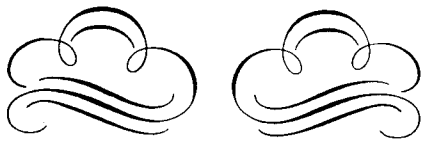
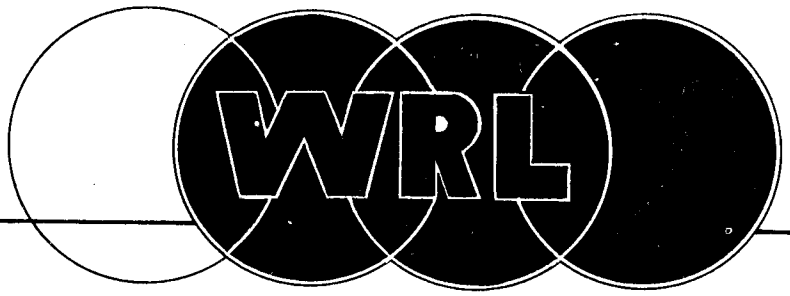
INSTRUCTION

ATLAS
2KW





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WORLD RADIO LABORATORIES

INSTRUCTION MANUAL FOR THE

ATLAS 2 KW

Section 1. UNPACKING. DAMAGE CLAIMS.

1-1. Unpacking. Damage claims.

All shipments from WRL Electronics Manufacturing, Inc., are packed by experienced personnel so that shipping damage can be held to a minimum. The carrier, upon receipt, assumes full responsibility for safe delivery. Follow these instructions to be certain of reimbursement for any damage to the equipment in shipping.

1. When a shipment arrives with visible damage, carton open or broken, do not sign receipt unless it clearly states that there is damage. Also, you must request that a joint inspection form be completed. This is an inspection for damages by you and a representative of the delivering agent.

   In the event the shipment comes Parcel Post, insured, report the damage to the Postmaster in your city. He will complete the necessary claim papers to be forwarded.

2. If there is no visible damage, but you find the shipment damaged after opening, contact the carrier or your Postmaster promptly to have a joint inspection form completed.

DO NOT RETURN THE SHIPMENT TO WRL Electronics Manufacturing, Inc. or your dealer without a joint inspection report or before filing a claim. All wrapping should be saved. On Parcel Post shipments, you will find the insured number on the wrapper.

If you refuse a shipment and send it back to WRL Electronics Manufacturing, Inc., or your dealer, without following the above instructions, it could nullify any claim made because of lack of proof of when the damage occurred. YOU would then be responsible financially for the damage.

If you follow these procedures, adjustments and claims will be handled faster and easier.

When unpacking, check carefully in the wrapping for any parts packed separately. In the ATLAS 2 KW, the four 572-A tubes, a phono plug and two cables are packed separately.

Section 2. INSTALLATION

2-1. Installing the tubes.

Remove the back panel of the ATLAS 2 KW by removing 8 screws, two from each

side, three from the bottom, and one from the lower center of the back panel. After loosening the screws, a screwdriver can be inserted carefully behind the back panel next to the ANTENNA jack and used to pry the panel loose. After removing the rear panel, the unit can be slid rearward out of the case.

Now remove the High Voltage shield, the perforated sheet metal running from the front to the back of the transmitter and covering the tube and tank coil area. It is only necessary to remove the small rear screws; the cover then will slide off the front screws. Do not loosen the front screws.

Insert the tubes in their sockets, one at a time, beginning with the bottom sockets. Handle the plate caps carefully, as forceful bending may break the resistor leads soldered to them. Be sure the tubes are seated properly, that the plate caps are firmly in place, and that there is air space between the tubes and between each tube and the chassis.

Twirl the blade on each cooling fan to be sure there is no binding.

Replace the High Voltage shield.

2-2. A. C. Power requirements and connections.

The ATLAS 2 KW can be operated from either 117 volt or 234 volt 60 cycle A. C. power. IT IS IMPORTANT THAT RATED VOLTAGE BE APPLIED! THIS CANNOT BE DONE FROM A LOW POWER A. C. CIRCUIT. BE SURE YOUR HOUSE WIRING WILL CARRY THE POWER! On 117 volts, peak drain at full input will be near 20 amperes. Many home circuits are rated at only 15 amperes. Further, the voltage drop in a lightwire circuit will reduce plate voltage and filament voltage on the 572-A tubes and make it impossible to operate at full power. While line voltages as low as 110 volts at full load may be used without damage to the ATLAS, realize that full 2 kilowatt peak power cannot be developed unless the power source -- the wall plug -- is adequate. Wherever 234 volt source is available, it is definitely recommended that it be used.

While you have the ATLAS 2 KW out of the case (see 2-1), turn it over and set the transformer primary for the voltage that will be used. It is supplied with the links set for 117 volt use. To change for 234 volt service, remove four nuts, put the links on the 230 volt positions, and replace the four nuts. Set the high voltage switch (on the chassis near the can condensers, marked "LMH") to the "H" position.

