

ARD 230A DATA, BUGS AND FIXES

by

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POWER LM3900 op-amp frequently shows non-existent
SUPPLY plate current and/or plate voltage increase when
switching from STBY to OPER; swap op-amps until
one is found which eliminates false readings, or
hand-match 10 Meg ohm resistors to about 0.01%
tolerance. Latest version boards have 2 nulling
pots to cure false readings. These boards also
frequently had ceramic 2 Watt resistors which went
open-circuit, causing flaky plate voltage readings,
also caused motors to move when switching from STBY to
OPER modes. In 230C,CA (3-tube models), the green
MOUSER filament current resistors weren't the right
value; 1 tube could be removed and amp would not show
filament trip. This was never fixed. Late models had
a fuse moved due to 3 amp fuse added in series with
soft-start resistor to prevent destruction due to HV
interlock being shorted during turn-on. Fuse F3 was
placed inside cabinet and new soft-start fuse was
placed on back panel in place of old F3. The single
wire which was plugged into the back of F3 now is
plugged into the top of the chassis mount fuse holder;
the 0.25 "fast-on" must be replaced with a 0.145. On
rare occasion, the soft-start resistor increases value
under load causing resistor to explode (not dangerous).
Replace resistor and expect no further problems.
Install 0.1uf caps from plug J18 pin 11 to ground
and pin 18 to ground-may help with 10M sensing
RFI. Breaker sometimes trips on boot-up:no problem.
Some connectors on PS harness were poorly crimped (most
harnesses were built by ACCU-TEK ASSEMBLIES). J6,
J16, and J18 were most likely defective. On the REV 1
boards, the pads for C100,1,2 were too small and
sometimes pulled-off the board. The lack of filtering
caused noticeable voltage drop and the ripple sometimes
caused problems. Transformers are 1750VAC Peter Dahl.

Output Coax hole moved to prevent center-to-shield
Board shorts. 90 MHz trap coil added. SWR sampler line
replaced with teflon to prevent cooking on 10 M at
1.5 + KW continuous duty. Germanium diodes known
to fail on occasion. First thirty 230A's produced

T7005

had relatively poor power and SWR accuracy; new alignment procedure significantly improve accuracy. 12 gauge wire from vacuum relay to linesampler replaced with 1/4" wide silver-plated strap to decrease lead length. Sampler line silver soldered to lugs/stand-offs to prevent lugs from shifting and possibly shorting out on grounded circuit board stand- offs (never saw such a short but good insurance).

Boards with small yellow-centered trim pots (I think they were MEPCO) were poor quality and had lots of backlash; square blue pots were much better. All boards have jumper on forward pot wiper because of missing trace. REV 1 = REV 2

77003C Input Check for no flow-thru solder through center pins of Board RCA sockets. Eliminate almost all RFI on 10 M by installing 0.01uF caps on underside of board across +12V, +28V, and BANDRTN. Check teflon coax jumpers under tube sockets; some male RCA's were poorly soldered with coax shield coming close to shorting out on center pin. REV 1 = REV 2. R115 set for 15.7K ohm.

Latest 230A values:

Freq	BAND	Cin	Cout	#turns	Dip
	160	2700pf ^{C107}	2700pf ^{C103}	21	2.5 ✓
	80	820 ^{C106}	820 ^{C107}	15	6.2 ✓
	40	820 ^{C108}	1000 ^{C109}	10	9.2 ✓
	20	430 ^{C114}	812 ^{C115}	5	19 ✓
	15	200 ^{C121}	500 ^{C122}	4	31 ✓
	10	100 ^{C125}	none ^{C126}	short	N/A

Under First 1 or 2 units had 10,000 pf silver mica coupling Tube cap: caused poor input SWR on 80 and 160M. The 20 Sockets meter additional cap was 100pf: increase to 250pf to raise efficiency and lower input SWR when used in conjunction with updated C and L values as per chart.

