

**JAYCOR  
HPM OPERATION**

# **OPERATIONAL MANUAL**

## **SOLID STATE MODULATOR FOR THE BARON SYSTEMS RADAR**

**WARNING**

**INTERNAL VOLTAGES MAY CAUSE SEVERE SHOCK  
OR DEATH; USE CAUTION AND AVOID CONTACT  
WITH ENERGIZED COMPONENTS.**

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# SECTION 1 GENERAL DESCRIPTION

## 1-1. INTRODUCTION

This manual contains information and procedures for operation of the Solid State Modulator for use in the Baron Transmitter using the Varian SFD-349 Magnetron.

The manual is organized into three sections as follows:

- Section 1. Introduction and General Description
- Section 2. Preparation For Use
- Section 3. Principles of Operation
- Section 4. Operating Instructions
- Section 5. Maintenance

## 1-2. GENERAL DESCRIPTION

**A Solid State Modulator, figure 1-1,** The Solid State Modulator in essence is a Hard Tube Modulator which uses low voltage IGBT switches and pulse transformers to drive SFD-349 Magnetron at the proper operating voltage of 25 kV. The SFD-349 coaxial magnetron will generate high-power microwave RF pulse energy in the frequency range of 8.5 to 9.6 GHZ with a peak power output of a minimum of 250 kilowatt. It is driven by a JAYCOR Solid State Modulator which will drive the magnetron with proper pulse widths and at a repetition frequency as directed by the external pulse groups. The duty cycle for the transmitter is limited 0.0011 as dictated by the magnetron specification. Protective circuitry will protect the magnetron by not allowing R.F. pulses to be generated at a combination of pulse width and rep rate not to exceed the .0011 duty. The magnetrons output frequency is adjusted manually.

Primary power is 220VAC, 60 Hz, 1 phase and is connected to the Transmitter through connector TB3 . The remote control signals from the host system is on connector J 2 and J3. J4 , BNC, is a pulse representing the magnetron peak current . Cooling for the emitter is provided by internal fans. The fans circulates cooling air over plenums and heatsinks.

## 1.3 REQUIREMENTS

### TRANSMITTER SPECIFICATION:

<b>Magnetron:</b>	SFD-349 or equivalent—8.5 to 9.6 GHZ
<b>Magnetron Input:</b>	25 kV, 26 amps (Nominal)
<b>Peak RF Power:</b>	250kw

**Pulse Widths** (measured at -3 dB power points):  
a. 0.5  
b. 1.00  
c. 2.00

**Rise Time:** equal to or less than 100 NSEC  
(measured between the 10 and 90% power points):

**Fall Time:** Less than 200 NSEC  
(measured between the 90 and 10% power points):

**Output Requirements:**

**Stability:** 0.1 dB, Pulse to Pulse

**Spectrum:** Side lobes greater than 12 dB down

**NOTE:** - The modulator will be capable of delivering the correct pulse stability and power to permit the necessary RF source performance. Maximum duty cycle will be limited by modulator circuitry.

**Output Pulse Variation:** Less than 1% at any combination PRF, Pulse Width and Pulse Code

**Jitter:** Less than 3 NSEC, RMS (Referenced to Input Trigger)

**Delay Stability:** Less than .1 usec after warm-up (One-half hour)

**Duty Cycle:** MAGNETRON IS .0011

**NOTE:** The modulators will employ magnetron "over duty" protection. JAYCOR will drop pulses when the duty cycle is exceeded, thus maintaining the maximum duty cycle. A fault light will alert the operator of the over duty.

**Modulator Output:** Output to the magnetron will approximate 250 kilowatts. Output Pulse Amplitude (Negative Pulse) shall be adjustable to a preset value between 22 to 26KV. A softstart build up of the operating voltage to the magnetron is preset and this shall occur during the first ten seconds after transmitter HV turn-on. Typical operating conditions require a pulse of 25

**Filaments:** KV at 26 amperes. .  
 Standby: 13.75 volts, 3.6amps:  
 Operate: Down to "0" volts at full duty

**Input Trigger:** 10 to 15 volts level signal with a pulse width of .5 usec to 2 usec via BNC connector. 50 ohm load

**Output Connections:** The Magnetron shall be connected directly to the Pulse Transformer using the 6 inch long leads provided with the magnetron..

**HVPS Regulation:** The output voltage regulation over the Modulator duty cycle range to .0011 shall be better than 1.0 percent. Output ripple shall be less than 0.1 percent, and recovery from a 50 percent transient spike on the load shall not be greater than 3 milliseconds.

**OTHER CONSIDERATIONS:**

**Altitude:**  
 Operating ..... To 10,000 Feet  
**Ambient temperature:** ..... - 40C to +55 degrees C  
**Humidity**..... 95 %, non-condensing  
**Cooling**..... Internal, forced air

**Dimensions:**  
 Height..... 19.25..... inches  
 Width..... 16.00..... inches  
 Depth..... 27.25..... inches

**Transmitter Weight:** ..... 50 pounds with Magnetron

**TABLE 1.1**  
**CONTROL INPUT/OUTPUT LINES/CONNECTOR TYPE**

**INPUT CONNECTOR FOR SINGLE PHASE 208VAC - MS3112E16-8P (J1)**

PIN A - PHASE A  
PIN H - NEUTRAL  
PIN G - GROUND

**CONNECTOR UG291B (BNC) (J3) - COMMAND PULSE**  
0-10V LOGIC PULSE INPUT FOR MODULATION

**CONNECTOR UG291B (BNC) (J4) - MAGNETRON CURRENT**  
VOLTAGE PULSE REPRESENTING MAGNETRON PEAK CURRENT

**INTERFACE CONNECTOR M24308/3-2F (J2)**

**PIN 1 - RESET COMMAND**  
ACTIVE HIGH, 10-28V INPUT, OPTO-ISOLATED

**PIN 2 - SUMMARY FAULT**  
ACTIVE HIGH, 10-15V TOTEMPOLE OUTPUT (VCC), OPTO-ISOLATED

**PIN 3 - BUSS VCC**  
10-15VDC TO POWER THE OPTO-COUPPLERS

**PIN 4 - FILAMENT VOLTMETER ( 15Volts, Full Scale )**  
0-1MA CURRENT OUTPUT FOR METER MOVEMENT, INDICATING FILAMENT VOLTAGE

