A.R.F. PRODUCTS, INC.

ENGINEERS AND MANUFACTURERS OF PRECISION ELECTRONIC EQUIPMENT

PRELIMINARY

OWNER'S MANUAL

A.R.F. 2001

SCANNING TRANSCEIVER

HOME OFFICE AND MANUFACTURING PLANT - RATON, NEW MEXICO

RESEARCH AND DEVELOPMENT LABORATORY - BOULDER, COLORADO

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Welcome to the new frontier in Personal Communications. The A.R.F. 2001 will take you on a fantastic voyage through the world of Personal Communications.

A small amount of your time, spent in familiarizing yourself with the operation and control functions of your new A.R.F. 2001 will be well spent.

The A.R.F. 2001 digital scanning transceiver brings you the very latest state of the art through the application of advanced communication theory and unique digital electronics circuits.

The A.R.F. 2001 was designed and manufactured in the United States by A.R.F. Products, Inc., an American Company founded in 1942 who has over 450 combined man-years of American Engineering experience in design and development of ground and misslebourne communications equipment. This experience was used in creating a superbly performing combination AM and single sideband transceiver.

The A.R.F. 2001 employs two unique circuits not found in any other Personal Communications equipment. They are SAM* and AMSIL*.

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SAM* is a Servo Amplitude Modulator, this unique speech processing circuit greatly improves the quality of voice communications. The SAM* system increases the average power in the speech signal while creating a spread spectrum within the authorized transmitter occupied bandwidth. The spread speech spectrum, like in FM transmission, displaces noise components within the operating bandwidth, thereby greatly improving the output signal to noise ratio of a distant receiver.

This speech enhancement technique has its basis in the special characteristics of the English language. The consonants of the English language convey most of the intelligence contained within a word. Studies of the spoken word show that the consonants contribute to the average power of the speech signal while the vowels are associated with the peak energy. This unique speech processing circuit eliminates the high peak energy in conversational speech and at the same time enhances the average power. The processor allows the transmitter to be modulated to the maximum percentage with the average of the speech signal. The direct result is that the power in the AM sidebands is dramatically increased over the conventional CB speech process circuits found in other CB

transceivers. The combined effects of increased sideband power and an improved signal to noise ratio within the authorized transmitter band width greatly improves the ability of the A.R.F. 2001 to communicate with distant stations.

In Single Sideband operation the processed speech modulation is applied to the sideband modulator and SSB quartz filters (8 poles). The filtered SSB signal is then amplified by a linear amplifier. The linear amplifier features an automatic load control circuit that maintains a constant peak envelope power during speech transmission.

The receiver employs dual gate MOSFET RF amplifier and mixer devices to provide the ultimate in high level signal handling capability. A single conversion design, featuring a high IF operating frequency eliminates image interference. Excellent adjacent channel rejection is provided by a series arrangement of 4 pole monolithic quartz crystal filters (a total of 16 poles) in the AM and SSB IF amplifiers. A.R.F.'s original development of AM Silencing (AMSIL*) scheme is a unique contribution to the sideband world of Personal Communications. AM transmission is squelched in the SSB IF. This suppression technique allows the set to respond only to sideband signals.

The keyboard entry calculator-microprocessor frequency control gives the user the ultimate in channel selection capability. The microprocessor brings the modern calculator technology to the Personal Communications world.

The transmitter will make your neighbor happy since a built in 7 pole eliptic filter superbly suppresses TVI.

Only the highest possible quality parts are used in the radio. Personnel thoroughly trained in advanced technology electronics have been employed to manufacture this unique radio. The A.R.F. 2001 has been inspected many times to assure you receive the high quality that people have come to expect from A.R.F. Products, Inc.

A.R.F. Products, Inc., located in Raton, New Mexico, has been involved in the manufacture of communication equipment for both private and military use since 1942. During this time we have learned what you want and expect in a good Citizens Band radio. We have used all this knowledge and experience in the engineering and production of the A.R.F. 2001.

