Rochester DX Association

CONTENTS

Deadline for Next Issue:

May 31, 2023

Want a new RDXA name badge?
Doug Stewart N2BEG is looking to put together an order. He's also asking about interest in new Field Day tee shirts.
Contact him directly at:
dstewart@akoustis.com

President's Letter

After the winter doldrums, looking forward to the clock change in a week or so. Even though (so far), we really haven't had much of a winter, the darkness an inability to consistently get outside wears on you.

So, as a ham operator, things have been great the last few months. Several very "rare" DXpeditions have been active as well as outstanding contest conditions. No too many more contests so "get while the getting is good". As has been reminded of you many times, submit your score to the RDXA.com score grid and be sure to list ROCHESTER (NY) DX ASSN as you affiliated club.

Though much smaller membership than most, we still rank highly in most DX contests, a true testament to the dedication and operating prowess of the group.

We welcome the return of the combined RVHFG/RDXA Awards Banquet after a few years off. Specific information will be forthcoming so watch the website and emails as we get closer to the proposed late April or early May time frame.

Looking forward to spring activities including Dayton – RDXA will have a flea market spot as in past years though we may opt for a single place as opposed to two. They'll still be a table to set up your "for sale" gear, take a seat and share a few stories, just don't seem to need that much space anymore (sadly).

The Rochester Hamfest will return in June and Field Day will once again be held at the end of the month.

As for Field Day, a planning meeting was already held with a review of the 2022 effort. Once again, we'll call Webster Park our home for the weekend and initial discussions revolve around entering the 3A category once again. Club membership participation is a must, mark you calendars now for the 23rd thru 25th of June.

While marking your calendars, IRVfest will once again be held this year at the Dolomite Lodge in Penfield. This very popular picnic will happen on Tuesday 22 August. Granted, it's a ways off but due to the lodge's use, we wanted to secure a spot earlier than later.

We've begun to return to "in person" meetings and have had some great presentations of late. Johnny's is a fantastic location and those who have attended have enjoyed the facility and hospitality. Consider joining us for one of the remaining sessions, it would be nice to return to per-Covid attendance once again.

Thank you for your continuing support of the club, looking forward to getting outside once again!

Best DX es 73,

Chris, K2CS

2023 AWA Spring Meet Info

Saturday May 13, 2023 — Bloomfield, New York
Mark Your Calendars For a Huge Event!

The annual ***AWA Spring Meet, Flea Market & Auction*** will be held at Veteran's Park in Bloomfield, NY. This is just across the road from the AWA Museum, 6925 State Route 5, just east of the intersection of Routes 5 & 20 and Route 444. AWA will be operating a ***Museum Bargain Table*** and a large ***Museum Book Sale*** in the former AWA Annex building located in the park.

As part of the meet, AWA will hold an ***Auction*** of duplicate and surplus items from the Museum's artifacts. Don't miss it! This auction will be held in the afternoon in the former ***AWA Annex***. Payment must be by cash or check. We will not be able to accept credit cards. Auction items will be listed on the AWA web site as they are identified. Watch for updates to the list.

Complete Schedule

Time	Event
7 am – Noon	***Open Flea Market***, at Veteran's Park
8 am – Noon	***AWA Bargain Table & Book Sale,*** in Annex
10 am – Noon	***Antique Wireless Museum*** open for visitors
8 am – 1pm	***Auction pre-view,*** at the former AWA Annex
1 pm – to end	***AWA Auction***

Admission for the Day is $5
Flea Market Vendor Pass is an additional $7

Auction Items A few weeks before the Spring Meet a list of items will be posted at :
https://www.antiquewireless.org/homepage/spring-meet/

Alpha Adventures - Part I

John “Jack” Kelly WA2CHV

1. Introduction

Back in 1967 as novice WN2EJG running a pair of 6146B’s, I often dreamed of someday having a coveted extra-class ticket and running a “full gallon.” Fast forward 50 years to December of 2017 when, with the extra-class ticket in-hand, I had the opportunity to purchase a used Alpha 87A 1.5 kW amplifier from a nearby fellow amateur for a not-too exorbitant price. In my mind’s eye I remembered the “brick on a key” ads that I salivated over back in the day. The price constituted major spending in the WA2CHV universe but after a consultation with my Chief Financial Officer (CFO), I wrote a check...

Fig. 1: A 1978 "brick on a key" advertisement[1] for Alpha Amplifiers from Dick Ehrhorn's earlier company, ETO, Ehrhorn Technical Operations.

The Alpha 87A is a microprocessor-controlled, nine-band (1.8-30 MHz including WARC bands) amplifier using a pair of 3CX800A7 triodes in grounded-grid configuration. It was designed by Dick Ehrhorn W4ETO (SK[2] June 26, 2022) at Alpha Power. Production of the Alpha 87A began in October of 1991[3] with my particular unit being built in March of 2000. It is capable of full break-in or QSK operation, automatic band changing, and automatic tuning optimization. It can be externally computer controlled via a DB-25 RS-232 interface on the rear panel. See Figures 2 and 3, below.

Fig. 2: The Alpha 87A on a desk at WA2CHV. Note the lack of "TUNE" or "LOAD" control knobs on the front panel. The TUNE and LOAD capacitors are adjusted via stepper motors and front-panel switches.

