# MICROTRONIX
# DX-2200
# DUAL-VIEW 2X1 SDI VIDEO SWITCHER

**USER MANUAL – VERSION 3.75**

4056 Meadowbrook Drive, Unit 126
London, ON Canada N6L 1E3
www.microtronix.com

## Document Revision History

This User Manual provides operating instructions and information on the Microtronix ***DX-2200 Dual-view 2x1 SDI Video Switcher***, (Model PN: DX-2200-SW-02).

The following table shows the document revision history.

| Date | Rev. | Description |
|---|---|---|
| Jan. 10, 2012 | 1.00 | Initial release |
| Nov. 12, 2012 | 1.01 | Added Digital zoom feature. |
| Jan. 09, 2013 | 1.02 | Added commands to show or hide a text string (this is in addition to the existing command to toggle visibility). |
| Feb. 14, 2013 | 2.00 | Revised Serial Command structure.<br>Added 1080i and 1080p video resolutions. |
| March 1, 2013 | 2.10 | Added NTSC and PAL resolutions.<br>Added text background & overlay transparency.<br>Added 'O' commands for output mode control.<br>Serial control mode changed to always be active. |
| March 12, 2013 | 2.20 | Added new commands to configure the control DIP & Toggle switches and changed the default DIP switch settings.<br>Removed the ML command.<br>Added font size 003 & 004. Add text field reset commands.<br>Strings in RS232 commands must now be enclosed in quotations.<br>Fixed a bug with I1, I2 commands in Overlay mode.<br>Added preset PiP sizes and control of x, y gap.<br>Increased number of text fields to 12.<br>Changes to RS232 input to support comment lines and ignore leading white spaces. |
| May 17, 2013 | 2.30 | Add Mode 7 – two images vertically stacked |
| June 27, 2013 | 2.31 | Added new section & Table 9: Low Level Text Control Commands & Codes |
| Aug 14, 2013 | 2.41 | Added new commands for a frame number counter text overlay.<br>Added a three digit 'Annn' command to control transparency with greater resolution. |
| Aug 26, 2013 | 2.50 | Added alpha blending transition effect in Alpha Blended Overlay Mode. (Table 6)<br>Added additional Frame Counter modes of operation. |
| Aug 30, 2013 | 2.51 | Added vertical and horizontal split screen in Alpha Blended Overlay Mode.<br>Changed transition commands from T to TP…<br>Added programmable size/position for the primary and secondary layers in Alpha Blended Overlay Mode |
| Sep 17, 2013 | 3.00 | Added zoom control commands for center position and window selection. |

| | | |
|---|---|---|
| | | Changed zoom to be controlled for selected/non-selected input instead of by input connector number.<br>Added alpha blending effects for secondary layer.<br>Changed second alpha set by TPB / TSB commands to apply to both transition effects and split screen modes.<br>For Mode 5, changed 'I1','I2','IT' to switch inputs and 'T' to apply inverse alpha for visibility reversal of the two inputs.<br>Added support for setting size in Alpha Blended mode in percent. |
| Nov 28, 2013 | 3.01 | Fix a problem causing improper configuration or no video output when the unit powers up with a saved configuration and the video inputs have been connected before power up.<br>Add S0, S1, ST commands. |
| Mar 18, 2014 | 3.10 | Add firmware update capability over RS232.<br>Add SnnSN, SnnHN, SnnVN commands to change text field visibility without updating the display.<br>Changes to command parsing. |
| Nov 14, 2014 | 3.20 | Add support for Rev E PCB.<br>Fonts are loaded at first use instead of power up so the unit starts faster.<br>Add fonts containing selected Wingding characters<br>Add selected extended ASCII characters to the Tahoma fonts. |
| Feb 11, 2015 | 3.50 | Add new 'S' commands to support rectangle drawing and graphic images on the overlay.<br>Add section about the DX-2200 Uploader.<br>Add the 'L' commands to control the overlay layer.<br>Add baud rate change command.<br>Product now supports 48 fields on the overlay layer instead of 12.<br>Add more information about image field transparency and background. |
| Jun 03, 2015 | 3.60 | Add additional Tahoma fonts<br>Add capability for G and S commands to operate on a range of fields<br>Add S/GnnNm and S/GnnJmm commands. |
| Jun 25, 2015 | 3.61 | Add additional Tahoma size 48 fonts and Bitstream Vera Mono Fonts<br>Updated Model number due addition of SDI Loop Output port and new enclosure<br>Update pictures of the enclosure and the DX-2200 board assembly |
| Oct 04, 2016 | 3.65 | Fix an issue causing slow updates in the SF0 buffer update mode |
| Jan 17, 2017 | 3.66 | Fix a problem with the 'TD' command.<br>Add PiP position presets P5, P6, P7, P8<br>Add U2 command<br>Add the APn and AFn transparency commands<br>Changed default DIP switch control mode to U2<br>Add RIn, RSn commands to report input video resolution |
| Apr 04, 2017 | 3.67 | Changed the zoom range permitted and updated the command description |
| Jul 20, 2017 | 3.68 | Added one additional arrow character to the Wingding fonts at code 005F |
| Aug 15, 2017 | 3.69 | Add zoom commands ZSP2, ZPP2, ZSP3, ZPP3, ZSLA, and ZPLA. |
| Aug 24, 2017 | 3.70 | Added configuration bypass function |

| | | |
|---|---|---|
| Aug 29, 2017 | 3.71 | Fix an issue when using ZSP3 / ZPP3 mode with interlaced video |
| Feb. 6, 2018 | 3.72 | Updated Appendix C outlining Serial Port Communication<br>Added section numbering to document layout |
| Mar. 21, 2018 | 3.75 | Updated the Tahoma 18 regular font to correct a character spacing issue |

**NOTE:** The graphics overlay feature requires the use of the ***DX-2200 Software Uploader*** utility which is used to upload graphic images into the unit. Contact *support@microtronix.com* for the latest release of the DX-2200 firmware and the Software Uploader utility.

# How to Contact Microtronix

## E-mail:

Sales Information: sales@microtronix.com
Support Information: support@microtronix.com

## Website:

General Website: http://www.microtronix.com
FTP Upload Site: http://microtronix.leapfile.com

## Phone Numbers:

General: (01) 519-690-0091
Fax: (01) 519-690-0092

## Product Design Customizations

Microtronix can customize the functionality of the **Dual-view 2x1 SDI Video Switcher** software to customer requirements. Contact Microtronix sales (sales@microtronix.com) with your requirements.

# Safety Critical & Life System Applications – Notice to User

The Microtronix DX-2200 SDI Video Products are not designed or approved by Microtronix for use in **safety-critical** or **life-critical system** or application in which a failure or malfunction may result in one (or more) of the following outcomes: (a) death or serious injury to people, (b) loss or severe damage to equipment/property, or (c) environmental harm.

Microtronix assumes **no liability** for any consequential damages – whether direct or indirect – if the product is used in this type of application.

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# 1 Key Product Features

The key hardware features of the ***DX-2200 – Dual-view 2x1 SDI Video Switcher*** (Model PN: DX-2200-SW-02) includes:

- Two 75Ω SD/HD-SDI input ports
- Two 75Ω SD/HD-SDI output ports
  - One the Switcher output
  - One loop through output of SDI input port 1
- One DB9, RS-232 Serial Control Port

**Note:** With custom DX-2200 firmware, the RTS & CTS modem signals on the DB9 RS-232 Serial Port can be configured to operate as a second Serial Data Port with RS-232 Receiver and Transmitter signals. A custom serial "Y" cable is used to bring out the two ports.

## 1.1 Supported Functionality

The DX-2200 2x1 SDI Switcher supports the following functionality:

- Digital switching between 2 SDI inputs using switches or a serial control port commands
- Glitch-free video switching between SDI inputs and modes of operation
- Video formats:
  - 720p @ 25 / 29.97 / 30 / 50 / 59.94 / 60 fps
  - 1080i @ 25 / 29.97 / 30 fps
  - 1080p & 1080PsF @ 23.98 / 24 / 25 / 29.97 / 30 fps
  - NTSC @ 59.94 fps
  - PAL @ 50 fps
- Video Modes:
  - 2x1 (Full-screen) Switcher
  - Alpha blended Picture-in-Picture with size and position control,
  - Dual view, Picture-and-Picture,
  - Split screen,
  - Alpha blended overlay, and
  - Standby switcher.
- Text overlay OSD:
  - Up to 48 independent Graphic Fields
  - Fields support Text, Rectangle, Corner Marker, Target Marker, and Image Field types.
  - Filled or open rectangles
  - Size, color, transparency and position control
  - Configurable background color for text
  - Alpha blended text and background
  - Alpha blending of graphic fields
- Output video Frame Counter text overlay display,
- Alpha blended video switching transition effects,
- Digital Zoom: 28 steps of 0.25 from 1x to 8x,
- User defined operation of DIP & Toggle switches

**Note:** The text/graphics overlay OSD is supported in progressive but not in either interlaced or Progressive segmented Frame (PsF) video formats.

# 2 Introduction

The Microtronix ***DX-2200 – Dual-view 2x1 SDI Video Switcher*** **(Model Part Number: DX-2200-SW-02)** is a high performance dual input SDI Video Switcher supporting enhanced video capabilities including: 2x1 glitch-free video switching, picture-in-picture (PiP), picture-and-picture (PAP), Split-Screen, text overlay / on screen display (OSD), Alpha Blending and Digital Zoom. The product is available as a stand-alone product in an aluminum enclosure or as an open printed circuit board for incorporation into embedded video system. The unit is designed for use in broadcast, professional video recording and high-end surveillance applications.

To ensure glitch-free continuous/artifact free video output, the two input SDI video streams are firstly frame synchronized then switched during the vertical interval period when a frame is complete. Additional frame buffers are used to eliminate artifacts which can occur when operating in a PiP or PAP mode during which scalers or clippers are being used.

When processing interlaced video, a field detector is used to synchronize the input frame buffers and video processing to ensure the correct alignment of the video fields when switching between the video streams or swapping PiP or PAP displays. The output video format can be the same as the format detect on the SDI input 1 (SDI-1) video source, or can be programmed independently.

The product supports synchronized switching of SD / HD SDI video formats. Text overlay is supported on progressive video only.

The units can be configured to retain the user configuration in on-board flash during power ON / OFF power cycles.

## 2.1 Text Overlay OSD Features

The DX-2200-SW supports text overlay OSD in all display modes of operation. Features of the text overlay OSD include:

1) Display of 48 independent Fields of up to 96 characters.
2) Alpha blending of the text on the video screen.
3) Active Frame Counter.
4) Independent color selection of text fields.
5) Configurable background color.
6) Opacity control.
7) Independent ON/OFF control of text fields.
8) X-Y position control.
9) Permanent retention of text fields in flash memory.
10) Eight font / text size combinations.

The text is supplied to the DX-2200 Switcher through the RS-232 serial port. The user can optionally store the text fields in the on-board flash in which case they will be retained power ON/OFF power cycles.

**Note:** The Text/graphic overlay feature is supported in progressive video formats only.

# 3 Hardware

The ***DX-2200 – Dual-view 2x1 SDI Video Switcher*** is available as a stand-alone product supplied in an enclosure as show in **Error! Reference source not found.** below or as an open-frame board (for building into embedded video system) as shown in **Error! Reference source not found.** shown in **Appendix B**.


**Figure 1: DX-2200 – Dual-view 2x1 SDI Video Switcher**

## 3.1 Power & Operating Requirements

The DX-2200-SW product is powered from either a 5 – 12Vdc 10W (100-240VAC 50/60Hz) regulated switching power adapter with a 2-pin circular plug (female) connector (Switchcraft PN: 16282-2SG-311), or optionally from a 14.4V Lithium ion brick battery.

### 3.1.1 AC Power Adapter

The DX-2200-SW unit has a current draw of 650mA when operating from at 12VDC regulated power source.

A picture of the AC power adapter is shown in the figure below.


**Figure 2: 12Vdc 1.33A 100-240VAC Power Adapter**

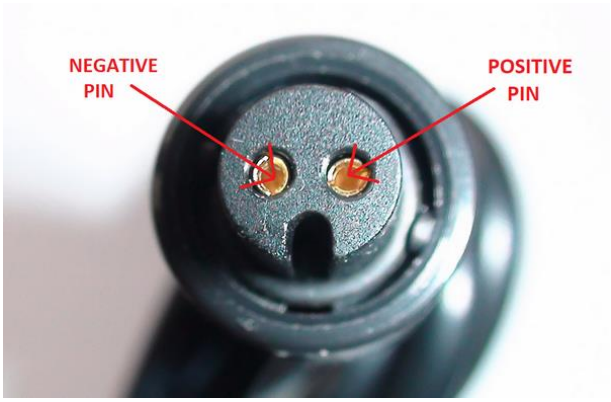


**Figure 3: Pin Assignments of 2-pin Power Plug**

### 3.1.2 Example of 14.4VDC Lithium Battery

A picture of a 14.4VDC the AC power adapter is shown in the figure below.


**Figure 4: 14.4VDC Lithium Batter and D-TAP Cable**

Microtronix does not sell Lithium Ion batteries. The 14.4VDC D-TAP adapter cable (shown in the figure above) can be ordered using Microtronix part number D-TAP-2P-C

## 3.2 Environmental Operating Limits

The DX-2200 unit uses passive convection cooling based on unrestricted airflow around the unit. The environmental operating limits are as follows:

| | |
|---|---|
| Ambient Temperature Range: | 0C to 40C |
| Relative Humidity: | 0 to 95% non-condensing. |

# 4 Operation

## 4.1 Display Modes

The DX-2200 Switcher supports the display of the SDI video either full-screen or in a variety of dual-viewer window modes. The display modes include:

- Mode 1: Full-screen 2x1 Switcher
- Mode 2: Picture-in-Picture,
- Mode 3: Dual view, Picture-and-Picture – side-by-side,
- Mode 4: Split screen,
- Mode 5: Alpha blended overlay, and
- Mode 6: Standby Switcher.
- Mode 7: Dual view, vertically stacked

The Text Overlay (On Screen Display) is supported in all Display Modes for progressive video formats only. The Text Overlay is always the top layer in the output video mix.

The Frame Counter capability is supported in all Display Modes for progressive video formats only.

The Zoom capability is supported in all Display Modes. Either input can be zoomed. Except in Display Mode 4 (Split Screen), the zoom can be configured either as zoom percentage and center position, or as top left corner and size. In Display Mode 4, only the zoom factor can be set and the zoom position cannot be changed.

### 4.1.1 Display Mode 1: Full-screen 2x1 Switcher

In the Full-screen Switcher mode, the selected input is displayed full screen and the unit can switch from one input to the other.

### 4.1.2 Display Mode 2: Picture-in-Picture

In Picture-in-Picture (PiP) mode, the selected input is displayed full and the other input is displayed as a picture in picture with configurable size, position and transparency (alpha blending). Using either the toggle switch or serial commands, the DX-2200 can switch between the inputs selected for display full screen and for the PiP.

### 4.1.3 Display Mode 3: Dual view, Picture-and-Picture

In the Picture-and-Picture (PAP) mode, the images are scaled to display both sources side by side. The selected input is displayed on the left side of the screen, and the other input is displayed on the right.

Using either the toggle switch or serial commands, the DX-2200 can switch inputs to interchange the left and right side images.

### 4.1.4 Display Mode 4: Split Screen

In the Split Screen mode, half of each input image is displayed. The left half of the selected input is displayed on the left side of the output video, and the right half of the other input is displayed on the right side of the output video.

Using either the toggle switch or serial commands, the DX-2200 can switch inputs to interchange the left and right side images.

### 4.1.5 Display Mode 5: Alpha Blended Overlay

In the Alpha Blended Overlay mode, both images are displayed with configurable alpha blending of the images. The selected input is displayed over a black background, with the non-selected layer mixed on top of it. The alpha of each input can be adjusted and the two images can be zoomed, moved, and re-sized in the output video.

### 4.1.6 Display Mode 6: Standby Switcher

The Standby Switcher automatically switches between the two inputs sources. The selected input is the preferred source, but if no signal is available the other source will be displayed. The DX-2200 returns to the preferred source if the signal is restored.

### 4.1.7 Display Mode 7: Dual-view, Vertically Stacked

In the dual-view vertically stacked mode, the images are scaled to display both sources one above the other. The selected input is displayed at the top of the screen, and the other input is displayed below it.

Using either the toggle switch or serial commands, the DX-2200 can switch inputs to interchange the upper and lower images.

## 4.2 Sample Outputs

Samples of the various output display modes are shown in the following figures.


**Figure 5: Digital Zoom PiP**


**Figure 6: Dual-view – Picture-and-Picture display with text & time code Frame Counter**


**Figure 7: Dual-view – Vertically Stacked with text OSD**


**Figure 8: Alpha Blended PiP with Text Overlay OSD**

## 4.3 Default Startup Configuration

The power up configuration is determined by both the DIP switch setting and the configuration saved in flash. The factory default setting has no saved configuration in flash and the following DIP switch settings:

### Table 4: Default DIP switch (SW4) setting

| Switch | Setting |
|---|---|
| 1 | Off |
| 2 | Off |
| 3 | Off |
| 4 | Off |

The factory default power on or reset configuration is set to operate in Mode 1, the full-screen 2x1 video switcher. The unit will initially display SDI input 1 (SDI-1) on the output. If there is no input signal (or if it cannot be properly detected), the SDI output will display black.

User specific setups can be stored in flash to enable the DX-2200 to start in other modes, for example, with a PiP or PAP configuration or with a preset text overlay.

## 4.4 LED Status Indicators

The location of the 5 LEDs is show in the following two figures.

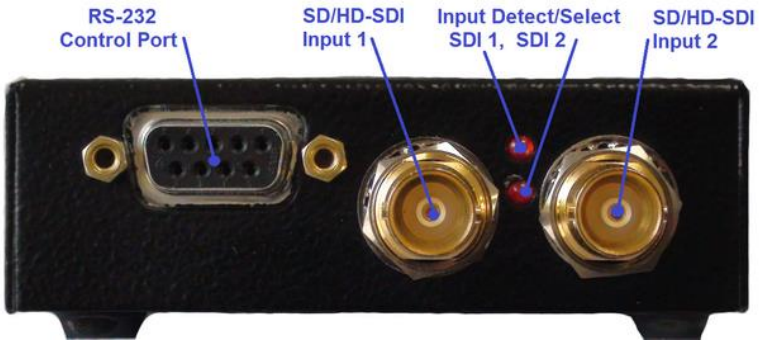


Figure 9: SDI Input LEDs

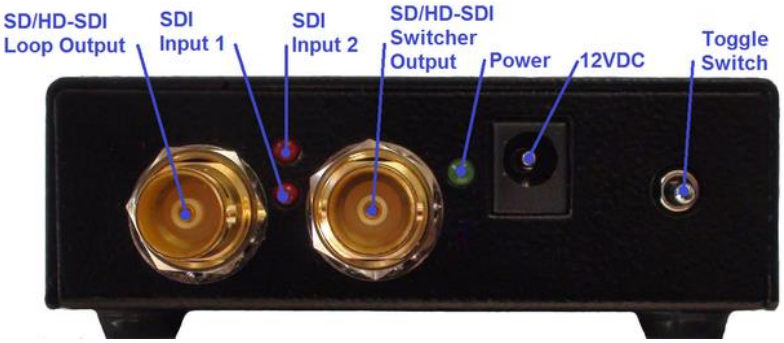


Figure 10: SDI Out & Power LEDs

The operation of the LEDs is summarized in Table 1 below.

### Table 1: Description of LED Status Indicators

| LED | Color | Use | Mode of Operation |
|---|---|---|---|
| Input-Top (Board D4) | Red | SDI Input 1 | **OFF:** SDI 1 input not available<br>**Flashing:** SDI 1 input available<br>**ON:** SDI 1 input available and selected as primary input |
| Input-Bottom (Board D4) | Red | SDI Input 2 | **OFF:** SDI 2 input not available<br>**Flashing:** SDI 2 input available<br>**ON:** SDI 2 input available and selected as primary input |
| Input (Board D3) | Green | Power | **ON:** Power ok |
| Output-Top (Board D5) | Red | SDI Input 1 Out | **OFF:** SDI 1 input not available<br>**Flashing:** SDI 1 input available<br>**ON:** SDI 1 input available and selected as primary input |
| Output-Bottom (Board D5) | Red | SDI Input 2 Out | **OFF:** SDI 2 input not available<br>**Flashing:** SDI 2 input available<br>**ON:** SDI 2 input available and selected as primary input |

## 4.5 Output Video Format

The settings of the DX-2200 and the video source connected to SDI input 1 (SDI-1) determine the output video format. The output video has three Modes of operation:

**Output Mode 1:** The output video format is the same as the SDI Input 1 format.

**Output Mode 2:** The output video format (resolution and frame rate) is set to a specific format that was set by a SERIAL Control command.

**Output Mode 3:** The output video format is the same as the SDI Input 1 format and the clock frequency is locked to the source frequency.

### 4.5.1 Video Output Modes 1 & 3

The default output video format is Mode 1 in which the SDI output is the same format as on SDI input 1. The mode can be changed by a SERIAL control command. Refer to Output Format SERIAL Command Codes (See Table 22) for details of the commands used to change the output video modes.

When operating in Output Mode 1 or Mode 3 (assuming the SDI-1 video source is recognized as one of the supported video formats) the DX-2200 will reconfigure itself to match the output video to the detected input format. Reconfiguration of the output video format momentarily stops video output. When no video is connected to SDI input 1, or if the format is not recognized, the unit will continue to operate without changing the output video format.

### 4.5.2 Video Output Mode 2

When operating in Video Output Mode 2, the output video resolution and frame rate is determined exclusively by the setting programmed into the DX-2200 by a SERIAL Control command. See commands listed in Table 22.

### 4.5.3 Default Output Video Mode

The factory default output video format is 720p 60 fps. If the unit is powered up, or reset by the factory reset SERIAL command, or reset by pressing the reset pushbutton when the board is out of the enclosure, without a video source connected to SDI input 1, then it will operate at 720p, 60 fps. The default video mode can be changed by saving a configuration to flash while the unit is operating with a different video format.

## 4.6 Input Video Format

When a supported video format is connected to one of the SDI Input connectors, the DX-2200 will recognize the signal and illuminate the corresponding LED.

Depending on the operating settings of the DX-2200, the format of the video connected to SDI input 1 may determine the output video format. If the SDI-1 video format is changed the unit may switch to a different output video format. The format of the video source connected to SDI Input 2 (SDI-2) never has any effect on the output format.

If the video source connected to SDI Input 2 has a different resolution or frame rate than the source connected to SDI Input 1, the DX-2200 will apply frame repetition, frame dropping, or scaling as required to convert the video to the format that is being output.

The DX-2200 does not convert between progressive and interlaced video formats. If the video source connected to an input is interlaced (or PsF) when the output format is progressive, or if the video source is progressive when the output format is interlaced (or PsF), then the Input will not be recognized. The indicator LED will be OFF and the video source cannot be selected for display.

The Text Overlay OSD remains available when the input video sources are not present.

## 4.7 Video Buffering and Delay

When operating with progressive video, the DX-2200 uses two frame buffers in each input path. Each buffer will delay by a minimum of one frame and a maximum of two frames, giving a total delay of between two and four frames on each input. The frame buffers account for the majority of the video delay through the DX-2200. Other elements in the video processing path will add additional delays of a few lines of video.

