1983

Inverse video for volker craig terminals

Michael J. Milway
University of Wollongong, mjm@uow.edu.au

Inverse Video for Volker Craig Terminals

Michael Milway

Department of Computing Science
University of Wollongong

Preprint No. 83-12 **December 16, 1983**

P.O. Box 1144, WOLLONGONG N.S.W. 2500, AUSTRALIA
tel (042)-270-859
telex AA29022

THE UNIVERSITY OF WOLLONGONG

DEPARTMENT OF COMPUTING SCIENCE

Inverse Video for Volker Craig Terminals

Michael Milway

Department of Computing Science
University of Wollongong

Abstract

Modifications have been made to the department's Volker Craig VC404 and VC4404 terminals to enable characters to be displayed in inverse video on an individual character by character basis. This feature has been put to good use in programs such as "Explain" and "Edit" where there is a need to highlight character strings.

The two terminal models have different internal designs necessitating the use of different control sequences to enable and disable inverse video. The VC404 uses "control Q" to toggle between normal and inverse video while the VC4404 uses "control Q" to enable inverse video and "control O" to disable it.

Preprint No 83-12 **December 16, 1983**

P.O. Box 1144, WOLLONGONG, N.S.W. AUSTRALIA
telephone (042)-270-859
telex AA29022

Inverse video for Volker Craig terminals

Michael Milway

Department of Computing Science
University of Wollongong

ABSTRACT

Modifications have been made to the department's Volker Craig VC404 and VC4404 terminals to enable characters to be displayed in inverse video on an individual character by character basis. This feature has been put to good use in programs such as 'Explain' and 'Edit' where there is a need to highlight character strings.

The two terminal models have different internal designs necessitating the use of different control sequences to enable and disable inverse video. The VC404 uses 'control Q' to toggle between normal and inverse video while the VC4404 uses 'control N' to enable inverse video and 'control O' to disable it.

1. Introduction

The original VC404 terminals, as purchased, were capable of only displaying lines of text without any form of highlighting. This fitted most of the needs of the department. When the 'Explain' programs were being developed it became apparent that there was a need to make certain parts of the display stand out. For instance the result of the last program line that was executed should be highlighted so that the user can easily see the results produced by that line.

Consequently the design of the VC404 was examined and a modification utilising an unused part of the display memory and some logic gates designed that would allow individual characters to be displayed in inverse video.

With the arrival of the newer VC4404 terminals a similar problem was created. An inverse video modification for the VC4404 was developed utilising the half intensity attribute of that terminal.

The control sequences to enable and disable the inverse video feature are different, due to the different internal design of the two types of terminal. This will cause problems with software that is designed solely for one type of terminal with the control sequences buried deep in the program. Software should be written as independent of the output device as possible, not only inverse video but for other attributes such as cursor addressing, which have different control sequences on different makes of terminal.

2. Inverse video for the VC404

2.1. Design modifications

Figure 1 shows the circuit modifications needed to install inverse video on the VC404 terminal. The modifications to the control board allow the terminal to change between normal and inverse video modes, while the modifications to the display board allow for the storage and display of normal or inverse characters.

When the terminal receives a 'control Q' character pin 11 of I.C. UD6 on the control board is asserted. This signal is fed into the clock input, pin 3, of a 74LS74 flipflop, UD1. This flipflop is wired up as a T type flipflop. Whenever it receives a positive edge on its clock input its Q output, pin 5, changes state. The state of this pin

determines whether subsequently received characters will be displayed in normal or inverse video. If the Q output is high characters are displayed in inverse video otherwise they are displayed in normal video. On power up or after a 'clear screen' command the Q output is set low. The Q output of the flipflop is connected to the display board as the most significant bit of a byte containing the next character to be displayed.

Characters to be displayed are stored in RAM on the display board. Characters are stored as ASCII codes requiring only seven bits per character. Extra memory chips are installed in spare positions on the display board to store the normal or inverse status for each character. As characters are received they are written into the seven least significant bits of the display memory. At the same time the most significant bit is set to the state of the inverse video toggle. Thus inverse video information is stored on a character by character basis.

As characters are displayed they are read from the display memory and used as inputs to a character generator ROM, UF9. The output of the ROM is a bit pattern representing the current row of that character. This is latched into a shift register, UD1, and shifted out to the display.

The VC404 has a strap option that allows the whole screen to be displayed in either normal or inverse video. Before the output of the shift register is fed to the display it is fed into one input of an exclusive OR gate, UB1 pin 13. The output of this gate, pin 11, is fed to the display. If the other input to the exclusive OR gate, pin 12, is held high the whole display will be in normal video. If it is held low the whole display will be in inverse video. By changing this input on a character by character basis individual characters may be displayed in either normal or inverse video. When a character is read out of the display memory the most significant bit (inverse video status) is latched into a flipflop (1/2 of UG1). The inverted output of this flipflop, pin 6, is then fed into the second input of the exclusive or gate, pin 12. If the most significant bit was low the character would be be displayed in normal video, and if it was high the character would be displayed in inverse video.

