



**An Overview of ALE**  
**by**  
**AAR2EY**  
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After receiving a number of questions regarding ALE (Automatic Link Establishment) directly and I hearing a fair amount of incorrect information on the air regarding ALE and our MARS use of the mode, I decided to put together this perspective on the subject for the ALE novice. I myself am not an expert on the subject of ALE, however, I am learning more and more daily and at this point figured I can provide a good overview of ALE. I have tried to put just enough information in this message to make this a good reference on ALE without too much detail and at the same time compare ALE to other modes those that many may have been working with can compare to ALE.

If you have a sound card in your PC, there is no reason not to be participating in MARS digital message procedures (<http://army.vamars.org/digital.htm>) using the various digital modes (<http://www.armymars.net/ArmyMARS/DigitalOps/index.html>) permitted. A number of sound card modes (PKS31, MFSK16, MT63, SSTV) and now ALE are being used. There is even an effort within MARS to develop a robust MARS specific sound card digital mode for added performance undertaken by Navy-Marine Corp MARS (<http://navymars.org/national/sound%20cards/SoundCardStatus.pdf>).

As MARS ALE use is now developing, it is even more important to interface your radio equipments for sound card based digital modes as it offers MARS operations numerous benefits. However, at this point and time, you still require a hardware TNC to be fully MARS digital capable to provide support for AMTOR (you can only receive AMTOR FEC with a sound card) and Pactor I (Pactor II and III are mostly used at the Gateway level) modes. For the basics of making use of your PC sound card for digital communications refer to: <http://www.navymars.org/central/reg4/al/soundcard.html>

To get started with your sound card all that is required for any mode is to route your receive audio to your sound card "Line In" or "Mic In" jacks. The use of "Mic In" should be made when your audio levels are too low for use with "Line In". So what are you waiting for, hook up that cable and starting in stalling your choice of software (MixW has become very popular in MARS see: <http://www.mixw.net/downloads.htm> )

Within Army MARS the first large scale public use of ALE was during Grecian Firebolt 2003 (<http://www.asc.army.mil/mars/news/ale.htm>) and with respect to Region 2 and ALE, Carlos, AAV2AS is leading the effort, listen to the ALE net on Monday evening (see the current Region 2 Net Plan) at 2001 local or e-mail Carlos at [wb2foz@juno.com](mailto:wb2foz@juno.com) to be added to his ALE e-mail list.

As we MARS members are all Radio Amateurs a warning is in order, within the world of Amateur Radio, ALE can NOT be used for its digital communications mode by U.S. Amateurs, only the ALE selective calling aspect can be utilized due to FCC Part 97 requirements. Thus no use of ALE can be made in the digital sub bands and not data (even AMD messages, more on AMD later) can be sent in the voice sub bands.

Regarding MARS use, in Army MARS Region 2, the use of "Automatic Link Establishment" a.k.a. "ALE" has been authorized for use ONLY by stations that have been pre-approved in accordance with Chapter 8, Section 8-8 of the US Army MARS NETPLAN August 2003. Authorization is required from their respective Chief, through the SMD to operate on Army MARS ALE Networks.

### **ALE Background:**

ALE was NOT developed as a sound card based digital mode as were PSK31, MFSK16, MT63 etc., nor is it anything like those modes or traditional TNC based modes Radio Amateurs are familiar with when taking into account is bandwidth and networking aspects. In actuality, ALE is NOT a digital mode in the true sense in comparison to other digital modes.

The implementation of ALE can however be undertaken by a PC Sound Card solution using one of the few packages that exist, in Army MARS we are using a program called PC-ALE, however it is not as easy to setup for use with the PC and sound card as digital modes you may already be familiar with.

ALE, due to the overhead involved for ARQ, bandwidth and radio control for frequency mode and automatic antenna tuner support, requires either a dedicated ALE modem or controller or a fast, RFI proof, dedicated computer is a real requirement. ALE supports both FEC (Broadcast) and ARQ (Handshaking) modes of data transmission, thus handshaking is made use of in ARQ for solid data copy, which depending on the conditions and amount of data being sent can slow down the data rate as in Amtor and Pactor ARQ modes.



ALE has traditionally been a firmware/hardware based hardware solution such as the stand alone Harris RF-7210A Autolink II ALE Controller (see Appendix for the RF-7210A Operators Cards) pictured below is the Frederick Electronics' (<http://www.nsgdata.com/NSGDatacom/html/fsk.html>) Model 1285 FSK Modem with



ALE option pictured above. A complete HF ALE communications system is represented by the Harris URC-119(V), Pacer Bounce system pictured below as seen tuned to 3996Khz in the 75m band, its range is from 1.6000MHz to 29.9999MHz and is tunable in 10Hz increments. It operates in USB, LSB, AME, CW, and AFSK. AFSK is optional and requires AFSK card installation. Tuning the URC-119(V) is a fairly simple two step process: punch in the frequency on the keypad and key the radio. The rest of the tuning process is done automatically, including tuning of the LPA and Antenna Coupler, the entire unit is under the control of the RF-7210 during ALE operation.



ALE is also available as imbedded options inside modern commercial/military grade HF radio equipment such as the Motorola Micom 2ES (<http://www.mobat.com/>) desktop transceiver pictured below.



The only Amateur equipment manufacturer to offer an ALE solution is ICOM, with their commercial grade IC-F7000 ([http://www.icom.co.jp/world/products/land\\_mobile/F7000/](http://www.icom.co.jp/world/products/land_mobile/F7000/)) offering pictured below, less expensive than other such units, it is still a costly proposition that most MARS operators cannot afford to implement.



