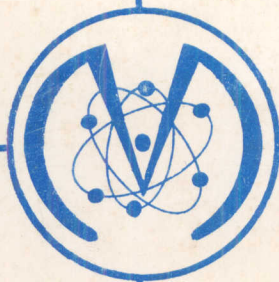


MTM 8101

TECHNICAL MANUAL
FOR
HOP ANTENNA MODELS
30/150 TV
150/350 TV
&
ANTENNA CONTROL UNIT
ACU6-HLB



Multronics, Inc.



MTM 8101

TECHNICAL MANUAL

FOR

HOP ANTENNA MODELS

30/150 TV

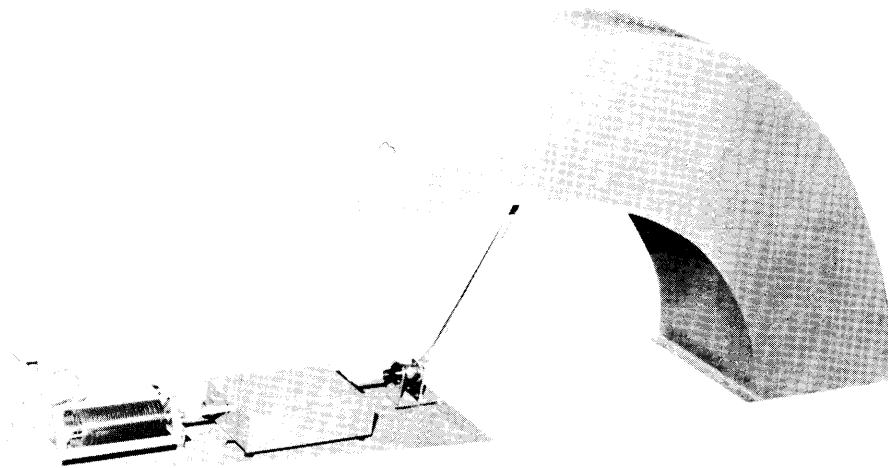
150/350 TV

&

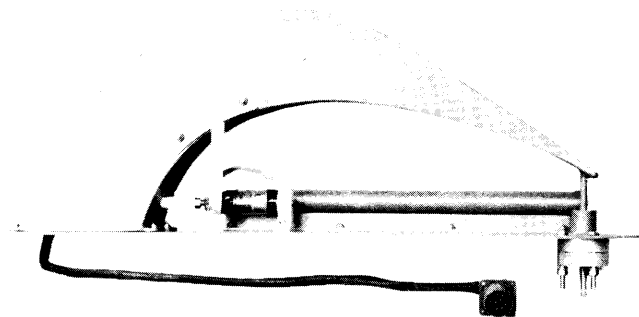
ANTENNA CONTROL UNIT

ACU6-HLB

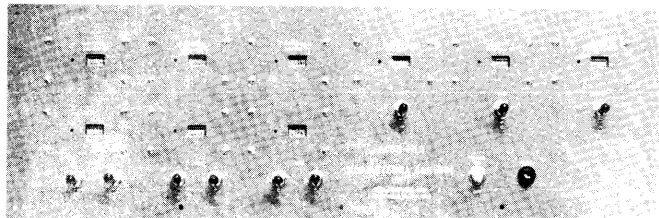
MULTRONICS, INC.
5712 FREDERICK AVE.
ROCKVILLE, MARYLAND 20852



Hop Model 30/150 TV



Hop Model 150/350 TV



ACU6-HLB Antenna Control Unit

THE HOP ANTENNA SYSTEM



GUARANTEE

This equipment is guaranteed against defects in material, workmanship, or manufacture for a period of one year from date of delivery. Disassembly beyond the levels specified in this manual shall render this guarantee void with respect to the item tampered with. Any obligations under this guarantee are limited to repairing or replacing any item which shall prove, by our examination, to be thus defective, provided that the item is returned to the factory for inspection with all transportation charges paid. Before returning any item believed to be of defective material, workmanship or manufacture, a detailed report must be submitted to the company, giving exact information as to the nature of the defect. The information shall include, in as much detail as possible, all subject material listed under instructions for replacement of parts. Upon receipt of the report by the company, detailed instructions as to how the equipment is to be returned, will be issued. Do not return any material until instructed to do so by the company.

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Multronics, Inc.



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GENERAL

The recent development of airborne television transmission practices and the present and future state of the art have placed great demands on the designers of antennas to propagate complex composite signals.

Heretofore, airborne television transmitting requirements have been accomplished by utilizing "single channel" transmitting antennas, which not only burdened operations by lack of frequency coverage but which also were aerodynamically clumsy. Size, weight and adaptability are the limiting factors in most airborne antennas applications.

Television transmission from an aircraft presents a problem in satisfying all the demands placed on an antenna system. In particular, the receiving antennas located on the ground appear non-homogenous to the

transmitter and therefore create a polarization problem. In order to cover maximum area; an omnidirectional antenna is required.

In general then, the requirement is for an antenna that must be physically small, light in weight, and flown at high altitudes at hundreds of miles per hour. It must be omnidirectional in the horizontal plane, and have polarity characteristics to match any and all receiving antennas. It must be sturdy and capable of handling large power levels. It must maintain a low VSWR over a wide range within the 30 MHZ to 350 MHZ band.

The asymmetrical, equiangular derived antennas of the Multronics HOP series are the only antennas today which are specifically designed to meet this rigorous mix of requirements.