**PIN 5 - HV POWER SUPPLY CURRENT METER ( 1.0 Amps, Full Scale )**  
0-1MA CURRENT OUTPUT FOR METER MOVEMENT, INDICATING MODULATOR CURRENT

**PIN 6 - HV POWER SUPPLY VOLTAGE METER ( 2000 VOLTS, Full Scale )**  
0-1MA CURRENT OUTPUT FOR METER MOVEMENT, INDICATING OUTPUT VOLTAGE

**PIN 7 - MAGNETRON CURRENT METER ( 50 ma , Full Scale )**  
0-1MA CURRENT OUTPUT FOR METER MOVEMENT, INDICATING AVERAGE MAGNETRON CURRENT

**PIN 8 - GROUND**  
RETURN FOR METER CIRCUITS, TRANSMITTER GROUND

**PIN 9 - HV ON/RADIATE COMMAND**

ACTIVE HIGH, 10-28V INPUT, OPTO-ISOLATED

**PIN 10 - FILAMENT READY**

ACTIVE HIGH, 10-15V TOTEMPOLE OUTPUT (VCC), OPTO-ISOLATED,  
INDICATING FILAMENT WARM-UP DELAY IS COMPLETED

**PIN 11 - MAGNETRON AIR FLOW**

SWITCH CONTACT TO GROUND INDICATING MAGNETRON COOLING AIR FLOW

**PIN 12 - N/C**

**PIN 13 - BUS RETURN/BUS COMMON**

RETURN VOR VCC IN, COMMON FOR COMMANDS

**PIN 14 - AC ON**

ACTIVE HIGH, 10-28V INPUT, OPTO-ISOLATED

**PIN 15 - N/C**

**NOTE:** THE COMMAND AND STATUS SIGNALS ARE ISOLATED FROM THE TRANSMITTER GROUND BY OPTO-COUPLEDERS. THE STATUS SIGNAL (SUMMARY FAULT AND FILAMENT READY) OPTO-COUPLEDERS ARE POWERED BY THE EXTERNAL BUSS VCC VOLTAGE, WHICH SHOULD BE +10-15VDC (20V MAX). THE POWER RETURN IS BUS RETURN/BUS COMMON, WHICH IS ISOLATED FROM THE TRANSMITTER GROUND.

**The Front Panel has the following meters:**

**FILAMENT VOLTMETER – 15 volts Full Scale**

**HV POWER SUPPLY CURRENT METER – 1.0 Amps Full Scale**

**HV POWER SUPPLY VOLTAGE METER – 2000 volts Full Scale**

**MAGNETRON CURRENT METER – 50 ma Full Scale**

**AC INPUT VOLTS – 220VAC – SYSTEM POWER**

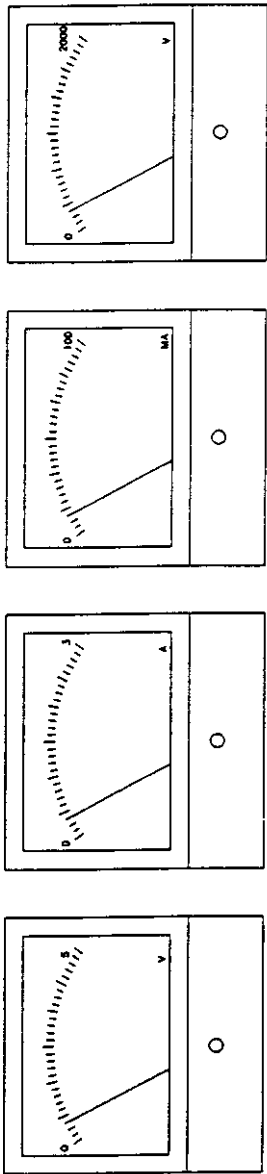
**AC INPUT VOLTS – 220VAC – TRANSMITTER POWER**