The IC-F7000 users manual makes for interesting reading as to what such an ALE hardware based radio is able to provide and how one must operate the equipment for ALE support in comparison to using a PC software based solution, refer to:

[http://www.icom.nu/i/i.nsf/F811A48F14D7AC24C1256E00004CCBFA/\\$FILE/IC-F7000.pdf](http://www.icom.nu/i/i.nsf/F811A48F14D7AC24C1256E00004CCBFA/$FILE/IC-F7000.pdf)

Frederick also sells a stand alone ALE board for embedded solutions that could (<http://www.nsgdata.com/NSGDatacom/html/eale.html>) possibly be the basis of experimentation by MARS members as a hardware solution, depending on its pricing as seen below.



## **ALE Development and Influence on Digital Communications:**

ALE development over the last 15 years or so is based on a U.S. government communications standard (MIL STD 188-141A) to support another standard, FED-STD-1045A, HF Radio Automatic Link Establishment (ALE), which was developed to make HF radio operation simpler by automatically selecting the best frequency available for establishing a radio link.

Certain aspects of MIL STD 188-141A have been incorporated into digital modes developed for data transfer and taking up less bandwidth, in such proprietary modes as G-TOR by Kantronics, refer to:

1. <http://www.arrl.org/FandES/field/regulations/techchar/G-TOR.html>
2. <http://home.teleport.com/~nb6z/g-tor.htm>

It heavily influenced the development of CLOVER and CLOVER 2000 at HAL, refer to:

1. <http://www.arrl.org/FandES/field/regulations/techchar/Clover.html>
2. <http://www.arrl.org/FandES/field/regulations/techchar/Clover-2000.html>
3. <http://www.halcomm.com/docs/e2006.pdf>
4. <http://www.halcomm.com/docs/e2007.pdf>

as well as the evolution of Pactor with Pactor III as SCS, refer to:

1. <http://ecjones.org/pactor.html>
2. <http://www.arrl.org/FandES/field/regulations/techchar/PACTOR-III.html>
3. <http://www.scs-ptc.com/pactor.html>

Regarding Pactor III, it is about equal to the ALE bandwidth, though not speed (note, Pactor III is also not legal in the U.S. as although it meets speed rule of Part 97, it is not a published protocol).

All of these examples are digital modes, they provide for the capability of digital communications only, they are not an addressable, linked network of stations, which can be automatically driven in a multi-channel network scheme taking into account changes in propagation as can ALE.

Not all ALE controllers are compatible, further developments have now produced 2 generations of link controllers mainly referred to AUTOLINK I and AUTOLINK II. The second generation controller is both downwards and upwards compatible with the first generation controllers as long as the compatibility features are enabled in the system software. The basic difference between the first and second generation units is in the type of addressing utilized. Call signs in the generation 1 controllers are limited to numerical digits (i.e. 112358) and call signs in the generation 2 controllers can employ up to 15 alphanumeric identifiers (i.e. UUT or UNIT1 etc.).

## **ALE Networking:**

Each station in an ALE network has its own address, stations record a link quality analysis (LQA) value each time they receive an ALE signal from another station. These LQA values allow the stations to in a full ALE implementation to make an informed analysis of propagation conditions and use optimal frequencies during future transmissions within the network. In order to transmit information the ALE station uses a set of 8 tones.

Each of these tones encompasses three bits of information, which may represent a portion of 1 ASCII character or may represent an entire predefined ALE symbol. This technique, known as 8-ary frequency shift keying, allows ALE systems to communicate at lower signal-to-noise ratios (SNR) than is normally possible with voice communications. The ALE protocol also specifies the combined use of forward error correction, interleaving, and redundancy in order to make ALE networks more resistant to interference.

In a full ALE system the cooperating radios periodically send sounding signals over a range of operating frequencies. Each receiver scores each sound (or any other received ALE signal) and keeps track of the best frequencies at any given time. When a link to another radio is desired, the ALE system automatically selects the best frequency and establishes a connection through an automatic protocol. If a chosen frequency proves to be unusable, the ALE system will automatically and iteratively connect on the next best frequency. Once the connection has been made, any normal type of traffic (voice or data) can be passed. ALE radios allow faster connection times, more reliable connections, simpler operation and therefore a reduced requirement for skilled operators. ALE systems are currently being used successfully by many government and military organizations.

However, for now, we in Region 2 Army MARS are making use of the system on a single channel basis, thus full computer controlled radios and broad and antennae systems are not required. To implement a full ALE sounding system your radio **MUST** be able to operate into your antenna system on each frequency to be used. This means that your radios automatic antenna (if needed) must be able to achieve a match and stop tuning fast. Again, at this time, this is not an issue.

ALE is primarily used by Military & Government stations worldwide, all U.S. Armed Forces and US Coast Guard use ALE, as does FEMA SHARES stations, although it is not just limited to those users. It can be setup for automated networks in a Selected Call (SELCAL) environment and will track as the net moves in frequency automatically predicated on band conditions. When one station in the ALE net needs to contact another station, the initiating station selects a frequency based on the best signal reports for the other station. The time required to set up a successful communications link is greatly reduced

When two or more stations are Linked in an ALE net, the ALE controller (or PC in the case of PC-ALE) indicates linked status and allows for instant message sending and net steering (full ALE sounding mode), however, stations are still able to communicate via voice or for that matter in another digital mode at the same time, in the future to include other sound card based digital modes using just one dedicated PC as the v1.04B beta software of PC-ALE already has added support for selection of a second sound card, one sound card for whatever and the 2nd card for ALE, however that use will require a really fast dedicated PC with a 1 to 2Ghz CPU.

