# Grant Application

**Application to:**

**PaEMA, Pennsylvania Emergency Management Agency**

**&**

**FEMA, Federal Emergency Management Agency**

**From:**

**Philadelphia Area Repeater Association, Inc. (PARA)**
**A 501(3)C Non Profit Corporation**

**For:**

**Radio Communications Equipment used for Emergency Communications: 3 Parts**

**Part I** **Equipment Upgrades**
**Part II** **PARALink (Linking of Repeaters)**
**Part III** **Data Radio Network**

***Part 1 and 3 are deemed to be the most important***

**May 5, 2004**

**Submitted by Eugene Mitchell, President, PARA**

## Index

# Grant Application

**This is an application for a Grant (or Grants) to fund the updating and replacement of existing radio repeater stations, a "PARA-Link" project, and new Data repeaters that are used for emergency communications and will become valuable to Homeland Security in times of any disaster. We are a 501(C)3 non profit organization in the "Amateur Radio Service".**

# Summary

**The Philadelphia Area Repeater Association (PARA) is a non- profit corporation and is also an IRS registered non-profit 501(C)3 organization whose purpose is to fund, sponsor, and operate radio repeater stations in Philadelphia and the surrounding area.**

**The purpose of these repeaters is to provide reliable extended portable handheld radio and mobile communications in and around the Philadelphia metropolitan area.**

**The Amateur Radio Service, nationally, and PARA in Philadelphia has been available for any disaster or emergency situation requiring emergency communications. The Amateur Service has proven its ability to assist and supplement regular first responders in the past. The system is working and ready, and is tested on a daily basis by its normal use as hobby type communications. Many parts of the system are used in drills with the counties involved for the Peach Bottom and Limerick nuclear generating stations as well as weather exercises.**

**PARA is in need of grants to accomplish 3 separate projects. First, upgrade older failing equipment with newer "commercial grade" equipment that is also not subject to interference from the close proximity of other commercial repeaters. Present equipment is "amateur grade", meaning it is not built to the same standards of commercial Motorola or GE equipment. Second, a "PARA-Link" would tie quadrant repeaters together for wide area coverage that would coordinate communications between different areas, not limited to any one community or County. The third part is installation of a Data Repeater System. The data repeaters are a new concept that would operate in addition to existing voice communications, and would allow high speed data communications to pass written messages, pictures, and maps. Estimated costs: Upgrade phase: $57,500. PARALink phase: $23,400. Data Network phase $34,750. Total $115,650.00. Phase 1 and 3 are deemed most important. We expect to use professional antenna riggers to climb towers and amounts have been included to cover these expenses.**

**Membership dues has funded this extensive working system 100% over the last 34 years, but in order to upgrade to commercial grade equipment, outside help is needed, especially because of the need for better reliability for "homeland security".**

**Attached are details about the organization, details about Amateur Radio, block diagrams of the system, pictures of the sites, and equipment lists of the needed equipment. The list details what is needed at each site as well as what is needed to implement the "PARA-Link" project as well as the "data repeaters" that are also proposed. The priorities of each site and project are also listed.**

# Grant Application – Purpose of the Grant

**The Philadelphia Area Repeater Association, or PARA, is in need of a grant to fund 3 separate phases of a project, all pertaining to a communications system that can provide emergency communications and supplement communications used by first responders. Although the first 2 phases are very important, the third phase has the potential to become more important and useful and it may well be adopted nationwide.**

**The first phase is to update the present system with newer "commercial grade" equipment that will replace older failing equipment that is 20 to 30 years old that is also subject to interference from the close proximity of other nearby repeaters. Present equipment is either "amateur grade", meaning it is not built to the same standards of commercial Motorola or GE equipment or is very old and outdated second hand equipment, obtained when commercial systems were updated. New commercial grade equipment is much more expensive. One site was recently upgraded with the help of Chester County, but the remaining equipment should also be replaced as soon as possible so that reliability is improved. Although the present system is fully operational, it requires constant maintenance. We want to cut the costs of maintenance, improve reliability, and be better prepared to be able to assist in any time of need.**

**The second phase is called "PARA-Link", which was recently conceived by one of our members, also a commercial radio engineer, who presented his plan to "PARA". PARA-Link would accomplish the linking of 4 quadrant repeaters, on a command signal, so there would be additional and separate wider area coverage facilities for occasions that this might be needed to coordinate between different area suburbs and counties. This would compliment an existing main system (76) with a second independent set of channels for the wide area coverage. The first phase must be accomplished before "PARA-Link" could be implemented.**

**The third phase was just recently conceived and would create an additional system that would handle data (email) on a "Radio Data Network". This system would operate just like the "Internet", but be completely separate, operating completely over radio waves on the "ham radio" frequencies instead of wires. This should not be confused with present wireless access called WIFI, or 802.11, to the Internet. This would be a completely separate system designed for email/data emergency communications. Each data radio repeater would serve hundreds of users in a given area and would be interconnected to each other, again by a "data" radio. There would be a "web/email server" in each area that would be accessed by radio (instead of landline) and would contain only data relating to amateur radio and emergency communications. The system could be accessed only by radio equipment that was equipped with the necessary data radio and computer. The system would be built from commercially available equipment that would be adapted for this use. We have already started design of the computer server software that would be used.**

**We propose to build a "pilot" system at a key location, using this "data repeater". Once this "pilot" system is operational and proven, we would want to expand it. It could eventually be expanded throughout the Philadelphia metropolitan area and connect various emergency groups together. It is conceivable that this, or a similar system, could grow to cover the entire country. It would not use the existing Internet to function, although we may include capabilities to expand email forwarding into the Internet.**

# Grant Application – The PARA System

**The Philadelphia Area Repeater Association,(PARA), is a non- profit IRS registered 501(C)3 corporation that funds and operates radio repeater stations in the Philadelphia area. "PARA" has 12 main repeater systems on 5 UHF and VHF bands using FM voice, Television, and Data, along with 6 remote receivers for the wide area system.**

**The purpose of these repeaters is to provide reliable extended portable handheld radio and mobile communications in and around the Philadelphia metropolitan area. The Philadelphia area has numerous hills and valleys around the suburbs, particularly to the North and West. Since VHF and UHF communications are usually line of sight, repeaters are needed to extend the range of portable and mobile communications. Radio signals are normally blocked by hills, mountains, buildings, and other obstructions. "Line of sight" for a portable or mobile, can be 1/2 mile to a few miles, depending on the terrain and other objects. Hams have been using repeaters since the early 1960's.**

**PARA is and has been available for any disaster-emergency situation requiring emergency communications. The system has been used in drills with several counties relating to the Limerick and Peach Bottom Nuclear power plants as well as weather related drills. The system is working and ready, and is tested on a daily basis by its normal use as hobby type communications.**

**The present system operates with 4 quadrant repeaters: West Chester, Sellersville, and Feasterville in Pennsylvania, and Camden, New Jersey. There is also a "Central" repeater on Valley Forge Mountain and linked to Worcester with numerous remote receivers in the 2 meter amateur band. Additionally, there are other repeaters: 1 on 52 Mhz, 3 on 224 Mhz UHF, a slow speed data packet repeater on 145 Mhz, and a television repeater in Chestnut Hill – Philadelphia on UHF.**

**It is the 2 meter repeaters that PARA wishes to update, upgrade, and expand. The PARA-Link project would link each of the quadrant repeaters together and the third project, a "Data Radio Network" would create a new high speed radio data network to pass email, similar to the Internet, but it would be completely separate and totally wireless. The Data Radio Network is very innovative and may prove to be extremely valuable.**

**"PARA" has had an alliance with Montgomery County (PA) and Chester County for many years. Equipment resides on one of Montgomery County's towers in Eagleville (PA) that is shared with PARA's main system providing a key remote receiver into the 76 wide area system. In Chester County, PARA's "94" quadrant repeater operates with redundancy from both the county tower in Westtown at the Government Services Building and at another county tower in downtown West Chester. This is the one repeater that does not need upgrading. Members of "PARA" have been participating with Chester County and Montgomery County in drills and other public service events for many years.**

**"PARA"'s flagship repeater on Valley Forge Mountain on "76" was one of the first ham repeaters back in the 1960's. It is also a special repeater in that it is a wide area repeater with 4-6 remote input receivers around the area. The original "voting system", or receiver selector, was designed and built by one of "PARA"'s own members. PARA (its members) originally funded all these systems and also maintains most of its equipment by its own members whom are all volunteers. These members donate their own time as well as membership dues to support and maintain the system. Membership dues also cover the cost of electric power for sites where needed.**

**"PARA" operates on the cutting edge of technology where possible. Computers coupled with TNC's, (special radio modems) and their companion radios, communicate using slow speed data on one system. This system uses GPS (Global Positioning System) and transmits precise "locations" which are also**

**relayed by this repeater. This data network is extremely slow by today's standards, but it proved data was a helpful means of communications. Below, we will relate a new and better plan for data communications, again, very much on the cutting edge of technology.**

**PARA operates another repeater in Chestnut Hill, Pennsylvania that relays television signals for hams. This is a ham system and not part of any commercial system. Members have taken portable cameras and transmitters and have relayed television signals via ham frequencies to prove those capabilities. This television demonstration has been used as part of some of the emergency drills in this region.**

**PARA originally had over 600 paid members, but paid membership has dropped to about 200 at this time. There are still almost a thousand hams that use the "system" on a regular basis. Paid membership has dropped because of hard financial times for many members. Membership is not required to use the system because FCC regulations state that Ham frequencies are open to all hams and fees can not be charged. Membership has to be optional.**

**"PARA" is governed by a "Board of Directors". The Board is made up of 2 members elected from each quadrant. In addition, a president, vice president, recording secretary, corresponding secretary, and treasurer are elected from the membership at large. Terms are 2 years with directors and officers elected in alternate years to maintain continuity. The Board meets quarterly with additional meetings as needed. A Technical Chairman and his committee are appointed by the Board to deal with day to day operations and maintenance. A quarterly newsletter and email are used to keep members informed. Membership meets twice a year, with elections in November.**

# History of PARA, The Philadelphia Area Repeater Association

**On November 1, 1967, some 30 FM'ers met at the WFIL (now WPVI) studio's on City Line Avenue in Philadelphia to organize. Personally owned repeaters, K3DSM and W3CKP, had been in operation, but they were only available when the owners were available to activate them. Users of these repeaters wanted a system that was available 24 hours a day. The organization name: Main Line VHF Association, an inactive club, was chosen to simplify matters since it was still licensed and several of the old members were active "FM'ers" (users of this technology) at the meeting.**

**A split-site repeater was put on the air that night on .34/.94 with the transmitter at Gene Mitchell's home (K3DSM) in Merion and with the receiver at Bill Winter's home (K3JPB) in Newtown Square. A 449 MHz link connected the two sites.**

**Different locations were tested for coverage. The biggest problem was finding good locations to serve most of the FM'ers. The technology called for having separate sites for the transmitter and receiver, unless a big enough of a tower could be found with enough vertical separation of the antennas. The Suburban Philadelphia area has numerous hills and valleys which made picking the right location important. Major site locations tested with fair results were Lankenau Hospital, Sellersville (old Western Union tower) and Berwyn Roller Rink. The Berwyn location proved to be exceptional. Immediate preparations were made for a single site repeater at Berwyn. Receiver "de-sensing" (interference) was a serious problem with 2 antennas on one mast, vertically separated by only 15-20 feet.**

**In May of 1968, an Exposition and ARRL Convention in Paramus NJ solved one of our biggest problems. A vendor was selling "duplexers" to hams at a reasonable price. We ordered and obtained a duplexer, a 4 cavity ring device with filters that allowed one antenna to be used for transmitting and receiving by creating isolation and pass only of the needed frequencies without the "de-sense" problem.**

**Another problem was the frequencies we were using. There was no standard plan for frequencies and we couldn't decide on whether to place the repeater on 146.94 Mhz or 146.76 Mhz. The input of 146.28 mhz or 146.34 Mhz was also undecided. Different members each wanted different combinations.**

**Coverage from Berwyn went all the way North to Allentown, some 55 miles away, and just as far South into Delaware. Yet, there was coverage problems close in at 5 to 8 miles away to the East, yet as you went further East, the coverage worked well, once out of the shadow of the hills.**

**Meanwhile another group, the Les Voyageurs, put up a very good repeater WA3IPP, in Sellersville on .28/.76. This repeater had very good coverage but was not solid near the city. It gave the WA3BKO repeater in Berwyn lots of competition. That repeater made use of a 100 foot walkup microwave tower, donated by the County of Bucks Civil Defense. Both groups grew rapidly. Also, both groups knew that cooperation between them was important. There were now reports in other areas of the country of groups that fought over frequencies where they could not get along. One of the systems tried between the 2 groups called for an increase in power to a quarter kilowatt at Sellersville on 76 out with a 34 receiver in Edgemont and a 28 receiver in Souderton. This worked well for coverage in the suburbs but was still marginal on the expressway and downtown Philadelphia.**

**While the repeater was at Berwyn, many improvements were made, such as the addition of a mechanical wheel for automatic ID, tape logging, hardline cable and a stationmaster antenna, raised 40 feet above the rink. The control receiver on 449 MHz, using a Secode decoder, had problems since the control receiver's "IF" was listening to Radio Moscow. Modifications had to be made to fix this. A "whistle-off" feature was also used, but it also had short-comings since anyone whistling to test their radio disabled the system.**

**Simplex'ing on .34 was common among newcomers which caused some friction with the repeaters. Again, the organization began testing new sites. Swarthmore was really poor. Coatesville covered Baltimore better than Philadelphia. Edgemont did not cover any better. Many of the group wanted to go back to .76 but a group in Sellersville was there now. It was decided to try to share the .76 frequency.**

**The repeater was moved to Penn Valley, central to the area to be covered. The duplexer could not operate on this pair of frequencies. The receiver was placed in North Philadelphia and linked on 449 MHz. Another receiver was placed in Devon also linked on the same 449 MHz frequency. Receiver selection was accomplished by hoping only one receiver heard the signal. Sellersville sent their .28 input to Penn Valley on another 449 MHz frequency. .34 and .28 could both access the .76 transmitter. At this point, the Sellersville transmitter was disabled. Power was raised, at Penn Valley, to equalize coverage.**

**On December 7, 1970, a large group of over a hundred users met at the GE facility in King of Prussia. Gene Mitchell, president of the Main Line VHF Association and Dave Zollers, president of the Les Voyageurs had decided to put the 2 groups together and talk about a merger. After a short discussion and the benefits discussed, a vote was taken and PARA, the Philadelphia Area Repeater Association was formed. Also, Gene Mitchell demonstrated his 446.0 to 449.0 Mhz repeater with an autopatch (automatic telephone patch) to the group. After the demonstration, the group decided that an autopatch should be placed on the PARA system. It was also decided to have multiple repeaters, both in Sellersville and the Main Line area as well as multiple receivers for the Main Line system. Frequency coordination would no longer be a problem for these repeaters under one roof. Papers were drawn up and membership cards were issued to the new organization's members. The group was formally incorporated on Sept 4, 1973.**

