ICS

ICS AMT-1 Amtor Terminal Unit User Manual - CW receive mod for AMT-1 - AMT-1 Operating Guide - AMT-1 Commodore 64 applications operator manual

AMT-1 Amtor Terminal Unit

USER MANUAL

I.C.S. Electronics Ltd.
PO BOX 2
ARUNDEL BN18 0NX
WEST SUSSEX
ENGLAND
Phone : (024 365) ~~312~~ 590

CONGRATULATIONS ON YOUR PURCHASE OF AN AMT-1 AMTOR TERMINAL UNIT. YOU WILL SOON HAVE ONE OF THE WORLD'S MOST ADVANCED H.F. RADIO DATA TRANSMISSION SYSTEMS ON THE AIR!

You should be able to get the AMT-1 running quickly and without problems with any modern SSB transceiver and any ASCII RS232 terminal or personal computer which is equipped with a serial interface, simply by reading the enclosed manual.

Below you will find a list of those transceivers and personal computers which are presently known to go "first time" with the AMT-1:

TRANSCEIVERS				PERSONAL COMPUTERS
FT ONE	FL 101/ FR 101	TS 180	TR 7	VIC 20
FT 707		TS 520	T4XC	BBC Model B
FT 901	TS 180S	TS 515	T4B/R4B	ABC 80
FT 902	TS 930	TS 820	FT 227ZD	
FT 101ZD	TS 130	TS 700	IC 701	
FT 101	TS 830	TS 120V	KWM 380	

A number of ready debugged applications programmes for personal computers already exist. Some of those for the more popular computers are enclosed, but I.C.S. actively solicits applications information from you for the benefit of future users.

Do take care with system grounds and ensure adeuate cable screening to reduce hash radiation into your receiver.

If you have not already purchased a personal computer and wish to use it with the AMT-1, check that a serial interface is available for it and that it can run full duplex at 110 or 75 Bauds at RS232 levels. Make sure that data can be transmitted and received over the interface simultaneously and that CONTROL and ESCAPE codes can be sent from the keyboard. Otherwise, you will have to use the CHR$ command from Basic to generate these codes from other key depressions.

Checking your system out in ARQ mode

To check out your system on ARQ, tune your transceiver (on upper sideband) to 14.075MHz (the dial reading should be around 14.073.7).
Then press control-A followed by one of the following selcals:-

GPLX (G3PLX)
HBAK (HB9AK)
TDJT (TI3DJT)
KRPA (K4PA)
KBBT (KB6BT)
VAGE (VK2AGE)

These stations are amongst those most active on AMTOR at the present time.

If the chosen station replies, type:-

(HIS CALL) de (YOUR CALL) +?

If the station requests further instructions type:-

HELP +?

In general, 14.075MHz should be avoided for long QSOs and used only for specific ARQ calls.
Once contact has been established, both stations should QSY up several KHz.
When calling CQ, you can call on 14.075MHz in FEC mode and QSY once contact has been made.

In many contries, there is also considerable AMTOR activity on 80 metres, centred on 3.588MHz.

Don't forget, if you call CQ in FEC mode, make sure you have first loaded your own selcal, so that your system will respond if called.

LATE NEWS

As the F.C.C. have just granted permission for U.S. amateurs to use Amtor, W1AW is about to commence broadcasting Amateur Radio News in Amtor FEC mode.

CONTENTS

= = = = = = = =

1. INTRODUCTION

The AMT-1 is designed to interface between an SSB radio transceiver and an ASCII VDU, teleprinter, or personal computer, using the error-correcting system known as TOR or AMTOR.
Normal RTTY and ASCII transceive facilities are also provided as well as CW transmit.
The interface to the transceiver is via an audio input/output socket, which provides frequency-shift keyed tone signals from the AMT-1 to the transceiver mike socket, and accepts received audio from the transceiver extension speaker connector.
There is also a keying line from the AMT-1 to switch from transmit to receive. This will normally be connected to the "push-to-talk" line on the transceiver.

All of these connections can normally be made between SK1 on the AMT-1 and the transceiver's mike or accessory socket.

The interface to the terminal sends ASCII serial data from the AMT-1 for display or printing, and accepts data in the other direction from the keyboard. These signals are represented by RS232 logic levels.

Most terminals, or small computers which can be used as terminals, will connect directly to the AMT-1 via SK2. The AMT-1 can be set to communicate with them at either 75 or 110 Bauds.

> **WARNING**
>
> DO NOT OPERATE YOUR TRANSCEIVER CONTINUOUSLY IN FEC OR RTTY TRANSMIT MODE WITHOUT FIRST REDUCING ITS OUTPUT TO UNDER HALF POWER. SERIOUS DAMAGE TO YOUR TRANSCEIVER MAY OTHERWISE RESULT.

2. BASIC THEORY

Teleprinter communication over radio links has always been achieved via frequency-shift-keying of the transmitter carrier frequency, the higher frequency representing one logic level and the lower, the other. In traditional RTTY, 32 characters are transmitted by various combinations of 5 data bits, transmitted serially and preceeded by a start bit which synchronises the receiver decoding. It is separated from the following character by a stop bit. This system, although usually generated and decoded in modern equipment electrically, was originally designed to be decoded mechanically, and suffers from problems when used on radio links which are subject to fading and interference. Any such interference or noise which causes a data bit to be received in the wrong-polarity results in an incorrectly printed character. Furthermore, the start-stop technique used often results in several characters being in error if a start-bit is mutilated.

The conceptual basis of the TOR system is that steps are taken to ensure that an error in the received signal does not necessarily cause an error in the output character. This is done by transmitting extra information along with the data, which enables the distant receiver to detect the presence of errors. Instead of 5 data bits, 7 are transmitted. Three bits are of one polarity and four are of the other. The vast majority of randomly-occuring errors result in this 3:4 ratio being altered at the receiver, enabling the receiving station to detect that the data is erroneous.

There are 35 possible combinations of 7 bits, and 32 of these are translated directly to the standard RTTY character set. Others are used as special control characters. The start-bit mutilation problem is overcome by transmitting the data bits synchronously at accurately-controlled intervals. The synchronisation at the receiver is achieved by accurately-controlled timing rather than by using a start bit.

There are two different types of communication available in AMTOR: Forward Error Correction (FEC), and Automatic Request (ARQ). In the FEC mode, the 7-bit characters are transmitted twice, and the receiving station can choose which of the two passes the 3:4 ratio test. Up to half of the received codes can therefore be in error before errors occur in the output. The second transmission of each character is delayed relative to the first, so that a prolonged fade or burst of interference will only result in one transmission of several characters being mutilated, rather than both transmissions of a few adjacent characters. Even if both transmissions are mutilated, the receiving station prevents an erroneous character being printed, suppressing the character completely and signalling the presence of the error via the ERROR lamp.

In ARQ mode, the transmitter sends a group of three 7-bit characters in a block. The distant receiver examines each one, and if any containes an error, an automatic request to repeat the whole block is made. In this case, the receiving station sends a repeat request character to the transmitting station. In this way interference or fading does not generally result in errors, but merely a slowing-down of the transmission of information each time a repeat is requested. Data blocks and control-codes are transmitted back and forth by the two stations working in quick break fashion, usually on the same frequency. This gives rise to the familiar chirp-chirp-chirp of AMTOR signals on the air.

In both FEC and ARQ modes, accurate synchronisation is essential between both ends of the link, and this is achieved by special phasing signals transmitted at the start of each contact, and maintained by crystal-controlled timing.

In practice, it is possible for errors to occasionally "beat" the 3:4 ratio check, and result in printed errors. Nevertheless, FEC is considerably better than conventional RTTY, and ARQ is very much better than FEC. The reason for including both FEC and ARQ features is that ARQ can only, by its nature, be used between two co-operating stations, whereas FEC can be transmitted by one station to any number of stations. Thus FEC is often used for broadcast messages such as news bulletins and CQ calls.

In the ARQ mode, it is necessary to know the identity of the other station before establishing the contact, hence FEC is often used at the start of a contact, followed by a change to ARQ. The requirement to identify the intended ARQ contact first arises from the initial process which is required at the start of the contact. This feature also enables the ARQ mode to be used to selectively contact one particular station among a number who may be monitoring a common frequency.

As well as the facility to transmit and receive FEC signals and make or receive calls in ARQ mode, the AMT-1 has a facility to enable it to monitor one side of an ARQ contact between two other stations. This ability is not inherent in the ARQ system itself, but is included since it is always interesting to be able to listen-in to other contacts.

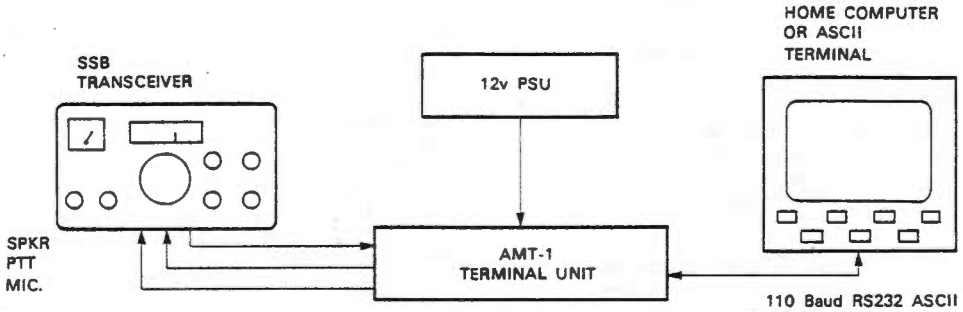
Apart from the AMTOR, the AMT-1 can also operate in conventional RTTY mode both in transmit and receive. It can also be used to send morse code (CW). The microprocessor in the AMT-1 carries out code conversions and other processing, but can be bypassed, allowing the ASCII terminal to connect direct to the FSK modulator/demodulator and communicate in ASCII over the air.

3. GETTING THE AMT-1 ON THE AIR

This section acts as a quick guide to the installation and operation of the AMT-1. Those sections which follow give more complete details, and may be consulted after the basic system is working, or whenever problems are encountered in getting the system working properly. References given in brackets refer to later sections where fuller information can be found.

The AMT-1 should be connected as follows:

> TO FORM YOUR OWN SELCAL
>
> SIMPLY COMBINE THE FIRST LETTER, TOGETHER WITH THE LAST THREE LETTERS OF YOUR CALL-SIGN. THUS THE SELCAL FOR W1AW SHOULD BE WWAW. THIS IS AN "UNOFFICIAL RULE" OF THE AMTOR COMMUNITY!



3.1 POWER SUPPLY

A 12 - 14 Volt power supply is required, capable of providing 800mA. The negative side of the supply should be connected to the outer contact of the power connector. The AMT-1 is protected against accidental polarity reversal or overvoltage, but an incorrectly applied voltage may blow the internal 1 Amp. fuse.

3.2 TRANSCEIVER CONNECTOR, SK1

This is a 7-pin socket, although a 5-pin DIN plug can be used in it. Pin 1 is the audio input from the transceiver, and should be connected via a screened cable, the screen of which should be taken to pin 2. Pin 3 is the audio output from the AMT-1 to the transceiver (usually to the MIKE socket) and should be similarly screened, with the screen taken to pin 2. An internal pre-set (RV1) can be used to vary the audio output level, although an external attenuator may be needed to reduce the level in some cases (7.3). Pin 5 is the transmit-changeover line from the AMT-1 to the "push-to-talk" line on the transceiver. In most cases all of the connections from SK1 can be made to the MIKE socket of the transceiver, the speaker output of the transceiver being taken to a spare pin on the MIKE socket. The connections and signals levels for SK1 are described more fully in section (7).

3.3 TERMINAL CONNECTOR, SK2

This is a 5 pin 240° DIN connector. Pin 1 is the serial data input to the AMT-1 from the terminal keyboard, pin 5 is the data output from the AMT-1 to the terminal display, and pin 3 is the common return for these pins. The signal levels are RS232 compatible. Pins 2 and 4 carry control signals which need not be connected initially (8.4 and 8.5).
The signal polarity can be changed by internal links (8). However, most terminals or small computers will interface directly without alterations. Any CTS or RTS control lines from the terminal can initially be left unconnected or strapped into the "unused" state, as appropriate to the terminal in question.
Further details about the CTS and RTS are given in sections (8) and (11).

If your terminal cannot operate at 110 Bauds, remove the cover of the AMT-1 and cut link 12 to give 75 Baud operation.

Connect power to the AMT-1. The front panel display should step through all the combinations of the display. This verifies that it is working, and it stops with the ESC LED lit, together with the ARQ, FEC, RTTY and CW LEDs all dimly lit. A carriage return and linefeed (newline) are sent to the terminal on power up. A further check that the terminal interface is working can be obtained by typing the letter Q, whereupon the following line should be displayed:

```
V:01 I:???? T;30 B:45 S:20 L:1 N:1
```

The V: number may be differenct on later versions of the software. The significance of this print-out is explained in (5.8).

Memorise the LED panel display at this point, with the ESC LED lit and all mode LEDs lit. This is called the ESCAPE condition, and from it, the AMT-1 can be commanded to enter any of its three operating modes. It can also be commanded to alter or set up any of its internal parameters. The ESCAPE condition is always reached by entering an ESCAPE character from the terminal, (except in the bypass mode) (5.4). The three modes may be entered by keying the letter A,R or C, for AMTOR, RTTY or CW (morse). Thus, to change from any mode to, for example, RTTY, enter ESCAPE followed by R. The ESCAPE character can normally be sent from the terminal by means of the key labelled ESC. However, in some computers this key may be used for a different function, in which case some other way must be used to send an ESCAPE code to the AMT-1 (11.4).

3.4 TUNING DISPLAY

The AMT-1 has a 16-LED tuning display located in the centre of the front panel. It is not illuminated in the ESCAPE condition. To observe how it operates, key the letter A on the terminal. The tuning display should light. If there is sufficient background noise from the receiver input, a broad flickering band should be seen. Tune in an unmodulated carrier in USB mode on the receiver, and slowly tune the tone across the passband.
At some point the display should stabilise to one or two LEDs lit at one end, the spot of light moving across the display to the other end as the tone frequency is tuned across the passband of the audio filter in the AMT-1.
The display wil finally break up into a broad band of noise as the tone is tuned out of the filter passband.

Now tune in an FSK signal, and notice how the signal appears as two dots joined by a dimmer band of light, as the signal keys from one tone to the other. Practise tuning such signals to the point where the two dots are placed symmetrically either side of the centre line of the display. Note that the AMT-1 is designed to receive the 170Hz FSK shift standard, and it may not always be possible to tune in wider shift commercial signals without one or the other (or both) tones remaining outside the 300Hz filter bandwidth of the AMT-1. On some transceivers with variable bandwidth capabilities, it may be advantageous to narrow the passband of the transceiver so that it just brackets the AMT-1 passband. Not all transceivers with a CW filter fitted will operate in this way if the position of the BFO is not suitably placed relative to the CW filter passband.

3.5 RTTY OPERATION

To switch to RTTY mode, enter ESCAPE then R. The RTTY mode LED will light, and some garbled characters will appear at the terminal until an RTTY signal is tuned in. At this point, text will become intelligible and the TRAFFIC and IDLE LEDs will light alternately.
If copy still remains garbled, there could be several reasons for it: the Baud rate of the signal could be wrong; the signal may not be RTTY at all, or it may be transmitting reverse polarity. To try another Baud-rate, enter ESCAPE followed by B, followed by the Baud-rate desired, entered as a two-digit number (5.2). Common Baud-rates in use are 45, 50 and 75. Then enter R to get back to RTTY mode. If the signal is reverse polarity, try receiving it on the other sideband.

