T221 installation & system attachement information

Model recommendation

The primary consideration, for choosing either the T221 model DG3 or DG5 is the rate at which it is desired to display image changes. Internal frame buffers within the T221 ensure that the panel is always refreshed at a suitable rate (41Hz in the DG3, 41-48Hz in the DG5); however bandwidth and I/O considerations on the DVI interface mean that the frame buffers may be updated with new data at a slower rate. For many applications this isn't an issue; however some applications require a higher rate so that motion or data changes are presented as quickly and smoothly as possible.

The following table summaries the recommended T221 model and graphics card(s) depending on the preferred update rate.

Image motion characteristic	Typical Applications		Minimum Screen Update Rate	T221			IBM Supported Graphics Cards (NVIDIA)
				Model	EDID	Firmware level	
Primarily static ↕ Smooth & life-like	2D	Office Applications Publishing Virtual Galleries & Museums Digital Photography	13Hz	DG3/5	29	DG3 – 4.0 DG5 – 4.3	FX1100 FX1300
	3D	Engineering & Modeling	20Hz	DG3/5	29		FX1100 FX1300
			24Hz	DG5	02		FX3000 FX3400
	Video	Image analysis (roaming, windowing, leveling) Video Creation	48Hz	DG5	06		FX3000 FX3400

Graphics cards

- IBM certified graphics cards
    - AGP

        NVIDIA Quadro FX 4000 (special bid only)
        NVIDIA Quadro FX 3000
        NVIDIA Quadro FX 2000 (special bid only)
        NVIDIA Quadro FX 1100 (supercedes the FX 1000)
        NVIDIA Quadro4 980 XGL

    - PCI-express

        NVIDIA Quadro FX3400
        NVIDIA Quadro FX1300

    - PCI

        NVIDIA Quadro FX 600 (special bid only)

    The above cards are only supported when purchased as part of a standard or special bid model of A Pro, M Pro or Z Pro IntelliStations. Possible differences in video BIOS and/or device drivers mean that non IBM versions of these cards may not operate with the T221 as expected

- IBM certified graphics cards (EOL)
    - AGP

        NVIDIA Quadro4 900 XGL
        ATI FireGL4

    Supported on earlier, standard M Pro or Z Pro IntelliStation models. Possible differences in video BIOS and/or device drivers mean that non IBM versions of these cards may not operate with the T221 as expected

- Other, non-IBM certified graphics cards

    It is possible to attach the T221 to other graphics cards, however IBM support cannot be provided for all possible options. The suppliers of the following cards claim to support the T221; they should be contacted direct for further information
    - PCI

        Matrox HR256

Installation

It's important to use the correct graphics card BIOS & device driver level when attaching the T221

When not pre-loaded, these are available from the IBM technical support web site (see http://www-1.ibm.com/support/docview.wss?rs=0&q=9503&uid=psg1MIGR-39635) or the card supplier's support site and are summarized below

Graphics card	BIOS	Device driver (minimum level)		
		Windows XP	Windows 2000	Linux
NVIDIA Quadro FX 3400	Standard	61.76 (IBM)		61.11 (NVIDIA)
NVIDIA Quadro FX 1300	Standard			
NVIDIA Quadro FX 4000	Standard			
NVIDIA Quadro FX 3000	Standard			
NVIDIA Quadro FX 2000	Standard			
NVIDIA Quadro FX 1100	Standard			
NVIDIA Quadro FX 600	Standard			
NVIDIA Quadro4 980 XGL	4.28.20.19.15 (IBM)			
NVIDIA Quadro4 900 XGL	4.25.00.29.25 (IBM)			
ATI FireGL4	1.26 (IBM)	6.12.10.2090 (IBM)		1.9.16 (ATI)

Note: The above device driver levels are the minimum required, it is generally advantageous to use the latest level available.

Configuration

The input flexibility offered by the T221, allows it to be driven in a number of different ways. There are a total of 4x single-link DVI inputs, however, operation from a single DVI input as a single monitor with a single desktop is the most simple and is typical of industry standard monitor attachment. The bandwidth of a single-link DVI channel is limited to a maximum pixel clock frequency of 165MHz, for the T221's 3840x2400 resolution, this corresponds to an update rate of 13Hz

Note: Internal frame buffers in the T221 retime the input data and display it at a fixed 41Hz (for the DG3) or 41-48Hz (for the DG5).