**Over the next year, a quadrant system of repeaters was formed due to the large area and its complexity due to the hills and valleys. 94 would be known as the Southwest Quadrant, 88 would be known as the NorthWest Quadrant, 82 would be known as the SouthEast Quadrant, and 97 would be known as the NorthEast Quadrant. The South Jersey Radio Association group merged their repeater with PARA to pick up the 82 repeater and also provide a remote site for the main 76 repeater. Another group in the NorthEast, Penn Wireless merged with PARA to pickup that area for that quadrant and remote input.**

**The structure of PARA was changed to have 2 directors from each quadrant as well as the officers from the group at large to make up the Board of Directors. PARA got its nickname and insignia from PARROT, which means Philadelphia Amateur Repeaters (and) Remote Operated Transmitters.**

**PARA has had many prominent member hams and officers over the years, including Bob Kinney, President of GE Communications, Lloyd Roach, owner of many commercial broadcast radio stations, Larry Will, engineer of the Jersey Public Broadcast network, and Jesse Wagner, owner of IET and the designer of the low light video systems now widely used, and many others.**

# Amateur Radio

**Amateur Radio, or Ham Radio, as it is sometimes called, is a Federally Licensed Hobby Radio Communications Service, enjoyed by about 600,000 licensed Americans. These hams build and operate 2 way radios and can communicate with other hams across the country and all around the world.**

**Ham Radio actually started with people like Marconi and others, who in the early 1900's, experimented with the wireless technology, believing that one day, communications, as we now have, would be possible. Many people were experimenting with radio after the first developments were announced. Many developments and refinements came about. All of these early experimenters were called hams.**

**Little was known about radio frequencies in the beginning, and the first type of communications were bursts of static created with a spark gap mechanism. Soon after, it was discovered that various frequencies existed and that they could be controlled. Various developments led to refining the methods that radio signals were generated. The first noise bursts of signals used a code developed by Samuel Morse that was developed for telegraph. Experimenters soon discovered methods for generating a continuous wave that refined signals and also discovered there were different frequencies or wavelengths. Voice communications soon became possible. Most refinements of voice communications including AM, FM, and single sideband came from ham operators.**

**Once technology developed, practical commercial and business uses evolved. Early radio was used for broadcast to the public, International Short Wave Broadcast, and ships at sea as well as International 2 way Communications. Business and public service radio also evolved shortly after. The Federal Government stepped in to organize and regulate communications as soon as there became a need for frequencies by the many early broadcasters. Allocations were made in the different frequency bands for Broadcast, Government, Public Service, Business, and Hams. Most of these early communications were on frequencies that are presently the Broadcast AM band and below.**

**Hams discovered shorter wave communications and longer distance communications came about. As the Hams developed the higher frequencies (short wave), they discovered that different wavelengths acted differently at different times of the day and night and different times of the year. The government assigned different bands to hams and other users at various different wavelengths.**

**Hams are assigned call letters, just like commercial broadcast stations.**
**Ham radio operators are assigned "bands of frequencies" throughout the radio spectrum, including short wave, as well as the VHF and UHF spectrum. The range of communications changes on these different bands at different times because the sun ionizes different layers of the ionosphere above the earth and radio signals bounce off these different layers at different times changing the range of communications and how far the radio signal is heard.**

**With the development of the vacuum tube, higher power communications and longer distance communications became possible. In the 50's, solid state electronic components (transistors) made communications more portable.**

**Ham Radio Operators are licensed by the Federal Communications Commission and there are five classes of licenses with various privileges with each license. Obtaining a license requires a person to pass a written and sometimes a Morse code test, depending on the class license sought. The written test is on federal law regulating ham radio as well as technical information on electronics and radio**

**communications. The requirements are kept so that hams appreciate the use of the valuable radio spectrum that they are assigned.**

**Hams communicate by code, voice, data, and even television. They experiment with new technology and, many times, build their own radios. They talk from their cars, boats, homes, vacation homes, and even places of business. They talk to local ham friends and form clubs. It's also important to note that they make new worldwide friends across the seas and this promotes world peace, friendship, and understanding. Many hams collect QSL confirmation postcards confirming or verifying their contacts with other hams.**

**Radio spectrum is much in demand. All of the allocations of frequencies are mostly filled and the frequencies are shared and sometimes overcrowded in large Metropolitan areas. Hams have been allowed to keep their valuable spectrum because of the continuing contributions in developing new techniques and technology. They have also proved their valuable emergency communication's ability in times of national and natural disasters. These stories of emergency communications can be read after any natural disaster in any part of the world that suffers an earthquake, weather related disaster, forest fire, plane crash, or similar disaster and hams even played a vital roll in "9-11" emergency communications.**

**Further information can be obtained from the American Radio Relay League (ARRL) in Newingtown, Connecticut, or any ham operator. Their web site is www.arrl.org .Other information can also be obtained from www.qsl.net. There is a wealth of information about ham radio on the World Wide Web.**

# Radio Frequencies and Bands of Frequencies

The key to understanding radio usage is understanding the radio spectrum. Most of us are familiar with the AM or FM radio dial, but they are a small portion of the radio frequencies. The AM broadcast radio band is near the bottom of the spectrum, yet there is an area below that, used for navigation. The area above the AM Broadcast band is known as the Short Wave bands. Above short wave are the VHF and UHF frequencies. From 3 Khz to 500 Khz, the spectrum is also known as VLF or very low frequencies. From 500 Khz to 30 Mhz, (Broadcast AM and Short Wave), the spectrum is known as HF or high frequencies. After HF and Short Wave comes VHF, UHF, and Microwave bands.

Short Wave frequencies react to the Ionosphere, the different layers in and above the atmosphere. The Ionosphere is made up of ionized particles that react from the radiation from the sun. There are several layers of the Ionosphere and different frequencies of Short Wave have different characteristics during different times of the day and different times of the year because of the differing sun radiating. The Ionosphere is also affected by "sun spots". The characteristics of the Ionosphere determine how far radio signals travel by bouncing off the different layers at different elevations as they change characteristics. This is why Short Wave stations have many channels in the different parts or bands of the short wave spectrum so that they can be heard in the far away places at the various times of the day and year. Listeners of Short Wave know to retune their receivers to different frequencies when the others fad out. Hams have 9 bands of frequencies throughout the short wave spectrum so they can communicate using the different characteristic of each band at the different times.

Unlike HF, most VHF and UHF frequencies usually only work line of sight which could be 1 to 40 miles depending on how high the antenna is and what is between. Frequencies from 30 to about 80 Mhz are affected sometimes by layers of cold and hot air that cause a "ducting effect" to make those signals travel much further than normal. Repeater stations on VHF and UHF extend the normal range to take advantage of a high hill or building with its antenna and repeater. Repeaters allow mobile and handheld transceivers or "handie-talkies" to communicate 10 to 40 miles between other units. Hams have 3 bands of frequencies assigned to them in the VHF spectrum, each with slightly different characteristics. On UHF, hams have 3 more bands of frequencies, and even many more bands in the "microwave" range. As frequency goes up, range becomes shorter. Also, as frequency goes up, antennas normally become smaller.

When radio was first discovered, hams were given unusable frequencies which, at that time, was all of short waves and above. As hams developed equipment and proved the usability of higher frequencies, commercial operations moved in to these ranges. Ham and commercial stations became regulated by the Federal Government, but the hams were left with bands of frequencies in each range because it was the hams that discovered the higher frequencies and their usability.

Certain bands have usability that makes it suitable only for certain operations. Police once used short wave and low VHF at about 40 Mhz. These frequencies proved unsuitable because of interference from distant areas. Police are assigned certain frequencies and do not have the ability to move off their licensed channel. Hams can move anywhere in their licensed bands all over the spectrum.

**The Big Radio Dial**

| VLF | AM-BC | SW | VHF-PS | Ham-6m | TV 2-6 | FM-BC | Air Craft | Ham-2m |
|---|---|---|---|---|---|---|---|---|
| 3khz-500khz | 530khz-1.8 Mhz | 1.8Khz- 30 Mhz | 30-50 Mhz | 50-54 Mhz | 54-88 Mhz | 88-108Mhz | 108-144 Mhz | 144-148 Mhz |

continued:

| PS | TV 7-13 | Ham | Gov't | Ham-UHF | PS | UHF TV 14-69 | PS/ Cell Phones |
|---|---|---|---|---|---|---|---|
| 148-174Mhz | 174-216Mhz | 219-225 Mhz | 225-420Mhz | 420-450Mhz | 450-470Mhz | 470-700Mhz | 700-902Mhz |

continued:

| Ham | Gov't | Ham | Satelllite-GPS | Fixed Microwave | C Band Satellite | Ku Band Satellite |
|---|---|---|---|---|---|---|
| 902-928 Mhz | 928-1215Mhz | 1215-1300Mhz | 1300-2100Mhz | 2100-3600 Mhz | 3600-4000Mhz | 5000-6000Mhz |

PS stands for public service including police, fire, business, etc

# Disaster Communications

## Why Amateur Radio (Ham Radio) is so important in times of disasters

All phone circuits, wire and cellular, become overloaded very quickly when disaster strikes. 911 centers become overwhelmed with so many calls that many calls never get through. Dispatchers become overwhelmed. Police and Fire Radio channels become overloaded as dispatchers are relaying all these calls to first responder units on the street. Ham Radio Operators usually set up in short order and supplement these communications. This happens over and over for forest fires, plane crashes, the space shuttle parts recovery, earthquakes, and even in New York on “9-11”. Hams are creative, flexible, very technically oriented, and are very willing to help.

Newer police communications are so complex that they rely on a “trunking system” where each repeater is looped to the next. When one of these loops goes down, the entire system can get messed up and may stop working correctly. If just one of these towers or repeaters is affected by the disaster, the entire system may be jeopardized.

Landline telephone systems are overloaded because they are calling family and friends. The phone company has limited equipment in their central office and limited lines between their switching centers. Even during snowstorms or when kids get out of school in the afternoon, it is sometimes hard to get dial tone and even harder to reach someone in an adjacent area. “All circuits busy” messages are common without a disaster. Additional communications between disaster sites, hospitals, and police become important. During the “9-11” disaster, landline communications in almost every area of this country was difficult to complete.

Cell phones also work on a limited basis during emergencies. Like the landline, there are limited channels available. During normal “drive time” from 7-9 am and 3-5 pm, it is sometimes difficult to get a radio channel. During “9-11”, cell phone usage in New York became almost impossible. In other metropolitan areas, it was also near impossible. If the plane over Pennsylvania been over a major city, those calls may not have been possible due to overloaded channels. The government has already discussed ways of limiting public access to cell phones. Limited access would cut off needed communications when that happens from volunteers and possibly even first responders.

Satellite cell type phones are available, but they are expensive and would not be available where needed because there is no way to know where they are needed and in what quantities. They do not function in extremely bad weather where there are dark thick clouds and they must have a clear view to the area of sky where a satellite is located.

Ham radio has proven itself over the years. The Federal Communications Commission has recognized this, and in the section of rules permitting and licensing ham radio, this is well stated. Ham radio operators are everywhere. They are technically qualified to run their radios because a license requiring technical competency is required. Hams have base stations, mobile stations, and portable “handie talkies”. They use repeater stations similar to police communications. They are very flexible. There are large numbers of ham operators in most areas. Many hams take part in emergency drills and have specific training to deal with emergencies. Most ham operators, being technically trained, can deal with a situation to move communications equipment and hook it up when and where necessary because they understand how it works.

Data communications has come of age, and we are proposing to supplement voice with data over ham frequencies, completely separate from public service radios and wire-lines. Data will also provide a layer of isolation from casual listeners.

# Meet The President of the Philadelphia Area Repeater Association,

## Gene Mitchell – Amateur Radio Station – K3DSM

Gene Mitchell is presently on his third 2 year term as president of the Philadelphia Area Repeater Association (PARA). He previously served on the board of directors for 3 years, just prior to his election to president and previously, in the 1980's for 6 years. He was also one of the founders of this organization, having been president of the Main Line VHF Association, one of the 2 organizations that merged to form PARA in 1969.

He was instrumental in building an elaborate shed for the Valley Forge Repeater back in the 80's and also in setting up a packet bulletin board/ repeater (data over radio) for PARA. His present main project is applying for grants to fund the upgrade and expansion of equipment so it will be better equipped and more reliable to handle emergency and "Homeland Security" communications.

He was first licensed as an amateur radio operator at age 15, in 1958 and has held his license continuously (45 years) since. He taught others, in his earlier years at a summer camp in New Hampshire, about amateur radio, and about 10 campers as well as the director of the camp, obtained amateur radio licenses through his efforts.

In the late 60's, early 70's, Gene Mitchell served as RACES (Radio Amateur Radio Civil Emergency Service) Radio Officer for Lower Merion Township, suburban Philadelphia for several years. Under his direction, a radio room in the basement of the Lower Merion police station was built and set up for amateur radio operators for the Township's Civil Defense program.

Gene presently serves with CCAR, the Chester County ARES- RACES organization (Amateur Radio Emergency Service & Radio Amateur Civil Emergency Service). He was also instrumental in forming a formal alliance with CCAR and PARA regarding the sharing of the 94 South-West PARA repeater and site.

He has been a Rotarian for 29 years and has served as president for 2 separate terms in the Rotary Club of Exton Frazer. He has served on the Rotary District 7450 Technical Committee continuously since 1996 and was responsible for starting his club's own web page as well as web pages for the District and other clubs in the district.