2.2. Installation

2.2.1. Control board

Install a 14 pin socket in the spare I.C. location UD1. Make the following connections using lengths of insulated wire wrap wire soldered to the pins on the solder side of the board:

UD2 pin 7 to UD1 pin 7
UD2 pin 14 to UD1 pin 14
UD6 pin 11 to UD1 pin 3
UD6 pin 15 to UD1 pin 1
UD1 pin 14 to UD1 pin 4
UD1 pin 2 to UD1 pin 6
UD1 pin 5 to Edge Connector pin 78

The wire for the last connection should first be soldered to the edge connector pin 78 on the component side of the board, taking care not to impede the proper action of the edge connector, passed through a suitable hole in the circuit board and then soldered to pin 5 of UD1. Install a 74LS74 in the socket at UD1.

2.2.2. Display board

Install two 16 pin sockets at locations UA8 and UD8. Remove the strap between pins 1 and 16 of UG4 if it is installed. Make the following connections using lengths of insulated wire wrap wire soldered to the pins on the solder side of the board:

UB2 pin 6 to UG1 pin 3
UG1 pin 14 to UG1 pin 1
UG1 pin 11 to UG1 pin 4
UG1 pin 6 to UG4 pin 1 (REV)
UG1 pin 2 to UG10 pin 1

Install two 2101L1 memory chips, or equivalent, at UA8 and UD8.

2.3. Operation

When the terminal is powered up or it receives a 'clear screen' character the inverse video toggle is set to normal video. Any character then received will be displayed in normal video. When the terminal receives a 'control Q' character the inverse video toggle will change to inverse video. Any characters now received will be displayed in inverse video. Previously received characters will be unaffected. If the terminal receives another 'control Q' the inverse video toggle will change back to normal video. Since 'control Q' is used as a toggle between normal and inverse video the driving software must remember which mode the terminal is in and only send a 'control Q' if the mode is to be changed.

3. Inverse video for the VC4404

3.1. Design modifications

Figure 2 shows the circuit modifications needed to install inverse video on the VC4404 terminal. The VC4404 has a half intensity attribute allowing characters to be individually displayed in either normal or half intensity. Each character is stored in the display memory as a seven bit ASCII code. The remaining most significant bit is used to signal whether the character is to be displayed in normal or half intensity. Characters displayed in normal video have the most significant bit high, while those displayed in half intensity have this bit low. Half intensity is turned on when the terminal receives a 'control N' and is turned off when the terminal receives a 'control O'.

As with the VC404 characters are displayed by reading their ASCII code out of the display memory and using them as the low order address inputs into a pair of character generator ROMs, U2 and U5. The high order address bits determine which row is being displayed. Separate circuits are used for the odd and even character columns to reduce the rate at which each ROM is accessed. The output of the ROMs is then shifted into the display. The original 2K by 8 bit ROMs have been replaced by a pair of 4K by 8 bit 2532 EPROMs. The most significant bit from the display memory is used as the most significant address input to the EPROMs. When the most significant bit of the display memory is high (normal video), the top 2K of the EPROM is selected. When this bit is low (half intensity) the bottom 2K of the EPROM is selected. The original character set has been copied directly into the top 2K of the EPROMs. A bit for bit inverted character set has been copied into the bottom 2K of the EPROMs. Consequently when normal video is selected the original character set is accessed and the display is unaffected, but when half intensity is selected the inverted character set is selected and the character is displayed in inverse video. It should be noted that the half intensity circuit is still in operation. That is, inverse characters are actually displayed in half intensity inverse video. This effectively takes the harshness out of inverted characters.

3.2. Installation

Remove the character generator ROMs, U2 and U5, from their sockets. Using an EPROM programmer, copy the character set into the top 2K of a pair of 2532 EPROMs. Copy an inverted character set into the bottom 2K of the EPROMs. The above is more easily carried out if a fully programmed 4k EPROM is available as the whole EPROM may then just be copied. Bend pin 18 of the EPROMs out at right angles and install the EPROMs in place of the original ROMs. Pin 18 should not go into the socket. Using two lengths of insulated wire wrap wire connect pin 18 of U2 to pin 9 of RP1 and pin 18 of U5 to pin 9 or RP2.

3.3. Operation

When the terminal is powered up it is set to normal video mode. Any character then received will be displayed in normal video. When the terminal receives a 'control N' character it will change to inverse video mode. Any characters now received will be displayed in inverse video. Previously displayed characters will be unaffected. If the terminal now receives a 'control O' character it will revert back to normal video. On receipt of 'control O' while in normal video or 'control N' while in inverse video mode has no effect. It should be noted that clearing the screen does not reset the terminal to normal video operation.

