

RADIO INTERFACE CARTRIDGE FOR THE COMMODORE:

VIC-20 **'64'**
 with AMTOR

**Complete terminal with
software in permanent ROM
for Sending and Receiving
RTTY and MORSE Code.**



CHAPTER 1

'AIR-1' PRELIMINARY CHECKOUT

After unpacking your unit, make sure that power to the computer is turned off, then plug the Microlog AIR-1 into the "expansion port" (The same one used for game and memory expansion modules), so that the components are on top, facing up. If you are using an expansion board, the components should face the front. Turn on the computer and video monitor. For clarity, only the VIC-20 display is shown in the following examples. The "64" display has one long top line with the same information as the two lines of the VIC-20. The word "MICROLOG" will appear on the screen for several seconds then the following "TOPLINE" display should appear on the video screen of the VIC-20:

R	B	0	6	0	W	P	M	N	O	R	U				
O								0	0	:	0	0	U	T	C

This indicates that the system is set to receive (R) RTTY Baudot (B) code at 60 WPM, and that the built-in dual tone demodulator is selected in the Normal (NOR) mode with the "UNSHIFT on SPACE" feature enabled (U). The 'O' on the second line is the 'red-dot' singletone tuning indicator. A four digit HH:MM clock which should start advancing is displayed on the second line.

The "Split Screen" cursor will be displayed in the left center of the VIC screen in blue, white on the C-64. The receive text cursor will be at the bottom left VIC screen in black, yellow on the C-64. If using a monochrome (black and white) TV/monitor, colors will appear as shades of gray.

In the event that the above does not appear on your video monitor's screen, check the cable between the computer and the TV monitor to make sure that it is not shorted or open. You may also have to adjust the TV monitor's various controls such as brightness, contrast, etc. Some monitors provide a switch which selects a low or high impedance input. You should select the low impedance (75 OHM) input. Also, if your monitor has a "PICTURE-DATA" switch it should be in the "DATA" position.

Some basic programs require the full 38K C-64 memory, which means you will have to unplug the AIR-1. *Do not* unplug with power on. It's also a good idea to disconnect all radio cables from the AIR-1 before unplugging it. An A.C. ground fault between your radio and the computer could damage both the AIR-1 and the computer.

CHAPTER 2

'AIR-1' SYSTEM FAMILIARIZATION

2.1 KEYBOARD:

Your VIC-20 or "64" keyboard has a total of 67 keys including all of the familiar Alpha-Numeric keys. In addition there are special symbol keys, and two keys, namely 'SHIFT' and 'CTRL' which are always used in conjunction with another key. The SHIFT key(s) are located on the bottom row and the CTRL key is located on the left side above the RUN/STOP key.

Note that some of the key tops have two symbols. For example, the 4 and the \$ symbols are engraved on the same key top. Much the same as in a standard typewriter you must hold the SHIFT key down while pressing the 4 key in order to type the \$ symbol. The CTRL key is used in a similar manner.

In the following description, references are made to various control functions or commands. These commands are executed by simultaneously pressing the CTRL (or SHIFT) key plus one other key. For example, a request to press (or type) 'CTRL X' means that you must hold down the CTRL key, and while holding it down, press the X key, then release both keys. Similarly, to type or press 'SHIFT X' means that you should hold down the SHIFT key, and while holding it press X. As soon as the X key has been pressed you can release both keys.

After familiarizing yourself with the location of the various symbols on the keyboard, type some Alpha-Numeric text. Observe that the characters you have typed are displayed on the upper part of the screen above the split-line. The 'INST/DEL' key which is located on the right side of the top row may be used to correct typing errors. Notice that typing 'INST/DEL' erases the previously typed character.

You can go to the "BASIC" computer mode by typing 'CTRL' and Commodore keys. Since you are then under the restraints of "BASIC" language, to go back to AIR-1 communication mode you must type: SYS 40969 then the 'RETURN' key for the VIC-20. USE: SYS32777 then return on the "64."

2.2 VIDEO DISPLAY COMMANDS:

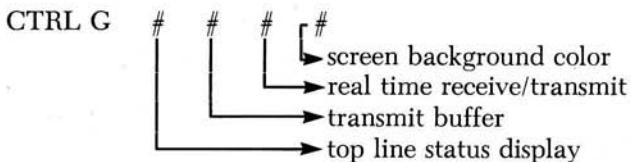
The split-screen option is user selectable. The 'CTRL S' command is used to toggle the split-screen option on and off. To remove the split-screen and use the entire video display for receive text,

TYPE: 'CTRL S' (HOLD 'CTRL' KEY AND PRESS 'S')

In the non split-screen mode, you can still enter text into the buffer, you just can't see it appear before it's transmitted.

2.2.1 ADDITIONAL VIDEO COMMANDS FOR C-64:

The screen and text colors can be changed with a single control command. "CTRL G" followed by a 4 digit number will change the following:



The #'s are the same as the 64's color codes as shown on page 139 of the 64 manual with one exception. To utilize a single digit for all 16 colors, you must enter it in "Hexadecimal" that is 0 through F instead of 0 through 15. The colors are as follows:

0 = Black	4 = Purple	8 = Orange	C = Med Gray
1 = White	5 = Green	9 = Brown	D = Light Green
2 = Red	6 = Blue	A = Light Red	E = Light Blue
3 = Cyan	7 = Yellow	B = Dark Gray	F = Light Gray

The colors will change upon typing the forth digit. Note: The default colors are:

(6) Blue	Top line
(1) White	TX buffer
(7) Yellow	Real time RX/TX
(E) Light Blue	Screen

These colors were picked as the best compromise for both color and monochrome display. You can experiment with different color patterns to suit your individual requirements. Suggestions: 0657, 1AE0, 192A, 569D, 062C. 8000

Note also, the tuning indicators and the RX buffer flags are always displayed in red, except when jumping to AMTOR where they change to the same color as the top line.

You can move the entire video display horizontally with the CTRL H command. This should take care of monitors with limited horizontal sync tracking range.

2.3 XMIT/RCV COMMANDS:

Typing 'SHIFT RUN/STOP' or 'SHIFT RETURN' (hold 'SHIFT', press 'RUN/STOP') places the system in the transmit mode. Observe that the top line display has changed and is now displaying:

T B 0 6 0 W P M N O R C H A R

indicating that the system is now in the Transmit Mode (T), the AFSK MARK/SPACE frequencies are NORmal at 2125 and 2295 HZ, respectively, and that each character will be transmitted as it is being typed (CHAR). Type some Alpha-Numeric text and observe that the typed text is displayed above the split-line and also below the split line. The text which is displayed below the split-line represents the actual text as it is transmitted. The text which is displayed above the line represents the entries into the system's text buffer.

Return the system to the receive mode with the RUN/STOP key by itself or by typing 'CTRL CLR/HOME' (hold the 'CTRL' key and press the key labled 'CLR/HOME'). Observe that the top line display has changed indicating that the system is in the Receive mode. Type in some text and note that it is no longer displayed below the split line.

2.4 SPEED SELECTION COMMANDS:

NOTE: the right hand bracket] is the symbol for a terminated command sequence which required further keyboard input such as speed select or memory store. When you first initiate these commands, you should not see anything on the screen. If you see the '] ' it means that particular command has been terminated. Hitting 'CTRL X' twice for example will only terminate the command without it taking affect.

The operating speed (TTY and MORSE) is selected by means of the 'CTRL X' command. The allowable RTTY BAUDOT speeds are 60, 66, 75, 100, and 132 WPM. ASCII code speeds are 110 and 300 baud. For MORSE, speeds from 5 to 149 WPM are permitted. To select an RTTY (BAUDOT) speed of 66 WPM (SAME AS 50 BAUD), first type 'CTRL B' if not in BAUDOT already, then:

TYPE: 'CTRL X'

(SPEED SELECT COMMAND
NOTHING SHOWS ON THE
SCREEN)

TYPE: 66

(DESIRED SPEED)

TYPE: 'CLR/HOME'

(OR ANY NON-NUMERIC KEY
PRINTS])

Observe that the top line displays

R B 0 6 6 W P M N O R

To select an RTTY (BAUDOT) speed of 100 WPM (same as 75 baud),

TYPE: 'CTRL X'

TYPE: 100

TYPE: 'CLR/HOME'

Observe the speed display on the top line is now 100 WPM.

To select an RTTY (ASCII) rate of 110 baud,

TYPE: 'CTRL A'

System will automatically go to 110 BAUD when ASCII is selected.

Observe that the top line displays A-110 BD (BAUD) where the 'A' indicates that the selected code is ASCII.

To select an RTTY (ASCII) rate of 300 baud, (no need to type 'CTRL A' since you are already in ASCII)

TYPE: 'CTRL X'

TYPE: 300

TYPE: 'CLR/HOME'

Note, if you are in 300 BAUD ASCII, to change to any other speed or code, you must first go to 110 BAUD ASCII. The jump from 300 BAUD ASCII to MORSE or BAUDOT directly is not allowed.

Go back to RTTY (BAUDOT) speed of 60 WPM (Same as 45 baud),

TYPE: 'CTRL B'

TYPE: 'CTRL X'

TYPE: 60

TYPE: 'CLR/HOME'

(ASCII stands for American Standard Code for Information Interchange, whereas 'BAUDOT', pronounced 'BAW DOUGH' is a man's name.)

NOTE, you can omit the 'CLR/HOME' key if you enter the speed with three digits, 110, 066, 075 etc., since the program automatically terminates the command on the third digit.

2.5 MORSE/TTY SELECT COMMANDS:

Enter the MORSE mode by typing 'CTRL M' (hold 'CTRL', press M) and the top display line should read:

R M 0 2 0 W P M N O R

indicating MORSE (CW) mode with speed set for 20 wpm. The system will remember the previous MORSE and RTTY speed when changing to and from modes. Go to the transmit mode by typing 'SHIFT RUN/STOP' and observe that the display has changed and the letter 'T' has replaced the 'R' on the left top display line. Turn up your audio channel volume, and type in some letters and numbers. You will hear the MORSE code as it is displayed below the split-line. To change the speed use the 'CTRL X' command. Also, when the text buffer is empty, if desired, the MORSE equivalent of a "diddle", BT, can be sent. Type 'CTRL D' to toggle the "diddle" mode on/off. To select a MORSE speed of 17 words per minute,

TYPE: 'CTRL X'

TYPE: 17 (NEW SPEED)

TYPE: 'CLR/HOME' (OR ANY NON-NUMERIC KEY)

Observe that the newly entered MORSE speed is now displayed on the top line. Any MORSE speed from 5 to 149 WPM may be selected.

NOTE: In the receive mode, the displayed MORSE speed will usually be within plus or minus one digit of the transmit speed you set. As you receive some MORSE characters, the receive speed readout will track the incoming speed, (assuming speedlock is not enabled) but will not change the selected transmit speed.

Return the system to BAUDOT TTY mode by typing 'CTRL B'. The top line should display,

T B 0 6 0 W P M N O R C H A R

2.6 CLOCK COMMANDS:

The AIR-1 includes a real time clock with a 4 digit display of hours and minutes, and a 3 character time zone. When the unit is first turned on the clock is reset to 00:00. You can set the clock to start at any time by means of the 'CTRL K' command. For example, initialize the clock to start at 1758GMT,

TYPE: 'CTRL K' (CLOCK SET COMMAND—CLOCK DISPLAY WILL FREEZE)
TYPE: 1758GMT (DESIRED TIME AND ZONE)
TYPE: 'CLR/HOME' (THIS STARTS THE CLOCK)

The clock will be restarted at 1758GMT as soon as you hit the 'CLR/HOME' key (or any non-numeric key) and the 2nd video line will display:

17:58 GMT

The clock obtains its timing reference from the CPU Crystal frequency and should maintain good accuracy. The clock will have to be reset if power is lost.

The system's clock time can be transmitted by means of the 'CTRL C' command. Type 'CTRL C' and observe that the clock time is displayed on the lower half of the screen as it is being transmitted. If you turn up the reference tone, you can hear the TTY code being transmitted, as you send the time.

2.7 MEMORY STORE/RETRIEVE COMMANDS:

The AIR-1 VIC-20 version includes a number of user programmable memories. There are 8 message memories of 128 characters each, 2 ID memories of 64 characters each, a WRU memory of 11 characters, and 2 Selective print memories of 11 characters each. You can store messages at any time, even during a transmission. In the "64", the first 7 memories contain 512 characters, #8 has 384 characters, other memories are the same as the VIC-20 version.

You can store your call-sign into the ID memory by means of the 'CTRL L' command. For example, to store the call sign W1USA,

TYPE: 'CTRL L' (HOLD 'CTRL' AND PRESS 'L' KEY
NOTHING SHOWS ON SCREEN)
TYPE: 'SPACEBAR' (PUTS A WORD SPACE)
TYPE: W1USA
TYPE: 'CLR/HOME' (EXITS MESSAGE STORE MODE
PRINTS])

As you type the call-sign in, it will be displayed above the split-line. You can correct typing errors by means of the 'INST/DEL' key. To retrieve and transmit the stored call-sign simply press the 'L' key. The call letters previously stored will be inserted into the text buffer for transmission and displayed above the split-line.

