

7.0 SCHEMATIC AND ASSEMBLY LIST

3233343	C-Band Klystron Amplifier MX9000 Interconnect Schematic
MX9000-000	Common Parts Klystron Amplifier
MX9000-1xx	Component Layout Options
32D3292	Primary Control & Distribution Drawer
D30200-40x	Primary Control & Distribution Drawer
32C3295	Solid State Relay CCA Schematic
C16799-100	Solid State Relay CCA
32D3291	Beam Power Supply Interconnect Schematic
D30200-20x	Beam Power Supply Assembly
32D3298	Filament Power Supply Interconnect Schematic
D30200-10x	Filament Power Supply Assembly
32C3302	Filament Current Sense CCA Schematic
D16801	Filament Current Sense CCA
32D1925	EMR Control PCB Schematic
C16455	EMR Control PCB Assembly
32C2936	Filament Power Supply Schematic
32C3289	Beam & Body Buffer CCA Schematic
C16798	Beam & Body Buffer CCA
32C2475	Arc Detector PCB Schematic
D16494-100	Arc Detector PCB Assembly
C16315-002	Circulator Fault PCB Assembly
D30200-004	Auxillary Plate Assembly

Table 18 - Control PCB Potentiometer Functions

POT	LOCATION	FUNCTION
A1PS1R1	PS1 in the cabinet	PS1 +15V Regulation Level Adjustment
A1A1R16	C16455	EMR Lower Window limit
A1A1R17	C16455	EMR Upper Window limit
A1A1R18	C16455	EMR Beam Voltage Set level
A1A2R3	C16798	Beam Current (AI08) Analog Status Trim
A1A2R7	C16798	Body Current (AI10) Analog Status Gain
A1A2R14	C16798	Beam Current (AI08) Analog Status Gain
A1A2R8	C16798	Beam Voltage (AI11) Analog Status Trim
A1A3R5	C16315-002	RF Overdrive Fault Threshold
A1A4R2	D16494-100	Q1 Threshold
A1A4R7	D16494-100	U4A Threshold
A1A4R8	D16494-100	Q2 Threshold
A1A4R12	D16494-100	U4B Threshold
A2A3R1	D16763*	Tube Drive Power (AIOO) Analog Status gain
A2A3R2	D16763*	RF Forward Power (AI01) Analog Status gain
A2A3R3	D16763*	RF Reflected Power (AI02) Analog Status gain
A2A3R4	D16763*	AI03 Analog Status gain - NOT USED
A2A3R5	D16763*	Analog Output reference voltage (top of scale)
A2A3R7	D16763*	Attenuator Drive (AO00) Analog Output Offset
A2A3R8	D16763*	AO01 Analog Output Offset - NOT USED
A2R1	CLM back panel*	LCD contrast
A3PS1R1	PS1 of PCD	PS1 +5 V Regulation Level Adjustment
A5A1R3	D16801	Filament Current (AI05) Analog Status Gain
A5A1R9	D16801	Filament Under Voltage Threshold
* SEE 38A1593 - APPENDIX ?.		

FAULT INDICATION PRESENT	REFERENCE SCHEMATIC	POTENTIAL PROBLEM AREA	DIAGNOSTIC AREA
24. Tube Overdrive fault	32E3343 32C3241 32D3198	Solid State Amplifier Analog scale Control & Logic Module	<ol style="list-style-type: none"> 1. Check MX9000 RF drive input. 2. Check trip level, FP25 of Table 7. 3. Check scale setting, FP33 of Table 7 4. Check attenuator setting & operation. 5. Check the SSA RF output. 6. Check AI00 circuitry on D16763.
25. RF low alarm	32E3343 32D3291 32C3241 32D3198	Klystron Tube Solid State Amplifiers Beam Power Supply Voltage SSA power Supply RF Inhibited RF FWD PWR scale Control & Logic Module	<ol style="list-style-type: none"> 1. Check RF Low trip level, FP23 of Table 7. 2. RF FWD PWR scale setting, FP34 of Table 7. 3. Check attenuator setting & operation. 4. See if the SSA is producing RF output. 5. See if the SSA is receiving RF input signal. 6. Check +15V to SSA. 7. Check RF plumbing from MX9000 input to tube input. 8. Check Beam P.S. 9. Check for RF INHB on front panel 10. Check RF Inhibit drive circuitry and AI01 circuitry on D16763.
26. RF High alarm	32E3343 32C3241 32D3198	Solid State Amplifier RF FWD PWR scale Control & Logic Module	<ol style="list-style-type: none"> 1. Check MX9000 RF drive input. 2. Check RF High trip level, FP24 of Table 7. 3. RF FWD PWR scale setting, FP34 of Table 7. 4. Check attenuator setting & operation. 5. Check SSA RF output. 6. Check AI01 circuitry on D16763.
27. Normal power out indication but no IPA power out registered.	32E3343	Solid State Amplifier	<ol style="list-style-type: none"> 1. Defective monitor port on SSA.
28. Waveguide Pressure fault	32E3343	User circuitry Control & Logic Module Interconnect harness	<ol style="list-style-type: none"> 1. Check circuit external to MX9000. 2. Check operation on D16763. 3. Check wiring from J6 pins 5 & 6.
29. External Interlock fault	32E3343	User circuitry Control & Logic Module Interconnect harness	<ol style="list-style-type: none"> 1. Check circuit external to MX9000. 2. Check operation on D16763. 3. Check wiring from J6 pins 3 & 4.
30. Exciter Alarm	32E3343	User circuitry Control & Logic Module Interconnect harness	<ol style="list-style-type: none"> 1. Check circuit external to MX9000. 2. Check operation on D16763. 3. Check wiring from J7 pin 6.

FAULT INDICATION PRESENT	REFERENCE SCHEMATIC	POTENTIAL PROBLEM AREA	DIAGNOSTIC AREA
13. Constant Waveguide Arc or Arc Test Failed fault.	32E3343 32C2475 32C3241 32D3198	Control & Logic Module Arc Detector	<ol style="list-style-type: none"> 1. Determine presence of 15 V at Arc Detector PCB. 2. Determine 20 ms fault output pulse on Arc Detector during Fault Test. 3. Check Arc Detector input on D16763. 4.* Reset potentiometer on Arc Detector PCB. 5. Check operation on D16763. 6. Check fiber-optic cables.
* Step 4 requires verification of Arc Detector performance and should be attempted only after all other probable causes have been rigorously verified. Incorrect settings allow the tube to be damaged by a waveguide arc.			
14. Constant filament fault.	32E3343 32C3298 32C3302 32C3241 32D3198	Tube failed AC to Filament P.S. Control Logic Module Fault Sensor Filament	<ol style="list-style-type: none"> 1. Determine proper filament operation status. 2. Check AC voltage to filament power supply. 3. Check operation of filament fault sense board D16801. 4. Check Filament fault input on D16763.
15. Body Current trip level exceeded.	32E3343 32C3241 32D3198 32D3291 32C3289	Beam Supply Tube Arc Tube tuning Beam & Body Buffer CCA Analog Scale (FP43) Control Logic Module	<ol style="list-style-type: none"> 1. Check RF Drive level. 2. Check voltage of Beam Supply. 3. Disconnect the tube and run into resistor load. 4. Check trip level, FP08 of Table 7. 5. Check tube tuning/swept response. 6. Check scale, FP43 of Table 7. 7. Check operation of C16798. 8. Check AI10 operation on D16763.
16. Beam Current Trip level exceeded.	32E3343 32C3241 32D3198 32D3291 32C3289	Beam Supply Tube Arc Beam & Body Buffer CCA Analog Scale (FP41) Control Logic Module	<ol style="list-style-type: none"> 1. Check RF Drive level. 2. Check voltage of Beam Supply. 3. Disconnect the tube and run into resistor load. 4. Check trip level, FP07 of Table 7. 5. Check AI08 operation on D16763. 6. Check scale, FP41 of Table 7. 7. Check operation of C16798.
17. RF Reflected power trip level exceeded.	32E3343 32C3241 32D3198	RF Load Waveguide Assembly RF Sensor Analog Scale (FP35) Control Logic Module	<ol style="list-style-type: none"> 1. Check VSWR of RF Load. 2. Check RF connections. 3. Check RF sensor for excessive output. 4. Check trip level, FP26 of Table 7. 5. Check AI02 operation on D16763. 6. Check scale, FP35 of Table 7.

Table 17 - Troubleshooting Guide

FAULT INDICATION PRESENT	REFERENCE SCHEMATIC	POTENTIAL PROBLEM AREA	DIAGNOSTIC AREA
1. No indication of primary power.	32E3343 32D3292 D30200-401 D30200-402	Primary Power Input Power Control & Distribution drawer	1. No primary power being delivered. 2. Circuit Breaker (System Power) is open. 3. Connection at A3FL1 not secure.
2. Indication of primary power on beam supply. No power supply LEDs illuminate on the CLM.	32E3343 32D3292 D30200-401 D30200-402	A3PS1 Power Supply Open CLM power con	1. Check A3PS1 operation in the PCD. 2. Check P1 & P6 of the harness (32E3343).
3. No standby indication.	32E3343 32B3254	Control & Logic Module	1. Check for presence of faults. 2. Check for failed LED.
4. Logic failed to go into Transmit.	32E3343 32C3241 30D2554 32D3197	Control & Logic Module Presence of Fault	1. Check for presence of system faults. 2. Be sure MX9000 is in Local. 3. Check Membrane panel. 4. Check operation of U13 & U14 on D16762.
5. Transmit activated but no voltage.	32D3292 D30200-401 D30200-402 32C3295 32C3241 32D3198	PCD wiring Solid State Relay CCA Beam Supply Contactor	1. Ensure that 15V is present on beam relay input. 2. Determine if return leg on beam relay is switched to return. 3. See if beam on relay on C16799 activates. 4. Check three phase AC to Beam Power Supply.
6. Transmit activated. Beam voltage higher than normal. No beam current indication.	32E3343 32D3291 32C3289 32C3298	Beam Supply Klystron Tube Beam & Body Buffer CCA Filament Power Supply Analog scale (FP44)	1. No high voltage to the tube, open wire? 2. Check for normal filament current. 3. Check operation of C16798. 4. Check FP44 value, see Table 7.

ITEM NO	QTY	DESCRIPTION	MANUFACTURER & MODEL NUMBER
1	1	Fluke DVM	Fluke 25
2	1	Precision Divider	Fluke 80E
3	1	Power Supply	10V DC @ 2A Adjustment
4	1	Resistor	1 ohm 5W Precision
5	1	HV (collector) Load, 8k ohm @ 8000W	MCL, C30074-707
6	1	Parallel Interface Test Fixture	MCL TD30200-707
7	1	Network Analyzer	HP 8722A
8	1	Power Meter	HP438A w/8481A
9	1	WR137 Calibrated Bidirectional Coupler	Waveline 474-40
10	1	Dummy Load, WIG	MCL 27C1469
11	2	Coaxial Isolator	MCL 27C1447
12	1	Think-Jet Printer	HP 2225A
13	1	Coaxial Directional Coupler	27C1771
14	1	10 dB PAD	Wheinchel 210-10
15	1	20 dB PAD	Wheinchel 210-20
16	1	Clamp-On Current Meter	Bell #GC-100D
17	1	Klystron Filament Load (3.552)	Ohmite #PFE5K3R50

REF #	PARAMETER NAME	SCREEN	CURRENT SETTING
FP09	Change Flag Delta %	Auto PWR & Chng Flag Set-Up	
FP16	Filament Delay	System Timing Set-Up	
FP18	HV Inrush Time	System Timing Set-Up	
FP19	Class IV Fault Enable Delay	System Timing Set-Up	
FP20	Filament Foldback Time	System Timing Set-Up	
FP28	Blower Inrush Delay Time	System Timing Set-Up	
FP32	Security Code (777 is the default)	System Timing Set-Up	
FP21	RF HIGH Alarm Inhibit RF?	RF Parameter Set-Up	
FP22	RF LOW Alarm Inhibit RF?	RF Parameter Set-Up	
FP23	RF LOW Alarm Trip Level	RF Parameter Set-Up	
FP24	RF HIGH Alarm Trip Level	RF Parameter Set-Up	
FP25	Tube Over Drive Fault Level	RF Parameter Set-Up	
FP26	RF Reflected Power Trip Level	RF Parameter Set-Up	
FP33	Tube Drive Power Full Scale Value	Analog Scale Set-Up	
FP34	RF Forward Power Full Scale Value	Analog Scale Set-Up	
FP35	RF Reflected Power Full Scale Value	Analog Scale Set-Up	
FP38	Filament Current Full Scale Value	Analog Scale Set-Up	
FP41	Beam Current Full Scale Value	Analog Scale Set-Up	
FP43	Body Current Full Scale Value	Analog Scale Set-Up	
FP44	Beam Voltage Full Scale Value	Analog Scale Set-Up	
FP10	Beam Over Voltage Trip Level	Beam Power Supply Set-Up	
FP07	Beam Over Cur Trip Lvl	Beam Power Supply Set-Up	
FP08	Body Over Cur Trip Lvl	Beam Power Supply Set-Up	
FP12	Beam Low Control Enable	Beam Power Supply Set-Up	
FP49	Auto Switching On?	Switchover Set-Up	

During this procedure you will have to lay the CLM front-panel face-down on a protective surface that will not scratch it.

