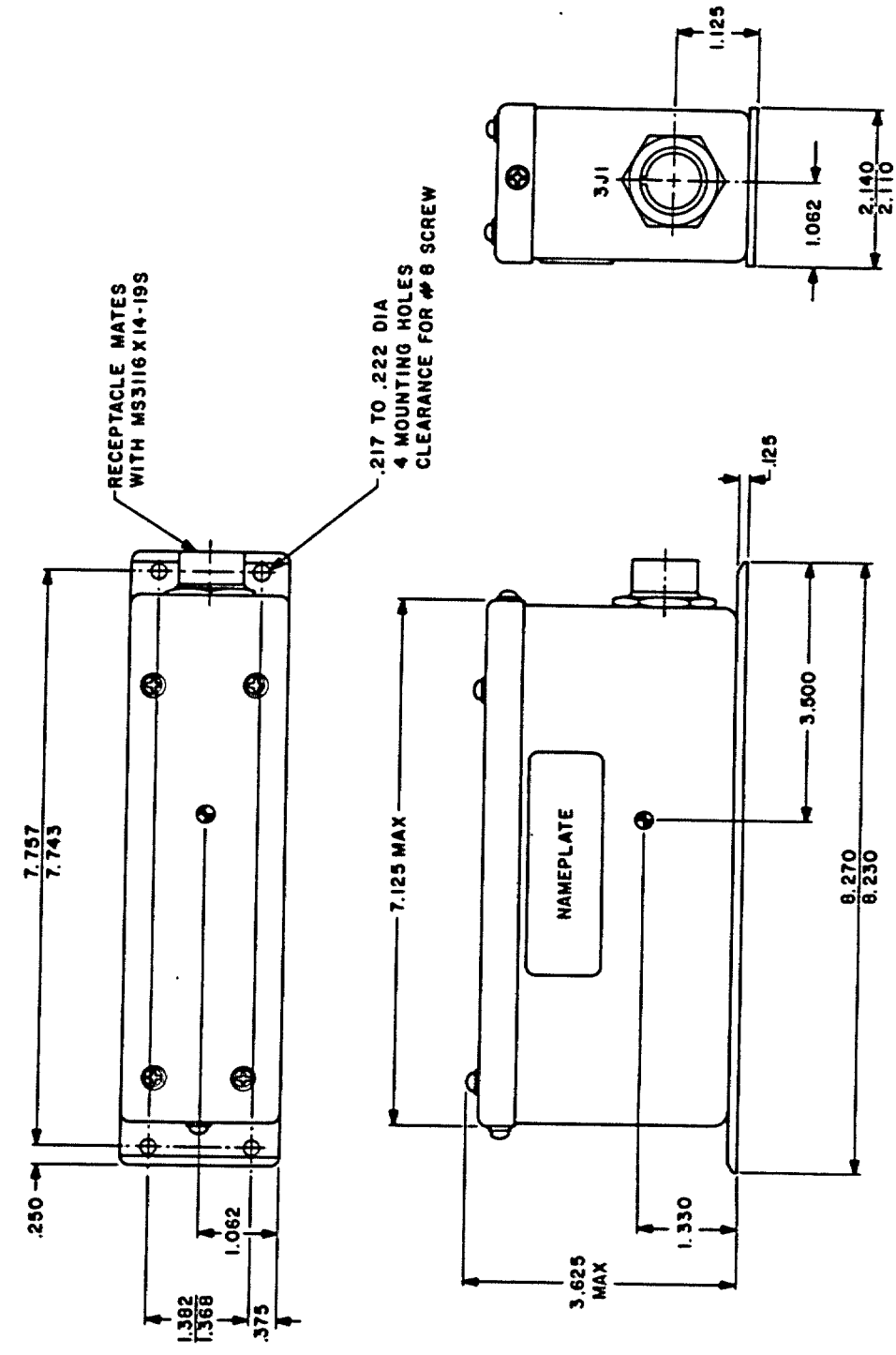
Figure 6. Pin Wiring for Actuator



NOTES:

1. ALL DIMENSIONS ARE IN INCHES.
2. WEIGHT: 4.5 LBS MAX.
3. ⊕ APPROX CENTER OF GRAVITY.
4. HEAT DISSIPATION 9 WATTS.

Figure 7. Throttle Control Computer



NOTES:
1. ALL DIMENSIONS ARE IN INCHES.
2. WEIGHT: 2.5 LBS MAX.
3. ⊕ APPROX CENTER OF GRAVITY.
4. HEAT DISSIPATION - VARIABLE 10.5 WATTS MAX.

Figure 8. Single Engine Electronic Control Amplifier (Installation and Outline)