A good indication that the signal is reversed, should it sound to be a hand-keyed signal with periods of no keying, is that the ERROR LED will be lit during such periods, indicating that the stop-bit is of the wrong polarity (9.3). If the signal is not RTTY, it may be an AMTOR FEC mode signal, in which case try entering ESCAPE A, as described later.

To transmit an RTTY signal, enter control-A from the terminal. This is normally done by holding down the CONTROL key and simultaneously keying the letter A. If this is not possible on some personal computers, then a software routine must be written, or a special function key programmed to send the ASCII code 01 (11.4).

On entering control-A, the AMT-1 turns the transmitter on via the PTT line. Check that the drive level on the transmitter does not exceed the continuous-carrier level. Adjust RV1 in the AMT-1 to achieve the desired level (7.3).

Having set the system to transmit an RTTY carrier, type on the keyboard and the text will be transmitted over the air, simultaneously appearing on the terminal display. If the terminal displays each letter twice, then enter ESCAPE L Ø and remember in future to do so each time the terminal is switched on. Also refer to section (5.6).

To end an RTTY transmission, enter control-D (ASCII code 04). The AMT-1 will then return to receive.

3.6 CW OPERATION

To send CW, enter ESCAPE C. The CW LED will then light. Enter data via the keyboard and the AMT-1 will send it as CW by keying the PTT line. The PTT line can be shorted to earth to keep the transmitter on between code elements, and the AMT-1 will still send perfect CW, since the tone output is also keyed.

The transmitted text is displayed on the terminal as it is sent. It is possible to type faster than the CW sending speed, but remember to use the space bar between words. To change the sending speed, enter ESCAPE S followed by the required speed in words-per-minute (5.10) followed by C to return to CW mode. Do not initially use sending speeds higher than 50 w.p.m. without consulting section 10.2 regarding setting RV2.

3.7 AMTOR OPERATION

Enter ESCAPE followed by A to enter AMTOR mode. The FEC LED will light, together with the STBY LED. The tuning display will also light. In this condition the AMT-1 will do nothing further until an FEC signal is received. If such a signal is tuned in, at first nothing will happen until the signal sends a phasing pattern, recognisable as a characteristic rhythm which is sent from time to time. It is this which distinguishes an FEC signal from an RTTY signal to the ear, since when an RTTY station pauses, it emits an unmodulated carrier. When an idle pattern is detected by the AMT-1, it will synchronise to it, the FEC and IDLE LEDs will light, and the tuning display will change from continuous mode to the "two dot" display, the line joining the two dots being no longer present (9.2). When the distant operator begins to type, the TRAFFIC LED will light and the message will be received at the terminal. At the end of the transmission, the STBY LED will come on as the distant station sends an "end of transmission" code. If the signal fades out and no such code is received, the STBY LED will come back on after some garble has been printed for a few seconds.

To make an FEC transmission, enter control-B from the terminal (ASCII code 02). The transmitter will switch on. Enter the message at the terminal, and end the transmission by entering control-D (ASCII code 04). It is important to end with control-D and not ESCAPE, in order to ensure that the "end of transmission" code is properly sent.

If the characteristic "chirp-chirp" sound of an ARQ signal is heard, then it should be possible to monitor it by entering control-F (ASCII code 06). If two signals are present on the same frequency, indicated by interleaved long and short bursts of signal, possibly at different signal strength, then it will be the one that is transmitting - sending long bursts - which can be monitored. If only one signal is heard, sending only short bursts, then the ARQ-listen mode will not lock until that station changes to sending long bursts.

After entering control-F, tune the signal in as accurately as possible and the AMT-1 will lock to the signal, possibly blinking the tuning display a few times at first if the signal is noisy, but ending with the display in the "two-dot" mode synchronised to the timing of the signal. The text being transmitted by the distant station will be displayed at the terminal. If the signal changes to receive mode (sending short bursts), the AMT-1 will drop out of sync., the PHASE LED will come on again and the tuning display will revert to the continuous mode, trying to sunchronise to another signal. It will also do this if it has not received an error-free block for 15 seconds, or if control-F is entered to force the unit to start synchronising to a new signal.
It is a characteristic of this ARQ-listen mode that, if the distant signal is idling, false synchronisation is quite possible. In this case, garble will be displayed and the ERROR LED may be on even if the signal is clean. The terminal may well display strings of IIIII, FFFFF, 88888, or %%%%% characters. In this case, enter control-F again to attempt another sync. Synchronisation will always be achieved quickly when the signal stops idling. To exit the ARQ-listen mode, simply enter control-D.

The signal being monitored may be making an ARQ phasing call. If this is the case, the terminal will display a repeated 4-letter group and the RQ LED will be on continuously.

This 4-letter group is the selective-call code of the station being called by the station being monitored. It is normal practice in AMTOR operation for each station to choose its own unique 4-letter group, usually chosen from the letters of the station callsign. The AMT-1 may be set to respond to its own unique code by entering ESCAPE I followed by the 4 letters chosen (5.5), followed by A to return to AMTOR standby. In this case, the FEC, ARQ and STBY lamps will light.

If you have entered your own selcal in this way, and a station calls using this code, then your station will respond. The STBY LED will go out, the transmitter will be keyed to reply with short bursts between the received long bursts of the calling station, and his message to you will appear at the terminal. This is one way that an ARQ contact can be initiated. The other way is to initiate the ARQ call oneself, using the selcal code of the station called. To do this: While the AMT-1 is in the AMTOR mode, enter control-A (ASCII code 01) followed by the four letters of the other station's selcal code. The PHASE LED will light, and the transmitter will be keyed with long bursts to initiate the call. When the other station replies, the PHASE LED will be replaced with the IDLE LED. You may then type your message to the distant station.

With either method of initiating an ARQ contact, the direction of sending can be changed in one of two ways. The normal way is for the sending station to end his transmission with the characters +? (no gap between them). This signals the other station to commence the change-over procedure. When this is completed, the two stations will have changed over from sending long bursts to short and vice versa. The other method which must be used with care, is for the receiving station to enter control-C (ASCII code 03).

To end an ARQ contact, the last station to be sending should enter control-D (ASCII code 04), whereupon an "end of contact" code will be sent, switching both stations back to STBY. Refer to (10.2) if you have problems with ARQ contacts.

If propagation between the two stations is poor, the contact may sometimes be held up by repeat sequences, indicated by either the ERROR or RQ LED being lit. In this case, the terminal data output will pause whilst the repeats are in progress. This occurs at the receiving end, and also during "local copy" at the sending end.

If the ERROR or RQ LEDs are on continuously for 15 seconds or more, then a PHASE operation will take place, during which the original calling station will repeat the call and the originally called station will cease keying and attempt to re-synchronise. No intervention by either operator is needed during this operation.

Typing may continue at either end, provided the internal buffer stores do not overflow (4.2). If, in the PHASE condition, contact is not re-established within 30 seconds, then the station will revert to STBY. This 30 seconds time-out can be changed to any value between one and 100 seconds by entering ESCAPE T followed by the required time-out figure (5.11).

4. OPERATING HINTS

4.1 In RTTY and AMTOR modes, transmission is by means of a code with 32 different combinations. Two of these are used to switch ensuing text between one set of 30 letter characters and another set of 30 figures and punctuation marks. These "lettershift" and "figureshift" characters are automatically generated by the AMT-1 in the translation from ASCII code. In most cases the user need not be aware of the operation. However, it sometimes happens that the received text gets in the wrong character set by mistake. If the received text appears in figure-shift erroneously, enter a DELETE character from the terminal (ASCII code 127, or HEX 7F). This will force the following received text back to letter-shift.

The AMT-1 has an automatic system for sending an extra shift character after either a carriage return, linefeed, or NULL character, which ensures that a distant station will always start a new line in the correct shift. Since the received shift will be unknown at the start of a transmission, therefore, it is always good practice to start each transmission with a carriage return and a line feed.

This also has the effect of ensuring that both the sending and receiving print-positions are synchronised and ensures that the distant receiving station's first line does not overrun the end of the line.

The AMT-1 also has an automatic system to generate a carriage return and linefeed if a space character is entered after the 60th character in a line. This ensures that overprinting can not occur at the receiving end, particularly if the user is typing faster than the terminal is echoing the text and is not aware of approaching the end of a line. This facility can be disabled by entering ESCAPE N Ø (5.7).

During RTTY and ARQ contacts, it is possible to type into the AMT-1 even whilst receiving. Any text so entered will be held in the internal buffer, and will then be transmitted as fast as possible when the terminal unit has changed to transmit. This type-ahead facility is not available on FEC mode, although, if text is entered faster than six character per second, it will build up in the buffer, as it will in CW mode.

Since, when transmitting in FEC mode, distant stations can only synchronise when the signal is idling, each transmission must start with a period of idles. The AMT-1 does this automatically for a short period, but if a longer period would help the distant station to tune in, then, after entering control-B, simply leave a suitable pause before commencing typing. The practice common in RTTY of sending a line of RYRYRYRY at the start of a transmission to allow the distant station to tune in is not helpful on FEC mode.

4.2 The internal transmit buffer will hold 960 characters, allowing a useful amount of text to be typed in advance if required. If the buffer fills, any more text entered will be lost. It is possible to prevent this if the user's terminal is an intelligent computer, by using the RTS output from SK2 pin 4 to inform the computer that the buffer is full. See section (8.4 and 11.1).
To cancel the buffer contents completely, enter control-X (ASCII code 24, or HEX 18).

Note that if there is still some text waiting in the buffer when control-D is entered to end the transmission (in RTTY or FEC) or end the contact (in ARQ mode), then the remaining text will be transmitted before closedown. If control-X is entered after control-D and before the closedown has taken place, then the closedown is cancelled. The transmission will then idle when the buffer has emptied.

In the previous section, it was mentioned that the use of control-C to "break-in" to the other station's transmission during and ARQ contact, must be used with care. The reason is that any subsequent +? sent after the break will probably leave the remainder of the distant station's broken transmission in figureshift. The DELETE key will have to be pressed quickly to correct this. It can also be confusing to the distant operator if he is interrupted in the middle of a transmission. If the distant station interrupts you in this way, and you wish to respond to the interruption, then enter control-X to clear the buffer and enter a carriage return linefeed to set the correct shift.

The normal method of establishing contacts on RTTY is to put out a CQ call and then listen for a reply, or to call a station after hearing him end a contact. On AMTOR, it is normal practice to make CQ calls in FEC mode, announcing your own selcal code during the call. At the end of your call, a distant station can then call you back in either FEC or ARQ mode, provided of course, that you have previously entered your selcal code using the ESCAPE I procedure (6.5). Another way to initiate an ARQ contact is to call a station directly in ARQ mode, perhaps as he is ending a contact. You must, of course, know his selcal to do this. It is also common for AMTOR stations to maintain a listening watch on a common frequency, in which case a selcal transmitted on the frequency will quickly establish if the station is available.

When making an ARQ call using a transceiver, it can happen that the replying station comes back slightly off-tune, indicated by an off-centre tuning display. It is tempting to correct this error by adjustment of the main tuning dial. This temptation should be resisted, as it will result in the transmitter frequency changing as well, and this will probably result in the distant station having to retune at his end.

This can result in an endless series of retune operations at both ends. The rule, therefore, is for the calling station to leave his main tuning control untouched, and to retune any offset with the receiver clarifier control (RIT). The called station should leave his RIT in the central position, and use the main tuning to ensure his tuning display remains central throughout the contact. A different technique may be needed if, for example, one station is crystal-controlled. It is even possible to adjust the transmitter frequency independently of the receiver, whilst watching the RQ LED. Set the frequency to the midpoint of the range outside of which the RQ LED comes on as a result of the distant station requesting a repeat when your signal is off tune in his receiver! A similar operation can be used to optimise the transmitter power level.

The power output of the transmitter can be reduced progressively during an ARQ contact to the point just before the RQ LED starts to come on. Remember that no text will be lost if the power is reduced too far for a moment or two. It is even possible to make a pre-arranged change of frequency or band. With care, this can be achieved in the middle of a contact without losing any text. The calling station must be the first to change frequency in this way, with the called station following, so that the calling station begins to send the phasing pattern on the new frequency if the change takes longer than 15 seconds.

4.3 There are some inherent operating limitations associated with the use of different transmission speeds at each end of the AMT-1. For example, if an RTTY signal is received at 100 Bauds, and is sending traffic at full speed with no gaps, characters will be entering the unit at a rate of 13.33 per sec. If the terminal is operating in 110 Baud ASCII, then characters will be sent to the terminal at a rate of 10 per second.

Text will build up in the internal 64 character buffer and this may eventually fill. If it does, some text will be lost. Although the unit is capable of copying RTTY at a data rate of 100 Bauds, it cannot handle a character rate faster than 10 c.p.s. when operating with a terminal at 110 Bauds, and no faster than 6.66 c.p.s. when operating at 75 Bauds.

There is no restriction on receive speeds when operating in AMTOR mode, as the maximum character rate receivable on AMTOR is 6.66 c.p.s. There may, however, be a problem when transmitting, as text entered at 110 Bauds from the terminal may build up in the transmit buffer when operating in AMTOR mode or in RTTY mode at Baudrates lower than 75. The transmit buffer is much larger (960 characters) and the RTS handshake line is available to extend this when required in computer applications (11.1). On slow speed CW, text will normally build up in the buffer anyway, and since CW is sent at a non-uniform character rate, it is an advantage that some text is held in the buffer to keep the letter spacing correct. If sending at high CW speeds, especially from a 75 Baud terminal, the buffer may always remain empty, and this will give rise to uneven letter spacing in the output morse code.

5. ESCAPE CODES

From previous sections, it should be clear that other than changing from one mode to another by using the ESCAPE key, further functions may also be carried out. These will now be described in detail. These codes are normally preceeded by ESCAPE, but if the AMT-1 is already in the ESCAPE condition, as shown by the ESC LED plus all four mode LEDs, then another ESC code is not needed.

5.1 ESCAPE A

This code enters the AMTOR standby mode from whence FEC signals may be received. ARQ can also be received if the selcal code has been entered. FEC or ARQ transmissions can be made, or ARQ signals may be monitored, by using control-B, control-A, or control-F, as described above.

5.2 ESCAPE B

This mode enables the user to set the Baudrate at which the AMT-1 is to operate when in the RTTY mode. After entering B, follow it with a two-digit number, indicating the desired Baudrate. Although the common Baudrates are 45, 50 and 75, the AMT-1 will accept any figure between 01 and 99. Note that if Baudrates below 10 are required, the leading zero must be entered. If 00 is entered, the unit will be set to 100 Bauds. Both transmit and receive are set to the same Baudrate. If a character other than a number in the 0 - 9 range is entered by mistake, the terminal will print a questionmark and the AMT-1 will return direct to the ESCAPE mode. While the Baudrate is being entered, the ESC and RTTY LEDs will be lit. When the second digit has been entered, the AMT-1 will return to the ESCAPE condition.

5.3 ESCAPE C

This code enters the CW mode, as previously described.

