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Mohawk 2A Amplifier Owner's Manual

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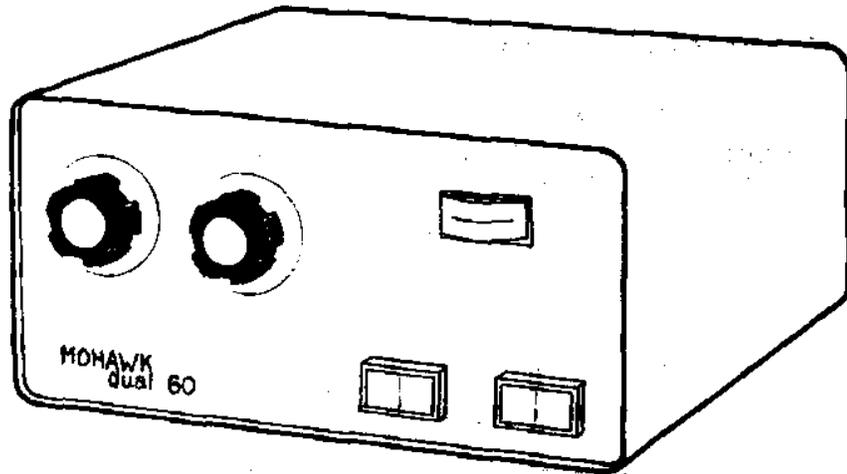
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Model 2A



Amateur Linear Amplifier

OPERATING INSTRUCTIONS

General Description

The Mohawk "dual 60" is an RF power amplifier that linearly amplifies an RF signal approximately 12 db in the 10 meter Amateur band.

The "dual 60" will operate on either 115 volts AC or 12 volts DC, depending on which plug-in power cord is used. The amplifier can be used interchangeably for either fixed or mobile operation. The power output, linearity and tuning adjustments remain the same for either case.

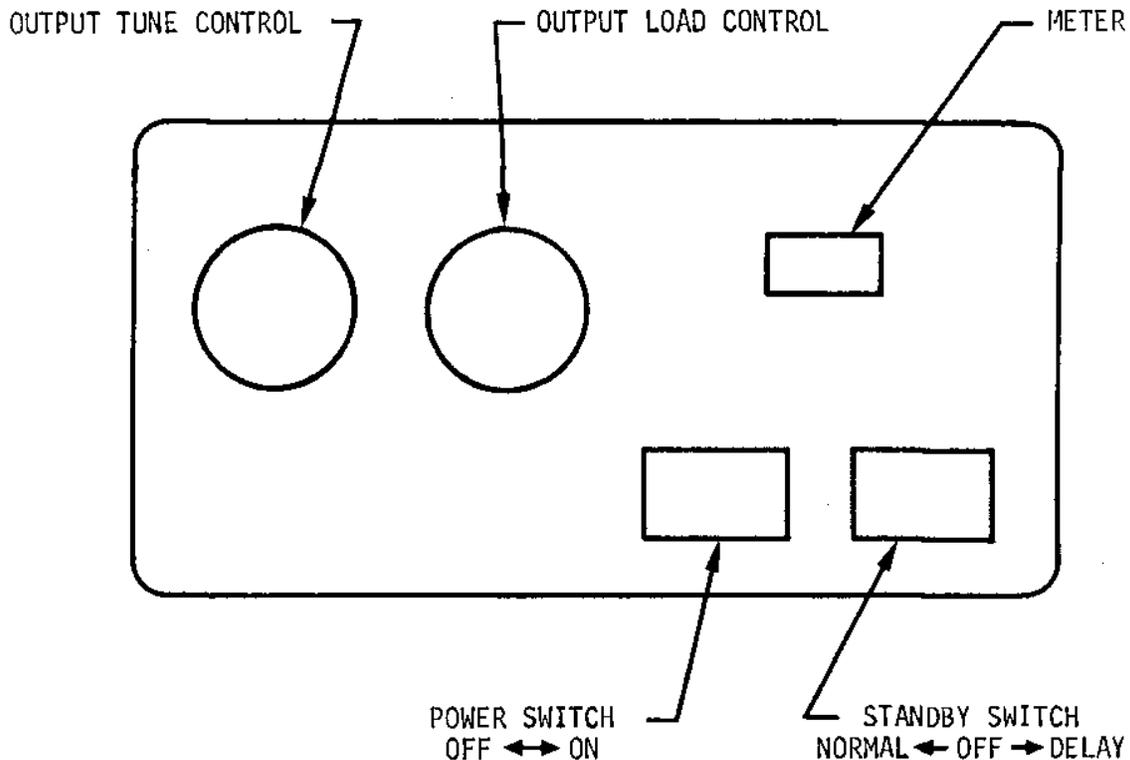
An automatic antenna switching circuit is incorporated in the "dual 60" and allows the user to switch readily from just the power output of his exciter-transmitter to the amplified power output of the Mohawk. This feature also permits the user to operate a transceiver through the amplifier, using the same antenna for transmit and receive.