By driving more than one input, the update rate can be increased. This is summarized below.

T221 Model	9503-DG3	9503-DG5
Inputs	Single-link DVI (each, max 4) - 165MHz pixel clock limit - 495MB/sec (24bit RGB)	Single-link DVI (each, max 4) - 165MHz pixel clock limit - 495MB/sec (24bit RGB) Dual-link DVI (1x), via converter box - 330MHz pixel clock limit - 990MB/sec (24bit RGB)
Internal panel refresh rate	41Hz	41-48Hz
Main high resolution modes (**recommended**)	**1x DVI input = 3840x2400@13Hz** 2x DVI input = 3840x2400@20Hz 4x DVI input = 3840x2400@41Hz	**Dual-link DVI modes** **1x DVI input = 3840x2400@24Hz** **Single-link DVI modes** **1x DVI input = 3840x2400@13Hz** 2x DVI input = 3840x2400@20Hz 2x DVI input = 3840x2400@24Hz 4x DVI input = 3840x2400@48Hz

Single monitor configurations.

1. Single monitor, single-link DVI (13Hz)
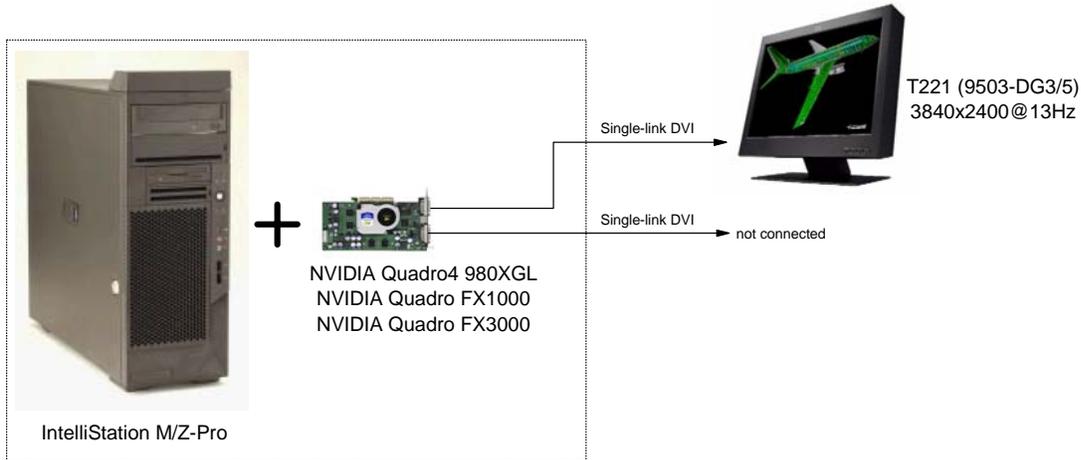
Single-link DVI

Single-link DVI → not connected

NVIDIA Quadro4 980XGL
NVIDIA Quadro FX1000
NVIDIA Quadro FX3000

IntelliStation M/Z-Pro

T221 (9503-DG3/5)
3840x2400@13Hz

Driver level	As per minimum level
Graphics cards	As per supported list
T221 EDID	029 (default)
Update rate	13Hz
Desktop	Single

