MICROTRONIX
DX-4400
SD/HD/2K/4K-SDI TEXT & GRAPHICS OVERLAY INSERTER

USER MANUAL – VERSION 1.6.0
DATE ISSUED: JUNE 18, 2020

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

Document Revision History

This User Manual provides operating instructions and information the Microtronix ***DX-4400, SD/HD/2K/4K SDI Text & Graphic Overlay Inserter***, (Model Part Numbers: DX-4400-TI-2K and DX-4400-TI-4K).

The following table shows the document revision history.

Date	Rev.	Description
Mar. 30, 2017	0.9	Beta Release
Feb 14, 2017	1.0	Add 4K support
July 12, 2017	1.1	Add commands for output mode, chroma key for the PiP Text Inserter mode. Added ancillary data enable/disable command for the PiP Text Inserter and Dual Text Inserter modes.
Aug 2, 2017	1.2	Add user defined commands used to configure toggle and DIP switch actions.
Aug 23, 2017	1.2.1	Add information about licensing of 4K product.
Sep. 20, 2017	1.3	Add frame delay command for Dual & PiP modes. Add double buffer option to allow running overlay with a single buffer. This will improve performance for overlays with lots of updates. Add ability to run QML scripts.
Nov. 2, 2017	1.3.1	Add QML application example for display of time, date and scrolling news feed. Updated information on Serial/Network port user connections. Fixed bug in QML scripts that required running in single buffer mode. Added TZ command and changed TS command to change system time too.
Feb. 22, 2018	1.3.2	Re-formatted document layout with section numbering. Fixed memory leak bug in QML.
April 11, 2018	1.3.3	Added Low Latency Dual mode and Dual mode with Zoom.
Aug. 10, 2018	1.4	Added feature to Savesets that allows the database to be used in memory thereby reducing flash wear and allow Saveset replication. Added Low Latency 4K mode. Reduced command response to improve speed.
Nov. 6, 2018	1.4.1	Fix Compliance Appendix information and other minor edits
Jan. 8, 2019	1.4.2	Document Web UI feature and add Index
Feb. 20, 2019	1.5.0	Add Z4K and LPiP Modes. Update zoom description.
Mar. 4, 2019	1.5.1	Updated available fonts of Table 8, Revised Web UI menu
May 1, 2019	1.5.2	Added PiP Output (PO) N/R Command for PiP TI Mode Added Drop Shadow feature §4.3.3 for Text & Graphic Fields.
July 8, 2019	1.5.3	Added Group feature. Add RER command to display groups. Added Erase command to String, Graphic, Image and QML fields to allow deletion of

		all fields in current saveset.
Dec. 19, 2019	1.5.4	Added support for GPS and gpio PPS. Added database update to allow current database to be upgraded to current database. Added QML libraries to allow the display of GPS data from QML scripts.
Jun. 18, 2020	1.6.0	First release with Interactive Overlay

How to Contact Microtronix

E-mail Contacts:

Sales Information: sales@microtronix.com

Technical Support: 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 **DX-4400 – SD/HD/2K/4K-SDI Text & Graphics Overlay Inserter** software to customer requirements. Contact Microtronix sales (sales@microtronix.com) with your requirements.

Safety Critical & Life System Applications – Notice to User

The Microtronix DX-4400 SDI Video product family is 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.

Table of Contents

Listing of Tables

Listing of Figures

1 Key Product Features

The key hardware features of the DX-4400 – SD/HD/2K/4K-SDI Text & Graphics Inserter includes:

- Two 75Ω 3G-SDI input ports
- Four 75Ω 3G-SDI output ports
  - Two for overlay on output
  - Loop outputs for SDI input 1 and input 2
- One DB9 RS-232 Serial Control Port
- One USB Serial Control Port
- One USB OTG Port,
- One 10/100/1000 Ethernet Port, and
- Integrated real-time clock with support for NTP & PTP protocols.
- Support for GPS NEMA devices.
  - GPS device can be used to synchronize system clock to GPS time.
  - GPS device can be placed on serial port 1 or serial port 2.
  - QML scripts support display of GPS data.

1.1 Supported Functionality

The DX-4400 SD/HD/2K/4K-SDI Text & Graphics Overlay Inserter supports the following functionality:

- Video Input formats::
  - NTSC @ 29.97 fps (frames per second)
  - PAL @ 25 fps
  - 720p @ 25 / 29.97 / 30 / 50 / 59.94 / 60 fps
  - 1080i @ 23.98 / 24 / 25 / 29.97 / 30 fps
  - 1080p @ 23.98 / 24 / 25 / 29.97 / 30 / 50 / 59.94 / 60 fps
  - 1080psf @ 23.98 / 24 / 25 / 29.97 / 30 fps
  - 2048x1080p @ 23.98 / 24 / 25 / 29.97 / 30 / 50 fps
  - UHD 4K: 3840x2160p @ 23.98 / 24 / 25 / 29.97 / 30 fps (Dual Link, 3 Gb/s SDI, Quad and 2SI mapping)
  - DCI 4K: 4096x2160p @ 23.98 / 24 / 25 / 29.97 / 30 fps (Dual Link, 3 GB/s SDI, Quad and 2SI mapping)
  - YCbCr 4:2:2
    Note: *Support for 4K video is an optional firmware upgrade.*
- Video Output automatically adjusts to match the input video format
- Text and Graphics Overlay OSD:
  - Multiple overlay layers
  - Unrestricted independent text or graphic Fields per layer
  - Fields support text, rectangle, line, circle, ellipse, and graphic images.
  - Filled or open shapes
  - Size, color, transparency and position control
  - Configurable background color for text
  - Alpha blended text and background
  - Alpha blending of graphic components
  - Scaling of text and graphic images
  - Text scrolling and crawling for news-feed applications
- User configurable frame delay from 1-20 frames

- Digital zoom (video scaling) of PiP input
- Supports the Qt Meta Language (QML) for enhancing user interface-centric applications
- File storage of user configuration and text fields for auto system recovery after power-off
- User control via: RS232 Control port, USB Serial Control port, a raw TCP/IP connection using either; a Telnet (terminal emulator) Client, a SSH connection or through a Web UI browser interface.
- Design of video overlay screens using:
  - Serial commands,
  - User friendly interactive WYSIWYG user interface (see: Section 6 Using the WYSIWYG Interactive Overlay User Interface) with mouse & keyboard control, or
  - Browser based Web user interface (see Section 5 Using the Web UI).

1.2 Product Variants

The **DX-4400** product has two variants:

1) PN: **DX-4400-TI-2K** – the ***SD/HD/2K Dual Channel -SDI Text & Graphics Inserter***, which supports 2 independent SDI links at standard broadcast video resolutions including SD, HD, FHD and 2K.
2) PN: **DX-4400-TI-4K** – the ***SD/HD/2K/4K-SDI Text & Graphics Inserter*** supports all the features of the above product with additional support for 4K video resolutions in a dual-link 3G-SDI configuration.

1.3 Package Contents

The DX-4400 package contents include either the DX-4400-TI-2K or the DX-4400-TI-4K hardware product and the following items:

- PN: 811-USB-RS-232 – the USB to DB9 RS-232 Serial Port MM Cable Adapter Kit,
- PN: 811- USB2HABM6 – a 6ft Mini USB 2.0 Type A to Mini B Cable Adapter,
- PN: 811-USB-OTG – a 5" OTG Micro USB to USB Male-to-Female Cable Adapter,
- PN: 2880SDC8 – 8GB microSDHC Class 4 Flash Card, (installed in microSD Card slot)
- PN: 5883-PSC30U-120L6 – a 100-240VAC – 12VDC / 2.5A power adapter, and
- User Manual & software utilities on CD.

2 Introduction

The Microtronix ***SD/HD/2K/4K-SDI Text & Graphics Overlay Inserter (PN: DX-4400-xx)*** is a high performance single/dual input Video Text Inserter supporting alpha blended text overlay / on screen display (OSD) on progressive, PsF and interlaced SD, HD, FHD, 2K and 4K video formats. It is designed for use in broadcast, professional video recording studios and embedded video information applications requiring live insertion of graphics and text streams onto a SDI video signal. Low-latency configurations enable the unit to operate with less then one frame of video delay between the input and the output.

A graphical WYSIWYG user interface is available for designing the overlay screens using a USB mouse and keyboard.

2.1 Text and Graphics Overlay OSD Features

Features of the overlay on screen display (OSD) include:

- ARM Linux graphics processor
- User selectable database Savesets to store field information
- Fields support Text, Rectangles, Lines, Circles, Ellipse and Image modes
- Text scrolling and crawling for news feed applications
- Text Field of up to 512 characters
- Alpha blending of the text for smooth edges
- Independent color selection of fields
- Configurable background color of text fields
- Transparency control
- Independent ON/OFF control of fields
- X-Y-Z position control
- Scale-able text sizes

Note: The microSD Card is shipped pre-installed in the unit since the DX-4400 operating system must be loaded from the card to enable the unit to operate

Warning: When installing the microSD Card be careful that it is sliding into the card slot or else the card will fall inside the unit requiring it to be opened to retrieve it.

2.2 Other Features

Other features include:

- User configuration of frame delay for video and ancillary data,
- Supports ancillary data and VBI content,
- Digital zoom (video scaling) of PiP input,
- Digital zoom (video scaling) of video paths in Zoom Dual TI,
- Low frame delay (less than one frame),
- Real-time clock with support of NTP & PTP protocols for use in time and date applications,
- Qt Meta Language (QML) supports enhanced user interface-centric applications,
- GPS support for devices supported by GPSD such as Garmin NEMA,
- MicroSD card storage of user configuration, text fields, images (PNG, JPG, BMP, etc.) and graphic elements,
- User configuration of functions,
- Overlay design via user friendly interactive WYSIWYG user interface with mouse & keyboard control,
- Web UI user configuration interface, and

- USB OTG (On-the-Go) Port can be used to:
  - Mount a USB flash drive to upload files to transfer to the microSD Card using standard OTG Micro USB to USB Male-to-Female Cable Adapter, (Microtronix PN: 811-USN-OTG).
  - Connect a USB mouse or keyboard to utilize the WYSIWYG Interactive Overlay user interface. See Section 6 Using the WYSIWYG Interactive Overlay User Interface.

Note: Not all features are supported across all video formats.

2.3 User Connections

The user connects to the DX-4400 product using the RS-232 Control port, the USB Serial Port or through a raw TCP/IP connection via the Ethernet port.. For more information on using these interfaces refer to Section 4.1 titled Control .

The raw TCP/IP connection is always available for external user control through Ethernet. For Serial Control, the factory default connection is sets Serial Control to the RS-232 Control Port interface. To switch Serial Control to the USB Serial Port requires the user to establish a connection to the Command Port (via either Telnet or through the DB9 Serial port) and issue a Set Mode command to the unit per Table 6: Set Mode Command Syntax.

2.3.1 RS-232 Control Port

The RS-232 Control Port can be used to connect the DX-4400 to a computer to allow external control of text and graphics overlay or as a GPS data input. For Serial Control, the factory default connection assigns the Serial Command Port to the RS-232 Control Port interface.

If you do not require the GPS PPS input an optional Y-cable can be purchased that allows the GPS to be connected to port 2. When the GPS is connected to port 1 the control port needs to be switched to the USB serial port. For more information refer to A.1.10 Garmin GPS 18x LVC Port Wiring. To display GPS data refer to Appendix E: Microtronix QML Libraries.

A USB to DB9 RS-232 Serial Port Male-Male Adapter Kit (see Appendix B) is supplied to connect to the DB9 RS232 Serial port to a USB port on a PC. For more information refer to Appendix B.

2.3.2 USB Serial Port

The USB Serial Control Port can also be used to control the text overlay. It is a USB mini-B connector and has an integral serial port set at 115,200 baud operation (8,N,1) and no flow control. The USB Serial port interfaces to a PC with a standard USB 2.0 – A to Mini-B (Male-Male) cable. Refer to section 4.1 External Control of the DX-4400 for more information on the use of this port.

2.3.3 USB OTG Serial Port

The USB OTG Serial port is used to connect a USB mouse or keyboard to the DX-4400 to utilize the WYSIWYG Interactive Overlay UI. Refer to Section 6.1 Connecting a USB Mouse and Keyboard for more information.

2.3.4 Ethernet Port

A user can control the DX-4400 over Ethernet via:

- a TCP Telnet client IP connection (using a Terminal Emulator) to the internal Command Port, (Refer to § 4.1.3.2 Default Static Network IP Address.)
- a TCP SSH connection to the Linux (Root) User port, or
- a TCP browser Web UI connection to the DX-4400 integrated web server. (Refer to § 5.1 Connecting to the Web UI.)

The TCP Telnet connection is always available for use by the external user in addition to the Serial port connection.

The RJ45 Ethernet port is a standard 10Base-T interface supporting data rates of 10/100Mbps and 1Gbps.

Note: The default static IP address is discussed in § 4.1.3.2 Default Static Network IP Address.

2.4 Hardware

The ***DX-4400*** product is available in either a chassis with a 120/240VAC wall adaptor as shown in the Figures below or optionally it can be purchased as an open-frame board for integration into an embedded video system.

Figure 1: DX-4400 – SD/HD/2K/4K-SDI Text & Graphics Overlay Inserter Product

2.4.1 Enclosure Dimensions

The DX-4400 chassis enclosure has dimensions of (L x W x H) of 6.75" x 5.75" x 1.5" where the width dimension applies to the ends with the connectors.

The DX-4400 OEM Board (PN: M6297-TI-2K or M6297-TI-4K) has dimensions of (L x W x H) of 6.0" x 5.25" x 1.125" where the width dimension applies to the side with the BNC connectors.

2.5 Power Requirements

The DX-4400 product draws up to a maximum of 1.5 amps from a regulated 12VDC 2.5A 30W 100-240VAC 50/60Hz power adapter.. To ensure EMC regulatory compliance, the negative (ground) input of the DC supply is connected to frame ground.

The AC power adapter is shown in the figure below.

Figure 2: 12Vdc 2.5A 100-240VAC Power Adapter

2.5.1 DC Power Connector

The DX-4400 product uses a chassis mounted 2-pin (male pins) secure circular bayonet locking connector made by Switchcraft PN: 17282-2PG-300 (Digi-Key: SC1206-ND). The mating connector on the power adapter is a Switchcraft PN: 16282-2SG-315 two-pin female socket connector (Digi-Key: SC2122-ND).

2.6 Environmental Operating Limits

The DX-4400 product is designed for the following ambient operating environment::

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

The chassis is vented for heat dissipation and requires approximately 6" of physical clearance on the top and vented sides to provide adequate air convection to ensure proper device cooling.

3 Operation

3.1 Powering on the DX-4400

The DX-4400 unit operates from at 12VDC from the supplied 120/240VAC power adapter. Each time the DX-4400 is powered on it requires the microSD Card installed in the card slot to enable it to boot the Linux Operating System contained on the card. The unit is shipped from the factory with the micro SD Card pre-installed in the card slot.

Warning: If it is necessary to install a microSD Card into the unit, be careful when sliding the card into the card slot so as to not misalign the card to the card slot connector. Otherwise, the card may accidently fall inside the unit and will require the chassis to be opened to retrieve the card.

3.2 Modes of Operation

The DX-4400 product has several selectable Modes of Operation. Each mode has different capabilities and features. The available modes are:

1) **Dual Text Inserter (Dual TI)**. In this mode the product provides two video channels with separate text and graphics overlays for each channel. Each channel supports the SD, HD, and 3G modes listed in the product specifications with ancillary data pass through.
2) **Low Latency Dual Text Inserter (LDual TI)**. In this mode the product provides two video channels with separate text and graphics overlays for each channel without frame buffers in the path. Each channel supports the SD, HD, and 3G modes listed in the product specifications with ancillary data pass-through. There is no SDI alpha blending.
3) **Zoom Dual Text Inserter (ZDual TI)**. In this mode the product provides two video channels with separate text and graphics overlays for each channel. Each channel supports the SD, HD, and 3G progressive modes (no interlaced or PsF modes) listed in the product specifications without ancillary data pass-through. Each channel supports separate zoom control.
4) **Picture in Picture Text Inserter (PiP TI)**. This mode provides a single text inserter with a main input and a secondary input. Both inputs have scaling capabilities to allow for use as Picture in Picture (PiP), split screen or side by side configurations. The unit has a single text and graphics overlay and supports the SD, HD, and 3G modes listed in the product specifications. Ancillary data from input 1 passes through the unit to the output.
5) **Low Latency Picture in Picture Text Inserter (LPiP TI)**. This mode provides a single text inserter with less than one frame of delay from input 1 to the output. Input 1 does not support PiP or Zoom. Input 2 supports PiP and Zoom. Ancillary data is supported on Input 1.
6) **Dual Link 4K Text Inserter (4K TI)**. The unit provides a text and graphics overlay for one channel of 4K (Quad and 2SI mapped) video transported in the dual link modes listed in the product specifications. Ancillary data pass through is NOT supported.
7) **Low Latency Dual Link 4K Text Inserter (L4K TI)**. The unit provides a text and graphics overlay for one channel of 4K (Quad and 2SI mapped) video transported in the dual link modes without frame buffers in the video path. Ancillary data pass through is supported in this mode of operation.
8) **Zoom 4K Dual Link 4K Text Inserter (Z4K TI)**. The unit provides a text and graphics overlay for one channel of 4K (Quad or 2SI mapped) video transported in the dual link mode. For 2SI mapped video only, the input can be zoomed. Ancillary data pass-through is supported in this mode of operation.

NOTE: Support for 4K video is an optional product upgrade and is not available in the base product configuration.

Within each mode of operation, the unit auto detects the format of the input video from the modes supported, and outputs in the same format. Custom user configurations and parameters can be stored on the microSD Card file system for auto restoration during power ON/OFF cycles.

The Mode of Operation can be changed by using the Set Mode (SM) Command described in § 4.2.1 Set Mode Commands or via the Web UI as described in § 5.3.1 General Environment – Mode of Operation Page.

3.3 Default Configuration and Video Mode

The factory default startup configuration for the DX-4400 uses a database Saveset named "default" to store Fields required to configure the unit for the default configuration. The default is to use the database on the SD flash card. If you operate in a Mode that requires many commands – such as moving an image on the screen – you may want to switch the Saveset to use an in-memory database to reduce flash writes. (See IM Command of Table 23: Command Syntax for Saveset Default Values.) This will also speed up the operation.

When powered up in the factory default configuration, the unit will operate as a **PiP TI** and pass the primary SDI 1 video through to the two outputs with text and graphic overlay items added. The DX-4400 will automatically output in the same video format as is detected at the SDI input.

If the input video format changes, the DX-4400 will momentarily switch off the output while the out format is adjusted to match the input. When the input format is detected and the video (pixel) clock is locked to the source, the video out path is enabled and the input video and ancillary data will appear at the output.

If the SDI input is disconnected, the unit continues to output in the last video format that was detected.

If there is no input signal (or if it cannot be properly detected), the DX-4400 operates in the default video mode and outputs the overlay information on a black background. In the **Dual TI, LDual TI, ZDual TI,** and **PiP TI** Modes, the video format will be 1920x1080p30. In the **4K TI** and **L4K TI** Modes, the default video format will be 3840x2160p30 in quadrant mode.

3.4 OSD Layers

The **DX-4400** uses a dual-core ARM Graphics Video Processor which supports two video paths shown in Figure 3 with a graphics video layer mixed on top of each SDI video input.

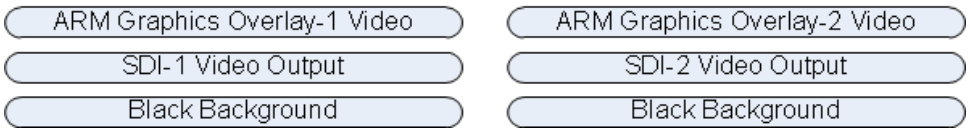

Figure 3: DX-4400 Layer Order for Dual TI mode

The top layer is the ***ARM Graphics Overlay Video*** which is the output overlay generated from the ARM Graphics Overlay Processor. This layer displays the Text, Graphic and Image Field information entered by the user using Text, Graphic or Image Overlay Commands.

The 2nd layer is the ***SDI Video***, and the 3rd layer is the ***Black Background.***

The ordering of layers in the ARM video output is determined by their Z Layer number with the higher layer numbers being at the top. If two Fields have pixels that occupy the same coordinates on the same Z-Layer, one will overwrite the other. The Field are rendered in the order they were defined (Text first, Image second followed by Graphic). The ID numbering assignments used for Text, Image and Graphic Fields are specific to each group.

When Graphic Fields on different Z Layers are placed at the same coordinates, they mix according to their transparencies. When a Field item is fully visible (no alpha assignment), all content that is on the layers below it will not be visible. When the Field is partly or fully transparent, it mixes with the layers below according to their transparencies.

3.5 LED Status Indicators

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

Figure 4: DC Power LED

Figure 5: SDI Input / Output Status LEDs

The operation of the SDI status LEDs is summarized in the table below.

Table 1: Description of SDI LED Status Indicators

LED	Color	Use	Description of LED Status
SDI 1 IN	Red	Valid Video	**OFF:** SDI 1 input has either no video, or an unsupported video format. **ON:** A signal is detected on the input.
SDI 2 IN	Red	Valid Video	**OFF:** SDI 2 input has either no video, or an unsupported video format. **ON:** A signal is detected on the input.
SDI 1 OUT	Red	Overlay Active	**OFF:** Arm Overlay off or not valid ON: Arm Overlay on SDI video output 1.
SDI 2 OUT	Red	Overlay Active	**OFF:** Arm Overlay off or not valid **ON:** Arm Overlay on SDI video output 2.
Power	Green	Power	**ON:** Power OK

3.6 Product Settings Database

The DX-4400 stores its parameters in a database. A set of parameters for the DX-4400 is referred to as a Saveset. Many Savesets can be stored in the database. The Database Saveset Commands can be used to select the current Saveset. In general, commands sent to the DX-4400 are automatically stored in the current Saveset. There is no specific command needed to make the current configuration permanent.

Warning: The operating system caches the database in memory. If commands are sent to the unit and then the power is disconnected before the database is written to the SD card some settings may be lost. The delay for writing to the SD card can vary depending on many factors, but typically several seconds is

sufficient for the process to complete. To guarantee that settings are written to the SD card, execute the SM command with no parameters to restart the unit before disconnecting the power.

The DX-4400 has an option to use an In Memory database for applications where it is not desirable to have parameters stored to the SD card. This may include applications that send a constant stream of commands to the unit that would cause wear to SD card, applications that need high performance, and applications where it is not desired to store data to the card for privacy / security reasons.

3.7 Video Overlays

The **DX-4400** has two different overlay systems that operate independently of each other. Both overlays provide methods to add text, graphical shapes and images to the video output, but the capabilities of the two overlays are not identical.

The first overlay system is controlled by text commands that can be sent via RS232, a network port, a USB port that implements a standard serial device (essentially a built in USB to RS232 converter), or from a web browser connected to the Web Server in the DX-4400. This overlay is configured using the commands described in section 4.3: Externally Controlled Overlay Fields.

The second overlay system is an Interactive Overlay controlled by a mouse and keyboard attached to the DX-4400 using an external USB hub. This overlay is configured using the built in menus and windows to add and position content. The Interactive Overlay is described in section 6: Using the WYSIWYG Interactive Overlay.

Both overlays store their settings in the database and use the same Saveset.

It's possible to use both overlay systems at the same time. When both are used, the Interactive Overlay always displays on top of the text command overlay. The Interactive Overlay cannot affect the contents of the text command overlay, and the text overlay commands cannot change the contents of the Interactive Overlay.

The Interactive Overlay provides control over the contents of overlay only. It does not provide a method to control the mode of operation and other product settings. In most cases the Web UI or one of the other command interfaces will be needed to setup the product.

3.8 ARM SoC Processor

The ARM System-on-Chip (SoC) (dual-core) processor hardware supports the user interfaces and generates the text and graphics for the video buffer memory used to overlay data onto the SDI video path(s). The ARM SoC runs Linux and boots the OS from the software installed on the microSD Card. The QML Qt cross-platform application framework is used to provide enhanced operational features and the generation of advanced graphic displays for the video overlay, for example, adding a digital clock overlay (see § 4.3.8.2 Example: QML Field Example of Time, Date & Scrolling News Feed Overlay).

3.9 Network Interface

The Network interface is a 10/100/1G interface which uses DHCP to acquire a Network address. Once the IP address is assigned you can use either a TCP/IP connection to the Command Port to issue DX-4400 commands, or an SSH connection to shell into the DX-4400 to obtain a terminal login to the Linux OS Root User Account.

3.10 Linux OS Root Account Login

To access QML Qt features, or to upload image files or modify system files on the microSD Card, it is necessary to:

1) Establish an SSH connection over IP to the assigned IP address, port 20 via the Ethernet port and login to the Root Account on the DX-4400 unit. This is accomplished by the use a Terminal Emulator program

(i.e PuTTY) to establish an SSH Connection to <IP address> 20.
Refer to section B.3 Establishing TCP/IP Connection to the DX-4400 Product for more information.

2) Or, alternately utilize the capabilities of the Web UI interface per § 5.6 Web UI – File Manager Menu for file management or § 5.7.1 System Configuration – Authentication Page to modify system parameters.

3.10.1 Default Linux OS User Login

The default Linux OS login user name is **root** and the password of **ArmOverlay**.

3.10.2 Mounting Removable File Systems

When you insert a USB Flash Key, the system will detect the drive and assign it to /dev/sda1. To mount the drive type:

```
mount /dev/sda1
```

which will mount the drive at `/media/sda1`.

If the Flash key has more than one partition you will need to create another mount point and specify the mount point in the mount command. Before removing the Flash Key you should un-mount the device:

```
umount /dev/sda1
```

3.10.3 Copying Files

You can modify the files on the microSD card using the **WinSCP** (Secure File Copy) program – available for free download from the web – (and supplied on the CD) or edit them on a workstation and then use **WinSCP** or other scp (secure file copy program) to transfer the file onto the SD Card.

The default location for Image files is in the directory /usr/local/graphics. To put files into the directory you can either copy them (as a root user) over using **scp** or **WinSCP** (Secure File Copy) or copy them from a USB flash drive or a local hard drive. For example, to copy an Image file from a USB key type drive the following command from a terminal port.

```
copy /media/sda1/image.png /usr/local/graphics
or
cp /media/sda1/image.png /usr/local/graphics
```

TIP: A USB drive can be connected using the supplied 5" Micro USB to USB 2.0 OTG Adaptor cable.

Note: To connect with WinSCP, connect to the device IP address at port 22 with the root user account (using **root** and the default password, **ArmOverlay**) and navigate to the appropriate source and the target **/usr/local/graphics** destination directory.

3.10.4 Adding New Font Files

You can add new true type font files by copying them to **/usr/lib/fonts**. After you have added the fonts to rebuild the font information cache files it is necessary to issue the following command from a terminal port.

```
fc-cache
```

Then restart the system via a power cycle (or with the Set Mode Command) for the new fonts to be accessible.

```
SM
```

Note: Font files can also be added using the Web UI per § 5.6.2 File Manager – Font Files Page.

3.10.5 Date and Time Configuration

The DX-4400 has a battery backed Real Time Clock (RTC). The real time clock is read at startup to set the system time and date.

3.10.5.1 Time Zone

The factory default time zone is Canada EST/EDT which can be changed by using the **`tzselect`** command from a raw TCP/IP or a SSH connection and following the prompts, or using the Web UI interface per section 5.7.2 titled System Configuration – Date and Time Page. You can also use the Command Port **TZ** Command (Table 24: Time Command Syntax) to the Time Zone.

3.10.5.2 Linux OS System Time

The Command **`dxhwclock <-s|-w>`** is used to either set the Linux OS System Time from the hardware Real Time Clock or set the RTC from the System Time. The **–s** sets the System Time and the **–w** writes the hardware RTC.

3.10.5.3 Accessing NTP Servers

The ntpd daemon is launched at startup. To configure NTP servers you can use the Web UI or edit the ntp.conf file located in /etc. If you want to use a GPS to act as the time server you will need to edit the ntp.conf file and uncomment the lines indicated. To do this remove the '#' from the start of the lines. You can edit the file from the Web UI under "System.->Edit System Files" and select NTP Server configuration.

3.11 GPS Configuration

A GPS receiver (not supplied with the DX-4400) that has a NMEA 0183 interface can be connected to the DB9 connector on the DX-4400. When the GPS is connected and configured:

- The Linux system clock can be synchronized to GPS time.
- GPS data can be displayed in the Interactive Overlay using GPS Fields.
- GPS data is available for use in QML via the Microtronix QML GPS Library (see Appendix E.1). QML provides extensive capabilities to format and display GPS data in both the Externally Controlled Overlay Fields, and the Interactive Overlay Fields.

The DB9 connector on the DX-4400 is multi-function can operate as an RS232 control port, a GPS input, or a general purpose data input. Two independent serial ports are available on the connector. The first port uses standard pinning and the second port is located on the CTS/RTS pin locations as shown in Appendix A.1.2: DB9 RS-232 Control Port, J10.

The DX-4400 supports a GPS connection with serial data only using either of the two channels on the DB9 port, or a connection with both serial data and the PPS signal using both channels on the port. When a PPS signal is used the time synchronization is more accurate. In this configuration the GPS data must be connected to the Rx data pin of the first channel, and the PPS signal must be connected to the Rx data pin of the second channel.

3.11.1 Electrical Connection of a GPS Receiver

A wiring example for the Garmin 18x LVC receiver is shown in Appendix A.1.10: Garmin GPS 18x LVC Port Wiring.

3.11.2 Software Configuration for GPS

The DX-4400 system must be configured to know that a GPS receiver is connected. This is best accomplished using the Web UI 5.3.1: General Environment – Mode of Operation Page to make changes to the system configuration. The Web UI prevents conflicting configuration settings for the DB9 connector as a GPS input or external command port.

The Web UI makes the configuration change by editing the GPS= parameter line in the file /etc/dx4400/dxenv in the DX-4400 file system. It is also possible to edit the file manually to change the value.

When GPS support has been configured, the Linux gpsd service is loaded when the DX-4400 starts. This service receives GPS data and makes it available to other processes in the system, including the network time protocol service (ntpd) that can use the data to synchronize the system clock.

To enable system clock synchronization to GPS time, the NTP Server Configuration must also be edited. The recommended way to do this is using the **Date and Time** page on the **System** menu of the Web UI. See 5.7.2: System Configuration – Date and Time Page. Set the time source to be **GPS** or **GPS+PPS** as appropriate.

Alternatively, the configuration can be edited manually using the Web UI or other editor. The configuration is located in the file /etc/ntp.conf. To edit with the Web UI, open the **System** menu tab and select **Edit System Files**. Open the NTP Server Configuration and edit the file to uncomment the three lines containing address 127.127.28.0. If the PPS signal is also being used, then also uncomment the two lines with address 127.127.28.1. An example of the file with GPS clock synchronization and the PPS reference signal enabled is shown in the following figure:

```
# This is the most basic ntp configuration file
# The driftfile must remain in a place specific to this
# machine - it records the machine specific clock error driftfile /var/lib/ntp/drift
# This should be a server that is close (in IP terms)
# to the machine.  Add other servers as required.
# Unless you un-comment the line below ntpd will sync
# only against the local system clock.
#
#server
#
# Read the rough GPS time from device 127.127.28.0
# Read the accurate PPS time from device 127.127.28.1
# Uncomment the server and fudge lines below for support
#
server 127.127.28.0 minpoll 4 maxpoll 4
fudge 127.127.28.0 time1 0.535 refid GPS
fudge 127.127.28.0 flag1 1
server 127.127.28.1 minpoll 4 maxpoll 4 prefer
fudge 127.127.28.1 refid PPS
#
# Using local hardware clock as fallback
# Disable this when using ntpd -q -g -x as ntpdate or it will sync to itself
server 127.127.1.0
fudge 127.127.1.0 stratum 14
# Defining a default security setting
restrict default
```

Figure 6: NTP Server Configuration for GPS with PPS signal

4 External Control of the DX-4400

4.1 Control Interfaces

The DX-4400 has four methods for interfacing an external user to the Text Command Port used to control the operation of the unit.

1) **Network Control** using a raw TCP/IP connection (to port 2121) over Ethernet from a Telnet or other terminal emulation client running on a PC.
2) **RS-232 Control** using the DB9 connector labeled "RS-232 Control".
3) **USB Serial Control** using the type B USB port labeled "USB Serial Port".
4) **Web UI Control** using a standard web browser and a TCP Ethernet connection. This method of control is discussed in section (§) 5 titled Using the Web UI.

To utilize Serial Control requires the user establish a connection via either the RS232 port or the USB Serial port. The factory default connection sets Serial Control to the RS-232 Control Port interface.

To switch Serial Control from the RS-232 Control Port to the USB Serial Port requires the user to establish a connection to the internal Command Port (via either Network Control port or through the DB9 Serial port) and issue a Set Mode Command to the unit per Table 6: Set Mode Command Syntax.

Alternately, the user can use Network Control via a TCP/IP connection to the Command Port since it is always available for external user control through a TCP Ethernet connection.

Note: For the examples provided in the following sections, the Commands are executed via a Serial (RS232 or USB) connection or a Network TCP/IP connection to the Control Port of DX-4400 unit.

Warning: Only one Network Control port user connection can be active at a time.

4.1.1 Serial Control Mode of Operation

When Serial Control is used, the DX-4400 is controlled via Commands sent to the Command Port via either the **RS-232 Serial Control Port** or the **USB Serial Port** using a terminal emulator program on a PC. Refer to **Appendix B**, section Establishing RS-232 Serial Communication to a PC page 125 for the recommended settings for the PuTTY terminal emulator.

Note: The Serial COM port of the computer connected to the DX-4400 should be configured for: 115,200 baud, 8-bit data, no parity, 1 stop bit and no XON/XOFF flow control.

The Command Port acknowledgement codes (supplied from the DX-4400 and received by the PC) are listed in Table 2 below.

4.1.1.1 USB 2.0 to RS-232 Serial Port Adapter Kit

Since most PC no longer come with a RS-232 Serial port, the DX-4400 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 on the unit 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 **Appendix B** titled Establishing User Connections to the DX-4400 Product for more information.

4.1.1.2 USB Serial Port

The USB Serial Control Port can also be used to control the text overlay. The port interfaces to a PC with a standard USB 2.0 – A to Mini-B (Male-Male) cable included with the product.

Since by default, the Serial Control Port is mapped to the RS-232 Serial port, to use the USB interface it is necessary to establish a connection to the Command Port (via either Network Control port or through the DB9 Serial port) and issue a Set Mode command to the unit per Table 6: Set Mode Command Syntax to switch Serial Control to the USB Serial Port. \

4.1.2 Network Control Using Raw TC/IP

The Network Control connection is used to sent commands to the DX-4400 over Ethernet, using a terminal emulator (Telnet, PuTTY) application to TCP port number 2121. The Ethernet address is either assigned via DHCP or by static IP address assignment (default 10.1.1.230/8)

From either a Windows command prompt or Linux command line, you can establish a Network Control user connection to the Command Port of the DX-4400 using the following commands:

Window Client	Linux Client
open <IP Address> 2121 telnet <IP Address> 2121	nc <IP Address> 2121 telnet <IP Address> 2121

Note: Refer to sections 4.1.3.2 or 4.1.3.3 below for information on the default static network IP address or the DHCP assigned IP address.

TIP: To confirm the connection to the Command Port of the DX-4400, type RV to cause the unit to display the revision of the software and the MAC & IP address.

Note: On a Windows PC, a Telnet Client is available from a Command Prompt window.

Warning: In Windows 7 and 10 the Telnet Client is turned off by default. To get more information on enabling the Telnet Client, search in Google with the term "Enabling Telnet Client on Windows".

TIP: PuTTY is a free PC terminal emulator utility which supports Telnet, SSH and Serial connections. Refer to section Appendix B:, titled Establishing TCP/IP Connection to the DX-4400 Product form more information.

The Command Port acknowledgement codes (i.e. the DX-4400 response to user commands) are listed in Table 2 below.

4.1.3 Network Control Using Web UI

The DX-4400 supports a web server which offers the user the ability to configure, manage and maintain the unit using a web browser. All of the features available via the Serial Control interface or the Network Control interface (TCP/IP) are available through the Web UI.

4.1.3.1 Connecting to the Web UI

To access the Web UI is it necessary to make an http connection using the IP address by the local DHCP network server. For example: **http://10.1.1.42** (Refer to § 4.1.3.3 titled DHCP Assignment of Network IP Address below for more information on obtaining the IP address.)

At the sign in (login) prompt enter the default Username and Password of **admin** and **admin**. The DX-4400 Web UI home page is shown below. For more information on using the Web UI refer to § 5 Using the Web UI.

Figure 7: DX-4400 Web UI Home Page

4.1.3.2 Default Static Network IP Address

The factory default Ethernet secondary static Network IP address is **10.1.1.230.** This assignment is stored in the ethenv (Ethernet environment) system file, namely **/etc/dx4400/ethenv**. This file can be edited using the Web UI under the System Configuration using the Edit System Files menu item. (See section 5.7.6 System Configuration – Edit System Files Page for more information.)

Note: This feature is only available in software version 1.5.0 and beyond.

4.1.3.3 DHCP Assignment of Network IP Address

When connected to an Ethernet Network, the DX-4400 unit uses DHCP to acquire an IP address from the Network. The unit self identifies to the DHCP Server as DX-4400_00-60-80-NN-NN-NN where NN represents the digits of the MAC address that can be found on the bottom of the unit.

Using the defined name, check with your Network Administrator who will be able to supply you with the IP address assigned by the Network DHCP Server. Alternatively, by using a Ping Command from the Command Prompt of a PC, it should be possible to get a response from the DX-4400 unit by typing:

```
ping DX-4400_<mac addr>
```

where <mac addr> is the address of the unit. For example if the nameplate label on the DX-4400 shows MAC Address of 00:60:80:40:00:02, then the Ping Command would be:

```
ping DX-4400_00-60-80-40-00-02
```

If the ping does not work, to determine the assigned IP address, you can use a Serial connection to the Command Port either through the RS-232 Control Port or the USB Serial Port. (Refer to sections above for details). Once connected to the Command Port, use the **RV** command to display the IP address.

Also included on the CD is a Windows application installer ipscan25.exe (Advanced IP Scanner) that can be used to find all the devices on the local Network. If the DHCP Server did not recognize the name given locate the device with a MAC address starting with 00:60:80 that will be the DX-4400.

4.1.4 Serial/Network Control – Command Port Syntax

To control the operation of the DX-4400, Serial and Network Commands are sent to the Control/Command Port.. The Command structure and rules are as follows:

- The Commands consist of ASCII alpha-numeric codes and are not case sensitive. All Commands are terminated with a carriage return (CR), a line feed (LF), or a semicolon. The use of a semicolon terminator allows more than one command per line to improve readability of script files.
- Commands may be sent directly to the DX-4400 one character at a time using a Terminal Emulation program running on a connected computer, or they may be developed in a text editor such as Notepad and then uploaded to the DX-4400 by the Terminal Emulator program (example, HyperTerminal). 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 separating parameters within a Command.
- 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 Commands are acknowledged with a '+' and '-' response respectively. Carriage return, line feed, or semicolon characters without a preceding command are acknowledged with a '*'.
- The Apostrophe (') character (when found outside of a quoted string) indicates that the remainder of the current line is a comment and will be ignored. The use of comment characters allows script files containing comments to be sent to the DX-4400 by a terminal program without generating error responses.
- The Command Codes are extensible, additional commands and functionality can be added to the product as required. Contact Microtronix sales or technical support (support@microtronix.com) with your requirements.

Note: The Web UI can be used as an alternate user interface and provides a higher level of abstraction minimizing some of the need to learn the command line syntax.

The Command Port acknowledgement codes are listed in the table below.

Table 2: Command Port Acknowledgement Codes

Response Code	Description
+	Valid command received
-	Invalid command received
*	Valid CR, LF, semicolon, or comment line received

4.1.5 Manual Mode of Operation

The operation of the DX-4400 can optionally be configured to be controlled using Command strings assigned to the momentary bi-directional Toggle Switch and the DIP Switches using User Defined Command as described in Table 3 and Table 4 below.

In the Manual Mode operational settings can be controlled by both the DIP Switch and Serial commands sent to the Command Port (see § 4.1.4 Serial/Network Control – Command Port Syntax). 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 temporally 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 user programmable by User Defined Commands per § 4.7 User Defined Commands and via the Web UI per § 5.5 Web UI – User-defined Commands Menu. The following section describes the factory default configuration.

4.1.5.1 Toggle Switch Settings

The Toggle Switch settings are user configurable to enable functions via Command Strings. The Command assignments are listed in Table 3 below.

Table 3: Operation of 2-Position Momentary Toggle Switch

Switch Movement	Description
Toggle Left (TL)	Command strings defined by UDTL. (See Table 25)
Toggle Right (TR)	Command strings defined by UDTR. (See Table 25)

4.1.5.2 DIP Switch Settings

The DIP switches can be grouped together to provide more options than string IDs 0 and 1. When the DIP switches are grouped the least significant digit is always the highest numbered DIP switch in the group. The Command assignments are listed in Table 4 below.

Table 4: Operation of 4-Postion DIP Switch

DIP Switch	Description
DIP Switch 1	Command strings defined by UDD1. (See Table 25)
DIP Switch 2	Command strings defined by UDD2. (See Table 25)
DIP Switch 3	Command strings defined by UDD3. (See Table 25)
DIP Switch 4	Command strings defined by UDD4. (See Table 25)

4.2 Setting DX-4400 Mode of Operation

The DX-4400 product has several Modes of Operation with each mode offering different functions and operational features as described in Table 5 below. Since some features are specific to a Mode of Operation, not all user commands (used to control the feature) are applicable to all modes. For example, the PiP / Zoom commands function only in the **PiP TI Mode**. Therefore, in other modes these commands have no effect.

The Modes of Operation of the DX-4400 is configured by the user using the **Set Mode** (SM) Command are described in the Table 6 below.

Table 5: DX-4400 Modes of Operation

Mode	Description
Dual Text Inserter (**Dual TI**)	The DX-4400 functions as a **Dual Channel SDI Text Inserter** (Dual TI). ➢ An overlay layer is added to the video on Input 1. The output is available on Output 1. ➢ A different overlay layer is added to the video on Input 2 and the output is available on Output 2. ➢ Input and 1 and 2 both pass all ancillary data including audio from the SDI input to the corresponding SDI output. ➢ Zoom and PiP functions are not supported. ➢ All the supported video modes are available except for the 4K modes. Each output will automatically adjust mode to match the signal on the corresponding input. Refer to the Video Input Formats list (under § 1.1 Supported Functionality) for the supported modes.
Low Latency Dual Text Inserter (**LDual TI**)	The DX-4400 functions as a low **Latency Dual Channel SDI Text Inserter** (LDual TI). The delay through the video path is less than one frame. ➢ An overlay layer is added to the video on Input 1. The output is available on Output 1. ➢ A different overlay layer is added to the video on Input 2 and the output is available on Output 2. ➢ Input and 1 and 2 both pass all ancillary data including audio from the SDI input to the corresponding SDI output. ➢ Zoom, Alpha and PiP functions are not supported. ➢ All the supported video modes are available except for the 4K modes. Each output will automatically adjust mode to match the signal on the corresponding input. Refer to the Video Input Formats list (under § 1.1 Supported Functionality) for the supported modes.
Zoom Dual Text Inserter (**ZDual TI**)	The DX-4400 functions as a **Dual Channel SDI Text Inserter** (ZDual TI)with zoom on both video paths. No ancillary data is passed through. ➢ An overlay layer is added to the video on Input 1. The output is available on Output 1. ➢ A different overlay layer is added to the video on Input 2 and the output is available on Output 2. ➢ PiP functions are not supported. ➢ All the supported video modes are available except for interlaced and 4K modes. Each output will automatically adjust mode to match the signal on the corresponding input. Refer to the Video Input Formats list (under § 1.1 Supported Functionality) for the supported modes.

