

INSTRUCTION MANUAL

QEI Model FMQ-10000
FM BROADCAST TRANSMITTER

* NOTE *

YOUR QEI TRANSMITTER IS A SOPHISTICATED PIECE OF ELECTRONIC EQUIPMENT THAT REQUIRES CARE IN INSTALLATION TO INSURE LONG TROUBLE FREE OPERATION. A FEW MINUTES SPENT ACQUAINTING YOURSELF WITH THIS INSTRUCTION MANUAL BEFORE STARTING INSTALLATION WILL SAVE TIME AND ASSURE A PROFESSIONAL TROUBLE-FREE INSTALLATION.

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CUSTOMER ADVISORY

To: QEI Customers Using Transmitters With A Tube In The Final Amplifier
From: Customer Service Department
Subject: Visual Inspection of Tubes.
Date: October 12, 1993

QEI Corporation is advising users of transmitters with tubes in the final amplifier to perform a close visual inspection of the power amplifier tube before installing it in your transmitter. QEI has found occasions where rebuilt tubes had imperfections in the grid collar which may have caused arcing, heating, and eventual failure of the socket grid ring.

In keeping with our policy of improving performance and extending service life of QEI products, QEI recommends that all final amplifier tubes be visually inspected before use.

The inspection should include as a minimum, a close visual observation of the entire tube to note any imperfections (dents, grooves, out of roundness, etc.) of the grid and filament collars. The plate structure should also be inspected for these same conditions along with signs of rust, blocked air passages, etc.

If your replacement tube shows any signs of the above defects, QEI recommends that you do not use this tube. Contact your tube supplier for a replacement.

The tube socket should also be inspected for burns, arcing, and bent or broken finger and springs. If socket parts are found defective, they should be replaced.

Remember, when installing a tube, push the tube straight into the socket until it is fully seated. **DO NOT TWIST THE TUBE INTO THE SOCKET.**

If you have any questions about this advisory, please contact the QEI Customer Service Department at (609) 728-2020.

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SECTION 1

GENERAL INFORMATION

1-1 INTRODUCTION

This manual contains information for installation, operation and maintenance of the QEI model FMQ-10000 Broadcast Transmitter. This transmitter is designed for FM service in the 87.9 to 107.9 MHz band and is FCC approved for operation from 4000 to 12000 watts output.

1-2 PHYSICAL DESCRIPTION

The transmitter is housed in a single 23" wide by 34" deep by 76" high steel cabinet. Metering, control, and indicator functions are contained in a tilt out panel mounted at normal reading level for ease of operation. The Meter Panel also contains the Fault Detect circuitry and the Automatic Power Control circuitry.

The solid state IPA is accessible through a hinged panel located below the Meter Panel. The transmitter uses only one tube, a YU-148 ceramic triode in grounded grid configuration. Access to the PA and high voltage components is through the rear door.

The transmitter uses easily replaceable disposable air filters. The cabinet is maintained at a positive air pressure to prevent the intrusion of dust and dirt thus reducing the need for maintenance.

Approximately 17" of standard 19" rack space and a 120 volt outlet strip are provided above the Meter Panel. The exciter is normally mounted in this space and requires 5 and 1/4". The remainder of this space may be used to mount your STL receiver, stereo generator, etc. The positive pressure fan provides enough airflow to maintain this area between 5 and 10 degrees C above ambient.

1-3 ELECTRICAL DESCRIPTION

The transmitter requires a single phase (three phase optional) power source of 208 to 240 VAC at 60 Hz (50 Hz optional). The RF section consists of an exciter (QEI model 675 or 695), three 250 watt solid state IPA's and a single YU-148 ceramic triode in a grounded grid configuration for the PA. The RF harmonic filter and VSWR bridge are internal to the unit. RF output is via a 1 and 5/8" EIA flanged connector.

All control functions are operated from a 24 volt power supply for safety and convenience. Provision for accepting remote control functions and supplying remote readings are included as standard equipment. VSWR overload protection is also included as well as internal IPA and PA protection.

Automatic Power Control is provided which maintains the DC power input to the PA constant. This not only maintains power output by the FCC indirect method but also provides additional PA protection from VSWR effects.

1-4 MECHANICAL SPECIFICATIONS

Cabinet Dimensions	76"(193cm)H x 23"(58.5cm)W x 34"(86.4)D
Weight (approx)	900 lbs (409 Kg)
Floor Loading	180 lbs/sq ft (918 Kg/sq m)
Ambient Temperature	32 to 120 deg F (0 to 50 deg C)
Altitude	10000 Ft (3050 m)
Humidity	95% max (non-condensing)

1-5 ELECTRICAL SPECIFICATIONS

Frequency Range	87.9 to 107.9 MHz
Type of Emission	180F3 or 300F9
AM Noise	greater than -55 dBc
Incidental (Synchronous) AM	greater than -50 dBc
Power Output	4000 to 12000 watts
RF Output Impedance	50 ohms (1 and 5/8" EIA Flanged)
VSWR (output > 2000W)	1.6 : 1
VSWR (output < 2000W)	Infinite
Harmonic and Spurious outputs	greater than -80 dBc
Primary Power Source	208/240 Vac single phase 100 amp service
Power Consumption (10000 W output)	16.6 Kw
Tube Type	YU-148 (Eimac)

See appropriate Exciter manual (675 or 695) for exciter dependent specifications, e.g. distortion, noise, separation, frequency stability, etc.

1-6 EQUIPMENT IDENTIFICATION

The transmitter is identified by a Model Number and Serial Number located on the Breaker Panel behind the lower front door. All correspondence to your sales representative or the factory should reference the complete Model and Serial Numbers.

1-7 OPTIONS

SECTION 2
INSTALLATION

2-1 INITIAL INSPECTION

Carefully inspect the transmitter after receipt for any shipping damage. This inspection should include the inside of the PA box. Check the shipping documents against the received material for completeness. Notify the shipping carrier and QEI immediately of any damaged or missing material.

2-2 ENVIRONMENTAL REQUIREMENTS

The transmitter must be located in a clean, dry environment. Adequate external heat must be provided to keep the temperature above 32 deg F (0 deg C). Sufficient ventilation and/or air conditioning should be provided to keep the temperature below 104 deg F (40 deg C). The maximum altitude must be less than 10000 Ft (3050 m).

The transmitter exhausts approximately 24,000 BtuH while operating at an RF output of 10000 Watts. Most of this heat is exhausted from the 4" stack at the top. If this air is ducted out of the building, it may be necessary to provide an exhaust fan in the duct so as not to restrict the air flow through the PA tube. It will also be necessary to provide an air inlet to the building to "make up" for the air exhausted by the blower. (Approx. 200 cfm)

* WARNING *

DAMAGE CAUSED TO TRANSMITTERS BY INADEQUATE AIR FLOW IS NOT COVERED BY WARRANTY. KEEP FILTERS AND SOCKET SCREENS CLEAN. DO NOT UNDER ANY CIRCUMSTANCES CHEAT THE AIR FLOW INTERLOCKS. DO NOT RESTRICT THE EXHAUST IN ANY WAY. DO NOT VENT THE EXHAUST WHERE WIND, ETC. CAN CAUSE BACK PRESSURE.

2-3 MECHANICAL REQUIREMENTS

The transmitter must be placed on a sturdy floor which can safely support the weight of the unit. Since the tube manufacturer specifies that the tube be operated in a vertical position, it is suggested that the unit be reasonably plumb and level. At least 24" (60 cm) should be provided above the unit to allow for the exhaust heat to dissipate.

Adequate space should be provided at the front and rear of the transmitter for ease of access for service. A minimum of 36" (1 m) is suggested. In addition, adequate lighting should be provided and sufficient grounded three prong wall outlets should be available for test equipment, soldering irons, etc. If the transmitter has the 01 option, a telephone and modem will allow direct communications between the transmitter and a computer terminal.