When operating in interlaced video modes, an additional frame buffer is required in the video output path. This buffer adds an additional delay of between one and two frames to the video path.

The actual delay will depend on the timing of the connection of the input signals and the phase relationship between the inputs if they are not locked to each other.

Depending on operation conditions, the video delay may remain constant, or may vary over time. The DX-2200 does not require the two video inputs to be synchronized, and the output video can either be locked in frequency to input 1, or use an internally video clock. When different video clocks are used, small differences between the clocks will cause the video delay to change. If the output clock is slower than the input clock, video will accumulate in the frame buffers until a frame is dropped to prevent buffer overflow. When the output clock is faster than the input clock, the length of video in the buffers will decrease until a frame must be repeated to prevent buffer underflow. If all video clocks are derived from the same source and are identical in frequency, the delay through the DX-2200 will remain constant.

## 4.8 SERIAL & MANUAL Control

The DX-2200 Switcher has two methods of control: SERIAL Control using the RS232 port, and MANUAL Control using the DIP switch and Toggle switch. SERIAL Control allows control full of the capabilities of the DX-2200, and MANUAL Control provides a subset of functions.

SERIAL Control is always active. In the factory default configuration the Toggle Switch and DIP switch are active.

The functions of the DIP switch and Toggle switch can be reconfigured by SERIAL Control commands to customize the Switcher so that the controls provide the set of functions required for a specific user application. The modified configuration can be saved on board in the flash configuration memory

### 4.8.1 SERIAL Mode of Operation

When SERIAL control is used, the DX-2200 Switcher is controlled via commands sent to the DB9 Serial Control Port.

The serial port of the computer connected to the DX-2200 should be configured for 115,200 baud, 1 stop bit, and no flow control.

The DX-2200 product is supplied with a **USB 2.0 to DB9 RS-232 Serial Port Adapter Kit** (PN: 811-USB-RS232 Kit) to connect the DB9F Serial Port to a USB 2.0 port of a PC or laptop. The Kit consists of a USB 2.0 to RS232 DB9 Serial Adapter Cable (StarTech PN: ICUSB232V2) and a 6 foot male to female DB9 RS232 serial cable. Refer to Error! Reference source not found. for more information.

#### *4.8.1.1 Serial Port Control Commands*

In the SERIAL mode commands sent to the Serial Control Port control the operation of the DX-2200. Commands consist of ASCII alpha-numeric codes and are not case sensitive. All serial commands are terminated with a carriage return (CR), a line feed (LF), or a semicolon. The use of a semicolon terminator allows more than 1 command per line to improve readability of script files.

Commands may be sent directly to the DX-2200 one character at a time using a terminal program running on a connected computer, or they may be developed in a text editor such as Notepad and then uploaded to the DX-2200 by the terminal program. The second method has the advantage of allowing the commands to be saved, viewed, edited and resent. The text editor used must save the configuration files as 8 bit ASCII data.

Space or tab characters before a command or trailing a command are ignored, as are spaces or tabs following a comma that separates parameters within a command. Any characters on a line following a tick (') character are treated as comments. A comment may begin after a delimiter, or may follow a command with or without spaces or tabs between the command and the comment.

ASCII string parameters are delimited with quotation marks. If a quotation mark or backslash character is required within a string (for example to display as part of a text overlay), then it must be preceded by a backslash character.

Valid and invalid serial commands are acknowledged with a '+' and '-' response respectively. Carriage return, line feed, or semicolon characters without a preceding command are acknowledged with a '*'.

The command codes are extensible, additional commands and functionality can be added as required. Contact Microtronix sales or technical support with your requirements.

### Table 2: Serial Port Command Acknowledgement Codes

| Response Code | Mode of Operation |
|---|---|
| + | Valid command received |
| - | Invalid command received |
| * | Valid CR, LF, or semicolon received |

#### *4.8.1.2 Input Selection SERIAL Commands*

The Input Selection SERIAL Commands, (see Table 1 Table 4), are used to select the SDI input. Switching between SDI inputs is supported at all video resolutions. The table below shows the function of the selected input and the non-selected input for each Display Mode.

### Table 3: Function of the Inputs for Each Display Mode

| Mode of Operation | Selected Input | Non-Selected Input |
|---|---|---|
| Display Mode 1:<br>Full-screen 2x1 Switcher | Full Screen Output | Not Visible |
| Display Mode 2:<br>Picture-in-Picture | Full Screen Background | PiP |
| Display Mode 3: Dual view,<br>Picture-and-Picture | Left Image | Right Image |
| Display Mode 4:<br>Split Screen | Left half of the source is is displayed as the left half of the output video | Right half of the source is displayed an the right half of the output video |
| Display Mode 5:<br>Alpha Blended Overlay | Mixed onto a black background. | Mixed on top of the selected input and background |
| Display Mode 6:<br>Standby Switcher | The preferred source. Displayed full screen if present | Alternate source displayed when preferred source not present |
| Display Mode 7:<br>Dual-view, Vertically Stacked | Displayed at the top of the screen. | Displayed at the bottom of the screen |

The ‘I1’ and ‘I2’ Input Selection Commands can select a specific input, or the ‘IT’ command can be used to select the other input.

The ‘T’ command has a function that depends on the operating mode. In Alpha Blended Overlay Mode, the ‘T’ command changes the alpha of the non-selected input to the inverse of the current value. When Alpha Blended Overlay Mode has the two inputs in the same location in the output video, the ‘T’ command has the effect of reversing the visibility between the two layers. In all other modes, the ‘T’ command performs the same function as the ‘IT’ command.

**NOTE:** Using the ‘T’ command to apply the inverse alpha to the non-selected input provides the highest quality switch between the two inputs when operating in Alpha Blended Overlay mode when both inputs are overlaid with partial visibility. If Alpha Blended Overlay mode is reconfigured so that the two inputs are not overlaid, then the ‘T’ command cannot be used as a switching command and ‘I1’, ‘I2’, or ‘IT’ must be used instead.

### Table 4: Input Selection SERIAL Command Codes

| Command Code | Mode of Operation |
|---|---|
| Input Selection Commands | |
| I1 | Select input 1 |
| I2 | Select input 2 |
| IT | Swap Inputs |
| T | In Display Mode 5, change the alpha of the non-selected input to the inverse of the current value to reverse visibility of the inputs.<br>In all other Display Modes, this command performs the same functions as the ‘IT’ command. |

#### *4.8.1.3 Input Auto Switch SERIAL Command*

The Input Auto Switch Commands are used to set auto switch mode on or off.

When auto switch is on, the **DX-2200** will automatically switch inputs if the selected input source is not available for display, but the other input is available.

Mode 5 (Alpha blended Overlay) does not support auto switch.

Mode 6 (Standby Switcher) is not affected by the auto switch setting and will always switch when the preferred input is not present but the other input is present.

### Table 5: Input Auto Switch Serial Command Codes

| Command Code | Mode of Operation |
|---|---|
| Input Selection Commands | |
| IA | Toggle auto switch between on / off |
| IA0 | Set auto switch off |
| IA1 | Set auto switch on |

#### *4.8.1.4 Alpha Blending Effects SERIAL Commands*

In the Alpha Blended Overlay Mode (Mode 5), the DX-2200 uses alpha blending to provide Transition Effects and Horizontal or Vertical Alpha Split modes. The difference between the wipe Transition Effects and the Alpha Split modes is that the transition effects automatically move the alpha transition point across the video after the effect has been triggered, and the Alpha Split modes allow manual control of the position of the alpha transition.

In the Alpha Blended Overlay mode, the video from both inputs is mixed into the output video and each video source can be independently sized and positioned in the output video. The selected input is mixed onto a black background. The other input is mixed on top of the selected input. The Alpha Blending effects operate only within the output video window of the source to which the effect is applied and change the alpha blending of the source as it is mixed into the output video.

When Alpha Blending Effects are applied to the selected layer, they change the transparency of the layer and determine the mix between the selected layer and the black background behind it. When applied to the non-selected layer, the Alpha Blending Effects determine the mix between the non-selected layer and the layers behind it, which could be the black background, the selected layer, or a mix between them.

When the two inputs are the same size and in the same position in the output video, the Alpha Blending effects can be used to switch from one input to the other by changing the top layer in the mix (the non-selected layer) from fully visible to fully transparent. The Transition Effects will then provide an automatic progressive switch from one image to the other, and the Horizontal / Vertical Alpha Split modes will provide a split image where the change from one layer to the other can be set (and changed) by Serial Commands.

The Alpha Blending Commands beginning with ‘TS’ affect the selected layer, and the commands beginning ‘TP’ affect the non-selected layer.

The DX-2200 provides Wipe effects in 4 directions and a fade effect. The rate of change for the Wipe effect is programmable in units of pixels per frame with the ‘TPI’ or ‘TSI’ command. The rate of change for the fade is programmable in units of alpha per frame by using the ‘TPA’ or ‘TSA’ command. After the Transition Effect completes, the Alpha blending value for the input is changed to a new value.

**Note:** If other commands that change the alpha of the transitioning input are executed during a Transition Effect, they won’t be applied until the transition completes.

The Horizontal Alpha Split and Vertical Alpha Split modes do not automatically move the transition point. They operate continuously until disabled by the 'TP0' or 'TS0' command, or by selecting a different Alpha Blending Effect. For each video frame, the initial alpha value is applied to the pixels before the transition row or column. For pixels after the transition point, a second alpha is applied. The 'TPS' or 'TSS' command sets the transition point to a specific row or column position. The row or column refers to a position within the output video window that the effect is applied to. For example if Input 1 is displayed in a 640x360 pixel window, then the range of transition points for the vertical split can be set at positions from 0 to 639 pixels, regardless of the output video format or the location of the 640x360 pixel window in the video. Unlike the Transition Effects, the Alpha Split modes do not permanently change the alpha of the input.

For all Alpha Blending Effects, the default alpha after the transition is the inverse of the initial value; A fully visible layer changes to fully transparent and vice-versa.

**Note:** If the initial alpha is set for half visibility, the transition effects will change from half visibility to the inverse, also half visibility, and no change will be visible on the output.

The 'TPB' or 'TSB' command can be used to set a specific alpha value to be used after the transition instead of the default alpha. If the alpha set in the command is the same as the initial alpha, then no change will be visible at the output.

### Table 6: Alpha Blended Overlay Transition Effects

| Command Code | Mode of Operation |
|---|---|
| Transition Effect Commands | |
| TP0 | Non-selected Layer: Complete any transition effect immediately or exit from the Alpha Split Modes |
| TP1 | Non-selected Layer: Wipe from Top to Bottom |
| TP2 | Non-selected Layer: Wipe from Bottom to Top |
| TP3 | Non-selected Layer: Wipe from Right to Left |
| TP4 | Non-selected Layer: Wipe from Left to Right |
| TP5 | Non-selected Layer: Fade |
| TP6 | Non-selected Layer: Horizontal Alpha Split |
| TP7 | Non-selected Layer: Vertical Alpha Split |
| TPInnnn | Non-selected Layer: Set the transition speed in units of pixels per frame for the wipe modes. 'nnnn' is a positive integer between 1 and 4 digits in length. |
| TPAnnnn | Non-selected Layer: Set the transition speed for the fade mode in units of alpha change per frame. 'nnnn' is a positive integer between 1 and 4 digits in length and between 1 and 255 in value. |
| TPSnnnn | Non-selected Layer: Set the transition point for the Split Screen Modes. 'nnnn' is the row or column number and can be between one and four digits in length. |
| TPBnnnn | Non-selected Layer: Set the alpha value used in the Horizontal and Vertical Alpha Split modes for pixels after the transition point. 'nnnn' is an integer of between one and four digits in length. The valid range for alpha is 0 to 255.Setting a value greater than 255 causes the DX-2200 to use the default alpha, which is the inverse of the initial alpha. |
| TS0 | Selected Layer: Complete any transition effect immediately or exit from the Alpha Split modes. |
| TS1 | Selected Layer: Wipe from Top to Bottom |
| TS2 | Selected Layer: Wipe from Bottom to Top |

| | |
|---|---|
| TS3 | Selected Layer: Wipe from Right to Left |
| TS4 | Selected Layer: Wipe from Left to Right |
| TS5 | Selected Layer: Fade |
| TS6 | Selected Layer: Horizontal Alpha Split |
| TS7 | Selected Layer: Vertical Alpha Split |
| TSInnnn | Selected Layer: Set the transition speed in units of pixels per frame for the wipe modes. 'nnnn' is a positive integer between 1 and 4 digits in length. |
| TSAnnnn | Selected Layer: Set the transition speed for the fade mode in units of alpha change per frame. 'nnnn' is a positive integer between 1 and 4 digits in length and between 1 and 255 in value. |
| TSSnnnn | Selected Layer: Set the transition point for the Split Screen Modes. 'nnnn' is the row or column number and can be between one and four digits in length. |
| TSBnnnn | Selected Layer: Set the alpha value used in the Horizontal and Vertical Alpha Split modes for pixels after the transition point. 'nnnn' is a number of between one and four digits in length. The valid range for alpha is 0 to 255.Setting a value greater than 255 causes the DX-2200 to use the default alpha, which is the inverse of the initial alpha. |

#### 4.8.1.4.1 EXAMPLE 1A:

- Set the DX-2200 to the Alpha Blended Overlay Mode (Mode 5),
- Set the alpha to full visibilty to provide a hard switch between the two input images, and
- Use the Vertical Alpha Split Mode to split the screen vertically with the split position at column 400.

The SERIAL Commands are as follows:

M5
A0
TPS400
TP7

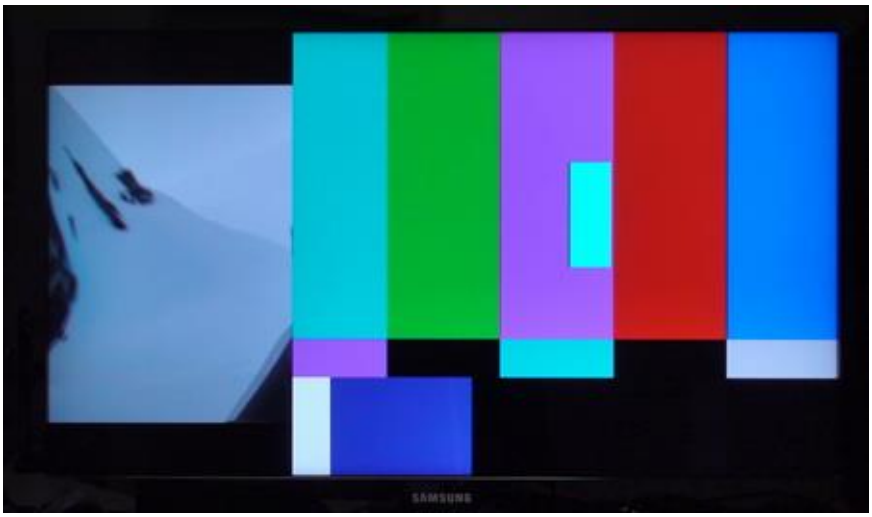

**Figure 11: Alpha Blended Vertical Split column 400 – Example 1a**

**Note:** It is possible for a user to create special wipe effects by writing software on a PC to issue a continuous string of TPSxxx SERIAL commands to wipe the video across the display as desired by the user.

#### 4.8.1.4.2 EXAMPLE 1B:

Starting from Example 1, move the split position to column 900.

TPS900

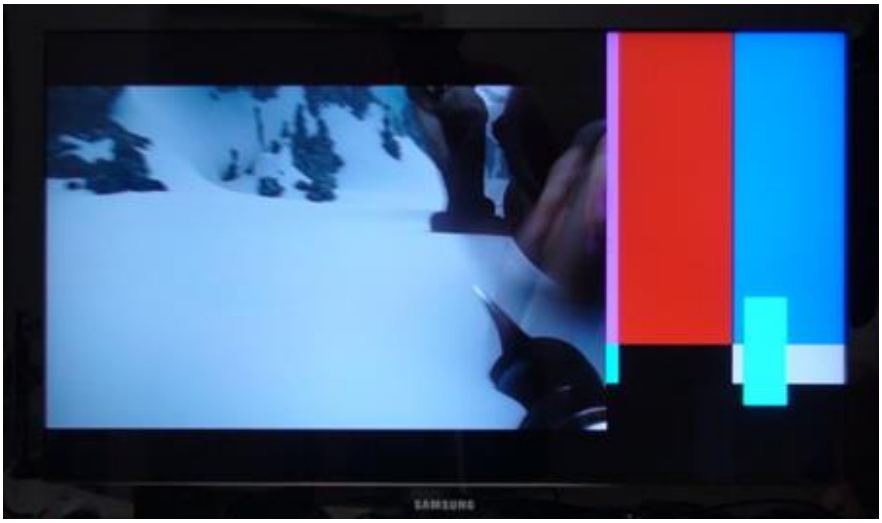

Figure 12: Alpha Blended Vertical Split column 900 – Example 1b

### *4.8.1.5 Mode Control SERIAL Command*

The Mode Control SERIAL Command selects between: 2x1 Full-screen Switcher, PiP, PAP Split Screen, Alpha Blended Overlay, Standby Switcher, and the Vertically Stacked modes of operation.

The Mode Commands are listed in Table 7 **Error! Reference source not found.**below.

### Table 7: Mode Control SERIAL Command Codes

| Command Code | Mode of Operation |
|---|---|
| Mode Control Commands | |
| M1 | Full screen 2x1 switcher mode |
| M2 | PiP mode |
| M3 | PAP (side-by-side) mode |
| M4 | Split-screen mode |
| M5 | Alpha Blended Overlay |
| M6 | Standby switcher mode |
| M7 | Vertcially Stacked mode |

### *4.8.1.6 Alpha Blended Overlay Size and Position SERIAL Commands*

When operating in Alpha Blended Mode, the DX-2200 allows the size and position of the output video windows corresponding to the selected and non-selected inputs to be changed. By default, both windows occupy the full screen.

The video window of the selected input mixes onto a black background. The 'BS' commands control the size and position of the selected input's window. The non-selected input is mixed on top of the video window of the selected input and the black background. The 'BP' commands control the size and position of the non-selected input's window.

The size and position of the output windows can be set either in pixels, or as a percentage of the output video size. To specify percentage, include a '%' character after the size. If the value for any parameter is set to '0' without a '%' character, the DX-2200 will use the default value for that parameter.

If either the width or height parameters for a window are set to '9999', then the DX-2200 will calculate a value for that parameter to preserve the aspect ratio of the input video. If both the width and height are set to '9999', then the video will be full screen.

The minimum size (width or height) for a window is 32 pixels. The DX-2200 will accept a smaller value in the commands, but will never display less than 32x32 pixels.

If a window size larger than full screen is specified, the DX-2200 will reduce the size to full screen. If a position and size are specified that causes a window to extend beyond the video, the DX-2200 will change the x and y position as required to fit the requested window size into the video. It is not possible to clip the video by placing a window partially off screen.

**Note:** If the window size is full screen, then it is not possible to move the window because any change in position would cause the window to extend off screen.

If these commands are executed in a mode other than Alpha Blended Overlay, the parameters are stored by the DX-2200, but won't have any effect until Alpha Bended Overlay mode is selected.

For interlaced video, the vertical position and height has a resolution of two pixels.

### Table 8: Alpha Blended Size and Position Control SERIAL Command Codes

| Command Code | Mode of Operation |
|---|---|
| Mode Control Commands | |
| BPXnnnn | Set the top left corner X position of the non-selected input window |
| BPYnnnn | Set the top left corner Y position of the non-selected input window |
| BPWnnnn | Set the width of the non-selected input window |
| BPHnnnn | Set the height of the non-selected input window |
| BSXnnnn | Set the top left corner X position of the selected input window |
| BSYnnnnn | Set the top left corner Y position of the selected input window |
| BSWnnnn | Set the width of the selected input window |
| BSHnnnn | Set the height of the selected input window |
| BP0 | Reset the Size and Position of the non-selected input window to Default |
| BS0 | Reset the Size and Position of the selected input window to Default |
| Where 'nnnn' can be a number of pixels between one and four digits in length, or be followed by a '%' sign to specify a percentage of the output video size, eg '50%'. When specified in %, the value can be an integer between 0 to 100. | |

#### 4.8.1.6.1 EXAMPLE 1A:

Select the Alpha Blended Overlay Mode and scale both inputs to 1000 x 562 pixels and position them in the center of the output video. This example is designed for use when the switcher operates with 720p output video.

The SERIAL commands are as follows:

M5
BPW1000
BSW1000
BPH562
BSH562
BPX140
BSX140
BPY80
BSY80

Figure 13: Alpha Blended with scaling – Example 1a

#### 4.8.1.6.2 EXAMPLE 1B:

Starting from Example 1, display the Frame Count in the upper right corner of the video, change to the alpha Vertical Alpha Split Mode with full visibility, and position the split at column 400. Note that the column number refers to the columns of the scaled output image, not to the input video size.

SFM4
SF1X2000
SF1Y0025
A0
TP7
TPS400


**Figure 14: Alpha Blended Vertical split with frame counter – Example 1b**

#### *4.8.1.7 Picture-in-Picture Position & Size SERIAL Commands*

The position and size of the Picture-in-Picture (PiP) display is selected through character commands sent via the RS-232 port per **Table 9** below.

The commands P1, P2, P3 and P4 set the PiP position to predefined values and take effect immediately. The pre-defined positions are referenced to the four corners of the screen and include a default horizontal and vertical offset from the corner that depends on the video resolution. The PAnnnn and PBnnnn commands may be used to change the offsets. If the combination of PiP size and the offsets does not fit within the output video, the offsets will be automatically reduced as required.

The commands PS01 through PS16 set the Pip size to predefined widths in units of 16ths of the screen width with height set to maintain the source video aspect ratio of the source. The W, H, X, and Y commands are used to configure a custom size and position of the PiP and do not take effect until a PU or PR command is received. This allows all parameters to be configured and then applied simultaneously.

The PU (PiP update) command sets the PiP size and position to values selected by W, H, X and Y commands. This command ensures the PiP window is not larger than the output video stream (display screen) and will ensure the entire PiP window is visible to the user. If the selected position would result in the PiP window being partially off-screen, the position will be adjusted so that no part of the PiP window is off-screen. For example, in the 1280x720 mode, if the PiP size is 640x360 and the selected PiP position is 700 pixels right and 400 pixels down, the PU command will place the window at 640 pixels right and 360 pixels down so it is completely visible.

The PR (PiP ratio) command is the same as the PU command except it ignores the height set by the H command and sets the height based on the width to keep the aspect ratio of the input video source. For example, if the command sequence is W0480, H0300, PR, the size of the PiP window will be 480x270 pixels.