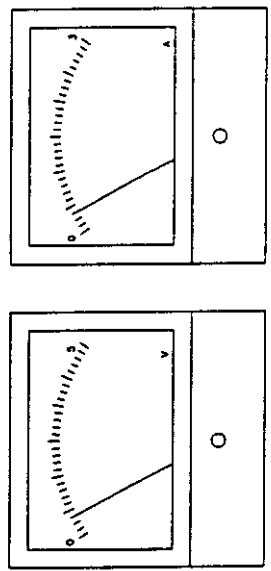
19.000

14.000

FILAMENT VOLTAGE P/S CURRENT MAG AVE. CURRENT P/S VOLTAGE



MAIN POWER TRANSMITTER POWER



ON  AC ON/STANDBY  HV ON/RADIATE

OFF  OFF

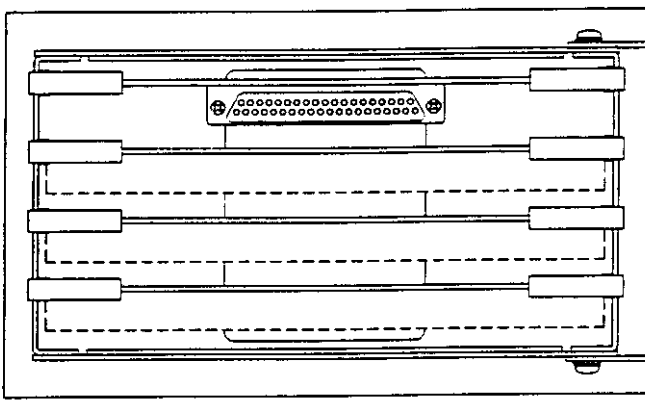
SAFE

RESET  FIL  HV  RADIATE

STANDBY  READY  MAG AIRFLOW

FAULT

CARD CAGE ACCESS DOOR



⊗ ⊗ ⊗ ⊗

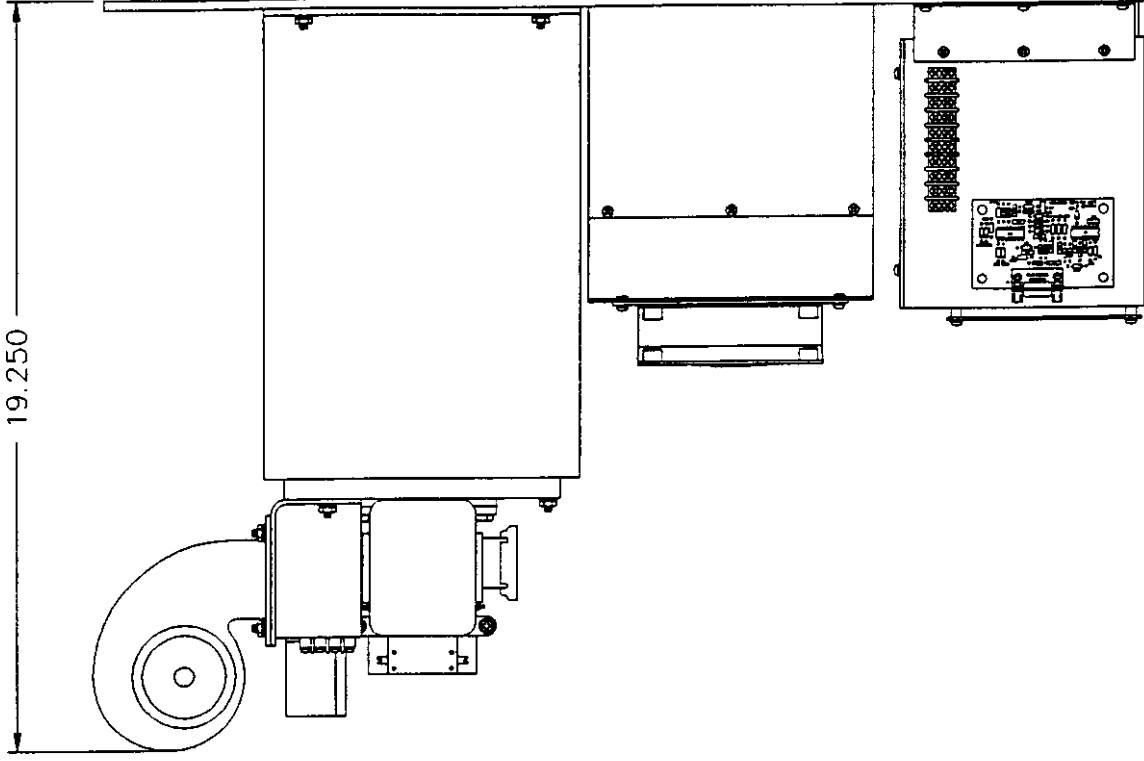
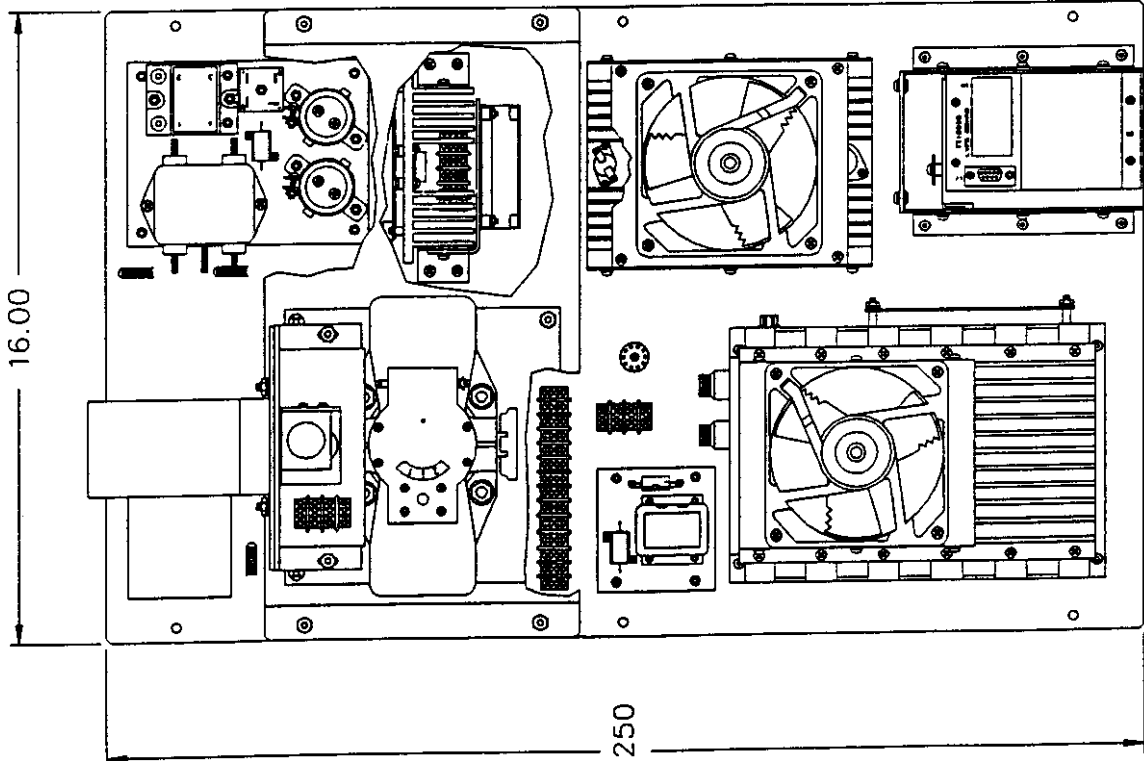
⊗ ⊗ ⊗ ⊗

ZONE	REV	DESCRIPTION	DATE	APPROVED
	-	INITIAL RELEASE	12/22/97	

19.250

16.00

26.250



CONTRACT NO. JAYCOR, HPM DIVISION	
APPROVALS DRAWN: K. KODING CHECKED: ISSUED:	DATE 12/22/97
TITLE X-BAND XMTR OUTLINE	
SIZE C	SHEET NO. BA9000
SCALE NONE	
SHEET 1 OF 1	

NEXT ASSY. USED ON	APPLICATION
-----------------------	-------------

DO NOT SCALE DRAWING

1

2

3

4

## **SECTION - 2**

### **PREPARATION FOR USE**

#### **2-1. INTRODUCTION**

This section contains unpacking, inspection and installation instructions for a Solid State Modulator/Transmitter for use with Baron Services Radar.