As an example, if I were the NCS of a net (like AAA2NJ/O) and all members of that net were ALE linked, during the net, at any time, in between a voice transmission or any digital mode contact, as all the stations in the net are linked, I could send a single AMD message up to 80 characters to all hands to broadcast what I needed to convey as the NCS. I could also send a message to and single station in the net. All this could be done instantly, without the need to call one or more stations, without having to agree on the selection of a digital mode, without having to do anything after the original linking process has been completed. Thus during a multimode net using ALE, we can continue to do what we have been doing in the past and integrate ALE as an additional layer. In addition, as the NCS, should I determine that conditions (interference, propagation etc.) warranted, I could steer the net automatically to a new regional frequency (all stations would need to have full ALE capability in their station equipments) and continue the net without need to re-establish the net, it would be seamless.

### **ALE and Army MARS equals PC-ALE:**

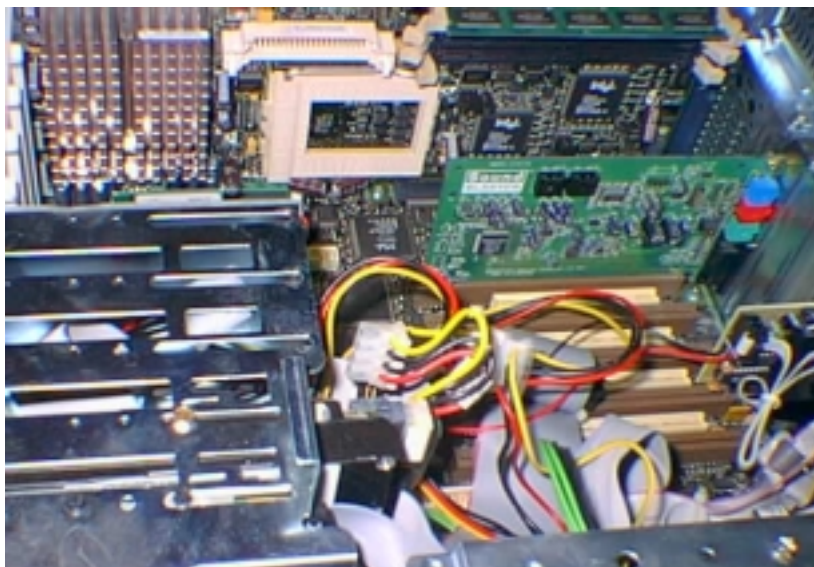
ALE was NOT developed as a sound card mode, it was developed as a firmware based, hardware modem solution, however, in an effort to make the advantages of ALE technology more widespread the Institute of Telecommunication Sciences (ITS) with the sponsorship of the National Communications System (NCS) developed a PC software application called ALE Lite. ALE Lite was developed as despite the advantages of ALE, it was not being widely implemented by non-government users because of its relatively high equipment cost by the mid 1990's. ALE Lite is an ALE controller program which runs on a standard personal computer (PC) in the MS-Windows environment. The PC connects to a standard (non-ALE) HF radio (at present only ICOM radios are supported) through a serial port or radio control and an audio cable for sending and receiving ALE tones. The ALE Lite program was written using Visual Studio C++ 6.0 with the Microsoft Foundation Class (MFC) library and placed on the NCS FTP site. The ALE Lite program is not a full featured application that supports a full implementation of ALE.

An enterprising Radio Amateur in the UK, Charles Brain, G4GUO who is also responsible for the G4GUO digital voice standard being used in the Amateur bands, has come up with a 32 bit MS-Windows application called PC-ALE that does implement a full PC sound card ALE solution. This software is free and can be downloaded to monitor ALE with, it is what we are using in MARS (your station must be authorized to transmit) and can be had at <http://www.chbrain.dircon.co.uk/pcale.html>. The PC-ALE software is

currently used under license by MARS, SHARES, Danish Military (for forwarding weather data and emails when Pactor fails over the link), the US Military & US Civilian Cargo Transports according its author.

Actually, the PC-ALE software has some advantage over hardware based ALE in that it offers keyboard vs. keypad data entry which permits fast on the fly message entry rather than tedious keypad or limited canned messages when dealing with a transceiver/ALE embedded solution, see the Harris RF-7210A operator cards in Appendix A for an idea the steps required are for its use in support of ALE. PC-ALE can even provide support for ALE data encryption (CRYPTO) capability, however this is disabled in the free software and such use within MARS is not authorized anyhow.

For the slower ALE Orderwire (375 bps modem) mode, a minimum PC for PC-ALE of a dedicated Pentium 133MHz and sound card is required. With the new FS-1052 (600bps modem) standard requiring at least a 1GHz dedicated computer. Although PC-ALE is written for Windows 95, it works on Windows 98, Windows SE and Windows XP according to its author. I have found PC-ALE works best using Windows 98, which I am running on my choice of used, inexpensive IBM PC-325 rack mount servers, configured with 330Mhz Pentium PRO II CPUs, 512MB RAM and true Creative Labs Sound Blaster cards.



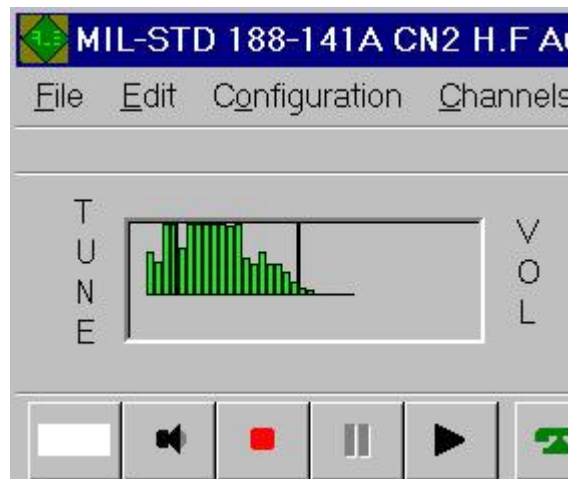
There are a number of parameters within the PC-ALE software that need to be properly configured, some of those parameters are going to be specific to your individual radio/PC/soundcard situation. You must also have your receiver bandwidth at 2.4Khz or if possible 2.6Khz wide.