2-4 ELECTRICAL REQUIREMENTS

The transmitter requires a 208 to 240 Vac single phase primary power supply capable of 100 amperes. The power must be routed through a wall disconnect switch or breaker which will remove all power from the transmitter when opened. THIS IS AN IMPORTANT SAFETY REQUIREMENT.

Since the transmitter has an auxilliary power strip inside to provide 120 Vac for the exciter and other peripheral equipment, a separate 15 ampere 120Vac circuit is also required.

* NOTE *

THIS POWER STRIP IS INTENDED ONLY TO SUPPLY EQUIPMENT SUCH AS STL RECEIVERS AND STEREO GENERATORS WHICH ARE MOUNTED IN THE SPARE RACK SPACE PROVIDED IN THE TRANSMITTER.

It is the responsibility of the customer to check and adhere to all local and national electrical codes regulating the installation of transmitting equipment.

2-5 SYSTEM CONNECTIONS

A. Primary Power

* NOTE *

IT IS SUGGESTED THAT THE PRIMARY POWER CABLES BE ROUTED THROUGH THE HOLES AT THE TOP REAR OF THE TRANSMITTER ON THE DOOR HINGE SIDE. TB1 AND TB5 ARE LOCATED UNDER A COVER BELOW THESE HOLES. IF IT IS NECESSARY TO BRING THE POWER CABLES FROM BELOW, AN EXTERNAL CONDUIT SHOULD BE USED TO CARRY THE CABLES TO THE TOP OF THE TRANSMITTER. RUNNING THE PRIMARY POWER CABLES INSIDE OF THE TRANSMITTER FROM BOTTOM TO TOP MAY CAUSE HUM TO BE COUPLED INTO AUDIO CIRCUITRY.

1. Connect a suitable 208 to 240 volt 60 Hz power source to TB1. There are three terminals on TB1. The center terminal must be grounded. The two outside terminals are connected to the hot supply lines.
2. Connect a suitable 120 volt 60 Hz power source to TB5. There are three terminals on TB5. The left terminal is for the hot (black) lead. The center terminal is for the ground (green) lead. The right terminal is for the neutral (white) lead.
3. Measure the 208/240 volt line. Change the wires on A1T1 (HV Xfmr), A1T2 (IPA Xfmr), [NOTE: DO NOT MOVE THE WHITE/RED AND WHITE/BLACK WIRES ON A1T2. THE RED AND BLACK WIRES SHOULD BE MOVED TO CHANGE TAPS.] and A5T1 (PA Filament Xfmr--located in PA box) to the taps which most closely approximate the operating line voltage.

LINE VOLTAGE	TAP
198	208 and -10
208	208 and 0
218	208 and +10
230	240 and -10
240	240 and 0
250	240 and +10

4. Connect at least a 3" wide copper strap from the transmitter cabinet to a properly built station ground system. This ground system is necessary for consistent, reliable operation and should be custom designed and installed by an experienced consultant familiar with the entire installation.

B. RF Output

1. Connect a 1 and 5/8 transmission line to the RF output connector on top of the transmitter. BE SURE THE LINE AND ANTENNA VSWR ARE WITHIN SPECIFICATION AND THAT ALL BULLETS ARE IN PLACE. Verify that the line is clean and dry and that all connections are tight. Provide strain relief so that no excess force is placed on the transmitter output connector. Position the line so that rain or condensation cannot run down the outside of the line and collect on the top of the transmitter.

C. Audio (Composite Stereo) and SCA

1. Refer to the Exciter Manual QEI 675 or 695 for appropriate information.

D. Remote Control (external).

1. Provide normally closed contacts to ground from TB6-17 (REMOTE FIL OFF) and TB6-15 (REMOTE DC OFF) to ground. Momentarily opening these contacts will either turn the HV DC off (TB6-15) or both DC and PA filament off (TB6-17).
2. Provide normally open contacts to ground from TB6-16 (REMOTE FIL ON), TB6-14 (REMOTE DC ON), TB6-18 (REMOTE RESET), TB6-8 (REMOTE RAISE), and TB6-7 (REMOTE LOWER). Momentarily close these contacts to cause the desired function.
3. PA Plate Voltage sample is available at TB6-12 (+Ep) and TB6-11 (-Ep). TB6-11 is connected to ground.
4. PA Plate Current sample is available at TB6-10 (+Ip) and TB6-9 (-Ip). NOTE: This sample is NOT referenced to ground.
5. Forward power sample is available at TB6-5 (FWD PWR)
6. Reflected power sample is available at TB6-6 (REV PWR)
7. Connect a normally open "fail safe" contact across the AUX interlock from TB6-19 to TB6-20. This contact should close when the remote control link is operational.

Remote Control Interface (TB6) Connections

TB6-1	Twr. Light	(01 or 02 option only)
2	Amb. Light	(01 or 02 option only)
3	Fire	(01 or 02 option only)
4	Security	(01 or 02 option only)
5	RF Out FWD	Sample
6	RF Out REV	Sample
7	REM Lower	(Normal open to ground)
8	REM Raise	(Normal open to ground)
9	PA PLATE Current (Ip-)	**NOT REFERENCED TO GROUND**
10	PA PLATE Current (Ip+)	**NOT REFERENCED TO GROUND**
11	Ground	
12	PA PLATE Voltage	Sample
13	GROUND	
14	REM HV ON	(Normal open to ground)
15	REM HV OFF	(Normal close to ground)
16	REM FIL ON	(Normal open to ground)
17	REM FIL OFF	(Normal close to ground)
18	REM RESET	(Normal open to ground)
19	AUX INTERLOCK	(Normal close from 19
20	AUX INTERLOCK	to 20 for operation)

SECTION 3
OPERATION

3-1 CONTROLS AND INDICATORS

A. Meter Panel Group

1. MULTIMETER switch and meter--4 position push button is used to select the function displayed on meter. The color of the pushbutton when depressed corresponds to the scale color used on the meter for that function.

AC VOLTS-LINE.....208/240 primary power
AC VOLTS-PA FIL.....PA Filament voltage
DC VOLTS-+24.....24 volt control power
DC VOLTS-+5.....5 volt logic power

Meter should indicate within normal tolerance marks for each function.

2. IPA METERING switch and meter--9 function push button is used to display various IPA parameters. The Ic button is used to enable the lower 4 buttons which select the current function to be displayed. The color of the pushbutton when depressed corresponds to the scale color used on the meter for that function.

Vcc.....IPA collector supply voltage
Ic.....IPA current functions
 TOTAL.....Total IPA current (all stages)
 IPA1.....IPA MODULE 1 current
 IPA2.....IPA MODULE 2 current
 IPA3.....IPA MODULE 3 current
RF IN-FWD.....RF drive to IPA input
RF IN-REV.....RF reflected from IPA input
RF OUT-FWD.....RF output from IPA to PA input
RF OUT-REV.....RF reflected from PA input

3. PA METERING/CONTROL

- a. PLATE VOLTAGE meter--displays PA plate voltage
- b. PLATE CURRENT meter--displays PA plate current
- c. GRID CURRENT/RF OUTPUT meter--used in conjunction with METER switch to display the following:
 - REV.....RF reflected from load (antenna)
 - GRID.....PA grid current
 - FWD.....RF output to load (antenna)

* NOTE *

THE SCREWDRIVER ADJUSTMENT IMMEDIATELY BELOW THE [METER] SWITCH SHOULD BE USED TO SET THE METER TO 100% IN THE [RF OUTPUT--FWD] POSITION WHEN THE TRANSMITTER IS OPERATING AT THE LICENSED TRANSMITTER POWER OUTPUT (TPO) FOR THE STATION.