You can store a second call sign by using the CTRL I command. For example, to store the secondary call sign K3ICH/4,

TYPE: 'CTRL I'
TYPE: 'SPACEBAR'
TYPE: K3ICH/4
TYPE: 'CLR/HOME'

The secondary call sign will be transmitted by pressing 'SHIFT £' with a "space" preceding it. You will find it useful to use the secondary ID to store the call of the station you're calling.

To store a message into any one of the 8 available message memories you must first type 'CTRL', and memory number (1 to 8), then enter the message text, and terminate by typing 'CLR/HOME'. For example, to enter: CQ CQ CQ DE N3JL N3JL N3JL into memory number 1,

TYPE: 'CTRL 1'(HOLD 'CTRL', PRESS '1')(NO DISPLAY)

TYPE: CQ CQ CQ DE N3JL N3JL N3JL (TEXT DISPLAYS)

TYPE: 'CLR/HOME' (SHOWS 'J' ON SCREEN)

To send this stored message, simply press and release the 'F-1' key (right hand function keys). In a similar fashion you can store and retrieve messages from the other 7 memories.

If your message is longer than the selected number of characters it will simply overflow into the next message memory location. For example, if you store a message that overflows into memory 2, it will be properly retrieved in its entirety by typing 'F1'. If you type 'F2', you will retrieve the last remaining characters of the message, which overflowed into 'F2'.

You must use the 'CLR/HOME' key, or any 'CTRL' key to terminate and exit the message store mode. If you do not, you will continue to store characters until you have filled the entire message buffer.

Normally, each of the user programmable memories in the VIC-20 version is 128 characters, which leaves about 2,400 characters for the text buffer. By typing CTRL '◊' (up/down cursor) you can create a receive buffer of 1,000 characters. Typing the same key '◊' by itself will send this new memory. The text buffer is shortened to about 1,400 characters when this additional receive buffer is enabled. See Section 7.2.3. for more information on utilizing this receive buffer and "64" data.

You can also recall and transmit two permanently programmed messages. Pressing 'CTRL' followed by the "Q" key, will recall the "QUICK BROWN FOX . . ." message, and following the "CTRL" by the "R" key, will recall the "RYRYRY . . ." message.

Up to 11 characters may be stored into the WRU (Who Are You) memory. To enter the desired keyword,

TYPE: 'CTRL = ' (HOLD 'CTRL', PRESS '=')

TYPE: XYZ . . . (UP TO 11 CHARACTERS)

TYPE: 'CLR/HOME' (PRESS THE 'CLR/HOME' KEY)

The WRU memory functions as follows. Whenever the AIR-1 'hears' or receives the stored WRU KEYWORD exactly, it will automatically go into the transmit mode and, after a short delay send whatever is stored in the ID memory three times (your call sign), along with the contents of the text buffer and then return to the receive mode.

The two selective print memories can store up to 11 characters each. These are entered exactly as for the WRU memory except that you access these memories by typing 'CTRL 9' and 'CTRL 0' respectively.

When the system 'hears' the specific string stored into the "9" memory, the printer port will be enabled, and when it 'hears' the string corresponding to the one stored in "0" memory, the printer port will be disabled. Manually typing 'CTRL P' or 'CTRL V' also enables/disables the printer port. See Chapter 6 for more info.

To display the current contents of these 3 memories press 'CTRL >' (period key). The contents of the "9" memory are shown next to PON: (printer on), and the contents of the "0" memory are shown next to POFF: (printer off).

The "=" memory contains the WRU KEYWORD, shown next to WRU.

You will hear the words, "SEL CAL" (SELECTIVE CALL) and "KEYWORD" used interchangeably on the air.

See Section 7.2.3 for information on creating 'OFF-THE-AIR' Receive Memory.

2.8 TRANSMISSION MODE COMMANDS:

The AIR-1 has a number of transmission modes. In the CHARacter mode (this is the system default mode), each character is transmitted as it is typed. In the WORD mode, an entire string of characters is transmitted as soon as the spacebar key is pressed. In the LINE mode the typed characters are transmitted as soon as the 'RETURN' key is pressed.

The system should be in the transmit mode displaying a 'T' on the left top line; if not, type 'SHIFT RUN/STOP'. Enter the WORD mode by typing 'CTRL W' (hold 'CTRL' and press the 'W' key) and note that the status display on the top line indicates that the WORD mode is active.

Now as you type a word, it will be displayed above the split-line. Press the spacebar on the keyboard and notice that the entire word is displayed below the split line as it is being transmitted. Go back to

CHAR mode by typing 'CTRL W' again, and note the mode displayed on the screen: CHARacter, WORD, LINE mode.

Now enter the LINE mode by typing 'CTRL L'. Type in some text, and it will be displayed on the upper part of the screen above the split-line. Now press the 'RETURN' key and the text will be transmitted and displayed below the split-line.

Note that in the WORD and LINE modes you can edit your text by means of the 'INST/DEL' key since it will not be transmitted until you press the 'SPACEBAR' or 'RETURN' keys respectively. If you are a "hunt and peck" typist, the WORD (or LINE) mode will smooth out your typing and make it sound professional.

Return to CHAR mode by typing 'CTRL W' or 'CTRL L' again. CHAR should then appear if you are in transmit mode.

2.9 TEXT EDITING COMMANDS:

The SPLIT-SCREEN option lets you see what you type, and allows you to correct typing errors before they are transmitted. If you are in the transmit mode, you can enable the WORD or LINE mode as explained above. In the receive mode you can compose and edit larger segments of text. Place the system in the receive mode by typing 'CTRL CLR/HOME'. Type in some Alpha-Numeric text and see it displayed, as you enter it, on the top half of the screen in blue. The characters you are typing are also stored into the system's text buffer memory. When the buffer fills up it inhibits further entry of characters.

You can correct typing mistakes by pressing the 'INST/DEL' key. Pressing this key will cause the previously entered character to be erased and you can correct it. Each press of the 'INST DEL' key will erase one character. Your edited text can be transmitted by typing 'SHIFT RUN/STOP'. This places the system in the transmit mode, and all characters entered into the text buffer will be displayed below the split line as they are transmitted.

The entire text buffer may be cleared at any time by typing 'CTRL CLR /HOME'. This will also clear the screen and place the system in the receive mode.

You can repeat a segment of text by means of the '←' key. To repeat the transmission of a text segment first type 'SHIFT ←' (press the 'SHIFT' and '←' keys). This serves to point to the beginning of your text. Now enter your text, which will be transmitted if you are in the transmit mode. Press the '←' key and the text will be repeated. Press it again and it will be repeated for the third time. For example, with the system in the receive mode,

TYPE: NAME IS
TYPE: 'SHIFT ←' SPACEBAR
TYPE: JOHN
TYPE: '←' '←' (PRESS '←' 2 TIMES)

This will be entered into the text buffer and will be displayed above the split line as

NAME IS JOHN ← ←

The "CHECKER BOARD" on the screen is a symbol for the 'SHIFT -', and the other two symbols represent the repeat function as entered in the text buffer.

Now press 'SHIFT RUN/STOP' or 'SHIFT RETURN' to enter the transmit mode. Observe the text which is displayed below the split-line as it is being transmitted. The word JOHN is sent 3 times, with a space between.

A segment of text may be repeated continuously, until stopped, by means of the 'CTRL →' command. The procedure is similar to the above example except that you type 'CTRL →' in place of '→'. For example, to send a continuous CQ message,

TYPE: 'SHIFT ←' (THIS SETS "BEGIN TEXT
POINTER")
TYPE: 'RETURN' (WILL START NEW LINE)
TYPE: CQ CQ CQ CQ DE N3JL N3JL N3JL
TYPE: 'CTRL ←'

observe the following display above the split line



CQ CQ CQ CQ DE N3JL N3JL N3JL £

The "CHECKER BOARD" is the symbol for shift \leftarrow . The reversed left arrow is the symbol for the RETURN (carriage return and line feed) key. The \mathcal{L} is the symbol for the infinite repeat key as entered in the text buffer.

This text will now be transmitted continuously as long as you are in the transmit mode ('SHIFT RUN/STOP'). Transmission will stop as soon as you go to the receive mode ('RUN/STOP') — it will restart if you return to the transmit mode by pressing 'SHIFT RUN/STOP'. You can also stop the continuous repeat function by pressing the 'INST/DEL' key and removing the infinite repeat command from the text buffer. If you type 'CTRL ←' and reinsert this command it will start again.

CHAPTER 3

'AIR-1' TRANSCEIVER CONNECTIONS

The AIR-1 provides all of the interfaces required for direct hookup to your transceiver (or transmitter and receiver). For the following description refer to the rear connection diagram. (Page B-3)

3.1 CW KEYING:

The \pm KEY jack provides the necessary connections for both positive (cathode, solid state) and negative (grid block) keying of most transceivers or transmitters. Before you actually make the connection to your keying line make sure that the open key voltage and closed key current do not exceed the following:

maximum negative keying voltage	-150 volts
maximum key-down negative current	50ma
maximum positive keying voltage	40 volts
maximum positive key-down current	100ma

Most popular modern transceivers will be within the allowable keying ratings, and you will be able to utilize this solid state \pm KEY jack on the AIR-1.

Check your transmitter CW keying specifications or verify them by actual measurement. Place a voltmeter across the transmitter CW keying line and ground. For negative keying connect the positive voltmeter lead to ground, the negative to the keying line. For positive keying reverse the voltmeter leads. With your transmitter on in the CW mode note this open key voltage. For positive keying transmitters place a milliamper meter in series with the CW keying line and ground. Close the keying line and note the value of this key down current. Typically, grid block keyed rigs use about -40 to -60 volts on the key to cut off the tube(s). Key down current is usually only a few millamps. Most solid state rigs switch +12 volts to ground with key down current being only about 5 to 20 ma. In the event your transmitter keying requirements exceed the above listed ratings, do not use the \pm KEY jack for CW keying. You will have to use an external keying relay (see Appendix A — External Relays).

NOTE: The keying outputs are directly connected to the collector of transistor switches through a series diode. NPN for positive and PNP for negative voltage. These are driven into saturation and therefore the outputs are pulled to within about 0.7 volts from ground. If your radio requires that the positive voltage keying line be pulled to a few tenths of a volt from ground, you can short out diodes D-5 and D-6, (lower left board). (This can also be accomplished by installing jumpers J2 and J3 on the C-64 version board. See Page B-3.)

3.2 TTY KEYING:

If your transmitter has provisions for FSK (Frequency Shift Keying) and the keying requirements are within the voltage and current limits described for CW, you can use the \pm KEY output for RTTY as well as CW. You will have to measure the voltage and current requirements of your transmitter's FSK keying line just as you did for the CW key.

If you choose to use the AFSK (Audio Frequency Shift keying) which is provided in the AIR-1, simply connect a shielded cable between the AFSK-PTT jack on the AIR-1 and the microphone input of your transceiver. The AIR-1 AFSK output is preset at the factory for MARK = 2125HZ AND SPACE = 2295HZ. By placing your transceiver in LSB you will transmit proper RTTY shifts. Some transceivers have an RTTY receive position which you can use instead of the LSB position.

NOTE: Even though the sideband phone convention is to use LSB on 160, 80 and 40 meters and USB above, the RTTY convention is to have "mark high" on all HF bands (when using LSB, the absolute transmitted frequency of the 2125HZ "mark" would be "higher" than the 2295HZ modulated space frequency). The VHF/UHF AFSK convention on the other hand, is to have "mark-low" which of course would occur when using the same 2125HZ mark and 2295HZ space tones to amplitude or frequency modulate a carrier.

Use of RTTY with FM (Frequency Modulation) on the VHF or UHF bands will also require the use of AFSK. Simply connect the AFSK output on the AIR-1 to your FM transceiver microphone input.

3.3 TRANSMIT/RECEIVE SWITCHING:

The AIR-1 has provisions for automatically switching your transceiver between receive and transmit. The jack labeled AFSK-PTT provides a closed contact to ground whenever the AIR-1 is in the transmit mode. The PTT control will open its grounded contact as soon as you have switched the system from transmit to receive mode ('RUN/STOP' command).

The T/R control output (PTT) is a solid state switch capable of handling a positive voltage of up to +40 volts at a maximum of 100 ma. These limits are well above the requirements of most modern transceivers. In the event that the T/R switching will not handle your radio's requirements, you will have to use an external relay for T/R control (see Appendix A — External Relays).

The AFSK-PTT jack (tip) should be connected to your transceiver's PTT (Push To Talk) line, or the transmit/receive switching jack usually found on a rear panel connector of most transceivers. The AFSK output is available on the "ring" of this 3 circuit jack. For details refer to the rear connection diagram.

3.4 AUDIO INPUT:

Audio from your receiver (transceiver) is connected to the SPKR AUDIO jack on the AIR-1. Connect a shielded cable between the speaker output of your transceiver (receiver) and the SPKR AUDIO input on the AIR-1. You will note that there are two "SPKR AUDIO" phono jacks on the AIR-1. These are jumped on the board. This allows you to plug one cable from your radio to the AIR-1, and one cable out to your external speaker, eliminating the need for a "Y" connector. Refer to the diagram showing the AIR-1 rear connections.