1. Put the **MX9000** into Standby and let it cool-down while you record all Field Modifiable Parameters in **Table 14**. Also record the communications address and baud rate from the **MAIN/MORE** screen.
2. Turn off the **MX9000** Main power switch then turn all AC power off to the **MX9000** at the wall breaker.

WARNING

The AC supply to the MX9000 must be turned off at this time, as the main AC on circuit is always live even when the main AC power switch is off?

3. Open the **MX9000** cabinet door, and turn the top two ¼ -turn screws to allow the CLM to swing down.
4. Disconnect the wires to the Main AC Power switch (first be sure they are marked as to where they connect). Using a flat blade screwdriver pop the back of the Emergency-Off switch off (put the blade of the screwdriver in the red tab on the back of the switch and lift the tab until the back pops off).
5. Disconnect all harness connectors from the back of the CLM (first be sure they are marked as to where they connect).
6. Remove the CLM from the **MX9000** by turning the bottom two ¼ -turn screws. Place the CLM on a bench then remove the lid.

CAUTION

Be careful not to scratch the LCD lenses in the membrane panel!

7. Remove the six nuts which hold the CLM chassis to the front panel. See D20107-250 included in the back of Appendix ?, *O&M Manual for MX9000 CLM*, to aid in disassembly of the CLM. Separate the chassis from the front panel (without putting stress on the interconnecting cables), lay the front panel face-down on a protective surface so that it does not get scratched. Disconnect the four interconnecting cables between the front panel and the **D16762** Local Interface CCA.

CAUTION

While tuning, Cavity #4 MUST always remain tuned above the center frequency. Otherwise the Body Current may rise beyond a safe level!

7. Body Current may rise above safe levels during some tuning conditions at large RF drive levels, so it is safer to perform retuning at low levels of RF drive power until a reasonably wide and flat response has been attained while observing the swept output power response on the oscilloscope.

Re-adjust each of the five cavities by inserting the Allen wrench tool successively into each of the five small holes located in a vertical line between the tuner control shafts until the wrench seats itself firmly in the socket head of the screw lying under each hole.

If the cavity frequency is being increased:

Turning the wrench in a clockwise direction will increase the resonant frequency of that cavity being tuned. Start the adjustment with cavity #4, then adjust cavities #2, #3, #1, and #5, respectively.

If the cavity frequency is being decreased:

Turning the wrench in a counter-clockwise rotation will decrease the resonant frequency of that cavity being tuned. Start the adjustment with #1, then adjust #2, #3, and #5, respectively, and adjust cavity #4 last.

The tuning rate of all the cavities is approximately the same. Each cavity should be adjusted by the same amount and, of course, in the same direction. The **tuning** rate is approximately 100 MHz/turn.

NOTE

ALWAYS end each tuning operation on each cavity in a COUNTER-CLOCKWISE direction to assure repeatability.

3. Rotate the TUNE knob in either direction until the desired channel is reached. A detent will automatically locate the new position. (Each channel position is marked by a number which appears in a window above the tune knob. A decal on the tube marks what frequency each channel has been factory tuned to.)
4. Rotate the Lock-Unlock knob in the reverse direction from step 2 until it stops.
5. Restore RF drive at the new frequency.

5.9.2 Klystron Channel Retuning

When field-retuning the tube, it will generally be a simpler and easier job if the nearest factory-tuned channel is used.

The following tools and test equipment are suggested for retuning:

1. Frequency-sweeping, single source with an output power of **+10dB**
2. Oscilloscope
3. Broadband microwave detector
4. Low-pass filter
5. Allen wrench, 1/16 inch across flats x 1-3/4 inch minimum length (one wrench supplied with each tube)
6. Frequency standard
7. RF Power Meter
8. Scalar network analyzer, or a crystal detector and oscilloscope

Set-up the equipment as follows:

1. Be sure the Body current trip (FP08) is set at or below 30 mA.
2. The tubes **Lock/Unlock** mechanism is fully locked.
3. Be sure the maximum input ratings of the test equipment cannot be exceeded.
4. Be sure the maximum input rating of the **MX9000** cannot be exceeded.
5. Be sure that you can not exceed the rated output power of the **MX9000**.

5.8 Removal/Disassembly/Replacement

5.8.1 Klystron Tube Replacement

The Klystron tube manufacturer rates the tube life of the C-band Klystron tube at a minimum of 25,000 hours. A more typical value seems to be 55,000 hours, which implies that tube replacement would be required on a maintenance basis approximately every 3.0 years operation in a given continuous mode. In order to remove the 3 kW Klystron tube, the following steps should be taken in the order given:

1. Remove RF input drive and place unit in Standby. Allow to cool for 5 minutes.
2. Switch off the Main AC power switch.
3. Remove AC input power to the amplifier system.
4. Open system door. Remove Beam Power Supply safety cover and Filament Pan front cover. Remove upper rear panel and left side panel.
5. Disconnect the exhaust hose from the tube collector and move the hose out of the way.
6. Loosen the hose clamps at the blower exhaust and the Air Plenum inlet. Disconnect hose.
7. Disconnect semi-rigid coax cable from Klystron tube input connector.
8. Disconnect output waveguide at tube waveguide flange.
9. Disconnect grounding strap between Filament Pan and waveguide support shelf and harnessing to the Air Pressure Sense assembly and Beam and Body Monitor circuit card assembly.
10. Unfasten the 1/4 turn captive fasteners at rear of Filament Pan that connects it to the waveguide support shelf.
11. Slowly pull the Filament Pan assembly forward while checking for snagged wires and mechanical interferences.
12. Remove the Air Plenum and then the brackets.
13. Disconnect the wires attached to the terminal block at the front of the Klystron tube on the tuning mechanism.
14. Disconnect, after carefully noting the attachment points, the Klystron tube filament and cathode high voltage wires.

5.0 PREVENTIVE MAINTENANCE

The Klystron amplifier system should be inspected on a three month basis for dust and dirt accumulation. This is especially important in any area operating at high voltage. All evidence of dust **and/or** dirt should be removed during the inspection process.

When the system has been shut off for any length of time, an inspection for moisture accumulation and water buildup in the interior of the cabinet should be performed before any attempt is made to activate the system.

CAUTION

Do not operate this system when excessive moisture is present in the interior.

The following guides are offered to aid in the event troubleshooting becomes necessary, and for routine preventive maintenance.

5.1 Air Intake Filter Screen

The filter should be cleaned after every 500 hours of operation, or more frequently as determined by local environmental conditions. The air filters are removable by sliding them out of the frames on the rear panel of the system. The filters may be serviced while the system is in any mode of operation, but extreme caution should be taken to avoid upsetting system operation. Soak the filter in a soapy water solution, or in a non-volatile cleaning agent such as Freon degreaser. Do not use a strong alkali or acid. After soaking, apply a soap and water solution with a pressure spray. Rinse thoroughly after cleaning and allow to dry before reinstalling.

5.2 Panel Lamps

The panel lamps are all solid state LED lamps and should never need replacement throughout operational life of the HPA. In the event of LED failure, remove all power from the system and remove the front panel LED PCB, A2A4, from the unit. Unsolder the LED and replace, observing LED polarity. Reinstall the PCB, reapply power.

5.3 Blowers and Fans

The blowers and fans in the Klystron amplifier system are permanently lubricated bearing types and should never require oiling or greasing. It is recommended that, on a six month schedule maximum, all blowers and fans be inspected at both the intake and exhaust for any potential obstruction build-up. Pressurized air can be used to free the blowers and fans of any dirt accumulation.

46 Gain and RF Power Output

When gain is considered, it is necessary to differentiate between gain experienced when the tube (or HPA) is in the linear region and gain when it is operating in the saturated output power mode. These two values of gain are called the "Small Signal Gain" and the "Saturated Gain" respectively. A curve of RF Power Output versus RF Power Input for a typical HPA is shown in **Figure 20** the saturated power output is the peak value of the curve. Rated power output is defined as the guaranteed maximum power output and is usually slightly less (<0.5 dB) than saturated power output.

The saturated gain is defined as the saturated RF power output divided by the RF power input required to produce the saturated power output:

$$\text{Gain (Sat., dB.)} = P (\text{out, dBm}) - P (\text{in, dBm}) \quad (1)$$

The difference between HPAs and solid state amplifiers is that solid state amplifiers are typically specified in terms of their RF power output at 1 dB gain compression. As shown in **Figure 20**, the RF power output at 1 dB gain compression is less than the RF power output at saturation. For most HPAs, the saturated gain is 5 to 6 dB less than the small signal gain.

Small signal gain is typically specified as the gain when the RF power output is 10 dB or more below the saturated RF power output. The small signal gain is then defined as:

$$\text{Gain (SSG, dB.)} = P (\text{out, SSG, dBm}) - P (\text{in, SSG, dBm}) \quad (2)$$

Maximum gain for the HPA or HPA system is, of course, when all variable attenuation is at a minimum.

NOTE

The exciter output must be limited to less than or equal to 3 dB greater than the level required to drive the system to rated output power. This level can be found on a warning tag attached to the front of each unit as well as in the system test data.

4.5.3 RF Output Waveguide Assembly

The output waveguide assembly consists of an arc detector elbow (W4) which allows 2 fiber optic cables to view up and down the output cables for arcs.

The next component is a high power circulator (HY3) which protects the Klystron tube by controlling the load VSWR into the Klystron output port.

The next component is a band-pass filter (FL1).

The last component in the waveguide assembly is a three port directional coupler (DC1). Port #1 has a nominal 46 dB forward coupling factor and through (CR1) drives the Forward Power input (AI01) of the CLM. The sample is calibrated at the CLM (A2A3R2 and FP34, see **Table 7**) to correspond to the RF forward output power at the MX9000 output flange. Port #2 has a 56 dB forward nominal factor and is connected to the output monitor port on the unit's top panel. The top panel sample port is factory calibrated before shipment. Port #3 has a 39 dB reflected nominal coupling factor and through (CR2) drives the Reflected Power input (AI02) of the CLM. The sample is calibrated at the CLM (A2A3R3 and FP35, see **Table 7**) to correspond to the RF reflected output power at the MX9000 output flange.