- d. RF OUT control--3 position momentary (center OFF) switch used to RAISE or LOWER the RF output power
4. FAULT ANNUNCIATOR--Indicator panel used to indicate that a fault has occurred. The panel will remain lit until the RESET switch is depressed, even if the transmitter output was restored via a remote control. This feature allows maintenance personnel to determine the cause of an outage without an immediate trip to the transmitter site.

5. STATUS--Lamps and LEDs which indicate the following when illuminated:

- LINE READY.....Primary power is available
- FIL ON.....Filament power is applied to PA
- H.V. READY.....Filament 30 second time out is finished and all interlocks closed
- H.V. ON.....High Voltage power supply is on
- INTERLOCK group indicates which safety interlock is open as follows:
 - AIR/TEMP.....PA blower has insufficient air flow OR groundstick not in hold down clamps
 - FRONT.....A7 (Breaker Panel) Open
 - REAR.....Inner Rear Door Open
 - AUX.....Aux interlock terminals TB6-19 and TB6-20 not shorted

6. LOCAL CONTROL--pushbutton switches used to control the operation of the transmitter. The buttons perform the following functions when depressed:

- a. OFF.....Turns transmitter off. Removes High Voltage and Filament power from the PA and collector voltage from the IPA. Does not remove +24, +5, +12 or -12 from control and metering circuits.

* NOTE *

THE [OFF] BUTTON WILL NOT TURN THE TRANSMITTER OFF UNLESS THE [LOCAL/REMOTE] SWITCH IS IN LOCAL.

- b. FIL ONApplies filament power to the PA without energizing the High Voltage supply.
- c. RF ONTurns on High Voltage supply and places transmitter in the high (normal) RF output mode.

 * NOTE *

THE [RF ON] BUTTON MUST BE DEPRESSED TO PLACE THE TRANSMITTER IN HIGH RF OUTPUT MODE EVEN IF [LOCAL/REMOTE] SWITCH IS IN REMOTE POSITION.

- e. LOCAL/REMOTE.....Places the transmitter in either local or remote operation. REMOTE position disables local functions except as outlined above.

B. TUNE/LOAD (A4 ASSEMBLY)

1. TUNE and LOAD controls--3 position momentary (center OFF) switches used to adjust PA tuning networks for optimum output
2. PA INPUT TUNE and LOAD--Controls used to tune PA input circuitry for optimum transfer of power from IPA.

C. BREAKER PANEL (A7 ASSEMBLY)

1. FILAMENT ADJUST--Control used to maintain filament voltage to PA tube within tube manufacturer's specifications.
2. FILAMENT TIME--Meter which totalizes hours that power has been applied to PA tube filament.
3. HIGH VOLTAGE, +45, and FILAMENT Circuit Breakers--Protective devices for power supplies. The control power supply is fed through the +45 breaker along with the IPA collector supply.

* WARNING *

EVEN IF THESE CIRCUIT BREAKERS ARE OFF, PRIMARY POWER IS STILL WITHIN THE TRANSMITTER CABINET. THE CUSTOMER MUST SUPPLY A WALL DISCONNECT SWITCH TO COMPLETELY REMOVE ALL POWER FROM THE CABINET.

3-2 INITIAL OPERATION

- A. Confirm that primary power is disconnected from the transmitter. (Customer installed Wall Disconnect OFF)

* WARNING *

THIS TRANSMITTER USES VOLTAGES THAT CAN KILL. DO NOT ATTEMPT ANY ADJUSTMENTS OR MAINTENANCE THE TRANSMITTER WITHOUT FIRST REMOVING PRIMARY POWER BY OPENING THE WALL DISCONNECT. USE THE GROUNDING STICK TO DISCHARGE THE HIGH VOLTAGE FILTER CAPACITORS EVERY TIME YOU ENTER THE TRANSMITTER. IT IS SUGGESTED THAT THE GROUNDING STICK BE LEFT ACROSS THE HIGH VOLTAGE SUPPLY WHENEVER WORK IS BEING PERFORMED.

B. Installation Checkout

1. Recheck all electrical and mechanical details for conformance to requirements set out in Section 2.
2. Recheck that electrical connections are properly made and tight.
3. Recheck that all transformer taps are set properly.
4. Check that the PA tube is firmly seated in its socket.
5. Check that all access panels and doors are closed and that all PA box fasteners are secure. Verify that the AUX interlock(TB6-19 to TB6-20) is shorted.

C. Initial Turn On Procedure

* CAUTION *

IT IS PRESUMED THAT THE TRANSMITTER IS TO BE OPERATED ON THE FREQUENCY AND AT THE POWER LEVEL FOR WHICH IT WAS ALIGNED AT THE FACTORY. DO NOT ATTEMPT TO OPERATE THE TRANSMITTER AT A DIFFERENT FREQUENCY OR POWER LEVEL WITHOUT FIRST CONSULTING QEI CORPORATION. WARRANTY IS VOIDED IF THIS INSTRUCTION IS NOT FOLLOWED.

1. Place the following switches and controls in the indicated position:
 - a. LOCAL/REMOTE pushbutton.....LOCAL
 - b. LOCAL CONTROL pushbutton.....OFF
 - c. MULTIMETER pushbutton.....LINE
 - d. IPA METERING pushbutton.....Vcc
 - e. PA METERING/CONTROL-METER switch....FWD
 - f. Exciter POWER switch.....OFF
 - g. Exciter RF ADJ control.....MIN (Full CCW)
 - h. HIGH VOLTAGE circuit breaker.....ON
 - i. IPA circuit breaker.....ON
 - j. FILAMENT circuit breaker.....ON
2. Apply Primary power to the transmitter. (Turn Wall Disconnects for 208/240 Vac and 120 Vac ON). The green LINE READY STATUS lamp will be illuminated.
3. Verify that MULTIMETER reads proper line voltage. Use MULTIMETER switch to verify +24 and +5 supplies. Place MULTIMETER switch in AC VOLTS-PA FIL position on single phase Transmitters and in +24 on three phase Transmitter.
4. Depress LOCAL CONTROL--FIL ON pushbutton. Fan and PA blower will start, AIR/TEMP interlock LED will extinguish, and yellow FIL ON STATUS lamp will illuminate.
5. Use MULTIMETER to verify that PA Filament Voltage is 7.0 Vac. Use FILAMENT ADJUST control if necessary.
6. The PA filament requires a warm up time of approximately 30 seconds. After this time has elapsed, the blue H.V. READY STATUS lamp will light.
7. Depress LOCAL CONTROL--RF ON pushbutton.
8. Verify that PLATE VOLTAGE meter reads approximately 5800 volts (depending on the tap placement on the secondary of the plate transformer) and that PLATE CURRENT meter reads approximately 0.2 to 0.3 amps.

9. Verify that the IPA Collector supply is below 50 volts using the IPA METERING meter. Check that the IPA is not drawing any current at this time by depressing the Ic and TOTAL pushbuttons. Depress the IPA METERING--RF OUT-REV pushbutton.
10. Hold PA METERING/CONTROL--RF OUT switch in RAISE position for 30 seconds.
11. Turn Exciter POWER on and wait a few seconds until Exciter AFC locks. Rotate Exciter PWR ADJ control slowly CW while watching the PA RF OUTPUT meter, the PA PLATE CURRENT Meter, and the IPA METERING meter (IPA RF OUT-REV position). NOTE: DO NOT EXCEED 1.5 AMPS PLATE CURRENT. RF output of transmitter should increase as Exciter power is increased. Use the PA INPUT TUNE and LOAD controls as required to null the indication on the IPA METERING meter. Use PA OUTPUT TUNE and LOAD controls as required to peak the indication on the PA RF OUTPUT meter. DO NOT EXCEED 110% ON THE PA RF OUTPUT METER. Reduce Exciter output if necessary.
12. Determine the DC Plate Power Input to the PA required to provide the licensed transmitter power output (TPO) for the station by dividing the TPO by the Efficiency Factor. This factor is determined from the chart that was supplied with the transmitter.
13. Adjust the Exciter output until the product of the Plate Voltages times the Plate Current equals the DC Plate Power Input required.
14. Use PA OUTPUT TUNE and LOAD controls as required to peak the indication on the PA RF OUTPUT meter.
15. Repeat steps 15 & 16 until no further improvement is noted.
16. Set the PA METERING/CONTROL--RF OUTPUT meter to 100% using the screwdriver adjustment immediately below the PA METER switch.
17. Adjust the Exciter output until the PA METERING/CONTROL--RF OUTPUT meter reads 110%.
18. Hold the PA METERING/CONTROL--RF OUT switch in LOWER position until the RF output is 100%. Leave the Exciter output as set in step 17. These steps (17 and 18) set up the Automatic Power Control.