CHAPTER 4

'AIR-1' RTTY OPERATION

The AIR-1 contains an AFSK demodulator designed to receive both amateur and commercial RTTY signals. If you are not familiar with RTTY, it is suggested that, before proceeding further, you read one of the RTTY-PRIMER handbooks.

The "WIDE-NARROW" switch selects between 170HZ "NARROW" shift, and 425/850HZ "WIDE" shift.

At the present time the 170HZ shift is in almost exclusive use by amateur RTTY operators. The standard tones for USA amateurs are 2125HZ mark frequency, and 2295HZ space frequency, whereas the European amateur standards are 1275HZ mark and 1445HZ space. Since both utilize 170HZ shift they are fully compatible on HF RTTY. As a matter of fact all tone pairs utilizing 170HZ shift will be compatible on HF RTTY.

Selection of inverted RTTY reception is accomplished by means of the 'CTRL -' (minus) command. 'CTRL +' (plus) selects normal (noninverted) RTTY operation. These commands are valid for receive and transmit.

The selected mode is always displayed on the top video line as NOR or INV whenever the system is in the Transmit or Receive mode.

In addition to the dual tone AFSK demodulator, which is the preferred detection method the user has the option of selecting a single channel (MARK or SPACE only) detector for reception of RTTY. The 'CTRL N' command is a toggle action function used to switch between the AFSK demodulator, and the single channel detector. When using the SINGLE TONE method, the receiver is tuned to an 800 HZ beat note and the RTTY cross hatch tuning aid is inhibited. In its place, a "GRID-BLANK" is displayed. This indicates that the single tone detector has been selected. In the normal reception mode this 800HZ note represents the MARK whereas in the inverted mode it represents the SPACE tone. You would use the single tone indicator red dot for tuning. This single tone detector is only suitable for HF RTTY and can not be used on VHF where AFSK is utilized. Also, note that since the single tone circuit is optimized for Morse code which is usually a much slower "BIT" rate, it is not suitable for the higher RTTY speeds of 110 and 300 BAUD.

If using the 800HZ single tone detector for RTTY, make sure that the "WIDE-NARROW" switch is in the "NARROW" mode. Otherwise, both mark and space tones will be simultaneously detected as one single tone and no decoding will take place. Always select the single tone detector after speed selection in RTTY, otherwise the tone select will shift back to the 2125/2295 instead of 800HZ.

4.1 AMATEUR OPERATION:

Place your transceiver in the RTTY mode (or LSB if RTTY is not available) and tune in an amateur RTTY signal. A good band to try is the 20 meter amateur band between 14080 and 14100 KHZ. Try to locate a relatively strong RTTY signal, and listen to the received audio. Your receiver should be tuned so as to produce the 2125/2295HZ tone pair. Note! you may be using a transceiver which "inverts" the RTTY signal. For example, the ICOM-701, when placed in the RTTY position, will invert the signal, but will not invert it if placed in the LSB mode. If your transceiver "inverts" the signal, place the AIR-1 in the INV mode by typing 'CTRL -' (minus). Transceivers such as the DRAKE TR7, or the KENWOOD TS820 do not invert the received RTTY signal. To insure compatibility, we recommend using LSB with the AIR-1 in normal mode.

When the signal is properly tuned, the on screen tuning indicator will flash on/off in synchronism with the incoming audio tones. The cross hatch tuning aid simulates the pattern observed when using an oscilloscope for tuning. Proper tuning is in the center when a cross is displayed. The mark displays a horizontal bar and space displays a vertical bar. You will also note that when properly tuned, the red dot "single tone indicator" is on constantly. As a further aid in tuning, the VIC tone synthesizer is used to generate an 800HZ switched reference tone. This tone is available on your television (monitor's) audio channel through the speaker just as various sound effects are heard when using game programs. Simply turn up the volume on the TV to hear the tone. The tone should sound clean and should be synchronized with the tuning indicator.

Set the system to 60 WPM RTTY operation as this is currently the most popular speed used by amateurs. The mode and operating speed are permanently displayed on the top line of your video screen. To change the operating speed use the 'CTRL X' command to set it directly.

If you are properly tuned, the tuning indicator will alternate between a vertical and horizontal bar at the received bit rate which appears as a cross. If you turn on the reference tone, it should sound clean and be in sync with the received audio.

4.1.1 SELECTABLE OPTIONS:

RTTY reception is further enhanced by means of a number of keyboard selectable options. For a full description of the available RTTY commands see Chapter 7.

You can eliminate the display of most non RTTY signals such as voice or CW by enabling the ANCW (ANTI-CW) option. This option is commanded ON/OFF by means of 'CTRL T' command. When enabled, this ANCW option will inhibit the display of voice and most CW signals. It will also inhibit the display of inverted RTTY signals. There will, however, be a slight delay when you first tune a new RTTY signal before the display is presented on the screen. The letters 'ANCW' will appear on the top line display when in RTTY receive mode.

The actual software (program) operation of the 'ANCW' is to inhibit the video display until 10 properly timed stop bits are received in a row. If two stop bits are missed, the "10" counter is reset and the display is disabled until 10 more stop bits are received in order.

The Unshift On Space function when enabled, will cause an automatic shift to the LTR (lower case) mode upon the receipt of a BAUDOT word space code. In transmit, an extra FIG code will be sent following a space if necessary, so that if the receive station is in "UNSHIFT" mode he will copy properly. This option is useful in that it will not get the system "hung-up" in the FIG (upper case) mode in the event of a failure to detect a BAUDOT LTR (down-shift) code. This option is enabled and disabled by means of the 'CTRL U' toggle action command. When receiving Weather Reports, turn the 'UNSHIFT' option off, as they do not send a FIG shift after each group of numbers. When not in "UNSHIFT" mode, the AIR-1 will react like a mechanical teleprinter in both receive and transmit. When enabled, the letter 'U' will appear near the right side of the top line. It is initially on at power up, and not displayed during transmit.

The reception of a CR (carriage return) code causes the display to start a new line. The system may be inhibited from starting a new line when the CR code is received. The CTRL F command is used to enable and disable the start of a new display line when the CR code is received.

Many printers automatically insert a line feed after receiving a carriage return. By utilizing the CTRL F command, double spacing can be eliminated on these printers.

To transmit, simply type 'SHIFT RUN/STOP' or 'SHIFT RETURN' placing the AIR-1 in the transmit mode. Your transceiver should automatically switch from receive to transmit provided the PTT output on the AIR-1 is connected to your transceiver's send/receive line. Any characters typed on the keyboard will be displayed above the

split-line as they are being typed. The text will be displayed on the lower part of the screen as it is being transmitted. If you turn up your monitor's audio volume, you will hear a steady tone (MARK) between characters. This tone, will switch off/on as characters are being transmitted.

You can enable and disable the SYNC (diddle or blank fill) option by typing 'CTRL D'. Enabling this option will cause the system to transmit a non -printing blank code (blank fill) whenever the text buffer is empty and there are no characters to transmit.

You do not have to worry about transmitting LTR or FIG codes in BAUDOT as the system takes care of this automatically. To send LTR code manually type 'SHIFT <', and to send FIG code manually, type 'SHIFT >'. The system also takes care of sending an automatic CRLF (carriage return/line feed) after a fixed number of characters in a line. This fixed number of characters (up to 80), is keyboard selectable. The system's default value is 72 characters. To select a value, type 'CTRL <', followed by the desired number, followed by any alpha key. To eliminate this automatic CRLF feature simply select a value of 0 characters per line. Auto CR/LF is disabled on power up. See section 7.3.2 for "BREAK BUFFER" operation.

In the actual QSO you can take advantage of the split-screen and edit capabilities and thus enter your text while the other station transmits. You will find it convenient to terminate your text typing 'SHIFT †', since this will automatically switch you back to receive mode as soon as all of the text preceding this 'SHIFT †' has been transmitted. This command will show in the text buffer as '†'.

4.2 COMMERCIAL RTTY:

Your AIR-1 can be used to copy many commercial RTTY stations transmitting news bulletins and weather data. While the use of a general coverage receiver is most useful, you will find some signals just above the amateur HF bands.

Most of these transmissions will be at 66 WPM (50 baud) with a few, especially weather stations, at 100 WPM (75 baud). These speeds are available to you by means of the 'CTRL X'.

You may also encounter some stations which are utilizing a non Latin alphabet, such as Russian, Arabic, etc. You will of course not be able to decode such transmissions. You should however find numerous stations using the standard Latin character set with transmissions in various languages including English.

Commercial stations in general use a wider shift, with 425HZ as the most typical. Your "NARROW-WIDE" switch should be in the "WIDE" position.

Note that there are many stations transmitting in other codes such as the 7 level ARQ code, or an encrypted code which you will not be able to copy. (AMTOR versions can copy 7 bit ARQ code)

You may use the AIR-1 dual tone demodulator to copy these commercial RTTY signals. The "NARROW" mode is optimized for 170HZ shift signals. In order to copy a 425HZ or a 850 HZ shift signal you would switch to "WIDE" and tune it in the same as a 170HZ shift but the MARK and SPACE tones would simply be farther away from the same center frequency as when using the narrow bandwidth position.

Note that WEATHER bulletins appear in a fixed format. The start of a bulletin is indicated by the 4 letter group ZCZC, and its end by the letter group NNNN. The actual weather information consists mostly of a number of 5 figure groups, interspaced with plain English and abbreviations.

When receiving a Weather bulletin, turn off the unshift on space option in order that you do not shift to letter mode when they send a word space code. If the "UNSHIFT" is on, you will print letter groups instead of figures. You can toggle the "UNSHIFT" option on/off by means of the 'CTRL U' command. If you miss a "FIG" code, you can force the unit to "FIGS" by typing "CTRL Y." This has the same effect as if you received the "FIG" code.

4.3.1 DEMODULATOR:

The proper demodulator circuit is automatically selected when changing modes. The dual tone (mark and space) is for RTTY and the 800HZ single tone decoder is for CW. You can, however, manually override this selection by typing 'CTRL N'.

The on-screen tuning indicator tells you which circuit has been selected. The cross pattern is displayed for dual tone (blank with no signal) and a red dot is used for single tone (red ring for no signal or 'KEY-UP'). The red dot should stay "on" (filled in) in RTTY. If it goes out, it is an indication of signal drop out or mistuning. In addition, the copying logic can be inverted by typing 'CTRL -' (minus). Similiarly, 'CTRL +' (plus) returns to normal select. The single channel detector is not suitable for faster RTTY speeds of 110 and 300 BAUD because it is optimized for MORSE. It is, however, adequate for 60 to 100 wpm BAUDOT RTTY.

4.4 AFSK MODULATOR:

The user may adjust for any pair of AFSK frequencies in the range from 1500 to 3000HZ. Thus there is a wide choice of both MARK and SPACE frequencies. The system is factory set for: MARK = 2125HZ, SPACE = 2295HZ. These are the standard frequencies for popular 170HZ shift, which are also compatible with the dual tone demodulator. (See Appendix B for adjustment instructions.)

4.5.4 SYNC LOCK:

Pressing 'CTRL O' will cause the RTTY stop bit to be extended to full character length, thereby slowing the transmission rate to half its normal value. This makes it easier for the receiver to copy especially in ASCII mode since it will help him to re-synchronize much faster. To disable this feature simply re-enter the RTTY speed using the 'CTRL X' command. This feature functions in BAUDOT as well as ASCII, thus enabling a "paced" transmission, slowing the actual data rate to allow for slower typing speeds.

CHAPTER 5

'AIR-1' CW (MORSE) OPERATION

The AIR-1 is designed to generate perfect MORSE code up to a speed of 149 WPM. The received code will be properly displayed even though not sent by machine. The AIR-1 will properly decode most hand sent MORSE provided sufficient spacing exists between characters.

The decoding algorithm is designed to continuously measure the average length of both dots and inter-element spaces. The decoding decision logic is such that if an observed space is longer than twice this measured inter-element space it is considered to be a character space. If it is longer than 5 inter-element spaces, it is considered to be a word space. Similarly, an observed mark (key down) is considered to represent a dash if it is longer than twice the measured average dot length.

Since for "perfect" code, a dash = 3 dots, an element space = 1 dot, a character space = 3 dots, and a word space = 7 dots, the above algorithm is very suitable. Furthermore, this algorithm will also decode less than perfect code, and is quite tolerant of extreme dash to dot ratios. The more severe restriction is that for inter-character spacing. In order to decode properly, the inter-character spacing must be at least as long as two times the average element spacing.

5.1 HAND KEY:

Before proceeding with "on the air" reception, you may find it useful and instructive to experiment with a hand key. Connect a hand key to the "HAND-KEY" jack on the rear of the AIR-1. This should be connected to the center pin of the phone plug as shown in the diagram illustrating the rear panel connections. The other hand-key terminal is grounded (sleeve of connecting plug). The HAND-KEY input simultaneously drives the AFSK modulator and CW output keying circuits as well as inputting to the computer when in receive mode.

Place the system in the MORSE mode by typing 'CTRL M'. Disconnect or turn down the audio from your receiver, and connect the hand-key. With the unit in the Receive mode send some V's with the hand-key. If you do not display these V's you must "calibrate". Speed calibration is accomplished by manually telling the system the approximate speed you are asking it to copy. You need not be extremely ac-

curate in your estimation since the AIR-1 allows a $\pm 50\%$ error in actual speed. Also, the "DEFAULT" speed is set to 20 WPM which will be close enough to the typical speeds in common use so as not to need any "RE-CALIBRATION."