The Mohawk "dual 60" is furnished with an adjustable delay in the antenna switching circuit so that the relays will not open during short pauses in the user's speech when operating single sideband suppressed carrier (A3J). Up to about two seconds of delay is available and this can be adjusted to suit the user's own talking speed.

The "dual 60" is also equipped with an eight-pin socket for connection to a remote control through a multiple conductor cable. Available separately as an optional accessory, the Mohawk remote control is especially useful for mobile operation where the amplifier can be mounted in the automobile trunk and controlled from the dashboard. The Mohawk remote controls will operate the "dual 60", however, from either power source and provide remote power switching, remote standby switching (normal, off and delay) and remote metering of the relative RF power output.

Front Panel Controls

The front panel of the Mohawk "dual 60" has the final tuning controls, a power on-off switch, a three position standby switch and a relative RF output meter.



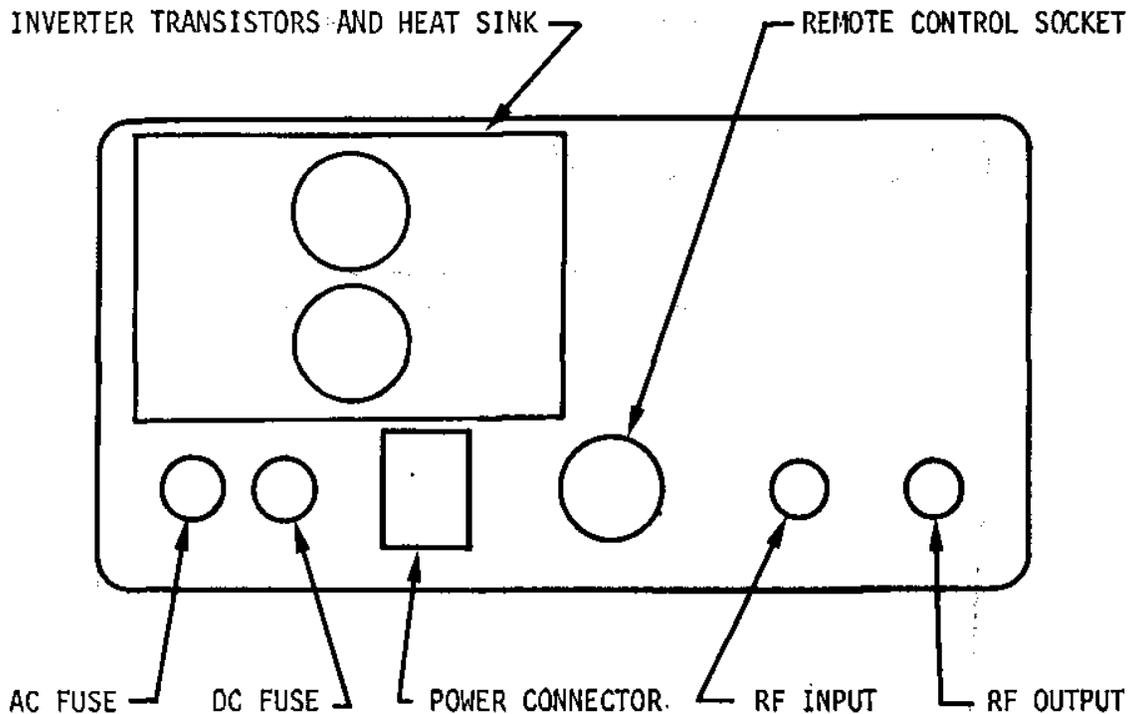
The final tuning controls are labeled TUNE and LOAD, and consist of the final plate tuning capacitor (TUNE) and the output loading capacitor (LOAD).

The POWER switch turns the complete amplifier on or off. The three position STANDBY switch controls the automatic relay switching circuit; the left position (NORMAL) activates the circuits with no delay, the center position is off, and the right position (DELAY) turns the relay circuits on with adjustable delay.

The front panel meter is a compact, "edgewise" instrument that indicates the relative RF output of the amplifier. Since it is small and has no zero adjustment, this meter should be used only for tuning. It cannot be expected to indicate true power output.