[1] radio1nz.com/about-amateur-radio/new-zealand-nets/nz-net/newsletters/nr87/
[2] www.arrl.org/arrlletter?issue=2022-07-14#toc04
[3] www.alpharfsystems.com/wp-content/uploads/2016/05/Alpha_Amplifier_Production_Dates.pdf

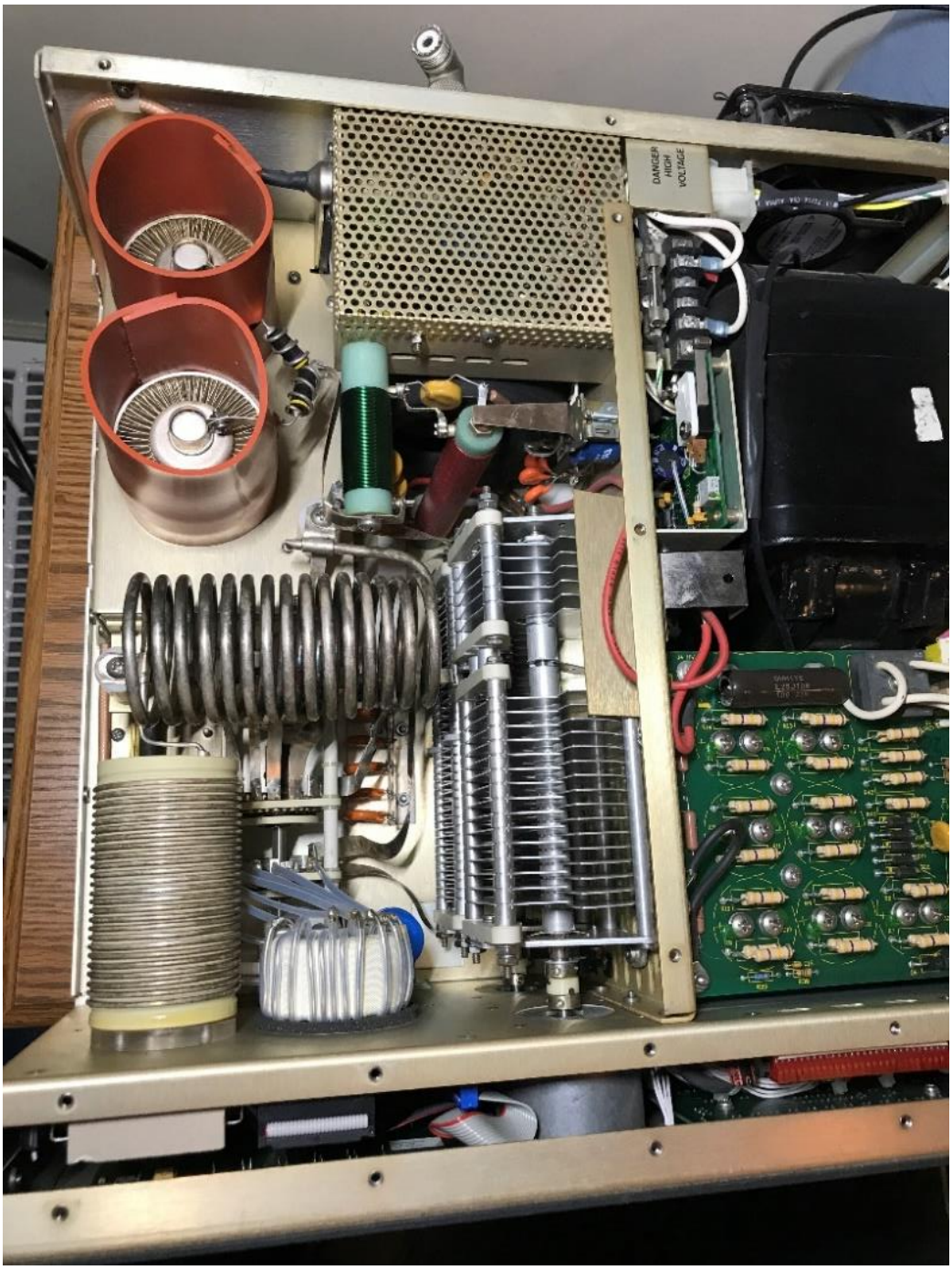


Fig. 3: Interior of the Alpha 87A. RF deck is on the left. The silver plating is tarnished. TUNE capacitor in the middle with the LOAD capacitor underneath it. High-voltage power-supply board on the right. Power transformer in the right rear.

The Alpha 87A requires 220 VAC at 20 Amps wall-plug power. The WA2CHV shack is on the second floor of a two-story house with only 120 VAC outlets so there was no opportunity to immediately power up the amplifier. By April of 2020, I had retired from full-time employment and had the time to oversee the installation of a 12/2 NM cable with ground from a new breaker in

my panelboard, across my basement, up through an interior wall and over the kitchen ceiling up to a new NEMA 6-20R receptacle in the upstairs shack wall. Time to power the Alpha up and get on the air!

Initial disappointment

After installation of a NEMA 6-20P plug on the Alpha's cord, it was plugged in. On powering up it emanated several mildly alarming groaning noises and began blinking its LOAD-up- and LOAD-down-switch LED's. Perusing the owner's manual revealed that the microprocessor had detected a "soft" fault associated with the LOAD capacitor and/or its stepper motor. "Soft" faults usually indicate an improper operating condition as opposed to "hard" faults which indicate the potential for serious amplifier damage.