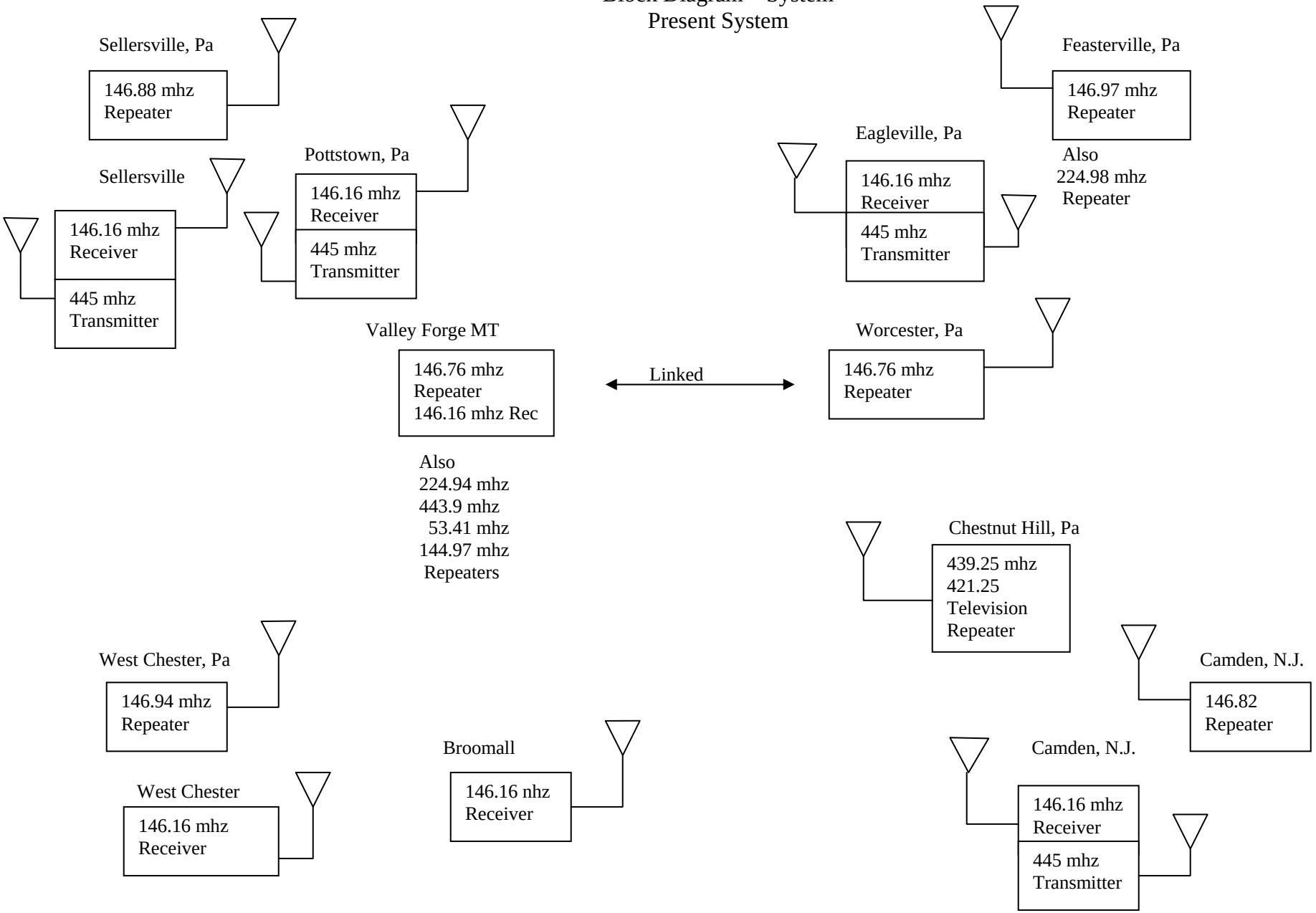
Gene Mitchell is presently the owner of Gene's Computer Outlet, Inc. in Frazer, Pa and has been selling custom built computers as well as repairing computers in that capacity for 16 years this June. Prior to that, he built, owned and operated a roller rink in Kimberton, PA for 15 years. During this time, he also installed alarm systems, P-A systems, and commercial 2-way radio systems, including radio repeaters.

Gene Mitchell is a graduate of Valparaiso Technical Institute, Valparaiso Indiana '65 with an Associate Degree in Electronic Engineering. His first job was with the Bell System, having responsibilities with switching, carrier, microwave, and private circuits.

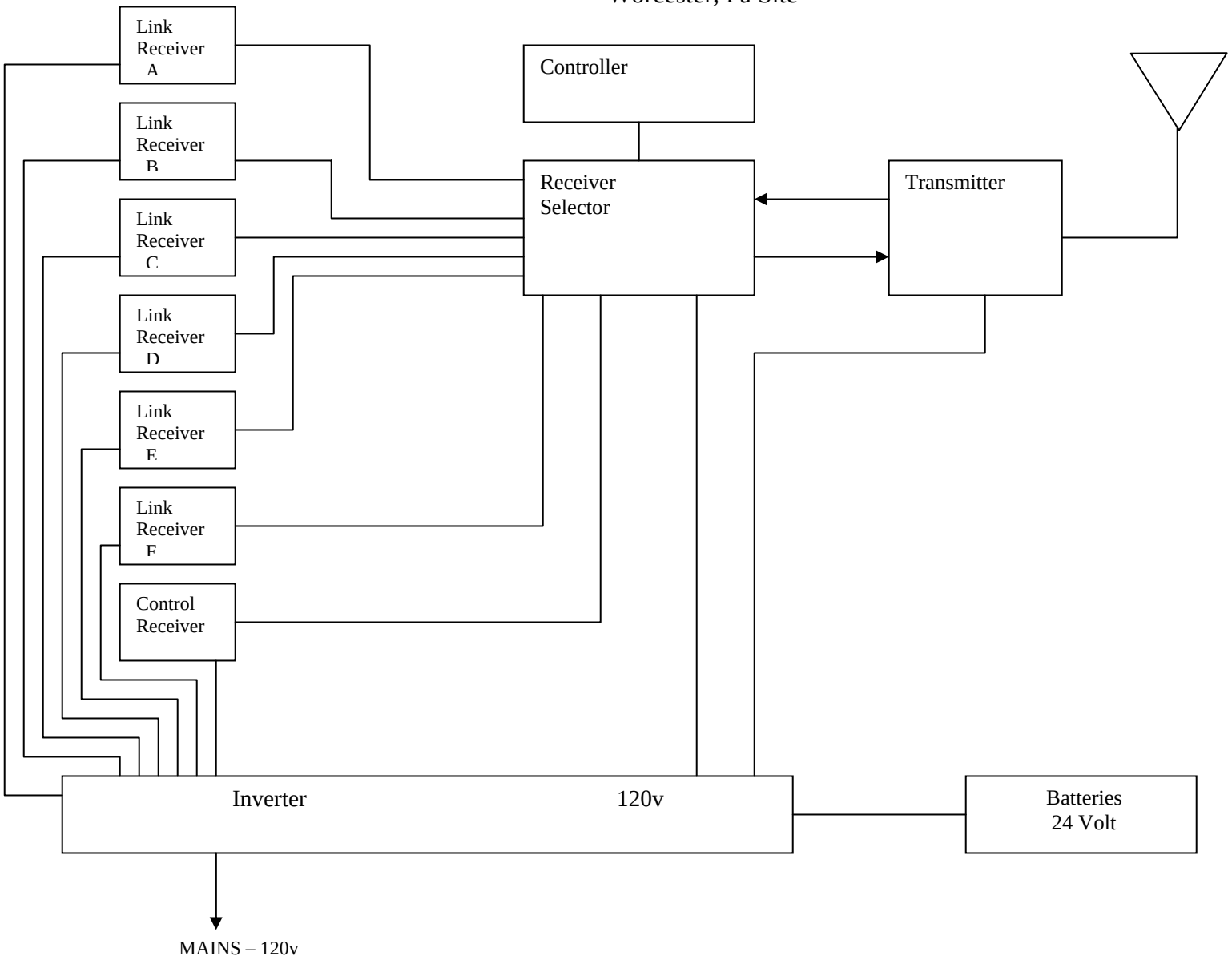
Gene Mitchell took on some responsibilities at radio station WCOJ Coatesville-West Chester, Pa in the spring of 2003 during weekends. He can be heard Sunday mornings, afternoons, evenings, and very early Monday mornings giving weather and other community announcements. He also sets up and engineers some remote broadcasts for the station. Gene once thought he might go into broadcasting while he was studying at Valpo Tech. He was a DJ on the school radio station WVTI, and later became the chief transmitter engineer. Gene obtained his commercial Second Class Radio-Telephone License in 1963 and has held it continuously since, now called General Radio Telephone License (41 years).

Gene is married 31 years this August, to Maria, and has a son, Michael (26), and a daughter, Anne, (25). Michael is a successful computer consultant and programmer holding many Microsoft Certifications and Anne is a veterinary assistant. Maria works on a farm/vineyard (Eagles Crest ) in Chester Springs, caring for the animals, including Alpacas, miniature horses, pigs, sheep, cats, and birds. Occasionally, she gets involved with the vineyard.

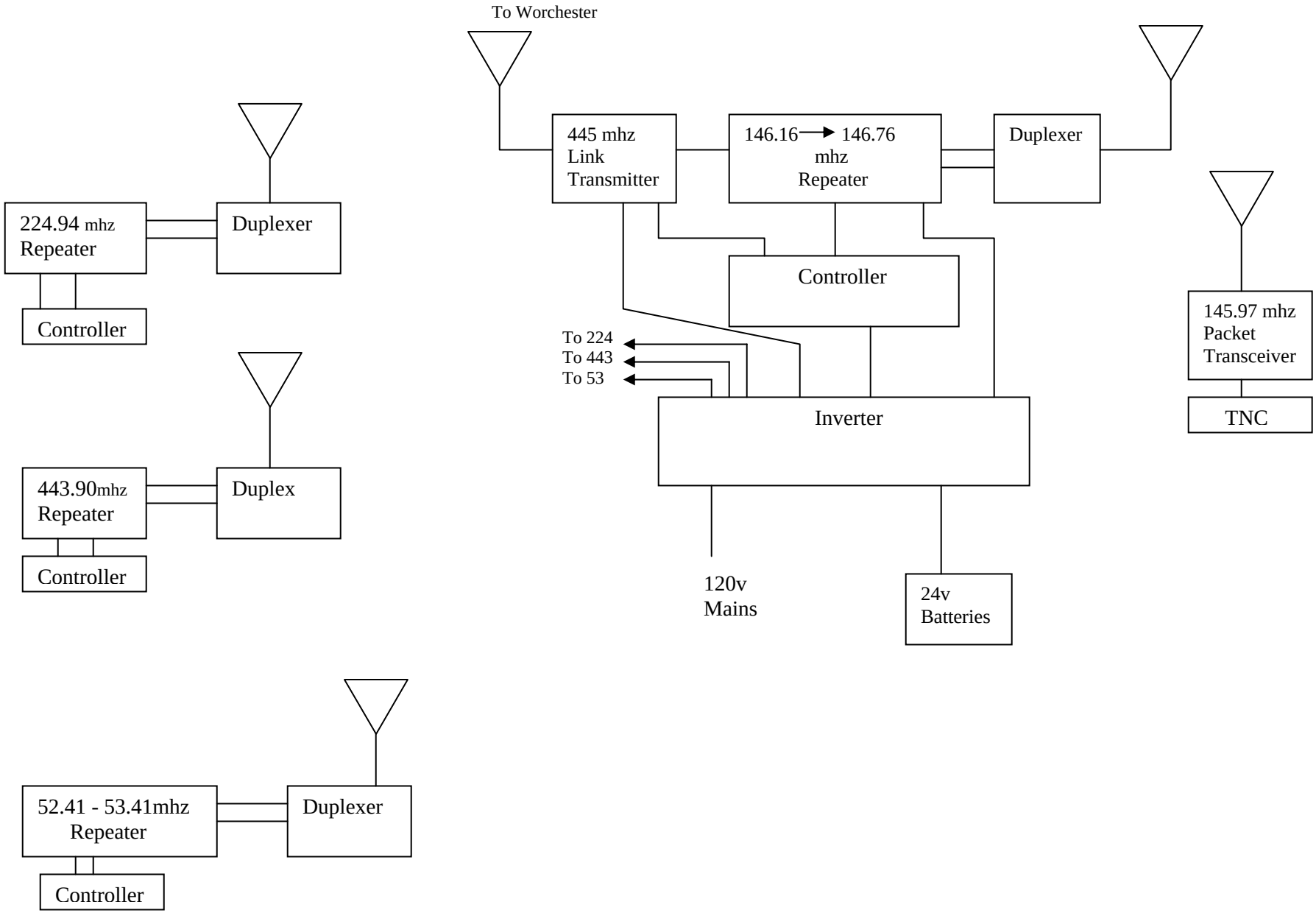
# Philadelphia Area Repeater Association
## Block Diagram – System
## Present System



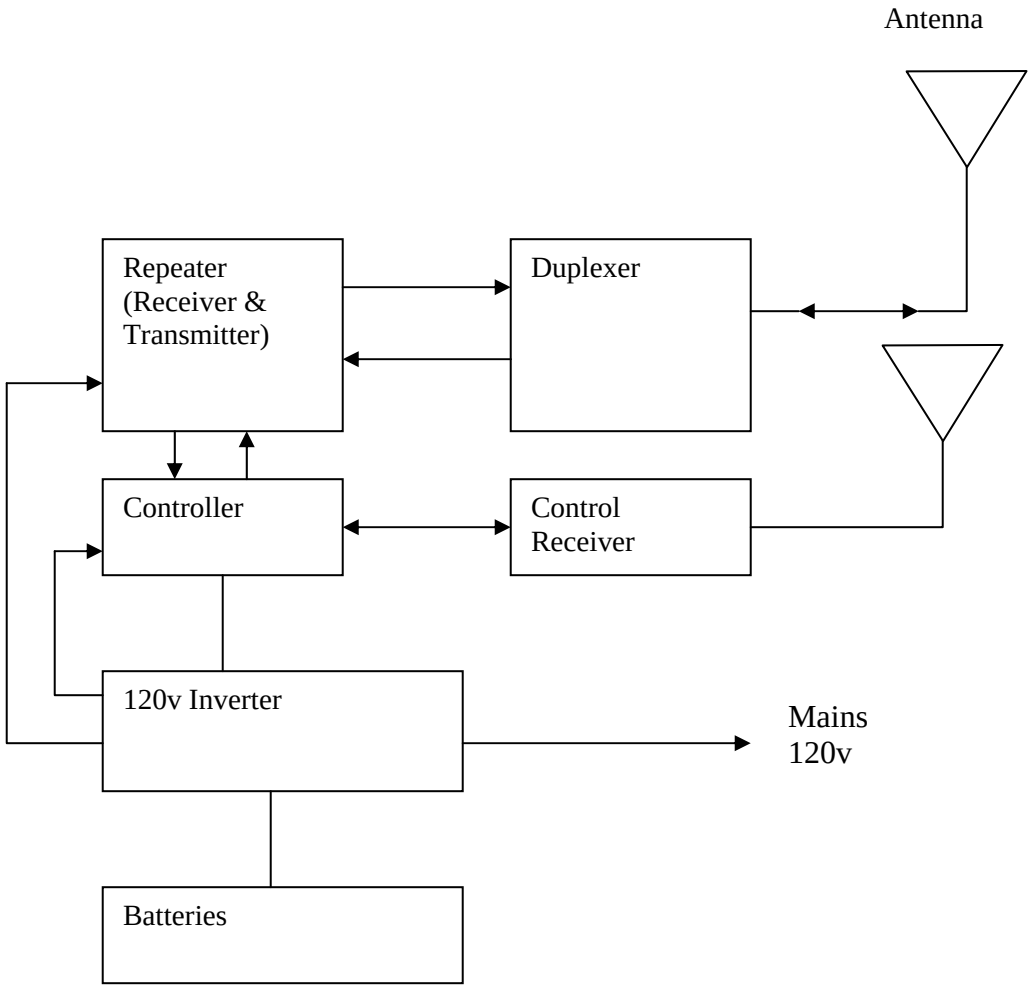
Philadelphia Area Repeater Association
Block Diagram
Worcester, Pa Site



