



The 21st Century R-390A/URR Technical Reference

A collection of wisdom for enthusiasts

The 21st Century R-390A/URR Reference (Y3K) Beta

Project Origins

This project was initiated to fill a gap in the documentation that was electronically available for the R-390A/URR receiver. Many of the issued manuals contained errors or had been superseded by newer manuals. Many of the copies available were of poor quality or incomplete.

Discussions over the past several years on the R-390 mailing list revealed that there was a great deal of additional knowledge about the R-390A/URR that had not been captured in the technical manuals nor anywhere else.

In July 1999, Barry Hauser and I began discussions with several recognized R-390A/URR experts to determine how to best capture the wealth of information that was known about the receiver but had not been gathered together and documented where it was easily referenced. Pete Wokoun, KH6GRT chimed in, volunteering to reproduce as many of the drawings as possible using modern drawing software. Dan “Hank” Arney graciously provided new color photographs for reference. Joe Foley provided safety information. We examined the manuals published from 1955 through 1985. The U.S. Navy Technical Manual for the R-390A/URR Radio Receiver (1985-May-15) was chosen as the basis for further work.

The stated goals of this project are to:

1. Re-create the 1985 U.S. Navy Manual in a format that would allow addition of commentaries, footnotes, and additional information.
2. Replace the poor black-and-white photographic images with new color plates.
3. Replace the line and schematic drawings with newly drawn ones.
4. Add footnotes referencing related documentation, attributing the additional material and corrections to the authors, and explaining unclear passages in the text.
5. Update the parts lists with currently available components.
6. Add descriptions, methods, and suggestions that were not covered in the original manual.

This document and subsequent revisions would not have been possible without the assistance of many volunteers who assisted with typing, proofreading, drawing, photographing, copying, and researching. We are deeply indebted to the following contributors for their assistance. If we have missed any names please inform the editors so we can correct our oversight.

Barry Hauser	Tom Marcotte	Walter Wilson	W. Li
Nolan Lee	Pete Wokoun, KH6GRT	David Wise	Al Tirevold
John Harvie	John Patterson, KB4SLV	Joe Foley	Dan “Hank” Arney
Walter Wilson	John Bunting, W4NET	Jim Miller, N4BE	Roger L. Ruszkowski
Al Solway	Dan Malone, KAØCWD	Dr. Gerald Johnson	Chuck Rippel
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Scott Seickel	Perry Sandeen	DW Holtman	Gary Gitzen
Tom Norris	James A. (Andy) Morrer	Scott Seickel	

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Preface to Release 3.0 Beta

Release 3 of the R-390A/URR Technical Reference (R-390A Y2K-R2) is primarily an editing process to make more efficient use of the paper space. The greatest amount of revision is the improved parts list. At the request of many, additional chapters of shared wisdom have been added to aid in receiver optimization.

Effective version numbers of sub-documents:

Document	Title	Revision	Pages
"This Document"	Front Matter	0	8
Chapter 1	General Information	0	10
Chapter 2	Operation	0	18
Chapter 3	Functional Description	0	28
Chapter 4	Scheduled Maintenance	0	4
Chapter 5	Troubleshooting	0	68
Chapter 6	Corrective Maintenance	0	88
Chapter 7	Parts List	0	58
Chapter 8	Installation	0	10
Chapter 9	Additional Trouble Shooting Data	0	TBD
Chapter 10	Gear Box Rebuilding	0	TBD
Chapter 11	Upgrades, Modifications, Part Data, Resources	0	TBD
	Old Total 313	Total:	292

In addition we want to thank Alan Waller, K3TKJ, for his generosity in providing a forum for use by enthusiasts of the R-390A/URR receiver - the R-390 mail reflector on QTH.net.

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This document is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. July 15, 2007.

The lead editor of this project is Perry Sandeen. I am solely responsible for all additions, re-paginating and the material in the additional chapters. Much of the material has been graciously provided by dedicated volunteers. But in the end I'm the one responsible for any errors or problems.

Please contact me at Sandeenpa@Yahoo.com for any errors, omissions, permissions, or lack of appropriate attribution. Many of the article and mods were copied from currently open websites. The addition of this material is to ensure it doesn't get lost as sometimes sites disappear without a trace.

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The most current copy of this document is available at <http://www.r-390a.net/y2k-r3/index.htm>.