5.4 ESCAPE D

This code enters the "direct" or bypass mode, in which the microprocessor is bypassed and serial data from the terminal is passed direct to the output frequency-shift generator. Serial data demodulated from incoming received audio is fed directly via the serial output to the terminal. In this mode, ASCII code can thus be transmitted and received (simultaneously, if required). The Baudrate is determined by the terminal, and indeed, any code or speed can be transmitted through the system under these conditions, subject to the limitations of the receive filter, which limits the top speed to about 120 Bauds. Note that in this mode the PTT line is continuously enabled. This is necessary in order to keep the tone generator switched on. The PTT line must be externally disconnected from the transceiver to allow it to pass received signals. The AMT-1 will not respond to any ESCAPE code in this mode. An ESCAPE code will be transmitted directly over the radio. The only way to "escape" from this mode is to switch the power supply off and then on again.

5.5 ESCAPE I

This code enables the user to set the selective call "ident" of the unit. This is the four-letter group to which the unit will respond in ARQ mode. If the ESCAPE I function has not been used since the unit was switched on, then the unit will not respond to ANY ARQ call, but only to FEC transmissions. To set the ident, enter ESCAPE I followed by the required four-letter group. Only the letters A - Z are accepted. If any other character is entered, the terminal will display a questionmark and revert to the ESCAPE condition. Whilst the ident is being entered, both ESC and ARQ LEDs will be lit. When the fourth letter has been entered, the unit will revert to the ESCAPE condition.

5.6 ESCAPE L

This code turns on or off the "echo" facility, whereby input from the terminal is sent back to the terminal to appear on the display. This is the normal way in which it will be used, with the terminal effectively working as a separate keyboard and display. If the terminal has its own "echo" or "local copy" facility, then this should be disabled. In the event that this cannot be done, then the echo facility of the AMT-1 will have to be disabled. This is achieved by entering a zero after the L. The lack of the AMT-1 echo facility is a distinct disadvantage, especially in ARQ mode, where the presence of the echo indicates when each character has been transmitted and accepted by the receiving station.

ESCAPE L 1 is used to turn the echo on again. On switch-on, the echo is enabled.

5.7 ESCAPE N

This code turns the automatic-newline facility on or off. It is enabled at switch-on and will automatically ensure that both a carriage return and a line feed are inserted into the text in substitution for any space which occurs after the 60th character position in any line. This ensures that no line is too long for the distant station's printer. In CW mode, carriage return and linefeed codes are not transmitted, but nevertheless the auto newline function serves to format the echoed text on the terminal into neat lines. When it is desired to use a different linelength, the auto-newline function may be disabled with ESCAPE N Ø and enabled with ESCAPE N 1.

5.8 ESCAPE Q

This code causes the AMT-1 to output to the terminal values of all of the parameters that have been programmed via other ESCAPE functions. This explains the print out when Q is entered to test that the AMT-1 is working. The number printed after the V: is the version number of the software. When the unit is switched on, the ident will be shown as I:????, to indicate that no ident has been set. The unit will not respond to any ARQ call. The AMTOR timeout is set to T:30, the Baudrate to B:45, the CW speed is S:20, and the L: and N: are both 1 at switch-on. Note that all these parameters are retained even though the mode may be changed. It is not necessary to re-enter the ident before entering AMTOR mode each time.

5.9 ESCAPE R

This code selects RTTY mode. On selection, the AMT-1 will receive RTTY. Control-A will change it to transmit, and control-D returns it to receive, as previously described.

5.10 ESCAPE S

This code allows the user to set the word-per-minute speed that will be used in CW mode. One should enter a two-digit number after the S, in a similar fashion to that used for Baudrate. Use a leading zero for speeds less than 10 w.p.m. Entering 00 will set 100 w.p.m., and if a character other than a number is entered, a questionmark will be printed.

5.11 ESCAPE T

This enables the user to set the time-out in the ARQ phasing condition, i.e. the length of time in seconds during which the unit will keep trying to resynchronise with the other station before giving up and returning to STBY. Again, a two-digit number between 01 and 99 can be entered, with 00 giving 100 seconds.

6. CONTROL CODES

Apart from ESCAPE sequences, other functions executed by the AMT-1 are selected by ASCII control codes, usually entered from the terminal by depressing the CONTROL key and simultaneously keying a letter. Not all control codes have the same meaning in different modes, nor are all active in all modes.

6.1 CONTROL-A

In RTTY mode, this code forces the AMT-1 from receive to transmit. In AMTOR mode, followed by four letters to form the outgoing selcal code, it initiates an ARQ call. If a character other than a letter (A - Z) is entered as any of these four, the unit will print a questionmark and then revert to AMTOR STBY. Control-A has no effect in CW mode.

6.2 CONTROL-B

In RTTY mode this code has the same effect as control-A. In AMTOR mode, it will initiate an FEC transmission. In CW mode it has no effect.

6.3 CONTROL-C

This code has the same effect as control-D in RTTY mode. During an ARQ contact, it can cause a "break-in" if the distant station is sending. Control-C has no effect in other modes.

6.4 CONTROL-D

In RTTY, control-D switches from transmit to receive. In AMTOR FEC transmit, it causes an "end of transmission" code to be sent, followed by switching off the transmitter and reverting to STBY. During ARQ contacts, control-D will cause the contact to be terminated, switching both stations to STBY. This works only when the station that entered control-D is in send mode and has finished sending any text that may be in the buffer. If control-D is entered whilst the station is in receive, then closedown will be delayed until the station switches to send. In the ARQ-listen mode, control-D terminates the listening mode and returns the unit to STBY. Control-D has no effect in CW mode.

6.5 CONTROL-E

This code is a special one and causes a specific non-ASCII code to be sent from the AMT-1 to the terminal. This code can be interpreted by a computer, the details of which are described in section (11.3). On most simple terminals, this "status" code may or may not print as a character of some sort. It might be interpreted as a control character by the terminal, and for this reason control-E should be used with care.

6.6 CONTROL-F

This is only valid in AMTOR mode, where it will initiate the ARQ-listen mode.

6.7 CONTROL-G

This is not strictly a control code, but will cause a BELL character to be transmitted to the distant station. The echo back to the terminal will be an asterisk. This ensures that if the terminal itself is configured to respond to a control-G by issuing an audible alarm, it will not do so if an alarm code is transmitted. If a BELL code is received over the radio, the AMT-1 will send a control-G to the terminal, however.

6.8 CONTROL-X

In RTTY, CW, ARQ and FEC transmit modes, control-X will cancel any text which may not yet have been sent from the buffer. In addition, if control-D had previously been entered to signal the end of the transmission or contact, control-X will effectively cancel control-D.

6.9 DELETE

In RTTY and AMTOR modes, this has the effect of forcing any subsequently received text into the "lettershift" character mode. It can be used to correct any received signal which has switched into figureshift in error.

Carriage return, linefeed and NULL control characters are treated as text and passed to the transmitter. They also have the effect of causing the next non-control character to be preceeded by the appropriate lettershift or figureshift.

7. SK1: TRANSCEIVER CONNECTOR

7.1 Pin 2 is the common earth return for the other signals carried by this socket. It is also strapped to the metal chassis of the AMT-1 to ensure good immunity from external RF fields. The screens of the leads to pins 1 and 3 should be connected to this pin.

7.2 Pin 1 is the audio input from the receiver. The input impedence is 100K Ohms and the audio level should be between 50m V. and 1 V. rms.
This signal may be derived from the external loudspeaker socket of the transceiver, but it is better if the audio can be taken from a point ahead of the gain (volume) control such that the speaker volume can be varied (or turned off) without affecting the audio level to the AMT-1. An audio output is often available from the accessory socket or phone-patch socket or it can simply be wired to a spare pin on the MIKE socket.
To check that the audio level is within the correct range, tune in an unmodulated carrier that can be varied in level. The position of the tuning display should not vary as the audio level is varied slightly up or down.

7.3 Pin 3 is the audio output from the AMT-1 to the transceiver. This is a sinewave and can be varied between zero and 1 V. rms by means of the internal preset, RV1. The tone is keyed on and off by the microprocessor, turning on a little after the PTT line does, such that there is no drive to the transmitter until the changeover to transmit is completed. This ensures that no key-clicks are radiated. Pin 3 can be connected to an auxiliary audio input on the transceiver if such an input is available. Normally it will be taken to the MIKE input. If the audio level from the AMT-1 is too high, fit a resistor in series with the MIKE input connection at the transceiver end of the lead. This will drop the audio level to that normally expected from a microphone.

It should be possible to leave the MIKE gain control in its normal position. Choose a series resistor such that RV1 can be set to give the correct transmitter drive level with its slider somewhere near the middle. It is important not to overdrive the MIKE input of the transceiver, or spurious emissions can be produced on either side of the wanted signal, even if the transmitter output stage is not overdriven.

7.4 Pin 5 is the PTT line connection. This is driven from the AMT-1 by an open collector transistor which connects the line to ground when the AMT-1 enters transmit mode. The PTT line must be positive with respect to earth at the transceiver when in receive condition. This is true of all popular transceivers. A simple connection can therefore be made between the AMT-1 and the PTT line which will normally be available on the MIKE socket. In the event that the PTT input on the transceiver is not of the "earth-to transmit" type, then a small relay should be connected between the AMT-1 PTT output and the + 12 V. supply. The contacts can be connected to the transceiver.

Pins 4, 6 and 7 are not connected.

8. SK2: TERMINAL CONNECTOR

8.1 Pin 3 of SK2 is the common earth return for the other pins on the socket. It is also connected to the AMT-1 chassis.

8.2 Pin 1 is the serial input from the terminal to the AMT-1. A negative voltage on this pin corresponds to the stop-polarity, and a positive voltage to the start polarity. The terminal should output a negative voltage to the AMT-1 on this pin when in idle condition. If the polarity needs to be reversed, the internal link LK7 in the AMT-1 can be cut. The data into the AMT-1 must be ASCII code with one start bit, 8-bit data bits, and either one or two stop bits. The eighth data bit (sometimes called the parity bit) is ignored by the AMT-1, and can be either zero, one, odd, or even parity. The data rate accepted by the AMT-1 is either 75 or 110 Bauds, selected by internal DIL switch SW3 (10.5).

8.3 Pin 5 is the ASCII output from the AMT-1 to the terminal. The logic levels and data format are as per the input on pin 1. The AMT-1 outputs are zero (start polarity) in the parity bit with the exception of the "status" character output. This is sent when the AMT-1 responds to a control-E character from the terminal (11.3). In this case the parity bit is one. The polarity of the output signal can be inverted by cutting LK5.

8.4 Pin 4 is the RTS (Request To Send) output from the AMT-1 which can safely be ignored in most applications. However, its purpose is to inform the terminal, or computer, when the AMT-1 can or cannot accept text for transmission. For example, if the internal 960 character buffer fills during entry of text from the terminal, then RTS changes. The computer should respond by stopping the flow of data until the AMT-1 signals that there is a space in the buffer. This line also indicates that the AMT-1 cannot accept data when it is not in a transmit mode, such as FEC-receive or ARQ-listen, or during an ARQ call before the distant station has replied. A positive voltage on this line indicates that text can be accepted, and a negative voltage indicates that it cannot. Note that the AMT-1 will still accept control characters even if this line is negative. The polarity of this signal can be inverted by cutting link LK4 (11.1).

8.5 Pin 2 is the CTS (Clear To Send) input to the AMT-1. For most applications, this pin can be left disconnected. It serves a similar purpose to that of pin 4, but in the opposite direction. It can stop text from being sent out by the AMT-1, e.g. when the computer is temporarily busy with another task, such as storing a block of text on disk or cassette. During this time any data from the AMT-1 might be missed. If this pin is taken negative, then any received text will be held in a temporary 64-character buffer within the AMT-1. It will be released when CTS is taken positive (or left open). The polarity of this signal can be reversed by fitting a link in LK6 position. If this is done and CTS is left open, then the AMT-1 will not permit any data output. In this case, CTS must be held negative if it is not used. See section (11.2).

9. FRONT PANEL DISPLAY LED'S

There are three displays on the front panel. The right-hand one, comprising four red LEDs, indicates which of the principal modes the AMT-1 is in. The centre display, comprising green LEDs, is a tuning display. It gives an analogue indication of the frequency of the received tones. The left-hand display indicates the status of the unit within each mode. The significance of each LED is described below:-

9.1 MODE DISPLAY

ARQ is lit when the AMT-1 is in AMTOR standby mode and is ready to receive either FEC or ARQ calls, or if it is in ARQ contact or making an ARQ call.

FEC is lit if the AMT-1 is either receiving or transmitting an FEC signal.

RTTY is lit when the AMT-1 is in RTTY mode, either transmit or receive.

CW is lit in the CW mode.

9.2 TUNING DISPLAY

The tuning display is turned on only when the AMT-1 is in receive. A high-frequency tone will give a spot on the left side of the display, and a low frequency tone on the right side. In RTTY receive, the display will be lit continuously. A signal will show as a dot which should flicker rapidly between the left and right-hand side of the display. In FEC receive, the display changes to the "two-dot" mode, where the display is only gated on at the exact centre of each data bit. Thus the display will not show the dot as it traverses from one side of the display to the other, but only as two separated dots - one on each side.

Interference and distortion on the incoming signal will show clearly as spurious dots in the centre of the display. In ARQ mode, either during contacts or in listening mode, the display will illuminate in synchronisation with the incoming signal, in two-dot mode. This makes it very easy to tune signals in, even when sending, when the distant station is only transmitting short bursts of signal. The display will change to continuous mode during periods of phasing.

9.3 STATUS DISPLAY

ERROR is lit in RTTY mode when the received character has a stop bit of the wrong polarity. This is a useful indication that the received polarity is wrong, or the Baud rate is incorrect, although a weak signal will also show short flashes of ERROR. In FEC receive, the ERROR LED will flash if both repeats of a character contained errors and the AMT-1 has not attempted to print it. In ARQ mode, whether sending or receiving, the ERROR LED will indicate that the received signal is bad and that the AMT-1 is making a request for a repeat. The ERROR LED will light in ARQ-listen mode if the received block contains an error. In this case the remaining characters in that block will be printed.

RQ will light in ARQ mode, when the distant station requests a repeat due to his received signal being bad (his error LED will also have come on at this time). In ARQ-listen mode, the RQ LED indicates that the signal being monitored is either requesting repeats from the station he is working or he is sending an ARQ phasing call, in which case the selcal code will be printed.

TRAFFIC will be lit in any mode when text is being processed through the unit - either being transmitted in "send" mode, or received.

IDLE will be lit when no traffic is being processed. In SEND mode, this means that the unit is waiting for input from the terminal. In RECEIVE mode, it means that the distant station is not, for the moment, sending text.

OVER will light only in ARQ contacts when a change-over in sending direction is in progress or when a closedown is about to occur.

PHASE will light in ARQ mode when the AMT-1 is trying to synchronise with a distant station during either an ARQ call, or during a contact when signals have been lost temporarily. In ARQ-listen, the PHASE LED has the same meaning.

STBY is lit only in AMTOR standby mode. The unit is then waiting to receive an FEC or ARQ call.

ESC is lit when the AMT-1 is in the ESCAPE mode. In this case, all four mode LEDs will be lit. The next letter typed will be interpreted as a mode command. ESC is also lit during certain parameter-setting commands in which case one or other of the mode LEDs will also be lit.

