

# USER MANUAL

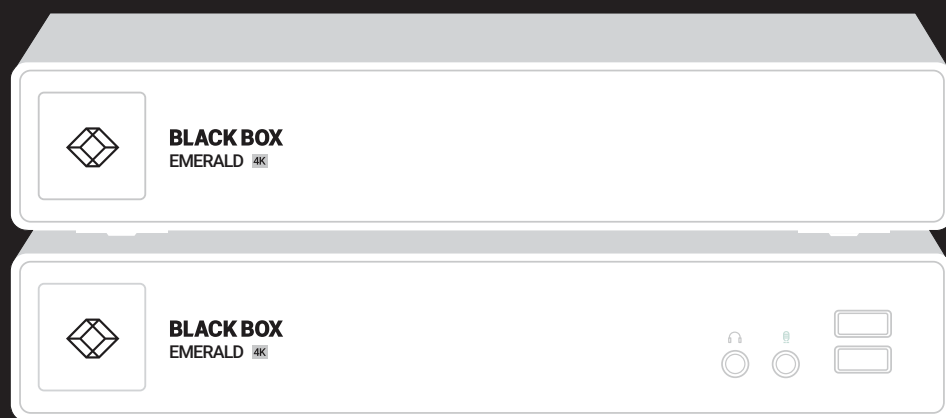
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EMD4000T, EMD4000R

# EMERALD 4K KVM MATRIX AND EXTENSION

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## LASER WARNING

WARNING: Laser. If using an optical fiber SFP+ adapter when connecting an Emerald to a switch or other device, the user must observe precautions for working with a Class 1 laser product.



# CHAPTER 1: SPECIFICATIONS

## 1.1 TX AND RX SPECIFICATIONS

**TABLE 1-1. TRANSMITTER AND RECEIVER SPECIFICATIONS**

SPECIFICATION	DESCRIPTION
Approvals	Unit: UL, CE and RoHS; Power Supply: TUV, UL
Connectors	EMD4000T: (1) DisplayPort, (1) Power, (1) DB9 serial, (1) USB Type B, (1) RJ-45, (2) SFP cages, (2) 3.5-mm audio; EMD4000R: (1) DisplayPort, (1) Power, (1) DB9 serial, (4) USB Type A, (1) RJ-45, (2) SFP cages, (2) 3.5-mm audio;
Maximum Distance between Transmitter and Receiver	Unlimited using IP rules
Indicators	Each TX or RX unit: (1) single bi-color LED (red/green)
Maximum Resolution	EMD4000T, EMD4000R: 4096 x 2160 @ 60 Hz
Material	Aluminum outer case with plastic bezel
Operating System Support	Microsoft Windows® Vista, XP, Windows 7, Windows 8, Windows 10, Server 2003, Server 2008, Server 2012, Linux®, Solaris, Mac OS
Operation	Default IP Address for Transmitter:192.168.1.22; Default IP Address for Receiver: 192.168.1.21; Default Username: admin; Default Password: N/A Blank password by default, just press the Enter key; EDID Support: Internal DDC table in Transmitter; Encryption: Secure Sockets Layer (SSL) over a TCP/IP up to 128-bit for transmitter to receiver with virtualized targets, depending on configuration
Environmental	Operating Temperature: 32 to 104° F (0 to 40° C); Storage Temperature: -4 to 140° F (-20 to 60° C); Operating Humidity: 5–95%
Power	Each unit: External desktop-style adapter, 100–240 VAC input, 12 VDC, 3 A connection to unit
Dimensions	EMD4000T: 1.5" H x 8.5" W x 7.4" D (3.9 x 21.6 x 18.7 cm); EMD4000R: 1.5" H x 8.5" W x 7.4" D (3.9 x 21.6 x 18.7 cm);
Weight	EMD4000T: 2.50 lb. (1.14 kg); EMD4000R: 2.55 lb. (1.16 kg)

# CHAPTER 1: SPECIFICATIONS

## 1.2 LICENSING

**NOTE:** For managed installations with more than 32 users, you will need to use Boxilla KVM AV/IT Manager. The basic Boxilla license (BXAMGR) supports 25 users.

Other available licenses for Boxilla are listed below:

- ◆ 50 Users, Devices or Connections (BXAMGR-50)
- ◆ 100 Users, Devices or Connections (BXAMGR-100)
- ◆ 200 Users, Devices or Connections (BXAMGR-200)
- ◆ 300 Users, Devices or Connections (BXAMGR-300)
- ◆ Unlimited Users, Devices or Connections (BXAMGR-ULT)

Available upgrade licenses for Boxilla are listed below:

- ◆ Add 25 Users, Devices or Connections (BXAMGR-LIC-25)
- ◆ Add 100 Users, Devices or Connections (BXAMGR-LIC-100)
- ◆ Add Unlimited Users, Devices or Connections (BXAMGR-LIC-ULT)



## CHAPTER 2: OVERVIEW

### 2.1 INTRODUCTION

The Emerald family is composed of Receivers, Transmitters, Boxilla and three network switches. Emerald leverages state-of-the-art technologies in compression, networking, and latency management. Some of the key features of Emerald are:

- Pixel perfect resolution—completely lossless. Emerald supports 60 fps, 8-bit color depth, so you get excellent video quality.
- Supports WAN access—you can work anywhere. Transmit data over long distances and between LANs.
- If one network/switch fails, the Emerald 4K extenders continue to operate. They have redundant SFP+ connectors.
- Easy Deployment: The Emerald system is designed to be easily and quickly deployed. No new drivers or software need to be installed on target PCs or Virtual Desktops. The system uses standard networking protocols and cabling. Users and connections are defined using an intuitive On-Screen-Display (OSD). Connections can be made via simple “click on target.” Multiple modes of operation such as private connections, auto-login, and auto-connect enable various workflows and collaborations to be supported.
- Supports full virtualization.
- Transparent USB Re-Direction: The Emerald system provides transparent USB re-direction for both virtual and physical desktop connections. Keyboards and mice are collated to a common channel while other USB devices are re-directed to virtual or physical targets. There is a limit of two non-keyboard/mice devices that can be re-directed to a Transmitter unit (i.e. physical PC/ Workstation).
- High Reliability and Highly Secure: The Emerald system minimizes maintenance for administrators. The intuitive On-Screen-Display is simple to learn and understand. All media streams transmitted between the Emerald devices are encrypted using 128-bit SSL. Password protection is also provided to control access to all administration functions.
- Flexible across platforms
- Customize to suit your application
- Includes an SFP port, enables you to use copper or fiber
- Manage via the Receiver’s OSD, X-key stick or Boxilla
- Supports video resolutions up to 2K/HD or 4K/UHD
- Supports digital audio

### 2.2 AVAILABLE MODELS

The following models are available:

- Single-Head 4K Transmitter (EMD4000T) and Receiver (EMD4000R)
- 1G 48-Port Network Switch (EMS1G-48)
- 10G 28-Port Network Switch (EMS10G-28)
- 100G 32-Port Network Switch (EMS100G-32)

**SPECIFICATION COMPARISON CHART: TRANSMITTERS AND RECEIVERS**

	NUMBER OF VIDEO HEADS	USB PORTS	NETWORK	SERIAL	AUDIO	SFP	RESOLUTION
<b>RECEIVERS</b>							
4K RECEIVER (EMD4000R)	(1) DISPLAYPORT	(4) USB TYPE A	(1) RJ-45	(1) DB9	(2) 3.5-MM	(2)	4096 x 2160
<b>TRANSMITTERS</b>							
4K TRANSMITTER (EMD4000T)	(1) DISPLAYPORT	(1) USB TYPE B	(1) RJ-45	(1) DB9	(2) 3.5-MM	(2)	4096 x 2160

## CHAPTER 2: OVERVIEW

COMPATIBLE SFPS	
PART NUMBER	DESCRIPTION
LSP421	SFP+ - 10-Gb, Extended Diagnostics, 850-nm Multimode Fiber, 300-m, LC
LSP422	SFP+, 10GBASE-R, 1310-nm single-mode, 10 km
CALL TECHNICAL SUPPORT	SFP+, Copper

**NOTE:** References to the Emerald system in this document refer to both Receivers (EMD4000R) and Transmitters (EMD4000T).

### 2.3 WHAT'S INCLUDED

EMD4000R includes:

- ◆ (1) Receiver
- ◆ (1) 12-VDC power supply with power cord

EMD4000T includes:

- ◆ (1) Transmitter
- ◆ (1) DisplayPort 1.2 cable
- ◆ (1) USB 2.0 Type B cable
- ◆ (2) 3.5-mm audio cables
- ◆ (1) 12-VDC power supply with power cord

### 2.4 APPLICATIONS

An Emerald system can be composed of just Receivers and Transmitters. In these types of systems—called unmanaged—there is no central management. Each device needs to be configured individually and upgraded individually. The admin can export the configuration from one Receiver and import it to all other Receivers using a USB Flash Drive.

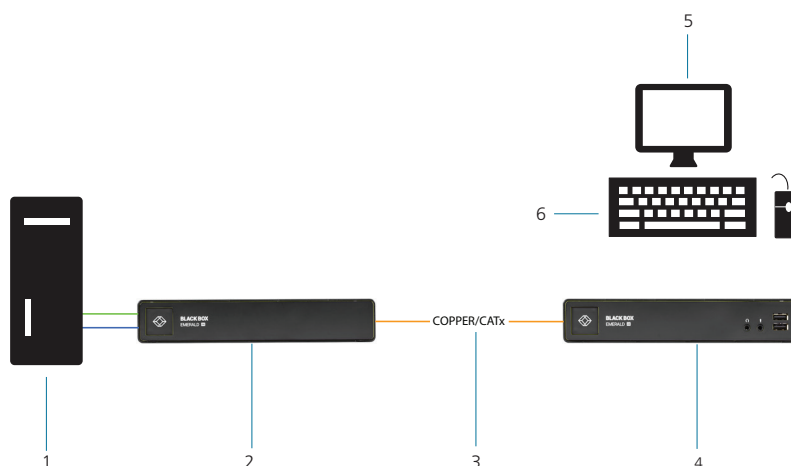


FIGURE 2-1. EMERALD EXAMPLE – UNMANAGED BASIC INSTALLATION



# CHAPTER 2: OVERVIEW

For larger configurations, a central manager is needed—Boxilla. Boxilla operates as a central manager for a “managed domain.” A managed domain is a collection of Emerald Receivers and Transmitters managed by a Boxilla. Once a Receiver or Transmitter has been added to a managed domain, it can only communicate with other Receivers or Transmitters within this managed domain.

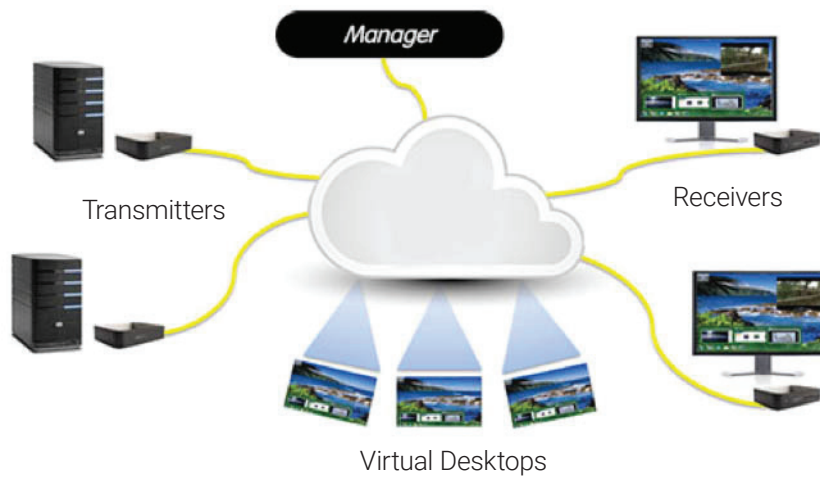


FIGURE 2-2. EMERALD EXAMPLE—INCLUDING PHYSICAL AND VIRTUAL DESKTOPS MANAGED BY BOXILLA

Connect your post-production installations located across the globe with Emerald transmitters and receivers. Connection distances are unlimited.