### Table 9: PiP Control Serial Command Codes

| Command Code | Mode of Operation |
|---|---|
| Pn – PiP Commands | |
| P1 | PiP upper right with preset size set by PS command |
| P2 | PiP lower right with preset size set by PS command |
| P3 | PiP upper left with preset size set by PS command |
| P4 | PiP lower left with preset size set by PS command |
| P5 | PiP top center with preset size set by PS command |
| P6 | PiP bottom center with preset size set by PS command |
| P7 | PiP center left with preset size set by PS command |
| P8 | PiP center right with preset size set by PS command |
| PSnn | Set the PiP size used with the predefined PiP positions. The width is set in units of 16ths of the output video width. For example PS05 set the width to 5/16ths of the video width. |
| PAxxxx | Set the horizontal gap in pixels between the reference corner and the Pip window when using the predefined PiP positions. Enter the value 9999 to use the default. |
| PBxxxx | Set the vertical gap in pixels between the reference corner and the Pip window when using the predefined PiP positions. Enter the value 9999 to use the default. |
| PU | PiP update – sets PiP size and position to values selected with W, H, X and Y commands |
| PR | PiP update, fixed aspect ratio – sets PiP size and position to values selected with W, X and Y commands, sets height to keep 16:9 aspect ratio |
| Wnnnn | PiP width ** |
| Hnnnn | PiP height ** |
| Xnnnn | PiP horizontal position ** |
| Ynnnn | PiP vertical position ** |
| ** where nnnn must be a four-digit number. Prefix 0s to any number less than four digits (i.e. 0720, 0064) | |

#### *4.8.1.8 Alpha Blending Transparency SERIAL Command*

For PiP mode, the Alpha Blending Transparency Commands set the transparency of the non-selected input (the PiP window). For Alpha Blended Overlay mode, the commands set the transparency of the selected and non-selected inputs.

Alpha blending for PiP is stored separately by the DX-2200 so that PiP and Full Screen Alpha Blended Overlay modes can be configured independently. The ‘An’ and ‘Annn’ commands set the PiP transparency when operating in PiP mode, and set the transparency of the non-selected input for Alpha Blended Overlay Mode when executed in any mode other than PiP.

When the transparency of the selected input is more than 0% in Alpha Blended Overlay Mode, the black background will be visible behind the video output window corresponding to the selected input.

When the transparency of the non-selected input is more than 0% in Alpha Blended Overlay Mode, the selected input and/or the black background will be visible behind the video output window corresponding to the non-selected input.

**Note:** In Alpha Blended Overlay mode with default window positions, setting the transparency of the non-selected input to 0 causes the non-selected layer to completely cover the selected layer, making it invisible.

**Warning:** When entering Alpha Blended Overlay Mode, it may appear that the transparency has not been preserved and has returned to default. This is because the factory DIP switch configuration also controls the transparency in Alpha Blended Overlay Mode. If desired, User Interface Command 'U0' can be used to reduce the priority of the DIP switch so that the settings are not applied when the Display Mode is changed.

### Table 10: Mode-Dependent Transparency SERIAL Command Codes

| Command Code | Mode of Operation |
|---|---|
| An – Set tranparency of the PiP window or the non-selected input for Alpha Blended Overlay Mode | |
| A0 | Non-selected input 0% transparency in full screen or PiP mode |
| A1 | Non-selected 12.5% transparency in full screen or PiP mode |
| A2 | Non-selected 25% transparency in full screen or PiP mode |
| A3 | Non-selected 37.5% transparency in full screen or PiP mode |
| A4 | Non-selected 50% transparency in full screen or PiP mode |
| A5 | Non-selected 62.5% transparency in full screen or PiP mode |
| A6 | Non-selected 75% transparency in full screen or PiP mode |
| A7 | Non-selected 87.5% transparency in full screen or PiP mode |
| A8 | Non-selected 100% transparency in full screen or PiP mode |
| Annn | Set the transparency with higher resolution<br>'nnn' – is a three digit number between 000 and 255 where 000 is 0% transparent and 255 is 100% transparent |

### Table 11: Non-selected Input Transparency Command Codes for Alpha Blended Overlay Mode

| Command Code | Mode of Operation |
|---|---|
| AFn – Set tranparency of the non-selected input for Alpha Blended Overlay Mode | |
| AF0 | Non-selected input 0% transparency in full screen mode |
| AF1 | Non-selected input 12.5% transparency in full screen mode |
| AF2 | Non-selected input 25% transparency in full screen mode |
| AF3 | Non-selected input 37.5% transparency in full screen mode |
| AF4 | Non-selected input 50% transparency in full screen mode |
| AF5 | Non-selected input 62.5% transparency in full screen mode |
| AF6 | Non-selected input 75% transparency in full screen mode |
| AF7 | Non-selected input 87.5% transparency in full screen mode |
| AF8 | Non-selected input 100% transparency in full screen mode |
| AFnnn | Set the transparency with higher resolution<br>'nnn' – is a three digit number between 000 and 255 where 000 is 0% transparent and 255 is 100% transparent |

### Table 12: Non-Selected Input Transparency Command Codes for PiP Mode

| Command Code | Mode of Operation |
|---|---|
| APn – Set tranparency of the non-selected input for PiP Mode | |
| AP0 | Non-selected input 0% transparency in PiP mode |
| AP1 | Non-selected input 12.5% transparency in PiP mode |
| AP2 | Non-selected input 25% transparency in PiP mode |
| AP3 | Non-selected input 37.5% transparency in PiP mode |
| AP4 | Non-selected input 50% transparency in PiP mode |
| AP5 | Non-selected input 62.5% transparency in PiP mode |
| AP6 | Non-selected input 75% transparency in PiP mode |
| AP7 | Non-selected input 87.5% transparency in PiP mode |
| AP8 | Non-selected input 100% transparency in PiP mode |
| ASnnn | Set the transparency with higher resolution<br>'nnn' – is a three digit number between 000 and 255 where 000 is 0% transparent and 255 is 100% transparent |

### Table 13: Selected Input Transparency Command Codes for Alpha Blended Overlay Mode

| Command Code | Mode of Operation |
|---|---|
| ASn – Set tranparency of the selected input for Alpha Blended Overlay Mode | |
| AS0 | Selected input 0% transparency in full screen or PiP mode |
| AS1 | Selected input 12.5% transparency in full screen or PiP mode |
| AS2 | Selected input 25% transparency in full screen or PiP mode |
| AS3 | Selected input 37.5% transparency in full screen or PiP mode |
| AS4 | Selected input 50% transparency in full screen or PiP mode |
| AS5 | Selected input 62.5% transparency in full screen or PiP mode |
| AS6 | Selected input 75% transparency in full screen or PiP mode |
| AS7 | Selected input 87.5% transparency in full screen or PiP mode |
| AS8 | Selected input 100% transparency in full screen or PiP mode |
| ASnnn | Set the transparency with higher resolution<br>'nnn' – is a three digit number between 000 and 255 where 000 is 0% transparent and 255 is 100% transparent |

#### *4.8.1.9 Baud Rate SERIAL Command*

The DX-2200 always powers up at 115200 baud. After power up, the baud rate can be changed using the MBnnnnnnn command, where nnnnnnn is the new baud rate between 9600 and 1000000 baud.

The response to the baud rate command is transmitted before the baud rate is changed. It is recommended to wait 100 ms after receiving the response before sending commands at the new baud rate to ensure the DX-2200 is ready to receive commands at the new rate.

**Note:** The DX-2200 always starts at 115200 baud. Changes to the baud rate cannot be saved to flash.

### Table 7: Baud Rate SERIAL Command Codes

| Command Code | Mode of Operation |
|---|---|
| Baud Rate Control Commands | |
| MBnnnnnnn | Set the baud rate to nnnnnnnn where nnnnnnnn is a number between 9600 and 1000000 baud. |

#### *4.8.1.10 Graphic Overlay SERIAL Commands*

The Graphic Overlay layer can display up to 48 user-defined Graphic Fields. Each Graphic Field can be configured to be Text, Rectangle, Corner Marker, Target Marker, or an Image Field. The fields can be configured and positioned using the Graphic Overlay Serial Commands below.

The Graphic Overlay utilizes two frame buffers located in memory. One of these frame buffers (the active buffer) generates a video output that is mixed on top of the input video, while the other buffer (the spare buffer) is prepared for use.

The video output of the layer is updated by rendering all Graphic Fields into the spare buffer using the parameters that have been set for each Field. The amount of time required to render the text to the spare buffer depends on the number of pixels that must be drawn. Typically, the rendering process takes more than one frame to complete. During this time, the active buffer continues to provide the Graphic Overlay video output. After rendering is complete, the DX-2200 switches the active and spare buffers. The buffer that was active before the update becomes the new spare buffer and is cleared by the unit to so that it is ready for text to be rendered again when the next update occurs. Buffer switching is always performed at the end of frame.

Many of the Graphic Field commands update the parameters of a Field (for example the visibility, color or transparency), but do not update the video output. This allows the user to change as many parameters as required before sending a command to show the updated output.

##### 4.8.1.10.1 GRAPHIC FIELDS

Graphic Fields are numbered 1 through 48. The Graphic Overlay Commands that apply to a single field include the field number in the command, for example the SnnS command enables display of field number nn.

For any command that uses a field number, the field can be specified as either a 1 or 2 digit number in the range 1 through 48.

Instead of specifying a single field, the commands can be applied to all fields on the layer by specifying a field number of 0. For example G0S enables the display all fields on the layer and is equivalent to the commands G1S, G2S, G3S… G48S.

Commands can be applied to a range of sequential fields using the syntax "f1-f2" for the field number where f1 is the first field and f2 is the last field the command applies to. For example the command G7-10S enables display of fields 7, 8, 9, and 10.

By default, all Graphic Fields are turned off and have default parameters. To display a field, the following steps are required:

- the field must be configured with the required field type
- the parameters must be set appropriately for the field type
- display of the field must be enabled
- the layer must be updated

Some commands combine the last two operations in the above list, for example the S2S command enables the display of Graphic Field 2 and also updates the layer.

The following commands are a simple example that displays a rectangle. These commands are intended for use with the DX-2200 in the factory default configuration:

```
S1M2                ‘ Set Field 1 to be a Rectangle Field
S1PA100,100         ‘ Coordinate A = (100,100)
S1PB300,300         ‘ Coordinate B = (300,300)
S1S                 ‘ Enable display of Field 1 and update the layer
```

#### 4.8.1.10.2 Reset Graphic Field

A Graphic Field can be reset to its default values with the SnnZ command where nn is the Graphic Field number to reset. The SZ command will reset all Graphic Fields.

Resetting a Graphic Field will clear the Text string, set the line color to white with full visibility, set the position to the top left corner, set the fill color to blue but fully transparent (not visible), and set the font to the default for the current video resolution. The overall visibility of the Field is set to off.

Resetting fields does not automatically update the video output of the overlay. Any fields that are visible in the video are not cleared until a command is received that causes the overlay to be updated.

#### 4.8.1.10.3 Graphic Field Visibility

Each Graphic Field can be turned on or off independently. By default, fields are off. The SnnV, SnnS, and SnnH commands control the visibility of field number nn. SnnS and SnnH turn visibility on and off respectively, and SnnV toggles visibility between on and off. Using any one of these commands will also cause the video output to be updated by rendering the fields to the spare buffer and performing a buffer swap. For this reason, it may be undesirable to use these commands when several graphic fields need to be turned on or off because the video output will be updated as each command is executed. This will result in the fields turning on or off one at a time.

The commands SnnVN, SnnSN, and SnnHN also control the visibility of Graphic Field nn, but without updating the output and are recommended when the visibility of more than one field is to be changed at the same time. The SU command can be sent to update the output after all visibility changes have been made.

The SnnHdddd command will turn off the visibility of text field nn after approximately dddd frames of video have been output. When the SnnH is used with a delay, the overlay is automatically updated after the delay.

#### 4.8.1.10.4 Update Graphic Overlay

The SU command updates the video output of the Overlay by rendering all fields to the spare buffer and exchanging the active and spare buffers.

After sending a sequence of commands that change the parameters of fields, send the SU command to make the changes visible.

#### 4.8.1.10.5 Coordinate System and Field Position

Each Graphic Field has two position coordinates referred to as Coordinate A and Coordinate B. One or both of these coordinates may be used depending on the Graphic Field Type.

The coordinate system designates x=0000 and y=0000 as the top-left corner of the overlay for all video formats. This is the default position for all fields.

The maximum value for the x and y coordinates is located at the bottom-right corner of the frame. For 1080p, 1080i, and 1080PsF formats the bottom-right corner is at coordinates x=1919, y=1079. For 720p formats the bottom-right corner is located at x=1279, y=719. For NTSC format the coordinates are x=719, y=485, and for PAL format x=719 and y=575.

NOTES:

1) Some monitors will not display the entire video frame, particularly when operating in NTSC or PAL modes. Graphic Fields placed close to the edges of the overlay may not be visible on some monitors.
2) If the Overlay has been re-sized, the coordinate range may be smaller than the defaults for each video mode listed above.
3) Any Field or portion of a Field that extends beyond the edges of the Overlay will not be visible.

The command set provides different options for setting the coordinates of a Graphic Field. The commands SnnXxxxx, and SnnYyyyy set the x and y position for Coordinate A individually. The commands SnnPAXxxxx and SnnPAYyyyy perform the same functions, but this form of the command can also set Coordinate B, for example SnnPBXxxxx or SnnPBYyyyy.

If it also possible to set both x and y in a single command for Coordinate A or Coordinate B with the commands SnnPAxxxx,yyyy and SnnPBxxxx,yyyy respectively. For all Graphic Field position commands, the parameters xxxx and yyyy can be from 1 to 4 digits in length and may optionally be prefixed with zeros. For example, sending S4X0200 and S4Y0400 sets the field position to (200, 400).

Changing the text position does not automatically update the video output.


**Figure 15: Samples of active text and graphic logo**

#### 4.8.1.10.6 LINE COLOR AND TRANSPARENCY

Each Graphic Field has a Line Color specified by Red, Green, and Blue Components in the range from 0 to 255. The Line Color is used for solid rectangles, for the outline of open rectangles, for corner markers, target markers, and the foreground of text.

The colors are entered as three Serial Commands by sending a Red, Green and Blue Serial Command. For example: sending S1R220, S1G025 and S1B250 sets line color to purple.

The default color is white (R255, G255, and B255). Changing the text color does not automatically update the video output.

The Line Color has a transparency property that can be controlled using the S1Aaaa command to set the alpha value for mixing with underlying layers. Setting the alpha value to 0 sets the Line Color to be fully

visible and no content on lower video layers will be visible through the Line Color. An alpha of 255 sets the Line Color fully transparent. At this setting the color will be completely invisible.

For example: sending G1A192 makes Field 1 approximately 75% transparent. Changing the text transparency does not automatically update the video output.

#### 4.8.1.10.7 BACKGROUND COLOR AND TRANSPARENCY

Each Field has a Background Color that is used for the background of Text Fields and the fill color of rectangles. Background Color is set in the same way as Line Color, except the commands used as SnnBRrrr, SnnBGggg, SnnBBbbb, and SnnBAaaa.

The following example commands set the Background Color of Graphic Field 1 to yellow with partial (50%) visibility: S1BR255, S1BG255, S1BB0, and S1BA128.

The Background Color will only affect those field types that make use of the Background Color.

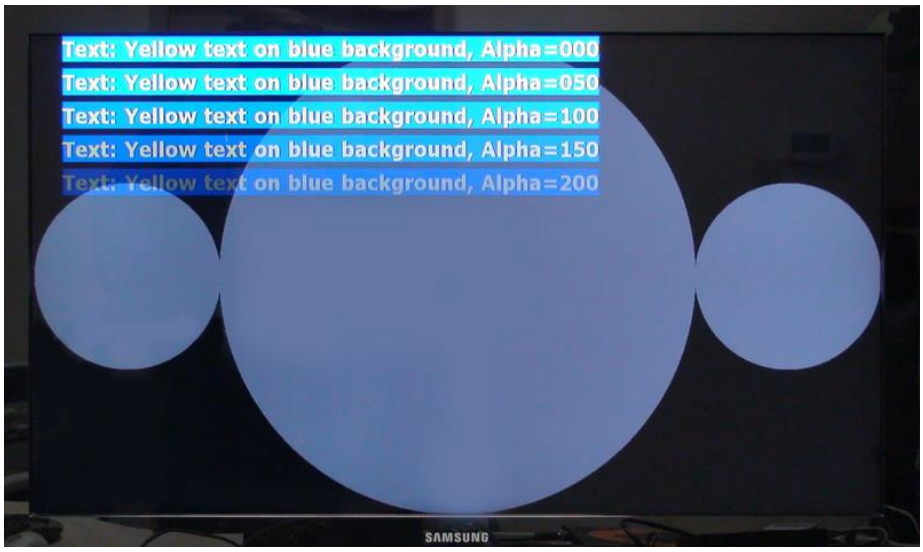


**Figure 16: Samples of transparent text and background**

NOTES:

1) When the text is partially transparent, its apparent color will be determined by the text color, the background color and the visibilities of the text and background.

   When a text background is displayed, the total number of color / transparency combinations is limited. Small changes in the color or transparency parameters of the text or background may not change the appearance

#### 4.8.1.10.8 TEXT FONT

For each Graphic Field, a font / size combination can be selected using the GnnFfff command to select one of the font options in the Text and Symbol Font Table below.

### Table 14: Text and Symbol Fonts

| Font Code | Font Name | Height Pixels | Fixed Width | Code Range (Hexadecimal) |
|---|---|---|---|---|
| 12 | Tahoma Bold | 18 | | 20-7E & A0-FF |
| 1 | Tahoma Bold | 26 | | 20-7E & A0-FF |
| 13 | Tahoma Bold | 32 | | 20-7E & A0-FF |
| 2 | Tahoma Bold | 40 | | 20-7E & A0-FF |
| 25 | Tahoma Bold | 48 | | 20-7E & A0-FF |
| 14 | Tahoma Bold | 60 | | 20-7E & A0-FF |
| 3 | Tahoma Bold | 78 | | 20-7E & A0-FF |
| 15 | Tahoma Bold | 116 | | 20-7E & A0-FF |
| 4 | Tahoma Bold | 156 | | 20-7E & A0-FF |
| 16 | Tahoma Regular | 18 | | 20-7E & A0-FF |
| 17 | Tahoma Regular | 26 | | 20-7E & A0-FF |
| 18 | Tahoma Regular | 32 | | 20-7E & A0-FF |
| 19 | Tahoma Regular | 40 | | 20-7E & A0-FF |
| 24 | Tahoma Bold | 48 | | 20-7E & A0-FF |
| 20 | Tahoma Regular | 60 | | 20-7E & A0-FF |
| 21 | Tahoma Regular | 78 | | 20-7E & A0-FF |
| 22 | Tahoma Regular | 116 | | 20-7E & A0-FF |
| 23 | Tahoma Regular | 156 | | 20-7E & A0-FF |
| 26 | Vera Sans Mono Regular | 18 | ✓ | 20-7E & A0-FF |
| 27 | Vera Sans Mono Regular | 26 | ✓ | 20-7E & A0-FF |
| 28 | Vera Sans Mono Regular | 32 | ✓ | 20-7E & A0-FF |
| 29 | Vera Sans Mono Regular | 40 | ✓ | 20-7E & A0-FF |
| 30 | Vera Sans Mono Regular | 48 | ✓ | 20-7E & A0-FF |
| 31 | Vera Sans Mono Regular | 60 | ✓ | 20-7E & A0-FF |
| 32 | Vera Sans Mono Regular | 78 | ✓ | 20-7E & A0-FF |
| 33 | Vera Sans Mono Regular | 116 | ✓ | 20-7E & A0-FF |
| 34 | Vera Sans Mono Regular | 156 | ✓ | 20-7E & A0-FF |
| 35 | Vera Sans Mono Bold | 18 | ✓ | 20-7E & A0-FF |
| 36 | Vera Sans Mono Bold | 26 | ✓ | 20-7E & A0-FF |
| 37 | Vera Sans Mono Bold | 32 | ✓ | 20-7E & A0-FF |
| 38 | Vera Sans Mono Bold | 40 | ✓ | 20-7E & A0-FF |
| 39 | Vera Sans Mono Bold | 48 | ✓ | 20-7E & A0-FF |
| 40 | Vera Sans Mono Bold | 60 | ✓ | 20-7E & A0-FF |
| 41 | Vera Sans Mono Bold | 78 | ✓ | 20-7E & A0-FF |
| 42 | Vera Sans Mono Bold | 116 | ✓ | 20-7E & A0-FF |
| 43 | Vera Sans Mono Bold | 156 | ✓ | 20-7E & A0-FF |
| 5 | BGP Courier | 26 | ✓ | 20-7E |
| 6 | BGP Courier | 40 | ✓ | 20-7E |

| | | | | |
|---|---|---|---|---|
| 7 | Larable Bold | 26 | ✓ | 20-7E |
| 8 | Larable Bold | 40 | ✓ | 20-7E |
| 9 | Wingdings | 40 | | 20-5F |
| 10 | Wingdings | 80 | | 20-5F |
| 11 | Wingdings | 160 | | 20-5F |
| Notes:<br>Refer to Table 28: Extended ASCII Character Table for a list of characters that are mapped to codes A0-FF.<br>Refer to Table 27: Windings Character Table for a list of characters and their codes. | | | | |

Fonts are loaded into memory individually the first time a layer update is performed that requires them. The requirement to load the font makes the first layer update significantly slower.

Selecting font 0 uses a default font that varies depending on the video output resolution. For 720p, the default font is Font 1, and for 1080p the default is Font 2. If the font has been set, it can be restored to the default by selecting font 0. For example, the S2F0 command restores text field #2 to the default font.

Changing the text font does not automatically update the video output. The Text Font selection has no effect on Fields unless the field type is set to Text.

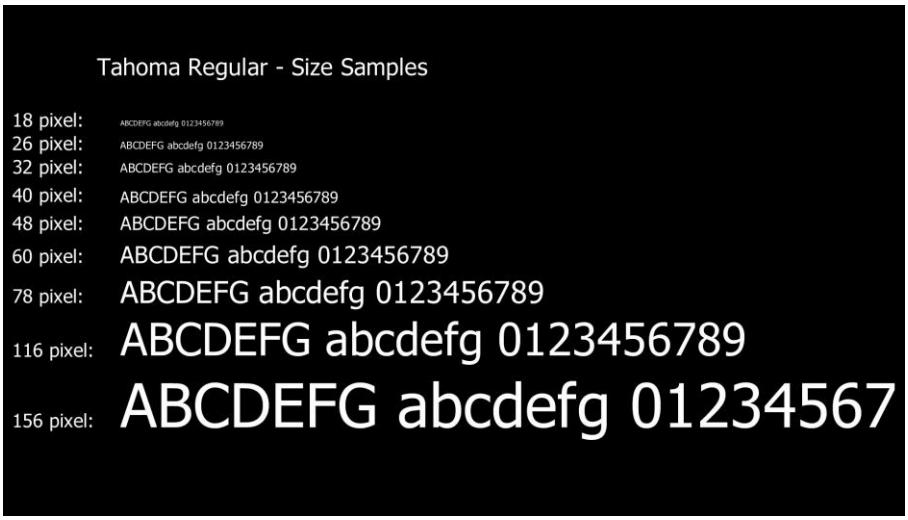


**Figure 17: Sample of the available Tahoma font sizes**

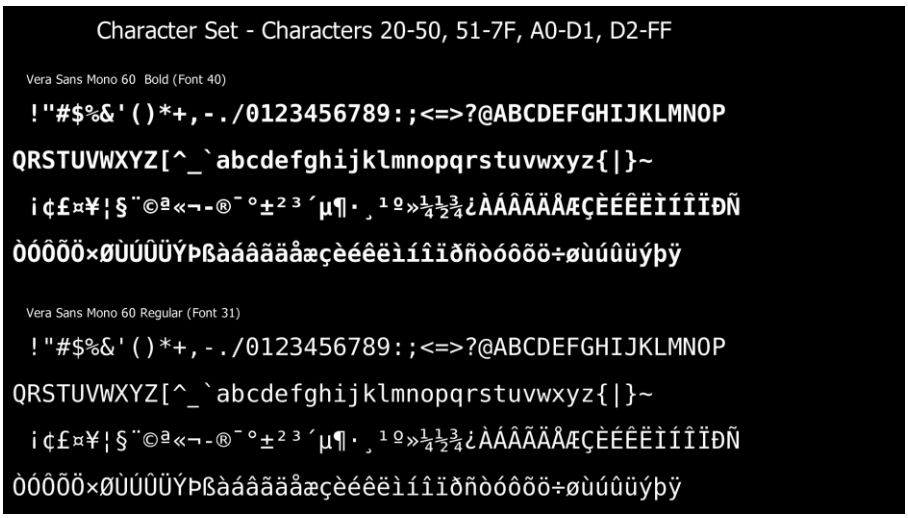


**Figure 18: Character set - codes 20-7F and A0-FF**

#### 4.8.1.10.9 GRAPHIC FIELD TYPE

Each Graphic Field has a type that can be set by the SnnMm command. The following Field types are supported:

1 – Text (default)
2 – Rectangle
3 – Corner Markers
4 – Target Marker
5 – Image

The parameters for the Graphic Fields have different functions depending on the type of field being used. Each field type is described further below:

##### *4.8.1.10.9.1 Text Fields – Field Type 1*

Text Fields are used to display a string of ASCII characters. Up to 195 characters may be displayed in a field. For a list available fonts refer to the command table.

