Assembly Manual for the

VZ-200 RTTY DECODER

K-6318

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DICK SMITH KIT

Reprinted in part by arrangement with Electronics Today International from their November 1984 edition.

Radioteletype (RTTY) is an increasingly popular transmission mode amongst radio amateurs. This kit is simply an add-on for the popular low-cost VZ-200 home computer. The project just plugs into the back of the VZ-200, attach your transceiver and type 'CQ DX'!

IF YOU'RE considering venturing into the world of radioteletype, an ancient and venerable form of digital communications (comparatively speaking), but would like to take the modern route — which means employing a computer — then this project is ideal. Or, if you've been playing with RTTY for some time, but have a combination of the older electromechanical technology and earlier electronic interfaces, and want to update, then this project represents a good 'stepping stone'.

If you're entirely new to radioteletype, then we recommend *"Radioteletype: It's finger-lickin' good"*, in the October '84 issue.

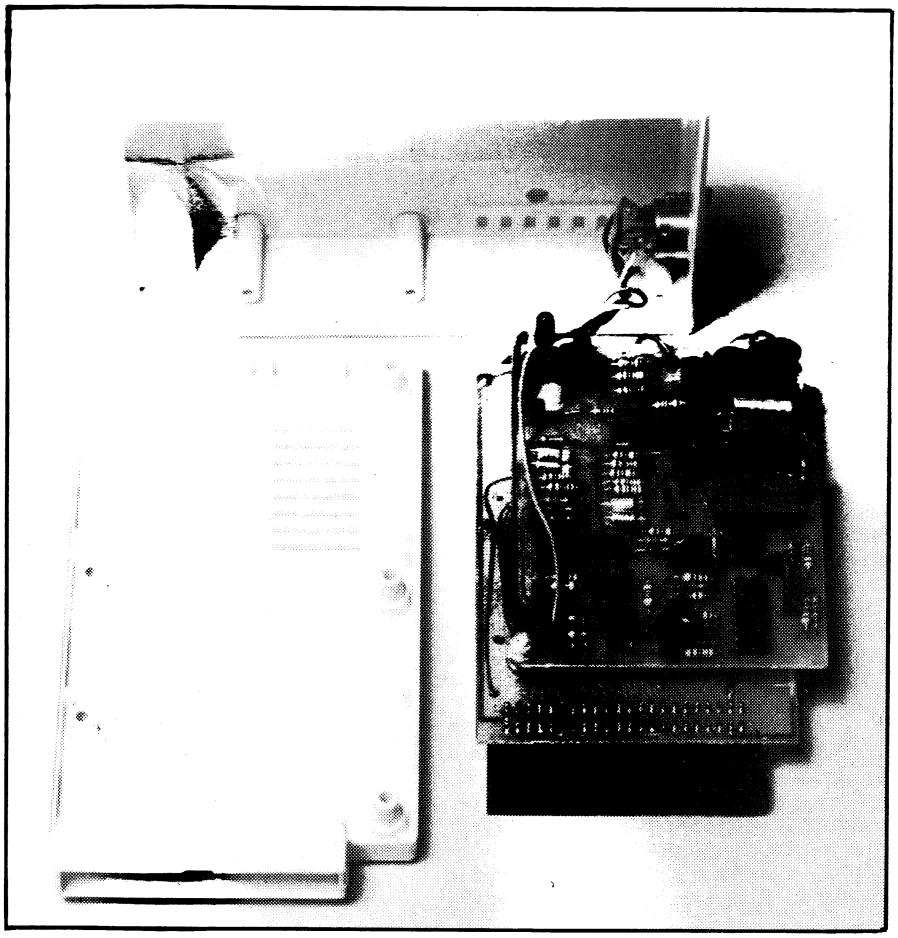
The system

The Dick Smith VZ200 is a low-cost home computer but not lacking in features. One useful feature is a full expansion buss accessible via an edge connector on the main pc board, projecting through the rear of the case. Using this buss, one can attach a variety of peripherals and communicate in and out of the computer by decoding any of the Z80 CPU's ports suitable for the purpose. This project makes use of that facility.

One of the lesser-known features of the VZ200 is its internal RF radiation shielding. If you've ever had an HF receiver near a computer, you'll know just how much and how strong is the 'crud' they radiate from one end of the spectrum to the other!

The VZ200 tackles this computer quirk with the inclusion of extensive tinplate shielding over sections of the circuitry prone to radiation — particularly the memory circuitry. Hence the VZ200 can be sited near sensitive HF receiving equipment without the problems that plague many other computers. It's not entirely free from 'birdies' but, in general, they're out of harm's way.

The project itself comprises two boards housed in a plastic peripheral box made by the VZ200 manufacturer. One board is the 'decoder' board, which contains the port decoding and RTTY terminal software in an EPROM, while the other board is the modulator/demodulator (or modem) board, containing the tone generator for driving the transmitter and the receiver converter for converting the incoming audio from the receiver and turning it into pulses for the computer to work on.



Insides out. The two boards mount inside a case from the VZ200's manufacturer. The bottom of the case is shown at left. The decoder board mounts to this, the modem board being mounted to the decoder board. Note the hole for the indicator in the case top.

The idea is that the VZ200's keyboard becomes your erstwhile 'teletype' keyboard, and the video screen becomes your 'printout' — hence the term 'glass teletype'. A printer can be attached to the VZ200's

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printer port to give you 'hard copy' on paper, if you so desire.

The receiving converter features two cascaded active bandpass filters. These have a steeply rolling-off response to reduce noise and interference; their adjacent 'skirts' coincide, providing an essentially 'flat' bandpass response across the 2100 Hz to 2300 Hz band, neatly enclosing the 'amateur standard' 2125/2295 Hz tones (170 Hz shift) with a little leeway to cope with variations. An XR2211 phase-locked loop is used to generate 'mark' and 'space' pulses from the incoming tones. This chip conveniently provides a 'lock detect' output pin and this is used to drive a LED which lights when you have a signal correctly tuned.

There is one special point worth noting about the PLL. The main VCO frequency determining component is C10, a 22n/400 V metallised polyester capacitor. This was chosen because it has a low temperature coefficient of capacitance around normal room temperatures (25° C). Substitutions may cause problems with excessive temperature drift and uncertain operation.

The transmitter section comprises a simple but reliable 'Walsh Function' pseudo-sinewave generator that generates, digitally, the two tones. This is followed by a filter, the output of which is fed to your transceiver's mic input.

Relay control of your transmitter is effected by a relay on the decoder board, the contacts of which go to the push-to-talk contacts (PTT) on your transceiver. This relay, and the transmitter section of the modem board, are each controlled by one of the decoded computer ports.

The project is powered from the VZ200 supply rail, via the expansion connector. The only interconnection required is to your transceiver's mic input, the PTT input and the audio output.

The software provides you with the two 'screens'. The upper screen is used to display the text you type, while the lower screen displays the received text. Each screen has independent scrolling. You can type and receive simultaneously. In other words, you can begin typing a reply while receiving text from another station.

You have a 'type ahead' buffer which can contain up to 1024 characters (1K). Apart from that, the software gives you a total of six transmit buffers, one of which is reserved as a 'who are you?' (or WRU) buffer. This versatile feature alerts you when another station calls you by your callsign or some other identification, and the unit will send a response. For example: say VK2ETI wishes to activate your WRU mode. He would send

VK2XYZ WRU VK2ETI

and your unit would respond with something like

STATION IDENTIFICATION DE VK2XYZ

and, if you had put a message in the WRU buffer, your unit would add

STAND BY
++ OPERATOR ALERTED ++

or whatever you had inserted. It is considered impolite to insert messages in the WRU buffer like

RACK OFF HAIRY LEGS!

HOW IT WORKS — ETI-756

There are two sections to the project, each contained on separate boards: the 'decoder' (or decoder/control) board and the 'modem' board. They are powered from the +9 V and +5 V supply rails of the VZ200. Let's take each section separately.

DECODER BOARD

This decodes five ports and contains the software in EPROM plus the transmitter control relay. IC1 decodes address lines A11-A13, five of its Q outputs selecting the EPROM, transmit control and receive control circuitry as required. The outputs are 'enabled' when 1-1-0 appears on A14, A15 and the MREQ line.

Serial baudot data for transmit and receive goes in and out on bit seven of the VZ200's data buss (D7).

When you select transmit operation from the VZ200, the relay closes the push-to-talk (PTT) contacts, turning on your transmitter. When you send text, the data is sent via D7 and to the modulator board via the flip-flop IC2b and the TXD line.

When you select receive operation, the pulses from the demodulator on the modern board come in via the RXD line, and are gated onto D7 via IC4d and c. Note that, on selecting receive operation, Q1 gets turned off and the relay PTT contacts open, turning off your transmitter.

Diodes D4 and D5 make a simple OR gate, allowing the 'chip enable' pin of the EPROM to be activated when either the lower or upper 1K block of the EPROM is selected.

IC2 is a flip-flop that sets up the transmit control. Its outputs must be preset on power-up, hence the two 'clear' pins (CD1 and CD2) are initially clamped to 0 V on power-up because C23 is initially uncharged. It will charge via R3, by which time the Q outputs of IC2 will be correctly set.

MODEM BOARD

The receiver portion comprises two op-amps from IC9 (a and b), and IC6, an XR2211 PLL chip.

The two op-amps are set up as bandpass filters, each with the centre frequency offset so that their adjacent skirts just overlap. The filter Qs were chosen to provide good skirt selectively so that noise and interference in the received channel do not adversely affect the demodulator's operation. The lower roll-off is at about 2070 Hz, the upper roll-off at about 2350 Hz, neatly encompassing the standard mark and space tones used in amateur RTTY of 2125 and 2295 Hz. Note that 1% components are used for the critical filter components.

The filter output, from pin 7 of IC9, couples to the PLL input via C11. The PLL centre frequency is determined by C10 (chosen for its low temperature coefficient — see main text) and R14/RV2. The latter sets the PLL on frequency.

The PLL's dc 'error' signal toggles from high to low as the incoming audio switches from 2295 Hz to 2125 Hz. This output is the RXD line, sending the baudot bit stream to the VZ200 via the decoder board.

The XR2211 provides a 'lock detect' pin and this is used to drive a LED indicator via a transistor buffer (Q2).

The audio input to the demodulator is taken from the receiver's speaker. The level is first attenuated and then clipped with back-to-back diodes, D2 and D3. The 500 mV pk-pk level here is further attenuated (via R34/R35) before being applied to the input of the filter stages.

The modulator comprises a 'Walsh Function' generator, which digitally generates a pseudo-sinewave, followed by a buffer filter. The Walsh Function generator consists of IC5, a 555 timer running at ten times the required output frequency, followed by a 4017 decade counter. The 555 is toggled between the two required frequencies (21 250 Hz and 22 950 Hz) by switching extra resistance across the 555's timing resistor, thus raising its frequency of oscillation. This is done using a 4066 CMOS switch to switch RV3-R53 in parallel with RV1-R9. The TXD line toggles the 4066.

The output of the 555 drives the clock input of the 4017. The decade counter's outputs are all 'chained' via resistors R21-R29 so that the voltage across R30 'steps' up and down, depending on the ratio of high-to-low outputs of the 4017. The CR network of C14-R30 provides some high frequency roll-off.

One op-amp from IC9 (d) provides a buffer/filter, 'rounding off' the digitally generated sinewave before it is passed to the transmitter's mic input. C15 provides ac coupling to the op-amp input. C17 prevents RF from creating havoc in the mic line.

The op-amps require a half-supply rail for their non-inverting inputs and this is provided by IC9c and the divider R38-R39. C21 bypasses the half-supply divider.