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PART I
HOP ANTENNA
MODEL 30/150 TV

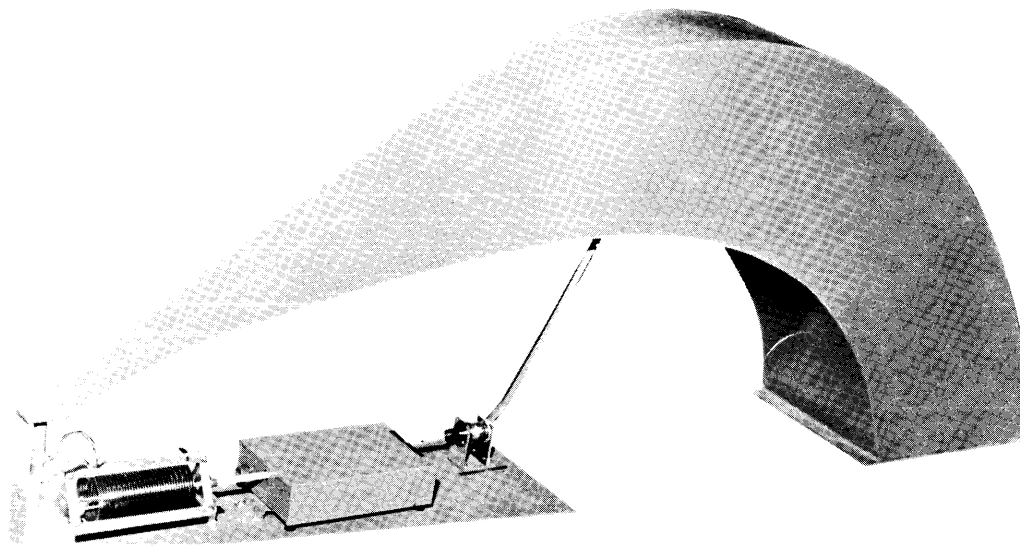
I-1 General Information

The Hop Model 30/150 TV is a physically small broadband antenna (30-150 MHz) exhibiting generally omnidirectional coverage with a complex mix of vertical and horizontal polarization. The antenna assembly is mounted inside an aerodynamically faired radome attached to the aircraft. *

The antenna assembly, Figure I-1, consists of the radiator, a base plate, a variable vacuum capacitor, a CAT line (variable line tuning unit), tuning control circuits, and a gas barrier RF connector.

The radiator is a curved horn with outside dimensions 130.5 inches long, 22 inches wide at the flared end, and 46.75 inches high at the highest point. The radiator narrows to 3 inches at the feed end, and the base plate narrows from 18 inches in width under the middle of the horn to 6 inches in width at the feed point. Both the flanges at the flared end of the radiator, and the base plate holding the CAT line and tuning circuits may be drilled and used for mounting surfaces.

* Radome not furnished



I-1 HOP ANTENNA 30/150 TV



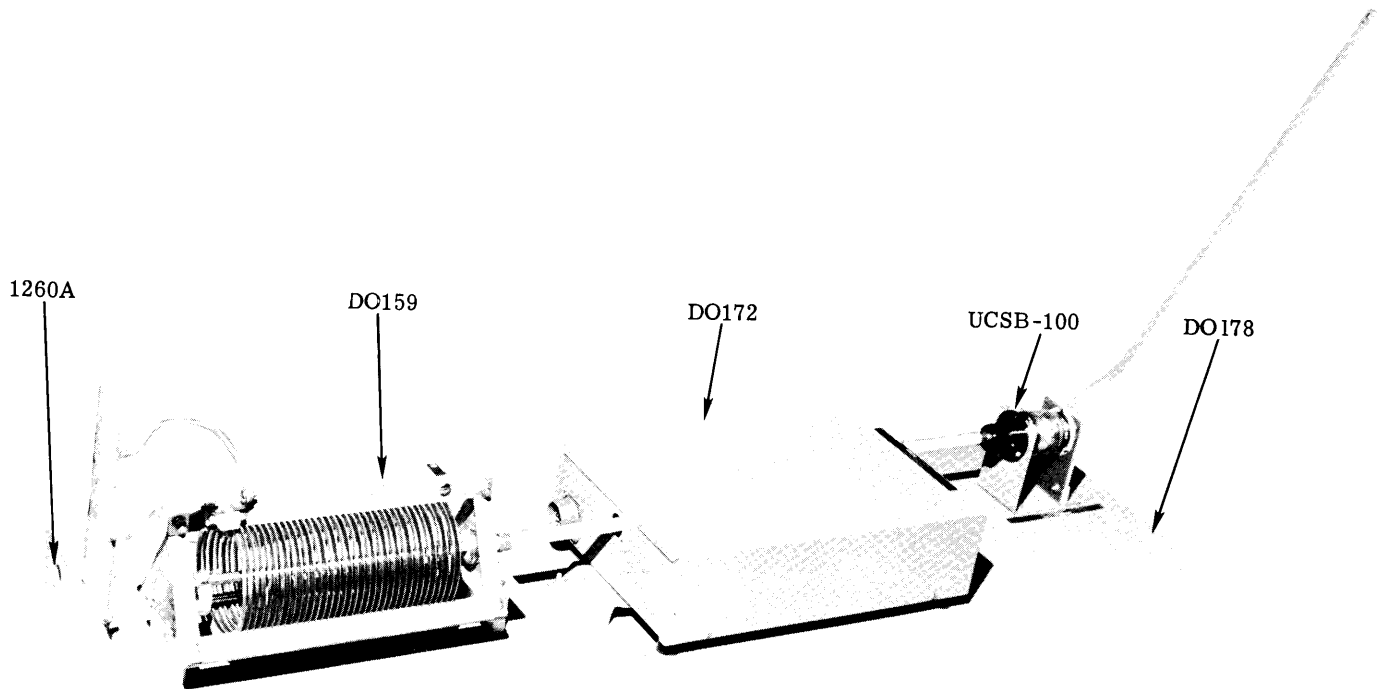
The CAT line, Figure I-2, is located next to the feed terminal of the horn. The variable vacuum capacitor, is located near the center of the platform. The motor and control circuits are mounted in an enclosure on the platform between the CAT line and the capacitor. The capacitor and CAT line digital transmitter units are also mounted in the enclosure. A 7/8 inch EIA gas barrier RF connector is located at the feed end for transmission line connection.