The ASCII text is set using the SnnT"Text" command where the characters to be displayed are enclosed in the quotation marks. If a quotation mark is required in the test, it must be preceded by the backslash character. For example to set the text string for Field 7 to display Model "DX-2200" use the command S07T"Model \"DX-2200\"".

The color and transparency of the character can be configured using SnnRrrr, SnnGggg, SnnBbbb to set the red, green and blue component of the character color and SnnAaaa to set the transparency. Similarly, the background can be configured using SnnBRrrr, SnnBGggg, SnnBBbbb to set the color and SNBAaaa to set the transparency. The parameters rrr, ggg, bbb, and aaa must be in the range 0 to 255. For transparency, a value of 0 is fully visible and a value of 255 is fully transparent. The default text is white and fully visible. The default background is blue and fully transparent.

Coordinate A of the Graphic Field is used to specify the position for the top-left corner of the Text. Coordinate B is not used for Text Fields.

#### 4.8.1.10.9.1.1 Text Field Display Example:

```
s4T" DX-2200 "          ' set the text to display
S4F3                    ' select Tahoma Bold 78 pixel height
S4R0                    ' character red=0
S4G255                  ' character green=255
S4B0                    ' character blue=0
S4A128                  ' 50% character visibility
S4BR0                   ' background red=0
S4BG0                   ' background green=0
S4BB64                  ' background blue=64
S4BA128                 ' 50% background transparency
S4X730                  ' start text at x=730
S4Y10                   ' start text at y=10
S4S                     ' enable Field 4 and update layer
```

### 4.8.1.10.9.2 Rectangle Fields – Field Type 2

Rectangle Fields are used to display a rectangle that can be either open or filled. A rectangle can be used as a vertical or horizontal line. The rectangle is drawn between Coordinate A and Coordinate B where Coordinate A must be the top-left corner and Coordinate B must be the bottom-right corner of the rectangle. No rectangle will be drawn if the coordinates are not specified in the correct order.

A rectangle may be drawn with either one or two regions depending on the parameters of the Graphic Field. The Line region is located around the perimeter of the rectangle and is drawn with the line color (as specified by the GnnRrrr, SnnGggg, SnnBbbb, and SnnAaaa commands). The Line region has a width in pixels that is specified in the width parameters of the Graphic Field. The default line width is 1pixel. If the line width is large, the entire interior of the rectangle may be part of the Line region. If the line width is narrow the interior of the rectangle contains a Fill region.

The command SnnWwwww set the line width to the same value for both the vertical and horizontal lines, and the command SnnWxxxx,yyyy sets the horizontal line widths (xxxx) and vertical widths (yyyy) independently. When the Width parameter is set to 0 in the above commands, or when the Width is greater than half the size of the rectangle, the entire rectangle is drawn with the line color. The line width can also be set for each side of the rectangle individually. The commands SnnWLwwww, SnnWRwwww, SnnWTwwww, and SnnWBwwww set the width of the left, right, top and bottom sides of the rectangle respectively. A parameter value of zero has a different meaning for these commands than it does for the previous commands. When used with these four commands, the width value zero 0 prevents that side of the rectangle from being drawn.

The Fill color parameters are set by the SnnBRrrr, SnnBGggg, SnnBBbbb, and SnnBAaaa commands. By default, the Fill region is the entire interior of the rectangle that is not drawn in the Line color, but it is also possible to limit the fill to a specified width around the interior of the line. Each side of the rectangle has a fill width associated with it. The command SnnFXwwww sets the Fill width in pixels inside the left and right sides of the rectangle, and, SnnFYwwww sets the fill width inside the top and bottom sides of the rectangle.

The commands SnnFLwwww, SnnFRwwww, SnnFTwwww, and SnnFBwwww set the fill width for the left, right, top, and bottom sides individually. Any pixel that is within the fill width for one or more sides of the rectangle is part of the Fill region. The default fill width for the left side is 9999, causing the left side fill to extend throughout the entire interior of any rectangle. The default fill width for the right, top and bottom sides is 10 pixels.

When a fill region exists, it may either be drawn with the background color, or else the pixels can be left undrawn. The command SnnBD0 prevents the fill from being drawn, and the command SnnBD1 draws the fill. By default, the rectangle Fill is blue, fully transparent, and not drawn. Choosing not to draw the fill is different than drawing a fully transparent fill:

Transparent fill overwrites any previously drawn pixels on the overlay layer, but not drawing the fill leaves the previous pixels unchanged.

Drawing filled rectangles is slower than drawing unfilled rectangles.

#### *4.8.1.10.9.3 Rectangle Field Display Example*

```
S2PA100,100                 ' top-left corner at (100,100)
S2PB1820,980                ' bottom-Right corner at (1820,980)
S2M2                        ' type = Rectangle Field
S2W7,4                      ' line color 7 pixel wide along top/bottom
                            ' and 4 pixels wide at the sides
S2R0;S2G0;S2B255            ' line color = blue
S2A64                       ' line color is 25% transparent
S2BD1                       ' draw the fill region
S2BR0;S2BG0;S2BB255         ' fill is blue
S2BA224                     ' fill is 7/8 transparent
S2S                         ' enable display of field 2 and update
```

#### *4.8.1.10.9.4 Corner Marker Fields – Field Type 3*

Corner Marker Fields are used to indicate a region of interest in the video.

The Corner Markers are drawn around the outside of the region specified by Coordinate A (top-left) and Coordinate B (bottom-right).

The Width parameter of the Graphic Field sets the width in pixels of the lines that make up the corner markers, and the Length parameter of the Graphic Field sets the distance in pixels that the lines extend from the corner.

Corner Markers are drawn in the line color (as specified by the SnnRrrr, SnnGggg, SnnBbbb, and SnnAaaa commands).

By default four corner markers are drawn. It is possible to suppress the corner markers individually using the SnnKcs command. The letter s represents either 1 to suppress the corner marker, or 0 to enable it. The letter c represents a letter that indicates which corner marker is being referenced as follows:

A = top-left
B = bottom-left
C = top-right
D = bottom-right

For example the command S1KB1 will suppress display of the bottom-left corner marker of Graphic Field 1.

**Note:** If the width of a Corner Marker is made too large relative to its length, the Corner Marker will appear as a square.
The x position for coordinate A should be less than that of coordinate B and the y position for coordinate A should be less than the y position for coordinate B. The DX-2200 will automatically reverse the x and/or y coordinates when drawing the corner markers if they are set incorrectly.

#### 4.8.1.10.9.4.1 Corner Marker Field Display Example

```
s1M3                    ' corner marker field type
S1PA100,100             ' top-left at (100,100)
S1PB1820,980            ' bottom-right at (1820,980)
S1W10                   ' 10 pixels wide
S1L300,150              ' 300 px long horizontal, 150 px vertical
S1R255;S1G255;S1B0      ' Yellow
S1A64                   ' 25% transparent
S1S                     ' display and update
```

### 4.8.1.10.9.5 Target Marker Fields – Field Type 4

The Target Marker Field displays a '+' marker at the position specified by coordinate A of the Graphic Field.

The Length parameter of the Graphic Field sets the length of the horizontal and vertical lines. Half the length extends each direction from the center of the Target Marker and the length has a resolution of 2 pixels so that the marker is always symmetrical.

The width parameter of the Graphic Field set the width of the lines that make up the Target Marker. The width has a resolution of 2 pixels with half the width on each side of center.

#### 4.8.1.10.9.5.1 Target Marker Field Display Example

```
s3M4                    ' target marker field type
S3PA960,540             ' location (960,540)
S3W2                    ' 2 pixels wide
S3L100                  ' 100 pixel long lines
S3R255;S3G0;S3B0        ' red
S3A0                    ' fully visible
S3S                     ' display and update
```

### 4.8.1.10.9.6 Image Fields – Field Type 5

An Image Field displays an image that has been uploaded to the DX-2200. Image Fields can be used to display a logo or other custom graphics. The DX2200 Uploader software supplied with the product is used to upload images and store them in flash memory. Refer to the section: Error! Reference source not found. for information about uploading images.

The image is displayed at the position specified by coordinate A of the Graphic Field. Any part of the image extends beyond the size of the overlay is not displayed.

Uploaded images may have transparency for some or all pixels in the image. Support for transparency depends on the file format of the image. Images that do not include transparency are always uploaded with all pixels fully visible. By default, images will be displayed with the transparency that was included in the uploaded image. The SnnAaaa command can be used to make the image more transparent. It is not possible to make an image less transparent than was defined in the original file.

When an image is fully transparent or partly transparent, the image frame background will be visible behind the image. The background color is set by the SnnBRrrr, SnnBggg, SnnBBbbb commands, and the background transparency is set by the SnnBAaaa command. When the image frame background has full or partial transparency, lower layers in the video mix will be visible behind the image. The default background transparency for a graphic field is 255 (fully transparent). The image frame background will not be visible unless the default transparency is changed.

Images are specified by an ID number that is set when the image is uploaded to the product. If the requested image is not found in memory, then the Graphic Field has no effect.

Images are loaded from flash into main memory the first time they are required for a layer update. The first layer update using an image will be significantly slower than subsequent updates.

#### 4.8.1.10.9.6.1 Image Field Display Example

```
S5M5                ' field type = Image field
S5PA800,300         ' location (800,300)
S5I35               ' display the image with id=35
S5A0                ' display with the uploaded transparency
S5S                 ' display the field and update the overlay
```

### 4.8.1.10.9.7 Rectangle XYWH – Field Type 6

This rectangle field type is the same as field type 2 with the exception that it is specified by top/left corner and width/height instead of top/left corner and bottom/right corner. In some applications it may be more convenient or efficient to specify the rectangle with width and height.

The SnnPBxxxx,yyyy is used to specify the width and height of the rectangle. All other commands are the same as for field type 2 rectangles.

#### 4.8.1.10.9.7.1 Rectangle Field Display Example

```
S6PA800,300         ' top left corner at 800, 300
S6PB200,400         ' width 200 pixels, height 400 pixels
S6M6                ' type = Rectangle Field XYWH
S6S                 ' enable display of field 6 and update
```


**Figure 19: Sample of Rectangle, Target Marker and Text**


Figure 20: Sample of Corner Markers, Target and Text

## Table 15: Graphic Overlay SERIAL Command Codes

| Command Code | Mode of Operation |
|---|---|
| Graphic Overlay Commands | |
| SZ | Reset all Graphic Fields to default. This command only resets the parameters of the Fields, but does not update the layer. The video will not change until the layer is updated. |
| SnnZ | Reset Graphic Field nn to defaults. The layer is not automatically updated and the video will not change until the next update. |
| SnnMm | Select the type for Graphic Field nn.<br>m = 1 Text (default)<br>m = 2 Rectangle<br>m = 3 Corner Markers<br>m = 4 Target Marker<br>m = 5 Graphic Image<br>m = 6 Rectangle specified by top/left corner and width/height |
| SU | Update the Overlay. The Graphic Fields are rendered to the spare frame buffer and when rendering is complete, the frame buffers are switched so that the spare buffer becomes active and the updated video is displayed. The new spare buffer is automatically cleared. |
| SnnV | Toggle the visibility of Graphic Field nn and update the layer. |
| SnnVN | Toggle the visibility setting for Graphic Field nn without updating the output. The visibility of the Field does not change until another command causes an update of the layer. |
| SnnS | Show (turn on) Graphic Field nn and update the layer so that the change becomes visible. |
| SnnSN | Enable the visibility setting for Graphic Field nn without updating the output. The Field does not appear until another command causes an update of the layer |

| Command Code | Mode of Operation |
|---|---|
| SnnH | Hide (turn off) Graphic Field nn and update the layer to make the change visible. |
| SnnHN | Disable the visibility setting for a Graphic Field without updating the output. The Field remains visible until another command causes an update of the output. |
| SnnHffff | Hide (turn off) Field nn after a delay of approximately ffff frames of video. ffff is a number between 1 and 4 digits in length. The layer is automatically updated when the delay expires. |
| SnnBRrrr | For Graphic Field nn, set the value of the red component of the background color to rrr, where rrr is a number between 1 and 3 digits in length and in the range 0 to 255.<br>The background color is used for text background and for the fill region of a rectangle. |
| SnnBGggg | For Graphic Field nn, set the value of the green component of the background color to ggg, where ggg is a number between 1 and 3 digits in length and in the range 0 to 255.<br>The background color is used for text background and for the fill region of a rectangle. |
| SnnBBbbb | For Graphic Field nn, set the value of the blue component of the background color to bbb, where bbb is a number between 1 and 3 digits in length and in the range 0 to 255.<br>The background color is used for text background and for the fill region of a rectangle. |
| SnnBAaaa | For Graphic Field nn, set the value of the transparency for the background to aaa, where aaa is a number between 1 and 3 digits in length and in the range 0 to 255.<br>aaa = 0 makes the background fully visible.<br>aaa = 255 makes the background fully transparent (invisible). |
| SnnBDm | For Graphic Field nn, this command controls if the fill region of a rectangle is drawn, or if the pixels are left unchanged when the field is set to Rectangle mode.<br>m = 0 - Do not draw the rectangle fill region<br>m = 1 - Draw the rectangle fill region.<br>Choosing to draw the fill region takes additional time to render and will overwrite any pixels on the same layer, even if the fill is transparent. |
| SnnRrrr | For Graphic Field nn, set the value of the red component of the line color to rrr, where rrr is a number between 1 and 3 digits in length and in the range 0 to 255.<br>The line color is used for text characters, the line region of rectangles, and for corner markers and the target marker. |
| SnnGrrr | For Graphic Field nn, set the value of the green component of the line color to ggg, where ggg is a number between 1 and 3 digits in length and in the range 0 to 255.<br>The line color is used for text characters, the line region of rectangles, and for corner markers and the target marker. |

| Command Code | Mode of Operation |
|---|---|
| SnnBbbb | For Graphic Field nn, set the value of the blue component of the line color to bbb, where bbb is a number between 1 and 3 digits in length and in the range 0 to 255.<br>The line color is used for text characters, the line region of rectangles, and for corner markers and the target marker. |
| SnnArrr | For Graphic Field nn, set the value of the transparency for the line or image to aaa, where aaa is a number between 1 and 3 digits in length and in the range 0 to 255.<br>aaa = 0 makes the background fully visible.<br>aaa = 255 makes the background fully transparent (invisible).<br>The line color is used for text characters, the line region of rectangles, and for corner markers and the target marker. |
| SnnFXwwww | For Graphic Field nn, set the fill width (in pixels) associated with the top and bottom (horizontal) lines of a rectangle.<br>wwww is a number between 1 and 4 digits in length. A width of zero means there is no fill associated with the top and bottom lines. |
| SnnFYwwww | For Graphic Field nn, set the fill width (in pixels) associated with the left and right (vertical) lines of a rectangle.<br>wwww is a number between 1 and 4 digits in length. A width of zero means there is no fill associated with the left and right lines. |
| SnnFLwwww | For Graphic Field nn, set the fill width (in pixels) associated with the left line of a rectangle.<br>wwww is a number between 1 and 4 digits in length. A width of zero means there is no fill associated with the left line. |
| SnnFRwwww | For Graphic Field nn, set the fill width (in pixels) associated with the right line of a rectangle.<br>wwww is a number between 1 and 4 digits in length. A width of zero means there is no fill associated with the right line. |
| SnnFTwwww | For Graphic Field nn, set the fill width (in pixels) associated with the top line of a rectangle.<br>wwww is a number between 1 and 4 digits in length. A width of zero means there is no fill associated with the top line. |
| SnnFBwwww | For Graphic Field nn, set the fill width (in pixels) associated with the bottom line of a rectangle.<br>wwww is a number between 1 and 4 digits in length. A width of zero means there is no fill associated with the bottom line. |
| SnnWxxxx,yyyy | Set the Width parameter of Graphic Field nn to the value xxxx for the x direction and to the value yyyy for the y-direction.<br>xxxx and yyyy are numbers between 1 and 4 digits in length.<br>For Rectangles, Width is the number of pixels drawn in the line color at the perimeter of the rectangle. Any remaining pixels inside the rectangle are the fill region and are drawn with the fill color (if drawing of the fill is enabled). If width is zero, the entire rectangle is drawn in the line color.<br>For Corner markers, Width is the width in pixels of the lines that make up the corner markers.<br>For the Target Marker, Width is the width in pixels of the vertical and horizontal lines that form the Target Marker. Width has a resolution of two pixels so that the target marker is always symmetrical with ½ the width drawn on each side of the center. |

| Command Code | Mode of Operation |
|---|---|
| SnnWwwww | Set the Width parameter of Graphic Field nn to the value wwww for both x and y directions. wwww is a number between 1 and 4 digits in length. |
| SnnWLwwww | For field nn, set the Line width of the left side of a rectangle to the value wwww.<br>wwww is a number between 1 and 4 digits in length. A width of zero causes the left line to be suppressed.<br>Note: This command has no effect for corner marker or target fields |
| SnnWRwwww | For field nn, set the Line width of the right side of a rectangle to the value wwww.<br>wwww is a number between 1 and 4 digits in length. A width of zero causes the right line to be suppressed.<br>Note: This command has no effect for corner marker or target fields |
| SnnWTwwww | For field nn, set the Line width of the top side of a rectangle to the value wwww.<br>wwww is a number between 1 and 4 digits in length. A width of zero causes the top line to be suppressed.<br>Note: This command has no effect for corner marker or target fields |
| SnnWBwwww | For field nn, set the Line width of the bottom side of a rectangle to the value wwww.<br>wwww is a number between 1 and 4 digits in length. A width of zero causes the bottom line to be suppressed.<br>Note: This command has no effect for corner marker or target fields |
| SnnLxxxx,yyyy | Set the Length parameter of Graphic Field nn to the value xxxx for the x direction and to the value yyyy for the y-direction.<br>xxxx and yyyy are numbers between 1 and 4 digits in length.<br>For Corner Markers, Length is the distance in pixels each marker extends from each corner.<br>For the Target Marker, length is the length in pixels of the horizontal and vertical lines and has a resolution of 2 pixels so that the Target Marker is always symmetrical with ½ the length on each side of the center point. |
| SnnLaaaa | Sets the Length parameter of Graphic Field nn to the value aaaa for both x and y directions. aaaa is a number between 1 and 4 digits in length. |
| SnnKcs | Set the control parameters for Graphic Field nn.<br>c = Parameter identifier, referenced by letter, from A to H inclusive<br>s = 1 to enable the function, or 0 to disable<br>For Corner Marker Fields,<br>parameter A = suppress top-left marker<br>parameter B = suppress bottom-left marker<br>parameter C = suppress top-right marker<br>parameter D = suppress bottom-right marker |
| SnnImmmm | Set the image number for Graphic Field nn to the value mmmm. |
| SnnT"ASCII text" | Set the ASCII text string for Graphic Field nn. The text string is used when the Field type is set to Text.<br>"ASCII text" is the content of the string framed with quotation marks. |

| Command Code | Mode of Operation |
|---|---|
| SnnFfff | Set the font / size for Field nn. fff is a number of between 1 and 3 digits in length. The following font/size combinations are available.<br>1 – Tahoma Bold 26 pixel height<br>2 – Tahoma Bold 40 pixel height<br>3 – Tahoma Bold 78 pixel height<br>4 – Tahoma Bold 156 pixel height<br>5 – BGP Courier 26 pixel height<br>6 – BGP Courier 40 pixel height<br>7 – Larable Bold 26 pixel height<br>8 – Larable Bold 40 pixel height<br>9 – Wingdings 40 pixel height<br>10 – Wingdings 80 pixel height<br>11 – Wingdings 160 pixel height<br>The default for 720p and 1080p is font 1 and 2 respectively. |
| SnnPAxxxx,yyyy<br>SnnPBxxxx,yyyy | Set location coordinates for Graphic Field nn.<br>Each Field has two location coordinates referenced by letter, either 'A' or 'B'.<br>Coordinate A is the top-left position of a Rectangle Field, Text Field, or Corner Marker Field, and is the center position of a Target Marker Field.<br>Coordinate B is the bottom-right position of a Rectangle Field or Corner Marker Field.<br>xxxx and yyyy are numbers between 1 a 4 digits in length. |
| SnnXxxxx | Set the x-direction position for coordinate A of the Graphic Field nn. This command is included for compatibility with the Text Overlay command set. |
| SnnXaaaa,bbbb | For Graphic Field nn, set the x-direction position for coordinate A to the value aaaa and set the x-direction coordinate B to the value bbbb. |
| SnnYyyyy | Set the y-direction position for coordinate A of the Graphic Field nn. This command is included for compatibility with the Text Overlay command set. |
| SnnYaaaa,bbbb | For Graphic Field, set the x-direction position for coordinate A to the value aaaa and set the x-direction coordinate B to the value bbbb. |
| SnnPAXxxxx<br>SnnPBXxxxx | For Graphic Field nn, set only the x-direction location of either coordinate A or coordinate B. |
| SnnPAYyyyy<br>SnnPBYyyyy | For Graphic Field nn, set only the y-direction location of either coordinate A or coordinate B. |

| Command Code | Mode of Operation |
|---|---|
| SnnNm | For Graphic Field nn, set the justification mode. These commands use the field length that is set separately by the SnnJmm command.<br>m = 0<br>No justification is selected<br>m = 1<br>Display the text string left justified in the field. If the string is longer than the field, it is clipped at the right. If the string is shorter than the field it is padded with spaces at the right.<br>m = 2<br>Display the text string right justified in the field. If the string is longer than the field, it is clipped at the left. If the string is shorter than the field, the string is padded with spaces at the left.<br>m = 3<br>Display the text string right justified in the field. If the string is longer than the field, the field expands to fit the string. If the string is shorter than the field, the string is padded with spaces at the right.<br>m = 4<br>Display the text string centered in the field. If the string is longer than the field, it is clipped at the left. If the string is shorter than the field, it is padded with spaces before and after to center it. |
| SnnJmm | For Graphic Field nn, set the field length to mm characters for justification. If the field length is 0, justification is disabled. |

**TABLE NOTES:**

Changes to a string do not take effect until either the text overlay is refreshed with the "SU" command or any string's visibility is toggled with SnV, displayed with SnS, or turned off with SnH.