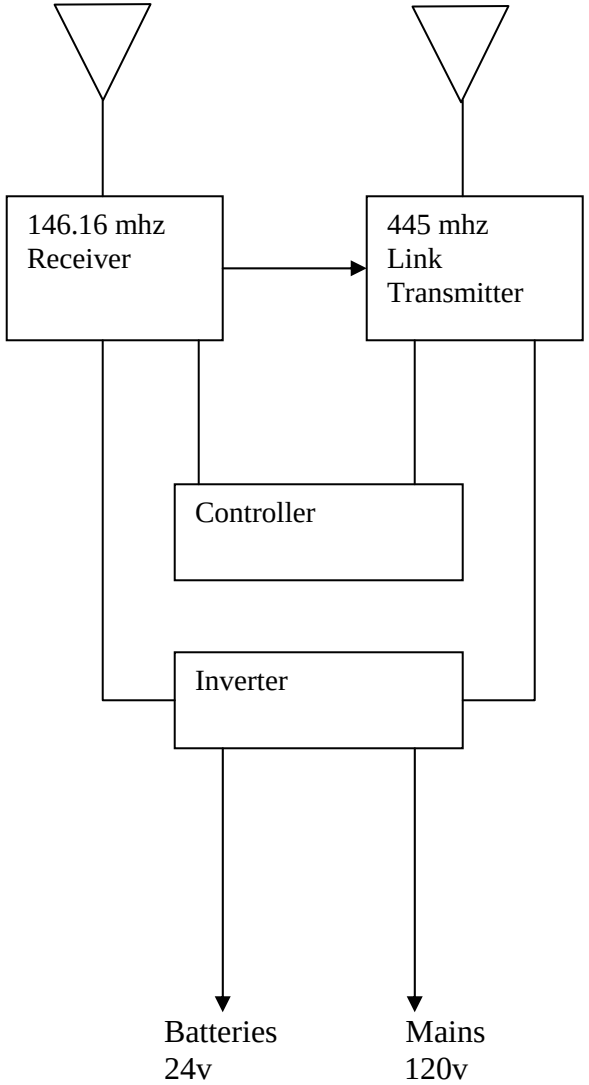
Philadelphia Repeater Association
Block Diagram
Valley Forge Mountain, PA



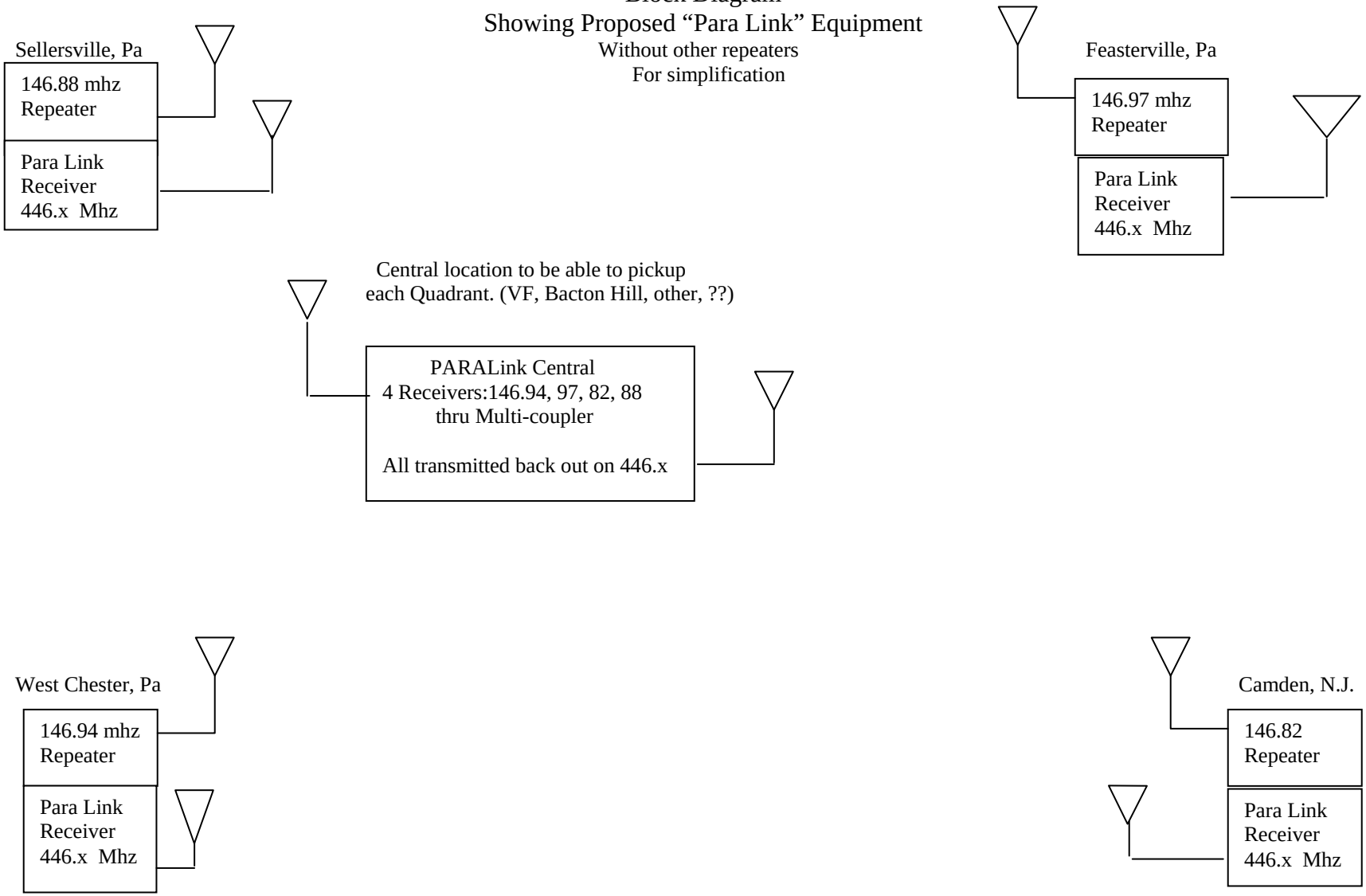
Philadelphia Area Repeater Association
Block Diagram
Typical Quadrant Repeater Site (4)
Camden, Feasterville, Sellersville, West Chester



Philadelphia Area Repeater Association
Block Diagram
Remote Receiver Sites
Camden, Eagleville, Newtown Square, Pottstown, West Chester



# Philadelphia Area Repeater Association
## Block Diagram
## Showing Proposed "Para Link" Equipment
Without other repeaters
For simplification



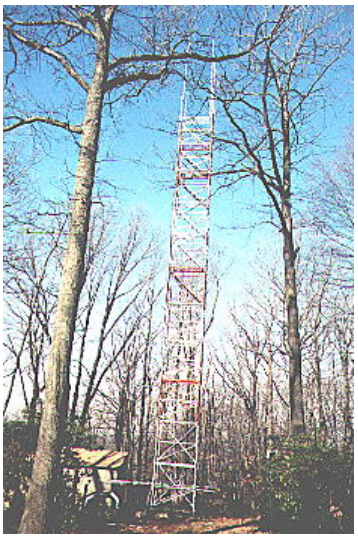

The PARALink Receiver at Quadrant site must mute when the local receiver is active

A conversation on the 94 repeater is picked up by the Central site and retransmitted out on 446.x Mhz to be received on all other Quadrant repeaters. The 94's 446.x receiver is muted. A responding station on the 97 repeater is picked up by the Central site and relayed to all other sites except its own 446.x receiver. PARALink is active only for the purpose of connecting the 4 Quadrants together. A local transmission on a Quadrant repeater has priority. Disabling PARALink is as simple as disabling the 446.x transmitter by codes. Each Quadrant must transmit the 131 PL tone and the PARALink Central must have PL receive on 131 to eliminate picking up other areas.

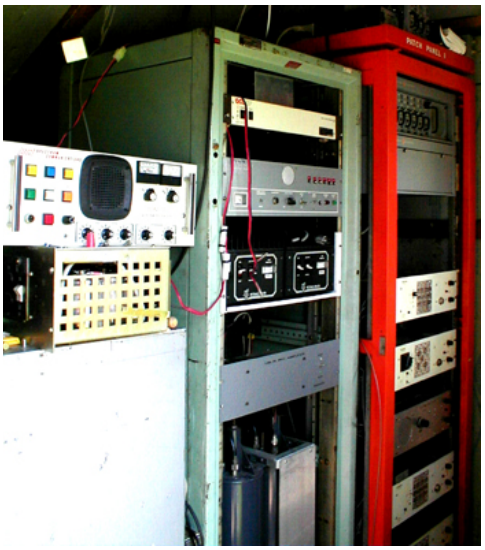
# Philadelphia Area Repeater Association - Main Sites

Valley Forge Site

Worcester Site



Valley Forge Tower



Worcester Equipment

Valley Forge Equipment

# Philadelphia Area Repeater Association

# Equipment List - Needed to Upgrade or Replace Obsolete Equipment

(grantlist1up.doc)

**Site:** **Note: All Repeaters, Receivers, and Transmitters are Motorola based on GR400 repeater**

| | | | |
|---|---|---|---|
| Valley Forge | Repeater 146.16Mhz in/ 146.76 Mhz Out | $1800 | |
| | Link Transmitter 445.xx Mhz out | $800 | |
| | Receiver 445.cx (control) | $800 | |
| | Stationmaster Antenna 146 Mhz | $1000 | |
| | (2) Yagi Antenna | $200 | |
| | Feedline 2 100 Ft runs Hardline @$2 Ft | $400 | |
| | Controller | $1400 | |
| | Trace Inverter #4024 | $3600 | |
| | 12V Batteries (4) | $400 | |
| | | | $10,400 |
| Worchester | Repeater 146.16 Mhz In / 146.76 Mhz Out | $1800 | |
| | Receivers 445.xx Mhz (7: 6 Link & 1 Control additional) | $5600 | |
| | Voter | $2500 | |
| | Duplexer: 146.16/76 | $800 | |
| | StationMaster Antenna | $1000 | |
| | Yagi Antenna (7) | $700 | |
| | Feedline 2 100 Ft runs Hardline @$2 Ft | $400 | |
| | Controller | $1400 | |
| | | | $14,200 |
| SE-Camden | Recently upgraded | | |
| NW-Sellersville | Repeater 146.28 Mhz In/ 146.88 Mhz Out | $1800 | |
| | Stationmaster Antenna | $1000 | |
| | 445 Mhz Control Receiver | $800 | |
| | 445 Mhz Yagi Antenna | $100 | |
| | Duplexer | $800 | |
| | Controller | $700 | |
| | Repeater: 146.16 Mhz In/445 Mhz Out | $1800 | |
| | Stationmaster Antenna 146.16 Mhz | $1000 | |
| | 445 Mhz Yagi Antenna | $100 | |
| | Feedline 2 100 Ft runs Hardline @$2 Ft | $400 | |
| | Trace Inverter #2512 | $2600 | |
| | 12 V Batteries (4) | $400 | |
| | | | $11,500 |
| Broomall | Repeater 146.16 Mhz In /445.xx Mhz Out | $1800 | |
| | | | $1,800 |
| NE-Feasterville | Repeater 146.37 Mhz In/ 146.97 Mhz Out | $1800 | |
| | Stationmaster Antenna | $1000 | |
| | 445 Mhz Control Receiver | $800 | |
| | 445 Mhz Yagi Antenna | $100 | |
| | Duplexer | $800 | |
| | Feedline 2 100 Ft runs @ $2 Ft | $400 | |
| | Controller | $700 | |
| | Trace Inverter #2512 | $2600 | |
| | 12 V Batteries (4) | $400 | |
| | | | $8600 |

| | | | |
|---|---|---|---|
| SW-West Chester | Recently Upgraded | | |
| Pottstown | Repeater 146.16 Mhz IN/ 445.xx Mhz Out | $1900 | |
| | Stationmaster Antenna | $1000 | |
| | 445 Mhz Yagi Antenna | $100 | |
| | | | $3000 |
| Eagleville | Recently Upgraded | | |
| Phila/Camden | Repeater 146.16 Mhz IN / 445.xx Mhz Out | $1900 | |
| | Stationmaster Antenna | $1000 | |
| | Yagi Antenna | $100 | |
| | Feedline (none needed) | | |
| | | | $3000 |
| Professional Installation assistance | | | $5000 |
| | | Grand Total | $57,500 |

PARALink and Data Link Equipment – Listed separately

# Philadelphia Area Repeater Association

# Equipment List #2 - Needed to Implement PARA-Link

(grantlist-pl.doc)

**Site:** **Note: All Repeaters, Receivers, and Transmitters are Motorola based on GR400 repeater**

| | | | | |
|---|---|---|---|---|
| Valley Forge | Receiver 146.94 Mhz | $800 | | |
| | Receiver 146.88 Mhz | $800 | | |
| | Receiver 148.82 Mhz | $800 | | |
| | Receiver 146.97 Mhz | $800 | | |
| | Link Transmitter 428.xx Mhz out | $800 | | |
| | Receiver MultiCoupler | $400 | | |
| | Stationmaster Antenna 146 Mhz | $1000 | | |
| | Stationmaster Antenna 446 Mhz | $1000 | | |
| | Antenna Notch/Pass Filters | $3000 | | |
| | Controller | $1000 | | |
| | | | | $10,400 |
| SE-Camden | Receiver 428.x Mhz | $800 | | |
| | 430 Mhz Yagi Antenna | $100 | | |
| | Antenna Notch/Pass Filters | $1000 | | |
| | Controller | $100 | | |
| | | | | $2000 |
| NW-Sellersville | Receiver 428.x Mhz | $800 | | |
| | 430 Mhz Yagi Antenna | $100 | | |
| | Antenna Notch/Pass Filters | $1000 | | |
| | Controller | $100 | | |
| | | | | $2000 |
| NE-Feasterville | Receiver 428.x Mhz | $800 | | |
| | 430 Mhz Yagi Antenna | $100 | | |
| | Antenna Notch/Pass Filters | $1000 | | |
| | Controller | $100 | | |
| | | | | $2000 |
| SW-West Chester | Receiver 428.x Mhz | $800 | | |
| | 430 Mhz Yagi Antenna | $100 | | |
| | Antenna Notch/Pass Filters | $1000 | | |
| | Controller | $100 | | |
| | | | | $2000 |
| Professional Installation Assistance | | | | $5000 |
| | | | Grand Total | $23,400 |

Note: PARALink is equipment to interconnect 82, 88 ,94, ,97 Quadrant repeaters

# Philadelphia Area Repeater Association

## Equipment List #3 - Needed to Implement Data Radio Network

(grantlist-data.doc)

**Site:** **Note: All Equipment manufactured by ICOM based on "D-Star" System**

| | | | |
|---|---|---|---|
| Site #1 | ICOM IDL-1 Data/Voice Repeater 1.2 Ghz | $5000 | |
| | ICOM Backbone 10 Ghz Link | $7000 | |
| | ICOM 1.2 GHZ Antenna | $250 | |
| | | | $12,250 |
| Site #2 | ICOM IDL-1 Data/Voice Repeater 1.2 Ghz | $5000 | |
| | ICOM Backbone 10 Ghz Link | $7000 | |
| | ICOM 1.2 GHZ Antenna | $250 | |
| | | | $12,250 |
| Site #3 | ICOM ID-1 Data Transceiver | $1500 | |
| | ICOM 1.2 GHZ Antenna | $250 | |
| | | | $1750 |
| Site #4 | ICOM ID-1 Data Transceiver | $1500 | |
| | ICOM 1.2 GHZ Antenna | $250 | |
| | | | $1750 |
| Site #5 | ICOM ID-1 Data Transceiver | $1500 | |
| | ICOM 1.2 GHZ Antenna | $250 | |
| | | | $1750 |
| Professional Installation Assistance | | | $5000 |
| | | Grand Total | $34,750 |

Notes: ID-1 Transceivers needed to setup system data repeaters and then they will become part of the integrated system. Individuals will purchase their own ID-1 transceivers to use into the data repeaters.