I-2 Reference Data

- (1) Frequency Range - 30 to 150 MHZ.
- (2) Pattern - generally omnidirectional in the horizontal plane for both vertical and horizontal polarization components (RSS method).
- (3) Polarization - essentially circular.
- (4) VSWR - does not exceed 2.0:1 over the specified frequency range. On visual television allocations VSWR may be

adjustable to as low as 1.5:1 with respect to 50 ohms.

- (5) Power Handling Capabilities - 10 KW PEP.
- (6) RF Connections - a 50 ohm 7/8 inch EIA gas barrier connector is supplied on the antenna.
- (7) Tuning Control Connectors - a connector mounted on the motor control box provides interface to all power control circuits.
- (8) Power Requirements - 115VAC, 1 phase 60 HZ at 1 amp. is required for tuning and control functions.
- (9) Tuning Control Panel - the Multronics Model ACU6-HLB is common to all antennas and is furnished for mounting inside the aircraft.
- (10) Antenna Construction - the antenna structure is all aluminum.



I-2 MAJOR COMPONENT LOCATION



- (11) Mounting Provisions - the antenna is designed to be mounted on a bracket furnished by the purchaser.
- (12) Size - 130.5 inches long and 46.75 inches high at the extremities.
- (13) Weight - approximately 115 pounds.

I-3 Installation

The Andrew Gas Barrier connector has been factory installed to the feed point assembly and the Andrew's Instructions should be followed carefully when attaching the feed line. The electrical components have been previously adjusted either at the Multronics plant or by Multronics field engineers.

The base plate of the antenna has been purposely abbreviated at the feed point to permit the greatest latitude in bringing both the coaxial cable and control cable through to the antenna within the space limitations imposed by the containing radome. Approximately 6 inches of front clearance is provided for this purpose.

The control cable is connected by way of an MS connector mounted on the motor box. The control cable must be well shielded because of the close proximity of the RF field. The control cable may be terminated at J4, J5, or J6 on the ACU6-HLB Control Unit

Positive electrical contact must be provided between all mounting surfaces of the antenna and the surface of the aircraft, therefore, cleanliness of these surfaces is important. Both High and Low Band antennas may be mounted in any position.

I-4 Tuning Procedures

Apply low power from the transmitter to the antenna sufficient to produce an up scale deflection on the transmitter reflected power meter.

Two controls are furnished on the Control Unit for tuning the 30/150 TV antennas, each of which compensate for a wide range of VSWR. One control switch must be held in neutral while the other is being adjusted as indicated in paragraph III-4 to obtain VSWR of less than 2.0:1. Tune alternately with first one control and then the other to obtain a dip in reflected power. The point giving the lowest VSWR should be selected for operation.

CAUTION

Do not apply full transmitter power until a VSWR of less than 2.0:1 is obtained.

Always log the indicator setting, VSWR, and frequency to facilitate future tune up. Once this has been done and it is desired to operate again on a frequency which has been prelogged it is only necessary to operate the appropriate channel read out indicator to the preset numerals and check the transmitter VSWR to assure that it is within acceptable limits. Operational power may then be applied to the antenna.

I-5 Preventive Maintenance

The only preventive maintenance required for this antenna is periodic cleaning of the electrical components to avoid a buildup of dirt or grease in order to prevent flashover.

Oilite bearings are used throughout the equipment. Since they are permanently lubricated, no lubrication procedures are required.

During installation and when performing maintenance, the glass vacuum capacitors should be protected from accidental damage by wrapping with a clean cloth. This wrapping must be removed before placing the equipment in operation.

Disassembly shall not be attempted at a level beyond removal and replacement of the major components as shown in Figure I-2. Further disassembly shall render the guarantee void.



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PART II
HOP ANTENNA
MODEL 150/350 TV

II-1 General Information

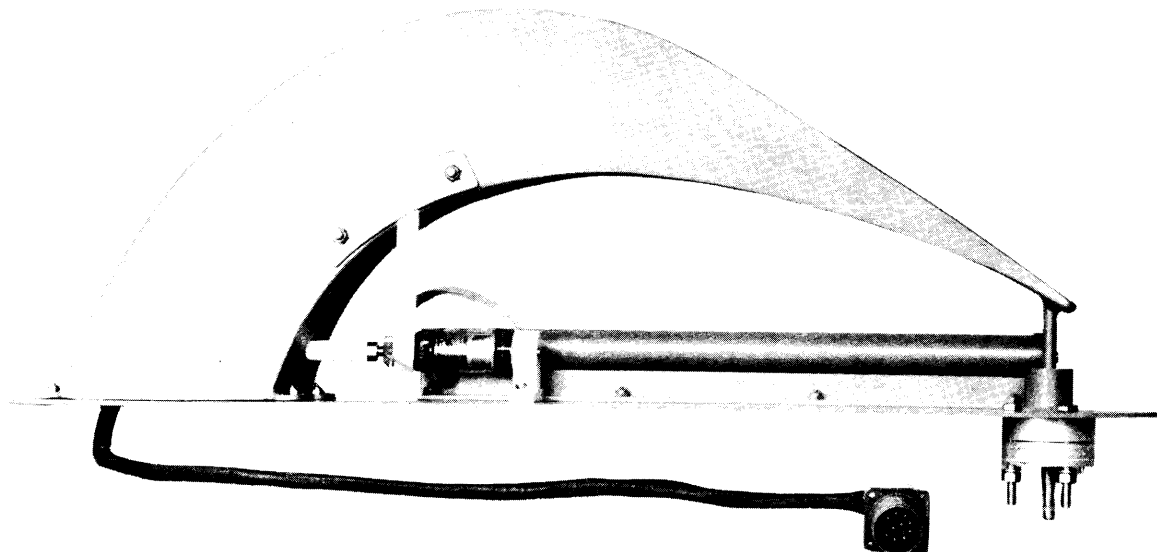
The Model 150/350 TV is a physically small broadband antenna (150-350 MHz) exhibiting generally omnidirectional coverage with a complex mix of vertical and horizontal polarization. The antenna assemblies are mounted inside aerodynamically faired radomes attached to an aircraft. *

The antenna assembly, Figure II-1, consists of an antenna, a base plate, a variable vacuum capacitor, a transmission line, a capacitor drive motor and control circuit and a gas barrier RF connector.