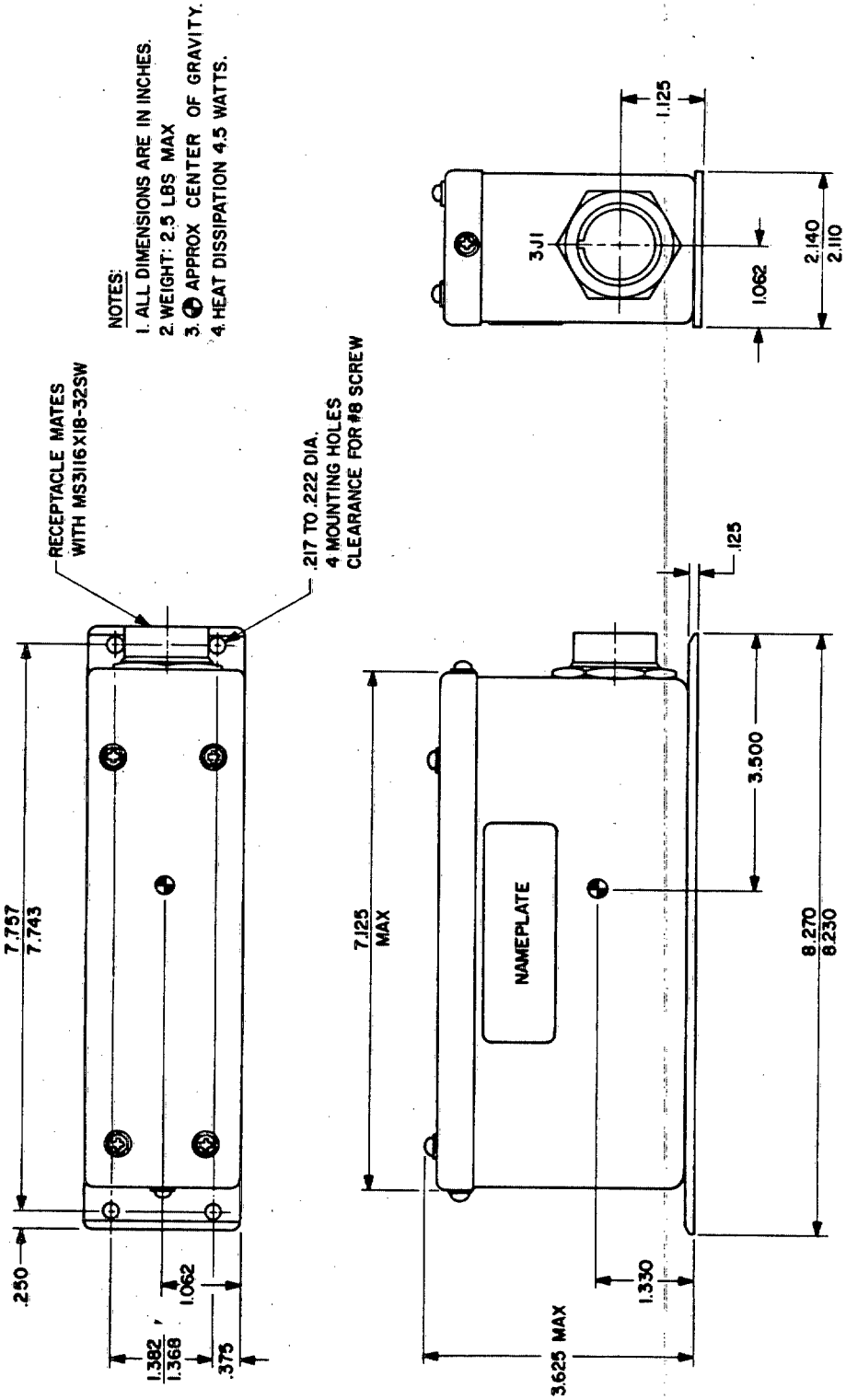
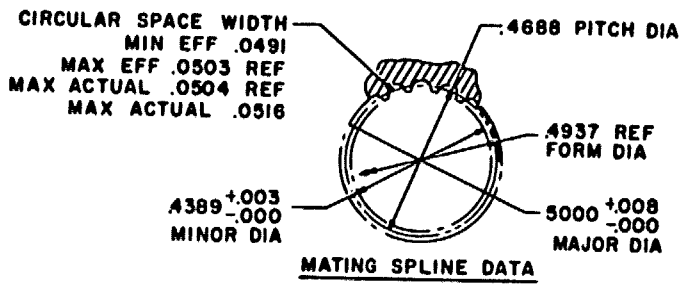


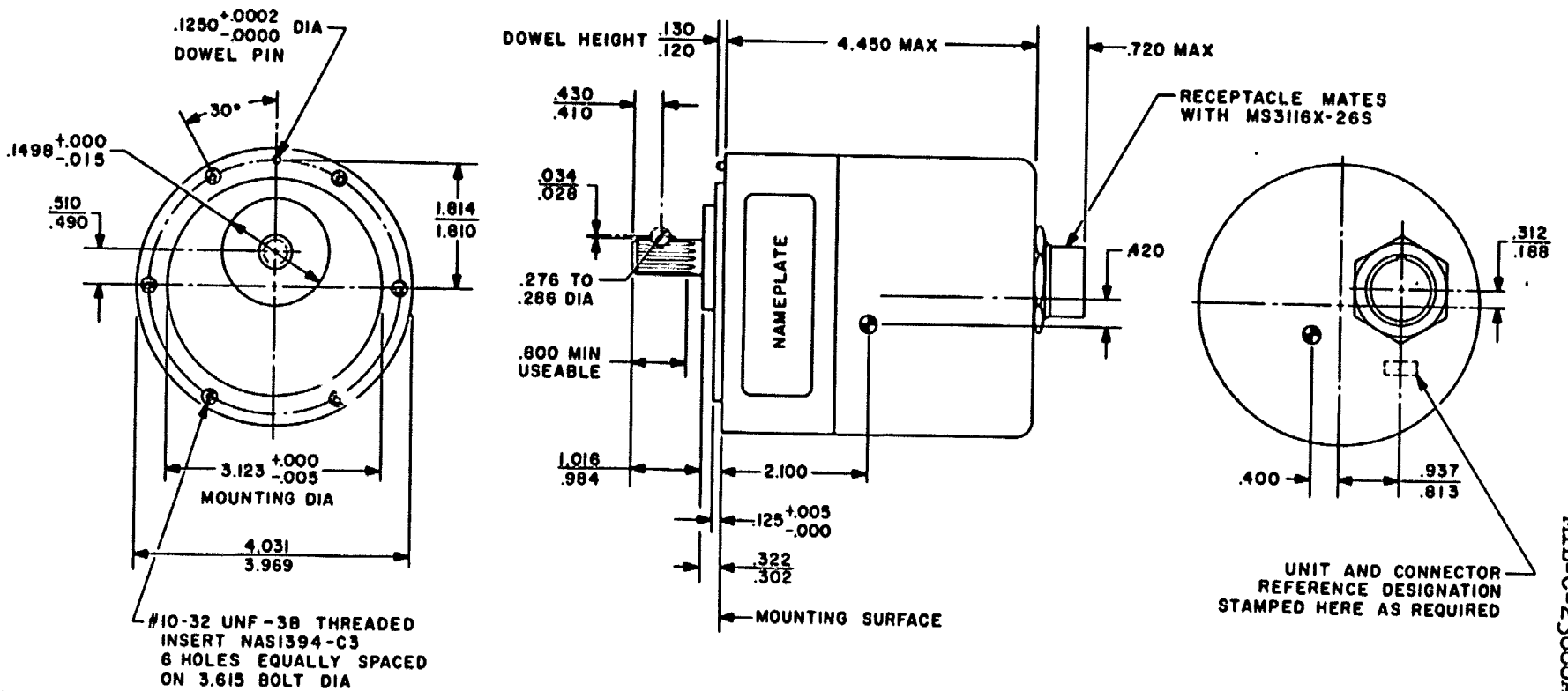
Figure 9. Twin Engine Electronic Control Amplifier (Installation and Outline)

NOTES:

1. ALL DIMENSIONS ARE IN INCHES.
2. WEIGHT 4.25 LBS MAX.
3. ⊕ APPROX CENTER OF GRAVITY.
4. HEAT DISSIPATION-33 WATTS, MAX.