77006 Motor Install 0.1uF caps across center wiper of feedback Wiring pots to ground-helps with 10m RFI. Also add (2) 0.01 HV ceramic disc caps from B+ vacuum relay switch coil to ground. Add ground jumper from chassis to gearhead ssembly for TUNE cap; motor isolated via grommets.

7500 Line-driver IC's 26LS31 and 26LS32 (not shown in manual) prone to dying from surges, or problems with control cable to microcontroller. I have schematics for parts of the schematic labeled "DATA COM CIRCUITS"- proprietary info; I don't think I will circulate these.

REV 1 needed cuts and jumpers under power relay, and 2 jumpers under board; REV 2 doesn't need relay mods, but still needs same 2 jumpers under board.

MICRO Backlights prone to dying (discoloration) due
CONTROL to being trimmed too closely with scissors. LCD's
touch front panel (display) creating "oil-spots".
Fix by adding washers between PCB and stand-offs (can be
very tricky).

Clear plastic windows are very easy to scratch.

Surface mount IC's prone to very poor soldering
causing missing LCD segments; touch-up connections with iron
and flux (NO MORE SOLDER). REV 1 needed cuts and
jumpers on backlight DC-DC converter; REV 2 needs no
cuts nor jumpers. If you don't like the LED to stay
lit while plugged in, you can unplug the 3-pin ID plug
and plug in backwards; now LED will light only when
turned-on. Beware: some units had this plug epoxied to
board. The top and bottom covers of the u-controller
frequently bulge out: metal vendor poorly bent pieces.

Backlights were either blue or ugly green color,
made by BONAR KARD-O-LITE, King of Prussia, PA 19406.
Backlights sometimes intermittent due to excessive
heat from soldering; best fix is to replace them.

7600 TLC274's slightly prone to dying from surges. Each
tank assembly must be calibrated with dedicated 7600 board
due to differences in U203. Q306 (was 2N2222, now 2N6045).
2N2222's died causing idle plate and grid current before
warm-up completed. Wire going through
ferrite under copper shield frequently uninsulated
causing about 1 K ohm from +28V to ALC line. Solved by
using insulated wire thru ferrite and lifting ferrite
off board using round insulator pad. The symptom was
+V on ALC output with no RF input. Ferrite in Grid
Current line replaced with large blue inductor (L303)
to decrease RFI on 160M. UCN-5823A IC's no longer
available and replaced with ? on new version
boards. Note that UCN-5821 is same as UCN-5823. R325
replaced with 0 ohm to increase grid current meter
accuracy. REV 1 = REV 2.

EXTERIOR Several different color panels were used;
originally grey with ICOM printed on rear panel of amp, then
white. Lights for POWER and ON have fairly short
life. Most grey panels had minor scratches; most
white panels had minor defects. First twenty amps
had black HEX-HEAD type screws which were a pain to
remove; replaced with black Phillips head steel screws
then replaced with black Phillips head stainless.

68 screws needed to replace all on amp; 8 on
microcontroller. Screws marked as PH PAN HD MAC

SC Z/P 4/40 X 5/8

DYA44020 Made USA

7610 (2) 100uf caps added accross output of motor driver IC's to eliminate spikes from causing data errors and erratic operation (motors jerk back and forth, LCD tune/load segments jump, and false trips occur). Chip carriers used on some boards using replacement motor driver chips.

R100 and R101 values repeatedly changed to speed-up or slow-down the slow speed. REV 2 boards have pot to vary slow speed. Some units stalled in slow mode. C121 was changed to 0.01uf to lower PWM frequency.

Old motor drivers are UDN-2952B. REV 1 has 1 jumper under board and 4 jumpers on top of board. REV 2 has shit-load of cuts and jumpers: add diode on top of board to restore KEY-OUT function, 1 cut under freq. counter header, ? more cuts in vicinity of J6. Pull-up sip resistors tacked on to new IC's on bottom of board. More cuts & jumpers that I can't remember. For maximum RF-proofing, 0.1 uf caps should be across all pins of J4 and J6 of both REV's.