* Radome not furnished.

The antenna is a curved horn measuring 24.1 inches in length and 9.25 inches in height at its highest point. The feed end (small end) of the antenna measures 0.75 inches wide by approximately 0.25 inches thick increasing in size until the large end measures 4 inches wide and 5 inches thick. The mounting platform measures 30.05 inches long x 4.75 inches wide.

The variable vacuum capacitor is mounted on the base plate near the large end of the antenna. The transmission line is a shorted stub constructed of 1 inch OD 7/8 inch ID aluminum tubing 15-3/4 inches long. A 5/16 inch silver plated brass rod inner conductor



II 1 HOP ANTENNA 150/350 TV



is held in place by a solid teflon dielectric.* *
The motor and control circuits are mounted on an aluminum bracket located inside the large end of the antenna. The capacitor digital transmitter unit is also mounted on this bracket.

At the feed end of the antenna a teflon insulated 5/16 inch inner conductor is mounted to mate with a 7/8 inch Gas Barrier EIA fitting for RF input to the horn.

II-2 Reference Data.

- (1) Frequency - 150 to at least 350 MHZ.
- (2) Pattern - generally omnidirectional in the horizontal plane for both vertical and horizontal polarization components (RSS method).
- (3) Polarization - essentially circular.
- (4) VSWR - does not exceed 2.0:1 over the specified frequency range. On visual television allocations VSWR may be adjusted to as low as 1.5:1 with respect to 50 ohms.
- (5) Power Handling Capabilities - 10 KW PEP.
- (6) RF Connections - a 50 ohm 7/8 inch EIA gas barrier connector is supplied on the antenna.
- (7) Tuning Control Connectors - a "pigtail" control lead harness, terminated in a connector is provided on the antenna.
- (8) Power Requirements - 115VAC, 1 phase 60 HZ at 1 amp. is required for tuning and control functions.
- (9) Tuning Control Panel - the Multronics Model ACU6-HLB is common to all antennas and is furnished for mounting inside the aircraft.

* * The transmission line is used only as part of the antenna tuning matrix when antenna additional fine tuning is required.
- (10) Antenna Construction - the antenna is all aluminum.
- (11) Mounting Provisions - the antenna is designed to be mounted on a bracket furnished by the purchaser.
- (12) Size - approximately 30.5 inches long, 4.75 inches wide, and 9.25 inches high at extremities.
- (13) Weight - approximately 9 pounds.

II-3 Installation

This antenna is shipped with all components installed and adjusted with the exception of the Andrew Gas Barrier. All adjustments to the antenna and its mechanism are made at the factory during assembly.

The antenna base plate will be attached to a mount installed on the aircraft by the installation activity. Four holes are provided on the base plate for this attachment; two at the rear of the antenna near the feed point, and two at the front of the antenna, at the base of the horn.

CAUTION

Insure that the base plate and mount are kept free of paint, oil, residue, or other foreign matter.

Prior to installation, check to insure electrical contact is made between the antenna base plate and the mount.

Attach the Gas Barrier to the feed point of the antenna by mating its center conductor with the center conductor of the antenna feed point, pushing the two together with positive hand pressure until the Gas Barrier fits snugly against the antenna mounting plate. Refer to Andrew's Instructions concerning further installation procedures.

The power and control connections to the antenna are through a pigtail lead which is terminated in an MS type connector. The connector may be bulkhead mounted if desired by the customer. The MS connector numbers used on the antennas and the Control Unit are shown on the electrical diagrams.



All control functions originate in the Multronics Model ACU6-HLB Antenna Control Unit. The control cable from any 150/350TV antenna may be routed to either J1, J2, or J3 on the Control Unit.

II-4 Tuning Procedures

The tuning procedure for the 150/350 TV is similar to the 30/150 TV except that only one operating adjustment is provided and the lever switch should be put in the minus position until the counters read zero before applying power.

After applying low power sufficient to obtain an up scale deflection of the transmitter reflected power meter, operate the lever switch to the plus position until the reflected power meter starts to dip. Continue until the minimum reading is obtained. Depending on the mounting location of the antenna on the aircraft, several points within the range of antenna tuning may be found with a low VSWR. If more than one low VSWR point is encountered, the point giving the lowest VSWR should be selected for operation.

Always log the indicator setting, VSWR, and frequency to facilitate future tune up. Once this has been done and it is desired to operate again on a frequency which has been prelogged it is only necessary to operate the appropriate channel read out indicator to the

preset numerals and check the transmitter VSWR to assure that it is within acceptable limits. Operational power may then be applied to the antenna.

A typical Horizontal Plane pattern is shown in Figure II-3.

CAUTION

Do not apply full transmitter power until a VSWR of less than 2.0:1 is obtained.

