

PACT ELECTRONICS LIMITED



RGB Colour Interface



The Pact RGB Colour Card is more than a "colour card" to let the Apple II computer display its colours. It provides a clearer, sharper display than other cards because it uses an RGB monitor, avoiding the picture degradation that occurs with composite colour systems.

The Pact card provides improved display of Apple colours, and adds its own set of brilliant colours. It can modify the colours of text and the background on which the displays appear, so that the entire screen is filled with colour, not just the central area.

All the Pact card's features are easily controlled by software.

The colours and display options provided by the card can be applied to 80-column text by using the optional Pact 80-Column Card. And the Multi-Colour Text option provides even more control of text colours. The manuals accompanying these options explain how to use them with the Pact RGB Colour Card.

YOUR APPLE

You can use your Pact RGB Colour Card with any Apple II or Apple II Europlus computer, regardless of the amount of memory you have or which peripherals are installed. An Apple with as little as 16K RAM will make good use of the card. You don't even need a disc drive except to run the demonstration disc included in the package.

The Pact demonstration disc needs Applesoft, one disc drive with DOS 3.3, and at least 32K RAM to operate correctly.

YOUR MONITOR

The Pact RGB Colour Card is designed to work with a particular kind of colour monitor. It is called an "RGB" monitor, because it accepts signals already split up into separate Red, Green, and Blue components. An RGB monitor may accept either linear or TTL signals; the Pact card will work with either. If you bought your Pact card and monitor together, your dealer should have supplied a suitable RGB monitor, ready to connect to the Pact card.

Ordinary colour monitors and domestic colour television receivers will not work with the Pact card. They expect an encoded signal, and decode it themselves into the three colour components. The Pact card does not supply encoded signals for such monitors. As a general rule, if your old monitor works when plugged into the Apple's own video socket or into a PAL colour card, it is the wrong kind of monitor for the Pact card.

If you did not buy your RGB monitor and the Pact card from the same source, you will probably have to assemble one of the two video cables supplied, so that the end with bare wires connects to your monitor. Do this before you start to install your Pact card. The connections to make are given at the back of this manual.

INSTALLING THE CARD

The Pact RGB Colour Card lives in slot 7 of your Apple. It cannot use any other slot, because only slot 7 has the video sync signal it needs. If some other card is using slot 7, it will of course have to come out before you can use the Pact card.

You can install the Pact card yourself if you read the following instructions carefully and take all the precautions they suggest. But you can damage the Pact card and the Apple by installing the card incorrectly. If you are worried about this, get your dealer to install and test the card for you.

1. Switch off mains power to your RGB monitor, and pull out its mains plug. Switch off mains power to your Apple II, and pull out its mains plug. This step is essential to avoid damaging components.
2. Remove the lid of the Apple II and locate slot 7. The slots are the long edge-connector sockets at the back, away from the keyboard. Slot 7 is the last slot at the right, nearest to the cassette and video sockets. If your Apple is new, there may be a label covering this slot. Remove it.
3. Remove the Pact card from its box, handling it by its edges. Hold the card so that the edge-connector tongue faces down and the side with the chips and other components faces right. Then insert the card into slot 7 by pressing down gently. Rock the card slightly to and fro until you feel it touch bottom.

4. Locate the Apple's auxiliary video output connector. It is on the printed circuit board at the back right corner, near the video jack. It has 4 pins in line, pointing up. (If your Apple has two connectors that look like this, you want the one nearest the back of the Apple.) Take the short single wire already attached to the Pact card, and hold its connector with its slots facing the back of the Apple. Push it down onto the 4-pin video output connector.

5. Connect your RGB monitor to the Pact card, using one of the two RGB cables supplied.

If you have a linear RGB monitor, use the cable ending in a round 5-pin DIN plug. Turn the plug so that the clip on its side faces the Pact card. Then push it down into the round 5-pin DIN socket near the back of the card.

If you have a TTL RGB monitor, use the cable with the rectangular connector. Turn the connector so that the side with the slots faces up. Then push it onto the pins of the connector marked PL3 at the top edge of the Pact card.

If the other end of the RGB cable is not already connected to your monitor, connect it now.

6. Look again at the top edge of the Pact card, and locate the connector marked PL2. It is at the top front edge of the card and has 3 pins pointing to the right. This connector should already have a rectangular jumper pushed onto it. The upper side of the jumper should be marked "40". If the upper side of the jumper is marked "80", pull it off gently, turn it over, and push it back on with the "40" side up.

This jumper sets the Pact RGB Colour Card for use with the Pact 80-column card when its "80" side faces up. For all other purposes the jumper should have its "40" side up.

7. If your RGB monitor has a termination switch, set the switch to 75 ohms.

8. Check that all connections are correct and that all plugs are firmly seated in their sockets. Then replace the lid on the Apple. Now, and not before, you may connect your Apple and monitor to the mains.

SETTING UP THE MONITOR

Before you try out the Pact RGB Colour Card you should set up your monitor for use with the card.