At this point I knew I likely would need experienced help from the current manufacturer's rep. Getting help would require knowing the unit's model number (87A) and the serial number. The serial number was located on the back of the unit and was…unreadable. See Figure 4, below:

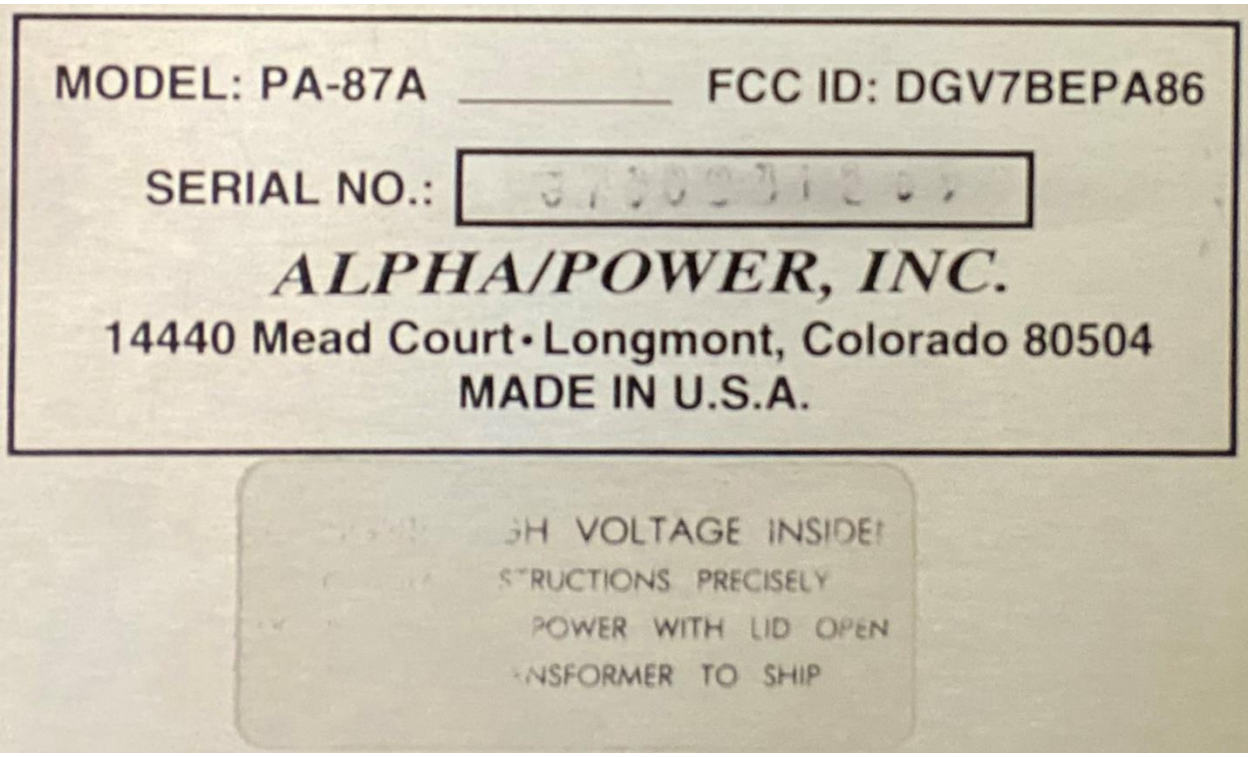


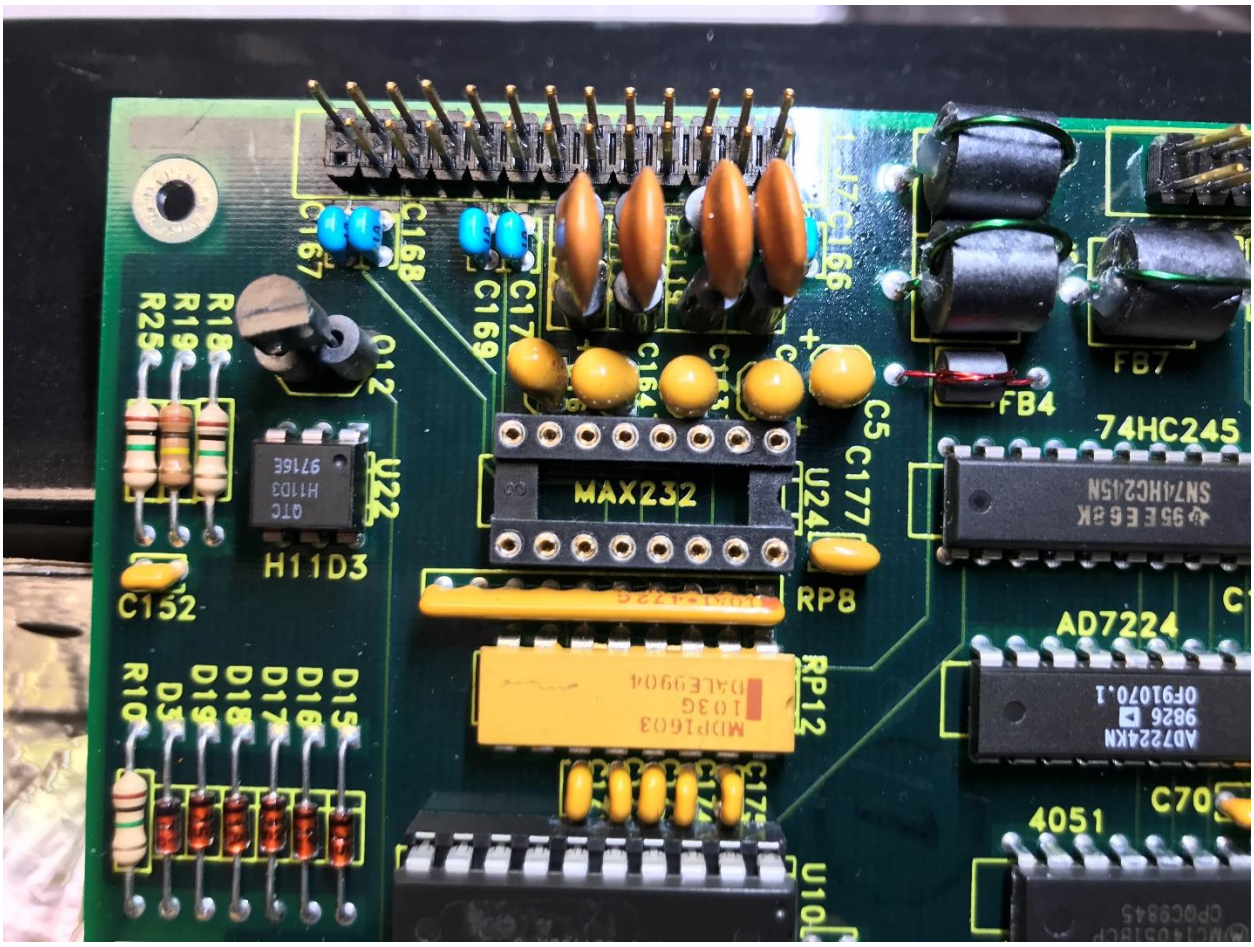
Fig. 4: Unreadable serial number on the back of the chassis.