4.5.4 D16494-100 ARC Detector PCB

The Arc Detector PCB (see 32C2475) is located on the right inside cabinet wall near the door (see **Figure 16** and D30200-004 Aux Plate Assembly print). The Arc Detector PCB is linked via fiber optic cables to the Arc Detector Waveguide Sense Elbow (see 32E3343). The Arc Detector Elbow is connected to the RF output of the Klystron tube. An arc, when generated will transmit light through a fiber optic cable back to Q1 or Q2 (which are biased slightly into cut-off via R2 and R12). When these photo-FETs are illuminated they conduct, turning U4A or U4B on, which supplies drive to U4C (see **Figure 19**). The transistor, U4C, supplies voltage to Q3 which will inhibit RF drive in under 10 microseconds. The RF inhibit signal is sent to the CLM (HDI20) through which it turns off the P.I.N. diode switch. Through U1A-7 and U5B the same signal also activates the CLM Fault input (HDI02).

The circuitry of U1B, U4D, U5C and U5D is used to test the arc sense path (ARC TEST).

The purpose of U2 is to generate -IOV for bias purposes (Q1 and Q2).

4.4.6 CLM Firmware Operation

The Firmware theory is detailed in Appendix ?, 38A1593 - *O&M Manual for MX9000 CLM*.

4.5 **RF Chain**

The RF Chain (see Figure 18 and 32E3343 page 2) consists of a SSA module, the Klystron tube, and the output waveguide assembly. The RF chain takes input power levels as low as -19 dBm and amplifies them to output levels of approximately 64 dBm.

4.5.1 SSA Pre-Amplifier

The Solid State Pre-Amplifier (SSA) is located on the right hand cabinet side wall near the Klystron tube input. This SSA supplies a RF level of up to +22 dBm with a gain of approximately 33 dBm to the Klystron tube.

The SSA has a built in PIN diode switch and attenuator which are controlled by the CLM. The PIN diode switch when activated reduces the RF drive to the Klystron tube by 30 dB minimum. The attenuator can be adjusted to as much as 30 dB of Klystron tube input power attenuation. When the attenuator drive voltage is 10V the attenuator will have 0 dB of attenuation, and 0 V will correspond to full attenuation.

The SSA has an output power monitor which sends a voltage sample to CLM analog input A100. This sample is then calibrated at the CLM (by A2A3R1 and FP33, see Table 7) to correspond to Klystron,tube drive.

A +15V DC regulated power supply (A1PS1), supplies DC power to the SSA and is located on the right hand cabinet side wall near the SSA.

4.5.2 Klystron Tube

The Klystron tube for standard C-band has a minimum gain of 40 dB at an output power of 2660W. The tube has 6, 12, or 24 channels of 45 MHz which covers the 5.850 to 6.425 GHz band.

For further information on the tube check the manufacturer's information enclosed in the tube shipping container.

The circuitry of K1, Q1, and PS1 supply power to the LCD module back light.

The circuitry of U12 and U19 is the logic power supply monitor. When the logic power supply is outside acceptable limits the corresponding LED will extinguish on the CLM control panel. The LED CCA B16785 is driven by U4 digital decoder.

The 30D2570 LCD module is driven by U10 digital decoder.

The circuitry of U5, U6, S1 through S4 is not used in this application.

4.4.3 HPA Interface CCA

This CCA contains an 80188 processor (U22), firmware (EPROM) program (U5), RAM memory (U23), and a serial data interface to the Base Board. This CCA includes digital and analog input and output interfaces to the internal HPA, User and Switchover.

The circuitry of U30, U27, and U29 is the serial interface between the CPU (U22) and the outside world.

There are sixteen analog inputs channels AI00-AI15 (see Table 12) four of which are buffered. The analog inputs are multiplexed by U36 and digitized by U13 and U3. U13 is a 12-bit analog to digital converter.

There are two analog outputs channels AO00 and AO01. The analog outputs are multiplexed and digitized by U2. U2 is a 12-bit digital to analog converter. U35A is used to invert the +10V V_{ref} out of U13 to a -10V reference for U2.

There are sixteen digital output channels HDO00-HDO15 (see Table 12). The outputs are digitally decoded by U26 and U31. Each channel is buffered by an optical-isolator. Two channels drive a relay on the output of the optical-isolator. At power-up the circuitry of Q3, U28A, and K3 will hold off the output channels until the CPU is up and has control of the output channels. The circuitry of U35C, and Q2 is used to provide a RF inhibit path from HDI22 and HDI23 to the P.I.N. diode switch through the HPA Interface CCA.

There are 24 digital Input channels HDI00-HDI23 (see Table 12). Each input is buffered by an optical-isolator then feed into U37 through U39 digital encoders.

4.4.4 Channel Changer Interface CCA

Depending on the channel changer option selected, there are two different CCAs that can perform this function. The channel changer theory is detailed in Appendix ? of this manual.

4.4.5 MXR Remote Panel

The remote panel theory is detailed in 38A1594, *O&M Manual for Klystron Remote Panel MXR*.