1. Turn on mains power to the monitor, but don't turn on the Apple just yet. When the monitor has warmed up, adjust its brightness control until you can just see light on the screen. Then turn the brightness down very slightly and leave it there.
2. Now turn on your Apple and get a screenful of text. If you have Autostart ROM with disc drive, put a disc (not the Pact demonstration disc) in the drive and boot it, then type CATALOG or LIST the HELLO program. If you don't have disc or Autostart ROM, just press RETURN a few times in Monitor to dump some memory on the screen.

The Pact RGB Colour Card starts working the moment the Apple is switched on, but it does not display colours at first. Your RGB monitor should now be showing ordinary Apple text in white on a black background.

If there is no text on the monitor, or if it is distorted or faulty, switch off the Apple and monitor and turn to the PROBLEMS page at the back of this manual.

If the text is too bright or too dark, but otherwise satisfactory, you can probably improve it by adjusting the Pact card's output level. The card is supplied with the output level set to about +4 volts peak video, which gives good results on most monitors. You can adjust it to give anything from 0 to +5 volts peak by following the next instructions.

3. Leave power to the monitor and to the Apple switched on. Carefully remove the lid of the Apple.
4. Locate the output level preset on the Pact card. It is a small round device near the back of the card with a slot for a screwdriver in its centre.
5. Put a small screwdriver in the preset's slot and rotate it while watching the RGB monitor. Rotate the preset clockwise to darken the screen, anti-clockwise to lighten the screen.
6. Replace the lid of the Apple.

WHAT THE PACT CARD CAN DO

The Pact RGB Colour Card controls the colours seen on the RGB monitor connected to the card. It has no effect on the Apple's own video output socket. If you have a monochrome monitor you may want to leave it plugged into the Apple's video socket for comparison.

The Apple has colour graphics built into it, but if you do not have a "colour card" you may never have seen the colours your Apple can produce. The Pact card can display all the normal Apple colours in both low-resolution graphics and high-resolution graphics.

The Pact card can also display low- and high-resolution graphics in its own set of "Pact colours" - brilliant, saturated primary colours that cannot be obtained with the Apple alone.

Text can be coloured by the Pact card too. Both the text letters and the background on which they are seen can be given separate colours - chosen from the 16 Apple colours or the 8 brilliant Pact colours.

Finally, low- or high-resolution graphics can be treated in the same way as text. In this mode, which we call "duochrome", the Pact card ignores the original colours in which the graphics were plotted. The plotted shapes can all be given one colour and the background another colour, chosen either from the Apple or Pact colour ranges.

When the Apple is used in one of its mixed graphics modes, with graphics in the upper part of the screen and four lines of text at the bottom, the graphics and text can be coloured separately. This makes it possible, for example, to plot high-resolution graphics in 8 colours and caption them with text in one of 16 colours.

All these colour displays are controlled by accessing three addresses in the Apple's input/output section. The Pact card responds to the values stored at these addresses and changes its colour display accordingly.

You can change the Pact card's colour display by typing up to three POKE statements from Applesoft or Integer Basic. The card will retain the display until you type new POKE statements, or until the Apple is turned off. Nothing else, not even pressing the RESET key, will change the colour display.

You can insert POKE statements into existing programs to change the colour display at appropriate moments. In machine-language programs, a STA instruction will have the same effect.

If you run the Pact demonstration disc now, you can try out the effect of the various colour commands without having to type out POKE commands on the keyboard.

When you boot the demonstration disc it will look for a Pact or Videx 80-column card in one of the slots in your Apple. If it finds one it will fill the 80-column screen with a table of the complete 80-column character set. Later, when you switch on bit 2 with the demo program, the 80-column screen will appear in whatever foreground and background colours you have chosen.

THE DEMONSTRATION DISC

Put the Pact demonstration disc in your drive and boot it. After a moment you should see the word "FACT" in red, with a green logo, on a blue background. Then the title "FACT RGB COLOUR CARD DEMONSTRATION DISC" will appear, with lettering in green, white, and magenta, on a dark red background. Both these displays are examples of high-resolution graphics, the first in Pact colours, the second in Apple colours.

Then the main menu will appear in white text on a black background. To select an item from this menu, use the two arrow keys on the Apple keyboard to move the pointer up and down the menu. When the pointer is at the item you want, press the RETURN key to select it.

The menu contains two test programs and four "demos". The test programs, one for low-resolution graphics and one for high-resolution graphics, illustrate all the effects you can get with the Pact card and show the commands you can use to get them. The demos are simple repeating graphic patterns which show the card in action. The last item on the menu lets you END your use of the demonstration disc and boot another disc of your own.

LO-RES COLOUR CHART

When you select this program from the menu, a colour chart is constructed on the screen showing all the 16 colours that can be plotted in low-resolution graphics. The number of each colour is printed in its colour box.

At the bottom of the screen is a sub-menu which lets you use the three Pact card addresses. Use the arrow keys to move the pointer to the address you want to change, and press RETURN to select it. When you are finished working with an address, press the ESC key to return to the sub-menu.

The COMMAND address controls the colour set in use and the brightness of the colours. When you first run the program, it is set to show solid Apple colours. You can get the same result by typing POKE -16142, 8 as shown on the COMMAND line. (This address also enables other Pact accessories such as the 80-Column Card

The FOREGROUND address holds the foreground colour number. Text is always displayed in this colour. When you first run the program the foreground colour is set to 15 (white). You can get the same colour by typing POKE -16143, 15 as shown on the FOREGROUND line.