Chester County is expected to be purchasing their own D-Star Repeater and our system will be the link between Chester County and Montgomery County initially, with proposed future expansion headed toward Philadelphia.

# Filters, Combiners, Duplexers, Ferrites (See more)

## Duplexers, VHF [440-31] (See more)

| | |
|---|---|
| **Manufacturer** | Decibel Products |
| **Table** | DB4062WOC-B |
| **TESSCO Part No.** | 51921<br>1 |
| **Drawing** |  |
| **Type** | Pass Reject |
| **Freq. Range (MHz)** | 143-156 |
| **Application** | A duplexer is a device that will allow both a transmitter and a receiver to operate from a singleantenna (freeing up tower space, and reducing cable runs etc.) |
| **Product Narrative** | Pass/reject duplexer. Handles extremely close frequency separations. |
| **Min. Separation (MHz)** | 300 kHz or more |
| **Maximum Input (Watts)** | 200 |
| **Insertion Loss (Tx/Ant-dB)** | 2.2 @.3 MHz |
| **Insertion Loss (Rx/Ant-dB)** | 2.2 @.3 MHz |
| **Isolation Rx (Notch-dB)** | 100 |
| **Isolation Tx Side** | 100 |
| **Connectors** | N Female |
| **No. of Cavities/Size** | 6 (8") |
| **temp. Range deg-C** | -30 to +60 |
| **Maximum VSWR @ 50 Ohms** | 1.5 to 1 |
| **Tuning Method** | TESSCO/Field Tune |
| **Size (HxWxD")** | 34.5 x 29 x 19.25 |
| **Finish** | Tek Black |
| **Comment** | *Specify Frequency |
| **Warranty** | 1 Year |
| **Qty/Uom** | 1 EACH |

| | |
|---|---|
| **List ($)** | 3,485.00 |

# Motorola GR1225

*Solves Coverage Issues Quickly and Easily*

## Features

The GR1225 has the following features:

- 12.5/25 kHz Switchable Channel Spacing - with X-Pand Technology
- Compact Styling - The GR1225 accommodates a built-in power supply as well as numerous internally housed accessories such as a duplexer, battery revert and an enhanced controller.
- Adjustable Power - Each channel can be programmed to either 25 or 45 (UHF) or 25 or 50 (VHF) watts to meet various coverage needs.
- 2-Character Numeric LED Display - Green light illuminates the channel that's in use.
- Battery Back-Up Tone - When the battery revert kit is installed, it alerts users that they are operating on the back-up battery supply.
- Time-Out Timer - Programmable from 1-255 seconds, this feature prevents a group from monopolizing the repeater with a single transmission.
- Repeater Enable/Disable - Temporarily enables or disables repeater operation from the front panel to allow use as a base station for dispatch operation.
- CWID (Continuous Wave Identification) - Continuous Wave Identification uses Morse code to automatically send out the station ID to identify the transmitting repeater.
- Courtesy Beep - This programmable alert indicates when a person is through talking so that other users are free to respond.
- Programmable Relay Delay - This “hangtime” keeps the repeater transmitter keyed from 0 to 7 seconds after the radio user releases the Push-to talk switch to enable other users to respond without having to re-activate the repeater.
- AdvantagePort Expandability - Allow an authorized dealer to add an Advantage Board to upgrade the repeater functionality.

## UHF Yagi, Corner Reflector [340-40] (See more)

| Manufacturer | Cushcraft/Signals | Cushcraft/Signals | Cushcraft/Signals | Cushcraft/Signals | Cushcraft/Signals | Cushcraft/Signals |
|---|---|---|---|---|---|---|
| **Table** | PLC456 Series | PLC456 Series | PE4576 | PC457N | PLC4510 Series | PLC4510 Series |
| **TESSCO Part No.** | 68149 1 In Stock | 54935 1 In Stock | 95826 1 In Stock | 58682 1 In Stock | 16542 1 In Stock | 93328 1 |
| **Drawing** |  |  |  |  |  |  |
| **Product Narrative** | 6 element, 7.5 dB gain broadband yagi. Excellent forward gain and front to back ratio with clean patterns for greatest side rejection. | 6 element, 7.5 dB gain broadband yagi. Excellent forward gain and front to back ratio with clean patterns for greatest side rejection. | 6 element, 8.2 dB gain yagi. Through the boom insulated mounting and has UV stabilized insulators and stainless steel retainers to reduce corrosion. | 7 element, 10 dB gain yagi. Boom and elements welded together for strength and weatherability. No tuning required. | 10 element, 11.5 dB gain broadband yagi. For applications where maximum gain is required. | 10 element, 11.5 dB gain broadband yagi. For applications where maximum gain is required. |
| **Specific Freq. (MHz)** | 406-420 | 450-470 | 450-470 | 450-470 | 450-470 | 470-490 |
| **Gain (dB)** | 7.5 | 7.5 | 8.2 | 10 | 11.5 | 11.5 |
| **Maximum Input Power (Watts)** | 250 | 250 | 250 | 350 | 250 | 250 |
| **Bandwidth >1.5 VSWR** | 20 | 20 | 20 | 20 | 20 | 20 |
| **H. Beamwidth (-3dB)** | 74 Deg. | 74 Deg. | 59 Deg. | 52 Deg. | 42 Deg. | 42 Deg. |
| **Vert. Beamwidth (-3dB)** | 53 Deg. | 53 Deg. | 50 Deg. | 44 Deg. | 37 Deg. | 37 Deg. |
| **Front to Back Ratio (dB)** | 25 dB | 25 dB | 8.2 dB | 20 dB | 25 dB | 25 dB |
| **Lightning Prot.** | DC Ground | DC Ground | DC Ground | DC Ground | DC Ground | DC Ground |
| **Direct Termination** | UHF Female | UHF Female | UHF Female | None | UHF Female | UHF Female |
| **Overall Length** | 2.6' | 2.6' | 3' | 3.17' | 5.5' | 5.5' |
| **Element Housing Length** | N/A | N/A | N/A | N/A | N/A | N/A |
| **Mount Hdw. Incl.** | U-bolts | U-bolts | U-bolts | U-bolts | U-bolts | U-bolts |
| **Weight** | 3.67 Lbs. | 3.67 Lbs. | 2.4 Lbs. | 1.5 Lbs. | 5.25 Lbs. | 5.25 Lbs. |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Warranty** | 1 Year | 1 Year | 1 Year | 1 Year | 1 Year | 1 Year |
| **Qty/Uom** | 1 EACH | 1 EACH | 1 EACH | 1 EACH | 1 EACH | 1 EACH |
| **List ($)** | 136.35 | 136.35 | 57.35 | 112.00 | 206.85 | 206.85 |

# Flexible.
# Cost Efficient.
# Durable.

LINK COMMUNICATIONS, INC.

*Repeater Control Products*

# Link Communications, Inc.

***Link Communications, Inc.*** was formed in 1989 with the purpose of developing a complete line of repeater and linking products for amateur and commercial radio. Since that time, Link has expanded its initial product offering to a complete line of products, with more support items being added each year. All facets of the engineering, manufacturing, and assembly are handled in our local facility. Thank you for your interest. We hope you continue to grow with us as we work to develop more flexible, durable and cost effective products for the radio industry.

LINK COMMUNICATIONS, INC.

*Repeater Control Products*

Flexible.
Cost Efficient.
Durable.

# Highlights

***The RLC-1*** is our smallest controller but it still packs a lot of features. Its two ports are most commonly used to run a repeater and a link; although they can also control separate repeaters or back-to-back links. The controller's ID's and command responses are in CW. This model does not support an autopatch.

***The RLC-3*** is the largest and most capable controller available anywhere. It comes standard with four radio ports and is expandable to eight. It is ideal for the hub of a linking system or for sites with three or more repeaters, links and remote bases. It ID's with synthesized voice. CW, or an optional DVR. An autopatch is optional and requires the use of one of the installed radio ports.

***The RLC-4*** has four radio ports (three available if the optional autopatch is installed) and is ideal for controlling multiple repeaters and links. With its I/O capability and remote base control features, it provides more bang for the buck than you will find anywhere else. It sends ID's and command responses in CW; a 75 second voice recorder is available as an option.

***The RLC-Club,*** with its built-in autopatch, is the ideal controller for a single repeater: The eight-second digital voice recorder lets you record custom messages to supplement those provided by the synthesized voice. The Deluxe option adds another radio port for a second repeater; a link or a remote base. It has all the bells and whistles of the RLC-3, but with less radio ports.

# Controller Comparison Table

| Features | RLC-1 | RLC-4 | RLC-CLUB | RLC-3 |
|---|---|---|---|---|
| No. of Ports | 2 | 4 | 1 stnd., 2w/deluxe | 4-8 expandable |
| Autopatch Uses Port | N/A | Yes | No | Yes |
| Synthesized Speech/No. Words | No | No | Yes / 680+ | Yes / 680+ |
| No. of Simultaneous Tones | 1 | 1 | 2 | 2 |
| DTMF Regeneration | No | Port 4/Autopatch Only | Yes | Yes |
| DVR | No | Optional | Standard | Optional |
| Separate DTMF Decodes per Port | No | Yes | Yes | Yes |
| No. of Control Outputs | 5 | 4 | 8 w/deluxe | up to 16 w/2 I/O Boards |
| No. of Contact Closure Inputs | 4 | 3 | 4* | up to 16 w/2 I/O Boards |
| No. of Analog Inputs | 4 | 4 | 5* | up to 16 w/2 I/O Boards |
| Analog Resolution | 256 steps | 256 steps | 1024 steps | 1024 steps |
| Serial Port Baud Rates | 2400 | 300-9600 | 300-19200 | 300-19200 |
| No. of Macros | 7 | 100 | 800 | 800 |
| No. of Programmable Messages | 8 | Uses Macros | Uses Macros | Uses Macros |
| Scheduler | No | No | Yes | Yes |
| Microprocessor (all Motorola MC Series) | 68HC711E9 | 68HC11E1 | 68HC16Z1 | 68HC16Z1 (one) 68HC11E1 (1 per port) |
| Current Draw | 25mA@12V | 110mA@12V | 155mA@12V | 600mA@12V (fully loaded) |
| Approximate Size | 4.5" x 7.5" | 7" x 7.7" | 5.75" x 7.8" | 13" x 7.1" |
| 19" Rack Mountable Cabinet | Optional | Optional | Optional | Standard |
| Height of Rack Cabinet | 1.75" | 1.75" | 1.75" | 3.5" |

* There are five inputs total on the RLC-CLUB. One is hard-wired to the power supply voltage. Each of the other four can be used to detect a contact closure or analog voltage.


For More Information:

**1-800-610-4085**

**http://www.link-comm.com**

LINK COMMUNICATIONS, INC.

Repeater Control Products

# RLC-1

## *RLC-1 Repeater Controller*

## *"Plus" Update*

This update converts the RLC-1 into the RLC-1 Plus controller. A few of the major new features included with this new update are: Voice Synthesizer, Time-of-Day Scheduler, HF Remote Base, 70 macros, etc.

The update only requires the old uProcessor to be removed, then simply plug the "Plus" into the old socket.

A completely new manual is available at Link Communications, Inc. Internet web site.

***The RLC-1*** is our smallest and most basic controller. Its two ports are most commonly used to run a repeater and a link. The controller ID's and command responses are CW based. This model does not support an autopatch. The RLC-1 can be upgraded to the RLC-1 Plus, or can be purchased with the update already installed.

### Flexible

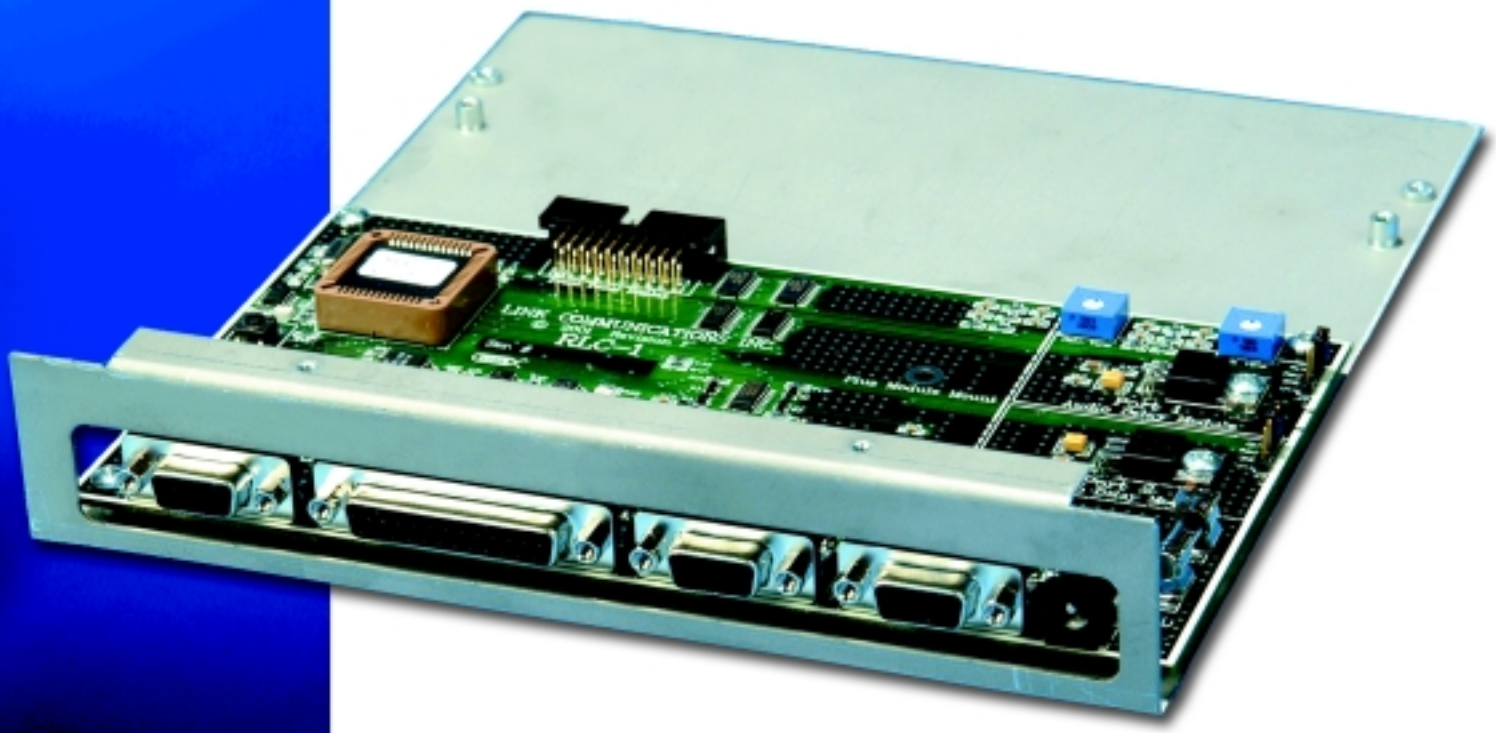
- Dual-Port design ensures repeater & link system flexibility
- Controller CW informs you of the conditions at your site
- DTMF commands can be entered from either port
- Multiple ports allow your controller to handle your growing system

### Cost Efficient

- Low power consumption reduces battery and overall system costs
- Controls up to two repeaters or links with only one RLC-1 controller, reducing system costs
- Modular connector design lowers set-up time & decreases system down time

### Durable

- High quality construction guarantees years of trouble-free operation
- Made in the U.S.A.



