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June 1971

MODIFICATIONS TO DEVENCO MODEL PPS-3A RADAR FENCE

Devenco Incorporated

Rome Air Development Center
Air Force Systems Command
Griffiss Air Force Base, New York

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13. ABSTRACT

The objective of this effort was to modify six GFE developmental Radar Fence Sets which were originally fabricated and delivered by Devenco, Inc., under a previous RADC contract. The modifications were designed to improve the basic equipment, mechanical, electrical, and operational characteristics to enable more effective and extensive field operational testing under more extreme environmental conditions.

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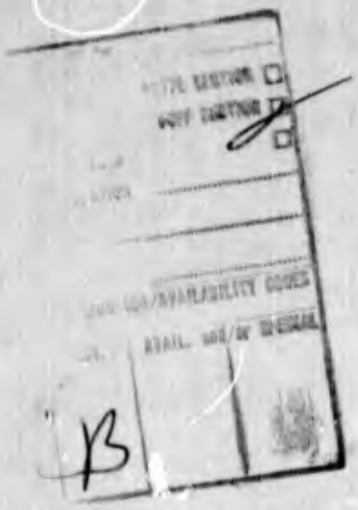

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14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Intrusion Detection Equipment						
Bi-Static Radar						
Surveillance						
Security Equipment						

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FOREWORD

This Final Report was prepared by Irwin Goldstein, Devenco, Incorporated, Research and Development Division, 250 Hudson Street, New York, N.Y., under Contract F30602-70-C-0293, Job Order Number 674B0000, for Rome Air Development Center, Griffiss Air Force Base, New York. This report, which covers the period 28 April 1970 to 22 March 1971, is identified by the contractor as 3664-F.

This document is directly related to and supplements RADC-TR-69-168, "Perimeter Protection System," June 1969, AD 503 039L.

Samuel J. Militello (COTS) was the RADC Project Engineer.

This Technical Report has been reviewed and is approved.

Approved: Samuel J. Militello
SAMUEL J. MILITELLO
Tactical Surveillance Section
Tactical Applications Branch

Approved: Joseph L Ryerson
JOSEPH L. RYERSON, TECHNICAL DIRECTOR
Communications and Navigation Division

FOR THE COMMANDER: Irving J. Gabelman
IRVING J. GABELMAN
Chief, Advanced Studies Group

EVALUATION

The intent of this effort was to improve and modify developmental equipment to allow utilization by SAC for operational testing under severe environmental conditions that exceeded design parameters of the developmental equipment. Basically, the improvements/modifications involved lower temperature operating capability, more rugged mechanical stability, elimination of problems related to rain and humidity, and facilitation of equipment set-up and alignment.

The modified equipment met or exceeded all specification requirements. The contract was phased to accommodate SAC testing schedules. As a consequence, the effectiveness of modifications was satisfactorily revealed before completion of the contract by actual field tests of the first four (of six) sets delivered to SAC. The remaining two sets were subsequently delivered to RADC and likewise satisfactorily passed acceptance testing.

It is contemplated that further operational tests will be conducted with the improved equipment.

Samuel J. Militello

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TABLE OF CONTENTS

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SECTION I

INTRODUCTION

This report includes general information relating to the work performed on six (6) Devenco Model PPS-3A Radar Fence systems. The work was performed in accordance with the Statement of Work under PR No. C-0-2173 dated April 28, 1970.

The objective of this effort was to improve the mechanical, electrical and operational characteristics of the PPS-3A systems which were built under Contract No. F30602-68-C-0257. The systems were originally built for technical feasibility evaluation without major concern for extreme environmental conditions.

TECHNICAL EFFORT DISCUSSION

In order to improve capabilities for subjective tests and evaluation, it was deemed necessary to improve the developmental models with regard to simplification of alignment for non-technical personnel. Provision for eliminating the AGC response of the detector voltage would enable the operator to precisely adjust the alignment of antennas without extensive know - ledge of AGC characteristics.

The "fail-safe" control was located in a position which made operator adjustment somewhat difficult. It was deemed essential to correct this condition.