The BACKGROUND address holds the background colour number. This colour appears as the background of the entire screen. When you first run the program the background colour is set to 0 (black). You can get the same colour by typing POKE -16144, 0 as shown on the BACKGROUND line.

While this program is running, you can change any of the Pact card addresses. You can see immediately how the change affects both lo-res graphics (upper part of screen) and text (lower part of screen). At the same time, the POKE value shown on the screen changes to the new value. When you see a colour effect you want, write down the POKE addresses and their values so you can type them later or enter them in a program.

To change one of the colour numbers, use the arrow keys to move the pointer to the FOREGROUND or BACKGROUND line and press RETURN to select it. A flashing cursor will appear over the colour number on the same line. Press the right arrow key to increase the colour number, the left arrow key to decrease it. The screen will show the new colour immediately. Press ESC to get back to the sub-menu.

Some combinations of foreground and background colours make text difficult to read. Some combinations make text and background the same colour, although the background is always slightly darker. If you make both foreground and background 0 (black), the text will disappear completely. It may help to have a monochrome monitor plugged into the Apple's normal video socket so that you can always see the menu, regardless of the colours you select. If you get really lost, press ESC twice to get back to the main menu, with a fully visible text screen, and start again.

To change the COMMAND, use the left arrow key to move the sub-menu pointer to COMMAND and press RETURN to select it. A flashing cursor will appear on the row of numbers to the right of the screen. These numbers represent the eight "bits" that make up the command number. Each bit controls one of the Pact card's functions. You can change each bit by moving the cursor over it with the left- and right-arrow keys and pressing RETURN. Each time you press RETURN, the bit will be changed to its other state - on if it was off, off if it was on. As soon as you change a bit, the screen shows the effect, and the command value on the same line is changed. When you have finished changing bits, press ESC to return to the sub-menu.

Here is a list of the useful bits and what they do.

BIT 6 switches between the Apple colour set and the Pact colour set. There are 16 different colours in the Apple colour set. There are only 8 in the Pact colour set, but they are more brilliant and more saturated than the Apple colours. When this bit is on, both graphics and text switch to Pact colours.

BIT 4 switches multi-colour graphics between "striped" colours and "solid" colours. Solid colours look better for bold graphic shapes, but striped colours may be necessary to read fine print in high-res graphics. This bit is on when you run the program, so that the colour chart is shown in solid colours.

BIT 3 affects the brightness of Pact colours only. It does not affect Apple colours or text. In general you should leave this bit off to get the brightest range of Pact colours.

BIT 1 switches graphics between the normal multi-colour mode and the duochrome mode. In duochrome, the original colours of graphics are ignored. All graphics shapes are shown in the current foreground colour, just like text. The duochrome mode can clear up many of the odd colour effects in Apple graphics, provided two colours are enough.

The other bits are less useful if you don't have the accessories they are meant to use.

BITS 7 and 8 do nothing. (They are shown on the screen so you won't wonder what happened to them.)

BIT 5 enables the Multi-Colour Text option. If it is turned on without MCT in your Apple it has odd effects on text and hi-res graphics.

BIT 2 switches between internal video and external video. It is meant for use with the Pact 80-Column Text Card. If you switch it on without that card in your Apple, the screen will go blank or "tear" horizontally. If you switch this bit on by mistake, press RETURN again to switch it off.

When you have finished using this program, press ESC to get back to the main menu. If there is a flashing cursor at the right of the screen, press ESC twice to get back to the main menu. Any colours and commands you may have set will be lost unless you have written them down.

HI-RES COLOUR CHART

When you select this program from the menu, a colour chart is constructed on the screen showing all eight colours that can be plotted in high-resolution graphics. The number of each colour is printed in its colour box. A line of high-resolution text is printed across the top of the screen, using standard Apple characters plotted in white (HCOLOR=7).

At the bottom of the screen is the same sub-menu that you saw when you ran the LO-RES COLOUR CHART program. It is used in exactly the same way, but here it shows the effects that various commands and colours have on high-resolution graphics and text.

To use this sub-menu, read the notes on the LO-RES COLOUR CHART program from the second paragraph on. When you are finished with this program, press ESC to get back to the main menu.

SLINKY DEMO

This demo program illustrates the use of the duochrome mode. It draws an endless series of hi-res shapes on the screen, plotted in white (HCOLOR=3) on a black background. But with each shape the program chooses a random combination of foreground and background colours from either the Apple or Pact colour range.

If you watch long enough you are likely to see every one of the 480 possible combinations you can get in the duochrome mode. The program avoids any combination which would use the same foreground and background colour.

The text at the bottom of the screen shows the current foreground and background colour numbers. If you see one you want to use, pause the program by pressing any key, and write down the numbers. (With some combinations the numbers are very hard to read. These combinations are obviously not much use for text, but they may look interesting with graphics.) Press any key to continue the program.

Press ESC to return to the main menu.