All was not lost. The unit's serial number could be recovered from its microprocessor. All that was required was to establish communication with it over the RS-232 link on the back of the chassis. Happily, the shack computer was old enough to have a DB-9 RS-232 connector. The ancient[4] Windows HyperTerminal application that Alpha manual recommended was also

[4] The reader may wonder why I did not go to a USB solution with a FTDI chip and a more modern terminal emulator. The reason is that I had enough unknowns with just the amplifier and wanted to minimize extraneous things to troubleshoot. Later when the Alpha was finally fully operational, I switched to PUTTY.

available. What then followed was an incredibly frustrating and interminable struggle with DB-25 and DB-9 pinouts and crossover and modem cables in an attempt to establish communications. The net result forced the conclusion that the Alpha's RS-232 link was dead. This was confirmed by connecting an oscilloscope across the MAX232 chip which implemented the Alpha's RS-232 link on the microprocessor motherboard. Communication signals in either direction went into the chip never to leave it.

The MAX232 chip is a 14-pin DIP package directly soldered into the microprocessor motherboard in the front of the amplifier. The microprocessor motherboard is a 6-layer circuit board made of the finest Unobtainium[5]. While a new MAX232 chip in a 14-pin DIP package is plentiful and inexpensive, an investment had to made in a Yihua hot-air rework station to safely and cleanly extricate the dead chip. The motherboard was removed from the amplifier, the chip was removed from the motherboard without damage, and was replaced with a machine-turned, gold-plated, 14-pin DIP socket. Isopropyl alcohol cleaned the solder flux and sweat of my brow that had contaminated the motherboard. See Figure 5, below. A new MAX232 was inserted in the socket.



[5] Unobtainium is the element located in the far upper right corner of the table of isotopes well beyond Einsteinium and is completely resistant to all known efforts to obtain it.

Fig. 5: New MAX232 chip's machine-tooled, gold-plated socket installed on the microprocessor motherboard.

With the motherboard reinstalled, RS-232 communication with the Alpha was readily established. See Figure 6, below:

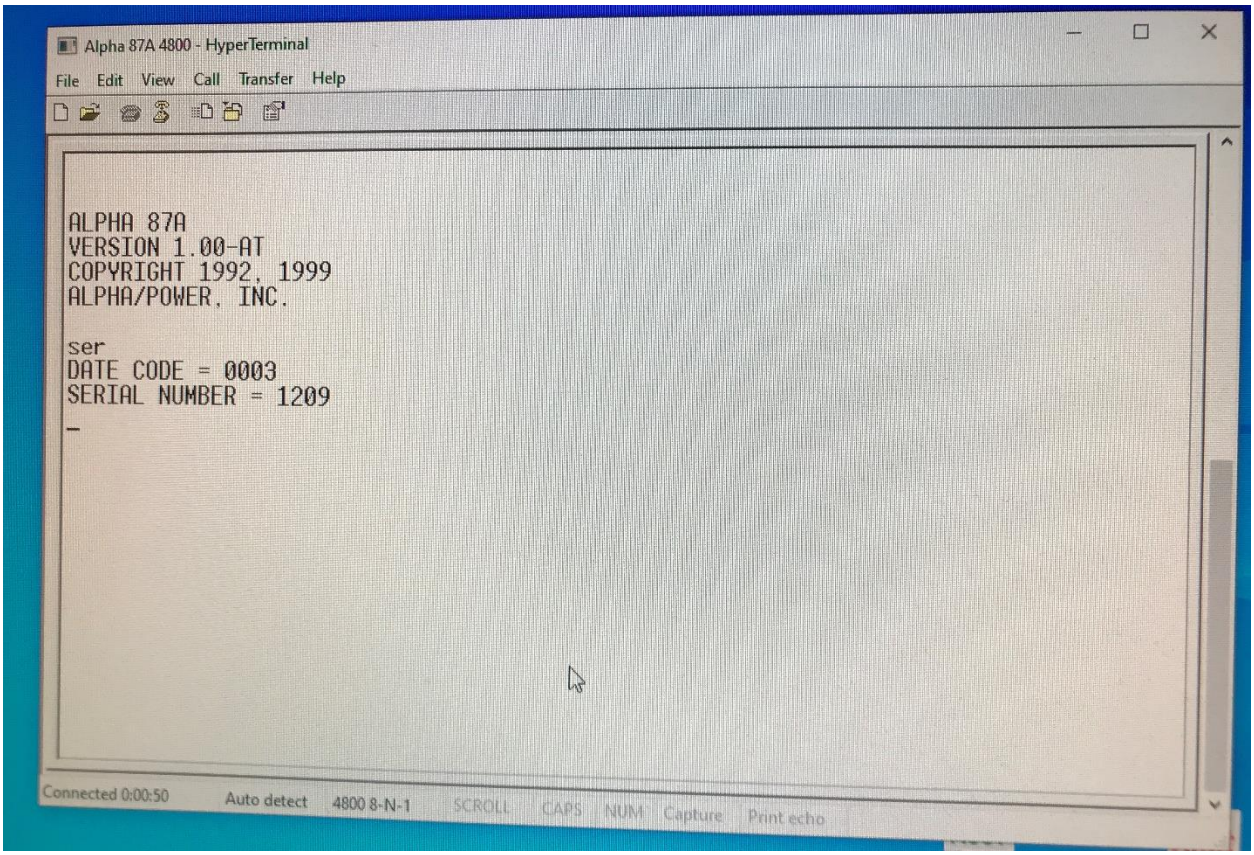


Fig. 6: First RS-232 communication from the Alpha 87A, serial number 1209.

Progress at last

With a model number and a serial number, I could now request technical assistance from the current manufacturer's rep. This effort to establish communication, however, had revealed three interesting things about the Alpha 87A. First the Alpha 87A's power switch doesn't turn off all power to the amplifier. If it's plugged in, logic power to the microprocessor is on. Second, study of the amplifier's schematic revealed that the RS-232 inputs and outputs to the MAX232 chip went directly to the DB-25 socket on the back of the chassis without any current-limiting, bypassing, or protection of any sort. This was probably not an optimum situation in a likely high-RF environment subject to I/O[6] errors. Finally, with communication to the microprocessor established, I could now take advantage of the more extensive diagnostics it provided.

[6] "I/O" = "Idiot Operator"

A relay box was built to disconnect all 220 VAC to the Alpha 87A whenever the exciter[7] was turned off and vice versa.

The lack of protection on the RS-232 lines was solved by using fully shielded RS-232 cables with clamp-on common-mode chokes[8] and installing a three-wire (Tx, Rx, Signal Gnd) opto isolator in the line to the shack computer. Opto-isolators can be inexpensively purchased on-line. Mine[9] came with non-existent documentation. Since RS-232 opto isolators typically draw power from the handshaking pins in the RS-232 interface, setting up an opto-isolator up can be tricky. There are typically three levels of RS-232 handshaking: none, hardware (Request To Send or RTS/CTS), and software (XON/XOFF). For the purchased opto isolator it was necessary that hardware RTS/CTS handshaking be enabled *on both sides of the isolator to supply power to both of its sides* via the RTS/CTS pins. The tricky part is that communication with the Alpha 87A had to be first established *without* the opto isolator so that RTS/CTS handshaking in the Alpha could be turned on. Turning RTS/CTS handshaking on in HyperTerminal on the PC was trivial.

With communication to the microprocessor established, much more diagnostic information became available. The LOAD capacitor problem was specifically the soft fault #36 "LOAD capacitor not rotating or zero sensor not working." By the groaning sounds emanating from the Alpha this was likely a mechanical problem. The Alpha's cover was removed[10] and the stepper motor and LOAD capacitor were observed during power-up. Visual observation made it clear that the stepper motor was trying to turn the LOAD capacitor but could not. By carefully dismantling the front panel of the Alpha, disconnecting the stepper motor shaft from the LOAD capacitor shaft at the Oldham coupling[11] and positioning the stepper motor aside, the LOAD capacitor shaft could be accessed and manually turned. The LOAD capacitor shaft was binding badly as it rotated. At this time, I attributed the binding to coagulated grease in the LOAD capacitor bearings due to lack of use. I exercised the LOAD capacitor manually until it rotated much more freely and reassembled the Alpha believing I had completely resolved the issue. I was wrong.

Catastrophe strikes

With the LOAD capacitor now freed up, I powered up the Alpha 87A and watched it successfully sail through its power-on sequence with much reduced groaning. I now began to learn how to tune this amplifier. Using the front panel switches, I set the band to 7 MHz, and set the band segment to +0.0 and the meter function[12] to TUNE. Using HyperTerminal, I set MODE HIGH voltage, OPER ON, and AUTOTUNE ENABLED. I set the power output of the exciter to 20 watts at a frequency of 7.050 MHz which was the center of the Alpha's band segment. When I applied drive to the amplifier, I noted that it made about 400 watts output power but that the

[7] "Exciter" is the amplifier's driver. In this case an Elecraft KX3 and KXPA100 amplifier combination.
[8] Type-31 ferrite material
[9] Dtech model number 9011 available on Amazon.
[10] The plate supply on the Alpha 87A is on the order of 3,000 volts and demands a healthy respect. Appropriate safety measures were observed.
[11] Oldham couplings join two shafts with primarily lateral offset rather than angular offset. See: https://en.wikipedia.org/wiki/Coupling
[12] What the front-panel meter displays when set to "TUNE" is not clear to me. At any rate, the owner's manual says that the correct way to tune this amplifier is to center this "TUNE" meter.

TUNE meter was far to the right. Removing drive and using HyperTerminal I therefore decreased the LOAD capacitor from 31 to 28 per the manual recommendation. I reapplied drive and found that the TUNE meter was about centered (the desired position) now. At this point the Alpha powered itself off! Hard fault 22, "Control system fault: A/D feedback "0" not working" was displayed.

A hard fault, as opposed to a soft fault previously encountered, is a very serious matter. In a hard fault the amplifier powers itself off to prevent damage. There is only a very brief time to diagnose any issue before the amplifier powers itself off and another hard fault is issued.