Back to receive, a good starting point with the PC-ALE software version 1.03Km which is what is currently being used in MARS you must see the vertical green bars in the "Tuning" window located in the upper right of the screen when your radio has audio output into your sound card to be able to begin two way communications with ALE. On

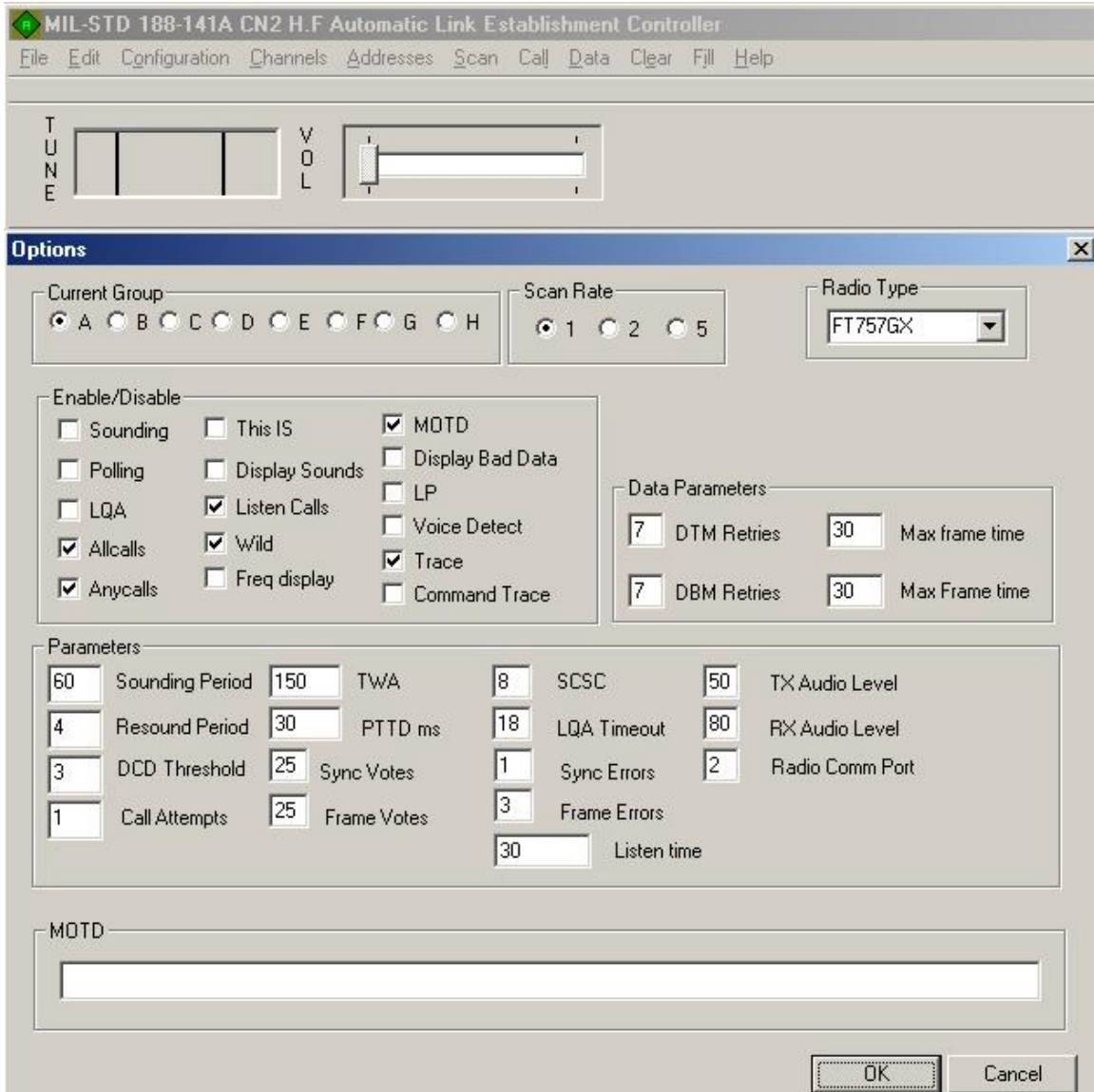
speech voice peaks, low frequency audio pips should make the bars spring to close to the top of the tuning window.



During reception of an ALE transmission the entire window between the 750hz and 2500hz vertical markers should have the green bars banging away at the top. Note that the VOL slide control, which should change the values of RX seen on the options screen, does not work. Its intent was to provide a handy means of changing RX while observing the TUNING window, it has been removed in the 1.04B software.



To achieve this you may need to readjust your sound card settings from how you have them setup for other modes such as PKS31, MFSK16 etc. using other software and reset them for that software. You may need to use Mic In rather than Line In to get more audio gain for the drive level coming from your receiver (a switch to go from one to the other just for PC-ALE is doable !). The PC-ALE software RX setting can go to 99, if you can not set activity in the Tuning with at 99, then you MUST look at other aspects of your receiver audio to sound card input and Sound Card Recording Panel settings. Also, note, you must select an available COM port even though you may not be using radio control, the port selection will NOT take effect until you shut down and restart the program.