#### **2-2. UNPACKING AND INSPECTION**

The **ASSEMBLY** is shipped in one container; carefully open the container and remove the Modulator assembly. Visually inspect Modulator for damage that may have occurred during shipment. Check for evidence of water damage, bent or warped chassis, loose screws or nuts, or extraneous packing material in connectors or air vents. Inspect all connectors for bent connector pins. Inspect all connectors on the card cage to be sure that the PCB's are properly seated and securely connected. After inspection, the SFD - 349 Magnetron is ready for **MOUNTING TO MODULATOR** . **Transmitter should be tested with dummy load prior to Radiating from the Antenna.**

#### **CAUTION**

**Exercise care in handling equipment during inspection to prevent damage due to rough or careless handling.**

#### **2-3. INSTALLATION**

The Transmitter assembly is designed for mounting on a flat stationary surface. Cooling for the Transmitter is provided by internal fans. Be sure when mounting into enclosure that enough cooling air is allowed from the intakes and also provisions are made for exhausting hot air.

#### **TO INSTALL THE TRANSMITTER, PROCEED AS FOLLOWS:**

- Install Transmitter and secure with (6) - 6/32 mounting bolts where indicated by the configuration drawing.

#### **NOTE**

**Be sure that the Transmitter is mounted close enough to the host equipment to prevent stress on the interconnecting cables.**

- Refer to figure 2-1 for location of Transmitter connectors and connect to power lines and host console with interconnecting cables.

- After the magnetron and dummy load is installed, Refer to paragraph 2.4, run minimum performance tests to ensure that the Transmitter meets performance standards.

#### 2.4 Installation Performance Check Out:

1. Insure Dummy Load is connected to transmitter RF Output Port
2. Place unit into standby operation, External trigger Pulse Train should be set for 1 usec PW at 500 Hz PRF. Modulator is awaiting 5 minute time out.
3. Verify Filament Voltmeter indicates approximately 13.75V.
4. After time out switch unit into radiate. Verify power supply meter ramps up to approximately 1200V and power supply current meter and magi average current meter have an indication.
5. While monitoring detected RF on oscilloscope change external settings PW to 2.0 usec and PRF to 250 PPS. Verify waveform is to specification and flat across the top. If not adjust CCA A4A5 R2 for a flat response.
6. If all tests have passed, shut down transmitter and remove dummy load. Connect transmitter RF output port to the antenna waveguide system.

## SECTION 3 PRINCIPLES OF OPERATION

### 3.1 INTRODUCTION

This section contains a functional description of the Solid State Transmitter. A glossary of interface signals is provided in Table 1-1, page 1-4.

Other sections give functional descriptions of the assemblies that make up the Transmitter Group. The schematics for each of the assemblies can be found in the back of the manual.

### 3.2 SYSTEM FUNCTIONAL DESCRIPTION

The Transmitter employs a SFD-349 pulsed magnetron. The tunable magnetron operates in the frequency band of 8.6 to 9.2 Ghz. The magnetron RF output frequency is set by manual control. The magnetron will generate peak RF power of 250 Kilowatts Peak. Besides the magnetron, the Transmitter has the following Sub - Assemblies.

- |                             |         |          |
|-----------------------------|---------|----------|
| 1. Rectifier Filter         | (A1)    | BA15000  |
| 2. 28vdc & Bias P.S.        | (A2)    | RC2003   |
| 3. Filament P.S.            | (A3)    | RC4000   |
| 4. Card Cage Assy           | (A4)    | RC7000   |
| 4.1 CCA Control Conditioner | (A4-A4) | TT 21000 |
| 4.2 CCA Interface & Control | (A4-A5) | RC 2004  |
| 4.3 CCA Master Regulator    | (A4-A6) | FPQ 1104 |
| 4.4 Low Voltage Monitor     | (A4-A1) | RC 2002  |
| 4.5 Low Voltage P.S.        | (A4-A2) | TT 10600 |
| 4.6 Extender Board          | (A4-A3) | TT 20200 |
| 5. DC-DC P.S.               | (A5)    | RC3000   |
| 6. Modulator Assy           | (A6)    | BA-16000 |
| 6.1 IGBT Assy               | (A6-A3) | RC5500   |
| 6.2 IGBT Driver             | (A6-A1) | TT10210  |
| 6.3 Oil Can Assy            | (A6-A2) | BA16500  |
| 7. Reset Circuit            | (A7)    | BA 17000 |

The RF output pulse width and PRF are controlled by an external pulse train supplied by the host system. The Transmitter is designed to operate at a pulse or pulse code repetition frequency (PRF) of 250 to 1200 Hz , Pulse Widths of .5, 1.0, 2.0 usec. and limited to a maximum duty cycle of .001 and 1200 PPS.

Cooling for the Transmitter is provided by internal fans .

### 3.3 SYSTEM OPERATION

When the Power circuit breaker is On and Standby is selected, filament voltage is applied to the magnetron by an AC (3.8 kHz nominal) square wave, isolated from the high voltage pulse by a specially designed transformer. After a warm-up period of 5 minutes, the Transmitter will indicate Filament Ready and will switch to the HV/Radiate mode if it has been selected. The magnetron will operate at the PRF and pulse width as received by external trigger.

When the magnetron starts pulsed operation, the peak current is sensed and converted to an average current for scheduling the filament voltages for proper magnetron operation. As the duty cycle is increased, the filament voltage is reduced. This type of scheduling allows the transmitter to be operated at different duty cycles without concern for damage to the magnetron. The average operating current of the magnetron is monitored by the Interface & Control Card (A4A5).

The primary 220 VAC is rectified and filtered to an unregulated voltage of 270V DC. The unregulated 270 VDC is boosted and regulated to a nominal voltage of 1240 volts by the DC-DC Converter ( A5 ). The HVPS remains off until warm-up is complete and the HV/Radiate mode is manually selected, by the operator, in concert with the selected repetition rate and pulse width. The high voltage is then ramped to the proper preset operating point in a period of 10 seconds. Master regulator circuit card assembly A4A6 maintain the DC voltage at a prescribed level by pulse width modulating the DC/DC converters drive pulses. It is advantageous to ramp the DC voltage, which in turn slowly increases the peak current to the magnetron. This enhances the magnetron reliability and also helps burn out any gases that may have built up if the magnetron has not been used for a period of time. Ramping the voltage allows the magnetron to be turned on at its minimum operating current and slowly increased to the peak operating current.