Modifications were required in the switching circuits of the Annunciator to provide for compatible operation with the AN/GSQ-113 in the AC mode of operation. This constituted a change from the Statement of Work under Contract No. F30602-68-C-0257.

In order to provide for improved resistance to rain and moisture, appropiate changes were made to all systems.

For the purposes of tests planned in cold environments, a simple heating system was added to three (3) systems. This change included the addition of thermostatic control on the T/R units. This was necessary since the systems were originally specified to operate at 32 degrees F. Although the systems actually operate at 10 degrees F (or below), this was not a low enough operating temperature for the planned tests in the cold weather environment.

Additional changes were made to provide for more stable tripod structures and improved bearing surfaces at swivel points.

The modifications were made to all six (6) systems, with the exception of the heating provision which was made on three (3) systems.

All systems were examined and tested upon receipt from the government. It was found that four (4) systems required repair and/or rework to reestablish operation. Of these, appreciable damage, attributed to poor shipping preparation and/or rough transportation handling, occurred to at least one system (#5). This was a system received from McCoy AFB. Appropiate reports were made to the Contracting Officer. Difficulties found and repairs accomplished are detailed in Appendix A.

Appendix B details the orientation procedures for alignment of the modified systems.

Appendix C details the method of adding the thermostatic controls to systems modified for cold temperature operation.

Final testing of the systems was followed by discussion with cognizant personnel at the test sites to verify satisfactory operation of the systems. Devenco personnel visited the Grand Forks AFB and Mc Coy AFB to assure proper operation and installation procedures although this was not a contractual requirement. Reasonable service and maintenance assistance in the accomplishment of these tests is assured by Devenco Incorporated.

REFERENCES

Statement of Work PR No. C-0-2173 dated April 28, 1970.

Statement of Work PR No. E-8-3215 dated August 28, 1967.

Instruction Manual dated November 1,1968. (Contract F30602-68-C-0257).

RADC-TR-69-168, June 1969, AD 503 039L

APPENDIX A

SPECIFIC CHANGES & REPAIRS

REPAIR OF RECEIVED SYSTEMS

Of the six (6) systems which were both mechanically and electrically modified, four (4) systems required repair. The following is a cursory breakdown of system trouble and repair effected.

(1) Symptom: No output on Channel "A".
Cause: Shorted coupling capacitor (C-115) in 30 Mc IF amplifier.
Repair: Component replaced.

(2) Symptom: No output on both Channel "A" and "B".
Cause: An unusual condition occurred in which both channel 2nd mixer oscillators were defective.
Repair: Oscillators replaced.

(3) Symptom: Overall system performance down radically.
Cause: Defective microwave bandpass filter.
Repair: Filter replaced.

(4) Symptom: Intermittent operation.
Cause: Corroded connectors J-701 and J-702 of T/R unit.
Repair: Replaced connectors J-701 and J-702.

ELECTRICAL MODIFICATIONS

Three (3) electrical modifications were completed on all the systems as well as the fungus proofing of all PC boards, wiring, etc. The following electrical modifications were made:

(1) AGC Man-Auto Modification

This modification was made to facilitate antenna alignment and required the installation of a switch, pot, and respective wiring and cables for each channel. In addition, mechanical modification of the power divider was made for the mounting bracket upon which these components are mounted.

(2) Fail-Safe Adjustment Control Modification

This modification changed the physical location of the controls of both channels from the PC board to the bulkhead in order to permit ready access by field personnel. In order to assure better grounds, a ground wire and lug was installed in all AGC and alarm boxes.

(3) Annunciator Modifications

In the Annunciator, pins "C" and "D" of J-4 and J-5 were paralled. Also, a jumper was installed on switch 7C to provide +12V to the 2 Hz detector in the AC mode of operation. This modification was made at the request of the COTR.

(4) Fungus Proofing

All PC boards were first vapor degreased with freon solvent, then spray coated with MS-450 protective varnish, which meets government specification MIL-V-173.

All solder joints, connections, etc., were brushed with Humi-Seal protective coating type 1A27. Particular attention was given in protective coating to connectors J-701 and J-702 of the T/R units. These connectors have been shown to be particularly vulnerable to corrosion due to their physical location at the bottom of the T/R housing where water would most likely accumulate.