For database management approach to your sound card setting take a look at QuickMix, a very handy little program is your tired if having to set up you Windows sound mixer for each application. This program lets you save and load up to 300 presets for volume, recording and voice settings, it is available free at:

<http://www.ptpart.co.uk/quickmix/>

On the transmit side, the PC-ALE author states that it is not advisable to connect the sound card directly to an HF transceiver as the output of the card will probably be at too high a level and not the correct impedance. He prefers that the sound card output levels are set to maximum and a 10k ohm multi-turn potentiometer is used to set the correct level for the transceiver transmit input.

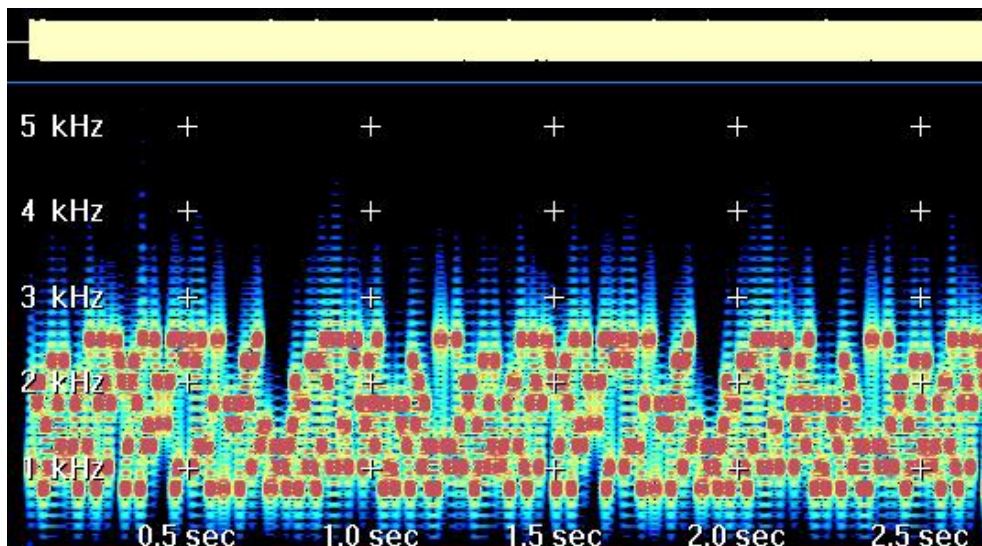
Also, when you have beginning to work and working well, if your computer is not fast enough or not 100% dedicated to PC-ALE during its use, you may have problems as the PC-ALE software and/or sound card is slowed or pre-empted by other tasks. If at any time you see the display in the PC-ALE Tuning window FREEZE for an instant or longer, your DEAD. If your PC is on a home network and someone accesses your shared hard drive your DEAD, your e-mail program running in the background starts to grab a bunch of e-mail once every 10 minutes or whatever, your DEAD, basically, you MUST be running a dedicated PC what has NO other processes running that will task the system to get the best use from PC-ALE.

### **ALE Modulation:**

In full ALE operation, a station will transmit a link quality burst, which may or may not contain the address of another station on a series of pre assigned frequencies. The listening station(s) will continuously scan through these frequencies. While scanning the receiving station will perform a link quality analysis and measure signal to noise ratio and bit error ratio. These measurements are used to set up a table in memory of link quality assessments for each station and frequency.

Based on the values of the table, the best frequency available is selected when the station wishes to transmit. When the ALE controller of a receiving station hears its own address (or the address of the group to which it belongs) it will stop the scanning and respond to the call. The stations will then either switch to a low speed data exchange mode or to a high speed data (FSK or PSK) modem or to voice mode.

The MIL-188-141A signal is an 8-tone MFSK signal in the range 750-2500Hz. spaced 250 Hz apart (you why Part 97 limits its use). Each tone (symbol) is 8 ms long corresponding to 125 Baud and represents three bits giving a bit rate of 375 bps. In the image below, the Red blobs are the 8 tones, in 250-Hz steps beginning at 750hz, with a duration of 8 ms. It is easy to see the cyclic nature of ALE data words, which accounts for this mode's distinctive gobbling sound.



The waveform (at the top) shows ALE's remarkably constant amplitude, even with ionosphere distortions. It really bangs the 2.5Khz wall, showing the receiver pass band needed for this mode, see the + markers left to right on the line with 1.0Khz, 2.0Khz etc., see how the tones start at 750hz and are spaced at 250hz intervals. A 2.5Khz or greater IF filter will pass it all, a 2.4khz crystal or ceramic filter with roll off will come close, but not be 100%, use of 2.1, 2.0. 1.8Khz filtering is not good, those with the newer DSP at IF rigs that set just about any brick wall DSP IF filter can adjust their pass band as needed.

Note: The above image was created using GRAM.EXE, which is an excellent free audio modeling program that you can get at:

<http://www.region-online.de/bildung/fjlsh/faecher/physik/exp/exp-13/spectro.zip>

The MIL-188-141A bit-stream is structured in 24-bit frame, which includes three bits preamble for the frame type and three 7-bit ASCII characters or just 21 bits unformatted binary data. To increase robustness the 24-bit frame is Golay encoded (24, 12), (Note: G-TOR in the Kam Plus TNC's is based on this) then interleaved giving a total frame length of 48 bits + 1 stuff bit. Each 49-bit code word is transmitted three times one after another to combat burst interference. The MIL-188-141A mode decoder processes the signal automatically after the center frequency is set. It synchronizes the signal in both USB and LSB polarities, display readable message in ASCII, HEX or both ASCII and HEX formats.

### **Full ALE Network Operation:**

In a full ALE operational network, the ALE adaptive controller is assigned the task of automatically controlling an HF transceiver in order to establish the highest quality communication link with 1 or multiple stations. Link establishment is dependent on many factors and is fully optimized by the ALE controller. What follows is a basic description of how ALE functions as the in-depth workings of ALE can be elaborate and complicated.