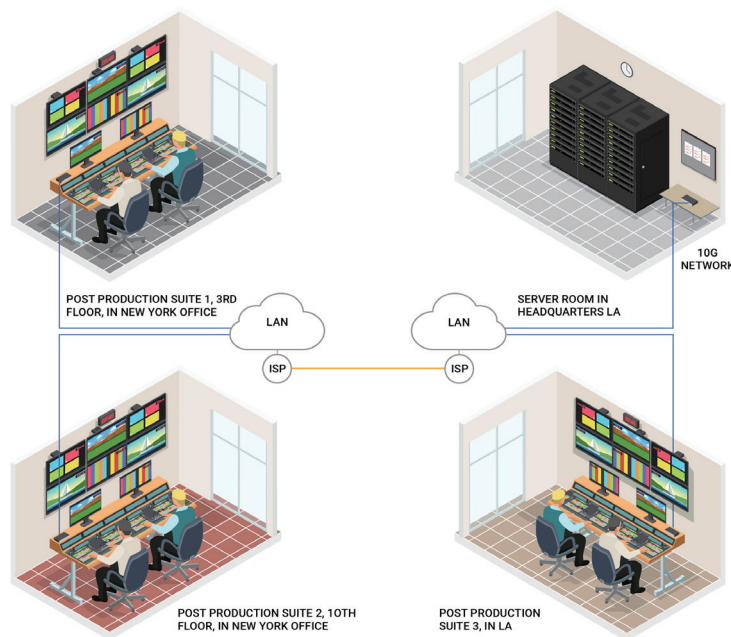


FIGURE 2-3. POST-PRODUCTION EXAMPLE

## CHAPTER 3: CONFIGURATION

### 3.1 CONFIGURATION OF RECEIVER

An Emerald Receiver connects to a physical PC or a virtual desktop over a TCP/IP network and decrypts and decompresses the streams to provide video, audio, and USB connections to a user. The user is presented with typical PC connections—video out (DisplayPort), USB (typically 2 ports of USB 2.0), line out, and microphone in.

The Transmitter-Receiver connection uses Black Box's compound compression algorithm for video called Dynamic Content Optimized Compression (DCOC). This algorithm optimizes compression based on content in the video stream and on available network bandwidth. Standard Microsoft RDP is used for connections to Virtual Desktops. Multiple versions of RDP are supported from RDP 8.1 to legacy versions. This allows Emerald Receivers to connect to Microsoft Hyper-V, VMWare ESX, and Citrix XEN based virtual desktops as well as session host based desktops (previously called Terminal Services). Emerald also supports PCoIP.

The Receiver is configured using an On-Screen Display (OSD) built into the Receiver or using the Boxilla - Enterprise Level KVM and AV/IT Manager. The network settings and unit name among others can be configured for a Receiver. The target connections are defined by their target name or IP address, log-in username/password, and TCP port number to be used. Users can be created and specific connections may be allocated to the different users. For more information, see the OSD section of this manual.

### 3.2 CONFIGURATION OF TRANSMITTER

An Emerald Transmitter converts the video, audio, and USB connections of a PC or Workstation to a format that can be connected and controlled over a direct connect or TCP/IP network. The Transmitter connects to the DisplayPort or DVI port(s) and USB ports of a PC or workstation. The Transmitter controls the connection to a remote Receiver and manages the flow of information to it. It converts and compresses video and audio information for transmission over standard TCP/IP networks, along with USB peripheral communications. All data communication uses 128-bit encryption.

The Transmitter-Receiver connection uses Black Box's compound compression algorithm for video called Dynamic Content Optimized Compression (DCOC). This algorithm optimizes compression based on content in the video stream and on available network bandwidth. Standard Microsoft RDP is used for connections to Virtual Desktops. Multiple versions of RDP are supported from RDP 8.1 to legacy versions. This allows Emerald Receivers to connect to Microsoft Hyper-V, VMWare ESX, and Citrix XEN based virtual desktops as well as session host based desktops (previously called Terminal Services). Emerald also supports PCoIP.

The Transmitter is configured from an Emerald Receiver or Boxilla. The network settings, unit name, and video quality are among the parameters that can be configured on a Transmitter. For more information, see the OSD section of this manual.

### 3.3 CONFIGURATION OF BOXILLA MANAGER

In a basic installation, you can configure Emerald via an Emerald receiver's built-in OSD display. For larger installations, a Boxilla Manager (BXAMGR) can manage a network of Emerald Receivers and Transmitters. The BXAMGR can manage 25 transmitters/receivers by default. It can manage an unlimited number of Emerald transmitters/receivers when using an upgrade license.

A Boxilla user profile is protected by username and password to permit different users to access the same unit securely. It maintains the central database that is distributed to all Receivers in the "domain" of the Boxilla (i.e. discovered and added to manager) – called the "managed domain". This distribution ensures that there is no single point of failure in the Emerald system – each Receiver has a copy of the database. This enables each Receiver to continue operation – log users in, make connections as required – even if the Boxilla goes off-line.

Using the intuitive Boxilla web-based interface, one or more administrators can manage potentially thousands of users who are interacting with an almost unlimited number of devices. Boxilla operates as a self-contained compact server unit that can be located anywhere within your network. Boxilla is supplied pre-loaded and is straightforward to deploy, requiring only a network connection and a power input to begin operation.

The current version of Boxilla provides management of Black Box's Emerald system. For more information on Boxilla, refer to the Boxilla user manual.

## CHAPTER 4: MODES OF OPERATION

The Emerald system supports the following modes: Auto-Login, Auto-Connect, Private Connection, and Shared Connection Modes.

### 4.1 AUTO LOGIN

In Auto-Login Mode, turning on the Emerald Receiver automatically causes a login as a pre-defined user. The user is presented with the permitted connections that have been predefined.

### 4.2 AUTO CONNECT

In Auto-Connect Mode, when a user logs-in to the Emerald Receiver, it causes an automatic connection to their pre-allocated workstation or virtual desktop. Auto-Login and Auto-Connect are defined independently of each other, but can be used together to auto login/auto connect devices that are difficult to reach.

### 4.3 PRIVATE CONNECTION

In Private Connection Mode, when a user makes a connection to a target workstation/virtual desktop, this connection is only accessible by this user. All other users will receive a "busy" message if they attempt to connect to the same workstation/virtual machine. This is the default mode for connections.

### 4.4 SHARED CONNECTION

In Shared Connection Mode, multiple users can connect to the audio and video of the same target computer over the network. They arbitrate for control of the keyboard and mouse of that computer. Non-keyboard and mice devices are not supported on shared connections (such as USB 2.0 devices due to the timing/OS limitations).

If the system has multiple shared mode connections, where more than one TX is sharing to separate RX's, then the administrator of the TX must update the Network Multicast address to be unique per each shared connection.

## CHAPTER 5: INSTALLATION

### 5.1 EMERALD RECEIVER (EMD4000R) CHECKLIST

Before installing your Emerald Receiver, refer to the list below to ensure that you have all the items necessary for installation:

- ◆ Emerald Receiver
- ◆ External power supply for the Emerald Receiver
- ◆ Power cord
- ◆ Emerald Quick Installation Guide (QIG) (You can download this from [blackbox.com](http://blackbox.com))

### 5.2 EMERALD TRANSMITTER (EMD4000T) CHECKLIST

Before installing your Emerald Transmitter, refer to the list below to ensure that you have all the items necessary for installation:

- ◆ Emerald Transmitter
- ◆ External power supply for the Emerald Transmitter
- ◆ Power cord
- ◆ DisplayPort 1.2 cable
- ◆ USB 2.0 Type B cable
- ◆ (2) 3.5-mm audio cables
- ◆ Emerald Quick Installation Guide (QIG) (You can download this from [blackbox.com](http://blackbox.com))
- ◆ DVI and USB cables (not included, ordered separately)

### 5.3 INSTALLATION OPTIONS



**WARNING:** To reduce the risk of electric shock or damage to your equipment, disconnect the power from the Emerald device by unplugging the power supply from the electrical outlet. To reduce the risk of electric shock or damage to your equipment, turn on the remote workstation and the Emerald Transmitter in the order described in the following procedures.

You can install the Emerald system either on a point-to-point or networked configuration.



**WARNING:** To avoid potentially fatal shock hazard and possible damage to equipment, please observe the following precautions:

- ◆ Test AC outlets at the workstation and monitor for proper polarity and grounding.
- ◆ Use only with grounded outlets at both the workstation and monitor. When using a backup Uninterruptible Power Supply (UPS), power the workstation and the Transmitter from the same supply.

**NOTE:** The AC outlet is the main disconnect.



The orientation of the unit needs to be sitting in the normal orientation or upside down but cannot be orientated on either of its sides as the ventilation holes would be blocked which would impact the product performance.



If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

## CHAPTER 5: INSTALLATION

### 5.4 CONNECT THE EMERALD RECEIVER

The recommended sequence to connect the receiver is:

1. Locate the power supply adapter and the AC line cord.
2. Plug the DC connector of the power supply into the matching socket on the rear of the receiver.
3. Attach the AC line cord to the power supply adapter.
4. Attach the monitor, keyboard, mouse, USB and audio devices to the Emerald Receiver.
5. Connect the SFP+ transceiver appropriate for the fiber cable type and distance you are running over fiber to SFP+1.
6. Connect from this transceiver to your 10G network switch or directly to the receiver.

NOTE: SFP+1 must be used as the primary network connection on the Emerald 4K Receivers.



FIGURE 5-1. FRONT VIEW OF EMERALD 4K RECEIVER (EMD4000R)

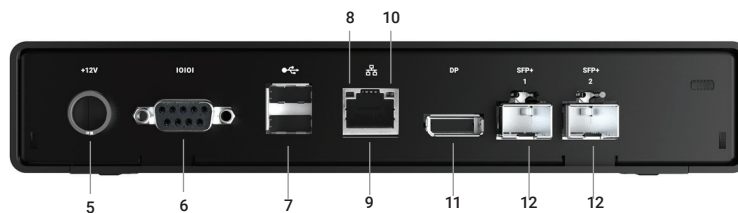


FIGURE 5-2. REAR VIEW OF EMERALD 4K RECEIVER (EMD4000R)

## CHAPTER 5: INSTALLATION

TABLE 5-1. EMERALD RECEIVER COMPONENTS

NUMBER IN FIGURE 5-1 AND 5-2	COMPONENT	DESCRIPTION
1	Power LED	Lights green when power is ON
2	(1) 3.5-mm connector	Connects to speakers
3	(1) 3.5-mm connector	Connects to microphone
4	(2) USB Type A connectors	Link to USB 2.0 peripherals
5	(1) 2.5-mm barrel connector for power	Links to 12-VDC, 3-A external in-line power supply
6	(1) DB9 connector	Links to RS-232 serial console interface for management
7	(2) USB Type A connectors	Link to USB 2.0 peripherals
8	(1) RJ-45 connector	Links to 10-/100-/1000-Mbps networks
9	(1) Link/Activity LED	Lights green when there is activity on the link
10	(1) Link Speed LED	LED blinks green 1= 10 Mbps, 2 = 100 Mbps and 3= 1 Gbps in a 1.5 second interval. No blinking means no valid link
11	(1) DisplayPort connector	Links to Display Port output
12	(2) SFP module slots	Twisted-pair or fiber optic modules install here: (2) SFP+ slots (included for redundancy)

## 5.5 CONNECT THE EMERALD TRANSMITTER

Before connecting the Emerald Transmitter to the remote workstation, ensure that the resolution and the refresh rate of the remote workstation are supported by the Emerald system. Set the screen resolution and refresh rate of the remote workstation. Unsupported settings will cause blank or distorted video at the Receiver.

The recommended sequence to connect the Transmitter is:

1. Locate the power supply adapter and the AC line cord.
2. Plug the DC connector of the power supply into the matching socket on the rear of the transmitter.
3. Attach the AC line cord to the power supply adapter.
1. Attach the Emerald Transmitter to the target PC/workstation using DisplayPort and USB Type B cables.
2. Connect the SFP+ transceiver appropriate for the cable type and distance you are running over the fiber to the SFP+1.
3. Connect from this transceiver to your 10G network switch or directly to a receiver. Emerald does support direct attach SFP+, typically this will be the most cost efficient option for a relatively short distance (less than 22.9 feet [7 meters]).



FIGURE 5-3. FRONT VIEW OF THE EMERALD 4K TRANSMITTER (EMD4000T)

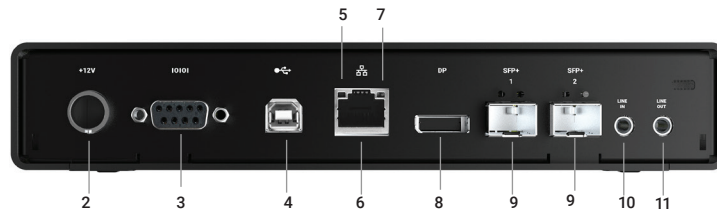


FIGURE 5-4. REAR VIEW OF THE EMERALD 4K TRANSMITTER (EMD4000T)

**TABLE 5-2. EMERALD TRANSMITTER COMPONENTS**

NUMBER IN FIGURE 5-3 AND 5-4	COMPONENT	DESCRIPTION
1	Power LED	Lights green when power is ON
2	(1) 2.5-mm barrel connector for power	Links to 12-VDC, 3-A external in-line power supply
3	(1) DB9 connector	Links to RS-232 serial console interface for management
4	(1) USB Type B connector	Link to USB 2.0 PC/workstation USB port
5	(1) RJ-45 connector	Links to 10-/100-/1000-Mbps networks
6	(1) Link/Activity LED	Lights green when there is activity on the link
7	(1) Link Speed LED	LED blinks green 1= 10 Mbps, 2 = 100 Mbps and 3= 1 Gbps in a 1.5 second interval. No blinking means no valid link
8	(1) DisplayPort connector	Links to Display Port input
9	(2) SFP module slots	Twisted-pair or fiber optic modules install here: (2) SFP+ slots (included for redundancy)
10	(1) 3.5-mm connector	Connects to microphone
11	(1) 3.5-mm connector	Connects to speakers

## CHAPTER 5: INSTALLATION

### 5.6 STARTING UP AND DEFAULT SETTINGS FOR IP

1. Once everything is connected, press the Power button on the front of the Emerald Receiver.
2. The On-Screen Display (OSD) will appear on the screen.
3. Enter the default administrator user name and password.
4. The default network setting for the Emerald Receiver uses a preconfigured static IP address.