Trimpot RV1 sets the low tone, while RV3 sets the high tone of the modulator. Note that RV3 is only a single-turn trimpot, while RV1 is a multi-turn type.

The following is a summary of the transmit commands, with the immediate commands summary on page 3.

TRANSMIT COMMANDS

When called, the following commands are inserted into the type — ahead buffer ready for transmission.

• SHIFT Q	Transmit buffer #1.
• SHIFT W	Transmit buffer #2.
• SHIFT E	Transmit buffer #3.
• SHIFT R	Transmit buffer #4.
• SHIFT T	Transmit buffer #5.
• SHIFT 0	Transmit buffer #0 (WRU buffer).
• SHIFT A	Transmit a row of RYs (32 characters).
• SHIFT I	Transmit "STATION IDENTIFICATION" along with your callsign.
• SHIFT P	Transmit "PLEASE KK KK KK" to terminate a call.
• SHIFT D	Transmit "DE" along with your callsign.
• SHIFT F	Transmit "THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG 0123456789".
• SHIFT C	Transmit a row of CQs (32 characters) along with your callsign.
• SHIFT 0	Transmit your callsign only.
• SHIFT 3	Terminate the transmission at this point and exit to receive mode. (SHIFT 3 produces a #).

There are various ways of using this feature. explained later.

There are seven pre-programmed messages stored in the unit's EPROM. Many are designed to insert your callsign automatically when called, saving you time and effort. You can send a string of CQs along with your callsign; a row of RYs (the accepted 'test' signal'; it contains the highest data density); the 'quick brown fox' message along with the numerals 0 to 9 (full alphanumeric series); the 'send — over' terminator; station identification; send your callsign; and send DE followed by your callsign.

There is a total of fourteen 'transmit' commands and nine 'immediate' commands, all called using the SHIFT key. The immediate commands control the overall operation of the 'glass teletype'. One toggles the current mode — i.e: from transmit to receive or from receive to transmit; one exits from the current operating mode to the menu; one controls the WRU mode; one gives you backspace; one changes the baud rate; one returns you to the 'callsign entry' — a sort of 'begin again' command, and two control the printer operation.

Construction

Before commencing any of the electronic assembly, carefully check the track side of each pc board. See that all the holes are drilled and of the correct size. Check that there are no solder 'bridges' between closely-spaced tracks, particularly between IC pads. See that there are no obvious breaks in any tracks.

Probably the best place to start is with the case. It comes in two halves. Mark out positions for the DIN socket and the LOCK DETECT indicator LED on the case lid (the larger piece). See the accompanying photograph. Drill them to size and then insert the DIN socket and screw it in place. The LED mounts on the pc board on the ends of its leads and protrudes through the hole in the case lid. The length of its leads will permit some variation in the exact hole position in the case lid.

Once that's out of the way, you can tackle the board assembly. It's easiest to start with the decoder board. It's marked ETI-756a/ZA1694. There are nine links required on this board; install them first. Use tinned copper wire. Next, install the resistors and capacitors. Make sure you get C23 the right way round. Solder ICs 1, 2 and 4 in place next, ensuring they are correctly oriented. Install a socket for IC3 next, but don't insert the EPROM yet. Now solder in the three diodes, followed by the relay. Check that the diodes are inserted the right way round. Now solder Q1 in place, then the 44-pin socket. Last of all, plug in the EPROM.

Put the decoder board aside and tackle the modem board next. As before, start by soldering in the links. There are only two (contrary to what you can see in the pictures — a prototype, later modified). One is located between R9 and R10, the other between R17 and R46. Use tinned copper wire. Insert all the resistors next. Follow with the two diodes, Q2 and LED1 - making sure you get them all the right way round. Now solder all the ICs in place, seeing that you have them correctly oriented before soldering. With IC6, IC7 and IC8, solder the ground pins first, followed by the Vcc pin, and then all the remaining pins. This prevents any static or leakage current failure problems with the CMOS during construction.

The trimpots can be soldered in place next. Note that RV3 (SET 22 950) is a signal turn, vertical-mounting type, not a 10-turn trimpot like the others (and as seen in the pictures).

All the capacitors are soldered in place last. See that the two tantalums (C21 and C22) are correctly oriented.

Before proceeding further, *give each board a thorough check*. See that all the semiconductors and other polarised components are around the right way and that there are no solder bridges between closely-spaced pads — particularly around the IC pins. Remedy any problems.

If all's well, link the two boards with short lengths of hookup wire, as per the wiring diagram, and wire them to the DIN socket. Colour-coding the wires helps identify them, now as well as later when you may need to fault-find on the unit. Secure the plastic bolts to the decoder board using two plastic nuts on each. These nuts will form the spacers between the two boards when screwed 'back to back'. If you're satisfied all is well, screw the assembly into the case bottom via the holes provided on the decoder board. This board faces down (components face the case). Leave the lid hanging loose so that the trimpots may be adjusted.

Aligning the unit

We will align the transmitter first, as the transmitter will be used to align the receiver.

Transmit alignment.

1) Cut the link connecting the two pads marked TXD on both boards. Solder a 10 cm length of wire to the modem board TXD pad.

2) Connect a frequency counter to pin 3 of IC5 (555).

3) Link the 10 cm wire to ground, and adjust RV1 for a frequency of 21250 Hz.

4) Now link the wire to +5 V, and adjust RV3 for a frequency of 22950 Hz.

5) Repeat steps 3 and 4 several times as necessary to ensure frequencies remain accurate when the wire is toggled between ground and +5 V.

Receiver alignment.

1) Wire a link connecting TX audio output to RX audio input.

2) Connect an audio generator to the wire used in the transmitter alignment.

3) Set the generator for a square wave, 0 dB attenuation, maximum amplitude, and a frequency of about 22 Hz. (This simulates a speed of approximately 45 baud).

4) Connect a CRO to pin 7 of IC6 (XR2211).

5) Adjust RV2 for a squarewave of equal mark space ratio.

6) Set the generator for a frequency of about 50 Hz. Check that the signal on pin 7 of IC6 is still a squarewave of equal mark/space ratio. If not, readjust RV2, then check again on 22 Hz.

7) Disconnect the generator.

8) Link the wire to ground. Pin 7 of IC6 should go logic high.

9) Link the wire to +5 V. Pin 7 of IC6 should go logic low.

That covers the alignment details. All that remains is to reconnect the two pads labled TXD and disconnect the link connecting the audio input to audio output.

Final testing

After powering up, go to receive mode. Using SHIFT Z, toggle between receive and transmit modes. You should hear the transmit/receive relay open and close. The relay should be in the open condition on receive.

While in the transmit mode, the idle tone should be 2125 Hz, and the TXD pad should be a logic high. When typing, TXD should show low-going data, and the tone should toggle to 2295 Hz in sync. This tone will probably be too low in level to be read by a counter at the audio output pin, but it can be read on pin 3 of IC5 (555). (NOTE: This reading is 10 times the final frequency, so don't be fooled.)

Try out

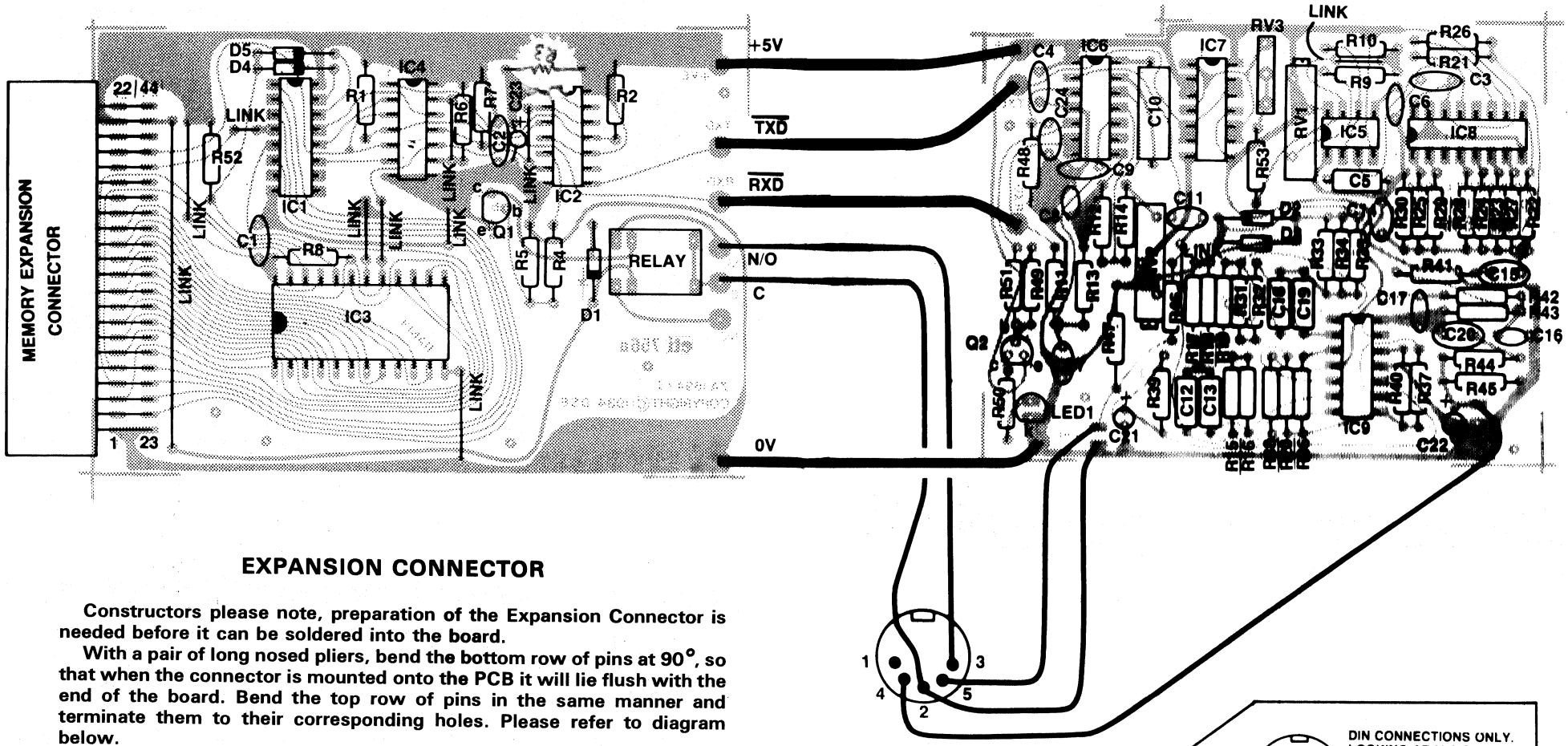
Plug the project into the VZ200 expansion slot with the decoder board components facing *down*. Failure to observe this could result in the unit being damaged.

Once the module is fitted, turn your VZ200 on. If your VZ200 has Version 2.1 BASIC, you should hold down the CTRL

IMMEDIATE COMMANDS

These commands operate in both transmit and receive modes.

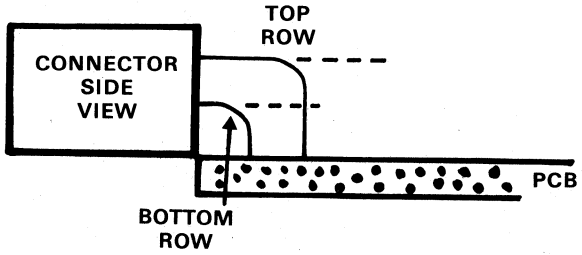
• SHIFT Z	Toggle from the current mode to the alternate mode. i.e: From TX to RX or from RX to TX.
• SHIFT X	Exit from the current mode to the menu.
• SHIFT U	Enable/disable the WRU mode. The current status is displayed on the command line at the top of the screen.
• SHIFT H	Enable/disable the PRINTER mode. The current status is displayed on the command line at the top of the screen.
• SHIFT M	Backspace key. Deletes the last character typed.
• SHIFT S	Change the BAUD RATE.
• SHIFT B	Clears the internal printer buffer.
• SHIFT G	Exit the current mode and restarts at the callsign entry mode.
• SHIFT (RET)	Inserts a CR/LF into the internal printer buffer, forcing it to dump it's contents to the printer.