ALE controllers function on the basic principles of LQA (Link Quality Analysis) and SOUNDing. These tasks are accomplished using the following common elements. Each controller has a pre-determined set of frequencies programmed into memory channels. Channels are continuously scanned (typically at a rate of 2 channels per second). Each controller has a pre-determined set of call signs programmed into memory which includes its own station call sign (SELF), NETWORK call signs, GROUP call signs and INDIVIDUAL call signs.

ALE controllers transmit LQAs which SOUND the programmed frequencies for best link quality factors on a regular, automated or operator initiated basis. When listening, ALE units log station call signs, frequencies heard on, and assign a RANKing score relevant to the quality of the link on a per channel basis.

When a station desires to place a call, the ALE controller attempts to **LINK** to the outstation using the data collected during ALE and SOUNDing activities. If the outstation's data has not been collected by the sending ALE, the controller will seek the station and attempt to LINK using all programmed channels.

Upon a successful "LINK", the ALE controllers will cease the channel scanning process and alert the operators that the system has establish a connection and that stations should now exchange traffic. Upon completion of a LINK session, the ALE controllers will send a "LINK TERMINATION" command and the ALE units will return to the scanning mode awaiting further traffic. Built-in safeguards also insure that ALE controllers will return to the SCAN mode in the event of loss-of-contact.

As well as being capable of LQA and Optimum Working Frequency channel selection, modern ALE controllers are also capable of sending short (87 ASCII characters long) orderwire digital messages known as Automatic Message Display (AMD) to ANY or ALL members on the network. ALE controllers can contact individual stations by their call sign, "ALL" stations, or "ANY" stations on the NETwork or GROUP. ALL call and ANY call make use of wildcard characters in substitution for individual call sings such as @?@ (ALL) and @@? (ANY). "NULL" Address Calls are used for system maintenance and are sent as @@@.

**For further additional reading on ALE see:**

ALE technical writing and documents:

<http://www.arrl.org/tis/info/ale.html>

<http://www.hfindustry.com/ale.html>

<http://www.armymars.net/ALE/Intro-ALE.pdf>

<http://www.its.blrdoc.gov/pub/oa-rpt/hf-ale/handbook/>

[http://www.e-publishing.af.mil/pubfiles/doctrine/tt/afttp\(i\)3-2.48/afttp\(i\)3-2.48.pdf](http://www.e-publishing.af.mil/pubfiles/doctrine/tt/afttp(i)3-2.48/afttp(i)3-2.48.pdf)

<http://www.spawar.navy.mil/sti/publications/pubs/td/2760/td2760.pdf>

<http://www.armymars.net/ArmyMARS/DigitalOps/>

<http://www.ncs.gov/n3/shares/interop.htm>

G4GUO related:

<http://www.chbrain.dircon.co.uk/aleuserguide.html>

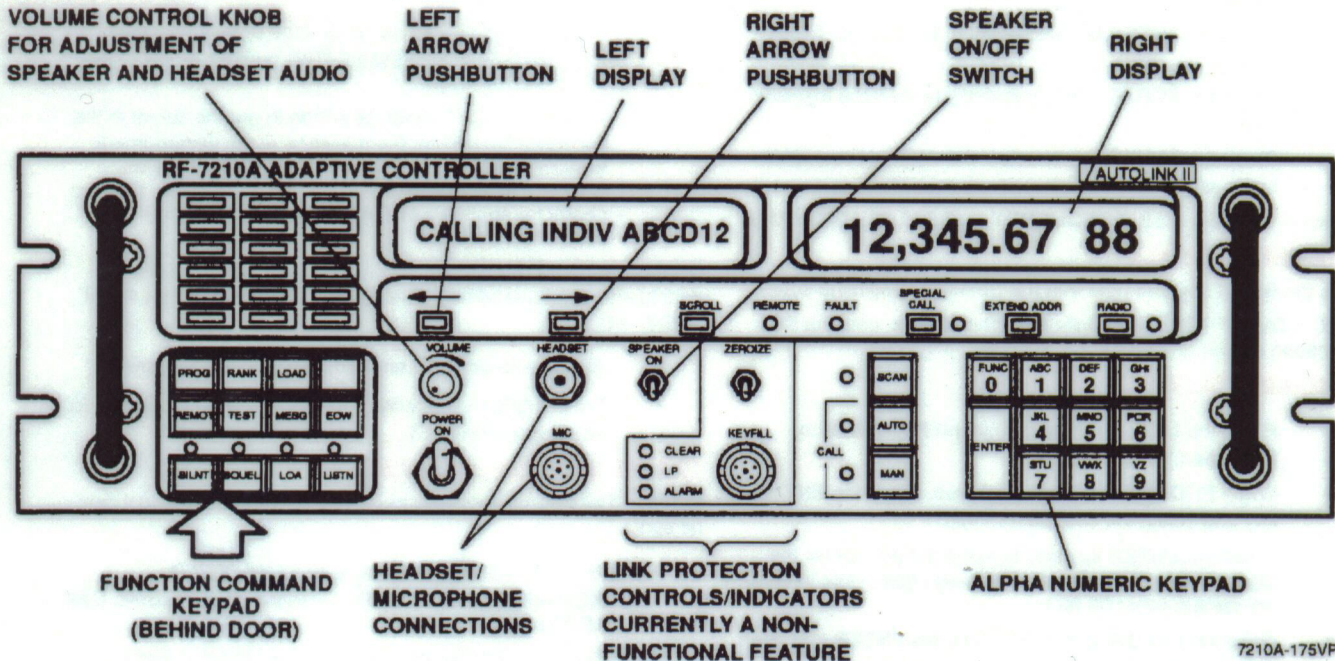
<http://www.geocities.com/n2uhc/ale.html>

<http://www.chbrain.dircon.co.uk/dvhf.html>

<http://www.aorusa.com/ard9800.html>

Anyone can feel free to ask me questions, I am not saying that I will have an answer, but you never know, feel free to e-mail me at: [AAR2EY@optonline.net](mailto:AAR2EY@optonline.net)

# RF-7210A OPERATOR'S CARD



## POWER ON

All systems operations are performed from the front panel of the Adaptive Controller or the associated radio(s).