Reinstall the ATLAS 2 KW in the cabinet and reinstall the back plate.

2-3. Location and Ventilation.

The ATLAS 2 KW produces a large amount of heat, as will any unit running such high power. IT MUST BE LOCATED WHERE THERE IS FREE AIR FLOW, ESPECIALLY IN THE AREA OF THE TUBES. DO NOT PLACE ANYTHING ON TOP OF, UNDERNEATH, OR AGAINST THE RIGHT SIDE OF THE CABINET.

Aside from ventilation, the ATLAS can be located anywhere, so long as it is not subject to physical damage or exposure to the elements. In particularly confined quarters, a small home-type electric fan can be used to keep a supply of fresh, cooler air directed at the right side of the unit.

2-4. Connecting to the GALAXY 300 Transceiver.

Cables are supplied to connect the ATLAS 2 KW to the GALAXY 300 in such a fashion that the GALAXY can be used either "barefoot" or "with shoes" (by itself or with the linear) by turning only one switch, the "POWER" A. C. switch on the ATLAS 2 KW.

Required cables are supplied. Connection is as follows:

Connect the antenna coax to the ANTENNA jack on the ATLAS 2 KW. It is advisable to include a good SWR meter, such as the CESCO REFLECTOMETER CM52, in the antenna coaxial feedline.

Take the cable with a coaxial plug on one end and an RCA phono plug on the other. Connect it from the GALAXY output jack to the "RF INPUT" jack on the ATLAS.

Take the cable with the RCA phono plug on both ends. Connect it from the GALAXY "External Control" jack (J4) to the ATLAS "Relay" jack.

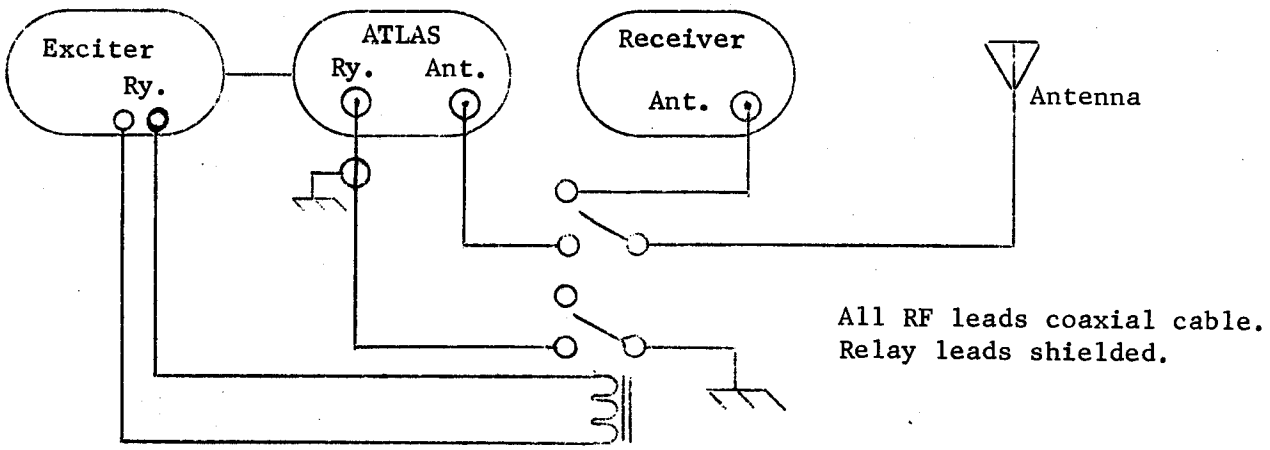
This completes the interconnection of the two units. When the A. C. "POWER" switch of the ATLAS is OFF, the GALAXY is connected straight through to the antenna. When the ATLAS A. C. "POWER" switch is ON, the ATLAS is automatically switched in on transmit, while the GALAXY is connected to the antenna on receive.

2-5. Connecting to other exciters and receivers.

Connection to other transceivers is similar to connection to the GALAXY 300, provided the transceiver transmit-receive circuitry supplies a contact which is grounded on transmit and open on receive. Such contact should be connected to the ATLAS "RELAY" jack, and will switch the ATLAS into the circuit when the transceiver is transmitting. The transceiver R. F. output should connect with RG-58/U or RG-8/U to the ATLAS "R. F. INPUT" jack.

2-5. Connecting to other exciters and receivers, Continued.

For separate receiver-exciter operation, an external antenna relay, controlled by the exciter, will be needed. See Figure 1 (below) for connections. If installed in this manner, the linear can be switched out of the circuit for "barefoot" operation by simply turning off the A. C. "POWER" switch on the ATLAS 2 KW. This hookup can also be used with a transceiver and a separate receiver when it is desired to listen to stations off the transceiver's transmitting frequency. The transceiver will still work normally for both receiving and transmitting, of course.