#### Default Settings:

- ◆ Transmitter IP Address: 192.168.1.22
- ◆ Receiver IP Address: 192.168.1.21
- ◆ Type: Static
- ◆ Subnet Mask: 255.255.255.0
- ◆ Default Gateway: 0.0.0.0
- ◆ Admin username: admin
- ◆ Admin password: no password, it is blank by default
- ◆ Ports Used: 3389

**IMPORTANT:** Do not lose the admin password once configured; there is no way to reset or retrieve it. The Emerald receiver has the option to create a second administrator account as a backup.





## CHAPTER 6: NETWORKED INSTALLATION

### 6.1 POINT-TO-POINT INSTALLATION

In a point-to-point configuration, no administrator setup of the Emerald Transmitter or the Emerald Receiver is required. This enables you to install the system quickly, directly out-of-the-box. However, in the point-to-point configuration, you can install only one Emerald Transmitter and Emerald Receiver pair on a subnet, and both must be on the same subnet unless a router is present in the network to span subnets. To span across different subnets, you will need to have admin rights to both routers on either side of the installation and setup port forwarding for Port 9020, 9030 and 3389 for KVM; Port 3389 for RDP for Remote Desktop.

Also if there are other devices with 192.168.1.21 (default Receiver IP address) or 192.168.1.22 (default Transmitter IP address) on the network, then the IP addresses for Receiver and/or Transmitter should be changed to unused IP addresses.

### 6.2 UNMANAGED OR MANAGED MATRIX INSTALLATION

The following instructions will enable you to install your Emerald Receiver and Emerald Transmitter in a networked configuration. In this installation, multiple Emerald Transmitters and Emerald Receivers are attached via the same Ethernet network. In this case, it is important for each unit to be configured with a unique IP address.

The Emerald Receiver has been preconfigured with factory-default network settings. If you install multiple units on the same network, you will need to assign a unique IP address to each unit or configure the Receiver for DHCP. This can be done via the On-Screen Display (OSD) on the Emerald Receiver and must be carried out before adding multiple devices on the same network.

In an IP installation, every Emerald transmitter and receiver requires its own IP address. The network setting is set to static, so the addresses will need to be configured manually:

1. Always configure the transmitter first by connecting the transmitter to the receiver, then connect a keyboard, monitor, and mouse to the receiver unit (receiver is on at this time).
2. Once the transmitter is configured, you can now configure the receiver.
3. A transmitter out of the box must be configured on the same subnet.

**TABLE 6-1. EMERALD SYSTEM DEFAULT NETWORK SETTINGS**

COMPONENT	IP ADDRESS	TYPE	DEFAULT GATEWAY	SUBNET MASK
Emerald Receiver (EMD4000R)	192.168.1.21	Static	192.168.1.1	255.255.255.0
Emerald Transmitter (EMD4000T)	192.168.1.22	Static	192.168.1.1	255.255.255.0
Boxilla Manager (BXAMGR)	192.168.1.24	Static	192.168.1.1	255.255.255.0

Once the IP addresses have been configured, each receiver will need to be configured for users, user passwords, user access rights and default video resolutions. You can access these settings from the receiver's OSD (reboot the receiver and login as admin) and begin configuring these parameters.

NOTE: Each receiver can support a maximum of 32 users and a maximum of 32 targets (virtualized or transmitter).

## CHAPTER 7: OPERATION OF EMERALD SYSTEM

### 7.1 LED IDENTIFICATION

#### Front panel

There is one LED on the front panel of an Emerald unit (integrated into the power-button on the Receiver) - called the STATUS LED. The STATUS LED will light up when the unit (Receiver or Transmitter) is turned on. The STATUS LED “blinks” when a unit is being upgraded.

#### Rear panel

Two LEDs are built into the RJ-45 connectors on the Emerald Receiver and Transmitter. The definition of the operation of these LEDs is shown in Table 7-1.

**TABLE 7-1. RJ-45 CONNECTOR LEDS ON THE REAR PANEL OF THE EMERALD RECEIVER AND TRANSMITTER**

LED	STATUS	DESCRIPTION
Activity	Green ON	Linked OK
	Green Flashing	Transmit/Receive activity
	Green OFF	No Link
Link Speed	ON	10G
	OFF	No valid link

### 7.2 ACCESSING THE SYSTEM

A connection is established using the OSD on an Emerald Receiver or Boxilla Manager. Once you are connected, a series of messages will be displayed on the screen to inform you of the progress of the connection. You will be able to interact with the remote workstation as if it were located at your desk.

NOTE: If the remote workstation is powered off, the Emerald system will display a “black” screen for video when a connection is made.

## CHAPTER 8: OSD FUNCTIONS

The Emerald Receiver and Boxilla incorporate an On-Screen Display (OSD) that allows you to view information about the configuration of your system and potentially also allows for setting connections and configuration parameters such as the IP address, depending on the type of user. The following sections describe the operation.

### 8.1 USER TYPES

The Emerald system supports three classes of users for Matrix products:

1. Administrator – users of this class have full rights to configure the system. They can create/modify/delete new users and connections, change network settings, etc.
2. Power User – users of this class can modify resolution for connections to virtual desktops and change his/her local password.
3. Standard User – users of this class can only select from a list of pre-defined connections to access and view system information. They cannot change any configuration settings.

### 8.2 LOG ON

A user must log-on to the Emerald Receiver or Boxilla to configure and manage the Emerald system. The log-on screen is shown in Figure 8-1. The username defines the access rights and configuration available to the user.

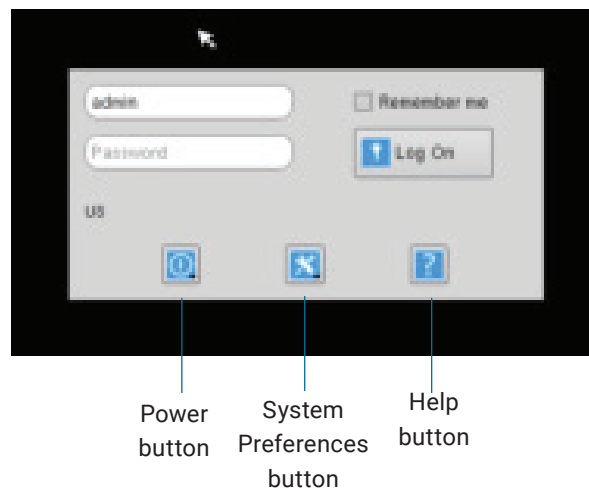


FIGURE 8-1. OSD LOG-ON SCREEN

The fields on this screen are:

- ◆ Username: the username to log-on as defined by the Administrator. Username is case-sensitive.
- ◆ Password: password for the user. Password is case-sensitive.
- ◆ Remember Me: When this box is checked, the unit keeps the username between log-ons and power-cycles. When this box is not checked, the username field is always presented as blank when powered-up and after a log-out. This tick-box only affects the username – the password is never preserved.
- ◆ Power Button: This button allows the user to reboot the client.
- ◆ System Preferences: This button has a drop down menu that allows the user to define system preferences for the Emerald Receiver.
- ◆ Help: This button opens a pop-up window with help on that screen.

## CHAPTER 8: OSD FUNCTIONS

### 8.3 DEFAULT USERNAME AND PASSWORD

The Emerald Receiver ships with a default username of admin with a blank password (i.e. no password). This user cannot be deleted, but the password can be changed.

NOTE: If you create a password for the default Admin account and forget it, there is no way to reset/retrieve it unless using a Boxilla. We recommend that the administrator creates a second Admin account for critical systems in case the main Admin account is locked out.

### 8.4 USER VIEWS AND CAPABILITIES

There are three different types of users in the Emerald System. Your user type will determine what exactly you will see on your OSD. For the purpose of this Manual, we show the screen of an Administrator. This means that some buttons shown here may not be available to other users.

The Emerald comes as an unmanaged system and as a managed system. There are some differences in the OSD for these systems that you may see here.

### 8.5 CONNECTIONS SCREEN

When a user successfully logs on to the Emerald Receiver, the Connection screen is displayed. This is shown in Figure 8-2. The connections that a user can make are listed in the connection window. The user logged on is shown in the top right corner of the OSD.

NOTE: Default\_TX  
is 192.168.1.22

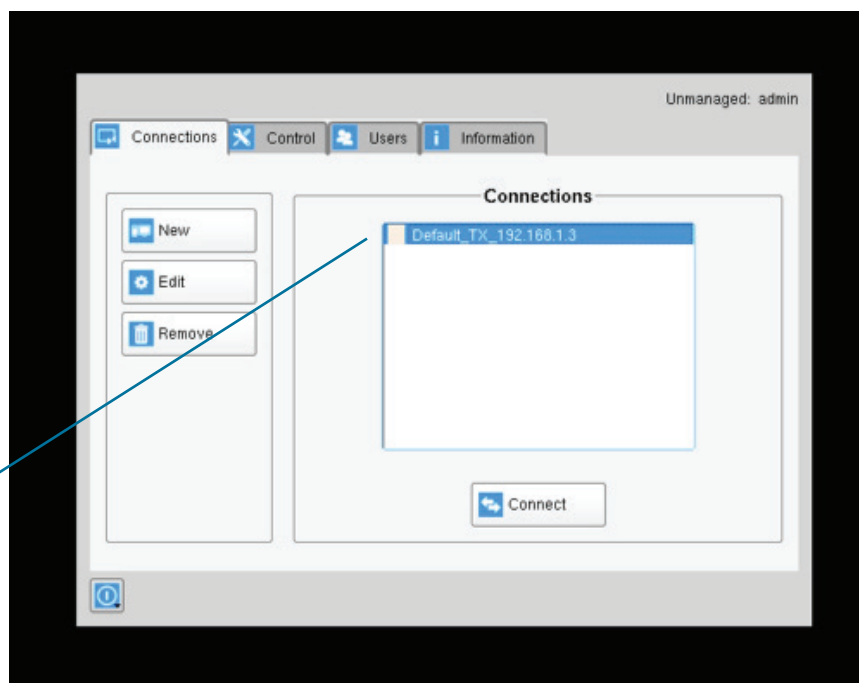


FIGURE 8-2. CONNECTION SCREEN

If the user is an Administrator type, the three buttons on the left (New, Edit, and Remove) will be displayed. These allow the user to create, edit, or remove connections. For Standard User types, no connections can be created, edited, or removed, so these buttons are not displayed or are greyed out.

## CHAPTER 8: OSD FUNCTIONS

By default, there is one connection called "Default Tx - 192.168.1.22" that defines a connection to an Emerald Transmitter with its factory defaults. A maximum of 32 connections can be defined for an Emerald Receiver by default, and these connections can be shared by users as defined by an administrator (different users can have the same connection). The number of connections can be increased to unlimited in a managed domain via a Boxilla upgrade license.

### 8.5.1 CREATING A NEW CONNECTION

To allow an Emerald Receiver to connect to a target Emerald Transmitter, an administrator must create a connection. The administrator clicks on the New button on the Connections screen. This causes the New Connections pop-up window to appear as shown in Figure 8-3.