The external generated pulse is processed and amplified by the control/conditioner CCA (A4A4) then fed to the IGBT Driver/Modulator assembly ( A6 ). The Control/Conditioner monitors the input pulse train. to keep the magnetron duty cycle from exceeding its limit of 0.001. When the duty cycle is exceeded, the circuitry on (A4-A5) drops out pulses to maintain the duty cycle at 0.001.

When the IGBTs are driven on they apply a nominal 1220 volt pulse to the primary of the pulse transformer. The secondary of the pulse transformer applies a nominal operating voltage of 25,000 volts to the magnetron at the specified rate of rise of voltage to assure its proper operation.

### **3.4 28 VDC AND BIAS POWER SUPPLY CCA (A2)**

This chassis mounted assembly contains two DC-DC converters that are powered by the unregulated 270 VDC. The 28 VDC converter is used to drive the programmed filament power supply A6 and LVPS A5. The 3.3 VDC Bias converter supplies reset current via A7 and L1 to the pulse transformers in the Oil Can Assembly A6-A2.

### **3.5 FILAMENT POWER SUPPLY ASSEMBLY (A3)**

The power supply pass and switching transistors are mounted through a heat sink to the CCA. The assembly has a small fan to help dissipate the 50 watts of loss. The power supply comprising a linear regulator and push-pull transformer driver is controlled by the Interface and Control and Monitor CCA A4A5. The Filament transformer is located in the Oil Can Assembly A6A2. The transformer driver operates at 3.8 KHz and is current limited. The filament transformer output is 13.75 VAC rms.

### **3.6 CARD CAGE (A4)**

The Card Cage houses the following " plug-in " circuit card assemblies (CCA):

- Master Regulator CCA (A4A6)
- Control Conditioner CCA (A4A4)
- Interface and Control CCA (A4A5)
- Extender Board (A4A3)

The LVPS CCA (A4A2) is mounted onto the left side of the Card Cage and the Standby P/S, LV Monitor And Relay CCA (A4A1) is mounted onto the back of the Card Cage.

### **3.7 MASTER REGULATOR CONTROL CCA (A4A6)**

The DC-DC Converter is configured as a current mode buck regulator with a push-pull inverter output. A pair of Pulse Width Modulator (PWM) ICs generate the regulator and inverter FET gate drive pulses. Circuitry monitors the output current for a fault condition and produces outputs for the panel meter.

### **3.8 CONTROL CONDITIONER CCA (A4A4)**

The command pulse is monitored by the duty cycle limiter circuit. The circuit is an integrating limiter. When the voltage on the capacitor is charged to the comparator limit, the pulses are inhibited for approximately 1.8 ms which can limit pulse widths as well as drop whole pulses. The duty cycle limit is set to .0011 to guarantee operation at .0010. Because there is a finite rise time and magnetron turn-on delay, the generated pulse must be stretched to obtain the proper RF pulse width. The compensation circuit adds approximately 300 ns to the pulse width.

The output buffer amplifiers drive the shielded lines that go to the IGBT Driver CCA (A6A1) The Mod Pulse turns on the main IGBTs and the End Pulse, that is generated by the trailing edge of the Mod Pulse, helps turn off the main IGBT.

The CCA has a Test switch that can be used to disable the IGBT gate drive pulses while the high voltage is on or enable the pulses without the high voltage being on. A LED on the CCA indicates if the switch is not in the Normal position.

### **3.9 INTERFACE AND CONTROL CCA (A4A5)**

The Interface and Control CCA performs eight functions:

1. Isolation of the external control and status signals from the Transmitter to ground.
  - This is accomplished by using optocouplers.
2. Generation of the 10 second ramp that controls the High Voltage Power Supply. (HVPS)
3. Monitoring of the actual HVPS output to insure that the output is less than 1925volts and at least 90% of the programmed voltage.
4. Monitoring of the peak magnetron current
  - If the peak magnetron current exceeds the normal operating current by 25%, the pulse is terminated. If there are two successive over current pulses, a magnetron current fault is generated and the radiate command is terminated.
5. Automatically resetting the magnetron current fault.
  - The circuitry will reset the fault three times, after that the fault has to be manually reset.
6. Automatic programming of the filament voltage based on the magnetron average current.

7. Filament warm-up time delay when the AC voltage is first applied.
8. Fault logic used to protect the transmitter.

The Interface and Control CCA has three adjustments which are as follows:

- High Voltage
- Maximum Magnetron Current (Fault Threshold)
- Filament Program Slope

The CCA also has a three position test switch which allows:

1. "TEST" ---The modulator IGBT gate drive to be enabled without having to wait for the filaments to time-out. This is an aid in troubleshooting.
2. CENTER – "OFF" ---Will disable the gate drives with the HVPS "On".
3. "ON" – Allows normal operation.

**CAUTION: ONLY in the "Normal Operation Mode" can the transmitter emit R.F.**

The Interface and Control CCA has 10 LED indicators which are as follows:

- DS2. H.V. Over Voltage Fault
- DS3. H.V. Under Voltage Fault
- DS4. Modulator (HVPS) Average Current Fault
- DS5. Magnetron Peak Current Fault
- DS6. In Test Fault. (Test switch not in "normal operate" position)
- DS7. HV On/Radiate (Green)
- DS8. Filament (under) Current Fault
- DS9. Filament Ready (Green) , Time out Complete.
- DS10. Low Voltage Fault
- DS11. Temperature Fault

All LED indicators are "RED" unless otherwise noted.

### **3.10 LOW VOLTAGE POWER SUPPLY CCA (A4A2)**

The chassis mounted Low Voltage Power Supply contains two DC-DC converters which provide three independent output voltages of +/-15 V DC and +5 V DC.

### **3.11 LOW VOLTAGE MONITOR (A4A1)**

The (LVMB) samples the following voltages:

- +5 vdc
- +15 vdc
- -15 vdc
- +28 vdc
- +3.3 vdc

If any of these voltage are out of tolerance, a Low Voltage fault signal is sent to (A4-A5) CCA



### **3.12 DC TO DC CONVERTER(A5)**

The DC to DC Converter is the line/load regulator and receives the unregulated 270 VDC output from the rectifier/filter.