The Alpha's 68HC11 microprocessor has two analog inputs labeled 0 and 1. Both of these inputs have eight analog signals, one of which is a check signal, multiplexed into them. The 68HC11's algorithm checks the value of the check signal on analog inputs 0 and 1 to verify correct operation. If the check signal is not correct, it generates a hard fault 22 or 23 depending upon the A/D input at fault. Working backwards through the analog input chain, I verified that the input "0" multiplexer chip had no +5 V_{CC} power. This cost me two hard faults 22. The +5 V_{CC} power for the multiplexers on the microprocessor board is derived from 12 V from the low-voltage power supply board which voltage was also verified to be absent. This cost an additional hard fault 22. The 12 V on the low-voltage power supply board is derived from a +36-volt power supply which was also verified to be missing. This cost the final hard fault 22 whereupon the Alpha issued the ominous "hard fault 99: Call Alpha customer support" and the amplifier now refused to do absolutely anything. After six consecutive hard faults the Alpha is designed to lock itself out for safety. I now had a very heavy (75 lbs) and expensive desk paper weight.

Internet to the rescue

Whatever problem you're having in life it's a good bet that you're not the first human to encounter that particular problem. A search of internet archives found instructions posted on how to reset fault 99 from Glenn Pladsen, AE0Q, a former engineer at Alpha RF who is very familiar with the Alpha 87A. This involved running a script in the "ZOC Terminal[13]" terminal emulator that put the Alpha 87A into a special "engineering mode" and overwrote 26 memory locations in EEPROM. After several very tense minutes preparing and running the script, fault 99 was gone and the Alpha came alive again!

Drilling for silicon

Returning to the original missing voltage problem, the low-voltage power supply board was removed from the chassis for bench testing. Ohm-meter checks revealed that at least one diode in the full-wave bridge supplying the 36 volts was shorted. A simplified schematic of this section of the low-voltage power supply is shown in Figure 7, below:

[13] https://www.emtec.com/zoc/

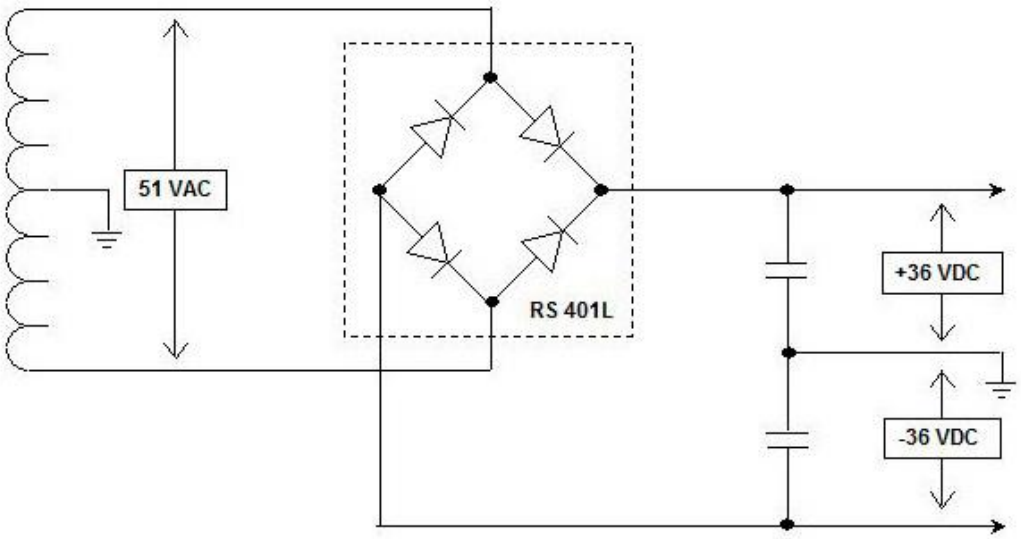


Fig. 7: Simplified low-voltage power supply schematic

The power supply develops ±36 VDC from a center-tapped 51 VAC secondary on the main power transformer. The RS 401L full-wave diode bridge in this circuit has a peak reverse voltage rating of 50 volts. Each diode in this circuit sees 1.4×51 VAC = 71 reverse volts! I don't know how this diode bridge survived in this amplifier for so long. The RS 401L bridge was replaced with a RS 403L bridge having the same current rating but a peak reverse voltage rating of 200 volts in the exact same package. Removing the failed unit from the circuit board was extremely difficult because it was nestled against another diode bridge, some capacitors, and it had heavy 16-gauge leads. It was impossible to grip the bridge's case to pull it from the board while heating all four leads simultaneously. See Figure 8, below:

Fig. 8: The failed RS 401 L on the low voltage power supply board.

Eventually I resorted to very carefully drilling through the case to remove it in pieces. Unfortunately, the adjacent electrolytic capacitor was also drilled. A replacement electrolytic was also ordered and soldered in. The low voltage power supply board was reinstalled into the Alpha's chassis.

I have seen the promised land

I powered up the repaired Alpha 87A and again watched it successfully sail through its power-on sequence. Going into OPERATE mode, I applied drive to the Alpha. After tuning at a drive of 32 watts to the amplifier, I noted that it made about 1,000 watts output power on 40 meters. See Figure 9, below:

Fig. 9: The Alpha 87A finally making power during tune-up.

My glimpse of the promised land of effortless power was to be brief, however. As I incrementally increased drive further in an attempt to get to 1.5 kW the amplifier issued the soft fault 1, "Receive PIN back bias voltage not at minimum required level with key down and no RF drive." This was very serious and incredibly disheartening.