SPIRALLING SQUARES DEMO

This program illustrates multi-colour high-resolution graphics in solid Apple colours. A series of squares is drawn from a shape table at random positions and rotated and scaled up to a random size. The colour of each square is randomly chosen from the eight available Apple colours (HCOLOR=0 to HCOLOR=7). At random intervals the background is cleared to the colour of the last square and the process continues.

The text at the bottom of the screen shows the current plotting colour. This program does not avoid plotting a square in the same colour as its background, so occasionally it may appear that nothing is happening. You can pause the program after every square by pressing any key. Press any key to continue it.

One of the oddities about plotting multi-colour high-resolution graphics with the Apple is the "colour anomalies" that occur. Sometimes, when a new colour is plotted near an old colour, the new colour changes the old colour in strange ways. Rather than trying to avoid these colour anomalies, this program makes full use of them to produce a rich texture.

Press ESC to return to the main menu.

SHAZAM DEMO

This demo program illustrates multi-colour high-resolution graphics in solid Pact colours. It creates an endless series of brilliant "explosions" by drawing lines of random length and rotating them about the centre of the screen. At random intervals a new colour is chosen from seven of the eight available Pact colours (HCOLOR=0 to HCOLOR=6). The second white, HCOLOR=7, is omitted to make the display more colourful. After rotating 180 degrees the length of the lines is shortened progressively.

The text at the bottom of the screen shows the current plotting colour. You can pause the program by pressing any key. Press any key to continue it.

This program, like SPIRALLING SQUARES, displays the Apple's colour anomalies - the "staircase" effect that occurs when some colours are plotted next to others.

Press ESC to return to the main menu.

KALEIDOSCOPE DEMO

This demo program illustrates multi-colour low-resolution graphics in Apple colours. It is a modified version of the kaleidoscope program on the Apple II System Master disc. The colours are chosen in numerical order from the sixteen available Apple colours.

You can pause the program by pressing any key, and continue it by pressing any key. Press ESC to return to the main menu.

BAND GRAPH DEMO

This demo program shows a businesslike way in which the Apple's colour plotting difficulties can be minimized, using the Pact card.

The program draws a series of random graphs in 4 Pact colours plus black, representing 5 variables changing with time. If this were plotted as a "line" graph, with different coloured lines for each variable, the lines would often overlap each other and change colours as they crossed. But plotted this way, as solid-coloured bands varying in width, each variable has its own space, and colour anomalies are reduced to a minimum.

To speed up the plotting process, colours are plotted in vertical lines at every other coordinate point, so that no time is wasted plotting a colour which Apple will not display. The Pact card is switched to solid Pact colours to conceal the unplotted and undisplayable lines. To reduce colour anomalies even more, the black band is not plotted but left unplotted.

Press a key to pause the display at the end of each graph. Press ESC at any time to return to the main menu.

USING THE PACT CARD WITH EXISTING PROGRAMS

When an Apple is switched on with a Pact RGB Colour Card installed, the card immediately starts supplying a "normal" colour display to the RGB monitor. Text is shown in white on a black background, and graphics are shown in their original Apple colours. Any programs you already have can be run with this normal display, of course, but they won't be using any of the Pact card's special features or brilliant colours.

If you can LIST and alter an existing program, you will be able to insert statements in it to control the Pact card's colour display. To adapt programs like these, read PROGRAMMING FOR THE PACT CARD on the next page.

But if you have commercial programs on copy-protected discs, you will be unable to insert Pact card statements in them. And if you have machine-language programs you didn't assemble yourself, it can be almost impossible to understand how they work, let alone insert new instructions in them.

You can still use some of the Pact card's features with "untouchable" programs like these. Simply type the necessary POKES as direct commands, from Applesoft or Integer Basic, and then run the program. The colour display you select will remain in effect while the program runs and afterward. Even booting a protected disc containing a program won't lose the colour display you have selected.

For example, suppose you have a commercial game program called Whizzbang that uses hi-res graphics. You think the game would look better in solid Pact colours. From either BASIC, type

```
1 POKE -16142, 40
1 RUN WHIZZBANG
```

or, if Whizzbang is on its own protected disc which must be booted,

```
1 POKE -16142, 40
1 PR#6
```

If you get tired of typing these commands every time you run Whizzbang, you can write a short BASIC program to do it for you, and SAVE it on the disc which contains Whizzbang.

```
10 REM WHIZZBANG STARTER PROGRAM
20 TEXT : HOME
30 POKE -16142, 40 : REM SOLID PACT COLOURS
40 POKE -16143, 7 : REM WHITE TEXT
50 POKE -16144, 0 : REM BLACK BACKGROUND
60 PRINT : PRINT CHR$(4) "RUN WHIZZBANG"
```

When you run this program, it sets the Pact card's colour display and then runs the Whizzbang program. It's good practice to set all three Pact card addresses, as in lines 40 and 50, because you won't necessarily run Whizzbang immediately after switching on the Apple, and a previous program may have left the Pact card displaying other colours.