INTERNAL INVOLUTE SPLINE DATA PER SPEC ASA B5.15-1960, FLAT ROOT CLASS 2, SLIDE FIT	
NUMBER OF TEETH	15
PITCH	32/64
PRESSURE ANGLE	30°



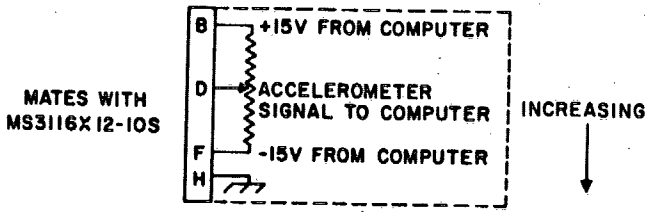


MIL-C-23866A(WP)

Figure 10. Rotary Electro-Mechanical Actuator (Installation and Outline)

NOTES:

1. ALL DIMENSIONS ARE IN INCHES.
2. WEIGHT: 1.55 LBS MAX.
3. ⊕ APPROX CENTER OF GRAVITY.
4. HEAT DISSIPATION: 1/2 WATT MAX.
5. SENSITIVE AXIS TO BE 90°±2° TO THE FLIGHT PATH FOR OPTIMUM APPROACH ANGLE OF ATTACK, AND PERPENDICULAR TO THE PITCH AXIS OF THE AIRPLANE. SENSITIVE AXIS IS PARALLEL WITHIN 1/4 DEGREE TO A LINE DRAWN THROUGH THE CENTER OF 2 MOUNTING HOLES MARKED "a" AND IN THE PLANE OF THE MOUNTING PADS.



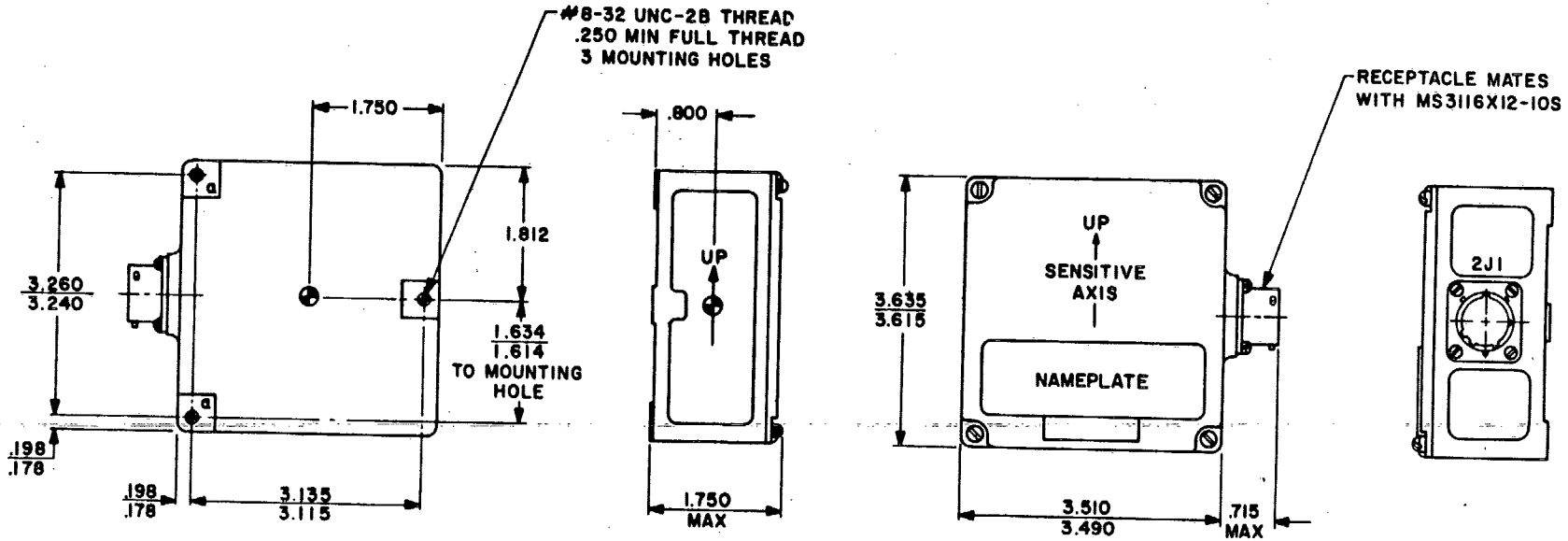


Figure 11. Accelerometer (Installation and Outline)

The digital copy of MIL-C-23866A, dated 15 September 1965 does not include the foldout of figure 12 on page 51 on the original document. Figure 12 must be ordered separately, please fax this page to 215-697-1462 and include your complete mailing address below.

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The digital copy of MIL-C-23866A, dated 15 September 1965 does not include the foldout of figure 13 on page 52 on the original document. Figure 13 must be ordered separately, please fax this page to 215-697-1462 and include your complete mailing address below.

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The digital copy of MIL-C-23866A, dated 15 September 1965 does not include the foldout of figure 14 on page 53 on the original document. Figure 14 must be ordered separately, please fax this page to 215-697-1462 and include your complete mailing address below.