MECHANICAL MODIFICATIONS

All the T/R units and target modulator units were repackaged in order to enhance resistance to rain. Three (3) T/R units were also lined with asbestos and equipped with heaters and thermo-switches set at 50°F. 1,000 feet of heavy duty cable was supplied with each system modified in this manner.

The tripods upon which the T/R units and targets are mounted were mechanically strengthened and improved (i.e. mechanism for positioning antennas).

TRIPOD IMPROVEMENTS

All antenna tripod cross-bar channels were replaced by rectangular tubes and welded for rigidity. The tripod mounting straps, previously sheet metal, were replaced by cast mounting flanges. Bronze seats were installed for all antenna pivots. The aluminum wing nuts were replaced by stainless steel T-bar bolts, permitting a more structurally sound quick release and lock. All hardware and structural parts subject to corrosion were replaced by stainless steel equivalents.

REALIGNMENT AND CHECKOUT OF ALL SYSTEMS

After all electrical and mechanical modifications were completed, each system was completely realigned, following the procedures given in the Technical Manual, Page 14, Paragraph i---Tuning the 30 MHz, 31 MHz, and 455 kHz Amplifiers---and Page 13, Paragraph h---Tuning the Solid-State Source.

Final operational checkout of each system was performed at the laboratory simulated ranges of 500 and 700 feet.

All systems were shipped to contractually designated destinations and/or in conformance with amended instructions issued by the Contracting Officer.

APPENDIX B

ORIENTATION PROCEDURES FOR PERIMETER PROTECTION SYSTEM
Applicable to Systems Modified

Modifications have been made, to sets numbered 1 to 6, to provide for simplified orientation procedures. These instructions, when followed, will allow maximizing signal and sensitivity without causing detector voltage to constantly revert to normal AGC determined level.

The Test Meter should be connected to the system for the orientation phase of system installation. This provides for continuous monitoring of the detector voltage.

With the cover of the T/R station removed and power turned off, visually align antennas for each leg of the system. Path A is the leg with the 30 MHz modulating signature and Path B has the 31 MHz modulating signature.

Modifications have been made which will provide the installer with a rising detector voltage reading as the signal level increases. This detector voltage will not be affected or brought to its normal value each time the signal changes. The Manual Gain Control voltage provided for the antenna alignment is independent of comparable signal strength with AGC.

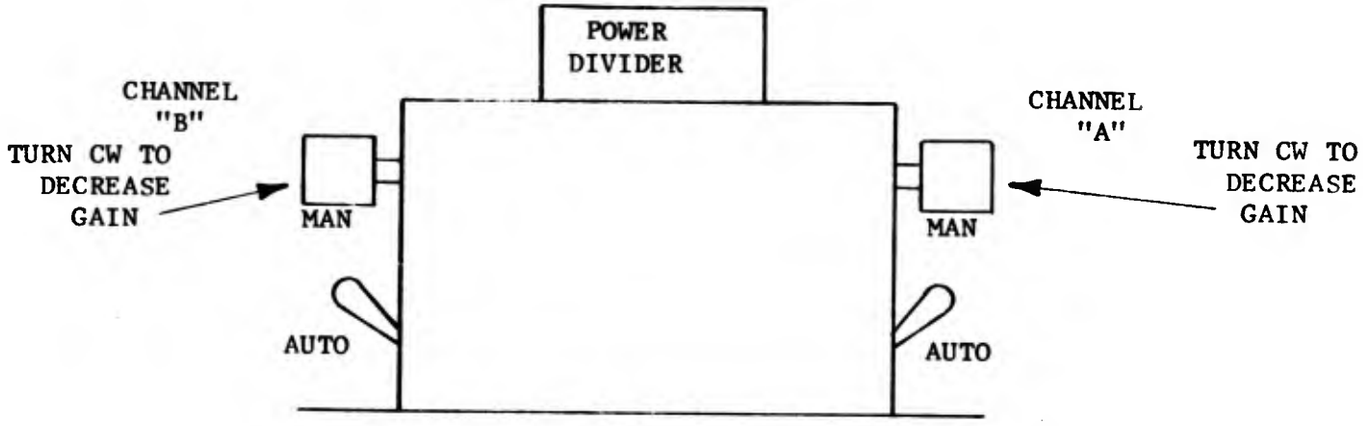
A switch and a voltage control has been added to the modified systems in order to control the detector voltage level during alignment of the antennas.