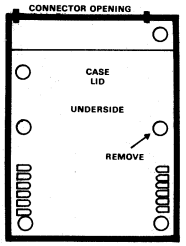
EXPANSION CONNECTOR

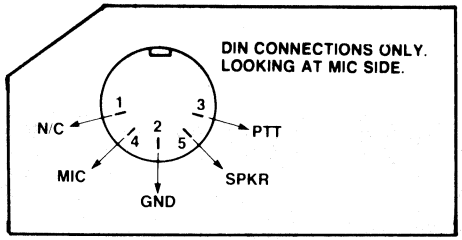
Constructors please note, preparation of the Expansion Connector is needed before it can be soldered into the board.

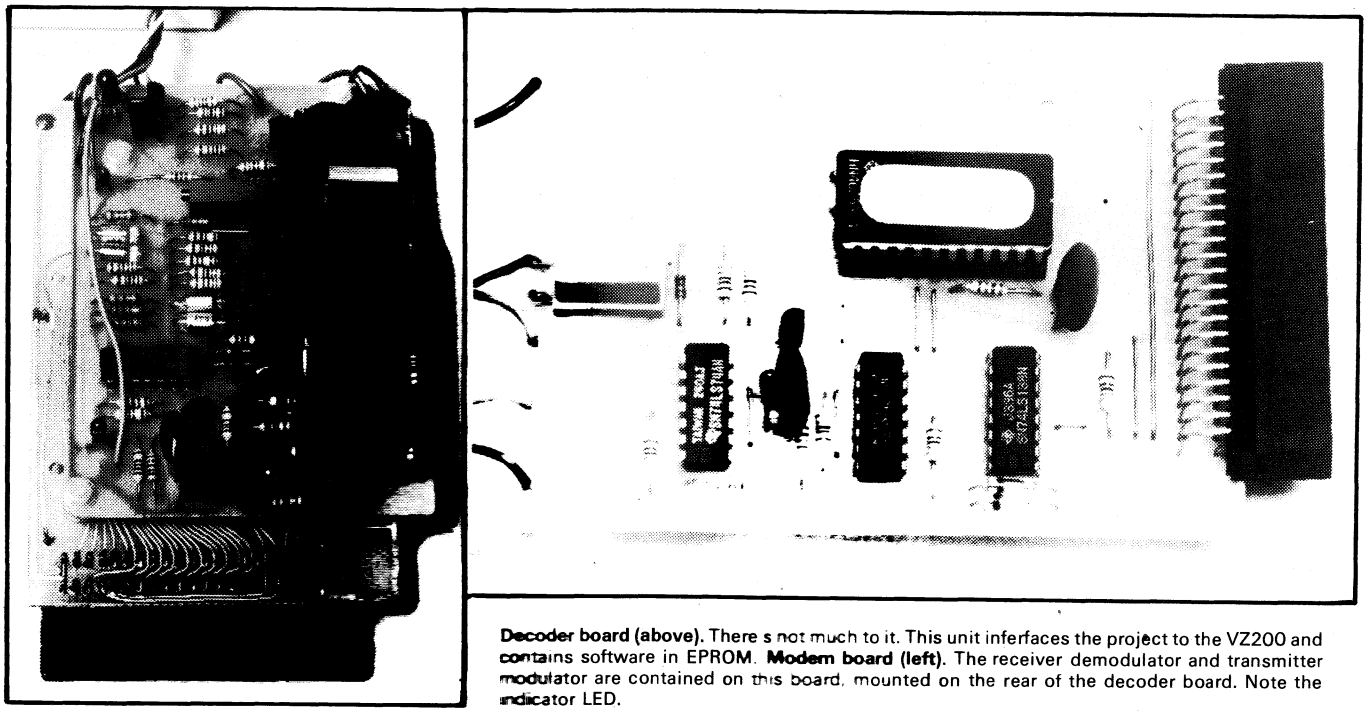
With a pair of long nosed pliers, bend the bottom row of pins at 90°, so that when the connector is mounted onto the PCB it will lie flush with the end of the board. Bend the top row of pins in the same manner and terminate them to their corresponding holes. Please refer to diagram below.



Prior to mounting the PCB's into the case, one spacer will have to be removed from the case lid. Refer to diagram below for correct location.







Decoder board (above). There s not much to it. This unit inferfaces the project to the VZ200 and contains software in EPROM. **Modem board (left).** The receiver demodulator and transmitter modulator are contained on this board, mounted on the rear of the decoder board. Note the indicator LED.

key as you turn on. or else the display will contain inverse characters. If all is well. the VZ-200 should display

★ VZ-200 RTTY ★
★ TERMINAL PACK ★

followed by a copyright message. If not, power down immediately, and check the project for errors.

PARTS LIST

RESISTORS

Constructors please note, all resistors are ¼W unless noted.

- 2x 3.9K Metal Film Resistor (R17, R33) ☐
- 1x 15K Metal Film Resistor (R14) ☐
- 1x 560K Metal Film Resistor (R15) ☐
- 2x 680K Metal Film Resistor (R31, R32) ☐
- 1x 1M Metal Film Resistor (R16) ☐
- 1x 33R Resistor (R47) ☐
- 1x 470R Resistor (R50) ☐
- 1x 560R Resistor (R45) ☐
- 2x 1K Resistor (R30, R46) ☐
- 2x 2.7K Resistor (R7, R8) ☐
- 1x 3.3K Resistor (R44) ☐
- 9x 4.7K Resistor (R1-R6, R49, R51, R52) ☐
- 1x 10K Resistor (R10) ☐
- 1x 18K Resistor (R25) ☐
- 3x 22K Resistor (R9, R24, R26) ☐
- 3x 27K Resistor (R23, R27, R34) ☐
- 2x 33K Resistor (R37, R41) ☐
- 1x 47K Resistor (R42) ☐
- 2x 56K Resistor (R22, R28) ☐
- 3x 68K Resistor (R38, R39, R43) ☐
- 1x 100K Resistor (R13) ☐
- 1x 120K Resistor (R40) ☐
- 4x 220K Resistor (R18, R21, R29, R53) ☐
- 1x 270K Resistor (R12) ☐
- 1x 330K Resistor (R35) ☐
- 1x 390K Resistor (R19) ☐
- 2x 470K Resistor (R11, R48) ☐
- 1x 1.2M Resistor (R36) ☐
- 1x 1.5M Resistor (R20) ☐
- 1x 10K Multiturn Trimpot (RV2) ☐
- 1x 50K Multiturn Trimpot (RV1) ☐
- 1x 200K Trimpot (RV3) ☐

CAPACITORS

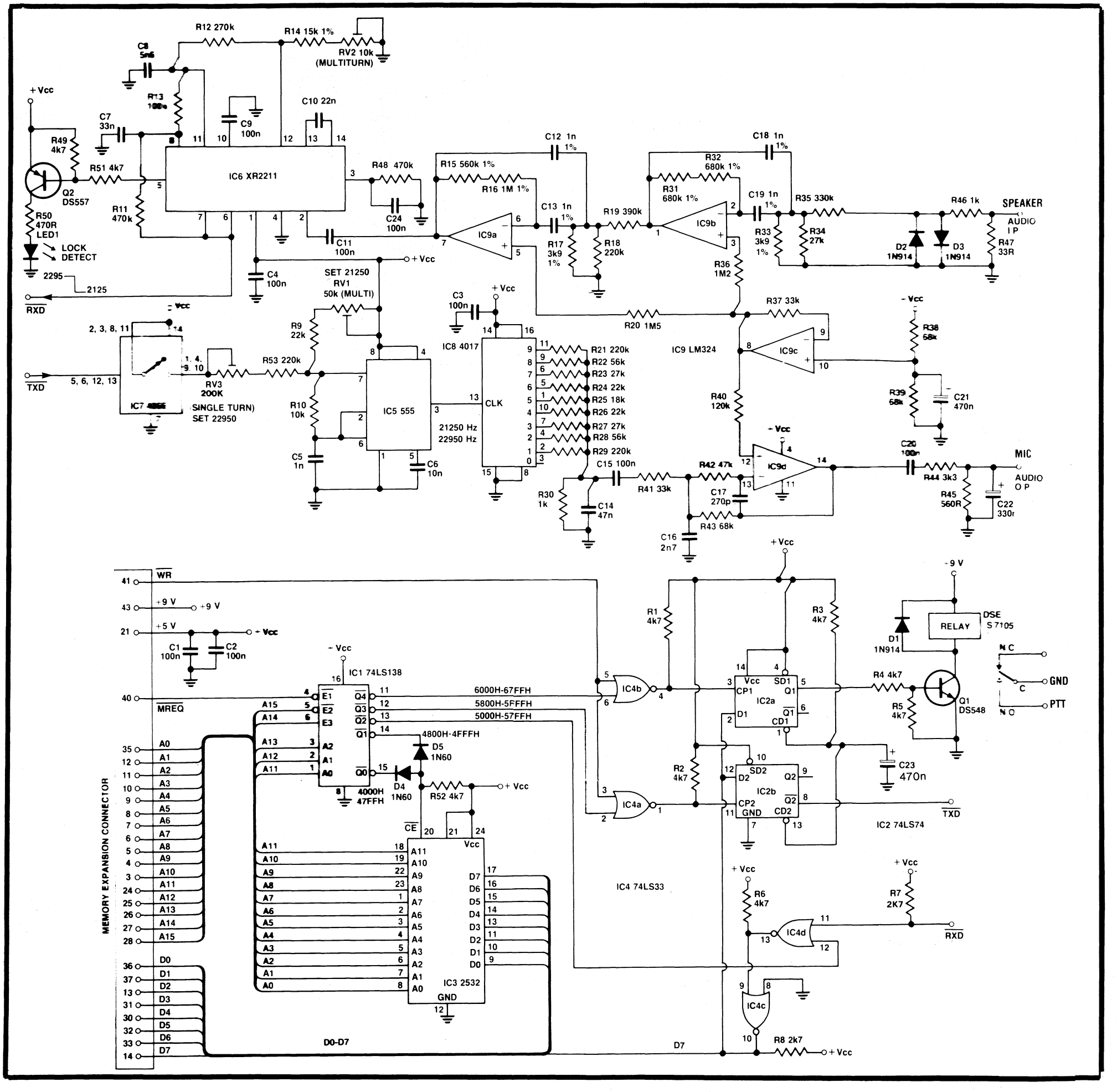
- 1x 0.0027uF Greencap (C16) ☐
- 1x 0.0056uF Greencap (C8) ☐
- 1x 0.033uF Greencap (C7) ☐
- 1x 0.047uF Greencap (C14) ☐
- 3x 0.1uF Greencap (C11, C15, C20) ☐
- 1x 0.01uF Ceramic (C6) ☐
- 6x 0.1uF Ceramic (C1-C4, C9, C24) ☐
- 1x 0.47uF Electro (C21) ☐
- 1x 0.33uF Tantalum (C22) ☐
- 1x 0.47uF Tantalum (C23) ☐
- 1x 0.022uF Metalcap (C10) ☐
- 1x 270pF Styrocap (C17) ☐
- 5x 1000pF Styrocap (C5, C12, C13, C18, C19) ☐

SEMICONDUCTORS

- 1x BC548 Transistor (Q1) ☐
- 1x BC557 Transistor (Q2) ☐
- 2x 1N60 Didoe (D4, D5) ☐
- 3x 1N914 Diode (D1, D2, D3) ☐
- 1x Red LED (LED1) ☐
- 1x 74LS74 IC (IC2) ☐
- 1x 74LS138 IC (IC1) ☐
- 1x 4017 IC (IC8) ☐
- 1x 4066 IC (IC7) ☐
- 1x LM324 IC (IC9) ☐
- 1x DS555 IC (IC5) ☐
- 1x XR2211 IC (IC6) ☐
- 1x 74LS33 IC (IC4) ☐
- 1x 2532 EPROM 'RTTY' IC (IC3) ☐

MISCELLANEOUS

Mini relay, screws and nuts, Din socket, hookup wire, solder, plastic case, PCB (A & B), 44 way connector, 24 pin IC socket ☐



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Now comes the time to connect your transceiver to the interface. Connection is made through the five-pin DIN plug on the rear panel. Wire the TX output and PTT pins to a microphone plug, and the RX input to a speaker plug. You will probably prefer to fit an extension speaker so you can monitor the received signals. Plug the microphone and speaker plugs into your transceiver anbd adjust the receive volume for a comfortable listening level to start with. High receive volume with the mute open on FM, will cause random characters to appear on the screen. This is to be expected if you over-drive the preamp/ filters. These high volume levels are not required, and normal operation will require the volume to be no more than normal listening level.