Mode	Description
Text Inserter with PiP (**PiP TI**)	The DX-4400 functions as a **Text Inserter with PiP** (PiP TI)supporting two inputs, one overlay, and two identical outputs. ➢ Input 1 is the main input. The product automatically adjusts the output to match the video detected on Input 1. All ancillary data (including audio) from input 1 is transported to both outputs. ➢ Input 2 is a secondary input that is typically used for a PiP display. Ancillary data from input 2 is discarded. Input 2 can be a different resolution or frame rate than Input 1, but if Input 1 is progressive, then Input 2 must be progressive, and if Input 1 is interlaced or PsF,, then Input 2 must be interlaced or PsF. ➢ Both input 1 and input 2 can be down scaled and clipped, allowing for display as Side by Side, or Split screen in addition to PiP display. ➢ All the supported video modes are available except for the 4K modes. Refer to the Video Input Formats list (under § 1.1 Supported Functionality) for the supported modes. ➢ Video latency is at least 1 frame and may be up to 2 frames as required to synchronize the video from the two inputs.
Dual Link 4K Text Inserter (**4K TI**)	The DX-4400 functions as a single channel, **4K Text Inserter** (4Kl TI). Video inputs and outputs operate as SDI Dual Links with each port operating at 3 GB/s supporting 4K video at frame rates up to 30 fps. ➢ 3840x2160 and 4096x2160 resolutions are supported. ➢ Ancillary data from the inputs is discarded. ➢ Zoom and PiP functions are not supported. ➢ If you switch into 4K mode without a having a 4K IP Core License File installed, the video is disabled.
Low Latency Dual Link 4K Text Inserter (**L4K TI**)	The DX-4400 functions as a single channel, **4K Text Inserter** (L4K TI). Video inputs and outputs operate as SDI Dual Links with each port operating at 3 GB/s supporting 4K video at frame rates up to 30 fps. The video delay is less than one frame. ➢ 3840x2160 and 4096x2160 resolutions are supported. ➢ Ancillary data and audio from the inputs is transported to the outputs. ➢ Zoom and PiP functions are not supported. ➢ If you switch into Low Latency 4K mode without a having a 4K License File installed, the video is disabled.
Zoom Dual Link 4K Text Inserter (**Z4K TI**)	The DX-4400 functions as a single channel, **4K Text Inserter** (Z4K TI). Video inputs and outputs operate as SDI Dual Links with each port operating at 3 GB/s supporting 4K video at frame rates up to 30 fps. ➢ 3840x2160 and 4096x2160 resolutions are supported. ➢ Ancillary data and audio from the inputs is transported to the outputs. ➢ Text overlay is supported for 2SI and Quad mapped video. ➢ High magnification zoom is supported for 2SI mapped video only. If you switch into this mode without a having a 4K License File installed, the video is disabled.

Mode	Description
Low Latency Text Inserter with PiP (**LPiP TI**)	The DX-4400 functions as a **Text Inserter with PiP** (LPiP TI)supporting two inputs, one overlay, and two identical outputs. ➢ Input 1 is the main input. The product automatically adjusts the output to match the video detected on Input 1. All ancillary data (including audio) from input 1 is transported to both outputs. This input has a latency of less than 1 frame from input 1 to output. Zoom and PiP functions are not available. ➢ Input 2 is a secondary input that is typically used for a PiP display. Ancillary data from input 2 is discarded. Input 2 can be a different resolution or frame rate than Input 1, but if Input 1 is progressive, then Input 2 must be progressive, and if Input 1 is interlaced or PsF, then Input 2 can be progressive, interlaced or PsF. ➢ Input 2 can be down scaled and clipped. ➢ Input two can support high magnification zoom with a latency of 2-3 frames or can have latency 1-2 frames with zoom limits of 100% for 3G, 150% for HD and 300% for SD modes. ➢ All the supported video modes are available except for the 4K modes. Refer to the Video Input Formats list (under § 1.1 Supported Functionality) for the supported modes.

Notes:

1) The Low Latency mode decreases the frame delay. and is described in § 4.4.6 Video Buffering and Frame Delay. The REM Command can be used to display the current Mode of Operation.
2) The Set Mode (SM) user command is used to configure the mode of operation of the DX-4400 product.

4.2.1 Set Mode Commands

The Set Mode (SM) commands are used to select the Mode of Operation for the DX-4400 product and optionally assign the Serial Command Port to either the RS-232 Serial port or the USB Serial port.

The SM command takes up to two arguments: the first is the mode to switch the DX-4400 into and the second is to assign the Serial Command Port to use for Command parsing. Changing between Modes takes several seconds during which time the output video is interrupted and no additional commands can be sent to the unit.

Table 6: Set Mode Command Syntax

Parameters	Description of Command
SM – Sets the Mode of Operation where <Serial> is optional and can be either RS232 or USB	
SM DUAL <Serial>	Selects the Dual Text Inserter Mode (Dual TI)
SM LDUAL <Serial>	Selects the Low Latency Dual Text Inserter Mode (Dual TI)
SM ZDUAL <Serial>	Selects the Dual Text Inserter Mode with Zoom (Dual TI)
SM PIP <Serial>	Selects the PiP Text Inserter Mode (PiP TI)
SM 4K <Serial>	Selects the 4K Text Inserter Mode (4K TI)
SM L4K <Serial>	Selects the Low Latency 4K Text Inserter Mode (4K TI)
SM Z4K <Serial>	Selects the Zoom 4K Text Inserter Mode (Z4K TI)
SM LPIP <Serial>	Selects the Low Latency PiP Text Inserter Mode (LPiP TI)
SM <serial>	Assigns location of the Serial user connection of the Command Port Where <Serial> can be either RS232 or USB
SM I	Initialize Saveset Database to factory defaults
SM	Restart the unit no changes

Notes:

1) The factory default configuration assigns the Serial Control Port to the RS232 Port (instead of the USB Serial Port).
2) The commands accept the shortest unique string. For example, it is acceptable to specify SM LD instead of SM LDUAL.
3) Use of the Set Mode (SM) Command does not clear the user information stored in the Saveset Database.

4.2.1.1 Example - Set Mode Command

To set the DX-4400 to operate as a **PiP Text Inserter** and to change the Serial Command port from the RS-232 Port (the factory default assignment) use the following command via the Control Port (Serial or Network):

```
SM PIP USB
```

4.3 Externally Controlled Overlay Fields

This section describes the Overlay Fields that are controlled by commands sent to the DX-4400 using RS232, USB, or network control. For the Interactive Overlay that is configured with a mouse and keyboard attached to the DX-4400, see section 6 Using the WYSIWYG Interactive Overlay.

To generate a Graphic Overlay / On Screen Display (OSD), Fields are defined to specify the parameters and features (attributes) of each object displayed. Four types of Overlay Fields are available:

1) **Text Fields** – display single line of ASCII characters and are defined using the 'T' Command.
2) **Graphic Fields** – displays shapes (Circle, Ellipse, Line, and Rectangle) and defined by the 'G' Command.
3) **Image Fields** – displays an image from a user supplied file stored on the DX-4400 and are defined by the "I" Command.
4) **QML Fields** – run QML Script files stored on the DX-4400 and are defined by the "Q" Command.

All Fields are mixed together taking into account their transparency and position in the layer stack up (defined by the Z parameter of the field) to generate a single blended Overlay Layer that is mixed on top of the SDI input video channels.

The video output of the Overlay Layer is updated by the ARM rendering the graphics to the video frame buffer. The amount of time required to render the graphic items is dependent on the number of items on the Overlay Layer.

All Overlay Fields are associated with a Saveset stored in the system Configuration Database. The DX-4400 always has a Saveset named "default" which cannot be deleted. You can create/delete your own named Savesets allowing the user to define different Overlay Configurations. When you delete a Saveset, all the Fields are removed from the overlay display.

For each Saveset, the Fields are numbered 1 through 999 by the ID parameter. Each of the four types of Fields (Text, Graphics, Images and QML) use separate ID values.

The Toggle and DIP Switch User Defined Command are numbered 1 through 15 by the ID parameter. (Refer to Table 25: Toggle Switch – User Defined Command Syntax and Table 26: DIP Switch User Defined Command Syntax for more information.)

By default, all Graphic Fields are visible and have default parameters (attribute settings). For example, the following Graphic Field Command draws a simple rectangle positioned with the top left corner at 100, 100. The rectangle has a length of 400 (X distance) and height of 200 (Y distance). The rectangle has a default border Color of white with white fill and no transparency.

```
G ID=1 S=rectangle X=100 Y=100 L=400 H=200 'add user comment if required
```

Each Graphic Field can be turned on or off independently by the Visibility parameter V taking a value of YES or NO. For example, to turn off the visibility of the above rectangle enter the command.

```
G ID=1 V=no 'Turn graphic ID 1 visibility OFF
```

A Graphic Field is updated when a change occurs.

4.3.1 Coordinate System and Field Position

Each Overlay Field has three position coordinates referred to as X, Y and Z with a default value of zero. One or all of these coordinates may be used when defining a Field.

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 Digital Cinema 2160p video formats the bottom-right corner is at coordinates x=4095, y=2159.
- For UHD 2160p video formats the bottom-right corner is at coordinates x=3839, y=2159.
- For 1080p, 1080i, and 1080PsF formats the bottom-right corner is at coordinates x=1919, y=1079.
- For 720p video formats the bottom-right corner is located at x=1279, y=719.
- For NTSC video format the coordinates are x=719, y=485, and for PAL format x=719 and y=575.

Note: 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.

Any Field or portion of a Field that extends beyond the edges of the Overlay will not be visible.

The Z position allows you to stack the Fields on top of each other. If the alpha value is other than zero the Fields will be blended with the higher Z value being at the top.

Note: By default, all fields are at Z position 0, but fields with higher ID numbers are placed above fields with lower ID numbers and will be blended above them.

Note: When Fields of different types overlap, and the Fields have the same Z layer (or no Z layer has been defined) the Fields may not appear in the same order after power cycling the DX-4400. This occurs because as Fields are being defined, they are drawn in the order the commands are given to the DX-4400, but at power up the Fields are drawn by their type and in order of ascending ID numbers with Text Fields drawn first, followed by Image Fields, followed Graphic Fields, and then QML Fields. To avoid this behaviour, it is good practice to always define the Z position of objects when they overlap.

4.3.2 Text and Graphic Field – Color and Transparency

Text and Graphic Fields have a Color specified by SVG Color Keyword Name assignments – as defined by the Scalable Vector Graphics (SVG) Specification – (see: http://www.december.com/html/spec/colorsvgsvg.html for a color chart) or by using Red, Green, and Blue Components in the range from 0 to 255.

There are two Color components for Graphic shapes: (1) the Foreground Color used for fill and (2) the Border Color used for the outline. The default Color is white (R255, G255, and B255).

For example, to change the fill Color of Graphic Field one to **darkgoldenrod** you can use either of the following Commands:

```
G ID=1 FC=darkgoldenrod
G ID=1 FC=#184134011
```

The Foreground color has a Transparency property that can be controlled using the **FA=aaa** to set the Alpha value for mixing with underlying layers. Setting the Alpha value to 0 sets the foreground color to be fully visible and no content on lower video layers will be visible through the Color. An Alpha of 255 sets the Color fully transparent. At this setting the color will be completely invisible.

For example: sending a **G ID=1 FA=192** command makes Graphic Field 1 approximately 75% transparent.

4.3.3 Text and Graphic Field – Drop Shadow

Text and Graphics Fields have a Drop Shadow effect that can be applied to the item. There are five components to the Drop Shadow:

1) Blur on edge of shadow 0 to 255,
2) X displacement of shadow -255 to 255,
3) Y displacement of shadow -255 to 255,
4) Color of the shadow values as defined in 4.3.2 above
5) Transparency alpha value 0 to 255.

The higher the Blur value the fuzzier the shadow will be. The default value is 1.

The X displacement is to the left for negative numbers and right for positive numbers. The Y displacement is up for negative numbers and down for positive numbers. The default value is 8 for both.

The default Color is grey with a Transparency of 255 turning it off.

Note: Refer to Table 9 and Table 10 for the Drop Shadow Command syntax

4.3.4 Fields Groups

Groups allow you to add fields to a named group. When you change a value for the group all fields in the group are affected, such as transparency alpha value. So if you want to make all the fields invisible set the alpha value to 255. These changes only apply while the field belongs to the group. If you remove it from the group the settings return to their previous value. If you delete a group that contains fields all the fields are deleted as well. You can empty all the fields from a group before deleting.

There is an overlay setting that controls which overlay the group applies to for the DUAL TI mode. When adding fields to a group the overlay setting for the field must match the group overlay or an error will be returned. You can freely change the group overlay value as long as no fields are in the group.

Text, Graphic, Image and QML fields have a new parameter "G" which takes a group name and adds it to the group. The Group must exist before you can add it to the field. Refer to Table 9, Table 10, Table 12 and Table 13.

Groups have the following settable values:

1) X, Y and Z positioning value 0 to 255.
2) Transparency alpha value 0 to 255.
3) Overlay value 1 or 2.

Table 7: Field Group Command Syntax

Parameters	Description of Command Syntax
GR – Identifies a Group Command string to the Command Port parser	
ID=	This is a unique number that identifies the Group and must be the first parameter in the list. Example: GR ID=1 "GroupName"
IDR=	This functions the same as the ID parameter but if the value exists the X, Y, Z, etc parameters are reset to default.
DELETE	Deletes the Group specified by the ID number. If there are items in the Group they are deleted as well. Command parsing stops, no other arguments are checked. Example: GR ID=1 DELETE
"Group Name"	Name of the Group that items can be added to.
X=	Sets the X coordinate for the top left corner for the group. The default value is 0.

Parameters	Description of Command Syntax
Y=	Sets the Y coordinate for the top left corner for the group. The default value is 0.
Z=	Sets the Z coordinate for the group which is used to determine the layer ordering for transparency. The layer ordering is from zero (the bottom of the stack) to the highest Z value being the top of the stack. The default value is 0.
M=	Moves the group by X,Y. The argument must have no spaces or the parsing will fail. Example GR ID=1 M=100,100
AL=	Sets the Alpha value for the group. The range is from 0 to 255 with 0 being opaque and 255 being full transparent. The default is 0.
E	Empty all items from the Group. This is useful if you want to delete the Group and not the items.
O=	Set whether the Group is on video path one or two. You cannot change this value if there are any items in the Group The default value is 1.

4.3.5 Text Overlay Fields

Each Text Field has a Background color that is used for the background of Text Fields. Background color is set in the same way as foreground Color, except the command used is **`BC=darkgoldenrod`**. The transparency for the Background color can controlled using the **BA=aaa** command to set the Alpha value from 0 to 255 (the default is fully transparent). A summary of the Text Overlay Commands is given in Table 9: Text Overlay Command Syntax below.

The following example Commands set the Foreground Color to Yellow and the Background Color to blue for Text Field 1 with partial (50%) visibility:

```
T ID=1 "Text: Yellow text on blue background, Alpha = 000"
T ID=1 FC=yellow FA=128 BC=blue BA=0
```

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.*
2) *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*

For each Text Field, a font / size combination can be selected using the **T ID=1 N="Font Name" P=xxx** command to select one of the font options in Table 8: Text Font and Symbol Font Attributes.

Each Text Field can be turned on or off independently by the Visibility parameter V taking a value of YES or NO. For example, to turn off the visibility of the above text enter the command.

```
T ID=1 V=no   'Turn Text ID 1 visibility OFF
```

After defining one or more Text Fields, all of the assigned Text Field strings can be listed using the follow Report Text Field Command (from Table 28: Miscellaneous Control Port – Reporting Commands):

```
RET
```

4.3.5.1 Available Text and Symbols Available Font & Symbol

The attributes of the text ASCI fonts and the extended font symbols available in the DX-4400 are listed in the Table 8 below.

Table 8: Text Font and Symbol Font Attributes

Font Name	Fixed Width	Font Name	Fixed Width
Bitstream Charter		DejaVu Serif	
Bitstream Vera Sans		Luxi Mono	YES
Bitstream Vera Sans Mono	YES	Luxi Sans	
Bitstream Vera Serif		Luxi Serif	
Courier	YES	Utopia	
Courier 10 Pitch	YES	Wingdings	
Cursor		Wingdings 2	
DejaVu Sans		Wingdings 3	
DejaVu Sans Mono	YES		

The default Saveset font is DejaVu Sans. The default font can be changed in a Saveset using **D N="Font Name"** The default pixel height and font attributes such as bold can also each be set using the **D P=40 SB=YES** (Default Pixel and Set Bold Commands) for the Saveset.

4.3.5.2 Text Overlay Command Syntax

The command line syntax used for the Text Overlay Commands is listed in the table below.

Table 9: Text Overlay Command Syntax

Parameters	Description of Command Syntax
T – Identifies a Text Command string to the Command Port parser	
ID=	This is a unique ID number (1-999) that identifies the Text Field and must be the first parameter in the list
IDR=	This functions the same as the ID parameter but if the value exists the X, Y, Z, etc parameters are reset to default.
DELETE	Deletes the user defined Text Field specified by the ID number. Command parsing stops, no other arguments are checked. Example: T ID=1 DELETE
"Text String"	Text to overlay on the screen. The backslash character '\' is an escape character that allows you to insert the "" or '\' character into the string. The length of the string is restricted to command buffer length (1024) minus the overhead of the surrounding "" (quotation marks), escape characters and the *T ID=x* minimum identifier.
X=	Sets the X coordinate for the top left corner for the text. The default value is 0.
Y=	Sets the Y coordinate for the top left corner for the text. The default value is 0.
Z=	Sets the Z coordinate for the text which is used to determine the layer ordering for transparency. The layer ordering is from zero (the bottom of the stack) to the highest Z value being the top of the stack. The default value is 0.
AA=	Enable or disable Anti-Aliasing. It takes **YES** or **NO** as an argument.
AP=	Sets the Anchor point for the field. The locations are TL (Top Left), TR (Top Right), BL (Bottom Left), BR (Bottom Right) or CT (Center). The default is TL.

Parameters	Description of Command Syntax
R=	Rotation of the text with zero being horizontal. Positive rotations move clockwise and negative rotations move counter clockwise. The default value is 0.
FC=	Sets the foreground Color for the text. The default color is white.
FA=	Sets the Alpha value for the Foreground Color. The range is from 0 to 255 with 0 being opaque and 255 being full transparent. The default is 0.
BC=	Sets the Background Color for the text. The default color is black.
BA=	Sets the Alpha value for the Background Color. The range is from 0 to 255 with 0 being opaque and 255 being full transparent. The default is 255.
DB=	Set the Blur for the Drop Shadow. The default is 1.
DX=	Set the X displacement of the Drop Shadow. The default is 8.
DY=	Set the Y displacement of the Drop Shadow. The default is 8.
DC=	Set the Color of the Drop Shadow. The default color is grey.
DA=	Set the Alpha value for the Drop Shadow. The default is 255.
N=	Font Name to use for the text. If the font name contains spaces the name must be enclosed in "". The default font is DejaVu Sans. NOTE: Although the Text Command will accept any case and abbreviation, if the Web UI interface is used to edit the Text Commend string, the UI will only recognize the full font name.
SB=	Set font style Bold. It takes **YES** or **NO** as an argument. It accepts the shortest unique argument. The default is **NO**.
SI=	Set font style Italic. It takes **YES** or **NO** as an argument. It accepts the shortest unique argument. The default is **NO**.
SU=	Set font style underline. It takes **YES** or **NO** as an argument. It accepts the shortest unique argument. The default is **NO**.
SS=	Set font Style strikeout. It takes **YES** or **NO** as an argument. It accepts the shortest unique argument. The default is **NO**.
SO=	Set font style overline. It takes **YES** or **NO** as an argument. It accepts the shortest unique argument. The default is **NO**.
P=	Set font Pixel size. The default value is 12.
O=	Set whether the Overlay text is on video path one or two. The default value is 1.
G=	Name of the Groiup the item belongs to.The Group must exist before you can add it.
E	Erase all string fields from current saveset. Further command processing stops.
V=	Sets whether the text is visible or not. It takes **YES** or **NO** as an argument. It accepts the shortest unique argument. The default is **YES**.

Notes:

1) *The Visible YES/NO Command can be used to turn display of the Text Field ON and OFF.*
2) *Once the font style and display assignments for the Text Field have been set, the text can be changed without re-entering the font style and display assignments.*

4.3.5.3 Example: Text Drawing Style Options

The following text listing of commands demonstrate some of the Text Drawing Style options of the DX-4000:

```
' Example: Text Drawing Style options
T ID=1 "Green text, default location, default Font (DejaVu)" FC=GREEN
T ID=2 "Red text, -90 degrees Rotation" FC=RED R=-90 x=1850 y=1000
T ID=3 "Red text,  90 degrees Rotation" FC=RED R=90 x=1850 y=80
T ID=4 FC=GREEN BC=WHITE BA=0 x=0 y=75
T ID=4 "Green text with opaque white background"
T ID=5 FC=GREEN BC=WHITE BA=128 x=0 y=150
T ID=5 "Green text with 50% transparent white background"
T ID=6 FC=GREEN BC=WHITE BA=128 FA=128 x=0 y=225
T ID=6 "Green text and white background both 50% transparent"
T ID=10 "Default Font and Style" x=0 y=400 SB=No
T ID=11 "Default Font with Bold" x=0 y=500 SB=yes
T ID=12 "Default Font with Italic" x=0 y=600 SI=yes
T ID=13 "Default Font with Underline" x=0 y=700 SU=yes
T ID=14 "Default Font with Strikeout" x=0 y=800 SS=yes
T ID=15 "Default Font with Overline" x=0 y=900 SO=yes
T ID=21 "45 degrees counter clockwise" x=800 y=900 FC=yellow R=-45.0
T ID=22 "30 degrees counter clockwise" x=825 y=940 FC=yellow R=-30.0
T ID=23 "15 degrees counter clockwise" x=850 y=975 FC=yellow R=-15.0
```

Note: This example assumes a video resolution of 1920x1080.

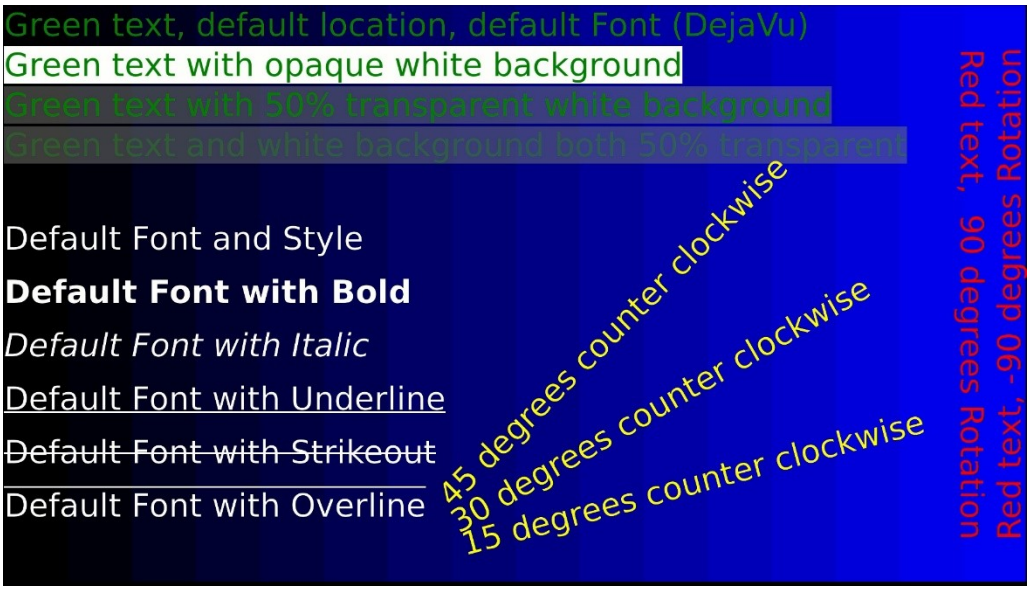

Figure 8: Examples of the DX-4400 Text Drawing Styles

4.3.5.4 Example: Sample of DX-4400 Font Styles

```
' Example: Sample of DX-4400 Font Styles
T ID=1 "Bitstream Charter" N="Bitstream Charter" y=0
T ID=21 "ABCDEFGHIabcdeghif012345678" N="Bitstream Charter" y=0 x=950
T ID=2 "Bitstream Vera Sans" N="Bitstream Vera Sans" y=75
T ID=22 "ABCDEFGHIabcdeghif012345678" N="Bitstream Vera Sans" y=75 x=950
T ID=3 "Bitstream Vera Sans Mono" N="Bitstream Vera Sans Mono" y=150
T ID=23 "ABCDEFGHIabcdeghif012345678" N="Bitstream Vera Sans Mono" y=150 x=950
T ID=4 "Bitstream Vera Serif" N="Bitstream Vera Serif" y=225
T ID=24 "ABCDEFGHIabcdeghif012345678" N="Bitstream Vera Serif" y=225 x=950
T ID=5 "Courier" N="Courier" y=300
T ID=25 "ABCDEFGHIabcdeghif012345678" N="Courier" y=300 x=950
T ID=6 "DejaVu" N="DejaVu" y=375
T ID=26 "ABCDEFGHIabcdeghif012345678" N="DejaVu" y=375 x=950
```

```
T ID=7 "DejaVu Sans" N="DejaVu Sans" y=450
T ID=27 "ABCDEFGHIabcdeghif012345678" N="DejaVu Sans" y=450 x=950
T ID=8 "DejaVu Sans Mono" N="DejaVu Sans Mono" y=525
T ID=28 "ABCDEFGHIabcdeghif012345678" N="DejaVu Sans Mono" y=525 x=950
T ID=9 "DejaVu Serif" N="DejaVu Serif" y=600
T ID=29 "ABCDEFGHIabcdeghif012345678" N="DejaVu SSerif" y=600 x=950
T ID=10 "Luxi Mono" N="Luxi Mono" y=675
T ID=30 "ABCDEFGHIabcdeghif012345678" N="Luxi Mono" y=675 x=950
T ID=11 "Luxi Sans" N="Luxi Sans" y=750
T ID=31 "ABCDEFGHIabcdeghif012345678" N="Luxi Sans" y=750 x=950
T ID=12 "Luxi Serif" N="Luxi Serif" y=825
T ID=32 "ABCDEFGHIabcdeghif012345678" N="Luxi Serif" y=825 x=950
T ID=13 "Utopia" N="Utopia" y=900
T ID=33 "ABCDEFGHIabcdeghif012345678" N="Utopia" y=900 x=950
```

Note: This example assumes a video resolution of 1920x1080.

Figure 9: Examples of the DX-4400 Font Styles

4.3.6 Graphic Overlay Fields

A Graphic Field has a shape assignment which defines what is drawn. The current shape assignments are:

```
1 – Rectangle
3 – Circle
4 – Ellipse
5 – Line
```

The parameters for the Graphic Fields have different functions depending on the type of shape being used. Each field type is described further below. A summary of the Graphic Overlay Field command is given in Table 10: Graphic Overlay Field – Command Syntax shown below.

4.3.6.1 Rectangle Shapes

Rectangle Shapes are used to display a rectangle that can be either open or filled. The rectangle is drawn from the top left corner at coordinate X, Y with a height and length.

A rectangle may be drawn with or without an outline. The outline is located around the perimeter of the rectangle and is drawn with the outline color (as specified by the *OC=white* parameter). The outline has a width in pixels that is specified in the outline width parameter (*OW=width*) of the Graphic Field. The default line width is 1 pixel. If

the line width is large, the entire interior of the rectangle may be part of the outline region. The outline width expands around the perimeter of the rectangle. For example, if the width is 4 pixels, 2 pixels will be inside the rectangle and 2 pixels will be outside the rectangle. When the outline width is set to zero there is no outline. When the outline is transparent the fill Color will be seen in part of the outline.

The Fill Color parameters are set by the **FC=white and FA=nnn**.

4.3.6.2 Example of Drawing an Ellipse.

The following Rectangle Field Display Command string will draw a blue rectangle with a green outline:

```
G ID=1 S=rectangle X=100 Y=100 H=880 L=1720 FC=blue FA=80 OC=green OA=60 OW=4
```

4.3.6.3 Circle and Ellipse Shapes

The circle and ellipse shapes are very similar. The ellipse uses the height and length to determine the proportions and the circle uses only the length.

The X, Y anchor location is set in the center of the circle and ellipse

The outline width parameter sets the width of the outline around the circle or ellipse.

4.3.6.3.1 Example of Drawing an Ellipse.

The following Ellipse Field Display Command string will draw a blue ellipse with a green outline:

```
G ID=1 S=ellipse X=100 Y=100 H=80 L=200 FC=blue FA=80 OC=green OA=60 OW=4
```

4.3.6.4 Line Shape

The Line Shape starting position is at X, Y with the end point being specified by the length (L) and the width (W) specified by the height (H) starting from a specified X,Y coordinate position.

. The Line Shape has no outline that surrounds it. Lines can have an end cap which can be flat or round. Lines are always drawn horizontally left to right with a rotation angle of zero degrees. To draw a vertical line you would rotate the line 90 degrees which can be positive or negative. Positive rotations are clockwise.

4.3.6.4.1 Example of Drawing a Line

The following Line Field Display Command string will draw a vertical line:

```
G ID=1 S=line X=400 Y=200 H=4 L=600 R=90 FC=crimson
```

4.3.6.5 Graphic Overlay Command Syntax

The command line syntax used for Graphic Overlay Commands is listed in the table below.

Table 10: Graphic Overlay Field – Command Syntax

Parameters	Description of Command Syntax
G – Identifies a Graphic Command string to the Command Port parser	
ID=	This is a unique ID number (1-999) that identifies the Graphic Field and must be the first parameter in the list.
IDR=	This functions the same as the ID parameter but if the value exists the X, Y, Z, etc parameters are reset to default.
DELETE	Deletes the user defined Graphic Field specified by the ID number. Command parsing stops at the end of the command, no other arguments are checked. Example: G ID=1 DELETE
S=	Identifies the Shape is to be drawn. Acceptable values are: rectangle circle ellipse line The argument will accept the shortest unique string – such as **r** for **rectangle**. The default value is **rectangle**.
X=	Sets the X coordinate for the top left corner for the rectangle/line shape and the center of the circle/ellipse shape. The default value is 0.
Y=	Sets the Y coordinate for the top left corner for the rectangle/line shape and the center of the circle/ellipse shape. The default value is 0.
Z=	Sets the Z coordinate for the shape which is used to determine the layer ordering for transparency. The layer ordering is from zero (the bottom of the stack) to the highest Z value being the top of the stack. The default value is 0.
AA=	Enable or disable Anti-Aliasing. It takes **YES** or **NO** as an argument.
AP=	Sets the Anchor point for the field. The locations are TL (Top Left), TR (Top Right), BL (Bottom Left), BR (Bottom Right) or CT (Center). The default is TL.
R=	Rotation of the shape with zero being horizontal. Positive rotations move clockwise and negative rotations move counter clockwise. The default value is 0.
L=	Length is the horizontal distance for shapes. For circles and ellipses the distance is from the center so it will be twice the length wide. The default value is 200.
H=	Height is the vertical-distance for shapes. Circles do not use the height argument. For ellipses the distance is from the center point so it will be twice as high. The default value is 100.
F=	Sets whether the shape is filled or not except for **lines**. It takes **YES** or **NO** as an argument. It accepts the shortest unique argument. The default is **YES**.
FC=	Sets the foreground Color for the shape. For **lines** this is the Color of the line. For **rectangles**, **circles** and **ellipses** this is the fill Color. The default is white.
FA=	Sets the Alpha value for the foreground Color. The range is from 0 to 255 with 0 being opaque and 255 being full transparent. The default is 0.
OC=	Sets the outline Color for **rectangles**, **circles** and **ellipses**. The default value is white.
OA=	Sets the Alpha value for the outline Color. The range is from 0 to 255. The default value is 0.
OW=	Set the Outline Width for **rectangles**, **circles** and **ellipses**. The default value is 1.

Parameters	Description of Command Syntax
EC=	Sets the end cap as **flat** or **round** for lines. The default value is round.
DB=	Set the Blur for the Drop Shadow. The default is 1.
DX=	Set the X displacement of the Drop Shadow. The default is 8.
DY=	Set the Y displacement of the Drop Shadow. The default is 8.
DC=	Set the Color of the Drop Shadow. The default color is grey.
DA=	Set the Alpha value for the Drop Shadow. The default is 255.
O=	Set whether the graphi Overlay is on video path one or two. The default value is 1.
G=	Name of the Groiup the item belongs to.The Group must exist before you can add it.
E	Erase all graphic fields from current saveset. Further command processing stops.
V=	Sets whether the shape is visible or not. It takes **YES** or **NO** as an argument. It accepts the shortest unique argument. The default is **YES**.

Note: The Visible YES/NO Command can be used to turn display of the Graphic Field ON and OFF.

4.3.7 Image Overlay Fields

Each Image Field has a Background Color and Transparency attribute that is used to control the appearance of the graphical image.

The Background Color of the Image Field is set in the same way as for the Foreground Color, except the command used is **BC=darkgoldenrod .**

The Transparency attribute for the background Color can controlled using the **BA=aaa** command which sets the alpha value from 0 to 255 (the default is fully transparent).

Each Image Field has a X, Y, Z position, can be rotated, scaled and the transparency adjusted. If just the file name is specified, the system looks for the file in /usr/local/graphics/. To specify a different location the full path name must be supplied.

The Image Fields Commands are listed in Table 12: Image Field Overlay Command Syntax below.

4.3.7.1 Image Field File Formats

Image Fields can overlay the file types listed in the table below.

Table 11: Supported Image Formats

Format	Description
BMP	Windows Bitmap
JPG	Joint Photographic Experts Group
JPEG	Joint Photographic Experts Group
PNG	Portable Network Format
PBM	Portable Bitmap
PGM	Portable Graymap
PPM	Portable Pixmap
XBM	X11 Bitmap
XPM	X11 Pixmap

4.3.7.2 Image Overlay Command Syntax

The syntax used for the Image Overlay Commands is listed in the table below.

Table 12: Image Field Overlay Command Syntax

Parameters	Description of Command Syntax
I – Identifies an Image Command string to the Command Port parser	
ID=	This is a unique number that identifies the Image Field and must be the first parameter in the list. Example: I ID=1 "FilePath/FileName"
IDR=	This functions the same as the ID parameter but if the value exists the X, Y, Z, etc parameters are reset to default.
DELETE	Deletes the user defined Field specified by the ID number. Command parsing stops, no other arguments are checked. Example: I ID=1 DELETE
"File Name"	Name of file to open and overlay on the output. The location of the file is /usr/local/graphics/. To override the location the full path name must be specified.
X=	Sets the X coordinate for the top left corner for the image. The default value is 0.
Y=	Sets the Y coordinate for the top left corner for the image. The default value is 0.
Z=	Sets the Z coordinate for the image which is used to determine the layer ordering for transparency. The layer ordering is from zero (the bottom of the stack) to the highest Z value being the top of the stack. The default value is 0.
AA=	Enable or disable improved quality scaling. It takes **YES** or **NO** as an argument.
AP=	Sets the Anchor point for the field. The locations are TL (Top Left), TR (Top Right), BL (Bottom Left), BR (Bottom Right) or CT (Center). The default is TL.
R=	Rotation of the image with zero being horizontal. Positive rotations move clockwise and negative rotations move counter clockwise. The default value is 0.
S=	Scales the image Size. A value between 0.0 and 1.0 scales down the image. A value greater then 1.0 up scales the image. The default is 1.0.
FA=	Sets the Alpha value for the image. The range is from 0 to 255 with 0 being opaque and 255 being full transparent. The default is 0.
BC=	Sets the Background Color for the image. The default is black.
BA=	Sets the Alpha value for the Background Color. The range is from 0 to 255 with 0 being opaque and 255 being full transparent. The default is 255.
O=	Set whether the image Overlay is on video path one or two. The default value is 1.
G=	Name of the Groiup the item belongs to.The Group must exist before you can add it.
E	Erase all image fields from current saveset. Further command processing stops.
V=	Sets whether the image is visible or not. It takes **YES** or **NO** as an argument. It accepts the shortest unique argument. The default is **YES**.

Note: The Visible YES/NO Command can be used to turn display of the Image Field ON and OFF.

4.3.7.3 Example: Image Field Overlay Display

The following Commands demonstrate use of Image Fields.

```
' Example: Image Field overlay display
' This example is for the PiP TI mode at 1920x1080 video resolution
' The files "Graticule 2-1.png", "Target1.png",
' "Compass1-Star-v2-380px.png", "Compass1-Dial-v1-600px.png"
' must be uploaded onto the DX-4400
PC1 X=75  Y=55 L=1778 H=975  ' set the display size for video from input 1
ZW1 X=52  Y=71 L=1778 H=975  ' select a video region for display equal in
                             ' size to the output window so there is no
                             ' scaling or distortion
' Display an Image of a ruler scale around the perimeter of the video
' default coordinates of 0, 0, 0
I idr=1 "Graticule 2-1.png"
' Display an image of a target marker. In this example the full path
' name is specified.
I idr=2 x=1200 y=400         ' position the target marker (1200, 400)
I id=2 "/usr/local/graphics/Target-2.png"
' Display the Compass
I idr=3 x=400 y=380 c=yes    ' position the compass dial
I id=3 "Compass1-Dial-v1-600px.png"
I idr=4 x=400 y=380 c=yes    ' position the compass star
I id=4 "Compass1-Star-v2-380px.png"
I id=4 r=20                  ' compass star with an image rotation
```

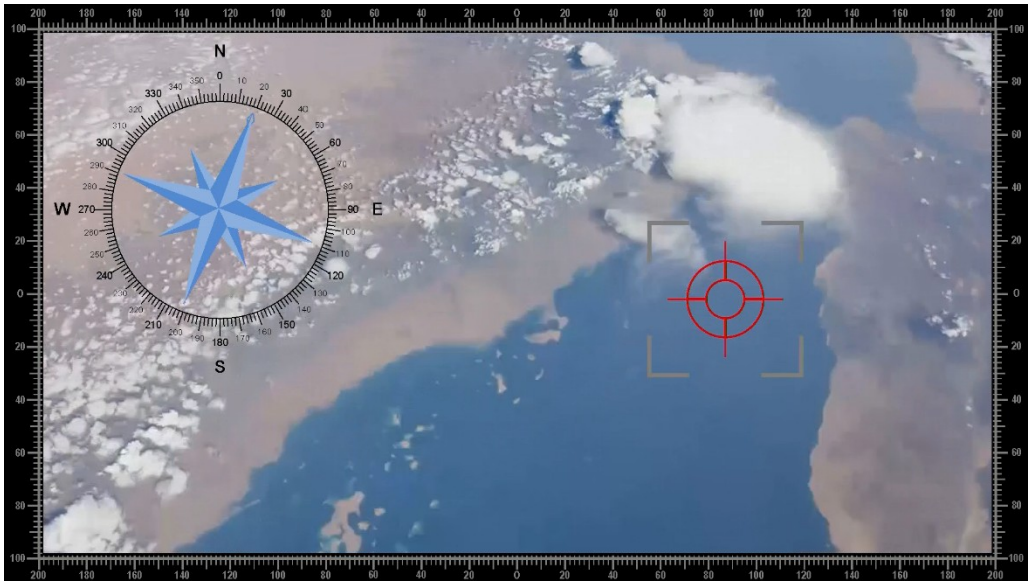

Figure 10: Image Field Overlay Display

4.3.8 QML Field Commands

QML (Qt Meta Language or Qt Modelling Language) is a user interface markup language used for designing enhanced user interface-centric application. QML Field commands allow the overlay of QML scripts onto the video output. Each Image Field has a X, Y, Z position, an angle for specifying the rotation, and the transparency assignment. If just the file name is specified, the system looks for the QML Script file in /usr/local/qml/ (the default directory). To specify a different location the full path name must be supplied.

4.3.8.1 QML Image Overlay Command Syntax

The command line syntax used for the QML Image Overlay Commands is listed in the table below.

Table 13: QML Field – Image Overlay Command Syntax

Parameters	Description of Command Syntax
Q – Identifies a QML Field Command string to the Command Port parser	
ID=	This is a unique ID number that identifies the QML Field. The ID assignment must be the first parameter in the list
IDR=	This functions the same as the ID parameter but if the value exists the item is deleted and a new one created.
DELETE	Deletes the user defined Field specified by the ID number. Command parsing stops, no other arguments are checked. Example Q ID=1 DELETE
"File Name"	Name of the QML script file to open and overlay the QML generated image on video output. The directory location of the file is /usr/local/qml/. To override the location the full path name must be specified.
X=	Sets the X coordinate for the top left corner for the QML image. The default value is 0.
Y=	Sets the Y coordinate for the top left corner for the QML image. The default value is 0.
Z=	Sets the Z coordinate for the QML image which is used to determine the layer ordering for transparency. The layer ordering is from zero (the bottom of the stack) to the highest Z value being the top of the stack. The default value is 0.
R=	Rotation of the QML image with zero being horizontal. Positive rotations move clockwise and negative rotations move counter clockwise. The rotation is around the centre point. The default value is 0.
FA=	Sets the Alpha value for the QML image. The range is from 0 to 255 with 0 being opaque and 255 being full transparent. The default is 0.
O=	Set whether the Overlay image is on video path 1 or 2. The default value is 1.
G=	Name of the Groiup the item belongs to.The Group must exist before you can add it.
E	Erase all QML fields from current saveset. Further command processing stops.
V=	Sets whether the QML image is visible or not. It takes **YES** or **NO** as an argument. It accepts the shortest unique argument. The default is **YES**.

Note: The Visible YES/NO Command can be used to turn display of the QML image ON and OFF.

4.3.8.2 Example: QML Field Example of Time, Date & Scrolling News Feed Overlay

The following examples of QML Commands demonstrate the use of QML Fields for launching a QML script file capable of displaying time, date and for launching a QML script file for a scrolling news feed.

```
' QML display example of Date and Time on screen display
q id=1 "Show_DateTime_01.qml" x=10 ‘ Loads from default folder /usr/local/qml
'
' QML display example of a News Feed on screen display
q id=2 "ss_news.qml" y=1030 ‘ Loads from default folder /usr/local/qml
```

Two QML script files are executed in this example. The first script, **Show_DateTime_01.qml** displays the time and date read from the clock of the DX-4400. The second script, **ss_news.qml** displays a scrolling news feed at

the bottom of the screen on a white background. Internet connectivity is required for the news feed example to function. The scrolling text is positioned at the bottom of the screen using the **y=1030** parameter in the command line, making the example specific to 1080 line video display modes.

The X-Y position, rotation, and overall transparency (visibility) of the QML scripts can be controlled using the respective parameters of the 'q' Commands (see Table 13 above). Other parameters are set in the QML script files.

You can manually edit the QML Script files included on the microSD card and the CD using the Web UI as described in § 5.6.4 File Manager – QML Files Page. If you are unfamiliar with QML scripts there is online information available on the web. The DX-4400 version of QML is based on QT v4.8 so restrict your search to QT 4.8 QML.

You can edit the QML script files on the SD card using the WinSCP (Secure File Copy) program – available for free download from the web – (and supplied on the CD) or edit them on a workstation and then use WinSCP or other scp (secure file copy program) to transfer the file onto the SD Card. Alternately you can use the Web UI Menu of section 5.2.1.

Note: The Linux OS login user name is **root** and the login password is **ArmOverlay**.

Figure 11: QML Field Example of Time, Date, & Scrolling News Feed Overlay

Table 14: List of Supplied Example QML Files

QML File Name (Case Sensitive)	Effect
Scroll_Text.qml	The QML sctipt scrolls text across the screen from right to left across the entire screen. The default is for 1280 pixel wide screen. The text scrolled across the screen is from an XML file located at /usr/local/qml and is named Scroll_Text_Data.xml. The default is a single line but you can have up to 10 defined strings. You can adjust the width by editing the QML file.
Show_DateTime.qml	Displays the date and time in UTC, Local and as a Date() time string.
Show_DateTime_01.qml	Displays the date and time as 00:00:00 2017/11/25.
Show_DateTime_02.qml	Displays the date and time centered on a 1280 pixel wide screen with a transparent black background.

QML File Name (Case Sensitive)	Effect
rss_news.qml	Displays RSS news feed with gray text on a white background selected at random from: feeds.reuters.com/news/wealth feeds.reuters.com/reuters/scienceNews feeds.reuters.com/reuters/technologyNews feeds.reuters.com/reuters/topNews feeds.reuters.com/reuters/topstories

4.4 Video Path Settings & Control

The following section discuss the commands used to control the video path, settings and features including; PiP, Digital Zoom, Alpha Blending, Output, Background and Frame Delay Compensation.

4.4.1 PiP Size and Position Commands

The PiP Commands allow the placement and size of the PiP display to be adjusted. There are two methods of setting up the PiP that are referred to as Pre-set Mode, and Custom Mode. The PiP function is supported in **PiP TI** mode where both inputs can be used a PiP sources, and in **LPiP TI** mode where only input 2 can be used as a PiP source.

Normally the SDI 1 input is the source for PiP 1, and SDI 2 input is the source for PiP 2. For the **PiP TI** mode of operation only, it is possible to exchange the video from input 1 and input 2 so that SDI 2 is the source for PiP 1 and SDI 1 is the source for PiP 2. One use of this function is to swap the sides in a side by side display.

4.4.1.1 PiP Pre-set Mode

In PiP Pre-set mode, the position is selected from one of the following nine standard locations using the **PPx** command in Table 15: PiP Size & Position Command Syntax.

Top Right Corner
Top Left Corner
Bottom Right Corner
Bottom Left Corner
Bottom Center
Top Center
Center Left
Center Right
Middle of the Screen

The size of the PiP window is selected in units of 1/16th of the screen size, allowing the PiP to be adjusted from a minimum of 1/16th of the screen up to a maximum of full screen.

The Pre-set sizes maintain the aspect ratio of the PiP window. If a standard definition source is used for PiP with 16:9 aspect ratio video output, the PiP will fill the screen vertically when set to maximum size, but will not fill the screen horizontally.

The PiP is offset from the vertical and horizontal edges referenced in the position command by a set number of pixels. These offsets can be adjusted with the **PVx** and **PHx** commands. The defaults are shown in the command table and are different between PiP 1 and PiP 2.

The PiP window must always fit fully within the video. Priority is given to the specified window size, with the requested position offsets reduced as required to make the PiP fit.