Back to the internet

The Alpha 87A uses PIN diodes to implement full-break-in or QSK. This is a complicated system of multiple diodes and switched (not switching) power supplies. It is fast and completely silent. I despaired of ever being confident enough of my understanding of it to troubleshoot it myself. Searching the internet archives revealed that Alpha RF Systems had developed a diagnostic procedure specifically for this complicated subsystem. An email to Glenn, AE0Q, put a copy of the diagnostic procedure in my in-box.

For soft fault 1, the very first step of the diagnostic procedure was to check the receive diode reverse bias power supply voltage. It should have been 900 volts in OPERATE mode. The Alpha had essentially zero volts. The 900 volts is derived from the 3 kV plate supply through a five Zener diode (D18-D22) – four resistor (R40-R43) chain on the high-voltage power-supply board as shown in Figure 10, below:

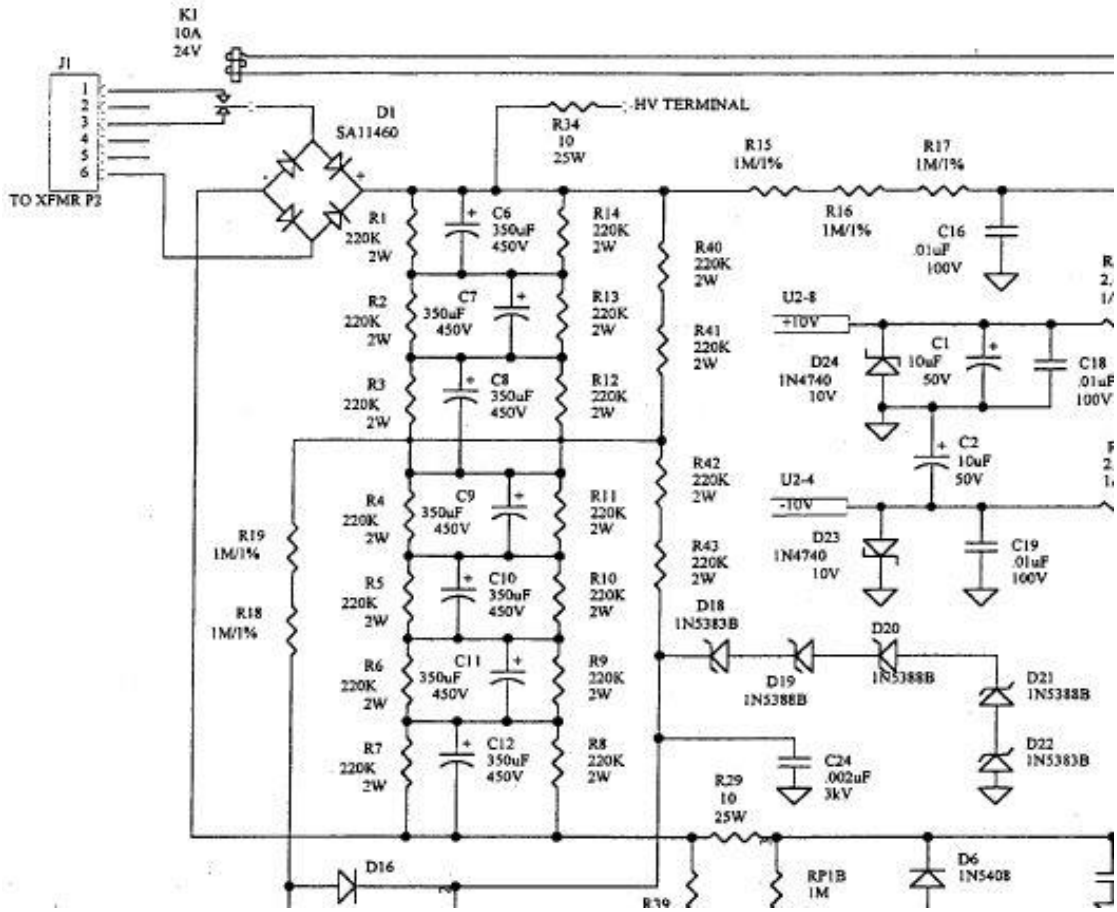


Fig.10: Receive QSK PIN diode 900 V reverse bias supply schematic. It consists of a chain of five Zener diodes (D18-D22) and four resistors (R40-R43).

Working backwards up the resistor chain starting at R43 up to R40 with a voltmeter revealed that resistor R40 was open. R40 was at the high-voltage end of the chain and was a carbon-film resistor. I had previously encountered carbon-film resistor opening failure due to corona discharge but never at the relatively low voltage of 3 kV. The high-voltage power-supply board was removed from the chassis. A new 2W carbon-film resistor was ordered and soldered in. The repaired high-voltage power-supply board was reinstalled into the Alpha's chassis.

An old nemesis returns

Testing the Alpha 87A now on each of the nine HF bands reveals that it refused to make any real power (>200 watts) on 160 and 80 meters. Infuriatingly, it now began to issue the soft fault #36 "LOAD capacitor not rotating or zero sensor not working" at startup again. Removing the LOAD capacitor's stepper motor revealed that the LOAD capacitor has resumed binding. It became clear that at some point the LOAD capacitor will need to be removed from the chassis, disassembled, its bearings cleaned and relubricated, and then reinstalled in the chassis. This task, while not hard, would be excruciatingly tedious due to the number of other components that would have to be removed in order to gain access. To paraphrase Donald Rumsfeld[14] though, this was a "known unknown" and the Alpha might still have "unknown unknowns" to be dealt with. Perhaps there was a more expedient way to deal with this issue. Upon querying Glenn, AE0Q, he advised using a long Q-tip dipped in anhydrous isopropyl alcohol to swab the capacitor bearings to reanimate their coagulated grease. Using a Q-tip in 91% isopropyl alcohol I was able to make only a marginal improvement. At this point, in desperation, I ordered[15] a precision oiler, filled it with 3-in-1 sewing machine oil, and applied a very small drop to each bearing. This made a dramatic difference in the operation of the LOAD capacitor. Once again reassembling the Alpha and testing it showed the soft fault 36 was gone. The rebuild of the LOAD capacitor had been deferred.