The SEND LED, a red one, is lit in any send mode. When lit, input from the terminal for subsequent transmission will be accepted. During a phasing operation in ARQ mode (though the unit may or may not be sending a call to try and resynchronise), the SEND LED will indicate which direction will re-establish itself when the resynchronisation is successful.

10. INTERNAL ADJUSTEMENTS

10.1 RV1

This sets the audio output level, as previously described. It should be set such that the audio output level matches that of the input to the transceiver.

10.2 RV2 sets the time delay between the turn-on of the PTT line and the turn-on of the audio tone and the commencement of transmission of data. This allows for the inevitable delays in change-over circuits within the transceiver. As it leaves the factory, this is set to mid-position, giving a delay of 25mS. This setting is not important for RTTY or FEC transmissions or slow-speed CW, but for high-speed CW and ARQ contacts, it is important that the transceiver has fully changed to transmit by the end of this delay.

Turning RV2 clockwise will increase the delay if the transceiver is particularly slow to change over - up to a maximum of 50mS. However, a long setting for RV2 will limit the maximum distance over which an ARQ contact can be made, and will also limit the maximum speed at which CW can be sent, so it is often necessary to set RV2 accurately. To do this requires an oscilloscope.

Arrange the oscilloscope to trigger externally from the negative-going edge of the PTT line signal. Display the RF output signal from the transmitter, either directly at RF frequency or via a detector arrangement and from a point on the antenna side of the antenna change-over relay. Set the timebase speed to 10mS per division, and set the AMT-1 to send an ARQ call. Turn RV2 fully anticlockwise. The oscilloscope should trigger at the start of each transmitted burst, and should display the start of the output envelope. Note the point at which the output first reaches full power and turn RV2 slowly clockwise until this point just starts to move to the right. At this point the AMT-1 is turning on the tone just at the point where the transmitter first achieves full gain. If this point cannot be found before RV2 reaches its endstop, then the transmitter is taking more than 50mS to turn on.

Some modification may therefore be needed in the transceiver if ARQ contacts are to be possible. See section (12) for assistance.

An alternative trial-and-error method of setting RV2, with the help of another station, is to send an ARQ call and ask him to monitor it in the ARQ-listen mode. Ask him to check for missing first and third characters in the printed selcal. Such missing characters (or no synchronisation at all) indicates that the setting of RV2 is too short for the transceiver. Do not adjust RV2 during a call, but make a small alteration and start a new call in order to arrive at the optimum setting.

10.3 RV3, RV4 AND COIL

These presets need not normally be touched, having been aligned at the factory. However, for reference, here is a procedure for adjusting them. They form part of the receiver demodulator.

With the AMT-1 in ARQ standby such that the tuning display is on, feed an audio signal generator, or variable tone (perhaps from the receiver tuned to an internal calibrator signal) into the AMT-1. Turn VR4 fully clockwise and adjust the input frequency until the tuning display is as far to the left as possible without folding back to the right or breaking up into noise. Then adjust RV4 until the displayed spot just reaches the lefthand end of the display. Be careful not to go too far, as the spot will hold on the end position rather than "go off the end". Now turn RV3 fully anti-clockwise and adjust the input frequency until the display is farthest to the right without folding back to the left or breaking up. Then turn RV3 until the spot just reaches the right end of the display. Swinging the frequency over the whole range should move the spot across the full display.

Now remove the transceiver connector (SK1) and make a shorting link between pins 1 and 3, to connect the transmit tone back to the receive side. Enter ESCAPE D from the terminal, and a spot should appear in the left half of the display. Key any characters on the terminal, and the spot should key into the other half of the display. Adjust the coil until the displayed spots are symmetrical about the centre. Switch the AMT-1 off and on again to return to normal operation.

10.4 VC1

This trimmer adjusts the main crystal oscillator in the AMT-1 and has been set accurately at the factory. The accuracy of this adjustment is most critical in ARQ mode. If ARQ contacts are periodically interrupted by phasing operations in the absence of any other cause, then VC1 may need adjusting (or the equivalent trimmer at the other station). To set VC1, a counter is required with a period-average mode. Connect the counter to TP2 and adjust VC1 until the period is exactly 1000.000 micro-seconds. 6-Digit accuracy is preferred for this measurement, which should therefore only be attempted if the counter accuracy is known to be of this order.

10.5 INTERNAL LINKS

Two internal links, L10 and L11, respectively allow the transmit and receive keying polarities to be changed. With both in the factory set position, an upper sideband SSB transceiver will give the correct polarity for amateur RTTY stations and for all TOR stations. If transmission has to be made in the opposite polarity, or the transmitter is only capable of operation in lower sideband, then link the two pins at L10.

The same applies to L11 for the receive polarity. When working through certain amateur satellites, it may be necessary to have L10 and L11 in opposite positions, but normally they would both be in the same position.

L12 determines which data rate the terminal interface will operate at. Open gives 75 Bauds and connected gives 110 Bauds. For convenience, L10 and L11 are brought out to unused pins on the XCVR connector. Switches can be connected between these lines and ground for external operation.

11 COMPUTER INTERFACING WITH THE AMT-1

Although the AMT-1 can be used effectively with a "dumb" terminal that is simply capable of displaying its input on a printer or video display and outputting serial ASCII data from keyboard entry, many users will want to use a small computer to carry out the function of a terminal. In this case, the processing power of the computer can be used to expand the system into a powerful communications facility.

11.1 For the simple connection of an ASCII terminal to the AMT-1, it has been assumed so far that no connection has been made to the two control lines RTS and CTS on SK2. However, if these are connected back into the computer, then complete control of the two-way flow of data between the two equipments is possible. For example, if the 960-character transmit buffer in the AMT-1 fills due to a hold-up in an ARQ contact, then RTS will go negative, and the computer will then hold any further output until RTS goes positive again, indicating that there is now space in the buffer. In this way, the computer can send very long texts without risking the loss of any part of it.

This pin will indicate if the buffer is full in CW, RTTY, ARQ and FEC transmit. It will also go negative in modes where the AMT-1 will not accept text, such as in ARQ-listen, FEC receive, ARQ standby, and during an ARQ call (in the interval between starting the call and the distant station replying). Note that when RTS is negative, the AMT-1 will still respond to control codes. It will often be necessary to enter a control when RTS is negative, to change modes. The computer will be required to have two output routines, one to output a character provided the line is positive, and another to output control codes regardless of the state of the RTS line.

11.2 Pin 2 of SK2 (CTS) can be taken negative by the computer to temporarily stop the flow of received (or echoed) text from the AMT-1. In this case, text will "pile up" in an internal 64 character buffer within the AMT-1. Depending on the rate at which text is being received, this buffer will then start to fill. In FEC receive and RTTY receive modes, text will be lost if the buffer fills completely, so there is a definite limit to the length of time that the computer can take CTS negative whilst it is busy. In ARQ contacts, if the buffer fills, then no text will be lost since the AMT-1 will send a "dummy" request for repeat to the distant station until there is space again in the receive buffer.

There is one situation where the AMT-1 will send a character even if CTS is held negative. That is when the status character is sent by the AMT-1 in response to a control-E code from the terminal. This enables the computer to establish the status of the AMT-1 even in the middle of a period of reception. It pulls CTS negative to stop the received traffic, then sends a control-E and receives the status from the AMT-1, before releasing CTS to copy the following received data.

11.3 STATUS CHARACTER

At any time, sending a control-E character from the terminal to the AMT-1 will cause it to respond with the status character. If this status character is considered as an 8-bit byte, then the individual bits can be interpreted by the computer in the following way.

Bits 0, 1 and 2 indicate which of the left-hand status LEDs is lit, as follows:-

bit 2	1	0	LED
0	0	0	error
0	0	1	RQ
0	1	0	traffic
0	1	1	idle
1	0	0	over
1	0	1	phase
1	1	0	STBY
1	1	1	ESC

Bit 3 is 1 if the SEND LED is on, and 0 if it is not.

Bits 4, 5 indicate which of the right-hand MODE LEDs is on, as follows:-

Bit 5	4	LED
0	0	ARQ
0	1	FEC
1	0	RTTY
1	1	CW

Note that in the ESCAPE condition, where all the mode LEDs are on, bits 4 and 5 will contain random data, i.e. they may indicate any of the four modes.

Bit 6 is a 1 if there is some text in the internal 64 character buffer waiting to be outputed, e.g. CTS has been held negative and some message has been received but not read by the computer. Note that an ESCAPE is the only way of clearing the 64 character buffer.

Bit 7 of the status byte is always 1. This is in contrast to bit 7 of any other character outputed from the AMT-1. It can thus be used to distinguish a status byte from a text character, e.g. if control-E is sent to the AMT-1 whilst reception is in progress. In this case the status byte will be mixed in with the text.

The status byte can be used for a variety of purposes. For example, if it is desired to automatically send the station call-sign on CW between periods of operation on RTTY, then the computer, when it wishes to send the CW, can first test to see that the transmit buffer is empty by waiting until a returned status byte has 0 1 1 in bits 2, 1, 0. It then sends ESCAPE C, followed by the station call-sign, then waits again until a returned status byte indicates the idle condition before sending ESCAPE R, to return to RTTY mode. If the wait is not included, then the AMT-1 will be cut short in sending the CW call-sign when ESCAPE is send immediately after sending the call-sign to the AMT-1 from the computer, since the speed of sending CW will usually be slower than the speed of sending from the terminal. In AMTOR standby, the computer can continuously send control-E to the AMT-1 to detect the start of a received call, and, for example, choose to print out only ARQ calls and not FEC calls, by examining bits 4 and 5 to see which mode is present when bits 2, 1, 0 change from 1, 1, 0 (standby) to 0, 1, 0 (traffic).

In most computer controlled applications, the local copy facility may be more of a nuisance than a help. It can easily be turned off with ESCAPE L Ø, as also can the newline facility if it is not required, or if an automatic new-line algorithm is used in the computer itself. The computer can also be programmed to automatically detect that the incoming received text is wrongly in figureshift, and send a RUBOUT character to correct this.

11.4 Some computer keyboards may not have keys such as ESCAPE or CONTROL, or these keys may have already been assigned to other tasks. For example, the ESCAPE key may always cause the computer to exit from its program back to a command mode. In these cases it will be necessary to write routines in the program to re-assign other keys to send these control codes to the RS232 port. In some computers, special-function keys are available and can be programmed for this function. The following table shows the control code names by these instructions, and their ASCII code equivalents, both in decimal and hexadecimal representation.

	decimal	hexadecimal
control-A	01	01
control-B	02	02
control-C	03	03
control-D	04	04
control-E	05	05
control-F	06	06
control-G	07	07
control-X	24	18
ESCAPE	27	1B
DELETE	127	7F

12 TRANSCEIVER CHANGEOVER PERFORMANCE

In ARQ and CW modes, a reasonably fast change-over from transmit to receive and vice versa is essential. If your transceiver takes longer than 50mS to change from receive to transmit, then it will not be possible to find a setting for RV2 that will allow the AMT-1 to operate in ARQ mode correctly. Even if the change-over time is less than 50mS and it is possible to set RV2, it may be necessary to modify the transceiver to shorten the delay time as much as possible.

The shorter the delay time, the greater will be the maximum distance that can be worked in ARQ mode. This is because radio waves take a finite time to travel, and the ARQ mode allows a maximum of 170mS for the radio signals to travel from one station to the other and back. If there were no other delays, this would give a maximum distance of 170 x 300 km between ARQ stations. Since radio waves travel at 300 km per mS, this would give a maximum distance of 25,500 km. The ARQ mode cannot work at a greater distance. Any additional delays will reduce this range, and it is for this reason that the shortest possible changeover delay is advantageous. With changeover delays of 10mS at both ends, it is just possible to work from one point of the globe to the antipodeal point.

Most transceivers perform well in this respect, especially the more modern ones and those noted for fast break-in CW. However, some require small modifications to be able to change over faster.

The first approach is to contact your transceiver dealer, who may already have details of the necessary modifications and can either carry them out or supply the necessary modification kit or information. In the absence of such help, contact other AMTOR operators who may already have devised modifications on the same type of equipment. As a last resort, obtain the service handbook or circuit diagram, and, with the aid of an oscilloscope, trace the path taken by the signal from the microphone socket through to the transmitter output, synchronising the scope from the PTT line, and observing the time interval immediately after the PTT line goes low, looking for any source of excessive delay.

It may often be found that excessive delays occur due to the charging-up of large capacitors - either those bypassing supply lines that are switched on or off between receive and transmit, or those coupling signals between stages that are operating from differently-switched supply lines.

The cure is usually to reduce the value of the offending capacitor. In some cases, it may be possible to move part of the circuitry, for example the microphone pre-amplifier, from a supply line that is switched, to one that is not, without affecting the performance of the transceiver. Experience has shown that the speed of operation of relays is quite adequate, except possibly some very large relays in high power amplifiers.

The speed of changeover from transmit to receive is also important in ARQ mode. More especially for a station making the initial call when working a nearby station - when the reply has to be received very soon after the end of the transmit burst. If problems are encountered when trying to initiate such a contact, but not when the other station initiates the call from his end, then suspect that the receiver is taking too long to switch back to full gain after the transmitter burst.

Again, the transceiver dealer, manufacturer, or other AMTOR users may be able to provide the solution. A similar analysis technique to that used for the transmitter may be used, but this time triggering the oscilloscope from the trailing edge of the PTT signal and tracing the signals through the receiver. Look for the effects of large capacitors in decoupling, coupling, or AGC positions. It is also possible that some relays may be slow to drop back to the receive condition if a diode is connected across the relay coil to suppress back-EMF spikes. This has the effect of slowing the drop-out of the relay. The cure is to add a resistor in series with the diode, with a value equal to that of the relay coil impedance.