4.4.1.2 PiP Custom Mode

In the Custom Mode the PiP is specified by the pixel coordinates of the top left corner of the PiP, and by the length and height of the window. The PiP window must always fit fully within the video. Priority is given to the specified window size, with the requested position being automatically adjusted to make the window fit. The requested size is automatically limited to the video output size.

The **PCx** command sets the parameters for Custom Mode.

Table 15: PiP Size & Position Command Syntax

Parameters	Description of Command Syntax
PPx – Selects the Pre-set PiP mode and sets the location for PiP x where x = 1 or 2. Example: PP1 TR – sets PiP 1 to top-right location	
location	Pre-set PiP location. It takes the following arguments: TR (top right), TL (top left), BR (bottom right), BL (bottom left), BC (bottom center), TC (top center), CL (center left), CR (center right) and MS (middle screen). The default is TL for PiP 1 and TR for PiP 2 If the location parameter is not specified, the previously specified location is used.
PSx – Set the size of PiP x when using the Pre-set PiP mode, where x = 1 or 2	
nn	Pre-set PiP Size where nn = 1 – 16. The default is 16 for PiP 1 and 5 for PiP 2 This command does not change the PiP mode from Custom mode to Pre-set mode
PVx – Vertical gap for Pip x when using the Pre-set PiP mode, where x = 1 or 2	
nnnn	Pre-set Vertical gap between the edge of the PiP window and the screen edge. The screen edge reference is to left and right. The default is 0 for PiP 1 and 20 for PiP 2
PHx – Horizontal gap for PiP x when using the Pre-set PiP mode, where x = 1 or 2	
nnnn	Pre-set Horizontal gap between the edge of the PiP window and the screen edge. The screen edge reference is to top and bottom. The default is 0 for PiP 1 and 11 for PiP 2
PCx – Select the Custom PiP mode and set the attributes for PiP x, where x = 1 or 2	
X=	Sets the X Coordinate for the top left corner for the image. The default value is 0. The PiP image cannot be placed off screen. The X parameter is automatically reduced as required to keep the PiP on screen.
Y=	Sets the Y Coordinate for the top left corner for the image. The default value is 0. The PiP image cannot be placed off screen. The Y parameter is automatically reduced as required to keep the PiP on screen.
L=	Length is the horizontal distance the PiP window covers. The default value is 240. The PiP cannot be wider than the screen width. The L parameter is automatically reduced to the screen size.
H=	Height is the vertical-distance the PiP window covers. The default value is 130. The PiP height cannot be larger than the screen height. The H parameter is automatically reduced if it exceeds the screen height.

Parameters	Description of Command Syntax
A=	Maintain the Aspect ratio of the PiP window according to the SDI input ratio. The height is set referencing the length setting. For example if the input is 1920x1080 and the length is 960 the height will be 540. It takes **YES** or **NO** as an argument and accepts the shortest unique argument. The default is **NO**.
PRx – Reset the PiP attributes to default values where x = 1 or 2. Example PR1 – reset PiP input 1 to default attribute values	
PO – Set the PiP source connections for PiP 1 and PiP 2.	
N	Sets the normal connection where the video from SDI 1 input feeds PiP 1, and video from SDI input 2 feeds PiP 2. This command is available for the PiP TI mode only.
R	Sets the reverse connection where the video from SDI input 2 feeds PiP 1 and video from SDI 1 input 1 feeds PiP 2. This command is useful for swapping the PiP input and main input in a typical PiP application, or exchanging the images in a side by side display configuration. This command is available for the PiP TI mode only and reverses the video only. It does not affect ancillary data pass through source or the clock lock source, which are always physical input 1. The default output video mode remains set by the format detected on input 1 and will not change when the inputs are swapped by this command.

Notes:

1) The PiP setting is established based on the last use of either the PPx or PCx Command.
3) For the Commands to set the PiP Alpha level of the PiP window refer to Table 19.

4.4.1.3 Example: Configuring Side By Side Display Using PiP Commands

The PiP Commands can be applied to down scale both input 1 and input 2 and position them in the output video. The following Commands can be used to show both inputs side by side. The Commands also place some explanatory text on the overlay. This example is intended for 1920x1080 video in the **PiP TI** mode.

```
PR1    ' reset input 1 PiP settings
PR2    ' reset input 2 PiP settings
ZR1    ' reset input 1 zoom settings
ZR2    ' reset input 2 zoom settings
PP1 TL   ' Input 1 position top left corner
PP2 TR   ' Input 2 position top right corner
PS1 8    ' Set input 1 is 8/16 of the screen width
PS2 8    ' Set input 2 is 8/16 of the screen width
PV1 0    ' Set input 1 position at the vertical ref edge
PV2 0    ' Set input 1 position at the vertical ref edge
PH1 200    ' Set input 1 to be 200 pixels from the horizontal ref edge
PH2 200    ' Set input 2 to be 200 pixels from the horizontal ref edge
T id=1 "Side by side display example" x=300 y=0 p=100
T id=2 "Input 1" x=0 y=800
T id=3 "Input 2" x=960 y=800
```

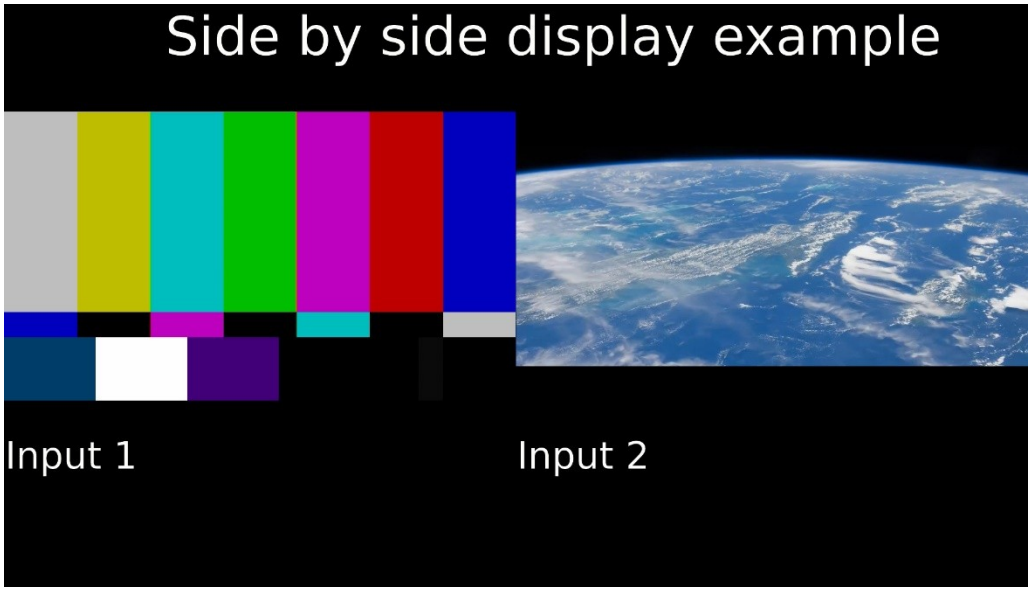

Figure 12: Side by Side Display Example

4.4.1.4 Example: Switching between two inputs using a Full Screen PiP

When operating in **PiP TI** or **LPiP TI**, the DX-4400 can be used as a glitch free switch to select the video from either input 1 or input 2. This can be accomplished by making input 2 PiP equal to the full screen size and then switching its visibility on or off. The toggle switch can be configured to select which source is shown. The source switches when the switch is toggled right.

```
PR1                 ' Reset PiP parameters for input 1
PR2                 ' Reset PiP parameters for input 2
PS2 16              ' Set Input 2 PiP window full size
UDTR ID=0 "VSD2"    ' Toggle switch - Disable input 2
UDTR ID=1 "VSE2"    ' Toggle switch - Enable input 2
```

4.4.2 Video Zoom Commands

The Video Zoom Commands work in **PiP TI**, **LPiP TI** (for input 2 only), **ZDual TI**, and **Z4K TI** modes. Different modes have different zoom capabilities. The **Z4K TI** and **ZDual TI** modes support high zoom magnifications. The **LPiP TI** mode supports high zoom magnifications by default, but also supports a restricted range zoom mode that has the benefit of reduced latency on the second input. The **PiP TI** mode always operates in the restricted zoom range mode.

In the restricted range zoom modes of operation, the total resulting magnification of the combined PiP and Zoom functions is limited as follows: For 3 Gb/s modes, pixels cannot be magnified above 1x. For 1.5 Gb/s modes, a total magnification up to 1.5x is possible. For SD modes, magnification can be a maximum of 3x. For example, a 3Gb/s video mode that is displayed as a PiP image at ¼ the frame size can be zoomed up to 400% because the two commands combined produce a 1x pixel magnification. If the PiP size in this example was then changed to full screen, the zoom would be automatically reduced to the maximum permitted value of 100%

In the high magnification zoom modes the maximum magnification that can be achieved depends on the video mode. In center point zoom mode and for 1920x1080p resolution, the limit is approximately 32x magnification (3200%) and for 1280x720p resolution, the limit is approximately 23x. The zoom function supports certain discrete steps in magnification. When the zoom percentage is low, the zoom steps are small. At high magnifications the steps become much larger. The zoom command selects the step nearest to the requested value.

Zooming can be performed around a center point or by specifying window coordinates. The center Zoom and window Zoom are mutually exclusive; the last command sent takes effect. The settable values listed in Table 16 below.

Table 16: Zoom Command Syntax

Parameters	Description of Command Syntax
ZCx – Center Zoom for SDI input x where x = 1 or 2	
C=	Sets the center zoom behaviour. The default value is 0. The valid values and effects are: 0 Zoom around the center position. 1 Zoom around the center position preserving exact center position by avoiding zoom steps which would cause a position shift. 2 Zoom around the center position preserving exact center position and aspect ratio by limiting only zoom steps that meet these requirements. C=0 gives priority to providing the maximum possible number of zoom steps. This mode selects the closest pixel position to the requested center point, and closest width/height to the required aspect ratio. This means the center can shift slightly between difference zoom steps. As a result, this mode is not suitable for implementing a digital zoom lens effect because of the center jitter that occurs as zoom changes. C=1 provides fewer zoom steps by selecting only those that have the same exact center point, but the aspect ratio is rounded to the nearest pixel. C=2 provides the fewest zoom steps by selecting only those that have the exact center point and aspect ratio. The number of zoom steps available is much less than the C=0 mode. In particular, the 2048x1080 pixel mode has very few possible steps due to the 256:135 aspect ratio.
E=	Enable an extra frame buffer in the video path. This option is accepted only for the **LPiP TI** mode and for input 2 only. When the extra buffer is enabled latency of the input increases by 1 frame. The zoom function support high magnification zoom when the extra frame buffer is enabled, otherwise the zoom operates in the restricted zoom range mode. The command accepts values of **YES** and **NO**. The default is **YES**.
P=	Percentage Zoom around center point. The range of values is for PIP is 100 to 800 percent, and for **ZDual TI** and **LPiP TI** the range is 100 to 3200 percent. For the **Z4K TI** mode, values from 100 to 5000 percent may be specified. The default value is 100 percent. The command uses 1 decmal place, for example 100.4 percent
PF=	Percentage Zoom Fast around center point but issues the command without waiting for response from FPGA or storing the value in the Saveset. This provides significantly faster updates. For this to happen it cannot be combined with other options ZCx command. The range of values for PIP is 100 to 800 percent, and for **ZDual TI** and **LPiP TI** the range is 100 to 3200 percent. For the **Z4K TI** mode, values from 100 to 5000 percent may be specified. The default value is 100 percent.
X=	Sets the X coordinate from the top left corner as a percentage of the width. The default value is 50.
Y=	Sets the Y coordinate from the top left corner as a percentage of the height. The default value is 50.
ZWx – Window Zoom for SDI input x where x = 1 or 2	
X=	Sets the X coordinate for the top left corner for the image. The default value is 0.
Y=	Sets the Y coordinate for the top left corner for the image. The default value is 0.

Parameters	Description of Command Syntax
L=	Length is the horizontal distance the PiP window covers. The default value is 1920.
H=	Height is the vertical-distance the PiP window covers. The default value is 1080.
ZRx – Reset the Zoom values to default where x = 1 or 2	

4.4.2.1 Example: Configuring a Split Screen Display Using PiP and Zoom Commands

The PiP and Zoom Commands can be used together to create a split screen display that shows the left half of input 1 on the left side of the output, and the right half of input 2 on the right side of the output. This example is intended for 1920x1080 video in the **PiP TI Mode**.

```
PR1 ' reset input 1 PiP settings
PR2 ' reset input 2 PiP settings
ZR1 ' reset input 1 zoom settings
ZR2 ' reset input 2 zoom settings
'Set input 1 display window to fill the left half of the output video
PC1 X=0   Y=0 L=960 H=1080
‘Set input 2 display window to fill the right half of the output video
PC2 X=960 Y=0 L=960 H=1080
'Use custom zoom setup to select the left half of input 1 for display
ZW1 X= 0 Y=0 L=960 H=1080
'Use custom zoom setup to select the right half of input 2 for display
ZW2 X=960 Y=0 L=960 H=1080
T id=1 "Split screen display example" x=200 y=0 p=100
T id=2 "Left half of input 1" x=0 y=950 p=70
T id=3 "Right half of input 2" x=960 y=950 p=70
```

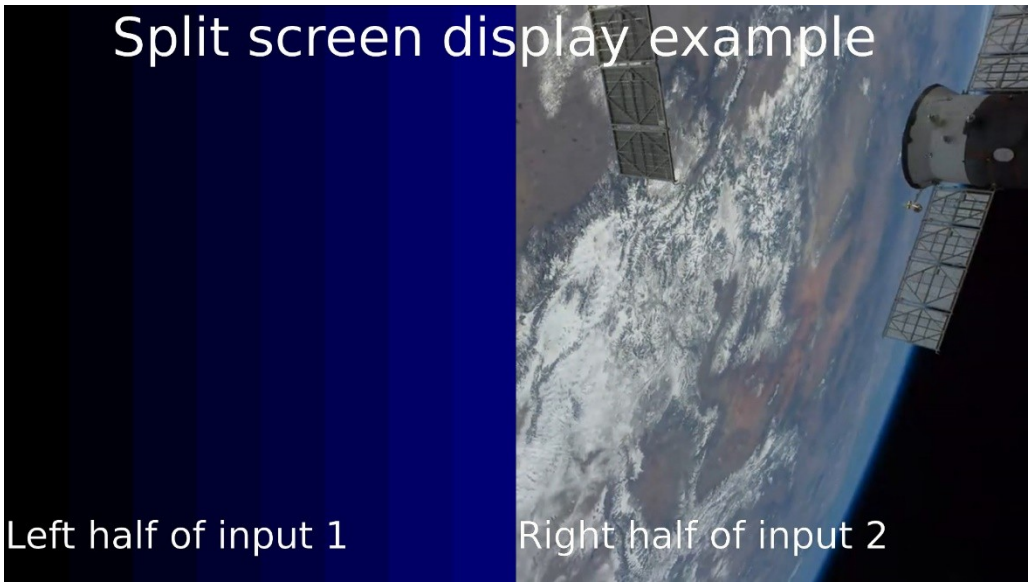

Figure 13: Split Screen Display Example

4.4.3 Video Output Mode Commands

The Video Output Command is available for the **PiP TI** mode of operation only (and not for the LPiP TI). In this mode, by default, the DX-4400 switches modes of the SDI Output to match the signal on SDI Input 1. It is possible to specify a specific output format instead using the Video Output Mode command. If this is done, the input signal

will be converted to the required frame rate by dropping and repeating frames, and the inputs will be scaled to fit the output frame size. Additionally, a progressive input will be interlaced to the match the output mode. However, an interlaced input cannot be de-interlaced to match a progressive output. In that case the input will be considered invalid and is not used.

When the output resolution or frame rate does not exactly match the main input, the pass-through of the ancillary data (i.e. the embedded audio and metadata) is automatically disabled.

Table 17: Video Output Mode Command Syntax

Parameters	Argument	Description of Command Syntax
O – Set the Output video format		
R=mode	Set the output Resolution where *mode* is one of the following:	
	Auto	Automatically match the main input resolution
	720p	Set 1280x720 progressive resolution
	1080p	Set 1920x1080 progressive resolution
	1080i	Set 1920x1080 interlaced resolution
	NTSC	Set 720x480 interlaced resolution
	PAL	Set 720x576 interlaced
	W1080p	Set 2048x1080 progressive resolution
PR=mode	Same as for Resolution parameter	Set a Preferred Resolution value. The preferred value may be used to set the output mode if the R=mode parameter is set to auto and the main input signal is not present.
F=rate	Set the output Rate. For interlaced video, this is the Field Rate. For progressive video it is the Frame Rate. The following values can be used for *rate*	
	Auto 23.98 24 29.97 30 47.95 48 50 59.94 60	- Automatically match the main input
PF=rate	Same as for Field/Frame parameter	Set a Preferred value for the Field / Frame rate. The preferred value may be used to set the output mode if the F=mode parameter is set to auto and the main input signal is not present.

Notes on using the Output Mode Command:

1) *It is possible to use the Output Mode command to select combinations of resolution and frame rate that are not supported video modes. In this case the DX-4400 will ignore the settings and not switch into the requested mode.*
2) *If only the resolution is specified, or only the frame rate is specified, then the DX-4400 will match the non-specified parameter to the main input video if the combination is a supported video mode. Failing that, if the requested resolution or frame rate is a valid mode when combined with the current operating mode, the DX-4400 will use that mode. Otherwise the DX-4400 will try the preferred value (if one was specified) or simply select a value that results in a valid mode. Specifying only one of the frame rate and resolution parameters may result in the DX-4400 operating in unusual video modes such as 720p30 that may not be supported by other equipment.*

For example, the following command sets the output to 1080i60:

```
O R=1080i   F=60
```

4.4.3.1 Conversion of Video Formats

The Output Mode Commands can be used to convert video formats, for example 720p video can be converted to 1080i or 1080p formats. Since the DX-4400 does not incorporate a video deinterlacer, it is not possible to NTSC into a progressive output.

4.4.4 Video Background Color Command

Background Color Command allows you to set the background color for the SDI inputs. Each Saveset has its own set of Background Color stored parameters. The background color is not visible through the SDI input when the Alpha Blend is set to 0.

The following commands are two examples of settings a green background for channel 1:

```
BC1 green
BC1 #000128000
```

The settable values for the background color listed in the table below.

Table 18: Video Background Color Command Syntax

Parameters	Description of Command Syntax
BCx – Set the Background Color value for SDI channel x where x = 1 or 2	
Color	The Background Color specified as RGB values or as a name. Refer to the section titled: Text and Graphic Field – Color and Transparency on page 34 for details

4.4.5 Video Alpha Commands

The Video Alpha Commands set transparency of the SDI input video streams. The function and availability of these commands depends on the current mode of operation:

- These commands are not available for **LDual TI** and **L4K TI**.
- In standard latency modes with a single video input per path (**Dual TI**, **ZDual TI, 4K TI, Zoom 4K TI**), making the SDI video transparent has the effect of making the background color visible behind the video.
- For the modes with two inputs per path (**PiP TI, LPiP TI**), making SDI input 1 transparent has the effect of making the background color visible behind the video, and making SDI input 2 transparent has the effect of making either input 1 or the background visible behind the video.
- Alpha modes other than Constant Alpha (M=0) are available only in the **PiP TI** and **LPiP TI** modes.

In the **PiP TI** and **LPiP TI** modes only, the command provides the capability to select a color range of the input video to be either visible or transparent (as in chroma key applications). This is useful for example when a computer-generated overlay is connected to the secondary input and only the non-black parts of the video are intended to be visible.

Each Saveset has its own set of Alpha Blend stored settings. The Video Alpha settable values are listed in the table below.

Table 19: Video Alpha Command Syntax

Parameters	Description of Command Syntax
ALx – Set the Alpha Blend value for SDI Input video x where x = 1 or 2	
M=n	Set the Alpha Mode for the selected SDI Input. This parameter is only available in the **PiP TI and LPiP TI** modes. For other modes, the unit always operates in the Constant Alpha mode and this command is not accepted. n=0 – Constant Alpha The entire video frame has the same visibility as set by the B= parameter of the command. n=1 – Select Visible Range The color parameters of the Alpha command select a range of input video colors that are to be visible and are displayed with the alpha setting specified by the B= parameter. Colors that do not fall within the selected range are transparent and are displayed with the alpha setting specified by the TB= command. n=2 – Select Transparent Range The color parameters of the alpha command select a range of the input video to be transparent. The transparent part is displayed with the alpha value set by the TB= command. Colors that do not fall within the transparent range are visible and are displayed with the alpha set the B= command.
B=nnn	Set the alpha of the visible part of the video. For the Constant Alpha mode, this command sets the alpha of the entire video frame. The value nnn ranges from 0 to 255 where 0 is opaque and 255 is fully transparent. The default is 0.
TB=mmm	Sets the alpha of the transparent part of the video. The default value is 255, making the video fully transparent. This parameter is available only in the **PiP TI** and **LPiP TI** Mode.
TC=#rrrgggbbb TC=<HTML Color>	This parameter sets a color used to determine if pixels are to be visible or transparent in Alpha modes 2 and 3. The color can be specified either as an RGB value or an HTML color name. To specify an RGB color, or for HTML use the parameter TC=#255255255 to select white (R:255, G:255, B:255) To specify it as an HTML color, use the parameter TC=white. When specifying an RGB color, there must be 3 digits for each color. The default color is black. This parameter is available only in the **PiP TI** and **LPiP TI** Mode of operation.
TV=nnnn	This parameter sets a range around the selected color used to determine visibility or transparency in Alpha Modes 2 and 3. The parameter nnnn ranges from 0 to 1023. The default value is 30. This parameter is available only in the **PiP TI** and **LPiP TI** Mode of operation.
R	Resets all parameter to their default values. For example: AL1 R – resets the parameters of SDI Inpput 1
TE=n	This parameter modifies how edges of visible areas are treated. n = 0 – default n = 1 – reduce visible area by 1 horizontal pixels n = 2 – reduce visible area by 2 horizontal pixels This parameter is available only in the **PiP TI** and **LPiP TI** Mode of operation.

Note: For HTML color names and RGB code equivalent refer to the web for more information for example: https://htmlcolorcodes.com/color-names/

4.4.5.1 Example: Alpha-blending of Computer-generated Graphics Overlay

The DX-4400 Alpha Command can be used to mix an externally generated overlay layer on top of a video source using transparency. In this example, a video source connects to SDI input 1 on the DX-4400 and a computer-generated graphics overlay layer connects to SDI input 2. The graphics overlay is generated on a black background and the DX-4400 is configured to display the overlay layer on top of the main video with black background treated as transparent.

To set the DX-4400 into the **PiP TI** mode of operation the command is as follows:

```
SM PIP      ‘ set the DX-4400 into the PiP Text Inserter Mode
```

Note: The unit will reboot after the use of the Set Mode (SM) command.

The commands to configure the DX-4400 for this alpha-blending example are as follows:

```
PS2 16          ‘ set input 2 to full size
AL2 M=2         ‘ input 2 uses alpha mode 2
AL2 TC=black TV=60‘ define transparent color & variance
```

Note: The DX-4400 could also have been configured using the Web UI.

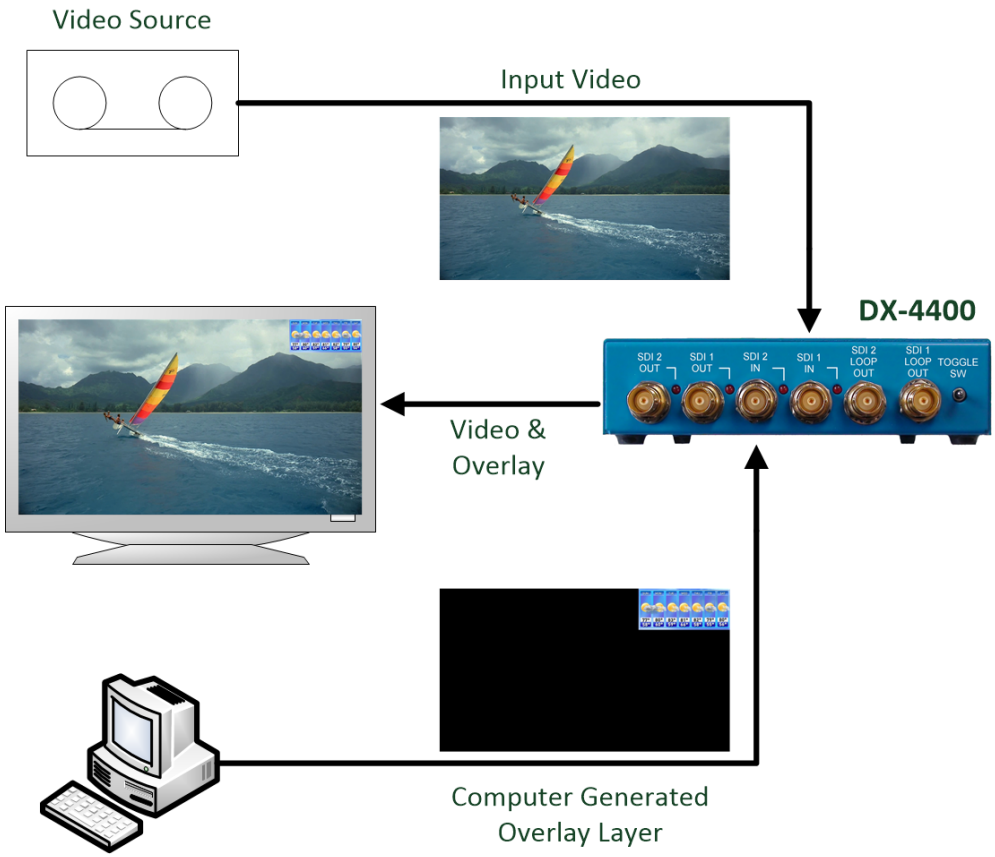

Figure 14: Example of Computer-generated Graphics Overlay with Transparency

4.4.6 Video Buffering and Frame Delay

The standard operating modes of the **DX-4400** (those that don't have "Low Latency" in the name) include a frame buffer in the video path with a minimum delay of 1 video frame, plus an additional delay of a few lines of video.

Some of the standard modes allow additional frames of delay that can be added independently to the video stream and/or to the ancillary data paths up to a total of 20 frames of delay per Table 20. This user settable feature is supported in the **Dual TI** and the **PiP TI** Mode.

The Low Latency modes do not have a frame buffer on the low latency video path and have less than one frame of delay. The delay depends on various factors including the video mode and is typically in the range of 1 to 8 lines of video. Refer to Table 5: DX-4400 Modes of Operation for more details about Low Latency modes of operation.

4.4.6.1 Video Frame Delay Compensation Commands

The Video Frame Delay compensation feature allows the user to independently adjust the frame delay for the video and for the ancillary data.. The commands work in **Dual TI**, **ZDual TI**, **PiP TI,** Z4K modes, and **LPiP TI** (input 2 only) but not in the **4K TI**, **L4K TI**, or the **LDual** Modes. The Frame Delay value can be set from 1 to 20 for video in all modes and for the ancillary data paths except for the Zoom Dual Mode of operation. The delays are settable for both SDI 1 and for SDI 2. In the **PiP TI** Mode, SDI input 2 does not allow the ancillary data to be delayed.

Each Saveset has its own set of Frame Delay stored settings. The Frame Delay settable values are listed in the table below.

Table 20: Video Frame Delay Compensation Command Syntax

Parameters	Description of Command Syntax
FDx – Set the Frame Delay value for SDI Input x where x = 1 or 2	
N=x	Sets the Frame Delay for both the video and ancillary data.. The value x takes values from 1 to 20.
A=x	Sets the Frame Delay for the ancillary data.. When operating in PiP mode there is no ancillary data on SDI input 2 so the command is not allowed. The value x takes values from 1 to 20.
V=x	Sets the Frame Delay for the video data. The value x takes values from 1 to 20.

4.4.6.1.1 Example: Setting Frame Delay of SDI Output

The following is an example of the Frame Delay command syntax:

```
FD1 A=5 V=4   ' sets SDI 1 with frame delay of 5 for aux data & 5 for video
```

4.4.7 Miscellaneous Video Path, Status & Report Control Port Commands

Other miscellaneous Video Path Control, Status and Reporting Commands are listed in the following table.

Table 21: Miscellaneous Video Path, Status & Report Control Port Commands

Command Code	Description of Command Syntax
RMn	Report the video Mode of operation for video path where n is 1 or 2
RNn	Report the input SDI video mode where n is 1 or 2. If the input is not recognized it is reported as "Unknown"
RLIn	Report the SDI input LED status where n is 1 or 2. The output is ON, OFF or BLINK.
RLOn	Report the SDI output LED status where n is 1 or 2. The output is ON, OFF or BLINK.
VADn	Video ARM Graphics overlay Disable for ARM Graphics overlay path where n is 1 or 2
VAEn	Video ARM Graphics overlay Enable for ARM overlay path where *n* is 1 or 2
VASn	Video ARM Graphics overlay Stop for ARM Graphics overlay path where *n* is 1 or 2
VSDn	SDI Video Disable for SDI path where n is 1 or 2
VSEn	SDI Video Enable for SDI path where *n* is 1 or 2
VSSn	SDI Video Stop of SDI path where n is 1 or 2
ANEn	Ancillary data Enable pass through for path n. This command is supported in the **Dual TI** with n=1 or n=2 and in the **PiP TI** with n=1 only. This command cannot be used in the **4K TI** mode.
ANDn	Ancillary data Disable pass through for path *n*. This command is supported in the **Dual TI** with n=1 or n=2 and in the **PiP TI** mode with n=1 only. This command cannot be used in the **4K TI** mode. When ancillary data pass through is disabled, the SDI output does not contain any ancillary data from the SDI input other than active video.

Note: Stopping either the Overlay path or the SDI input reduces memory usage and may improve performance in critical application. Alternately, the VAS Command can be used to temporally disable (stop) a video path, however restarting via the VAE command

4.5 Database Saveset Commands

The database Saveset commands each allow you to create separate overlay system configurations which can be switched between without re-entering the overlay user data or user defined system configuration data.

The first Saveset is "default" and cannot be deleted. The Text, Image, Graphics and QML items can all be deleted if you issue a **SD "default"** (Saveset Delete) command when not in the default Saveset. Any database Savesets configurations you create can be deleted. You can only delete a Saveset which is not active. You can Replicate the current Saveset using the **SR "newname"** which will create a new Saveset called **newname** with the same values as the current database containing a duplicate copy of all the Fields contained in it.

The Commands for managing the Saveset database are listed in the Table 22 below.

Table 22: Database Saveset Command Syntax

Parameters	Description of Command Syntax
SC – Saveset Create: Creates or switches the database Saveset **SR** – **Saveset Replicate**: Replicates current Saveset (must not already exist) **SD** – **Saveset Delete**: Deletes a Saveset (must not be the current active one).	
"name"	This is the Saveset name that is being created, changed, replicated or deleted.

4.5.1 Saveset Default Commands

Savesets each have their own set of default values for video paths and font assignments. The Saveset default settable values are listed in Table 23.

Table 23: Command Syntax for Saveset Default Values

Parameters	Description of Command Syntax
D – Identifies a Default Command string to the Command Port parser	
VO1=	This setting determines if the video overlay for channel 1 is visible at start up. It takes **YES** or **NO** as an argument. It accepts the shortest unique argument. The default is **YES**.
VO2=	This setting determines if the video overlay for channel 2 is visible at start up. It takes **YES** or **NO** as an argument. It accepts the shortest unique argument. The default is **YES**. Only the Dual Text Inserter mode supports channel 2.
VS1=	This setting determines if SDI input 1 is visible at start up. It takes **YES** or **NO** as an argument. It accepts the shortest unique argument. The default is **YES**.
VS2=	This setting determines if SDI input 2 is visible at start up. It takes **YES** or **NO** as an argument. It accepts the shortest unique argument. The default is **YES**. This setting is applicable to the 4K Text Inserter and Text Insert with PiP modes.
AA=	Sets the default Anti-Aliasing for Text and Graphics Fields, and the improved quality scaling attribute for Image fields. It takes **YES** or **NO** as an argument. It accepts the shortest unique argument. The default is **YES**.
N=	Sets the default font name used for text strings if none is specified by the text command. The font name is not verified. The default is **DejaVu Sans**
SB=	Sets the default bold setting for text commands if not specified. It takes **YES** or **NO** as an argument. It accepts the shortest unique argument. The default is **NO**.
SI=	Sets the default italic setting for text commands if not specified. It takes **YES** or **NO** as an argument. It accepts the shortest unique argument. The default is **NO**.
SU=	Sets the default underline setting for text commands if not specified. It takes **YES** or **NO** as an argument. It accepts the shortest unique argument. The default is **NO**.
SS=	Sets the default strikeout setting for text commands if not specified. It takes **YES** or **NO** as an argument. It accepts the shortest unique argument. The default is **NO**.
SO=	Sets the default overline setting for text commands if not specified. It takes **YES** or **NO** as an argument. It accepts the shortest unique argument. The default is **NO**.
P=	Sets the default text font size for text commands if not specified. It accepts any number >= 0, the default value is 60.
DB=	Set the default double buffer setting. It takes **YES** or **NO** as an argument. It accepts the shortest unique argument. The default is **YES**.
IM=	Sets the save to use an in memory copy of the database. When **YES** a copy of the database is made in memoy. When **NO** the flash database is used. When you set the value to **YES** the copy is made and the DX-4400 switches to the in memory database. When you set the value to **NO** the database in memory is copied back to the flash database. The default is **NO**.

4.6 Time Commands

The Time Commands allow you to read or set the hardware Real Time Clock (RTC). When you set the clock, the System Time is also updated. Since the RTC is battery backed, the time and date information is retained when the unit is power cycled.

Note: The RTC can be set from the Linux OS Root system User Account (see § 3.10.5 Date and Time Configuration) or by using the Web UI, (see § 5.7.2 System Configuration – Date and Time Page).

Table 24: Time Command Syntax

Parameters	Description
TR – Read Real Time Clock **TS** – Update the Real Time Clock. Also changes system time.	
YYYYMMDDWHHMMSS	This is the output format when you read the time. This is the format of the parameter used for setting the real time clock.
TZ – Change timezone setting	
<timezone name>	The timezone name. Refer to Appendix C: Time Zone Names for accepted names.

4.7 User Defined Commands

User Defined Commands allow the assigning of Command Strings to the Toggle and DIP Switches. One or more commands can be assigned to a switch.

To delete all the User Defined Switch assignments from the current Saveset use the following command:

```
UDRE
```

4.7.1 Configuring Toggle Switch Functions

The toggle left and toggle right switches can have up to 16 Command strings assigned to them refer to Table 25. When the Toggle Switch is activated it increments the Command string index starting from 0 incrementing up to 15 and then wrapping back to 0. On power up, the index always starts at 0.

Table 25: Toggle Switch – User Defined Command Syntax

Parameters	Function of the Command Syntax
UDTL – define string commands for Toggle Left switch action **UDTR** – define string commands for Toggle Right switch action	
ID=	Identifies the Command String Index. It takes values from 0 to 15.
"Command"	Where Command is the command or commands that will be processed when the Index Number occurs. NOTE: The quotations around the Command are required.
RESET	Deletes all the user defined strings. Must be the first and only argument to command. Example: UDTL RESET – reset Toggle Left User Defined Strings
DELETE	Deletes the user defined string index specified by the ID number. Example: UDTR ID=0 DELETE – delete Toggle Right String index number 0

Note: The **UDRE** Command deletes the current User Defined Switch assignments from the Saveset database.

4.7.1.1 Example 1: Toggle Switch Control of PiP Window Functions

This example will use User Defined Commands to:

1) Configure the Toggle Switch left position to move the PiP window clockwise around the outside corners of the display.
2) Configure the Toggle Switch right position to turn OFF and ON the PiP display by disabling and enabling the SDI 2 video path.

```
' set the Toggle Left switch functions to reposition PiP placement
UDTL ID=0 "PP2 BR" ' set PiP window 2 to Bottom Right corner
UDTL ID=1 "PP2 BL" ' set PiP window 2 to Bottom Left corner
UDTL ID=2 "PP2 TL" ' set PiP window 2 to Top Left corner
UDTL ID=3 "PP2 TR" ' set PiP window 2 to Top Right corner
' set the Toggle Right switch functions to enable/disable PiP display
UDTR ID=0 "VSD2" ' Disable the SDI 2 video path
UDTR ID=1 "VSE2" ' Enable the SDI 2 video path
```

Notes:

1) If there is a gap in the ID numbers, the Toggle Switch will wrap at the gap. (For the syntax of the PiP Command,, see Table 15: PiP Size & Position Command Syntax.)
2) The VSD and VSE Commands are defined in Table 21: Miscellaneous Video Path, Status & Report Control Port Commands.
3) To display the saved Switch settings, use the REU Command per Table 28: Miscellaneous Control Port – Reporting Commands
4) If the DX-4400 is switched to the DUAL TI mode without changing the Saveset database, the VSD2 Command in the above example will disable the SDI 2 Output if the Toggle Right switch is activated.

Warning: These Switch definitions will be retained even if the unit is re-configured for another Mode of Operation. Therefore, if this example was applied and later the mode of operation is changed, the SDI 2 input will be disabled/enabled by the Toggle Right switch assignment in the new mode of operation.

4.7.1.2 Example 2: Toggle Switch Control of ARM Graphics Overlay Fields

The following two User Defined Command string examples (see Commands listed in Table 25) will configure the Toggle Switch to turn the ARM Graphics Overlay ON and OFF using the VADn Disable and VAEn Enable Command (See Table 28).

For example, the following User Defined Command strings will assign a Command String Index to program the Toggle Switch left and right action to disable and enable all Fields (text, graphics and images) assigned for display on the ARM Graphics Overlay video stream.

```
UDTL ID=0 "VAD1"
UDTR ID=0 "VAE1"
```

The next set of User Defined Command strings will assign a Command String Index to program the Toggle Switch left action to cycle through turning OFF and ON by use of the Video Path Disable and Video Path Enable Command for the ARM Graphics Overlay video stream.

```
UDTL ID=0 "VAD1"
UDTL ID=1 "VAE1"
```

Note: Use of the VADn/VAEn Command disables and enables all of the Fields – Text, Graphic elements and Images – assigned for display by the ARM on the Graphics Overlay Video stream (either path 1 or path 2).

4.7.1.3 Example 3: Controlling the Display of a Single Text Field

This User Defined Command string example uses a Toggle Right action to turn OFF & ON (see Table 25) a specified Text Field by changing the visibility setting of the field to Yes and No (see Table 9).

```
'First assign and define the Text Field
T ID=20 "Toggle Switch right to turn this text OFF / ON" x=0 y=400
'assign Toggle Switch Right action via a User Defined Command string
UDTR ID=0 "T ID=20 V=No"
UDTR ID=1 "T ID=20 V=Yes"
```

A toggle right action will turn OFF and ON the display of Text Field number 20.

4.7.2 Configuring DIP Switch Functions

The DIP Switches can be used individually with a command string for the ON position and another string for the OFF position. The switches can also be grouped together to form a set with more than 2 states. For example, a group of 2 DIP switches can have 4 command strings assigned to it. There are seven group configuration options available for the DIP switches.

When grouping DIP switches together the least significant bit is the highest numbered DIP switch in the group.

The DIP Switches vary between 2 to 16 strings depending on the grouping refer to Table 27 for settings. The strings are identified by ID numbers in the range of 0 to 15 using the DIP switch commands listed in Table 26. On power up the DIP switches are read and the associated commands executed. After that the switches are only read when a DIP Switch changes.

Warning: Do not *assign* SM commands to the DIP switch. These commands cause the unit to restart, and on restart the switch setting is applied again, causing a repeating reset loop.

Table 26: DIP Switch User Defined Command Syntax

Parameters	Function of the Command Syntax
UDD1 – define string commands for DIP Switch 1 action **UDD2** – define string commands for DIP Switch 2 action **UDD3** – define string commands for DIP Switch 3 action **UDD4** – define string commands for DIP Switch 4 action	
ID=	Identifies the command string index. An Individual switch takes values from 0 to 1. A group of 2 switches takes values from 0 to 3. A group of 3 switches takes values from 0 to 7. A group of 4 switches takes values from 0 to 15.
"Command"	Where Command is the command or commands that will be processed when the index number occurs. The quotations around the Command are required.
RESET	Deletes all the user defined strings . Must be the first and only argument to command.
DELETE	Deletes the user defined string specified by the ID number.

Note: The **UDRE** Command deletes the current User Defined Switch assignments from the Saveset database.

Table 27: DIP Switch – User Defined Group Command Syntax

Group	DIP Switch Grouping	User Defined String
UDDG<0 – 6> Group DIP Switch assignments		
0	DIP switch 1 individual DIP switch 2 individual DIP switch 3 individual DIP switch 4 individual	UDD1 id=0..1 UDD2 id=0..1 UDD3 id=0..1 UDD4 id=0..1
1	DIP switch 1 individual DIP switch 2 individual DIP switches 3 &4 grouped	UDD1 id=0..1 UDD2 id=0..1 UDD4 id=0..3
2	DIP switch 1 individual DIP switches 2, 3 & 4 grouped	UDD1 id=0..1 UDD4 id=0..7
3	DIP switches 1, 2, 3 & 4 grouped	UDD4 id=0..15
4	DIP switches 1, 2 & 3 grouped DIP switch 4 individual	UDD3 id=0..7 UDD4 id=0..1
e5	DIP switches 1 & 2 grouped DIP switch 3 individual DIP switch 4 individual	UDD2 id=0..3 UDD3 id=0..1 UDD4 id=0..1
6	DIP switches 1 & 2 grouped DIP switches 3 & 4 grouped	UDD2 id=0..3 UDD4 id=0..3

4.7.2.1 Example: Control of PiP Window Size via DIP Switch Settings

This User Defined Command string example will configure the DIP Switch position 1 & 2 as a Group for use in configuring the PiP window size to 4, 5, 6, and 7.

```
' set the DIP Switch 1 and 2 to function as a group
UDDG 5           ' set DIP Switch 1 & 2 as a group
UDD2 ID=0 "PS2 7"    ' set DIP 1&2 = 11 PiP size = 7
UDD2 ID=2 "PS2 6"    ' set DIP 1&2 = 01 PiP size = 6
UDD2 ID=1 "PS2 5"    ' set DIP 1&2 = 10 PiP size = 5
UDD2 ID=3 "PS2 4"    ' set DIP 1&2 = 00 PiP size = 4
```

Notes:

1) For the syntax of the DIP Switch Commands , see: Table 26 and Table 27 listed above.
2) For the syntax of the PiP Size & Position Commands, see Table 15.
3) To display the saved Switch settings, use the REU Command per Table 28.

4.8 Miscellaneous Control Port – System Status & Report Commands

Other miscellaneous Control Port System Status and Report Commands are listed in the following table.

Table 28: Miscellaneous Control Port – Reporting Commands

Command Code	Description of Command Syntax
RD	Report DDR memory test status
RES	Report the currently defined Savesets.
REG	Report the defined Graphic objects (see § 4.3.6) for the current Saveset.
REI	Report the defined Image files (see § 4.3.7) for the current Saveset.
REM	Reports the current Mode of Operation, i.e. PIP TI
REQ	Report the defined QML fields (see § 4.3.8) for current Saveset.
RER	Repport the defined Groups (see § 4.3.4) for current Saveset.
RET	Report the defined Text Field strings (see § 4.3.5) for current Saveset.
REU	Report the User Defined Commands (see § 4.7) for the current Saveset.
RV	Polls the board for the FPGA product ID, MAC & IP Address and IP Core firmware revision
RVB	Polls the board to report the FPGA board assembly ID information
RVF	Report the FPGA IP Core firmware version

4.8.1 Serial Port Command Buffer Reset

Sending a Carriage Return or a Linefeed (CR or LF) ASCII code resets or clears/flushes the Command input buffer to the Control Port.

5 Using the Web UI

The Web UI offers the user the ability to configure, manage and maintain the DX-4400 unit using a web browser. The interface provides a higher-level interface and simplifies the process of uploading new firmware, graphics images and font files. It and offers improved management of user configuration data. All of the features available via the Serial Control interface or the Network Control interface (TCP/IP or SSH) are available through the Web UI. The following sections provide an overview of the Web UI.

5.1 Connecting to the Web UI

To access the Web UI is it necessary to make an http connection to using the IP address by the local DHCP network server. For example: **http://10.1.1.42** (Refer to § 4.1.3.3 titled DHCP Assignment of Network IP Address below for more information on obtaining the IP address.)

At the sign in prompt enter the default Username and Password of **admin** and **admin**. The DX-4400 Web UI home page is shown in the figure below.