Now try sending some code by hand and observe the display. Notice that your sending speed will be displayed on the top line. The displayed speed will change as you speed or slow your sending.

Experimenting in this fashion with hand sent code will assist you in becoming familiar with the MORSE decoding algorithm. You can also listen to your code by turning up the volume on your video monitor's audio channel.

Now enable the SPEED-LOCK feature by typing 'CTRL T'. You should still be able to speed up or slow down within the $\pm 50\%$ range and properly display the decoded characters, however the speed display on the top line will no longer be updated. You may still calibrate the system to your fist by pressing 'CTRL X', then the speed. Note that when the SPEED-LOCK is enabled, the word 'LOCK' appears in the status block on the top video line.

Remember that the speed displayed on the top line simply represents the system's internal value of the average dot + element space. For example, consider the case of the perfect code at 20 WPM. Both dot and element space will be equal in length, the actual dot length will be .06 seconds. This is based on the formula,

$$(\text{speed in WPM}) \times (\text{dot length in seconds}) = 1.2$$

Thus, when the top line displays a MORSE speed of 20 WPM it means that the system's current value for the so called "average dot" is 60 milliseconds. All incoming code elements (dots, spaces, dashes) are then compared against this current "average dot" value as part of the decoding algorithm's decision process as previously described. This "average dot" is continuously being updated based on the incoming code elements, and the speed display gets updated periodically.

5.2 RECEIVING:

You should now be ready to copy MORSE signals from your receiver. Entering this mode will automatically enable the single channel detector. To verify simply observe the topline display. The cross hatch is inhibited and the red dot is used as the tuning indicator. Note that "NOR/INV" does not function in MORSE.

Disconnect the hand key input, and reconnect the audio from your receiver to the rear panel of the AIR-1. Tune the receiver to a MORSE signal, and place your receiver's AGC in the fast position. The "WIDE-

"NARROW" switch should be in the "NARROW" position resulting in an effective CW copying bandwidth of about 200 to 300HZ. The bandwidth in the "WIDE" position is over 800HZ, too wide to separate signals in a crowded band, but is useful in auto-response operation on VHF for example since tuning is much less critical and QRM is not a problem.

As you tune the signal across your receiver's pass band you should be able to hear a regenerated signal if you turn up the audio volume on your video monitor (or television). In the single tone mode the system is designed to "hear" an 800HZ note, and the internal reference oscillator is set to this value. If you are properly tuned, the regenerated tone should sound "clean" and the on-screen indicator will flash in unison with it. A key down (mark) causes the red circle indicator to fill in and the reference tone to be heard. O = key up • = key down. (C-64 display does not show circle, just blank or dot.)

You will be properly tuned if the audio from your receiver matches, that is, zero beats with the frequency of the internally generated 800HZ note. A little bit of experimentation is all that is required to display good copy on the screen. If the receiver volume is too high, the tone will be raspy all the time and the red indicator will flicker constantly even though there's no input signal. Turn down your radio's audio so that with no input signal, the red indicator does not flicker and only an occasional 'beep' is heard from the monitor's audio channel. (See Appendix B for information on varying the detection threshold.)

Of course, under marginal reception conditions you can expect less than perfect copy even if the code is machine sent. In general it is best if you use a fast AGC in your receiver.

Under noisy conditions you will find it best to use the SPEED-LOCK feature since noise pulses may falsely set the system's internal "average dot" to value representing a very high speed. Note that even with SPEED-LOCK the system still tolerates reasonable speed variations up to about $\pm 50\%$. As you will usually send and receive at the same speeds it is most convenient to simply select the operating speed by means of the CTRL X command, and enable the SPEED-LOCK by typing 'CTRL T'.

You will also find that your receiver's CW filter is helpful in rejecting nearby signals from interfering with the reception of the desired signal. The AIR-1 includes a sharp 300HZ effective bandpass which is sufficient for rejecting undesirable signals. Your receiver's AGC however may act in such a way as to reduce its gain due to a strong signal near the desired one. This is a case where a sharp CW filter in your receiver's IF will be very useful. If you do not have one, you may find it desirable under such conditions to completely turn off your receiver AGC, and backoff on the RF gain.

The de-coding algorithms used in the AIR-1 program provide copying ability as good as a machine is capable and are considered the best in the industry. However, you will probably observe that manually sent code, such as by means of a hand key, will not be properly decoded if it is sent "all bunched together" without sufficient inter-character spacing. It is a common tendency of many CW operators to suddenly speed up and leave insufficient spacing. This is especially true when the call sign is sent. You can improve on the reception of such senders by selecting a slightly higher speed than he is using. For example, if his average speed is 20 WPM, set the system to a speed of 27 WPM by means of the CTRL X command. Also make sure that the SPEED-LOCK feature is enabled. Use of this technique will enable you to copy the "FAST DOTS" and "SLOW DASHES" typical of semi-automatic key users.

As mentioned previously, if you were using 300 BAUD ASCII, you must first go to 110 BAUD, then to MORSE or BAUDOT. The jump from 300 BAUD to any speed other than 110 BAUD is not allowed.

5.3 TRANSMITTING:

To transmit you simply type 'SHIFT RUN/STOP'. Your transceiver should switch to transmit mode if the PTT is tied to your transceiver's send/receive line. The top display line will indicate that the transmit mode is active ("T" replaces the "R" on the left side of the top line video display) and it will also display the MORSE speed.

If you now type text on the keyboard, it will be displayed on the top half of the screen in blue as each character is typed. The text will also be displayed below in black as each character is sent. You can hear what you are sending by turning up the audio volume on your monitor. At the end of your text type 'SHIFT ↑' in order to automatically return to the Receive mode as soon as all of the previously entered text has been transmitted. ('SHIFT ↑' is displayed as reversed up arrow.)

If you are a slow typist, and you are sending fast code, you may find it useful to use the WORD mode (CTRL W) so as to send your text in bursts of entire words.

With the SYNC = ON, you will automatically send BT (- . . . -) code, whenever the text buffer is empty, and there are no characters to send. This feature is helpful when you want to keep the communication channel active during idle transmission periods. To turn this option off, simply type 'CTRL D' again. Refer to Chapter 7 for listing of commands.

CHAPTER 6

'AIR-1' PERIPHERAL DEVICES

6.1 PRINTERS:

The VIC/Commodore printer will work acceptably with the AIR-1 as will a standard Centronics parallel type. The VIC/Commodore printer connects as it normally would to the appropriate 'DIN' connector on the VIC-20 or 64. The ON/OFF toggle command for the VIC printer is 'CTRL V' (displays 'V'). The same command for the parallel printer is 'CTRL P' (displays 'P'). Either (not both) can be used. If the VIC printer is not connected or unable to accept data, the 'V' will not be displayed and the screen will 'freeze' for a few seconds until the AIR-1 decides not to wait any longer for the printer 'HAND-SHAKE.' Note that the AIR-1 expects the VIC printer to be "DEVICE NUMBER 4".

CTRL F3 (function key 3) causes the VIC printer to print oversize letters. CTRL F1 resets to normal letter size.

Once the VIC/Commodore printer is selected by typing 'CTRL V', either 'CTRL V' or 'CTRL P' will act as the ON/OFF toggle. The last one selected determines which is enabled automatically by the 'P-ON' SEL CAL. If you are using the parallel port with automatic 'SEL-CAL' control, type 'CTRL P' twice, once for enable and once for disable. This tells the AIR-1 that it should write out to the 'user port.'

Both these outputs are code and speed converted and any text appearing on the bottom of the screen will be printed. The parallel output uses the following pins on the VIC-20 or '64' 'user's port'. The pins in parentheses are for the '64' port.

COMPUTER'S USER PORT		SIGNAL TO PRINTER	
PIN C	PB0	DATA 1	PIN 2
PIN D	PB1	DATA 2	PIN 3
PIN E	PB2	DATA 3	PIN 4
PIN F	PB3	DATA 4	PIN 5
PIN H	PB4	DATA 5	PIN 6
PIN J	PB5	DATA 6	PIN 7
PIN K	PB6	DATA 7	PIN 8
PIN L	PB7	DATA 8	PIN 9
PIN M(8)	CB-2	STROBE	PIN 1
PIN 4(M)	JOY 0	BUSY	PIN 11
A-N-1-12	GND	GROUND	PIN 19 thru 30 AND PINS 14, 16, 17, 33

6.1.1

The jack on the AIR-1 marked "PRINT OUT" is not code converted and is driven simultaneously with the keying output. It is capable of switching up to +100 volts dc to ground at up to 100 mA. This should be adequate for all 100 volt/60 mA current loop printers. Note that the tip of this jack must be positive and is switched to chassis ground by an internal darlington transistor pair.

Note, continuous 300 BAUD data will exceed the mechanical print speed capability of the VIC printer and characters will be lost. It is, however, adequate at slower rates, or if breaks in transmission are allowed.

6.2 SAVING MEMORIES ON TAPE

The eight user memories including the two ID's occupy memory locations \$19CF to \$1FFF (6607-8191 decimal) in the VIC-20, and \$C000 to \$CFFF (49152-53247 decimal) in the "64." You can save these to tape by first going to VIC-basic and using the following "SYS" commands to save and load.

First, go to BASIC by typing 'CTRL COMMODORE' (HOLD 'CTRL', and hit the commodore key located on the bottom left row). To save the memories to tape,

for VIC-20	for "64"
type:	type:
SYS 40985	SYS 32793 (location of tape save routine)
RETURN	RETURN

You will then be requested to press "PLAY" and "RECORD" on your data set. When memory save is finished, the program will automatically jump back to "AIR-1". You can continue normal operation, or shut down knowing your programmable memories are safe on tape for later.

When loading the memories, go to VIC-BASIC, as when "SAVING", then

for VIC-20	for "64"
type:	type:
SYS 40988	SYS 32796 (location of tape load routine)
RETURN	RETURN

Press "PLAY" on the data set. When finished, the program will jump to AIR-1 as before, ready for communication.

6.3 64 DISK PROGRAM

We have included with the "C-64" version of the AIR-1 a disk operating system program in BASIC. You should manually enter this program and save it as the first file on a new disk. You can then save or load either your programmable messages, or the data in your receive buffer. A 10 character file name makes it easy to search the directory for a particular message. This menu based system allows the disk to be filled in 14000 character blocks so that many messages, bulletins, etc. can be archived or retransmitted. The operation is similar to using a disk for normal BASIC program storage and retrieval. Once a stored message is re-loaded back into the computer, it can be reviewed, printed or transmitted, just as if you had typed it in.

6.4 JUMPS TO/FROM BASIC

The AIR-1 program for both the VIC-20 and the "64" allow transition to and from BASIC without "POWER-DOWN" or master reset, thus preserving your user programmable memories. This is known as a "WARM-START" as opposed to a "COLD-START" which leaves all memory empty.

When going to BASIC from the AIR-1 program by typing 'CTRL COMMODORE', the memories are preserved. To return to AIR-1 program:

for VIC-20	for "64"
type:	type:
SYS 40976	SYS 32784 (location of WARM-START routine)
RETURN	RETURN

Note also that the "COLD-START" command is

for VIC-20	for "64"
type:	type:
SYS 40969	SYS 32777
RETURN	RETURN

which erases all memory same as master reset or power down.

CHAPTER 7

'AIR-1' KEYBOARD COMMANDS

7.1 ALPHA NUMERIC LISTING

KEYS PRESSED	DESCRIPTION
CTRL A	Go to ASCII code RTTY.
CTRL B	Go to BAUDOT code RTTY.
CTRL C	Send clock time. Sends 4 digits plus zone. Time sent is actual time of transmission — not the time of command entry.
CTRL D	Sync (DIDDLE) ON/OFF. When sync is enabled and system is in transmit mode, an RTTY blank code or MORSE BT code will be transmitted if the text buffer is empty.
CTRL E	Delete receive buffer and return transmit buffer to normal size, erase screen, buffer and go to receive.
CTRL F	Ignore received carriage return code. ON/OFF toggle.
CTRL G	64 only — Change screen colors See 2.3
CTRL H	64 only — Horizontal screen shift See 2.3 2.2 1
CTRL I	Enter secondary ID text, of up to 64 characters. Follow the 'CTRL I' by the desired text, and terminate by typing 'CLR/HOME' key. Text will be entered into the text buffer for transmission by typing 'SHIFT £'.
CTRL J	AMTOR only— invert video display of transmitted text
CTRL K	Set clock.
CTRL L	Line mode, ON/OFF toggle.
CTRL M	MORSE mode selection. If system is in RTTY it will switch to MORSE.
CTRL N	Use single tone 800HZ detector for RTTY. Mark only is normal. Space only is inverted. No action in MORSE.
CTRL O	Enable synclock mode for RTTY transmission.
CTRL P	Parallel (Centronics) Printer enable/disable toggle . Displays 'P' when enabled.