If Whizzbang is on its own protected disc, rewrite the end of the program to give the user a chance to insert the Whizzbang disc.

```
55 PRINT "INSERT WHIZZBANG DISC AND PRESS A KEY " ; : GET A$
60 PRINT : PRINT CHR$(4) "PR#6"
```

If your starter program must be written in Integer Basic you will have to type a CTRL/D (shown here as D) into line 60 instead of using CHR\$(4).

```
60 PRINT : PRINT "D RUN WHIZZBANG"
70 END
```


PROGRAMMING FOR THE PACT CARD

Statements which control the Pact card can easily be added to programs you write yourself, or to accessible BASIC programs you already have. Just insert a line with POKE statements at the point you want the colour display to change.

```
1000 POKE -16142, 1 : POKE -16143, 14 : POKE -16144, 2
```

It's a good idea to clear the screen of any old text or graphics just before a colour display statement. If you don't, you may see the old screen flash momentarily to the new colour display, which can be distracting.

The Pact card can be used to give different colour displays to different parts of a program, to help remind the user where he is. For example, in a program which plots curves specified by the user, the instructions could be in white text, data entry in yellow text, and the curves themselves could be plotted in duochrome with black plots on a yellow background.

```
100 POKE -16142, 0 : POKE -16143, 15 : POKE -16144, 0
110 REM INSTRUCTION TEXT HERE
200 POKE -16142, 0 : POKE -16143, 13 : POKE -16144, 0
210 REM DATA ENTRY HERE
300 HGR2 : POKE -16142, 1 : POKE -16143, 0 : POKE -16144, 13
310 REM PLOT GRAPH HERE
```

Some interesting effects can be achieved by changing the Pact card's colour display while the same picture is on the screen. For example, here is a program which makes both text and graphics flash on and off like a neon sign.

```
10 REM NEON SIGN
20 HOME : GR : COLOR=7
30 POKE -16142, 1 : REM DUOCHROME IN APPLE COLOURS
40 POKE -16143, 0 : REM BLACK FOREGROUND
50 POKE -16144, 3 : REM MAGENTA BACKGROUND
60 HLIN 10, 30 AT 10 : VLIN 11, 29 AT 30 : HLIN 10, 30 AT 30 : VLIN 11,
  29 AT 10 : REM RECTANGLE
70 VTAB 22 : HTAB 4 : PRINT "AND HERE IS SOME TEXT TO FLASH,
  TOO"
80 FOR W = 1 TO 2000 : NEXT : REM INITIAL WAIT
90 F = NOT F : POKE -16143, F * 13 : REM FLASH FOREGROUND
  YELLOW
100 FOR W = 1 TO 500 : NEXT : REM FLASH WAIT
110 GOTO 90
```

This program sets the Pact Colour Card to display duochrome, so that both graphics and text are shown in whatever colour is stored at the foreground address. The flashing is created in line 90 by alternating the variable F between 0 and 1, and multiplying F by 13 to get either colour 0 (black) or colour 13 (yellow).

To get an idea of the versatility of the Pact card, change line 30 and run the program again.

```
30 POKE -16142, 8 : REM SOLID APPLE COLOURS
```

Now the text still flashes, but the rectangle doesn't - it appears as light violet, the colour in which it was originally plotted. Switching the Pact card from duochrome to graphics in Apple colours has left only the text able to respond to the flashing foreground colours.

This program illustrates an important point to keep in mind when putting Pact statements into programs. The three Pact card addresses are "write-only" addresses. You can POKE values into them, but you cannot PEEK values out of them to see what colour or command is stored there. So, in line 90, a variable is used to keep track of whether the flash is on or off.

If, against our advice, you do try to PEEK the Pact addresses, you will find that PRINT PEEK (-16143) and PRINT PEEK (-16144) set both foreground and background to white, while returning meaningless values. PRINT PEEK (-16142), or any other such access to the command address, will set the Pact card to external video. Your RGB monitor will go blank, or lose synchronization. If this happens to you, you will have to type POKE -16142, 0 without seeing what you are typing on the screen - or switch your Apple off and lose your program.

It's possible to let the user select the colour display he wants at the start of a program. You should be careful about doing this, because if the user chooses similar or identical colours for foreground and background he won't be able to see much on the screen. Here is a simple program which lets the user choose text and background colours from the Apple range.

```
10 HOME : GR
20 POKE -16142, 8 : POKE -16143, 15 : POKE -16144, 0
30 FOR C = 0 TO 15
40 COLOR = C
50 VLIN 0, 39 AT 4 + 2 * C : VLIN 0, 39 AT 5 + 2 * C
60 VTAB 21 : HTAB 5 + 2 * C : IF C > 9 THEN PRINT "1"
70 VTAB 22 : HTAB 5 + 2 * C : PRINT (C / 10 - INT (C / 10)) * 10
80 NEXT
90 VTAB 23 : INPUT "ENTER TEXT COLOUR: " ; FG% : POKE -16143,
    FG%
100 VTAB 23 : PRINT SPC(40)
110 VTAB 23 : INPUT "ENTER BACKGROUND COLOUR: " ; BG% : POKE
    -16144, BG%
120 POKE -16142, 0
130 TEXT : HOME : VTAB 5 : PRINT "NOW LET'S CONTINUE . . . "
```

Line 20 sets the Pact card to display lo-res graphics in solid Apple colours, and lines 30 to 80 construct a colour bar chart labelled with COLOR= numbers. The user can then pick the colours he wants from the chart and enter them in lines 90 to 110. As he presses RETURN after each entry, the text or background changes to the colour he has chosen, and the rest of the program uses those colours.