# RLC-1 Technical Specifications

## Ports

• 2 - Full duplex ports that can operate independently or can be connected. Ports can operate as links or repeaters.

## Port Functions

• There is a Hang Timer, Time-out Timer, Courtesy Timer, Courtesy Beep, and ID Timer for each port; All variables are user programmable. All ports can control with DTMF. Each port has a COR input, a CTCSS (PL) detect input, PTT output, an audio input (10K ohm), and an audio output (600 ohm). Each port contains a jumperable -6dB/Octave de-emphasis filter for discriminator input.

## Input & Output

• 5 - Output Control lines capable of 150mA current sink.
• 4 - Contact Closure inputs capable of 0-15V input voltages.

## Analog Inputs

• 4 - Analog inputs with the ability to read voltages from 0-5V and 0-25V.
• Analog input voltage conversion faceplates convert the input voltage to a number. Conversion faceplates supported: 0.00 - 5.00, 00.0-25.0, Fahrenheit and Celsius temperature (using the LM-335 sensor)
• Analog inputs can be remotely calibrated.

## Remote Bases

• ***Doug Hall RBI-1***

The RLC-1 supports the Doug Hall RBI-1 Kenwood remote base control system. This allows the user to remotely change frequency, offset, power and PL of a Kenwood mobile radio.

• ***RLC-ICM***

The RLC-1 supports the Link Communications, Inc. RLC-ICM Icom 900/901 band modules remote base control system. This allows the user to remotely change frequency, offset, power and PL of the Icom 900/901 band modules. The controller supports 4 separate band modules.

## Serial Port

• RS-232 serial port with baud rate of 2400 Baud.
• 10 digit user password to access controller

## Program Features

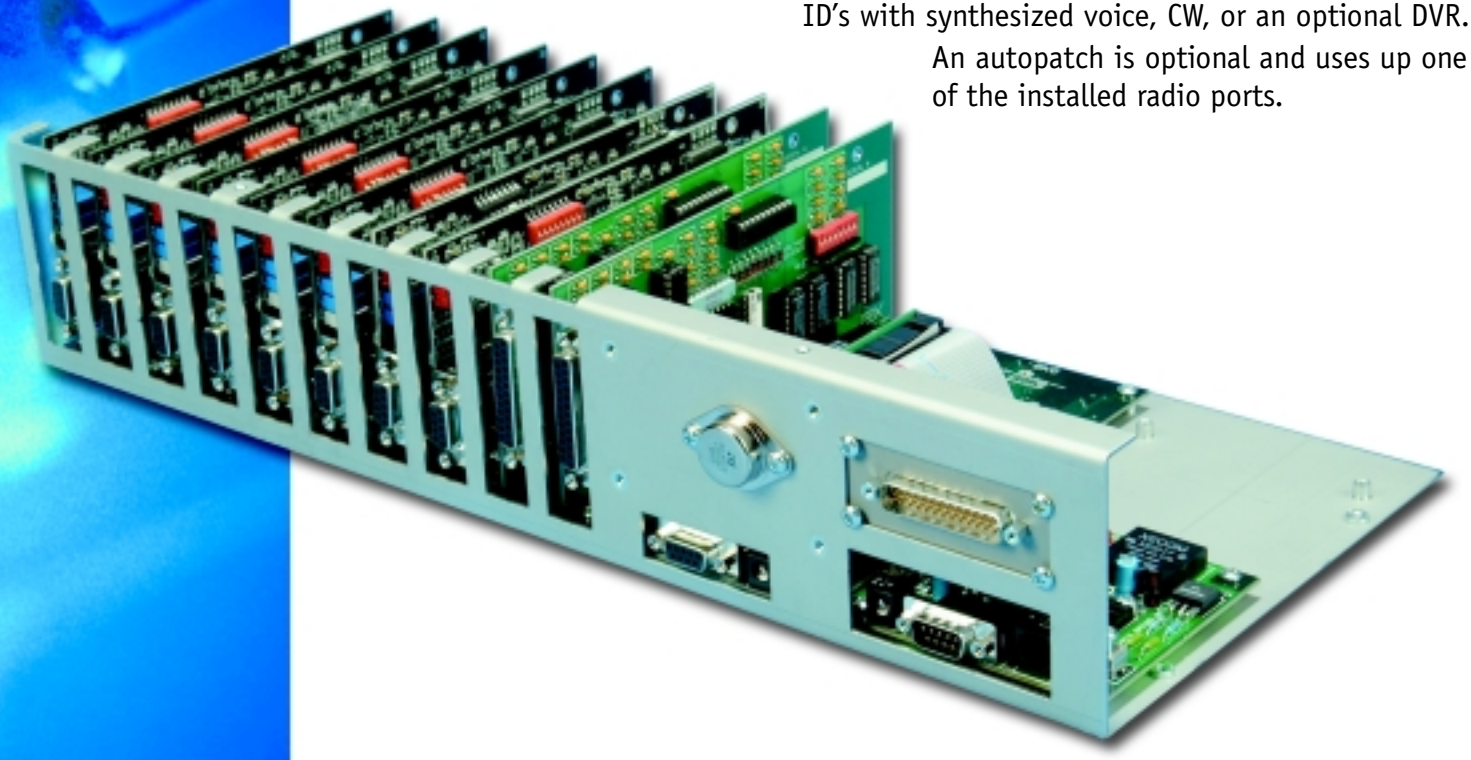
• CW based message response.
• CW speed and frequency are user programmable.
• User DTMF keypad test.
• 7 multi-command macros that can allow short entry to long sequences.
• All events can be programmed using DTMF or Serial.
• 8 Message slots that can be programmed for a CW message.
• Each port has its own DTMF mute function which can be enabled/disabled.

## DC Characteristics

• Operating voltage of 11V-15V with a current draw of 25mA@ 12V
• Microprocessor: Motorola MC68HC711E9 with EEPROM variable storage
• DTMF decoder: Teletone M-8870 with valid DTMF LED display
• Connectors: DB-9 female for radio ports and serial port. User I/O uses a DB-25 female.
• 4.50" x 7.50" board outline.

# RLC-3

***The RLC-3*** is the largest and most capable controller available anywhere. It comes standard with four radio ports and is expandable to eight. It is ideal for the hub of a linking system or for sites with three or more repeaters, links and remote bases. It ID's with synthesized voice, CW, or an optional DVR. An autopatch is optional and uses up one of the installed radio ports.



## Flexible

- Expandable design ensures repeater & link system flexibility
- Your controller informs you of the conditions at your site
  All ports can operate independently of other ports
- Upgradeable features allow your controller to grow with your system

## Cost Efficient

- Allows you to control up to eight repeaters or links with only one RLC-3 controller, reducing system costs
- Separate connectors lower set-up time & decrease system down time

## Durable

- Independent radio port card design ensures reliable operation
- High quality construction guarantees years of trouble-free operation
- Made in the U.S.A.

# RLC-3 Technical Specifications

## Ports

- 8 - Full duplex ports that can be connected in any combination. Ports can operate as links or repeaters.
- 2 - Input/Output options slots for analog/digital I/O cards.
- 19" rack mount enclosure included.

## Port Functions

- Each port has its own DTMF decoder, DTMF generator, TTL/RS-232 serial port and microprocessor. Functions on each port include Hang Timer, Time-out Timer, Courtesy Timer, Courtesy Beep, and ID Timer; All variables are user programmable. All ports can control with DTMF. Each command contains a DTMF execution mask to limit each port's access to certain commands. Each port has a COR input, a CTCSS (PL) input, a PTT output, an audio input (10K ohm), and an audio output (600 ohm). Each port contains a switchable -6dB/Octave de-emphasis filter for discriminator input.

## Input & Output

- I/O features require an optional I/O board. Up to two I/O boards can be installed
- 8 - Output Control lines per I/O card capable of 500mA current sink.
- 8 - Contact Closure input lines per I/O card capable of 0-15V input voltages.

## Analog Inputs

- I/O features require an optional I/O board. Up to two I/O boards can be installed
- 8 - Analog input lines per I/O card with the ability to read voltages from 0-5V and 0-25V.
- Analog inputs can be calibrated to any input voltage between the above given limits. Each analog line can be offset calibrated to account for any changes in the input signal. Each analog input can be alarmed to allow the system to execute commands in a high and low alarm condition.
- Temperature faceplates supported using the National Semiconductor LM335 sensor: Fahrenheit and Celsius (1 degree resolution)
- Analog inputs monitor high and low variations and can contain high and low alarm points.

## Remote Bases

***Doug Hall RBI-1***

- The RLC-3 supports the Doug Hall RBI-1 Kenwood remote base control system. This allows the user to remotely change frequency, offset, power and PL of a Kenwood mobile radio.

***RLC-ICM***

- The RLC-3 supports the Link Communications, Inc. RLC-ICM Icom 900/901 band modules remote base control system. This allows the user to remotely change frequency, offset, power and PL of the Icom 900/901 band modules. The controller supports 4 separate band modules.

***Icom / Kenwood / Yaseu***

- The RLC-3 supports remote frequency control for ICOM/Kenwood/Yaseu HF radios with computer controlled serial inputs.

## Autopatch Option

- The RLC-3 supports an onsite autopatch. This feature allows both forward and reverse telephone operation, extensive long distance dialing checking, DTMF tone regeneration and complete remote programming from the phone. There are 1,000 18-digit autodial slots. The autopatch interfaces to 1 of the 8 radio port cards. This allows either onsite or offsite RF linked phone access.

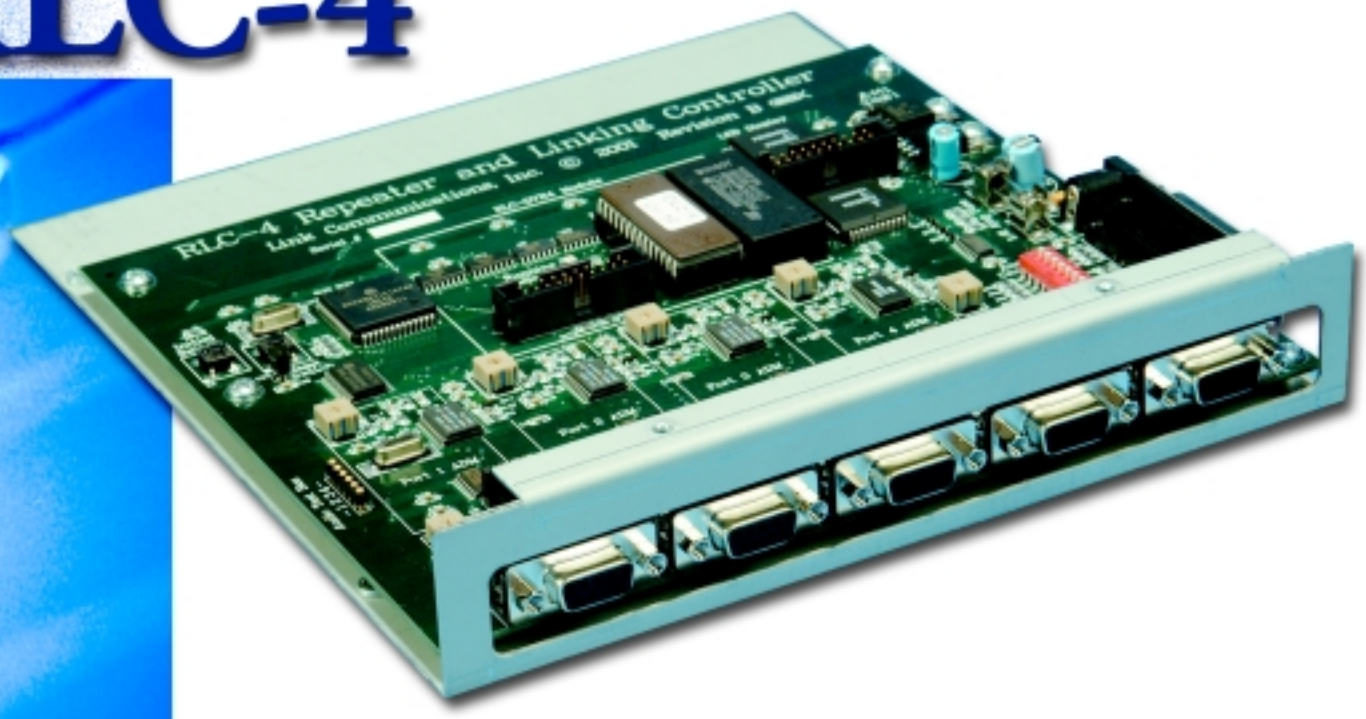
## Serial Port

- RS-232 serial port with user selectable baud rates of 300 - 19200 Baud.
- User programmed password to access controller with the option to enable/disable log-on requirement.

## Program Features

- Voice synthesizer with 680+ word vocabulary.
- 100 timed event scheduler slots with real time clock and voice readback of time/date in male or female.
- 800 multi-comand macros that allow short entry of long sequences.
- Macros can be chained together to allow complex program execution with macros.
- User programming language allows logical function execution and operations
- DTMF regeneration on every port.
- All events can be programmed using DTMF, Serial or the Autopatch interface.
- 2 drop-out messages per port that are sent before the transmitter PTT is turned off.
- Voice, CW, Command, or Digital Voice Recorder messages.

# RLC-4




***The RLC-4*** has four radio ports (three available if the optional autopatch is installed). It is a very economical way to control multiple repeaters and links. It ID's in CW; a 75 second digital voice recorder, the RLC-DVR4, is also available.

## Flexible

- Multi-Port design ensures repeater & link system flexibility
- Your Controller responds in CW or Recorded Voice (optional)

## Cost Efficient

- Low power consumption reduces battery and overall system costs
- Allows you to control up to four repeaters or links with only one RLC-4 controller, reducing system costs
- Separate connectors lower set-up time & decrease system down time

## Durable

- High quality construction guarantees years of trouble-free operation
- Made in the U.S.A.