Not every problem was in the Alpha

The Alpha now made effortless power into a dummy load on all bands except 160 and 80 meters. Using HyperTerminal I was able to query the input wattmeter and found that the Alpha was seeing less than half of the exciter's output power on 160 and 80 meters. I was set to once again tear into the Alpha when some providential hand instructed me to check the exciter. The exciter had two selectable outputs, one routed directly to the OCF dipole antenna and the other routed to the Alpha. The exciter has a very capable Antenna Tuning Unit (ATU) and matching memories for both outputs. Previously, the exciter output to the Alpha had been used to drive a G5RV during NYQP. Although I had carefully disabled the ATU on the output to the Alpha and set the all the matching memories on seven bands for 50 Ω, I forgot 160 and 80 meters. A classic

[14] Donald Rumsfeld, Secretary of Defense 1975-1977 and again 2001-2006.

[15] From Amazon. The auxiliary equipment and parts needed to get this amplifier running amounted to approximately one third of its original purchase price.

I/O error. Resetting the exciter's 160- and 80-meter band matching memories for 50 Ω let the Alpha make effortless power on all nine bands.

On February 12, 2023 I connected the Alpha to my OCF dipole and sent 1.2 kW to the ether for the first time just in time for 3Y0J to go QRT.

Part II of this article, if ever written, will describe integration of the Alpha into the station and the mitigation of unintended consequences (EMI) of being QRO in a residential environment. It will also describe as much of the Alpha's automatic tuning optimization algorithm that I have reverse-engineered to date.

RDXA 2022-23 Calendar

September 2022

~~14~~	~~BOD~~
~~11-13~~	~~**ARRL September VHF**~~
~~20~~	~~Meeting~~
~~**24-25**~~	~~**CQWW RTTY**~~

October 2022

~~5~~	~~BOD~~
~~**15-16**~~	~~**NYQP**~~
~~18~~	~~Meeting~~
~~**29-30**~~	~~**CQWW SSB**~~

November 2022

~~9~~	~~BOD~~
~~**5-7**~~	~~**ARRL SS CW**~~
~~15~~	~~Meeting~~
~~**19-21**~~	~~**ARRL SS SSB**~~
~~**26-27**~~	~~**CQWW CW**~~
~~**30**~~	~~**BULLETIN DEADLINE**~~

December 2022

~~**2-4**~~	~~**ARRL 160m CW**~~
~~**7**~~	~~**BOD**~~
~~**10-11**~~	~~**ARRL 10m**~~
~~20~~	~~RDXA Holiday Dinner~~
~~26-28~~	~~RMSC Event - **tentative**~~
~~**24-25**~~	~~**Stew Perry 160m CW**~~

January 2023

~~4~~	~~BOD~~
~~**7-8**~~	~~**ARRL RTTY Roundup**~~
~~17~~	~~Meeting~~
~~**21-23**~~	~~**ARRL January VHF**~~
~~**27-29**~~	~~**CQWW 160m CW**~~

February 2023

~~1~~	~~BOD~~
~~**11-12**~~	~~**CQWW WPX RTTY**~~
~~14~~	~~Meeting~~
~~**18-20**~~	~~**ARRL DX CW**~~
~~**24-26**~~	~~**CQWW 160m SSB**~~
~~**28**~~	~~**BULLETIN DEADLINE**~~

March 2023

1	BOD
4-5	**ARRL DX SSB**
14	Meeting
25-26	**CQWW WPX SSB**

April 2023

TBD	BOD
18	Meeting—Zoom, K2CS—DXAC
TBD	Annual Combined Awards Banquet

May 2023

TBD	BOD
16	Meeting
19-21	Dayton Hamvention
27-28	**CQWW WPX CW**
31	**BULLETIN DEADLINE**

June 2023

TBD	BOD
3	Rochester Hamfest - **tentative**
10-12	**ARRL June VHF**
20	Meeting – FD preparation review
24-25	**ARRL Field Day**

July 2023

8-9	**IARU**
16-17	**CQWW VHF**

August 2023

TBD	**IRVfest**
26	ROC City Hamfest - **tentative**
31	Contest season concludes
	Membership year concludes
31	**BULLETIN DEADLINE**

Rochester DX Association

Club Station — W2RDX

Club Website —http://www.rdxa.com

Facebook group —RDXA QTH

This Bulletin is the official publication of the Rochester DX Association and is published quarterly.

All those with an interest in amateur radio, DXing and contesting are cordially invited to any meeting and to join RDXA.

Meetings are held at 19:00 Local time on the 3rd Tuesday of each month, September through June. Meetings are located at Johnny's Irish Pub located at 1382 Culver Rd. Rochester, NY.

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Secretary Bill Rogers – K2TER

Please send all newsletter submissions, comments, and complaints to the editor:
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Appointed Positions

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Membership Dues can be sent via:
Paypal: treasurer@rdxa.com
US Mail: Mike Sanchez KM2B
8 Piccadilly Square
Rochester, NY 14625

Regular Membership: $25.00

Family, Full time Student or Out of State member: $6.25