This method should not be used where exact colour choices matter, since the 16 lo-res colours are not always the same brightness as the 16 foreground/background colours the user is choosing. Background colours are generally a bit darker than lo-res colours.

Machine-language programmers can use all the same methods of controlling the Pact card's colour displays. This routine sets the Pact card to the same display as the first example in this section.

```
LDA #*1
STA %C0F2
LDA #*E
STA %C0F1
LDA #*2
STA %C0F0
```

It is much easier in machine-language to change individual bits of the Pact card's command address. The following routine assumes that the current values of the Pact addresses have been stored at addresses labelled COLCOM, COLFG, and COLBG. It switches a graphics display from striped to solid colours without changing anything else.

```
LDA COLCOM
ORA  #$8
STA  $C0F2
LDA  COLFG
STA  $C0F1
LDA  COLBG
STA  $C0F0
```

The ORA #\$8 instruction makes certain that bit 4 of the colour command is set, whether or not the value stored in COLCOM had it set. The command is then fed to the Pact card, followed by the foreground and background colours. Whether the command specified Apple or Pact colours, they will now be displayed as solid colours.

REFERENCE SECTION

The first two programs on the Pact demonstration disc provide the easiest way to use to Pact card's features. Just boot the disc, run LO-RES COLOUR CHART or HI-RES COLOUR CHART, and play with the display until you find the settings you want to use. Write down the POKE values shown on the screen, and then write them into your program.

The following pages provide an detailed list of the Pact card's functions and colours for those who prefer to work from paper rather than a screen.

FACT CARD ADDRESSES

COMMAND

Decimal -16142 (or 49394)

Hexadecimal \$C0F2

The value stored at this address controls the graphics mode, the colour range, and the appearance of Pact colours. External video and the Multi-Colour Text option are also controlled by this address. A detailed description of the function of each bit in this value is given below.

FOREGROUND COLOUR

Decimal -16143 (or 49393)

Hexadecimal \$C0F1

The value stored at this address specifies the colour in which text is displayed. If the duochrome mode is selected, all graphics are also displayed in this colour.

BACKGROUND COLOUR

Decimal -16144 (or 49392)

Hexadecimal \$C0F0

The value stored at this address specifies the colour in which the background of both text and graphics is displayed.

COMMAND BITS

Each bit of the value stored at the command address controls one function of the Pact RGB Colour Card. Some functions, however, are affected by others. The actual value to be stored is the sum of the binary values of all the bits which are to be turned on.

BIT 1 selects the graphics mode. It has no effect on text.

OFF (binary 0) selects normal multi-colour graphics. Low-resolution graphics can plot 16 colours, high-resolution can plot 8. The specific colours and their brightness are affected by other bits.

ON (binary 1) selects duochrome graphics. Any graphics area plotted in a COLOR greater than 0, or an HCOLOR other than 0 or 4, is displayed in the current foreground colour. Any graphics area plotted in COLOR 0 or HCOLOR 0 or 4 is displayed in the current background colour. If mixed text and graphics are displayed, both are displayed in the same colours.

BIT 2 selects the source of the video signal which the Pact card displays.

OFF (binary 0) selects internal video - the Apple's own video output signal.

ON (binary 2) selects external video from any source connected to connector PL1 on the Pact RGB Colour Card. In practice this source must be a Pact 80-Column Card or other peripheral card inserted in another slot of the same Apple and deriving its sync from the Apple's clock. When bit 2 is on, any acceptable signal on PL2 is treated and coloured in the same way as signals from Apple video.

BIT 3 selects one of two brightness ranges for Pact colours. It has no effect when Apple colours are selected.

OFF (binary 0) selects the brighter Pact range. High-resolution graphics plot HCOLOR 1-3 and 5-7 as bright colours. Low-resolution graphics plot COLOR 1-7 as medium colours, COLOR 9-15 as bright colours.

ON (binary 4) selects the darker Pact range. High-resolution graphics plot HCOLOR 1-3 and 5-7 as dark or medium colours (depending on bit 4). Low-resolution graphics plot COLOR 1-7 as medium colours, COLOR 9-15 as dark colours.

BIT 4 controls a filter which causes multi-colour graphics to appear either solid or striped. It has no effect on duochrome or on text.

OFF (binary 0) enables the filter. Colours appear striped, but fine detail in high-resolution graphics may be clearer.

ON (binary 8) disables the filter. Colours appear solid, but fine detail may be less clear.

BIT 5 controls the Multi-Colour Text option. It only affects text. If you do not have MCT you should leave this bit off. It is fully explained in the manual supplied with MCT.

OFF (binary 0) disables Multi-Colour Text. Text is shown as usual in the foreground colour.

ON (binary 16) enables Multi-Colour Text. Text is shown in white, regardless of any foreground colour, unless the MCT option (if fitted) assigns a specific colour to it.

BIT 6 switches between the Apple and Pact colour sets. Foreground, background, and multi-colour graphics appear in the particular colour set selected by this bit.

OFF (binary 0) selects the Apple colour set. A list of Apple colours is given below.