Rear Panel Connections

The rear panel of the Mohawk "dual 60" has INPUT and OUTPUT connections to the amplifier, a twelve pin POWER connector, an eight pin socket for connecting a Mohawk Remote Control, and two fuseholders.



The POWER connector will accept either the 115 volt AC power cord or the 12 volt DC power cord, depending on which source of power is used. Note that the twelve pin connector will only go together one way.

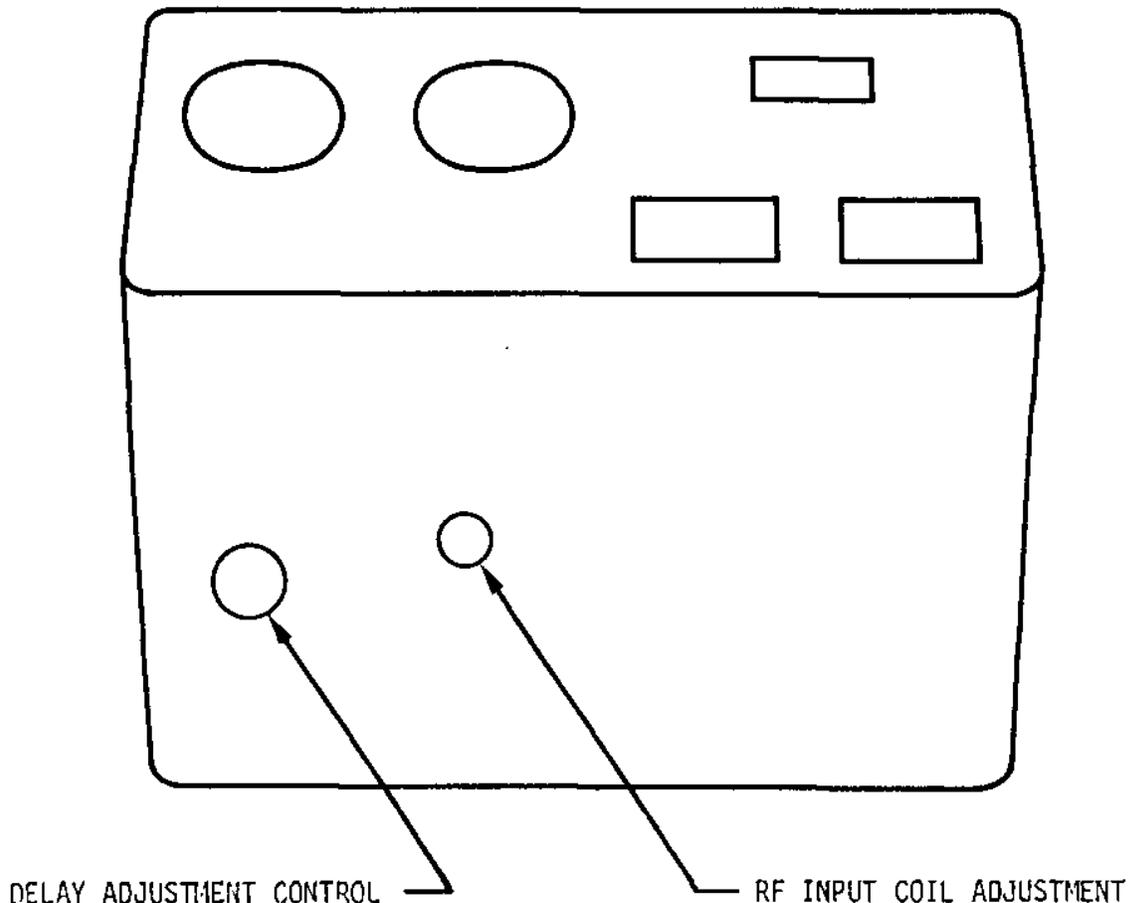
Power to the "dual 60" is separately fused. One fuse, labeled AC FUSE 5 AMP, is only for 115 volt AC power, and the other fuse, labeled DC FUSE 20 AMP, is only for 12 volt DC power.

The eight pin "octal" socket, labeled REMOTE, will accept a mating plug from the cable that is supplied with either the Model 21 or the Model 22 Mohawk Remote Control. Complete instructions for using these Remote Controls are furnished with each unit.

Both the INPUT and OUTPUT connections are standard UHF coaxial connectors (SO-239) that will accept a standard UHF coaxial plug (PL-259 or equivalent).

Internal Controls

There are two internal adjustments in the Mohawk "dual 60", and both are accessible through holes in the bottom of the cabinet. One is the delay adjustment control for single side band (A3J) operation and requires a screwdriver to adjust. A maximum delay of about two seconds is available with this control in the full clockwise position.