# RLC-4 Technical Specifications

## Ports

- 4 - Full duplex ports that can be connected in any combination to all other ports. Ports can operate as links or repeaters connected or stand alone.

## Port Functions

- Each port has its own Hang Timer, Time-out Timer, Courtesy Timer, Courtesy Beep, and ID Timer. All the timers are user programmable. All ports can control the RLC-4 with DTMF. There is a separate DTMF decoder on every port. Each port has a COR input, a CTCSS (PL) input, a PTT output, an audio input (10K ohm), and an audio output (600 ohm). Each port contains a jumperable -6dB/Octave de-emphasis filter for discriminator input.

## Input & Output

- 4 - Output Control lines capable of 500mA current sink.
- 3 - Contact Closure inputs capable of 0-15V input voltages.

## Analog Inputs

- 4 - Analog inputs with the ability to read voltages from 0-5V and 0-25V.
- Analog inputs can be calibrated to any input voltage between the above given limits. An offset can be added to the reading from each analog line to compensate for variations in sensors. Each analog input can be alarmed to allow the system to execute commands in a high and low alarm condition.

## Remote Bases

- ***Doug Hall RBI-1***

  The RLC-4 supports the Doug Hall RBI-1 Kenwood remote base control system. This allows the user to remotely change frequency, offset, power and PL of a Kenwood mobile radio.

- ***RLC-ICM***

  The RLC-4 supports the Link Communications, Inc. RLC-ICM Icom 900/901 band modules remote base control system. This allows the user to remotely change frequency, offset, power and PL of the Icom 900/901 band modules. The controller supports four separate band modules.

## Autopatch Option

- The RLC-4 supports an autopatch option. This feature allows both forward and reverse phone operation, long distance dialing checking, DTMF tone regeneration and remote programming from the phone. Autodial slots are available using up to 50 macros. The autopatch interfaces to 1 of the 4 radio ports.

## Serial Port

- RS-232 serial port with user selectable baud rates of 300 - 9600 Baud.

## Program Features

- CW response with user adjustable frequency and speed on each port.
- Digital Voice Recorder with 75 seconds of voice storage (Optional)
- 100 macro slots that can contain multiple commands to allow short entry of long sequences. 50 macros are 50 characters in length. 50 of the macros are 20 characters in length and can be used for autodial numbers.
- Event triggered commands including user timers.
- DTMF regeneration on the 4th port
- Separate DB-9 connectors for radio ports and RS-232, DB-25 for I/O.

## DC Characteristics

- Operating voltage of 11V-15V, with a current draw of 110mA@ 12V.

## Options

- 19" rack mount enclosure with LED display.

# RLC-Club

***The Club*** is the ideal controller for a single repeater with autopatch. The "Deluxe" option adds another radio port for a second repeater, a link or a remote base. It has all of the bells and whistles of the RLC-3, but with less radio ports.

## Flexible

- Single port design with built-in autopatch and voice
- Deluxe option adds a second radio port
- Ports can operate independently or be connected
- Upgradeable features allow for system growth

## Cost Efficient

- Pay only for the features that you need
- Easy upgrade adds additional port without new controller
- Separate connectors lower set-up time & decrease system down time

## Durable

- FCC Part 68 telephone interface and Part 15 class A noise type accepted
- Multi-layer design for low noise and years of trouble-free operation
- Made in the U.S.A.

# RLC-Club Technical Specifications

## Ports

- 1 - Full duplex port used for repeater, link or remote base radio.
- 1 - Additional full duplex port for a second repeater, link or remote base radio. (Requires the RLC-Club Deluxe Interface.)

## Autopatch

- Built-in autopatch with DTMF regeneration, forward and reverse programming functions.
- 500 number autodial memory, 500 callsign slots, long distance dialing table.
- FCC Part 68 approved with 3-way voltage surge protection and line current detection.

## Input & Output

- 4 - Analog inputs for reading of voltage, temperature and any analog functions.
- Analog inputs can be calibrated, alarmed and voice message formatted with high/low monitoring.
- Analog inputs can be used for contact closure detection for site alarm monitoring.
- 8 - Output lines available with the RLC-Club Deluxe Interface.

## Remote Bases

***Doug Hall RBI-1***

- The 'CLUB' supports the Doug Hall RBI-1 Kenwood remote base control system. This allows the user to remotely change frequency, offset, power and PL of a Kenwood mobile radio.

***RLC-ICM***

- The 'CLUB' supports the Link Communications, Inc. RLC-ICM Icom 900/901 band modules remote base control system. This allows the user to remotely change frequency, offset, power and PL of the Icom 900/901 band modules. The controller supports 4 separate band modules.

***Icom / Kenwood / Yaesu***

- The 'CLUB' supports remote frequency control for ICOM/Kenwood/Yaseu HF radios with computer controlled serial inputs.

## Serial Port

- RS-232 serial port with user selectable baud rates of 300 - 19200 baud.

## Windows™ Software

- Complete Windows™ Programming software included for graphical computer programming of the 'CLUB' features. This program allows set-up of the system timers, users, messages, macros, autopatch numbers, tones, inputs and outputs, commands, scheduler and much more.
- Serial terminal support allows users to upload from disk current controller configurations.

## Program Features

- Voice synthesizer based on the TI TSP53C30 processor with 680+ words.
- Single or dual tone generation for courtesy beeps, CW and any tone response.
- 100 timed event scheduler slots with real time clock and voice readback of time/date.
- 800 multi-command macros allow you to make customized commands.
- Built-in front panel LED display panel shows COR, PL, DTMF and PTT for all ports.
- Built-in basic Digital Voice Recorder for recording ID's, announcements and messages.
- Support for the RLC-DVR1 complete voice mail based Digital Voice Recorder System.

## DC Characteristics

- Operating voltage of 11V-15V, with a current draw of 155mA@ 12V.
- Microprocessor: Motorola MC68HC16Z1 with 256K SRAM variable storage.
- FCC Part 68 telephone interconnect, FCC Part 15 class A noise acceptance.
- DTMF decoder: Teletone M-8870. Tone DAC generators: Analog Devices AD558JN.
- Separate DB-9 connectors for the radio ports, serial and I/O signals.

# Controller Options


## RLC-ICM

Your Icom IC 900/901 band modules are supported using the RLC-ICM Icom interface adapter. This interface allows up to four of the Icom modules to be controlled from the RLC-1, 2, 3, 4, 5 and Club controllers. Frequency, offset, splits, PL encode/decode frequency and access modes can all be controlled remotely. Individual PL functions are supported on each module using the Communications Specialists TS-64 tone module. Each module can be in receive or transmit at the same time allowing multiple transmit/receive operations to occur.

### RLC-ICM Features

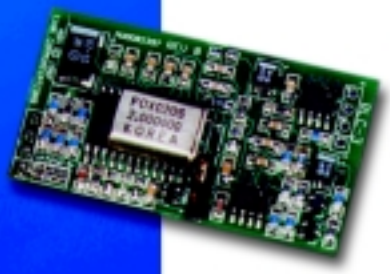
- 4 individual band modules supported
- Separate PL decode and encode features supported on each band module
- 100 Khz, 500 Khz, 600 Khz, 1 Mhz, 1.5 Khz, 1.7 Mhz, 12 Mhz and 20 Mhz splits supported on each band module.
- Adds a frequency agile remote to any Link Communications Inc. Controller

## The RLC-MOT

The RLC-MOT adds a fast "dual action" squelch to any FM receiver. Simply provide discriminator audio and power and the RLC-MOT will supply a COR output and squelched audio.

### RLC-MOT Features

- Uses the M7716 squelch chip, the same chip used in the Motorola Mocor.
- "Dual action" provides very short squelch tails with strong input signals without chopping on weaker signals.
- Ideal for link systems with multiple "hops" and as a replacement squelch for radios with poor squelch circuits.
- Small size makes it easy to mount inside most radios.
- Multi-turn pot allows for precise adustment.
- LED indicated when squelch is open.



## The RLC-ADM

The RLC-ADM is a digital audio delay module that can delay the audio from a receiver up to 197mS. It simply plugs into a header connector on most of our repeater controllers. It provides the following benefits for one receiver (multiple ADM's can be used if desired, one per receiver):

### RLC-ADM Benefits

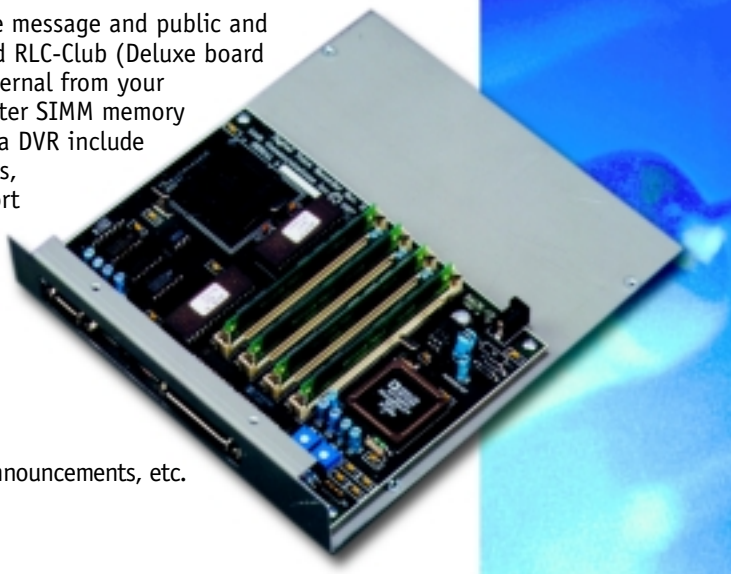
- Eliminates the squelch tails normally heard when a user of a repeater unkeys (the one before the courtesy beep)
- Enables the repeater controller to completely mute DTMF digits. Without an audio delay module, the first 40 to 50mS of the first DTMF digit entered will be transmitted before the repeater controller detects it and mutes the audio.

## The RLC-3/4 Autopatch

The RLC-3/4 autopatch enables the RLC-3 and the RLC-4 controllers to interface with the telephone line for autopatch calls. The module is designed to be mounted into the rack enclosure but can be easily radio remoted to a remote location. The module plugs into one of the radio ports, utilizing an included interface cable. The RLC-3 and RLC-4 controllers see the module like a normal radio port. This allows all the normal controller functions to be applied when operating the module. Included on the module is a 3-way lighting protection circuit with isolated grounding connection. The module is a full-duplex device.

# DVR-1

The RLC-DVR1 adds to your repeater the ability of real speech voice message and public and private voice mail. This option is designed for the RLC-2, RLC-3 and RLC-Club (Deluxe board required) controllers. The interface is a separate module that is external from your controller cabinet. Messages are stored using normal 30 pin computer SIMM memory modules, additional memory allows more message storage. Uses of a DVR include club announcements, individual private voice mail for club members, customized ID's and the list goes on. With the use of an RS-232 port your voice messages can be uploaded and downloaded to your computer's disk drive for permanent storage. The RLC-DVR1 does not contain any moving parts to fail when temperature variations and vibration occur.

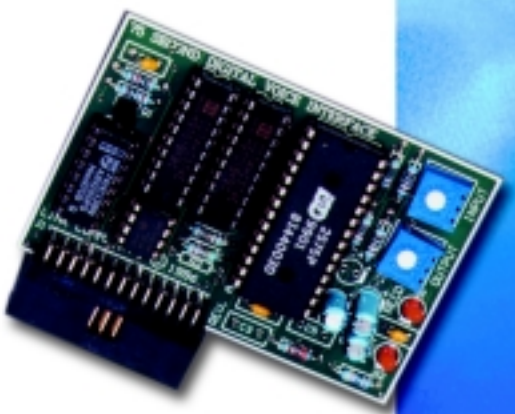


## DVR1 Features

- 131 seconds/megabyte highest quality
- 2 megabyte - 16 megabyte memory supported
- 250 separate message slots with variable length messages for ID's, Announcements, etc.
- 1,000 private mail box slots with variable length messages
- RS-232 serial port upload/download of voice message files

# DVR-2

The RLC-DVR2 is a lower cost, smaller version of the RLC-DVR1. This option is designed for the RLC-2 and RLC-3 controllers. The DVR-4 is similar but designed for the RLC-4 controller. This digital voice recorder mounts inside your controller's cabinet and offers 75 seconds of recording time. The messages are divided into 35 slots with 25 one-second slots and 10 five-second slots. The messages can fit in one slot or slots can be combined to allow for longer messages.

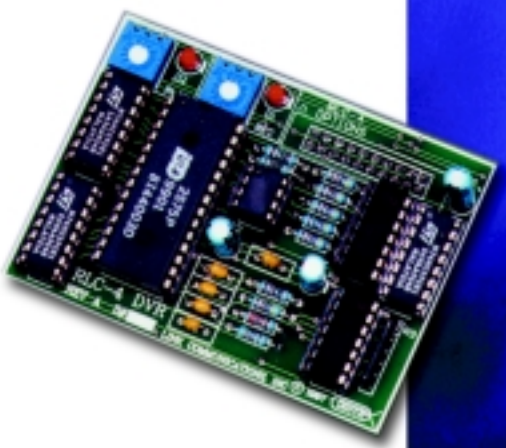


## DVR2 Features

- 75 seconds of non-volatile voice message storage
- 35 total message slots
- Allows voice message announcements, and ID's in real speech.
- Lower cost, smaller space, lower power consumption
- Easy way to add real speech to your RLC-2 and RLC-3 controllers.

# DVR-4

The RLC-DVR4 has the same features as the DVR-2, but is designed for use with the RLC-4 controller. It mounts inside the RLC-4's cabinet and offers 75 seconds of recording time. The messages are divided into 35 slots with 25 one-second slots and 10 five-second slots. The messages can fit in one slot or slots can be combined to allow for longer messages.

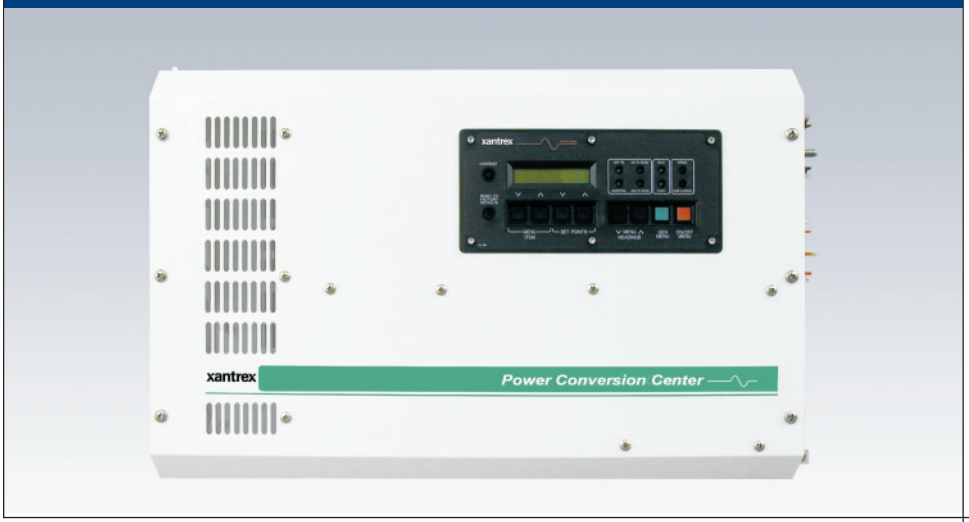


## DVR4 Features

- 75 seconds of non-volatile voice message storage
- 35 total message slots
- Allows voice message announcements, ID's and number readback in real speech
- Lower cost, smaller space, lower power consumption
- Easy way to add real speech to your RLC-4 controller.