### *4.8.1.11 Sample Text Field Commands*

#### *4.8.1.11.1.1 Example 1:*

Display of a single text field with the following attributes:

- Text: A sample of RED text on a WHITE background
- Text size: 2
- Position: X=0100, Y= 0200
- Color: red
- Background Color: white
- Background Visibility: 100%

The SERIAL Commands to display this text as Field 1 are as follows:

S1T“A sample of RED text on a WHITE background”
S1F002
S1X0100
S1Y0200
S1R255
S1G000
S1B000
S1BA000
S1BR255

S1BG255
S1BB255
S1S


**Figure 21: Example 1 - Red text OSD with white background**

This text field can be updated and replaced with new text have the same attributes by overwriting with a new text string. For example, if the new text was:

This is an updated text string for Text Field 1

The command would be:

S1T“This is an updated text string for Text Field 1”
SU

#### *4.8.1.11.1.2 Example 2:*

The addition of a second text field with the default font and color:

- Text: A text sample using default values for Text Field 2
- Default text size at 720p: 002
- Position: X=0600, Y=0200
- Default color: white

The SERIAL Commands to display this text as Field 2 are as follows:

S2T“A text sample using default size for Text Field 2
S2X0600
S2Y0200
S2S


Figure 22: Example 2 – Sample of default text

The command to turn Text Field 1 off is:

S1H

#### *4.8.1.12 Low Level Text Control Commands*

The Low Level Text Control Commands provide an additional level of control for text rendering that can improve performance in certain situations.

The DX-2200 text overlay process uses two memory buffers where text strings are converted to a rendered image that is mixed with the output video. At any one time, one buffer is being mixed with the video and the other is the spare buffer used to render the next image when the text overlay is changed (eg by the SnV, SnS, or SnH commands). When these commands are executed they render the text to an image, swap the two buffers so that the next image is displayed, and clear the new spare buffer to prepare it for the next update. The Low Level Text Control Commands provide additional control of the process.

### Table 16: Low Level Text Command Codes

| Command Code | Mode of Operation |
|---|---|
| Text Overlay Commands | |
| SB | Renders the text to the spare buffer. The buffers are not automatically exchanged. |
| SW | Swap the overlay buffers and clear the spare buffer |
| SS | Swap the overlays buffers. |
| SC | Clear the spare buffer |
| SnU<br>SnnU | Render only the text for the specified text field to the spare buffer |

#### 4.8.1.12.1 APPLICATION EXAMPLE 1

Suppose that it's necessary to update the text overlay at a specific time. If the S1T commands have been used to configure the strings, then executing SU will not take immediate effect because the strings must be rendered to the spare buffer before the buffer is switched. The time required to render text depends on the number of characters drawn and the font size and can cause a noticeable delay.

By using the Low Level Text Commands the overlay update can be controlled more accurately. After setting the text fields with the S1T command, execute SB to render the text to the spare buffer. This must be done prior to the desired switching time so that the text has time to render to the spare buffer. At the time when overlay switching is required, execute SW and the buffers will be switched.

When the output video mode is progressive there is no frame buffering between the mixer and the output. The overlay change appears in the next frame output from the DX-2200. For interlaced modes there is additional buffering before the output and the overlay change will typically appear in the output video 2 frames later.

#### 4.8.1.12.2 APPLICATION EXAMPLE 2

Suppose that 5 text fields are being displayed and the one field needs to be updated regularly (in the same screen location) while the others do not change. In this case it's possible to use the Low Level Text Commands to update only the one field that changes to avoid the time required to re-render the other four strings that don't need to change.

Configure all 5 strings with the SnT commands and set their visibility and color. When all strings are displayed execute SB so that the strings are also rendered to the spare buffer. When the SS command is executed the overlay can switch between two identical buffers. Now, the content of one string can be changed with the SnT command and SnU can be used to render only that string to the spare buffer. When SS is executed, the buffers will be switched and the update is displayed without need of rendering the other strings that were not changed. Note that this procedure never clears the spare buffer and so no pixels can be removed from the overlay except by overwriting them with different text or blank spaces. If the length of the new string is shorter than the previous string, spaces can be appended to overwrite the pixels of the previous string. When leaving this mode of operation, the SC command should be executed to clear the spare buffer so that it's in the state expected by the other overlay commands.

### *4.8.1.13 Frame Counter Overlay SERIAL Commands*

The DX-2200 has a Frame Counter that displays the frame number as a text overlay on the video. The Frame Counter is supported for progressive video modes only and counts the output frames from the DX-2200.

The Frame Counter has 5 Modes of operation that are selectable using the 'SFMn' command (See **Table** 18).

#### 4.8.1.13.1 FRAME COUNTER MODE 0

Frame Counter Mode 0 turns off the running frame count display. When the automatic counter is off, it is possible to send a string and display it on the video by serial command. This mode supports writing short custom strings at a high frame rate. If the external controller can send commands synchronized with video frames, it is possible to draw at frame rate.

#### 4.8.1.13.2 FRAME COUNTER MODE 1

Frame Counter Mode 1 is a counter formatted as 'HH:MM:SS:FF', where FF is the frame number and increments from 00 to a maximum value of the video frames per second rate minus one. When the frame count resets, the seconds field ('SS') is incremented. After 24 hours, the counter rolls over to zero. For video modes of 24, 24, 30, 50, 60 frames per second, the frames counter always counts sequentially from 0 to the maximum value. For video modes that use (1000/1001) clock rates, eg 29.97 Hz, and 59.94 Hz, the frame

counter includes frame number skipping similar to that used in ancillary data time codes. Frame number skipping maintains a closer relationship between the counter value and real time by skipping some frame numbers at the start of minutes 00, 10, 20, 30, 40, and 50.

#### 4.8.1.13.3 FRAME COUNTER MODES 2 – 4

Frame Counter Modes 2, 3, and 4 display the frame count as a four digit “NNNN”, a six digit “NNNNNN”, or an eight digit “NNNNNNNN” number with leading zeroes. The count increments on every output frame and will reset to 0 when all digits are ‘9’.

Commands are provided to configure the position and color of the Frame Counter and to set the current count to a specific value. The current frame count value for Mode 1 can be set using the ‘SFT:HH:MM:SS’ command. The current frame count value used in Modes 2, 3 and 4 can be set by the ‘SFNnnnn’ command. The two count values are independent of each other. Both counters start at zero when the DX-2200 is powered on or reset. The frame counts continue to be updated when the counter is not displayed for progressive video formats.

The syntax for many of the Frame Counter Commands (see **Table 17Error! Reference source not found.**) is similar to that used by the Text Overlay Commands but there are also important differences. Many commands include a string number. String number may be either one or two digits, for example ‘01’ or ‘1’. At present there is one text field supported by the frame counter and the string number should always be set to 1. Other values are reserved for future use. The string numbers used by the Frame Counter commands are independent of those used by the Text Overlay.

To support high speed (frame rate) operation, the frame count is drawn directly into the active text overlay buffer. (See ‘Low Level Text Control Commands’ for more information). A consequence of drawing to the active buffer is that the number of pixels drawn should be kept small so that the text is drawn within the time of one frame, otherwise one or more frames will be generated with partially draw text.

The fonts used by the Frame Counter are not the same as those used in the Text Overlay. All fonts are fixed width and hard edge. Setting the font to 0 selects a video mode dependent default font. Other font settings are listed in the command table. To ensure the frame counter is drawn at the video rate, it is recommended not to use a font larger than the default font.

The automatically updating Frame Counter modes continuously overwrite the same location in the video. When the frame counter is turned off, or when the font, size, or position is changes, the frame count is drawn once with the alpha set for full transparency. This erases the frame count text from the video and a frame will be displayed without the frame count before the counter appears with the new settings.

If the Frame Counter is set to Mode 0 and is being manually controlled, the ‘SF1D’ command is used to draw the text with the specified color and transparency and the ‘SF1H’ command is used to erase the text by drawing over it with 100% transparency. If a Text Overlay command causes the two text memory buffers to be swapped, the text written by the Frame Counter will **not** be automatically written to the new memory buffer. To display the text again, the ’SF1D’ must be used to redraw the text in the new active buffer.

The default text properties for the Frame Counter are:

| | |
|---|---|
| Foreground: | Red = 255, Green = 255, Blue = 255, Alpha = 000 |
| Background: | Red = 000, Green = 000, Blue = 255, Alpha = 255 |
| Position: | X = 0, Y = 0 |

#### 4.8.1.13.4 SAMPLE FRAME COUNTER COMMANDS

##### *4.8.1.13.4.1 Frame Counter Example 1:*

With DX-2200 starting from the factory defaults, turn on the frame counter in the upper left corner of the screen with white text on a blue background and set the current frame counter value to 11:25:00

SF1BA000
SFT:11:25:00
SFM1

##### *4.8.1.13.4.2 Frame Counter Example 2:*

Show the message “Frame Counter (hh:mm:ss:ff)” in the top left corner of the video and show the frame counter below it. The text properties are set for yellow text on a blue background for both.

S1X0050
S1B000
S1BA000
S1T"Frame Counter (hh:mm:ss:ff)"
S1S
SF1Y0050
SF1X0050
SF1B000
SF1BA000
SFM1


**Figure 23: Frame Counter text display – Example 2**

#### *4.8.1.13.4.3 Frame Counter Example 3:*

Show the message “Frame Count” in the top left corner of the video and show the frame counter below it. The text properties are set for default white text with no background.

S1F008
S1X0050
S1T"Frame Count"
S1S
SF1Y0045
SF1X0050
SFM4


**Figure 24: Frame Counter text display – Example 3**

### Table 17: Frame Counter Overlay SERIAL Command Codes

| Command Code | Mode of Operation |
|---|---|
| Frame Counter Overlay Commands | |
| SFMn | Control the frame counter operating mode<br>0 – Off / Manual Drawing<br>1 – Frame Counter Mode “HH:MM:SS:FF”<br>2 – Frame Counter Mode “NNNN”<br>3 – Frame Counter Mode “NNNNNN”<br>4 – Frame Counter Mode “NNNNNNNN” |
| SFZ | Reset all fields to the default text, size, position, color and font. |
| SnnZ | Reset text field nn to the default text, size, position, color and font.<br>‘nn’ - the one or two digit Text Field / String number to modify. |
| SFnnXxxxx | Set the X position - xxxx must be a four-digit number.<br>‘nn’ - the one or two digit Text Field / String number to modify.<br>Set nn equal to 1 to control the position of the frame counter. If the position places some or all of the text off screen, the text is positioned so that the end of the text is at the right edge of the video. |

| Command Code | Mode of Operation |
|---|---|
| SFnnYyyyy | Set the Y position - xxxx must be a four-digit number. If the position places the text off screen, then the text is placed at the bottom of the video. |
| SFnnRrrr | Set the Red color value of string nn - rrr must be a three-digit number from 000 and 255. |
| SFnnGggg | Set the Green color value of string nn - ggg must be a three-digit number from 000 to 255 . |
| SFnnBbbb | Set the Blue color value of string nn - bbb must be a three-digit number from 000 to 255. |
| SFnnAaaa | Set the transparency of string nn - aaa must be a three-digit number from 000 to 255. The value 000 sets the string fully visible and 255 is fully transparent. |
| SFnnBRrrr | Set the Red color value of the background for string nn - rrr must be a three-digit number from 000 and 255. |
| SFnnBGggg | Set the Green color value of the background for string nn - ggg must be a three-digit number from 000 and 255. |
| SFnnBBbbb | Set the Blue color value of the background for string nn - bbb must be a three-digit number from 000 and 255. |
| SFnnBAaaa | Set the transparency of the background for string nn - aaa must be a three-digit number from 000 and 255. The value 255 sets the background fully transparent and the value 000 sets the background fully visible. |
| SFnnFxxx | Set the font where xxx is the three digit font number. The following fonts are available:<br>001 – Larable Bold 26 pixel height<br>002 – Larable Bold 40 pixel height<br>003 – BGP Courier 26 pixel height<br>004 – BGP Courier 40 pixel height<br>005 – Tahoma Bold 26 pixel height<br>006 – Tahoma Bold 40 pixel height<br>xxx = 000 selects the recommended default font<br>xxx = 001 selects a 26 pixel font recommended for 720p resolution<br>xxx = 002 selects a 40 pixel font recommended for 1080p resolution<br>NOTE: Using the Frame Counter with a larger font than recommended may result in slower updates and/or video frames with partially drawn count values. |
| SFm | Update mode. The Text Overlay and Frame Counter use the same video frame memory. This command affects the update sequence when the Text Overlay performs a buffer swap.<br>SF0: The Text Overlay swaps buffers immediately when it has completed rendering text or is commanded to so. This mode provides fast response to the Low Level Text Overlay buffer swap commands, but will often result is a frame without the frame count displayed after the buffer switch.<br>SF1: The Text Overlay buffer swap is delayed while the frame count is drawn into the new buffer before the buffers are switched. This avoids a frame without the frame the frame counter display, but delays the buffer switch. |
| SFT:HH:MM:SS<br>or<br>SFT:HH:MM:SS:FF | Set the value of the frame counter for Mode 1, for example to match local time.<br>'HH' is the two digit number of hours from 00 to 23<br>'MM' is the two digit number of minutes from 00 to 59<br>'SS' is the two digit number of seconds from 00 to 59<br>'FF' is the two digit frame number from 00 to [frame per second -1] |

| Command Code | Mode of Operation |
|---|---|
| | If the command without 'FF' is used, the frame number will be set to 00. |
| SFNnnnnnnnn | Set the value of the frame counter for modes 2, 3, and 4.<br>'nnnnnnnn' is a positive integer of between 1 and 8 digits. |
| SFnnT"text" | Set the text string used in Manual Drawing mode.<br>"text" is the string enclosed in quotation marks. |
| SFnnD | Draw the text string. This command is valid only in Manual Drawing Mode. |
| SFnnH | Erase the text string by drawing it with 100% transparency. This command is valid only in Manual Drawing Mode. |
| ** Prefix 0s to any number with fewer digits. | |

#### *4.8.1.14 Overlay Control SERIAL Commands*

The Overlay Control SERIAL Commands act as a master control to enable or disable the display of all Graphic Fields and the frame counter. The visibility settings of the individual fields and the frame counter are not changed by these commands. This allows all overlay items to be toggled on and off with a single command. By default, the overlay features are enabled.

**Note:** If these commands are used to disable the overlay display, then the visibility commands for the individual graphic fields and the frame counter cannot make them visible again. The Overlay Control SERIAL Commands must be used to re-enable display.

The Overlay Control Commands are listed the below.

### Table 18: Overlay Control SERIAL Command Codes

| Command Code | Mode of Operation |
|---|---|
| S0 | Disable display of the overlay including all graphic fields and the frame counter. |
| S1 | Enable display of the overlay including all graphic fields and the frame counter (only those items that have also been enabled by their individual control commands will be displayed). |
| ST | Overlay toggle. If the overlay is enabled, then disable it. If the overlay is disabled, then enable it. |

#### *4.8.1.15 Layer Control SERIAL Commands*

The Layer Control SERIAL Commands allow the overlay layer to be updated, reduced in size, and moved. These commands also duplicate some of the capabilities provided in the Graphics Overlay commands.

The Layer Control commands include a layer number as a parameter that is represented by 'nnn' in the command descriptions. The DX-2200 Dual View Switcher supports a single overlay layer. The layer number used in the commands should be set to '1'. A value of '0' is also accepted and has the same effect.

For example the LnU command updates layers:

L1U – Update the Graphic Overlay
L0U – Update the Graphic Overlay

#### 4.8.1.15.1 Low Level Buffer Control

The Layer Control Serial Commands can be used to access the same Low Level Overlay Functions that are provided in the Graphic Overlay Commands.

The Low Level Buffer Control Commands are LnB, LnW, LnC, and LnS.

#### 4.8.1.15.2 Visibility of Layers

The Graphic Overlay can be enabled and disabled at the mixer. This provides a high speed method of turning the overlay on and off because the individual fields don't need to be rendered.

The LnD command disables the visibility of a layer, and the LnE command enables visibility. The LnT command toggles visibility on and off.

These visibility commands act as a master control to enable or disable the entire layer. The visibility settings of the individual Fields on the layer are not changed by these commands. By default, all layers are enabled.

**Note:** If these commands are used to disable the overlay, then the visibility commands for the individual Fields cannot make them visible again. Only the LnE command or resetting the layer to defaults can make them visible

#### 4.8.1.15.3 Enabling and Disabling Layers

If the graphic overlay is not required in an application, it can be disabled using the LnH command. The graphic overlay can be re-enabled using the LnA command.

These commands are relatively slow and may disturb the output video. They are recommended for use during initial setup or at times when clean video output is not required.

#### 4.8.1.15.4 Re-Sizing Overlays

By default, the graphic overlay is the same size as the video output of the DX-2200. The LnKxxxx,yyyy command sets a preferred size for the overlay. If the preferred size is smaller than the video size, the overlay is reduced in size to match the preferred size. The overlay will never be larger than the output video size.

When the overlay size is changed, the layer will be disabled momentarily and both the active and spare frame buffers will be cleared. To see the content of the overlay after a size change the layer must be updated, for example using the LnU command.

Setting xxxx and/or yyyy to 0 restores the default overlay size. It is not possible to set the overlay width or height smaller than 16 pixels.

#### 4.8.1.15.5 Moving An Overlay

When the Overlay has been reduced in size, (via the LnKxxxx,yyyy command) it is then possible to change the x, y position of the overlay item within the boundaries of the output video. This process can then be used for moving/panning an OSD target marker around the displayed video.

The LnPxxxx,yyyy sets the x and y position of the overlay. The overlay must always fit completely within the boundaries of the output video. It is not possible to have an overlay partially off screen. This is the reason that the overlay must be reduced in size before the position can be changed. It is also possible to change only the x position using the LnPXxxxx command, or only the y position using the LnPYyyyy command.

By default, the overlay position coordinates refer to where the top-left corner of the overlay is located in the output video. The reference point can be changed to the center of the overlay instead of the top left corner using the LnPM2 command.

Moving the overlay is very fast because it does not require rendering any Fields or switching the overlay buffers. The overlay item can be repositioned at the video frame rate by sending serial commands at an appropriate interval.

### Table 19: Layer Control SERIAL Command Codes

| Command Code | Mode of Operation |
|---|---|
| Layer Control Commands | |
| LnU | Update layer n by rendering all Fields on the layer(s) to the spare buffer, then switching the spare and active buffers to make the update visible.<br>n is the layer number(s), See **<br>After the buffer switch, the new spare buffer is automatically cleared. |
| LnB | Renders the Text or Graphics Fields on Layer(s) n to the spare buffer, but the buffers are not swapped. The video output does not change.<br>n is the layer number(s), See ** |
| LnW | Swap the active and spare buffers on layer n, then clear the new spare buffer. No fields are rendered and the spare buffer is displayed with its existing content.<br>n is the layer number(s), See ** |
| LnS | Swap the active and spare buffers on layer n without rendering and fields or clearing of any buffers.<br>n is the layer number(s), See ** |
| LnC | Clear the spare buffer on layer n.<br>n is a number in the range 0 to 3, See ** |
| LnD | Disable display of layer n. The entire layer is disabled without changing the settings of any Text or Graphic Fields on that layer. Use LnE to make the layer visible again.<br>n is the layer number(s), See ** |
| LnE | Enable display of layer n. If the layer was previously disabled with LnnnD, then this command makes the layer visible again.<br>The LnD and LnE commands provide a very fast method of turning an entire layer on and off.<br>n is the layer number(s), See ** |
| LnH | Disable layers that are not needed. Note: This command may disturb the output video. |
| LnA | Enable a layer that has been previously disabled with LnH. Note: This command may disturb the output video. |
| LnT | Toggle the visibility of layer n between on and off.<br>nnn is the layer number(s), See ** |
| LnZ | Set the size and visibility of layer n to default. The defaults are visible and the same size as the output video of the DX-2200.<br>nnn is the layer number(s), See ** |
| LnKxxxx,yyyy | Set a preferred size for an overlay layer. xxxx and yyyy are numbers between 1 and 4 digits in length. The size of an overlay cannot be less than 16 pixels in either direction. Setting xxxx=0 and/or yyyy=0 uses the default size, which is the same size as the output video.<br>nnn is the layer number(s), See ** |

| Command Code | Mode of Operation |
|---|---|
| LnPxxxx,yyyy | Set the x and y position of the overlay for Layer n.<br>xxxx and yyyy are numbers between 1 and 4 digits in length.<br>The overlay must always fit completely within the output video and the position specified in this command is automatically adjusted to prevent the overlay extending beyond the edges of the video.<br>Therefore, if the overlay is at the default size (the same size as the output video) it can only be positioned in one location and this command will have no effect. The overlay can only change positions if the size has been reduced to be smaller than the output video size.<br>nnn is the layer number(s), See ** |
| LnPXxxxx | Set the x-direction position only for overlay layer n.<br>nnn is the layer number(s), See ** |
| LnPYyyyy | Set the y-direction position only for overlay layer n.<br>nnn is the layer number(s), See ** |
| LnPM1 | Set the position coordinates for layer nnn to be specified as top-left corner of the overlay<br>nnn is the layer number(s), See ** |
| LnPM2 | Set the position coordinates for the layer nnn to be specified as center position of the overlay.<br>nnn is the layer number(s), See ** |
| ** The layer number n should be set to 1 for all Layer Control Serial Commands | |

#### *4.8.1.16 Digital Zoom Command*

The DX-2200 supports Digital Zoom of the video input channels. Zoom can be specified independently for the selected and non-selected inputs. The zoom function operates by selecting a region of the input video for processing instead of using the full size video. The selected region is referred to as the zoom window in this manual. The scaler in the DX-2200 will scale up the selected zoom window to the size needed for the output video, resulting in a zoomed in view. The zoom function allows for increasing the size of the video above full size (100%). It is not possible to use the zoom function decrease the size of the video.

The Digital Zoom Commands in this section begin with either ‘ZS’ to refer to the selected input, or with ‘ZP’ to refer to the non-selected input. The following section refers to ‘ZS’ commands only, but the same applies for ‘ZP’ commands.

Two methods of setting the zoom are provided. The ‘ZSP’ command enables setting the zoom as center position and zoom percent. This is the default zoom control method. The ‘ZSnnnn’ command specifies the zoom as a percentage. The command accepts percentages from 100% to 3400% however the maximum zoom that can be displayed is dependent on the video mode. Refer to Table 20: Digital Zoom Command Codes for more information. The ‘ZSCXnnn’ and ZSCYnnn’ commands specifies the zoom window center x and y position respectively as a percentage of the video size in the range from 0% to 100%. The parameters can include up to 1 decimal place. The zoom window must always fit within the input video. The DX-2200 will adjust the zoom position as required to make the window fit.

For example, if the zoom is set to 200%, then the zoom center position can be moved between 25% and 75% of the video size in both the x and y directions. When the zoom position is at 25%, the left / top of zoom window will be at the left / top of the video window, and when the zoom position is at 75%, the right / bottom edge of the zoom window will be at the right / bottom of the input video. Attempting to move the zoom center

outside the range of 25% to 75% won't have any additional effect. If the zoom center is set to 20%, and then later if the zoom percentage is increased to 400%, the zoom center will move to the 20% position because the zoom window is now smaller and fits within the video when located at the 20% position.