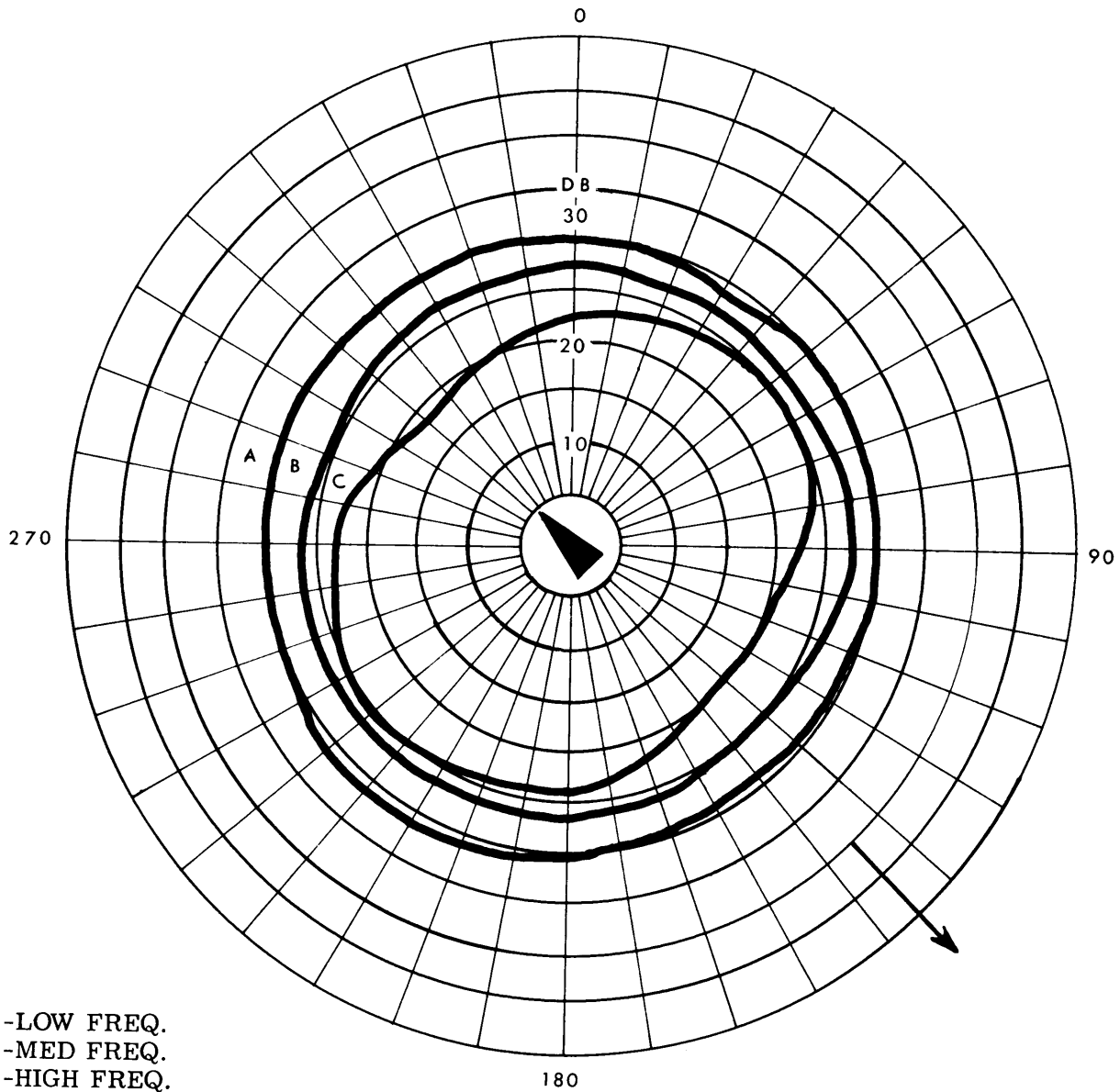
II-5 Preventive Maintenance

The only preventive maintenance required for this antenna is periodic cleaning of the electrical components to avoid a buildup of dirt or grease in order to prevent flashover.

Oilite bearings are used throughout the equipment. Since they are permanently lubricated, no lubrication procedures are required.

During installation and when performing maintenance, the glass vacuum capacitors should be protected from accidental damage by wrapping with a clean cloth. This wrapping must be removed before placing the equipment in operation.

Disassembly of the antenna shall not be attempted under any circumstances. To do so shall render the guarantee void.



A-LOW FREQ.
B-MED FREQ.
C-HIGH FREQ.

DB scale is
arbitrary

FIGURE II-2 TYPICAL HORIZONTAL PLANE PATTERN FOR HOP ANTENNAS



PART III
HOP ANTENNA
CONTROL UNIT
MODEL ACU6-HLB

III-1 General Information

The ACU6-HLB Control Unit provides control circuits for three High Band and three Low Band antennas in a single unit. Digital readout units are located on the Control Unit which indicate the position of the tuning components within the antennas. See Figure III-1.

III-2 Reference Data

- 2-1 Power Requirements - 115V, 60 HZ, single phase, 2 Amps max. to the AC socket at the rear of the unit. See Figure III-2.
- 2-2 Tuneable Units - 6 variable vacuum capacitor position indicators; 1 each for the three Low Band and the three High Band Antennas. 3 CAT line position indicators; 1 each for the three Low Band Antennas.

2-3 Connections - Control connections are made at the rear of the unit by means of six multi-pin connectors. The three Low Band connectors are MS3102A-20-33S, and the three High Band connectors are MS3102A-24-5S. See Figure III-2.