Reference is made to Figure 1 attached. Turn power switch ON at the Annunciator and set both switches on modified bracket to "MANUAL" position (up). Adjust control for appropiate channel until detector voltage, as read on Test Meter, is mid-scale (with voltage switch in the 0-5 volt position).

Adjust antennas in azimuth and elevation for maximum detector voltage reading. If meter goes off scale, reduce detector voltage level by adjusting control on modified bracket. This reduces gain by increasing AGC voltage. Perform the same operations for both channels A and B.

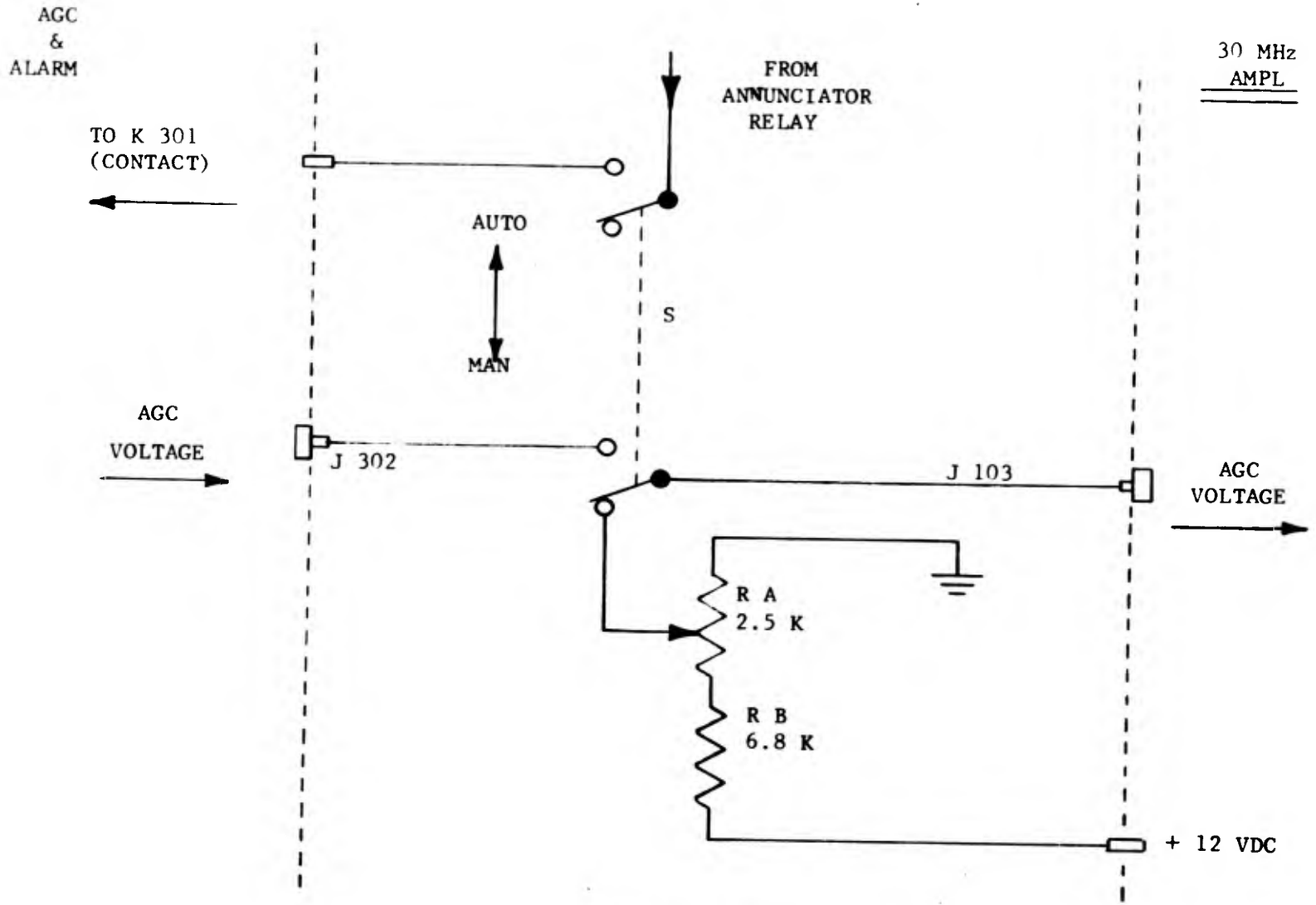
When both channels are aligned for maximum detector voltage, return the switches to the "AUTO" position (down). <u>THE SWITCH SHOULD BE IN THE "AUTO" POSITION AT ALL TIMES EXCEPT WHEN ALIGNING ANTENNAS.</u>