2. Single monitor, twin single-link DVI (20Hz)
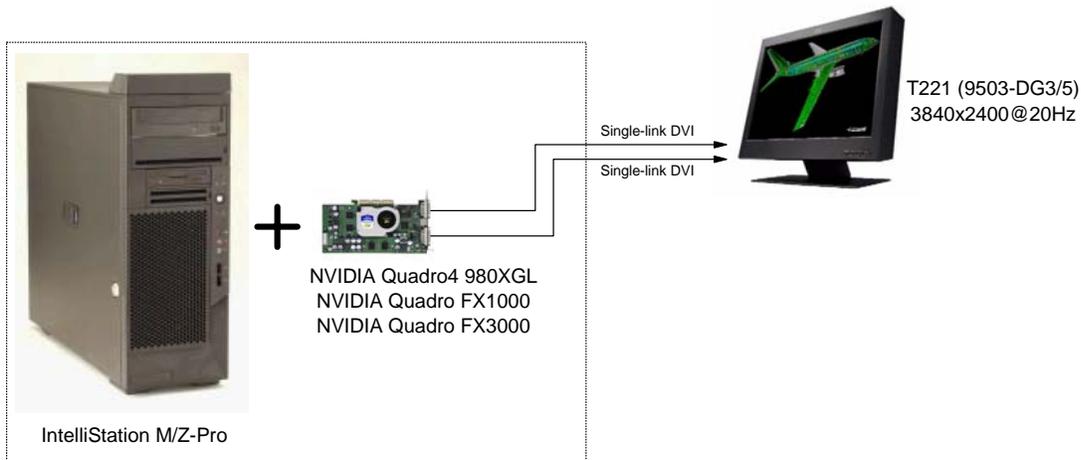
Single-link DVI

Single-link DVI

NVIDIA Quadro4 980XGL
NVIDIA Quadro FX1000
NVIDIA Quadro FX3000

IntelliStation M/Z-Pro

T221 (9503-DG3/5)
3840x2400@20Hz

Driver level	As per minimum level
Graphics cards	As per supported list
T221 EDID	029 (default)
Update rate	20Hz
Desktop	Single (horizontal span via NVIEW utility) Dual view (extend desktop via OS)

3. Single monitor, twin single-link DVI (24Hz, DG5 only)

Single-link DVI

Single-link DVI

T221 (9503-DG5)
3840x2400@24Hz

NVIDIA Quadro4 980XGL
NVIDIA Quadro FX1000
NVIDIA Quadro FX3000

IntelliStation M/Z-Pro
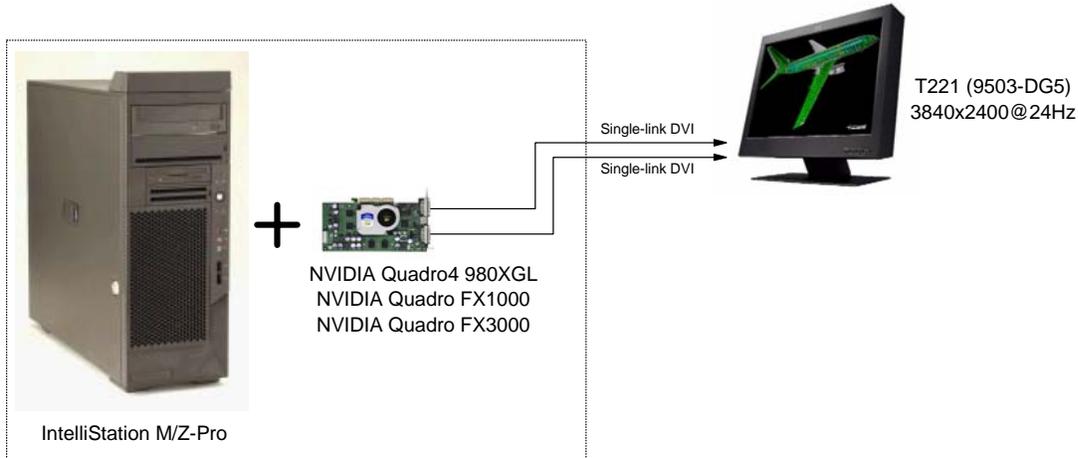
Driver level	As per minimum level
Graphics cards	As per supported list
T221 EDID	034 (default)
Update rate	24Hz
Desktop	Single (horizontal span via NVIEW utility) Dual view (extend desktop via OS)