To power on the Controller switch to the **POWER ON** position at the Adaptive Controller front panel.

- All displays are lit. (Power On Self-Test)
- The **REMOTE** Mode indicator is lit.
- After initialization, the Adaptive Controller will be scanning.

## SELECTING ADDRESSES

**NOTE:** The Adaptive Controller cannot be in Remote Mode to perform the following.

To Manually select an address, use one of the following methods:

- Press **SCROLL** repeatedly to scroll through the available addresses.  
-OR-
- Enter the address index number using the **KEYPAD**.  
Example: **100ABC**, where 100 = index number, ABC = address  
-OR-
- Press the **RIGHT ARROW** button to select the address field. Enter the desired address using the keypad (see using alphanumeric keypad). Pressing **RIGHT ARROW** button repeatedly advances to the next character and **LEFT ARROW** button deletes the previous character.

## USING ALPHANUMERIC KEYPAD

The first press of a key displays the numerical value of that key, the next three key presses displays the associated alphabetic characters in order.

Example: Pressing the **1** **KEYPAD** key four times = **1, A, B, C**

## DISPLAYING EXTENDED ADDRESSES

If an address is more than seven (7) characters in length, it is displayed with a "+" after the first 6-characters. To show the entire address, press **EXTEND ADDR**. To return to the previous display press **EXTEND ADDR** again.

Example: ABCDEF123456 is displayed the display will show ABCDEF+. Pressing **EXTEND ADDR**, ABCDEF123456.

## TO PLACE AN AUTO CALL

- Press the **AUTO** key, select or enter the desired address.
- Press the **ENTER** key to initiate the call to the desired address.

**NOTE:** To select the optimum channel, run an **LQA** prior to placing a call.

## TO PLACE A MANUAL CALL

- Press the **MANUAL** key, select or enter the address.
- Press the **ENTER** key, observe the **CHANNEL NUMBER** prompt. Enter the desired channel at the keypad.
- Press the **ENTER** key to initiate a call on the desired channel.

## MANUAL RADIO CONTROL

Press **SCAN** until the **SCAN** LED turns off.

### To Change the Channel

- Press the **RADIO** button until channel number prompt is displayed.
- Enter the desired channel number at the keypad.
- Press the **ENTER** key to activate the desired operating channel.

Example: **MODE = USB** **FREQUENCY = 12,345.67**

### To Change the Frequency Mode, and or AGC

- Press the **RADIO** button until the **FREQUENCY** prompt is displayed. Enter the desired operating frequency at the keypad.
- Press the **ENTER** key and observe the **RADIO MODE** prompt.
- Press **SCROLL** repeatedly to view the available modes.

# RF-7210A OPERATOR'S CARD

- Press the **ENTER** key and observe the **RADIO AGC** prompt.
- Press the **SCROLL** key repeatedly to view the available **AGC** rates.
- Press the **ENTER** key to select the desired Frequency, Mode and AGC rate.

Example: **MODE = USB FREQUENCY = 12,345.67 AGC = FAST**

## TO TERMINATE A CALL

Press the **SCAN** key and note that the Controller begins to scan.

**NOTE:** The RF-7210A transmits a short message, causing the destination station to return to **SCAN** also.

## TO INITIATE A SINGLE LQA OR SOUND

- Press the **LQA**, Function Command Key. (Refer to illustration.)
- When **PROGRAM LQA** is displayed, press the **ENTER** key and select the desired address.
- Press the **ENTER** key and observe the prompt for the **LQA** interval. Press the **ENTER** key again. (The interval will remain set at 00.00.)
- Observe the **LQA** start time. Press the **ENTER** key. Start time is now at current value.
- Press the **ENTER** key and observe "PROGRAM LQA" in the left display.
- Press the **SCAN** key to initiate the single **LQA**.

**NOTE:** To initiate a **SOUND LQA**, follow the above procedure, **EXCEPT** the **LQA** button is pressed until "PROGRAM SOUND" appears.

## TO PROGRAM AN LQA OR SOUND (TIMED)

- Press the **LQA** until "PROGRAM LQA is displayed.
- Press the **ENTER** key and select the desired address.
- Press the **ENTER** key. The display shows the **LQA**—start time prompt. Enter start time (HH,MM) with the front panel keypad.
- Press the **ENTER** key to store the timed **LQA** program information. Observe "PROGRAMMED LQA" in left display.
- Press the **SCAN** key to return to scanning (**LQA** will be stored.)

**NOTE:** To **PROGRAM A SOUND**, perform the above, **EXCEPT** the **LQA** button is pressed repeatedly until "PROGRAM SOUND" appears.

## TO STOP AN LQA OR SOUND

- Press **LQA** until "REMOVE LQAS/SOUNDS" is shown.
- Press **ENTER** and use the **SCROLL** button to select the desired address.
- Press **LOAD** (see illustration). This aborts the **LQA** or Sound and erases the timed **LQA** or Sound program information.

## TO PROGRAM A SLOW SPEED DATA MESSAGE

- Press **MESG** (see illustration) until "EDIT TX MESSAGE" is displayed.