Tank HV coupling caps sometimes developed black punch-thru Ckt holes from high current (3-tube models used 5-6 caps instead of just 3). 10M coil tap sometimes comes unsoldered from cont. duty. Bandswitch, and cap set- screws come loose. 1-hole couplers replaced with 2- hole couplers. Bandswitch sensing rotary switch almost Always loose, causing catastrophic arcing due to rotor falling between positions. 230A loading caps sometimes arc in casual operation; 230C and CA used wider-spaced caps due to higher power but they too sometimes arc.

Nylon screw holding B+ choke is poor RF dielectric and sometimes touches metal pin and blows-up. One serious bug is the use of feedback potentiometers for the TUNE and LOAD caps. These pots may last a lifetime, or may last a day. These are CLAROSTAT hermetically sealed pots (probably the best 1-turn pots available). The problem is that they have mechanical stops to prevent more than about 300 degree rotation. If RF gets into the feedback system, the gearhead motors will force the pot to travel past the stop. Once this happens, the pots will be intermittent and cause lots of problems. I tried removing the stops on a prototype and was unhappy that I had to break the hermetic seal; otherwise the mod worked and the pots could never crash. To replace the pots, remove the shaft set screws and the 2 #4 phillips screws holding the pot bracket, cut wires, solder wires to new pot (don't forget which wire goes to which terminal!), apply "lock-tite" liquid to pot thread and install lock washer and nut; tighten very well!, turn pot to middle of it's rotation, e-install assembly with 2 Phillips

screws, and re-tightening the set screws. Now you must re-calibrate the tank.

Loosen the 2 or 4 set screws on the shaft-coupler between the output of the gearhead motor assembly and the shaft of the capacitor. On the 230A's the loading cap is mounted such that this procedure is very difficult.

In amps with the wide-spaced loading cap, this is no problem. Disconnect the transformer H.V. secondary and disconnect the blower power plug. Close all interlocks. Turn on the amplifier. Keep fingers out of power supply! Turn the appropriate knob on controller to cause the cap to go to maximum capacitance (as per LCD display). Now spin the cap by hand until it too is at max capacitance, and tighten all set screws. Re-check the amount of travel in the capacitor by running the cap from min to max capacitance; if it does not reach min and max positions then you must go back and re-do calibration procedures.

With some 7600 boards, full 180 degree rotation is not possible (maybe only 150 degrees). If this is the case, adjust for compromise. Re-connect transformer and blower and re-assemble amplifier. Experienced person can perform entire operation (including disassembly and re-assembly of amp) in about 1-2 hours for 230C-CA; 3 hours for 230A. Pots are marked "381 N-10K-S"

"19-8917"

CLARO USA

SOFTWARE Early EPROMs computer control interface had a minimum of 1 second motor on-time (too long, causes overshoot).

Late version 7610 required new software V2.04.

If wrong version software is used, the cap motors will run at slow speed continuously causing pots to crash; also amp will not boot-up properly. Bandswitch motor timing was never perfect on any model; rotor would land between contacts on occasion. Software mod suggested by me which never got done by Mike; remove bandswitch lock-out while transmitting in favor of input relay lock-out to prevent bandswitch momentum loss from causing poor contact meshing. Also should have done software mod to force bandswitch to finish going to its destination before it changes direction (avoid loss of momentum) which could occur if you try to go to band "A" while the bandswitch is in motion going to band "B".

Sometimes microcontroller shows air trip at initial turn-on (cause never determined, but guess Mike screwed-up new software when he increased grid trip time). When the fake trip showed up, press reset and it never reoccurs while on. When updating software versions, frequently the tune and load "pre-sets" will be shifted and require re-programming (sometimes only presets above 14 Mhz are

shifted). Only version V1.04 or V2.04 are capable of operating on 18 and 24 Mhz (230A and 230CA). Either software or A/D converted design prohibits TUNE or LOAD capacitors to be memorized if they are at their extreme minimum: this may only occur above 29 MHz.