**CAUTION: The 270 VDC is not referenced to ground.**

The DC to DC Converter contains a Buck regulator and a push-pull inverter that provides the step-up in output voltage and the necessary isolation between the primary AC input lines and the rest of the system. The DC to DC Converter has three current sense transformers, which are as follows:

- **REGULATOR**
- **INVERTER**
- **OUTPUT**

The sensed regulator current is used by the regulator IC to control the voltage feedback loop. The Inverter current is monitored to limit the transformer primary current. The output current is filtered and buffered to drive the panel meter and monitored for high average current.

### **3.13 MODULATOR ASSEMBLY (A6)**

The modulator Assembly has five major components or assemblies which are as follows:

- **CAPACITOR BANK**
- **IGBT DRIVER CCA**
- **IGBTS**
- **SNUBBER ASSEMBLY**

The Capacitor Bank supplies the peak current drawn by the IGBTs when they are driving the primary of the HV pulse transformer. The IGBT Driver CCA is the interface between the PRF and Pulse Width Conditioner on CCA (A4-A4) and the IGBTs. The IGBT Driver CCA output uses a low leakage inductance pulse transformer to isolate and drive the gates of the IGBTs. The Mod Pulse turns on the IGBTs and the End Pulse helps turn off the IGBTs. The Snubber Assembly absorbs the inductive energy left in the primary of the HV pulse transformer at the end of the pulse.

### **3.14 OIL CAN ASSEMBLY (A6-A2)**

The Oil Can Assembly contains the HV pulse transformer, filament transformer and the pulse shaping network. Also, there is a current sense transformer to monitor the magnetron current. The HV pulse transformer has a reset winding that when biased with a direct current allow a larger flux swing (volt microsecond product).

### **3. 15 RESET CIRCUIT (A7)**

The Reset Circuit is comprised of resistor (R2) and inductors (L1) that provides a constant reset bias current for the pulse transformer. The 3.3V converter on the A2 CCA supplies the power and the current is set by the resistor.

### **3.16 OVER-TEMPERATURE PROTECTION**

The Transmitter contains two thermostats; one mounted on the DC/DC Heatsink and one mounted on the Modulator Assembly Heatsink. The thermostat contacts are normally closed,

and open when the transmitter internal operating temperature exceeds 95 degrees C. When an over-temperature occurs, one or more of the thermostats will open and generate a fault signal on the Fault Interface CCA A4-A5. When an over temperature fault occurs, the logic disables the HV/Radiate command. When the open thermostat is sufficiently cooled, it will reset (close) and the transmitter will automatically initiate HV ramp-up and radiate.

### **3.17 MAGNETRON ASSEMBLY (V1)**

The magnetron generates a pulsed RF output of 250kw. The magnetron is manual tunable from 8.5 to 9.6 Ghz.

**SECTION - 4**  
**OPERATING INSTRUCTIONS**

**4.1 INTRODUCTION**

This section contains operating instructions for the Solid State Modulator using a "X" Band, SFD-349, 250kw Magnetron for the Baron Systems Radar. The Transmitter has a control panel for local operation and an I/O interface for remote control by a host system.

**4-2. CONTROLS AND INDICATORS**

The location and function of all controls and indicators on the modulator assembly are shown in figure 4-1 and are described in table 4-1.

---

**TABLE 4-1.**

---

**TRANSMITTER CONTROLS AND INDICATORS**

---

Name	Function
------	----------

---

**OPERATING MODE**

**CONTROLS/INDICATORS**

**AC POWER:** Load protection for primary 220VAC power source.  
**(CB1)** Circuit Breaker (CB1)Opens if transmitter exceeds normal load. Turn "OFF" then back "ON" to reset.

**OFF/STANDBY:** In OFF position, AC voltage to the transmitter is off.  
**(Switch. S1)** In STANDBY position, AC voltage is applied to transmitter Power supplies and power is applied to all control circuits and magnetron filaments. In "Standby" , with the filaments warming -up the triggers are inhibited. (Local mode only)

**MAIN POWER** Used to indicate the AC input voltage  
**(Meter. M1)** The nominal indication is 230 VAC.

**P/S VOLTAGE** Allows the operator to check the voltage from the  
**(Meter. M6)** power supply. Will be in the range of 1200 to 1400 VDC.

**P/S CURRENT** Gives the operator a indication of the proper operation of the  
**(Meter. M4)** Transmitter. The maximum high voltage power supply current is .8 Amps.

**FILAMENT VOLTAGE**  
**(Meter. M3)**

Let s the operator know what the voltage on the filaments are at standby and when in "RADIATE" to see if the filaments are being programmed properly. The standby voltage is 13.75 volts.

**TRANSMITTER POWER**  
**(METER M2)**

Indicates the transmitter AC voltage is "ON" and the transmitter is in Standby awaiting time-out. The nominal indication is 230VAC.

**FAULT**  
**(Indicator.DS3)**

Indicates one or more faults exist. The fault(s) will be indicated on the Control/Conditioner CCA (A4A4) and Interface Control CCA (A4A5) by edge mounted LED's

**STANDBY**  
**(Indicator. DS2)**

**Green LED:** When lit, indicates that power is applied to the transmitter control circuits and filaments.

**MAGNETRON AIRFLOW**  
**(INDICATOR, DS4)**

Indicates magnetron cooling air is restricted or the Blower has failed

**MAGNETRON AVERAGE CURRENT:**  
**(Indicator, M5)**

The Meter is a indication of average R.F. power and the meter is calibrated for 50 milliamps full scale.

**FILAMENT READY**  
**(Indicator, DS2)**

**GREEN LED** , When lit, indicates that the transmitter has completed the warm-up cycle.

**HV RADIATE -**  
**(Indicator DS5)**

When RADIATE is selected, the green HV / Radiate LED will be illuminated and the average current meter will indicate that R.F. is being emitted.

**PULSE WIDTH AND REP RATE IS SUPPLIED EXTERNALLY THROUGH THE BNC CONNECTOR. THE TRANSMITTER IS SET FOR .5 USEC TO 2 USEC PULSE WIDTH AND A REP RATE FROM 250 TO 1200 PPS.**

**RESET**  
**(Switch S2)**

Depressing the push button will clear the latched faults.