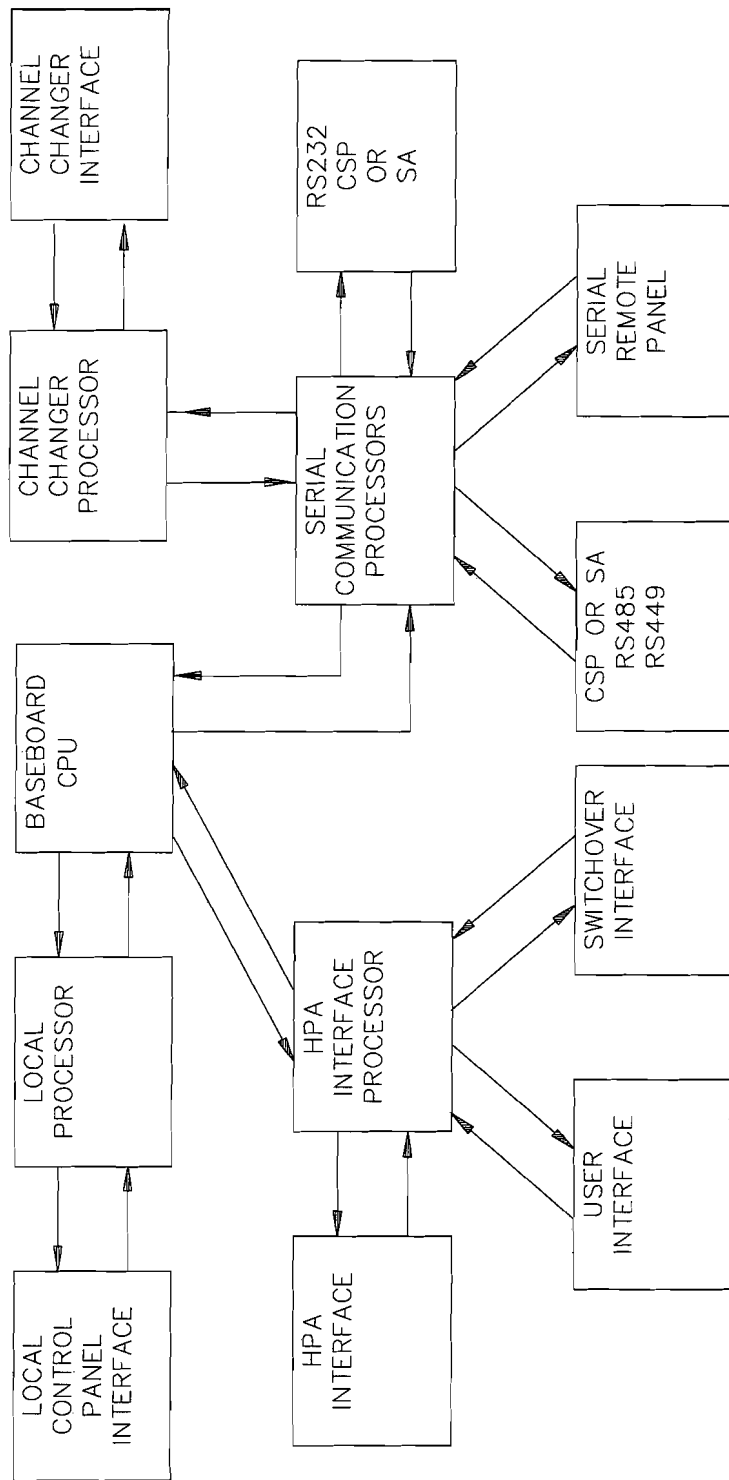


Figure 17 - MX9000 CLM Block Diagram

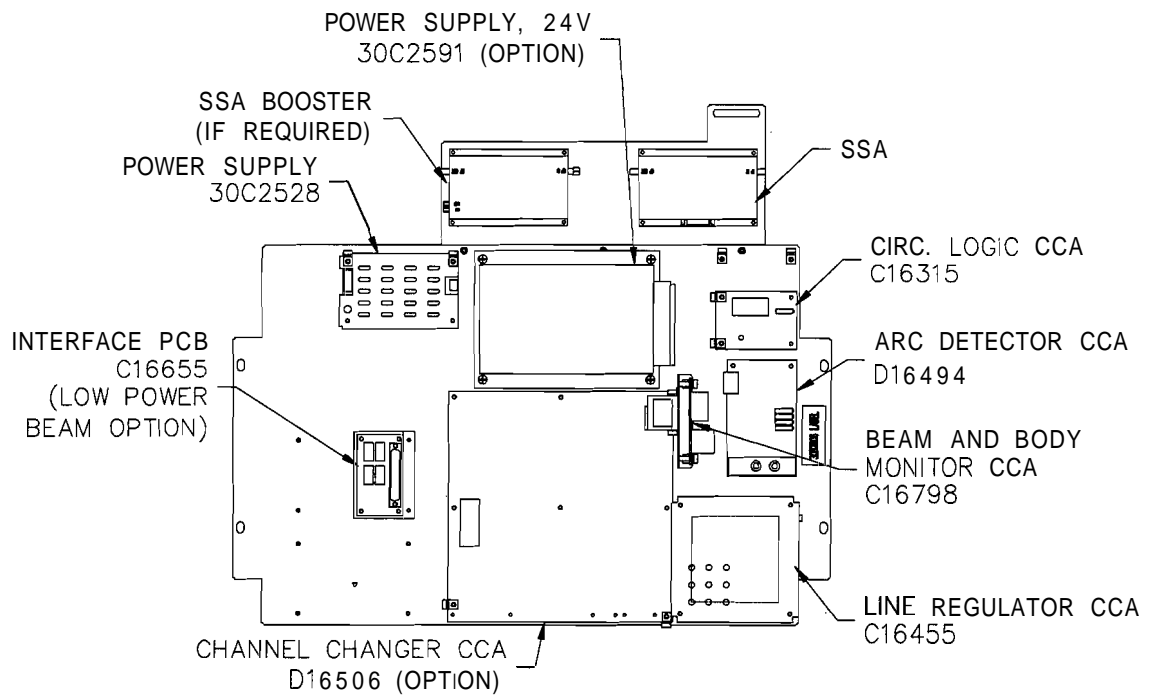


Figure 16 - Auxiliary Plate Component Location

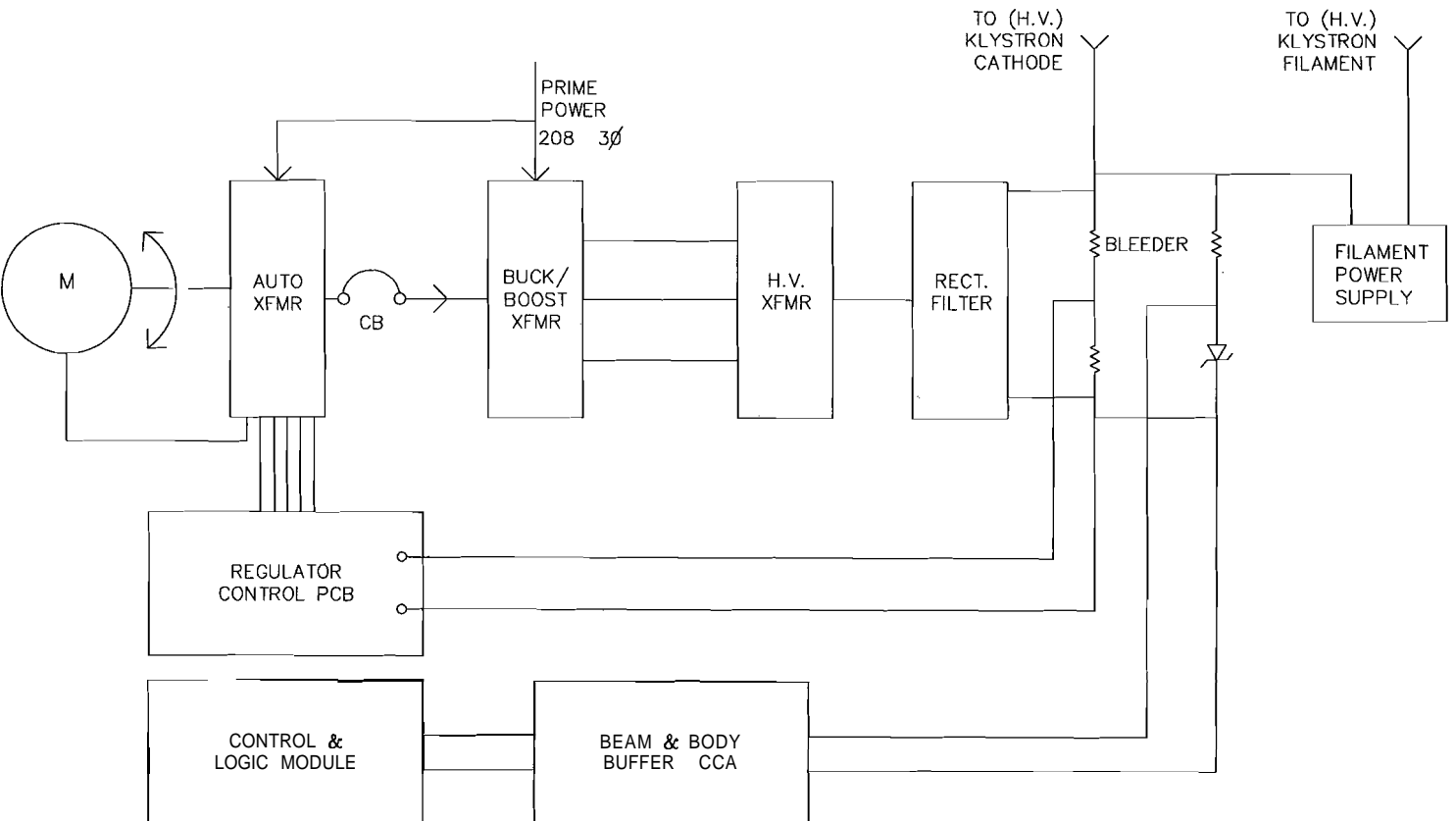


Figure 15 - EMR Block Diagram

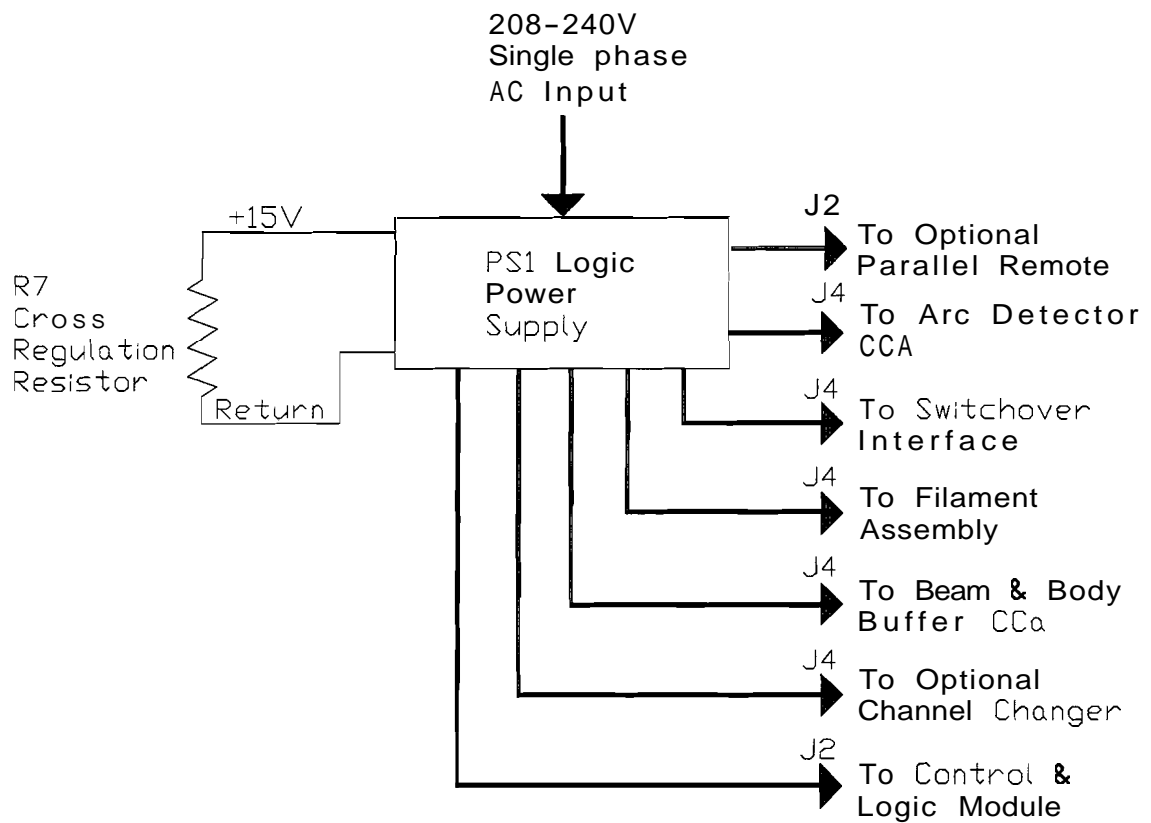


Figure 14 - Logic Power Distribution Diagram

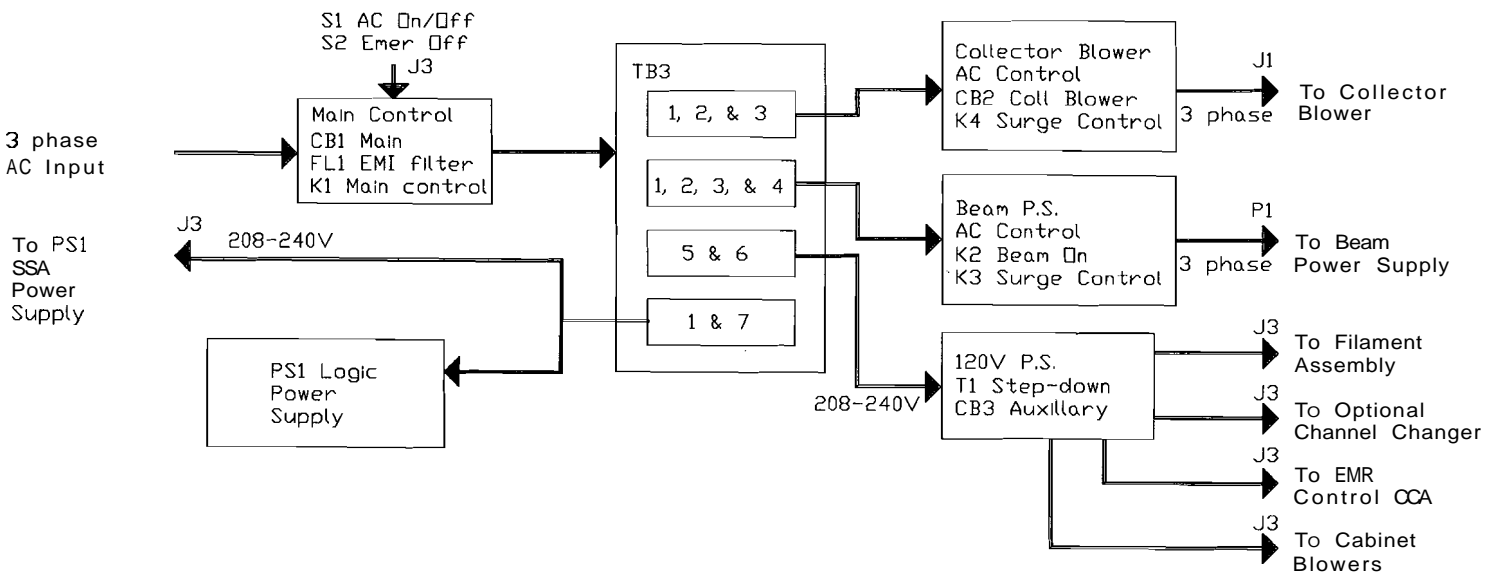


Figure 13 AC Block Diagram

3.5.2.3 Exciter Label

If the exciter has an output meter, place label over this meter showing maximum output permitted.

3.5.2.4 MX9000 Trip Levels

Go to the "RF PARAMETERS" set-up screen and set "RF H ALM TRIP LVL" to rated power out. (Do not use saturated power out for this adjustment.) Obviously, if you are using the HPA at a lower power out, continue to do so. If you do not exceed rated power out, you cannot over-drive the tube. For the RF High alarm to occur and prevent overdrive, you must Enable the function. Go to the "RF PARAMETERS" set-up screen and set "RF H ALM RF INHB" to "YES." This will actuate the ability of the pin diode switch to remove the RF drive. User adjustable RF high and RF low alarm trip points are included on the "RF PARAMETERS" set up screen. The RF low set-point must be set above 1/100th of full scale for reliable operation.

3.6 Tube Degassing

See Section 5.0 - Preventive Maintenance, for procedures to prevent excessive cathode emissions.

If spare tubes are going to remain in storage for long periods of time it is recommended that a MCL degassing station is purchased and used before installation.

3.7 Setting the Clock

To set the clock to local time from the "MAIN screen press "SET UP," then "CONT," then "SEL" until "SYSTEM TIMING," then "GOTO," then "MORE." The time set up screen ("SYSTEM TIMING SET U P) should be on the display. Notice the "SET" button. When the "SET" button is pressed the clock will be set to the date and time currently displayed in the EDIT window. EDIT the hours, minutes, and seconds to match local time (set the seconds/minutes ahead at least 30 seconds to allow you time to get ready to press the "SET" button). If required EDIT the date also. Press the "SET" button, about one second later you will see the clock change. Press "MAIN to return.

3.4 Operating Caution List

Table 9 is a list of improper operating conditions. These conditions are to be avoided. These are conditions which could damage the Klystron amplifier system, and their probable sources.

Table 9 - Operating Cautions

SYMPTOM	ORIGIN
High or Low System AC Input Power or AC Line Unbalance	a) Customer Power Source. b) Continuous system operation with circuit breakers bypassed ("cheated").
High or Low Klystron Filament Voltage or Current	a) Klystron Tube Filament Supply in Model D30200-102 Assembly. b) Continuous system operation with circuit breakers bypassed ("cheated").
High Beam Current	a) Electro-Mechanical (C16455) Regulator Failure or Misadjustment (Schematic 32C1925). b) Beam Transformer Improperly Tapped on Primary (Model D30200-20x Schematic 32D3291).
High or Low Beam Voltage	c) Continuous system operation with circuit breakers bypassed ("cheated"). d) Attempting to force unit into Transmit with fault condition present.
Excessive Tube Drive Power	Overdrive on RF System Input or HPA Gain Adjustment Set Incorrectly.
Airflow Fault	System operation with blocked air intake and exhaust ports.
Tube Temperature	a) System operation outside the specified environmental range. b) Continuous system operation with circuit breakers bypassed ("cheated").
Excessive Output Reflected Power Meter Indication	a) System Output Transmission Line Connection and Customer Waveguide/Load Incompatibility. b) Operating HPA with unterminated RF input or output ports.
Non-Indication of Fault Parameter	a) D16763 HPA Interface CCA located in the CLM. b) "Forced" operation by defeating the fault protection circuitry or control system (do not defeat fault circuitry unless specifically recommended by MCL).