A.R.F. PRODUCTS, INC., HEREBY CERTIFIES THAT THIS EQUIPMENT HAS BEEN DESIGNED, MANUFACTURED AND FURNISHED IN ACCORDANCE WITH VOL. VI, PART 95 OF THE CURRENT F.C.C. RULES AND REGULATIONS FOR CLASS D CITIZENS BAND OPERATION.

A.R.F. PRODUCTS, INC.

RATON, NEW MEXICO

UNPACKAGING AND INSTALLATION

1. NOTE: PLEASE SAVE ALL PACKAGING MATERIAL AND BOX.

   THIS WILL BE NEEDED IF WARRANTY WORK IS REQUIRED.

2. The A.R.F. 2001 is supplied with a ASTATIC UG8D104 microphone. This is packaged in two sections, the base and the microphone itself. Plug the microphone into the base and connect the mike cable to the unit.

3. Plug the unit into any 117 Volt AC outlet. Note: The A.R.F. 2001 is supplied with a three way grounded plug. If your outlet will not accept this plug you can obtain an adaptor from your local hardware store. Be sure to use the ground wire on this adaptor.

4. Set the clock with a pen or pencil by first pressing the fast (F) to get close to the desired time. The light in the upper left hand corner of the clock indicates AM. Then by pressing the slow (S) bring the clock to the desired time. This clock will maintain very accurate time. Should you have a power failure the clock will need to be reset as described above.

5. Connect any high quality base station CB antenna to the SO239 connector labeled "A" at the rear of the unit and switch the antenna switch to the "A" position.

6. Set the controls as follows:

RF GAIN	FULLY CLOCK WISE (10)
MODE SELECTOR	TO AM
VOLUME CONTROL	SET TO TWO (2)
PA SWITCH	OFF (DOWN)
TALK BACK SWITCH	OFF (DOWN)
EXTERNAL SPEAKER SWITCH	OFF (DOWN)
NOISE BLANKER SWITCH	OFF (DOWN)
AMSIL* SWITCH	OFF (DOWN)
SWR SWITCH	OFF (DOWN)
SQUELCH CONTROL	FULLY COUNTER CLOCKWISE (0)
TONE CONTROL	SET TO FIVE (5)
FINE TUNE CONTROL	SET TO FIVE (5)
SCAN SELECTOR	OFF (CENTER)
SAM*	OFF (DOWN)
MIKE GAIN CONTROL	SET TO FIVE (5)

Turn the power switch on (up) and set the volume and tone as required.

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7. As you will note the A.R.F. 2001 has come to life on channel 19. This is a good time to check the SWR of your antenna system.

A. Turn the CAL control fully counter clockwise to zero.

B. Set the SWR switch to the ON position (up).

C. Key the mike and advance the CAL control until the left hand meter is set at "SWR CAL". The SWR may now be read on the right hand meter.

NOTE: If the SWR ratio is greater than 3 to 1 you should check your antenna system and correct to a reading of 1.5 to 1 before continuing to operate the A.R.F. 2001.

8. At this point you are ready to operate on AM.

(THE FOLLOWING SECTION IS USED TO EXPLAIN THE CONTROL FUNCTIONS)

1.	MIKE GAIN CONTROL	To adjust the percentage of modulation. NOTE: The A.R.F. 2001 is equiped with a modulation meter.
2.	SAM*	When in the upward position the transceiver is compressing the speech signal such that the ratio of peak and average levels are equal. When in the downward position the set operates as a normal transceiver.
3.	VOLUME CONTROL	Varies the sound output of the loudspeaker.
4.	SQUELCH CONTROL	Reduces excessive noise when no signal is present. NOTE: the setting of the squelch control is very important when operating in the scan mode.
5.	TONE CONTROL	Adjust for a pleasing sound to fit each operator's tastes. Only effective in the receive mode.