The other adjustment is the RF input coil and requires an insulated 3/32" hex tool. Because this adjustment has been pre-set during manufacture, satisfactory operation will be obtained without touching it further. However, to perfectly adjust the "dual 60" to your exciter-transmitter, this adjustment can be made after the front panel adjustments have been completed. Being careful to use an insulated tool, adjust the core in this coil for either maximum output or, if the proper equipment is available, minimum SWR between the exciter-transmitter and the amplifier. This adjustment can be made with an unmodulated carrier and, once set, will not need to be touched again unless a different exciter-transmitter is used.

AC Power Requirements

When the AC power cord is plugged into the POWER connector on the rear panel of the Mohawk "dual 60", the amplifier will operate on standard 60 Hz AC (alternating current) line power. In this mode, it is designed for operation at 115 volts, although satisfactory performance will be obtained within the range from 105 volts to 130 volts.

The AC power cord of the "dual 60" is equipped with a grounding type plug. When properly used this type of plug connects the amplifier chassis to the ground in the electrical power system. Its purpose is to minimize the possibility of shock hazard from the cabinet in power equipment of this type. It further insures proper grounding of the amplifier to permit full power to be delivered to the antenna while minimizing unwanted (and TVI causing) radiation from the chassis. The grounding plug of the Mohawk "dual 60" should not be defeated by the use of adapters unless the ground connection of the adapter is properly grounded.

DC Power Requirements

When the DC power cord is plugged into the POWER connector on the rear panel of the Mohawk "dual 60", the amplifier will operate on standard automotive DC (direct current) power. In this mode, it is designed for operation at 13.8 volts (which is the usual voltage when the automobile generator or alternator is running), although satisfactory performance will be obtained within the range from 10 volts to 15 volts. The "dual 60" will only operate on negative ground systems, since the negative power lead is connected internally to the amplifier chassis.

Since the "dual 60" draws approximately 20 amperes of current during DC operation, the user should be sure that the power wire used will safely handle this requirement. At least 12 AWG wire is required and 10 AWG is preferred, with the wire length kept to a minimum (less than 20 feet is recommended) to avoid serious power losses.

RF Input

The Mohawk "dual 60" will accept an input signal of 1 watt minimum and 5 watts maximum continuous (10 watts maximum intermittent). The input impedance is a nominal 50 Ω and the input receptacle is a standard UHF coaxial connector (SO-239).

The "dual 60" uses a solid-state automatic switching circuit that serves the dual function of antenna switch-over and bias switching. This is accomplished by sensing the input RF signal within the amplifier

and no relay switching connections to your exciter-transmitter are required.

When the "dual 60" is fed with an RF signal of at least 1 watt and with the front panel STANDBY switch in either of its two "on" positions (NORMAL or DELAY), the disabling bias is removed from the amplifier tubes, the input signal is fed to the cathodes of the tubes through an impedance matching coil and the output from the tubes is fed to the output connection.

When no RF input signal is present, or when the STANDBY switch is turned off, the input and output connectors of the Mohawk "dual 60" are connected together through the change-over relay. This feature permits low power operation directly from the exciter-transmitter and is especially useful for local communications where excessive power would only create QRM for someone else.