2-6. Antenna Requirements.

THE ATLAS 2 KW LINEAR AMPLIFIER MUST, REPEAT, ABSOLUTELY MUST BE CONNECTED TO A 50 OR 52 OHM COAXIAL FEEDLINE OPERATED WITH AN S. W. R. BELOW 2:1.

To build such a high power unit in so small a space, it is necessary to design for specific operating conditions. If these conditions are not adhered to, component failure will definitely result, and will not be covered by warranty. An antenna with high standing wave ratio may cause destruction of the following:

572-A tubes, tank coil by overheating, variable capacitors by excessive arcing, plate blocking capacitor by exceeding R. F. voltage or current rating, output R. F. choke because of shorting of the plate blocking capacitor allowing B plus to reach the choke, and power supply damage resulting from this last preceding item.

Section 3. OPERATION.

3-1. Antenna and/or dummy load requirements. IMPORTANT.

THE ATLAS 2 KW IS DESIGNED TO OPERATE INTO A CLOSELY MATCHED 50 OR 52 OHM LOAD SUCH AS A PROPERLY TERMINATED COAXIAL LINE. OPERATION INTO A HIGH SWR ANTENNA WILL CAUSE COMPONENT FAILURE WHICH WILL NOT BE COVERED BY THE WARRANTY. MEASURE YOUR ANTENNA STANDING WAVE RATIO. IF IT IS HIGHER THAN 2:1, FIX IT BEFORE OPERATING THE ATLAS 2 KW. IN ADDITION TO POSSIBLE FAILURE OF THE 572-A TUBES, THE FINAL PLATE BLOCKING CONDENSER, THE FINAL RF CHOKES, THE VARIABLE CONDENSERS, AND EVEN THE POWER SUPPLY, A HIGH SWR ANTENNA WILL GIVE YOU TVI, BCI, TPHI (telephone interference), HI-FI-I, AND PROBABLY GALLOPING DANDRUFF FROM SCRATCHING YOUR HEAD OVER YOUR TROUBLES.

This time, do like the book says. Measure the antenna SWR and get it below 2 to 1 before you operate the ATLAS. And measure it on the frequencies and bands on which you intend to operate.

During tune up procedures, the ATLAS is operated at powers exceeding one kilowatt D. C. input. To comply with F. C. C. regulations, such tune up should be done with the ATLAS connected to a dummy load capable of handling the power. We recommend the Heathkit Cantenna Model HN-31, filled with transformer oil, not mineral oil. Transformer oil is available from most public power companies or major oil companies.

3-2. Tune up. IMPORTANT.

Follow these tune up instructions exactly. If the instructions concerning maximum full-carrier-on-time are disregarded, R1, R2, R3, R4 and R13 may be damaged. In such cases, these parts will not be covered by the warranty.

3-2. Tune up, Continued.

Connect the exciter, antenna, and A. C. as detailed in preceding paragraphs. Set the ATLAS bandswitch to the desired band. Set the "RELATIVE R. F." control to 10. Set the "POWER" switch to "OFF".

Turn on the GALAXY 300 (or other exciter) and tune it up for full output on the desired band. Then adjust the carrier balance (NULL control) for zero or minimum output.

If available, connect a high-power 50 or 52 ohm dummy antenna to the ATLAS, in place of the regular antenna.

Set the "P. A. TUNING", "ANT. LOADING" and "AUX. ANT. LOADING" controls to the positions indicated in Table 1, below, for the desired band. This will preset the controls to the proper position for a non-reactive 50 ohm load, and if the antenna is well matched, it should not be necessary to make other than minor adjustment.

BAND	P. A. TUNING	AUX. ANT. LOADING	ANT. LOADING
80 (3.9)	5-1/2	3	8
40 (7.2)	3-1/4	2	3-3/4
20 (14.3)	1-1/4	0	1

Set the "PLATE METER" switch to "Ep". Turn ON "POWER" switch. Meter should rise to between 2000 and 2250 volts (2 to 2-1/4 on the red scale). If under 2000 volts, low line voltage is probable cause.

Set "PLATE METER" switch to "Ip". The meter should read under 100 milliamperes (1 on the black scale). Inject a small amount of carrier, enough to bring the meter reading to 300 milliamperes (3 on the black scale). If the exciter is a GALAXY 300, turning the "NULL" control slightly away from the minimum output point will inject carrier as required above.

Adjust the "P. A. TUNING" control for maximum reading on the "RELATIVE R. F." meter. Increase carrier injection from the exciter until the "RELATIVE R. F." meter reaches full scale. Then set the "RELATIVE R. F." control until the "RELATIVE R. F." meter drops to about 1/3 scale. NOW TURN OFF THE EXCITER FOR THIRTY SECONDS TO PERMIT THE ATLAS TO COOL DOWN.