If operating on VHF/UHF, the RTTY signals will probably be FM. This makes things easy, as the received tones will be of the correct frequency. Simply select the channel and adjust the volume. The 'lock detect' LED will light when a signal is being received correctly.

When operating on HF using SSB, care is required in tuning to the correct frequency. The LED will indicate when you are close. If you can't resolve it, try the other sideband.

This RTTY interface is designed to use a shift of 170 Hz. If you wish to receive commercial TTY (many of which use larger shifts), simply tune into one tone only. The 'lock' effect of the XR2211 will ensure correct data reception. Again, if you have difficulty, try the other sideband, the other tone, or another baud rate. NOTE: When receiving commercial, wide-shift TTY, the LED will flash in time with the data, due to the out-of-lock condition on one tone.

The normal specifications for Amateur RTTY are as follows

Mark (logic low) ..... 2125 Hz
Space (logic high) ..... 2295 Hz
Shift ..... 170 Hz
Speed ..... 45.45 baud
Idle: logic high
1 start bit
5 data bits
1.5 stop bits

That concludes the general operation of the RTTY interface. Those Sydney operators who are new to RTTY will find plenty of activity on the Sydney RTTY repeater on 146.675 MHz. There is also a RTTY simplex channel on 146.600 MHz You will find many operators only too glad to encourage newcomers to this mode of communications.

GENERAL OPERATION

Entering your callsign.
On power-up, your VZ200 RTTY interface will introduce itself. To continue, press any key. You will then be asked to enter your callsign. You may enter anything up to 64 characters but it is recommended that if you wish to use the WRU mode, you use the following format:

enter your callsign
VK2FGH (PETER)

There should be no leading space before the callsign and there should be at least one space after the callsign. Apart from that, you may add anything you like up to 64 characters total. This enables your callsign to be used as the WRU code. You may wish to use another code instead. If so, it must not be longer than a normal callsign (i.e: six letters) although it may be shorter, and it must always be followed by a space character. If you press <RETURN> at this point instead of entering text, the callsign buffer will contain a null and any attempt to send a callsign will give no response. The disadvantage of this is that your WRU system (when activated), instead of being selective, will respond to any WRU sent.

Loading the programmable buffers.
Once you have entered your callsign, press <RETURN> and you will enter the buffer entry mode. In this mode, you are able to enter text into any of the six programmable buffers. Each buffer may contain up to 64 characters. You may start entering text by typing the number of the buffer you require. Your VZ200 will display the buffer number you have selected. Simply enter your text as you require.

Note: the SHIFT M command is used for the backspace key.

Press <RETURN> when you are finished, and your buffer is programmed. Repeat the process for each buffer you require to program, including the WRU buffer (buffer 0). When you have finished, press SHIFT X to enter the MENU.

Menu mode.
From the MENU you are able to enter the three main operation modes, i.e: receive mode, transmit mode, and buffer entry mode. You can return to the menu at any time from any of these modes by using SHIFT X.

Receive mode.
In this mode you are able to receive RTTY. The first thing you will notice is the command line at the top of the screen. This line tells you the current status of the system. In the RECEIVE mode it will display RECEIVE MODE on the left. On the right will be the number 45. This is the current BAUD rate. The system will always default to 45.45 baud.

The command line is also used to display the current status of the PRINTER and WRU modes. These modes always default to the OFF status.

To demonstrate this, hold down the

MODIFICATIONS TO VZ/RTTY DECODER TO IMPROVE PERFORMANCE ON WIDEBAND COMMERCIAL RTTY

The following changes to component values will allow less critical receiver tuning when decoding wideband commercial RTTY found on the HF bands.

While values are given for both 425 Hz and 850 Hz shifts, prototype units constructed for 850 Hz shift use were quite capable of resolving stations using 425 Hz shifts.

It should be noted that once these modifications have been performed, it is highly unlikely that the decoder will resovle 170 Hz shift amateur RTTY.

CHANGES FOR 850 Hz SHIFT (1450/2300 Hz)

i) Changes to filter stages
Change:
R35 from 300k 5% to 180k 5%
R34 from 27k 5% to 27k 1%
R33 from 3k9 1% to 27k 1%
R32 from 680k 1% to 1M 1%
R31 from 680k 1% to 18k 5%
R19 from 390k 5% to 100k 5%
R18 from 220k 5% to 470k 5%
R17 from 3k9 1% to 8k2 1%
R16 from 1M 1% to 47k 5%
R15 no change.

ii) Changes to FSK decoder
Change:
RV2 from 10k to 20k
R14 from 18k 1% to 15k 1%
R12 from 270k 5% to 47k 5%
R11 from 470k 5% to 1M5 5%
C7 from 330n to 39n

CHANGES FOR 425Hz SHIFT (1875/2300Hz)

i) Changes to filter stages
Change:
R35 from 330k 5% to 220k 5%
R34 from 27k 5% to 39k 1%
R33 from 3k9 1% to 12k 1%
R32 from 680k 1% to 820k 1%
R31 from 680k 1% to 68k 1%
R19 from 390k 5% to 150k 5%
R18 from 220k 5% to 47k 5%
R17 from 3k9 1% to 8k2 1%
R16 from 1M 1% to 100k 1%
R15 no change

ii) Changes to FSK decoder
Change:
RV2 from 10k to 20k
R14 from 18k 1% to 12k 1%
R12 from 270k 5% to 100k 5%
R11 from 470k 5% to 1M5 5%
C7 from 330n to 39n

SHIFT key and press U. The command line will display WRU. This indicates that the WRU mode is now active. Again press SHIFT U, and the WRU will no longer be displayed, indicating the WRU mode is disabled. Try the same with SHIFT H. This enables and disables the printer. Similarly, SHIFT 5 changes the BAUD rate.

The screen is split into two sections, each with independent scrolling. All received text is displayed on the bottom screen, while the top screen is used to display your typed text. You may type and receive simultaneously. The type ahead buffer can contain up to 1024 (1K) characters. Any data from the buffers may be added as you go by pressing the appropriate enable keys. A graphic block will be displayed as you type to show you that a buffer has been enabled. You may terminate your text with the '#' code. When this code is found during transmission, your system will automatically revert to the receive mode.

Transmit mode.
When the station you are communicating with has finished his transmission, you may reply to him by pressing

SHIFT Z

This sends your terminal to the transmit mode, enabling your transmitter, and sending the test you previously typed. You may continue typing if you wish. Your system will continue to send the stored text, including any programmed text, until it catches up with your typing, whereby it will follow the text as you type it. During all this time, the text is displayed on the bottom screen, along with the contents of any programmed buffers you may have enabled. Thus you can see everything being sent in its final form. You may exit to receive by using either

#
or
SHIFT Z

Note: SHIFT Z will not work if there is still data in the buffer waiting to be sent. This prevents you from accidentally terminating the transmission prematurely. If you wish to abort your transmission intentionally, use

SHIFT X

to get back to the menu.

WRU mode.
The WRU mode is a special feature included to add versatility to your system. To activate this mode, press

SHIFT U

The letters WRU will appear on the command line. When this mode is active, any station sending your callsign (or any other code entered on power-up), followed by the letters WRU, will activate your system. When this happens, your VZ200 will first Beep to let you know that your system is being called. After checking to ensure the frequency is clear, your transmitter will then activate automatically, sending 'STATION IDENTIFICATION DE <callsign>', along with any message stored in the WRU buffer (buffer # 0).

For example, if you had entered on power-up 'VK2FGH (PETER)' any station wishing to activate your WRU mode would need to send

VK2FGH WRU

Your system would then respond with

STATION IDENTIFICATION DE VK2FGH (PETER)

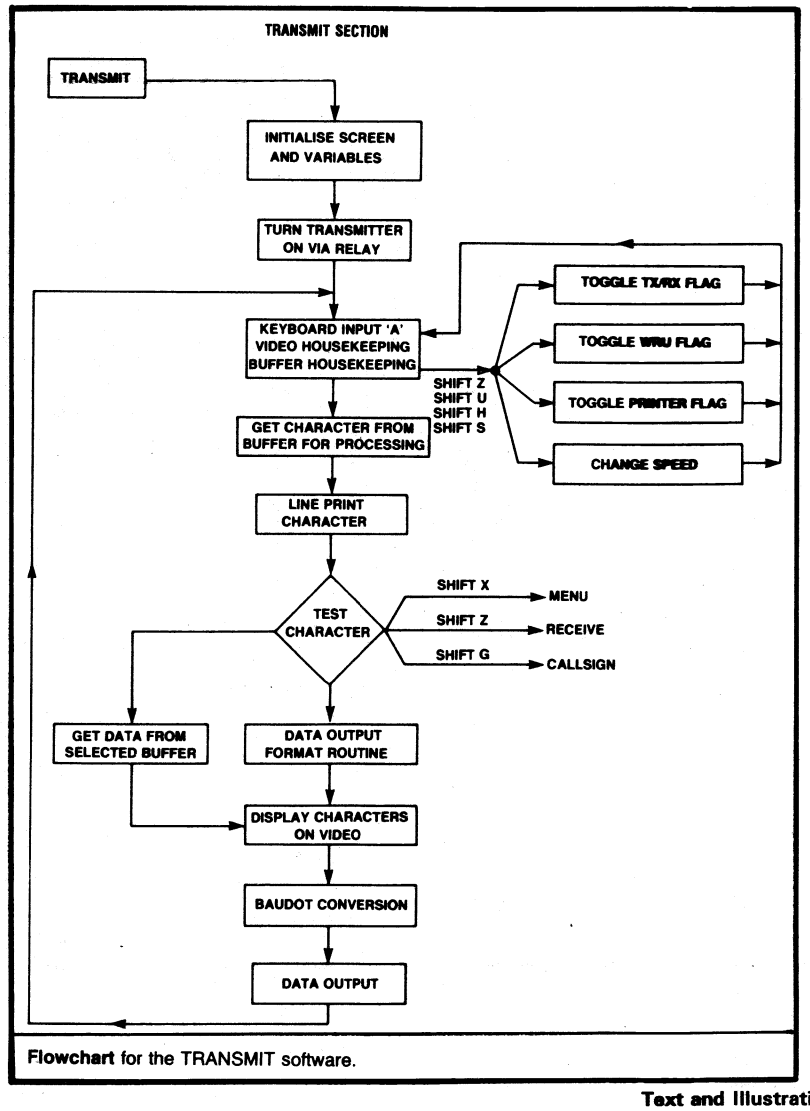
If you had programmed the WRU buffer, your system might also add