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6. RF GAIN	Turn this control counter-clockwise to reduce the gain of the RF amplifier.
7. FINE TUNE	Adjusts receiver frequency slightly to compensate for stations transmitting off frequency.
8. ANTENNA SWITCH	You may select either antenna "A" or "B" for your omni or beam antenna systems.
9. POWER	The upward position is on. The downward position is off. The clock remains on all the time.
10. TALK BACK	Turns on the intercom system in the A.R.F. 2001.
11. EXTERNAL SPEAKER	Selects the internal or external speaker.
13. NOISE BLANKER (NB)	This switch activates a very effective type of noise elimination circuit. The blanker is usually left "ON" in operation since it is the only noise rejection circuit in SSB

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operation.

14. AMSIL* — AM Silencing is used on upper and lower sideband operation to prevent AM transmissions from unsquelching the transceiver. It is automatically deactivated in the AM mode.

15. SWR SWITCH & CAL CONTROL — Set mode switch to AM and key the transmitter. Using the CAL control, set the left hand meter indicator to the red "SWR CAL" line. Read the SWR on the right hand meter. The two meter SWR type network can be used to determine the relative forward and reflected power during transmission.

16. DIMMER CONTROL — Changes the intensity of the following indicators: Modulation Meter, S/RF/SWR Meter, Mode and Scan switches.

17. MODE LEVER SWITCH

Use to select USB, AM, or LSB operation. This switch also has a light to indicate which mode of operation you are in. Red for USB, yellow for AM, and green for LSB.

18. SCAN LEVER SWITCH

There are two modes of scanning: BUSY and OPEN. The A.R.F. 2001 will act as a search receiver to find you an open channel or one that is active.

Busy channels: The frequency synthesizer is automatically tuned from channel to channel until the receiver is unsquelched. The receiver then locks on to the busy channel. The reciever will stay on the channel after the reoeiver is squelched for a short period of time approx. 3 to 6 seconds During this time the receiver is waiting for any further communications on

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18. SCAN LEVER SWITCH (CONTINUED)

the channel. After the delay period, the receiver will continue on automatic search for busy channels.

Open channels: The frequency synthesizer is automatically tuned from channel to channel until the receiver is squelched indicating an open channel. The user can then turn the scan switch off.

19. CLOCK SET

With a pen or pencil depress the (F) fast set button until the clock approches the time desired, then depress the (S) slow button to set the exact time. The red light in the upper left corner of the clock indicates AM.

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INDICATORS AND METERING SYSTEMS

1. MODULATION AND SWR CAL METER

With the SWR switch in the off (down) position this meter indicates percentage of modulation while transmitting in the AM mode, with the SWR switch in the on (up) position the meter acts as a SWR calibration meter when transmitting in the AM mode.

2. "S" METER
POWER METER
SWR METER

The right hand meter in the A.R.F. 2001 acts as a "S" meter during the receive mode, providing a relative indication of the strength of incoming signals. During the transmit mode this meter measures relative peak envelope power. When the SWR switch is in the on (up) position this meter tells you the standing wave ratio after calibration has been made.

3. TRANSMIT INDICATOR	This indicator lights up red when the unit is in the transmit mode.
4. HIGH SWR INDICATOR	Lights up when the SWR ratio exceeds 3 to 1 or higher. NOTE: This display is independent of the dimmer control.
5. AMSIL*	Lights up yellow to let you know that the AM silencer is on.
6. RECEIVE INDICATOR	Glows green in the receive mode.
7. AM CLOCK INDICATOR	In the upper left hand corner of clock there is a red dot that indicates AM.
8. CLOCK READOUT	Displays the time in hours and minutes with the colon counting the seconds. NOTE: This display is independent of the dimmer control.

9. MODE INDICATOR

The display section next to the channel indicator will show what mode the unit is in:

U = Upper sideband operation

A = AM operation

L = Lower sideband operation

PA = Public address operation

NOTE: These indicators are independent of the dimmer control.

10. CHANNEL INDICATOR

Displays the channel currently in use.

NOTES: A. If an invalid channel is entered the unit will automatically go to channel 19.

B. This indicator is also independent of the dimmer control.

THE A.R.F. 2001 KEYBOARD ENTRY

MICROPROCESSOR

All keys are dual function keys and indicated by the markings on the keyboard.