4. Single monitor, dual-link DVI (24Hz, DG5 only)

Dual-link DVI

not connected

Single-link DVI

T221 (9503-DG5)
3840x2400@24Hz

NVIDIA Quadro FX3000

IntelliStation M/Z-Pro
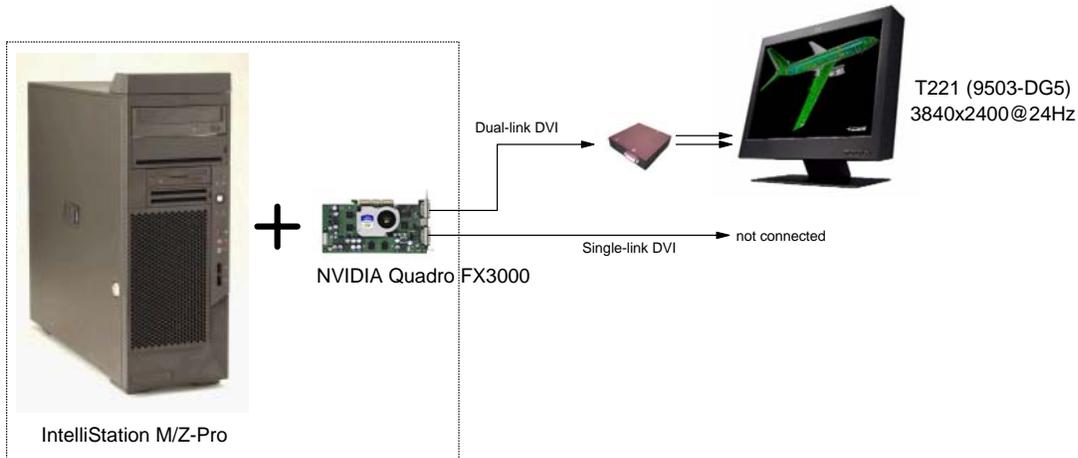
Driver level	Minimum as per FX2000 or FX3000
Graphics cards	FX2000 or FX3000 or FX4000 or FX3400
T221 EDID	002
Update rate	24Hz
Desktop	Single

(*) Note : Dual link converter should be connected to graphics card DVI connector that locates close to AGP or close to PCI express.

5. Single monitor, single+dual-link DVI (48Hz, DG5 only)

IntelliStation M/Z-Pro

Dual-link DVI

Single-link DVI

NVIDIA Quadro FX3000

T221 (9503-DG5)
3840x2400@48Hz
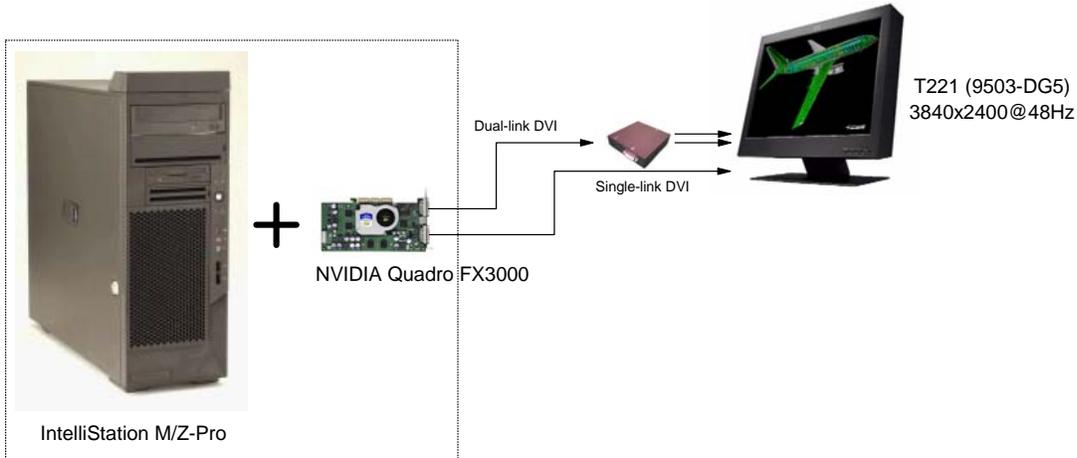
Driver level	53.03
Graphics cards	FX3000 or FX3400
T221 EDID	006
Update rate	48Hz
Desktop	Single (horizontal span via NVIEW utility)

(*) Note : Dual link converter should be connected to graphics card DVI connector that locates close to AGP or close to PCI express.