Regardless of what the factory says, the "automatic" mode is worthless. Don't even consider using it; use the "semi-automatic" mode. The auto-tune algorithm is a joke; tune time is usually on the order of 1 minute.

BUGS- Processor hash noticeable on some bands, mainly on 10M.

IN-USE Prototype had shield around entire 7500 board which was eliminated in production units because of cost (a lousy ten bucks or so). Hash can easily be reduced by building similar shield and trying grounding braid between rig and microcontroller. In general, hash was not objectionable. Grid trips during voice peaks is probably the most obnoxious "bug" in the whole amp.

Grid protection circuit taken to extreme. Either decrease grid current by increasing loading or drop input power or change value of R322 or R325 to decrease metering accuracy (do at tubes' risk) or change software limiting (not too easy). Frequency reading sometimes in error. When changing bands in OPER mode, the counter will sometimes read twice the actual frequency. This is not too common and will never happen when changing bands in STBY mode. No fix ever found to eliminate this bug, mainly because no one ever spent much time trying.

On very rare occasions, the bandswitch will be 180 degrees off, effectively disconnecting the tank from the tubes; this can come about by either RFI in the processor during a bandswitch, or by turning off the amp while moving into 10M or 160M band then turning the amp back on. Remedied by disconnecting motor harness from 7610 board, then applying 5-10 volts dc to bandswitch motor until bandswitch moves back into correct position; can be in any of the 6 correct bands as the processor will correctly read the new band.

MISC The DAYTON blower used in the 230A's sometimes leak oil. The yellowish grease can be seen on the motor coil, and sometimes drips onto the power supply board. I've never seen one of these blowers freeze. I don't think ARD ever paid the bill, and never tried to get warranty exchange.

The blowers used in the 230AX,C,CA were slightly superior and more quiet, although about \$20 more.

The transformer in the 230A's would get very hot and smoke when the amp was burned-in at 1.5KW out for over 30 minutes.

NOTES ON MY PERSONAL 230A AMP:

7600 REV 2, sockets added for U205 and U203. 7610 REV 1, Power Supply REV 2 (with carbon resistors), 7500 REV 2, 7510 REV 2, software V1.04, P.S. harness modified (1 wire moved) to accommodate H.V. transformer without center-tap. Wide-spaced loading cap used (from 3-tube models). All wire under tube sockets is teflon. Black 20 Meter relay removed (added 200 pf cap not needed in my amp with cathode resistors). My transformer was rated 1750VAC at 1.5A continuous by Peter Dahl serial #050687 (was a 3-tube unit prototype without center-tap).

PRODUCTION STAFF:

Angie	Gloria
Dave (died)	Dale Lester
Emad	Neicy
Sung	Bernadine Carpenter
Diane	Ngn

Dr. Robert Sullivan: Ex. CEO

W0YVA

Charles White: Engineering Manager

WA3KNB

Mike Densmore: Junior Engineer

KD3??

Mark Moon: Ex. Junior Engineer/Amplifier Testing, etc.

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Laura Monish: Ex. Test Technician (non-amplifier)

Gail: Ex. Purchasing Agent

Howard Pruner: Ex. Production Manager

Najeeb Anwar: Shipping/Receiving; Production Manager

Ann Wintersteen: Receptionist/Secretary

Ann ?: Ex. Accountant

KA4???

Suzanne Jones (Ex. Suzanne Sullivan): Ex. Personnel Director

Tom ?: Ex. Engineer/Consultant

Tina ?: P/T accountant

Products Produced:

AIRFLOW	dead	
STULZ		air conditioning systems
HUNTER	dead	power supplies
ROTOR	dead	never made production
AMPLIFIERS		
VALCOM	dead	custom 4-channel HF amplifiers

IPC Integrated Power Co. - Solar Panel
regulators
COMMONWEALTH SCIENTIFIC Ion generator power supply-
consulting
MITRE dead occasional PCB mil-spec stuffing and
soldering