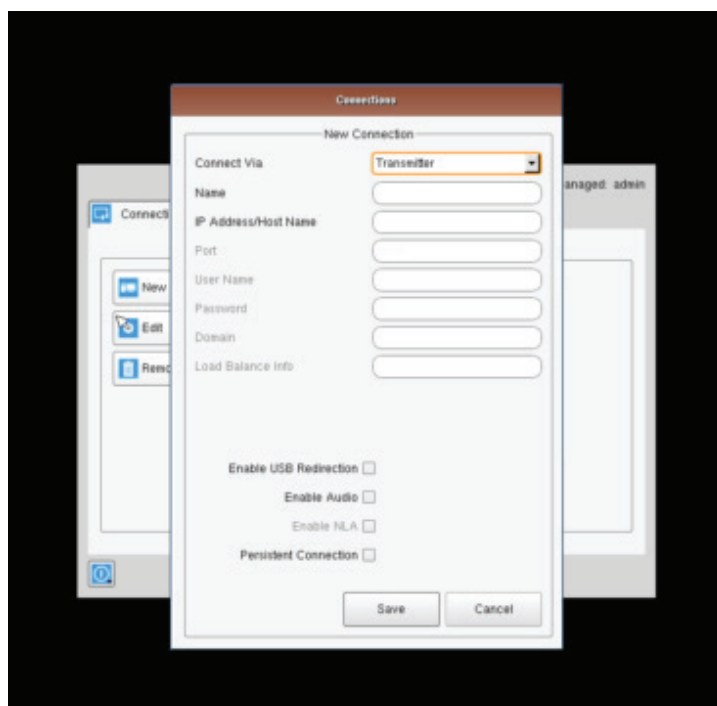


FIGURE 8-3. NEW CONNECTION WINDOW

The fields on this screen are:

- Name: this is a unique name for the new connection. The name can be between 1 and 32 characters. The name can be composed of any Alphanumeric characters and special characters except for " " / \ [ ] ; | = , + \* ? < > `.
- IP Address/Host Name: IP Address of Emerald Transmitter (if Connection Via set to Transmitter) or VM in IP v4 format. Alternatively it can be the Host Name if this can be resolved in the local DNS server.
- Port: defines the port to be used for the RDP connection for connections via VM Direct or Broker. Uses 3389 by default;
- Username: defines username to be used on a VM connection. Only used for connections via VM Direct or Broker. If left "blank" on VM Direct – user will be presented with Windows Login screen on VM;
- Password: defines username to be used on a VM connection. Only used for connections via VM Direct or Broker;
- Domain: defines domain that a Virtual Machine is part of (if part of a windows domain). Not used for connections to Transmitters.

NOTE: Using Host Name will increase the switching time by the time needed to resolve the Host Name to an IP address.

## CHAPTER 8: OSD FUNCTIONS

- ◆ Enable USB Redirection: when set, this enables non-keyboard and non-mice devices (such as tablets and USB headsets) to be redirected for this connection.
- ◆ Enable Audio: when set, this enables audio to be supplied to the remote audio connectors.
- ◆ Enable NLA: when set, this enables Network Level Authentication requiring that the user be authenticated to the RD Session Host server before the session is created. This is not used for when Connection Via is set to Transmitter.
- ◆ Persistent Connection: When turned on, Persistent Connection will constantly try to connect the Receiver with the Transmitters until successful. This is useful when using Emerald for digital signage or an application that does not need a keyboard/mouse to stay connected to a defined source.

### 8.5.2 CONNECTING

To make a connection, the user highlights the required “connection” in the window and then clicks on the “Connect” button. Alternatively, a user can double-click on the connection. This action causes the Emerald Receiver to attempt to connect to the target remote workstation or virtual machine. If the target is available, the connection will be made.

If another user is already connected to the target defined in the connection, the user will receive a pop-up window indicating the target device is already allocated.

### 8.5.3 EDIT CONNECTION

To edit a connection and change its parameters, an administrator clicks on the Edit button on the Connections screen. The Edit Connections pop-up window appears.

The administrator changes required fields and clicks Save to confirm or Cancel to discard any changes.

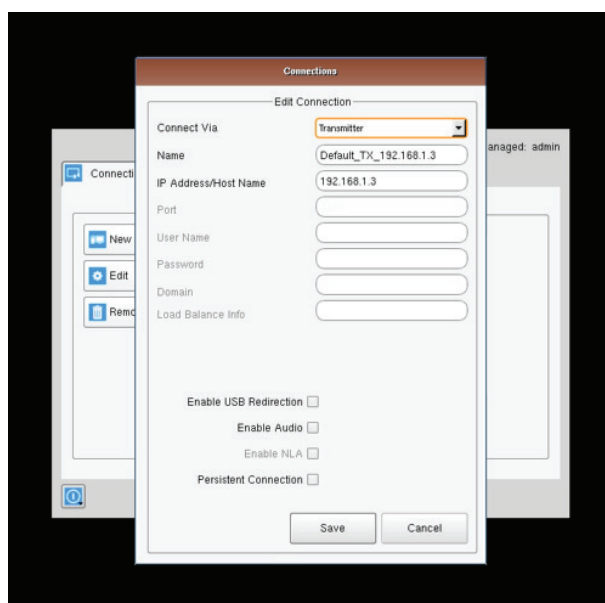


FIGURE 8-4. EDIT CONNECTIONS SCREEN.

## CHAPTER 8: OSD FUNCTIONS

### 8.5.4 REMOVE CONNECTION

To remove or delete a connection, an administrator highlights a connection in the list and then clicks on the Remove button on the Connections screen (shown in Figure 8-5). This causes the Remove Connection pop-up window to appear where a user confirms the removal or cancels the attempt.

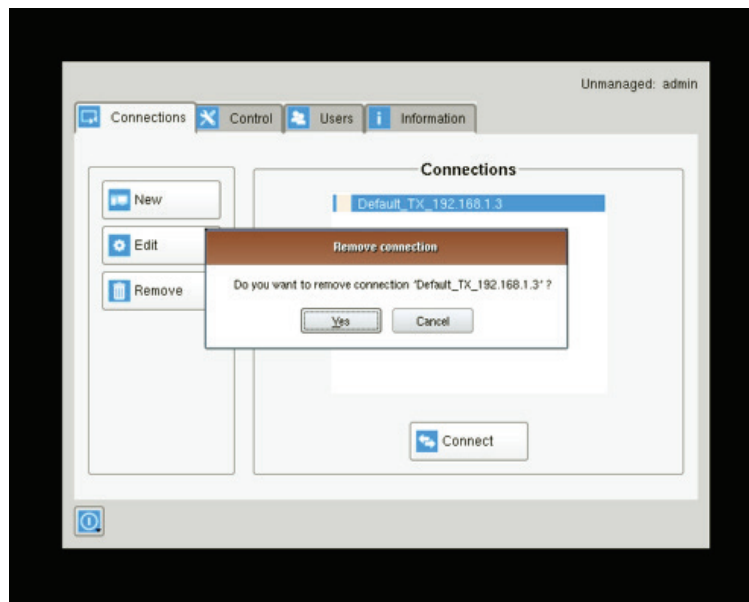


FIGURE 8-5. REMOVE CONNECTIONS SCREEN.

## CHAPTER 8: OSD FUNCTIONS

### 8.6 CONTROL TAB

The Control Tab on the OSD enables an administrator to change the configuration of the Emerald system. The Control Tab is shown in Figure 8-6.

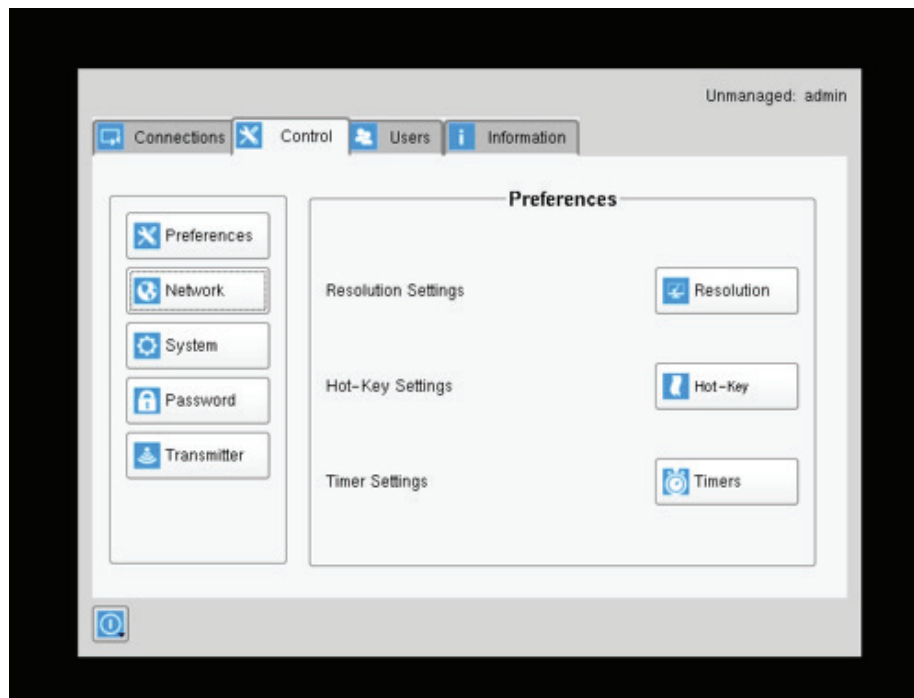


FIGURE 8-6. CONTROL TAB

There are five functions that can be accessed on this tab:

1. Preferences – allows users to change preference settings for:
  - i. Resolution Settings – allows change of preferred resolution for OSD screens and Virtual connections.
  - ii. Hot-Key Settings – allows changing of the active hot-key for keyboard short-cuts.
  - iii. Timer Settings – allows setting of pre-emption timer and various inactivity timers
2. Network – allows administrator to change network parameters for the Emerald Receiver or Manager.
3. System – allows upgrading of unit firmware, reset unit to factory defaults, and to save/restore unit configuration to a USB drive.
4. Password – change the administrator or user password.
5. Transmitter – allows changing of Transmitter parameters.



## CHAPTER 8: OSD FUNCTIONS

### 8.6.1 PREFERENCES

#### Resolution

The Resolution button allows an administrator or power user to set the preferred resolution for the RDP Connection and for the OSD. By default, both the RDP Resolution and the OSD Resolution are set to Auto.

The RDP Connection Resolution allows the resolution to be changed for an RDP connection, (i.e. defines the resolution that the virtual desktop will be accessed with). If the preferred resolution is not supported, the Receiver will use the next highest resolution supported by both monitor and Receiver.

The OSD Resolution is set to Auto by default, but can be changed to the available OSD resolutions if the user wants to set a specific resolution. This setting has no effect when connecting to an Emerald Transmitter.

Click Apply button to save the change.

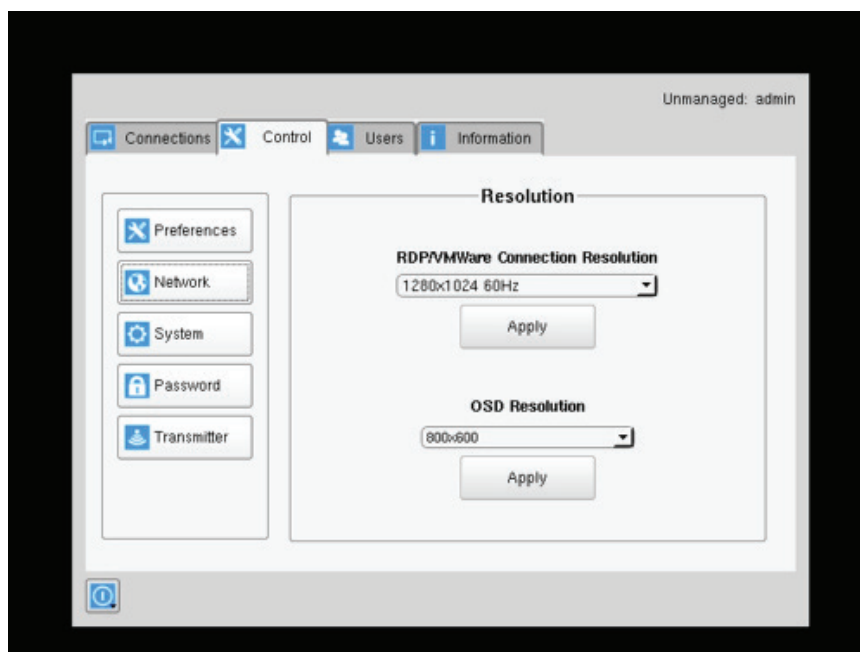


FIGURE 8-7. RESOLUTION SCREEN

## CHAPTER 8: OSD FUNCTIONS

### Hot-Key

The Hot-Key button allows the administrator to change the hot-key configuration. The hot-key is used with the “o” key to terminate the current connection and bring up the OSD. The hot-key with “p” key is used to switch to the previous connection without loading the OSD. Example: PrtScrn, O (default).

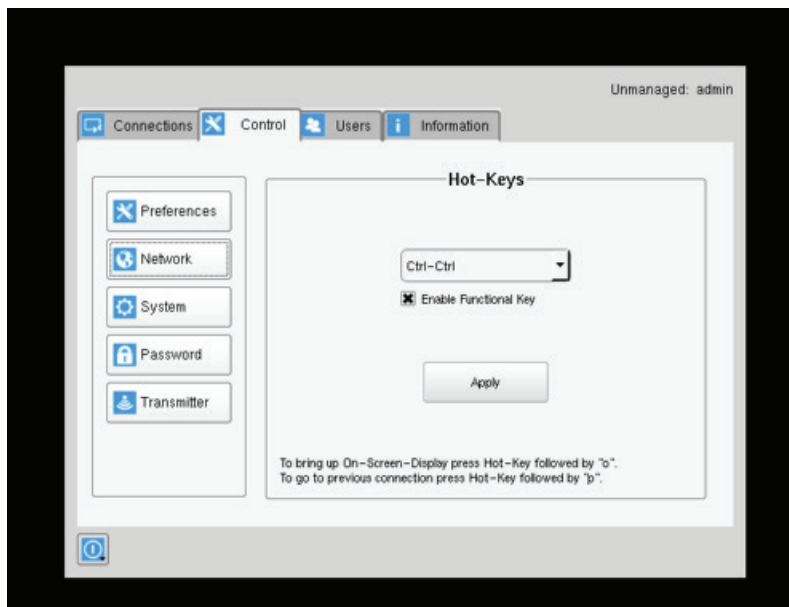


FIGURE 8-8. HOT KEY DEFINITION

The default hot-key is Print-Screen (PrntScrn). The alternatives are shown in the table. Click the Apply button to confirm a hot-key change.