# SW2512MC & SW4024MC2

## Heavy Duty True Sine Wave Inverter/Charger




Certified to UL and CSA Standards

### Applications

- Widely used in RV, marine, truck, and other mobile applications, the SW2512MC and SW4024MC2 instantly supplies true sine wave, utility grade, AC output power.
- Ideal for heavier loads, the SW2512MC and SW4024MC2 offers high capacity battery charging, high surge current ability (inrush current), and easy installation.

### Product Features

- 120 VAC output at 2500 watts (12 V model) or 4000 watts (24 V model)
- Three-stage battery charging (bulk, absorption, and float) with remote temperature sensor for increased charge accuracy
- Dual AC source inputs - shorepower and generator
- Programmable control module with LCD and LED indicators
- Low idle current (less than 16 watts) conserves energy when no loads are present
- Soft start capability for starting heavy loads
- Two year warranty

### Options

- Series stacking capability for 120/240 VAC operation (optional equipment is required)
- Parallel stacking capability for greater output at the same voltage (optional equipment is required)
- Remote panel and status indicator (SWRCII)
- User-programmable generator start mode can be set to automatically start the generator, allows the inverter to run in parallel with the generator, and assists with intermittent heavy loads
- Integral auxiliary relays can automatically start and stop auxiliary loads, such as fans, based on programmable voltage parameters

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Part Number 970-5037-01-01 Rev A Printed in Canada

**www.xantrex.com**

# SW2512MC & SW4024MC2

xantrex

## Heavy Duty True Sine Wave Inverter/Charger

### Electrical Specifications

| Model | SW2512MC | SW4024MC2 | |
|---|---|---|---|
| AC input voltage | 120 VAC | 120 VAC | |
| AC input voltage range | 80 – 149 VAC | 80 – 149 VAC | |
| AC input current | 60 amps AC pass thru | 60 amps AC pass thru | Required for full pass through and full charging |
| | 30 amps AC charging | 30 amps AC charging | |
| Continuous power (@ 25 °C) | 2500 VA | 4000 VA | |
| Efficiency (Peak) | 90% | 94% | |
| AC output voltage (RMS) | 120 VAC | 120 VAC | |
| AC output voltage regulation | +/- 5% | +/- 5% | |
| Frequency | 60 Hz | 60 Hz | Nominal ± 0.04% Crystal Controlled |
| Waveform | Sine wave, 34 – 52 steps per cycle | Sine wave, 34 – 52 steps per cycle | |
| Total harmonic distortion | < 5 % | < 5% | |
| Continuous output (@ 25 °C) | 21 amps AC | 33 amps AC | |
| Surge capability | | | |
| 5 sec rating (resistive) | 4000 watts | 8000 watts | |
| 1 mSec | 65 amps AC | 110 amps AC | |
| 100 mSec | 46 amps AC | 78 amps AC | |
| Automatic transfer relay | 60 amps | 60 amps | |
| DC input voltage (Nominal) | 12 VDC | 24 VDC | |
| DC input voltage range | 11.8 – 16.5 VDC | 22 – 33 VDC | |
| DC current at rated power | 275 amps | 200 amps DC | |
| Idle consumption | < 16 watts | < 16 watts | Typical at Full Voltage |
| Search mode consumption | < 1 watt | < 1 watt | |
| Max. charge rate (adjustable) | 150 amps DC at 12 V nom. | 120 amps DC at 24 V nom. | |

### General Specifications

| Model | SW2512MC | SW4024MC2 | |
|---|---|---|---|
| Specified temperature range | 32 °F – 77 °F (0 °C – 40 °C) | 32 °F – 77 °F (0 °C – 40 °C) | Power derated above 25 °C |
| Enclosure type | Indoor, ventilated, steel chassis with powdercoat finish | | |
| Unit weight | 90 lb (41 kg) | 105 lb (48 kg) | |
| Shipping | 96 lb (45 kg) | 111 lb (50 kg) | |
| Inverter dimensions (H x W x D) | 15 x 22.5 x 9″ | 15 x 22.5 x 9″ | |
| | (38 x 57 x 23 cm) | (38 x 57 x 23 cm) | |
| Shipping dimensions (H x W x D) | 15 x 27 x 21″ | 15 x 27 x 21″ | |
| | (38 x 69 x 53 cm) | (38 x 69 x 53 cm) | |
| Mounting | Bulkhead mount | Bulkhead mount | |
| Warranty | Two years | | |
| Part numbers | SW2512MC | | |
| | SW4024MC2 | | |
| | SWRC (SW remote control panel with LCD and 25′ cable for SW4024MC2 and SW2512MC) | | |
| | SWRC/50FT (same as above but with 50′ cable) | | |

### Regulatory Approvals

cETL approved to UL 1741, UL 458, and CSA 107.1

Note: Specifications subject to change without notice.

DIGITAL 1.2GHz TRANSCEIVER D-STAR **ID–1**

## SPECIFICATIONS

### GENERAL

| | |
|---|---|
| Frequency Coverage | 1240-1300MHz |
| Type of emission | FM,GMSK (Digital) |
| Transmission speed (theoretical value) | |
| Data | 128kbps |
| Digital voice | 4.8kbps |
| Codec | AMBE |
| Number of memory channels | 105 (inc. 2 scan edges and 3 calls) |
| Frequency resolution | 5, 6.25, 10, 12.5, 20, 25, 50, 100kHz |
| Operating temperature range | -10°C to +60°C; +14°F to +140°F |
| Frequency stability | +/- 2.5ppm (-10°C to +60°C) |
| Current drain (at 13.8 V DC:approx) | |
| Transmit | at 10 W Less than 7 A |
| Receive | max. audio Less than 1.5 A |
| Antenna connector | Type-N (50 W) |
| Dimensions (proj. not included) | |
| Main Unit | 141(W) x 40(H) x 165.8(D) mm<br>$5^{1}/_{2}$(W) x 1 $^{9}/_{16}$(H) x 6 $^{17}/_{32}$(D) in |
| Remote controller (RC-24) | 150(W) x 50(H) x 49.5(D) mm<br>5 $^{29}/_{32}$(W) x 1 $^{31}/_{32}$(H) x 1 $^{15}/_{16}$(D) in |
| Weight (approx) | |
| Main unit | 1.2kg; 2 lb 10 oz |
| Remote controller | 220g; 7.7 oz |

### RECEIVER

| | |
|---|---|
| Receiver system | |
| FM, Digital voice | 1st: 243.95MHz<br>2nd: 31.05MHz<br>3rd: 450kHz |
| Data | 1st: 243.95MHz<br>2nd: 10.7MHz |
| Sensitivity (FM: at 12dB SINAD/Digital: at BER 1x10-2) | |
| FM | Less than 0.18uV |
| Digital voice | Less than 0.35uV |
| Data | Less then 1.58uV |
| Squelch sensitivity (threshold) | Less than 0.18uV (FM only) |
| Selectivity (typical) | |
| FM | More than 12kHz/6dB<br>Less than 30kHz/60dB |
| Digital voice | More than 6kHz/6dB<br>Less than 18kHz/50dB |
| Data | More than 140kHz/6dB<br>Less than 520kHz/40dB |
| Spurious and image rejection | More than 50 dB |
| AF output power (at 13.8 V DC) | More than 2.0W at 10% distortion with an 8 Ω load |
| Ext. speaker connections | 2-conductor 3.5 (d) mm (1/8˝) 8Ω |

### TRANSMITTER

| | |
|---|---|
| Modulation system | |
| FM | Variable reactance frequency modulation |
| Digital | Quadrature modulation |
| Output power | 10/1 W |
| Max. frequency deviation | +-5.0kHz |
| Spurious emissions | Less than –50dB |
| Microphone connector | 8-pin modular (600 Ω) |

### Supplied accessories

- Hand microphone • External speakers (SP-22)
- Remote Controller Unit (RS-24)

*(RS-24 includes: mounting bracket and mic extension cables)*

All stated specifications are subject to charge without notice or obligation.

## OPTIONS

**RC-24** REMOTE CONTROLLER UNIT (same as supplied)
**MB-17A** MOBILE MOUNTING BRACKET

**ID-RP2C** REPEATER CONTROLLER
**ID-RP2V** 1.2GHz LOCAL VOICE REPEATER
**ID-RP2D** 1.2GHz LOCAL DATA REPEATER

**AH-107** 1-METER 10GHz DISH

**OTHER OPTIONS NOT PICTURED:**

**HAND MICROPHONES**
**HM-118N** HAND MICROPHONE (same as supplied)
**HM-118T** DTMF MICROPHONE (not needed for D-STAR)

**CONNECTION CABLES**
**OPC-647** 2.5m (8.2 ft.) (same as supplied)
**OPC-440** 5.0m (16.4 ft.)

**EXTERNAL SPEAKERS**
**SP-7**
**SP-10**
**SP-22**

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ICOM

DIGITAL 1.2GHz AMATEUR RADIO TRANSCEIVER

# ID–1 D-STAR


- *Digital voice (D-STAR standard)*
- *High-speed data*
- *Analog FM*
- *“Traditional”, Full-Featured 1.2GHz Amateur Operation*

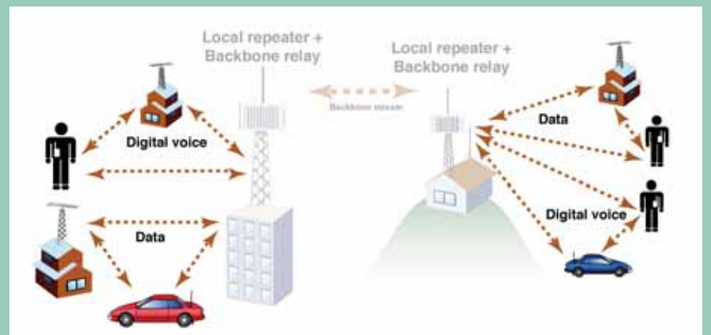
# Cutting edge digital voice and high-speed data with analog FM compatibility!

## D-STAR: The Future Is Now

The ID-1 is a blend of new and traditional operations, all in one box. New is its D-STAR communications standard compliance – looking to become the likely possible "future" data language of amateur radio. Icom is the first major manufacturer to offer a D-STAR compliant rig. The ID-1 also offers the best of traditional amateur operations, usable on the current repeaters. This is an advanced amateur transceiver, whether for D-STAR or traditional operations.

## High Speed Internet

Use the ID-1 and your laptop to gain wireless 128 Kbps speed access to the Internet from remote locations – all via the free amateur radio bands. Now you may surf the Web from your vacation cabin. In your car. On your boat. D-STAR repeaters and base stations offer reliable, long range 1.2GHz voice and data communications.




## What is D-STAR?

The D-STAR system is an off-the shelf, 128K open protocol DATA system that combines the analog and digital worlds into a seamless communications network at 1.2 and 10GHz. Picture being in your vehicle, helping with emergency communications with the 128K DATA – you can visually communicate what is happening simply by emailing a photo or live video. The power of the D-STAR system is limited only by your imagination!

## Increase ARES® Efficiency

Out in the field, fast emergency information is key. Send pictures and weather charts at high speeds to or from a remote location with the ID-1. "A picture is worth a thousand words", and the fast send/receive opens up your repeater for other emergency communications.

## Features of the D-STAR System

- Open Ethernet compatible TCP/IP structure
- Digital voice and data
- Data 128kbps (130k bandwidth)
- Multi-site capability with high-speed microwave backbone 10Mbps
- ATM multiplex (on the backbone)
- Internet linking capability

## Roam Anywhere, Easily

One of the limitations of traditional repeater linking over the Internet is having to know where a remote repeater is, or a node number to link to it. With D-STAR your long distance communications can be seamless. You can simply enter a call sign into a D-STAR radio, and the system will automatically route your call to the remote station. When users travel between repeaters, they can register with the local system, and communications can follow them.

## Auto Call Sign Identification

With every transmit in digital voice mode, the ID-1 automatically incorporates a programmed call sign along in the data stream. When talking on the air, and the reception is picked up on another ID-1, the sender's call sign is automatically displayed on the unit's backlit LCD or software interface. You'll immediately know who's calling!

## Simultaneous Digital Voice and Data

While you are transmitting in digital voice mode, the ID-1 is capable of sending a slow speed data stream. Now you can use a single channel for voice and data! APRS® like operation or other new software operations can now be utilized simultaneously while a conversation is underway.

## Digital Clarity

Eliminate nearly all background signal interference with Digital Signal Processing (DSP). DSP offers pindrop clear reception. Any signal received in a digital mode must match codec in order to be heard. Intermod is virtually eliminated from your communications!

## Super Narrow Bandwidth

Create higher density repeater groups using the ID-1 to access a D-STAR repeater network. More repeaters means greater coverage. More coverage means more reliable communications. Emergency communications is more efficient, and mobile amateur operations "dead spots" are reduced or eliminated.

## Complete Software Control

Before the ID-1, there was no way to FULLY control your transceiver from a PC. Now, the functionality of your radio is limited only by the software used to control it, for every single ID-1 feature is ultimately PC controllable. Potential software applications could be full voice control via speech recognition, or frequency hopping. Customize your communications to best serve your wants or needs!



## Advanced, "Traditional" ID-1 Features

- REMOTE CONTROL HEAD with long connection cable. Plug the mic into the head or the radio body.
- CTCSS ENCODE/DECODE
- FULL 10 WATT OUTPUT on 1.2GHz
- LARGE HEAT SINK. One piece, die cast aluminum chassis
- CTCSS and tone encode/decode
- 3 SCAN MODES, including 1 priority watch
- ALPHANUMERIC CHANNEL NAMES, front panel or PC programmable

## And More

- ICOM SOFTWARE INTERFACE CONTROL comes with the ID-1
- USB CONNECTION POINT on back of radio. USB extensions cable included.
- ETHERNET CONNECTION POINT on back of radio. Ethernet extensions cable included.
- EMERGENCY MODE. Activation of emergency button causes all squelch to drop, allowing station calls to come in. (Digital Modes)
- AUTO REPLY to D-STAR station calls, even if away from transceiver
- DIGITAL CODE. Squelch for use in the digital mode
- DIGITAL MONITOR. With the push of a button, hear analog signals while operating in digital modes
- AUTO RXCALL REG incoming call signs are stored automatically while in digital modes. Lets you know who called while you were away.
- OPTIONAL DTMF MIC available (not needed with D-STAR)

ID-1 D-STAR