Turn on the exciter and set for full carrier output. Adjust the ATLAS "P. A. TUNING" and "ANT. LOADING" for maximum reading on the "RELATIVE R. F." meter. THIS ADJUSTMENT MUST BE COMPLETED WITHIN THIRTY SECONDS, OR RESISTORS R1, R2, R3, R4 and R13 MAY OVERHEAT. If this adjustment cannot be completed within thirty seconds, turn off the exciter for thirty to sixty seconds, then turn it

3-2. Tune up, Continued

back on and complete the tune up. If loading is too light, a minor non-destructive arc may occur in the plate tuning capacitor when full drive is applied. If this happens, remove excitation, set the "ANT. LOADING" to a higher number and apply excitation again.

When the preceding steps are completed, the ATLAS plate current should be between 750 and 1000 milliamperes on the black scale (Ip). Plate voltage should be between 1750 and 2000 volts on the red scale (Ep). If both plate current and plate voltage are low, the probable cause is low A. C. line voltage at the wall socket. The ATLAS can be operated safely at 110 volts on the AC line, but full power output will not be achieved. If the line voltage drops below 110 at full load, heavier wiring should be installed. On 234 volt circuits, this is not often a problem as these are usually installed for air conditioners or other heavy duty circuits and can handle the power with less voltage drop. If the plate voltage is 1750 or higher and the plate current is under 750 milliamperes, the usual cause is insufficient excitation. The exciter must supply 180 watts for full output. Again, satisfactory operation is possible, but at less than maximum power level.

If necessary, the "AUX. ANT. LOADING" switch may be set to another position to achieve maximum output with your particular antenna, but NEVER CHANGE THE POSITION OF THE "AUX. ANT. LOADING" SWITCH WHILE EXCITATION IS APPLIED. TURN OFF THE EXCITER BEFORE OPERATING THE "AUX. ANT. LOADING" SWITCH.

If the plate current is too high, more capacitance is needed at the output of the pi-network. Turn the "ANT. LOADING" variable capacitor to a lower number and readjust the "PLATE TUNING" for maximum output. It may be necessary to adjust the "AUX. ANT. LOADING" switch to a higher number if the "ANT. LOADING" control does not have enough range. Note warning in preceding paragraph.

3-3. Operation. IMPORTANT.

After tune up as described above, the unit is ready to operate in SSB, AM, or CW modes. It is only necessary to supply the proper amount of SSB, AM, or CW drive from the exciter.

The power limit is the F. C. C. maximum for grounded grid operation. This is defined as a maximum of 1000 watts plate input to the final amplifier and driver amplifier combined. This will be between 800 and 900 watts D. C. input to the ATLAS, or 400 to 450 milliamperes of plate current.

For SSB operation, the mike gain control of the exciter should be set so that the loudest speech peaks do not drive the ATLAS Ip meter over 450 milliamperes plate current.

3-3. Operation, Continued

For CW operation, the exciter carrier injection should be set so that the key-down ATLAS plate current is not over 450 milliamperes.

The ATLAS 2 KW is operating quite conservatively at this power level.

For AM operation with the GALAXY 300 as exciter, carrier injection should be set so that ATLAS plate current does not exceed 300 milliamperes. This may come with the GALAXY plate current at less than the recommended 190 milliamperes, but this will be satisfactory. The GALAXY should not be operated at higher than 190 milliamperes plate current, even if this does not drive the ATLAS to 300 milliamperes. Transmissions on AM should be held to under four minutes in length, due to possible overheating. AM transmissions with units other than the GALAXY 300 as exciter, should also be limited to not over 300 milliamperes plate current and four minute transmissions.

When the A. C. "POWER" switch on the ATLAS is "OFF", the exciter is connected directly to the antenna at all times and can be operated "barefoot". When the ATLAS A.C. "POWER" switch is "ON", the ATLAS is switched into the circuit whenever the exciter is in transmit operation. The exciter may need a minor touch up of its tuning and loading controls when switched from the linear input to the antenna, depending on the SWR and feedline of the antenna.

When tuned up as described above, the exciter VOX or push-to-talk will control the ATLAS. Operation consists of merely talking into the mike if VOX-equipped, or pressing and releasing the push-to-talk mike button.

Section 4. PARTS LIST, SCHEMATIC AND TROUBLE SHOOTING.

4-1. Parts list with prices.