KEYS PRESSED	DESCRIPTION
CTRL Q	Send "QUICK BROWN FOX" test message
CTRL R	Send "RYRY"
CTRL S	Split screen toggle On/Off.
CTRL T	MORSE speed-lock On/Off. Top line video displays "LOCK" when enabled in speed-lock mode. If "LOCK" is not displayed when in MORSE receive, the automatic speed tracking is enabled.
	RTTY-ANTI-CW ON/OFF TOGGLE. This feature if enabled in RTTY mode will inhibit display of non RTTY SIGNAL. Displays 'ANCW' when enabled.
CTRL U	'UNSHIFT ON SPACE' ON/OFF toggle. When selected, the reception of a baudot space code (11011) will cause automatic shift to lower case letters mode.
CTRL V	VIC printer enable/disable toggle. Displays 'V' when enabled.
CTRL W	Word Mode ON/OFF toggle.
CTRL X	Select operating speed. Follow this command by the desired speed in WPM for MORSE or BAUDOT, and in ASCII, by the baud rate.
CTRL Y	Changes current case during reception. FIG to LTR or LTR to FIG.
CTRL Z	No action.
CTRL 1	Load memory F1
CTRL 2	Load memory F2
CTRL 3	Load memory F3
CTRL 4	Load memory F4
CTRL 5	Load memory F5
CTRL 6	Load memory F6
CTRL 7	Load memory F7
CTRL 8	Load memory F8
CTRL 9	Load printer ON SEL CAL
CTRL 0	Load printer OFF SEL CAL
CTRL ⇧ (cursor up-down)	Creates 1000 character receive buffer message. Clear by typing 'CTRL E'.

KEYS PRESSED	DESCRIPTION
CTRL ←	Same as repeat function key “←” except that text will be repeated continuously. To stop type ‘CTRL CLR/HOME’ which will clear the buffer or type backspace key (INST/DEL) which removes the infinite repeat command.
CTRL +	IN RECEIVE — Go to “normal” RTTY demodulation (MARK LOW) IN TRANSMIT — Set AFSK to normal mark = 2125HZ space = 2295HZ
CTRL-(minus)	IN RECEIVE — “INVERT” RTTY demodulation (MARK HI) IN TRANSMIT — “INVERT” AFSK, mark = 2295HZ space = 2125HZ
CTRL £	User’s ID of up to 64 characters is entered by means of this command. Follow with the text and terminate by pressing the ‘CLR/HOME’ key. To send the ID the user presses the £ key.
CTRL CLR/HOME	Halt transmission and go to receive mode. Erase text buffer and entire screen.
CTRL INST/DEL	No action.
CTRL @	Go to AMTOR with 80 msec Slave PTT delay in mode A.
CTRL *	Go to AMTOR with 40 msec Slave PTT delay in mode A.
CTRL †	No action.
CTRL RESTORE	No action.
CTRL RUN/STOP	No action.
CTRL =	Load WRU SEL CAL (KEYWORD)
CTRL C = (Commodore key)	Go to “BASIC”, normal VIC-20 computer operation. To re-enter AIR-1 communications mode type “SYS” command then ‘RETURN’ key. Select number of characters per line. Follow this command by a number representing the number of characters to be transmitted prior to the transmission of an automatic CRLF (Carriage return, line feed) code, which is off at power up. The numeric entry is terminated by typing CLR/HOME. Screen will then display entry bracketed by ‘#’ & #’.
CTRL <	Display contents of WRU, print on, print off SEL CALS
CRTL >	Display contents of WRU, print on, print off SEL CALS

KEYS PRESSED	DESCRIPTION
CTRL ?/	No action.
CTRL F 1	Restores VIC printer to normal size print.
CTRL F 3	Causes large character print on VIC printer.
CTRL F 5	Enables storage into receive memory buffer.
CTRL F 7	Disables (stops) storage into receive memory buffer.
CTRL "SPACEBAR"	The space bar and CTRL keys are pressed to change intercharacter spacing for MORSE code. There are three progressively longer than normal spacings selected with each 'CTRL SPACEBAR' command.
SHIFT ←	Pointer for repeat function. This character enters the text buffer and acts as a "BEGIN REPEAT" text pointer.
SHIFT +	Enter 'BREAK BUFFER' mode which halts text entry into normal buffer and saves current text buffer pointers. Typed text is sent directly when going to 'TRANSMIT' without its being placed in the text buffer.
SHIFT -(minus)	Exit 'BREAK BUFFER' mode. Normal text buffer is undistributed. (Go to receive first, otherwise transmission of normal text buffer will commence.)
SHIFT £	Place secondary ID text into text buffer. NOTE: ID'S CANNOT BE LOADED INTO "F1-F8" MEMORIES DIRECTLY.
SHIFT INST/DEL	No action.
SHIFT @	No action.
SHIFT *	Blank in RTTY.
SHIFT †	Disable transmit mode (go to receive) if text buffer is empty. Displayed as an up arrow.
SHIFT RESTORE	No action.
SHIFT RUN/STOP	Enable transmit mode.
SHIFT RETURN	Also enables transmit mode same as shift run/stop.
SHIFT C = (commodore key)	Random code option selected. System will cause 5 character random code groups to be transmitted. Press any key to deactivate.

KEYS PRESSED	DESCRIPTION
SHIFT <	Letters code in BAUDOT; < in ASCII.
SHIFT >	Sends figures code in RTTY BAUDOT; > in ASCII.
SHIFT 0 (zero)	Go to MORSE. Action will occur at that point in text. (DO NOT USE with 300 BAUD operation).
SHIFT A	Send . . . - in MORSE. (A) European Characters
SHIFT W	Send . - - - in MORSE. (A)
SHIFT E	Sends . . - - in MORSE. (E)
SHIFT O	Sends - - - . in MORSE. (O)
SHIFT U	Sends . . - - in MORSE. (U)
SHIFT N	Sends - - . - - in MORSE. (N)
SHIFT H	Sends - - - - in MORSE. (CH)
SHIFT I	Sends . . - - - in MORSE.
←	Repeat command. All text in buffer is repeated once for each "REPEAT" command, starting at the beginning of the buffer, or from last "SHIFT ←" entry.
+	Sends BK in MORSE
—	Sends - - in MORSE: - 'dash' in RTTY.
£	Places contents of ID memory into text buffer for transmission.
CLR/HOME	Used as command terminator.
INST/DEL	Backspace one character and delete it from the text buffer. Action is visible if split screen is enabled. Once text is transmitted, no further editing is permitted.
@	Send AS . - . . . in MORSE.
*	Send SK - in MORSE. Blank in RTTY.
↑	Send AR . - . . . in MORSE. Line feed in RTTY.
< > (Cursor)	Sends carriage return in RTTY.
^ (Cursor)	Places contents of receive buffer into transmit buffer.
RESTORE	No action.
RUN/STOP	Halt transmission and go to receive but does not erase buffer. Re-enable transmit by typing shift RUN/STOP.

KEYS PRESSED	DESCRIPTION
=	Sends - . . . -BT in MORSE. = in RTTY.
RETURN	Sends . . . - .VE in MORSE. Carriage Return and Line Feed Codes in RTTY.
COMMODORE KEY	Sends CQ_CQ_CQ_DE in all codes. 797
<	Sends comma in all codes.
>	Sends period in all codes.

7.2 MEMORY STORE/RETRIEVE COMMANDS:

7.2.1 MEMORY STORE:

The 'CTRL 1 to 8' commands are used for entering up to 8 messages into the 'HERE IS' memory area plus 3 additional message (11 characters each) are provided for WRU and PRINTER ON/PRINTER OFF SELCAL. User's ID of up to 64 characters, plus a second ID are entered by means of the 'CTRL £' and the 'CTRL I' commands.

To enter the desired text into any of the 8 message memories the user presses the 'CTRL' key, and the memory number (a single digit 1-8) followed by the desired text, terminating with the 'CLR/HOME' key.

To enter the WRU recognition text, the user types 'CTRL =' followed by the text (11 characters or less), terminating with the 'CLR/HOME' key.

To enter the 2 'SELCAL' (selective print) recognition texts, the user types 'CTRL' and one of the numbers 9 or 0, designating the particular SELCAL memory, followed by the recognition text (11 character maximum) and finally ending by typing 'CLR/HOME'.

To enter the ID text, the user types 'CTRL £', then the text (64 character maximum) ending by typing 'CLR/HOME'. To enter the secondary ID text, type 'CTRL I' and proceed as above (64 character maximum). Note that the primary ID can be 128 characters if no secondary ID is used.

To erase previously entered text, simply type 'CLR/HOME' as the first text entry.

7.2.2 MEMORY RETRIEVE:

Any one of the 8 user programmable memories may be retrieved by simply pressing the function keys F1 through F8 representing the memory number.

To retrieve the ID text, press the 'L' key. To retrieve the 'Secondary ID' text, press 'SHIFT L'.

7.2.3. CREATING THE RECEIVE BUFFER MEMORY:

The AIR-1 program when used with the unexpanded VIC provides for a 2400 character text buffer. 1000 characters of this can be set aside for a receive buffer that can accept data directly off the air for retransmission. You must first 'create' this new memory by typing 'CTRL ↑' (up-down cursor). A large X will be displayed on the top line. The action of this new receive memory is closely tied to the printer and, like the printer, responds automatically to the 'P-ON/P-OFF' SELCALS even if the printer is not on. Manual control is via the commands: 'CTRL F 5' (right hand "function" key number 5) to enable storage and 'CTRL F 7' to stop or disable storage. Flag up 'F' will replace the large X when storing receive text. You can enable/disable storage continuously until the 1000 characters are filled. Typing 'CTRL ↑' again, erases the previously stored receive text. Note, CTRL F 5/F 7 do not control the printer, only receive data storage. To transmit data from this memory, hit the '↑' key by itself. You can use the 'BREAK-BUFFER' and the 'SHIFT 1' commands to a great advantage when re-transmitting this memory. The 'CTRL E' command returns the text buffer to 2400 characters and erases the receive buffer memory. The normal text buffer in the "64" is 28,000 characters. When the receive buffer is created, the 28K is split so that both the type ahead transmit buffer and the receive buffer memory contain 14,000 character capacity. The same commands apply.

7.3 TRANSMIT/RECEIVE COMMANDS:

7.3.1 TRANSMIT:

The system is enabled to transmit by pressing the 'SHIFT RUN/STOP' or 'SHIFT RETURN' keys. If line or word modes are active, it may be necessary to follow the transmit command with the 'RETURN' or 'SPACEBAR' keys. The top display line will indicate that the system is in the transmit mode by displaying the letter 'T' on the far left.

7.3.2 BREAK-BUFFER:

Pressing 'SHIFT +' places the system in the break buffer mode and saves the current text buffer pointers. The typed text is sent direct-

ly without its being entered into the text buffer. This is a useful mode when the other station wants a quick answer and you have already entered some text into the text buffer. You can use this feature to answer his quick question without destroying what you have already entered into the text buffer. After completing your answer, go to receive and type 'SHIFT -' to restore the system to normal operation. If you do not first go to receive, the normal transmit text buffer will commence transmitting. When selected, the word 'BRK' will be displayed on the top line in place of CHAR, WORD, or LINE.

7.3.3 RECEIVE:

As soon as the user presses 'RUN/STOP' or 'CTRL CLR/HOME' the system will stop transmitting and go to the receive mode. The letter R will replace the letter T on the top display line. If 'CTRL CLR/HOME' was pressed, the system will also clear the screen and the text buffer. If 'RUN/STOP' was pressed, the text buffer will maintain its contents which will be transmitted as soon as the user enables the transmit mode with 'SHIFT RUN/STOP.'

Pressing 'SHIFT ↑' will also disable the transmit mode and return the system to receive mode provided that the text buffer is empty. Thus, any text typed after the 'SHIFT ↑' will not be transmitted until the user types 'SHIFT RUN/STOP' to enable the transmit mode.

7.4 RTTY/MORSE SWITCHING COMMANDS:

7.4.1 MORSE TO RTTY:

Pressing 'CTRL B' will immediately switch the system to the RTTY (BAUDOT). Similarly, 'CTRL A' will switch to RTTY (ASCII) mode. Operation will be at whatever was the last selected RTTY speed.

7.4.2 RTTY TO MORSE:

Pressing 'CTRL M' will immediately switch the system from RTTY to MORSE. Operating speed will be whatever was last selected in the MORSE mode. [Note — A direct change from 300 baud ASCII to MORSE is not allowed. Make sure to select 110 BAUD ASCII before switching to MORSE.] Pressing 'SHIFT Ø' will cause the system to switch to MORSE mode as soon as all preceding characters entered into the text buffer have been transmitted.

7.5 TEXT EDITING COMMANDS:

7.5.1 ERROR CORRECTION:

When the split-screen option is enabled, and the system is in the Receive mode, the user sees what he types and has the opportunity to correct typing errors before they are transmitted. Pressing 'INST/DEL' key will erase the previously typed character and move the cursor back one position. In the transmit mode the same procedure applies except that the user must type faster than the transmission speed. Alternatively, going to the word or line modes affords the same edit capability as in the receive mode since the typed text is not transmitted until such time as the user presses the 'SPACEBAR' or 'RETURN' keys.