TABLE 8-1. HOTKEY SEQUENCES

SEQUENCE	ACTION
Print Screen (Default)	-press Prnt Scrn key
Ctrl + Ctrl	-press Ctrl key twice within 1 second
Alt + Alt	-press Alt key twice within 1 second
Shift + Shift	-press Shift key twice within 1 second
Open OSD: Hotkey O	Switch to previous target: Hotkey P
Mouse-Left + Right	-press mouse left and right buttons at the same time for 2 seconds

The “Enable Functional Key” tick-box is used to disable the use of the function keys after the hot-key. So only the Hot-Key is required to bring up the OSD. The Enable functional Key is set by default.

### Timer Settings

There are 2 timer settings available to users as shown in Figure 8-9. By default, they are turned off. If you wish to turn them on, you have to select the desired timer, set the time you wish, and click apply. The three timer settings are:

1. OSD Inactivity Timer – This sets a limit on how long a user can be logged on to the OSD without any keyboard or mouse activity. Once the user reaches the inactivity timer, he/she will be logged out of the OSD. The timer value can be set to a number from 2 to 60 minutes.

## CHAPTER 8: OSD FUNCTIONS

2. Connection Inactivity Timer – This sets a limit on how long a user can be connected to a source (virtual machine, Transmitter etc.) without any keyboard or mouse activity. Once the session reaches the inactivity timer, he/she will be logged out of their connection and return to the OSD. The timer value can be set to a number from 2 to 60 minutes.

NOTE: Inactivity occurs when the mouse or keyboard is not pressed or moved for a set period of time.

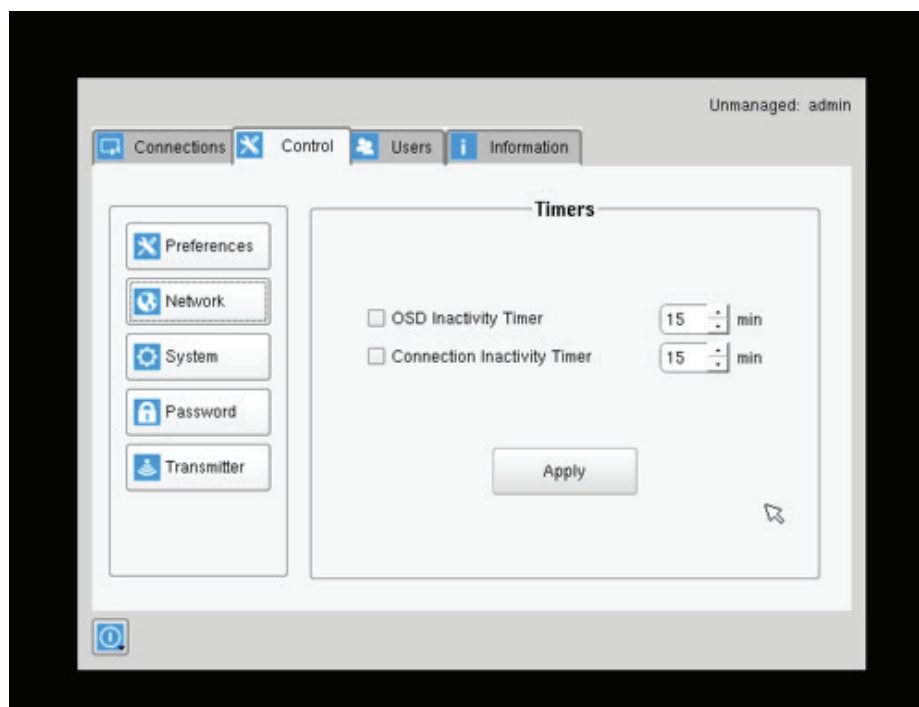


FIGURE 8-9. TIMER SETTINGS

### 8.6.2 NETWORK

The network screen shown in Figure 8-10 allows an administrator to change the settings for the Emerald Receiver. The default network setting for the Receiver is a static IP address of 192.168.1.21. It has a Network Mask of 255.255.255.0 and a Gateway 192.168.1.1. If DHCP is selected, the Receiver or Manager gets its IP address from the DHCP server. Click the Apply button to confirm any changes to network settings.

NOTE: Only IPv4 addressing supported in current firmware version.

## CHAPTER 8: OSD FUNCTIONS

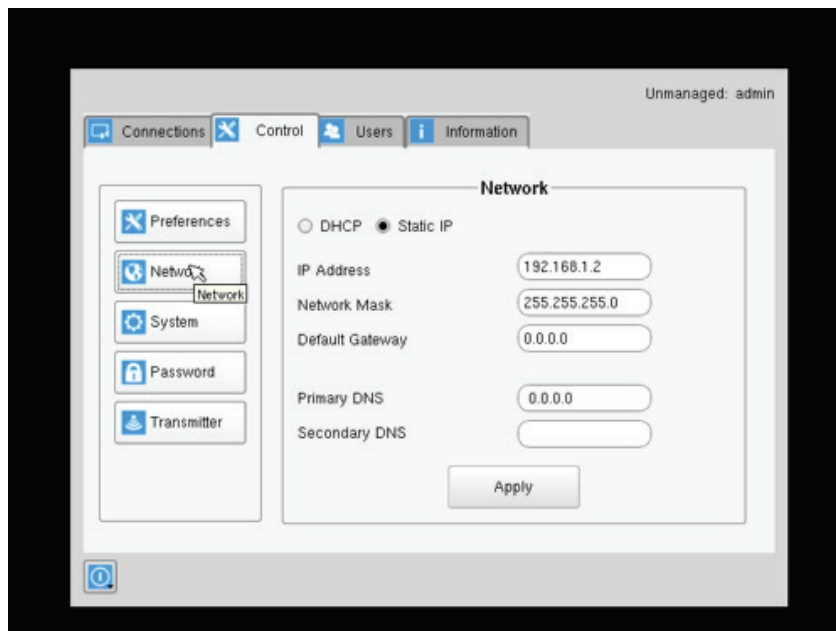


FIGURE 8-10. NETWORK SETTINGS

### 8.6.3 SYSTEM

The System screen shown in Figure 8-11 allows an administrator to upgrade the firmware in the Emerald Receiver, reset it to factory defaults, import/export the configuration to an external USB drive, and perform a system diagnostic.

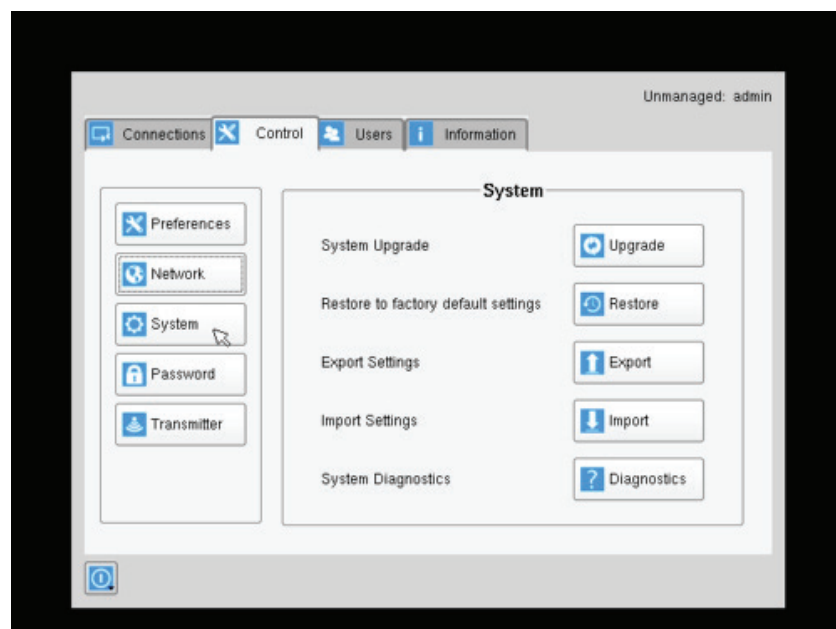


FIGURE 8-11. SYSTEM SCREEN

## CHAPTER 8: OSD FUNCTIONS

### System Upgrade

The Emerald Receiver can be upgraded from a USB Flash drive. Simply take the “firmware.clu” file and place it in the root directory of the flash drive. When you click the Upgrade button, the “valid” upgrade files on the USB drive are displayed. A valid file has the extension .clu – an example is shown in Figure 8-12. If the flash drive isn’t recognized, format the drive using Fat32 file system.



FIGURE 8-12. UPGRADE FILES

Once the administrator has selected the file and clicked Ok, the system checks that the selected file has no errors before upgrading the Emerald Receiver or Manager. The configuration of the unit is preserved through the upgrade.

### Restore Factory Defaults

The administrator can click the Restore button to reset the Receiver back to factory defaults.

### System Diagnostics

The diagnostics provides information for Black Box to debug customer encountered issues. When this button is clicked the user is asked to save the diagnostics onto a memory stick in the Receiver unit. This file should be sent back to Black Box for analysis. There is a similar diagnostic that can be run on a transmitter.

## CHAPTER 8: OSD FUNCTIONS

### 8.6.4 PASSWORD

The Password button when clicked allows the current user's password to be changed. This button is only visible to Administrators.

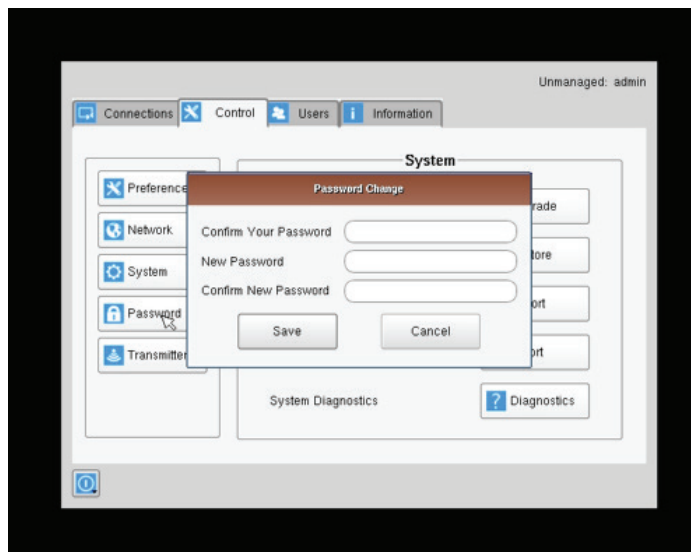


FIGURE 8-13. PASSWORD CHANGE

### 8.6.5 TRANSMITTER

The Transmitter button on the Control Tab allows administrators to change the configuration of an Emerald Transmitter (this button is only visible to administrators). The following options are available when the Transmitter button has been activated:

1. Transmitter Information
2. Transmitter Firmware Upgrade
3. Transmitter restore factory defaults
4. Transmitter reboot
5. Network Settings
6. Discover Transmitter IP address

## CHAPTER 8: OSD FUNCTIONS

### Configuring a Transmitter

To configure a Transmitter, the IP address must be defined for the target Transmitter. When there is no active IP address defined, the TX Setting window has all the buttons grayed out except for the Apply and Discover buttons.

The IP address for the transmitter can be entered into the field at the top of window and click Apply button to activate. If a valid IP address is entered, the Transmitter settings window makes all the options available for the administrator shown in Figure 8-14.

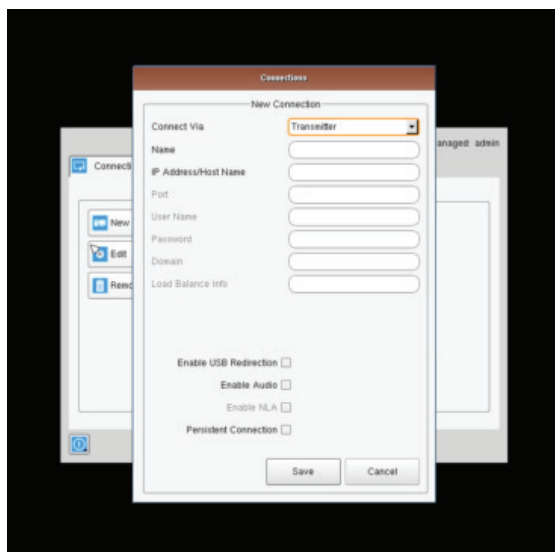


FIGURE 8-14. ENTER TRANSMITTER IP ADDRESS

Alternatively the Discover button can be used to find the IP address of a transmitter. First click the Discover button and follow the instructions. Basically once in discovery mode, the Receiver (or Boxilla) can capture the IP address from a Transmitter once it has been power-cycled.

