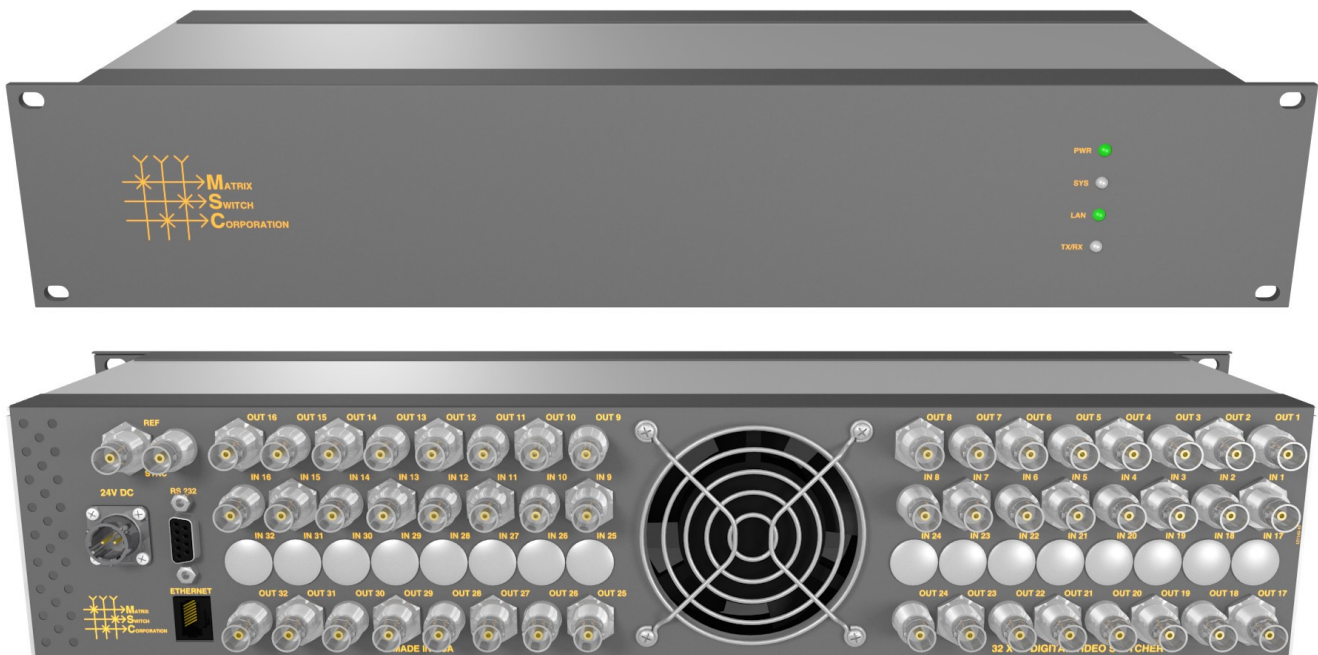


# **Matrix Switch Corporation MSC-2HD1632S+DC Product Manual**

**Aviation ready 2RU 16 input 32 output 3G-SDI Video Router with Status Panel**

**Revision 1.4**



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Table 1: Document Revision History

Revision & Date	Changes
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## 1 Getting Started

Congratulations on your purchase of a quality Matrix Switch Corporation product. This section contains a general overview of device functionality and provides information to get you up and running quickly. Additional sections in this manual can be consulted for more detailed information on the subsystems and features of this product.

### 1.1 Device Connections

The **MSC-2HD1632S+DC** comes with an internal DC-DC power supply and a documentation CD. Additional cables and hardware are not usually provided.