Simple operation is provided by using the following procedure:

TO SELECT A CHANNEL

A. Press the ENTER key [*]

B. Press the desired channel number [1] [2]

C. Press the ENTER key [*]

The A.R.F. 2001 will then lock on to channel 12.

EMERGENCY CHANNEL

Press the [9] (HELP) key and the A.R.F. 2001 immediately locks on to channel 9.

MANUAL SCAN

Press and hold [1] FST ▽ And the channel numbers will decrease at a fast rate.

[2] SLO ▽ And the channel numbers will decrease at a slow rate.

[3] SLO △ And the channel numbers will increase at a slow rate.

[0] FST △ And the channel numbers will increase at a fast rate.

When you have reached the desired channel release the key and you are locked in and ready to operate.

RECALL (RCL)

Select the channel you wish to place in the recall register and press the [6] (RCL) key. You may now move off to any other channel and at any time be able to recall the original channel by pressing the [6] (RCL) key again. NOTE: The channel you were on when you pressed the recall key is now loaded in the recall register.

MEMORY

The memory can hold up to 10 channels. Press the [8] (MEM) to enter a channel in to memory. Each additional press of the [8] (MEM) key rolls the memory register stack through one step and displays the channel in memory. To enter a channel into memory press the following sequence:

[*] [1] [0] [*] [8]

When the 8 is pressed channel 10 is loaded into the memory register and the display will show the channel in the memory register or 00 indicating the register is empty.

To remove a channel from memory press [8] (MEM) until the channel you wish to delete is displayed. Press [*] [0] [0] [*] [8] That channel has been deleted from memory and the next channel in the memory register will be displayed.

SCANNING

All 40 channels for busy or active channels. In order to scan all forty (40) channels press 7 5 The A.R.F. 2001 will scan the channels until it finds an active channel that breaks squelch. In this mode it will lock on that channel and the 5 key must be pressed again in order to restart the scanning.

SPECIAL NOTES ON SCANNING:

A. The scan direction up or down is controlled by the last time one of the following keys was pressed

1 2 3 or 0

B. The scanner will not function if the receiver is not squelched in the OFF or BUSY SCAN MODE.

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SPECIAL OPERATIONAL NOTES

SQUELCH ADJUSTMENT: The squelch control is used to eliminate background noise when there are no signals present on the channel. To adjust the squelch control select a channel where there is no signal. Turn the volume up to a fairly high level. Rotate the squelch control clockwise until the background noise disappears. This point is called the "squelch threshhold". At this squelch position the receiver will be quiet when there is no signal on the channel. But an incoming signal will be able to overcome the squelch action and be heard. This control is variable, and as advanced, the squelch action is increased. Consequently a stronger signal is required to break the threshold. To receive extremely weak signals or disable the squelch circuit, merely turn the control fully counter-

wise.

PUBLIC ADDRESS OPERATION: Provision has been made for utilizing the A.R.F. 2001 for public address operation. For PA connect an external 8 ohm speaker into the phone jack identified "PA" at the rear of the unit. Set the "PA" switch to the upward position. Press the push-to-talk bar on the microphone and talk into it as you would when transmitting on a CB channel. Your voice will be heard on the external speaker. The MIKE GAIN control will act as a volume control on the speaker. Start with a low MIC GAIN control setting.

INTERCOM OPERATION

In conjunction with the Public Address operation, the A.R.F. 2001 may be used as an intercom. When the TALK BACK switch is in the up position, the PA speaker can be heard

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through the normal speaker in the unit. Pressing the microphone switch places the set back into the PA mode.

EXTERNAL SPEAKER OPERATION An optional accessory speaker can be used with a A.R.F. 2001 to provide remote reception of CB signals. For this operation, connect the speaker into the phone jack identified "EXT" at the rear of the unit. Attachment of a remote speaker will automatically silence the built-in speaker. To utilize the PA speaker for listening to CB, move the EXT SPKR switch to the upward position.