CABLE CONECTIONS

Enter the connections for your equipment for future reference

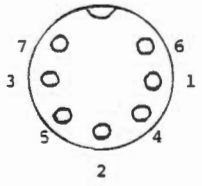
SK1 (XCVR)		TRANSCEIVER CONNECTOR	
PIN	SIGNAL	SIGNAL	PIN
1	Audio Input		
2	Common Earth Return		
3	Audio Output		
4	N/C		
5	PTT		
6	N/C		
7	N/C		

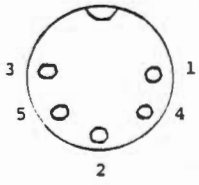
PC DB9 RS232

SK2 (TERMINAL)		TERMINAL CONNECTOR	
PIN	SIGNAL	SIGNAL	PIN
1	Data Input	TXD	3
2	CTS	RTS	7
3	Common Earth Return	GND	5
4	RTS	CTS	8
5	Data Output	RXD	2

PIN LAYOUT:

SK1 (XCVR)





SK2 (TERMINAL)

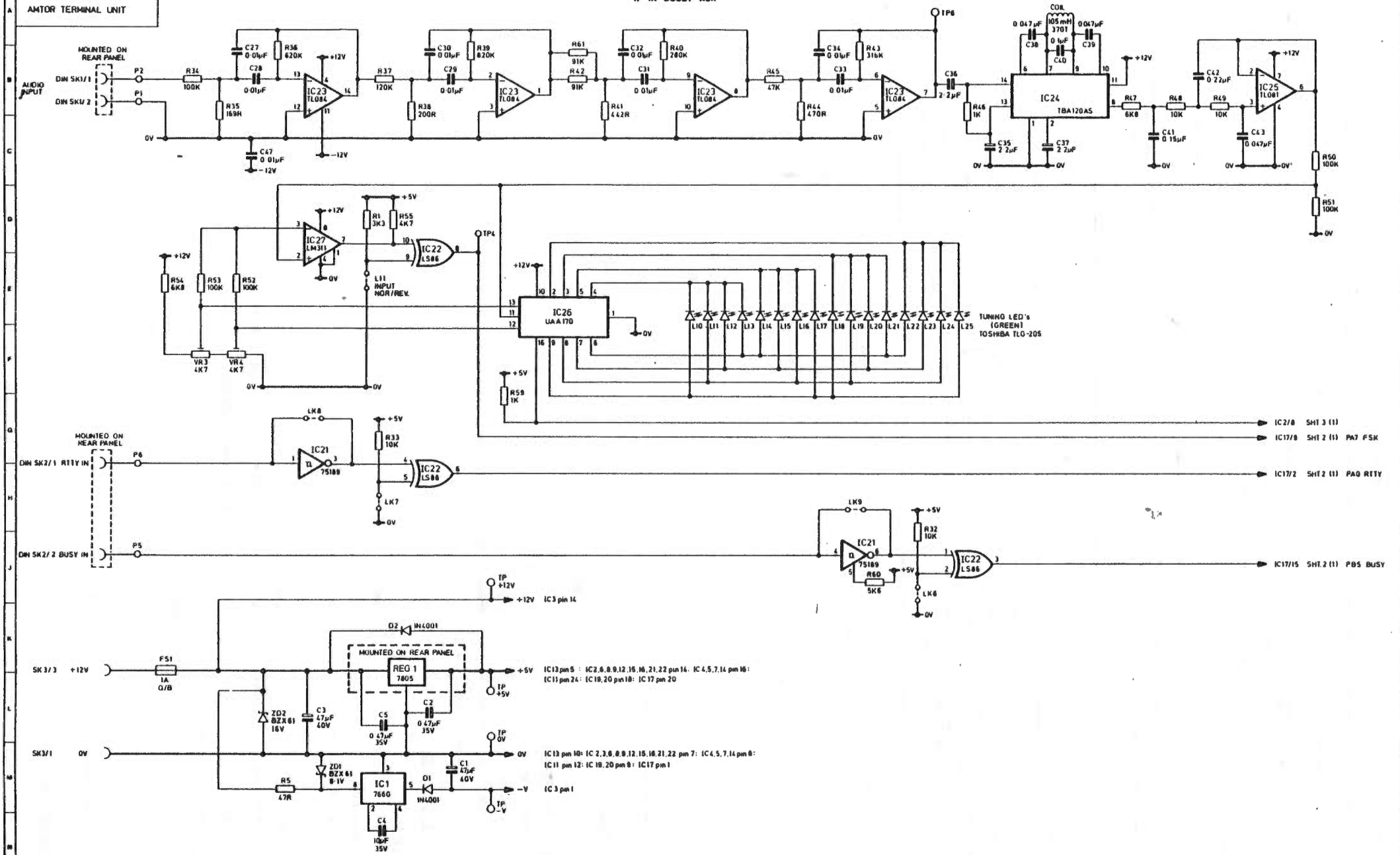
S P E C I F I C A T I O N

SUPPLY VOLTAGE:	12 - 14 Volts
SUPPLY CURRENT:	800mA typical 1 Amp fuse fitted internally
MODES OF OPERATION:	
Morse code send	1 - 100 w.p.m.
RTTY (ITA2 code)	Transmit and receive 1 - 100 Baud
FEC (CCIR recommendation 476)	Transmit and receive 100 Baud
ARQ (CCIR recommendation 476)	
AUDIO INTERFACE:	
Input:	
Input Level:	50mV - 1 Volt rms
Bandwidth:	300Hz, four pole filter
Tone Frequencies:	1275, 1445Hz. (170Hz shift)
Output:	
Output Level:	Continuously variable 0 to 1 Volt rms
Output Tone Frequencies:	1275, 1445Hz. (Crystal-controlled sinewave)
PTT Line:	Ground to transmit, open-circuit (positive) to receive
TERMINAL INTERFACE:	
Interface Standard:	RS232
Data Rate:	75 or 110 Bauds, selected by internal switch
Data Format:	1 Startbit, 7 data bits, parity bit send 0, ignore receive, send 2 stopbits, receive 1 or 2 stopbits, ASCII code
INTERNAL BUFFERS:	960 Characters transmit. 64 Characters receive
DIMENSIONS:	310 mm (W) x 60 mm (H) x 235 mm (D). (12.25 x 2.50 x 9.25 inches)
TEMPERATURE RANGE:	+ 10°C to + 35°C.

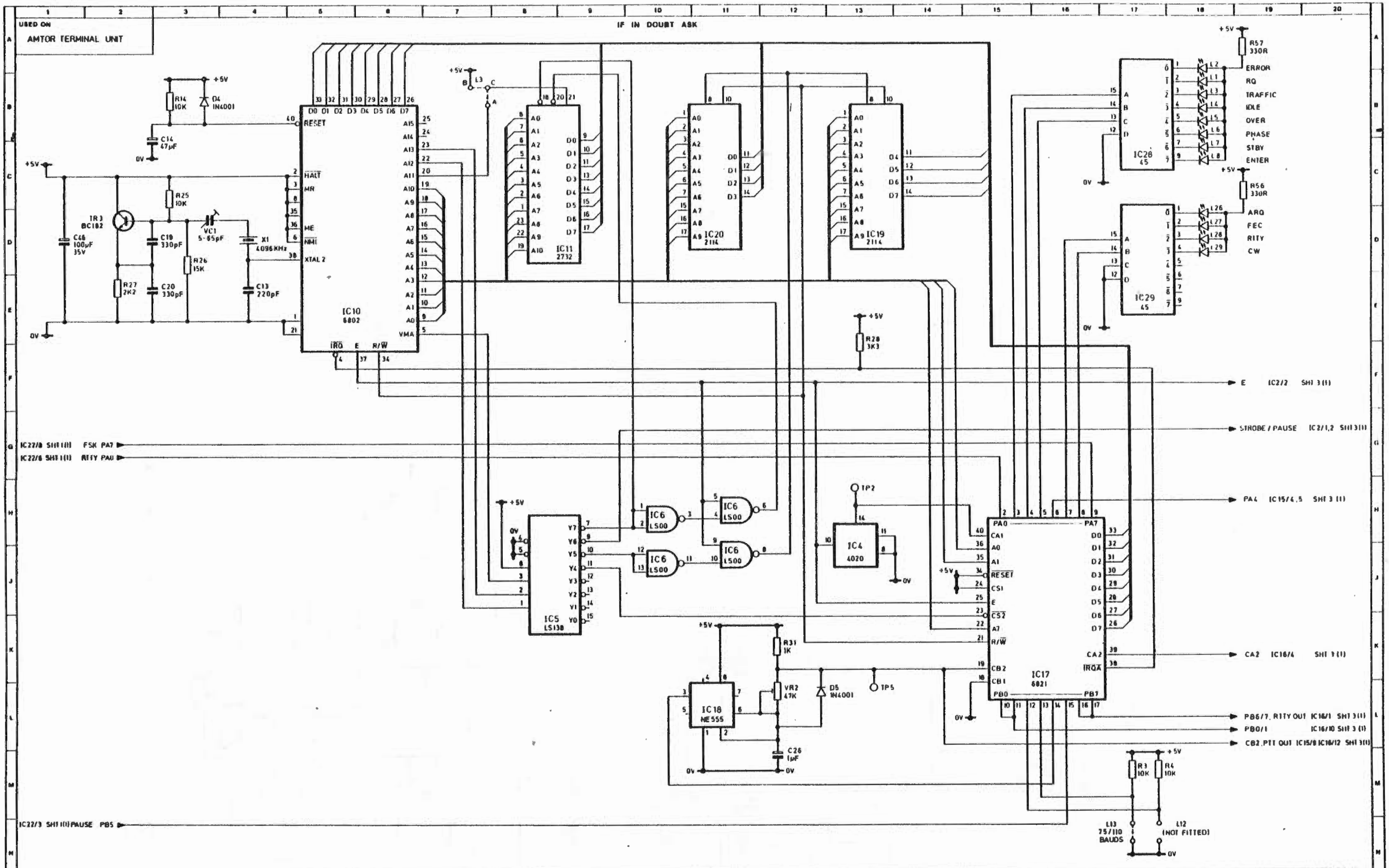
- - - - - - - - - - -

USED ON
AMTOR TERMINAL UNIT

IF IN DOUBT ASK



ALL DIMENSIONS IN mm	TOLERANCES	DO NOT SCALE															DRAWING No	SD 10 000.01	
SCALE	1 place ± 0·4 mm																		
MATERIAL	2 places ± 0·25mm	3rd ANGLE															TITLE	AMTOR TERMINAL LOGIC	
FINISH	3 places ± 0·13mm																		
	UNLESS OTHERWISE STATED	SHEET 1 OF 3																	
	SQUARENESS ± 0·25°		ISSUE	DATE	DRAWN	CHECK	E C N No	ISSUE	DRAWN	DATE	CHECK	E C N No							
			01					01	JS	14/7/82		358							



ALL DIMENSIONS IN mm	TOLERANCES	DO NOT SCALE
SCALE	1 place ± 0.4 mm	3rd ANGLE
MATERIAL	2 places ± 0.25 mm	SHEET 2 OF 3
FINISH	3 places ± 0.15 mm	
	UNLESS OTHERWISE STATED	
	SQUARENESS ± 0.25°	

DRAWING Nº SD 10000.01

TITLE AMTOR TERMINAL LOGIC

ISSUE	DATE	DRAWN	CHECK	ECN Nº	ISSUE	DRAWN	DATE	CHECK	ECN Nº

USED ON
AMTOR TERMINAL UNIT

IF IN DOUBT ASK

X2 5570.56 KHz
R24 1K
R23 1K
C18 0.01µF
IC12 LS04
IC14 7497
IC13 LS93
IC9 4024
IC8 4030
IC7 4051
IC16 LS86
IC15 LS00
IC2 LS122
IC3 75188
R13 4K7
R12 4K7
R11 4K7
R10 22K
R2 3K3
R30 10K
R29 10K
R58 560R
R16 10K
R15 10K
R22 1K
R21 330R 1%
R20 390R 1%
R19 680R 1%
R18 1K 1%
R17 1K 1%
R9 1K 1%
R6 680R 1%
R7 390R 1%
R8 2K2 1%
C11 100µF
C10 2n2
C16 4n7
C6 1µF
C7 0.1µF
VR1 1K
TR2 BC182
TR1 2N2222
D3 IN4001
L8 SEND
LK1
LK2
LK4
LK5
TP1
TP3
MATRIX FOR ALTERNATIVE TONES/SHIFTS
L10 OUTPUT NOR/RCV

SHT 2 (1) IC17/10,11 PB0/1
SHT 2 (1) IC5/9
SHT 2 (1) IC10/37 E
SHT 1 (1) IC26/16
SHT 2 (1) IC17/4 IC18/3 PB4 DELAY
SHT 2 (1) IC17/18 CB2 PTT OUT
SHT 2 (1) IC17/16,17 PB6/7
SHT 2 (1) IC17/6 PA6
SHT 2 (1) IC17/39 CA2

MOUNTED ON REAR PANEL
P3 DIN SK1/3 AUDIO OUT
P4 DIN SK1/5 PTT OUT
MOUNTED ON REAR PANEL
P7 DIN SK2/5 RS232/TTL, RTTY OUT
P8 DIN SK2/3 0V
P8 DIN SK2/4 BUSY OUT

ALL DIMENSIONS IN mm	TOLERANCES	DO NOT SCALE	DRAWING NO SD 10 000.01
SCALE	1 place ± 0.4 mm	3rd ANGLE	TITLE AMTOR TERMINAL LOGIC
MATERIAL	2 places ± 0.25mm	SHEET 3 OF 3	
FINISH	3 places ± 0.18mm		
	UNLESS OTHERWISE STATED		
	SQUARENESS ± 0.25°		