An additional feature of the modifications provides for the alarm lamp to be on when the switch is in the "MANUAL" position for antenna alignment. If the alarm lamp does not operate properly in the operational mode (Interface), the switch position should be checked to be certain it is in the "AUTO" position.



MANUAL GAIN CONTROLS

FIGURE 1



SCHEMATIC - MODIFICATIONS

FIGURE 2

APPENDIX C

PERIMETER PROTECTION SYSTEM

INSTRUCTIONS FOR ADDITION OF
HEATED COVERS TO T/R STATION

Install connectors on 1,000 ft. reel of power cable. One end receives the standard AC plug and the other end receives the Cannon type MS 3106E-16-10S connector. Both connectors are supplied and are to be used in conjunction with the adapter cable provided. (See Figure 1.)

Heater blankets added to standard covers provide for cold weather operation. Modifications of a standard system are simple and can be performed by following the steps outlined. Refer to Figure 2.

1. Remove T/R Station cover.
2. Loosen the two bracket hold-down screws.
3. Slide the slotted end of the thermostat mounting plate under the AGC control bracket.
4. Tighten the two bracket hold-down screws.
5. Connect P_1 (from cable to thermostats) to S_1 (cable from heater blankets).
6. Replace cover on T/R Station.
7. Connect adapter cable to cover on T/R Station and opposite end to heavy duty power cable.
8. Provide power for heater blankets from any standard AC outlet capable of handling 600 watts.