RF Output

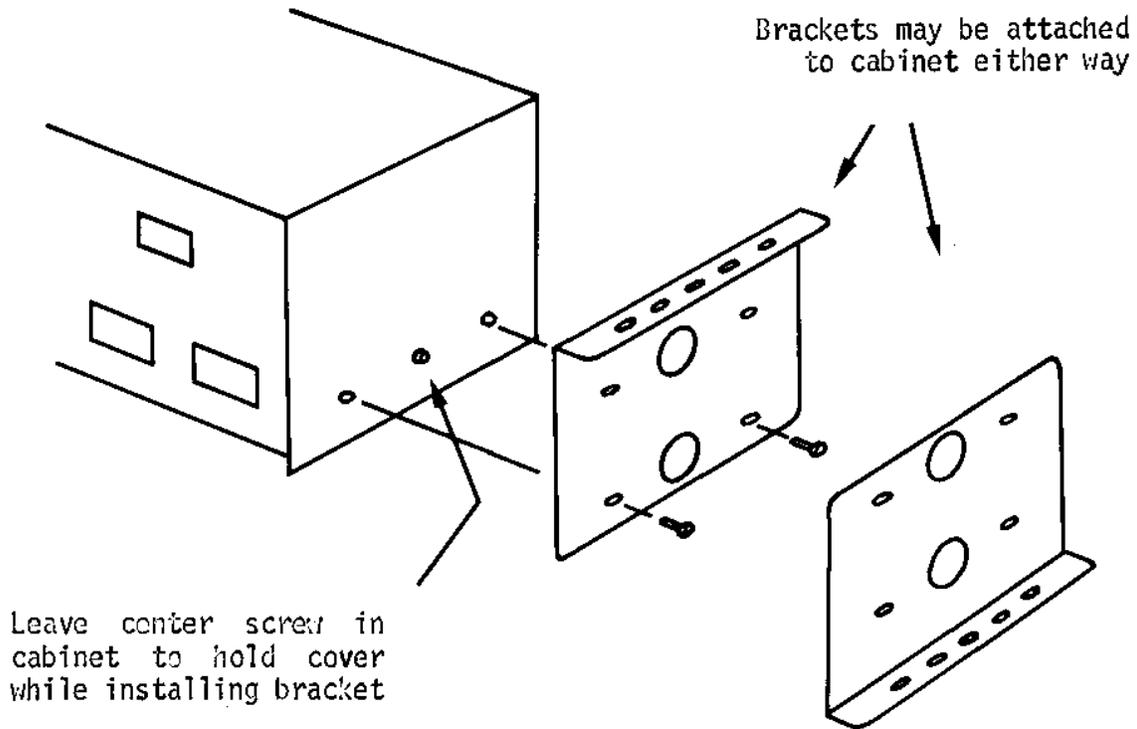
The output of the Mohawk "dual 60" is designed to feed directly into a 50 Ω coaxial cable transmission line to the antenna. The output receptacle is a standard UHF coaxial connector (SO-239).

Installation

The most unique feature of the Mohawk "dual 60" amplifier is its built-in capability of being used either fixed or mobile. Hence, provision is made for either type of installation; in the user's "ham shack" or in his automobile.

When operated in the "shack", the "dual 60" requires no special installation. The non-marring plastic feet allow it to be placed on a table or bench where the controls will be accessible to the user. Plug the AC power cord of the "dual 60" into a source of 115 volts 60 Hz AC power, connect the antenna transmission line to the OUTPUT receptacle and connect the exciter-transmitter to the INPUT receptacle.

When operated mobile, the "dual 60" may be mounted either under the dashboard or in the trunk of the automobile, using the mounting brackets furnished with each unit. These mounting brackets are reversible so that the amplifier may be mounted upright in either case and are furnished with foam padding to prevent any marring of the finish of the "dual 60" cabinet. Refer to the illustration showing the proper attachment of these brackets to the amplifier cabinet.



Connect the red (positive) lead of the DC power cord to the positive side of the automobile electrical system, preferably directly to the positive (+) terminal of the battery. Use wire that is capable of carrying approximately 20 - 25 amperes of current; 10 AWG wire is recommended although 12 AWG may be used if the length is less than 10 feet. Connect the black (negative) lead of the DC power cord to the automobile frame or body.

Whether installing the "dual 60" at home or in a car, be sure to allow sufficient room all around the unit to permit good air circulation for cooling. Especially do not place anything on top of the amplifier that will restrict a free flow of air through the cabinet. When installing the amplifier in an automobile, do not allow any metal to touch the transistors on the back of the cabinet. These transistors are insulated from the chassis and should not, under any conditions, be short circuited either to ground or to each other.

Operation

After installing the Mohawk "dual 60" and checking all wiring, turn the front panel POWER switch on and allow the tubes to warm up for at least 30 seconds. Set the front panel tuning knobs (TUNE and LOAD) so that the pointers are straight up. This position has been pre-set at the factory as a starting point for the tuning procedure, although proper tuning can be accomplished starting with the knobs in any position - it will just take a little longer.

Turn the front panel STANDBY switch to either of its two "on" positions (NORMAL or DELAY). This energizes the power relay and keying circuits, and the amplifier is now ready to receive an incoming RF signal. When the "dual 60" is operated from AC power, the power relay is not connected to anything. When operated from DC power, the power relay energizes the inverter circuits and a slight hum will be heard, indicating that the high voltage (B+) has been applied to the tubes. This feature of the "dual 60" is especially useful for mobile operation where excessive battery drain can be a problem. With only the POWER switch on, just the tube filaments are energized and the amplifier draws only three amperes, although it is ready for instant use as soon as the STANDBY switch is turned on to energize the inverter circuits.

When the exciter-transmitter is activated, a second click will be heard as the RF signal actuates the changeover relay. With the amplifier turned on and functioning, the operator should proceed to the proper tuning method described next for the mode of operation to be used.