7.5.2 REPEAT TEXT FUNCTION:

By means of the 'SHIFT ←' and '←' keys the user can cause any segment of the text to be repeated a fixed number of times, or to be repeated until stopped by another user action. To repeat any segment of text, the user first types 'SHIFT ←'. This serves as a pointer to the beginning of the text which is to be repeated. The text is then typed followed by '←' key presses. The text following the 'SHIFT ←' will be repeated once for every '←' key press. For continuous repeat, simply type 'CTRL ←' instead of '←'. To stop type 'CTRL CLR/HOME' which clears the entire text buffer, or type 'INST/DEL' which will remove the 'CTRL ←' and thus stop the continuous repeat function.

CHAPTER 8

'AIR-1' SPECS

8.1 INPUT

8.1.1 MORSE; BAUDOT, ASCII, AMTOR:

- (A) Audio from receiver speaker or phone jack. MED. Z 1 Kohm typical -30 dBm sensitivity
- (B) Digital (TTL). Up to + 40 volt max.
- (C) Electronic keyer.
- (D) Hand key.

8.2 OUTPUT

8.2.1 MORSE, BAUDOT, ASCII, AMTOR:

- (A) Solid state positive and negative voltage transistor keying. Maximum Switching Parameters
 - POSITIVE — + 40VDC @ 100 ma.
 - NEGATIVE — -150VDC @ 50 ma.
- (B) AFSK with independent, MARK/SPACE frequencies from 1500 to 3000HZ. -30 dBm signal into 600 ohm.

8.2.3 PRINTER:

- (A) Uses "CENTRONICS" parallel or standard Commodore printer for hard copy of receive and transmit text. Code converted.
- (B) HI volt transistor switch for 60 mA loop switching not code converted. Open circuit loop supply must not exceed 100 volts. For higher loop voltages, use external relay as shown in Appendix A.

8.3 CODES

- 8.3.1 MORSE:** International code A-Z, 0-9, comma, period, slash, question mark, parentheses, colon, semicolon, dash, double dash, AR, AS, BT, SK, BK, VE, ERROR, plus 7 special European characters.
- 8.3.2 BAUDOT:** 5 data bits, 1 start bit, 1.5 stop bits. International alphabet, A-Z, 0-9, LTR, FIG, CR, LF, SPACE, blank, bell, \$ - ! : (") # ? & . / ; automatic insertion of LTR/FIG and CRLF (user selectable).
- 8.3.3 ASCII:** 110 baud, 11 bit code with one start bit, 8 data bits, 2 stop bits, 300 baud, 10 bit code, one start bit, 8 data bits and 1 stop bit.
- 8.3.4 RANDOM:** 5 character random code groups in MORSE, BAUDOT or ASCII.
- 8.3.5 AMTOR:** Synchronous 7 unit error detecting, as defined in CCIR 476-2.

8.4 DATA RATES

- 8.4.1 MORSE:** 5-149 WPM keyboard selectable in 1 WPM steps. Automatic speed tracking of received code.
- 8.4.2 BAUDOT:** All standard baud rates of 45, 50, 57, 74, 100 baud (60, 66, 75, 100, 132 WPM) are keyboard selectable.
- 8.4.3 ASCII:** Keyboard selectable, 110, 300 baud.
- 8.4.4 AMTOR:** Mode A and Mode B: 50 baud equivalent.

8.5 MODULATOR:

MARK/SPACE frequencies of 1500 to 3000HZ are adjustable. Factory set for 2125/2295HZ.

8.6 DEMODULATOR:

- (A) RTTY - Dual tone computer enhanced demod copies any shift up to 850HZ, normal or inverted, factory set for 2125/2295HZ plus single channel MARK/SPACE. Effective input band pass filter for narrow (170HZ) and wide (425 and 850HZ) shift.

- (B) MORSE - Computer enhanced and narrowband (300HZ) detector centered at a nominal frequency of 800HZ.

8.7 TUNING INDICATOR

On screen RTTY cross hatch indicator for MARK/SPACE dual tone demodulation plus regenerated reference audio tone. Red dot "on screen" indicator for single tone RTTY and CW.

8.8 MECHANICAL DATA

8.8.1 SIZE: Overall 5½" wide, 4½" deep, ¾" high.

8.8.2 WEIGHT: <1 lb.

8.8.3 BOARD: Fiberglass double sided board, plated through holes, solder masked and silk screened for parts layout.

8.8.4 POWER: +5V DC at 100 ma max supplied by host computer — **DOES NOT** require external power supply.

8.8.5 CONNECTION TO COMPUTER:

Plugs in expansion port only — **DOES NOT** require any other connection to host computer.

8.9 MEMORY SIZES

		VIC-20	"64"
XMT BUFFER	WO/RX	2,400 CHAR	28,000 CHAR
	W/RX	1400 CHAR	14,000 CHAR
REC BUFFER		1,000 CHAR	14,000 CHAR
PON-POF-WRU		11 CHAR	11 CHAR
ID'S EACH		64 CHAR	64 CHAR
F1-F7 MEM		128 CHAR	512 CHAR
F8 MEM		128 CHAR	384 CHAR

CHAPTER 9 — AMTOR

Definition of Terms used in this manual and in CCIR 476-2

Mode	Definition
AMTOR	AMateur Teleprinting Over Radio. Amateur Radio adaption of ARQ operation
ARQ A	AMTOR (Automatic Repeat reQuest) Mode A, Handshake or Chirp Mode
FEC	Forward Error Correcting — The Non Handshake mode used for general broadcast where data is transmitted in time diversity. (See CBSS).
SELFEC	Selective FEC same as FEC, but data is inverted after initial call block transmission. Used as a “selective” broadcast mode where receiving station automatically inverts copy upon receipt of a predetermined call block. (See SBSS).
STANDBY (IDLE)	Condition where unit will automatically switch to Mode A, FEC or SELFEC upon receipt of proper input. (See Chapter on Operational Differences).
CBSS/CBRS	Collective Broadcast Sending/Receiving Station. Indicates operation in FEC Mode.
SBSS/SBRS	Selective Broadcast Sending/Receiving Station, indicates operation in SELFEC mode.
SELCALS	SElective CALLs (See Chapter on Operational Differences)

- (B) MORSE - Computer enhanced and narrowband (300HZ) detector centered at a nominal frequency of 800HZ.

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ID'S EACH		64 CHAR	64 CHAR
F1-F7 MEM		128 CHAR	512 CHAR
F8 MEM		128 CHAR	384 CHAR

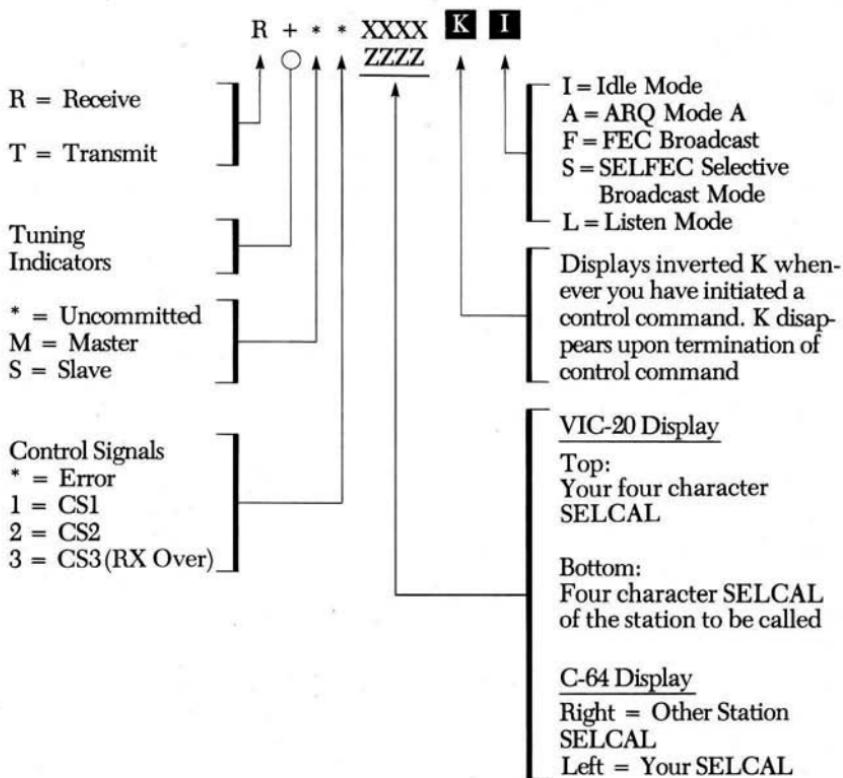
CHAPTER 9 — AMTOR

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SELCALS	SElective CALLs (See Chapter on Operational Differences)

TOP LINE VIDEO STATUS DISPLAY

The status line in AMTOR is different from the Standard AIR-1 display for RTTY and CW.



OPERATIONAL DIFFERENCES BETWEEN AMTOR AND CONVENTIONAL RTTY

There are some very subtle variations between "on the air" AMTOR and the modes we're used to. Even if you're on RTTY now, this section should be "required reading". Each variance will be discussed by heading.

CALLING CQ:

Since Mode A by definition, is a one on one "handshake" mode, you can only establish contact with a station if *you know his selcal* and, of course, have it loaded into memory. It is easy to check and simple to load. More on this later. It is not recommended to adopt "CQCQ" as our selcal, so that the unit would respond automatically to a patterned

CQ. The possibility of half-a-dozen AMTOR stations responding to a CQ, all chirping back madly might not be too satisfactory. AMTOR Mode A therefore does not lend itself to a general CQ. The broadcast FEC Mode is much more suitable, during which you would include your SELCAL, so that a calling station would respond in MODE A. Or, once establishing contact in FEC, and exchanging SELCALS, both stations can then switch to Mode A.

SELCALS:

The selcals, short for **SE**lective **C**ALL, in normal usage means an auto response keyword that the computer recognizes, which tells it to take some pre-determined action. In the realm of AMTOR, the selcals are coded "call blocks" that allow two stations to seek each other out and maintain communication. They are absolutely necessary in order to communicate in Mode A and in the "selective FEC" mode. Each selcal is exactly four alpha characters, no more — no less. The top (2) line(s) display both selcals. Yours is on top (left for C-64), the other station's is below (right for C-64).

They are loaded just like a F1-F8 or ID memory. To load your selcal, first, go to AMTOR by typing 'CTRL *' then type 'CTRL ;' (semicolon), then the four letters of your selcal. The convention at this time is to use all letters with the first and last three of your call. A 1×3 call such as K3ICH would be KICH. A 2×3 call such as WA30YW would be WOYW, likewise, KA4UPH would be KUPH. A 1×2 call, N3JL for instance would double the first letter to become NNJL. Note, these are the currently accepted standards to generate the selcal keywords. These selcals *do not* in any way *replace* your FCC assigned call. They are merely convenient methods to compact one's call into a four-letter block. The MICROLOG unit will accept any four letters into the selcal memories.

In order to call another station in Mode A, you must load his selcal. Do this by typing 'CTRL :' (colon) then the four letters of his selcal. It is not necessary to follow with the 'CLR / HOME' key since the unit will only accept the four characters as a valid entry. If you terminate the entry early by hitting the 'CLR / HOME' key, the existing selcal will be left unchanged.

An easy way to remember which key to use for which SELCAL is by physical placement of the keys. Your SELCAL (the semicolon key) is closest to your ID, the £ key.

IDLE, THE THIRD CONDITION:

A standard, non-AMTOR unit, can be in either of two conditions regardless of the code or speed in use. Either it is in receive or transmit. The AMTOR mode allows for a third, the Standby or Idle Condition. From Idle, the unit will switch automatically to Mode A (ARQA), FEC (known as CBRS or Collective Broadcast Receiver Station) or "SELFEC" (known as SBRS or Selective Broadcast Receiver Station) if it hears the proper signal activity on its input. During this Idle Mode, the text buffer is locked out, not allowing entry of data. You can load the selcal memories in the Idle Mode, ARQA, FEC or SELFEC. It is necessary however to load the ID and programmable F1-F8 memories before going into AMTOR Mode.

AUTOMATIC-MANUAL ENTRY INTO MODE A

You *manually* enter Mode A from IDLE by typing 'CTRL A', the top line will show the inverted A, plus an M for Master, when you start transmitting. As Master, your unit sets the timing for the communication. Mode A can also be entered automatically from IDLE if the unit is called with the correct selcal. If another station calls you in Mode A by sending your selcal, your unit will automatically switch to Mode A, "phase up" and lock into communication. In this case an S will also show indicating that you are the Slave, and subject to the timing of the other calling unit which is the Master. The Mode A indicator "A" will also be displayed. It will stay locked until one of you terminates by typing CLR / HOME . The only difference between manual and automatic is that in automatic, your unit will return to Idle upon the reception of the "EoC" sequence (End of Communications; sent by typing CLR / HOME). In manual, you must manually go back to Idle by typing 'CTRL CLR / HOME '.

PHASING AND TRACKING

As described in the sections on mode A and master/slave, when two stations are *phased* or *timing locked*, there is no automatic frequency control of the radios. Only the timing of each transmission burst is varied. The master sets the *pace* of exactly when in time both transmissions start and stop. The required frequency stability of the radios is exactly the same as when using conventional RTTY. If one drifts too far, the signal will be lost and communication will cease.