PLEASE STAND BY . . .
++ OPERATOR ALERTED ++

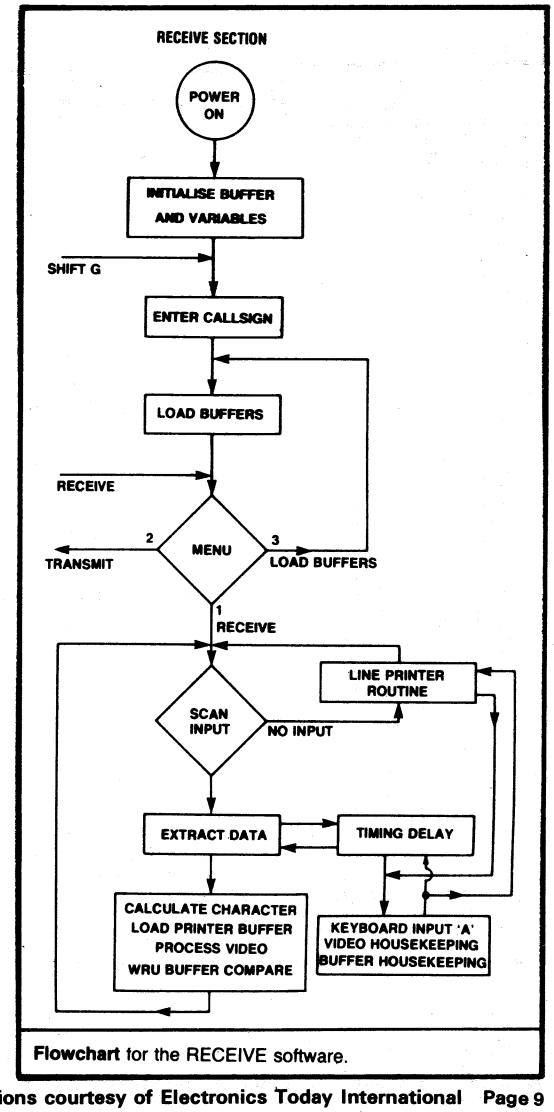
or something similar.

If you wished to leave a special message your could put any code up to six letters long (followed by a space, of course) in the callsign storage buffer, and the special message in the WRU buffer. Only the stations aware of your code will be able to access the message.

Inbuilt pre-programmed buffers.
There are seven pre-programmed messages stored in your VZ200 terminal. Many of these are designed to insert your callsign automatically when called, to save you time and effort. These buffers and their enable commands are listed below:



Flowchart for the TRANSMIT software.



Flowchart for the RECEIVE software.