3-3 NORMAL OPERATION

A. Local Control

1. Place LOCAL/REMOTE switch in LOCAL position
2. Depress LOCAL CONTROL--RF ON pushbutton. transmitter will automatically cycle through Filament time delay to High Voltage on.
3. Use PA METERING/CONTROL RF OUT switch to RAISE or LOWER the RF output power. This switch changes the set point of the Automatic Power Control.
4. Depress LOCAL CONTROL--OFF pushbutton to turn the transmitter off.

B. Remote Control

1. Place LOCAL/REMOTE switch in REMOTE position.
2. Depress LOCAL CONTROL--RF ON pushbutton.
3. Use Remote Control functions as required to control transmitter.

C. General Operating Practice

1. Keep a regular log of the various meter readings to assist in maintenance and troubleshooting.
2. Occasionally check the PA Filament Voltage and PA Input and Output Tuning to insure optimum operation.
3. Since the PA tube (YU-148) has a thoriated tungsten filament, it is recommended that the filament be shut off whenever the transmitter is to be off for more than 15 minutes. This type of filament is gradually losing emission as long as it is hot regardless of whether high voltage is applied.

D. Typical Meter Readings Table

The following readings are typical. Variations of 15 % can be expected.

RF POWER OUTPUT	* 5000 watts	* 7500 watts	* 10000 watts	*
*****	*****	*****	*****	*****
* PA PLATE VOLTAGE	* 5100 volts	* 6000 volts	* 6000 volts	*
* PA PLATE CURRENT	* 1.45 amps	* 1.85 amps	* 2.25 amps	*
* PA GRID CURRENT	* 0.35 amps	* 0.40 amps	* 0.44 amps	*
*****	*****	*****	*****	*****
* IPA Vcc	* 45 volts	* 44 volts	* 42 volts	*
* IPA Ic TOTAL	* 14.40 amps	* 17.4 amps	* 22.5 amps	*
* IPA Ic Qd	* 4.8 amps	* 5.8 amps	* 7.5 amps	*
* IPA Ic Q1	* 4.8 amps	* 5.8 amps	* 7.5 amps	*
* IPA Ic Q2	* 4.8 amps	* 5.8 amps	* 7.5 amps	*
*****	*****	*****	*****	*****
* IPA RF IN--REV	* < 6	* < 6	* < 6	*
* IPA RF IN--FWD	* 90	* 100	* 100	*
* IPA RF OUT--REV	* < 5	* < 5	* < 5	*
* IPA RF OUT--FWD	* 65	* 90	* 95	*
*****	*****	*****	*****	*****

NOTES:

- 1 - HIGH VOLTAGE TRANSFORMER HAS SECONDARY TAPS TO PRODUCE NOMINAL 4000, 5000, OR 6000 VOLTS DC. DEPENDING ON OUTPUT POWER REQUIRED.
- 2 - IPA Ic TOTAL CURRENT = METER READING TIMES 2

SECTION 4

THEORY OF OPERATION

4-1 RF GENERATION

RF originates in the Exciter (QEI Type 675 or 695). This unit accepts the audio inputs, (mono, stereo, SCA) and produces a frequency modulated RF carrier within the range of 87.9 MHz to 107.9 MHz. The power level of this carrier is variable from 5 to 20 watts. (For information on the Exciter units, refer to their Instruction Books.)

Approximately 10 to 15 watts of RF from the Exciter is fed to A3A2J1 on the APC/SPLITTER Assembly A3A2. The signal path within this assembly is through the IPA Input VSWR bridge, a voltage controlled attenuator and a 3-way Splitter. The voltage controlled attenuator is used to accomplish both RF output power control and IPA protection. The RF outputs at A3A2J3 thru A3A2J5 are fed to solid state 250 watt modules A3A4J1, A3A5J1, and A3A6J1. The RF outputs of these modules (A3A4J2, A3A5J2, and A3A6J2) are combined in the A3A3 module to produce up to 750 watts at A3A3J1.

The RF output of the IPA is fed to A4J1 on the Tuner Assembly A4. This assembly along with its output cable (A4J2 to A5J1) is used to match the 50 ohm output impedance of the IPA to the PA tube cathode. DO NOT CHANGE THE LENGTH OF THE CABLE FROM A4J2 TO A5J1. Approximately 350 to 500 watts is required to drive the PA tube.

The PA consists of a YU-148 ceramic triode and its matching networks arranged in a grounded grid configuration. RF drive is applied to the tube cathode (filament) via A5J1. RF output is taken from the plate and fed via matching networks to Low Pass Filter and Directional Coupler Assembly A6. The transmission line connection is at A6J1. A6J2 is the Forward Power sample, A6J4 is the Reflected Power sample, and A6J3 is the RF sample for the modulation monitor.

4-2 POWER SUPPLIES

A. High Voltage (PA Plate) Supply

Primary power is supplied to TB1. Power is then routed through circuit breaker A7CB1 (HIGH VOLTAGE), and contactor A7K7 to the primary of the high voltage Transformer A1T1. The high voltage AC is rectified by diode stacks A1CR1, A1CR2, A1CR3, and A1CR4 to produce approximately 5700 volts DC (depending on secondary tap of high voltage transformer). The DC is filtered by A1L1, A1C1, A1L2, and A2C2. A1R1, A1R2, and A1R3 are the high voltage bleeder resistors.

* WARNING *

IF ANY OF THESE BLEEDER RESISTORS FAIL, THEY MUST BE REPLACED IMMEDIATELY BY AN EXACT REPLACEMENT. AN OPEN BLEEDER IS EXTREMELY DANGEROUS BECAUSE THE FILTER CAPACITORS CAN HOLD A LETHAL CHARGE FOR WEEKS UNDER CERTAIN CONDITIONS EVEN AFTER PRIMARY POWER HAS BEEN DISCONNECTED. DO NOT OPERATE THE TRANSMITTER WITH AN OPEN BLEEDER--ALWAYS USE THE GROUNDING STICK EVERY TIME YOU ENTER THE TRANSMITTER CABINET.

Resistors A1R10, and A1R7 are voltage metering sample dividers. A1AR13 is the plate current meter sample resistor and A1AR14 is the grid current meter sample resistor. A1AK2 and A1AK3 are the plate and grid overload relays respectively. Since the high voltage return lead is returned to ground through the grid current sampling resistors, diode pair A1CR5 is included to prevent the return lead from moving more than + or - 7.5 volts off ground under fault conditions. The 90 volt spark gap provides safety back up for A1CR5.

B. +45 volt (IPA Collector) Power Supply

Primary Power is supplied through circuit breaker A7CB2 (IPA) to A1T2. The low voltage AC from A1T2 is rectified by diode bridge A1CR6 and filtered by A1L3 and A1C5 through A1C8. A1R13 is the bleeder resistor. Approximately +45 volts of filtered DC is fed via relay A7K1 and metering shunts A1R18 through A1R21 to the IPA assembly A3.