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Conventions and Notations used in the preparation of this document:

1. Additional material will be identified by the use of a shaded text block with attribution to the author in a footnote. For example:

This is text that was added to the original manual¹

2. Removed material will be identified by the use of a 'strike-through' with attribution to the author in a footnote. For example:

~~This is text that was removed from to the original manual²~~

3. Reference material will be identified by the use of a footnote that specifies the document name, number and issue date.

This is text that needs a reference³

Joe Foley's Safety Section⁴

I guess I'm the lucky sucker that was appointed author. OK, just so everyone understands that I take NO responsibility for anyone getting hurt playing around with this radio stuff.

YOU'RE ON YOUR OWN!!!! This is a general discussion of safety advice ONLY. Its by NO means the ultimate last word, and it sure WON'T guarantee that you won't get zapped or drop the silly thing on your foot. I won't even get into the magnetic repulsion heavy objects demonstrate when hurtling toward steel toe boots. They always hit that part of the foot that's not covered. Hello, Mr. Murphy!

So, you got this thing home without hurting yourself, you can still stand up straight, that's good. Now you know why radiomen were the strongest men in the military. Proper lifting techniques are important here. Lift with your legs, with your back straight, if its too heavy, don't hesitate to get help, or the right equipment. Now you know why military radios have BIG handles. Planning helps if you buy one of these at a hamfest, ask anyone who's carried one to the parking lot, you'll need a strong cart of some kind. Yeah, right, if you buy more than one you'll need a strong car! That's why the standard Boatanchor Search and Recovery Vehicle is a 3/4 ton truck!

All right! We've got it to the bench. It should go to the bench first. Before you plug it in take a LONG close look at it. Is the cord grounded, does it have three wires, one being green? Make sure that is securely fastened to the chassis. What's the cord cap look like? That's the end that goes into the wall socket, sorry, some people don't know that's what its called.

The screws used to fasten the wires WILL come loose from repeated heating, or handling, check to see that they're tight, also that they're assembled right, white wire/silver screw, black wire/gold screw, green wire/green screw. DON'T ASSUME THE LAST OWNER KNEW WHAT HE WAS DOING. Check everything.

¹This is the reference to the author of the added text.

² This is the reference to the author of the deleted text.

³ This is the name, number and issue date of the reference document.

⁴Version 1, Courtesy of Joe Foley

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Are the fuses the right ones? Time to check the manual. Oh, yeah, the manual! You are going to read the manual aren't you? The R-390 and early versions of the R-390A only had one fuse in the back. It was deemed necessary to put two more in because when the radio developed shorts they were spectacular!! Fire ball time! Fuses are good, fuses work!

Now that the power into the radio has been checked do a visual check on the innards. Look for burn marks, hot spots, bad wiring. Do the resistance checks in the manual at every tube socket and resistor. Check the operation of all switches, if any bind or feel loose this is a good time to fix them. The FUNCTION switch has a microswitch mounted on it. If this isn't adjusted right you won't be able to shut down the power to the radio, this isn't good on a radio you're doing a first startup test on. Pay close attention to the Filter Capacitors, they are a popular failure point. They may work fine, explode, or just get very hot, like mine did. You might want to pull all of the modules and continue your visual check, this should be mandatory if its an older model as the Black Beauty capacitors may act just like the above mentioned Filter Capacitors.

Is it power time? That's your decision.

If you do it's a good idea to bring it up to full voltage on a variable transformer (variac), slowly, while checking for smoke/heat/sparks. One problem with a variac is that the voltage is dependent on the current passing through it. It should always have a voltmeter attached to it. It should also be connected to a Ground Fault Circuit Interrupter.

⇒ Danger:	Under no circumstances should you attach power to the receiver without a proven good ⁷ ground wire attached properly to the frame GND terminal 16. Filter leakage is present with the receiver turned off.
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A properly grounded 3 wire power cord attached to a properly operating R390A with the original RFI filter FL101 installed, will cause a GFCI circuit to trip. Please read the additional safety notes section.⁵

⇒ Danger:	A variac is an adjustable auto-transformer and does not provide any current leakage isolation.
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Places that normally get hot after warm-up, besides the tubes, are the crystal oven (switchable), the mechanical filters, and the small round can in the back right corner, this is another crystal oven with a thermostat that clicks on and off, there's no switch for it.

