Quadra Series, Centris Series: Displays, Video Pinouts (8/93)

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TOPIC ---

This article details how to wire the video connector sense pins to access
all the supported video modes of the Macintosh Quadra series and the
Macintosh Centris series.

DISCUSSION ---

The Macintosh Centris and Quadra frame buffer determines what type of
display is attached to the video connector by examining the state of 3
sense line pins. The following chart details how these three pins must be
wired for each of the supported display types. For each supported display,
the screen resolution (horiz. pixels X vertical pixels), bandwidth, and
the vertical and horizontal scan rates are listed.

The Macintosh Quadra series and the Macintosh Centris series should support
any display, whether from Apple or from another vendor, that meets one of
the following specifications:

STANDARD SENSE CODES:

Display	Sense pins 10	7	4	Hor x Vert (Pixels)	Band Width (MHz)	Vert Refrsh (Hz)	Horiz Refrsh (KHz)
Apple 21 Color	0	0	0	1152 x 870	100	75	68.7
Apple Portrait	0	0	1	640 x 870	57.2832	75	68.9
12" AppleColor RGB	0	1	0	512 x 384	15.6672	60.15	24.48
Apple 2-Page Mono.	0	1	1	1152 x 870	100	75	68.7
NTSC	1	0	0	underscan-512x384	12.2727	59.94	15.7
	1	0	0	overscan- 640x480	12.2727	59.94	15.7

(To produce a color NTSC signal, a RGB-to-NTSC converter is required.)

Display	Sense pins 10	7	4	Hor x Vert (Pixels)	Band Width (MHz)	Vert Refrsh (Hz)	Horiz Refrsh (KHz)
12" Apple High-Res Monochrome	1	1	0	640 x 480	30.24	66.7	35.0

Display	Sense pins			Hor x Vert Pixels	Bandwidth (MHz)	Refresh (Hz)	Scan (KHz)
13" AppleColor High-Res RGB	1	1	0	640 x 480	30.24	66.7	35.0
Apple 16" Color Disp.	(See Note 4)			832 x 624	57.63	75	49.7
Portrait Color, such as Radius	1	0	1	640 x 870	57.2832	75	68.9

NOTES:

1) NOTE: Sense pins 4, 7, and 10 are referred to as MON.ID1, MON.ID2, and
   MON.ID3 in the Macintosh Quadra pinout table or SENSE0, SENSE1, and
   SENSE2 in pinout tables for the video connectors.

   A sense pin value of 0 means that pin should be grounded to the
   C&VSYNC.GND signal; a value of 1 means do not connect the pin.

2) Extended sense codes will be examined if the following sense code is
   detected: 1 1 1.

3) The terms 'underscan' and 'overscan' are used to describe the active
   video resolution for NTSC and PAL modes. Underscan means that the
   active video area appears in a rectangle centered on the screen with a
   black surrounding area. This ensures that the entire active video area
   always is displayed on all monitors. Overscan utilizes the entire
   possible video area for NTSC or PAL. However, most monitors or
   televisions will cause some of this video to be lost beyond the edges of
   the display, so the entire image will not be seen.

4) The Apple 16" Color Display should have pins 4 and 10 tied together and
   pin 7 should be unconnected. If used with a Macintosh Display Card, the
   Apple 16" Color Display also requires the Macintosh Display Card 4•8,
   8•24, or 8•24 GC with revised ROMs.

EXTENDED SENSE CODES:

NOTE for extended sense codes: Sense pin pair value of 0 means those pins
should be tied together (as opposed to grounding 10, 7, or 4 to pin 11);
value of 1, do not connect. DON'T wire any of these pins to ground.

| Display | Sense pins | | | Hor x Vert Pixels | Bandwidth (MHz) | Refresh (Hz) | Scan (KHz) |
	4-10	10-7	7-4				
16-inch Color, such as E-Machines	0	1	1	832 x 624	57.2832	75	49.7

PAL

PAL has two wiring options, using the extended sense pin configuration. To
produce a color PAL signal, an RGB-to-PAL converter is required.

```
PAL Option 1        0    0    0    underscan-640x480  14.75      50      15.625
                                   overscan-768x576   14.75      50      15.625


PAL Option 2        1    1    0    underscan-640x480  14.75      50      15.625
                                   overscan-768x576   14.75      50      15.625
```

This sense code also requires a diode between sense pins 10 and 7, with
anode towards pin 7, cathode towards pin 10.