C. Filament Power Supply

Primary Power is supplied through circuit breaker A7CB3, relay A7K5 and rheostat A7R17 to the filament transformer A5T1 which is located in the PA box. A7R17 is the FILAMENT ADJUST control. A5T1 is a specially designed transformer which limits the filament cold inrush current to a safe value, thereby extending tube life. Replace only with an exact duplicate.

D. Control Power Supply

The Control Power Supply provides +24 volt to operate the relay ladder. This supply is located in the A7 Breaker Panel Assembly. +12 and -12 power supplies for metering and fault detect amplifiers and comparators, and +5 for the fault detect logic circuitry are contained in the Meter Panel sub-assembly. Primary power for these supplies is fed through the IPA circuit breaker and then through 2 control fuses. The fuses are on the A7 Breaker Panel Assembly.

E. Cooling

The PA tube is cooled by a high pressure squirrel cage blower mounted to the PA box. Positive cabinet pressure and auxiliary cooling is accomplished by a fan mounted in the rear of the transmitter. Power for cooling is supplied through 2 blower fuses and relay A7K10.

F. Automatic Power Control

PA Plate voltage and Plate current samples are fed to subassembly A3A2 (Dwg. 350330). These samples are multiplied by a four quadrant multiplier and compared to a reference voltage obtained from a motor driven potentiometer. The output voltage produced (0 to 2 volts) is used to drive the voltage controlled RF attenuator in the A3A2 assembly. Therefore, the DC Plate Power Input to the PA is held constant. This not only satisfies the FCC indirect power computation but also prevents VSWR effects from causing possible overdrive conditions.

4-3 CONTROL LADDER

A. Sequence

1. Depress LOCAL CONTROL--FIL ON or RF ON
2. A7K1 energizes which in turn energizes A7K6
3. A7K6 turns on fan and PA blower
4. If air flow is sufficient, vane switch A1S2 closes.
5. If the grounding stick is in place, (S-3) A7K5 is energized through A1S2. A7K5 applies power to the PA tube filament and turns on the FIL ON lamp.
6. At this time, A7K4 (30 second time delay relay) is also energized.
7. After A7K4 times out, the H.V. READY lamp will light provided all interlocks are closed and A7K2 relay is energized (no faults detected).
8. The sequence stops at this point if FIL ON was depressed. If RF ON was depressed, the sequence automatically continues.
9. A7K3 energizes which energizes A7K7 (High Voltage Supply AND +45 IPA Collector Supply).
10. If there are no IPA or PA faults detected, Exciter RF drive is available, and the +45 IPA collector supply is less than +49 volts, the RF drive will ramp up to full output within a few seconds.

B. Overload Protection

Overload sensing is accomplished by circuitry contained within the A2 Meter Panel Assembly on the A2A2 Interface and the A2A3 Fault Detector Circuit boards. Operational amplifiers are used to buffer the various samples and the outputs of these amplifiers are compared with reference voltages to determine if a fault has occurred. Once a fault has been detected, the logic circuits must be reset manually locally or remotely. The FAULT ANNUNCIATOR panel will show the type and location of the fault. This indication will remain until reset at the transmitter even if the fault itself has been reset remotely.

C. Fault Table

FAULT	TRIP POINT	ACTION
* IPA OVERCURRENT	* 13 amps/module	* HV off--RF off *
* IPA OVERTEMP	* 100 degrees C	* HV off--RF off *
* IPA OVERVOLTAGE	* 53 volts	* RF off *
* IPA OVERVOLTAGE	* 58 volts	* HV off--RF off *
* IPA VSWR	* 3:1	* RF LOW POWER *
* PA GRID OVERCURRENT	* 0.75 amps	* HV off--RF off *
* PA PLATE OVERCURRENT	* 3.5 amps	* HV off--RF off *
* OVERTEMP (PA Stack)	* 120 degrees C	* HV off--RF off *
* OVERTEMP (Cabinet)	* 60 degrees C	* HV off--RF off *
* OUTPUT VSWR	* 1.6:1	* RF LOW POWER *

SECTION 5
MAINTENANCE

* WARNING *

TRANSMITTERS CONTAIN VOLTAGES THAT CAN KILL. ALWAYS DE-ENERGIZE THE TRANSMITTER BY SHUTTING THE POWER OFF AT THE WALL DISCONNECT AND SHORTING THE HIGH VOLTAGE FILTER CAPACITORS WITH THE GROUNDING STICK BEFORE ATTEMPTING ANY MAINTENANCE. IT IS SUGGESTED THAT THE GROUNDING STICK BE LEFT ACROSS THE HIGH VOLTAGE SUPPLY WHILE WORK IS BEING DONE. DO NOT UNDER ANY CIRCUMSTANCES JUMPER ANY OF THE SAFETY INTER-LOCK SWITCHES. IT IS ALSO HIGHLY RECOMMENDED THAT NO ONE PERFORM MAINTENANCE ON THE TRANSMITTER WITHOUT A SAFETY PERSON AVAILABLE.

5-1 PREVENTIVE MAINTENANCE

- A. It is extremely important that the transmitter be kept clean and free from any accumulation of dust and lint. Positive pressure design reduces the need for cleaning but does not eliminate it. The following procedures should be accomplished at least MONTHLY but more often under extremely dusty conditions.
1. Change the disposable air filter. These filters are readily available 16" x 20" x 1" fiberglass units for furnace or air conditioning use.
 2. Inspect and clean interior of transmitter as required.
 3. Inspect fan blades and blower squirrel cage for accumulation of dust. Vacuum as required.
 4. Inspect the screen mesh in the PA box air outlet for accumulation of dust and lint. Vacuum as required.
 5. Inspect PA tube anode fins for accumulation of dust. Vacuum as required.
 6. Inspect all connections and components for evidence of rust, corrosion or discoloration due to overheating.

- B. Blower and fan motors have sealed bearings and require no further lubrication.

5-2 ACCESS TO COMPONENTS

- A. All components prefixed A1 are part of the transmitter main cabinet assembly. Most of these components are accessible through the rear door.
- B. All components prefixed A2 are part of the Meter Panel assembly. The Meter Panel pulls out from the front of the transmitter. The Meter Panel hinged rear cover can then be unscrewed for access to the inside. See Pictorial Assembly Drawing 350202 for detail.
- C. All components prefixed A3 are part of the IPA assembly. This unit is mounted behind the lower front door of the transmitter. Access to the inside of the A3 assembly is through the hinged front panel which is secured with quarter turn fasteners.
- D. All components prefixed A4 are part of the Tuner assembly. This unit is mounted on the front of the transmitter immediately below the Meter Panel.
- E. All components prefixed A5 are part of the PA Box assembly. This unit is mounted in the rear of the transmitter and is accessed through the rear door. The rear of the PA Box is removeable for service. It is secured by quarter turn fasteners.

* CAUTION *

THE PA BOX REAR COVER MUST BE IN PLACE AND ALL FASTENERS SECURE BEFORE ENERGIZING THE TRANSMITTER.

- F. The A6 assembly is the Harmonic Filter and Directional Coupler. It is mounted to the top of the PA Box.
- G. All components prefixed A7 are part of the BREAKER PANEL assembly. This unit is mounted behind the lower front door of the transmitter. Access to the inside of the A7 Assembly is through the hinged front panel.