PROGRAM LISTING

```
ADDR   0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F

4000:  AA 55 E7 18 21 FF 7F F9 F3 3E 0D 21 09 80 77 11
4010:  0A 80 01 80 01 ED B0 3E EC 32 08 80 AF 32 06 80
4020:  32 07 80 CD EF 49 CD D9 49 CD C9 01 21 F7 43 CD
4030:  A7 28 CD 20 47 FE 00 28 F9 CD C9 01 21 AC 44 CD
4040:  A7 28 21 8F 81 C3 2E 46 CD DA 41 CD C9 01 AF 32
4050:  00 60 21 F6 81 22 F4 81 77 11 F7 81 01 01 04 ED
4060:  B0 CD CA 46 32 F2 81 21 60 42 CD A3 45 21 90 42
4070:  CD A7 28 21 D6 42 CD A7 28 21 09 43 CD A7 28 CD
4080:  F4 2E FE 31 CA 93 40 FE 32 CA .. 48 FE 33 CA B5
4090:  45 18 EC AF 32 00 60 CD C9 01 21 1E 42 CD A3 45
40A0:  CD 77 46 CD D9 49 CD EF 49 21 C0 71 22 00 80 21
40B0:  E0 70 22 F0 81 CD 70 4B AF 32 05 80 CD 23 49 3A
40C0:  05 80 FE FF CA 28 48 CD 8F 46 1E 00 3A 00 50 CB
40D0:  7F 28 E9 CD 23 49 3A 05 80 FE FF CA 28 48 CD 8F
40E0:  46 3A 00 50 CB 7F 20 EB 0E 08 CD 1E 45 CD 18 45
40F0:  3A 00 50 CB 17 CB 11 38 05 CD 18 45 18 F2 CD 18
4100:  45 21 E0 46 06 00 16 00 79 FE 1B 20 02 1E 01 FE
4110:  1F 20 02 1E 00 CB 21 19 09 7E FE 09 FA 2E 41 FE
4120:  0D 20 02 1E 00 CD 68 45 CD 30 41 CD 5B 41 18 A3
4130:  E5 D5 F5 3A 07 80 FE 00 28 1D 37 3F ED 5B F8 85
4140:  21 38 86 ED 52 28 10 F1 FE 0C 38 08 2A F8 85 77
4150:  23 22 F8 85 D1 E1 C9 F1 D1 E1 C9 F5 D5 F5 3A 06
4160:  80 FE 00 20 03 F1 18 2F 21 D0 81 11 DA 81 01 0A
4170:  00 ED B0 21 DA 81 11 D1 81 01 09 00 ED B0 11 D0
4180:  81 F1 12 21 E4 81 11 D9 81 1A BE 20 0A 23 1B 7E
4190:  FE AA 28 06 1A 18 F3 D1 F1 C9 D1 F1 21 0C 42 ED
41A0:  5B F4 81 01 06 00 ED B0 ED 53 F4 81 3E 06 32 F2
41B0:  81 CD F6 41 3E 0D CD 30 41 3A 00 50 CB 7F 20 F9
41C0:  0E 32 CD 1E 45 CD 18 45 3A 00 50 CB 7F 20 EA 0D
41D0:  20 F3 3A 05 80 2F 32 05 80 C9 21 8F 81 11 E4 81
41E0:  7E 12 FE 20 23 13 28 02 18 F6 06 04 21 FC 44 7E
41F0:  12 23 13 10 FA C9 06 0C 21 7F 00 C5 01 64 00 CD
4200:  5C 34 01 00 20 CD 60 00 C1 10 ED C9 95 0D 0D 90
4210:  0D 23 57 52 55 00 20 20 20 00 50 52 54 00 52 45
4220:  43 45 49 56 45 20 4D 4F 44 45 20 20 20 20 20 20
4230:  20 20 20 20 20 20 20 20 20 20 20 20 20 20 00 54
4240:  52 41 4E 53 4D 49 54 20 4D 4F 44 45 20 20 20 20
4250:  20 20 20 20 20 20 20 20 20 20 20 20 20 20 00 00
4260:  20 20 20 20 20 20 20 20 20 56 5A 2D 32 30 30 20
4270:  20 52 54 54 59 20 20 20 20 20 20 20 20 20 00 00
4280:  34 35 20 00 35 30 20 00 37 35 20 00 31 31 30 00
4290:  0D 0D 0D 20 20 20 20 20 20 20 20 20 20 20 20 20
42A0:  4D 45 4E 55 0D 0D 20 20 20 31 29 20 52 45 43 45
42B0:  49 56 45 20 20 20 32 29 20 54 52 41 4E 53 4D 49
42C0:  54 0D 20 20 20 33 29 20 4C 4F 41 44 20 42 55 46
42D0:  46 45 52 53 0D 00 0D 20 20 50 52 45 53 53 20 D3
42E0:  C8 C9 C6 D4 20 D8 20 41 54 20 41 4E 59 20 54 49
42F0:  4D 45 0D 20 20 20 20 20 20 20 20 20 20 46 4F
4300:  52 20 4D 45 4E 55 0D 0D 00 0D 20 20 20 20 20 20
4310:  20 20 20 53 45 4C 45 43 54 20 28 31 2D 33 29 0D
4320:  00 0D 0D 20 20 20 20 20 20 42 55 46 46 45 52 20
4330:  49 4E 50 55 54 20 52 4F 55 54 49 4E 45 0D 0D 0D
4340:  0D 0D 20 20 45 4E 54 45 52 20 42 55 46 46 45 52
4350:  20 4E 55 4D 42 45 52 20 28 30 2D 35 29 00 20 57
4360:  52 55 20 42 55 46 46 45 52 0D 00 20 42 55 46 46
4370:  45 52 20 23 31 0D 00 20 42 55 46 46 45 52 20 23
4380:  32 0D 00 20 42 55 46 46 45 52 20 23 33 0D 00 20
4390:  42 55 46 46 45 52 20 23 34 0D 00 20 42 55 46 46
43A0:  45 52 20 23 35 0D 00 44 45 20 0D 43 52 20 43 51
43B0:  20 43 51 20 43 51 20 43 51 20 43 51 20 43 51 20
43C0:  43 51 20 43 51 20 43 51 20 0D 20 50 4C 53 20 4B
43D0:  4B 20 4B 4B 20 4B 4B 0D 52 59 52 59 52 59 52 59
43E0:  52 59 52 59 52 59 52 59 52 59 52 59 52 59 52 59
43F0:  52 59 52 59 52 59 0D 0D 0D 20 20 20 20 20 20 20
4400:  2A 2A 2A 2A 2A 2A 2A 2A 2A 2A 2A 2A 2A 2A 2A 2A
4410:  2A 2A 0D 20 20 20 20 20 20 20 20 2A 20 56 5A 2D
4420:  32 30 30 20 20 52 54 54 59 20 20 20 20 20 20 20
4430:  20 20 20 20 2A 20 54 45 52 4D 49 4E 41 4C 20 20
4440:  50 41 43 4B 20 2A 0D 20 20 20 20 20 20 20 2A 2A
4450:  2A 2A 2A 2A 2A 2A 2A 2A 2A 2A 2A 2A 2A 2A 2A 2A
4460:  0D 0D 20 20 20 20 20 20 20 20 20 20 20 20 20 20
4470:  46 52 4F 4D 0D 20 20 20 20 20 20 44 49 43 4B 20
4480:  4D 49 54 48 20 45 4C 45 43 54 52 4F 4E 49 43 53
4490:  0D 20 20 20 20 20 20 20 43 4F 50 59 52 49 47 48
44A0:  54 20 28 43 29 20 31 39 38 34 0D 00 0C 45 4E 54
44B0:  45 52 20 59 4F 55 52 20 43 41 4C 4C 53 49 47 4E
44C0:  20 3A 0D 00 54 48 45 20 51 55 49 43 4B 20 42 52
44D0:  4F 57 4E 20 46 4F 58 20 4A 55 4D 50 53 20 4F 56
44E0:  45 52 20 54 48 45 20 4C 41 5A 59 20 44 4F 47 20
44F0:  30 31 32 33 34 35 36 37 38 39 20 0D 5F 52 55 AA
4500:  53 54 41 54 49 4F 4E 20 49 44 45 4E 54 49 46 49
4510:  43 41 54 49 4F 4E 20 0D CD 1E 45 CD 23 49 C5 3A
4520:  08 80 06 0B 10 FE 3D 20 F9 C1 C9 2A 9C 80 FE 0D
4530:  28 05 FE 20 30 23 C9 ED 5B 20 78 D5 22 20 78 3E

4540:  0D 21 02 80 BE 28 06 CD 3A 03 32 02 80 2A 20 78
4550:  22 00 80 D1 ED 53 20 78 C9 FE 40 38 02 D6 40 77
4560:  32 02 80 23 22 00 80 C9 E5 D5 C5 F5 CD 2B 45 7C
4570:  FE 71 28 02 18 06 7D FE E0 D4 81 45 F1 C1 D1 E1
4580:  C9 F5 21 40 71 11 20 71 01 A0 00 ED B0 21 C0 71
4590:  3E 20 77 11 C1 71 01 20 00 ED B0 21 C0 71 22 00
45A0:  80 F1 C9 11 00 70 7E FE 00 C8 FE 40 30 02 C6 40
45B0:  12 23 13 18 F1 CD C9 01 21 21 43 CD A7 28 21 D6
45C0:  42 CD A7 28 CD 63 4B CD 20 47 CD 79 4B FE 01 CA
45D0:  48 40 FE 30 28 16 FE 31 28 1D FE 32 28 24 FE 33
45E0:  28 2B FE 34 28 32 FE 35 28 39 18 DB 21 5E 43 CD
45F0:  A7 28 21 09 80 18 37 21 6B 43 CD A7 28 21 4A 80
4600:  18 2C 21 77 43 CD A7 28 21 8B 80 18 21 21 83 43
4610:  CD A7 28 21 CC 80 18 16 21 8F 43 CD A7 28 21 0D
4620:  81 18 0B 21 9B 43 CD A7 28 21 4E 81 18 00 06 40
4630:  CD 70 4B E5 C5 CD 20 47 C1 FE 01 28 36 FE 00 28
4640:  F3 FE 08 E1 28 12 77 FE 0D CA B5 45 23 CD 3A 03
4650:  CD 70 4B 10 DE C3 B5 45 78 FE 40 28 D1 3E 08 CD
4660:  3A 03 3E 20 CD 3A 03 3E 08 CD 3A 03 04 2B CD 70
4670:  4B 18 C0 E1 C3 48 40 3A 08 80 FE EC CA 65 4C FE
4680:  D7 CA 47 4C FE 8D CA 51 4C FE 61 CA 5B 4C C9 F5
4690:  C5 E5 D5 CD C4 05 CB 47 20 18 3A FA 85 FE 00 28
46A0:  11 CD DB 46 FE 0D 20 07 3E 0A 32 FA 85 18 E4 CD
46B0:  B7 46 D1 E1 C1 F1 C9 11 FA 85 21 FB 85 01 40 00
46C0:  ED B0 2A F8 85 2B 22 F8 85 C9 AF 21 FA 85 22 F8
46D0:  85 77 11 FB 85 01 40 00 ED B0 C9 D3 0E D3 0D C9
46E0:  05 05 54 35 0D 0D 4F 39 20 20 48 00 4E 2C 4D 2E
46F0:  00 00 4C 29 52 34 47 24 49 38 50 30 43 3A 56 3D
4700:  45 33 5A 2B 44 00 42 3F 53 27 59 36 46 25 58 2F
4710:  41 2D 57 32 4A 27 04 04 55 37 51 31 4B 28 07 07
4720:  21 FE 68 0E 08 06 06 7E F6 04 1F 30 4F 10 FB CB
4730:  05 0D 20 F1 06 04 21 DF 68 7E CB 57 28 23 CB 05
4740:  7E CB 57 28 20 CB 05 7E CB 57 28 1D CB 05 CB 05
4750:  CB 05 7E CB 57 28 16 3E FF 32 04 80 AF 32 03 80
4760:  C9 0E 03 18 17 0E 02 18 13 0E 01 18 0F 3A 03 80
4770:  CB CF 32 03 80 3E FF 32 04 80 AF C9 21 B0 47 1E
4780:  00 3A 03 80 CB 4F 28 02 1E 30 3E 08 91 4F 3E 06
4790:  90 47 CD A3 47 83 06 00 4F 09 7E 21 04 80 BE 28
47A0:  D9 77 C9 AF B9 28 07 C6 06 0D 28 02 18 F9 80 C9
47B0:  54 57 20 45 51 52 47 53 20 44 41 46 42 58 20 43
47C0:  5A 56 35 32 20 33 31 34 4E 2E 20 2C 20 4D 36 39
47D0:  2D 38 30 37 59 4F 0D 49 50 55 48 4C 3A 4B 3B 4A
47E0:  75 72 00 73 71 74 85 87 00 84 89 8F 83 01 00 81
47F0:  0A 00 25 22 20 23 21 24 00 00 00 00 00 08 26 29
4800:  3D 28 90 27 00 82 91 95 88 94 86 3F 00 2F 2B 00
4810:  21 20 71 3E 20 77 11 21 71 01 C0 00 ED B0 C9 CD
4820:  C9 01 21 E0 70 22 F0 81 CD 10 48 3E FF 32 05 80
4830:  AF 32 EF 81 21 3F 42 CD A3 45 CD 77 46 CD D9 49
4840:  CD EF 49 21 C0 71 22 00 80 CD 70 4B 3E FF 32 00
4850:  60 06 96 CD 18 45 10 FB CD 23 49 3A 05 80 FE 00
4860:  CC C6 48 CD 8F 46 CD 10 4A FE 00 28 EB FE 71 CA
4870:  CD 4B FE 72 CA D7 4B FE 73 CA E1 4B FE 74 CA EB
4880:  4B FE 75 CA F5 4B FE 81 CA 84 4B FE 82 CA 9B 4B
4890:  FE 84 CA 94 4B FE 88 CA A5 4B FE 89 CA AF 4B FE
48A0:  8F CA B9 4B FE 90 CA C3 4B FE 95 CA 8D 4B FE 23
48B0:  CA CE 48 CD 30 41 CD D4 48 CD 68 45 FE 0D CA 3E
48C0:  4B CD B7 4A 18 92 21 F6 81 7E FE 00 C0 F1 CD 63
48D0:  4B C3 93 40 F5 F5 FE 0D 28 1A FE 20 28 0E 3A EF
48E0:  81 FE 3E 28 0F 3C 32 EF 81 F1 F1 C9 3A EF 81 FE
48F0:  39 DA E5 48 AF 32 EF 81 F1 FE 0D 28 ED FE 20 28
4900:  08 3E 2D CD 68 45 CD B7 4A CD 5E 4B CD 59 4B 3E
4910:  0D CD 68 45 F1 FE 20 28 08 F5 3E 01 32 EF 81 F1
4920:  C9 AF C9 D5 C5 CD 20 47 FE 00 28 66 FE 01 28 68
4930:  FE 0A CA B7 49 FE 87 CA 9E 49 FE 83 28 66 FE 86
4940:  CA CD 49 FE 94 CA C1 49 FE 85 28 5D FE 91 28 5F
4950:  CD 3F 4A F5 E5 C5 FE 08 20 16 2A F2 81 7C B5 CA
4960:  03 4A 2B 22 F2 81 2A F4 81 2B AF 77 3E 08 18 1C
4970:  F5 ED 4B F2 81 21 FC 03 ED 42 7C B5 CA 0D 4A 2A
4980:  F2 81 23 22 F2 81 F1 2A F4 81 77 23 22 F4 81 C1
4990:  E1 F1 C1 D1 CD 70 4A C9 C1 D1 F1 C3 48 40 CD 17
49A0:  4C C1 D1 C9 CD CA 46 18 F8 C1 D1 F1 C3 39 40 3E
49B0:  0D 2A F8 85 77 18 EA C1 D1 3A 05 80 2F 32 05 80
49C0:  C9 3A 06 80 2F 32 06 80 CD D9 49 18 D4 3A 07 80
49D0:  2F 32 07 80 CD EF 49 18 C8 3A 06 80 FE 00 20 05
49E0:  21 16 42 18 03 21 12 42 11 10 70 CD A6 45 C9 3A
49F0:  07 80 FE 00 20 05 21 16 42 18 03 21 1A 42 11 15
4A00:  70 18 EB C1 E1 F1 C1 D1 AF CD 70 4A C9 F1 18 F3
4A10:  2A F2 81 7C B5 C8 2B 22 F2 81 21 F6 81 7E FE 00
4A20:  C8 F5 21 F7 81 01 00 04 09 AF 77 21 F7 81 11 F6
4A30:  81 81 00 C4 ED B0 2A F4 81 2B 22 F4 81 F1 C9 E5
4A40:  C5 D5 F5 2A F0 81 7D FE 3F D2 6B 4A 21 60 70 11
4A50:  40 70 01 A0 00 ED B0 21 E0 70 3E 20 77 11 E1 70
4A60:  01 20 00 ED B0 21 E0 70 22 F0 81 F1 D1 C1 E1 C9
4A70:  FE 00 28 25 FE 0D 28 05 FE 20 30 28 C9 ED 5B 20
```



```
4A80:  78 D5 2A F0  81 22 20 78  3E 0D CD 3A  03 2A 20 78
4A90:  22 F0 81 D1  ED 53 20 78  C9 2A F0 81  3E 20 2B 77
4AA0:  22 F0 81 C9  FE 40 38 06  FE 60 30 02  D6 40 2A F0
4AB0:  81 77 23 22  F0 81 C9 D6  0A FE 03 CA  5E 4B D6 13
4AC0:  FE 40 D0 FE  03 CA D8 4A  FE 21 D2 D8  4A 08 FE FF
4AD0:  28 10 3E FF  08 C3 33 4B  08 FE 00 28  05 AF 08 C3
4AE0:  28 4B 08 CD  E7 4A C9 21  76 4C 01 00  00 4F 09 4E
4AF0:  06 06 CB 11  CB 11 CB 11  DA 07 4B C3  12 4B 10 F6
4B00:  CD 1C 4B CD  8F 46 C9 3E  FF 32 00 58  CD 18 45 C3
4B10:  FE 4A AF 32  00 58 CD 18  45 C3 FE 4A  3E FF 32 00
4B20:  58 CD 18 45  CD 1E 45 C9  F5 0E 1F CD  F0 4A F1 CD
4B30:  E7 4A C9 F5  0E 1B CD F0  4A F1 CD E7  4A C9 0E 02
4B40:  CD F0 4A C3  46 4B 0E 08  CD F0 4A C3  58 48 0E 04
4B50:  CD F0 4A 08  AF 08 C3 58  48 0E 08 C3  F0 4A 0E 02
4B60:  C3 F0 4A 01  FF BF CD 60  00 01 FF BF  CD 60 00 C9
4B70:  C5 01 FF 5F  CD 60 00 C1  C9 F5 C5 01  FF 2F CD 60
4B80:  00 C1 F1 C9  FD 21 AB 43  CD FF 4B 18  07 FD 21 00
4B90:  45 CD FF 4B  FD 21 A7 43  CD FF 4B FD  21 8F 81 CD
4BA0:  FF 4B C3 58  48 FD 21 CA  43 CD FF 4B  C3 58 48 FD
4BB0:  21 D8 43 CD  FF 4B C3 58  48 FD 21 C4  44 CD FF 4B
4BC0:  C3 58 48 FD  21 09 80 CD  FF 4B C3 58  48 FD 21 4A
4BD0:  80 CD FF 4B  C3 58 48 FD  21 8B 80 CD  FF 4B C3 58
4BE0:  48 FD 21 CC  80 CD FF 4B  C3 58 48 FD  21 0D 81 CD
4BF0:  FF 4B C3 58  48 FD 21 4E  81 CD FF 4B  C3 58 48 FD
4C00:  7E 00 FE 0D  C8 F5 CD 68  45 CD 30 41  CD 8F 46 CD
4C10:  B7 4A F1 FD  23 18 E8 3A  08 80 FE EC  28 0D FE D7
4C20:  28 10 FE 8D  28 13 FE 61  28 16 C9 3E  D7 32 08 80
4C30:  18 15 3E 8D  32 08 80 18  18 3E 61 32  08 80 18 1B
4C40:  3E EC 32 08  80 18 1E 11  1B 70 21 84  42 CD A6 45
4C50:  C9 11 1B 70  21 88 42 CD  A6 45 C9 11  1B 70 21 8C
4C60:  42 CD A6 45  C9 11 1B 70  21 80 42 CD  A6 45 C9 01
4C70:  FF FF CD 60  00 C9 08 02  00 04 00 00  00 0B 16 00
4C80:  1A 1E 09 00  11 06 18 07  17 0D 1D 19  10 0A 01 15
4C90:  1C 0C 03 0E  00 00 0F 00  13 00 18 13  0E 12 10 16
4CA0:  0B 05 0C 1A  1E 09 07 06  03 0D 1D 0A  14 01 1C 0F
4CB0:  19 17 15 11  FF 04 FF 04  FF 4C FF 4C  FF 4C FF 4C
4CC0:  FB 48 FB 48  FB 48 FB 08  FB 08 FB 00  FB 00 FB 00
4CD0:  FB 48 FB 08  FB 08 FB 08  FB 00 FB 00  FB 00 FB 00
4CE0:  FB 48 FB 48  FB 48 FB 08  FB 00 FB 00  FB 00 FB 00
4CF0:  FB 48 FB 08  FB 08 FB 08  FB 00 FB 00  FB 00 FB 00
4D00:  37 00 FF 04  FF 04 FF 04  FF 0C FF 0C  FF 0C FF 0C
4D10:  FF 04 FF 04  FF 04 FF 04  FF 0C FF 0C  FF 0C FF 0C
4D20:  FF 04 FF 04  FF 04 FF 04  FF 0C FF 0C  FF 0C FF 0C
4D30:  FF 04 FF 04  FF 04 FF 04  FF 0C FF 0C  FF 0C FF 0C
4D40:  FB 08 FB 08  FB 08 FB 08  FB 00 FB 00  FB 00 FB 00
4D50:  FB 08 FB 08  FB 08 FB 08  FB 00 FB 00  FB 00 FB 00
4D60:  FB 08 FB 08  FB 08 FB 08  FB 00 FB 00  FB 00 FB 00
4D70:  FB 08 FB 08  FB 08 FB 00  FB 00 FB 00  FB 00 FB 00
4D80:  37 0C FF 0C  FF 0C FF 0C  FF 4C FF 0C  FF 4C FF 0C
4D90:  FF 0C FF 04  FF 04 FF 04  FF 4C FF 4C  FF 4C FF 0C
4DA0:  FF 0C FF 0C  FF 0C FF 0C  FF 4C FF 0C  FF 4C FF 0C
4DB0:  FF 0C FF 04  FF 0C FF 04  FF 4C FF 0C  FF 4C FF 4C
4DC0:  FB 48 FB 08  FB 48 FB 08  FB 08 FB 08  FB 08 FB 08
4DD0:  FB 08 FB 08  FB 08 FB 08  FB 08 FB 08  FB 08 FB 08
4DE0:  FB 48 FB 08  FB 48 FB 08  FB 08 FB 08  FB 08 FB 08
4DF0:  FB 08 FB 08  FB 08 FB 08  FB 08 FB 08  FB 08 FB 08
4E00:  37 0C FF 0C  FF 0C FF 04  FF 0C FF 0C  FF 04 FF 04
4E10:  FF 04 FF 04  FF 04 FF 04  FF 0C FF 0C  FF 0C FF 04
4E20:  FF 0C FF 04  FF 0C FF 0C  FF 0C FF 04  FF 0C FF 04
4E30:  FF 04 FF 04  FF 04 FF 04  FF 0C FF 04  FF 0C FF 0C
4E40:  FB 08 FB 08  FB 08 FB 00  FB 08 FB 08  FB 08 FB 08
4E50:  FB 08 FB 00  FB 08 FB 00  FB 08 FB 08  FB 08 FB 08
4E60:  FB 08 FB 08  FB 08 FB 00  FB 08 FB 08  FB 08 FB 08
4E70:  FB 08 FB 08  FB 00 FB 00  FB 08 FB 08  FB 08 FB 08
4E80:  17 0C FF 0C  FF 04 FF 04  FF 0C FF 04  FF 04 FF 04
4E90:  FF 04 FF 04  FF 04 FF 04  FF 04 FF 04  FF 04 FF 04
4EA0:  FF 04 FF 04  FF 04 FF 04  FF 04 FF 04  FF 04 FF 04
4EB0:  FF 04 FF 04  FF 04 FF 04  FF 04 FF 04  FF 04 FF 04
4EC0:  FB 08 FB 00  FB 00 FB 00  FB 08 FB 08  FB 08 FB 08
4ED0:  FB 08 FB 00  FB 00 FB 00  FB 08 FB 08  FB 08 FB 00
4EE0:  FB 00 FB 00  FB 00 FB 00  FB 08 FB 08  FB 08 FB 08
4EF0:  FB 00 FB 00  FB 00 FB 00  FB 08 FB 00  FB 00 FB 08
4F00:  37 04 FF 04  FF 04 FF 04  FF 04 FF 04  FF 04 FF 04
4F10:  FF 04 FF 04  FF 04 FF 04  FF 04 FF 04  FF 04 FF 04
4F20:  FF 04 FF 04  FF 04 FF 04  FF 04 FF 04  FF 04 FF 04
4F30:  FF 04 FF 04  FF 04 FF 04  FF 04 FF 04  FF 04 FF 04
4F40:  FB 00 FB 00  FB 00 FB 00  FB 00 FB 00  FB 00 FB 00
4F50:  FB 00 FB 00  FB 00 FB 00  FB 00 FB 00  FB 00 FB 00
4F60:  FB 00 FB 00  FB 00 FB 00  FB 00 FB 00  FB 00 FB 00
4F70:  FB 00 FB 00  FB 00 FB 00  FB 00 FB 00  FB 00 FB 00
4F80:  37 0C FF 0C  FF 0C FF 04  FF 0C FF 04  FF 04 FF 04
4F90:  FF 04 FF 04  FF 04 FF 04  FF 04 FF 04  FF 04 FF 04
4FA0:  FF 0C FF 04  FF 04 FF 04  FF 04 FF 04  FF 04 FF 04
4FB0:  52 4F 4D 20  43 4F 4E 54  45 4E 54 53  20 43 4F 50
4FC0:  59 52 49 47  48 54 20 28  43 29 20 31  39 38 34 20
4FD0:  44 49 43 4B  20 53 4D 49  54 48 20 45  4C 45 43 54
4FE0:  52 4F 4E 49  43 53 20 50  54 59 2E 20  4C 54 44 2E
4FF0:  20 41 55 53  54 52 41 4C  49 41 2E 00  00 00 00 00
```