ON (binary 32) selects the Pact colour set. A list of Pact colours is given below. When Pact colours are selected their brightness is affected by the setting of bit 3.

BITS 7 and 8 are not used and have no effect if turned on.

COMPLETE COMMANDS

It is possible to set the Pact card for any combination of the commands listed above by adding the binary values of the individual bits to be turned on and POKEing -16142 with the sum. For simplicity, however, some of the most useful combinations of commands are listed below.

POKE -16142, 1

Duochrome text and graphics in any 2 of 16 Apple colours.

POKE -16142, 33

Duochrome text and graphics in any 2 of 8 Pact colours.

POKE -16142, 37

Duochrome text and graphics in any 2 of 8 medium and 8 bright Pact colours.

POKE -16142, 0

Multi-colour graphics in striped Apple colours.

POKE -16142, 8

Multi-colour graphics in solid Apple colours.

POKE -16142, 32

Multi-colour graphics in striped Pact colours.

POKE -16142, 40

Multi-colour graphics in solid Pact colours.

To use any of these combination commands with external video, add 2 to the POKE value. To use them with the Multi-Colour Text option, add 16 to the POKE value.

The following chart summarizes all the useful combinations of bit settings for quick reference.

BITS SET	DEC	HEX	MODE	COLOURS		TYPE	RANGE
				LO	HI		
-----	0	0	multi	16	8E	striped	Apple
----4---	8	8	multi	16	8E	solid	Apple
--6-----	32	20	multi	8M+8E	8E	striped	Fact
--6-4---	40	28	multi	8M+8E	8E	solid	Fact
--6--3---	36	24	multi	8M+8D	8D	striped	Fact
--6-43---	44	2C	multi	8M+8D	8M	solid	Fact
-----1	1	1	duo	16	-	-	Apple
--6----1	33	21	duo	8M+8E	-	-	Fact
--6--3-1	37	25	duo	8M+8D	-	-	Fact

multi multi-colour graphics
duo duochrome graphics & text
E bright
M medium
D dark

COLOURS

The lists of colour names given below should be regarded only as a guide, not as an exact description. Differences between colour monitors and individual colour vision make it impossible to specify colours exactly. Use the COLOUR CHART programs on the Pact demonstration disc to see exactly what colours will be produced on your monitor under different circumstances.

Whether the Apple or Pact colour set is selected, the same colours are available for low-resolution graphics and background or foreground. A particular colour, however, will appear darker as a background colour than it will as graphics or text. This makes it possible to plot low-visibility grids or game boards using the same colour number. Black, however, always appears the same, and black text on a black background is always invisible.

THE APPLE COLOUR SET

When the Apple colour set is selected, 16 colours are available for low-resolution graphics, and as background and foreground colours. To plot these colours as low-resolution graphics, use COLOR= followed by the colour number. To use these colours as foreground or background, POKE -16143 or POKE -16144 with the colour number. A background colour will appear in graphics areas where nothing has been plotted or where COLOR 0 has been plotted.

LO-RES/FOREGROUND/BACKGROUND COLOURS

- 0 black
- 1 dark red
- 2 dark blue
- 3 magenta
- 4 dark green
- 5 dark yellow
- 6 medium blue
- 7 light violet
- 8 brown
- 9 orange
- 10 medium grey
- 11 pink
- 12 light green
- 13 yellow
- 14 light blue
- 15 white

When high-resolution graphics are plotted in Apple colours, only 8 colours are available (and two appear the same, giving only 6 visibly different colours). To plot in these colours, use HCOLOR=. Except for black = 0, the numbers give quite different colours to their low-resolution counterparts. When high-resolution graphics are displayed, the 16 colours listed above are still available for text and background.

HI-RES COLOURS

- 0 black
- 1 light green
- 2 magenta
- 3 white
- 4 black
- 5 orange
- 6 blue
- 7 white

THE PACT COLOUR SET

When the Pact colour set is selected, 8 colours are available for low-resolution graphics, and as background and foreground colours. To plot these colours as low-resolution graphics, use COLOR= followed by the colour number. To use these colours as foreground or background, POKE -16143 or POKE -16144 with the colour number.

If you plot or poke with a number from 8 to 15, the colours produced will repeat the colours from 0 to 7 but with a different brightness. If bit 3 is on, the second range will be brighter than the first. If bit 3 is off, the second range will be darker than the first.

The two blacks, numbered 0 and 8, will appear identical. However a graphics area plotted in COLOR 0 will take on any background colour, but a graphics area plotted in COLOR 8 will remain black regardless of background colour.

LO-RES/FOREGROUND/BACKGROUND COLOURS

- 0 8 black
- 1 9 red
- 2 10 blue
- 3 11 magenta
- 4 12 green
- 5 13 yellow
- 6 14 light blue
- 7 15 white

When high-resolution graphics are plotted in Pact colours, a different range of 8 colours is available. As with the Apple set, there are only 6 visibly different colours. The numbers are different from the 8 low-resolution colours. To plot in these colours, use HCOLOR=.