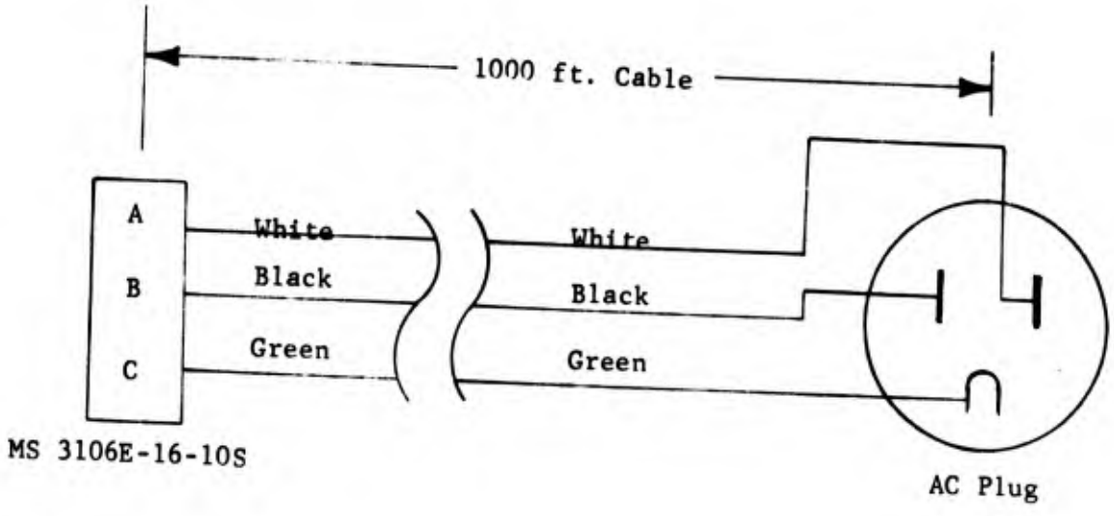


FIGURE 1

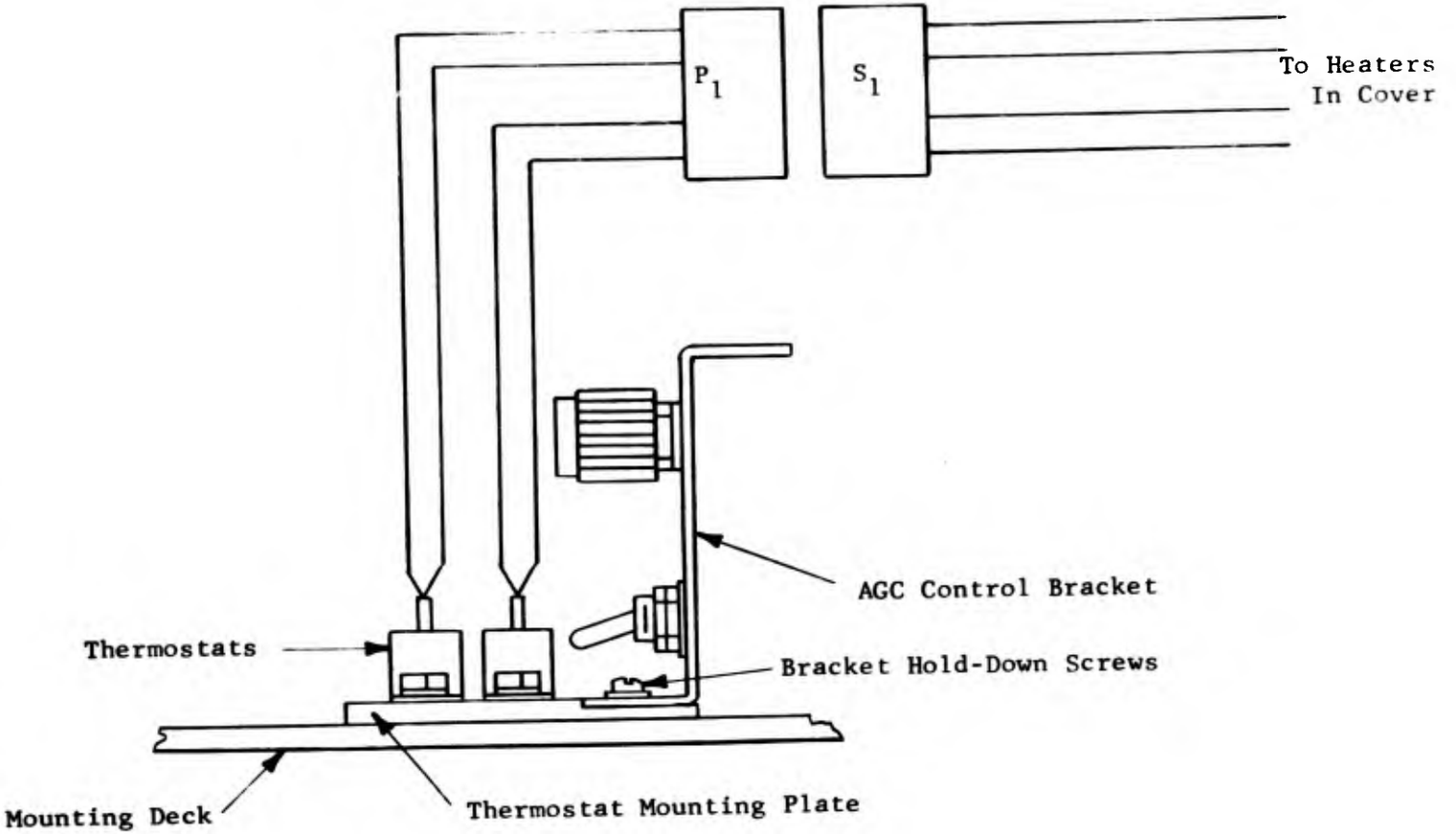


FIGURE 2

TEMPERATURE MODIFICATIONS TO PPS-3 A