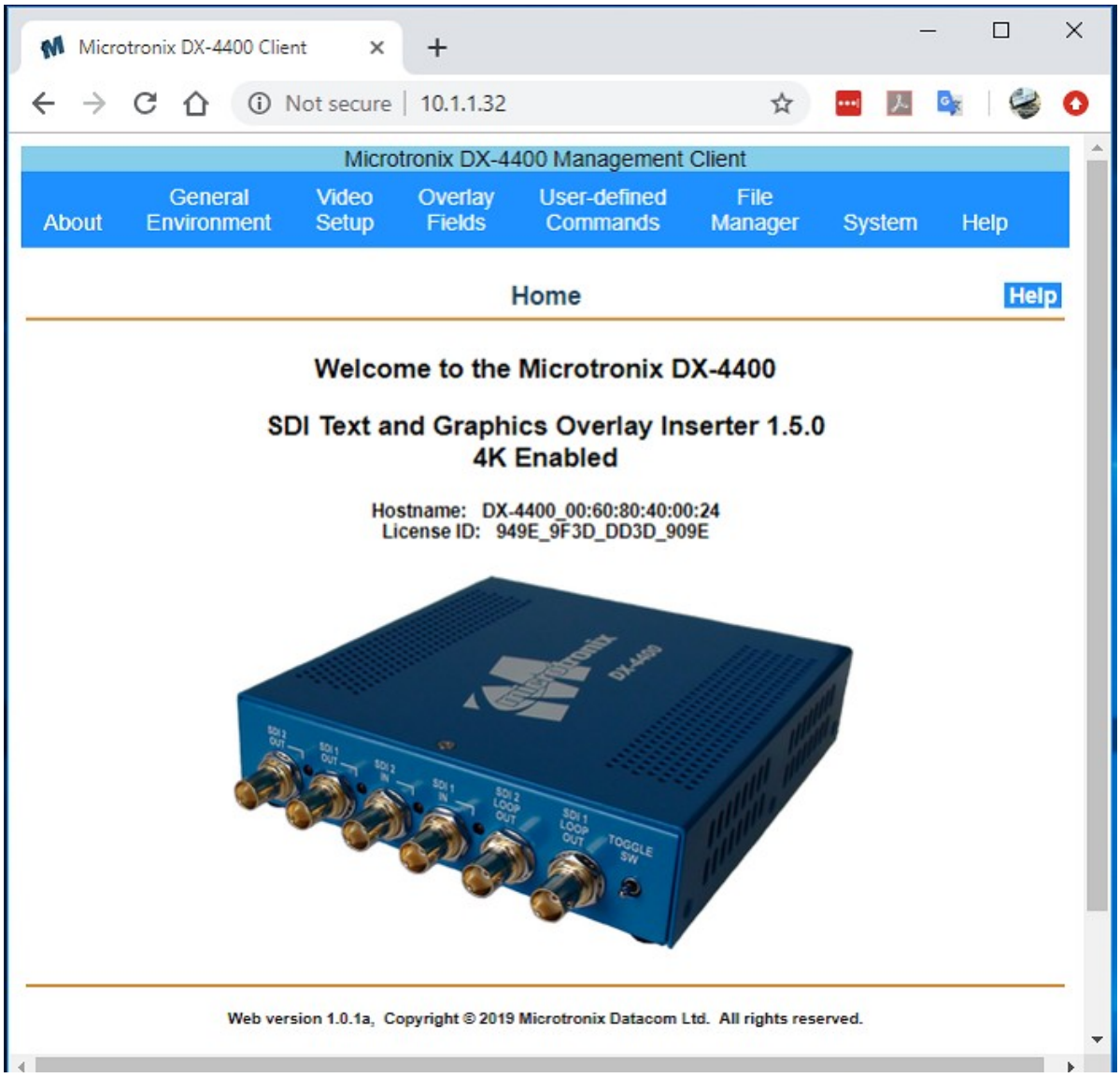

Figure 15: DX-4400 Web UI Home Page

5.2 Overview of Web UI

The Web UI runs on an integrated Web Server running on the DX-4400 to provide a high-level user interface to manage and control the product. As shown in the Figure 15 above, the Web UO provides a tabbed menu on the top with pull-down menu for each tab. A context sensitive **Help** button it always available on the top right. Clicking on the **Help** button opens another window providing context relevant information.

The Web UI menu is designed to be intuitive and self-navigating and where possible and offers the user a higher level of abstraction by minimizing the need to establish a user connection via RS232 using a Terminal Emulator program or a connection via a TCP/IP or SSH session. Using this interface, it is possible to execute all of the user Commands discussed in previous sections of this Manual. Each component of the WEB UI menu is discussed in the sections below.

5.2.1 Web UI Menu

The **Web UI menu** (shown in Figure 15 above) provides the user with eight sections used for configuring, controlling and managing the DX-4400 unit. The sections include:

1) **About tab** offers two selections namely:
    a. Home: provides the user with the current mode of operation and the system identification information.
    b. Contact Microtronix: provides the company contact information for sales and Technical Support. to configure items related to the operation and use of the DX-4400 including: Mode of Operation
2) **General Environment tab** enables the user to configure items related to the operation and use of the DX-4400 including: Mode of Operation, management of Savesets, the Control Interface for executing User Command to the Control Port and displaying the current status of unit including the overlay status and video resolutions of each port.
3) **Video Setup tab** is used to configure the video operation including: Alpha Blending is video streams, set Background Colors, Frame Delay Compensation, PiP Settings, Video & Ancillary data control, configuration of the Video Output video resolutions, and adjusting the Digital Zoom.
4) **Overlay Fields tab** is used enter the Graphic Shapes, Image, QML Scripts and Text Overlay Fields.
5) **User-defined Commands tab** – enables the user to reset the unit and assign Command Strings to the DIP switches Toggle left/right switch functions and DIP Switches to enhance operation control of overlay display functions.
6) **File Manager tab** supports the management, addition and application of:
    a. DX Command Files containing pre-defined sets of overlay and other video commands. Files may be uploaded, downloaded, modified, deleted, and applied to the overlay video processor.
    b. Font files.
    c. Image Files containing pre-defined images. Files may be uploaded, downloaded, and deleted.
    d. New IP Cores files and License files.
    e. QML Script Files containing pre-defined sets of overlay and other video QML commands. Files may be uploaded, downloaded, modified, and deleted. QML Scripts may be included in the overlay configuration by using the QML (q) command:
7) **System tab** provides the user with the means to:
    a. **C**onfigure User Authentication ID's and passwords,
    b. Access the Control Port for executing user commands,
    c. Set the date & time,

d. Edit System Files used management of Linux OS System parameters related to the ARM OS including: edit system files, Device Maintenance items, management of System Log files, database files, Ethernet/IP Address, and system log files.

e. the Web Server parameters and

f. View System log files.

8) **Help tab** provides access to the sensitive help menu, run System Command Line commands and to manage System Log files.

The Web UI Configuration pages are discussed in the following section.

5.3 Web UI – General Environment Menu

The **General Environment menu** enables the user to configure items related to the operation and use of the DX-4400 including: Mode of Operation, management of Savesets, executing User Command to the Control Port and displaying the current status of unit including video resolutions of each port.

5.3.1 General Environment – Mode of Operation Page

The **General Environment – Mode of Operation Page** is used to set the Mode of Operation for the unit, assign the location for the Serial Control Port to either the RS-232 Control Port or the USB Serial Port, and to specify the location of an optional GPS receiver. This page is displayed in the figure below.

The first menu item **Text and Graphics Overlay Inserter mode** displays the current Mode of Operation of the DX-4400 unit. The factory default mode is PIP Text Inserter as shown. A new Mode can be selected using a pull-down menu which lists the available modes as per § 3.2 Modes of Operation.

The next menu section, **Overlay Serial Control Port** is used to assign the location of the Serial Control Port to either port 1 on the DB9 RS-232 Connector, or the USB Serial Port. For more information on assigning the Serial Control Port, refer to § 4.1.1 Serial Control Mode of Operation.

The final section **Serial interface for GPS** specifies if a GPS receiver has been connected to the DX-4400 and which of the two communication ports on the DB9 connector have been used. If "PORT 1" is selected, then a GPS PPS signal can be connected to the Rx pin of the second serial channel of the DB9 connector. When "PORT 2" is selected for the GPS, the PPS signal should not be connected to the DX-4400.

If "PORT 1" is selected for the GPS and the Serial Control is set to "RS-232 (PORT 1)" then a conflict exists and the control port will be automatically changed to "USB" when the Apply button is pressed.

Refer to section 3.11: GPS Configuration for more information about connecting and configuring a GPS receiver.

The Apply button is used to apply the changes and restart the unit (and reload the FPGA firmware) in the new mode of operation.

The final section **Serial interface for GPS** specifies if a GPS receiver has been connected to the DX-4400 and which of the two communication ports on the DB9 connector has been used. If "PORT 1" is selected there is an option to use a PPS signal from the GPS. If PPS is set to "YES", then the PPS signal from the GPS should be connected to the Rx pin of the second serial channel of the DB9 connector. When "PORT 2" is selected for the GPS, the PPS signal cannot be used and should not be connected to the DX-4400.

Refer to section 3.11: GPS Configuration for more information about connecting and configuring a GPS receiver.

The Apply button is used to apply the changes and restart the unit (and reload the FPGA firmware) in the new mode of operation.

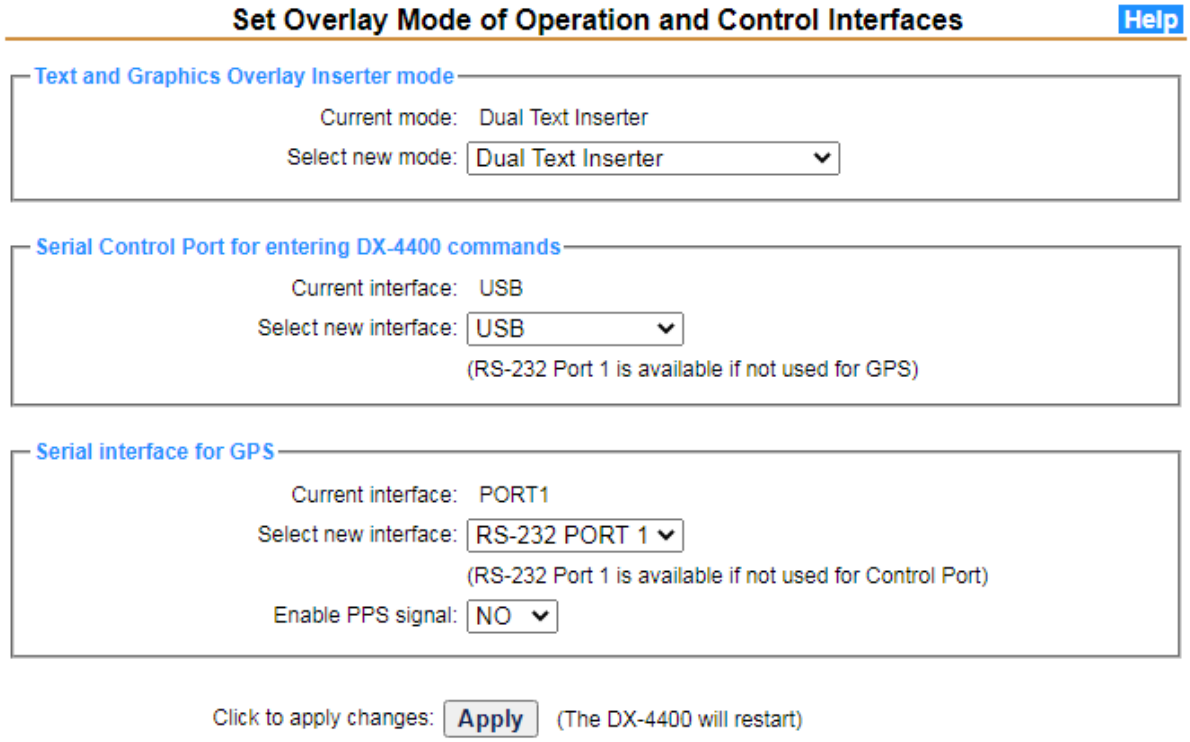

Figure 16: General Environment – Mode of Operation Page

5.3.2 General Environment – Manage Savesets Page

The **General Environment – Manage Savesets Page** is used for managing the Saveset database which contains the user configuration data (see section 4.5 Database Saveset Commands for more information on the use of the Saveset databases). The actions available to the user include:

- Setting the default values for the current Saveset "defaults" file,
- Management of user defined Savesets, and
- Add/create (SC Command), replicate (SR Command) a Saveset database.

The Manage Database and Saveset page (menu) is shown in the following figure.

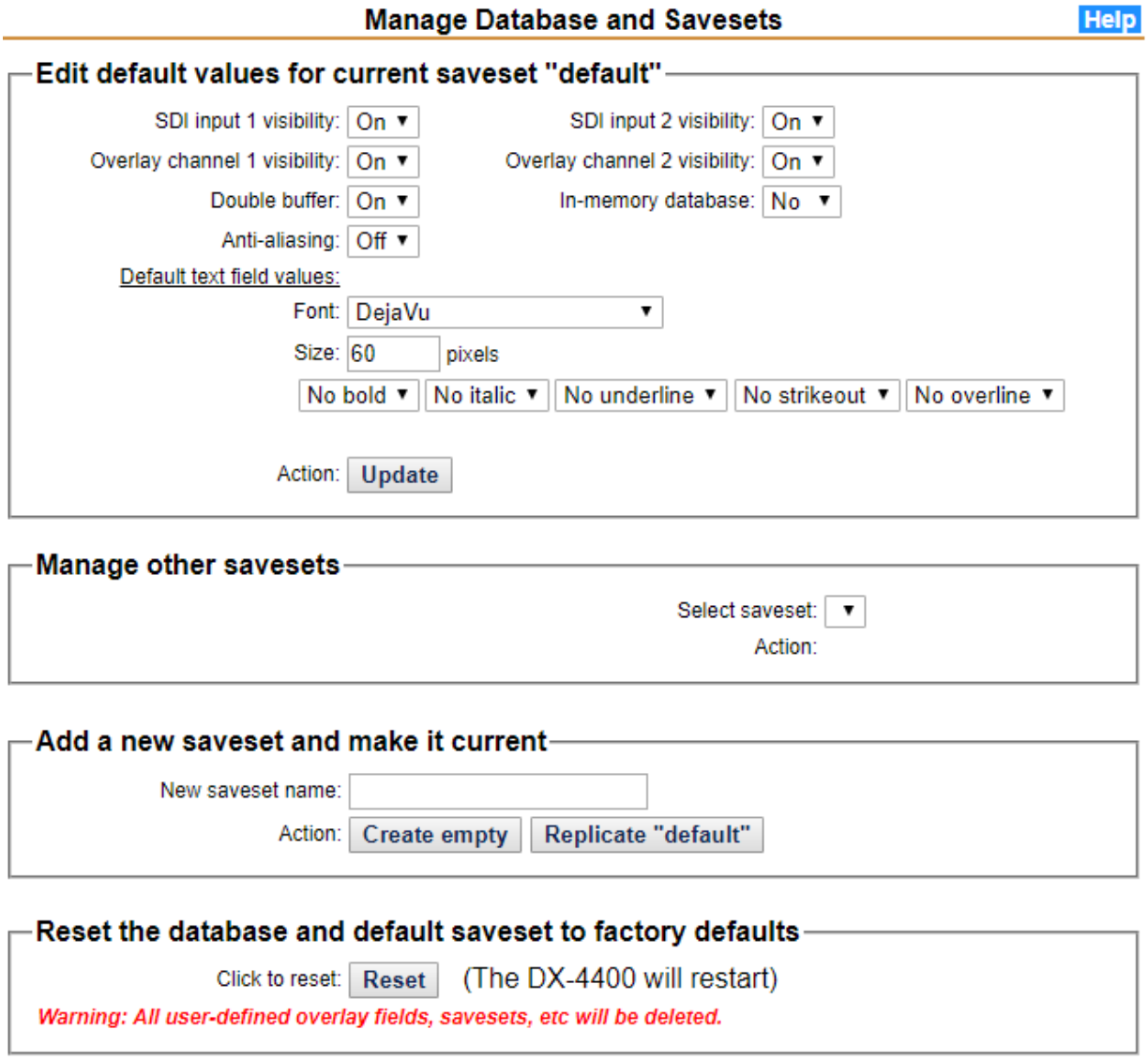

Figure 17: General Environment – Manage Database and Saveset Page

5.3.2.1 Use of Savesets

All user overlay data and configuration settings are saved in the current database Saveset. By either creating a new or replicating an existing Savesets (and making the necessary changes) it is possible to change the configuration of the unit by switching between Savesets.

The steps to create two overlay configurations using the Web UI are as follows:

1) To Create a new Savesets using the "Add a saveset menu" as follows:
   a) In the Add a new saveset window enter the new name: Overlay-w-Text
   b) Beside the Action option either "Create empty" or select "Replicate
2) Configure the unit as required.
3) To Replicate the current Saveset by entering a new savest name.
   a) In the Add a new Saveset window enter: Overlay-no-text and select Replicate to replicate the current saveset called Overlay-w-text

4) Remove the text from the configuration using the Text Field Delete Commands as necessary for the configuration.
5) It is now possible to switch between the two configurations (Savesets) using the Manage defined saveset window.

5.3.3 General Environment – Control Interface Page

The **General Environment – Control Interface Page** allows video overlay commands to be issued to the Command Port for execution by the ARM Graphics Overlay Processor. The page consists of a Command input field (box) at the bottom and a text window at the top for displaying the command output response received from the DX-4400 unit.

Overlay Commands are entered in the command input field, terminating with the <ENTER> key. Multiple commands may be entered separated by a semi-colon. Command output will be displayed in the text window.

The Web UI Control Interface page is shown in the Figure 18 below.

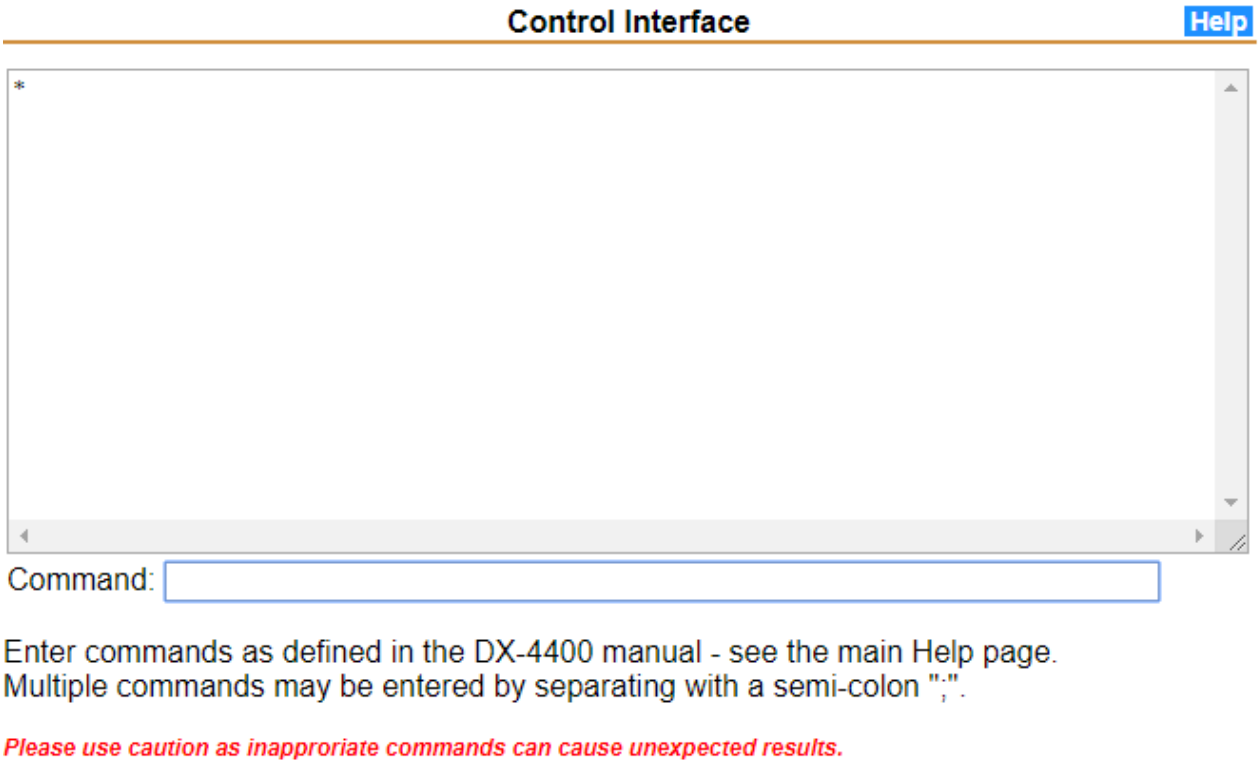

Figure 18: General Environment – Control Interface Page

5.3.4 General Environment – Status Page

The **General Environment – Status Page** lists the current operating status of the unit including the video ON/OFF status of the SDI inputs and outputs and video resolution. The Overlay Status page shown in the figure below.

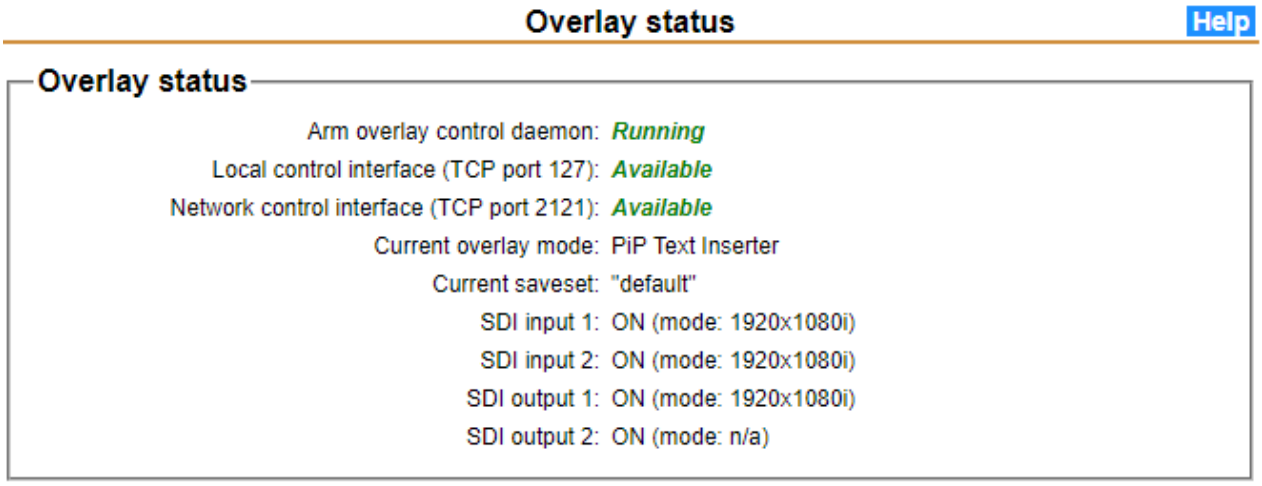

Figure 19: General Environment – Command Files Page

5.4 Web UI – Video Setup Menu

The **Video Setup menu** enables the user to configure items related to the operation and use of the DX-4400 per § 4.4 Video Path Settings & Control of this User Manual including; Mode of Operation, management of Savesets, executing User Command to the Control Port and displaying the current status of unit including video resolutions of each port.

5.4.1 Video Setup – Alpha Blend Page

The **Video Setup – Alpha Blend Page** allows the configuration of the alpha blending parameters for each SDI input per § 4.4.5 Video Alpha Commands . Alpha Blend sets the transparency of the SDI input video for all modes of operation except for the Low Latency Dual (**LDual TI)** and the Low Latency Dual Link 4K (**L4K TI**) modes.

- In the **Dual TI** and **4K TI** mode of operation (refer to Table 19: Video Alpha Command Syntax) there is only one video channel, so by making the input video transparent the background color of the DX-4400 will become visible.
- In the **PiP TI** configuration this allows the user to make the inserted PiP overlay transparent so the main SDI 1 source can be seen below.
- In the **PiP TI** mode only, the Alpha Bland command also provides the capability to select a color range of the input video to be either visible or transparent (as in chroma key applications). This is useful for example when a computer-generated overlay is connected to the secondary input and only the non-black parts of the video are intended to be visible.

When changes are made on the menu the Update box is activated to inform the user a change has been made to a parameter. Using the Apply button will apply the new parameter setting(s) to the unit.

The Alpha Blend page settings shown in the figure below.

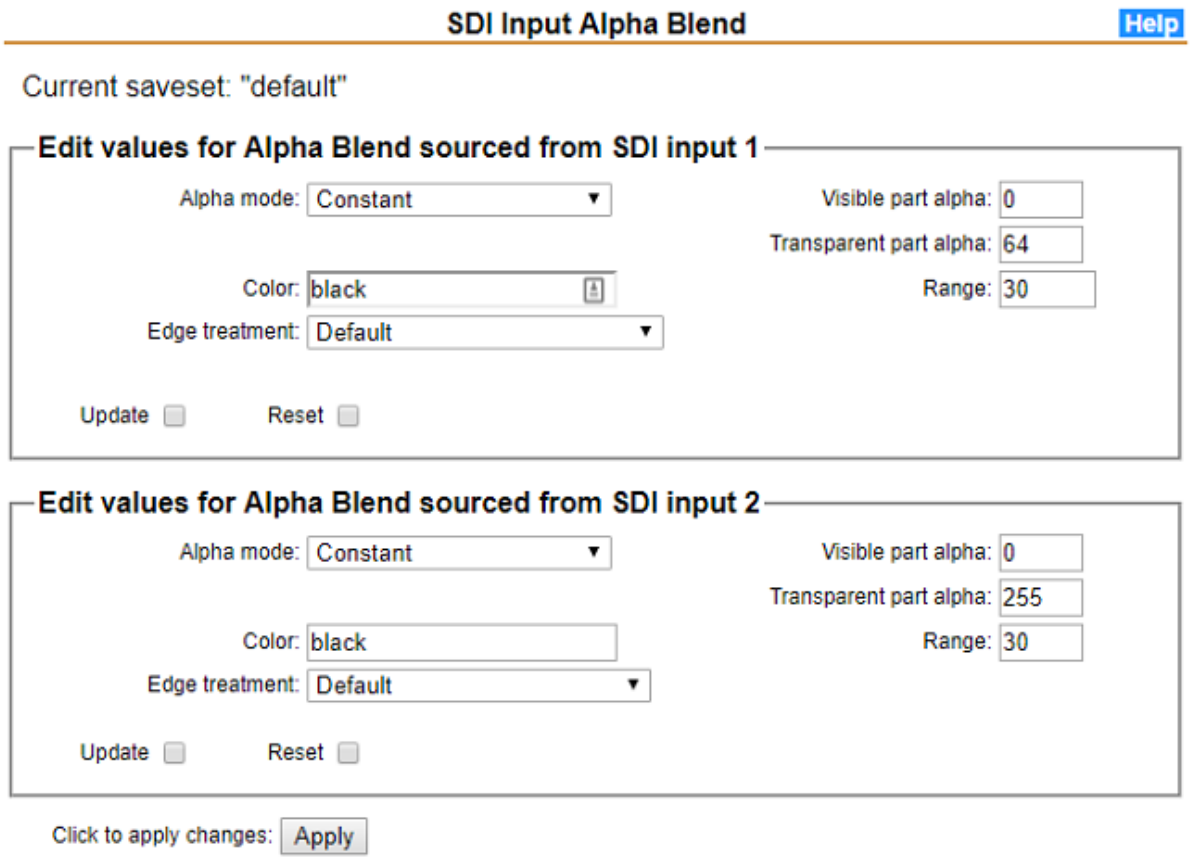

Figure 20: Video Setup – Alpha Blend Page

5.4.2 Video Setup – Background Color Page

The **Video Setup – Background Color Page** allows the configuration of the output background color for SDI input 1 per § 4.4.4 Video Background Color Command. The menu uses the user parameters of Table 18: Video Background Color Command Syntax.

When changes are made on the menu the Update box is activated to inform the user a change has been made to a parameter. Using the Apply button will apply the new parameter setting(s) to the unit.

The SDI Input Background Color page is shown in the figure below.

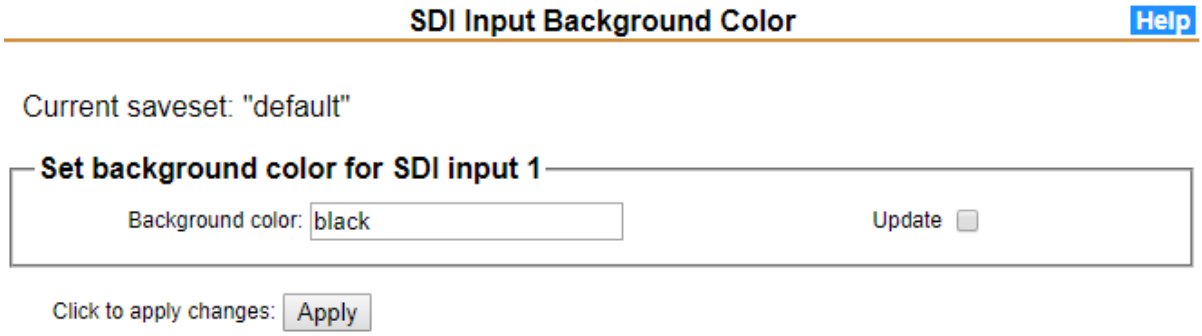

Figure 21: Video Setup – Alpha Blend Page

5.4.3 Video Setup – Frame Delay Compensation Page

The **Video Setup – Frame Delay Compensation Page** allows the configuration of the SDI Frame Delay Compensation for the two SDI inputs per § 4.4.5 Video Alpha Commands.

The menu restricts the user parameters to the listed values of Table 20: Video Frame Delay Compensation Command Syntax.

When changes are made on the menu the Update box is activated to inform the user a change has been made to a parameter. Using the Apply button will apply the new parameter setting(s) to the unit.

The SDI Input Background Color page is shown in the figure below.

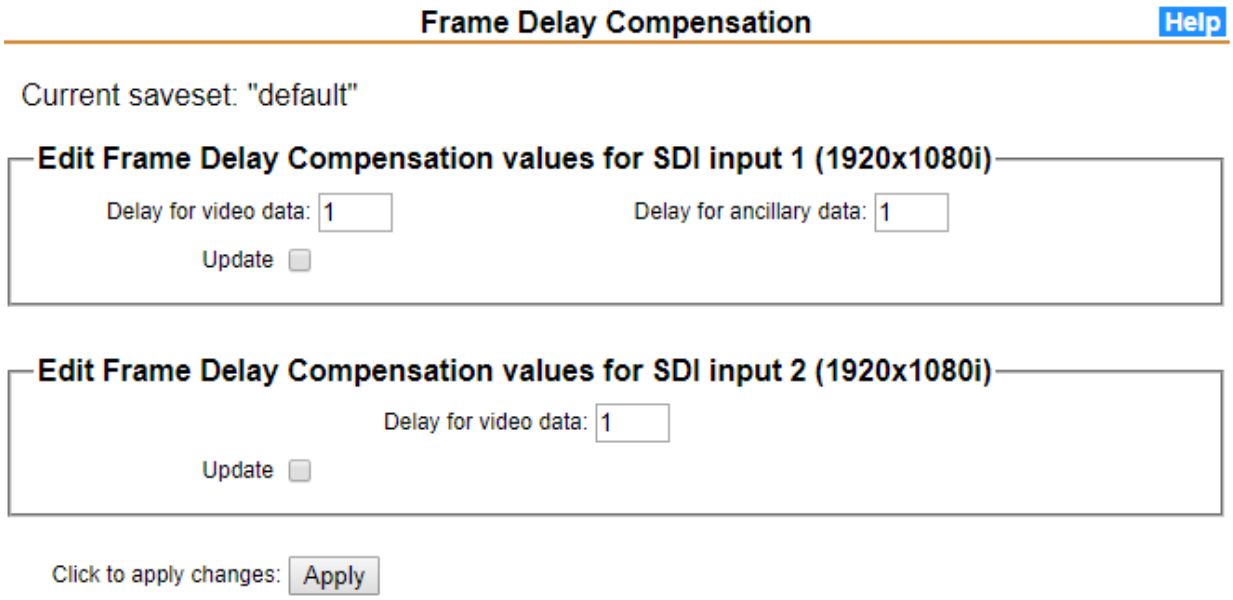

Figure 21: Video Setup – Frame Delay Compensation Page

5.4.3.1 Video Setup – PiP Display Settings Page

The **Video Setup – PiP Display Settings Page** allows the configuration of the size and position of the PiP window using the User Commands outlined in § 4.4 Video Path Settings & Control

The following section discuss the commands used to control the video path, settings and features including; PiP, Digital Zoom, Alpha Blending, Output, Background and Frame Delay Compensation.

PiP Size and Position Commands for two SDI input channels. The menu uses the user parameters outlined in Table 15 .

When changes are made on the menu the Update box is activated to inform the user a change has been made to a parameter. Using the Apply button will apply the new parameter setting(s) to the unit.

The PiP Display Settings page is shown in the figure below.

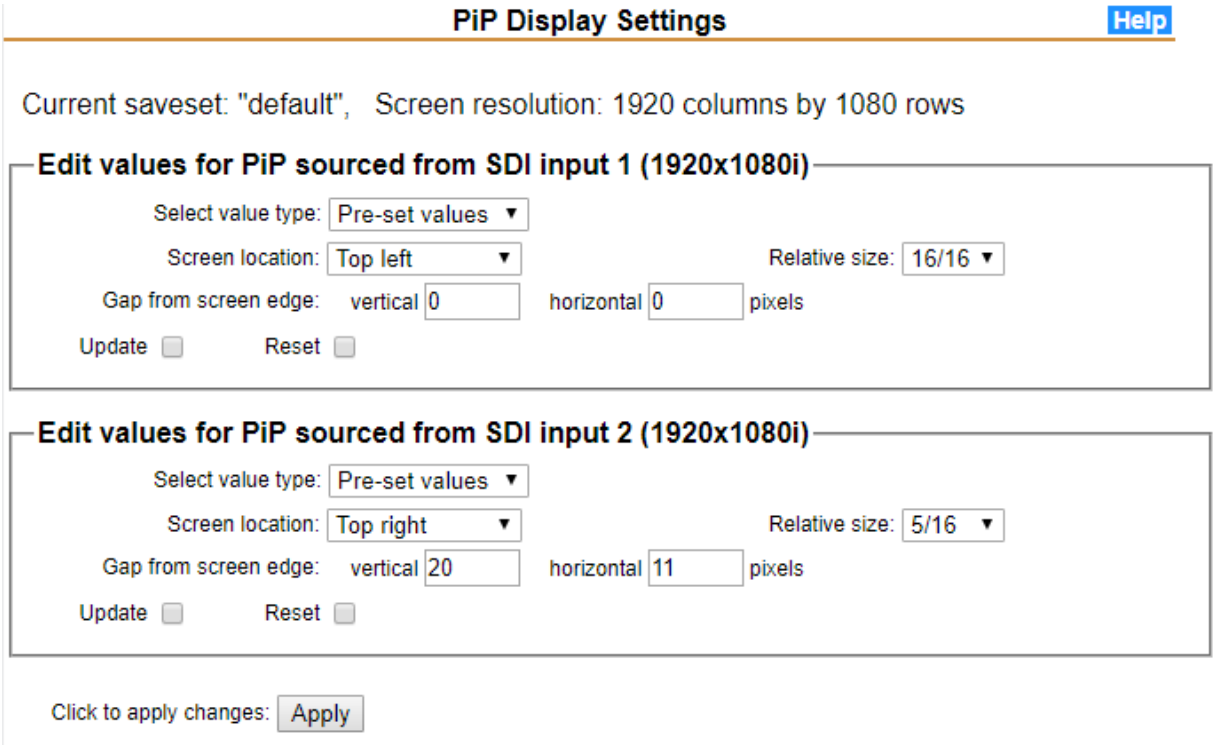

Figure 23: Video Setup – PiP Display Settings Page

5.4.3.2 Video Setup – Video Control Page

The **Video Setup – Video Visibility and Ancillary Data Control Page** allows for the temporary control of the SDI input and graphics overlay paths. The second menu box allows for the permanent control of the Ancillary data in the video input paths. These setting have immediate affect and prevail during any system restart. Temporary settings will be lost if the overlay is restarted.

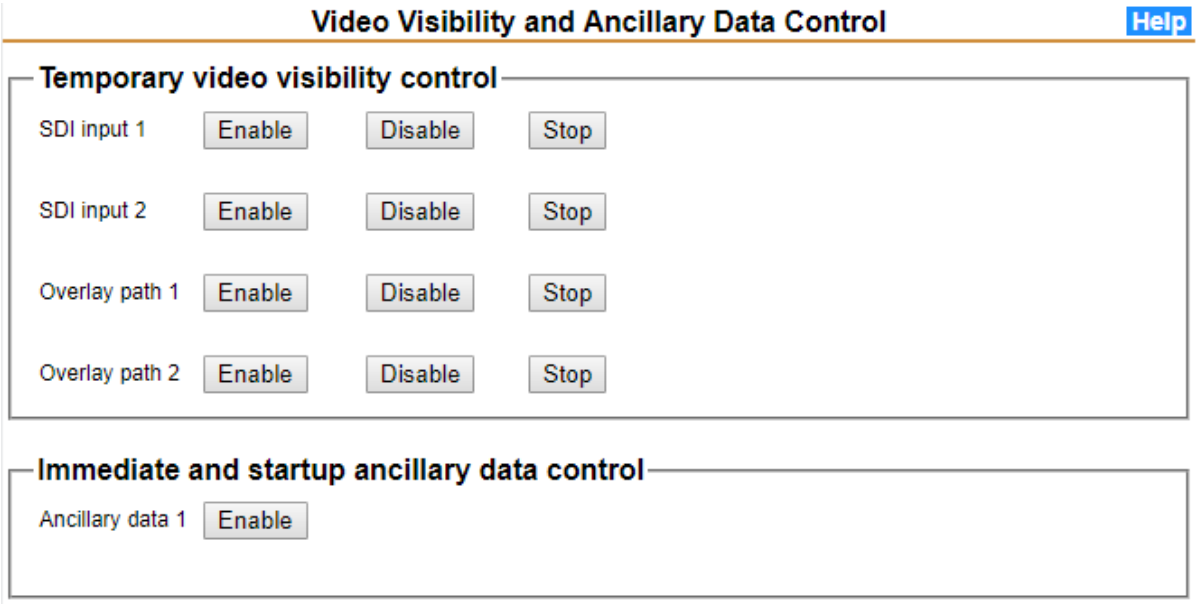

Figure 24: Video Setup – Video Control Page

5.4.3.3 Video Setup – Video Output Page

The **Video Setup – Video Output Page** allows for configuration of the SDI output video mode. Use the Apply button will apply the new parameter setting(s) to the unit.

The Zoom page is shown in the figure below.

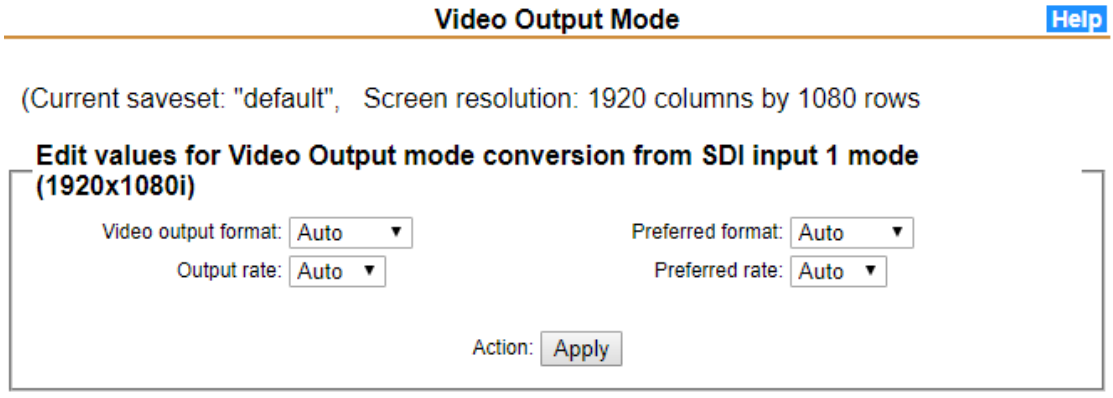

Figure 25: Video Setup – Video Output Mode Page

5.4.3.4 Video Setup – Zoom Page

The **Video Setup – Zoom Page** allows for configuration of the SDI input zoom scaling parameters as outlined in § 4.4.2 Video Zoom Commands and the parameter settings of Table 16: Zoom Command Syntax.

When changes are made on the menu, the Update box is activated to inform the user a change has been made to a parameter. The Rest button sets the parameters to the factory default settings. Using the Apply button will apply the new parameter setting(s) to the unit.

The Zoom page is shown in the figure below.

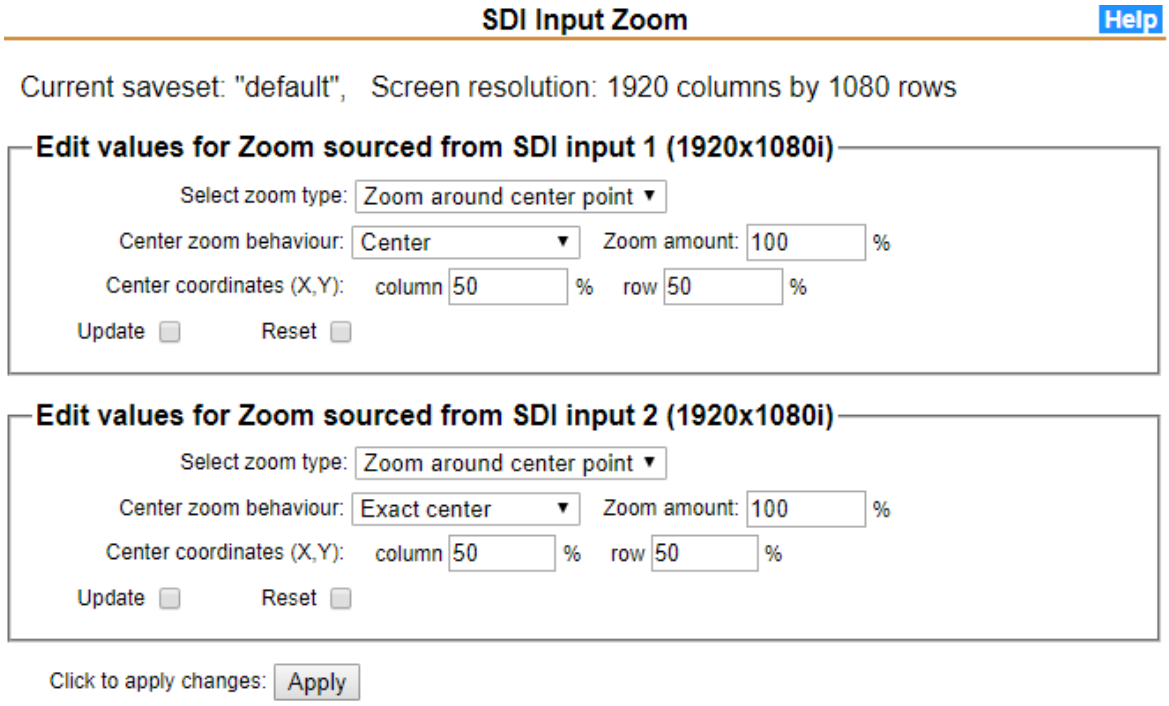

Figure 26: Video Setup – Video Output Mode Page

5.4.4 Web UI – Overlay Fields Menu

The **Overlay Fields menu** enables the user to add, manage and use the Overlay Fields discussed in § 4.3 Externally Controlled Overlay Fields of this User Manual. The Web UI does not provide control of the Interactive Overlay described in section 6

The use of this menu is discussed in the following sections.

5.4.4.1 Overlay Fields – Graphic Field Page

The **Graphics Field Page** is used to enter and manage Graphic Fields which are to be overlaid onto the SDI video path as discussed in § 4.3.6 Graphic Overlay Fields of this User Manual..

The Graphic Field Page is shown in the figure below.