12. From the "MAIN" screen "ENBL" RF. /
13. Go to the "PWR LVL" screen and press "GAIN INC" slowly and very carefully increase the system RF input drive until maximum RF Forward Power is obtained from the amplifier system while staying within the Klystron tube current and voltage limitations. Monitor the output reflected RF power to insure that the transmission line is reflecting less than 10% of the output forward power.
14. Use the "GAIN adjust control to set the system to the desired RF Forward Power level (and adjust the MX9000 system RF input drive if necessary) and then allow the system to thoroughly stabilize for no less than 5 hours.
15. Check all meter readings to insure that parameters are within operational tolerances.
16. On the "FAULT STATUS" screen press the "CLEAR LOG" button.

At all times during various activation phases, spurious faults may occur and can be immediately cleared by depressing the "Fault Reset" switch momentarily and then releasing.

This completes the procedure necessary to bring the MX9000 Klystron amplifier system into full and complete system operation. The MX9000 Klystron transmitter system is now fully operational and will stay functional until either operator shutdown or a fault condition is detected.

If problems occur during the execution of this procedure, refer to Section 6 - *Troubleshooting* for diagnostic information, and/or Appendix ?, 40A1845 - *MCL's Customer Service Department Policy Summary*.

3.2.3 Delay and Standby Analog Status

The analog status displays will read as follows during Delay and Standby while RF is Inhibited:

Meter Readings (Warm-Up and Standby Conditions):

- | | | |
|----|-------------------------------------|-----------------|
| 1. | HPA filament current | 7 A nominal |
| 2. | Tube drive power (while RF Enabled) | 175 mW maximum* |

* Depends on attenuator setting.

All other meters should not be indicating at this time (due to the high resolution A to D circuitry used, a small amount of fluctuation may be present on various analog displays).

3.2 Turn-On Procedure

3.2.1 Initial Turn-On Check List

All MCL Klystron amplifier systems are ready to be activated when the following table check list has been complied with:

1. Cabinet securely bolted in place.
2. Ground strap (earth) attached to safety ground tie point in cabinet (lower rear).
3. Appropriate 3-phase AC connected to line side of **RFI/EMI** filter on upper bracket of Klystron system cabinet.
4. AC neutral wire attached to terminal block next to **RFI/EMI** filter.
5. All waveguide flanges securely fastened together and input RF coaxial cable firmly attached.
6. All electrical connections double checked mechanically and electrically.
7. All cabinet rear panels securely attached.
8. Air intake and exhaust unobstructed and properly ducted.
9. Air shroud on Klystron tube firmly attached and connected to blower.
10. System RF input and output properly connected.
11. All drawers and assemblies securely fastened in their normal operational position.
12. The Main AC Power switch is in the OFF position, the Emergency switch is pulled out, and all circuit breakers are in their On position except CB2 collector blower.

3.2.2 Power-UP Procedure

When the above check list has been completed, the system is ready for activation. To activate the system, the following steps should be followed:

1. Check AC system voltages by measuring phase-to-phase across the PCD RFI/EMI line filter before activating the Main AC Power switch. Check K5 phase monitor in the PCD, the LED must be off. Activate the circuit breaker. After circuit breaker activation, check the voltage LEDs on the front panel to be sure the logic power supplies are operational. Press the Standby button to verify that XMT DELAY is canceled.

Table 7 - Field Modifiable Parameters (Continued)

REF #	PARAMETER NAME	SYSTEM CRITICAL	UNITS	DEFAULT	LIMITS	FUNCTIONAL DESCRIPTION
FP25	Tube Over Drive Fault Level	Y	milli-watts	180	002-999	When the tube RF drive power [AI00] rises above this level a Tube Overdrive fault and Sum Fault will occur.
FP26	RF Reflected Power Trip Level	Y	Watts	0260	0010-2000	When the RF Reflected power [AI02] rises above this level a RF Reflected fault and Sum Fault will occur.
FP27	Attenuation Level	N	dB	32.0	00.0-32.0	The current Attenuator setting for HDO00.
FP28	Blower Inrush Delay Time	Y	Seconds	05	04-20	The delay between AC power on and HD03 Disabling the blower inrush circuit.
FP31	Invert Screen Video	N	N/A	No	Yes/No	Yes is white background with blue characters. No is blue background with white characters.
FP32	Security Code	Y	N/A	777	000-999	Three digit number which must be entered to allow (unlock) adjustments of system critical parameters (column three of this Table).
FP33	Tube RF Drive Power [AI00] Full Scale Value	Y	mW	300	020-999	The value used by software to calculate the current value of AI00 status.
FP34	RF Forward Power [AI01] Full Scale Value	Y	W	03500	0100-9999	The value used by software to calculate the current value of AI01 status.
FP35	RF Reflected Power [AI02] Full Scale Value	Y	W	0300	0010-2000	The value used by software to calculate the current value of AI02 status.
FP38	Filament Current [AI05] Full Scale Value	Y	A	15.00	05.00-25.00	The value used by software to calculate the current value of AI05 status.
FP41	Beam Current [AI08] Full Scale Value	Y	A	02.00	00.01-05.00	The value used by software to calculate the current value of AI08 status.
FP43	Body Current [AI10] Full Scale Value	Y	mA	100.0	010.0-200.0	The value used by software to calculate the current value of AI10 status.
FP44	Beam Voltage [AI11] Full Scale Value	Y	V	10000	06000-20000	The value used by software to calculate the current value of AI11 status.

Table 7 - Field Modifiable Parameters

REF #	PARAMETER NAME	SYSTEM CRITICAL	UNITS	DEFAULT	LIMITS	FUNCTIONAL DESCRIPTION
FPO0	Automatic Fault Counter Window	Y	Seconds	30	5-120	After the first fault the maximum amount of time before the fault counter resets to zero. Used only if Fault Counter enabled (FP01).
FP01	Enable Fault Counter & Automatic Fault Reset	N	N/A	No	Yes/No	Y to enable automatic reset & fault counter. This will cause the CLM to attempt to automatically reset faults and put the HPA back into Transmit. N to disable automatic fault reset.
The Fault Counter window size must be set by the operator as follows: FPO0 FP02 (FP03 + FP18 + FP19 + 30 ms) OR FP02 FP00/(FP03 + FP18 + FP19 + 30 ms)						
FP02	Auto Fault Reset Retry Count	Y	N/A	02	01-10	Maximum number of times the CLM will count a fault within the window (FPO0). When this number is reached the CLM will latch a SUM Fault (HDO15) and will not attempt to put the HPA back into Transmit. Used only if Fault Counter is enabled (FP01).
FP03	Fault Counter Fault Reset Wait Time	Y	Seconds	05	01-10	Time the CLM waits from the beginning of a fault RESET command and the attempt to go back into Transmit. Used only if Fault Counter is enabled (FP01).
FP04	Auto Power Set to Level	N	Watts	0000	0000-9999	The center of the regulation window for Auto power (AO00). 0 = Auto Power Off (disabled).
FP05	Auto Power % Regulation	Y	±%	05	03-20	% of FP04 to which the CLM regulates (AO00 & AI01) the output power. Auto Power will use the larger of FP05 and FP06 as the regulation window.
FP06	Auto Power Minimum Regulation & Change Flag Delta Minimum	Y	Watts	00090	0002-1000	Used at the bottom of the scale for AI01 as the Auto Power regulation window. Auto Power (AO00 & AI01) will use the larger of FP05 and FP06 as the regulation window. The Change Flag (SA compatible communications) logic will use the larger of FP06 and FP09 as the change flag window.
FP07	Beam Over Cur Trip Level	Y	A	01.15	00.02-05.00	When AI08 exceeds this limit the CLM will generate a Beam Over Current Fault and Sum Fault.

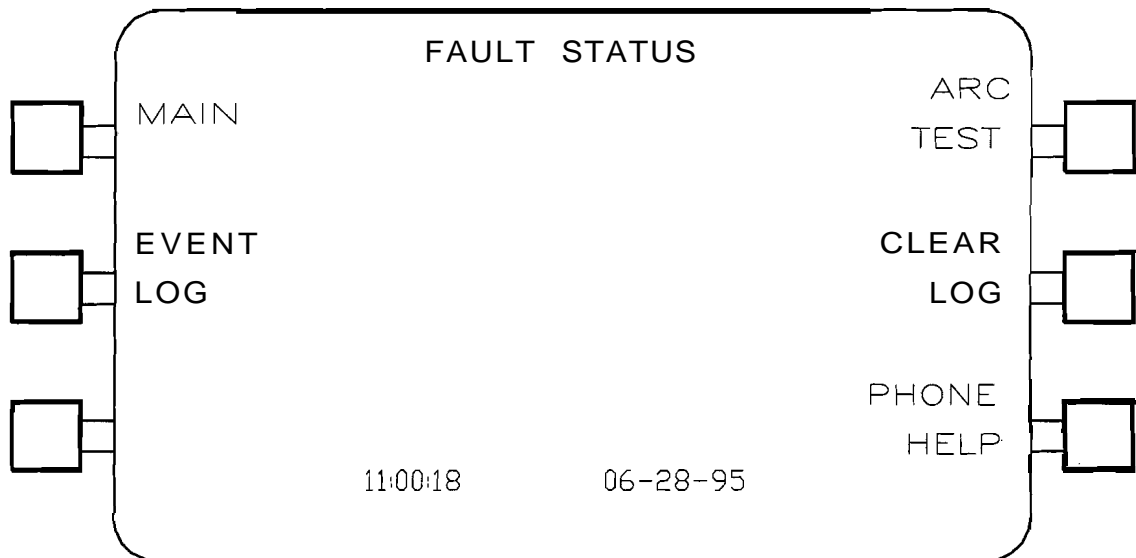


Figure 11 - Fault Status Screen

3.1.6.6 The "SET UP" Menu Screen

When the "Set up" soft key is pressed from the MAIN screen a security code screen (see **Figure 12**) will be displayed. The user must enter the correct security code to be allowed access to all system parameters. If no security code or the wrong security code is entered the operator will have access to noncritical (see the System Critical column of **Table 7**) parameters ONLY.



NOTE

The default security code is 777, this is the code which will be installed when the MX9000 leaves the factory.

The "Set up" menu is invoked by depressing the "Cont" button on the security code screen. From this menu the operator selects which group of MX9000 parameters to display. When "Goto" is pressed the screen containing the selected parameters will be displayed. Each "Set up" screen is used for setting various field modifiable parameters like the trip levels for the faults in the system. From these screens parameters such as **date**, time of day, fault levels and time delays can be adjusted to the user's specifications. See **Table 7** for a detailed list of field modifiable parameters as they are set from the factory for a typical MX9000 in this frequency band. Consult the factory before changing "System Critical" parameters as the MX9000 calibration may be changed or a wrong setting could damage the HPA.