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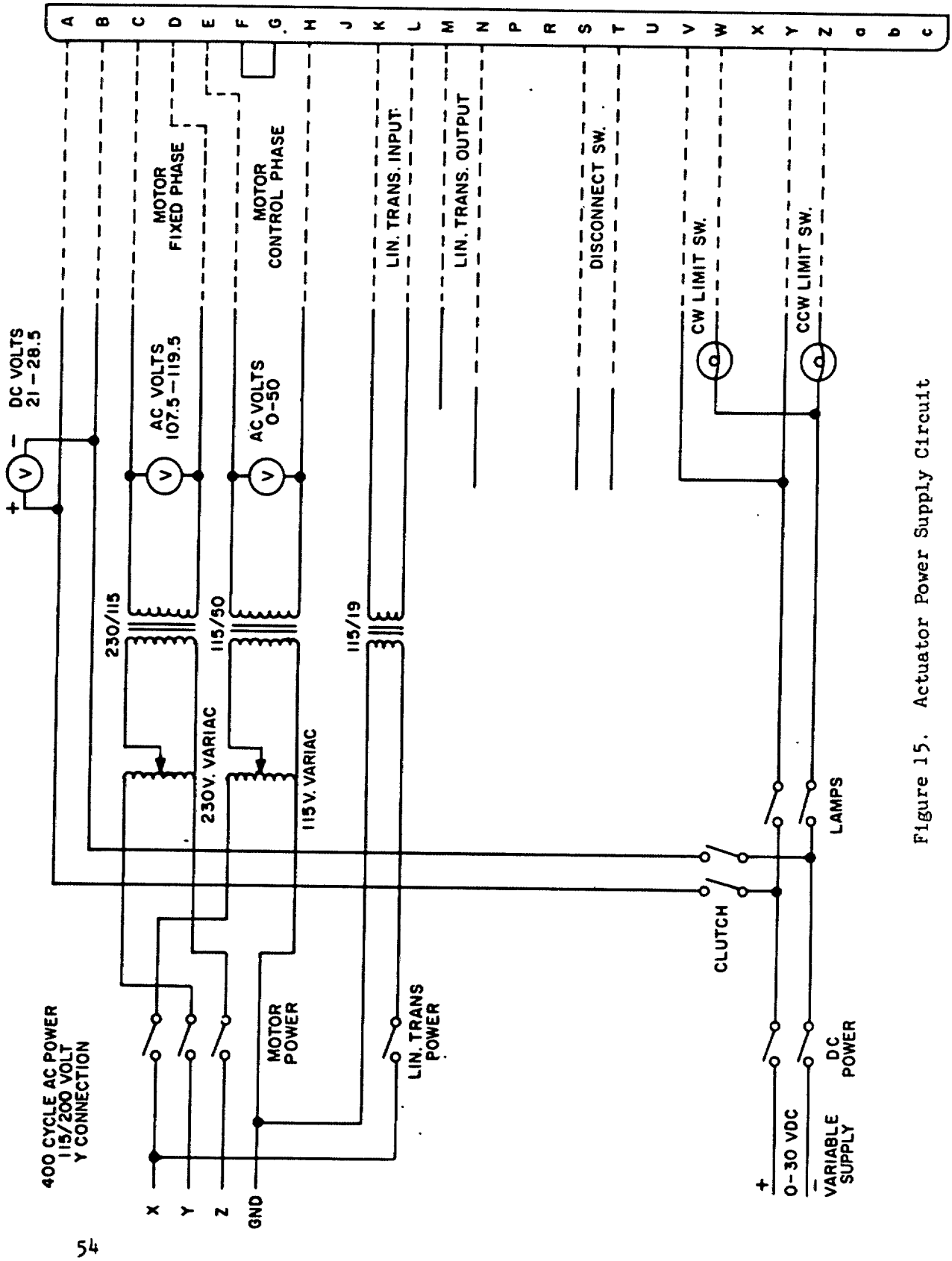