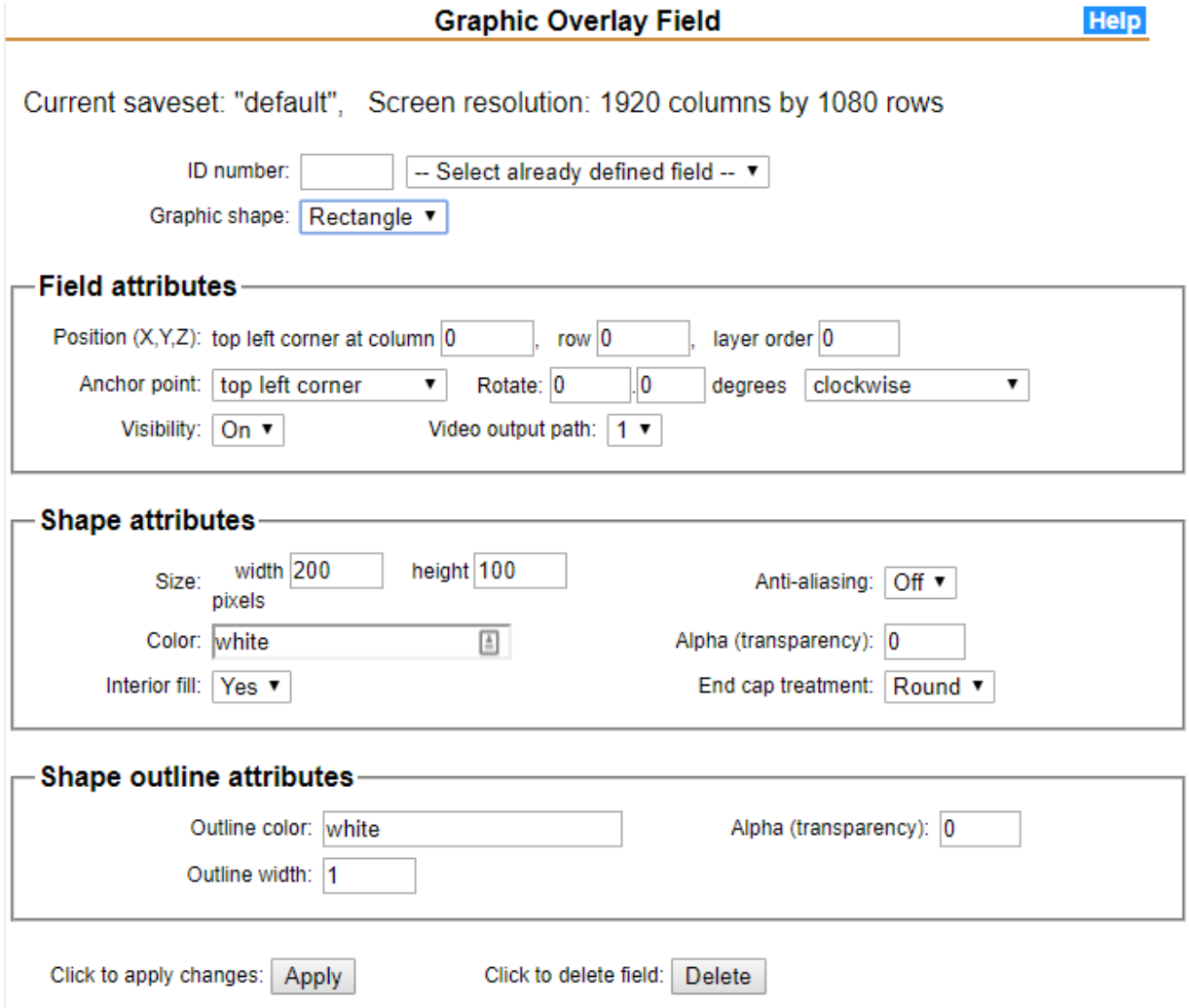

Figure 27: Overlay Fields – Graphic Field Page

5.4.4.1.1 USE OF GRAPHIC FIELDS PAGE

Using the menu, the user can either enter (assign) a new Graphic ID number or select and edit an existing previously defined Field ID number. For each Graphic Field ID the user can enter; the shape type (Rectangle, Circle, Ellipse or Line), the position attributes, the shape attributes and the shape outline attributes.

5.4.4.2 Overlay Fields – Image Field Page

The **Image Field Page** is used to enter and manage Image Fields which are to be overlaid onto the SDI video path as discussed in § 4.3.7 Image Overlay Fields of this User Manual..

The Image Overlay Field Page is shown in the figure below.

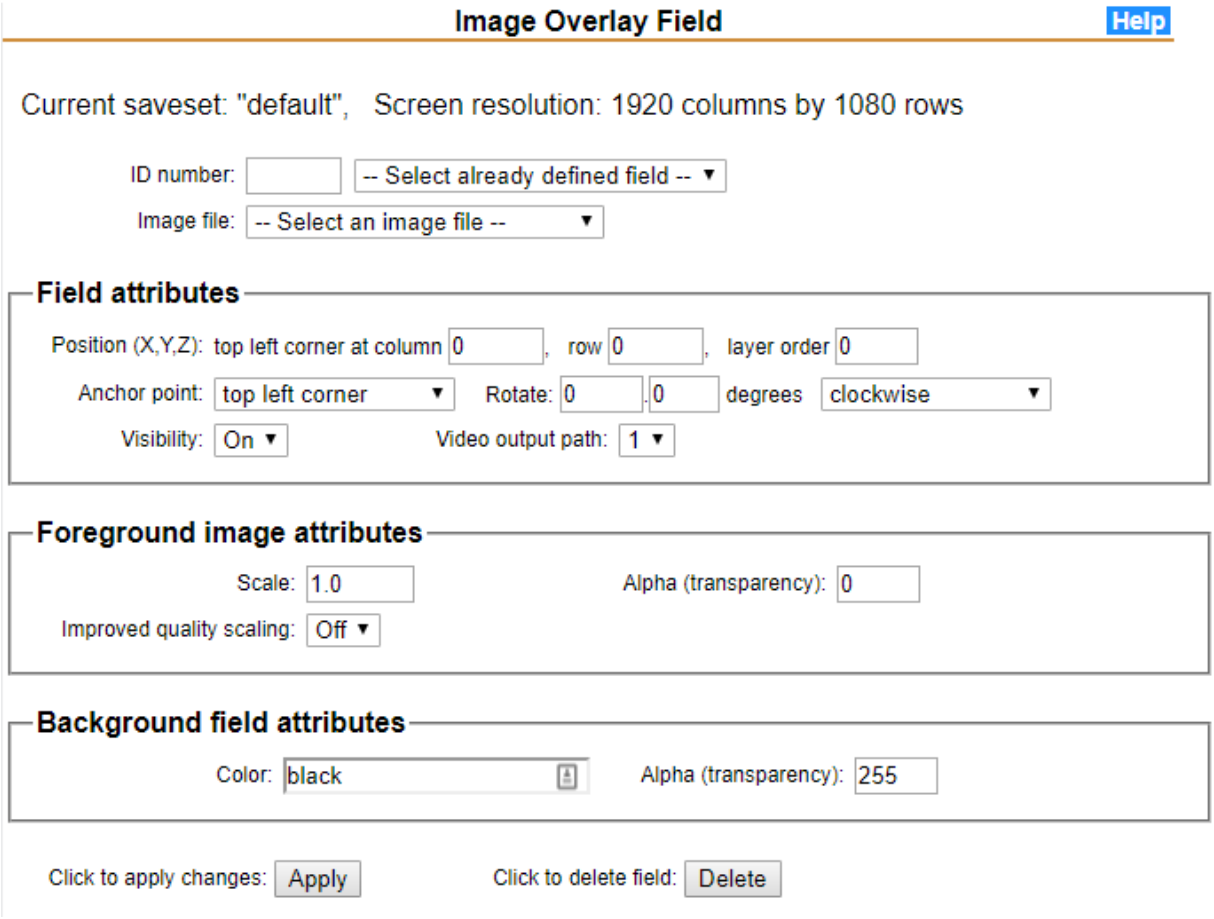

Figure 28: Overlay Fields – Image Field Page

5.4.4.2.1 USE OF IMAGE FIELD PAGE

Using the menu, the user can either enter (assign) a new Image ID number or select and edit an existing previously defined Image ID number. Using the menu for each Image Field, the user selects an Image file using the pull-down menu which will list all of the current image files loaded on the unit. To load additional Image files use the Web UI – File Manager Menu of § 5.6 of this User Manual. To control how the Image file is displayed, additional attributes are assigned including position, anchor point, Rotation visibility and SDI output video path. Foreground and background attributes can also be assigned.

5.4.4.3 Overlay Fields – QML Script File Page

The **Image QML Script File Page** allows management of QML Script files containing pre-defined sets of overlay and other video QML Commands as documented in § 4.3.8 titled QML Field Commands. Using the menu, QML files may be uploaded, downloaded, modified, and deleted.

The QML Scrip File Page is shown in the figure below.

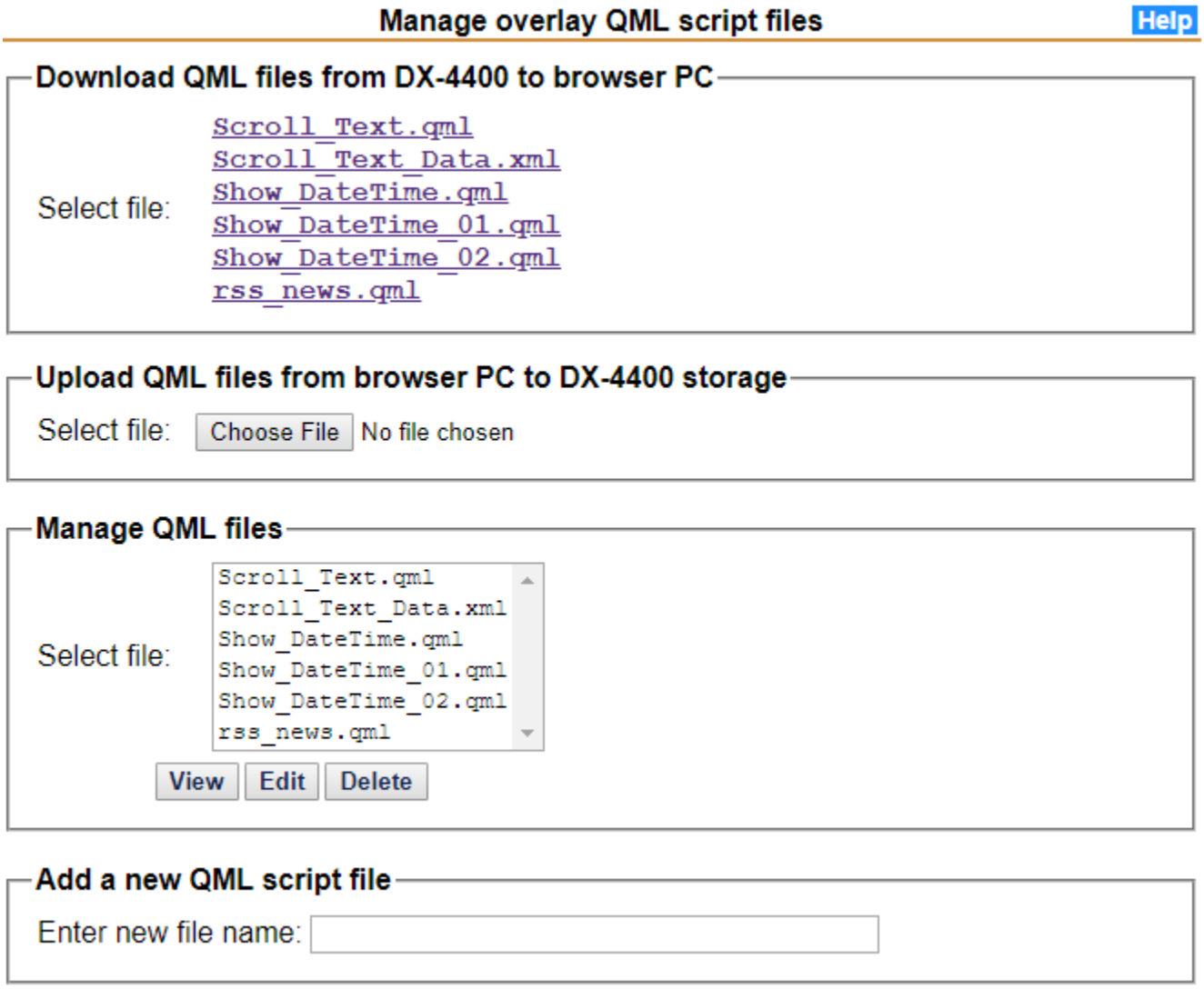

Figure 29: Overlay Fields – Image Field Page

5.4.4.3.1 MANAGEMENT OF QML SCRIPT FILES

To download QML script files from the DX-4400 to a PC using a web browser:

- Select the file or files that you wish to download onto your PC. The files may be edited on your PC and returned to the DX-4400 using the **Upload QML files** menu option.

To upload QML script files (using a browser) from a PC to the DX-4400 SDcard:

- Click on the **Browse** button and select the file or files that you wish to upload from your PC onto the DX-4400.

Toe manage QML files on the DX-4400 unit:

- Select the file(s) that you wish to manage, then click on the action button to perform that action on each file selected.
- **View** - Display the contents of the selected file(s).
- **Edit** - Modify the contents of the selected file.
- **Delete** - Remove the selected file(s) from the DX-4400 file system.

5.4.4.4 Overlay Fields – Text Fields Page

The **Text Field Page** allows for the definition of Text Fields.

which are to be overlaid onto the SDI video path as discussed in § 4.3.5 Text Overlay Fields of this User Manual..

The Text Field Page is shown in the figure below.

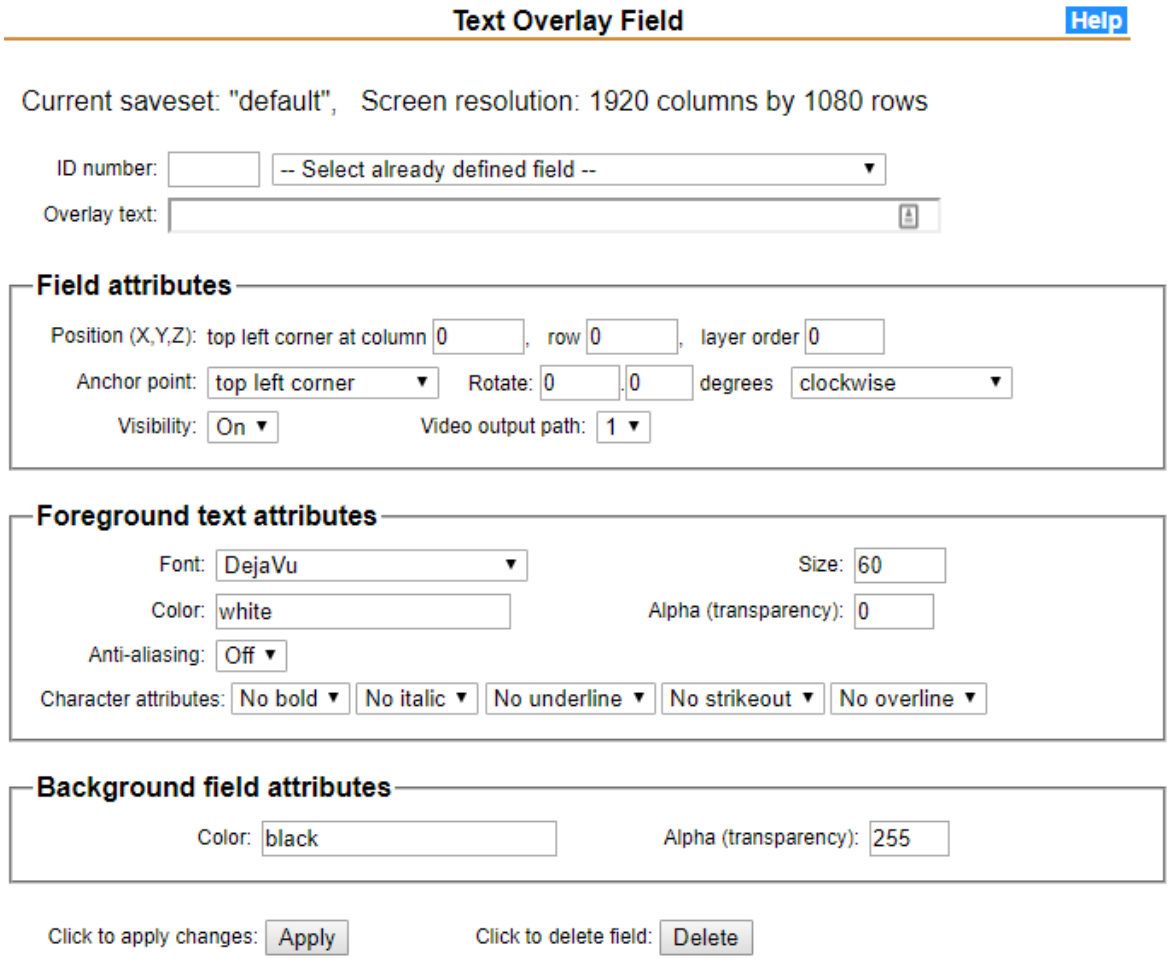

Figure 30: Overlay Fields – Image Text Page

5.4.4.4.1 USE OF TEXT FIELDS PAGE

Using the menu, the user can either enter (assign) a new Text ID number or if you wish to edit an existing previously defined Text Field, use the menu to select from the list of previously defined text fields to populate the ID number and the Overlay text box.

For each Text Field ID the user can enter; the position attributes, foreground and background attributes.

- For Field attributes options include; position, anchor point, rotation, visibility and SDI video path.
- For Foreground attributes include; font style, font size, color, antialiasing and character attributes.

Once complete the Apply button will save the Text Field under the assigned ID.

5.5 Web UI – User-defined Commands Menu

The **User Defined Command menu** enables the user to assign Command Strings to the Toggle and DIP Switches which can be used for controlling the operation of the DX-4400 unit. One or more commands can be assigned to a switch.

5.5.1 User-defined Commands – Reset Page

The **User Defined Commands – Reset Page** is used to delete all the User Defined assignments for the current Saveset database. The page is shown below.

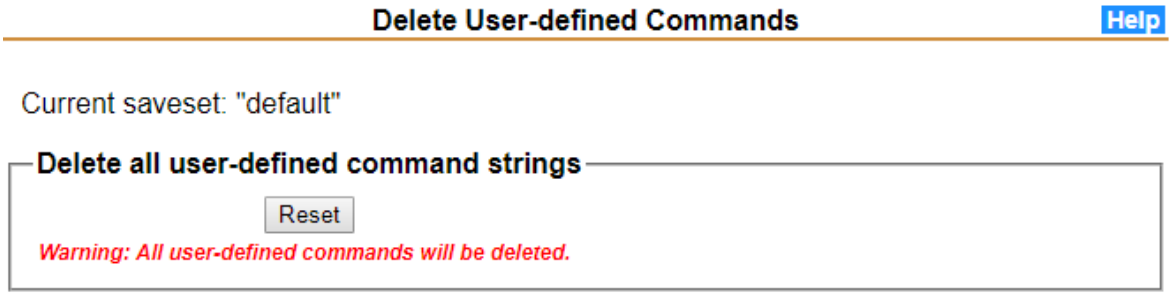

Figure 31: User Defined Command – Reset Page

5.5.2 User-defined Commands – DIP Switches

The **User Defined Commands – DIP Switches Page** is used to assign user functions to the DIP Switches as discussed in § 4.7 User Defined Commands and § 4.7.2 Configuring DIP Switch Functions.

The page is shown in the figure below.

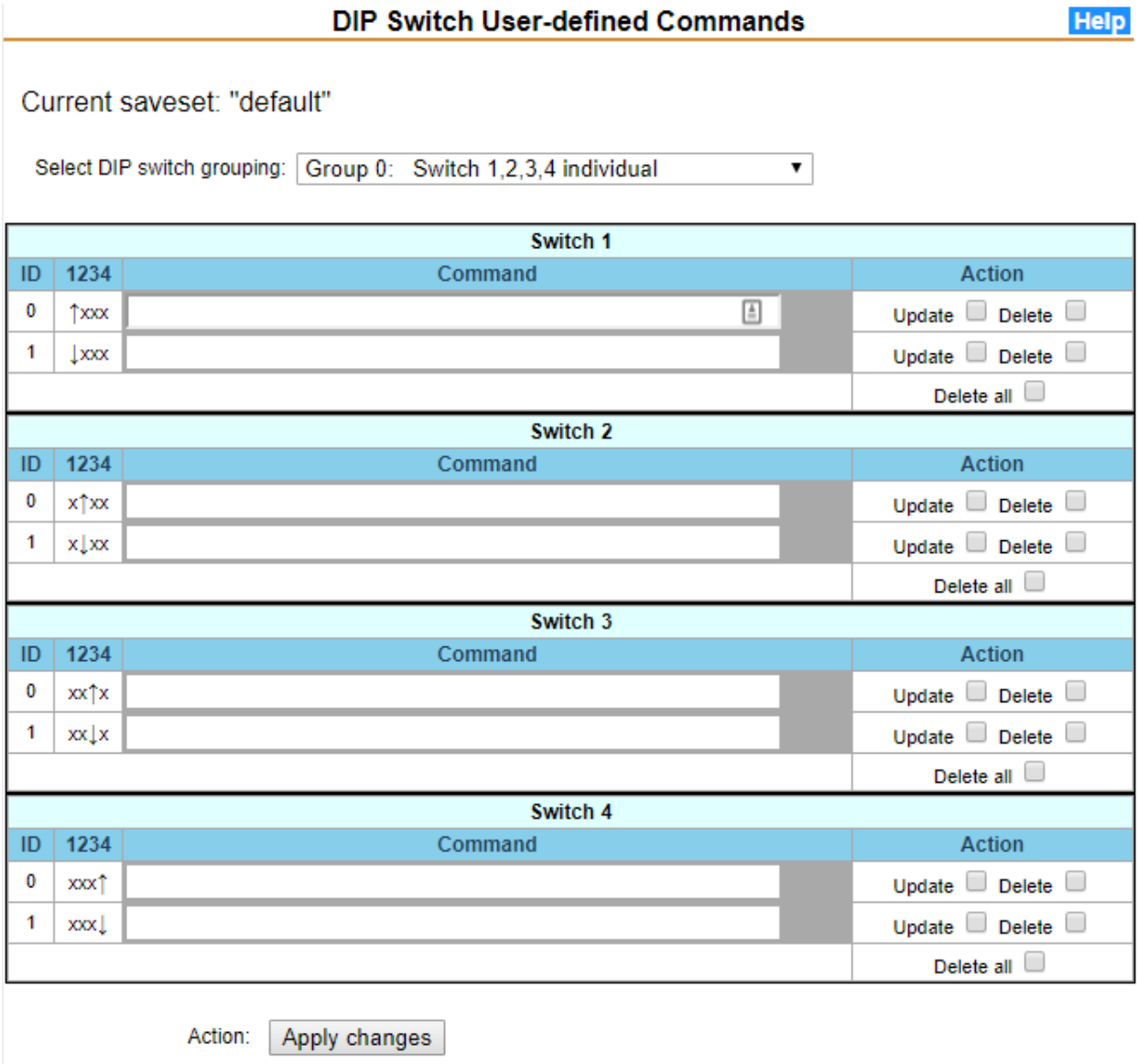

Figure 32: User Defined Command – DIP Switch Page

5.5.2.1 Use of DIP Switch Page

The **User Defined Command – DIP Switch page** is divided into four sections:

- The first item is used to define the DIP switch groupings per Table 27: DIP Switch – User Defined Group Command Syntax.
- The next four sections are used to define the ID number and the associated Command String for each switch per Table 26: DIP Switch User Defined Command Syntax. For each DIP switch position the user can either enter a new command string assignment or delete an existing one.

5.5.3 User-defined Commands – Toggle Switch Left Page

The **User Defined Commands – Toggle Left Page** is used to assign user functions to the Toggle Switch – Left action position as discussed in § 4.7.1 Configuring Toggle Switch Functions based on using the functionality defined in Table 25: Toggle Switch – User Defined Command Syntax.

The Toggle Switch Right page is shown in the figure below.

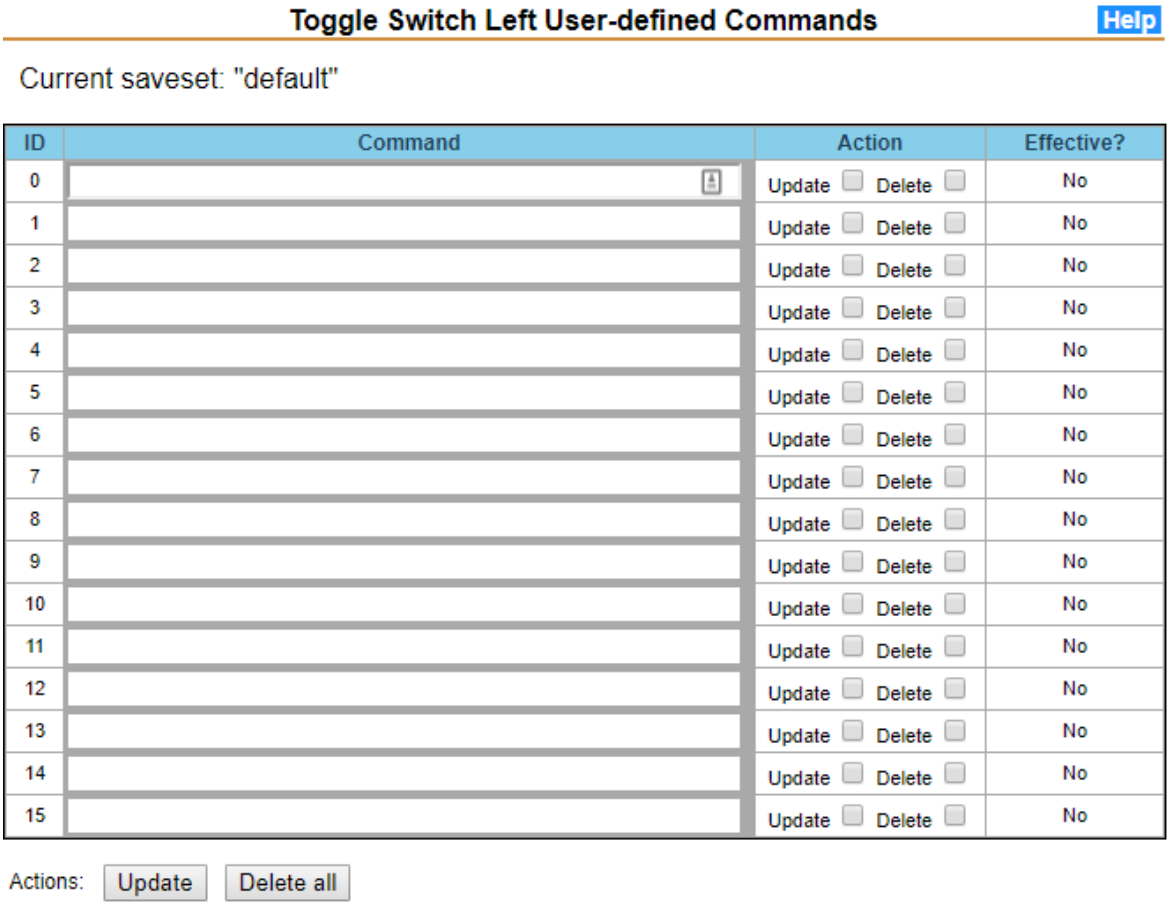

Figure 33: User Defined Command – Toggle Switch Left Page

5.5.3.1 Use of Toggle Switch Left Page

The **User Defined Command – Toggle Switch Left page** is supports up to 16 Switch ID Command String Index assignments functions (per Table 25: Toggle Switch – User Defined Command Syntax). For each of the 16 ID String Indexes, the user can either enter a new Command String assignment or delete an existing one.

5.5.4 User-defined Commands – Toggle Switch Right Page

The **User Defined Commands – Toggle Right Page** is used to assign user functions to the Toggle Switch – Right action position as discussed in § 4.7.1 Configuring Toggle Switch Functions based on the functionality defined in Table 25: Toggle Switch – User Defined Command Syntax.

The Toggle Switch Right page is shown in the figure below.

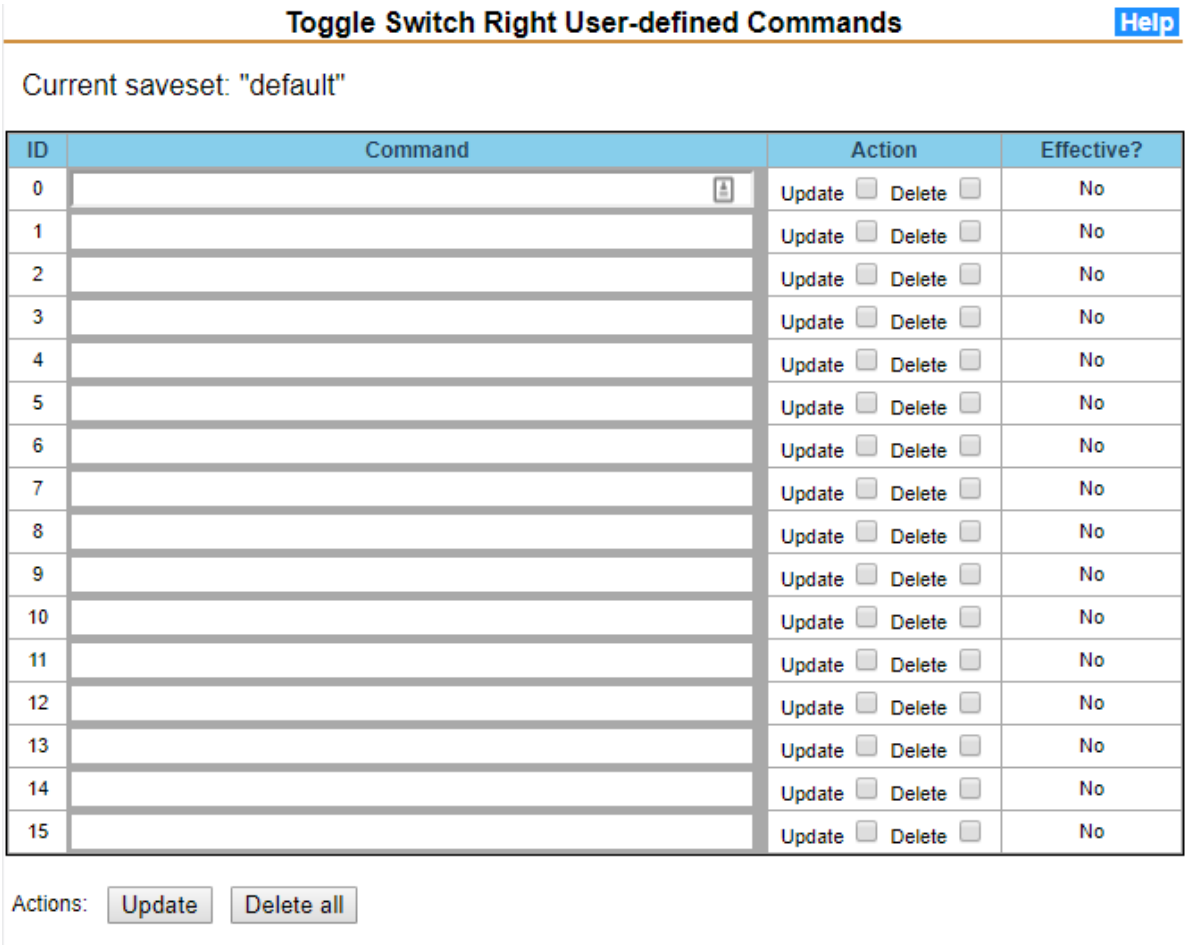

Figure 34: User Defined Command – Toggle Switch Right Page

5.5.4.1 *Use of Toggle Switch Right Page*

The **User Defined Command – Toggle Switch Right page** is supports up to 16 Switch ID Command String Index assignments functions (per Table 25: Toggle Switch – User Defined Command Syntax). For each of the 16 ID String Indexes, the user can either enter a new Command String assignment or delete an existing one.

5.6 Web UI – File Manager Menu

The **File Manager Page** is used for managing the Overlay Command files, the Image files and the Overlay QML Script files used to automate functions on the DX-4400 unit.

5.6.1 File Manager – DX Command Files Page

The **File Manager – DX Command Files Page** allows for the management and application of Overlay Command files containing pre-defined sets of overlay and other User Command strings stored in a standard .txt file format. Command Files can be created with a standard .txt file editor (Notepad) then uploaded, downloaded, modified, deleted, and applied to the unit by means of the ARM Graphics Overlay Video Processor. They files are used to simplify and automate the configuration of the DX-4400 unit enabling the user to save a variety of system configurations to streamline re-configuration of the product.

The Web UI File Manger DX Command Files page is shown in the Figure 35 below.

Figure 35: File Manager – Command Files Page

5.6.1.1 Use of Command Files Manager Page

Command files contain a list of user Commands stored in a standard text file which can be uploaded and executed on the DX-4400 to quickly configure the unit (and also save the information in the Saveset database). The standard DX-4400 software distribution includes several examples as provided throughout this User Manual.

The menu actions available to the user include:

1) Download Command files from the DX-4400 using a browser into the download directory of a PC for editing, management and backup storage.
2) Uploading Command files from a PC onto the DX-4400 using a browser.
   Note: The text Command files are stored by default in the "/usr/local/commands/" directory.
3) On-line management and editing and application of the Text Command files located on the DX-4400 unit. The user can:
   a. **View** - Display the contents of the selected file(s),
   b. **Edit** - Modify the contents of the selected file,
   c. **Apply** - Submit the commands contained in the selected file(s), and
   d. **Delete** - Remove the selected file(s) from the DX-4400 file system.
2) The Create a new command file section allows the user to create a new Command file.
   a. Enter the file name that you wish to create, then click on the **Create** button when it pops up to create an empty file on the DX-4400.
      Note: The file name should be relevant to the function it will perform. Avoid using spaces. You can use the **Edit** button described above to enter commands into the file.

In addition to the upload/download capability for the browser PC, stored files can also be pushed/pulled by remote SCP and SFTP clients by logging into user "root", using a password of "ArmOverlay", and changing to the "/usr/local/commands/" directory. Remote clients may be command line programs (scp, sftp, etc), or GUI-based (FileZilla, WinSCP, etc).

5.6.2 File Manager – Font Files Page

The **File Manager – Font Files Page** allows for the management – uploading, downloading and deletion of Image files. This page streamlines the process of adding new fonts manually as documented in §3.10.4 Adding New Font Files.

5.6.2.1 Use of Image Files Manager Page

There are three action windows available to the user:

1) The Download Image section shows the Image files currently installed on the DX-4400 unit. It also allows the user to select a file or files to download onto it a PC. The files may be edited on your PC and returned to the DX-4400 using the **Upload image files** option.
2) The Upload Image section allows the user to browse on the user's PC or network to choose a file to upload onto the DX-4400 unit.
3) The Manage Image section allows the user to delete the file from the DX-4400 file system.

The Image files are stored by default in the "/usr/local/graphics/" directory.

The Web UI Image File page is shown in the figure below.

5.6.3 File Manager – Image Files Page

The **File Manager – Image Files Page** allows for the management of font definition files used in Text Overlay Fields. Files may be uploaded and added to the existing list of supported fonts. Image files. The supported file formats are specified in § 4.3.7.1 Image Field File Formats.

5.6.3.1 Use of Font Files Manager Page

To add additional fonts to the DX-4400 product, click on the Choose File button and select the file or files that you wish to upload from your PC onto the DX-4400. After the font file is uploaded and added to the system, the ARM Overlay Command process must be restarted (using a power cycle or executing a Set Mode (SM) command via the Control Interface under the General Management tab of the Web UI.

The Web UI Image File page is shown in the figure below.

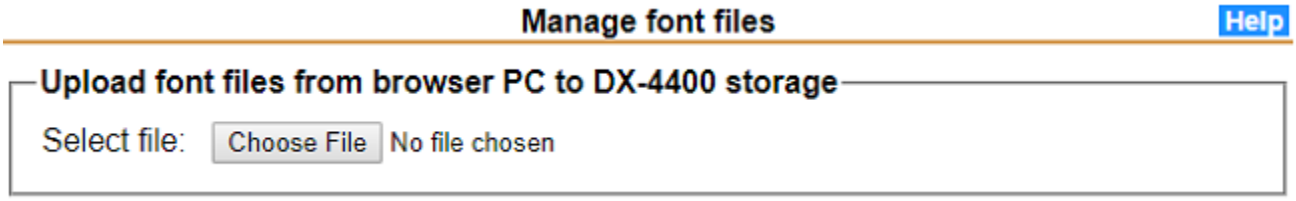

Figure 36: File Manager – Font Files Page

5.6.4 File Manager – QML Files Page

The **File Manager – QML Files Page** allows management of QML script files containing pre-defined sets of overlay and other video QML commands. Using the Web UI, files may be uploaded, downloaded, edited/modified, and deleted in the identical manner to Graphic and Image files.

The QML Script files are stored by default in the "/usr/local/qml/" directory.

The QML Files Management page is shown in the Figure 37 below.

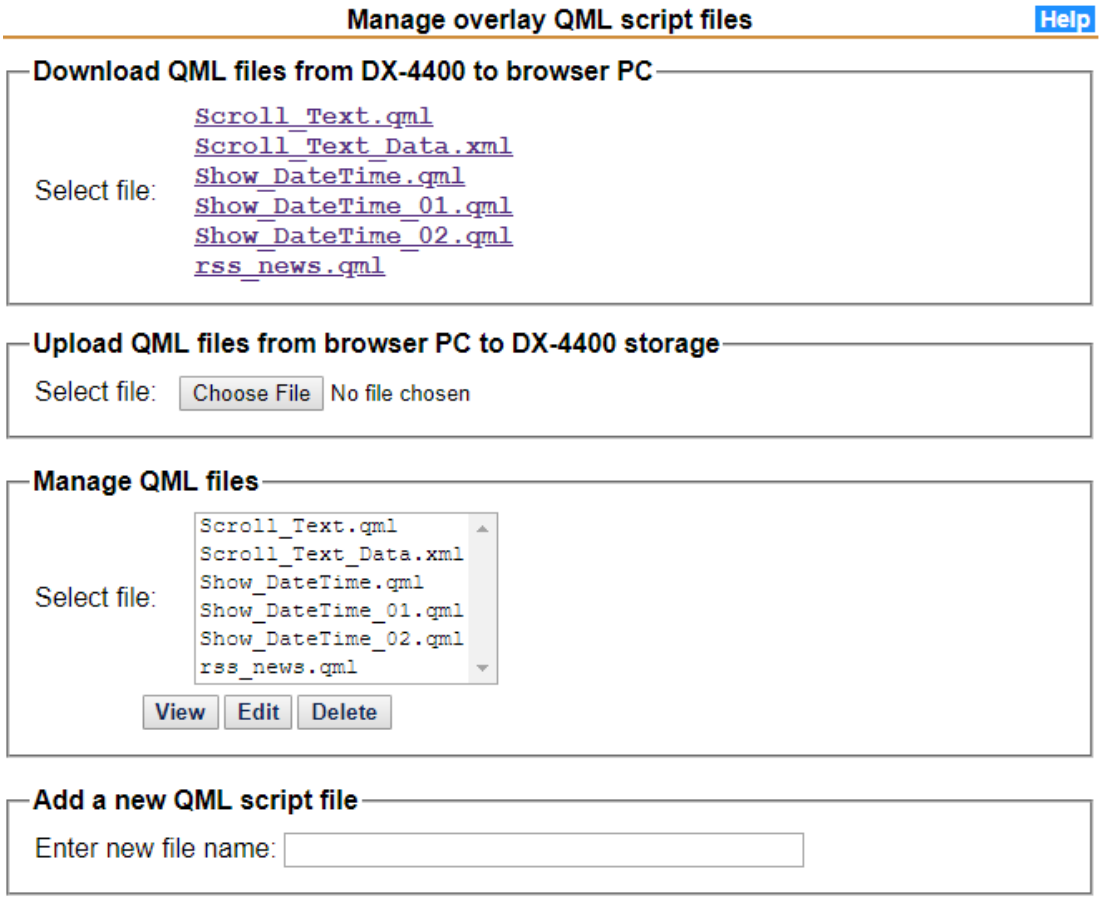

Figure 37: Overlay Configuration – QML Files Page

5.7 Web UI – System Configuration Menu

The **System Configuration menu** enables the user to execute commands to set parameters associated with the Linux Operating System. The web UI establishes an SSH connection to the DX-4400 and completes a user login to the Linux Root User Account using the default password which enables the user to execute system commands.

5.7.1 System Configuration – Authentication Page

The **System Configuration – Authentication Page** allows the user to:

1. Update the DX-4400 system root and admin passwords, and
2. Configure (if applicable) the address of the RADIUS Authentication Server and the Shared Secret used for validation.

The Web UI Authentication page is shown in the figure below.

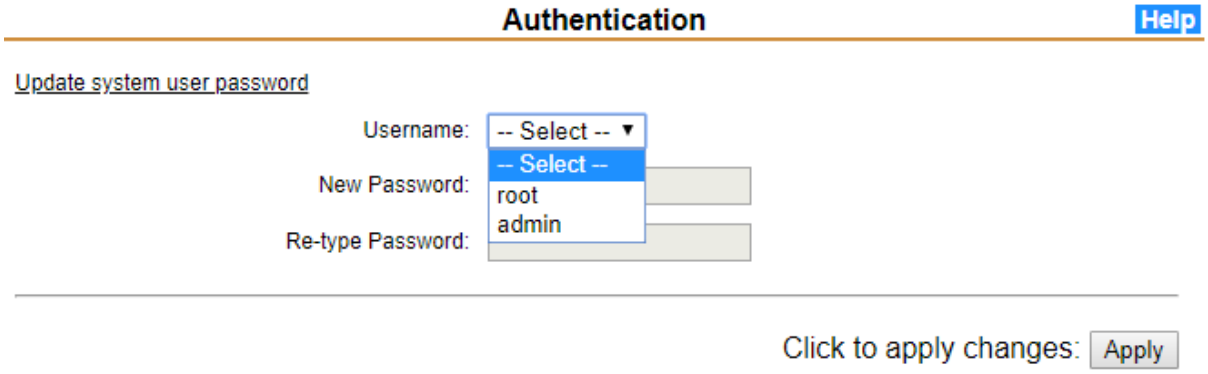

Figure 38: System Configuration – Authentication Page

5.7.2 System Configuration – Date and Time Page

The Web UI Date and Time page allows the user to set the date, time, timezone and the source for the NTP time service. This menu is shown in the figure below.

The Source selection can be set to be one of the following values:

- None - NTP not used
- Server - Time is synchronized to the specified time server
- GPS - GPS time is used (an external GPS source must be connected)
- GPS+PPS - GPS time is used and the PPS signal is used for additional accuracy

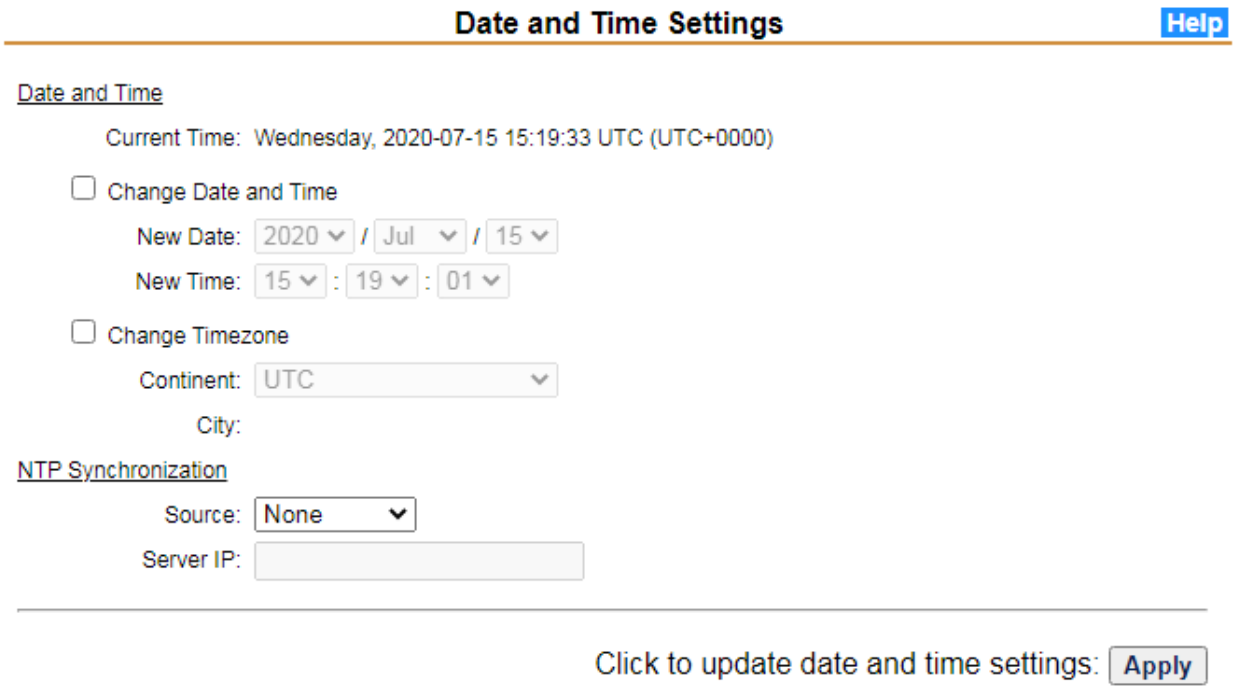

Figure 39: System Configuration – Time and Date Page

5.7.3 System Configuration – Maintenance Page

The **System Configuration – Maintenance Page** allows the user to make changes to system level parameters. This includes:

- Update the system (ARM) software,
- Update the IP Core Firmware,
- Install an IP Core License,
- Save (the current) and restore (a previous) system configuration data (i.e. a database Saveset), and
- Reboot the unit to apply the configuration.

The System Maintenance menu is shown in the figure below.