Multi-monitor configurations

1. Dual monitor configuration, twin single-link DVI (13Hz + 13Hz)

IntelliStation M/Z-Pro

Single-link DVI

Single-link DVI

NVIDIA Quadro FX3000

T221 (9503-DG3/5)
3840x2400@13Hz

T221 (9503-DG3/5)
3840x2400@13Hz
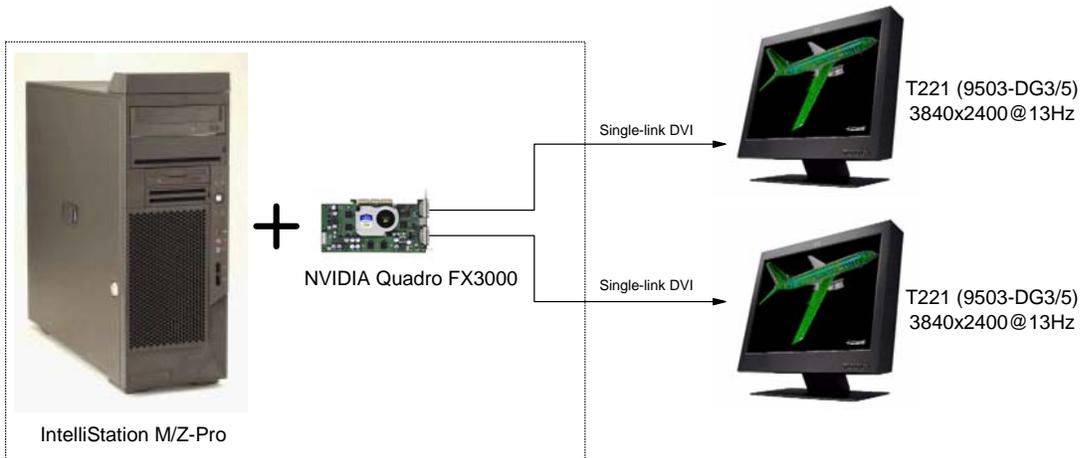
Driver level	Minimum as per FX3000	
Graphics cards	FX3000 Note: other dual output cards can be used as per the supported list, however features such as OpenGL, portrait operation etc. will be restricted due to memory limitations	
	Monitor 1	Monitor 2
T221 EDID	029 (default)	029 (default)
Update rate	13Hz	13Hz
Desktop	Single (horizontal span via NVIEW utility) Dual view (extend desktop via OS)	

2. Dual monitor configuration, single + dual-link DVI (13Hz + 24Hz, DG5 only)
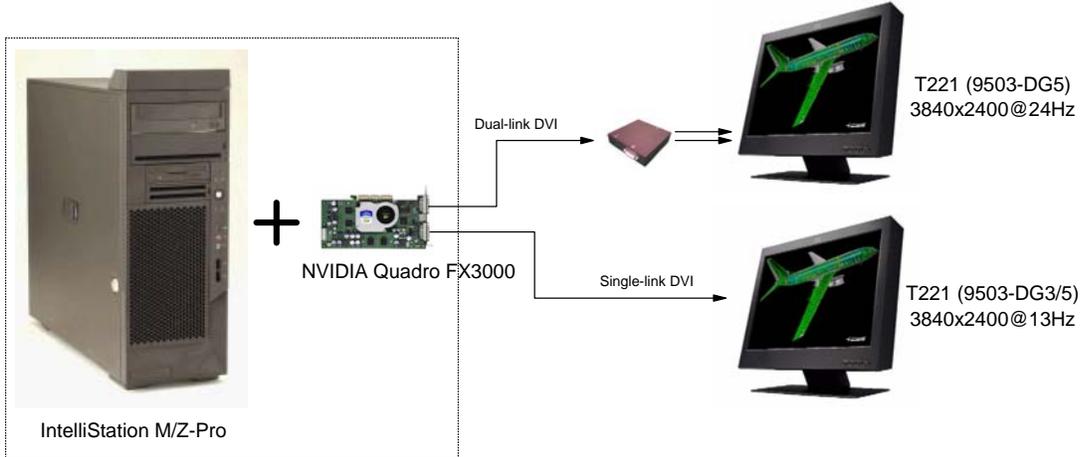
Driver level	Minimum as per FX3000 or FX3400	
Graphics cards	FX3000 or FX3400 Note: other supported dual output cards can be used, however full performance (OpenGL, portrait operation etc.) will be limited due to available memory limitations	
	Monitor 1	Monitor 2
T221 EDID	002	029 (default)
Update rate	24Hz	13Hz
Desktop	Single (horizontal span via NVIEW utility), Dual view (extend desktop via OS)	