SCHEMATIC NUMBER	PART NUMBER	DESCRIPTION	PRICE
		CAPACITORS	
C1, 2	W7-11	.02 mfd. ceramic disc	$ .24
C3, 4	20-5	.01 mfd. ceramic disc	.24
C5, 6	W7A-205	1000 pf, 5kv, ceramic cup, screw mount	5.85
C7, 8	W7A-209	19-488 pf. variable	19.05
C9, 10, 11	WH-1014	350 pf, 2.5kv, high-current mica	1.95
C12, 13, 14, 15, 16, 17	W7-211	140 mfd, 475 volt, electrolytic can with plastic sleeve	2.24
C18, 19, 20, 21	20-5	.01 mfd. ceramic disc	.24
		RESISTORS	
R1, 2, 3, 4	W31-287	37.5 ohm, 10 watt. Each unit is composed of two 75 ohm, 5 watt Sprague N1. Per pair, that is, two 75 ohm resistors	1.45
R5	W31-377	10 K, 1 watt	.18
R6	W37-375	1.2 K, 1 watt	.18
R7	W31A-250	50 K linear taper potentiometer	1.02
R8	W31-293	5 ohm, 10 watt	.48
R9, 10, 11, 12, 13, 14	W31-285	82 K, 2 watt	.24
R15, 16	WH-1001	680 K, 1 watt, 5%, hand-selected at factory	.30
R17	11-6C	1 ohm, 1%, 2 watt	1.34
		INDUCTORS	
L1, 2, 3, 4	W37A-72	Parasitic suppressor	1.00
L5	W37-74	Tank coil, air wound, 20 meters	3.00
L6	W37-76	Tank coil, ceramic form, 80/40 meters	9.00
RFC1	W38-78	R.F. Choke, bi-filar, filament	12.00
RFC2	W37-67	R.F. Choke, plate	2.05
RFC3	WRL-49-089	R.F. Choke, 2.5 mhy, National R-100-U	.48

4-1. Parts list with prices, Continued.

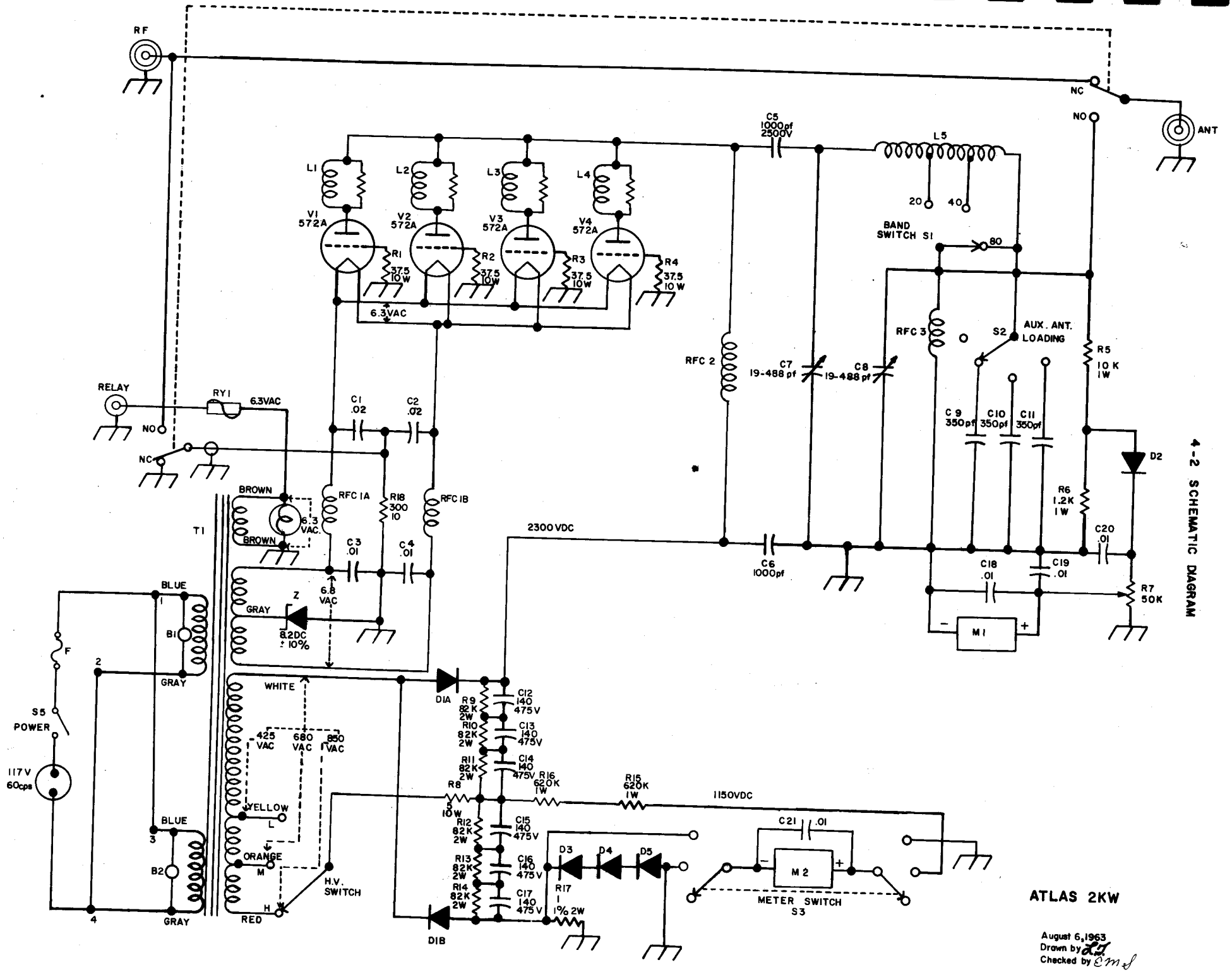
SCHEMATIC NUMBER	PART NUMBER	DESCRIPTION	PRICE
		SWITCHES	
S1	W35-66	Bandswitch, 3-position, rated at 4500 volts R.F., 10 amperes	$ 18.30
S2	W35A-68	"AUX. LOADING", 4-position, progressive shorting	4.80
S3	W35-A61	"PLATE METER", 2-pole, 3-position	3.32
S4	W35-A60	"High-Medium-Low" plate voltage, 1-pole, 3-position	3.32
S5	WH-1013	A.C. "POWER"	3.06
		MISCELLANEOUS, ELECTRICAL	
D1	W32-51	Rectifier, 4kv, 1 ampere per leg	54.75
D2	112-1N48	1N48 diode	.48
D3, 4, 5	112-501	Diode, silicon, 0.6 V zener, meter protection	.79
B1, B2	WRL-50-092-093	Fan, Barber Coleman DYAB with blade	3.44
Ry	W29A-40	6.3 volt A.C. coil	6.80
M1	115-4	Meter, relative output	5.80
M2	115-5	Meter, plate voltage/current	5.80
F	-----	Fuse, 3AB, 20 ampere for 117 volt operation	.05
F	-----	Fuse, 3AB, 10-12 ampere for 234 volt operation	.05
P	-----	#1815 pilot lamp for reduced brilliance	.15
P	-----	#44 or 47 pilot lamp for increased brilliance	.15
Z	W32A-54	Zener diode, 8.2 volt, 50 watt	9.60
T1	WT-2001	Transformer: Primary 117-234 volt, 60 cycle Sec. 1 - High voltage. Sec. 2 - 6.8 volts @ 1 ampere Sec. 3 - 7.0 volts @ 16 amperes	135.00
V1, 2, 3, 4	110-572A	United Electronics 572-A tube	19.60