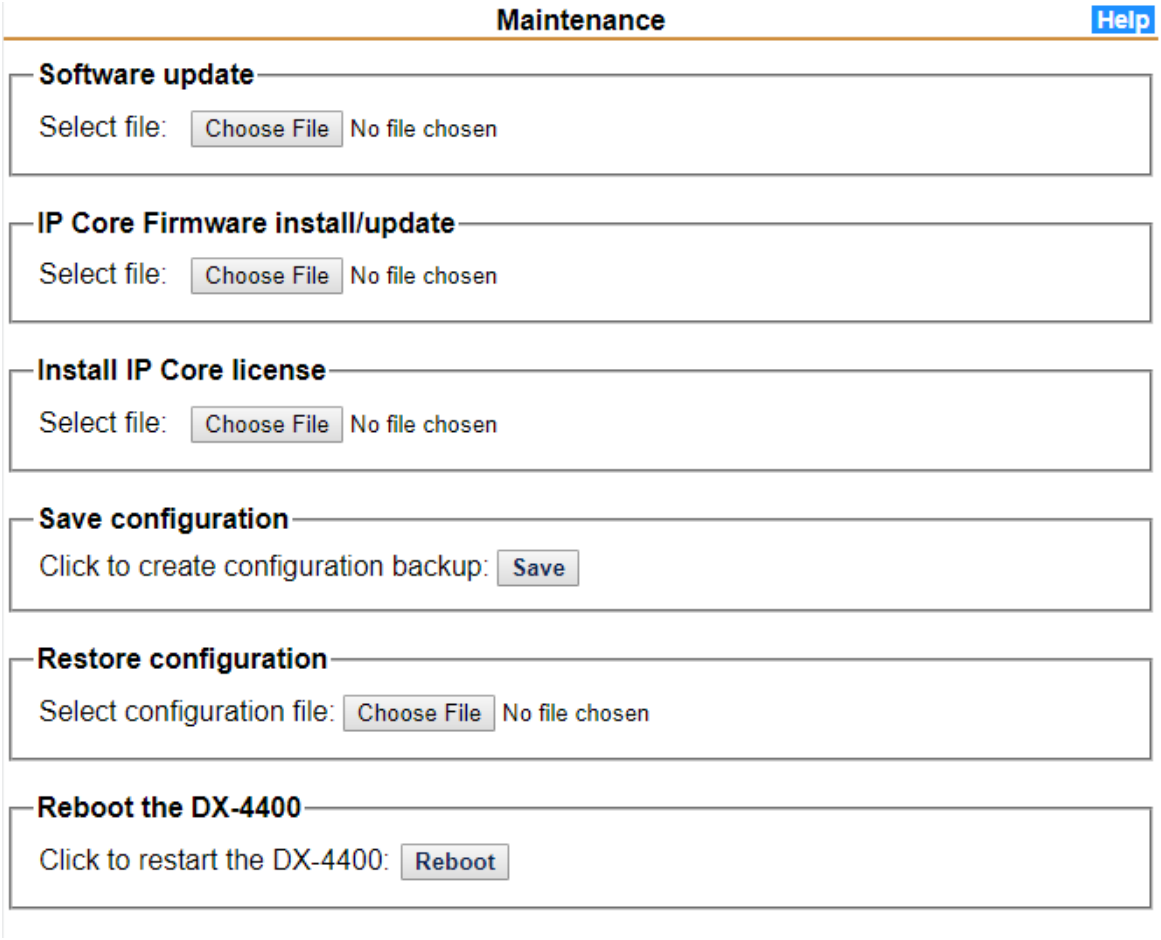

Figure 40: System Configuration – Maintenance Page

5.7.4 System Configuration – System Log Page

The **System Configuration – Edit System Files Page** provides an editing utility to manually edit any text file on the DX-4400. Changes to configuration files will not take effect unless the application using the file; is capable of detecting the change, the application is restarted, or the box is restarted.

Clicking on one of the listed files will open a page with an on-line text editor.

The Edit System Files menu is shown in the figure below.

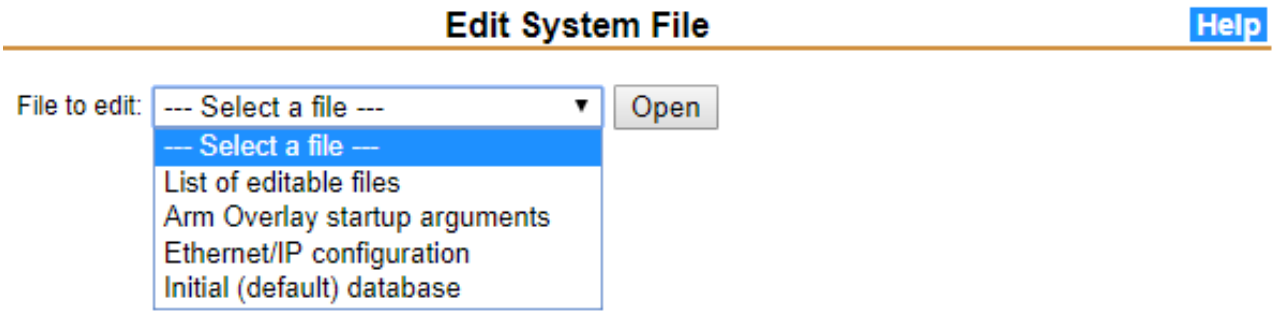

Figure 41: System Configuration – System Log Page

5.7.5 System Configuration – Web Server Page

The **System Configuration – Web Server Page** enables the user to configure the parameters for the web server including the username and passwords. This menu is shown in the figure below.

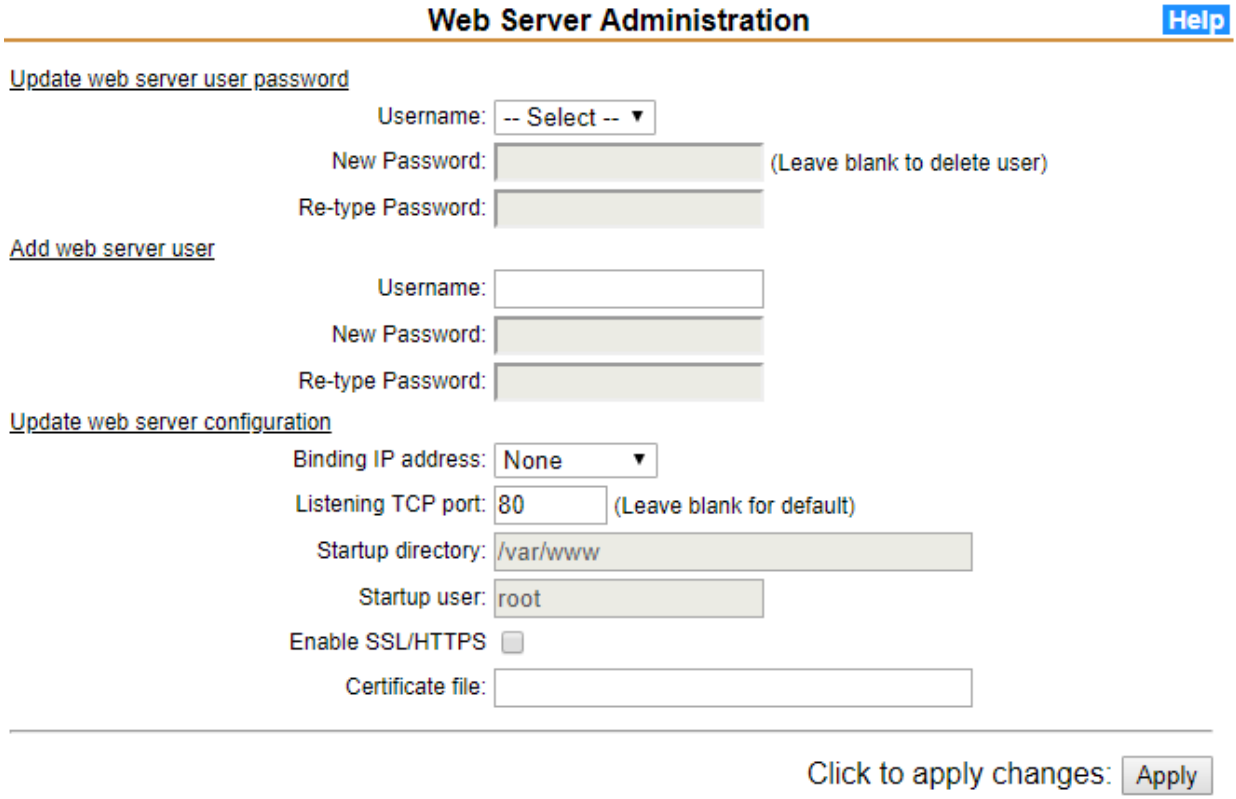

Figure 42:System Configuration – Web Server Page

5.7.6 System Configuration – Edit System Files Page

The **System Configuration – Edit System Files Page** enables the user to manually edit any text file on the DX-4400. The user simply selects a file is selected from the pull-down menu and click "Open" to load the selected file in the text window where an on-line editor can be used to make edits as required. Changes to any configuration file will not take effect unless the application using the file is; capable of detecting the change, the application is restarted, or the box is restarted. This menu is shown in the figure below.

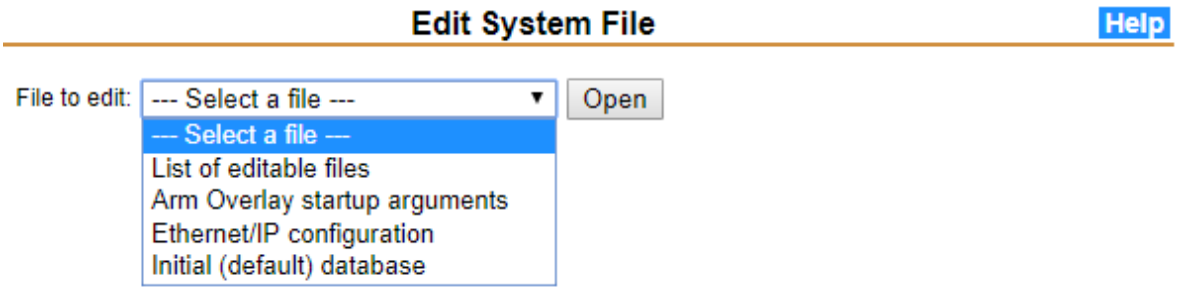

Figure 43:System Configuration – Web Server Page

5.8 Web UI – System Status Menu

The **System Status Page** establishes an SSH connection to the Root User Account DX-4400 and provides a Command line window for the user to send Linux commands to the Linux Operating System running on the ARM embedded processor. A display window provides the response from the Linux OS.

Note: This level of user access is not required for the normal the operation of the DX-4400 unit as Text and Graphics Overlay Inserter.

5.8.1 System Status – Command Line Page

The **System Status – Command Line Interface (CLI) page** provides window (at the bottom) for the user to send Linux commands to the Linux Operating System running on the ARM embedded processor. A text display window at the top to provide the response from the Linux OS. A Linux command is entered in the command input field, terminating with the <ENTER> key. Command output will be displayed in the text window at the top.

Note: This level of command line user access is not required for the normal the operation of the DX-4400 unit as Text and Graphics Overlay Inserter. Use caution in using commands as inappropriate commands can cause system failure of the Linux Operating System.

The Web UI Command Line page is shown in the following figure.

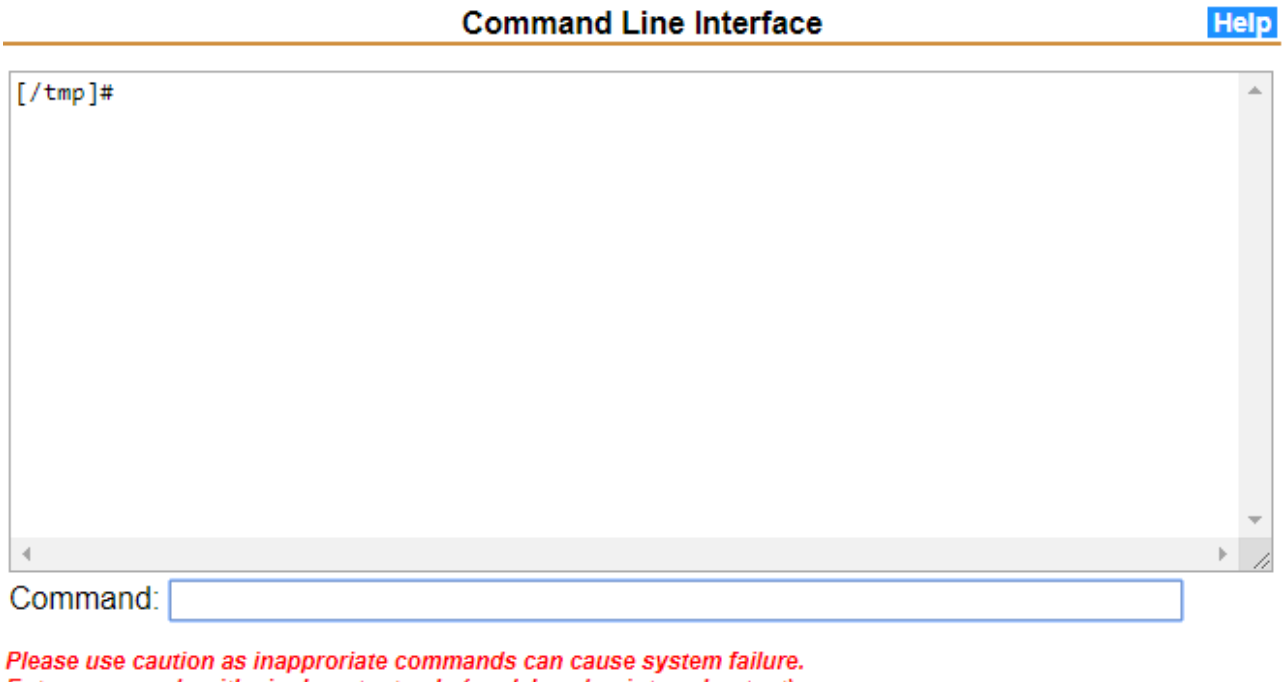

Figure 44: System Status – Command Line Page

5.8.2 System Status – System Logs Page

The **System Status – System Log Page** enables the user to view the Linux System Log (syslog), the Web Server Log (klog) and the Kernel Ring Buffer (klog) files for the purpose of debugging the ARM OS and for system maintenance. This page is shown in the figure below.

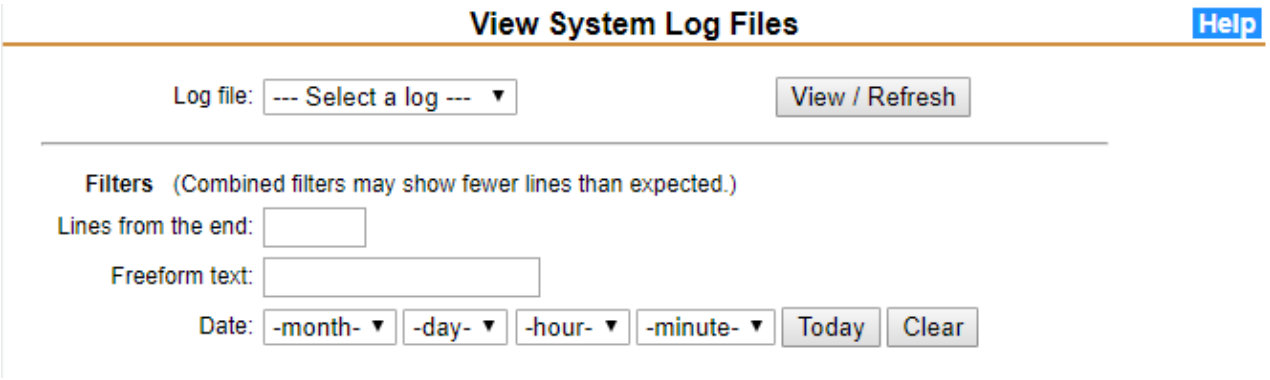

Figure 45: System Status – System Log Page

6 Using the WYSIWYG Interactive Overlay User Interface

The WYSIWYG Interactive Overlay user interface (UI) offers the user a WYSIWYG method to configure an overlay display using a mouse and keyboard attached to the DX-4400. Configuring the Overlay Fields of the Interactive Overlay does not require a network connection, external PC or other controller to send commands to the DX-4400.

The Text, Images, and Graphics of the Interactive Overlay are a separate layer that mixes above any overlay that is constructed using the commands described in section 4.3: Externally Controlled Overlay Fields. The Interactive Overlay cannot modify the contents of the externally controlled overlay, nor can the commands of the externally controlled overlay access the Fields on the Interactive Overlay. The Fields of the two overlays are independent.

The current version of WYSIWYG Interactive Overlay configures Overlay Fields (Text, Images, and Graphics) only. It does not provide control of other aspects of the DX-4400 such as the operating mode, PiP, zoom, and Savesets. For these functions, the external control commands in section 4.3 must be used.

The settings for the WYSIWYG Interactive Overlay are stored in the same database used for all other aspects of the DX-4400 configuration. Settings of the Interactive Overlay are always loaded and saved to the active Saveset. Refer to section 4.5 for information on Savesets. The Interactive Overlay always loads settings from the active Saveset at start-up. After that, the settings can be saved or reloaded from the database manually using the Setup Window. Interactive Overlay can also be configured to save automatically on exit, and to save automatically as changes are made.

6.1 Connecting a USB Mouse and Keyboard

The DX-4400 has a single USB OTG Port (identified as J4 on the printed circuit board). It is a USB OTG (On-the-Go) port that can function as either a host or device port. To attach a keyboard and/or mouse, the port must operate in Host mode. This requires a standard OTG Micro USB to USB Male-to-Female Cable Adapter. A suitable cable is supplied with the DX-4400 product (Microtronix item PN: 811-USN-OTG). The cable converts the USB Micro OTG port to a standard Type A socket. A keyboard, mouse, or hub can be connected to the Type A socket.

The DX-4400 requires an external USB Hub to connect both a mouse and keyboard simultaneously. It is possible to configure the overlay using only the keyboard and in that case the keyboard can be plugged directly into the Type A socket, however the addition of a mouse simplifies operations.

The USB port provides up to 500mA at 5V. A bus powered hub can be used and most such hubs will work with a keyboard and mouse attached. If other higher power devices will be attached to the hub then an externally powered hub may be required.

6.2 Editing with WYSIWYG Interactive Overlay

The WYSIWYG Interactive Overlay can be fully operated using the keyboard or using both a mouse and keyboard. When only a mouse is available, it is not possible to edit text strings on the overlay, but most other configuration options are available.

6.2.1 Mouse Cursor Visibility

The mouse cursor can be turned on and off. The cursor should be on during data entry or editing of the Overlay and can be turned off after configuration is complete so that it does not appear on the video. When the mouse cursor is visible, other editing features are also enabled: The selected Overlay Field displays with a rectangular frame around it to indicate it has the keyboard focus, and a blurred rectangular frame appears around the Overlay Field under the mouse cursor to indicate what would be selected if the mouse is clicked. These selection frames only appear while the cursor is visible.

The cursor always becomes visible when a menu or window of the editing interface is open but will turn off again when the editing interface is closed unless **Cursor Always Visible** is set. The cursor can be set always visible in the following ways:

1) The **Cursor Always Visible** setting can be toggled on/off using Ctrl+M on the keyboard. In the Dual Text Inserter modes, the mouse moves across the overlays for both SDI outputs and may not be visible on the monitor being viewed. If the cursor is not on screen, try moving the mouse to position it on the monitor. Alternatively, pressing Ctrl+1 on the keyboard will select the overlay for SDI output 1 and move the cursor to the center of that screen. Pressing Ctrl+2 will select the overlay for SDI output 2 and move the cursor (in the Dual Text Inserter modes only).
2) The **Cursor always visible** setting can be turned on/off using the main menu. The main menu can be opened by pressing Ctrl+W on the keyboard. The menu can also be opened by right clicking. If an empty spot on the screen is right clicked the main menu opens and the **Cursor Always Visible** item can be selected. If an overlay field is clicked, the context menu of the overlay is displayed first. In that case, select **Main Window Menu** to open the main menu. A check mark is displayed beside **Cursor Always Visible** in the menu if the setting is enabled.

6.2.2 Adding Fields with WYSIWYG Interactive Overlay

Each item on the overlay is referred to as an overlay Field. Each Field has a context menu and can be controlled using the mouse and keyboard. Fields can be added from the main menu and deleted from their own context menu.

The Interactive Overlay supports the following types of Fields:

- Text Field - Displays a line of text
- Image Field - Displays a PNG, JPG, or BMP image from file
- Time Field - Displays the system clock date or time in configurable formats
- Data Field - Displays data received from a serial device
- Shape Field - Displays a line, rectangle or ellipse
- GPS Field - Displays parameters from an optional GPS receiver
- QML Field - Executes and displays a QML (Qt Modeling Language) file

To add a new Field, open the main menu by pressing Ctrl+W, or right clicking on an empty location on the screen. The menu can also be opened by opening the context menu of an existing Field, and then selecting **Main Window Menu**. The main menu offers a choice of Field types that can be added.

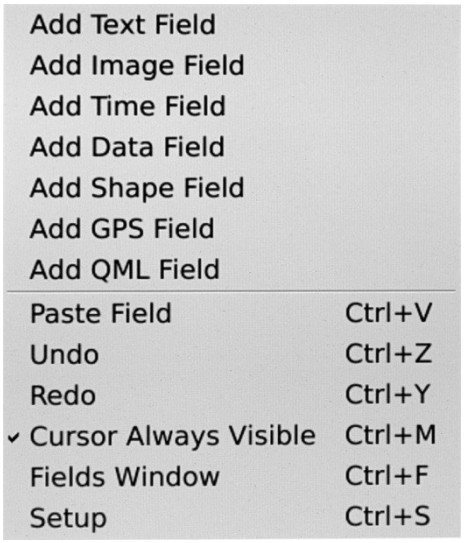

Figure 46: Interactive Overlay – Main Menu

6.2.2.1 Text Fields

Text Fields display a single line of text. When first created the text is set to "Default Text".

The context menu of a Text Field is shown below.

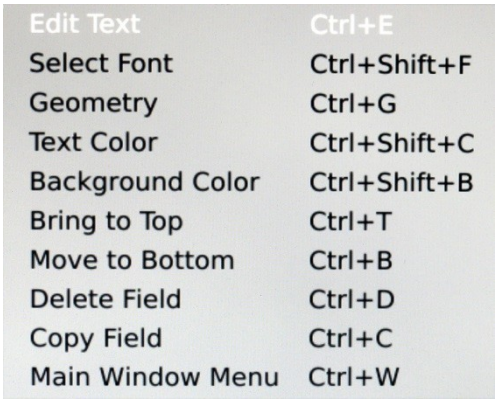

Figure 47: Interactive Overlay – Text Field Context Menu

To set the text, open the Edit Text window from the menu or use the Ctrl+E shortcut while the Field has the keyboard focus (has the solid frame around it). Pressing the Apply button (or using its shortcut Shift+Enter) will update the text immediately. Once the text has been updated, the change cannot be cancelled.

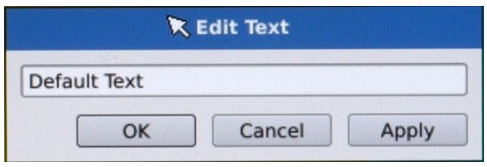

Figure 48: Interactive Overlay – Edit Text Window

The height of a text field is always determined automatically from the font. The width can be set in three ways: The width can be changed by dragging the size grip in the bottom right corner of the Field, from the Geometry Window, or from the Font Window (by changing the point size).

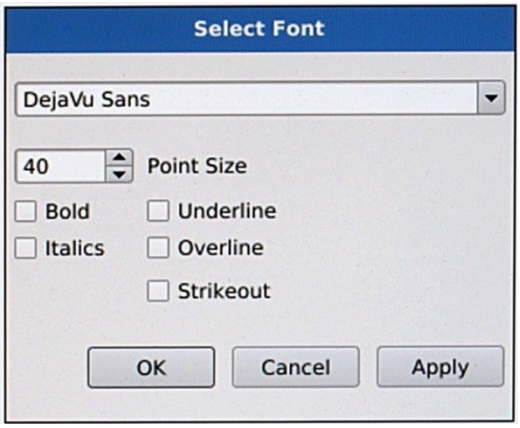

Figure 49: Select Font Window

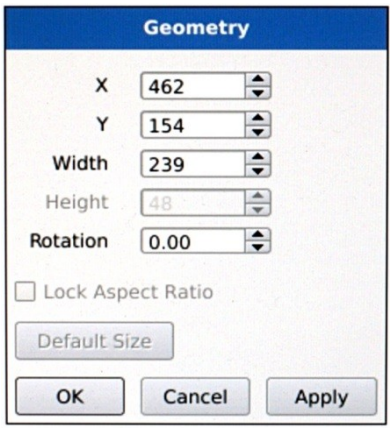

Figure 50: Text Geometry Window

Text Fields can be moved by dragging then with the mouse, or by opening the Geometry window and changing the X and Y coordinates.

The context menu also has items to select the text color and background color. The color includes a Transparency that ranges from 0 (fully opaque) to 255 (fully transparent).

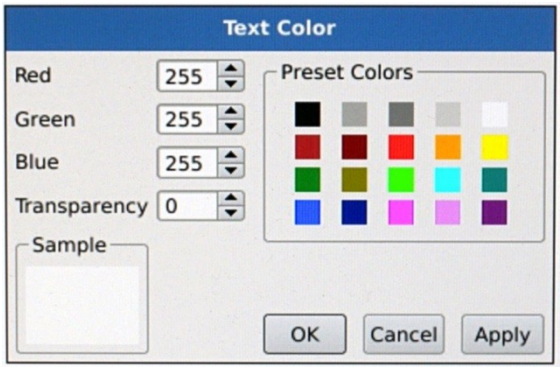

Figure 51: Text Color Window of a Text Field

6.2.2.2 *Image Fields*

Image fields display an image from a file in the DX-4400 file system. The default file location is /usr/local/graphics. It is the same default location for image files used by the text command overlay.

A new Image Field and its context menu are shown below:

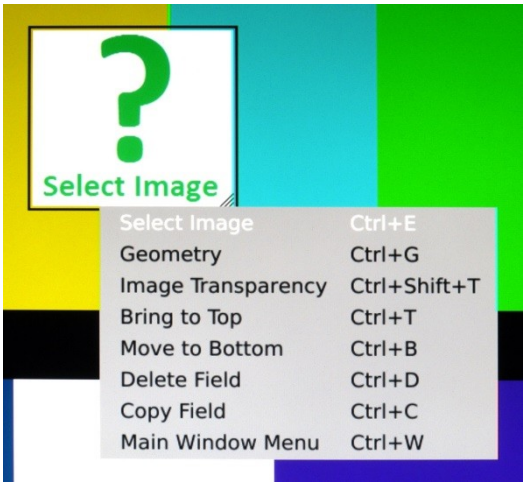

Figure 52: A New Image Field and Context Menu

The question mark graphic is displayed until the Select Image window is used to select a file for display.

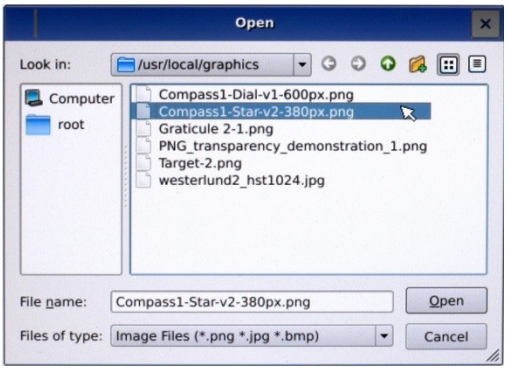

Figure 53: Select Image Window

Image Fields can be resized using the Geometry window or by using the mouse to move the size grip.

PNG images with an alpha layer are supported. An additional amount of transparency can be added to the entire image using the Image Transparency window.

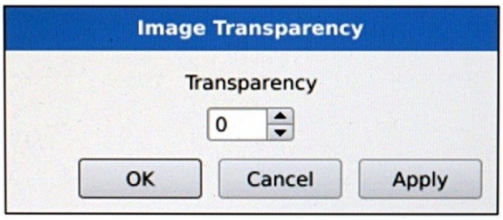

Figure 54: Image Transparency Window

6.2.2.3 Shape Fields

Shape Fields can be configured to display a line, ellipse, or rectangle, or rounded rectangle. The default shape is a white rectangle with transparent fill color.

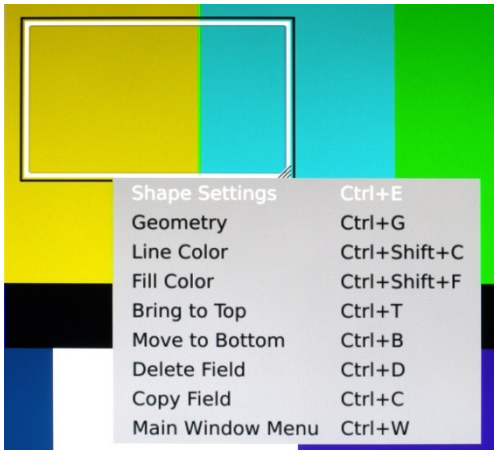

Figure 55: New Shape Field and Context Menu

The Shape Settings window selects the type of shape and other options. For any shape the default line style is solid. Four other styles can be selected (dot, dash, dash-dot and dash-dot-dot). For Rectangles only, the Corner Style option is available. Rounding Width is specified for Rounded Rectangles only.

The **Rounded line ends** option is applicable to Lines only and draws a line end instead of the default square end.

The option **Mouse changes aspect ratio** allows the mouse to change the width and height separately when sizing the shape using the size grip. When this option is not checked, the width and height can only change in proportion to each other. Changing the aspect ratio is only possible when the shape is not rotated. For rotated shapes, sizing with the mouse will always maintain the same aspect ratio regardless of this option.

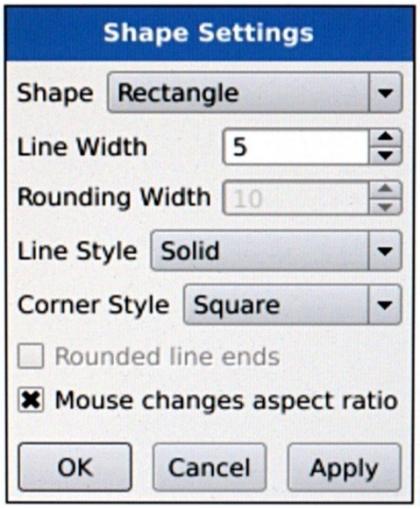

Figure 56: Shape Settings Window

All shapes have a line color that can be set with the Line Color option on the context menu. All shapes except Lines also have a fill color. Setting the fill color when the shape is a line has no effect.

6.2.2.4 Time Fields

Time Fields are similar to Text Fields but display a time and / or date from the DX-4400 system clock instead of a fixed text string. The output format is set by a format string that can include both regular text characters and codes beginning with the '%' symbol that are replace with the current time and date.

The display format is edited with the Edit Time Format window. The window allows the format string to be edited directly and shows a sample of the out output. Preconfigured formats can also be selected from a list for either

local time or UTC time. When a pre-set format is selected, the corresponding format string is inserted into the edit window.

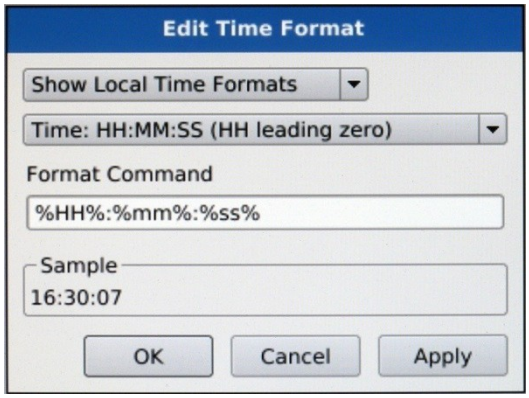

Figure 57: Edit Time Format Window

The following table lists the time and date codes that can be used in the format string.

Table 29: Time and Date Format Codes

Data Code	Description
insert u after the leading % in the following commands to reference UTC time instead of local time	
%yyyy%	four digit year
%yy%	two digit year
%MMMM%	Long month name, for example "November"
%MMM%	Short month name, for example "Nov"
%MM%	Two digit month number
%dddd%	Long day of week name, for example "Monday"
%ddd%	Short day of week, for example "Mon"
%hh%	Hours as two digits in 12 hour format
%HH%	Hours as two digits in 24 hour format
%h%	Hours as two characters in 12 hour format. Leading 0 is replaced with a space
%H%	Hours as two characters in 24 hour format. Leading 0 is replaced with a space
%mm%	Minutes as two digits
%ss%	Seconds as two digits
%ap%	either "am" or "pm"
%zzz%	milliseconds as three digits
%zz%	hundredths of a second as two digits
%z%	tenths of a seconds as 1 digit

6.2.2.5 Data Fields

Data Fields are similar to Text Fields but display an item of data received from a serial port instead of a fixed text string. The serial data source is expected to be organized into packets of data that have a start of packet character or characters, followed by some number of delimited data items, and ending with an end of packet

character or characters. A maximum of 64 data items can be captured per packet. Data items are identified by their position in the packet, which is a number from 1 to 64.

The data to display in the Overlay Field is configured using the Select Data window shown in Figure 58: Select Data Source Window. The Data Source box allows selection of one of the eight sources available in the Interactive Overlay. The button to the right opens the Configure Data Source window for the selected source. The data source typically needs to be configured before any data will be available. The Data Item box contains a list of numbered data item, and, if data is being detected, a sample of the data in that position.

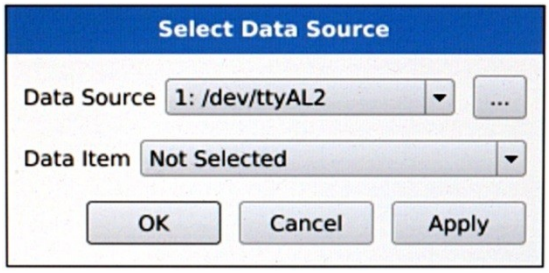

Figure 58: Select Data Source Window

6.2.2.5.1 Data Source Window

The Configure Data Source window is shown in Figure 59: Configure Data Source Window below.

The **port** box contains the Linux path to the serial port device.

Note: ***Do not configure more than one Data Source to use the same Linux device because data is likely to be lost or corrupted. Similarly, do not attempt to connect to a GPS serial device that is being used by the Linux system.***

Table 30: Standard Serial Ports lists the built-in serial ports that can be used as data input ports to the Linux OS. Additional ports can be added by connecting USB serial devices to the system using an external hub.

Table 30: Standard Serial Ports

Port Path	Description
Note: Port names are case sensitive. Use the forward slash character in path names.	
/dev/ttyAL1	This port is located on the pins 2 & 3 of the DX-4400 DB9 connector. The port can be used for multiple other purposes in the DX-4400. 1) It can function as an RS232 control port for the DX-4400 (See 5.3.1). 2) It can be used a GPS device input used to synchronize the system clock with GPS time and make GPS data available to the overlay. When the port has not been configured for either of these purposes, it is available as a general-purpose data input for Interactive Overlay. More information about the DB9 connector can be found in A.1.2
/dev/ttyAL2	This port is located on the pins 7 & 8 of the DX-4400 DB9 connector. This port may be configured as a GPS input port for the DX-4400 system. When it is not used for that purpose, it is available as general purpose data input for Interactive Overlay. More information about the DB9 connector can be found in A.1.2

Port Path	Description
/dev/ttyS1	This port is located on pins 4 & 5 of internal connector J5. See Table 42: RS-232 Serial Console Port, J5. This port may be used as a data input port in OEM board applications.

The **Start of Packet** box contains the character or string that indicates the start of a new packet. Characters can be entered as text, as one of the serial control codes shown in Table 31: Serial Control Character Codes, or in the format <0xdd> where dd is the hexadecimal character code from 00 to FF.

The **End of Packet** box contains the character or characters that mark the end of a data packet. If this box is empty, end of packet can still be detected by the data timeout.

The **Separator** box contains the character or character string that separates one data item from the next within the packet.

Data Timeout is a length of time when no data is received, and the current packet is considered to have ended.

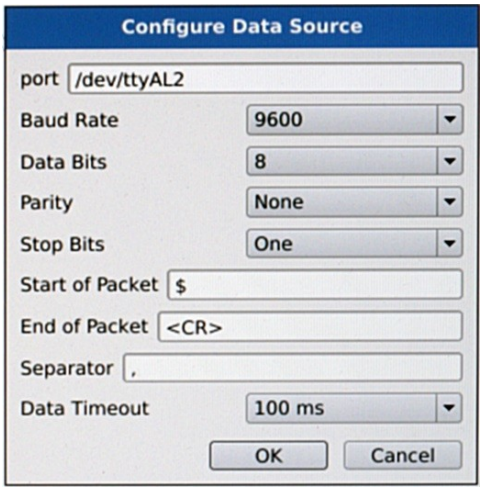

Figure 59: Configure Data Source Window

Table 31: Serial Control Character Codes

Code	Hex Value	Name
<SOH>	0x01	Start of Heading
<STX>	0x02	Start of Text
<ETX>	0x03	End of Text
<EOT>	0x04	End of Transmission
<ENQ>	0x05	Enquiry
<ACK>	0x06	Acknowledgement
<BEL>	0x07	Bell
<BS>	0x08	Backspace
<HT>	0x09	Horizontal Tab
<LF>	0x0A	Line Feed
<VT>	0x0B	Vertical Tab
<FF>	0x0C	Form Feed
<CR>	0x0D	Carriage Return

Code	Hex Value	Name
<SO>	0x0E	Shift Out
<SI>	0x0F	Shift In
<DLE>	0x10	Data Link Escape
<DC1>	0x11	Device Control 1
<DC2>	0x12	Device Control 2
<DC3>	0x13	Device Control 3
<DC4>	0x14	Device Control 4
<NAQ>	0x15	Not Acknowledged
<SYN>	0x16	Synchronous Idle
<ETB>	0x17	End of Transmission Block
<CAN>	0x18	Cancel
<EM>	0x19	End of Medium
<SUB>	0x1A	Substitute
<ESC>	0x1B	Escape
<FS>	0x1C	File Separator
<GS>	0x1D	Group Separator
<RS>	0x1E	Record Separator
<US>	0x1F	Unit Separator
<DEL>	0x7F	Delete

6.2.2.6 GPS Fields

GPS Fields display data from an optional GPS receiver connected to the DB9 RS232 connector of the DX-4400. For information on connecting a GPS to the DX-4400, refer to 3.11: GPS Configuration. When GPS support is not enabled on the DX-4400, no data will be available to display in GPS Fields.

The data to display is specified by a format command that may contain a mixture of text and special codes that are replaced with GPS data. The supported codes are listed in Table 32: GPS Data Format Codes.

Note that the only time related code is the time of the last GPS update. The DX-4400 uses the GPS to synchronize the system clock with GPS time. To display the current date or time, use a Time Field instead of a GPS Field.

For example the format command:

Latitude = %lat%

Displays on the overlay as:

Latitude = 42.961322

GPS Receivers are typically configurable with either RS232 commands or software supplied by the manufacturer. The availability of the different data items is dependent on what messages the GPS receiver is configured to transmit. The DX-4400 does not configure the GPS receiver. Follow the manufactures instructions to setup the receiver.

To setup the data and display format, open the fields context menu and select **Edit Data Format**. The window is shown in the figure below. The window allows the format command to be edited directly on the edit line, or a preset can be chosen from the drop down list. When the format command is changed so it does not match a preset, 'Custom' will be displayed in the preset list.

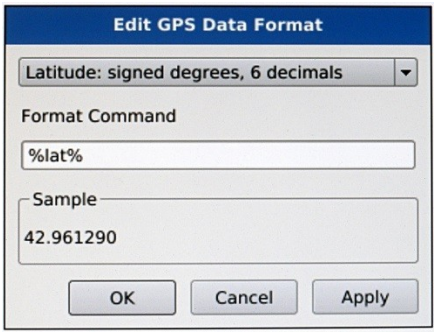

Figure 60: Edit GPS Data Format Window

Table 32: GPS Data Format Codes

Data Code	Description
Longitude	
%lon%	Longitude displayed as signed degrees with 6 decimals
%lon4%	Longitude displayed as signed degrees with 4 decimals
%lon.%	Fractional part of the longitude as 6 digits without the decimal '.' character
%lon.4%	Fractional part of the longitude as 4 digits without the decimal '.' character
%lonDD%	Degrees as an integer with no sign
%lonS%	Sign of the longitude, either '+' or '-'
%lons%	Sign of the longitude, either ' ' or '-'
%lonD%	Direction of the longitude, either 'E' or 'W'
%lonMM%	Minutes of longitude as an integer
%lonMM.%	Fractional part of minutes of longitude as 4 digits without the decimal '.' character
%lonSS%	Seconds of longitude as an integer
%lonSS.%	Fractional part of seconds of longitude as 2 digits without the decimal '.' character
Latitude	
%lat%	Latitude displayed as signed degrees with 6 decimals
%lat4%	Latitude displayed as signed degrees with 4 decimals
%lat.%	Fractional part of the latitude as 6 digits without the decimal '.' character
%lat.4%	Fractional part of the latitude as 4 digits without the decimal '.' character
%latDD%	Degrees as an integer with no sign
%latS%	Sign of the latitude, either '+' or '-'
%lats%	Sign of the latitude, either ' ' or '-'
%latD%	Direction of the latitude, either 'E' or 'W'
%latMM%	Minutes of latitude as an integer
%latMM.%	Fractional part of minutes of latitude as 4 digits without the decimal '.' character
%latSS%	Seconds of latitude as an integer
%latSS.%	Fractional part of seconds of latitude as 2 digits without the decimal '.' character
Other Parameters	
%spd%	Speed in m/s as an integer

Data Code	Description
%spd1%	Speed in m/s with 1 decimal
%spdkn%	Speed in knots as an integer
%spdkn1%	Speed in knots with 1 decimal
%spdkph%	Speed in km/h as an integer
%spdkph1%	Speed in km/h with 1 decimal
%alt%	Altitude in meters
%altft%	Altitude in feet
%trk%	Course relative to true north in degrees
%trk1%	Course relative to true north in degrees with 1 decimal
%clm%	Climb (m/s). This parameter may not be available for all GPS receivers
%fix%	The type of fix reported by the GPS. May be "2D", "3D", or "None"
%tou%	Time of last update for example "Thu May 21 12:46:40 2020"
%sav%	Number of satellites visible
%sau%	Number of satellites used in the fix

6.2.2.7 QML Fields

QML Fields execute a file containing QML language statements and display the visual content that is generated. QML files can display images and generate complex static or animated graphics. The DX-4400 includes a GPS component for QML that makes data from the optional GPS available to QML code, see Appendix E: Microtronix QML Libraries. Custom QML code can provide more control of the GPS data display than is possible using a GPS Field.

When a new QML Field is created, a place holder is displayed containing a question mark character. Open the context menu of the field and **Select QML File** to choose the command file.

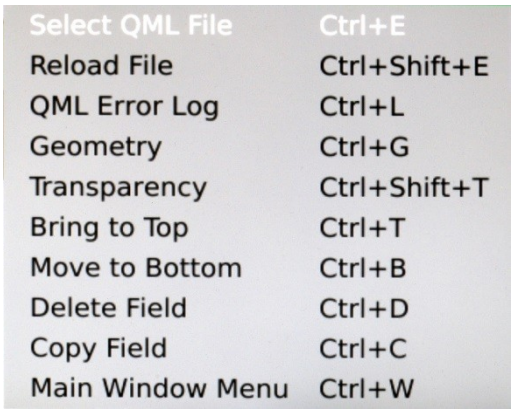

Figure 61: QML Field Context Menu

The QML Field initially has the size specified in the QML code, but can be scaled with either mouse or the **Geometry** window. It is also possible to add an overall amount of transparency using the **Transparency** window found on the context menu.

QML files cannot be edited from within the Interactive Overlay software. The DX-4400 web UI can be used to edit the files. WinSCP also provides a convenient method of editing QML files from a Windows PC. Some knowledge of the QML language is required to edit the files.

Once a file has been selected, it can be reloaded from the context menu of the field, or with the Ctrl+Shift+E key combination. Reloading a file is useful to apply the changes made by editing the QML file.

If the QML code contains errors the Field may appear empty. A list of errors can be displayed from the context menu or by using the Ctrl+L key combination. Edit the QML file to correct the problems reported.

The DX-4400 supports QtQuick versions 1.0 and 1.1.

6.2.3 Editing Fields

Overlay Fields can be selected by clicking them with the mouse or using the Tab or Shift+Tab keys to cycle through the Fields. In addition to toggling through the Fields, these key sequences also include selection of the main overlay window. To assist in editing, the selected Field is shown with a rectangular outline any time the mouse cursor is visible.

Right clicking a Field with the mouse or pressing enter on the keyboard while a Field is selected opens the context menu. The menu will appear near the Field but is always positioned to be on the visible screen area. The context menu of the Overlay Field varies depending on the type of field, but some items are common to all types of fields.

6.2.3.1 Blending Order

Overlay Fields have a layer order that determines how overlapping Fields are blended. The order can be changed from the context menu using the **Bring to Top** (Ctrl+T) and **Move to Bottom** (Ctrl+B) options. These options change the order of the fields in the Interactive Overlay only. Any Field in Interactive Overlay will always be on top of any Field that might be defined in the text command overlay, and both overlays are blended on top of the SDI video.