How to put it into a rack?? That's not easy if the rack is six feet high and it goes at the top. I'm able to tip my rack onto its back, then I can lower the radio carefully into it, without scratching the paint. The front panel IS NOT to be used to support the whole weight of the radio. The transmission will be mechanically stressed causing it to bind. Your rack needs slides for the radio to slip in properly, at the very least the back needs to be supported, solidly. Make sure your rack is balanced, some racks need weight placed on the bottom if the load is top heavy, especially if its on casters. Tip-overs could get ugly

Additional Safety Section⁶

At the time these radios were in service what is known as a "live front" caps were used extensively. What "live front" means is that when a paperboard type of insulated spacer was removed from the cap front, the wire mounting terminals were exposed. Do to the tight fit it was common practice to tin these wires with solder to keep from having any stray strand(s) from sticking out and allowing easier tightening of the screws. Unfortunately, solder will "cold flow" allowing the terminals to loosen and overheat. Any cap like this is now illegal and should be replaced before powering up. Modern 3 wire plugs as used on power tools will be fine.

Here becomes the first of problems you will face. A properly grounded R390A with the originally installed line filter that is perfectly functional will trip the standard USA GFCI protected circuit. It does this as the filter design passes a little more than 5 Ma. to ground and the GFCI trip current is 4 Ma. GFCI protected circuits are a NFPA mandatory electrical code requirement in new or remodeled construction for a number of years now in the USA. In most areas requiring electrical inspection, it is law. If the receiver is operated on 220 volts, this current leakage doubles.

You have several choices. One is to use an isolation transformer. A second is to remove the original filter. This is not a particularly good plan as the original filter provided EMI protection. The third choice, which most chose, is to use a modern computer power supply filter or an equivalent type low leakage filter mounted inside the chassis.

Why should one do these changes? Glad you asked.

"Electrocution" is a bit of a misnomer that isn't self-explanatory. In most cases it is actually death caused by the heart rhythm being interrupted by 60 cycle current. This is called ventricular fibrillation. The heart is still beating but the four chambers are not in synchronization so blood is not pumped through the body. You may still be breathing more or less normally. In this process you black out and in 3 to 4 minutes your brain dies due to lack of oxygen.

Depending on the moisture of your hands, the quality of the alternative ground circuit, the leakage through an ungrounded R390A with its original filter going in one hand and out through the other (worst case scenario) has a very reasonable chance of killing you without blowing a fuse or circuit breaker.

^{5,6}Courtesy of Perry Sandeen

⁷Beyond scope of this manual. Check with published references such as NFPA or equivalent standards.

The original 1985 Navy Manual cover:

SPAWAR 0913-LP-009-1400
EE125-AB-OMI-010/P610 R390A/URR

Technical Manual

Radio Receiver R-390A/URR

Operation, Maintenance and
Installation Instructions
with Parts Lists

This manual supersedes NAVELEX 0967-LP-063-2010
of 15 April 1970 including
Interim Changes T-1 through T-7.

Published by Direction of
Commander, Space and Naval Warfare System Command

15 MAY 1985

Forward

EE125-AB-OMI-010/P610 R390A/URR describes and provides instructions and parts list for the installation, operation, and maintenance of Radio Receiver R-390A/URR.

The technical content of this manual reflects the installation of the following changes, performed in the field of the listed equipment.

Radio Receiver R-390A/URR	Field Change
All	No. 1
Shipboard only	No. 2
Shipboard only	No. 3
Shipboard only	No. 4
Shipboard only	No. 5
Shipboard only	No. 6
Shipboard, Supplementary Radio Spaces only	No. 7
Selected Ships only	No. 8

EE125-AB-OMI-010/P610 R390A/URR was comprised of eight chapters:

Chapter 1	General Information
Chapter 2	Operation
Chapter 3	Functional Description
Chapter 4	Scheduled Maintenance
Chapter 5	Troubleshooting
Chapter 6	Corrective Maintenance
Chapter 7	Parts List
Chapter 8	Installation

This Technical Manual is in effect upon receipt and supersedes NAVELEX 0967-LP-063-2010 (formerly NAVSHIPS 0967-063-2010) of 15 April 1970 including Interim Changes T-1 through T-7. Extracts from this publication may be made to facilitate preparation of other Department of Defense publications.

Supplemental Chapters

Chapter 9	Additional Trouble Shooting Information
Chapter 10	Gear Box Rebuilding
Chapter 11	Upgrades, Modifications, Part Data, Resources