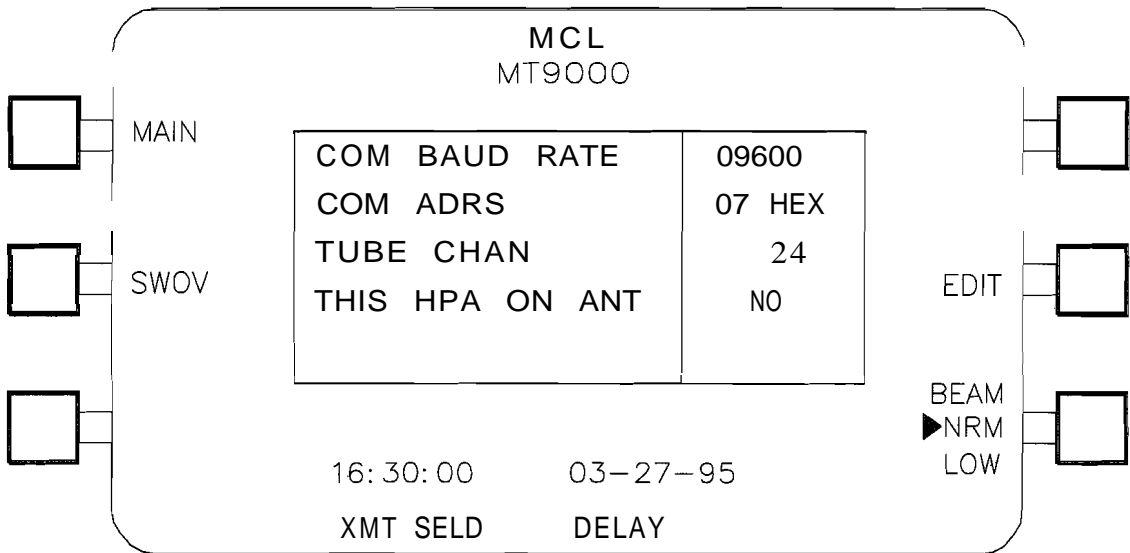
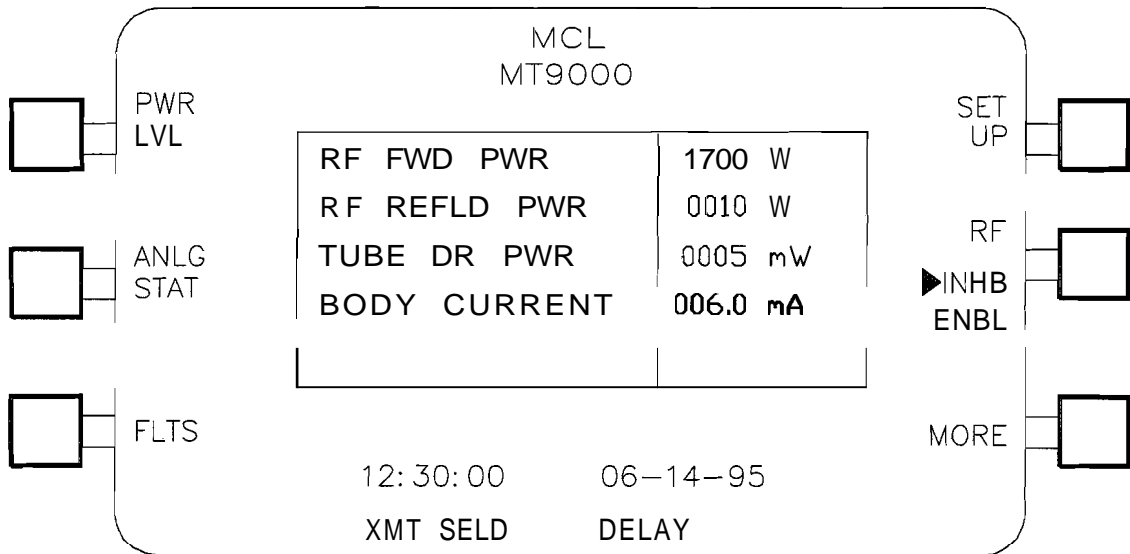


Figure 8 - Main Screen

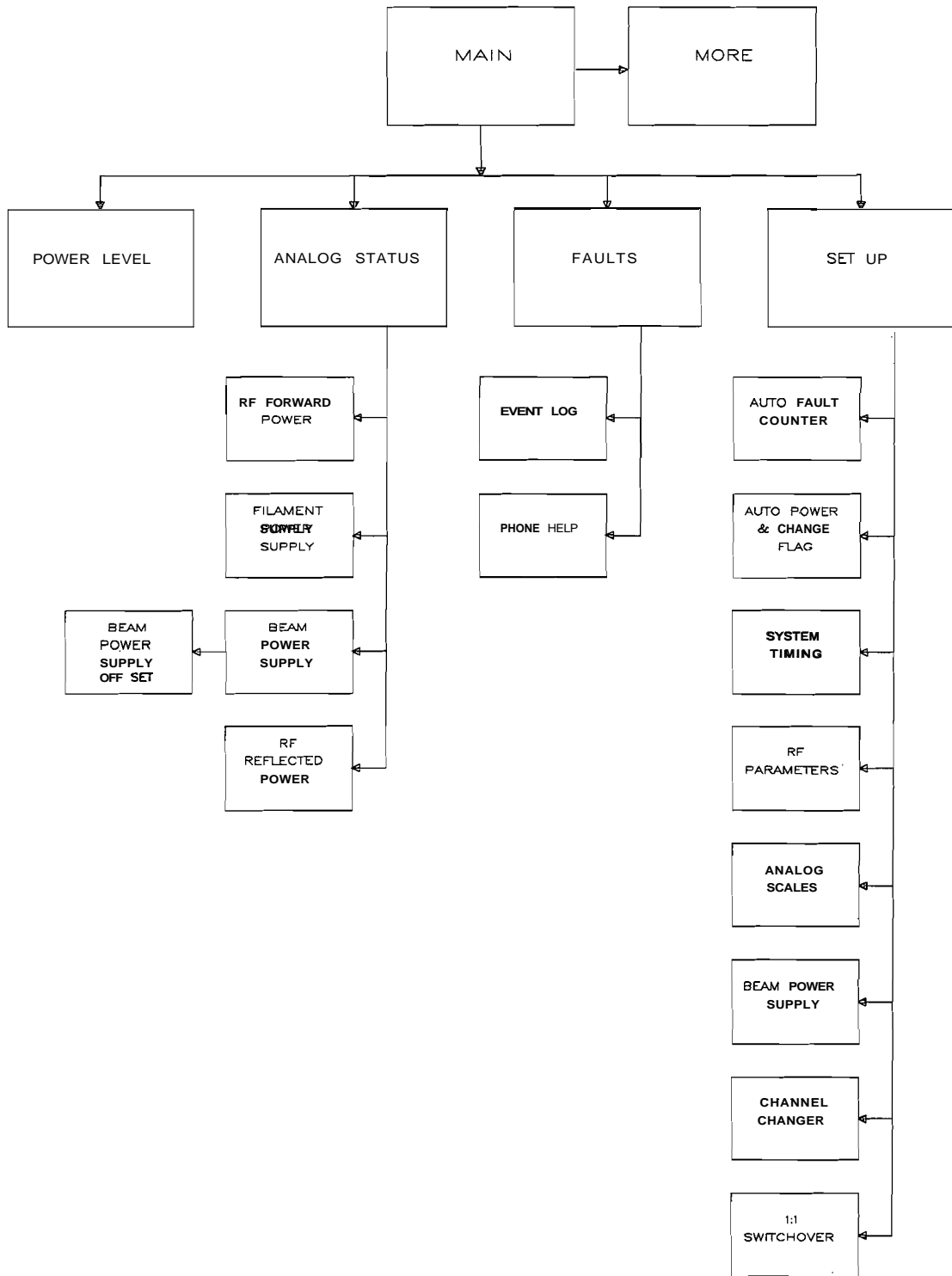


Figure 7 - CLM Screen Structure

3.1.5 Additional Status Indicators

In addition to the LEDs embedded in the above function switches there is a column of status LEDs on the right side of the CLM panel. The following LEDs are present on that column.

1. Com Tx (Green) When illuminated this LED indicates the **MX9000** is Transmitting a message on the Computer Interface.
2. Com Rx (Yellow) When illuminated this LED indicates the **MX9000** is receiving a message on the Computer Interface.
3. RF Inhibit (Yellow) When illuminated this LED indicates the **MX9000** PIN diode switch is turned on shutting off the RF flow out of the **MX9000**.
4. +5V (Green) When illuminated this LED indicates the **MX9000** +5V power supply is within acceptable limits.
5. +15V (Green) When illuminated this LED indicates the **MX9000** +15V power supply is within acceptable limits.
6. -15V (Green) When illuminated this LED indicates the **MX9000** -15V power supply is within acceptable limits.

There are also indicators on the sub-panels inside the cabinet door. These indicators are as follows:

7. Beam P/S On This indicator is a clear window located on K2 Beam Power Supply contactor (on the PCD drawer), and is labeled "1." When illuminated this LED indicates the primary side of the **MX9000** Beam Power Supply is on.
8. Primary Over I This indicator is a clear window located on K2 Beam Power Supply contactor (on the PCD drawer), and is labeled "I>>." When illuminated this LED indicates the primary side current of the **MX9000** Beam Power Supply has exceeded the maximum allowable current.
9. HV On This indicator is a red neon bulb located on the Beam Power Supply. When illuminated it indicates the primary side of the **MX9000** Beam Power Supply is on.

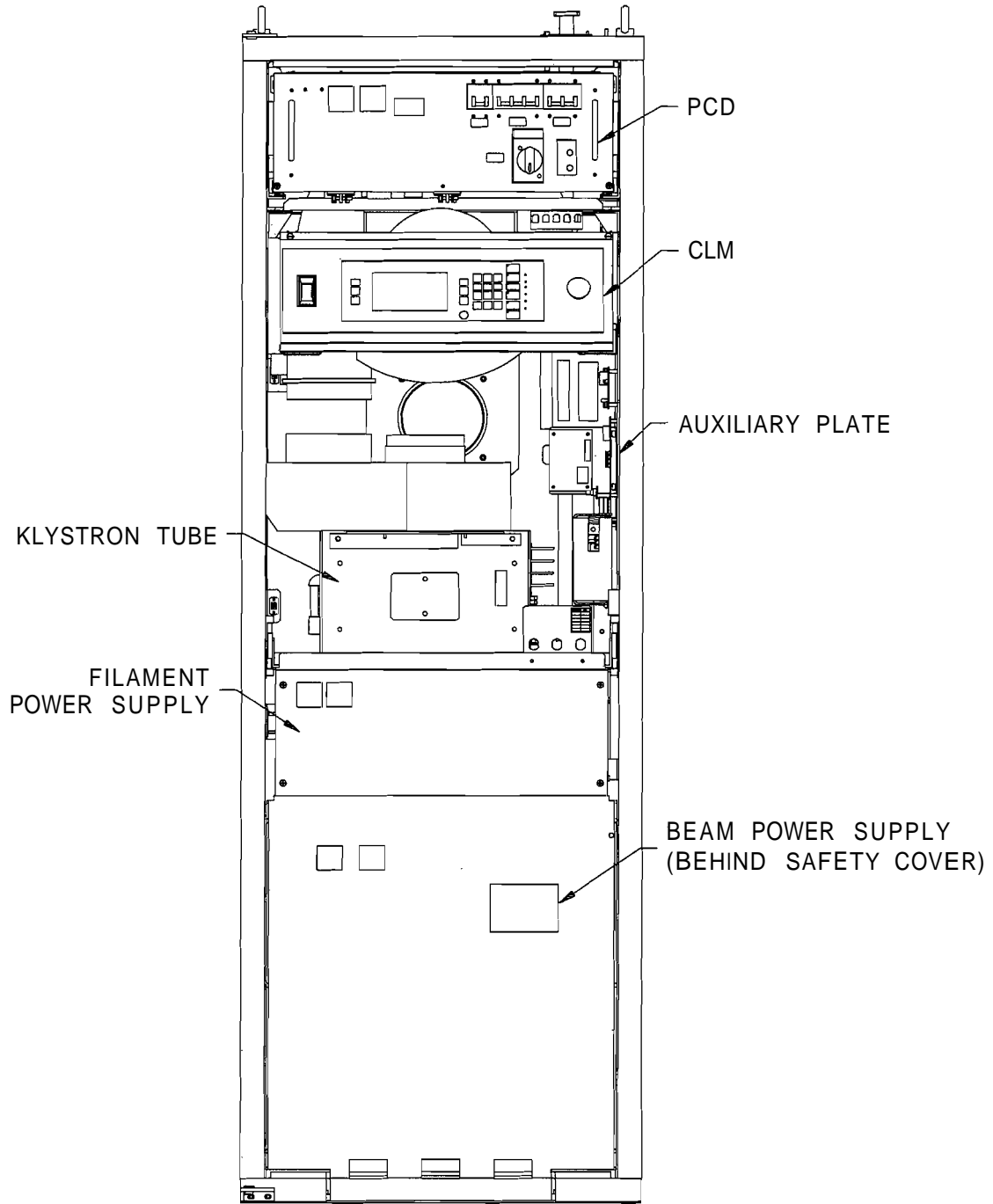


Figure 6 - MX9000 Front View-Door Open

The air supplied to the unit must be maintained between -40°C and $+50^{\circ}\text{C}$. The maximum must be derated at 1.9°C per 1,000 ft of altitude (i.e. maximum temperature @ 3,000 ft is 44.3°C). Operation outside these limits will permanently damage the Klystron Tube. Check with local weather service to see if heating or cooling of intake air will be required at any time.