ISSUE	DATE	DRAWN	CHECK	E C N No
01	15	15/11/82		356
02	17	17/11/82		356
03	15	27/1/83		356

APPENDIX 1: MICROCOMPUTER APPLICATIONS

PROGRAMS

- Commodore VIC-20
- BBC Model B
- ABC 80

```
1 REM *** PROGRAM TO ENABLE VIC-20 WITH RS-232 INTERFACE TO BE USED WITH AMT-1
MTOR TERMINAL UNIT..
2 REM  *** THIS PROGRAM USES THE FUNCTION KEYS TO PRODUCE THE NECESSARY CONTROL
KEYS...
3 REM ***  F1 = ESCAPE
4 REM ***  F2 = CTRL C
5 REM ***  F3 = CTRL A
6 REM ***  F4 = CTRL X
7 REM ***  F5 = CTRL D
8 REM ***  F6 = CTRL B
9 REM ***  F7 = CTRL F
10 REM***  F8 = RUBOUT (ERASE)
11 REM *** PROGRAM WRITTEN BY D.J.INGLEDEW (G8AXZ)

15 REM **** CLEAR SCREEN ,OPEN RS232 CHANNEL AND SET BAUD RATE ETC.
20 PRINT"<CLR>":OPEN 2,2,3,CHR$(131) + CHR$(0)

25 REM **** CHECK FOR KEY DEPRESSION..
30 A = PEEK(203) : IF A = 64 THEN 210

35 REM **** CHECK FOR FUNCTION KEY DEPRESSION ..
40 IF A = 39 THEN K = 1: GOTO 90
50 IF A = 47 THEN K = 3: GOTO 90
60 IF A = 55 THEN K = 5: GOTO 90
70 IF A = 63 THEN K = 7: GOTO 90

75 REM **** FUNCTION KEY NOT PRESSED, GET CHARACTER FROM KEYBOARD
80 GOTO 190

85 REM ***** CHECK IF SHIFT KEY WAS DEPRESSED..
90 B = PEEK(653) : IF B > 1 THEN B = 0
100 K = K + B

105 REM ****  ALLOCATE CONTROL CODES TO FUNCTION KEYS >>>
110 IF K = 1 THEN A$ = CHR$(27) : GOTO 200
120 IF K = 2 THEN A$ = CHR$(03) : GOTO 200
130 IF K = 3 THEN A$ = CHR$(01) : GET Z$ : GOTO 200
140 IF K = 4 THEN A$ = CHR$(24) : GOTO 200
150 IF K = 5 THEN A$ = CHR$(04) : GOTO 200
160 IF K = 6 THEN A$ = CHR$(02) : GOTO 200
170 IF K = 7 THEN A$ = CHR$(06) : GOTO 200
180 IF K = 8 THEN A$ = CHR$(127) : GOTO 200

185 REM **** IF NOT A CONTROL CODE THEN GET CHARACTER FROM KEYBOARD..
190 GET A$

195 REM **** SEND CHARACTER TO RS-232 PORT
200 PRINT#2,A$;

205 REM ****  GET CHARACTER FROM RS-232 PORT
210 GET#2,B$   :REM GETS CHARACTER FROM RS-232 PORT


215 REM PRINT CHARACTER ON VDU..
220 PRINT B$;
230 GOTO 30
```

```
 10 REM DRIVER PROGRAM FOR AMT-1
 20 REM WITH BBC MODEL B COMPUTER
 30 REM VERSION 0,1 OPERATING SYSTEM
 40 REM
 50 REM AMT-1 MUST BE SET TO 75 BAUD
 60 REM STRAP CTS TO RTS ON BBC RS423 SOCKET
 70 REM BEWARE. USE BREAK TO EXIT PROGRAM.
 80 DIM CODE 100
 90 FOR X=0 TO 2 STEP 2
100 P%=CODE
110 STATUS=&FE08
120 RS423=&FE09
130 OSBYTE=&FFF4
140 OSWRCH=&FFEE
150 [     \ASSEMBLER CODE
160 OPT X
170 .LOOP
180 LDA #01
190 BIT STATUS   \ANYTHING RECEIVED?
200 BEQ getkey   \BRANCH IF NOT
210 LDA RS423
220 BMI getkey   \DON'T PRINT STATUS BYTE
230 JSR OSWRCH
240 .getkey
250 LDA #&81
260 LDX #00
270 LDY #00
280 JSR OSBYTE
290 TYA
300 CMP #&FF
310 BEQ LOOP     \NO KEY PRESSED, LOOP
320 CMP #&1B     \IS IT ESC?
330 BNE CHAR
340 LDA #&7E     \YES CLR ESC FLAG ...
350 LDX #0
360 LDY #0
370 JSR OSBYTE
380 LDX #&1B     \... REPLACE BY ASCII"ESC"
390 .CHAR
400 TXA
410 CMP #&8A     \IS IT "CURSOR DOWN"?
420 BNE OUT
430 LDA #&A      \REPLACE BY "LINEFEED"
440 .OUT         \RS 423 OUTPUT ROUTINE
450 PHA
460 LDA #&02
470 .OUT1
480 BIT STATUS
490 BEQ OUT1
500 PLA
510 STA RS423
520 JMP LOOP
530 ]
540 REM END OF ASSEMBLER CODE
550 NEXT
560 CLS
570 REM DISABLE CURSOR KEYS (GET ASCII)
580 *FX4,1
590 REM TC=75 baud
600 *FX 8,1
610 REM RC=75 baud
620 *FX 7,1
630 CALL CODE
```

```
 10 REM DRIVER PROGRAM FOR AMT-1
 20 REM WITH BBC MODEL B COMPUTER
 30 REM VERSION 1.0 OPERATING SYSTEM
 40 REM
 50 REM AMT-1 MUST BE SET TO 75 BAUD
 60 REM STRAP CTS TO RTS ON BBC RS423 SOCKET
 70 REM BEWARE. USE BREAK TO EXIT PROGRAM
 80 REM
 90 REM
100 *FX5,2
110 *FX7,1
120 *FX8,1
130 *FX229,1
140 *FX4,1
150 *FX3,7
160 *FX2,2
170 X = INKEY(0)
180 IF X = -1 THEN 210
190 IF X = 138 THEN X = 10
200 PRINT CHR$(X);
210 *FX3,4
220 *FX2,1
230 X = INKEY(0)
240 IF X = -1 THEN 150
250 PRINT CHR$(X);
260 GOTO 150
```

```
10 REM TRANSMIT/RESEIVER PROGRAM FOR AMT-1 ON 8080. 80 LETTERS AND 24 LINES.
20 REM LASEF,  EINAR ADOLFSEN, BOKS 13, N-2030 NANNESTAD,NORWAY.
30 ;
40 ; CHR$(12%)" ***** TRANSMIT AMT-1   110 BD" : ; STRING$(40%,95%)
50 ; "A: AMTOR STBY                CTRL+A: ARQ TO CALL SIGN: RX TO TX MODE RTTY"
60 ; "B: BAUDRATE RTTY             CTRL+B: AMTOR STBY TO FEC"
70 ; "C: ENTER CW                  CTRL+C: STOP PROGRAM"
80 ; "D: ENTER DIRECT              CTRL+D: TX TO RX - RTTY - PHASE TO STBY ARQ"
90 ; "I: SEL CALL CODE             CTRL+F: AMTOR STBY TO PHASE "
100 ; "L: ECHO                      CTRL+P: BREAK-IN: ARQ: TX TO RX -- RTTY"
110 ; "N: AUTO-NEWLINE  (NO)(N1)    "
120 ; "P: PRINTER PARAMETERS        CTRL+X: CANSEL"
130 ; "R: ENTER RTTY                CTRL+() DELETE"
140 ; "S: SPEED CW                       T: TIME OUT - ARQ"
150 ;
160 ; "*******  (- TO RECEIVER.          *******"
170 ; "*******  CTRL-E = RETURN TO ESC. *******" : ; STRING$(80%,35%)
180 GET A$ : A%=ASC(A$)
190 IF A%=15% THEN A%=3%
200 IF INP(56%)=136% THEN 340
210 IF A%=64% THEN A%=81% : GOSUB 250 : GOTO 390
220 IF A%=13% THEN ; CHR$(7%); : A%=10% : GOSUB 250 : A%=13%
230 IF A%=8% THEN GOSUB 250 : A%=32% : GOSUB 250 : A%=8%
240 GOSUB 250 : GOTO 190
250 ; CHR$(A%);
260 D%=1%
270 OUT 58%,0% : GOSUB 330
280 FOR J%=1% TO 7% : IF (A% AND D%) THEN OUT 58%,6% : GOSUB 330 ELSE OUT 58%,0% : GOSUB 330
290 D%=D%*2% : NEXT J%
300 OUT 58%,0% : GOSUB 330
310 OUT 58%,6% : FOR I%=1% TO 2.2*28% : NEXT I%
320 RETURN
330 FOR I%=1% TO 28% : NEXT I% : RETURN
340 ; CHR$(12%)" ****** RECEIVER AMT-1    110 BD" : ; STRING$(45%,95%)
350 ; " ** RETURN:- RETURN TO TRANSMIT. **"
360 ;
370 IF INP(56%)=141% THEN W%=0% : GOTO 40
380 IF ((INP(58%) AND 1%) XOR R%) THEN 370 ELSE FOR I%=1% TO 7% : NEXT I%
390 GOSUB 490 : C%=C%+1%*((INP(58%) AND 1%) XOR R%)
400 GOSUB 490 : C%=C%+2%*((INP(58%) AND 1%) XOR R%)
410 GOSUB 490 : C%=C%+4%*((INP(58%) AND 1%) XOR R%)
420 GOSUB 490 : C%=C%+8%*((INP(58%) AND 1%) XOR R%)
430 GOSUB 490 : C%=C%+16%*((INP(58%) AND 1%) XOR R%)
440 GOSUB 490 : C%=C%+32%*((INP(58%) AND 1%) XOR R%)
450 GOSUB 490 : C%=C%+64%*((INP(58%) AND 1%) XOR R%)
460 GOSUB 490 : GOSUB 490
470 ; CHR$(C%);
480 C%=0% : GOTO 370
490 FOR I%=1% TO 31% : NEXT I% : RETURN
```

```
10 REM TRANSMIT/RESEIVER PROGRAM FOR AMT-1 ON ABC80. 40 LETTERS AND 24 LINES.
20 REM LASSE, EINAR ADOLFSEN, BOKS 18, N-2030 NANNESTAD,NORWAY.
30 ;
40 ; CHR$(12%)"****** TRANSMIT AMT-1  110 BD ******" : ; STRING$(40%,85%)
50 ; "******    (- TO RECEIVER.      ******"
60 ; "******    -) FUNCTION KEYS     ******" : ; STRING$(40%,85%)
80 GET A$ : A%=ASC(A$)
90 IF INP(56%)=137% THEN 410
100 IF A%=15% THEN A%=3%
110 IF INP(56%)=136% THEN 250
120 IF A%=64% THEN A%=81% : GOSUB 160 : GOTO 300
130 IF A%=13% THEN : CHR$(7%); : A%=10% : GOSUB 150 : A%=13%
140 IF A%=8% THEN GOSUB 160 : A%=32% : GOSUB 150 : A%=8%
150 GOSUB 160 : GOTO 30
160 ; CHR$(A%);
170 D%=1%
180 OUT 58%,0% : GOSUB 240
190 FOR J%=1% TO 7% : IF (A% AND D%) THEN OUT 58%,8% : GOSUB 240 ELSE OUT 58%,0% : GOSUB 240
200 D%=D%*2% : NEXT J%
210 OUT 58%,0% : GOSUB 240
220 OUT 58%,8% : FOR I%=1% TO 2.2*26% : NEXT I%
230 RETURN
240 FOR I%=1% TO 28% : NEXT I% : RETURN
250 ; CHR$(12%)" ****** RECEIVER AMT-1    110 BD" : ; STRING$(45%,85%)
260 ; " ** RETURN:- RETURN TO TRANSMIT. **"
270 ;
280 IF INP(56%)=141% THEN W%=0% : GOTO 40
290 IF ((INP(55%) AND 1%) XOR R%) THEN 280 ELSE FOR I%=1% TO 7% : NEXT I%
300 GOSUB 400 : C%=C%+1%*((INP(55%) AND 1%) XOR R%)
310 GOSUB 400 : C%=C%+2%*((INP(55%) AND 1%) XOR R%)
320 GOSUB 400 : C%=C%+4%*((INP(58%) AND 1%) XOR R%)
330 GOSUB 400 : C%=C%+8%*((INP(58%) AND 1%) XOR R%)
340 GOSUB 400 : C%=C%+16%*((INP(58%) AND 1%) XOR R%)
350 GOSUB 400 : C%=C%+32%*((INP(58%) AND 1%) XOR R%)
360 GOSUB 400 : C%=C%+64%*((INP(58%) AND 1%) XOR R%)
370 GOSUB 400 : GOSUB 400
380 ; CHR$(C%);
390 C%=0% : GOTO 280
400 FOR I%=1% TO 31% : NEXT I% : RETURN
410 ; CHR$(12%)
420 ; "****** CTRL+E = RETURN TO ESC. ******" : ; STRING$(40%,85%)
430 ; "A: AMTOR STBY"
440 ; "B: BAUDRATE RTTY"
450 ; "C: ENTER CW  "
460 ; "D: ENTER DIRECT"
470 ; "I: SEL CALL CODE"
480 ; "L: ECHO  "
490 ; "N: AUTO-NEWLINE  (N0)(N1)"
500 ; "P: PRINTER PARAMETERS "
510 ; "R: ENTER RTTY  "
520 ; "S: SPEED CW "
530 ; "T: TIME OUT - ARQ"
540 GET A$
550 ; "CTRL+A: ARQ TO CALL SIGN: RX TO TX MODE RTTY"
560 ; "CTRL+B: AMTOR STBY TO FEC"
570 ; "CTRL+C: STOP PROGRAM"
580 ; "CTRL+D: TX TO RX - RTTY - PHASE TO STBY ARQ"
590 ; "CTRL+F: AMTOR STBY TO PHASE "
600 ; "CTRL+P: BREAK-IN: ARQ: TX TO RX — RTTY"
610 ; "CTRL+X: CANSEL"
620 ; "CTRL+( DELETE"
630 GET A$ : GOTO 40
```

CW RECEIVE MODIFICATION FOR AMT-1

Available with AMT-1 units fitted with V;03 and later ROMS, and American version v:A0 and later ROMs. IF YOUR UNIT HAS AN EARLIER ROM, PLEASE SEND IT IN CONDUCTIVE PACKAGING TO I.C.S. FOR FREE RE-PROGRAMMING

INSTALLATION

Connect the red wire to +5v ; the black wire to 0v ; the orange wire to TP6 and the white wire to the right hand LK13 pin.

In addition, remove the main board from the box and inspect the underside. If a wire link is not fitted across the board, fit it as follows:-

Find pin 1 of IC14, which is a 7497. Cut the copper track adjacent to this pin. From the pin side of this cut, solder a length of insulated hookup wire, and route it across the board to pin 4 of IC29, soldering it to this point.

This additional link ensures that the CW transmit signal is output on the centre frequency of the passband, rather than on the mark or space tone frequency. This ensures that if a CW signal is tuned-in in the centre of the passband, a transmitted reply will be zero-beat with the incoming signal. This feature depends for correct operation on the correct setting of a transmitted keying polarity link. For European models of the AMT-1, this link must be set so that correct conventional keying polarity on RTTY and AMTOR is obtained with the transceiver in upper sideband. On the USA version, the keying polarity strap should be in the lower sideband position.

SETTING UP

With the CW board installed, set the preset potentiometer nearest to the leadout wires to the fully clockwise position. This is the input gain adjustment. With the AMT-1 in the AMTOR standby, or RTTY receive condition, tune in a constant carrier from a calibrator or other stable source, so that the tuning display is in the centre position. Key ESCAPE C. Adjust the centre-frequency pot on the CW board (furthest away from the leadout wires) until the tuning display comes on. Set it to the centre of the range over which the tuning display is lit. To get an accurate setting, turn the gain preset until the tuning display just goes off, then fine-tune the centre frequency until the tuning display just comes on at one point only. To check this setting, tune the signal either side of the centre point. The display should turn off at the same distance on either side of the centre point. Finally, tune the receiver to a frequency on which there is only noise present on the band, and adjust the gain preset so that the tuning display is not illuminated, with perhaps the occasional noise pulse causing the display to flicker.

OPERATION

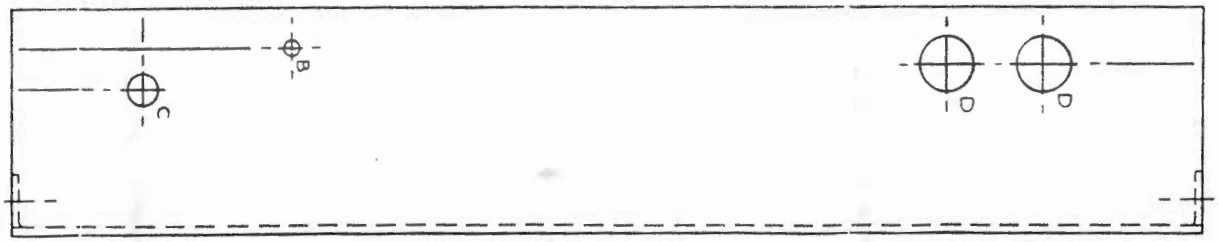
To receive CW, Key ESCAPE C, and tune in the signal until the tuning display keys in sympathy with the incoming signal and then

tune the receiver so that the dot on the display is in the centre of the display. If required, adjust the receiver audio gain or RF gain to get the cleanest display with no "noise" visible on the display when the signal is off, and only a single dot in the centre of the display when the incoming signal is key-down.

If the sending speed of the signal is known in advance, then set it into the AMT-1 beforehand using the ESCAPE S function, entering the speed in words-per-minute. If the speed is not known, then leave the AMT-1 set to 20 w.p.m. Observe the print-out of the receive CW and the status display on the AMT-1. If text is displayed correctly but with spaces between each letter, the AMT-1 speed setting is too fast. Slow it down by 1 w.p.m. by keying control-D. If text is displayed correctly with no spaces between words, then the AMT-1 speed setting is too slow. Speed it up by 1 w.p.m. by keying control-C. Repeat keying of control-C or -D will continue the speed adjustment as required. If the display shows only letters E and T, then the AMT-1 speed setting is much too fast. Key ESCAPE Q, note the S: setting, and key in a speed of half that shown, then re-enter the CW mode. If the display shows little or no text, and the ERROR STATUS LED is on a lot, then the AMT-1 speed setting is much too slow. Again, display the Q: settings, and key in an S: figure about twice the original setting.