**FAULT INDICATORS:**

**TEMPERATURE -**  
**Indicator (DS11)**

**RED LED** Indicates modulator/power supply heatsinks over temperature.

**FILAMENT CURRENT -**  
**Indicator (DS8)**

**RED LED** Filaments not connected or filament supply not operating correctly.

**DUTY CYCLE -**                    **YELLOW LED** Duty cycle exceeded, (pulse  
Indicator (DS3)                    width x rep rate) and pulses are being  
dropped. ( Warning Only)

**POWER SUPPLY OVER CURRENT -**   **RED LED** Indicates  
Indicator (DS4)                            the DC to DC converters has exceeded it  
rated output current.

**(THIS FAULT IS LATCHED)**

**LOW VOLTAGE POWER SUPPLY -**        **RED LED** indicate one or more of  
Indicator (DS10)                        the voltages are under voltage.

**MAGNETRON PEAK CURRENT -**    **RED LED** Indicates the peak  
Indicator (DS5)                        current has exceeded 33 amps for two  
pulses in a row.

**(THIS FAULT IS LATCHED)**

## **CONNECTORS**

**TB3 MAIN POWER**            Screw Terminal Block. Receives 230 VAC and out put Load.

**J2 INTERFACE CONNECTOR**

**J3 COMMAND PULSE**

**J4 MAGNETRON CURRENT SAMPLE**

**WAVEGUIDE**                    WR- 112 Waveguide flange. Will have a gasket and FLANGE  
protective cover for shipping and storage.

## **4-3. OPERATING PROCEDURES**

To operate the emitter, proceed as follows;

1. Air flow is important for proper cooling, make sure that the intake and exhaust outlets have no obstructions.
2. Check to be sure that RF power output Waveguide is properly connected . Check to be sure that all transmitter power and I/O cables are properly connected to the host system.
3. Refer to fig 4.1 On the transmitter control panel, turn " ON " the power with CB1 and be sure (OFF/SAFE/HV RADIATE) to (SAFE) position.

4. Set OFF/STANDBY switch to STANDBY position. The STANDBY indicator on the transmitter control panel should be lit and the internal cooling fans should operate.
5. Set the RF frequency adjustment on the magnetron for the desired output frequency .

**NOTE:**

**THE TRANSMITTER WARM-UP CYCLE TAKES APPROXIMATELY  
5 MINUTES. WHEN THE WARM-UP CYCLE IS COMPLETE, THE FILAMENT/  
READY INDICATOR WILL BE LIT.**

6. Set OFF/SAFE/RADIATE switch to HV/RADIATE position and observe the magnetron average current. The Average current meter will indicate the average R.F. Power.

**SECTION 5**  
**MAINTENANCE**

**5-1. INTRODUCTION**

This section contains periodic maintenance, test and trouble analysis procedures for the Solid State Transmitter located in the Baron Radar System. It also contains a description of test equipment required to perform the identified tasks.

**5-2. PERIODIC MAINTENANCE**

Periodic maintenance requirements and the intervals at which the tasks should be performed. are listed in Table 5-1

**CAUTION**  
**WEAR PROPER EYE PROTECTION TO AVOID EYE**  
**INJURY WHEN USING COMPRESSED AIR**  
**TABLE 5-1. PERIODIC MAINTENANCE**

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<b>TASK</b>	<b>INTERVAL</b>	<b>ACTION</b>
Clean magnetron cooling fins, Cathode Stem	6 Months	
Power and Pulse Width Check	As required	Check power and pulse width per paragraph 5-4.

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**WARNING**

**INTERNAL VOLTAGES MAY CAUSE SEVERE SHOCK OR DEATH.**  
**USE CAUTION AND AVOID CONTACT WITH ENERGIZED COMPONENTS.**

**CAUTION**

**INTERNAL VOLTAGES MAY ALSO CAUSE ARCING AND BURNS.**  
**REMOVE ALL JEWELRY WHICH MAY CAUSE SHOCK OR HAZARDS.**

### **5-3. INSPECTION AND CLEANING**

Inspection and cleaning should be performed every six (6) months. If the transmitter is operated in a severe dust environment, perform inspection and cleaning more often.

**MAKE SURE THE CIRCUIT BREAKER IS OFF AND THE OFF/SAFE/HV RADIATE SWITCH IS IN THE SAFE POSISTION**

Remove covers as necessary so cooling fans and interior of transmitter can be inspected for dirt and dust. Inspect and if necessary, clean the fan blades. If dust and dirt are allowed to accumulate, the cooling efficiency may be diminished.

Using either compressed air or a brush with soft bristles, loosen and remove accumulated dust and dirt from the air vents (if added) and fan blades.

After completion of inspection and cleaning, return the "Off/Safe/HV Radiate" and "Off/Standby switches to the "OFF" position.

### **5-4. POWER AND PULSE WIDTH OUTPUT CHECK**

To check the transmitter RF power output and/or pulse width, the following equipment and procedures are recommended:

1. Connect appropriate test equipment to external RF MONITOR connector. Use any combination of the following test equipment available to monitor the RF output.
  - a. Spectrum analyzer
  - b. RF Crystal detector and Oscilloscope.
  - c. Peak Power Meter.
2. Generate required PRF and pulse width
3. Activate Transmitter and select LOCAL/RADIATE modes of operation.
4. Check power and if necessary adjust the H.V. is set for the flattest response on the Detected .RF. at the 2.0 usec setting.



## 5.5 REMOVAL OF MODULES

### Procedure #1 - Standby Power Supply Low Voltage Monitor (Removal)

1. Remove 4 mounting screws on A2.
2. Loosen 2 captive screws on A2J1.

### Procedure #2 - DC-DC Converter A5 (Removal)

1. Loosen 2 captive screws on assembly's J1.
2. Remove 4 mounting screws from underside of drawer.
3. Disconnect black and white output cables from TB2.

### Procedure #3 - Modulator Assembly A6 Removal

1. Remove 4 mounting screws underneath shelf.
2. Disconnect black and white high voltage cables.
3. Disconnect J1 and P1 from module.
4. Remove 6 screws on upper and lower interconnecting bars to oil can.