- Press the **ENTER** key and input the desired message number (0-9) at the keypad. (This number or any of the 10 stored messages.)
- Press the **RIGHT ARROW** button to put the cursor in the message field. Enter the message at the alphanumeric keypad (see using alphanumeric keypad). Press the **RIGHT ARROW** button to advance the cursor to the next character and the **LEFT ARROW** button to delete the previous character.

**NOTE:** Repeatedly pressing "0" on the keypad displays the punctuation marks available. (The ? character is located on the "9" keypad key.)

- After the message is entered, press **LOAD** to store it.
- Press **MESG** repeatedly to select another operation or to return to **SCANNING**.

## TO SEND SLOW SPEED DATA MESSAGE

**NOTE:** The desired message must be programmed before it can be sent.

- Press the **SPECIAL CALL** button until "SEND MESSAGE - AUTO" is displayed and the **SPECIAL CALL LED** turns on.
- Press the **ENTER** key and select or input the desired message number, using the **SCROLL** button to scroll through the available messages or the keypad "0-9".
- Press the **ENTER** key to send the desired message to the selected address.

**NOTE:** To send a message on a specific channel, press the **SPECIAL CALL** button until "SEND MESSAGE - MANUAL" is displayed. Proceed as specified above and enter the desired channel when prompted.

## TO DISPLAY CHANNEL RANKINGS

- Press **RANK** (see illustration). Select or enter the address.
- Press the **ENTER** key and note the display of channels and their associated rankings.

Example: **09\120 01\87 03\25**

- channel 09 best with score of 120
- channel 01 second best with score of 87
- channel 03 third best with score of 25

**NOTE:** Scores range between 0 (lowest) and 120 (highest). Dashes indicate no attempt was made to call the address on the specified channel. Example: 07\— (channel 07, in this example). A display of 07\XXX indicates an attempt was made to call the address on the specified channel, but the destination did not respond.

- Press the **RIGHT ARROW** button to scroll the remaining scores (right to left) across the display. To scroll the scores in the other direction, press the **LEFT ARROW** button.

## SUPPRESSING AUTOMATIC SYSTEM TRANSMISSIONS

To prevent the RF-7210A from automatically responding to call or **LQA's**, do the following:

- To **ENABLE:** Press **SILNT**. The **SILNT LED** lights.

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- To **DISABLE**: Press the **SILNT** again. The **SILNT LED** turns off.

## PERFORM A SELF TEST

With the RF-7210A in Scan or Manual Mode, press **TEST** (see illustration) and observe the Built-In Test routine execution:

- All display segments light.
- All **LED's** light.
- "**TEST ACTIVE**" is displayed in the left display.
- When done, "**TEST PASSED**" or appropriate fault code is displayed in the left display.

## DIGITAL SQUELCH

The speaker activates when a link is established. To squelch the speaker (squelch):

- To **ENABLE**: Press **SQUEL**. The **SQUEL LED** lights.
- To **DISABLE**: Press **SQUEL** again. The **LED** turns off.

## LISTEN BEFORE TRANSMIT

Perform the following to enable the station to "Listen" for other Automatic Link Establishment (**ALE**) traffic before transmitting:

To **ENABLE**: Press **LISTN**. The **LISTN LED** lights.

To **DISABLE**: Press **LISTN** again. The **LISTN LED** turns off.

## TO SELECT REMOTE CONTROL BY Adaptive Controller

- Press **REMOT**. The **REMOT LED** lights. Stations can be remotely controlled.

- To return to local control, press **REMOT** again. The **REMOTE LED** turns off and the station is now in **LOCAL Mode**.

## DATA TEXT MESSAGE (DTM) OR RF-7110 AUTOLINK ENG. ORDERWIRE (EOW)

- Press **EOW** to send a MIL-STD-1045/1046 Data Message (**DTM**) or RF-7110 Autolink Engineering Orderwire. The display will prompt for an address.
- Repeatedly press **SCROLL** to display, in succession, all addresses to which a **DTM** or **EOW** can be sent. The keypad and **ARROW** buttons are also used to enter index, numeric, or alphanumeric address.
- When the desired address is displayed, press **ENTER** to initiate the **DTM** or **EOW**.

**NOTE:** The RF-7110 Autolink **EOW** initiates only when a four-character numeric address is selected. Otherwise the default is a **DTM**.

- When the terminal or computer displays **ENTER MESSAGE NOW**, enter the message at the computer keyboard or perform a download using **ASCII File Transfer** software.
- Upon completion, press **CTRL+C** on the computer keyboard to mark the end of the message. This causes the message to be sent. Pressing **CTRL+Y** aborts it.

## RF-7210A OPERATIONAL STATUS DISPLAY MESSAGES

Controller is in Receive Scan. Time is 10:31:55 pm:

**SCANNING 22.31.55**

ALE signal detected. Controller waiting to see if call or LQA is for the local address:

**SIGNAL RCVD 22.05.01**

Unit is calling individual station ABC. Stations are not yet linked:

**CALLING INDIV ABC**

A NET call to the NET address XYZ. Stations are not yet linked:

**CALLING NET XYZ**

Call received from ABC:

**CALL FROM ABC**

Unit is linked and is in radio contact with station ABC:

**LINKED TO ABC**

Station ABC has not responded to a call:

**NO RESP FROM ABC**

Controller performing an LQA with station ABC:

**LQA CALLING ABC**

Controller performing a sound using the local address HRS:

**SOUNDING SELF HRS**

Controller in Manual Mode (USB),  
Transmitter not keyed, time is 11:25:31 am:

**USB RX 11.25.31**

Controller in Manual Mode (LSB),  
Transmitter keyed, time is 11:25:31 am:

**LSB TX 11.25.31**

Controller cannot communicate with the Transceiver,  
(Transceiver is probably off):

**NO COMM WITH XCVR**

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