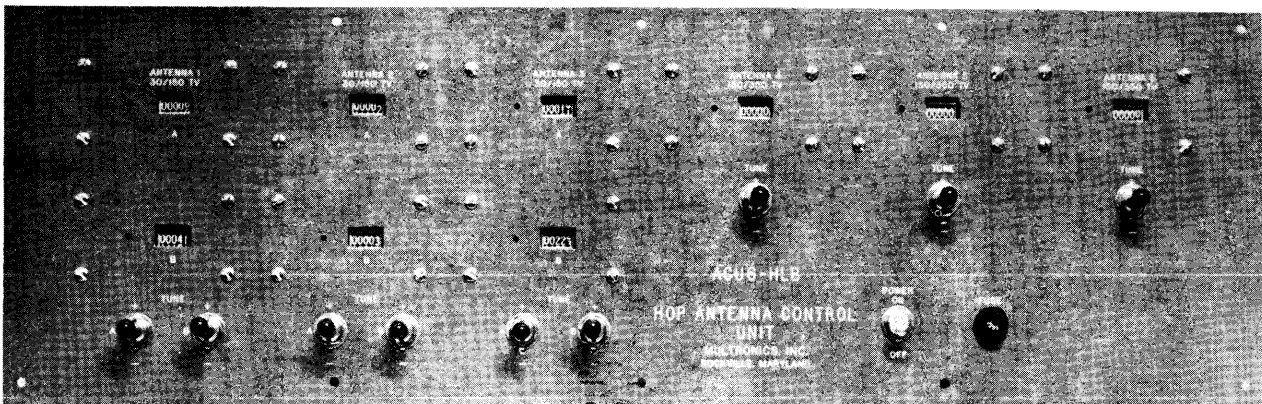
2-4 Mounting Provisions - Recess mounting is provided for by means of mounting holes in the front panel. Panel dimensions are 8.5 inches high by 27 inches long. See Figure III-3.

2-5 Dimensions - Width 27 inches; height 8.5 inches; depth 6.8 inches. A minimum of 5 inches additional rear clearance is required for the cabling attached to the rear of the Control Unit.

2-6 Weight - This unit weighs 28 pounds.

III-3 Installation

Mounting holes are provided on the front panel of the ACU6-HLB Control Unit for mounting by the installer. See Figure III-3.



III-1 ACU6-HLB, FRONT VIEW SHOWING CONTROLS



III-4 Tuning Procedure

All tuning and control of the HOP antennas is accomplished with the switches and readout units on the front panel of the ACU6-HLB Control Unit. The Control Unit uses primary AC power of 115 volts connected to the center plug in the rear of the unit.

Calibration of the readout units is required after installation to assure accurate tracking of the moveable antenna components. Each readout unit is calibrated separately.

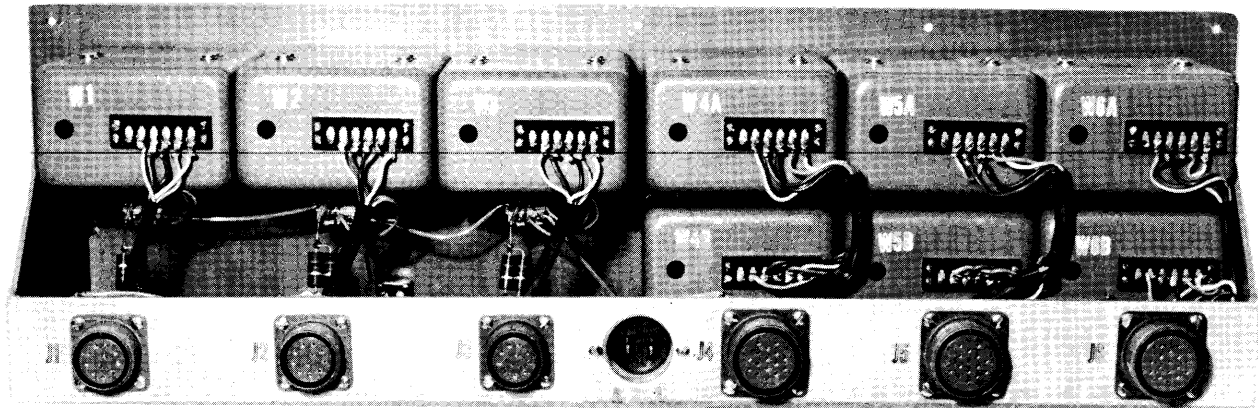
TO CALIBRATE

- 1) Depress tuning control key to the minus position and hold until the limit is reached, and no further change is observed in numbers on the readout unit.
- 2) Adjust, as required, so that the readout value is zero for the minus limit.
- 3) Depress tuning control key to the plus position and record the value given in the readout unit for the plus limit.
- 4) Repeat step 1 to assure that the minus limit remains at zero.
- 5) The plus limit recorded for each readout unit provides for future indications that full travel of the moveable antenna components is being obtained.

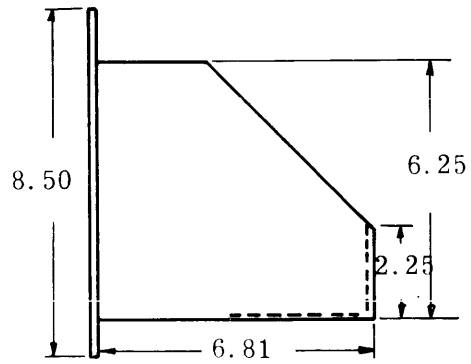
A typical system block diagram is shown in Figure III-4. The schematic diagram is shown in Figure III-5.

To Adjust:

- (1) Insert a screw driver in the small hole provided to the left of each readout window to engage it in the adjustment screw provided.
- (2) Rotate the screw until a zero reading is obtained on the digital indicator. The indicator and its associated control system are now calibrated. This procedure should be used for each readout unit of the control panel before operation. This is the only non-operating adjustment in the antenna system. All other adjustments must be made by Multronics personnel.