NOTE

The front panel meter on the Mohawk "dual 60" can only be used to indicate relative output for tuning purposes. It has no zero adjustment and its location near the magnetic field of the power transformer affects its accuracy. This meter will often show a reading, even when no signal is present, because of the transformer's influence. However, when used for tuning, where only a relative reading is required, the meter is adequate and reliable. If greater accuracy is desired, refer to the section on "Remote Control" in this instruction manual where the use of an external meter is described.

CW, SSB, FM or RTTY Operation (A0, A1, A3J, F0, F1, F3 & F5)

Turn the exciter-transmitter on. With the STANDBY switch of the Mohawk "dual 60" turned on (either NORMAL or DELAY) and the front panel TUNE and LOAD controls set with their pointers straight up, observe the RELATIVE OUTPUT meter.

Adjust the TUNE and LOAD controls alternately to obtain the maximum indication on the meter. Because of the interaction between these controls (and their effect on the impedance transformation of the output π network), it will be necessary to go back and forth between these controls at least three, and often six or more, times to obtain maximum output.

When the π network (TUNE and LOAD controls) is tuned for maximum power output, as described above, the tuning adjustments for CW, FM, and AM-SSB types of operation are complete.

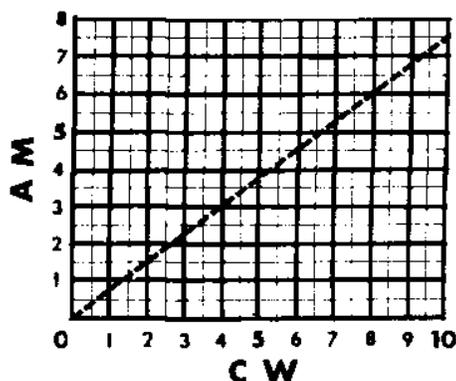
AM Operation (A3, A3A & A5)

For operation in modes requiring linear amplification of an amplitude modulated carrier, it is necessary to adjust the Mohawk "dual 60" for linearity, as follows:

First, adjust the amplifier for maximum CW output as described in the preceding section.

Second, reduce the output (as indicated by the relative output meter) of the amplifier by 25 percent by turning the LOAD control clockwise. Readjust the TUNE control for maximum, then readjust the LOAD control in a clockwise direction to regain the 25 percent decrease. Repeat this procedure several times until no further change in output is obtained.

To aid you in this adjustment, the chart on the right shows the relationship between the relative output for CW operation and the relative output for linear AM operation. For example, if your initial tuning results in a maximum relative output of 8, the chart shows that this should be reduced to 6 for linearity. Turn the LOAD capacitor clockwise until the relative output reads 6, then adjust the TUNE capacitor for maximum output, then readjust the LOAD capacitor so that the output reads 6 again. Repeat this back and forth three or four times.



The unit is now completely adjusted for linear AM amplification of amplitude modulated signals.

Adjustable Relay Delay

The Mohawk "dual 60" is equipped with an adjustable turn-off delay in the automatic relay switching circuits. This feature enhances the operation of the amplifier when it is used in single sideband suppressed carrier operation by delaying the opening of the change-over relays so that they will not open during short pauses in the user's speech.

This delay feature is activated by the front panel STANDBY switch which has three positions. The center position is "standby" or "off" and completely deactivates the relay circuits. The left hand position (marked NORMAL) activates the relay circuits without the delay feature for operation in services that contain a carrier. The right hand position of the STANDBY switch (marked DELAY) turns the relay keying circuits on with the adjustable delay activated for single sideband use.

Only the turn-off, or relay opening, is delayed; the relay closing is not delayed. The amount of delay is adjustable to suit the user's speech patterns and the delay adjustment control, which requires a screwdriver for adjustment and is colored blue for identification, is accessible through a hole in the bottom of the "dual 60" cabinet. A maximum delay of about two seconds is obtained with this control in the full clockwise position.

Remote Control

The Mohawk "dual 60" is equipped with an eight-pin ("octal") socket for connection to a remote control through an eight-conductor cable. Available separately as an optional accessory, the Mohawk remote control is especially useful for mobile operation where the amplifier can be mounted in the automobile trunk and controlled from the dashboard.

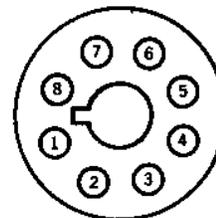
Two different remote control models are available from your Mohawk dealer. The Model 21 control is a small unit that is especially suited for under dashboard mounting and includes a POWER switch, a STANDBY switch and a small RF power output meter. The Model 22 control is a larger unit that includes remote metering of the amplifier tube plate voltage and current, as well as the switches and power output metering. Both units include connecting cable, mounting hardware and complete instructions.