NOTES:
• The Macintosh Quadra 700 and 900 support PAL Option 1 at up to 8 bpp.
• The Macintosh Centris 610, 650, and Quadra 800 support PAL Option 1 at up to
  16 bpp.
• The Macintosh Quadra 950 supports PAL Option 1 up to millions of colors.


```
VGA                 1    0    1    640 x 480          25.175     59.95   31.47


Super VGA           1    0    1    800 x 600          36         56      35.16
```
To enable Super VGA, after configuring and connecting the monitor for VGA,
open the monitor's control panel and select Options. Choose Super VGA from
the dialog and restart your system.

```
19" Color           1    1    0    1024 x 768         80         75      60.24
```

No external monitor
```
(video halted)      1    1    1
```


MACINTOSH QUADRA AND CENTRIS VIDEO PINOUTS:

```
Pin    Signal         Description
-----  -----------    ----------------------------------------
1      RED.GND        Red Video Ground
2      RED.VID        Red Video
3      CYSNC~         Composite Sync
4      MON.ID1        Monitor ID, Bit 1 (also known as SENSE0)
5      GRN.VID        Green Video
6      GRN.GND        Green Video Ground
7      MON.ID2        Monitor ID, Bit 2 (also known as SENSE1)
8      nc             (no connection)
9      BLU.VID        Blue Video
10     MON.ID3        Monitor ID, Bit 3 (also known as SENSE2)
11     C&VSYNC.GND    CSYNC & VSYNC Ground
12     VSYNC~         Vertical Sync
13     BLU.GND        Blue Video Ground
14     HSYNC.GND      HSYNC Ground
15     HSYNC~         Horizontal Sync
Shell  CHASSIS.GND    Chassis Ground
```


IF YOUR MONITOR IS A VGA TYPE, YOU CAN TRY THE FOLLOWING CABLE PINOUTS:

A cable wired as follows may allow many different brands of VGA monitors to

work on a Macintosh Quadra. We advise you to test the monitor on a
Macintosh Quadra prior to purchase to see if it meets your expectations.

```
Macintosh Video                        VGA Connector
DB-15
-------------                          -------------


2  ------------------- Red Video ------------ 1
1  ------------------ Red Ground ----------- 6
9  ------------------ Blue Video ---------- 3
13 ------------------ Blue Ground ---------- 8
5  ------------------ Green Video ---------- 2
6  ------------------ Green Ground --------- 7
15 ------------------ Hsync --------------- 13
12 ------------------ Vsync --------------- 14
14 ----------------- Sync Ground ---------- 10
10 -----------------|
7  -----------------| Connect 7 and 10 so the sense pin ID will equal VGA
```

There are a few issues to keep in mind with VGA monitors:

  • VGA monitors will vary depending on the vendor. Check with the vendor
    about Macintosh Centris and Quadra compatibility before buying, or
    better yet, actually try the monitor with a Centris or Quadra to see if
    it works and if the quality is acceptable.

  • Vendors have different image quality specifications. There may be
    significant differences between Apple monitors and the wide range of
    VGA monitors. Do a side-by-side comparison of the monitors you are
    considering before buying.

  • Many third party cable vendors have off-the-shelf cables that should
    work.

MACINTOSH QUADRA TO NTSC VIDEO CABLE EXAMPLE:

Most NTSC devices use a RCA-type phono-connector and the following diagram
uses that as a reference point. A cable wired as follows may allow many
different brands of NTSC monitors to work on a Macintosh Centris or Quadra.
We advise you to test the monitor on one of these machines prior to
purchase to see if it meets your expectations.

Adjust the phono-connector side to whatever type of connector is used
(RCA, BNC, etc.). "Tip" is the pin in the center of the connector (the
signal); the sleeve is the flange around the outer edges of the connector
(the chassis ground).

```
Card Connector                       RCA-Type Phono-Connector
--------------                       -----------------------
4      MON.ID1  (sense0) --|
7      MON.ID2  (sense1) --|
11     C&VSYNC.GND --------|
```

```
5       GRN.VID  -----------------> Tip (signal)
Shell  CHASSIS.GND -------------> Sleeve (ground)
```

By grounding pin 4 and pin 7 to pin 11, the Macintosh Centris and Quadra
CPUs are told that an interlaced (NTSC) monitor is attached. The actual
black and white video signal is on pin 5 and connects to the center (Tip)
of the phono-plug. The shell of the card connector connects to the sleeve
of the phono-plug.

To acquire a color NTSC signal from a Quadra (or any Apple Macintosh
display card), an RGB-to-NTSC converter is required, such as those
available from RasterOps, Truevision, and Computer Friends. We do not have
the cable requirements for any of these interface devices.

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