THE SOFTWARE

There is an unused section in the VZ200 memory map between 4000H and 67FFH. This area was set aside for use with plug-in software packs. The RTTY unit fits into this area of memory.

For design simplicity, this section is decoded into five 2K blocks. The first two blocks are used for the main software routines. The other three blocks are used for receive data, transmit data and relay data.

All data transfer is done through bit 7 (D7). The software also uses a section of RAM starting at 8000H. This area is used to store volatile data such as buffers and flags.

Some useful RAM and EPROM addresses are given below.

RAM LOCATIONS

8000/01	Receive character cursor position
8005	Receive/transmit toggle flag
8006	WRU flag
8007	Printer flag
8008	Timing loop value (231 = 45.45 baud)
8009	Start of buffer 0
804A	Start of buffer 1
808B	Start of buffer 2
80CC	Start of buffer 3
810D	Start of buffer 4
814E	Start of buffer 5
818F	Start of callsign storage area
81F0/F1	Transmit cursor position
81F6	Start of keyboard input buffer

EPROM LOCATIONS

4000	EPROM entry point
4039	Callsign entry routine
45B5	Buffer entry routine
4048	Menu entry point
4093	Receive routine entry point
468F	Line printer routine entry point
4518	Delay routine
4923	Keyboard input and video processing routine
4810	Transmit entry point
484C	Transmit active point
4568	Transmit data video display routine
4AB7	ASCII to baud conversion
49B7	Toggle receive/transmit relay on/off
49C1	Toggle WRU on/off
49CD	Toggle printer on/off
499E	Change baud rate 45-50-75-110-45 etc.

OTHERS

5000	Receive data
5800	Transmit data
6000	Transmit/receive relay

Note: one row of text here is 32 characters. Thus it will only fill one half of a normal 64 character screen.

SHIFT C: Send — CQ
One row of CQs is sent along with your callsign

SHIFT A: Send — RYs
One row of RYs is sent.

SHIFT F: Send — QBF
Send 'THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG 0123456789'

SHIFT P: Send — over terminator.
The message 'PLEASE KK KK KK' is sent to terminate your call.

SHIFT I: Identify your station.
The message 'STATION IDENTIFICATION DE (callsign)' is sent. This is the same as is sent by the WRU mode.

SHIFT O: Send — Callsign.
Your callsign (as entered on power-up) is sent.

SHIFT D: Send — DE callsign.
As above except 'DE' is added to the start of your callsign.

Following are the commands to send the programmable buffers.

SHIFT Q: Send buffer #1

SHIFT W: Send buffer #2

SHIFT E: Send buffer #3

SHIFT R: Send buffer #4

SHIFT T: Send buffer #5

SHIFT 0: Send WRU buffer (buffer #0)

At any time you may require to restart the system. This is useful if you wish to re-enter your callsign, or enter your own WRU code. To do this, type

SHIFT G

This exits the current mode and restarts at the callsign entry mode. You may now re-enter your callsign.

Printer Function.
Your VZ200 will also drive a line printer. You may enable or disable the printer mode using

SHIFT H

Once enabled, all text received or transmitted will be sent to the printer to be stored as 'hard copy'. Note: If you enable the printer but do not have a printer on-line, your system will not be affected and will ignore the enable mode. *But*, text will still be stored in the internal printer buffer until the buffer finally fills up.

The internal print buffer is only 64 characters long and is designed to hold characters only when the printer is busy printing. Because of this, any text received when the printer is not on-line but the print routine is enabled, will be truncated in the buffer. If you have the print mode enabled and don't want to print the text which has been stored in the internal print buffer, you may clear the buffer with the following command

SHIFT B

There will be times when a station does not terminate his contact with a CARRIAGE RETURN (CR). When this happens, you may find the last line of text does not get printed on the line printer. This is because many printers wait for a CR before printing the next line of text. By using the command

SHIFT <RETURN>

a carriage return will be inserted into the print buffer, thereby forcing it to print the last line. This can be done at any time to clear the printer's buffer, by forcing it to dump its contents onto paper.

That concludes the main operation description. The rest will come with experience, as will normal RTTY operating procedures.

For further information on amateur RTTY, we suggest you contact *The Australian National Amateur Radio Teleprinter Society* at the following address:

The Secretary,
ANARTS,
PO Box 860,
Crows Nest NSW 2065 ●

Text and Illustrations courtesy of Electronics Today International

ZA9545

Connection Details and General Operation of the VZ-200 RTTY Decoder.

Connecting Your Radio.

Now comes the time to connect your transceiver to the interface. Connection is made through the 5 pin din plug on the rear panel. Wire the TX output and PTT pins to a microphone plug, and the RX input to a speaker plug. You will probably prefer to fit an extension speaker so you can monitor the received signals. Plug the microphone and speaker plugs into your transceiver and adjust the receive volume for a comfortable listening level to start with. High receive volume with the mute open on FM, will cause random characters to appear on the screen. This is to be expected if you over-drive the preamp/filters. These high volume levels are not required, and normal operation will require the volume to be no more than normal listening level.

If operating on VHF/UHF, the RTTY signals will probably be FM. This makes things easy, as the received tones will be of the correct frequency. Simply select the channel and adjust the volume. The DATA L.E.D. will light when a signal is being received.

When operating on HF using SSB, care is required in tuning to the correct frequency. The DATA L.E.D. will indicate when you are close. If you can't resolve it, try the other sideband.