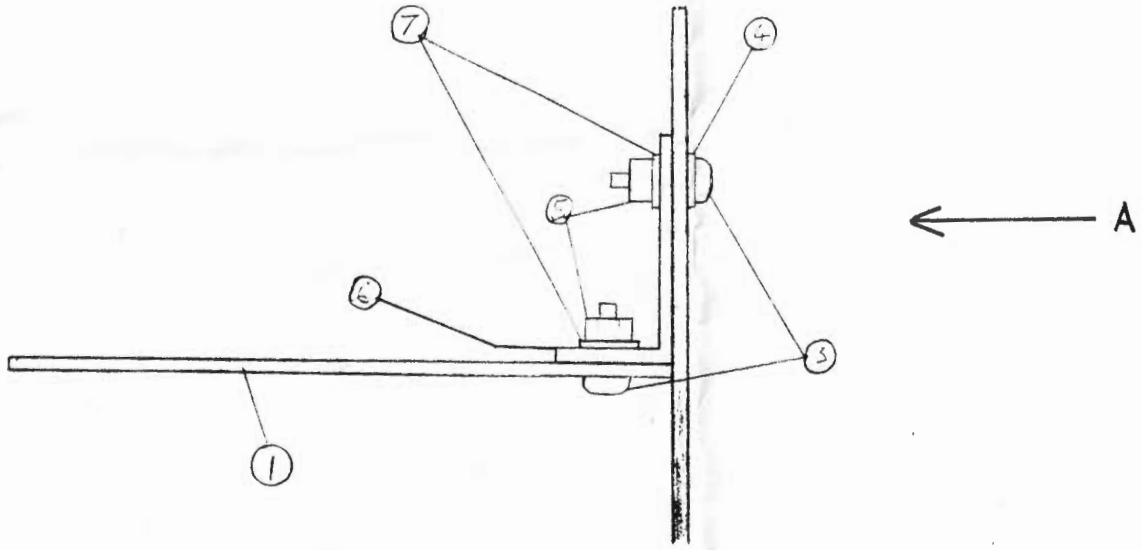
To send CW, no control keys need be touched. Simply key the desired characters and the AMT-1 will send them. If CW text is being received as the outgoing message is typed, the AMT-1 will wait until a pause in the received message before starting to send. The speed of transmission is always the same as the reception speed.

In addition to the Control-C and Control-D keys to speed up and slow down the w.p.m. speed, control-B puts the key down (for tuning purposes). Keying any other key will release the key. The space bar is the most convenient key to press to bring the key up after using the control-B key.



VIEW ON ARROW A

BRACKET (ITEM 6) FIXES ON INSIDE SURFACE OF HOLE B.



ISSUE	P1				
PCN					

DRN GPM	GPW electronics ltd	USED ON: AMT I
CH'K'D RSC 28/6/83	ASSEMBLY DETAIL FOR CW RX UNIT	ASSY: GA.10000
APP'D		DRG. NO: GA 001
		SHT 2 OF 2

ICS

AMT-1 AMTOR
TERMINAL UNIT

Operating Guide

I.C.S. Electronics Ltd.

Set Up Codes:

ESC	Mode	Function
I	IDENT	Followed by 4 letters to make the unit's own selcal code.
T	TIMEOUT	Followed by 2 digits, to set the AMTOR timeout limit. (Power-up value 30 seconds).
B	BAUD RATE	Followed by 2 digits, to set the RTTY baud rate. (Power-up value 45 bauds).
S	SPEED	Followed by 2 digits, to set the CW speed. (Power-up value 20 words per minute).
L	LOCAL	Followed by 0 or 1, to turn on or off the local copy. (Power-up value – local copy enabled)
N	NEWLINE	Followed by 0 or 1, to turn on or off the autonewline function. (Power-up value – auto newline enabled)
Q	QUERY	Prints out current values of I, T, B, S, L and N.

Control E entered in any mode causes the AMT-1 to output a non-printable status byte. See handbook for details.

Mode Control Codes:

ESC	Mode	Remarks
A	AMTOR	In STBY, will receive ARQ or FEC signals.
R	RTTY	Enters RTTY mode in RECEIVE.
C	CW	Pressing any text key will send the equivalent morse code, returning to receive between letters.
D	DIRECT	Connects FSK modem direct to the terminal. There is no escape from this mode except by switching the power off and on again.

DELETE	Forces received copy to lettershift. (AMTOR, RTTY only)

Function Codes:

AMTOR MODE		
CONTROL	**Function**	**Remarks**
A	Call ARQ	Followed by 4 letters to make a selcal code.
B	Call FEC	
C	Break-in ARQ	Only operates when in ARQ mode.
D	QRT from ARQ	Only operates when in ARQ send.
F	Listen-ARQ	To copy another ARQ signal.
X	Clear buffer	To clear any un-sent input text.

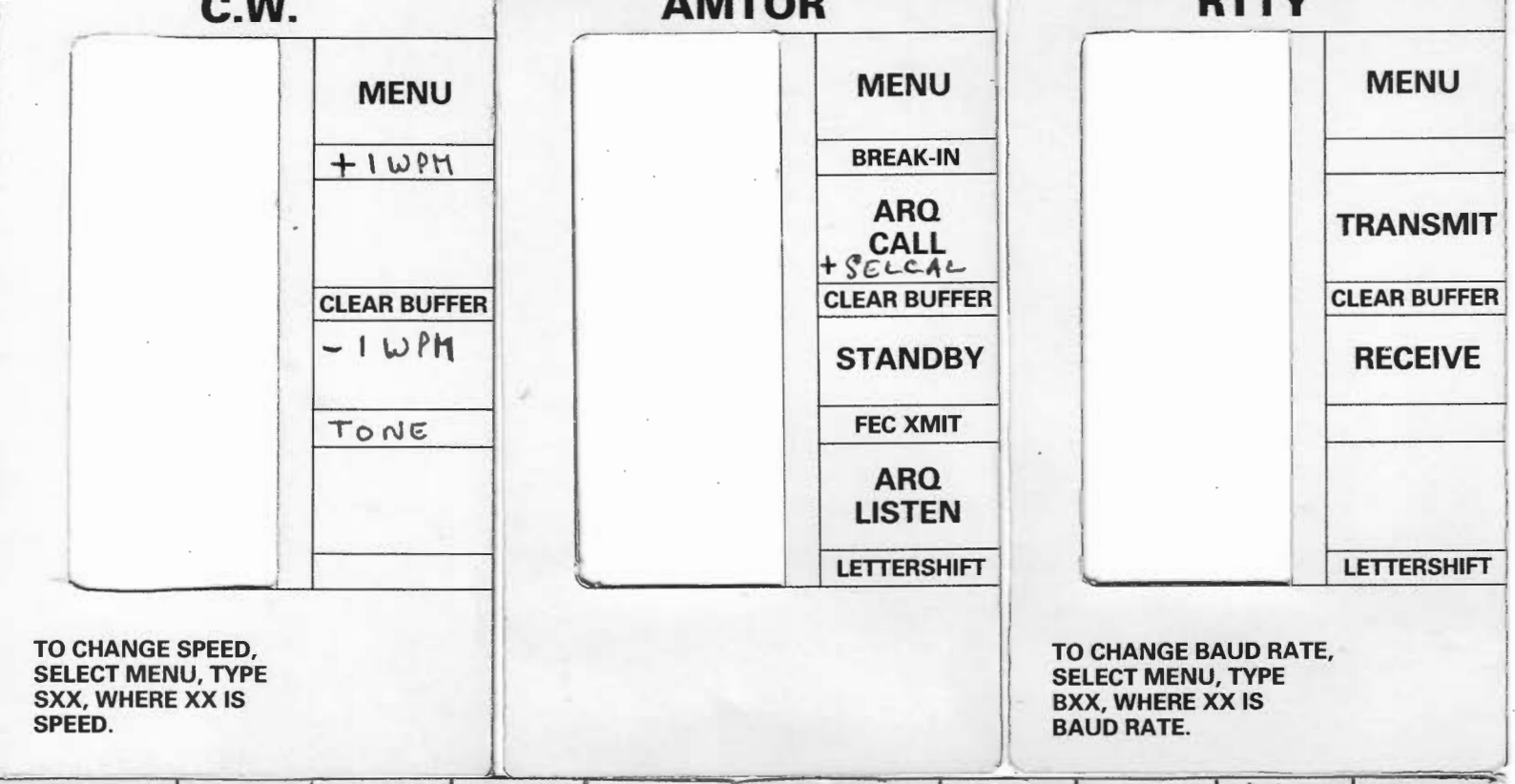
Function Codes: (continued)

RTTY MODE		
CONTROL	**Function**	**Remarks**
A	Transmit	
B	Transmit	
C	Receive	
D	Receive	
X	Clear buffer	To clear any un-sent input text.

CW MODE		
CONTROL	**Function**	**Remarks**
X	Clear buffer	To clear any un-sent input text.

DIRECT MODE
Transparent to all control, ESC codes.

I.C.S. Electronics Limited
P O Box 2, ARUNDEL, West Sussex BN18 0NX, England.
Telephone (0243 365) 590



MORSE	WPM UP	WPM DOWN	TX	RX
SHIFT	UNLOCK	LOCK SPEED	TX CLEAR	
C=				ABORT

AMTOR	RX FEC	TX FEC	ARQ CALL	STANDBY
SHIFT	ARQ BKIN	LETTR SHIFT	TX CLEAR	STANDBY + CW ID
CTRL	RX REV	TX REV	USOS	WIDS SHIFT
C=	SRX ALL	SELFEC TX	ARQ RX	ABORT

RTTY	BAUD UP	BAUD DOWN	TX	RX
SHIFT		LETTER SHIFT	TX CLEAR	RX + CW ID
CTRL	RX REV	TX REV	USOS	WIDS SHIFT
C=				ABORT

Commodore 64 cards to place over the function keys

ICS

ICS
ELECTRONICS
LTD

PO BOX 2, ARUNDEL
WEST SUSSEX BN18 0NX
ENGLAND
Telephone (024 365) 590

AMT-1 / COMMODORE 64 APPLICATIONS SOFTWARE PACKAGE

OPERATOR MANUAL

SERIAL NUMBER:

NOVEMBER 1983

The program is available in two versions: for either 50Hz or 60Hz mains frequency. If you have the wrong version of the program for your area, the on-screen real time clock will not keep the correct time. I.C.S. will exchange the program cartridge if required.

Program author: Tony Mountifield (G4CJO)

This manual applies to program revisions from V:Ø6 onwards.

- - - - - - -

AMT-1 APPLICATIONS PACKAGE for the COMMODORE-64

1. INTRODUCTION

The AMT-1 applications package is part of a complete range of AMTOR equipment offered by I.C.S. Electronics and provides sophisticated AMTOR/RTTY/CW capability in conjunction with the AMT-1 AMTOR Terminal Unit.

The package consists of a plug-in cartridge for the Commodore 64, containing the program, and an interface cable to convert between the User Port signals of the computer and the RS232 signals of the AMT-1.

Features offered by the program are: split screen display with typeahead while receiving; manual and automatic modes; full handshake control of AMT-1; message buffers (memories); real time clock display; switchable unshift-on-space and word mode; printer capability in manual and auto; tape mode for auto without printer; MENU mode for easy selection.

2. INSTALLATION

IF YOUR AMT-1 IS NEW AND UNUSED, DISREGARD THE NEXT PARAGRAPH.

If the AMT-1 has been previously used with the VIC-20 or another computer at TTL levels, remove the lid of the AMT-1 and check the following:

IC3 installed, either a 1488 or a 75188
IC21 installed, either a 1489 or a 75189

LK4, LK5, LK6, LK7, LK8, LK9 all open
LK12 closed (for 110 Baud)
LK1, LK2 in b-c position.

It has been found necessary to remove R60 from the AMT-1. This resistor was originally included so that the CTS input would default to the enabled state if default to the enabled state is left open.
This modification must be done even with a new AMT-1.

Connect the interface cable between the Commodore 64 user port and the AMT-1 "Terminal" socket. The component side of the circuit board should be uppermost.

Connect the transceiver and power supply to the AMT-1 as described in the AMT-1 manual.

Insert the program cartridge into the back of the computer and connect up a T.V. or (preferably) a video monitor. In addition, a Tape Unit and/or a Printer may be connected if required.

Re-check all connections and then switch on.

3. PROGRAM INITIATION

When the Commodore 64 is switched on with the cartridge inserted, the program starts up automatically.
There is no need to give a RUN command; indeed, there is no way to access the BASIC environment without switching off and removing the cartridge.

The program first requests your callsign, which should be typed in without any spaces, and terminated by (RETURN), at which point the split-screen display will appear.

First a status poll of the AMT-1 is generated, to determine whether it is in ESCAPE mode. If the AMT-1 is not connected, the program will hang up at this point: connect up the AMT-1 and restart the program with RUN/STOP - RESTORE or by switching the computer off and on.

If the AMT-1 is in ESCAPE mode (as it would be when switched on), then a prompt will be issued for your own SelCal code as in 5.1.2, otherwise the cursor will appear with the status line indicating AMTOR, RTTY or CW.

4. SCREEN DISPLAY

The screen display comprises three sections: the Receive Area, the Transmit Area and the Status Display.

4.1 Received Text Area

This consists of 14 lines and displays all text received from the AMT-1, both incoming text and echoed outgoing text. (See 5.1.8 also).
Text is displayed on the bottom line, resetting to the left end on a Carriage Return and scrolling up one line on a Line Feed.
The CLR key may be used to clear this area of the screen.
A new line is also started whenever a space is displayed after the 32nd column, to minimize splitting of words.

4.2 Transmit Text Area

This consists of 6 lines and displays text that is typed on the keyboard or output from memories.
Text so displayed is entered into the Transmit Buffer for subsequent sending to the AMT-1.
The flashing cursor indicates that text may be entered. If the cursor is not present, the program is in the process of a special operation (e.g. ARQ call initiation, MENU etc.). The Delete key may be used to delete characters not yet transmitted to the AMT-1, including CRLF's. (See Word Mode 7.4).

Using the RETURN key causes a CR and LF to be transmitted . There is no way to send CR or LF separately.

In addition, if certain characters are entered into memories or used directly from the keyboard, they will be replaced by text as follows:

£	Pound sign	- replaced by your Callsign entered at start-up.
↑	Up-arrow	- replaced by the current time.
]	RH square bracket	- replaced by your Selcal entered via MENU.

It is possible to type ahead of the transmission or even prepare a message before beginning to transmit; the size of the Transmit Buffer for typing in advance is over 2000 characters, although only the last six lines are displayed.

4.3 Status Display Line

This consists of one line which is between the Transmit Area and Receive Area. It consists of up to five single characters, the mode display and the Real-Time Clock.

The single characters have the following meaning:

(i) Reversed - @ means the AMT-1 will not accept text; Normal - @ means it will.
This character thus reflects the Busy output from the AMT-1.

(ii) This is a graphics character which represents the last status byte received from the AMT-1. It is mainly for diagnostic purposes, although certain characters will become familiar.

(iii) This is a 'U' if Unshift-on-Space is enabled, otherwise it is blank. (See 7.2).

(iv) This is a 'P' if the Printer is enabled, otherwise it is blank. (See 7.3).

(v) This is a 'W' if Word Mode is enabled, otherwise it is blank. (See 7.4).