**NOTE:** The default network setting for the Transmitter is a static IP address of 192.168.1.22. It has a Network Mask of 255.255.255.0 and a Gateway 192.168.1.1.

## CHAPTER 8: OSD FUNCTIONS

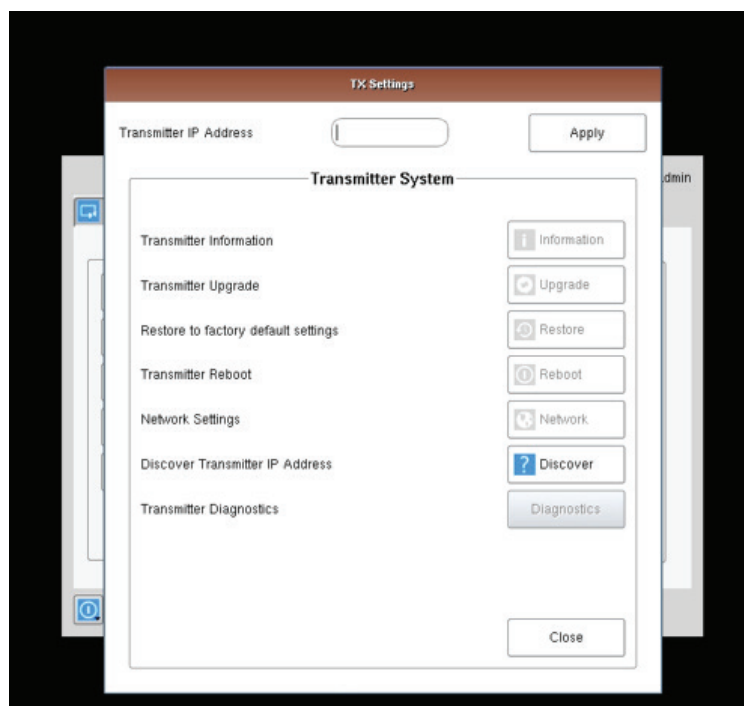


FIGURE 8-15. TRANSMITTER SETTINGS CONFIGURATION WINDOW - DISCOVER BUTTON

If the IP address of the Receiver and Transmitter are not on the same subnet, a router is required to allow them to communicate. This is true even when the Receiver “discovers” the Transmitter’s IP address. One way to avoid this is to change the Receiver address to be on the same subnet as the Transmitter, make the required configuration changes to the Transmitter, and then change the Receiver back to its required IP address.

### Transmitter Information

The Information button provides Transmitter related information such as Device Model, Serial Number, MAC address, and current Firmware Version to the administrator.

If the active IP address is not the address of a valid Emerald Transmitter or this address is unreachable, an error message is returned.

### Transmitter Upgrade

The administrator can click the Upgrade button to change the firmware on a Transmitter. The upgrade file is selected from the set of files on an attached USB drive. These files will have the extension .clu . The selected file is checked to be a valid Transmitter upgrade file before starting the upgrade. The OSD provides a series of screens to walk the user through the process.

The upgrade can take a few minutes to complete and the power to the Transmitter and the Receiver must not be disconnected during the upgrade. During the upgrade process, the Transmitter may reboot.

If the active IP address is not the address of a valid Emerald Transmitter or this address is unreachable, an error message is returned.



## CHAPTER 8: OSD FUNCTIONS

### Transmitter Restore Factory Defaults

The administrator can click the Restore button to reset the Transmitter back to factory defaults. If the active IP address is not the address of a valid Emerald Transmitter or this address is unreachable, an error message is returned.

### Transmitter Reboot

The administrator can click the Reboot button to power-cycle the Transmitter. If the active IP address is not the address of a valid Emerald Transmitter or this address is unreachable, an error message is returned.

### Transmitter Network Settings

The administrator can click the Network Settings button to edit the Transmitter Network Settings.

To change the IP address settings for a Transmitter, the administrator can enter the new IP address, subnet mask, and gateway, and then click on the Apply button.

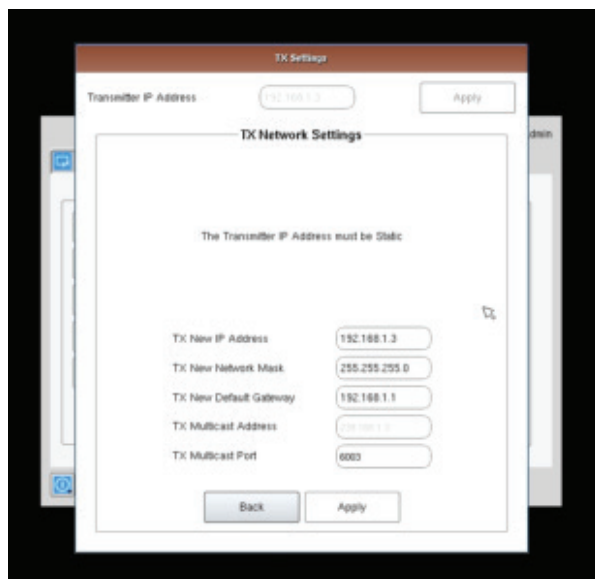


FIGURE 8-16. TRANSMITTER DEFAULT NETWORK SETTINGS

If the new IP address for the Emerald Transmitter is on a different subnet than the Receiver, the Receiver or Boxilla will not be able to communicate with it without going through a router. This is the case even on a point-to-point link between devices.

If the entered IP address is not the address of a valid Emerald Transmitter or this address is unreachable, an error message is returned.

If the system is configured to have multiple shared mode connections, then the network mask must be unique for each Transmitter per shared mode connections. In this example, the second Shared Mode connection Transmitter has been modified to not use the default address.

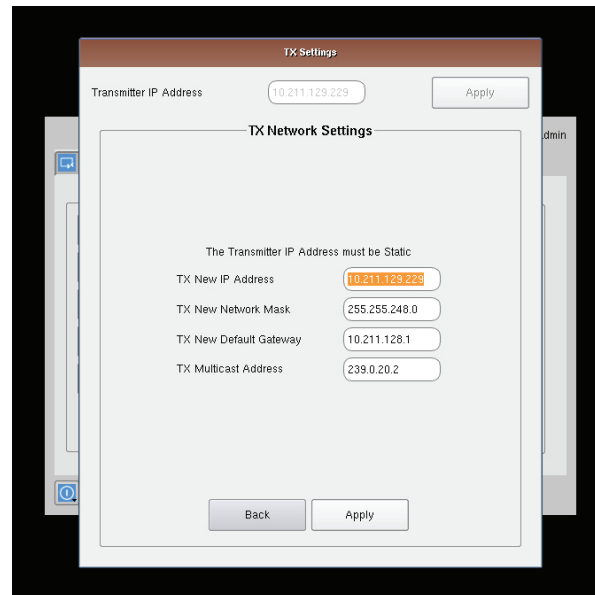


FIGURE 8-17. TRANSMITTER WITH UPDATED NETWORK MASK

## Discover Transmitter IP Address

This requires the Transmitter to be connected to the Receiver or Boxilla on a point-to-point link or be the only Transmitter on the attached network. In this case, the administrator can click on the Discover button and follow the wizard to discover the IP address of the attached Transmitter. This is required in the case when an administrator does not know the IP address of the Transmitter.

## Transmitter Diagnostics

The Transmitter provides diagnostics information for Black Box to debug customer encountered issues. When this button is clicked the user is asked to save the diagnostics onto a memory stick in the Receiver unit. Send this file back to Black Box for analysis.

## Transmitter Preferences

The Transmitter Preferences screen provides six options: Video Quality, Video Source Optimization, HID Configurations, EDID Settings DVI 1, EDID Settings DVI 2. Here we focus on the HID Configuration option, Absolute Mouse.

### Absolute Mouse

This feature can be used to enable interoperability with KM switches with built-in "Glide & Switch" capability such as ServSwitchTC and Freedom. For normal usage, where mouse is directly connected to Receiver, then the Default or Basic options should be used. For normal use where the mouse is directly connected to the Receiver, you should use the Default or Basic options.

OSD Option:

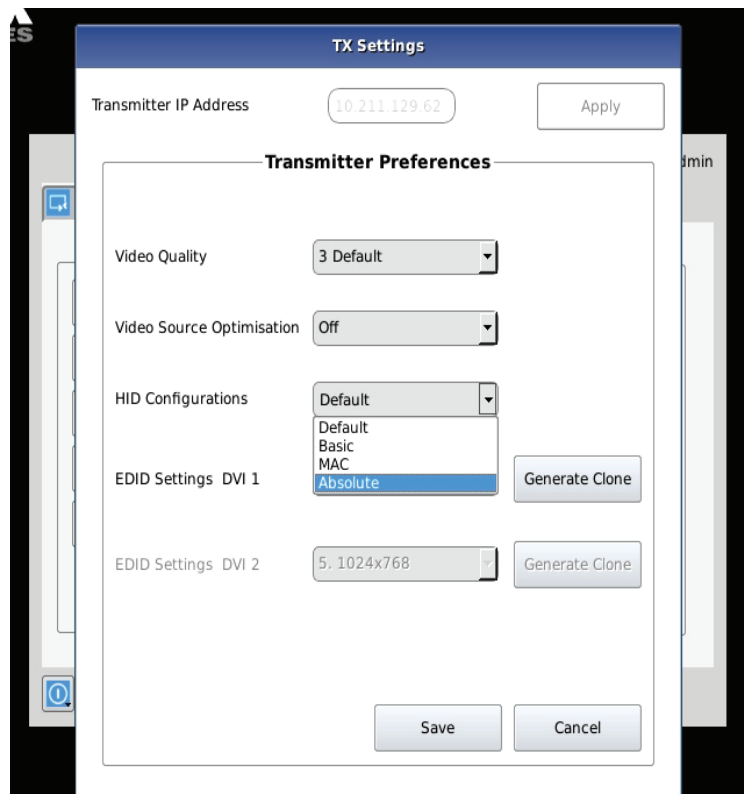


FIGURE 8-18. ABSOLUTE MOUSE

## 8.7 MANAGING USERS

Users are defined in the Emerald system to provide rights to manage the system, rights to connect to different target devices and set parameters for connections. There are three types of users that can be created in an Emerald system.

1. Administrator – users of the class have full rights to configure the system. They can create/modify/delete new users and connections, change network settings, etc.
2. Power User – users of this class can modify resolutions for connections to virtual desktops and change his/her local password.
3. Standard Users – users of this class can only select from a list of pre-defined connections to access and view system information. They cannot change any configuration settings.

The Emerald Receiver and Boxilla have one default user – admin, which is a member of the administrator group. This user is defined by default and cannot be deleted. An Emerald Receiver or Boxilla can have a maximum of 32 users defined, unless in a Boxilla manager domain with an “upgrade” license installed. With the upgrade license installed, unlimited users can be defined.

To manage users, an administrator selects the Users tab (this Tab is only visible to Administrator class users).

## CHAPTER 8: OSD FUNCTIONS

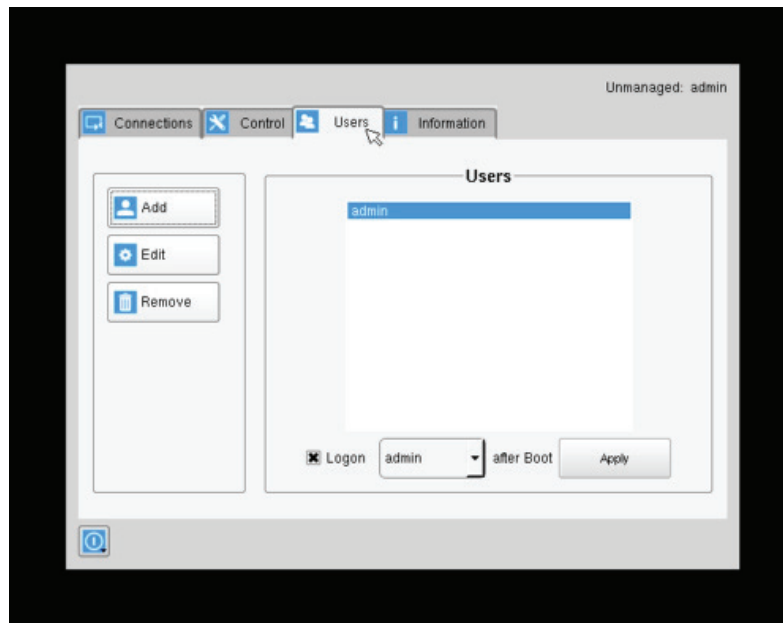


FIGURE 8-19. USERS SCREEN

### 8.7.1 ADD A USER

---

To add a user, click the add button. This causes the New-User window to be displayed.

### 8.7.2 AUTO LOG ON

---

When the Log-on button is selected and a user is chosen, this user will be automatically logged on after power is applied to unit or after a reboot.