1. EXTERNAL SPEAKER JACK:	3.5 MM jack for connection of an accessory speaker.
2. PA SPEAKER JACK:	3.5 MM jack for connection of optional accessory PA horn type speaker. Also used for intercom while in the TALK-BACK mode.
3. ANTENNA CONNECTORS:	Standard SO239 jack to accomodate PL259 plug. Labled "A" and "B" to correspond with the antenna switch on the front panel.
4. CLOCK FUSE:	Standard AGC-3AG ½ amp fuse
5. CB FUSE:	Standard AGC-3AG 2 amp fuse.

RECEIVER

TYPE		Single conversion with separate 8 pole Monolythic quartz crystal filters for AM and SSB (16 poles).
SENSITIVITY (10 dB $\frac{s+n}{n}$)	SSB	Better than 0.25 uV
	AM	Better than 0.35uv, 50% AM
		Better than 0.50uV, 30% AM (EIA)
SELECTIVITY (3 dB)	SSB	Center frequency to lower bandedge 200-300 Hz
		Center frequency to upper bandedge 2500 to 3000 Hz
	AM	$\pm$ 2.2KHz Min, $\pm$ 2.7 KHz Max
RF GAIN		Adjustable, 30 dB Minimum
SQUELCH		Adjustable, from sensitivity to over 1000uV
AGC		Less than 10 dB change in audio output with input signal level from 1uV to 10,000uV

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ADJACENT CHANNEL REJECTION AND DESENSITIZATION	Better than 65 dB (EIA-RS-382) Better than 80 dB (common)
IMAGE REJECTION	Better than 80 dB
SSB AM SILENCING *(AMSIL)	All but unusually strong AM signals may be squelched so that only SSB signals are received.
SCANNING FUNCTION BUSY	Automatically seeks busy channels: stays on busy channel for 3 to 5 seconds after end of conversation to pick up any reply. Then continues to search for next busy channel.
OPEN	Automatically seeks open channels.
NOISE BLANKER	Automatic series gate.
ANTENNA TERMINAL	Less than 0.2 Nanowatt at any frequency in the range 25 to 500 MHz.

CASE RADIATION	Less than 5uV/m at a distance of 3 meters from receiver case in the frequency range of 25 to 500 MHz.
CONDUCTED LINE	Less than 100uV at any frequency in the range of 0.45 to 25 MHz.

TRANSMITTER

TYPE	SSB	Linear class AB in SSB with automatic level control (ALC)
	AM	Class C in AM with a closed loop Servo Amplitude Modulator (SAM)
SSB MODE (U or L)		12 Watts PEP with two tone modulation of 500 and 2400 Hz
ALC RANGE		Maintains rated PEP for microphone signal level change of 16 dB.
IMD		3rd order intermodulation distortion is greater than 25 dB down

MODULATION FREQUENCY RESPONSE AT ONE HALF RATE PEP	± 0.5 Watt from 300 Hz to 2100 Hz.
AM MODE	
OUTPUT POWER	Average unmodulated carrier power 4.0 Watts (Max) Average modulated waveform power * (SAM) ON 7.2 Watts (Max) OFF 6.0 Watts (Max) Peak modulated power 16 Watts (Max)
UNMODULATED CARRIER FLATNESS CHANNEL 1 to 40	± 0.2 Watt
MODULATION DEGREE	100 Percent Max
SAM	ON Maintains full AM modulation and unmodulated carrier power for normal range of voice signals The power in each sideband (talk power) is maintained at 1.57 Watt. OFF Conventional CB transmitter maintains each sideband power at 0.15 Watt.
OUTPUT FILTER	7th order Elliptic