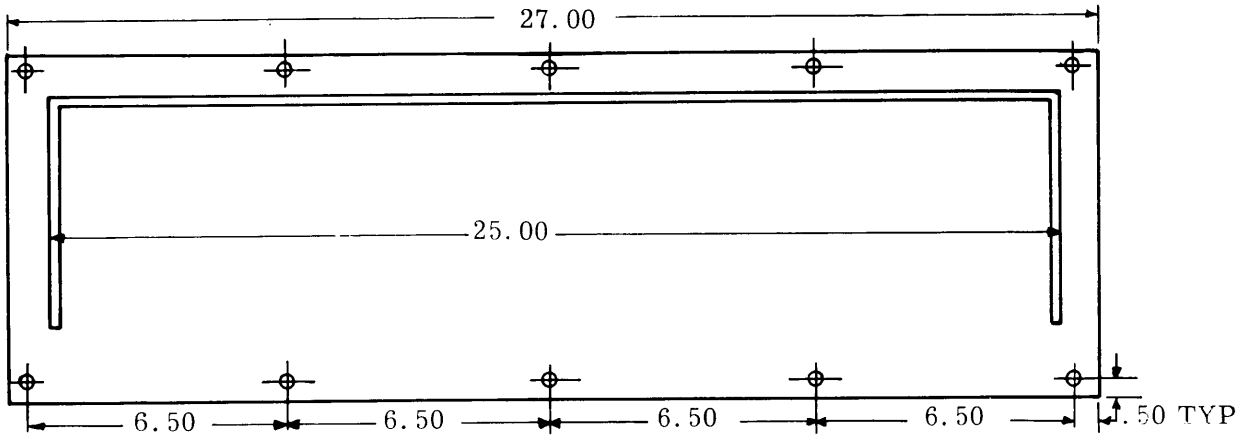


III-2 ACU6-HLB, REAR VIEW SHOWING CONNECTORS

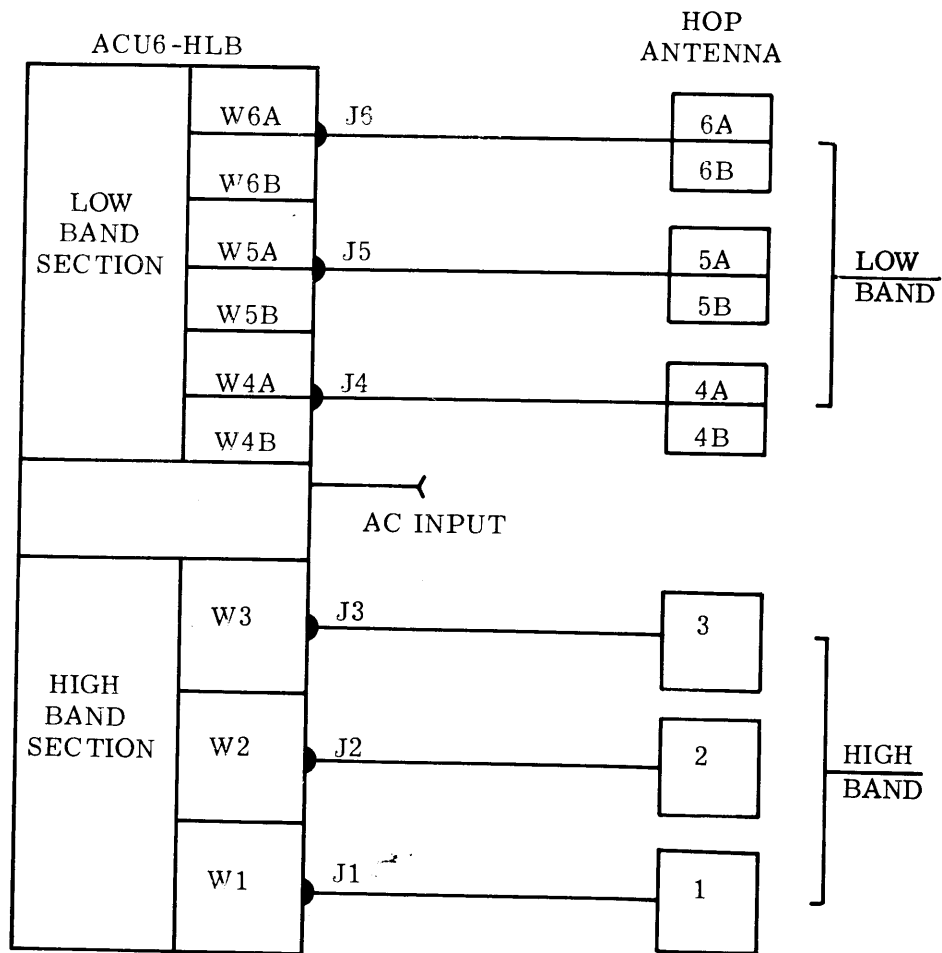


SIDE VIEW

Mounting holes are
No. 10 drill holes.
(.193 Dia.)