4-1. Parts list with prices, Continued.

SCHEMATIC NUMBER	PART NUMBER	DESCRIPTION	PRICE
		MISCELLANEOUS, ELECTRICAL, Cont'd.	
	163-6	Cable, RF, RG-58/U w/83-1SP and phono plugs	$ 2.15
	163-7	Cable, relay control, w/2 phono plugs	.79
	105-1	Phono plug	.08
	101-1	Coax socket, chassis mount, SO-239	.49
	66-1	Fuseholder	.33
	WH-1002	A. C. Cord	3.50
	H-220	Groundpost	.75
	H-3501FP	Phono receptacles, one-nut mount	.44
	WH-1003	Coax cable, C8 to relay, 15 inches, Teflon	7.50
	H-51	Pilot lamp receptacle, w/jewel	1.96
	H-CP-572	Plate caps for 572-A tubes	.22
		MISCELLANEOUS	
	WH-1005	Chassis, w/sub panel & rear panel	31.25
	140-12	Cabinet	21.00
	141-10	Front Panel, anodized & screened	10.15
	130-8	Knob, small, gold inlaid	.45
	WH-1004	Knob for high-voltage switch	.60
	130-13	Knob, large, black	1.50
	133-6	Foot, small	.05
	133-7	Foot, large	.05
	182-11	Carton, shipping, w/liners	2.43
	120-3	6-32 x 3/8 screws, BHMS, plated	.05
	WH-1015	4-40 x 3/8 screws, Phillips flathead	.05
	120-5	4-40 x 1/4 screws, BHMS, plated	.05
	121-1	6-32 nuts, plated	.05
	124-6	#6 lockwashers, plated	.05
	WH-1006	6-32 cap nuts, plated	.05
	WH-1007	6-32 x 3/8 hex. metal stand off posts	.15
	124-16	Mounting plate, fiber, for can condenser	.05
	WH-1008	Terminal board, five-position	2.25
	WH-1009	Terminal board, six-position	2.25

4-1. Parts list with prices, Continued.