## CHAPTER 8: OSD FUNCTIONS

NOTE: Default\_TX  
is 192.168.1.22

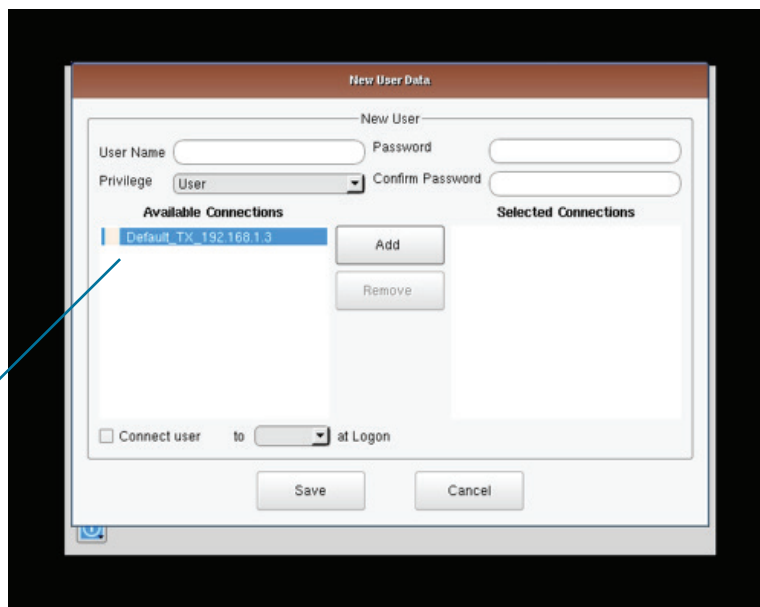


FIGURE 8-20. NEW USER WINDOW

When adding a new user, the following fields are used to define the user:

- **User Name:** This is a unique name that uses 1–32 characters. The username can be any valid username for a Microsoft O/S. This means the username cannot contain “/ \ [ ] ; | = , + \* ? < > `”.
- **Password:** This field can be a minimum of 0 characters (i.e. blank) and a maximum of 32 characters. The password can be any valid password for a Microsoft O/S. This means the password cannot contain “/ \ [ ] ; | = , + \* ? < > `”.
- **Confirm Password:** This field must match the Password field. If there is a mismatch, a message is presented to the user in a pop-up screen.
- **Privilege:** This field, which is a drop-down list, defines the type of user the new user will be—Administrator or User.
- **Selected Connections:** The new user must be allocated Connections that he/she can access. These are selected from the Available Connections window by the user selecting a set of connections (click on the connection in the Available Connection window and then click the “Add” button). This causes the selected connections to be “added” to a user’s selected connection window.
- **Connect to at login:** This tick box defines whether the Emerald Receiver or Boxilla attempts to connect immediately to the selected connection after a logon by the user. This automatic connection only occurs after a logon. If a user exits the connection, the connection tab is displayed to the user for selection of a connection. This Connect to at Login is only saved when the Save button is clicked. If not clicked and another tab is selected, the changes are ignored. If not ticked, no automatic connection is made on log-in.

Once the new user fields have been filled out, the Save button must be clicked to create the new user. Clicking the Save button causes the validation of the new username checking that it is unique and that the two password entries match. If this validation fails, a pop-up window displays the reason for the failure – and the new user is not created. After dismissing the pop-up window, the user can fix the error and click Save again.

The Cancel button should be clicked if the new user is not to be created.

# CHAPTER 8: OSD FUNCTIONS

## CONNECTION FAVORITES

Connection favorites provide a quick, convenient mechanism for users to switch between their pre-defined connections. Favorites are configured by the administrator where a maximum of 10 favorites can be assigned to users using a combination of hotkey and [0-9].

### Assigning Connection Favorites

A pre-requisite is that the user exists and has connects assigned.

The following screenshot demonstrates the administrator assigning connections for the user to the available hotkeys. Favorites do not need to be allocated sequentially and hotkeys can be skipped.

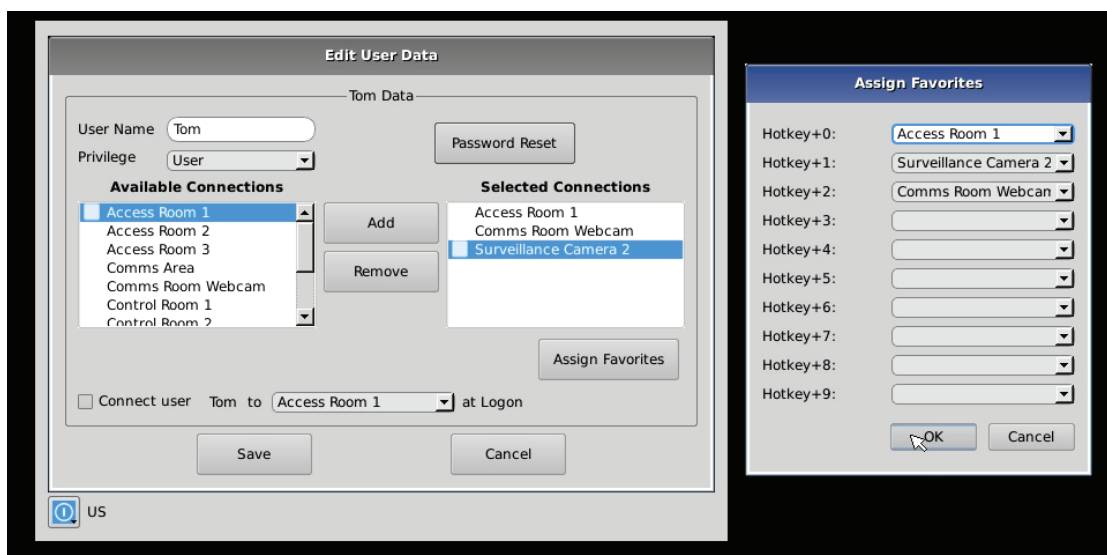


FIGURE 8-21. ASSIGN CONNECTION FAVORITES

### Listing Connection Favorites

When a user logs in, they can view their assigned favorites.

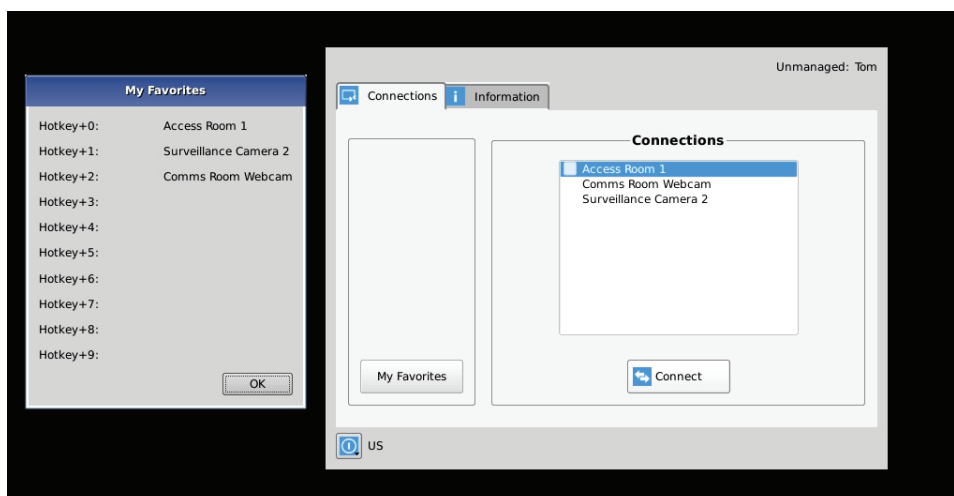


FIGURE 8-22. VIEW CONNECTION FAVORITES

## 8.7.3 EDIT A USER

To edit a user, click on the Edit button. This causes the Edit-User window (shown in Figure 8-19) to be displayed.

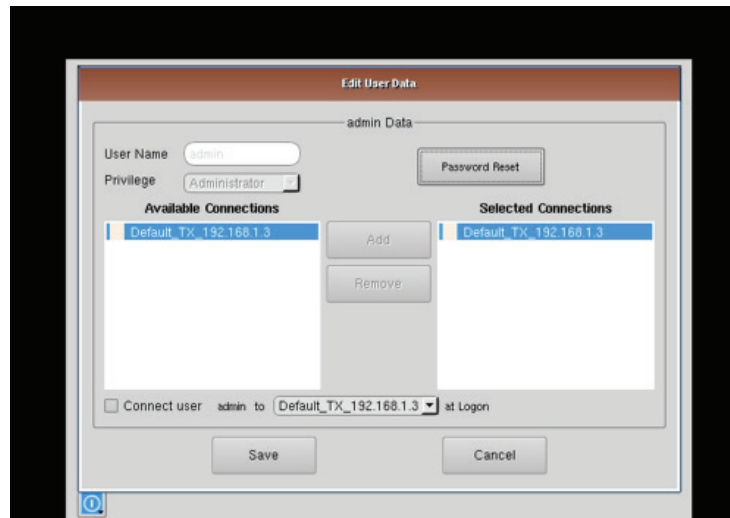


FIGURE 8-23. EDIT USER WINDOW

This window allows the user privilege type, the permitted connections available, the password, and the auto-connect option to be changed.

The default "admin" account gets access to all connections; this list cannot be modified. Other administrator-type users can have their connection list modified.

Once the changes have been made for a user, they only become active once the Save button has been clicked. The changes can be abandoned by clicking the Cancel button.

## CHAPTER 8: OSD FUNCTIONS

### 8.7.4 REMOVE A USER

To remove a user, highlight the user's name and press "Remove."

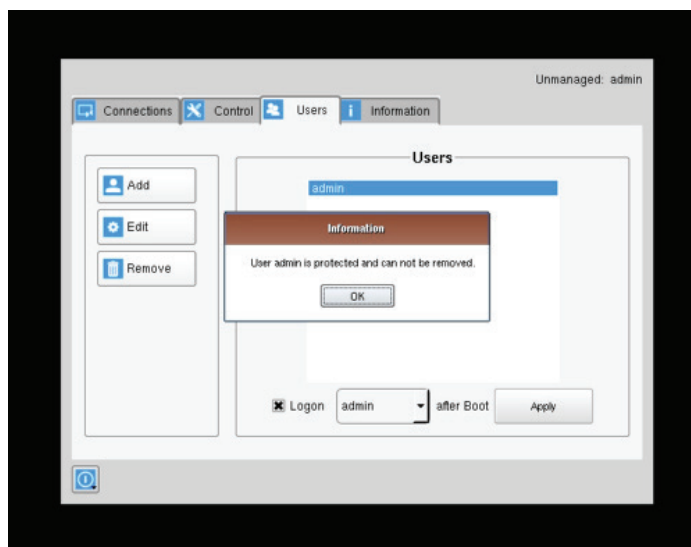


FIGURE 8-24. REMOVE USER

When the Remove button is clicked, a pop-up window is displayed to prompt confirmation that this user is to be deleted. Click the Yes button to remove the user. Clicking the No button causes this action to be aborted and the user is not removed.

**NOTE:** There must always be a user of the name admin in the Emerald system so the system can always be administrated. When attempting to remove the user, the system checks if the username is admin before it will allow the user to be removed.



## CHAPTER 8: OSD FUNCTIONS

### 8.8 INFORMATION TAB

This tab shows the unit information and the network information.