The mode display indicates the current mode of the system, either AMTOR, RTTY, CW, AUTO, MENU or VIEW.

The time display shows hours, minutes and seconds.

5. MENU MODE

MENU mode is entered by using the function key f1, and causes the AMT-1 to be put into ESC mode. (This will of course abort any on-air activity).
On entry to this mode, the Transmit Text Area is replaced by a menu listing these 14 operations and the status line indicates "--MENU--".

There are 10 operations which correspond directly to AMT-1 escape operations, and four which are specific to this program. The desired operation is selected by typing the appropriate letter. (The CLR key and CBM 2-4, 8 are also recognised in MENU mode).

5.1 AMT-1 Operations

5.1.1 (A) AMTOR

This key causes the AMT-1 to enter AMTOR mode and the CBM64 to exit from MENU mode. The menu will be replaced by the Transmit Area and the status line will indicate "--AMTOR--".

5.1.2 (I) IDENT

This key is used to enter the station's own AMTOR Selcal and also defines the "]" key. The menu is replaced by the prompt "YOUR SELCAL?",. and then four alphabetic characters will be accepted, although the DEL key may be used to correct errors. Having entered four letters, and hit the RETURN key, the new Selcal will be sent to the AMT-1 and the MENU will re-appear.

5.1.3 (T) TIMEOUT

This key is used to enter the ARQ rephasing timeout. The menu is replaced by the prompt "ARQ TIMEOUT (1-99)?", and then one or two digits must be typed, followed by RETURN. No other characters will be accepted, although the DEL key may be used to correct errors. If only one digit is typed, the program will add a leading zero before sending to the AMT-1, after which the menu will re-appear.

5.1.4 (R) RTTY

This key causes the AMT-1 to enter RTTY mode and the CBM64 to exit from MENU mode. The menu will be replaced by the Transmit Area, and the status line will show "--RTTY--".

5.1.5 (B) BAUD

This key is used to enter the RTTY Baud rate to be used. The menu is replaced by the prompt "BAUD RATE (1-99)?", and entry is as for (T).

5.1.6 (C) CW

This key causes the AMT-1 to enter CW mode, and the CBM64 to exit from MENU mode. The menu will be replaced by the Transmit Area, and the status line will show "--CW--".

5.1.7 (S) SPEED

This key is used to enter the CW speed in Words per Minute. The menu is replaced by the prompt "CW SPEED (1-99)?", and entry is as for (T) and (B).

5.1.8 (L) LOCAL ECHO

This key is used to enable or disable the local-echo facility of the AMT-1, whereby it echoes text to the Receive Area as it is transmitted over the air. The menu is replaced by the prompt "LOCAL ECHO (Ø/1)?", and a Ø or 1 must be typed, followed by RETURN. Again the DEL key may be used to correct errors, and only the digits Ø and 1 will be accepted. When the command has been sent to the AMT-1, the menu will re-appear. The AMT-1 is usually operated with local echo enabled, except in AUTO mode. If the program is re-started from AUTO mode with the RESTORE key, it may be necessary to enable local echo manually.

5.1.9 (N) AUTO NEWLINE

This key is used to enable or disable the auto-newline facility of the AMT-1, whereby it inserts a CR and LF at the first space transmitted after the 60th column on a line.

5.1.10 (Q) QUERY PARAMETERS

This key is used to request the AMT-1 to send the current settings of all the above parameters, and also the version number of the AMT-1.
The menu remains displayed.

5.2 CBM-64 Operations

5.2.1 (P) PUT MEMORIES

This key allows the contents of the user-programmable memories (MEM1-MEM4) to be saved to cassette for later retrieval, allowing such things as station details etc. to be prepared. (See sections 7.1 and 8).
The menu will be cleared for the "PRESS RECORD" message, and restored when the save is complete.

5.2.2 (G) GET MEMORIES

This key allows the contents of the memories (MEM1-MEM4) to be loaded from a previously saved file. The file must have been created using the (P) command, and must be the first file found - no error messages are generated if this is not the case. If the file is not found, use the STOP key (without RESTORE).

5.2.3 (U) AUTO AMTOR

This key initiates the automatic mode of operation, which enables the system to acknowledge an incoming call, identify the callsign of the calling station, accept a message, acknowledge the message, closedown, and then dump the message either to tape or to a printer, indicating the time of reception.
This mode is only available in ARQ-mode; incoming FEC is ignored.

When this mode is initiated, the Receive and Transmit Text Areas are cleared, the AMT-1 is initiated, the status line displays "--AUTO--", and the program begins repeatedly polling the AMT-1 for status.
When an ARQ call is received, the incoming text is read and examined. Anything before the word "DE" is ignored, such as your own callsign and the word following "DE" is interpreted as the calling station's callsign.
The rest of the over is discarded.
The callsign is then checked to ensure it contains at least one letter and one number before any non-alphanumeric character such as "/", and is otherwise discarded as invalid.

If a valid callsign was not found, the program replies with a "QRZ?" message.
If the QRZ message is sent five times, the program will close the contact down.

If a valid callsign is found (e.g. G3ABC) then the message "G3ABC DE G9XYZ AUTO HH:MM UTC" is sent (assuming the called station is G9XYZ).
The calling station may then type a message of up to 2000 characters in length (approx.), ending of course with +?. The program will then send an acknowledgement message and close down, sending a CW ID to finish.
After that, the message is dumped to either tape or printer as follows:

If dumping to tape is required, the RECORD and PLAY buttons must be pressed whilst still in MENU mode, before hitting the 'U' key.
The tape is prevented from moving in MENU mode.
If the tape is not on when 'U' is entered, the program will assume printer dump is required.
If there is no printer present either, then incoming messages will appear on the screen only, and the calling station will be informed that the

message was not stored.

To exit from AUTO mode, use the MENU key (f1).

5.2.4 (V) VIEW TAPE

This key is used to examine messages which were dumped to tape in AUTO mode (the tape should be rewound while still in AUTO mode, since MENU mode inhibits tape motion, as mentioned previously).
The menu will be cleared for the "PRESS PLAY" message, and the tape should then be started. Since the screen blanks when the tape is being read, the message is read one block at a time (186 characters).
When the screen un-blanks, the block just read will be displayed in the Receive Text Area. If the menu has also appeared, then the end of the message has been reached, and 'V' must again be keyed to read any subsequent message. If the menu is not displayed, the status line will indicate "--VIEW--", and the RETURN key should be hit to read the next block of the message, or MENU keyed to exit from VIEW mode.

It is not possible to dump from tape on to the printer, since tape AUTO mode is primarily intended for stations without a printer.

N.B. If there is no (further) file on the tape, the searching must be terminated by using the STOP key alone (without RESTORE), at which point the menu will re-appear.

6. FUNCTION KEYS

The function keys are used within AMTOR, RTTY and CW modes to control initiation of calls, return to standby, etc. They correspond directly to AMT-1 control codes as follows:

f1 = ESC	f2 = control-C
f3 = control-A	f4 = control-X
f5 = control-D	f6 = control-B
f7 = control-F	f8 = DEL (lettershift code).

Some of the keys have additional functions withing the program. Each will be described in turn, and reference should be made to the keyboard overlays supplied.

f1: This key puts the AMT-1 into ESC mode, and the program into MENU mode.

f2: In AMTOR mode this key is used to break into the other stations transmission (ARQ only).
In CW mode, this key is used to increase the speed by one w.p.m. (Not in AMT-1 V:Ø1).

f3: In AMTOR mode this key is used to initiate a call in ARQ. The outgoing Selcal must then be typed as four letters.
In RTTY mode this key just switches to transmit.

f4: In all modes this key clears the AMT-1 internal buffer, AND the Transmit buffer in the CBM-64. The Transmit Text Area is also cleared.

f5: In AMTOR mode this key causes a return to standby mode. If an FEC transmission or an ARQ contact is in progress, the return to standby is delayed until all text in the buffer has been sent.

f5: (Continued)
In RTTY mode this key switches to receive, again being delayed until all text has been sent.
In CW mode this key is used to reduce the speed by one w.p.m. (not in AMT-1 V:Ø1).

f6: This key is used to initiate an FEC transmission in AMTOR mode only. It may also be used in CW mode to provide a tune-up signal, which is turned off again by keying SPACE or RETURN.

f7: This key is used to enter ARQ listen mode in AMTOR mode only. It is also used to re-start phasing in listen mode, in the event of false synchronization

f8: This key causes the shift of incoming text to be set to Letter shift, until the next valid shift code received. (But see the USOS facility in 7.2).

7. CBM (C=) KEYS

These keys operate various ancillary functions within the program, and are activated by holding down the Commodore key, and typing a digit from 1 - 8. (These are, in fact, the second set of colour codes).
Keys 1 - 4 and 7 - 8 are defined.
All work in AMTOR, RTTY and CW mode, and all except 1 and 7 work in MENU mode.

7.1 CBM-1 Write Memory 1 - 4

This key is used to load one of the user-programmable memories from the keyboard. The display will ask which memory, and expects a number from 1 to 4.
Text may then be typed in up to a maximum of 256 characters. The '£', '↑' and ']' will appear literally in this mode, but will be interpreted as callsign, time and Selcal when the message is later recalled for transmission.
When the complete message has been entered, use CBM-1 again to return to normal mode.

7.2 CBM-2 Unshift-on-Space (USOS)

This key causes the unshift-on-space feature to be switched on or off, as indicated by the 'U' on the status line. When USOS is enabled, a "force to LTRS" code is sent to the AMT-1 every time a SPACE, a CR or a LF is received. This feature is useful in RTTY mode and ARQ LISTEN, if reception is bad and incoming LTRS shift codes may be corrupted, and prevents large blocks being received wrongly on FIGS shift. In effect, this mode is an automatic version of the 'f8' function key.

7.3 CBM-3 Printer On/Off

This key turns the printer output on or off, as indicated by the 'P' on the status line. If there is no printer connected, or it is not powered up, the program detects this and the printer output can not be enabled.
With the printer on, all text displayed in the Receive Text Area in AMTOR, RTTY or CW modes is also sent to the printer, on device #4.
With most printers, the line is stored up until a CR or LF is received, at which point the whole line is printed. Some printers hold the computer in the busy state while a line is being printed, which means that the cursor stops flashing and the keyboard is not recognised. In this case, care needs to be exercised if printing while typing-in text for transmission.

7.4 CBM-4 Word mode On/Off

This key turns the word mode on or off, as indicated by the 'W' on the status line. With wordmode disabled, any text in the Transmit Buffer will be sent to the AMT-1 (provided it is not busy).
With word mode enabled, only text up to and including the last SPACE or RETURN is sent. This allows the current word being typed to be corrected using the DEL key; it is not sent until terminated with SPACE or RETURN.
It is therefore necessary to use RETURN after +? in ARQ, and always before STANDBY or RECEIVE, so as not to lose the last word (PLUS-QUERY-RETURN soon becomes a natural habit!).
In AMTOR and RTTY, it is a matter of personal preference whether to use word mode. In CW it is recommended that word mode ALWAYS be enabled - this ensures correct inter-letter spacing within words, since the text is sent a whole word at a time.

N.B. In RTTY or CW with word-mode enabled, do not expect to hear a character sent each time a key is pressed - they will be sent as a group when a SPACE or RETURN is typed.

7.5 CBM-5

This key is reserved for future enhancement.

7.6 CBM-6

This key is reserved for future enhancement.

7.7 CBM-7 CW Identification

This key causes the CW Identification to be sent in the form "DE G9XYZ". It is only effective in AMTOR and RTTY modes, and resets the AMT-1 back to AMTOR and RTTY as appropriate. If an ARQ contact, an FEC transmission or an RTTY transmission is in progress the program sends a STANDBY or RECEIVE request, and waits until the AMT-1 stops sending before activating the CW ID. Hence it is not necessary to also hit "f5".

7.8 CBM-8 Set Clock

This key activates the clock-setting procedure. The cursor will flash over the tens of hours digits. A number must then be typed, and the cursor will advance to the next digit.

This is repeated for each digit, and the clock is started immediately the last digit is typed. For correct operation with AUTO mode, and with the message in CTRL-Ø, the time should be set to UTC (the same as G.M.T.).

8. CONTROL KEYS

The control keys 1 to Ø are used to retrieve pre-programmed or user-programmed message memories and load them into the Transmit Buffer. Of the 10 memories, MEM1 to MEM4 are programmable by the user. (See 5.2.1, 5.2.2 and 7.1). The other six are pre-programmed and are not alterable. Their contents are as follows

MEM5: "CQ CQ CQ CQ CQ DE £ £"

MEM6: "SELCAL:]]]"

MEM7: "PSE K"

MEM8: "RYRYRYRYRYRY.....RY"

MEM9: "THE QUICK BROWN FOX....."

MEMØ: "TIME IS ↑ UTC"

All these memories are terminated with a CRLF. This was chosen, rather than commencing with CRLF, to provide compatibility with Word Mode. Also note the use of '£', ']' and '↑' characters, to provide universality.

As an example, to generate the text of a CQ call, the following keys would be used, in AMTOR, RTTY or CW:

RETURN	(good practice)
CTRL-8	(RTTY only)
CTRL-5	
CTRL-5	
CTRL-5	
CTRL-6	(AMTOR only)
CTRL-7	

Note that in AMTOR, CQ calls should be made in FEC (mode-B) rather than in ARQ. This allows all stations in standby to copy the call, and identify your callsign and Selcal. There are some who advocate calling in ARQ with the Selcal CQCQ. This has several drawbacks:

(i) A replying station has to respond in order to identify you - the Selcal blocks do not identify who is sending them.

(ii) In order to reply, the distant station will usually have to 'see' you in Listen Mode to know that you are calling CQCQ, and then program CQCQ in place of his own Selcal to respond.

(iii) If synchronization is lost and the master station begins rephasing, the CQCQ Selcal might be picked up by a different station listening for CQ calls.

The best method is to call in FEC, as above, using MEM6 to identify your Selcal, and then to wait for another station to call you in ARQ (or FEC if he desires). Note also that sending RY's (MEM8) is of no advantage in either ARQ or FEC, only in RTTY.

9. TROUBLESHOOTING

If you have problems getting the system to work properly, here is a list of possible points to check:

(i) If characters are lost while printing a line , or two presses of MENU are required to display the menu, it is likely that the busy output from the 64 to the AMT-1 is not functioning.
Check the CTS input to the AMT-1 for a faulty connection. This would be especially possible if a TTL-level interface were being used rather than the ICS RS232 interface. Check R60 was removed as in section 2.

(ii) If characters appear to be received incorrectly by the CBM-64 from the AMT-1, check that there is not excessive proximity to transmitter RF. If the local echo is not perfect there is likely to be a problem with the CBM-64 input port.
Check the voltage on pin 3 of the User Port connector (pin 1 is ground). It should be nominally 5V. If it is less than about 4.75V., the 64's power unit is a bit low - ask your dealer to replace it.
(Low supply voltage affects the start-bit edge detector within the CBM-64).

(iii) If the AMT-1 fails to respond to a status poll while in AUTO mode, an error message will be displayed. The error number will indicate what operation was taking place at that time.
The most likely cause is a faulty AMT-1 connection, or the AMT-1 has lost power.
If the condition happens repeatedly, please inform I.C.S., giving details.

(iv) If the program should hang due to mains-borne noise or RF interference, hold down the RUN/STOP key and hit the RESTORE key, which will restart the program.
This should also be done in the event of an error message described above.