The second method of setting the zoom is by specifying a window by the x and y position of the top left corner, and the size. All parameters for this control method are specified in pixels. This 'ZSW' command enables control by top left corner and size. The zoom window position is set by the 'ZSLXnnn' and 'ZSLYnnn' commands. The zoom size is set by the 'ZSLWnnn' and 'ZSLHnnn' commands. The minimum zoom window the DX-2200 will display is 64 x 64 pixels. If the requested zoom window is larger than the input video size, the window will be reduced to the video size. If the position places the window outside the input video, then the position is automatically adjusted to make the window fit.

For example, if the commands: ZSLX100;ZSLY100;ZSLW1600;ZSLH900 are sent, and the video input at the selected input connector is 1280x720, the DX-2200 will reduce the window size to 1280x720, and since a window of this size can only fit within the input video when located at (0,0), the output of the Digital Zoom will be the full input video. If the input resolution is later changed to 1920x1080, then the DX-2200 will output a 1600x900 pixel region of the input signal with a top left corner at x=100, y=100.

Note: If the aspect ratio of the chosen zoom window does not match the aspect ratio of the output video window, the video will be distorted (stretched or compressed to fit).

The Digital Zoom feature operates in all Display Modes, but functionality is reduced when operating in Mode 4 (Split Screen). In this mode, only the zoom factor in percent can be used, regardless of what zoom control mode has been selected, and the zoom center position cannot be changed. The intended purpose of the Split Screen Mode requires that the zoom position is fixed.

**Note:** The zoom window horizontal position and width are truncated to an even pixel number by the DX-2200, resulting in a minimum two pixel resolution for setting the size and position of the window. For interlaced video, the vertical zoom window position and height have a two pixel resolution.

### Table 20: Digital Zoom Command Codes

| Command Code | Mode of Operation |
|---|---|
| Zoom Commands | |
| ZR | Reset the zoom control mode to zoom/center position mode. Reset the position to center (50%) and the zoom factor to 100% for all channels. |
| ZSP | Set the zoom control mode for the **selected** input to be the zoom/center position mode. |
| ZPP | Set the zoom control mode for the **non-selected** input to be the zoom/center position mode. |
| ZSP2 | Set the zoom control mode for the **selected** input to be the zoom/center position mode with priority given to maintaining the center position at the cost of having fewer zoom steps. If the zoom is being adjusted to simulate a zoom lens, this mode shows less jitter than the ZSP mode. |
| ZPP2 | Set the zoom control mode for the **non-selected** input to be the zoom/center position mode with priority given to maintaining the center position at the cost of having fewer zoom steps. If the zoom is being adjusted to simulate a zoom lens, this mode shows less jitter than the ZPP mode. |
| ZSP3 | Set the zoom control mode for the **selected** input to be the zoom/center position mode with priority given to maintaining the center position and preventing distortion due ot roundoff by allowing only zoom selections that are an integer multiple of the aspect ratio. This mode has many fewer zoom steps than the ZSP2 mode. |
| ZPP3 | Set the zoom control mode for the **non-selected** input to be the zoom/center position |

| | |
|---|---|
| | mode with priority given to maintaining the center position and preventing distortion due ot roundoff by allowing only zoom selections that are an integer multiple of the aspect ratio. This mode has many fewer zoom steps than the ZPP2 mode. |
| ZSW | Set the zoom control mode for the **selected** input to be top / left corner and size. |
| ZPW | Set the zoom control mode for the **non-selected** input to be top / left corner and size. |
| ZSxxxx | Set zoom factor of the **selected** input for the zoom/center mode<br>'xxx' is a zoom value from 100 to 3400% and may optionally include up to one decimal place.<br>The command accepts zoom values up to 3400%, but the maximum zoom that can be displayed is dependent on the video mode:<br>1080p – max. zoom 3375%<br>720p – max. zoom 2250%<br>1080i – max. zoom 1687%<br>Increasing the zoom setting beyond these limits does not increase the magnification.<br><br>Note: Only certain discrete zoom values are acheivable and the step size between achievable values increases as the zoom increases. The DX-2200 will automatically select the closest acheivable zoom based on the parameter. For example at low zoom a change from 100.0% to 100.1% may produce a change in the display, but at high zoom selecting 3320% and 3375% result in the same display. |
| ZPxxxx | Set zoom factor of the **non-selected** input for the zoom/center mode<br>'xxx' is a zoom value from 100 to 3400% and may optionally include up to one decimal place.<br>Refer to the ZSxxx command for zoom limitations |
| ZSCXaaa<br>ZSCYbbb | Set the zoom window center position for the **selected** input when operating in the zoom/center mode.<br>aaa = horizontal center position of the zoom region<br>bbb = vertical center position of the zoom region<br><br>The parameters must be in the range 0% and 100% and may optionally include up to one decimal place. |
| ZPCXaaa<br>ZPCYbbb | Set the zoom window center position for the **non-selected** input when operating in the zoom/center mode.<br>aaa = horizontal center position of the zoom region<br>bbb = vertical center position of the zoom region<br><br>The parameters must be in the range 0% and 100% and may optionally include up to one decimal place. |
| ZSLXaaa<br>ZSLYbbb<br>ZSLWccc<br>ZSLHddd<br><br>ZSLAaaa,bbb,<br>www,hhh | Set the zoom window top left corner and size for the **selected** input in pixels when operating in the top/left corner and size mode.<br>aaa = position of left edge of zoom window in pixels<br>bbb = position of top edge of zoom window in pixels<br>ccc = width of zoom window in pixels<br>ddd = height of zoom window in pixels.<br><br>The parameters may be between 1 and 4 digits in length. The zoom window cannot be set smaller than 65x65 pixels.<br>Using the ZSLA form of the command has the advantage of ensuring that all parameters are set simultaneously. |

| | |
|---|---|
| ZPLXaaa<br>ZPLYbbb<br>ZPLWccc<br>ZPLHddd | Set the zoom window top left corner and size for the **non-selected** input in pixels when operating in the top/left corner and size mode.<br>aaa = position of left edge of zoom window in pixels<br>bbb = position of top edge of zoom window in pixels<br>ccc = width of zoom window in pixels<br>ddd = height of zoom window in pixels. |
| ZPLAaaa,bbb,<br>www,hhh | The parameters may be between 1 and 4 digits in length. The zoom window cannot be set smaller than 65x65 pixels.<br>Using the ZPLA form of the command has the advantage of ensuring that all parameters are set simultaneously. |

### *4.8.1.17 User Interface Commands*

The user interface commands control the behavior of the DX-2200 and allow reconfiguration of the functions performed by the DIP switch and toggle switch to customize the product for specific applications.

Configuration of the switches consists of two steps. The switch(s) to be configured are assigned to a user interface function, and the user interface function is programmed to perform the required operations.

The DX-2200 has 4 DIP switches than can be assigned and a toggle switch that can toggle left and toggle right. Different commands are used to assign the DIP and toggle switches.

#### 4.8.1.17.1 DIP Switch Assignments

DIP Switch Assignments DIP switches are assigned to user interface functions using the 'US' commands.

An assignment command example is US1:01. This command will assign DIP Switch #1 to control user interface function 01.

The previous assignment assigns the switch for all modes of operation, but it's also possible to set the behavior of the switch to be different for different modes of operation. The mode specific assignment command is used for this purpose. Following the previous assignment command with US1M02:02 will re-assign DIP switch #1 to user interface function 02 only when the switcher is operating in mode 02 (PiP). When the switcher operated in other modes, the switch is still assigned to user interface function 01.

One or more DIP switches can be assigned to the same user interface function. The number of switches assigned determines how many different operations can be selected from the user interface function. When one switch is assigned, two operations are available. Two switches allow four operations, three switches allow eight operations and four switches allow the selection of 16 operations.

#### 4.8.1.17.2 Toggle Switch Assignments

Toggle switches are assigned using the UL and UR commands to assign the left and right toggle operations. The assignments can apply either to all modes of operation, or to one specific mode. The example commands: UR:03, URM02:04 will set toggling the switch to the right to control user interface function 03 in all modes except mode #2, where it is assigned to user interface function 04 instead.

### *4.8.1.18 User Interface Function Configuration*

The user interface functions are software components that have a selection input that is controlled by the physical switches that are assigned to it. For each value of the selection input, a different serial command string can be assigned.

The DX-2200 has 20 user interface functions numbered 01 through 20. Each user interface function supports up to 16 selections that are numbered 00 to 15. In the factory default configuration, all user interface functions are unused and have no commands assigned to them.

The switches that control a user interface function can be either one or more DIP switches, or a Toggle Switch.

If DIP switches have been assigned, then the value set on the switches determines the selection. Each switch that has been assigned becomes one bit of the selection value, with the least significant bit being the switch with the lowest number (as marked on the DIP switch component). When a switch is OFF, the bit value is 0. When the switch is on, the bit value is 1.

If a toggle switch has been assigned, then the switch increments the selection each time is is toggled, until a selection is found with no command assigned, or the maximum number of selections has been reached. This indicates the end of the toggle switch function loop and the selection is reset to 0.

The UF commands are used to assign commands to the user interface functions. For example, the command UF07,00:"M2" assigned user interface function 07, selection number 00 to have the command M2 (set the mode of the DX-2200 to PiP). Any previous command assignment for this user interface function and selection is erased by this command.

The command string that is being assigned is always enclosed with quotation marks. More than one command can be assigned in the above command using a semicolon delimiter. For example UF07,00:"M2;P1" will set the mode to PiP and also set the PiP position to predefined position P1.

Another version of the UF command supports appending additional commands to a selection that already has a command assigned. The command UF07:00+"PS01", executed after the previous example, adds the command PS01 to set the PiP size to 1/16$^{th}$ of the screen width.

Executing UF07,00:"" clears any command that was previously assigned to Selection 00 of user function 07.

When executing the UF commands, the command response (either '+' or '-') indicates only that the syntax of the UF command was accepted. It does not indicate the command string being assigned to the user interface function is correct. Commands can be tested by executing them prior to assigning them to user interface functions.

#### *4.8.1.19 Resetting DX-2200 Switches to Factory Default Configuration*

The DX-2200 provides commands to clear the user functions and restore the default switch settings. All selections of a user functions can be cleared using the UFnnC command where nn is the user function number. All user functions can be cleared with the UFC command. The UR command restored the default DIP and Toggle switch settings, but does not clear any user interface functions that the user has configured.

#### *4.8.1.20 Recommendations for DX-2200 Configuration*

Don't set a selection of a user interface function to both change the operating mode and switch the inputs. This can cause switching glitches.

Don't re-assign switch functions from a user interface selection.

Assign either one set of DIP switches, or one toggle switch to a user interface function. Assigning more than one toggle switch, or both DIP and toggle switches will usually have undesirable results.

Don't assign toggle type commands to DIP switches. For example, don't assign 'T' to a dip switch. Use 'I1' or 'I2' instead to select a specific input.

### Table 21: User Interface Command Codes

| Command Code | Mode of Operation |
|---|---|
| User Interface commands | |
| USn:ff | Assign DIP switch number n to user interface function ff for all operating modes.<br>n must be one digit and ff must be two digits. |
| USnMmm:ff | Assign DIP switch number n to user interface function ff for operating mode mm only. The assignments for other modes remain unchanged.<br>ff and mm must both be two digits. |
| UL:ff<br>UR:ff | Assign toggle left or toggle right to user interface function ff in all modes of operation.<br>ff must be be two digits |
| ULMmm:ff<br>ULMmm:ff | Assign toggle left or toggle right to user interface function ff in mode mm only.<br>ff and mm must both be two digits. |
| UFff,ss:"str" | Assign a command string to user interface function ff, selection ss where both ff and ss must be two digits. Any previous command is erased. |
| UFff,ss+"str" | Append additional commands to the command string for user interface function ff, selection ss where both ff and ss must be two digits. |
| TL<br>TR | Perform the toggle left or toggle right operation as if the switch had been toggled. |
| TLnn<br>TRnn | Set the toggle left or toggle right loop position to setting nn where nn may be either one or two digits. |
| UR | Reset the DIP and toggle switches to perform the factory default functions. |
| UFC | Clear the commands from all selections of all user interface functions |
| UFnnC | Clear the commands from all selections of user interface function nn, where nn is two digits. |
| TD | Disable the toggle switch. Toggling the switch will have no effect, but the TL / TR commands will continue to function. |
| TE | Enable the toggle switch |
| UD | Disable the DIP switches. |
| UE | Enable the DIP switches |
| UU | Read the DIP switches immediately and execute the commands for the current setting. |
| U0 | DIP switch settings are applied only when the DIP switches are changed. This mode may be useful when the DX-2200 is operating primarily under SERIAL control, but the DIP switches are also being used. |
| U1 | DIP switch settings are applied when the DIP switches are changed, at startup, and also whenever the mode is changed. This is the default mode of operation. |
| U2 | DIP switch settings are applied when the switch is changes and also at startup if there is no saved configuration in the unit. This is the default setting of the DX-2200-TI |

### *4.8.1.21 DX-2200 Example Configuration Command File*

The following an example DX-2200 Configuration Command File that can be uploaded to the switcher using a (commercial) Terminal program.

```
' ---------------------------------------------------------------------------------------------
' DX-2200  - Sample of a MANUAL control mode configuration script
'
' The dip switches and toggle switch on the DX-2200 can be re-defined to customize the
' controls to provide the functions needed in specific user applications.
' This script is one example of how the product can be configured using SERIAL commands.
'
' ( all lines starting with ' can be transmitted to the DX-2200 and will be ignored as comments )
' ---------------------------------------------------------------------------------------------

' Reset the user interface to factory default
UR

' Set the Toggle switch in mode 2 so that it will cycle through predefined PiP
' sizes. In all other modes, the switch continues to perform the factory default function
' of switching between input 1 and input 2.
' The following UF commands set the functions to be performed by the toggle switch loop. The
' second parameter is the position number in the toggle loop. The toggle switch increments
' it's position number each time it's toggled, so the commands will execute in the sequence
' defined by the second parameter of the UF command.
uf02,00:"ps01"
uf02,01:"ps02"
uf02,02:"ps03"
uf02,03:"ps04"
uf02,04:"ps05"
uf02,05:"ps06"
uf02,06:"ps07"
uf02,07:"ps08"
uf02,08:"ps09"
uf02,09:"ps10"
uf02,10:"ps11"
uf02,11:"ps12"
uf02,12:"ps13"
uf02,13:"ps14"

' Assign toggle right to perform function 02 that was assigned above.
' The urMnn:ff form of the command is used so that the assignment only applies
‘ when in mode 2 (PIP)
urM02:02

' Set the position in the toggle right loop to start at a preferred PIP size. The loop position
' is set to 05, corresponding to the "ps06" command set above.
M2
TR05

' Assign the toggle left operation to perform function 03 in all modes of operation.
UL:03

' Assign commands to user interface function 03. Assume the user wants the toggle loop to
' cycle through modes 1 to 5, but also wants to select from the 4 pre-defined pip positions
' available in mode 2. To accomplish this, the toggle loop can be setup for the sequence:
'      Mode 1, Mode 2 (position 1), Mode 2 (position 2), Mode 2 (position 3),
```

```
'       Mode 2 (position 4), Mode 3, Mode 4, Mode 5
‘
uf03,00:"m1"
uf03,01:"m2;p1"
uf03,02:"m2;p2"
uf03,03:"m2;p3"
uf03,04:"m2;p4"
uf03,05:"m3"
uf03,06:"m4"
uf03,07:"m5"

' Assume the user wants the DX-2200 to display the operating mode using text overlay
' momentarily after each toggle of the switch. This allows us to demonstrate use of text
' command in configuration commands, including the use of \" when a quote is used within
' a string. We use the append form of the UF command to add text setup to the
' previously defined commands for user interface function 03.
‘
uf03,00+"S12T\"Mode 1\";s12x0050;s12f003;s12r000;s12b000;s12s;s12h0090"
uf03,01+"S12T\"Mode 2 (P1)\";s12x0050;s12f003;s12r000;s12b000;s12s;s12h0090"
uf03,02+"S12T\"Mode 2 (P2)\";s12x0050;s12f003;s12r000;s12b000;s12s;s12h0090"
uf03,03+"S12T\"Mode 2 (P3)\";s12x0050;s12f003;s12r000;s12b000;s12s;s12h0090"
uf03,04+"S12T\"Mode 2 (P4)\";s12x0050;s12f003;s12r000;s12b000;s12s;s12h0090"
uf03,05+"S12T\"Mode 3\";s12x0050;s12f003;s12r000;s12b000;s12s;s12h0090"
uf03,06+"S12T\"Mode 4\";s12x0050;s12f003;s12r000;s12b000;s12s;s12h0090"
uf03,07+"S12T\"Mode 5\";s12x0050;s12f003;s12r000;s12b000;s12s;s12h0090"

' In mode 2 only, set switch 4 to select the input.
us4M02:01
uf01,00:"i1"
uf01,01:"i2"

' In mode 2, clear the assignment from switch 3
us3M02:00

' In mode 2, set switches 1 & 2 to select from 4 PIP alpha settings
' More than one dip switch can be assigned to the same user interface function.
' When a user interface function has 2 switches assigned, it can select up to 4 different
' functions.
us1M02:04
us2M02:04
uf04,00:"a0"
uf04,01:"a2"
uf04,02:"a4"
uf04,03:"a6"
```

### *4.8.1.22 Output Video Format Command*

The Output Video Format commands determine the video format that is output by the DX-2200.

**Note:** If the video format is set to a specific mode and input video sources are not compatible with the selected mode the output video will be black. For example, if the output is set to an interlaced mode while both inputs are progressive video, then neither input can be displayed.

### Table 22: Output Video Format Command Codes

| Command Code | Mode of Operation |
|---|---|
| Output Video Format Mode | |
| On | Select the Output Video Format Mode<br>n=1: The output video format matches the format detected on SDI Input 1.<br>n=2: The output video format is the preset format (see below) and is independentof the source connected to SDI Input 1.<br>n=3: The output video format matches the format detected on SDI Input 1, and the output clock frequency is locked to the input frequency. |
| Video Format Selection | |
| OMxxx | Selects the Output Video Mode that is used when operating in Output Video Format Mode = 2.<br>Where xxx determines the video format as follows:<br>012 – 720p @ 25 fps<br>013 – 720p @ 29.97 fps<br>014 – 720p @ 30 fps<br>015 – 720p @ 50 fps<br>016 – 720p @ 59.94 fps<br>017 – 720p @ 60 fps<br><br>030 – 1080p @ 23.98 fps<br>031 – 1080p @ 24 fps<br>032 – 1080p @ 25 fps<br>033 – 1080p @ 29.97 fps<br>034 – 1080p @ 30 fps<br><br>040 – NTSC 720x487 @ 59.97 fields per second<br>041 – PAL 720 x 576 @ 50 fields per second<br><br>050 – PsF 1080 / 23.98 fps<br>051 – PsF 1080 / 24 fps<br>052 – 1080i @ 25 fps and PsF 1080 / 25 fps<br>053 – 1080i @ 29.97 fps and PsF 1080 / 29.97 fps<br>054 – 1080i @ 30 fps and PsF 1080 / 30 fps |
| Note: xxx must always be three digits | |

#### *4.8.1.23 Configuration Flash Serial Commands*

The DX-2200 uses Flash memory to retain user configuration information. The Flash is configured using the "Fx" software commands shown in **Table 23** below.

To save the current configuration, use the 'FW' command. This command saves the current operating settings of the DX-2200 including the display mode (PiP, Stacked, etc…), default resolution, and graphic field settings. The unit will restart with the saved settings each time it powers up.

**Notes:**

It is not necessary to erase the Flash before storing a new configuration. A write will automatically erase the old configuration.A saved configuration is only valid for the DX-2200 firmware version that saved it.

If the DX-2200 firmware is updated, the saved configuration will be lost.

Baud rate cannot be saved in the configuration. The DX-2200 always starts at 115200 baud.

### Table 23: Flash Serial Command Codes

| Command Code | Mode of Operation |
|---|---|
| Fx – Flash Write/Erase/Reset Commands | |
| FW | Write the current configuration to flash |
| FE | Erase the saved configuration from flash. The DX-2200 will use default configuration after the next restart. |
| FR | Erase the saved configuration flash and restart the DX-2200 in default factory configuration |

#### *4.8.1.24 Other Serial Command Codes*

Other miscellaneous Serial Command codes are listed in **Table 24** below and discussed in the following sections.

##### 4.8.1.24.1 Serial Port Reset Serial Command

Sending a Carriage Return or a Linefeed (CR or LF) ASCII code resets or clears the Serial Command buffer on the DX-2200 Switcher.

### Table 24: Other Serial Command Codes

| Command Code | Mode of Operation |
|---|---|
| IP Core Revision Code | |
| RV | Polls the board for the IP Core revision |
| RSn | Report the input video resolution at input n where n = 1 for input 1 and n=2 for input 2. When these commands are received, the DX-2200 outputs a response message in the format X<LF>+, where X is one of the following values:<br>X = 0: No video or unsupported mode<br>X = 1: 720p<br>X = 2: 1080p<br>X = 3: 1080i<br>X = 4: NTSC<br>X = 5: PAL<br>When this command reports a video resolution, it only indicates that the input video is recognized by the DX-2200. It does not mean the input is compatible with the current operating mode of the product, or that it is available for display. See also the RIn commands. |
| RIn | Report input video resolution at input n where n = 1 for SDI Input 1 and n=2 for Input 2. When these commands are received, the DX-2200 outputs a response message in the format X<LF>+, where X is one of the following values:<br>X = 0: No video or unsupported mode<br>X = 1: 720p<br>X = 2: 1080p<br>X = 3: 1080i |

| | |
|---|---|
| | X = 4: NTSC<br>X = 5: PAL<br>NOTE: The RI commands will return X=0 when the input video mode is not supported by the product, or when the video is not valid for the current configuration. For example if input 1 is 1080p video, and input 2 is 1080i, the RI2 command returns return X=0. Even though 1080i is supported by the DX-2200, it cannot be used as a PiP overlay when Input 1 is a progressive video format. In this case, the return value of 0 indicates the video cannot be displayed. |
| FS | Restart (reset) the DX-2200 |

### 4.8.2 MANUAL Mode of Operation

In the MANUAL mode, the operation of the DX-2200 is controlled by the momentary bi-directional Toggle Switch and the DIP switches as described in **Table 25** and **Table 26** below. SERIAL Control is still available when MANUAL mode has been enabled.

When MANUAL mode is enabled, some settings can be controlled by both the DIP switch and SERIAL commands. In the case where a SERIAL command is used to change a setting that is also controlled from the DIP switch, the setting of the switch will be overridden. Changing the position of the switch will return control of the setting to the DIP switch.

The functions of the DIP and Toggle Switch are programmable by Serial Commands. The following section describes the factory default configuration.

#### *4.8.2.1 Toggle Switch*

In the factory default configuration, the 2-position momentary Toggle Switch (labeled SW2) is used to switch input and to select the operating mode from a variety enhanced video processing functions described in the table below.