4. Conclusions

The inverse video modifications described above are very useful. They do, however, differ quite markedly in their method of operation. This means that a program written for one type of terminal will not work when used with another type of terminal. (This not only applies to turning inverse video on or off, but to other commands, such as cursor addressing, that vary in operation between terminal types. This applies not only to Volker Craig terminals but equally as well to other types that may be purchased in the future.)

Software should be written that is independent of the type of terminal being used. A set of standards should be developed and adhered to that tell the operating system what attribute is to be changed. It is then up to the operating system to know what type of terminal is being used and to issue the correct control sequence. Also the program should remember the state of the terminal and only issue commands if an attribute is to be changed. i. e. if inverse video is already on then no attempt should be made to turn it on again.

5. Bibliography

1. VC404 Maintenance Manual.
2. VC404 Operations Manual.
3. VC4404 Maintenance Manual.
4. VC4404 Operations Manual.

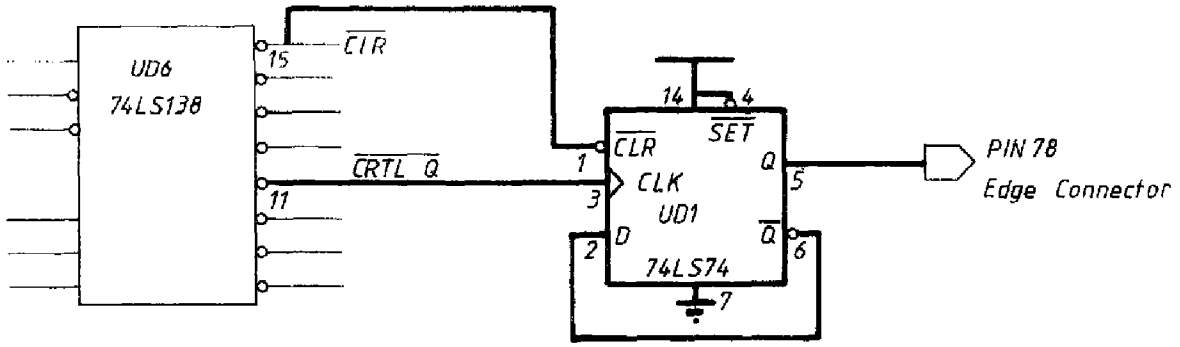

fig 1a VC404 Control Board modifications

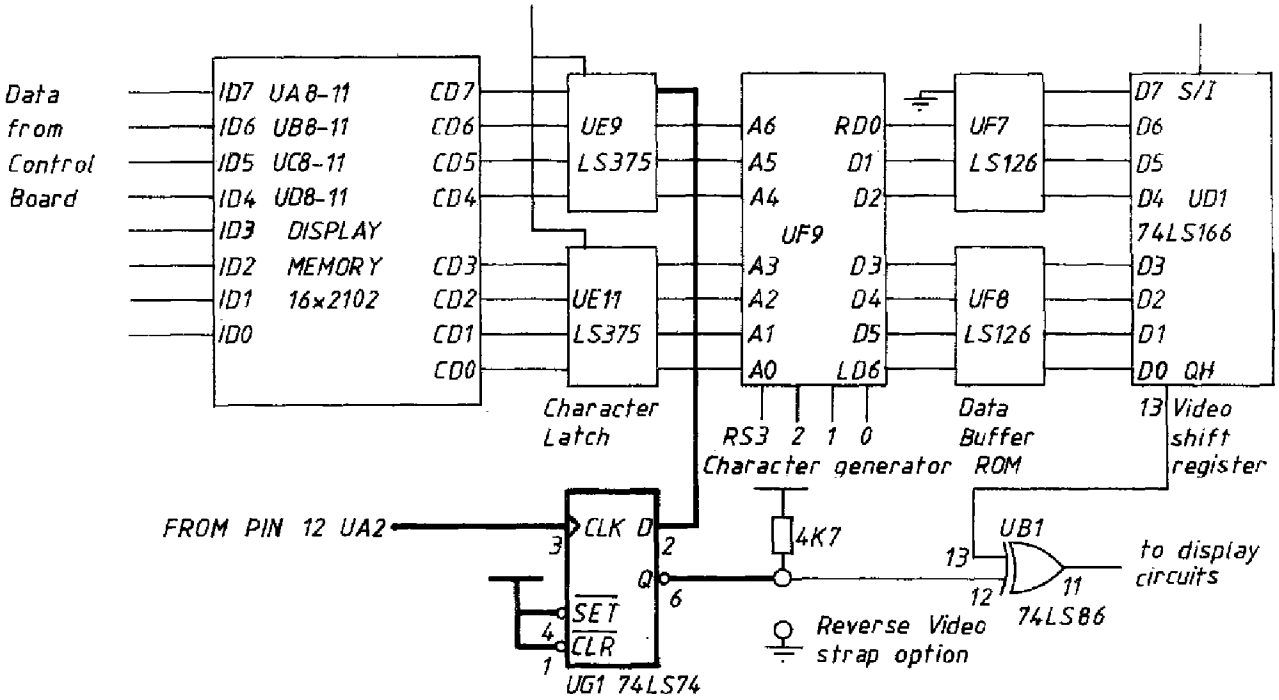

fig 1b VC404 Display Board modifications

existing circuits ——

added circuits ——

fig 1 Inverse video modifications for VC404

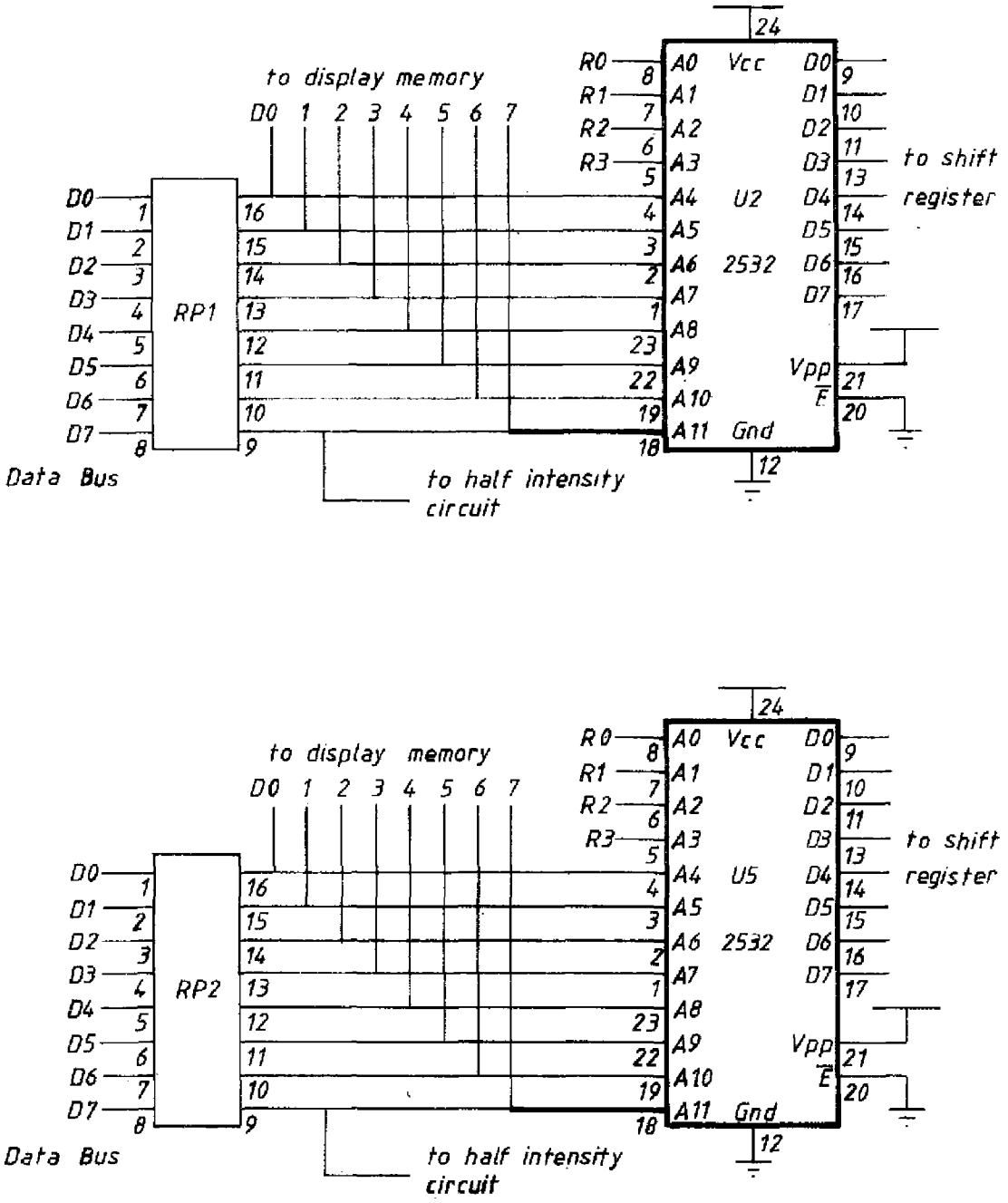

fig 2 Inverse video modifications for VC4404