Figure 15. Actuator Power Supply Circuit

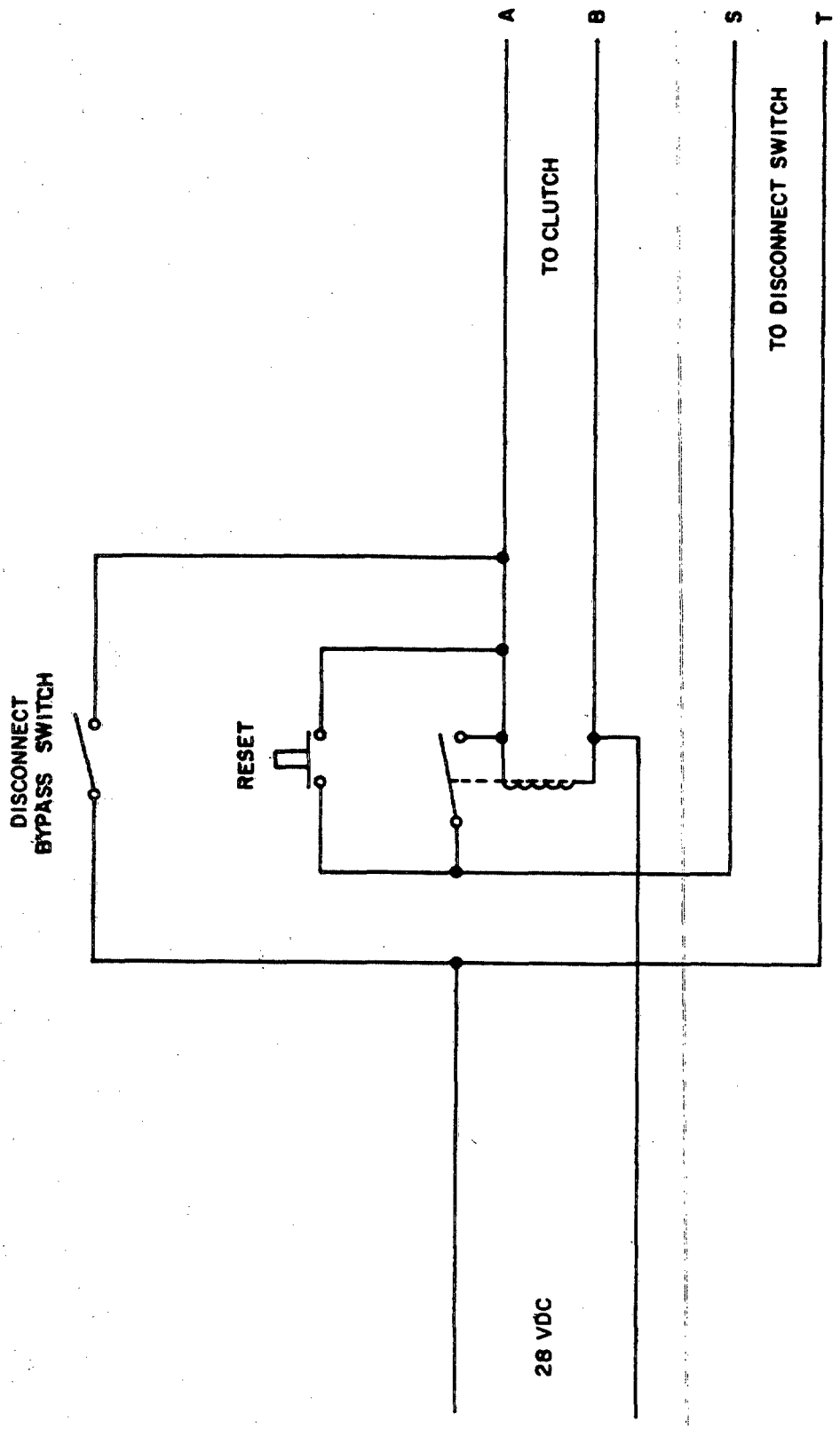


Figure 16. Drop-Out Relay Circuit

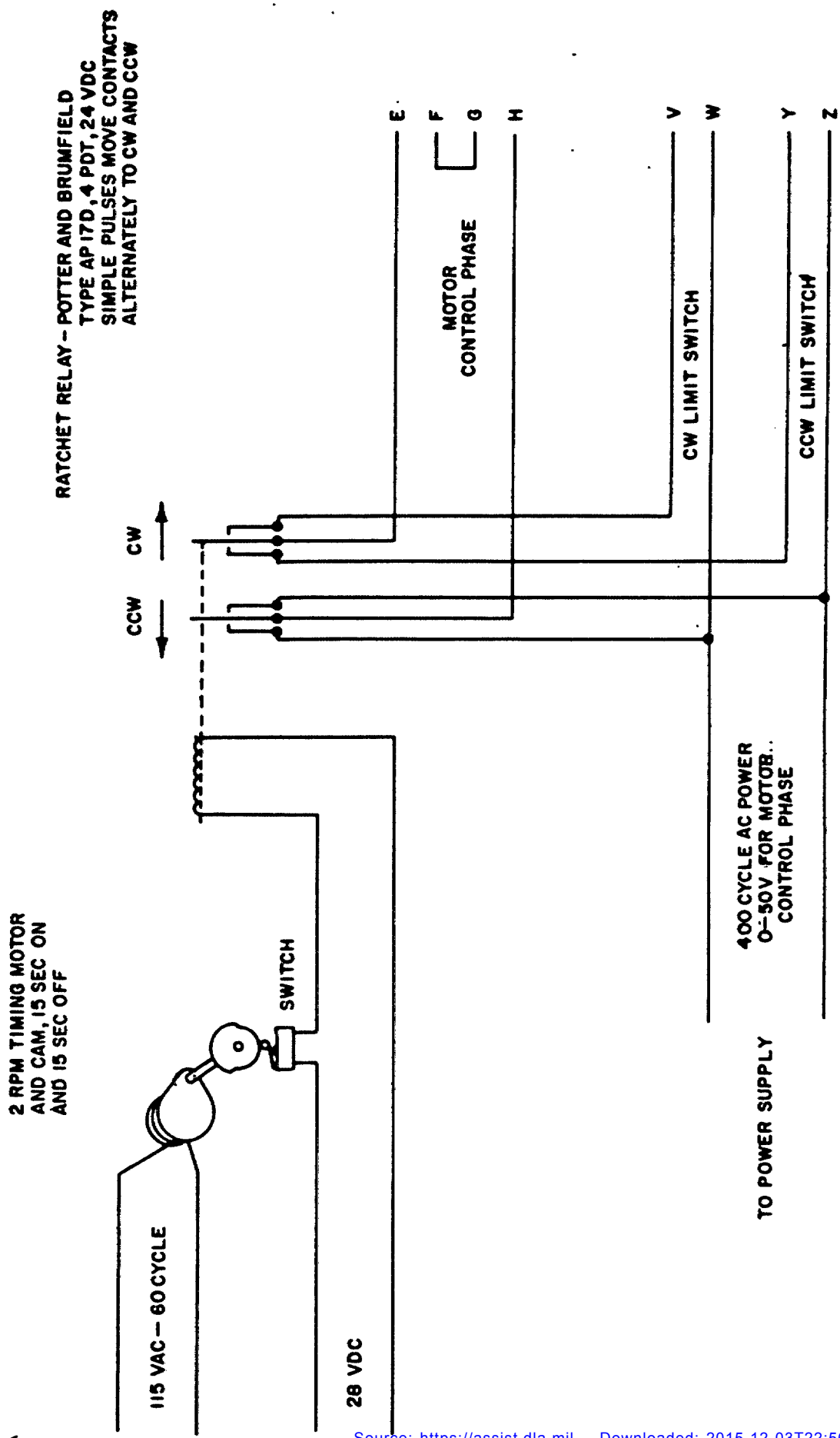


Figure 17. Actuator Cycling Device