### Table 25: Operation of 2-Position Momentary Toggle Switch

| Switch Movement | Mode of Operation |
|---|---|
| Toggle Left (TL) | Each toggle steps through the 5 modes of operation:<br>Mode 1: 2x1 Full-screen Switcher<br>Mode 2: PiP<br>Mode 3: PAP<br>Mode 4: Split Screen<br>Mode 5: Alpha Blended Overlay<br>Mode 6: Standby Switcher<br>Mode 7: Vertically Stacked |
| Toggle Right (TR) | Toggles output display between the SDI Input sources by executing the 'T' command:<br>In Alpha Blended Overlay Mode, reverse visibility of the two layers by changing the alpha of the non-selected layer to the inverse of the current value.<br>**Notes:**<br>This assumes the output windows from both inputs are overlaid in the output video. If the windows have been reconfigured to different locations, the alpha change will not have the effect of reversing visibility.<br>If in other Modes, change the input selection to the opposite input to the one currently selected. |

**Note:** On power on, the unit will select SDI Input 1 as the master input (unless the saved configuration had input 2 selected). If auto switch is enabled and there is no signal on SDI Input 1, the unit may switch to SDI Input 2.

#### *4.8.2.2 Bypass the Saved Configuration Using the Toggle Switch*

The DX-2200 normally loads the saved configuration at power up. If the saved configuration is corrupted then it is possible the unit will not start. To recover from this situation, disconnect power from the unit, push the Toggle Switch left (towards the power connector), and then re-connect power while continuing to hold the Switch for four seconds. The DX-2200 will start with the defaults instead of loading the saved configuration.

**Note:** The saved configuration is not erased by this procedure and will load again the next time the DX-2200 is reset or powered up. To permanently clear the configuration, issue the FR command, or use the FW command to write the current configuration to the flash.

#### *4.8.2.3 DIP Switch Settings*

In MANUAL mode, the factory default DIP switch settings control the operation of the DX-2200. The settings are summarized below:

### Table 26: Operation of the 4-Position DIP Switch

| SW4 | SW3 | SW2 | SW1 | Output Display Mode |
|---|---|---|---|---|
| OFF | X | X | X | Alpha blending:. If mode is PiP, the PiP is 0% transparent. If the mode is Alpha Blended Overlay, the non selected input is 75% transparent.. |
| ON | X | X | X | Alpha Blending: If mode is PiP it is displayed at 50% transparency. If the mode is Alpha Blended Overlay, then the non selected input has 50% transparency and both the selected and non-selected inputs are equally visible. |
| X | OFF | X | X | PiP Width is 1/4 of the output video width. |
| X | ON | X | X | PiP Width is 3/8 of the output video width |
| X | X | OFF | OFF | PiP ON: Upper right position (with some border spacing) |
| X | X | OFF | ON | PiP ON: Lower right position (with some border spacing) |
| X | X | ON | OFF | PiP ON: Upper left position (with some border spacing) |
| X | X | ON | ON | PiP ON: Lower left position (with some border spacing) |
| By default, the settings of the DIP switch are read when the switch is changed and also at startup if there is no saved configuration. When there is a saved configuration the switch is not read at startup to avoid overriding the saved settings. Refer to the user interface commands for other DIP switch options. | | | | |

# 5 DX-2200 Software Upload Utility

The ***DX2200 Software Uploader*** is a Java application supplied with the DX-2200 that can be used to update the product firmware, or to upload graphic images into the product for use as an Overlay. The

The program is supplied on the product CD supplied with the unit. It is also available for download for the support area of our website, see: http://www.microtronix.com/software-updates.html You can also contact support@microtronix.com for the latest release of the DX-2200 product firmware and Software Uploader utility.

## 5.1 Firmware Update Procedure

The firmware update procedure is documented in the **DX-2200 Software Uploader User Manual** available for download from the Document Library in the Support area of our website at: www.microtronix.com/SUPPORT/downloads.html

**Note:** DX-2200 Dual View Switchers that are running firmware versions less than 3.10 cannot be upgraded over RS232. It is recommended not to downgrade a unit to any version less than 3.10 because it will lose the ability to update over RS232. For units that cannot be updated by RS-232, refer to Appendix A or contact Microtronix sales about upgrading the unit.

## 5.2 Uploading Images

The DX-2200 can store one or more images in memory. A stored image can be displayed on the Overlay by configuring a Graphic Field to show that image.

A maximum of slightly less than 2 Mega Pixels can be stored in flash memory. The pixels can be used for a single large image, or for many smaller images. For example, one full frame image for 1920x1080 video can be stored, or up to 64 images at 240 by 135 pixels each.

When an image is uploaded, an identification number (ID) is assigned to the image. The ID is used to select that image when it is to be displayed on the overlay. It is recommended to keep a record of the ID number used when images are uploaded.

The DX2200 Software Uploader program can show a list of images that are stored in the memory with their sizes and ID, and also reports how many pixels are available in flash memory. Individual images can be deleted, or the entire memory can be cleared to remove all images.

The DX2200 Uploader software accepts image files in PNG and JPEG format. The PNG file format supports Red, Green, and Blue channels, and also supports an optional transparency channel to set the visibility of each pixel. The JPEG file format support Red, Green and Blue channels. The DX-2200 accepts files with or without the transparency channel. When a file without transparency is uploaded, all pixels are visible. When the file includes a transparency channel, different parts of the image can have different visibility for example to generate smooth edges, or to overlay images that are not rectangular.

**Note:** Most PNG files do not include a transparency channel. To generate a PNG file with transparency an image editor such as Adobe Photoshop or Gimp can be used.

**Warning:** The capability to store images permanently in flash memory requires a DX-2200 unit with 16 MB of serial flash memory. Units shipped prior to April 2014 do not have the required flash memory and cannot permanently store images. Images can still be uploaded to the unit, but are lost on reset or power-off.

# 6 Extended Font Tables

## 6.1 Wingding Font

The wingdings fonts have been selected from the three wingdings tables and the webding table.

### Table 27: Windings Character Table

| Symbol | Char | Hex Value | Symbol | Char | Hex Value | Symbol | Char | Hex Value |
|---|---|---|---|---|---|---|---|---|
| ⌛ | space | 0020 | ↺ | 7 | 0037 | ⏪ | L | 004C |
| 🖫 | ! | 0021 | ↻ | 8 | 0038 | ⏩ | M | 004D |
| ✇ | " | 0022 | ← | 9 | 0039 | ⏮ | N | 004E |
| ✋ | # | 0023 | → | : | 003A | ⏭ | O | 004F |
| ☺ | $ | 0024 | ↑ | ; | 003B | ⏸ | P | 0050 |
| ☹ | % | 0025 | ↓ | < | 003C | ■ | Q | 0051 |
| ☠ | & | 0026 | ↖ | = | 003D | ● | R | 0052 |
| ✈ | ' | 0027 | ↗ | > | 003E | 🛠 | S | 0053 |
| ☸ | ( | 0028 | ↙ | ? | 003F | ✔ | T | 0054 |
| ● | ) | 0029 | ↔ | @ | 0040 | 🏭 | U | 0055 |
| ■ | * | 002A | ↕ | A | 0041 | ⓘ | V | 0056 |
| ☝ | + | 002B | ▲ | B | 0042 | 🗡 | W | 0057 |
| ✍ | , | 002C | ▼ | C | 0043 | 🗲 | X | 0058 |
| ⦸ | - | 002D | △ | D | 0044 | ✦ | Y | 0059 |
| ⇇ | . | 002E | ▽ | E | 0045 | ⬤ | Z | 005A |
| ⇉ | / | 002F | ◀ | F | 0046 | 🗘 | [ | 005B |
| ⇈ | 0 | 0030 | ▶ | G | 0047 | ⦸ | \ | 005C |
| ⇊ | 1 | 0031 | ◁ | H | 0048 | ⊖ | ] | 005D |
| ⇃ | 2 | 0032 | ▷ | J | 004A | 🗲 | ^ | 005E |
| ↺ | 3 | 0033 | ◂ | K | 004B | ↘ | _ | 005F |
| ↳ | 4 | 0034 | ▸ | H | 0048 | | | |
| ↰ | 5 | 0035 | ▴ | 7 | 0037 | | | |
| ↻ | 6 | 0036 | ▾ | 8 | 0038 | | | |

## 6.2 Extended ASCII Fonts

### Table 28: Extended ASCII Character Table

| Symbol | Hex Value | Symbol | Hex Value | Symbol | Hex Value | Symbol | Hex Value |
|---|---|---|---|---|---|---|---|
| | 00A0 | ¸ | 00B8 | Ð | 00D0 | è | 00E8 |
| ¡ | 00A1 | ¹ | 00B9 | Ñ | 00D1 | é | 00E9 |
| ¢ | 00A2 | º | 00BA | Ò | 00D2 | ê | 00EA |
| £ | 00A3 | » | 00BB | Ó | 00D3 | ë | 00EB |
| ¤ | 00A4 | ¼ | 00BC | Ô | 00D4 | ì | 00EC |
| ¥ | 00A5 | ½ | 00BD | Õ | 00D5 | í | 00ED |
| ¦ | 00A6 | ¾ | 00BE | Ö | 00D6 | î | 00EE |
| § | 00A7 | ¿ | 00BF | × | 00D7 | ï | 00EF |
| ¨ | 00A8 | À | 00C0 | Ø | 00D8 | ð | 00F0 |
| © | 00A9 | Á | 00C1 | Ù | 00D9 | ñ | 00F1 |
| ª | 00AA | Â | 00C2 | Ú | 00DA | ò | 00F2 |
| « | 00AB | Ã | 00C3 | Û | 00DB | ó | 00F3 |
| ¬ | 00AC | Ä | 00C4 | Ü | 00DC | ô | 00F4 |
| - | 00AD | Å | 00C5 | Ý | 00DD | õ | 00F5 |
| ® | 00AE | Æ | 00C6 | Þ | 00DE | ö | 00F6 |
| ¯ | 00AF | Ç | 00C7 | ß | 00DF | ÷ | 00F7 |
| ° | 00B0 | È | 00C8 | à | 00E0 | ø | 00F8 |
| ± | 00B1 | É | 00C9 | á | 00E1 | ù | 00F9 |
| ² | 00B2 | Ê | 00CA | â | 00E2 | ú | 00FA |
| ³ | 00B3 | Ë | 00CB | ã | 00E3 | û | 00FB |
| ´ | 00B4 | Ì | 00CC | ä | 00E4 | ü | 00FC |
| µ | 00B5 | Í | 00CD | å | 00E5 | ý | 00FD |
| ¶ | 00B6 | Î | 00CE | æ | 00E6 | þ | 00FE |
| · | 00B7 | Ï | 00CF | ç | 00E7 | ÿ | 00FF |

# 7 Product Warranty

## 7.1 Hardware Warranty

Microtronix warrants Product hardware to the original purchaser to be free from defects in material or workmanship under normal use for **one (1) year** from the date of purchase, when used within the operating limits set forth in this Product User Guide. Microtronix agrees under this warranty, to repair or replace it with a new or reconditioned product at no additional charge. Replacement products are warranted for the balance of the original warranty time period.

If the Product proves defective during the warranty period, call Microtronix Technical Support in order to obtain a Return Materials Authorization number. Microtronix will provide **Cross Shipment Support** for warranty replacement of defective units during the warranty period. Customers shall be held responsible for shipping and handling charges incurred in returning the product to Microtronix. Microtronix (as opposed the customer) will cover the cost of shipment of the replacement Product provided a warranty defect has occurred.

Our hardware warranty does not cover any Product, which has been subject to neglect, unreasonable use, accident, and violation of operating instruction or any product that has been repaired or modified by an unauthorized service agent.

## 7.2 Firmware Warranty

Microtronix warrants that commencing from the date of delivery to the Customer for a period of one (1) year the Product Firmware (Software) will substantially conform to its published specifications. The Customer's sole and exclusive remedy and the entire liability of Microtronix under this limited warranty will be, at Microtronix's option; firmware replacement, or firmware upgrade repair. In no event does Microtronix warrant that the Software is error free or that the Customer will be able to operate the Software without problems or interruptions.

### 7.2.1 Limited Liability

Microtronix Products are not designed or approved by Microtronix for use in **safety-critical** or **life-critical system** or application in which a failure or malfunction may result in one (or more) of the following outcomes: (a) death or serious injury to people, (b) loss or severe damage to equipment/property, of (c) environmental harm. Microtronix assumes **no liability** for any consequential damages – whether direct or indirect – if the product is used in this type of application.

IN NO EVENT SHALL MICROTRONIX'S LIABILITY EXCEED THE PRICE PAID FOR THE PRODUCT FROM DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES RESULTING FROM THE USE OF THE PRODUCT, ITS SOFTWARE, OR ITS DOCUMENTATION.

Microtronix makes no warranty or representation, expressed, implied, or statutory, with respect to its Products, its software, or the contents or use of its documentation, and specifically disclaims its quality, performance, merchantability, or fitness for any particular purpose. Without limiting the foregoing, in no event shall Microtronix or its suppliers be liable to the Customer for any incidental, special, punitive, exemplary or consequential damages experienced by either the Customer or a third party (including, but not limited to, loss of data or information, loss of profits, or loss of use). Microtronix reserves the right to revise or update its Products, software, or documentation without obligation to notify any individual or entity.

## Appendix A: Internal Circuit Board Description

The DX-2200 – Dual-view 2x1 SDI Switcher Board is shown in the following figure.

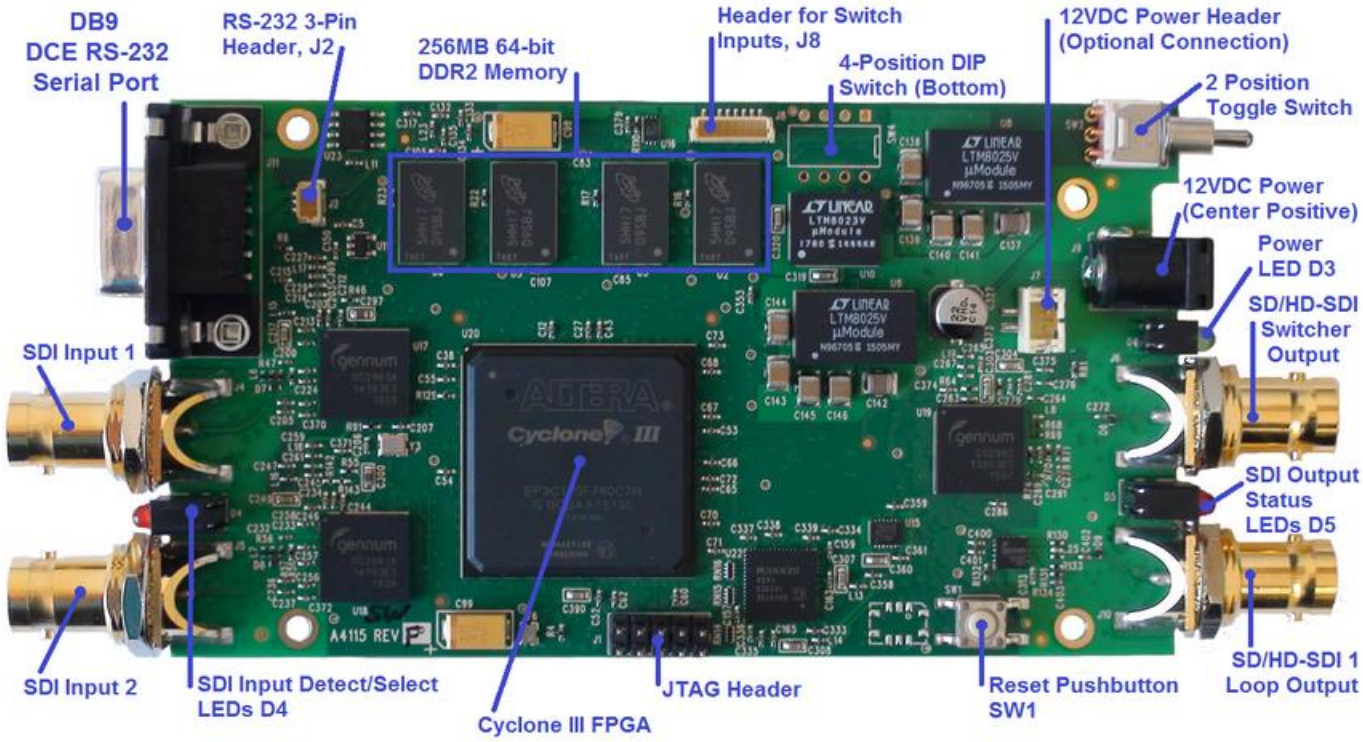


**Figure 25: DX-2200 – Dual-view 2x1 SDI Switcher Board**

The DX-2200 – Dual-view 2x1 SD/HD-SDI Switcher Board utilizes the following hardware devices:

- FPGA: Altera Cyclone EP3C120F780C7N
- Memory: Micro MT47H32M16BN-3 – 256MBDDR2 – 32Mx16 (operating with a 64-bit data interface)
- Gennum GS2962 3G/HD/SD-SDI Serializer (Transmitter) with Cable Driver
- Gennum GS2962 3G/HD/SD-SDI Deserializer (Receiver) with Equalizer
- Gennum GS4911B HD/SD/Graphics Clock and Timing Generator
- Gennum GS2988 HD/SDI Cable Dual Driver

The following sections describe the product component hardware.

## A.1 SDI Video Interfaces

The **DX-2200-SW** supports two SD/HD-SDI inputs and two SD/HD-SDI output ports. These interfaces support SMTP 292M video formats. The primary SDI switcher output port is reclocked from a Gennum Timing Generator which runs asynchronously to the video inputs. The SDI Loop Output port is a buffered version of the video received on SDI Input 1 port.

## A.2 RS-232 Serial Control Port

The RS-232 Serial Control Port is used to control the text overlay. It is a DB9 female connector. The Control Port transmit and receive data is on the standard pin numbers 2 & 3, and the port is set at 115,200 baud operation (8N1). There is no hardware flow control for the Control Port.

For units with board revision D and above, the connector is customized with a second port on pins 7 & 8. The second port is used for the GPS data receiver function and other customized product variations. The baud rate of the second port depends on the application.

Both receivers accept standard RS-232 levels and can also accept 5V logic signaling. For 5v logic signaling, the low level must be less than 0.6V and the high level must be greater than 1.5V. The transmitter output levels are typically +5.5V and -5.5V into a 3 kΩ load.

An optional splitter cable is available that connects to the DB9 connector and provides both ports on separate DB9 sockets with transmit data on pin 2 and receive data on pin 3.

The pin assignments of the DB9 connector on the DX-2200 are provided in the following table.

### Table 29: RS-232 Serial Port DB9 Pin Assignments

| Pin | Signal Direction | Function | Signal Name |
|---|---|---|---|
| 2 | DX-2200 Output | Control Port | Transmit Data |
| 3 | DX-2200 Input | Control Port | Receive Data |
| 5 | - | - | Signal Ground |
| 7 | DX-2200 Input | GPS Port | Receive Data |
| 8 | DX-2200 Output | GPS Port | Transmit Data |

### A.2.1 RS-232 3-Pin Header, J2

The RS-232 Serial Control Port is also available on J2, a 3-pin 1mm header (JST part number: BM03B-SRSS-TB(LF)(SN) available from Digi-Key 455-1789-1-ND). The pins assignments are listed in the following table.

### Table 30: RS-232 3-Pin Header, J2

| Pin | Signal Direction | Signal Name |
|---|---|---|
| 1 | Input | Receive Data |
| 2 | - | Signal Ground |
| 3 | Output | Transmit Data |

## A.3 Power Requirements

The board is powered from a standard 5.5mm center positive 5-12Vdc 10W (120/240VAC) regulated power adapter. The unit draws a maximum of 650mA at 12VDC.

### A.3.1 Power Connectors

The power connector J9 is standard 2.5mm diameter by 5.5mm long jack PN: CUI PJ-202BH (Digi-Key CP-202BH-ND).

For embedded applications requiring a board-to-board wire harness connection, header J7, PN: JST B2B-PH-SM4-TB(LF)(SN)(P) (Digi-Key 455-1734-1-ND) can also be used for the power connection.

## A.4 JTAG Header

The JTAG header is used to program the configuration flash device used load the FPGA device on power up with the DX-2200 program file. This method is designed for OEM's who have purchased the DX-2200 product as an open-frame board. The procedure required the user to load a JIC file into the on-board serial flash configuration device through the JTAG Interface. This requires the use of suitably configured PC with an Altera or Terasic USB Byte Blaster (available for optional purchase) connected to the JTAG connector (J1) as shown in the following figure.

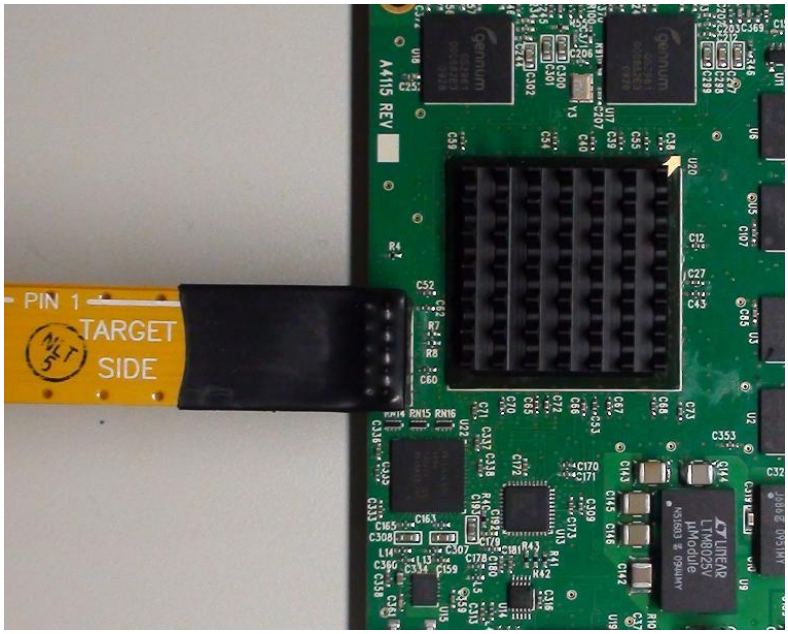


**Figure 26: JTAG Cable Connection**

### A.4.1 JTAG Firmware Upload Procedure

The steps to upgrade the firmware using the JTAG port are as follows:

1) Start Quartus II on the PC. Note that Quartus must be version 12.1 or later to load the JIC programming files for the DX-2200-TI.
2) From the **Tools** menu, select **Programmer**.
3) Click Auto Detect.

4) A dialog box may appear with a selection for EP3C120 or EP4CE115. Select **EP3C120**, and click **Close**.
5) Select the line in the programmer window containing the EP3C120 device.
6) Click **Change File…** and browse to the .jic file to load. Select it and click **Open**.
7) Check the Program/Configure box.
8) Click **Start** to program the FPGA.

## A.5 Reset Pushbutton SW1

The Reset pushbutton (SW1) is not available if the unit is in the enclosure. It is used to reset the FPGA and restart the switcher.

## A.6 Board Mechanical Dimensions

The board mechanical dimensions are shown in Figure 27 below.