SCHEMATIC NUMBER	PART NUMBER	DESCRIPTION	PRICE
		MISCELLANEOUS, Continued	
	WH-1010	Mounting bracket for filament choke	$ .45
	WH-1011	Stand off insulator, single terminal	.45
	WH-1012	Grommet, 1/2 inch O. D., 3/8 inch I. D.	.10
	134-2	Escutcheon for meters	.15
	WRL-1-202	Socket for 572-A	.62
	183-26	Instruction manual	3.00


RF
NC
NO
ANT
C5
1000pf
2500V
L5
20
40
L1
L2
L3
L4
V1
572A
V2
572A
V3
572A
V4
572A
R1
37.5
10W
R2
37.5
10W
R3
37.5
10W
R4
37.5
10W
6.3VAC
BAND
SWITCH S1
80
RFC 3
S2
AUX. ANT.
LOADING
RFC 2
C7
19-488 pf
C8
19-488 pf
R5
10 K
1W
C9
350pf
C10
350pf
C11
350pf
D2
RELAY
RY1
6.3VAC
C1
.02
C2
.02
NO
NC
BROWN
RFC 1A
R18
300
10
RFC 1B
T1
6.3
VAC
BROWN
C3
.01
C4
.01
2300 VDC
C6
1000pf
R6
1.2K
1W
C20
.01
C18
.01
C19
.01
R7
50K
M1
BLUE
1
B1
GRAY
Z
GRAY
8.2DC
± 10%
6.8
VAC
F
2
S5
POWER
117 V
60cps
WHITE
D1A
R9
82K
2W
R10
82K
2W
R11
82K
2W
R8
5
10W
C12
140
475V
C13
140
475V
C14
140
475V
R16
620K
1W
R15
620K
1W
1150VDC
425
VAC
680
VAC
850
VAC
YELLOW
L
BLUE
3
B2
ORANGE
M
H.V.
SWITCH
H
RED
4
GRAY
R12
82K
2W
R13
82K
2W
R14
82K
2W
C15
140
475V
C16
140
475V
C17
140
475V
D3
D4
D5
R17
1
1% 2W
D1B
C21
.01
M2
METER SWITCH
S3
ATLAS 2KW
August 6, 1963
Drawn by LL
Checked by EMJ
4-2 SCHEMATIC DIAGRAM

4-3. Trouble shooting.

WARNING. LETHAL VOLTAGES ARE PRESENT. USE EXTREME CAUTION!

UNPLUG FROM A. C. AND LET STAND 60 SECONDS OR UNTIL Ep METER DROPS TO ZERO BEFORE TOUCHING ANY INTERNAL COMPONENTS.

Very little trouble will be experienced in this unit. Most likely are: damaged or inaccurate meters, defective filter capacitors, damaged zener diode.

NOTE: SHORTING THE B PLUS TO GROUND TO DISCHARGE THE FILTER CAPACITORS IS A GOOD WAY TO BLOW METER PROTECTING DIODES D3, 4, and 5, THE PLATE CURRENT METER, THE RECTIFIER DIODES D1a, D1b, AND THE FILTER CAPACITORS. LET THE VOLTAGE BLEED THROUGH THE STRING OF 82K RESISTORS, EVEN THOUGH IT DOES TAKE NEARLY A FULL MINUTE TO REACH ZERO.

Voltages noted on the schematic diagram are no load voltages; that is, with no R. F. drive applied to the unit, but with the tubes in the sockets.

Here are typical resistance measurements, taken with the A. C. cord unplugged from the wall socket. Note that measurement of the various diode resistances will vary widely, depending on the meter used to make the measurements. This is especially true of the forward (low) resistance.

(I) Power transformer resistance:

Primary, strapped for 234 volts, measured at A. C. line cord plug -- 0. 6 ohms.
Primary, strapped for 117 volts, measured at A. C. line cord plug -- 0. 15 ohms.
High voltage, measured between center terminal of D1 and red lead on high voltage switch -- 8 ohms .
High voltage, D1 center to orange lead on switch -- 5. 75 ohms.
High voltage, D1 center to yellow lead on switch -- 4 ohms.
Relay/pilot lamp winding, with pilot lamp removed from socket -- 0. 07 ohms.
Filament -- too low to measure with conventional ohm meter.

4-3. Trouble shooting, Continued

(II) Diode and other resistances:

D1a and D1b - back resistance, after filters charge -- 200K ohm or higher.
D1a and D1b - forward resistance -- depends greatly on meter used to make the reading. 3500 ohms a typical value using a Simpson 260 VOM.
Z (Zener diode) - back resistance -- 300K ohm or higher.
Z - forward resistance -- depends greatly on ohm meter used -- 4 to 15 ohms typical.
High voltage to ground -- after filters charge -- 200K or higher.

TYPICAL TROUBLE SYMPTOMS AND MOST LIKELY CAUSES

SYMPTOM	CAUSE
Low B plus	Low line voltage
Normal B plus but low plate current	Insufficient drive or loading. Check antenna SWR
Plate current will not go below 200 mils with no excitation	Zener diode shorted
Relative RF meter not reading	Control turned to zero. D2 defective
Fuse blows as soon as A. C. turned on	Shorted filter capacitor. Shorted D1a or D1b. Shorted Power Transformer. Shorted C5. If C5 shorted, check RFC 3, may be open
Fuse blows while tuning up	Check fuse rating. Should be 20 amp. for 117 volt operation, 10 or 12 amp. for 234 volts
Loaded too heavy, cannot be unloaded	Check antenna SWR. Open S2. Open C9, 10, 11
Tuning condenser arcs	Not loaded heavy enough. Check antenna SWR
Metallic rattling noise when A. C. is turned on	Fan blade striking tube or metal. Bend blade, as needed.