The connections available at the REMOTE socket also enable the user to build his own remote control and provide a convenient means of connecting an external meter to read plate voltage, plate current and relative RF power output for adjustment and testing purposes.

Referring to the schematic and the socket diagram on the right, note that pins 1 and 8 of the REMOTE socket are connected in parallel with the POWER switch (S1), and pins 4, 5 and 7 are connected in parallel with the STANDBY switch (S2). Connecting similar external switches to these pins of the REMOTE socket will provide a suitable remote control system.

Pins 2, 3, 6 and 7 of the REMOTE socket can be used as connections for an external voltmeter that will monitor plate voltage (B+), plate current, or relative RF power output. Any direct current (DC) voltmeter with an input impedance of 20,000 Ω /volt or better can be used. Connect the positive and negative leads of the voltmeter as indi-

outside view



REMOTE

cated in the following chart to read plate voltage, plate current or relative output. If desired, separate voltmeters may be used to read all three functions simultaneously.

Meter to Pin No.		Multiply Meter Reading By:	To Obtain:
+	-		
7	2	1	Current in milliamperes
3	2	1360	Plate Voltage in volts
6	7	use 10 v scale	Relative RF Power Output

Maintenance

The Mohawk "dual 60" has been designed for a long trouble-free life, but it doesn't always turn out that way. If you do have trouble, the "dual 60" is built so that many repairs are easy. The input keying circuit, the high voltage power supply, the tube base circuits and the tube plate circuits are assembled on replaceable printed circuit boards. In the event of trouble, the complete circuit boards may be removed and replaced. Rebuilt circuit boards, with all parts assembled and tested, are available on an exchange basis.

WARNING 1200 VOLTS

While the "dual 60" is designed for safe operation, there are dangerously high voltages present inside the cabinet. If it ever becomes necessary to remove the top or bottom chassis covers, use extreme care and avoid the possibility of severe electrical shock. Unplug the power cord before removing the covers and let the voltages bleed themselves to ground for two or three minutes. To be extra safe, discharge all high voltages to the chassis immediately after removing the covers.

When testing the "dual 60" with the covers off, be very careful of the B+ voltages, which can be as high as 1200 volts and which are present at many uninsulated points within the cabinet. Remember: these high voltages are present whether operating from 115 volts AC or 12 volts DC.

Routine maintenance with the "dual 60" is minimal. Sooner or later, of course, the tubes will fail and will need to be replaced, but these tubes are commonly available and are reasonably inexpensive. Be sure to replace these tubes with the proper types, although it is not necessary to use "matched pairs".

In the event of serious operating difficulties with your "dual 60", contact your dealer or write directly to the factory. If it becomes necessary to contact the factory, please be as complete and detailed as possible in describing the problem.

Parts List

When ordering replacement parts, specify both the Model Number and the Serial Number of the amplifier, and specify the part by both its Part Number and Description (for example - "P/N 47-0085-10K, Resistor, 10K Ω \pm 10% $\frac{1}{2}$ W").

Prices shown on this schedule are effective March 1, 1972, and are subject to change without notice. Prices shown are f.o.b. Madison Heights, Michigan, and do not include shipping charges or sales tax.

Symbol	Part Number	Part Description	Price
	14-0154	Front Panel	\$ 3.90
	14-0155	Rear Panel	4.50
	14-0156	Cover	6.50
	14-0169	Bottom Plate	3.00
	14-0191	Mounting Bracket	4.50
C1-C3	15-0012-60U	Capacitor, 60 μ F 450 wvdc Electrolytic	2.33
C4, C5A-C5C	15-0020-U001	Capacitor, 0.001 μ F 2 kv Disc	.57
C6	15-0158-25P	Capacitor, 25 pF Air Variable	5.90
C7	15-0009-730P	Capacitor, 2 x 365 pF Air Variable	8.90
C8	15-0181-2U	Capacitor, 2 μ F 50 wvdc Electrolytic	.58
C9-C10	15-0016-U01	Capacitor, 0.01 μ F Disc	.40
C11-C12	15-0016-U02	Capacitor, 0.02 μ F Disc	.32
C13	15-0180-100U	Capacitor, 100 μ F 15 wvdc Electrolytic	.63
C14	15-0180-250U	Capacitor, 250 μ F 15 wvdc Electrolytic	.82
C15	15-0194-27P	Capacitor, 27 pF Mica	.43
C16	15-0180-25U	Capacitor, 25 μ F 15 wvdc Electrolytic	.58
C17-C20	15-0016-U02	Capacitor, 0.02 μ F Disc	.32
C21	15-0194-5P	Capacitor, 5 pF Mica	.53
C22	15-0194-5P	Capacitor, 5 pF Mica	.53
C23	15-0016-220P	Capacitor, 220 pF Disc	.25
	17-0171-SUB	High Voltage Circuit Board, Assembled	25.28
	17-0171-SUBEX	High Voltage Circuit Board, Exchange	14.00
	17-0172-SUB	Output Circuit Board, Assembled	7.07
	17-0172-SUBEX	Output Circuit Board, Exchange	4.00
	17-0173-SUB	Tube Base Circuit Board, Assembled	10.27
	17-0173-SUBEX	Tube Base Circuit Board, Exchange	6.00
	17-0174-SUB	Input Circuit Board, Assembled	18.92
	17-0174-SUBEX	Input Circuit Board, Exchange	11.00
L1	18-0157	Choke, 355 μ H	.83
L2-L3	18-0026	Parasitic Choke	.48
L4	18-0198	Final Output Coil	1.00
L5	18-0193	Input Coil	.95
J1-J2	21-0045	UHF Receptacle, S0-239	1.00
J3	21-0151	Power Connector	1.23
J4	21-0048	Remote Control Socket	.43