### Procedure #4 - Filament P/S A3 (Removal)

1. Loosen 2 captive screws on A6 J1.
2. Remove 4 mounting screws on power supply brackets.

### Procedure #5- Low Voltage Power Supply A4A2 (Removal)

1. Remove card cage cover panel.
2. Loosen 2 captive screws on A5J1.
3. Remove 4 screws on A5 module.

### Procedure #6- 28Volts and Bias Power Supply A2 (Removal)

1. Loosen 2 captive screws on A4J1.
2. Remove 12 screws on both power supply modules.
3. Wipe terminal compound off yourself.

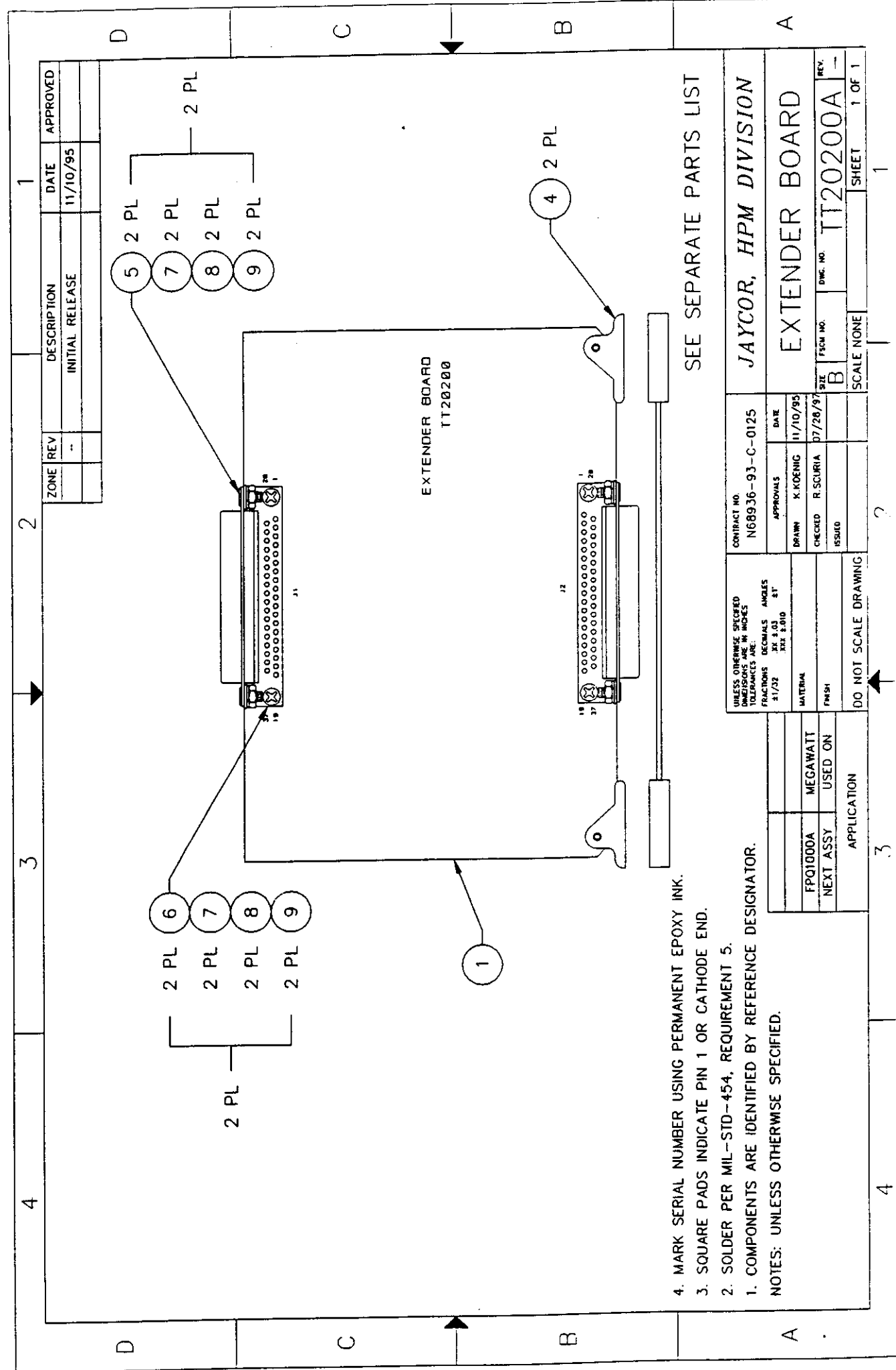
### Procedure #7- Magnetron (Removal)

1. Remove 2 screws on magnetron return cable strap.
2. Remove J1 and J2 from the oil can. (Fig. 1, Ref. 2)
3. Remove 8 screws on the magnetron output flange.

**CAUTION: Be sure the high voltage lead labeled "Filament" is on the magnetron filament lead!**

**CAUTION: Be sure to tighten the magnetron plate screws  
or the contact resistance to ground for the magnetron can cause problems**

1. Connect the magnetron return braid with 2 screws
2. Connect P1 and P2 to the oil can.



SEE SEPARATE PARTS LIST

CONTRACT NO. N68936-93-C-0125		DATE 11/10/95	
APPROVALS DRAWN K. KODENIG		CHECKED R. SCURIA	
ISSUED		SCALE NONE	
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES ±1/32 .XX ±.03 ±1° XXX ±.010		MATERIAL FINISH	
DO NOT SCALE DRAWING		SHEET 1 OF 1	
APPLICATION		REV. TT20200A	
FP01000A MEGAWATT		DWC. NO. TT20200A	
NEXT ASSY USED ON		SITE B	
APPLICATION		SCALE NONE	

4. MARK SERIAL NUMBER USING PERMANENT EPOXY INK.
  3. SQUARE PADS INDICATE PIN 1 OR CATHODE END.
  2. SOLDER PER MIL-STD-454, REQUIREMENT 5.
  1. COMPONENTS ARE IDENTIFIED BY REFERENCE DESIGNATOR.
- NOTES: UNLESS OTHERWISE SPECIFIED.

ZONE	REV	DESCRIPTION	DATE	APPROVED
	--	INITIAL RELEASE	11/10/95	