This RTTY interface is designed to use a shift of 170 Hz. If you wish to received commercial TTY, (many of which use larger shifts), it is suggested you modify your decoder as shown for wide band signals. Once modified however, it is unlikely that it will work on Amateur TTY. Again, if you have difficulty, try the other sideband, the other tone, or another baud rate.

That concludes the general operation of the RTTY Interface. Those Sydney operators who are new to RTTY will find plenty of activity on the Sydney RTTY repeater on 146.675 MHz. There is also a RTTY simplex channel on 146.600 MHz. You will find many operators only too glad to encourage newcomers to this mode of communications.

For further informtion on Amateur RTTY, we suggest you contact 'The Australian National Amateur Radio Teleprinter Society' at the following address:-

The Secretary,
A.N.A.R.T.S.,
PO Box 860,
Crows Nest,
N.S.W. 2065.
Australia.

MODIFICATIONS TO VZRTTY DECODER TO IMPROVE PERFORMANCE ON WIDE BAND COMMERCIAL RTTY.

The following changes to component values will allow less critical receiver tuning when decoding wide band commercial RTTY found on the HF bands.

While values are given for both 425Hz and 850Hz shifts, prototype units constructed for 850Hz shift use were quite capable of resolving stations using 425Hz shifts.

It should be noted that once these modifications have been performed, it is highly unlikely that the decoder will resolve 170Hz shift amateur RTTY.

1-CHANGES FOR 850Hz SHIFT (1450/2300Hz).

i)-CHANGES TO FILTER STAGES.

Change R35 from 330K 5% to 180K 5%.
R34 from 27K 5% to 27K 1%.
R33 from 3.9K 1% to 27K 1%.
R32 from 680K 1% to 1M 1%
R31 from 680K 1% to 18K 5%

R19 from 390K 5% to 100K 5%.
R18 from 220K 5% to 470K 5%
R17 from 3.9K 1% to 8.2K 1%.
R16 from 1M 1% to 47K 5%.
R15 no change.

ii)-CHANGES TO FSK DECODER.

Change VR2 from 10K to 20K.
R14 from 18K 1% to 15K 1%.
R12 from 270K 5% to 47K 5%.
R11 from 470K 5% to 1.5M 5%.
C7 from .033uF to .039 uF.

1-CHANGES FOR 425Hz SHIFT (1875/2300Hz).

i)-CHANGES TO FILTER STAGES.

Change R35 from 330K 5% to 220K 5%.
R34 from 27K 5% to 39K 1%.
R33 from 3.9K 1% to 12K 1%.
R32 from 680K 1% to 820K 1%
R31 from 680K 1% to 68K 1%

R19 from 390K 5% to 150K 5%.
R18 from 220K 5% to 47K 5%
R17 from 3.9K 1% to 8.2K 1%.
R16 from 1M 1% to 100K 1%.
R15 no change.

ii)-CHANGES TO FSK DECODER.

Change VR2 from 10K to 20K.
R14 from 18K 1% to 12K 1%.
R12 from 270K 5% to 100K 5%.
R11 from 470K 5% to 1.5M 5%.
C7 from .033uF to .039 uF.

GENERAL OPERATION.

Entering Your Callsign.

On power up, your VZ-200 RTTY Interface will introduce itself. To continue, press any key. You will then be asked to enter your callsign. You may enter anything up to 64 characters but it is recommended that if you wish to use the WRU mode, you use the following format:

Enter your callsign:
VK2FGH (PETER)

There should be no leading space before the callsign and there should be at least one space after the callsign. Apart from that, you may add anything you like up to 64 characters total. This enables your callsign to be used as the WRU code. You may wish to use another code instead. If so, it must not be longer than a normal callsign (i.e. 6 letters) although it may be shorter, and it must always be followed by a space character. If you press <RETURN> at this point instead of entering text, the callsign buffer will contain a null and any attempt to send a callsign will give no response. The disadvantage of this is that your WRU system (when activated), instead of being selective, will respond to any WRU sent.

Loading The Programmable Buffers.

Once you have entered your callsign, press <RETURN> and you will enter the buffer entry mode. In this mode, you are able to enter text into any of the 6 programmable buffers. Each buffer may contain up to 64 characters. You may start entering text by typing the number of the buffer you require. Your VZ-200 will display the buffer number you have selected. Simply enter your text as you require. Note : the SHIFT M command is used for the backspace key. Press <RETURN> when you are finished, and your buffer is programmed. Repeat the process for each buffer you require to program, including the WRU buffer (buffer 0). When you have finished, press SHIFT X to enter the MENU.

Menu Mode.

From the MENU you are able to enter the three main operation modes, i.e. Receive Mode , Transmit Mode, and Buffer Entry Mode. You can return to the Menu at any time from any of these modes by using SHIFT X.

Receive mode:

In this mode you are able to receive RTTY. The first thing you will notice is the command line at the top of the screen. This line tells you the current status of the system. In the RECEIVE mode it will display RECEIVE MODE on the left. On the right will be the number 45. This is the current BAUD rate. The system will always default to 45.45 bauds. The command line is also used to display the current status of the PRINTER and WRU modes. These modes always default to the OFF status. To demonstrate this, hold down the SHIFT key

...../

and press U. The command line will display WRU. This indicates that the WRU mode is now active. Again press SHIFT U, the WRU will no longer be displayed, indicating the WRU mode is disabled. Try the same with SHIFT H. This enables and disables the printer. Similarly, SHIFT S changes the BAUD rate.

The screen is split into two sections, each with independant scrolling. All received text is displayed on the bottom screen, while the top screen is used to display your typed text. You may type and receive simultaneously. The type ahead buffer can contain up to 1024 (1k) characters. Any data from the buffers may be added as you go by pressing the appropriate enable keys. A graphic block will be displayed as you type to show you that a buffer has been enabled. You may terminate your text with the '#' code. When this code is found during transmission, your system will automatically revert back to the receive mode.

Transmit Mode.

When the station you are communicating with has finished his transmission, you may reply to him by pressing :

SHIFT Z

This sends your terminal to the Transmit Mode, enabling your transmitter, and sending the text you previously typed. You may continue typing if you wish. Your system will continue to send the stored text, including any programmed text, until it catches up with your typing, whereby it will follow the text as you type it. During all this time, the text is displayed on the bottom screen, along with the contents of any programmed buffers you may have enabled. Thus you can see everything being sent in its final form. You may exit to receive by using either :

#

or

SHIFT Z

Note : SHIFT Z will not work if there is still data in the buffer waiting to be sent. This prevents you from accidently terminating the transmission prematurely. If you wish to abort your transmission intentionally, use :

SHIFT X

to get back to the Menu.

WRU mode.

The WRU mode (WRU stands for Who aRe yoU) is a special feature included to add versatility to your system. To activate this mode, press :

SHIFT U

...../

The letters WRU will appear on the command line. When this mode is active, any station sending your callsign (or any other code entered on powerup) followed by the letters WRU, will activate your system. When this happens, your VZ-200 will first BEEP to let you know that your system is being called. After checking to ensure the frequency is clear, your transmitter will then activate automatically, send 'STATION IDENTIFICATION DE <callsign>', along with any message stored in the WRU buffer (buffer # 0).

e.g. If you had entered on powerup VK2FGH (PETER)

Any station wishing to activate your WRU mode would need to send :

VK2FGH WRU

Your system would then respond with :

STATION IDENTIFICATION DE VK2FGH (PETER)

If you had programmed the WRU buffer, your system might also add :

PLEASE STAND BY.. ++ OPERATOR ALERTED ++

or something similar.

If you wished to leave a special message, you could put any code up to six letters long (followed by a space of course) in the callsign storage buffer, and the special message in the WRU buffer, and only the stations aware of your code will be able to access the message.

Inbuilt Pre-programmed Buffers.

There are seven pre-programmed messages stored in your VZ-200 terminal. Many of these are designed to insert you callsign automatically when called, to save you time and effort. These buffers and their enable commands are listed below :-

Note : One row of text here is 32 characters. Thus it will only fill one half of a normal 64 character screen.

SHIFT C : Send - CQ
One row of CQ's is sent along with your callsign

SHIFT A : Send - RY's
One row of RY's is sent.

SHIFT F : Send - QBF
Send 'THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG 0123456789'

SHIFT P : Send - over terminator.
The message 'PLEASE KK KK KK' is sent to terminate your call.

SHIFT I : Identify your station.

...../

The message 'STATION IDENTIFICATION DE (callsign)' is sent.
This is the same as is sent by the WRU mode.

SHIFT O : Send - Callsign.
Your callsign (as entered on powerup) is sent.

SHIFT D : Send - DE callsign.
As above except 'DE' is added to the start of your callsign.

The following are the commands to send the programmable buffers.

SHIFT Q : Send buffer #1

SHIFT W : Send buffer #2

SHIFT E : Send buffer #3

SHIFT R : Send buffer #4

SHIFT T : Send buffer #5

SHIFT O : Send WRU buffer (buffer #0)

At any time, you may require to restart the system. This is useful if you wish to re-enter your callsign, or enter you own WRU code. To do this, type :

SHIFT G

This exits the current mode and restarts at the callsign entry mode. You may now re-enter your callsign.

Printer Function.

Your VZ-200 will also drive a line printer. You may enable or disable the printer mode using :

SHIFT H

Once enabled, all text receive or transmitted, will be sent to the printer to be stored as 'hard copy'. Note : If you enable the printer but do not have a printer on line, your system will not be affected, and will ignore the enable mode. BUT, text will still be stored in the internal printer buffer until the buffer finally fills up. The internal print buffer is only 64 characters long and is designed to hold characters only when the printer is busy printing. Because of this, any text received when the printer is not on line but the print routine is enabled, will be truncated in the buffer. If you have the print mode enabled and don't want to print the text which has been stored in the internal print buffer, you may clear the buffer with the following command :

...../

SHIFT B

There will be times when a station does not terminate his contact with a CARRIAGE RETURN (CR). When this happens, you may find the last line of text does not get printed on the line printer. This is because many printers wait for a CR before printing the next line of text. By using the command :

SHIFT <RETURN>

a CR will be inserted into the print buffer, thereby forcing it to print the last line. This can be done at any time to clear the printer's buffer, by forcing it to dump it's contents onto paper.

That concludes the main operation description. The rest will come with experience, as will normal RTTY operating procedures.

...../

PROBLEMS WITH KEYBOUNCE

The keybounce is caused by light corrosion in the VZ-200 keyboard itself, probably caused by finger marks on the keyboards PC Board during assembly. Because the key scan in basic is very slow, the problem does not normally occur. However, it becomes more apparent when using the RTTY project due to the faster key scan required. You will also have noticed that some keys are affected more than others.

The solution is to disassemble the keyboard and clean it with white spirits. Metholated spirits is not recommended as it leaves a residue.

First, take note of any keys which appear worse than the others. Next, remove the four case screws in the base of the VZ-200 and remove the top case. Take care not to exert excessive force on the keyboard connector cable. Remove the keyboard from the top case, (it just pops out), and carefully remove all the tiny screws from the keyboards PC Board side. Clean the entire PC Board and the rubber contacts on the membrane, giving extra attention to the keys which showed the most keybounce. Reassemble the keyboard, taking care not to touch the surfaces, then reassemble the case.

Your keybounce problem should now be cured.

If you would prefer a full size moving keyboard for your RTTY project, we sell a kitset keyboard (K-3601) (as used on the Super 80 and Micro Bee Computers), which can be wired on a suitable matrix, and fitted via a suitable connector. Our workshop sample works very well, and is a pleasure to type on.

DICK SMITH ELECTRONICS.


VZ
QC
TMS
2532JL
MEA8449
JAPAN