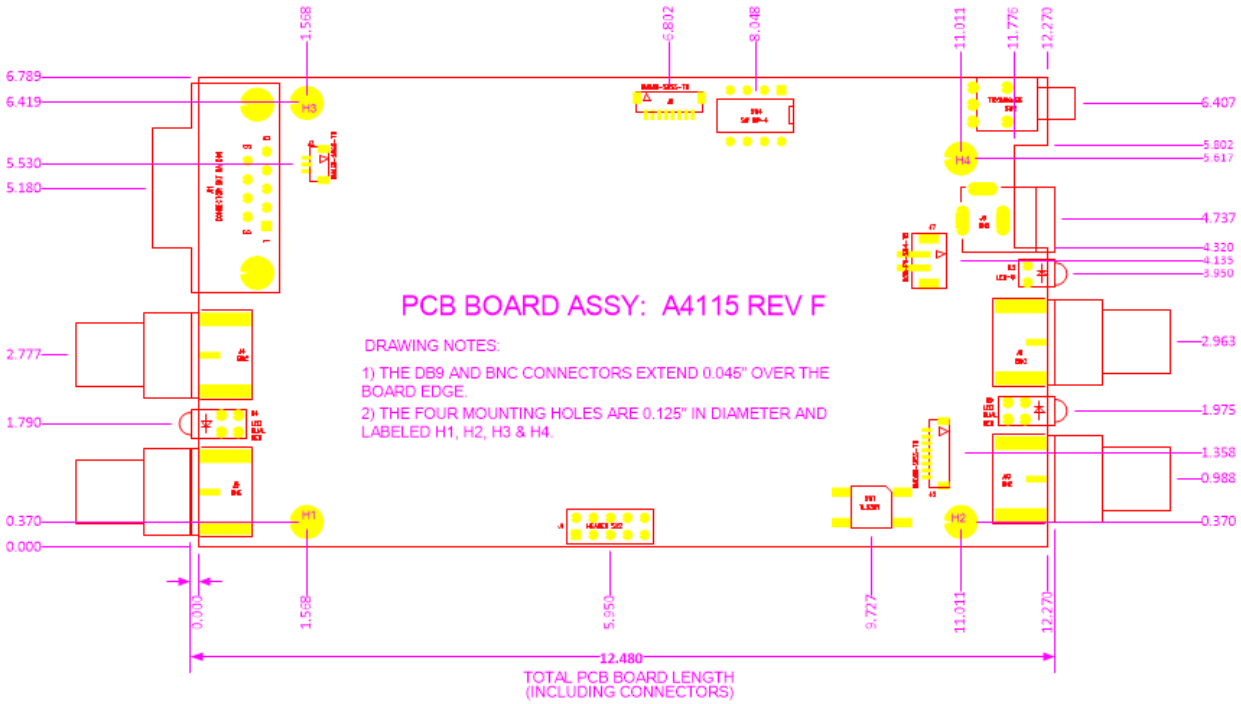


**Figure 27: DX-2200 Board (PN: P4115-SW-02) Mechanical Drawing**

# Appendix B: USB to RS-232 Serial Port Adapter

The **USB to DB9 RS-232 Serial Port Adapter Kit** (PN: 811-USB-RS232 Kit) is used to connect the DB9F Serial Port to a USB port of a PC. The Kit consists of a USB 2.0 to RS232 DB9 Serial Adapter Cable (StarTech PN: ICUSB232V2) and a 6 foot male to female DB9 RS232 serial cable as shown in the figure below.

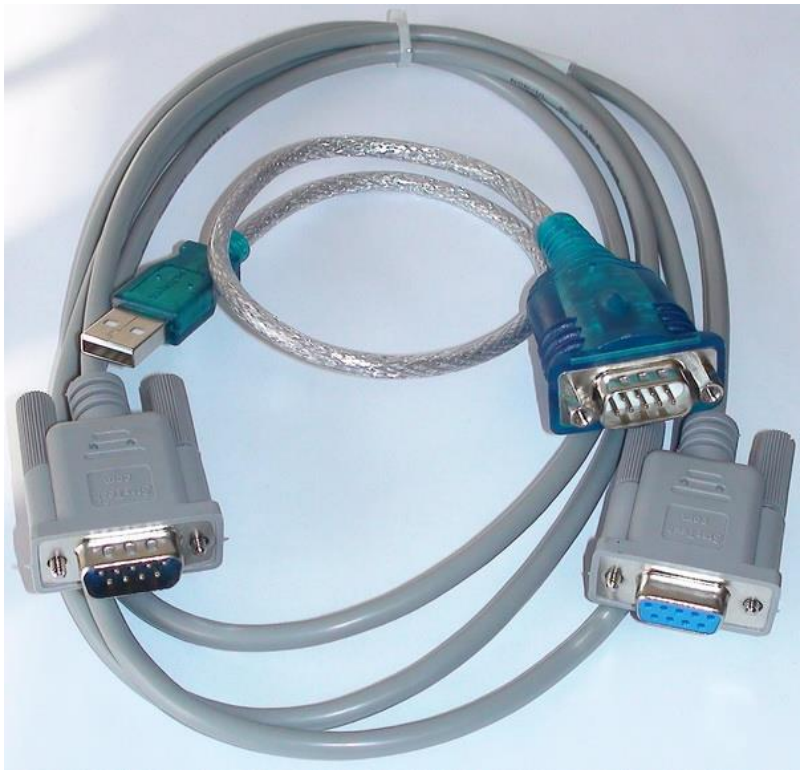

**Figure 28: USB to DB9 RS-232 Serial Port Adapter Kit**

## B.1 ICUSB232V2 Software Drivers

The StarTech ICUSB232V2 adapter is used to convert the RS232 serial interface to a USB 2.0 interface when connecting to a PC which does not have a DB9M RS232 serial port (i.e. most PCs today). The software drivers for the ICUBS232V2 adapter are supplied by StarTech and are available for free download from www.startech.com/downloads.

Connect to the website using a browser and search for the product using product ID (ICUSB232V2) and click Search. Select the product from the search results and download the available Prolific_PL23203.zip file. Once downloaded right-click the zip file and extract the contents to a temp directory. Browse to the directory of the relevant OS and read the supplied text and pdf files on how to install and use the USB to RS232 serial adapter.

### B.1.1 Installation of ICUSB232V2 Serial Driver and Terminal Emulator Program

1) Follow the instructions supplied with the StarTech PN: ICUSB232V2 – USB – RS-232 Serial Adapter.
2) Once the driver is installed, attach the USB Serial adapter to a USB port.
3) To identify the serial COM port the operating system has assigned to the port:

a) Use the “WINDOWS Key + X” to bring up the device manager.

b) Under Ports note the port number assigned to the “Prolific USB-to-Serial Comm Port. For example, COMx when x is from 1 to 14.

**Note:** StarTech has also supplied a program called checkChipVersion_v1006.exe which can also be used to identify the serial port.

**Caution:** If the USB Serial Adapter is moved to a different port on the PC, the OS will assign it a new COM port number requiring a change to the Terminal Emulation port assignment.

4) Download and install a Terminal Emulator program to facilitate serial communion of user commands to the DX-2200. For example PuTTY. (Available from: https://www.chiark.greenend.org.uk/ )

## B.2 Establishing Serial Communications

1) Run the PuTTY program.

**TIP:** It is convenient to place a shortcut link on the desktop to the PuTTY software application.

2) Configure PuTTY as follows:

a) Select the Session item:

i) For Serial line >> enter the assigned Port i.e. COM3

ii) Set Speed to 115200.

iii) For Connection type: >> select Serial

iv) Under Saved Session: Assign a name to this user setting. i.e. DX-2200 Serial

v) Save the configuration.

b) Select the Terminal item.

i) Additionally check the boxes for:

ii) Implicit CR in every LF and for

iii) Implicit LF in every CR.

c) Select the Serial item.

i) Set the Serial line to the required come port i.e. COM3

ii) Set the Speed to: 115200, Data bits to: 8, Stop bit to: 1, Parity to: None, and Flow Control to: None.

d) Select the Session item again and re-save the configuration to DX-2200 Serial.
**NOTE:** Going forward when restarting PuTTY, it is only necessary to select the DX-2200 Serial configuration and “Load” it from disk.

e) Connect the USB Adapter to the DB9 serial cable and attach the male DB9 connector to the serial port of the DX-2200 unit.

f) In the Session section,

i) Confirm the DX-2200 Serial configuration is selected and then click Load.

ii) Click “Open” to a Terminal connection to the unit.

iii) Type the “ENTER” to get an * response from the unit.

iv) Type **rv** to display the version of the software used by the DX-2200 product.

This confirms Serial communication with the DX-2200 product. The figures below show some of the PuTTY configuration screens.

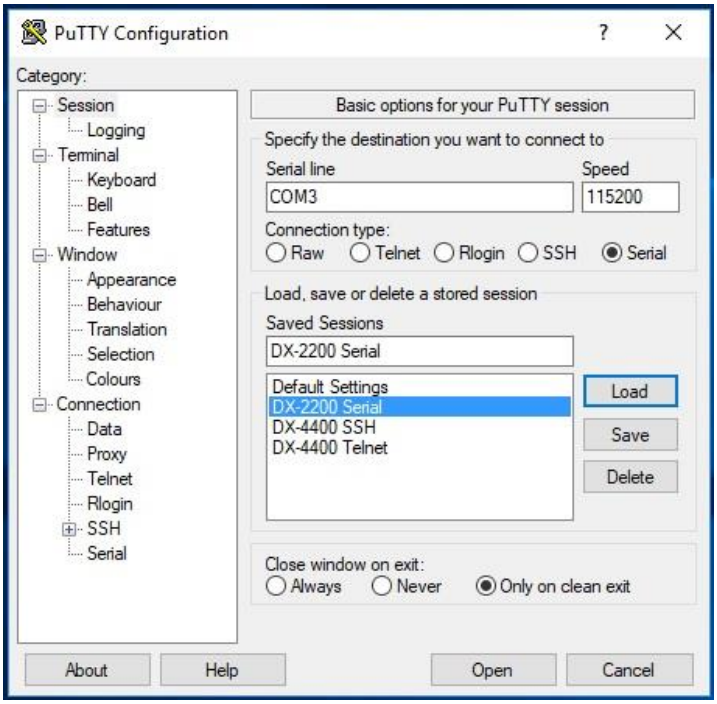


Figure 29: PuTTY Session User Settings

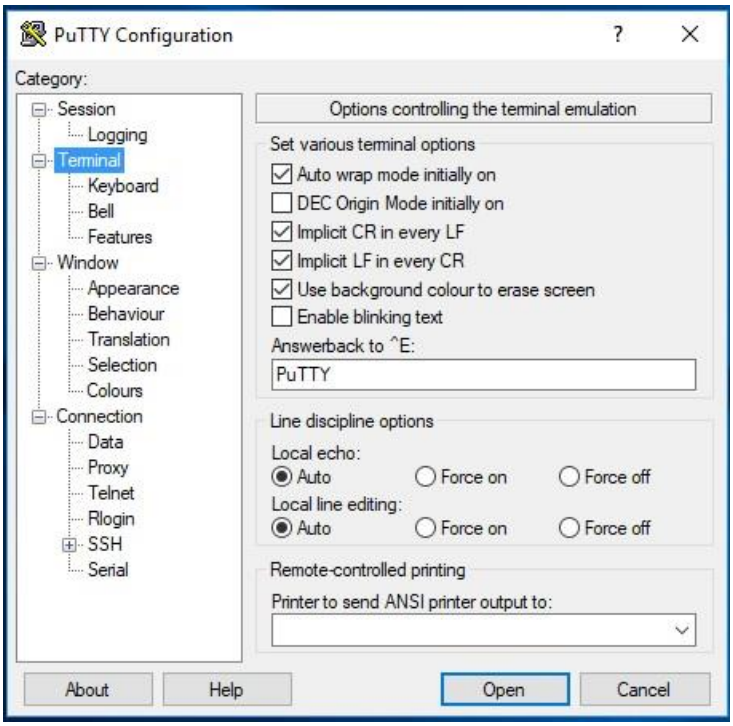


Figure 30: PuTTY Terminal Settings

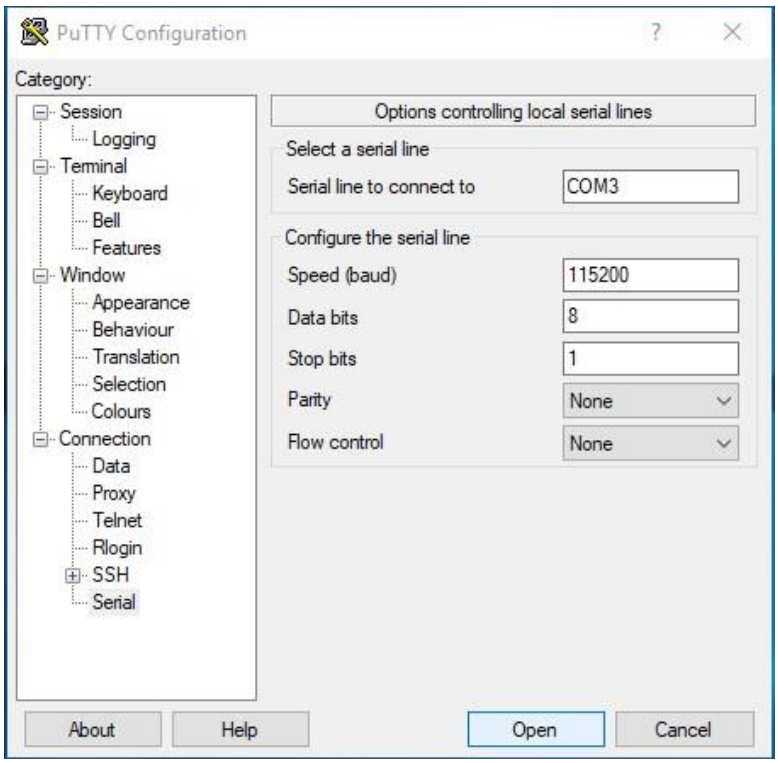


**Figure 31: PuTTY Serial Port Settings**

# Appendix C: Regulatory Compliance Information

Equipment Type: Information Technology Equipment

Product: DX-2200 Dual-view SDI Video Switcher

Model No: DX-2200-xx-xx where xx are any combination of the alphanumeric characters.

**NOTE:** The DX-2200-TI, HD-SDI Text Inserter product is a sub-set of the DX-2200, 2x1 Dual-view SDI Video Switcher Product, a unit which uses the exact same board but has the components for two SDI video inputs installed. The unit was tested for compliance in a DX-2200, 2x1 Dual-view SDI Video Switcher configuration.

## C.1 Industry Canada (IC)

The **DX-2200, 2x1 SDI Video Switcher** product has been tested and found to comply Industry Canada ICES-003, Issue 5, Class A – Information Technology Equipment (ITE), the compliance as suggested by Industry Canada is as follows:

| |
|---|
| CAN ICES-3 (A)/NMB-3(A) |

## C.2 Federal Communications Commission (FCC) Declaration of Conformity

Responsible Party: Microtronix Datacom Ltd.
4056 Meadowbrook Drive, Unit 126, London, ON Canada
TEL: +(1) 519-690-0091

The Responsible Party declares the DX-2200, 2x1 SDI Video Switcher product has been tested and found to comply FCC PART 15, SUBPART B, Class A – Unintentional Radiators.

Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment OFF and ON, the user is encouraged to try to correct the interference by one or more of the following measures:

- Ensure that all mounting screws, attachment connector screws, and ground wires are tightly secured.
- Reorient the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Call the dealer or an experienced radio/TV technician for help.

## C.3 CE Declaration of Conformity


(CE Conformity Marking)

I, the undersigned, hereby declare that the equipment as tested is representative within manufacturing tolerance to units and found to comply with the following standard(s):

STANDARD(S) TO WHICH CONFORMITY IS DECLARED:

The **DX-2200, 2x1 SDI Video Switcher product** has been tested in accordance with:

- CISPR 24: 2010 / EN 55024:2010 – Electromagnetic Compatibility Requirements – Information Technology Equipment – Immunity Characteristics – Limits and Methods of Measurements, and
- CISPR 22:2008-09 / EN 55022:2010, Class A – Information Technology Equipment.

The results and observations recorded were in compliance to the requirements.

TEST LABORATORIES: UltraTech Engineering Labs Inc.

3000 Bristol Circle, Oakville, ON, Canada, L6H-6G4

DATE OF ISSUE OF DECLARATION: May 8, 2013

| Manufacturer | |
|---|---|
| Company Name | Microtronix Datacom Ltd |
| Signature: | Norman McCall |
| Full Name: | Norman McCall |
| Title: | President |
| Address | 4056 Meadowbrook Drive, Unit 126 |
| | London, ON, Canada, N6L-1E3 |
| Phone No.: | (+1) 519-690-0091 |
| Email: | nmccall@microtronix.com |

**WARNING:** This is a Class A product. In domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

# VERIFICATION CERTIFICATE

**NOT TRANSFERABLE**

This Verification Certificate is hereby issued to the named GRANTEE and is VALID ONLY for the equipment identified hereon for use under the rules and regulations listed below:

| | |
|---|---|
| **GRANTEE:** | Microtronix Datacom Ltd. |
| Address: | 4056 Meadowbrook Drive, Unit 126<br>London, Ontario<br>Canada, N6L 1E3 |
| Contact Person: | Mr. Norman McCall<br>Phone #: 519-690-0091 x264<br>Fax #: 519-690-0092<br>Email Address: nmccall@microtronix.com |
| **Equipment Type:** | Class A Information Technology Equipment (ITE) |
| **Product Name:** | DX-2200 2x1 SDI Video Switcher, |
| **Model No.:** | DX-2200-xx-xx where xx are any combination of alphanumeric characters. |
| **The above product was tested by UltraTech Engineering Labs Inc. and found to comply with:** | Industry Canada ICES-003, Issue 5 - Information Technology Equipment (ITE) — Limits and methods of measurement |
| **Date of Authorization:** | May 14, 2013 |

- **Note(s):** *See attached report, UltraTech's File No.: MDL-029_ICES-003, dated* May 14, 2013 *for details and conditions of Verification Compliance.*

*Approved by: Tri M. Luu BASc.*
*V.P. – Engineering*


**UltraTech**

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4
Tel.: (905) 829-1570 Fax.: (905) 829-8050
Website: www.ultratech-labs.com Email: vic@ultratech-labs.com, Email: tri@ultratech-labs.com


| FCC | VCCI | Industry Canada Approved Test Facility | NVLAP | BSMI | Korea KCC-RRL |
|---|---|---|---|---|---|
| 91038 | 1309 | 46390-2049 | NVLAP LAB CODE 200093-0 | SL2-IN-E-1119R | CA2049 |

# VERIFICATION CERTIFICATE

**NOT TRANSFERABLE**

This Verification Certificate is hereby issued to the named GRANTEE and is VALID ONLY for the equipment identified hereon for use under the rules and regulations listed below:

| | |
|---|---|
| **GRANTEE:** | Microtronix Datacom Ltd. |
| Address: | 4056 Meadowbrook Drive, Unit 126<br>London, Ontario<br>Canada N6L 1E3 |
| Contact Person: | Mr. Norman McCall<br>Phone #: 519-690-0091 x264<br>Fax #: 519-690-0092<br>Email Address: nmccall@microtronix.com |
| **Equipment Type:** | Unintentional Radiators for Use in Non-Residential Areas |
| **Product Name:** | DX-2200 2x1 SDI Video Switcher |
| **Model No.:** | DX-2200-xx-xx where xx are any combination of alphanumeric characters. |
| **The above product was tested by UltraTech Engineering Labs Inc. and found to comply with:** | FCC Part 15, Subpart B - Class A Unintentional Radiators for Use in Commercial and Industrial Areas. |
| **Date of Authorization:** | May 8, 2013 |

- **Note(s):** *See attached report, UltraTech's File No.: MDL-092_FCC15A, dated* May 8, 2013 *for details and conditions of Verification Compliance.*

*Approved by: Tri M. Luu BASc.*
*V.P. – Engineering*


**UltraTech**

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4
Tel.: (905) 829-1570 Fax.: (905) 829-8050
Website: www.ultratech-labs.com Email: vic@ultratech-labs.com, Email: tri@ultratech-labs.com


| FCC | VCCI | Industry Canada Approved Test Facility | NVLAP | BSMI | Korea KCC-RRL |
|---|---|---|---|---|---|
| 91038 | 1309 | 46390-2049 | NVLAP LAB CODE 200093-0 | SL2-IN-E-1119R | CA2049 |

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This Verification Certificate is hereby issued to the named GRANTEE and is VALID ONLY for the equipment identified hereon for use under the rules and regulations listed below:

| | |
|---|---|
| **GRANTEE:** | Microtronix Datacom Ltd. |
| Address: | 4056 Meadowbrook Drive, Unit 126<br>London, Ontario<br>Canada, N6L 1E3 |
| Contact Person: | Mr. Norman McCall<br>Phone #: 519-690-0091 x264<br>Fax #: 519-690-0092<br>Email Address: nmccall@microtronix.com |
| **Equipment Type:** | Information Technology Equipment |
| **Product Name:** | DX-2200 2x1 SDI Video Switcher |
| **Model No.:** | DX-2200-xx-xx where xx are any combination of alphanumeric characters. |
| **The above product was tested by UltraTech Engineering Labs Inc. and found to comply with:** | CISPR 24: 2010 / EN 55024:2010 - Electromagnetic Compatibility Requirements - Information Technology Equipment - Immunity Characteristics - Limits and Methods of Measurements |

**Note(s):** *See attached report, UltraTech's File No.: MDL-029_EN24, dated* May 9, 2013 *for details and conditions of Verification Compliance.*

***Approved by: Tri M. Luu BASc.***
***V.P. – Engineering***


UltraTech

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4
Tel.: (905) 829-1570 Fax.: (905) 829-8050
Website: www.ultratech-labs.com Email: vic@ultratech-labs.com, Email: tri@ultratech-labs.com


| FCC | VCCI | Industry Canada Approved Test Facility | NVLAP | BSMI | Korea KCC-RRL |
|---|---|---|---|---|---|
| 91038 | 1309 | 46390-2049 | NVLAP LAB CODE 200093 0 | SL2-IN-E-1119R | CA2049 |

# VERIFICATION CERTIFICATE

**NOT TRANSFERABLE**

This Verification Certificate is hereby issued to the named GRANTEE and is VALID ONLY for the equipment identified hereon for use under the rules and regulations listed below:

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| **GRANTEE:** | Microtronix Datacom Ltd. |
| Address: | 4056 Meadowbrook Drive, Unit 126<br>London, Ontario<br>Canada, N6L 1E3 |
| Contact Person: | Mr. Norman McCall<br>Phone #: 519-690-0091 x264<br>Fax #: 519-690-0092<br>Email Address: nmccall@microtronix.com |
| **Equipment Type:** | Class A - Information Technology Equipment |
| **Product Name:** | DX-2200 2x1 SDI Video Switcher |
| **Model No.:** | DX-2200-xx-xx where xx are any combination of alphanumeric characters. |
| **The above product was tested by UltraTech Engineering Labs Inc. and found to comply with:** | European CISPR 22:2008-09 / EN 55022:2010 |
| **Date of Authorization:** | May 8, 2013 |

- **Note(s):** *See attached report, UltraTech's File No.: MDL-029_CISPR22A, dated* May 8, 2013 *for details and conditions of Verification Compliance.*

*Approved by: Tri M. Luu BASc.*
*V.P. – Engineering*


UltraTech

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4
Tel.: (905) 829-1570 Fax.: (905) 829-8050
Website: www.ultratech-labs.com Email: vic@ultratech-labs.com, Email: tri@ultratech-labs.com


| FCC | VCCI | Industry Canada | NVLAP | BSMI | Korea KCC-RRL |
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