5-3 TUBE REPLACEMENT

- A. Remove primary power from transmitter by opening wall disconnect.
- B. Open rear door and USE GROUNDING STICK TO DISCHARGE THE HIGH VOLTAGE FILTER CAPACITORS. LEAVE THE GROUNDING STICK ACROSS THE HIGH VOLTAGE SUPPLY.
- C. Remove the rear cover of the PA Box.
- D. Loosen the clamp around the PA tube.
- E. Remove the tube by pulling straight up. Tube may be "rocked" slightly from side to side to facilitate removal, however, DO NOT TWIST THE ASSEMBLY IN THE SOCKET.
- F. Carefully press the new tube straight into the socket. Verify that the tube connector flanges have "bottomed" against the socket.
- G. Tighten the clamp around the tube.
- H. Secure the PA Box rear cover, replace the grounding stick in its clamps, and close the rear door.
- I. Follow initial turn on procedure in Section 3-2

SECTION 6
PARTS LISTS

6-1 ORDERING INFORMATION

A. To order parts for the FMQ-10000 transmitter, write:

QEI Corporation
P.O. Box 805
Williamstown, NJ 08094

or call:

1-609-728-2020

B. Provide the following information:

1. Station Call
2. Transmitter model and serial no.
3. QEI Part No. or manufacturers part no.
4. Shipping Address
5. Billing Address
6. Desired method of shipment

6-2 PARTS LISTS

A 1 TRANSMITTER ASSEMBLY

<u>REF. DES.</u>	<u>DESCRIPTION</u>	<u>QEI PART NO.</u>
C1, C2	Cap. Oil 4uf, 5KV	110-8046
C5 - C7	Cap.Elect.5000uf 75V	110-3508-75
C8	Cap. N.P. 60uf	110-3606
C10, C11	Cap.Oil 4uf 370 VAC	110-3405
C12, C13	Cap.Elect. 15uf 100V	110-3156-100V
C14	Cap.Elect.500uf 50V	110-3507-50
CB1	Circuit Bkr. Main 100A	120-1100
CB2	Circuit Bkr. 45V 20A	120-1020-2
CB3	Circuit Bkr. Fil. 5A	120-1005
CR1a, CR1b, CR2a, CR2b	Diode, High Voltage	113-0105
CR5	Diode, High Voltage	113-0105
CR4	Diode, Bridge Rect.	113-1990-3
CR6 - CR18	Diode, Sil.1N4001	113-04001
CR22, CR23	Diode, Zener, 12v	113-25242
K1	Relay, High Voltage	136-0009
K2, K3	Relay, DPDT	136-0010
K4, K10	Relay, DPDT	136-0011
K5	Relay, 3PDT	136-0012
K6 - K8	Relay, 4PDT	136-0003
K9	Relay, Time Delay	136-0015
L1, L2	Inductor, High Vol.	180-22934
L3	Inductor, 45V	180-22879
M1	Meter, Filiment Time	145-0013
R1 - R3	Res. W.W.30K 200W.	166-0303
R4, R10	Res. W.W.10M 1%	166-0336
R6	Res. W.W.30 ohm 160W	166-0300
R5, R7	Res. Film 100K 1%	165-1003
R8, R9, R15	Res. W.W. 10 ohm 10W	166-0011
R11	Res. Film 2.55K 1%	165-2551
R12	Res. Film 4.99K 1%	165-4991
R13, R14.	Res. W.W. .5 ohm 10W 1%	166-00R5
R16	Res. Cathode Selected	
R17	Res. Var.25 ohm 150W	167-0250
R18 - R21	Res. W.W. 02 ohm 10W 1% CH. MTG.	166-0R02-10
R22	Res. Film 20k 1%	165-2002

<u>REF. DES.</u>	<u>DESCRIPTION</u>	<u>QEI PART NO.</u>
S1, S2	Switch, Interlock Air	175-0023
S4 - S6	Switch, Interlock	175-0024
S3	Switch, Interlock Grd.Stick	220-0001
T1	Trans., High Voltage	180-22815
T2	Trans., 45V	180-22880
T3	Trans. Control	180-3266
T4 - T6	Transformer Metering	180-3008
TB1	Term.Block, 240 VAC	181-1100.2
TB4	Term.Block, Fuse	181-2489.2
TB5	Term.Block, 115 VAC	181-1100.2
TB6	Term.Board, Remote	181-0020
TB7	Term.Board, Telco	181-0006
U4 - U6	I.C.Temp.Sensor	182-0590

A1A OVERLOAD BOARD

<u>REF. DES.</u>	<u>DESCRIPTION</u>	<u>QEI PART NO.</u>
A1A	Circuit Board	100-821001A
A1A	Circuit Board	100-821001B
C1 - C5	Cap. Cer., .01uf 1KV	110-0103-K
K2, K3	Relay, DPDT	136-0010
L1, L2	Choke, Wideband	140-2008
R8, R9, R10, R10	Res. W.W., 10 ohm 10W	166-0011
R11	Res. Film, 2.55K 1%	165-2551
R12	Res. Film, 4.99K, 1%	165-4991
R13, R14	Res. W.W., .5 ohm 10W 1%	166-00R5
R15, R16	Res. Var., 1K	RV4LAYS A102A

A2 CONTROL BOX ASSEMBLY

<u>REF.DES.</u>	<u>DESCRIPTION</u>	<u>QEI PART NO.</u>
CR1 - CR4	Diode, LED Red	113-3000
DS1 - DS6	Lamp	117-0327
J1	Connector, 26 Pin	130-3029
J2, J3	Connector, BNC	130-0001
J8	Connector, 37 pin	130-8037MR
J9	Connector, 37 pin	130-8037FR
M1	Meter, Voltmeter	145-0006
M2	Meter, Multimeter	145-0006
M3	Meter, Final Voltage	145-0006
M4	Meter, Final Current	145-0006
M5	Meter, Rev/Grid/Fwd	145-0006
R1, R2	Res. Carb. 2.2K	RC20GF222J
S1	Switch Reset	175-0031-F
S4	Switch Raise/Lower	175-0016-F
S5	Switch Rev/Grid/Fwd	175-0014-F
XDS1 - XDS6	Socket, Lamp	192-0001

A2A2 INTERFACE ASSEMBLY

<u>REF. DES.</u>	<u>DESCRIPTION</u>	<u>QEI PART NO.</u>
A2A2	Circuit Board	100-T100020
C1 - C5, C21, C22 C6, C16-C20 C23, C49	Cap. Mica 1000pf	110-1102
C7 - C11	Cap. Tant. 1uf	110-3105T
C12, C14, C24-C36	Cap. Cer. .01 uf	110-0103
C38-C48	Cap. Cer. .1uf	110-0104
C13, C15	Cap. Elect. 100uf	110-3107
CR1	Diode, Zener, 5.6V	113-25232
CR2	Diode, Zener, 4.7V	113-25230
J101-J108 J1A, J1B	Socket, 16 pin DIP	130-0316-1
L1 - L7	Choke, Wideband	140-2008
Q1 - Q5	Transistor, PNP 2N5401	160-05401
R1, R8, R22, R28 R3, R10, R17, R24, R30	Res. Film, 2.49K 1%	165-2491
R4 - R7	Res. Film, 4.99K 1%	165-4991
R9, R16, R23, R29, R36, R38, R40, R41, R42, R44, R46, R103, R106, R114	Res. Var. 1K	167-3102
R12, R19, R32, R51, R72, R82, R87, R91, R94, R98, R102, R108, R110, R115	Res. Film, 1.00K 1%	165-1001
R13, R20, R26, R33, R52, R54, R60, R62, R65, R66, R69, R70, R73, R74, R76, R78, R80	Res. Carb., 10K	RC20GF103J
R14, R21, R27, R34	Res. Carb., 1K	RC20GF102J
R35, R37, R39, R47-R49, R56-R58, R68, R75, R77, R79, R84	Res. Film, 1.5K 1%	165-1501
R45	Res. Film, 10K 1%	165-1002
R50, R59, R116, R117	Res. Film 20K 1%	165-2002
R53, R55, R61, R63	Res. Film, 499 ohm 1%	165-4990
R64, R71	Res. Carb., 12K	RC20GF123J
R67	Res. Var., 10K	167-3103
R81, R83, R92, R93, R99, R100, R109, R111	Res. Film, 5.11K 1%	165-5111
R85	Res. Carb. 1Meg	RC20GF105J
R86	Res. Var., 250 ohm	167-3251
	Res. 220 ohm 1%	165-2210