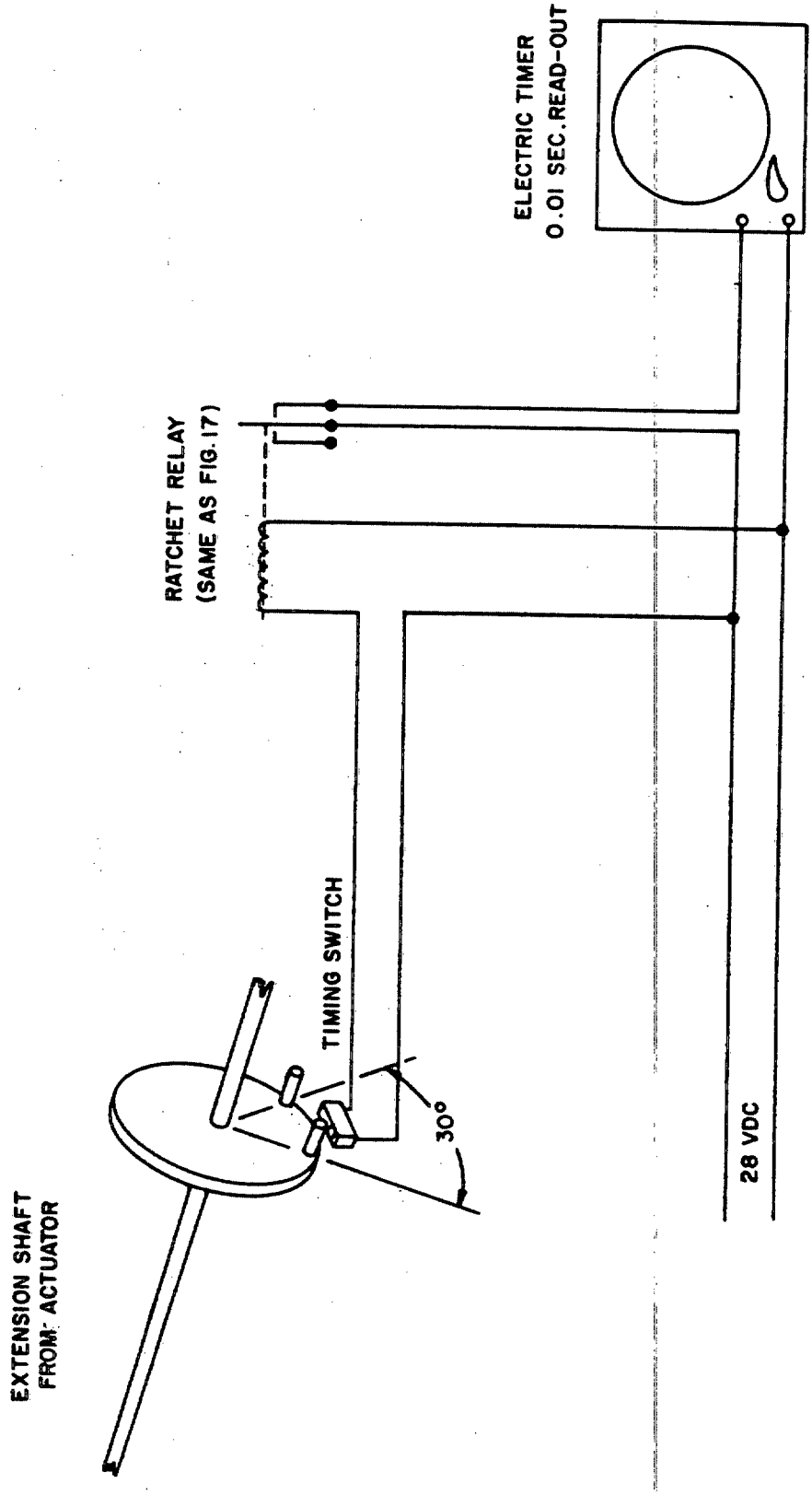


Figure 18. Output Speed Timing Circuit

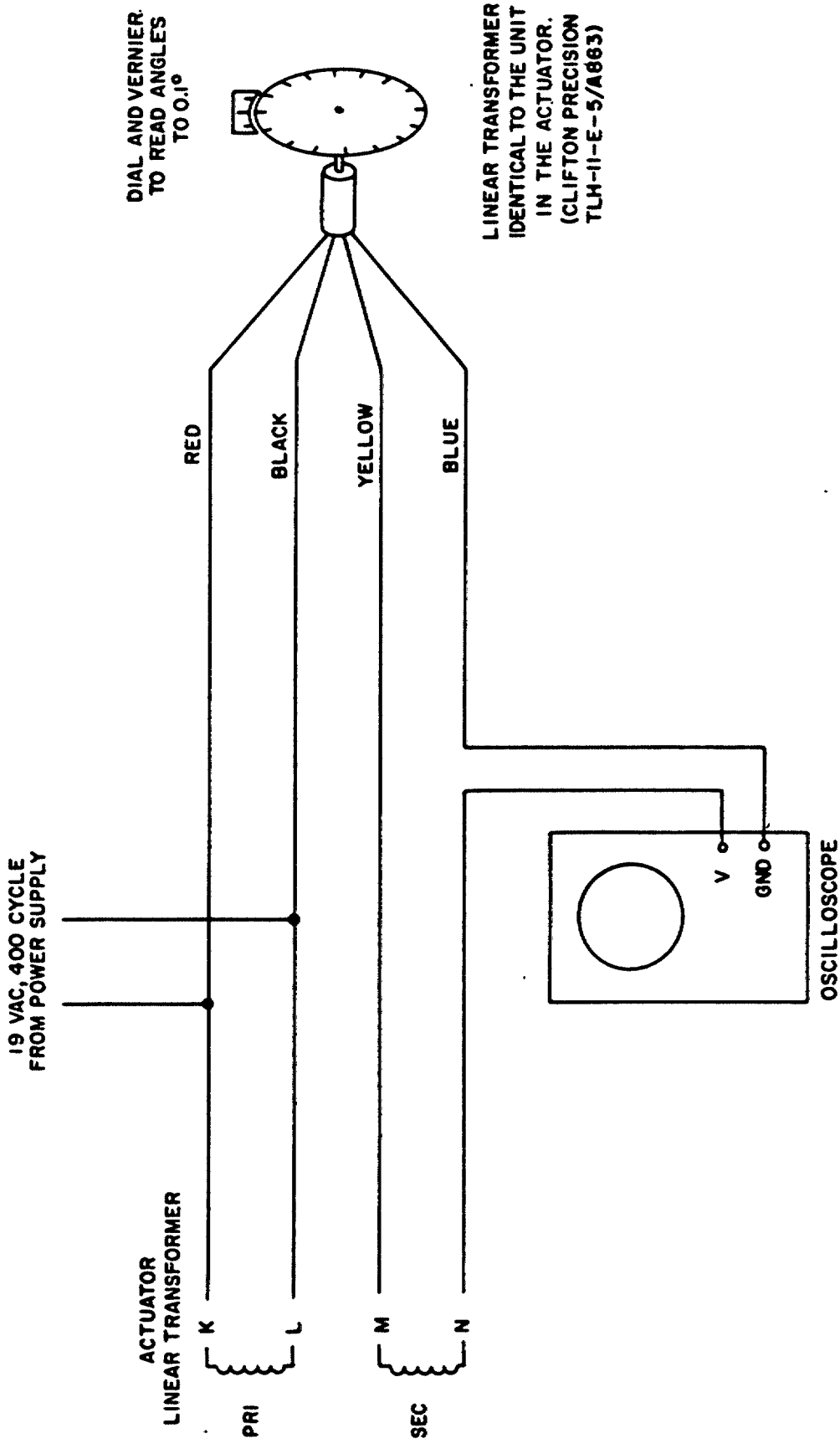
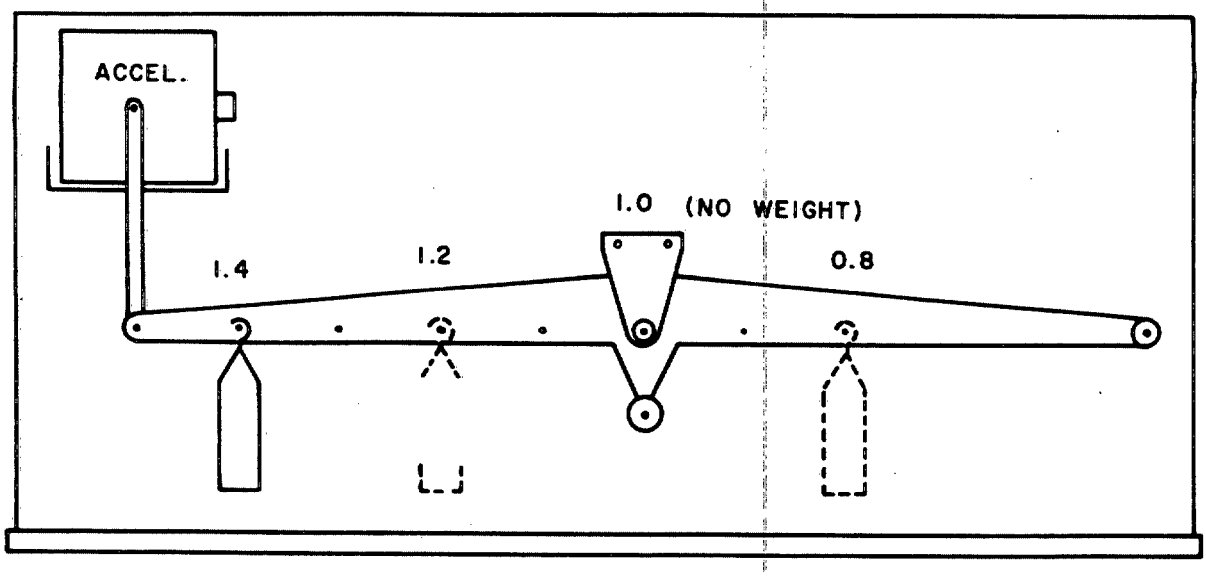