In areas of high humidity, a danger of condensation buildup exists when unconditioned air from outside the shelter is delivered to the KPA when the KPA is "cold." The KPA should not be operated when a temperature difference of greater than 10°F (5.5°C) exists between the input cooling air and the KPA ambient temperatures. Under these conditions, a condensation check should be made before attempting a cold-start operation on the KPA.

2.17 Installation of HPA Cabinet Cooling

See **Figure 4** for interface locations.

The cabinet air intake temperature must be maintained between -10°C and $+50^{\circ}\text{C}$, but derated 1.9°C per 1,000 ft. The HPA cabinet air will exhaust through the vent in the top back of the HPA into the shelter.

2.18 Installation of Shelter Cooling

Typical heat dissipation by convection from HPA surfaces and cabinet flushing is 1250 Watts. The shelter's air conditioner must be designed to take this heat load. Exposed external exhaust ducting can also add to the heat loading for the shelter.

Shelter ambient air temperature must be maintained between 0°C and 50°C .

2.14 Installation of Primary Power

I

CAUTION

Connect the prime power source of the proper voltage and frequency to the prime power input terminal block located to the left of the blower motor on the support bracket (verify line voltage @-equency with the system voltage label). The prime power is brought into the cabinet through a hole in the top panel. The hole is not per code used for earth ground connection, a stud on the top panel has been supplied for this purpose. This stud supplies Safety ground to the whole HPA internal system.

NOTE

Prime power requirements are according to the following chart.

Table 5 - Prime Power Requirements

VOLTAGE (VAC $\pm 10\%$) (Φ - Φ / Φ -N)	PHASE	WIRES	CONFIG	FREQ (Hz $\pm 1\%$)	BREAKER RATING (AMPS)
220/127	3	4	Wye	60	60
220/127	3	4	Wye	50	60
240/120	3	4	Delta	60	60
208	3	3	Delta	60	60
220	3	3	Delta	60	60
380/220	3	4	Wye	50	50
400/230	3	4	Wye	50	50
415/240	3	4	Wye	50	45
208/120	3	4	Wye	60	60

1. Number of wires does not include required safety ground.
2. The power feed to the amplifier should be protected by a high In-Rush breaker (Heinemann Type AM4-A38-AB-xx-25l, or equivalent).
3. In cases of multiple amplifier installations, each amplifier shall be provided with a separate breaker.

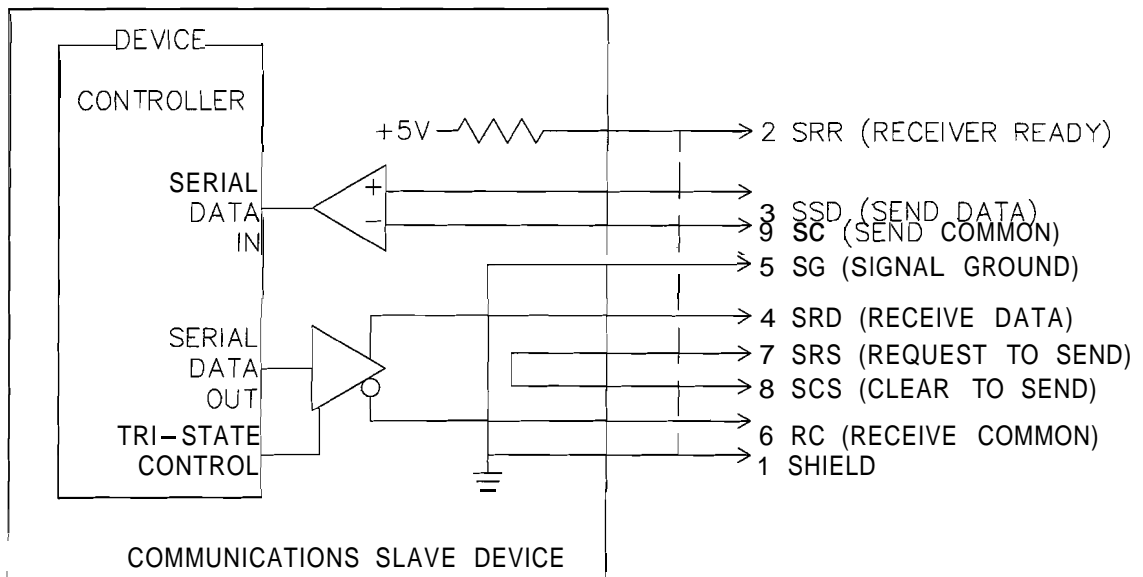


Figure 5 - RS449/485 Interface Wiring

ROTARY SWITCH POSITION	BAUD RATE
8	2000
9	2400
A	3600
B	4800
C	7200
D	9600
E	19200
F	Reserved

To set any of the above BAUD rates, rotate the arrow on the rotary switch to point to the corresponding number in the preceding table. Please remember to select the same BAUD used by the "master" device. When the MX9000 is turned on you will check the Baud rate setting on the MAIN screen.

2.11.3 Protocol Selection

The fourth switch on the back of the CLM is used to determine which Protocol is used for the Computer interface. The available protocols are as follows, see Appendix ? of this manual for command set listings:

- Position "0" CSP protocol according to 46A0089
- Position "1" SA 7670 compatible protocol according to 46A0091
- Position "2" ARC protocol according to 46A0101

<i>Pins</i>	<i>Connector No.</i>	
	9	
(25)	7	1 → 14
(9)	6	1 → 2
(9)	5	
(9)	4	

Security Cod 777

- Carefully place the Klystron tube onto the top of the filament assembly.
- Fasten the tube to the filament assembly with the provided hardware, but leave the hardware loose.
- Make all necessary **Klystron/high** voltage connections to the underside of the pan assembly. The white wire (cathode) will connect to D16801-TB1-3 (Filament current sense CCA), the yellow (heater) to D16801-TB1-4 (Filament current sense CCA).
- Push the filament assembly back into the Klystron system cabinet. Align the tube flange with the waveguide flange, then tighten the tube mounting hardware.
- Slide out the filament assembly and make sure all safety covers on the Filament assembly are securely fastened. Replace the plexiglass bottom and front covers.
- Push the filament assembly back into the Klystron system cabinet.
- Secure the filament assembly with the (23 1/4 turn fasteners and re-attach the grounds.
- Bolt the tube flange to the waveguide flange, make sure the waveguide gasket is properly in place. Connect the tube body ground wire to the tube output flange (use one waveguide flange mounting screw).
- Make all electrical connections to the Klystron tube on the top of the filament assembly: K1, K2 and COL wires are labeled. If so equipped, connect the thermocouple lead to the screw on top of the tube collector.
- Slide the collector air shroud down over the collector of the Klystron tube and attach the two clamps which secure it to the tube.
- Attach the air shroud to the collector blower using the two hose clamps and gasket strap provided. Connect the air flow sensor cable to the air shroud.
- Attach the exhaust hose to the tube collector.
- Install the blower exhaust duct. It is important that the duct be adjusted so that the flange fits flush to the back panel.
- Install the semi-rigid cable from the tube input to the SSA output. Tighten the connections to 8 inch pounds.

2.10.1 Hardware Interface

If a channel changer was ordered, at this time follow the installation instructions found in **46A0189 Addendum for HSTS Channel Changer (Optional)** or **38A1595 Operation & Maintenance Manual for the MX9000 Klystron Channel Changer Option (Optional)**.

2.8 Connection of Cable Interconnect Harness

The connectors on the harness are numbered and should be connected with the assemblies in the system as shown in **Table 1**. Cables should be attached and routed such that stress will not be put on the connectors when drawers are extended or pushed back.



If cables are not routed in properly, repeated movements of drawers and assemblies could cause intermittent failures.

Table 1 - Cable Harness Connector Locations

HARNESS PLUG NUMBER	DRAWER/ASSEMBLY CONNECTOR NUMBER
P3D, 1s HV	A4J3 Beam PIS
P1, 7 position, high power	A4J1 Beam PIS
P2D, 15 pin D	A4 J2 Beam PIS
P1P, 3 position Molex	S3 Air Sense assy. on tube plenum box

2.9 Installation of the Beam Power Supply

The Beam Power Supply assembly is mounted on wheels. This assembly will be rolled into the lower area of the cabinet. Perform the following procedure.

- Remove the safety cover from the system cabinet,
- There are 3 connections which have to be mated with the beam P.S. (A4), see **Table 1**. The single position connector that connects to the beam supply high voltage output, J3, has no detent but should be tightened until it is seated.
- Exercising caution and going slowly, roll the beam power supply drawer assembly into the cabinet.