4-3. Trouble shooting, Continued.

TYPICAL TROUBLE SYMPTOMS AND MOST LIKELY CAUSES, Continued

SYMPTOM	CAUSE
Meter readings seem incorrect	To check meter, hook VOM on 2.5 volt or other low DC voltage scale directly across meter terminals. 1 volt DC should be full scale, each 1/10 volt should equal 100 mils on plate current scale. Meter resistance 950 ohms plus or minus 10%

Section 5. Replacement parts and return of units for service.

5-1. Replacement parts for units in warranty. WRL warranty covers tubes and labor for 90 days from the date of purchase, all other parts for one (1) year. See last page for the complete warranty.

Write to: WRL Electronics Manufacturing Co.
Div. of World Radio Laboratories, Inc.
3415 W. Broadway, Council Bluffs, Iowa

Give the following information:

1. Model of unit.
2. Serial number of unit.
3. WRL schematic number (if any) of desired part.
4. WRL part number.
5. WRL description of the part. Items 3, 4, and 5 will be found in the parts lists in Section 4 of this manual.

State the apparent nature of the defect and describe any tests made to locate the defect. If, in the opinion of WRL Manufacturing Company a replacement part is required, the part will be forwarded to you and instructions will be given for the return of the defective parts.

DO NOT send parts without authorization and instructions.

5-2. Replacement parts for units not in warranty.

Write to the WRL Electronics Manufacturing Co. and include the information regarding the unit, serial number, schematic number, part number and description as detailed in 5-1 above. Note the amateur net prices of the parts lists in Section 4 of this manual. Remit this amount plus adequate postage. Prices shown in the parts list are subject to change without notice. Or, if desired, billing on a Net 10 day basis may be requested where a charge account has previously been established.

Please do not include correspondence or order pertaining to other equipment with your letter. Doing so will delay the shipment of the parts.

5-3. Returning units for service.

If it is necessary to return a unit for service, use the original packing material if available in good condition. Otherwise, pack

5-3. Returning units for service, Continued.

securely in a sturdy container with plenty of padding material. In all cases, insure the shipment for full value.

NOTE: UNITS RECEIVED IN DAMAGED CONDITION WILL BE DELAYED WHILE CLAIMS ARE PROCESSED. WRL ELECTRONICS MANUFACTURING DOES NOT ASSUME RESPONSIBILITY FOR LOSS DUE TO DAMAGE.

PRINT your full name and address clearly on the shipping carton and, in addition, attach a tag with your full name and address to the unit, itself. Ship PREPAID, NOT collect.

BEFORE SHIPPING, write for authorization and special labels to:

WRL ELECTRONICS MANUFACTURING CO.
Div. of World Radio Laboratories, Inc.
ATTN: Repair Department
3415 W. Broadway
Council Bluffs, Iowa

State the nature and details of any difficulties experienced briefly and concisely in your letter. Do NOT include correspondence pertaining to other matters.

If your unit is within warranty, repairs will be made at no cost other than transportation. If out of warranty, costs may be billed on a 10 day basis where an account has been previously established. Otherwise, indicate whether shipment should be made C.O.D. for all costs as soon as repairs have been completed or whether we should hold the unit and advise you of the costs.

WARRANTY

World Radio Laboratories, Inc. warrants each new product manufactured by it to be free from defective material and workmanship and agrees to remedy any such defect or to furnish a new part in exchange for any part of any unit of its manufacture which under normal installation, use and service discloses such defect, provided the unit is delivered by the owner to World Radio Laboratories, Inc. intact, for examination, with all transportation charges prepaid, and provided that such examination discloses in our judgment it is thus defective. Component parts, with the exception of tubes, are warranted for a period of 1 year, tubes and workmanship for a period of 90 days, from the date of sale to the original purchaser.

This warranty does not extend to any of our products which have been subjected to misuse, neglect, accident, incorrect wiring not our own, improper installation, or to use in violation of instructions furnished by us, nor to extend to units which have been repaired or altered outside of our factory, nor to cases where the serial number thereof has been removed, defaced or changed, nor to accessories used therewith not of our own manufacture. We do not authorize the purchase of any replacement for any faulty component that may be found in this unit. Under no circumstances will World Radio Laboratories, Inc. re-imburse the purchaser of this unit for any such purchase.

This warranty applies only to the original purchaser and is not transferable. This warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for us any other liability in connection with the sale of our products.

World Radio Laboratories, Inc. reserves the right to make circuit or component changes or incorporate new features at any time without incurring any obligation to owners of its products previously sold.