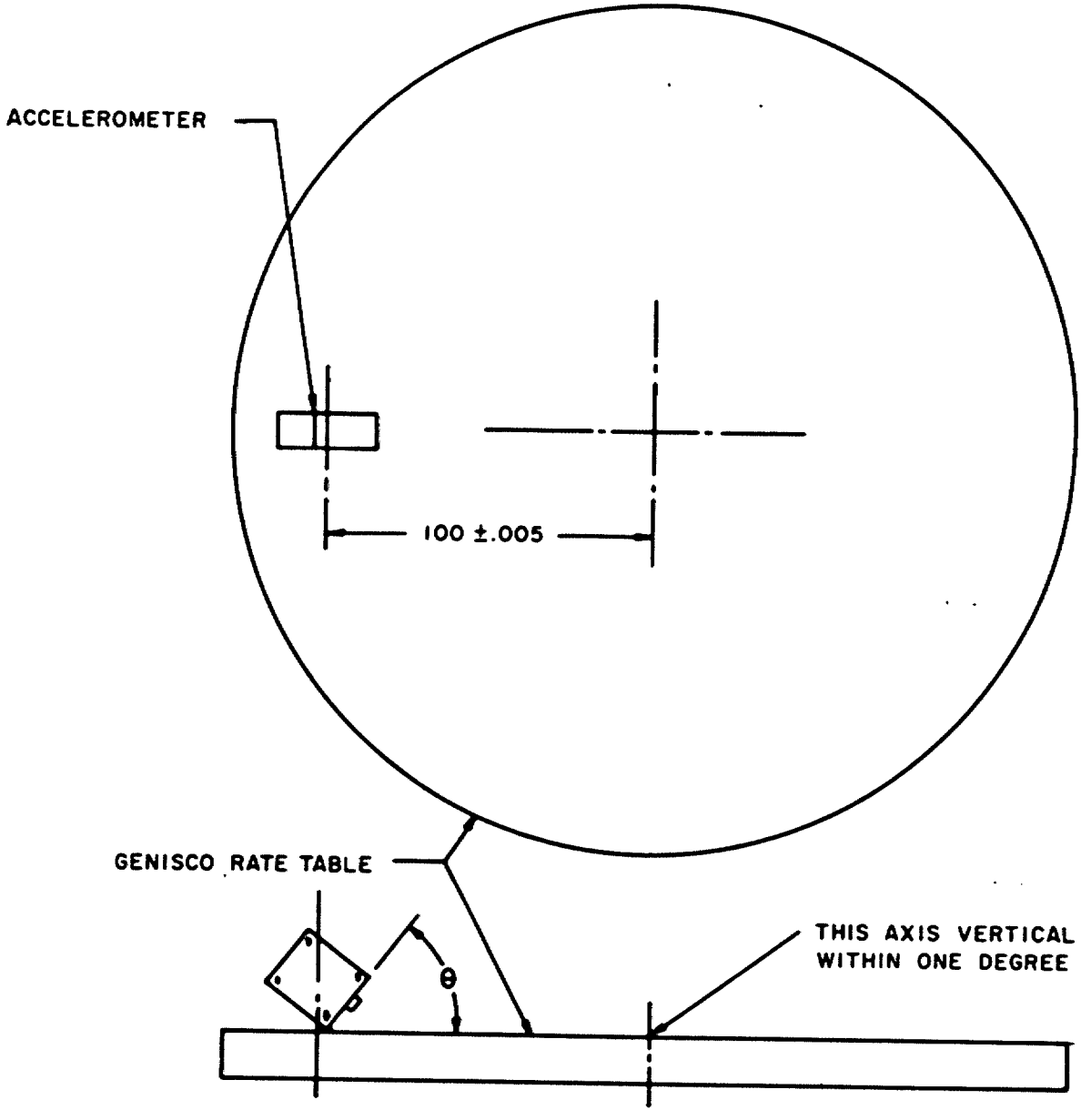
Figure 19. Electrical Read-Out Circuit



NOTES:

AVERAGE EFFECTIVE MASS OF ACCELEROMETERS - - - - - - - - 217.4 GMS.
BEAM IS SUPPORTED ON 1/4 INCH O.D. BALL BEARINGS (SILICONE LUBRICANT).
LINK CONNECTS LEFT END OF BALANCE BEAM TO MASS IN ACCELEROMETER.
COUNTERBALANCE WEIGHTS EXACTLY BALANCE BEAM, PLUS LINK, SCREWS ETC GIVING NEUTRAL STABILITY.
CRITICAL DIMENSIONS ALONG BEAM ARE HELD TO ±.001 INCH.
STATIC BEARING FRICTION OF THE TESTER SHALL BE 0.4 GM IN. MAXIMUM.