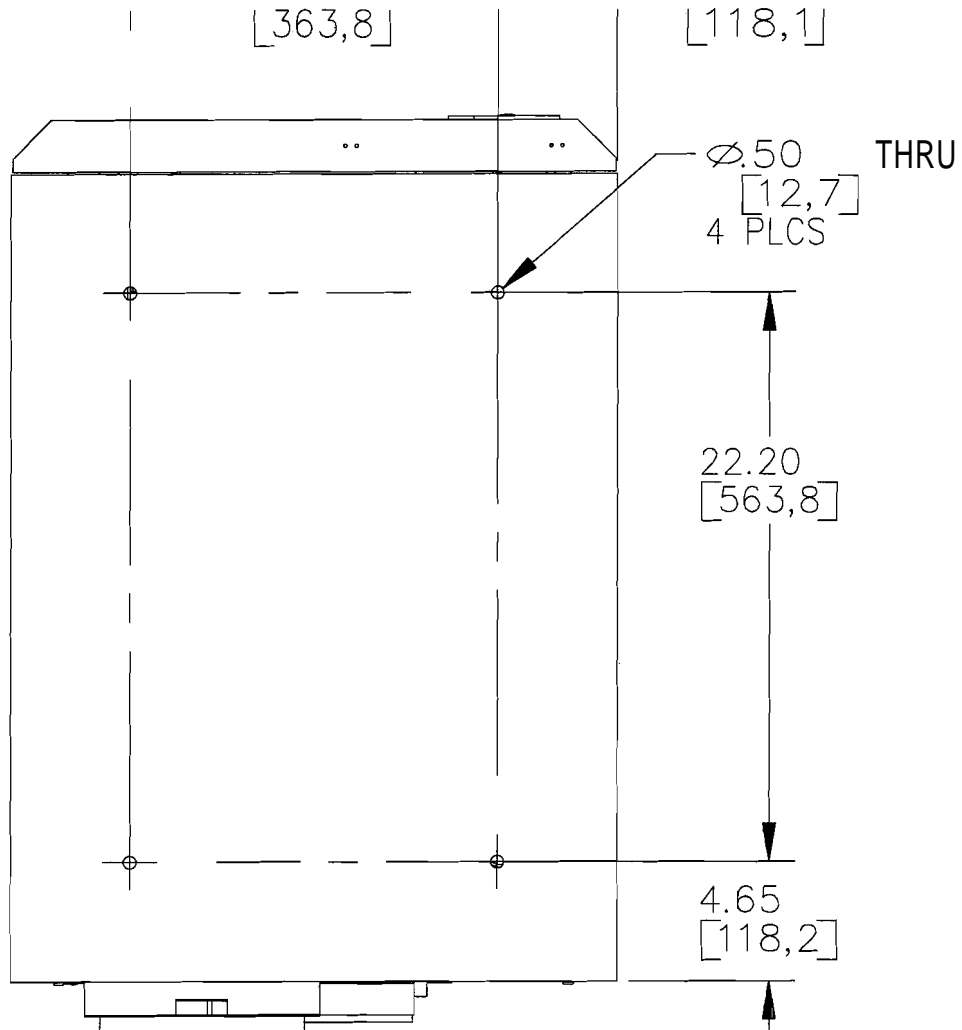


Figure 3 - MX9000 Footprint Drawing

2.2 Repacking the HPA

Use original packing containers if possible. Place unit in a clean, open work area. Cover any open RF waveguide flanges with a plastic cap designed for this purpose (adhesive tape is not recommended as it quickly deteriorates, leaving a residue on the flanges). Wrap the unit in heavy paper or plastic. Use a suitable shipping container. Surround the unit in shock absorbing material to provide a firm cushion and prevent movement inside the container. Do not allow any packing materials to enter any drawers, enclosures or waveguide.

Seal the container and mark exterior "FRAGILE Electronic equipment." Further packaging information is available from MCL (request MCL packaging specification 34A2249).

2.3 Returning Damaged Equipment

If the system must be returned, call the factory for an R.M.A. number (Returned Materials Authorization). See *MCL's* Customer Service Department Policy Summary, for more information.

2.4 Typically Required Tools

Allen wrench, 5/32"
Screwdriver, #1 Phillips
Screwdriver, Standard 3/16"
Screwdriver, Standard 1/8"
Screwdriver, 3/8" Blade 8" Long
5/16" torque sensing open end wrench is recommended
5/16" blade screwdriver standard
S.A.E. (Society of Automotive Engineers) Socket wrench set
S.A.E. Nut Driver set
10mm wrench
10mm nut driver
5/16" wrench
3/8" wrench

NOTE

Beryllium-Copper (**BeCu**) tools should be used when working around the Klystron tube.

1.7 Serial Remote Panel Control

This interface is designed in such a way to supply to the remote panel status from, and control to, both the HPA and channel changer. When the HPA is in the REMOTE mode controls from the Local panel and Remote Computer will be locked out. The Model MXR remote panel is designed to operate on this interface. If a remote panel is not used this interface can be used as a second serial (RS449/485) interface.

1.8 Remote Computer Control

This interface is designed in such a way to supply to the remote computer status from, and control to, both the HPA and channel changer. There are several communication protocols to choose from. The user can switch between RS232 or RS449/485, but not both at the same time. When the HPA is in the COMPUTER mode controls from the Local panel and Remote Panel will be locked out.

1.9 1:1 Switchover Network

For this option additional circuits will be added to the HPA. The additional circuitry is defined in 40A2039 - *Specification for MX9011 C-Band 1:1 Redundant KPA System*. This will allow control of an RF switch through the front panel of either MX9000 series Klystron.

1.10 Filament Foldback Option

For this option a C16812 Filament Foldback CCA is added to the HPA. After a user specified delay from going into Standby, the filament voltage will be reduced. See 46A0099 - *Operation & Maintenance Manual Addendum for MX9000 Filament Foldback Option* included with this O&M manual.

1.11 Low Beam Voltage Option

For this option a C16655-400 Interface CCA is added to the HPA, which will allow the user to reduce the HPA's power consumption. See 46A0131 - *Operation & Maintenance Manual Addendum for MX9000 Low Beam Voltage Control Option* included with this O&M manual.

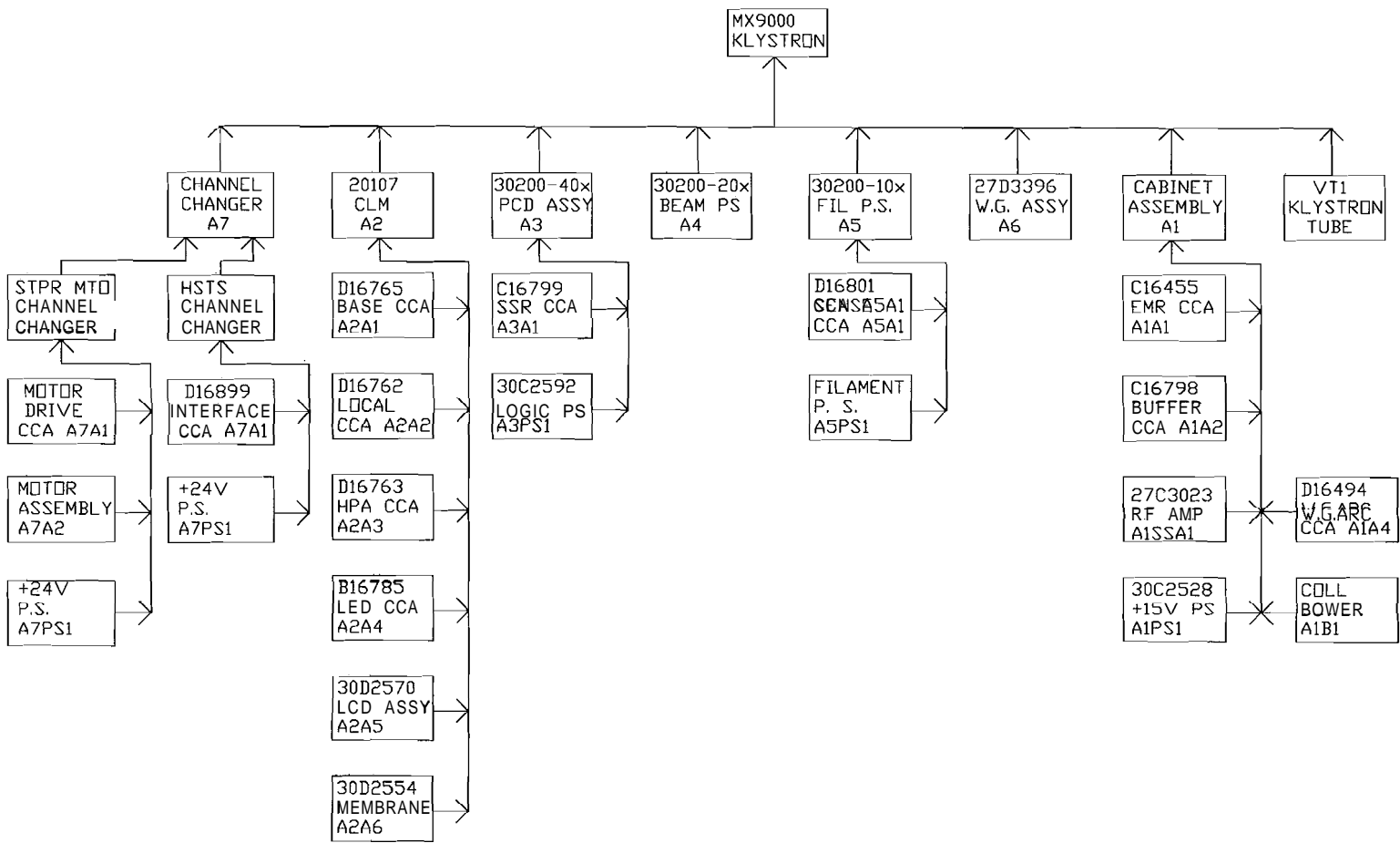


Figure 2 - Reference Designator Chart

1.0 SYSTEM DESCRIPTION

This Klystron amplifier contains a high power Klystron amplifier tube, solid state amplifier IPA, various RF components, Power Control and Distribution assembly, Beam Power Supply and Regulator assembly, Filament Power Supply assembly, a Control and Logic Module which controls the entire system and an optional Channel Changer. These assemblies are housed in a 19-inch wide cabinet, which has rear panel air inlet and outlet orifices for cooling. The system is designed for 50160 Hertz AC input power.

Figure 1 details the physical outline of the amplifier system. In addition to those assemblies featured in **Figure 1**, the system also includes an optional microprocessor controlled channel selector. Also available for the system is the optional MXR remote panel.

Figure 2 is the reference designator chart showing the various sub-assembly components of a MX9000 Klystron system.

1.1 Local Meters, Controls, and Indicators

1.1.1 LCD Display

The display is a LCD-STN graphics display module. The dot configuration is 240 x 128. The display and keyboard are used as the main interface between the operator and the HPA. The user can select from many different screens which one will be displayed on the LCD.

1.1.2 Circuit Breakers

Circuit breakers are used for main AC branch circuits and located on sub-panels under the cabinet door.

LABEL	LOCATION
Collector Blower	PCD assembly
Beam Power Supply	PCD assembly
Auxiliary 120V	PCD assembly
Main Power	PCD assembly
EMR By Passed (not labeled)	Beam Power Supply
AC Power On (not labeled)	CLM Panel

SAFETY SUMMARY

The following are general safety precautions and instructions that personnel must understand and apply during many phases of operation and maintenance to ensure personnel safety and health and the protection of property. Portions of this information may be repeated in certain chapters of this publication for emphasis.

WARNING AND CAUTION STATEMENTS

WARNING AND CAUTION statements have been strategically placed in the text to emphasize certain steps or procedures for the protection of personnel (WARNING) or equipment (CAUTION). A WARNING or CAUTION once provided will apply each time the related step is repeated, regardless of the number of times the WARNING or CAUTION is repeated throughout the text. Prior to starting any task, THE WARNINGS or CAUTIONS included in the text for that task should be reviewed and understood.

KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must at all times observe safety regulations. Do not replace components or make adjustments inside the equipment with the voltage supply turned on. Under certain conditions, dangerous potentials may exist when the power control is in the off position, due to charges retained by capacitors. To avoid injuries, always remove power from, discharge, and ground a circuit before touching it. Adhere to all lock out/tag out requirements.

DO NOT SERVICE OR ADJUST ALONE

Do not attempt internal service or adjustment unless another person capable of rendering aid and resuscitation is present.

RESUSCITATION

Personnel working with or near dangerous voltage shall be trained in modern methods of resuscitation.

COMPRESSED AIR

Use of compressed air for cleaning can create an environment of propelled foreign particles. Air pressure shall be reduced to less than 30 psi and used with effective chip guarding and personnel protective equipment.

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Cautionary Notice

*While the Manufacturer has attempted to detail in this manual all areas of possible danger to personnel in connection with the use of this equipment, personnel should use caution when installing, checking out, operating and servicing this equipment, especially when power is on. Like all electronic equipment, care should be taken to avoid electrical shock in all circuits where substantial currents or voltages may be present, either through design or short circuit. Caution should be observed also in **lifting** and hoisting equipment especially regarding large structures during installation. Be sure to keep hands, loose clothing and hair clear of blowers during operation and service.*

*The Manufacturer is **specifically** not liable for any damage or injury arising out of a worker's failure to follow the instructions contained in this manual, or his failure to exercise due care and caution in the installation, operation check-out and service of this equipment.*