Symbol	Part Number	Part Description	Price
P1-P2	21-0152	Power Connector (female)	\$ 2.22
	21-0187	Tube Socket	.24
	24-0168	Knob	1.86
	28-0176	Foot	.15
	28-0053	Grommet, $\frac{1}{8}$ " x $\frac{1}{4}$ "	.05
	28-0202	Grommet, $\frac{1}{4}$ " x $\frac{3}{8}$ "	.05
	28-0056	Cable Strap	.06
	28-0204	Plastic Bushing	.10
	28-0175	Plastic Spacer	.42
	M1	29-0149	Panel Meter
	42-0206	Operating Instruction Manual	2.00
K1	45-0143	Changeover Relay, 3PDT	7.77
K2	45-0167	Power Relay, SPDT	6.42
R1	47-0084-1R	Resistor, $1\Omega \pm 10\%$ 1W	.29
R2-R4	47-0083-100K	Resistor, $100K\Omega \pm 10\%$ 2W	.40
R5	47-0086-220R	Resistor, $220\Omega \pm 5\%$ $\frac{1}{2}$ W	.40
R6	47-0086-390R	Resistor, $390\Omega \pm 5\%$ $\frac{1}{2}$ W	.40
R7-R8	47-0083-47R	Resistor, $47\Omega \pm 10\%$ 2W	.40
R9	47-0085-10K	Resistor, $10K\Omega \pm 10\%$ $\frac{1}{2}$ W	.20
R10	47-0081-10R	Resistor, $10\Omega \pm 5\%$ 11W	1.32
R11	47-0084-470R	Resistor, $470\Omega \pm 10\%$ 1W	.30
R12-R13	47-0085-1K	Resistor, $1K\Omega \pm 10\%$ $\frac{1}{2}$ W	.20
R14-R15	47-0085-10K	Resistor, $10K\Omega \pm 10\%$ $\frac{1}{2}$ W	.20
R16	47-0085-100R	Resistor, $100\Omega \pm 10\%$ $\frac{1}{2}$ W	.20
R17	47-0085-4K7	Resistor, $4.7K\Omega \pm 10\%$ $\frac{1}{2}$ W	.20
R18	47-0085-6K8	Resistor, $6.8K\Omega \pm 10\%$ $\frac{1}{2}$ W	.20
R19	47-0182-500K	Resistor, $500K\Omega$ Variable	.65
Q1-Q2	48-0144	Transistor, 2N2156	6.83
Q3	48-0148	Transistor, 2N5305	.75
CR1A-CR1G	48-0186 1A 7000 V	Rectifier, 1N4006	1.25
CR2	48-0090	Rectifier, 1N4003	.75
CR3	48-0184 1W-13 V	Zener Diode, 13v, 1N4743 -5K 3750-143 A	2.10
CR4-CR5	48-0185 1W	Zener Diode, 36v, 1N4753	2.10
CR6-CR7	48-0141	Diode, 1N4454	.40
	48-0164	Heat Sink	2.25
S1	51-0120	Power Switch, SPST	2.03
S2	51-0121	Standby Switch, DPDT	2.70
	51-0177	Fuseholder	.77
F1	51-0178	Fuse, 3AG 5 ampere	.18
F2	51-0179	Fuse, 3AG (SFE) 20 ampere	.12
T1	56-0145	Power Transformer	29.25
T2	56-0146	Inverter Transformer	14.40
V1-V2	57-0147	Tube, 6KD6	9.75
	60-0222	AC Power Cord Assembly	7.00
	60-0223	DC Power Cord Assembly	6.50