(*) Note : Dual link converter should be connected to graphics card DVI connector that locates close to AGP or close to PCI express.

3. Dual monitor configuration, dual + dual-link DVI (24Hz + 24Hz, DG5 only)
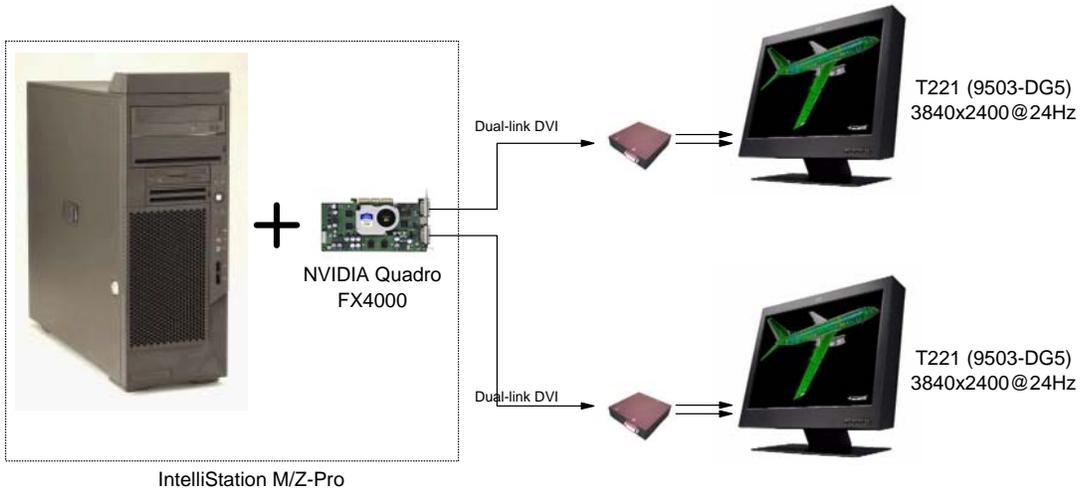
Driver level	Minimum as per FX4000	
Graphics cards	FX4000 Note: other supported dual output cards can be used, however full performance (OpenGL, portrait operation etc.) will be limited due to available memory limitations	
	Monitor 1	Monitor 2
T221 EDID	002	002
Update rate	24Hz	24Hz
Desktop	Single (horizontal span via NVIEW utility), Dual view (extend desktop via OS)	

GUI & application optimization (Windows)

The very high resolution of the T221 means that features of the graphical user interface (GUI), such as icons & fonts, become smaller. These can be adjusted through the 'display properties' window as per the following instructions.

Note: Many of these settings are subjective, and some users may prefer values different than those suggested here. Also, after these settings have been made, some application programs and system dialog boxes may still not be scaled properly. For information concerning operating system graphical user interface scaling features available to application developers, please contact Microsoft.

Win2000

1. Increase System Scaling Size (called Font Size)

Right click on the desktop background, and select properties to bring up the display properties window. (The display properties window can also be launched by sequentially selecting start/settings/control panel/display.) In sequence, select settings/advanced/general/font size/other. Set the font percentage to 213%, by typing in this number in the highlighted box. Click OK as necessary in the following pop-up boxes and reboot. (It is necessary to reboot at this point because the following steps depend upon the font setting.)

 2. Increase Mouse Pointer Sizes

Launch Control Panel by sequentially selecting start/settings/control panel. Click on the mouse icon, then select in sequence
Pointers/Scheme. Select Magnified from the list and click on OK.

3. Change other Windows Feature Sizes

As in step 1, launch Display Properties window, and select Appearance. Select the following items and make changes according to the table. You will have to click on apply for each entry individually.