<u>REF. DES.</u>	<u>DESCRIPTION</u>	<u>QEI PART NO.</u>
R88	Res. Carb. 56K	RC20GF563J
R89	Res. Carb. 5.6K	RC20GF562J
R90,R97	Res. Carb. 100K	RC20GF104J
R96	Res. Carb. 220K	RC20GF224J
R101	Res. Film, 2.21K 1%	165-2211
R105	Res. Film, 2.67K 1%	165-2671
R107,R113	Res. Carb. 15K	RC20GF153J
R112	Res. Film, 2.0K 1%	165-2001
R2,R152	NOT USED	
U1 - U9	IC, Dual Op Amp. NE532	182-0532
U10 - U13	IC, Quad Comp. LM339	182-0339

A2A3 FAULT DETECTOR ASSEMBLY

<u>REF. DES.</u>	<u>DESCRIPTION</u>	<u>QEI PART NO.</u>
A2A3	Circuit Board	100-1350032
C1,C8	Cap.Tant. 1.0 uf	110-3105T
C2,C3	Cap.Elect. 15 uf	110-3156
C4,C5	Cap.Elect. 100 uf	110-3107
C7	Cap.Cer. .1 uf	110-0104
C9 - C20	Cap.Cer. .01 uf	110-0103
CR1 - CR3	Diode, Silicon	113-04446
CR4	Diode, Silicon	114-04001
J1D,J202-J208	Socket, 16 pin DIP	130-0316-1
Q1 - Q11	Transistor, NPN 2N4401	160-04401
R1-R14,R36,R37, R42,R43,R62,R63	Res. Carb. 1K	RC07GF102J
R15,R55	Res. Carb. 1K	RC20GF102J
R16,R56	Res. Carb. 1.2K	RC20GF122J
R17,R54	Res. Film, 46.4K 1%	165-4642
R18	Res. Film, 2.21K 1%	165-2211
R19,R53	Res. Carb. 27K	RC20GF273J
R20,R31,R38,R40	Res. Carb. 4.7K	RC07GF472J
R21,R32-R35	Res. Carb. 1.5K	RC20GF152J
R22	Res. Carb. 220K	RC20GF224J
R23	Res. Carb. 3.3K	RC20GF332J
R24	Res. Carb. 2.2M	RC20GF225J
R25,R52	Res. Carb. 4.7K	RC20GF472J
R26 - R28	Res. Carb. 33K	RC20GF333J
R29,R48	Res. Carb. 22K	RC20GF223J
R30,R45,R46,R50, R51,R61	Res. Carb. 2.2K	RC20GF222J
R39,R41	Res. Carb. 10K	RC07GF103J
R44,R49	Res. Carb. 820 ohm	RC20GF821J
R57	Res. Film 2.49K 1%	165-2491
R59	Res. Carb. 47K	RC20GF473J
R60	Res. Carb. 12K	RC20GF123J
R58	Res. Carb. 100K	RC20GF104J
U1	I.C. TTL 7410	182-7410
U2,U3,U12,U15	I.C. TTL 7440	182-7440
U4 - U11	I.C. TTL 7400	182-7400
U13	I.C. TTL 7402	182-7402
U14	I.C. Quad Comp. LM339	182-0339
U16	I.C. TTL 7405	182-7405

A2A5 MULTIMETER SWITCH

<u>REF. DES.</u>	<u>DESCRIPTION</u>	<u>QEI PART NO.</u>
A2A5	Circuit Board	100-T10012
CR1,CR2	Diode, Silicon	113-04001
J502	Socket, 16 pin DIP	130-0316-1
R1	Res. Film 470K 1%	165-4703
R2	Res. Film 24.9K 1%	165-2492
R3	Res. Film 1.5K 1%	165-1501
S1	Switch, 6 position	175-0028

A2A6 IPA CURRENT SWITCH

<u>REF. DES.</u>	<u>DESCRIPTION</u>	<u>QEI PART NO.</u>
A2A6	Circuit Board	100-T350011
J601	Socket 16 pin DIP	130-0316-1
S1	Switch, 4 position	175-0027

A2A7 VOLTMETER SWITCH

<u>REF. DES.</u>	<u>DESCRIPTION</u>	<u>QEI PART NO.</u>
A2A7	Circuit Board	100-T350011
CR1,CR2	Diode Silicon	113-04001
J703	Socket 16 pin DIP	130-0316-1
R1	Res. Film 46.4K 1%	165-4642
R2	Res. Film 121K 1%	165-1203
R3	Res. Film 321K 1%	165-3213
R4	Res. Film 221K 1%	165-2213
R5	Res. Film 28.7K 1%	165-2872
S1	Switch, 4 position	175-0026

A2A8 FINAL METER ASSEMBLY

<u>REF. DES.</u>	<u>DESCRIPTION</u>	<u>QEI PART NO.</u>
A2A8	Circuit Board	100-T350015
C1 - C3	Cap. Cer. .001 uf	110-0102
CR1 - CR6	Diode, Silicon	113-04001
J804	Socket 16 pin DIP	130-0316-1
R1	Res. Var. 25K Dual	200-0253-2
R2	Res. Film 768 ohm 1%	165-7680
R3	Res. Film, 1.5K 1%	165-1501
R4	Res. Film 6.61K 1%	165-6611
R5	Res. Film 332 ohm 1%	165-3320
R6	Res. Film 23.7K 1%	165-2372
R7	Res. Film 649 ohm 1%	165-6490

A2A9 TRANSMITTER CONTROL SWITCH

<u>REF. DES.</u>	<u>DESCRIPTION</u>	<u>QEI PART NO.</u>
A2A9	Circuit Board	100-T350008
J906	Socket 16 pin DIP	130-0316-1
R1 - R5	Res. Carb. 68 ohm 2W	RC42GF680J
S1	Switch 5 position	175-0029

A2A10 FAULT ANNUNCIATOR ASSEMBLY

<u>REF. DES.</u>	<u>DESCRIPTION</u>	<u>QEI PART NO.</u>
A2A10	Circuit Board	100-TX009-1
C1 - C10	Cap. Cer. .01 uf	110-0103
CR1 - CR10	Indicator LED Red	113-3003
CR11 - CR20	Diode, SCR	113-45061
J1005	Socket 16 pin DIP	130-0316-1
R1	Res. Carb. 51 ohm 5%	RC20GF510J
R2	Res. Carb. 100 ohm 5%	RC20GF101J
R3	Res. Carb. 68 ohm 2W.	RC42GF680K
R4 - R13	Res. Carb. 270 ohm 1W.	RC32GF271J
R14 - R22	Res. Carb. 510 ohm 5%	RC20GF511J
R23 - R33	Res. Carb. 2.2K 5%	RC20GF222J

A3A2 SPLITTER/APC ASSEMBLY

<u>REF. DES.</u>	<u>DESCRIPTION</u>	<u>QEI PART NO.</u>
B1	Motor, Raise/lower	194-2M024
R1	Res. Var. 20K 10 turn	200-0203