HI-RES COLOURS

- 0 black
- 1 green
- 2 magenta
- 3 white
- 4 black
- 5 red
- 6 light blue
- 7 white

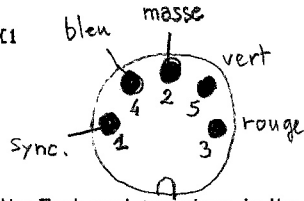
It is worth noting that the two blacks available in lo-res or foreground/background can be an advantage to the careful programmer. Black 0 takes on a background colour, black 8 does not. This actually allows lo-res plotting in 9 colours, including true black. The effect is not available in hi-res plotting, where both black 0 and black 4 take on a background colour.

CONNECTIONS TO THE PACT RGB COLOUR CARD

The connections for linear video output from the Pact card are given in the table below, with the standard insulation colours for such cables. Please note that a fully isolated monitor must be used; the Pact card circuitry must not come into contact with the monitor chassis supply.

LINEAR OUTPUTS FROM CONNECTOR SK1

- PIN 1 linear sync output (yellow)
- PIN 4 blue signal output (blue)
- PIN 2 common zero volts (white)
- PIN 5 green signal output (green)
- PIN 3 red signal output (red)



The connections for TTL video output from the Pact card are given in the table below, with the standard insulation colours for such leads. Either 3-bit or 4-bit connections may be used, but if a 3-bit connection is used the second set of Pact colours will not be available (command bit 4 will be ignored).

TTL OUTPUTS FROM CONNECTOR PL3

- PIN 1 blue signal output (brown)
- PIN 2 red signal output (red)
- PIN 3 intensity signal output (orange)
- PIN 4 green signal output (yellow)
- PIN 5 TTL sync output (green)
- PIN 6 common zero volts (blue)

The following table gives the connections for external video input to the Pact card. Note that pin 1 must not be commoned to earth, and that the composite video input is not terminated. If a Pact 80-column card is used at this input a correctly wired lead is supplied.

EXTERNAL VIDEO INPUT TO CONNECTOR PL1

- PIN 1 common zero volts
- PIN 2 (not used)
- PIN 3 inverse TTL external sync output
- PIN 4 composite video input

The following table gives the connections for the Multi-Colour Text option. A correctly wired lead is supplied.

MULTI-COLOUR TEXT CONNECTIONS TO PL4

- PIN 1 LS logic input
- PIN 2 LS logic input
- PIN 3 LS logic input
- PIN 4 LS logic input
- PIN 5 common zero volts

PROBLEMS

If you follow the instructions given in this manual under **INSTALLING THE CARD** and **SETTING UP THE MONITOR**, you should see white text on a black background when you first switch on the Apple. If you don't, here are some possible causes.

An incorrect connection to the Apple's auxiliary video output connector. The single wire from the Pact card should connect to the second pin from the right of the Apple's connector, when you face the Apple from the keyboard. The connector may have been reversed, or misaligned a pin to the right or left.

An incorrect connection to the monitor. Check the pin wiring tables in the next section for connector SK1 or PL3, depending on the type of monitor in use.

The jumper in PL2 is reversed or missing. This jumper should have its "40" side up. If its "80" side is up, or if the jumper is missing, the Pact card is expecting a signal from an 80-column card rather than from the Apple's video output. If in doubt, turn the power off and reverse the jumper.

If you see some sort of picture on the monitor, but not clear text, any of the causes listed above might apply. A "torn" image or a screen full of moving dots or lines could be caused by an incorrect sync output connection to the monitor.

If the text is visible but coloured, one or two of the colour signal connections to the monitor may be incorrect. Yellow text suggests a missing blue signal, magenta (red-violet) text a missing green signal, cyan (blue-green) text a missing red signal.

If the text is correct but too dim or too bright, try a different setting of the termination switch on your monitor (if it has one). Dim text could also be caused by a linear output to a TTL monitor, and too-bright text by a TTL connection to a linear monitor.

If the text is streaked to the right - an "8", for example, looks like a "B" - the video output level may be set too high. Try a lower setting by turning the output level preset a little clockwise. If this improves the shape of the text, compensate for the reduced brightness by raising the monitor's brightness level.

WARRANTY

We warrant each new product to the original end-user purchaser to be free from defects in material and workmanship for a period of twelve (12) months from date of purchase as shown on purchaser's receipt. PACT ELECTRONICS Limited will repair or replace, at its option and free of charge, during the warranty period, any part which proves defective in material and/or workmanship under normal installation, use, and service. **DO NOT SEND YOUR INTERFACE DIRECTLY TO PACT ELECTRONICS.** Return the faulty item(s) to the dealer from which they were originally purchased, complete with original packaging or physical equivalent, transportation charges prepaid, and proof of purchase date. **THIS WARRANTY IS LIMITED TO DEFECTIVE PARTS REPAIR AND/OR REPLACEMENT ONLY AND DOES NOT COVER ANY ACCESSORY ATTACHMENT OR PERIPHERAL USED IN CONNECTION WITH THIS PRODUCT.** Labour charges and/or damage incurred in installation, repair, or replacement, as well as incidental and consequential damages connected therewith are excluded. Any damage to this product as a result of misuse, abuse, neglect, accident, incorrect wiring (not our own), improper installation, repair or alteration outside our factory, or any use violative of instructions furnished in writing by us **WILL VOID THIS WARRANTY.**