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FREQUENCY SYNTHESIZER

TYPE	Micro computer controlled phase lock loop.
CHANNELS	40
CHANNEL DISPLAY	2 Digit ½ inch LED
CHANNEL SELECTOR	Keyboard entry
ILLIGITIMATE CHANNEL ENTRY	Synthesizer goes to channel 19
FREQUENCY RANGE	26.965 to 27.405 MHz
FREQUENCY ACCURACY	± 150 Hz
TEMPERATURE STABILITY	± 200 Hz (-30°C to 50°C)
FINE TUNE RANGE	± 600 Hz Min; ± 1350 Hz Max
KEYBOARD FUNCTIONS	
MONITOR	Automatically monitors the emercency recall register for a short period of time once every 10 to 15 seconds

SCAN	Automatically searches for busy channels or open channel in memory or all 40 channels.
MEMORY	Memory storage for up to ten (10) channel numbers.
EMERGENCY 9	Immediate channel 9 entry.
CHANNEL SELECTOR	Fast or slow up-down channel selector.
RECALL (RCL)	Recall loads the displayed channel into a recall register (memory). Also recalls and displays the content of the recall register.

GENERAL SPECIFICATIONS

AUDIO OUTPUT	
POWER	4.0 Watts into 8 ohms
	6.0 Watts into 4 ohms

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FREQUENCY RESPONSE	AM	6dB 200 Hz to 2500 Hz
	SSB	6dB 300 Hz to 2500 Hz
	PA	6 dB 100 Hz to 2500 Hz
POWER SUPPLY	VOLTAGE	117V AC at 60 Hz
	REGULATOR	Precision series regulator
	WEIGHT	22 lb.
	SIZE	7 x 18 x 15 (HWD) inches
FCC TYPE ACCEPTED		A.R.F. 2001

*PATENT PENDING

NOTE: This radio has been designed for FCC class "D" operation in the 11 meter citizens radio service. It uses a frequency synthesizing circuit with phase locked loop (PLL) techniques to provide crystal controlled transmit and receive operation on all 40 channels. The PLL circuitry assures ultra-precise frequency control. It is designed to meet the Federal Communications Commission requirements applicable to equipment operating in the class "D" service, and is not to be used for any other purpose. Part 95 of the FCC regulations defines operation in this service and you are required to read and understand these regulations prior to operating this equipment. You are also required to complete FCC license application form 505 and submit it to the FCC, Gettysburg, Pa. 17325 in order to receive your license to operate this unit. While your form 505 is being processed by the FCC, you may use FCC temporary license form 555-B as a temporary permit. You will be in violation of part 95 of the FCC regulations if you operate this equipment on the air, prior to receiving your license and call signs or if you transmit with the unit without complying with the procedures explained on FCC temporary licens form 555-B. FCC forms 505 and 555-B as well as a copy of part

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95 of the commissions rules are packed with the transceiver for your convenience.

WARNING: Transmitter section adjustments must be performed by a qualified technician holding a valid first or second class FCC radiotelephone license.

SERVICE

In the event that your A.R.F. 2001 requires service - either in or out of warranty - we suggest that you return it directly to A.R.F.. Ship the unit to :

A.R.F. Products, Inc

Attn: Service Department

Gardner Rd.

Raton, New Mexico 87740

Packed in the original shipping carton, include a letter with the unit indicating what is wrong with the transceiver.

Do not ship by parcel post unless insured for full value.

We recommend United Parcel Service

One Year Limited Warranty

A.R.F. Products, Inc warrants to the purchaser of each new A.R.F. 2001 that such product shall be free from defects in material and workmanship under normal use and service for a period of one (1) year from the date of sale to the purchaser provided you return your warranty registration card to A.R.F. Products, Inc., within 10 days of date of purchase.

If a defect should be found within the warranty period and if the radio has not been subject to neglect, misuse, accident, improper installation or such defect is caused by service other than that performed by A.R.F. Products, Inc. A.R.F. Products, Inc. will, at its option either replace or repair the radio.

To obtain warranty repair the customer must return the radio properly packed, freight prepaid, to A.R.F. Products, Inc.. It will be returned freight prepaid.

Where permitted by law, this warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for us any other liability. Some states do not allow limitations on implied warranties so the above limitation may not be applicable, you may have rights as defined by each states law.

A.R.F. PRODUCTS, INC.

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