A3A2B POWER CONTROL ASSEMBLY

<u>REF. DES.</u>	<u>DESCRIPTION</u>	<u>QEI PART NO.</u>
A2A4	CIRCUIT BOARD	100-APC0024
C1	Cap. Elect. 15 UF	110-3156
C2,C3,C9	Cap. Elect. 100 uf	110-3107
C4,C5,C10-C14, C18,C19	Cap. Cer. .01uf	110-0103
C6	Cap. Tant. 1uf	110-3105T
C7,C8	Cap. Elect. 200uf	110-3207
C15	Cap. Elect. 5uf	110-3505
C16,C17,C20	Cap. Cer. .1uf	110-0104
CR1	Diode, Zener 12V	113-25242
CR2,CR3	Diode, Silicon	113-04001
CR4	Diode, Zener 4.7V	113-25230
J302	Socket, 16 pin DIP	130-0316-1
K1,K2	Relay, DPDT DIP	136-0014
Q1,Q3	Transistor NPN 2N4401	160-04401
Q2	Transistor NPN 2N3053	160-03053
R2,R3,R6,R7	Res. Film 499 ohms 1%	165-4990
R4,R1,R30	Res. Film 110 ohms 1%	165-1100
R8 - R10	Res. Film 7.87K 1%	165-7871
R11,R20	Res. Var. 10K	167-3103
R12	Res. Film 11K 1%	165-1102
R13	Res. Carb. 2.7K 5% **	RC20GF272J
R14,R15	Res. Film, 2.21K 1%	165-2211
R18,R19	Res. Film 100K 1%	165-1003
R21	Res. Carb. 5.6K 5%	RC20GF562J
R22	Res. Carb. 10K 5%	RC07GF103J
R23	Res. Carb. 39K 5% **	RC07GF393J
R24	Res. Carb. 100K 5%	RC20GF104J
R25	Res. Carb. 1K 5%	RC20GF102J
R26,R29	Res. Carb. 4.7K 5%	RC20GF472J
R27	Res. Carb. 120 ohms 5%	RC20GF121J
R28	Res. Carb. 1.5M 5%	RC20GF155J
R16,R17	Res. Film 5.11K 1%	165-5111
U1	IC Multiplier MC1595	182-1595
U2,U3	IC Dual Op-Amp NE532	182-0532

A3A4 IPA MODULE ASSEMBLY

<u>REF. DES.</u>	<u>DESCRIPTION</u>	<u>QEI PART NO.</u>
A3A4	Board, P.C.	100-FMQA3A
C1, C10	Cap. Uncased Mica 68pf	110-2680
C2, C13, C16	Cap. Uncased Mica 120pf	110-2121
C3	Cap. Uncased Mica 82pf	110-2820
C4, C19, C20	Cap. Uncased Mica 470pf	110-2471
C5, C25, C29	Cap. Feed-thru 1000pf	110-7102
C6, C24, C28	Cap. Ceramic .01uf, 1KV	110-0103-K
C7, C23, C27	Cap. Elect. 5uf 100V	110-3505-100
C8, C22, C26	Cap. Uncased Mica 1000pf	110-2102
C9	Cap. Uncased Mica 100pf	110-2101
C11, C12, C30, C31	Cap. Uncased Mica 270pf	110-2271
C14, C17	Cap. Uncased Mica 15pf	110-2150
C15, C18	Factory Select	
C21	Not Used	
C32, C33	Cap. Mica 1000pf	110-1102
H1	Handle, Black	150-0922
J1, J4, J5	Connector, BNC Bulkhead	130-0001
J2	Connector, N Female	130-0004
J3	Connector	130-3004
L4, L10, L12	Choke, Wideband	140-2008
Q1 - Q3	Transistor	160-0175
R1 - R3	Res. 10 ohm 2W.	RC42GF100J
U1	I.C. AD590JH	182-0590

A3A5 IPA MODULE ASSEMBLY

PARTS LIST IDENTICAL TO A3A4 SUB-ASSEMBLY

A3A6 IPA MODULE ASSEMBLY

PARTS LIST IDENTICAL TO A3A4 SUB-ASSEMBLY

A4 TUNER ASSEMBLY

<u>REF. DES.</u>	<u>DESCRIPTION</u>	<u>QEI PART NO.</u>
C1, C2	Cap. Air Var. 4-50 pf	110-9450
J1, J2	Connector, Type "N"	130-0004
J3	Connector, 10 pin	130-3005
L1	Inductor	140-Q8001
S1	Switch, Tune	175-0016-F
S2	Switch, Load	175-0016-F

A5 POWER AMPLIFIER ASSEMBLY

<u>REF. DES.</u>	<u>DESCRIPTION</u>	<u>QEI PART NO.</u>
C1, C3	Cap. Cer. 500pf 15KV	110-0500-15
C2	Cap. HV By-Pass	110-Q8700
C4, C5	Cap. Tune/Load Assy.	110-Q8800
C6	Cap. Socket By-Pass	110-Q8701
C7, C8	Cap. Filament By-Pass	110-Q8702
C9 - C13	Cap. Feed-Thru 1000pf	110-7102
J1	Connector Female Cable End	130-0030
J2	Connector Female	130-0004
L2	Inductor, Shunt Tune	140-Q8700
L3, L4	Inductor, Filament	140-Q8701
L5	Inductor, Series Tune	140-Q8702
L7	Inductor, Shunt Trap	140-Q8703
P1	Plug Type "N" Right Angle	130-0032
T1	Transformer, Filiment	180-22816
V1	Tube, YU148	162-148
W1	Cable, RG8/U	000-Q1001

A6 LOW PASS FILTER & DIRECTIONAL COUPLER ASSEMBLY

<u>REF. DES.</u>	<u>DESCRIPTION</u>	<u>QEI PART NO.</u>
C1, C4	Cap. Teflon 27 pf	110-Q9001
C2, C3	Cap. Teflon 52 pf	110-Q9002
C5, C6	Cap. Cer. .001uf	110-0102
C7	Cap. RF Pickup	110-Q9003
CR1,CR2	Diode, Silicon	113-0005
J1	Connector EIA 1 5/8" Flanged	
J2 - J4	Connector, BNC	130-0001
L1 - L3	Inductor	140-Q8008
R1, R4	Res. Carb. 390 ohm	RC20GF391J
R2, R3	Res. Carb. 10K	RC20GF103J
R5, R6	Res. Var. 1K	167-3102

A7 RELAY & BREAKER PANEL ASSEMBLY

<u>REF. DES.</u>	<u>DESCRIPTION</u>	<u>QEI PART NO.</u>
C1	Cap., Elect. 15uf 100V	110-3156-100
C2	Cap., Elect. 4900uf 50V	110-3498
C3, C4	Cap., Ceramic, .05uf 100V	110-0503-100
CB1	Circuit Breaker, 100 Amp.	120-1100
CB2	Circuit Breaker, 3 Amp	120-1003
CB3	Circuit Breaker, 20 Amp.	120-1020-2
CR1	Bridge Rectifier	113-1960-1
CR2-CR10	Diode, Silicon, 1 Amp.	113-04001
F1, F2	Fuse, 5 ASB	120-0007
F3, F4	Fuse, 3 Amp. 3AG	120-0005
F5, F6	Fuse, 1.0 Amp. 3AG	120-0002
K1, K2, K3	Relay 4PDT 24 VDC	136-0003
K4	Timer	136-0015
K5	Relay 3PDT 24 VDC	136-0012
K6	Relay DPDT 24 VDC	136-0013
M1	Meter, Fil. Time 240V	145-0013
	Knob	150-0717
R1	Resist., Var. WW 25 ohm	167-0250
R2	Resist., 18K 1/2W.	RC20GF183J
R3	Resist., 1K 1W.	RC32GF102J
T1	Transformer, Control	180-341X
T2	Transformer, Power	180-3140/B
T3	Transformer, Power	180-3008
TB1	Terminal Board, 20 pt.	181-0020
	Marker Strip	181-0020A
	Terminal Strip, 4 pt.	181-0054
TB2	Terminal Board, 13 pt.	181-0013A
	Marker Strip	181-0013B
U1	I.C.	182-0350
V1, V2	Varistor, Metal Oxide	168-1001
XK1, XK2, XK3	Relay	130-4001C
XK4, XK6	Relay Socket	130-4002C
XK6	Relay Socket, 11 Pin	130-4004

SECTION 7
SCHEMATICS