The procedure of a "HOT QSY" by changing frequency *while trying to maintain phasing* is to be discouraged. This is sometimes done to move off the calling frequency on an active band, but sliding past a QSO in progress can only be considered discourteous. Technically, it works, but it is obviously quite poor operating practice.

MODE L, LISTEN MODE

You should utilize the LISTEN MODE to copy and identify other stations. This will allow "Eavesdropping" without any interference. Since Mode A is a "one on one" handshake mode, you should not attempt to "break into" a QSO in progress by loading one of the other station's SELCAL, which will cause your unit to try to "Phase-Up". This will severely disrupt the other stations making you an unwanted partner! (A "Roundtable" QSO is theoretically impossible in Mode A.) The copy in the LISTEN MODE might at first appear a bit strange if many repeats are requested, since you may print them all. "THE QUICK BROWN FOX" might print: THE QU QU QUICKICKICKICK BR BR, etc. You can enter the LISTEN MODE by typing 'CTRL L', and terminate by typing the CLR / HOME key. No other functions are permitted while in the LISTEN MODE.

TONE PAIRS:

In normal RTTY, the mark is the higher transmitted frequency. This results from using a lower audio frequency and transmitting in lower sideband (Mark = 2125 Hz, Space = 2295 Hz). In AMTOR, or more appropriately, according to CCIR 476-2, these conditions are defined in reverse, so that by transmitting the same tone pair in upper sideband, we are "normal" for AMTOR. Unfortunately, this can be inconvenient when changing modes, since some radios cannot change sidebands readily when they are in an RTTY mode. For this reason, we have included the ability to "invert" the sense of the receive and transmit data, just as you can in normal Baudot or ASCII. You must however, perform this function while in the non AMTOR mode. Simply type 'CTRL -', then switch to AMTOR by typing 'CTRL *'. "INV" will replace "NOR" on the top line display. This will allow you to stay in lower sideband without having to retune or alter the passband.

C-64 TUNING INDICATORS:

Upon entering the AMTOR mode, the top line tuning indicators both go to the same color as the top line display. They will stay that color when you return to normal AIR-1 RTTY/CW mode. If you now re-select a screen color (CTRL G) the tuning indicators will go back to red.

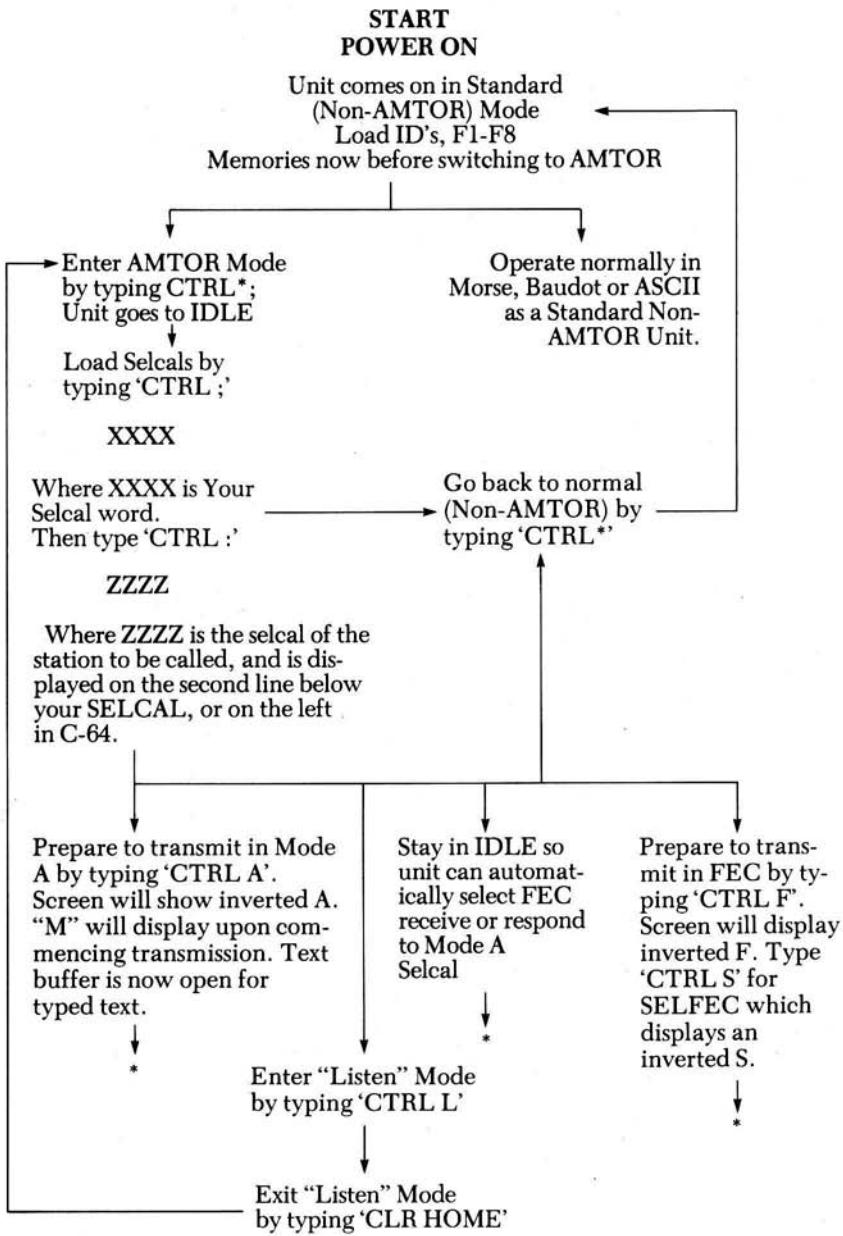
AMTOR +

Your new AIR-1 has the latest AMTOR + program included. AMTOR + will provide improved operation with systems where the 'clocks' are not exactly in SYNC. We have found that some available AMTOR programs are virtually intolerant of bit rate timing error, which can be due to minor crystal variation in the computer's clock. AMTOR + attempts to analyze timing differences, and correct them by slightly altering the received 10 millisecond ARQ code bit period. This tracking is fully automatic and does not require typing control commands to manually alter timing as required in some other programs.

Another feature which does require some keyboard input is the added ability to alter the T/R switching delay for rigs with long 'turn-around' time. If you enter AMTOR normally with 'CTRL *' you will have the standard 40 millisecond delay of data transmission after 'PTT ON'. If you enter AMTOR with 'CTRL @' the delay will be 80 millisecond. (Only 'CTRL *' will exit AMTOR though.) Note that the fixed delay of 40 or 80 msec. only affects the system when you are 'SLAVE'. As 'MASTER', we always have a sliding delay whereby the PTT line is turned on as soon as the last 'BIT' of data (or control signal) has been detected and verified. This results in a constant tone on for as much as 100-120 msec before data is sent at the proper time. This is why AIR-1's may 'sound' different when they're 'MASTER'. It's that constant 100 msec or so tone that people mistake as "too long" or "wrong timing", when in reality, we're just giving the transmitter (and other station's receiver) the maximum time possible to 'turnaround' or come to full sensitivity.

The choice of 40 and 80 msec is very logical. A 40 msec delay will allow for propagation half way around the world (the maximum distance for Mode A AMTOR). The 80 msec delay is the maximum practical time that will allow the full 210 msec data block to be transmitted. The maximum range with 80 msec delay on both stations is 3000 KM. Having steps in between 40 & 80 msec just over complicates the system. You'll find that you will only need one or the other. If your transmitter is slow to come up in transmit, or the other station's receiver is slow to recover, then jump out of AMTOR with 'CTRL *', and quickly hit 'CTRL @' to re-enter AMTOR with the long delay. All SELCALS and memories will be retained.

OPERATIONAL FLOW-CHART



* Exit by typing 'CTRL CLR HOME' to return to IDLE

1. AMTOR Initialization

When power is first applied to the unit it will be initialized to its standard RTTY mode. As a first step the user should initialize the system clock by means of the 'CTRL K' command. Next, load the ID's and F1-8 memories normally, either manually or from Disk/Tape. If you want to stay in LSB for AMTOR, you should type 'CTRL -' to invert the RX and TX data as described in the preceding chapter. Type 'CTRL *' to switch to AMTOR. To go back to non-AMTOR operation, type 'CTRL *' again. The system status will be displayed on the top line of the video screen.

Enter your 4 character selective call (SELCAL) by pressing 'CTRL ;' (semicolon) followed by 4 letter sequence. See section on AMTOR DIFFERENCES for further discussions.

2. IDLE

The top line on the video display will indicate that the system is in the IDLE or standby position by displaying an inverted I (IDLE) in the top line display. The selective call (SELCAL) of the station should be entered if not previously done.

The system is now ready to receive data, by automatically switching to ARQ or FEC modes.

3. ARQ

3.1 Automatic Entry:

This mode will be entered automatically (from IDLE) as soon as the selective call of the station is received. The inverted letter A will then replace the I display. The letter S is also displayed to indicate that the station is in the "SLAVE" condition.

3.2 Manual Entry:

To initiate communications with a selected station, the user must have previously input the selective call of the station to be called. This is accomplished by pressing the 'CTRL and :' key, followed by the 4 characters representing the desired selective call. Press 'CTRL A' and the inverted letter A will replace the I on the top video line.

Transmission will begin when the normal SHIFT RUN/STOP or SHIFT RETURN is typed. The letter M will appear on the screen to indicate that it is the MASTER or CALLING STATION. Characters entered on the keyboard will be displayed above the split-line on the video screen. They will be displayed below the split-line as they are actually being transmitted. You can have the transmitted text display as inverted video by typing 'CTRL J', which is a "Toggle" command.

During breaks between character entry, non-printing "IDLE BETA" characters are sent automatically. This is similar to the RTTY "DIDDLE" but cannot be turned off since there must be 'something' transmitted to maintain phasing.

3.3 MASTER/SLAVE

The system timing, which is the critical synchronism between the two stations in Mode A is set by the MASTER. The SLAVE station adjusts its response timing "clock" to that of the MASTER. Do NOT confuse the functions "RECEIVE/TRANSMIT" with "MASTER/SLAVE." They are NOT the same. According to CCIR 476-2, the distinction between MASTER and SLAVE is defined by which station initiates the call in Mode A. The calling station IS THE MASTER and stays MASTER throughout the communication until termination. Even if phasing is lost due to propagation, the MASTER will automatically re-call the SLAVE.

3.4 CONTROL SIGNALS

Throughout the communication session, the status of various conditions is displayed on video screen. In the process of exchanging control signals between the two stations 1, 2, or 3 which indicate CS1, CS2 or CS3 are displayed. As soon as the two stations are "phased" the control signals will start to toggle between 1 and 2. In the event that a request for signal repetition has been received, the control signal display will freeze until that block is verified. The lower screen display will also stop if that particular 3 character block is not verified. You should only see a "3" as verification of receipt of the over sequence.

The transmitted message will be printed if the printer is on line. Use either 'CTRL V' or 'CTRL P' to enable the proper printer.

The "over sequence" is initiated *immediately* by pressing the "up arrow" key. The over sequence "FIG + ?" will be transmitted, and when acknowledged, the letter R or T will reverse as the role of RECEIVE and TRANSMIT changes. To initiate an "over" when your text buffer empties, type 'SHIFT ↑.'

AMTOR COMMANDS

Active In	Type:	Action:
I A F/S		
	CTRL *	Go to AMTOR (Toggle command, 2nd CTRL * goes to normal RTTY/CW) 40 msec Slave PTT delay
•	CTRL @	Same as * but 80 msec PTT Delay EXIT with CTRL *
•	CTRL A	Enter ARQ Mode A
•	CTRL F	Enter FEC (Collective Broadcast)
•	CTRL S	Enter SELFEC (Selective Broadcast)
•	CTRL L	ARQ Listen Mode
• • •	CTRL V	Vic Printer ON/OFF control
• • •	CTRL P	Parallel printer on/off control
•	CTRL Y	FIG/LTR Shift toggle on RCVD ARQ-A
•	CTRL W	sends who are you request (FIG D)
• • •	CTRL J	Display transmitted text in inverted video (Toggle)
• •	CTRL CLR HOME	Go to IDLE mode
• • •	CTRL ;	Enter 4 CHAR selective call (your unit)
• • •	CTRL :	Enter 4 CHAR selective call (his unit)
• •	SH-RUN/STOP	Transmit mode
•	SHIFT↑	End of message—will “over” on Empty Buffer
• •	CTRL CRL/HOME	End of Communication—goes to IDLE mode
•	↑(UP ARROW)	Over-reverse ISS/IRS roles
• •	F1 to F8	Send contents of a memory F1-8

BREAK (IMMEDIATE “OVER”)

Pressing the \dagger key will immediately initiate the “over” sequence “FIG + ?”. A detailed description is given in CCIR 3.1.6 of Rec 476-2. This allows the user to exchange roles between ISS/IRS. (Information Sending Station/Information Receiving Stations), and is defined as a control signal, NOT in uppercase. Some programs will improperly shift to uppercase upon receipt of an “over” (PRINT FIGS). If this is reported, just send an uppercase character first to force transmission of a LTR shift.