Figure 20. Calibration Tester, Beam Balance



ACCELEROMETER MUST BE MOUNTED WITH ITS SENSITIVE AXIS TOWARD THE CENTER OF ROTATION OF THE RATE TABLE WITHIN ±1°

θ = 53.2 ±1.0°

Figure 21. Accelerometer, Calibration Test

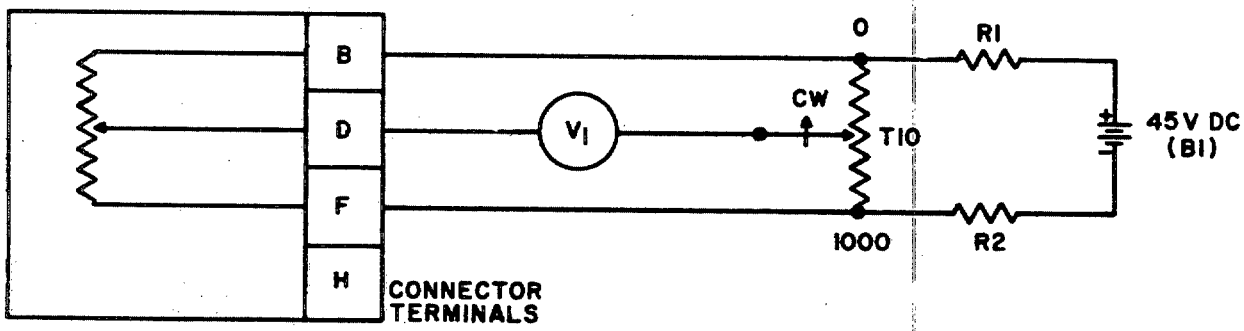


Figure 22. Accelerometer Calibration Test Circuit

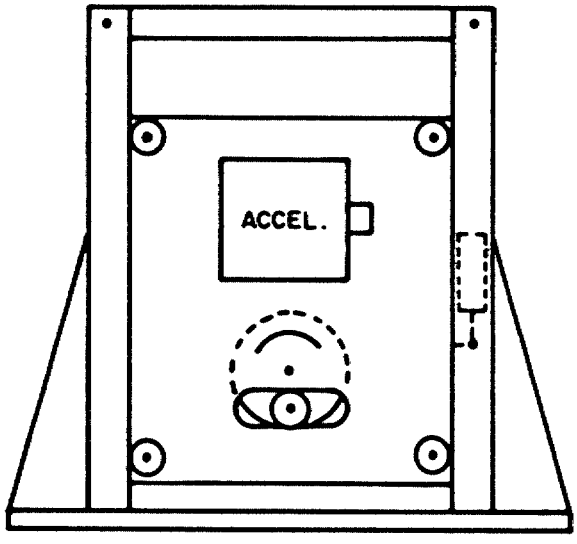


Figure 23. Accelerometer Dynamic Tester

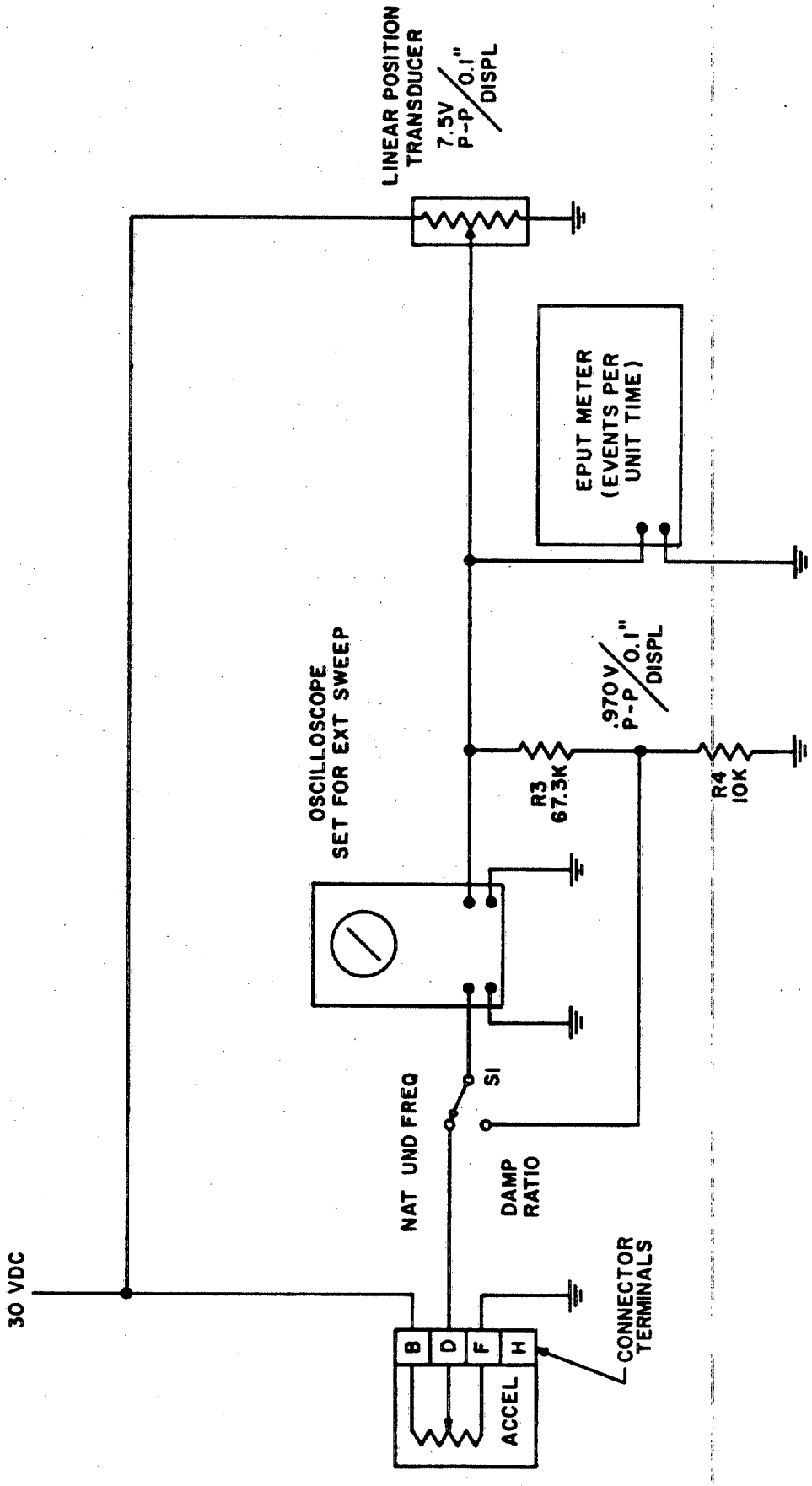


Figure 24. Accelerometer Damping Ratio Test