Item	Size	Font Size	Font
Active Title Bar	36	8	MS Sans Serif
Active Window Border	1		
Caption Button	36		
Icon	50	8	MS Sans Serif
Icon Spacing Horizontal	95		
Icon Spacing Vertical	95		
Inactive Title Bar	36	8	MS Sans Serif
Inactive Window Border	1		
Menu	31	8	MS Sans Serif
Message Box		8	MS Sans Serif
Palette Title	31	8	MS Sans Serif
Scroll Bar	24		
Selected Items	31	8	MS Sans Serif
Tooltip		8	MS Sans Serif

4. Change taskbar icon sizes.

The taskbar contains a start button typically in the lower left corner, with the task bar running along the bottom of the screen. To the right of the start button are a number of quick launch icons for applications. Right click anywhere in the quick launch portion of the taskbar, that is not on an icon. A pop-up menu appears. Select view, then large. This increases the size of the quick launch icons.

5. Change Application user interface feature sizes.

Some applications, such as MS Office, Lotus Suite, and others allow icon sizes and other features to be changed through user preferences dialog. If possible, choose large icons for each application. For some applications, standard accessibility options provide an easy path to increasing icon size.

WinXP

1. Increase System Scaling Size (called Font Size).

Right click on the desktop background, and select properties to bring up the display properties window. (The display properties window can also be launched by sequentially selecting start/settings/control panel/display.) In sequence, select settings/advanced/general/DPI setting/custom setting. Set the custom DPI setting to 213%, by typing in this number in the highlighted box. Click OK as necessary in the following pop-up boxes, exit out of display properties dialog, and reboot. (It is necessary to reboot at this point because the following steps depend upon the DPI setting.)

2. Change Windows Feature Sizes.

For WinXP, many user appearance settings change automatically when the DPI setting is changed. This includes mouse pointer size. If you prefer an even larger mouse pointer, click on start, control panel, mouse icon, pointers, scheme, and set to Magnified (system scheme) or another preferred choice. Here are the default settings XP provides with DPI setting to 213% (204 ppi).

Item	Size	Font Size	Font
Active Title Bar	38	8	Tahoma
Active Window Border	2		
Caption Buttons	38		
Icon	50	8	Tahoma
Icon Spacing Horizontal	101		
Icon Spacing Vertical	101		
Inactive Title Bar	38	8	Tahoma
Inactive Window Border	2		
Menu	38	8	Tahoma
Message Box		8	Tahoma
Palette Title	32	8	Tahoma
Scroll Bar	34		
Selected Items	38	8	Tahoma
Tooltip		8	Tahoma

3. Change Application user interface feature sizes.

Some applications, such as MS Office, Lotus Suite, and others allow icon sizes and other features to be changed through user preferences dialog. If possible, choose large icons for each application. For some applications, standard accessibility options provide an easy path to increasing icon size.

Application dependent features

It may be necessary to adjust application settings (or, persuade the application developers to modify the source code). The attached article from Microsoft explains this further:

"How to write High-DPI Applications" by Nick Kramer msdn.microsoft.com

See http://msdn.microsoft.com/library/default.asp?url=/library/en-us/dngdi/html/highdpiapp.asp

Resolution Switching Utility

There may still be some cases were it's better to run applications at a lower resolution for some tasks, and at high resolution for others. A Windows 2000/XP utility is available to enable 'on the fly' switching between resolutions.

See http://www-1.ibm.com/support/docview.wss?rs=0&q=9503&uid=psg1MIGR-39635 for details.

Color Management

The T221 incorporates a brightness & color calibration facility. This enables the brightness and color characteristic of the monitor to be preset to match certain profiles.

A Windows 2000/XP utility is available which enables calibration profiles to be loaded into the T221.

See http://www-1.ibm.com/support/docview.wss?rs=0&q=9503&uid=psg1MIGR-39635 for details.

The utility has been tested in conjunction with calibration hardware & software from GretagMacbeth and IMAGE Smiths. The IMAGE Smiths VeriLUM tool supports T221 calibration to DICOM requirements.