When selecting Fields with the mouse, only the top item in any screen location can be selected. To select a Field that is under another Field, select the higher field first and move it aside, or move it to the bottom so the other Field can be selected. Alternatively, the WYSIWYG Overlay Fields Window can be used to select the Field and activate its context menu, or use the tab key to the select the Field and the keyboard to open the context menu and make changes.

6.2.3.2 Adjusting Size and Position

Fields can be dragged with the mouse by holding the left button, and can be sized by moving the size grip in the bottom right corner. Fields can be positioned partly or fully off the visible screen area. A Field that is completely off screen cannot be selected with the mouse, but will still appear in the Tab keyboard sequence. The WYSIWYG Overlay Fields Window can also be used to select and move Fields positioned off the visible screen area.

When an Overlay Field is selected, it can be moved in 1 pixel increments with the arrow keys, allowing fine adjustment of the position. For adjustment in 10 pixel steps, the Shift key can be combined with the arrows, and for 100 pixel steps, Shift+Alt can be combined with the arrow keys.

All Field types have a Geometry option on the context menu that has options for setting the position and size of the Field.

6.2.3.3 Copy, Paste, Undo and Redo

Overlay Fields can be copied from the context menu or using the Ctrl+C keyboard shortcut. Ctrl+V can then paste copies of the selected Field. In Dual Text Inserter mode, a copied Overlay Field can be pasted to its own overlay window, or to the other window. Selection of more than one Field at a time is not supported.

Undo and **Redo** editing functions are available for Overlay Fields. These functions can be selected from the main menu, or by using the keyboard shortcuts Ctrl+Z and Ctrl+Y. They are useful for correcting editing mistakes. Only changes to Overlay Fields and their settings are affected by these functions. They do not affect changes made to program settings, for example those on the setup menu, or data source configurations. In Dual Text Inserter

mode, each Overlay has a separate undo history. If changes are undone, and then subsequent new changes are made from that point, it is no longer possible to redo the changes.

6.2.3.4 Editing in Dual Text Inserter Modes

When the DX-4400 operates in one of the Dual Text Inserter modes there are two independent overlay windows. In all other modes there is only one overlay. Each overlay operates and mouse cursor can be moved between them. The second overlay (for SDI output #2) is positioned to the right of the first overlay with respect to mouse movement. Each overlay is an independent screen and Fields always belong to the overlay in which they were created. Positioning a Field off the right edge of the first overlay will not cause it to appear on the second overlay.

6.2.3.5 Keyboard Shortcuts

The following keyboard shortcuts are generally available for editing the overlay. Some of these may be temporarily disabled, for example while editing a text or numeric value, or, while a modal window is open.

Table 33: Keyboard Shortcuts

Key	Function
Ctrl+M	Toggle the mouse cursor visibility on/off
Ctrl+1	Select the SDI output 1 overlay for keyboard focus and move the mouse cursor to the center of the screen.
Ctrl+2	Select the SDI output 2 overlay and move the mouse cursor to the center of the screen.
Ctrl+F	Open the Fields window.
Ctrl+Q	Close all open windows.
Ctrl+S	Open the Setup window.
Ctrl+V	Paste a previously copied field.
Ctr+Y	Redo change(s) to the Overlay Fields
Ctrl+Z	Undo change(s) to the Overlay Fields
Tab	If an Overlay Field has the focus: Select the next Overlay Field. If a has the focus: Select the next control on the window.
Shift+Tab	If an Overlay Field has the focus: Select the previous Overlay Field If a window is in focus: Select the previous control on the window
Ctrl+Tab	If a non modal window (ie the Fields Window) has the focus: Return focus to the main window
Ctrl+⇦ Ctrl+⇨ Ctrl+⇧ Ctrl+⇩	If a Window has the focus: Move the window in the direction indicated. If combined with Shift, then move the window by 10 pixels. If combined with Shift+Alt then move 100 pixels.
Enter	If the main window has focus: Opens the main menu
space	On many controls, pressing space will enter edit mode for the selected control, or toggle a check box
Ctrl+A	Select all content while editing a numeric or text data field.

The following keyboard shortcuts can be used when a Field is selected:

Table 34: Keyboard Shortcuts for Overlay Fields

Key	Function
⇦ ⇨ ⇧ ⇩	Arrow keys move the selected Overlay Field one pixel in the indicated direction. If combined with Shift then move the field 10 pixels in the indicated direcrtion. If combined with Shift+Alt then move 100 pixels.
Enter	Opens the context menu of the field.
Ctrl+T	Move the field to the Top of the layer stack so that it is in front of all other Overlay Fields
Ctrl+B	Move the field to the Bottom of the layer stack so that it is in behind all other Overlay Fields
Ctrl+D	Delete the Field
Ctrl+C	Copy the Field to the clipboard.
Ctrl+G	Open Geometry window
Ctrl+E	Open the main edit window of the Field.
Ctrl+Shift+F	Open Font window (Text, Time, Data Fields, GPS)
Ctrl+Shift+C	Open Text / Line Color window (All types except Image & QML Fields)
Ctrl+Shift+B	Open Background/Fill Color window (All types except Image & QML Fields)
Ctrl+Shift+T	Open Transparency window (Image & QML Fields Only)

6.3 WYSIWYG Overlay Fields Window

The Overlay Fields Window shows a table that lists all Overlay Fields on the selected overlay. For the Dual Text Inserter modes each video output has an independent Fields Window. The Overlay Fields window is not modal and updates in real time as Overlay Fields are edited.

The Field Window is useful for determining what Fields exist in the overlay, for accessing Fields that are under other Fields, accessing Fields that are off screen and accessing Fields that have been made too small to select with the mouse.

An example of the Overlay Fields Window is shown in Figure 62: Overlay Fields Window.

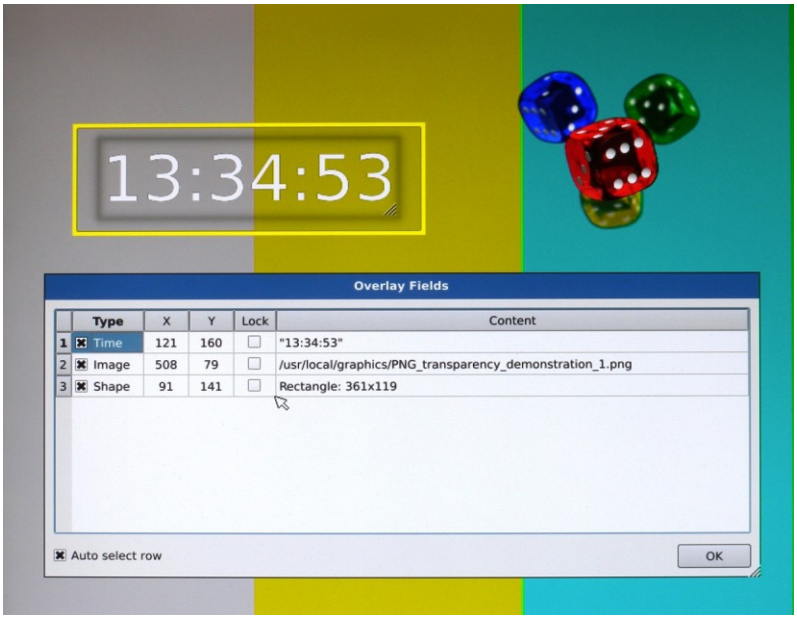

Figure 62: Overlay Fields Window

Each row in the table represents a different Overlay Field. Fields are displayed in their layer blending order in the overlay. The field in row 1 is blended on top of all other Interactive Overlay Fields.

The **Type** column identifies the type of Field. The checkbox indicates if the field is enabled for display. Select the *Type* column and press space or F2 to toggle the check box with the keyboard or click the check box with the mouse. Disabled Overlay Fields are not visible on the overlay and cannot be selected with the mouse or Tab key. They can only be accessed from the Fields Window.

The **X** and **Y** columns show the current position of the Field. The position can be edited directly from the Fields Window by selecting the column with the keyboard and pressing space or F2 to enter edit mode, or by double left clicking the column with the mouse. Changes to position take effect when edit mode completes by pressing Enter, clicking to a different cell, etc.…

The checkbox in the **Lock** column indicates the field is not selectable with the mouse or keyboard and can only be edited from the Fields Window. Locked Overlay Fields are transparent to mouse clicks, allowing items under them to be edited.

The **Content** column provides a description of the fields. The format of the description depends on the type of Overlay Fields and could be a filename, the text string that is displayed, or a brief description of a shape. This column cannot be edited.

From the Field Window, the context menu of the selected Overlay Field can be opened by either pressing M on the keyboard, or by right clicking on the row. The menu will open on the screen near the object position, but will be adjusted to always be on screen. Opening the context menu does not change the focus to the Overlay Field. Focus will return to the Fields Window when the menu is closed.

Pressing S on the keyboard will switch the focus to the selected Overlay Field the Field is enabled and not locked.

When row is selected in the table, the blurred selection frame automatically appears around the corresponding field to highlight its location. Note that it's possible to have more than one field showing the blurred selection frame at the same time because both the mouse and the Fields Window can display the blurred selection frame.

The checkbox **Auto select row** enables automatic selecting of the corresponding row in the table when a Field in the overlay is clicked with the mouse.

Table 35: Overlay Fields Window Keyboard Shortcuts

Key	Function
Tab	Select the next control on the panel
Shift+Tab	Select the previous control on the panel
Ctrl+Tab	Return focus to the main window
Ctrl+F	Open the Fields Window or give the Fields Window focus if it is already open
⇦ ⇨ ⇧ ⇩	Arrow keys navigate through the rows and columns of the table.
Ctrl+⇦ Ctrl+⇨ Ctrl+⇧ Ctrl+⇩	Move the window in the direction indicated. If combined with Shift, then move the window by 10 pixels. If combined with Shift+Alt then move 100 pixels.
Ctrl+Home Ctrl+End	Increase or decrease the width of the window.
Ctrl+PgUp Ctrl+PgDn	Increae or decrease the height of the window.
Enter	End editting an item in the table, or select the Enter button to close the window.
Esc	Close the Fields Window
Ctrl+Enter	Close the Fields Window
space or F2	Toggle a check box, or if the X or Y table column is selected, enter edit mode.
S	Switch focus from the Fields Window to the Overlay Field selected in the table.
M	Open the context menu of the Overlay Field selected in the table. Keyboard focus returns to the Fields Window when the menu closes.
Ctrl+A	Select the contents of the X or Y columns while editing the cell.
space or F2	Toggle a check box, or if the X or Y table column is selected, enter edit mode.
S	Switch focus from the Fields Window to the Overlay Field selected in the table.
M	Open the context menu of the Overlay Field selected in the table. Keyboard focus returns to the Fields Window when the menu closes.
Ctrl+A	Select the contents of the X or Y columns while editing the cell.

6.4 Interactive Overlay – Setup Window

The Interactive Overlay – Setup Window can be opened by pressing Ctrl+S on the keyboard, or by selecting **Setup** from the main window menu.

Figure 63: Setup Window

The Settings Window includes:

- A **Save Settings** button to save the current overlay configuration to the active Saveset. Depending on the other settings on this panel, Interactive Overlay may or may not save changes automatically. If the unit is shuts down without saving the configuration, any changes will be lost. This button is disabled if the current save set is configured for In-memory database. No changes can be made to the database when it is set in this mode.
- A **Load Settings** button to reload the configuration from the active Saveset. Any changes that were not saved will be lost. When the Auto Save Changes option is off, this button can be used to restore the saved configuration and discard unwanted changes. The **Save on Exit** option will not cause a save when this button is pressed.
- A **Clear Fields** button to delete all overlay Fields.
- An **Exit** button to close the Interactive Overlay software. Unless the **Save on Exit** or **Auto Save Changes** option is checked, any changes that have not been manually saved will be lost. Interactive Overlay automatically restarts when the DX-4400 is restarted.
- An **About** button that shows the software version and DX-4400 system information. This panel also lists the active Saveset, and if it is an "In Memory" Saveset, that is also indicated.
- A **Save on Exit** checkbox to automatically save the configuration to the database when shutting down the Interactive Overlay. Note that Interactive Overlay shuts down and restarts when the video resolutions are changed, and when the **Exit** button is pressed. Any unsaved changes would be lost at that time if both this box and **Auto Save Changes** are unchecked. This box is disabled when an In-memory database is selected because settings cannot be saved.
- An **Auto Save Changes** checkbox to automatically save changes as they are made. When this function is enabled changes don't need to be saved manually, but since changes are committed to the database immediately, you will no longer have the option of using **Load Settings** to discard unwanted changes. This box is disabled when an In-memory database is selected. For complex overlays with many Fields, enabling this option may make editing noticeably slower because of the time required to update the database on the SD card.
- A **Cursor Visible at Start** checkbox to make the cursor visible when settings are loaded. The menu setting **Cursor Always Visible** is not saved in the database because during editing, the cursor is typically turned on, and therefor would be saved in the database as visible, while in normal overlay operation the cursor is usually not wanted. This separate setting **Cursor Visible at Start** is provided to automatically enable the cursor in cases where cursor visibility is required. This box is disabled when an In-memory database is selected and the setting cannot be changed, but if it was checked prior to setting the database as in-memory then the setting will still apply.

7 IP Core Firmware

The ***DX-4400 – SD/HD/2K/4K-SDI Text & Graphic Overlay Inserter product*** uses IP Core firmware to control, manage/detect the SDI video streams (SD/HD/2K/4K etc) and blend the user overlay data (generated by the ARM SoC in the video buffers) onto the SDI video output ports. For example, the product mode/features; **Dual TI**, **PiP TI** and **4K TI** are each different IP Core firmware versions which are loaded on startup from the microSD card.

7.1 IP Core Firmware Files

The IP Core Firmware files are stored in the **/usr/local/fpga** directory on the microSD-Card.

Note: To see the files requires the use of a terminal emulator program (i.e PuTTY) to establish an SSH Connection to <IP address> and be logged into the Linux OS as the root user.

The current versions of the IP Core Firmware files are displayed using the Linux **list** command. For example:

```
ls /usr/local/fpga
```

The IP Core files issued in the DX-4400 product include:

```
4K_TI_1v29_2018_0109.rbf
Dual_TI_1v30_2018_0228.rbf
Dual_TI-Zoom_1v01_2018_0411.rbf
LowLatency_4K_TI_1v01_2018_0328.rbf
LowLatency_Dual_TI_1v02_2018_0403.rbf
PIP_TI_1v33_2018_0723.rbf
```

Notes:

1) *The version and revision dates of the IP Core files may be different from the above listing.*
4) The file named **fpgaload.rbf** is a symbolic link to the IP Core file which the DX-4400 will boot with upon startup. This IP Core file selection is set using the Mode Command of Table 6: Set Mode Command Syntax.

7.1.1 IP Core Firmware Upgrades

Some DX-4400 product feature enhancements may require a new IP Core firmware revision necessitating that a new (or updated) IP Core file be installed into the **/usr/local/fpga** directory on the microSD card. To put the new IP Core Firmware files into the directory you can either copy them over Ethernet using a Secure File Copy program (**scp** or **WinSCP** for example) or alternately, copy them (as a root user) from a USB flash drive attached to the unit via the USB OTG Port. After installing new IP Core Firmware files you will need to use the command port and give the proper **SM** command to set the proper symbolic link for the **fpgaload.rbf** file.

Note: The Web UI can also be used to upload new Firmware. Refer to § 5 Using the Web UI for more information.

After IP Core Firmware upgrades you will end up with multiple versions of the files. This is ok since when you use the **SM** (set mode) command it will automatically select the newest file.

7.2 Firmware Licensing of 4K Features

The **DX-4400-TI-4K** version of the product is a firmware upgrade (from the base **DX-4400-TI-2K** product) and requires a **4K IP Core License File** to be installed to enable 4K video output. To evaluate 4K operation, you can request a temporary License that will allow the unit to run for one hour. To run it continuously, you can purchase the upgrade from Microtronix by contacting sales@microtronix.com.

The **PiP TI** and the **Dual TI** product features available on the **DX-4400-2K** do not require a IP Core License file to enable these features.

In order to obtain a License File you need to provide Microtronix with the ID number displayed when you issue the **RV** command. Microtronix (support@microtronix.com) will generate a License File and email it to you.

7.2.1 IP Core License Installation

You will need to install the file onto the DX-4400 in the **/usr/local/license** directory using a Secure Copy program for example **scp** or **WinSCP** . Or, you may alternately use the Web UI to install the License per § 5.7.3 System Configuration – Maintenance Page.

After the file is installed, you will need to create a symbolic link to it named **4K-license.txt** in the same directory using the following command from a terminal port connection:

```
ln -s <filename> 4K-license.txt
```

If you are using **WinSCP** to copy the file over, you can open a terminal window with **WinSCP** to create the symbolic link.

8 Extended Font Tables

8.1 Wingding Font

Table 36: Windings Character Table

Symbol	Char	Hex Value	Symbol	Char	Hex Value	Symbol	Char	Hex Value
	space	0020		@	0040		`	0060
	!	0021		A	0041		a	0061
	"	0022		B	0042		b	0062
	#	0023		C	0043		c	0063
	$	0024		D	0044		d	0064
	%	0025		E	0045		e	0065
	&	0026		F	0046		f	0066
	'	0027		G	0047		g	0067
	(	0028		H	0048		h	0068
	)	0029		I	0049		i	0069
	*	002A		J	004A		j	006A
	+	002B		K	004B		k	006B
	,	002C		L	004C		l	006C
	-	002D		M	004D		m	006D
	.	002E		N	004E		n	006E
	/	002F		O	004F		o	006F
	0	0030		P	0050		p	0070
	1	0031		Q	0051		q	0071
	2	0032		R	0052		r	0072
	3	0033		S	0053		s	0073
	4	0034		T	0054		t	0074
	5	0035		U	0055		u	0075
	6	0036		V	0056		v	0076
	7	0037		W	0057		w	0077
	8	0038		X	0058		x	0078
	9	0039		Y	0059		y	0079
	:	003A		Z	005A		z	007A
	;	003B		[	005B		{	007B
	<	003C		\	005C		|	007C
	=	003D		]	005D		}	007D
	>	003E		^	005E		~	007E
	?	003F		_	005F			

Table 37: Windings 2 Character Table

Symbol	Char	Hex Value	Symbol	Char	Hex Value	Symbol	Char	Hex Value
	space	0020		@	0040		`	0060
	!	0021		A	0041		a	0061
	"	0022		B	0042		b	0062
	#	0023		C	0043		c	0063
	$	0024		D	0044		d	0064
	%	0025		E	0045		e	0065
	&	0026		F	0046		f	0066
	'	0027		G	0047		g	0067
	(	0028		H	0048		h	0068
	)	0029		I	0049	⓪	i	0069
	*	002A		J	004A	①	j	006A
	+	002B		K	004B	②	k	006B
	,	002C		L	004C	③	l	006C
	-	002D		M	004D	④	m	006D
	.	002E		N	004E	⑤	n	006E
	/	002F	×	O	004F	⑥	o	006F
	0	0030	✓	P	0050	⑦	p	0070
	1	0031	☒	Q	0051	⑧	q	0071
	2	0032	☑	R	0052	⑨	r	0072
	3	0033	☒	S	0053	⑩	s	0073
	4	0034	☒	T	0054	⓿	t	0074
	5	0035	⊗	U	0055	❶	u	0075
	6	0036	⊗	V	0056	❷	v	0076
	7	0037	⊘	W	0057	❸	w	0077
	8	0038	⊘	X	0058	❹	x	0078
	9	0039		Y	0059	❺	y	0079
	:	003A	&	Z	005A	❻	z	007A
	;	003B	&	[	005B	❼	{	007B
	<	003C	&	\	005C	❽	|	007C
	=	003D		]	005D	❾	}	007D
	>	003E		^	005E	❿	~	007E
	?	003F		_	005F			

Table 38: Windings 3 Character Table

Symbol	Char	Hex Value	Symbol	Char	Hex Value	Symbol	Char	Hex Value
	space	0020		@	0040		`	0060
←	!	0021		A	0041		a	0061
→	"	0022		B	0042		b	0062
↑	#	0023		C	0043		c	0063
↓	$	0024		D	0044		d	0064
↖	%	0025		E	0045		e	0065
↗	&	0026		F	0046	←	f	0066
↙	'	0027		G	0047	→	g	0067
↘	(	0028		H	0048	↑	h	0068
↤	)	0029		I	0049	↓	i	0069
↦	*	002A		J	004A	↖	j	006A
↑	+	002B		K	004B	↗	k	006B
↓	,	002C		L	004C	↙	l	006C
↖	-	002D		M	004D	↘	m	006D
↘	.	002E		N	004E	↔	n	006E
↕	/	002F		O	004F	↕	o	006F
↕	0	0030		P	0050	▲	p	0070
↔	1	0031		Q	0051	▼	q	0071
↕	2	0032		R	0052	△	r	0072
⇠	3	0033		S	0053	▽	s	0073
⇢	4	0034		T	0054	◀	t	0074
⇡	5	0035		U	0055	▶	u	0075
⇣	6	0036		V	0056	◁	v	0076
↯	7	0037		W	0057	▷	w	0077
↵	8	0038		X	0058	◣	x	0078
↳	9	0039		Y	0059	◢	y	0079
↰	:	003A		Z	005A	◤	z	007A
↱	;	003B		[	005B	◥	{	007B
↰	<	003C		\	005C	◂	|	007C
↱	=	003D		]	005D	▸	}	007D
↳	>	003E		^	005E	▴	~	007E
↴	?	003F		_	005F			

8.2 Extended ASCII Fonts

Table 39: Extended ASCII Character Table

Symbol	Hex Value	Symbol	Hex Value	Symbol	Hex Value	Symbol	Hex Value
	00A0	¸	00B8	Đ	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

9 Troubleshooting

When troubleshooting make sure the Ethernet is connected.

Table 40: Troubleshooting Symptoms

Problem	Action
No power led	Check power adaptor is outputting 12 VDC. No Contact Microtronix about a power adaptor replacement. Yes Contact Microtronix about unit replacement or repair.
No SDI LEDs	Check if unit got a DHCP IP address. No Image a new microSD card and restart unit using new card. Yes If so, try to ssh to the unit and issue "dmesg | grep ttyAL". If four UARTs are not listed FPGA failed to load properly. Image a new SD card and restart unit using new card. If new card does not work contact Microtronix about unit replacement or repair.
No Command Prompt	Connect to unit using ssh and issue "ps | grep armoverlaycmd". There should be two lines output, the overlay process and the grep. If only grep is listed overlay process failed to start. Image a new SD card and restart unit using new card. If overlay process is running a TCP/IP connection to the unit and check for command prompt. No Image a new SD card and restart unit using new card. Yes Verify Serial cable is working. If Serial cable is working contact Microtronix.
No Overlay's	From command prompt issue VAEx replacing x with 1 or 2 for output being used. Make sure your overlay items do not have "V=N". Make sure the SDI monitor supports the resolution/frame rate being output.
No SDI Input Led	The SDI resolution/frame rate is not supported check the rates listed in section 1.1. The set output resolution/frame rate prevents the passing of the SDI video. For example, if the output is set to 1920x1080p60 no interlaced input is supported.

10 Product Warranty

10.1 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, contact Microtronix Technical Support (support@microtronix.com) 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.

10.2 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.

10.2.1 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: Description of the DX-4400 OEM Board

The DX-4400 – Dual-view 2x1 SDI Switcher Board is identified as PN: M6297-TI-xx, where xx is either 2K or 4K. The board shown in the following figure.

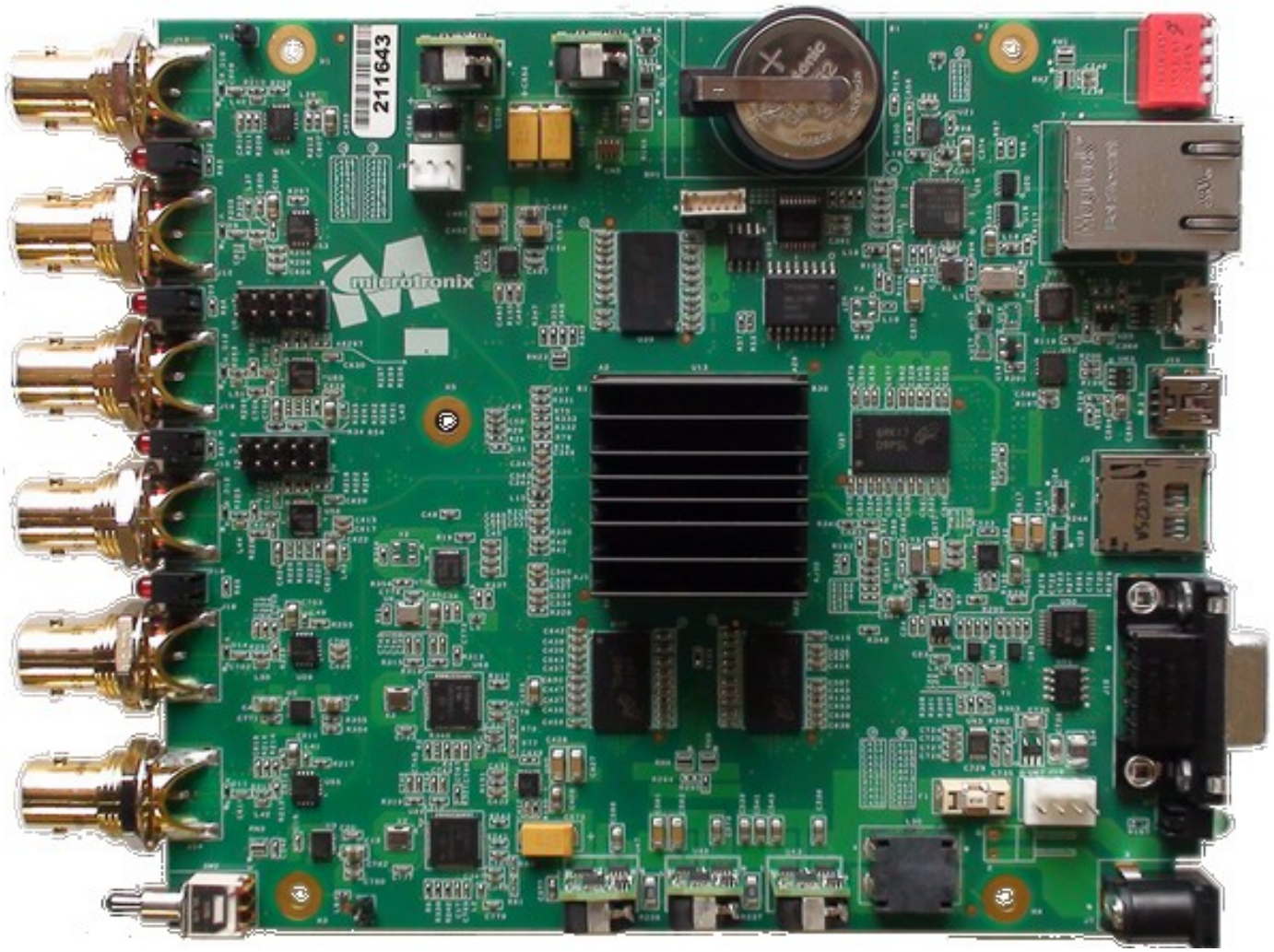

Figure 64: DX-4400 – SD/HD/2K/4K-SDI Text & Graphics Overlay Inserter OEM Board

A.1 DX-4400 OEM Board – Hardware Features

The DX-4400 – SD/HD/2K/4K-SDI Text & Graphic Overlay Inserter Board utilizes the following key hardware components:

- Intel/Altera Cyclone 5CSXFC6D6F31C6N ARM SoC FPGA
- SDRAM Memory: 512 MB (64-bit interface), 8 x Micro MT41J128M16, 128Mx16b DDR3
- Gennum GS2988 3G/HD/SD-SDI Cable Driver
- Gennum GS2993 3G/HD/SD-Cable Equalizer
- Silicon Labs SI5342A High-performance Low Jitter (Video) Clock Generator
- Microchip MCP79412 Real-time Clock/Calendar,

The following sections describe the product component hardware.

A.1.1 SDI Video Interfaces

The **DX-4400** supports two SD/HD/3G-SDI input and two SD/HD/3G-SDI output ports and two SD/HD/3G-SDI loop output ports which are a pass-through of the SDI inputs. These interfaces support SMTP 424M video formats. The SDI Outputs are reclocked through IP logic in the FPGA and run asynchronously to the video inputs.

A.1.2 DB9 RS-232 Control Port, J10

The DB9 RS-232 Control Port is the primary port used to control the text overlay. It is a DB9 female connector and defaults to 115,200 baud and 8,N,1 and no flow control. The pin assignments are provided in the following table.

Table 41: RS-232 Serial Control Port, DB9 Pin Assignments

Pin	Signal Direction	Signal Name
2	Output	Transmit Data (Port 1)
3	Input	Receive Data (Port 1)
8	Output	CTS (Port 2 Tx)
7	Input	RTS (Port 2 Rx)
5	-	Signal Ground

A.1.3 USB Serial Control Port, J11

The USB Serial Control Port is an RS-232 serial port which can also be used to control the text overlay. It is a USB mini-B connector and is set at 115,200 baud operation (8,N,1) and no flow control. The port interfaces to a PC with a standard USB 2.0 – A to Mini B (Male-Male) cable.

A.1.4 USB OTG Port, J4

The USB OTG (On-the-Go) Port can also be used to mount a USB flash drive to upload files to transfer to the SD Card. The port interfaces a standard OTG Micro USB to USB Male-to-Female Cable Adapter, (Microtronix item PN: 811-USN-OTG).

A.1.5 RS-232 Serial Console Port, J5

The RS-232 Serial Console Port is available on J5 if a user wishes to connect to the Linux operating system by logging in as a user to issue Linux operating system commands to the operating system for system level debugging or special configuration. The default Serial communication parameters are 115,200 baud, 8, N, 1. The Console Port does not require a user login to the Root Account.

J5 is a 6-pin 1.25mm header (Hirose Electric Co Ltd DF13-6P-1.25DSA(50) / Digi-Key part number H3309-ND). The mating connector is a Hirose Electric Co Ltd DF13-6S-1.25C available from Digi-Key as PN: H2183-ND. The pins assignments are listed in the table below.

Table 42: RS-232 Serial Console Port, J5

Pin	Signal Direction	Signal Name
1	Output	Console Port Transmit Data
2	Input	Console Port Receive Data
3	-	Signal Ground
4	Input	Additional Port Receive Data
5	Output	Additional Port Transmit Data
6	-	Signal Ground

A.1.6 10/100/1G Ethernet Port, J2

The Ethernet Port is an industry standard RJ45 10/100/1G Ethernet interface supporting auto-detection of 10/100/1000 Mbps Ethernet speeds. It is used for making a TCP/IP connection to the Command Port (DX-4400 IP address / port 2121) per § 4.1.2 Network Control Using Raw TC/IP or establishing a SSH IP connection to the Linux Root Account (DX-4400 IP address / port 22).

A.1.7 Power Requirements

The **DX-4400** board draws up to a maximum of 1.5A from a 12VDC 2.5A (120/240VAC) regulated power adapter using a 2-pin secure bayonet locking connector. The negative (ground) input is tied to the chassis frame ground.

A.1.8 12VDC Board Power Header, J7 & J8

For applications requiring board-to-board wire harness connection, header J8, can optionally be used for the DC power connection. It is a 2-pin, 0.100" (2.54mm) unshrouded header made by TE Connectivity AMP Connectors part number 640456-2, a straight header (Digi-Key A1921-ND) or alternately PN: 640455-2, a right-angle header (Digi-Key A19450-ND). The mating 2-pin connector made by TE Connectivity AMP Connectors is PN: 1375820 (Digi-Key A99613-ND) with a PN: 1375819-2 (Digi-Key A100454CT-ND) 22-26AWG crimp.

The pin assignments for the J8 power header are listed in the table below.

Table 43: 12VDC 2-Pin Header, J8

Pin	Assignment
1	Ground
2	+12VDC

Note: Pin 1 is marked on the silkscreen with a dot and on the board a square solder pad.

The alternate 12VDC power connector J7 is a standard 2.5mm diameter by 5.5mm long jack, PN: CUI PJ-202BH (Digi-Key CP-202BH-ND). This jack is optional and not normally installed.

A.1.9 Fan Header, J9

For applications requiring forced air cooling, there is one 3-pin 2.54mm header fan connector on the top of the board, connector J9. It is a Molex, LLC 0022232031 available from Digi-Key WM4201-ND. The mating connector is Molex, LLC 0022013037 available from Digi-Key WM2001-ND. The fan connector is powered directly from the 12VDC power supply input of the board. The pin assignments of the fan connector are listed in the following table.

Table 44: Fan 3-Pin Header, J9

Pin	Assignment
1	NC
2	+12VDC
3	Ground

Note: Pin 1 is marked on the silkscreen with a dot and on the board a square solder pad.

A.1.10 Garmin GPS 18x LVC Port Wiring

In this example the GPS receiver is wired to the DB9 connector for data and a USB connector to supply +5V power for the GPS. Alternatively, and external power source can be used to power the GPS.

To use the Garmin 18x LVC GPS requires connecting the wires to a male DB9 serial connector and a USB series A plug for power. Use an old USB cable and cut off the flat series A connector to connect up for power. If the Garmin comes with a small connector cut the connector off. Use the following table to help connect the GPS to the DB9 and USB cable. If you do not require the PPS or your GPS does not provide a PPS signal you can connect the GPS to Port 2 on the optional Y-cable which does not support a PPS signal. When using the PPS signal you must connect directly the DB9 connector and not the Port 1 of the Y-cable.

Table 45: Garmin 18x LVC to RS232 and USB wiring

Wire	DB9 Male Serial	USB	Function
Red	-	Red	+5 volt power
Black (thick)	-	Black	Power Ground
Black (thin)	5		Signal Ground
Black (loose in cable)	-	-	Not used
Yellow	7		PPS Pulse
White	3		TxD from GPS
Green	2		RxD to GPS
Shield	-	Shield	Shield

Appendix B: Establishing User Connections to the DX-4400 Product

B.1 Installation of USB to RS-232 Serial Port Adapter Software

The **USB to DB9 RS-232 Serial Port Adapter Kit** (PN: 811-USB-RS232 Kit) is used to connect the DB9F Serial Port of the DX-4400 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.

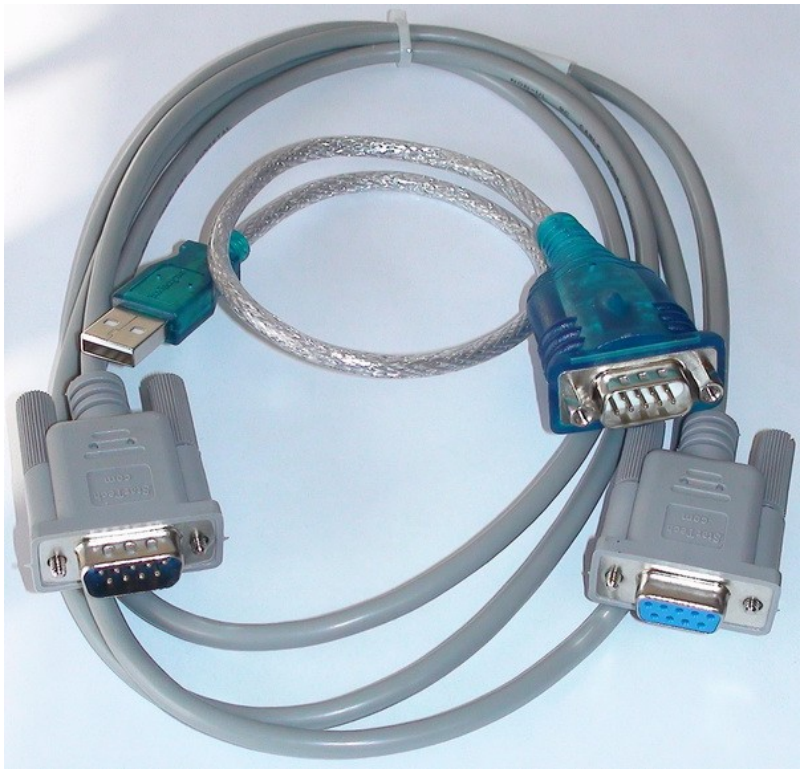

Figure 65: USB to DB9 RS-232 Serial Port Adapter Kit

B.1.1 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.1.1.1 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 Command Port of the DX-4400. For example, PuTTY. (Available from: https://www.chiark.greenend.org.uk/)

B.2 Establishing RS-232 Serial Communication to a PC

By default, the Serial Command Port is assigned to the DB9 RS-232 Control Port (instead of the USB Serial Port). As the Serial Command Port can be assigned to either the RS-232 Control port or to the USB Serial Port, if the factory default setting for the Serial Control Port has been changed to the USB port, it is necessary to make either a USB connection or a TCP/IP connection to issue the necessary command to reassign Serial control to the RS-232 Port prior to connecting to a PC. Since the TCP/IP connection is always available, establish a TCP/IP telnet client connection and use the Commands in Table 6: Set Mode Command Syntax to select the RS232 mode. For example, if the unit is to be operated in the PIP Mode, the command **'SM PIP RS232'** sets the unit to PIP mode with the Serial Command Port on the DB9 connector..

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) Under Category, select the Session item:
      i) For Connection type select Serial >> 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-4400 Serial
      v) Save the configuration.
   b) Under Category, select the Terminal item.
      i) Additionally, check the boxes for:
         (1) Implicit CR in every LF and for
         (2) Implicit LF in every CR.
   c) Under Category, 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-4400 Serial.
      NOTE: Going forward when restarting PuTTY, it is only necessary to select the DX-4400 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-4400 unit.
   f) In the Session section,
      i) Confirm the DX-4400 Serial configuration is selected and then click Load.
      ii) Click "Open" to a establish a Terminal connection to the unit via the serial port.
      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-4400 product.

This confirms Serial communication with the DX-4400 product. The figures below show some of the PuTTY configuration screens.

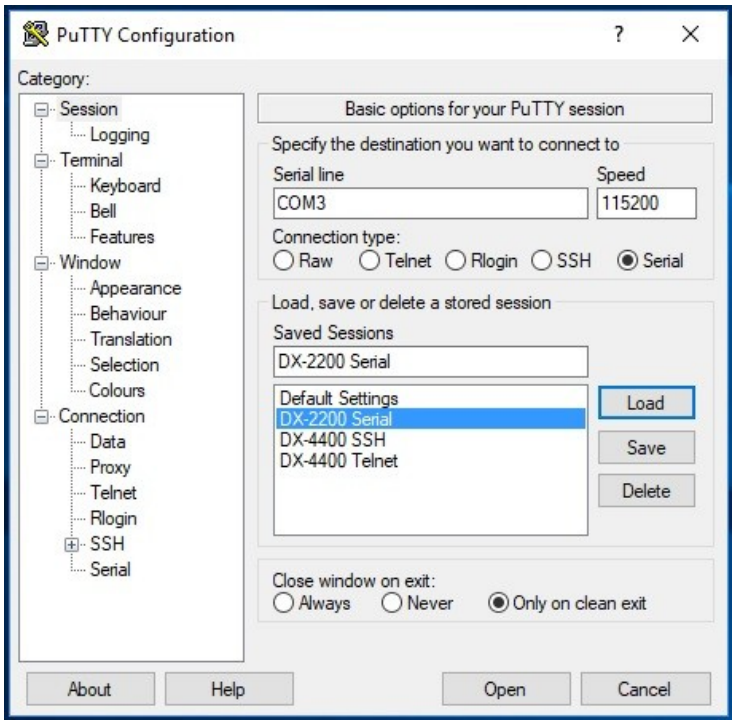

Figure 66: PuTTY Serial Port Session Settings

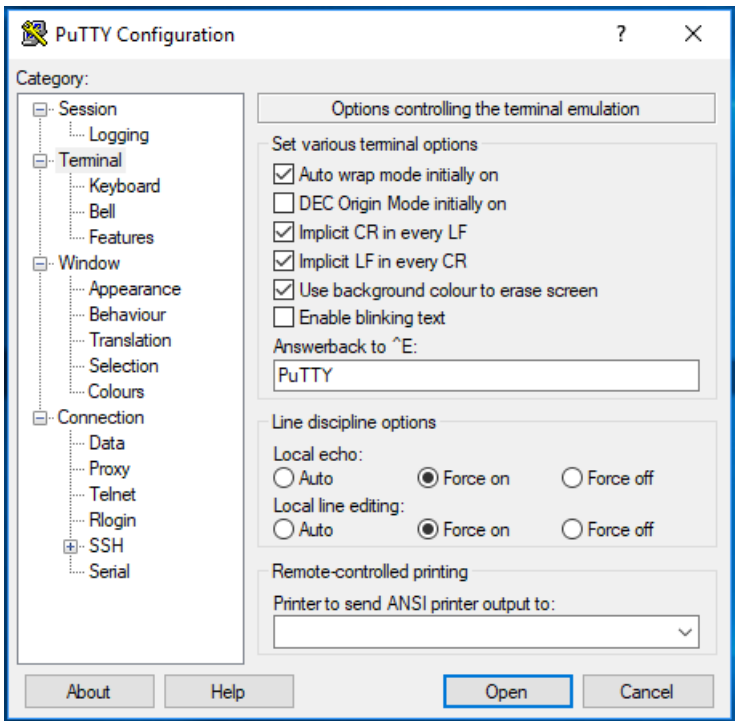

Figure 67: PuTTY Serial Port Terminal Settings

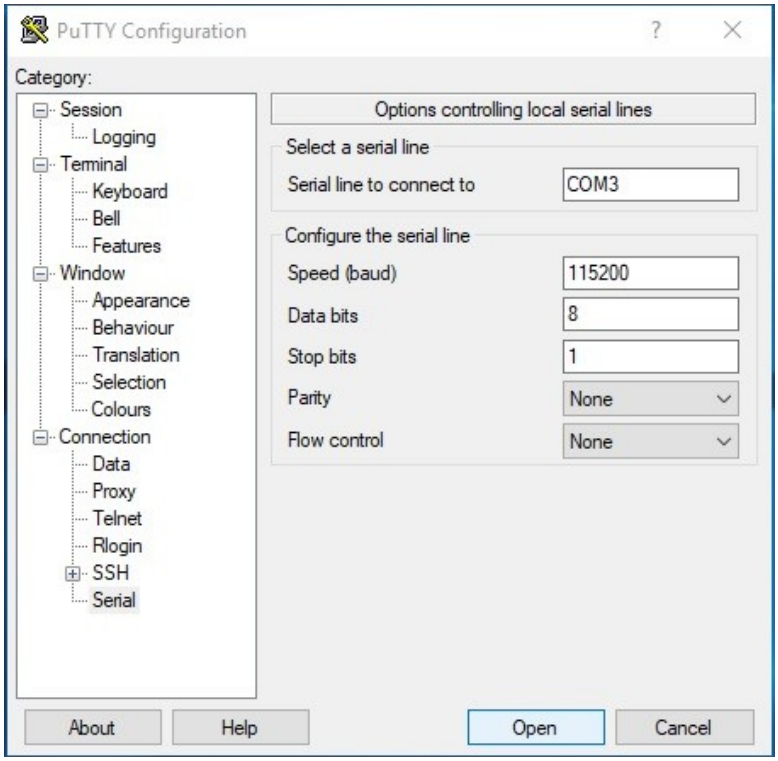

Figure 68: PuTTY Serial Port Settings

B.3 Establishing TCP/IP Connection to the DX-4400 Product

The following steps are required to establish a raw TCP/IP (IP address, Port 2121) connection over Ethernet to the DX-4400 product.

1) Launch 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. Under Category, select the Session item:

      i. For Host Name Enter the assigned IP address assigned by the DHCP Server or the Static factory default (i.e. 10.1.1.230.

      ii. For Port enter 2121

      iii. Under Saved Session: Assign a name to this user setting. i.e. DX-4400 Telnet

      iv. Save the configuration.

      Note: Going forward when restarting PuTTY, it is only necessary to select the DX-4400 Telnet configuration and "Load" it from disk.

   b. Under Category select the Terminal section, configure the settings per Figure 70: PuTTY Terminal Settings below.

   c. Under

      i. Confirm the DX-4400 Raw configuration is selected and then click Load.

      ii. Click "Open" to a establish a raw TCP/IP terminal connection to the unit via Ethernet.

      iii. Type ENTER (the enter key) to get the user prompt.

      iv. At the prompt, type **rv** to display the product information and the current mode of operation.

This confirms the TCP/IP connection to the DX-4400 product. The figures below show the values used for the PuTTY TCP/IP Session and default Terminal configuration screens.