SHIFT \dagger (“OVER” ON EMPTY BUFFER)

Pressing the SHIFT and \dagger keys simultaneously will cause the over sequence to be initiated as soon as all of the preceding text has been sent.

EoC (End of Communications)

This command is executed by pressing the CLR / HOME key. It causes the “end of communications” signal to be entered into the text buffer. The “end of communications” signal is in accordance with section 3.1.8 of Rec 476-2 to provide an orderly shutdown of both units.

WRU (Who aRe you)

When responding to a “Who are you” request, the unit will send the contents of the text buffer, then the contents of the ID memory. (Entered by typing ‘CTRL L’.) Load the WRU keyword by typing ‘CTRL =’ in a non AMTOR mode.

Pressing the ‘CTRL W’ key while in Mode A communications causes the transmission of request for answerback (FIG D). The other station will automatically respond with his ID, providing his program adheres to the 476-2 spec.

3.4 Operational Hints

SELCAL	Make sure that your selective call (4 letters) is entered so that other stations can call you.
WRU	When responding to a “Who are you” request, the unit will send the contents of the text buffer, then the contents of the ID memory. (Entered by typing ‘CTRL L’.)
ARQ	Upon receiving its selective call the system will switch from the IDLE to ARQ Mode A. The received data will be displayed on the CRT, below the split-line and printed if the printer is on-line.

4. FEC Mode-B Time Diversity

In the Stand-By (IDLE) position the reception of the phasing sequence, as described in 3.2.5 of Rec 476-2 will cause the system to automatically switch to the FEC position. The user may also switch to the FEC position manually by pressing 'CTRL F' on the keyboard. The selected CBRS (Collective Broadcast Receiving Station) condition will be displayed as an inverted F on the top video line. Be sure to delete the other stations SELCAL in collective FEC to prevent auto-switching to selective modes type CTRL: CLR/HOME.

When started as CBRS, the system will change to SBRS (Selective Broadcast Receiving Station) position upon the reception of the characters representing its selective call letters.

The received message will be displayed on the screen, and will be output to the printer if enabled. A * symbol will be displayed at the control signal position of the top line whenever both the direct (DC) and the repeated (RX) characters are in error. The system will revert back to IDLE (Standby) position upon the receipt of End of Communications signal, or if the number of received errors is excessive.

During unattended IDLE MODE monitoring, a 30 second software timer will not allow the unit to hang up in FEC MODE which of course, would prevent an automatic shift to Mode A should someone attempt to call letters. This condition will be displayed as an inverted S on the top video line.

Loss of phasing during a message will cause the system to automatically re-synchronize. Failure to re-synchronize after an excessive number of errors (or a 30 second lapse of activity) will switch the system to IDLE position. To transmit a message, the user must first enter the FEC (CBRS) position which is accomplished by pressing 'CTRL F' in the IDLE (STBY) position. The desired message(s) are entered directly on the keyboard or retrieved from message memory as previously explained.

To initiate transmission in SELFEC (SBSS), the selective call number of the called station must be entered by means of the 'CTRL :' command. The called station's selective call will then appear on the display line.

Pressing 'SHIFT RUN/STOP' will cause the transmission to be initiated and the system switches to the (FEC or SELFEC) position. The characters will be displayed below the split line as they are being

transmitted. They can also be output to the printer. After the last character is transmitted, the 'end of communications' signal will be transmitted if a ' CLR / HOME ' keypress was entered into the text buffer. This will cause the system to revert back to the IDLE (STBY) position.

If a ' CLR / HOME ' keypress was not entered into the text buffers the system remains in the FEC (or SELFEC) positions, and will continuously emit phasing signals in accordance with 3.2.2.1 and 3.2.3.3 of REC-476.

5. CCIR 476-2

The AMTOR system used in the Microlog AIR-1 is the same protocol as defined by the CCIR 476-2. The only difference involves the actual characters used for the SELCAL blocks. The maritime service typically uses 5 numbers which are condensed into a 4 letter block. AMTOR skips the step and uses 4 letters directly.

No.	Letter/Figures	International Alphabet No. 2 Code (1)	Emitted 7-Unit Signal (2)
1	A -	ZZAAA	BBBYYYB
2	B ?	ZAAZZ	YBYYBBB
3	C :	AZZZA	BYBBBBYY
4	D WRU	ZAAZA	BBYYBYB
5	E 3	ZAAAA	YBBYBYB
6	F !	ZAZZA	BBYBBBBY
7	G &	AZAZZ	BYBYBBY
8	H #	AAZAZ	BYYBYBB
9	I 8	AZZAA	BYBBYYB
10	J BELL	ZZAZA	BBBYBBY
11	K (ZZZZA	YBBBBYY
12	L)	AZAAZ	BYBYYBB
13	M .	AAZZZ	BYYBBBBY
14	N ,	AAZZA	BYYBBYB
15	O 9	AAAZZ	BYYYBBB
16	P 0	AZZAZ	BYBBYBY
17	Q 1	ZZZAZ	YBBBYBY
18	R 4	AZAZA	BYBYBYB
19	S '	ZAZAA	BBYBYYB
20	T 5	AAAАЗ	YYBYBBB
21	U 7	ZZZAA	YBBBYYB
22	V =	AZZZZ	YYBBBBY

23	W	2	ZZAAZ	BBBYYBY
24	X	/	ZAZZZ	YBYBBBY
25	Y	6	ZAZAZ	BBYBYBY
26	Z	+	ZAAAZ	BBYYYBB
27	Carriage Return		AAAZA	YYYBBBB
28	Line feed		AZAAA	YYBBYBB
29	Letter shift		ZZZZZ	YBYBBYB
30	Figure shift		ZZAZZ	YBBYBBY
31	Space		AAZAA	YYBBBYB
32	Unperforated tape		AAAAA	YBYBYBB

(1) A represents a start element and Z a stop.

(2) B represents the higher emitted frequency and Y the lower.

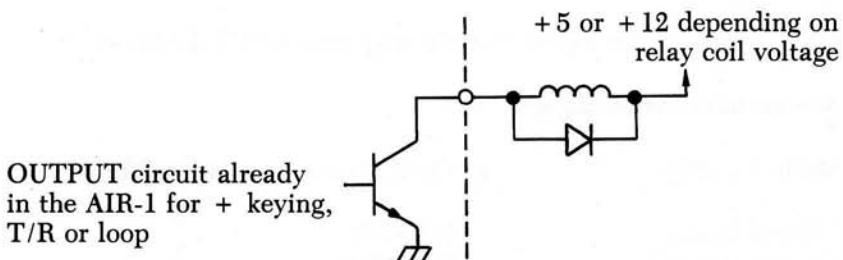
Service information signals

Mode A (ARQ)	Emitted Signal	Mode B(FEC)
Control signal 1	BYBYYBB	
Control signal 2	YBYBYBB	
Control signal 3	BYYYBBYB	
Idle signal β	BBYYBBY	Idle sign. (sel.)
Idle signal α	BBBBYYYY	Phasing signal 1
Signal repetition	YBBYYBB	Phasing signal 2

APPENDIX A

'AIR-1' EXTERNAL RELAYS

To use an external switching relay for CW/RTTY keying, T/R (PTT) control, or printer loop, the following circuit can be used:



Just make sure that your relay coil requirements are below the internal transistor switch ratings of +40 volts at 100 ma. Almost any small relay will work for the T/R switching. The relay you choose for keying should be checked for speed; in other words, will it switch fast enough for your operation. Most small open frame type relays will be adequate for moderate CW speeds, but may not be fast enough for RTTY. In which case, you should use a "REED" or "Mercury-Wetted" type which will be much faster. This is particularly true in the case of the printer loop switch. There, the requirements of high voltage (100-150) volts, moderate current (60 ma.), and high speed limit the field to mercury-wetted types such as the Clare # HGSR 511M000.

APPENDIX B

'AIR-1' CIRCUIT TAILORING

COVER: *The black aluminum cover must be removed in order to change any fixed components. Remove all four 3/8 × 24 nuts and washers from the four 1/4" phone jacks and slide the cover straight back.*

AFSK OUTPUT LEVEL

The AFSK tone level is factory set at about -30 dBm by a single, fixed 1KΩ resistor, R-13 (last resistor in string below 'hand-key' jack.)

Increasing this value raises the AFSK output level. The formula is approximately 60 millivolts per 1KΩ, so that for 1 volt output, the value should be 16.6K (use 15K or 18K 5%). Simply change the resistor value for the desired level.

AFSK FREQUENCY

Nominally set for MARK = 2125HZ, SPACE = 2295HZ, the two pots R17 and R15 located between the handkey jack and the AFSK/PTT jack, adjust the mark and space frequencies respectively. The nominal adjustment range is about 1500 to 3000HZ. To lower the range, raise the value of both R16 and R18 equally. Connect a frequency counter to the ring of the AFSK/PTT jack to read frequency. Go to transmit RTTY (diddle off - steady tone output) for mark and tune R-17. Go to transmit morse to simulate 'space condition' and adjust R15 for desired 'space' tone. (Hand key input also drives AFSK switch - key down = MARK.)

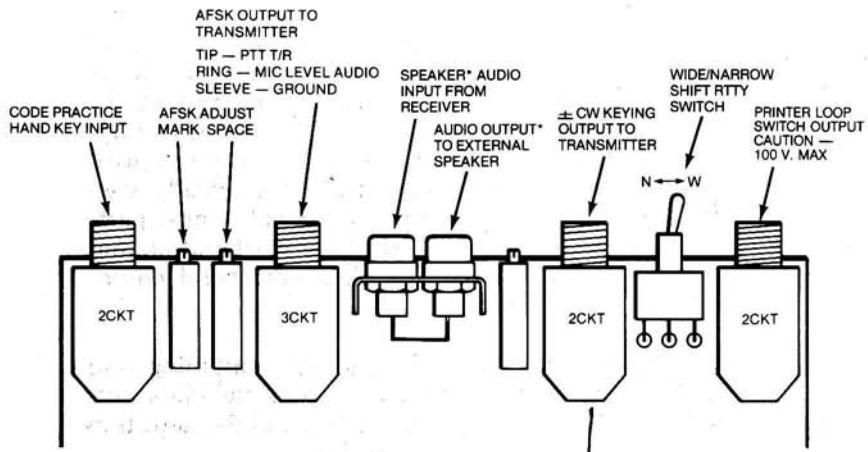
DEMODULATOR SENSITIVITY

R-31, a 1KΩ resistor can be changed to vary the detection threshold level for both RTTY & CW which is nominally -30 dBm. If you would like to run with lower audio volume, you can make this resistor 470Ω which will cut the required level in half. Likewise, raising the value to 2KΩ means that you'll have to run twice the audio into the AIR-1 for good copy. This linear relationship holds over a range of values for R31 of about 270-4700Ω. R31 is the last resistor in the string below the narrow-wide switch.

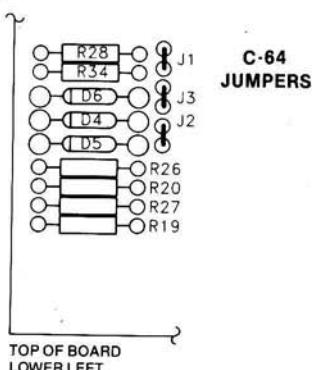
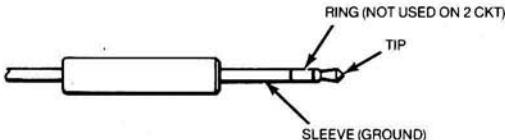
DEMODULATOR TUNING

No attempt should be made to adjust the demodulator to other frequencies. Do not adjust R7 located between 'SPEAKER-AUDIO' and the '± KEY' jacks. There is a close correlation between this setting and the actual computer program. If other frequency pairs for RTTY are desired, please consult the factory.

AIR-1 REAR CONNECTIONS



* BOTH "SPEAKER AUDIO" PHONO JACKS ARE JUMPERED TOGETHER,
SO EITHER CAN BE USED FOR INPUT-OUTPUT CONNECTIONS.



Microlog Corporation warrants each new AIR-1 to be free from defects in materials and workmanship for one year from the date of purchase by the final user. Receipt of the properly completed warranty registration card postmarked within 10 days of the date of purchase is required to validate the warranty. Units judged by our inspection to have been misused mechanically or electrically will automatically void the warranty. This warranty covers only units, parts and materials supplied by Microlog Corporation and does not cover customer-supplied peripheral equipment or accessories.

Mark the outside of the package containing your AIR-1: "Attention Repair Dept", and include a note fully describing the suspected defect and the steps/tests taken by you to verify the problem.

MICROLOG WARRANTY REGISTRATION CARD

(Must be mailed within 15 days of purchase)

Name: _____	Model: _____
Call: _____	Serial Number: _____
Address: _____	Unit received in _____ condition.
_____	Date: _____
_____	Dealer's Name: _____
_____	Located in: _____
Telephone: (_____) _____	Which magazines do you subscribe to, or read regularly?
How did you hear of MICROLOG?	
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<input type="checkbox"/> Friend	<input type="checkbox"/> Magazine
<input type="checkbox"/> Other _____	<input type="checkbox"/> CQ
	<input type="checkbox"/> 73
	<input type="checkbox"/> Ham Radio
	<input type="checkbox"/> Other _____

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