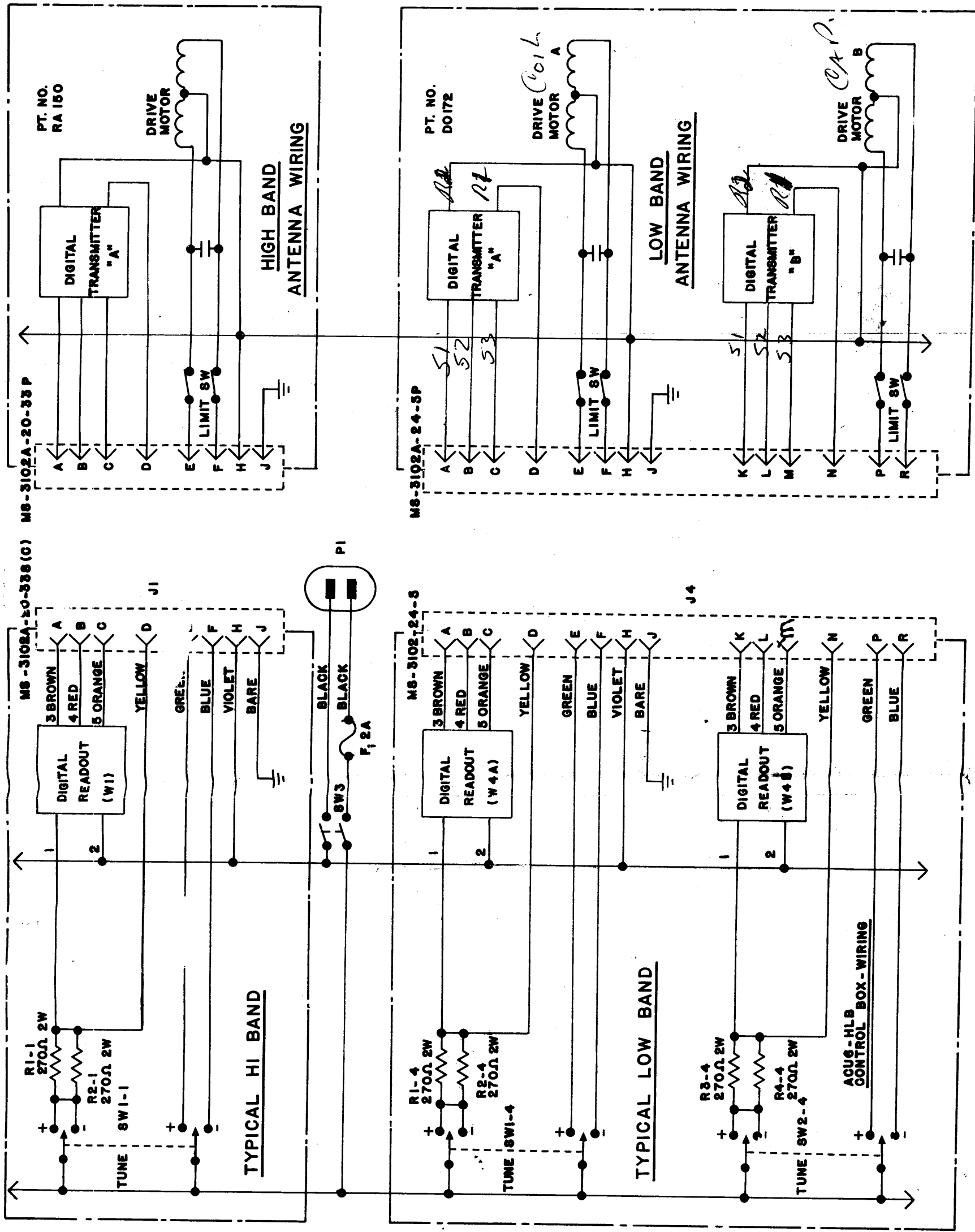
III-3 ACU6-HLB, INSTALLATION DATA



III-4 BLOCK DIAGRAM, ANTENNA CONTROL CIRCUITS

Interconnecting cables are not supplied. Exact cabling specifications are to be determined by the users minimum installation requirements.

Interconnecting wire should not be smaller than #20 AWG. Insulation is required for a maximum of 115 VAC 60 HZ 1 ampere. Shielded wire is not ordinarily required.



III-5 SCHEMATIC DIAGRAM OF ACU6-HLB AND HOP ANTENNA CONTROL CIRCUITS



**PART IV
HOP ANTENNA
PARTS LIST**

IV-1 General Information

Since the HOP Antennas are proprietary units, spares are procurable by the user on a black box basis. When requesting spare parts, include the Item Number, Part Number, Nomenclature, and Manufacturer as listed in Paragraphs IV-2 thru IV-5.

Further details are called for in the Guarantee, located in the front of this Technical Manual. Send requests for parts and services to:

Multronics, Inc.
ATTN: Communications Products Div.
5712 Frederick Avenue
Rockville, Maryland, 20852

IV-2 Model 30/150 TV

Item No.	Occurrence	Part Number	Nomenclature	Mfg. Code
1	1	RA100	Assembly, radiator	A
2	1	D0172	Assembly, Motor Box	A
3	1	UCSB-100	Capacitor, vacuum, variable	B
4	1	1260A	Gas Barrier, 7/8 inch EIA connector for 50 ohm impedance transmission line.	C
5	1	DO159	CAT Line	A
6	1	DO 178	Assembly, Base Plate	A

IV-3 Model 150/350 TV

1	1	RA150	Assembly, radiator	A
2	1	1260A	Gas Barrier, 7/8 inch EIA connector for 50 ohm impedance transmission line.	C



IV-4 Model ACU6-HLB

Item No.	Qty.	Part Number	Nomenclature	Mfr. Code
1	18	RC42GF271K	Resistor, Fixed, Composition; 270 ohm, 2 watt, 10%; R1-1 thru R1-6, R2-1 thru R2-6, R3-4 thru R3-6, R4-4 thru R4-6.	E
2	9	16038	Switch, Lever; SW1-2 thru SW1-6; SW2-4 thru SW2-6.	F
3	1	11051G	Switch, Toggle, SPST; Power On, SW3.	G
4	9	CO219	Readout Unit, Digital; W1 thru W3, W4A thru W6A, W4B thru W6B.	A
5	3	MS3102A-20-33S(C)	Connector, Receptacle; J1 thru J3 for connection of HOP Model 30/150TV Antenna.	H
6	3	MS3102A-24-5S	Connector, Receptacle; J4 thru J6 for connection of HOP Model 150/350TV Antenna.	H
7	1	61-M10	Plug, Male; AC Power.	H
8	1	Type HKL	Fuseholder; XF1.	D
9	1	Series 312000	Fuse, Glass Cartridge; 2 Amp, 3 AG.	D

IV-5 List of Manufacturers

CODE	MANUFACTURER	LOCATION
A	Multronics, Inc.	Rockville, Maryland
B	Jennings Radio Manufacturing Corporation	San Jose, California
C	Andrew Corporation	Chicago, Ill.
D	Littlefuse Incorporated	Des Plaines, Illinois
E	International Resistance Co.	Philadelphia, Pennsylvania
F	Switchcraft Incorporated	Chicago, Illinois
G	Arrow-Hart and Heggman Electric Company	Hartford, Connecticut
H	Amphenol Corporation	Maywood, Ill.