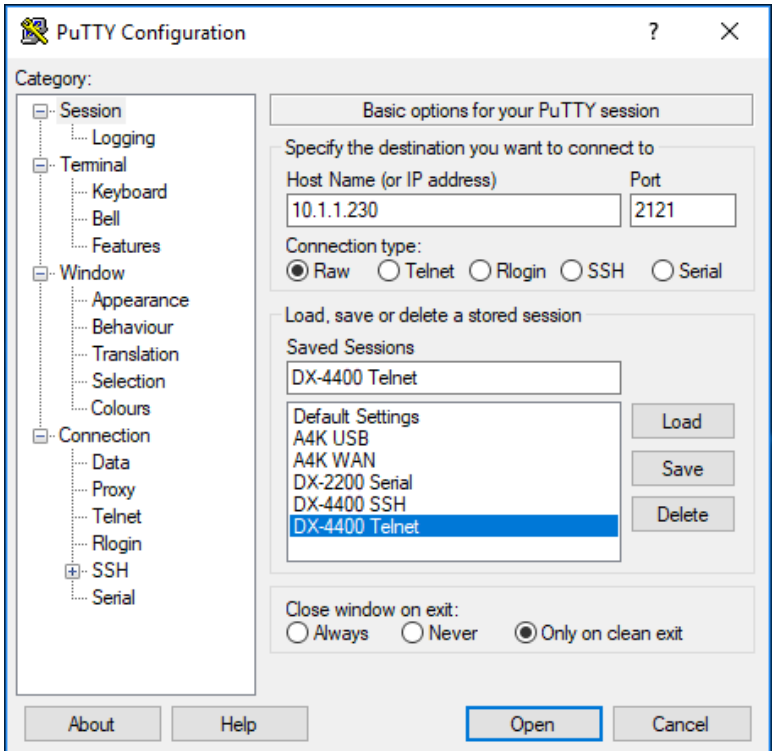

Figure 69: PuTTY TCP/IP Session Settings

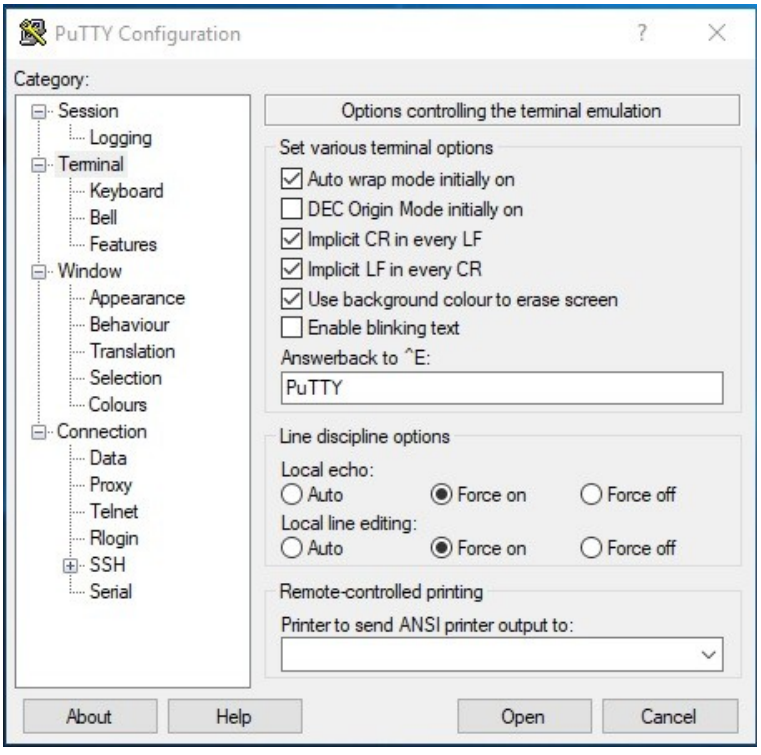

Figure 70: PuTTY Terminal Settings

B.4 Establishing SSH Connection to the DX-4400 Product

The following PuTTY setup is required to establish an SSH (IP address, port 20) connection over Ethernet to the DX-4400 product.

Note: It is only necessary to connect via SSH when connecting to the Linux OS console to complete a firmware upgrade, adding a 4K IP Core License or adding additional fonts to the DX-4400 product.

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. Under Category, select the Session item:
        i. For Host Name Enter the assigned IP address assigned by the DHCP Server or the Static factory default (i.e. 10.1.1.230)
        ii. For Port enter 22
        iii. For Connection type select SSH
        iv. Under Saved Session: Assign a name to this user setting. i.e. DX-4400 SSH
        v. Save the configuration.

        Note: Going forward when restarting PuTTY, it is only necessary to select the DX-4400 SSH Serial configuration and "Load" it from disk.
        No changes are required to the default Terminal (emulator) settings.
    b. In the Session section,
        i. Confirm the DX-4400 SSH configuration is selected and then click Load.
        ii. Click "Open" to a establish an SSH Terminal connection to the unit via IP over Ethernet.
        iii. At the "login as:" prompt, type **root** the ENTER
        iv. At the next prompt enter the default password **ArmOverlay** then ENTER
        v. The DX-4400 will proved the Linux system root prompt, namely: **root@DX-4400:~#**

This confirms a SSH connection to the DX-4400 product. The figures below show the values used for the PuTTY Session and default Terminal configuration screens.

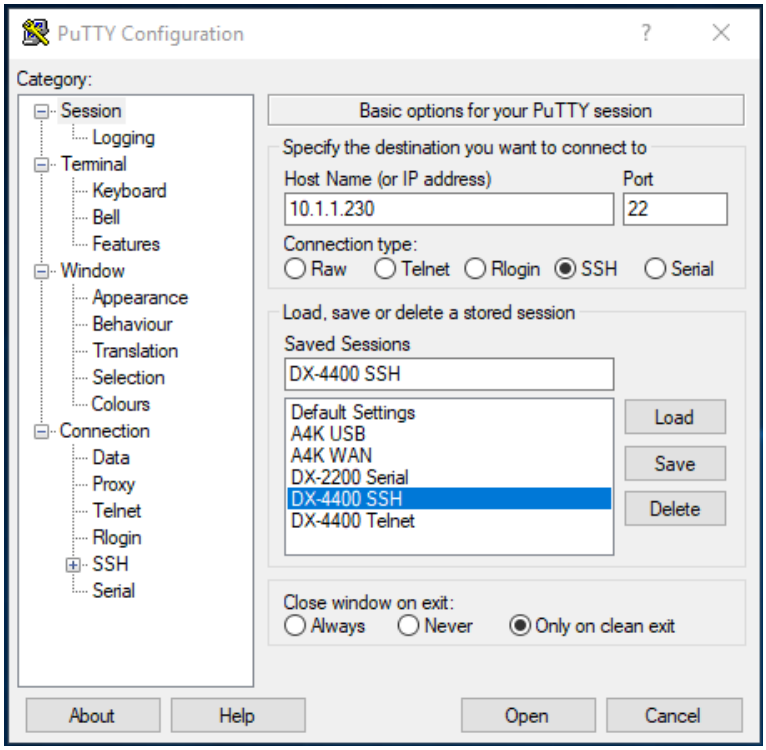

Figure 71: PuTTY SSH Session Settings

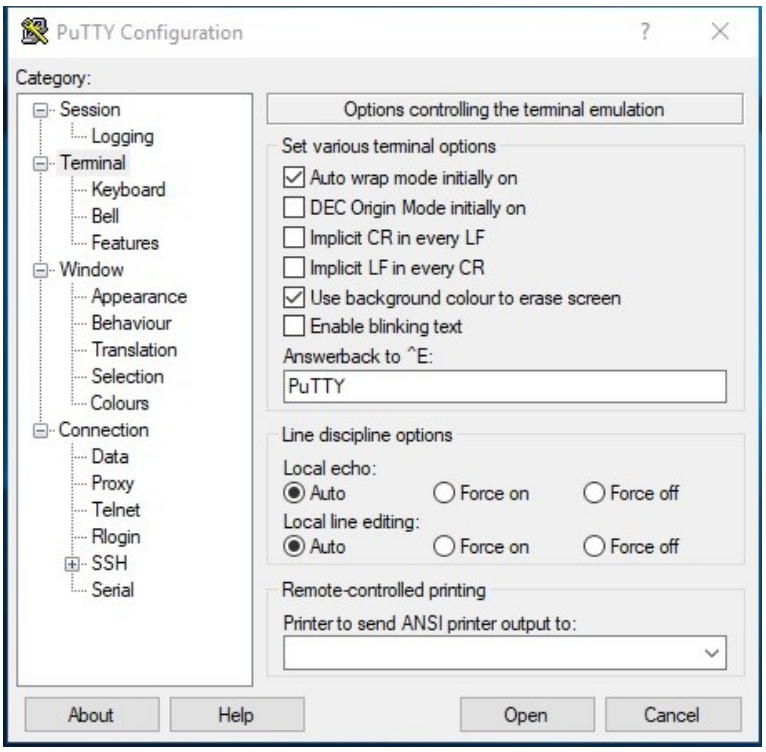

Figure 72: PuTTY SSH Terminal Settings

Appendix C: How to Image a New SD Card

If the SD card has gone bad you can image a new card using the supplied image on the CD. This will be the base image that was sent on the original unit. If you have configured overlay settings, you may be able to recover them from the existing SD card. You will need to unzip the DX-4400_8GB_<date>.img.zip which will be 8GB when unzipped.

C.1 From a Windows Machine

If you are using a Windows PC, you can use the Win32DiskImager supplied on the CD. To use the program, unzip the file on the Windows PC into a folder and then start the Win32DiskImager in the folder. If Windows prompts to allow the program answer Yes. Now browse to where you unzipped the image file and select it. Under Device select where Windows mounted the SD card and then select Write.

C.2 From a Linux Machine

If you are using a Linux PC use the dd command to image the new SD card this takes quite a while. The command line is

```
dd if=DX-4400_8GB_<date>.img of=/dev/sdx
```

Replace the <date> with the file date and sdx with the location Linux mounted the SD card.

Appendix D: Time Zone Names

Africa/Abidjan
Africa/Accra
Africa/Addis_Ababa
Africa/Algiers
Africa/Asmara
Africa/Bamako
Africa/Bangui
Africa/Banjul
Africa/Bissau
Africa/Blantyre
Africa/Brazzaville
Africa/Bujumbura
Africa/Cairo
Africa/Casablanca
Africa/Ceuta
Africa/Conakry
Africa/Dakar
Africa/Dar_es_Salaam
Africa/Djibouti
Africa/Douala
Africa/El_Aaiun
Africa/Freetown
Africa/Gaborone
Africa/Harare
Africa/Johannesburg
Africa/Juba
Africa/Kampala
Africa/Khartoum
Africa/Kigali
Africa/Kinshasa
Africa/Lagos
Africa/Libreville
Africa/Lome
Africa/Luanda
Africa/Lubumbashi
Africa/Lusaka
Africa/Malabo
Africa/Maputo
Africa/Maseru
Africa/Mbabane
Africa/Mogadishu
Africa/Monrovia
Africa/Nairobi
Africa/Ndjamena
Africa/Niamey
Africa/Nouakchott
Africa/Ouagadougou
Africa/Porto-Novo
Africa/Sao_Tome
Africa/Tripoli
Africa/Tunis
Africa/Windhoek
America/Adak
America/Anchorage
America/Anguilla
America/Antigua
America/Araguaina
America/Argentina/Buenos_Aires
America/Argentina/Catamarca
America/Argentina/Cordoba
America/Argentina/Jujuy
America/Argentina/La_Rioja
America/Argentina/Mendoza
America/Argentina/Rio_Gallegos
America/Argentina/Salta
America/Argentina/San_Juan
America/Argentina/San_Luis
America/Argentina/Tucuman
America/Argentina/Ushuaia
America/Aruba
America/Asuncion
America/Atikokan
America/Bahia
America/Bahia_Banderas
America/Barbados
America/Belem
America/Belize
America/Blanc-Sablon
America/Boa_Vista
America/Bogota
America/Boise
America/Cambridge_Bay
America/Campo_Grande
America/Cancun
America/Caracas
America/Cayenne
America/Cayman
America/Chicago
America/Chihuahua
America/Costa_Rica
America/Creston
America/Cuiaba
America/Curacao
America/Danmarkshavn
America/Dawson
America/Dawson_Creek
America/Denver
America/Detroit
America/Dominica
America/Edmonton
America/Eirunepe
America/El_Salvador
America/Fort_Nelson
America/Fortaleza
America/Glace_Bay
America/Godthab
America/Goose_Bay
America/Grand_Turk

America/Grenada
America/Guadeloupe
America/Guatemala
America/Guayaquil
America/Guyana
America/Halifax
America/Havana
America/Hermosillo
America/Indiana/Indianapolis
America/Indiana/Knox
America/Indiana/Marengo
America/Indiana/Petersburg
America/Indiana/Tell_City
America/Indiana/Vevay
America/Indiana/Vincennes
America/Indiana/Winamac
America/Inuvik
America/Iqaluit
America/Jamaica
America/Juneau
America/Kentucky/Louisville
America/Kentucky/Monticello
America/Kralendijk
America/La_Paz
America/Lima
America/Los_Angeles
America/Lower_Princes
America/Maceio
America/Managua
America/Manaus
America/Marigot
America/Martinique
America/Matamoros
America/Mazatlan
America/Menominee
America/Merida
America/Metlakatla
America/Mexico_City
America/Miquelon
America/Moncton
America/Monterrey
America/Montevideo
America/Montserrat
America/Nassau
America/New_York
America/Nipigon
America/Nome
America/Noronha
America/North_Dakota/Beulah
America/North_Dakota/Center
America/North_Dakota/New_Salem
America/Ojinaga
America/Panama
America/Pangnirtung
America/Paramaribo
America/Phoenix
America/Port_of_Spain
America/Port-au-Prince
America/Porto_Velho
America/Puerto_Rico
America/Punta_Arenas
America/Rainy_River
America/Rankin_Inlet
America/Recife
America/Regina
America/Resolute
America/Rio_Branco
America/Santarem
America/Santiago
America/Santo_Domingo
America/Sao_Paulo
America/Scoresbysund
America/Sitka
America/St_Barthelemy
America/St_Johns
America/St_Kitts
America/St_Lucia
America/St_Thomas
America/St_Vincent
America/Swift_Current
America/Tegucigalpa
America/Thule
America/Thunder_Bay
America/Tijuana
America/Toronto
America/Tortola
America/Vancouver
America/Whitehorse
America/Winnipeg
America/Yakutat
America/Yellowknife
Antarctica/Casey
Antarctica/Davis
Antarctica/DumontDUrville
Antarctica/Macquarie
Antarctica/Mawson
Antarctica/McMurdo
Antarctica/Palmer
Antarctica/Rothera
Antarctica/Syowa
Antarctica/Troll
Antarctica/Vostok
Arctic/Longyearbyen
Asia/Aden
Asia/Almaty
Asia/Amman
Asia/Anadyr
Asia/Aqtau
Asia/Aqtobe
Asia/Ashgabat
Asia/Atyrau
Asia/Baghdad
Asia/Bahrain
Asia/Baku
Asia/Bangkok
Asia/Barnaul

Asia/Beirut
Asia/Bishkek
Asia/Brunei
Asia/Chita
Asia/Choibalsan
Asia/Colombo
Asia/Damascus
Asia/Dhaka
Asia/Dili
Asia/Dubai
Asia/Dushanbe
Asia/Famagusta
Asia/Gaza
Asia/Hebron
Asia/Ho_Chi_Minh
Asia/Hong_Kong
Asia/Hovd
Asia/Irkutsk
Asia/Jakarta
Asia/Jayapura
Asia/Jerusalem
Asia/Kabul
Asia/Kamchatka
Asia/Karachi
Asia/Kathmandu
Asia/Khandyga
Asia/Kolkata
Asia/Krasnoyarsk
Asia/Kuala_Lumpur
Asia/Kuching
Asia/Kuwait
Asia/Macau
Asia/Magadan
Asia/Makassar
Asia/Manila
Asia/Muscat
Asia/Nicosia
Asia/Novokuznetsk
Asia/Novosibirsk
Asia/Omsk
Asia/Oral
Asia/Phnom_Penh
Asia/Pontianak
Asia/Pyongyang
Asia/Qatar
Asia/Qyzylorda
Asia/Riyadh
Asia/Sakhalin
Asia/Samarkand
Asia/Seoul
Asia/Shanghai
Asia/Singapore
Asia/Srednekolymsk
Asia/Taipei
Asia/Tashkent
Asia/Tbilisi
Asia/Tehran
Asia/Thimphu
Asia/Tokyo
Asia/Tomsk
Asia/Ulaanbaatar
Asia/Urumqi
Asia/Ust-Nera
Asia/Vientiane
Asia/Vladivostok
Asia/Yakutsk
Asia/Yangon
Asia/Yekaterinburg
Asia/Yerevan
Atlantic/Azores
Atlantic/Bermuda
Atlantic/Canary
Atlantic/Cape_Verde
Atlantic/Faroe
Atlantic/Madeira
Atlantic/Reykjavik
Atlantic/South_Georgia
Atlantic/St_Helena
Atlantic/Stanley
Australia/Adelaide
Australia/Brisbane
Australia/Broken_Hill
Australia/Currie
Australia/Darwin
Australia/Eucla
Australia/Hobart
Australia/Lindeman
Australia/Lord_Howe
Australia/Melbourne
Australia/Perth
Australia/Sydney
Europe/Amsterdam
Europe/Andorra
Europe/Astrakhan
Europe/Athens
Europe/Belgrade
Europe/Berlin
Europe/Bratislava
Europe/Brussels
Europe/Bucharest
Europe/Budapest
Europe/Busingen
Europe/Chisinau
Europe/Copenhagen
Europe/Dublin
Europe/Gibraltar
Europe/Guernsey
Europe/Helsinki
Europe/Isle_of_Man
Europe/Istanbul
Europe/Jersey
Europe/Kaliningrad
Europe/Kiev
Europe/Kirov
Europe/Lisbon
Europe/Ljubljana

Europe/London
Europe/Luxembourg
Europe/Madrid
Europe/Malta
Europe/Mariehamn
Europe/Minsk
Europe/Monaco
Europe/Moscow
Europe/Oslo
Europe/Paris
Europe/Podgorica
Europe/Prague
Europe/Riga
Europe/Rome
Europe/Samara
Europe/San_Marino
Europe/Sarajevo
Europe/Saratov
Europe/Simferopol
Europe/Skopje
Europe/Sofia
Europe/Stockholm
Europe/Tallinn
Europe/Tirane
Europe/Ulyanovsk
Europe/Uzhgorod
Europe/Vaduz
Europe/Vatican
Europe/Vienna
Europe/Vilnius
Europe/Volgograd
Europe/Warsaw
Europe/Zagreb
Europe/Zaporozhye
Europe/Zurich
Indian/Antananarivo
Indian/Chagos
Indian/Christmas
Indian/Cocos
Indian/Comoro
Indian/Kerguelen
Indian/Mahe
Indian/Maldives
Indian/Mauritius
Indian/Mayotte
Indian/Reunion
Pacific/Apia
Pacific/Auckland
Pacific/Bougainville
Pacific/Chatham
Pacific/Chuuk
Pacific/Easter
Pacific/Efate
Pacific/Enderbury
Pacific/Fakaofo
Pacific/Fiji
Pacific/Funafuti
Pacific/Galapagos
Pacific/Gambier
Pacific/Guadalcanal
Pacific/Guam
Pacific/Honolulu
Pacific/Kiritimati
Pacific/Kosrae
Pacific/Kwajalein
Pacific/Majuro
Pacific/Marquesas
Pacific/Midway
Pacific/Nauru
Pacific/Niue
Pacific/Norfolk
Pacific/Noumea
Pacific/Pago_Pago
Pacific/Palau
Pacific/Pitcairn
Pacific/Pohnpei
Pacific/Port_Moresby
Pacific/Rarotonga
Pacific/Saipan
Pacific/Tahiti
Pacific/Tarawa
Pacific/Tongatapu
Pacific/Wake
Pacific/Wallis

Appendix E: Microtronix QML Libraries

The **DX-4400** is supplied with custom QML libraries that make additional classes available for use in QML scripts to provide capabilities that are not a standard part of QML. Some of the example scripts supplied with the **DX-4400** make use of the custom QML libraries. The sections of this appendix describe the libraries that are available and provide examples of using the custom types.

E.1 GPS Version 1.0

The DX-4400 uses the Linux gpsd service daemon to receive information from an optional external GPS receiver. The GPS library includes the **GPSReceiver** type that makes information from the GPS available to QML, and the S**atellite** type used by the GPSReceiver to return data for a specific satellite. The following tables list the properties of the GPSReceiver and Satellite.

To make the types in the GPS library available to QML, include the following import line in the QML script:

```
import Microtronix.GPS_1_0  1.0
```

Table 46: Properties of the GPSReceiver Type

GPS 1.0: GPSReceiver			
Property / Function	**Type**	**Settable**	**Description**
deviceAddress	QString	✓	Address string used to access the gpsd service. Default is "localhost"
devicePort	QString	✓	Port string used to access the gpsd service. Default is "2947"
deviceStatusMessage	QString		Contains a status message generated when attempting to connect to the gpsd service
deviceOpenStatus	bool		returns true when the connection to the gpsd service has been opened.
deviceOpen()	void		Calling this function will open or reopen the connection to gpsd. This function may be needed if there was an error connecting or the address / port parameters have been changed. By default, the connection is opened when the GPS component is instantiated.
deviceClose()	void		Close the connection to the gpsd service.
updateOnlyOn3DFix	bool	✓	When true, the component does not update GPS data parameters (other than fixType) when only a 2D fix is available. The default is false.
updateOnlyOnDataValid	bool	✓	When true, the component updates GPS parameters only if the gpsd service reports the data is valid. The default is true.
clearDataOnFixLost	bool	✓	When true, the GPS data is cleared when the GPS device stops providing updates. The default is false.
clearDataOnDataValidLost	bool	✓	Clear GPS data parameters when the dataValid status changes to false. The default is false.
clearDataOnLossOfUpdates	bool	✓	Clear GPS data parameters when the GPS stops providing updates. The default is false.
dataValid	bool		Report the dataValid status from the gpsd service.
deviceBaudRate	uint		Reports the RS232 baud rate used by gpsd.

GPS 1.0: GPSReceiver			
Property / Function	**Type**	**Settable**	**Description**
deviceParity	QString		Reports the RS232 parity setting used by gpsd.
deviceStopBits	uint		Reports the RS232 stop bits setting used by gpsd.
devicePath	QString		Reports the device port path string used by gpsd.
deviceDriver	QString		Reports the device driver name used by gpsd.
deviceCycleTime	double		Reports the GPS update rate.
updating	bool		This status reports if the GPS has sent new data within the timeoput period set by updatingTimeoutMilliseconds. This property can be used to detect if the GPS has been unplugged or stopped working.
updatingTimeoutMilliseconds	uint	✓	This is the timeout in milliseconds to detect when the gps has stopped sending data. The default is 5000.
timeOfUpdate	QDateTime		The time and date of the last update received from the GPS device.
fixmode	int		Reports the type of fix that GPS device has. The value may be 0, 2 (2D) or 3 (3D).
longitude	double		GPS longitude
longitudeUncertainty	double		A calculated longitude uncertainty in meters
latitude	double		GPS latitude.
latitudeUncertainty	double		A calculated latitude uncertainty in meters
speed	double		GPS Speed in meters/second.
speedUncertainty	double		A calculated speed uncertainty in m/s.
altitude	double		GPs altitude.
altitudeUncertainty	double		A calculated altitude uncertainty.
climb	double		GPS climb. Not all GPs devices will report this value.
climbUncertainty	double		A calculated climb uncertainty
courseOverGround	double		GPS course over ground in degrees
courseOverGroundUncertainty	double		A calculated uncertainty of the course over ground.
xDop	double		X dilution of precision
yDop	double		Y dilution of precision
pDop	double		P dilution of precision
hDop	double		H dilution of precision
vDop	double		V dilution of precision
tDop	double		T dilution of precision
gDop	double		G dilution of precision
satellitesUsed	int		The number of satellites the GPS has used
satellitesVisible	int		The number the satellite the GPS detects
satellite1	*Satellite		Parameters for Satellite 1
satellite2	*Satellite		Parameters for Satellite 2
satellite3	*Satellite		Parameters for Satellite 3
satellite4	*Satellite		Parameters for Satellite 4

GPS 1.0: GPSReceiver			
Property / Function	**Type**	**Settable**	**Description**
satellite5	*Satellite		Parameters for Satellite 5
satellite6	*Satellite		Parameters for Satellite 6
satellite7	*Satellite		Parameters for Satellite 7
satellite8	*Satellite		Parameters for Satellite 8
satellite9	*Satellite		Parameters for Satellite 9
satellite10	*Satellite		Parameters for Satellite 10
satellite11	*Satellite		Parameters for Satellite 11
satellite12	*Satellite		Parameters for Satellite 12
satellite13	*Satellite		Parameters for Satellite 13
satellite14	*Satellite		Parameters for Satellite 14
satellite15	*Satellite		Parameters for Satellite 15
satellite16	*Satellite		Parameters for Satellite 16
satellite17	*Satellite		Parameters for Satellite 17
satellite18	*Satellite		Parameters for Satellite 18
satellite19	*Satellite		Parameters for Satellite 19
satellite20	*Satellite		Parameters for Satellite 20
satellite21	*Satellite		Parameters for Satellite 21
satellite22	*Satellite		Parameters for Satellite 22
satellite23	*Satellite		Parameters for Satellite 23
satellite24	*Satellite		Parameters for Satellite 24
satellite25	*Satellite		Parameters for Satellite 25
satellite26	*Satellite		Parameters for Satellite 26
satellite27	*Satellite		Parameters for Satellite 27
satellite28	*Satellite		Parameters for Satellite 28
satellite29	*Satellite		Parameters for Satellite 29
satellite30	*Satellite		Parameters for Satellite 30
satellite31	*Satellite		Parameters for Satellite 31
satellite32	*Satellite		Parameters for Satellite 32

Table 47: Properties of the Satellite Type

GPS 1.0: Satellite			
Property	**Type**	**Settable**	**Description**
prn	int		Satellite code
used	int		Non zero indicates the satellite is used in the GPS fix
azimuth	int		The direction of the satellite.
elevation	int		The elevation of the satellite.
snr	double		Signal to Noise Ratio.

There is no time clock available as a property of the GPSReceiver. The GPS time sets the Linux system clock using the ntpd service to provide a time clock that is synchronized to the GPS time. The Linux system clock should be used to obtain the current date and time for use in the overlay.

Note: Only those parameters that the GPS unit supplies will be available. The user may need to configure the GPS using serial commands or software supplied by the manufacturer to enable or disable transmission of different data messages.

The following QML example uses the GPSReceiver component and also displays the Linux system time:

```
import QtQuick 1.0
import Microtronix.GPS_1_0   1.0

Item
{
   width:1920
   height:1080

   // round off a floating point value to some number of digits
   function roundDigits(number, digits)
   { var m = Math.pow(10,digits); return Math.round(number * m) / m  }

   function roundToText(number, digits)
   { var text = number.toFixed(digits); return text; }

   function trunc( input)
   { if( input >= 0 ) { return Math.floor(input) } else { return Math.ceil(input) } }

   function coordinateDegreesInt( input )
   { return  trunc(input) }

   function coordinateMinutes( input )
   { return 60.0*Math.abs(input - (trunc(input))) }

   function coordinateMinutesInt( input )
   { return trunc(coordinateMinutes(input)) }

   function coordinateSeconds( input )
   { return 60.0 * (coordinateMinutes(input) - coordinateMinutesInt(input)) }

   // Display from the system clock
   function setSystemDateText()
   {
      text.text = "System Date(): " + Date()
   }

   // Instantiate the GPS receiver component that provides access to GPS data
   GPSReceiver
   {
      id: gps_1
      updatingTimeoutMilliseconds: 3000
      updateOnlyOn3DFix: true
   }

   // Display GPS positioning data
   Rectangle
   {
      x:100;  y:100
      width: parent.width
      height: parent.height
      color:"#00FFFFFF"   // Sets color and transparency. First byte is alpha, 00 is transparent.
      opacity: 1.0        // Sets opacity of the moving text, 1.0 is full visible
      //visible: gps_1.updating == true

      // Latitude as degrees, minutes as double precision
      Text
      {
         x: 0; y: 0
```

```
            font.pixelSize: 30; color: "green"
            text: "Latitude: " +  coordinateDegreesInt(gps_1.latitude) + "\xB0  " +
                  roundToText(coordinateMinutes(gps_1.latitude), 5) + "'"
         }
         // Longitude as degrees, minutes as double
         Text
         {
            x: 0; y: 50
            font.pixelSize: 30; color: "green"
            text: "Longitude: " +  coordinateDegreesInt(gps_1.longitude) + "\xB0  " +
                   roundToText(coordinateMinutes(gps_1.longitude), 5) + "'"
         }
         // speed as double precision
         Text
         {
            x: 0; y: 100
            font.pixelSize: 30; color: "green"
            text: "Speed: " + roundToText( gps_1.speed, 2) + " m/s"
         }
         // altitude
         Text
         {
            x: 0; y: 150
            font.pixelSize: 30; color: "green"
            text: "Altitude: " + roundToText(gps_1.altitude, 1 ) + " m"
         }
         // course over ground
         Text
         {
            x: 0; y: 200
            font.pixelSize: 30; color: "green"
            text: "Course over ground: " + roundToText(gps_1.courseOverGround, 1) + " \xB0"
         }
      }


      // Display the Linux system date/time
      Rectangle
      {
         x:100;  y:0
         width:parent.width
         height:parent.height
         color:"#00FFFFFF"      // Sets color and transparency.
         opacity: 1.0           // Sets opacity of the moving text, 1.0 is full visible

         Text
         {
            id: text
            color:"blue"        // Set the color of the text
            font.pixelSize: 40  // Set the size of the text
            text: "default"     // Initial text string
            Rectangle
            {
               width: text.width
               height: text.height
               color: "black"
               z: -1
            }
         }
         Timer
         {
            interval: 100       // timer interval for updates in milliseconds
            repeat: true
            running: true
            triggeredOnStart: true
            onTriggered: setSystemDateText()  // Call Java script function above to set the time
         }
       }

}
```

E.2 BarGauge Version 1.0

The DX-4400 BarGauge library contains the custom **BarGauge** type that draws a simple bar gauge to display a measurement on the overlay.

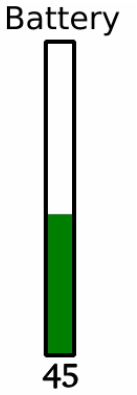

Figure 73: QML BarGauge Example

To make the BarGauge type available to QML, include the following import line in the QML script:

```
import Microtronix.BarGauge_1_0 1.0
```

Table 48: Properties of the BarGauge Type

GPS 1.0: BarGauge			
Property / Function	**Type**	**Settable**	**Description**
width	unsigned	✓	The width of the border in pixels
height	unsigned	✓	The height of the border in pixels
frameWidth	unsigned	✓	The width in pixels of the border lines
topScale	float	✓	The top of scale value for the gauge
bottomScale	float	✓	The bottom of scale value for the gauge
reading	float	✓	The reading to display. This sets the height of the bar and the value displayed below the gauge.
barColorLow	QColor	✓	A color used for the bar when the reading is below the low threshold
barColorMid	QColor	✓	A color used from the bar when the reading is >= to the reading low threshold and <= reading high threshold.
barColorHigh	QColor	✓	A color used for the bar when the reading is above the high threshold value.
readingLow	float	✓	The low reading threshold value
readingHigh	float	✓	The high reading threshold value
frameColor	QColor	✓	The color of the border.
textColor	QColor	✓	The color of the text reading displayed below the gauge
font	QFont	✓	The font used for text

GPS 1.0: BarGauge			
Property / Function	**Type**	**Settable**	**Description**
singleColor	bool	✓	Draw a single color bar. The default is true. If set to false, then the part of the bar below the low reading threshold is drawn using barColorLow and the part of the bar above the high readiing threshold is drawn using barColorHigh.
roundingSize	unsigned	✓	Set the amount of rounding on the corners of the barGauge in pixels.
showReadingText	bool	✓	Display the reading as text below the Gauge. The default is true.
displayDecimals	unsigned	✓	The number of decimals to display in the reading. The default is 0.

The following QML script shows an example of using the BarGauge to display the example shown in Figure 73: QML BarGauge Example. The title is not part of the BarGauge component. It is added using a standard QML Text object. Both the Text and the BarGauge are constructed inside a Rectangle for ease of positioning on the overlay.

```
import QtQuick 1.0
import Microtronix.BarGauge_1_0 1.0

Item
{
   width:1920
   height:1080

   // Display a status indicator using a barGauge
   Rectangle
   {
     x:50; y:0
     Text
     {
        x: 0; y: 0;
        text: "Battery"
        color: "black";  font.pixelSize: 30
     }
     BarGauge
     {
       id: barGauge1
       x:40; y:40               // position within the rectangle
       width: 27                // width of the bar gauge frame
       height: 300              // height of the bar gauge frame
       frameColor: "black"      // color of the border
       frameWidth: 4            // width of the border
       bottomScale: 0           // bottom if scale value
       topScale: 100            // top of scale value
       reading: 45              // the reading to display on the gauge
       font.pointSize: 32       // font size for the reading
       textColor: "black"       // text color for the reading
       barColorHigh: "green"    // bar color for readings above high threshold
       barColorMid: "green"     // bar color for readings that are neither low or high
       barColorLow: "red"       // bar color for readings below the low threshold
       readingLow: 20           // low reading threshold
       readingHigh: 80          // high reading threshold
     }
   }

}
```

E.3 ScaleGauge Version 1.0

The DX-4400 ScaleGauge is a custom QML component that draws a scale and a pointer to indicate a measurement on the overlay. The library contains two components: The S**cale** type draws the scale only with no measurement displayed, and the **ScaleGauge** type that includes all the properties of scale and also adds properties for the pointer.

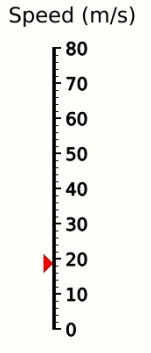

Figure 74: QML ScaleGauge Example

To make the types in the ScaleGauge library available to QML, include the following import line in the QML script:

```
import Microtronix.ScaleGauge_1_0 1.0
```

Table 49: Properties of the Scale Type

GPS 1.0: Scale			
Property / Function	**Type**	**Settable**	**Description**
majorScaleIncrement	float	✓	The measurement increment per major scale division.
bottomScale	float	✓	The measurement value at the bottom of the scale.
topScale	float		This read only property indicates the top of scale value. It is equal to the bottom of scale plus the majorScaleIncrement multitplied by the the number of majorDivisions.
pixelsPerDivision	unsigned	✓	The number of pixels per minor division of the scale. This value is ignored if lineLength has been set greater than zero.
minorDivisions	unsigned	✓	The number of minor divisions within each major division.
majorDivisions	unsigned	✓	The number of major divisions on the scale.
majorLength	unsigned	✓	The length in pixels of the major division indicator marks on the scale.
minorLength	unsigned	✓	The length in pixels of the minor division indicator marks on the scale.
majorWidth	unsigned	✓	The width in pixels of the major division indicator marks on the scale.
minorWidth	unsigned	✓	The width in pixels of the minor division indicator marks on the scale.
lineWidth	unsigned	✓	The width in pixels of the scale line.

GPS 1.0: Scale			
Property / Function	**Type**	**Settable**	**Description**
displayDecimals	unsigned	✓	The number of decimals to display for the numeric value of the major divisions.
rightJustify	bool	✓	If true, the numeric values for the major scale divisions are right justified instead of left justified. The default is false.
lineColor	QColor	✓	Color of the scale line.
majorColor	QColor	✓	Color of the major division indicator marks.
minorColor	QColor	✓	Color of the minor division indicator marks.
textColor	QColor	✓	Color of the major division numeric value text.
horizontalReversed	QColor	✓	Draw the scale with the major and minor division indicators on the left side of the line instead of the right side.
rotation	float	✓	Rotation of the scale in degrees.
font	QFont	✓	The text Font for the numeric values of the major divisions.
width	unsigned		This read only property returns the width of the scale
height	unsigned		This read only property returns the height of the scale.
showText	bool	✓	When true the numeric value of the major divisions is displayed. The default is true.
lineRectNom	QRect		A read only property that returns the nominal bounds of the scale index line. This information may be useful when combing the scale with other objects.
lineRectDraw	QRect		A read only property that return the bounds of the scale index line adjusted to take into accound the major division width. This information may be useful when combing the scale with other objects.
lineLength	int	✓	When this value is <= 0, the length of the scale is determined by the the number of major divisions, number of minor divisions, and pixels per division. This guarantees each division is exactly the same number of pixels. If this value is greater than zero, then pixels per division is ignored and the value set here is used to determine the length of the scale line. The default is -1.
suppressTopScaleLabel	bool	✓	When true the numeric value at the top of scale is not shown. The default is false.
suppressBottomScaleLabel	bool	✓	When true the numeric value at the bottom of scale is not shown.Tthe default is false.

Table 50: Additional Properties of the ScaleGauge Type

GPS 1.0: ScaleGauge			
Property / Function	**Type**	**Settable**	**Description**
reading	float	✓	The reading to display on the gauge
pointerColor	QColor	✓	The color of the pointer that indicates the reading
pointerSize	unsigned	✓	The size in pixels of the pointer that indicates the reading.

The following QML example generates the ScaleGauge shown in Figure 74: QML ScaleGauge Example.

```
import QtQuick 1.0
import Microtronix.ScaleGauge_1_0 1.0
Item
{
   width: 1920
   height: 1080

   // Display Speed using a ScaleGauge
   Rectangle
   {
     x: 100; y: 100
     Text
     {
        x: 0; y: 0;
        text: "Speed (m/s)"
        color: "black";  font.pixelSize: 24
     }
     ScaleGauge
     {
        id: scaleGauge1
        x:40;  y: 40
        majorWidth: 2
        lineWidth: 4
        opacity: 1.0
        bottomScale: 0
        majorScaleIncrement: 10
        pixelsPerDivision: 8
        majorDivisions: 8
        minorDivisions: 5
        font.pointSize: 20
        showText: true
        lineColor: "black"
        textColor: "black"
        majorColor: "black"
        minorColor: "black"
        reading: 19
     }
   }

}
```

Appendix F: Regulatory Compliance Information

The **DX-4400** SDI video product (as specified below) has been tested for regulatory compliance.

Equipment Type:	Information Technology Equipment
Product Name(s):	DX-4400 – 2K Dual-channel 3G-SDI Text & Graphics Overlay Inserter DX-4400 – 4K Dual-link 3G-SDI Text and Graphics Inserter
Model No:	DX-4400-xx-yy where xx and yy are any combination of the alphanumeric characters.

The applicable compliance statements and declarations are provided in the following sections.

F.1 Industry Canada (IC)

The **DX-4400, SD/HD/2K/4K-SDI Text & Graphics Overlay Inserter product** (as listed above) has been tested and found to comply with ISED Canada ICES-003, Issue 6, Class A – Information Technology Equipment (including Digital Apparatus), the compliance as suggested by ISDE Canada is as follows:

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

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 London, Ontario Canada, N6L 1E3
Contact Person:	Mr. Norman McCall Phone #: 519-690-0091 x264 or 519-630-6366 Fax #: 519-690-0092 Email Address: nmccall@microtronix.com
Equipment Type:	Class A Information Technology Equipment (Including Digital Apparatus)
Product Name:	DX-4400 - 4K Dual-link 3G-SDI text & Graphics Inserter DX-4400-Dual-channel 3G-SDI Text & Graphics Inserter,
Model No.:	DX-4400-xx-yy where: xx and yy are alpha-numerics specifying the product hardware and software variants
The above product was tested by UltraTech Engineering Labs Inc. and found to comply with:	ISED Canada ICES-003, Issue 6 - Information Technology Equipment (Including Digital Apparatus) — Limits and methods of measurement
Date of Authorization:	July 13, 2017

- Note(s): *See attached report, UltraTech's File No.: 17MDL031_ICES-003, dated July 13, 2017 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

91038 1309 46390-2049 AT-1945 SL2-IN-E-1119R CA2049

F.2 Federal Communications Commission (FCC) Declaration of Conformity

Responsible Party: Microtronix Datacom Ltd.
4056 Meadowbrook Drive, Unit 126, London, ON Canada
TEL: +01-519-690-0091

The Responsible Party declares the DX-4400, SD/HD/2K/4K-SDI Text & Graphics Overlay Inserter product (as listed above) 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:

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

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 London, Ontario Canada, N6L 1E3
Contact Person:	Mr. Norman McCall Phone #: 519-690-0091 x264 or 519-630-6366 Fax #: 519-690-0092 Email Address: nmccall@microtronix.com
Equipment Type:	Unintentional Radiators for Use in Non-Residential Areas
Product Name:	DX-4400 - 4K Dual-link 3G-SDI Text & Graphics Inserter DX-4400 - Dual-channel 3G-SDI Text & Graphics Inserter
Model No.:	DX-4400-xx-yy where: xx and yy are alpha-numerics specifying the product hardware and software variants
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:	July 13, 2017

- Note(s): *See attached report, UltraTech's File No.:17MDL031_FCC15A, dated* July 13, 2017 *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

91038 1309 46390-2049 AT-1945 SL2-IN-E-1119R CA2049

F.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-4400, SD/HD/2K/4K-SDI Text & Graphics Overlay Inserter product (as listed above) has been tested in accordance with:

- CISPR 24: 2010+A1:2015 / EN 55024:2010+A1:2015 – Electromagnetic Compatibility Requirements – Information Technology Equipment – Immunity Characteristics – Limits and Methods of Measurements.
- CISPR 32: 2012 / EN55032:2012/AC:2013, Class A - Multimedia Equipment.

TEST LABORATORIES: UltraTech Engineering Labs Inc.
3000 Bristol Circle, Oakville, ON, Canada, L6H-6G4

This declaration of conformity is issued under the sole responsibility of the manufacturer.
The object of the declaration described above is in conformity with the relevant Union harmonization legislation.

DATE OF ISSUE OF DECLARATION: July 13, 2017

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 a 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 London, Ontario Canada, N6L 1E3
Contact Person:	Mr. Norman McCall Phone #: 519-690-0091 x264 or 519-630-6366 Fax #: 519-690-0092 Email Address: nmccall@microtronix.com
Equipment Type:	Information Technology Equipment
Product Name:	DX-4400 - 4K Dual-link 3G-SDI text & Graphics Inserter DX-4400-Dual-channel 3G-SDI Text & Graphics Inserter,
Model No.:	DX-4400-xx-yy where: xx and yy are alpha-numerics specifying the product hardware and software variants
The above product was tested by UltraTech Engineering Labs Inc. and found to comply with:	CISPR 24: 2010+A1:2015 / EN 55024:2010+A1: 2015 - Electromagnetic Compatibility Requirements - Information Technology Equipment - Immunity Characteristics - Limits and Methods of Measurements

Note[s]: *See attached report, UltraTech's File No.: 17MDL031_EN24, dated July 13, 2017 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

91038 1309 46390-2049 AT-1945 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 London, Ontario Canada, N6L 1E3
Contact Person:	Mr. Norman McCall Phone #: 519-690-0091 x264 or 519-630-6366 Fax #: 519-690-0092 Email Address: nmccall@microtronix.com
Equipment Type:	Multimedia Equipment
Product Name:	DX-4400 - 4K Dual-link 3G-SDI text & Graphics Inserter DX-4400-Dual-channel 3G-SDI Text & Graphics Inserter
Model No.:	DX-4400-xx-yy where: xx and yy are alpha-numerics specifying the product hardware and software variants
The above product was tested by UltraTech Engineering Labs Inc. and found to comply with:	**CISPR 32:2012 / EN55032:2012/AC:2013, Class A- Multimedia Equipment.**
Date of Authorization:	July 13, 2017

- Note(s): *See attached report, UltraTech's File No.: 17MDL031_CISPR32A, dated July 13, 2017 for details and conditions of Verification Compliance.*

Approved by: Tri M. Luu BASc.

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

91038 1309 46390-2049 AT-1945 SL2-IN-E-1119R CA2049

F.4 RoHS/REACH Compliance Statement

This confirms that the product(s) listed below have been evaluated against Regulation (EC) 1907/2006 of the European Parliament, "**Registration, Evaluation, and Authorization of Chemicals (REACH),** as interpreted by EU Court of Justice decision C-106/14 of 10 September 2015.

Table 51: Microtronix RoHS/REACH Compliant DX-4400 SDI Video Products

Product Family	Product Part Number(s)
DX-4400 Product Family:	
DX-4400 – SD/HD/2K/4K SDI Text & Graphics Inserter	**DX-4400-xx-xx**, where xx are any combination of alphanumeric characters
DX-4400 OEM Board Assemblies:	
SD/HD/2K/4K SDI Text & Graphics Inserter board assembly	**6297-xx-xx**, where xx are any combination of alphanumeric characters

The articles listed above have been evaluated for the presence of the 191 REACH SVHCs as updated BY ECHA on June 27, 2018. Per article 33 of EU Regulation 1907/2006, the article(s) and sub-articles* contained within the article(s) MAY CONTAIN the following SVHCs in amounts no more than 1000ppm, as provided in the table below

Table 52: List of SCHC Compounds

SVHC Name	Worst Case Concentration (ppm) of SVHC
Cadmium and its compounds	<100 ppm (0.01 weight %)
Mercury and its compounds	<1000 ppm (0.1 weight %)
Hexavalent chromium and its compounds	<1000 ppm (0.1 weight %)
Lead and its compounds *	<1000 ppm (0.1 weight %)

*Except when allowed by the Directive. For example, 3500 ppm in steel, 4000 ppm in aluminum alloys and 40000 ppm in copper alloys.

Authorized Signature: Norman McCall

Name: Norman McCall

Title: President / CTO

Date Last Updated: September 21, 2018

Index