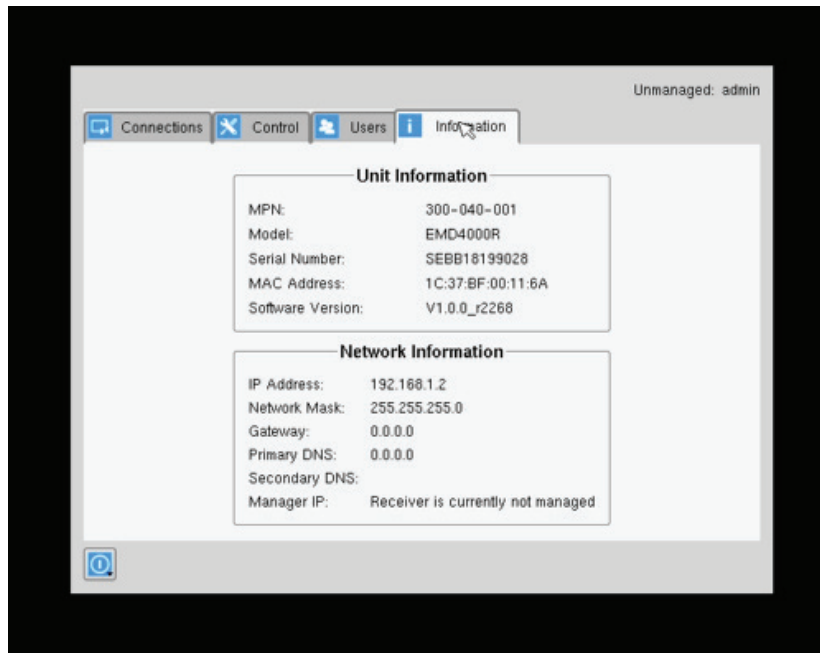


FIGURE 8-25. INFORMATION TAB

## APPENDIX A: EMERALD VIDEO RESOLUTIONS SUPPORTED

The Emerald supports the resolutions listed below:

- ◆ 640 x 480 @ 60 Hz
- ◆ 640 x 480 @ 75 Hz
- ◆ 800 x 600 @ 60 Hz
- ◆ 800 x 600 @ 70 Hz
- ◆ 800 x 600 @ 72 Hz
- ◆ 800 x 600 @ 75 Hz
- ◆ 800 x 600 @ 85 Hz
- ◆ 1024 x 768 @ 60 Hz
- ◆ 1024 x 768 @ 75 Hz
- ◆ 1024 x 768 @ 85 Hz
- ◆ 1280 x 800 @ 60 Hz
- ◆ 1280 x 960 @ 60 Hz
- ◆ 1280 x 960 @ 85 Hz
- ◆ 1280 x 1024 @ 60 Hz
- ◆ 1280 x 1024 @ 75 Hz
- ◆ 1280 x 1024 @ 85 Hz
- ◆ 1366 x 768 @ 60 Hz
- ◆ 1400 x 1050 @ 60 Hz
- ◆ 1440 x 900 @ 60 Hz
- ◆ 1600 x 900 @ 60 Hz
- ◆ 1680 x 1050 @ 60 Hz
- ◆ 1600 x 1200 @ 60 Hz
- ◆ 1680 x 1050 @ 60 Hz
- ◆ 1280 x 720 @ 60 Hz
- ◆ 1920 x 1080 @ 60Hz
- ◆ 1920 x 1200 @ 60 Hz
- ◆ 3840 x 2160 @ 60 Hz
- ◆ 4096 x 2160 @ 60 Hz

Emerald also will pass all the above resolutions at refresh frequencies from 15 Hz to 60 Hz. Those with non-defined VESA resolutions will be displayed at 60 Hz even if the incoming resolution is not 60 Hz.



## APPENDIX B: CONFIGURING WINDOWS VIRTUAL MACHINES

A few properties must be configured on a target Windows Virtual Machine for Emerald to connect with it.

On the Windows Virtual Machine click on the Start button and launch a command window. Then launch group policy editor – gpedit.msc.

Start >> Run >> "cmd" >> "gpedit.msc"

Once the Local group Policy editor is open follow this path:

Computer Configuration >> Administrative Templates >> Windows Components >> Remote Desktop Services >> Remote Desktop Session Host >> Remote Session Environment

Ensure the following three policies are set as follows:

1. Optimize visual experience when using RemoteFX.

- ◆ For this policy set both the "Screen Capture Rate" and "Screen Image Quality" to Highest.

2. Configure RemoteFX.

- ◆ Set this policy to enabled

3. Limit maximum color depth.

- ◆ Set this policy to "Client Compatible."

Once the above policies have been applied, reboot the Virtual Machine. It is now enabled for Emerald connections.

There are different settings to optimize the performance of Emerald with different Windows operating systems. These are defined in the application note – Emerald Group Policies for Optimal Performance for Windows Targets.

It is not possible to connect to a transmitter from a computer/laptop running RDP. A receiver is always required.

## APPENDIX C: EMERALD NETWORK PROTOCOLS OVERVIEW

Emerald uses standard IP protocols for communication between Receivers and Transmitters. Port 3389 is used for unicast communications.

For management purposes some other ports are used. The Black Box Discovery protocol uses UDP Multicast Group 224.0.1.249 (port 39150). This is sent by the Boxilla Manager to discover Emerald devices in the network. The router must allow UDP Multicast forwarding to allow devices on subnet different to where Boxilla is located to be discovered.

Emerald devices respond to the discovery multicast by sending a UDP unicast back to the Boxilla IP address on the same port (Port 39150).

Once an Emerald device is part of the managed domain, the Boxilla periodically “audits” the device to determine information such as if the device on-line, who is logged into devices, device statistics, etc. These audit requests and responses are unicast UDP to specific IP addresses (responses are sent back to the Boxilla’s IP address) on port 39150.

On power-up, a Transmitter sends out a “here I am” multicast message on multicast group 225.0.0.37 on port 12345.

As part of management configuration, the Boxilla may communicate to a specific device on port 22 (TCP unicast communications).

Emerald can operate across multiple VLANs or subnets. Basic IP networking rules need to be followed; there should be a router in the network to enable the various devices on different subnets to communicate with each other.

To allow Black Box’s Emerald discovery protocol to operate, Multicast routing should be enabled. Black Box’s Emerald “discovery” protocol is not required for Emerald systems to operate but it is recommended to enable a Boxilla Manager to search for devices across the network. If the Emerald discovery protocol is not enabled, i.e. router does not have multicast routing enabled, the administrator will have to manually add in all devices not on its subnet, i.e. add in each device individually by its IP address.

## APPENDIX D: TROUBLESHOOTING

This page covers some basic notes & troubleshooting when using the Emerald.

Operating Modes: Connecting to an Emerald transmitter from an RDP client that is from a laptop / computer is not possible; you must use an Emerald receiver for this. An Emerald receiver can connect to an Emerald transmitter and RDP server.

**TABLE D-1. OPERATING MODES CONFIGURATIONS**

USER SIDE	COMPUTER SIDE	OPERATION
Laptop/Computer w/RDP Client	Emerald Transmitter	This is not supported and will not work
Emerald Receiver	Emerald Transmitter	Fully supported
Emerald Receiver	RDP Server on VM or OS	Fully supported

Sluggish Mouse: When using the Emerald, you may find that the mouse is not being very responsive, or has a noticeable delay. This can typically occur if the video card is using Dithering technology. You can contact Black Box to get a small utility to disable video card dithering on AMD graphics cards.

Error Codes: The following error codes expanded.

- 1 GENERAL\_ERROR Connection protocol failure. Are units at the correct and compatible software version?
- 2 INIT\_FAIL Can't start protocol. Is the receiver at the correct software version?
- 3 GET\_SOCKET Protocol Start Failure Are units at the correct and compatible software version?
- 4 CREATE\_SESSION\_FAIL Can't create session. Is transmitter connected and powered on?
- 5 CONNECT\_FAIL Can't create session. "Is transmitter connected and powered on? Is port 22 open between units."
- 6 TX\_CHECK\_FAIL Target device is not a transmitter. Is transmitter IP address correct?
- 7 VER\_CHECK\_FAIL Can't read device Version. Is transmitter connected and powered on?
- 8 LED\_FLASH\_FAIL Start LED Flash command failed on remote device Is transmitter connected and powered on?
- 9 FILE\_SEND\_FAIL Can't send upgrade file to transmitter. Is transmitter connected and powered on?
- 10 PERMISSION\_CHANGE\_FAIL Update to change settings on Transmitter Is transmitter connected and powered on?
- 11 EXTRACT\_UPGRADE\_FAIL Failed to extract upgrade file. Is upgrade file correct or damaged?
- 12 RUN\_UPGRADE\_FAIL Upgrade failed Is upgrade file correct or damaged?
- 13 REBOOT\_FAIL Failed to reboot remote device unit. Is remote device connected and powered on?
- 14 FILE\_SEARCH\_FAIL Upgrade file format failed Is upgrade file correct or damaged?
- 15 LISTEN\_ERROR Connection protocol failure. "Are units at the correct and compatible software version? Is transmitter connected and powered on?"
- 16 SOCKET\_OPTION\_ERROR Connection protocol failure. "Are units at the correct and compatible software version? Is transmitter connected and powered on?"
- 17 SOCKET\_BIND\_ERROR Connection protocol failure. "Are units at the correct and compatible software version? Is transmitter connected and powered on?"
- 18 RECVFROM\_ERROR Connection protocol failure. "Are units at the correct and compatible software version? Is transmitter connected and powered on?"
- 19 GET\_INFO\_FAIL Failed to retrieve Info tab from remote device "Are units at the correct and compatible software version? Is transmitter connected and powered on?"
- 20 COMPATIBILITY\_FAIL Upgrade file is incompatible with version on unit Please check release notes for correct version and compatibility information.

## APPENDIX D: TROUBLESHOOTING

- 21 **BRAND\_CHECK\_FAIL** This is not a correct upgrade file for Emerald. Please check release notes for correct version and compatibility information.
- 22 **CLASS\_CHECK\_FAIL** Can't upgrade Transmitter with Receiver file or visa versa. Please check release notes for correct version and compatibility information.
- 23 **PACKAGE\_CHECK\_FAIL** Incorrect upgrade file for this model. Please check release notes for correct version and compatibility information.
- 24 **NO\_UPGRADE\_REQUIRED** No upgrade required. This version of code is already on the device. No upgrade required.



## APPENDIX E: SETTING UP EMERALD 4K WITH SHARE MODE

### E.1 INTRODUCTION

Emerald 4K uses multicast to achieve Share mode whereby the transmitter can send video and audio to the IP address of a multicast group and have the data reach all receivers that are sharing the connection to that single transmitter.

If the network is not configured correctly, the system can broadcast video and audio traffic to every port on the connected switch.

The following is a guideline for the network configuration options that should be enabled to protect the traffic.

Reference the Emerald User Manual on how to configure multicast addresses and enable Shared Mode on Emerald.

### E.2 PRE-REQUISITES

Emerald has been verified against the following Black Box switches:

- ◆ 1G 48-Port Network Switch (EMS1G-48)
- ◆ 10G 28-Port Network Switch (EMS10G-28)
- ◆ 100G 32-Port Network Switch (EMS100G-32)

However, a customer can connect Emerald extenders to any number of switch vendors; therefore, it's important that the correct version of standards are supported, in this case, IGMPv2.0 .

In addition, the switch must support IGMP querier, mrouter, and fast leave, and must be a non-blocking switch.

### E.3 CONFIGURING THE SWITCH

Support IGMP snooping:

- ◆ IGMP snooping must be enabled at the switch level and at the VLAN to support Share Mode.

NOTE: On the Black Box switches, it is not possible to enable IGMP snooping on the default VLAN 1. Therefore, the following steps need to be taken:

- Create a separate VLAN
- Move all ports into a new VLAN
- Enable IGMP snooping on a new VLAN
- ◆ If you have not designated a VLAN, the default VLAN, typically VLAN 1, must have IGMP snooping enabled.
- ◆ If the switch has a separate Bridge Multicast Filtering setting, it must be enabled to support Share Mode.

IGMP Querier service is required to support IGMP snooping in a standalone switch, or if the Emerald system is deployed in a multi-switch environment, the IGMP Querier service needs to be available on one switch or router.

If you have multiple switches, try to get as many of the transmitters and user stations that connect to each other most often on the same switch. That way, their traffic, when connected, is across the backplane of the same switch, instead of having their traffic cross a low bandwidth inter-switch link or a medium bandwidth stacking module. To enable the multicast traffic to pass between two switches, both ports connecting the switches must have mrouter set.

## APPENDIX F: REGULATORY INFORMATION

### F.1 FCC STATEMENT



This equipment has been 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. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Shielded cables must be used with this equipment to maintain compliance with radio frequency energy emission regulations and ensure a suitably high level of immunity to electromagnetic disturbances.

All power supplies are certified to the relevant major international safety standards.



This equipment complies with the CE mark and Declaration of Conformity.



This equipment complies with the Restriction of Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive and the Waste Electrical and Electronic Equipment Directive (WEEE).



## APPENDIX F: REGULATORY INFORMATION

### F.2 NOM STATEMENT

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.
2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.
3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.
4. Todas las instrucciones de operación y uso deben ser seguidas.
5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc.
6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.
7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.
8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.
9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.
10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.
11. El aparato eléctrico deberá ser conectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.
12. Precaución debe ser tomada de tal manera que la tierra física y la polarización del equipo no sea eliminada.
13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.
14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.
15. En caso de existir, una antena externa deberá ser localizada lejos de las líneas de energía.
16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.
17. Cuidado debe ser tomado de tal manera que objetos líquidos no sean derramados sobre la cubierta u orificios de ventilación.
18. Servicio por personal calificado deberá ser provisto cuando:
  - A: El cable de poder o el contacto ha sido dañado; u
  - B: Objetos han caído o líquido ha sido derramado dentro del aparato; o
  - C: El aparato ha sido expuesto a la lluvia; o
  - D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o
  - E: El aparato ha sido tirado o su cubierta ha sido dañada.

## APPENDIX G: DISCLAIMER/TRADEMARKS

### G.1 DISCLAIMER

Black Box Network Services shall not be liable for damages of any kind, including, but not limited to, punitive, consequential or cost of cover damages, resulting from any errors in the product information or specifications set forth in this document and Black Box Network Services may revise this document at any time without notice.

### G.2 TRADEMARKS USED IN THIS MANUAL

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Any other trademarks mentioned in this manual are acknowledged to be the property of the trademark owners.







**NOTES**

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