- **Internal DC-DC power supply** – This router is powered by an internal DC-DC power supply. DC voltages from 18 to 50 VDC (28 VDC nominal) can be used as a power source. Refer to the [Aviation Ready](#) section for more details on connector, voltage polarity, and other considerations for aviation use.
- **Ethernet connector (Optional)** – Connect to a network switch with an Ethernet cable. Required for accessing the web page interface, TCP/IP Mascot interface or for interfacing with remote control panels. This device can also be connected directly to a computer or remote panel (with a crossover Ethernet cable).
- **SDI BNC Video Inputs** – Connect SDI sources to input connectors using 75 Ohm Coax cable with BNC connectors designed for high speed SDI video applications. Unused inputs can be left unconnected. Inputs with supported standard rate (3G, HD or SD) SDI signals will be auto re-clocked for reduced jitter. Other non standard rates between 125 Mbit/s and 2.97 Gbit/s will be passed through without re-clocking or jitter reduction. Adaptive cable equalization on each input can equalize input signals from Belden type 1694A cables up to lengths of 120m (@3G), 140m (@HD) and 400m (@SD).
- **SDI BNC Video Outputs** – Connect SDI destinations to output connectors using 75 Ohm Coax cable with BNC connectors designed for high speed SDI video applications. Unused outputs can be left unconnected. Outputs utilize standard SMPTE levels of 800mV peak-to-peak.
- **Composite Video** – Connect composite video sources to input connectors and destinations to output connectors using 75 Ohm Coax cable with BNC connectors. Unused inputs or outputs can be left unconnected.
- **Sync Reference (Optional)** – If switching on vertical sync pulse is desired, connect one of the Sync Reference connectors to a sync pulse signal (NTSC, PAL or tri-level) using 75 Ohm Coax with BNC connectors and the other Sync Reference connector can be used as a pass-through to additional properly 75 Ohm terminated equipment or a 75 Ohm terminator should be installed. If the sync reference functionality is not used, both connectors can be left unconnected.
- **RS-232 Serial (Optional)** – If serial control is desired, using the [Mascot Protocol](#), connect a D9 female to male straight through cable to a control system, such as a computer. Use 9600 bps 8N1 as the serial configuration and enable local echo to see typed characters. See [Serial Interface Pinout](#) for additional details.

### 1.2 Aviation Ready

This router is an aviation ready model, which has the following additional features:

- 18-50 VDC isolated internal power supply (28 VDC nominal) with Mil-Spec power connector for aircraft DC power interfaces

- Secured (Loctite) screws and chassis components for anti-vibration and airworthiness
- 24 hour burn in
- Manufacturer's conformance certificate issued for all systems

## 1.2.1 Power Connector

Power is connected to the router's two pin **MS3112E8-2P** connector, which is a MIL-C-26482 series 1 male connector with 20 gauge pins. This mates with a **MS3116F8-2S** or compatible female connector (not included).

DC input polarity of the power connector, as viewed from the back of the router, is pin A positive (+) DC and pin B is chassis ground – as depicted in Figure 1.

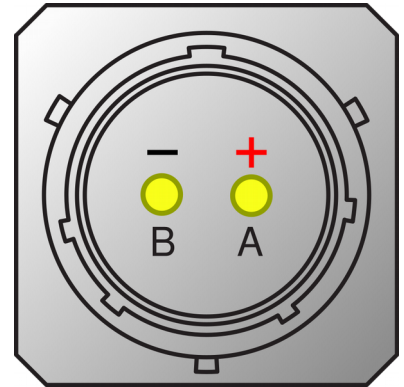


Figure 1: DC Power Connector

## 1.3 Powering Up The Device

This device is not equipped with a power switch and is simply connected to a suitable DC power source, to power it up.

Once the device is powered it goes through the following startup sequence:

- 5 second startup delay to allow for [Power On Software Updates](#).
- Routing matrix is initialized to Preset 0 state (defaults to source 1 connected to all destinations).
- The status panel RUN/SYS LED will flash at regular intervals once the system has booted up.

## 1.4 Front Status Panel

The MSC-2HD1632S+DC has a status front panel with 4 LED indicators, described in the following table:

LED Label	Description
PWR	Active when power is supplied to the device.
SYS	Flashes at regular intervals to indicate the system is running.
LAN	Active when the Ethernet port is physically connected.
TX/RX	Flashes on Ethernet transmit or receive activity.

Table 2: Status Panel Indicators

This model is not equipped with a built-in button control panel, however several options are available for controlling the device, including the web page interface, telnet, RS-232 serial and remote control panels.

## 1.5 Web Page Interface



All Matrix Switch Corporation router and panel devices come with a built-in web page interface.

This is the recommended interface for configuration and is also a convenient way to control the matrix routing of the device.

Devices come factory configured with default settings, unless a pre-configuration request is made during purchase, an example being a multi device application.

## 1.5.1 Accessing The Web Page Interface

The default network IP address for this device is 192.168.2.60. Refer to the table below for the default IP addresses for other types of Matrix Switch Corporation devices.

Device Type	Default IP Address
Video/Audio Routers	192.168.2.60
Remote Button Panels	192.168.2.64
Remote LCD Screen Panels	192.168.2.80

*Table 3: Default System IP Addresses*

To access the web page interface of the device:

1. Connect the Ethernet port of a computer either directly to the device using a crossover cable to the same Ethernet network through a network switch or other LAN infrastructure.
2. Manually configure the computer's IP address to be a **unique** address on the same IP subnet as the device. For example 192.168.2.10. The Netmask should be 255.255.255.0. A Gateway address is not necessary for this purpose, but could be set to 192.168.2.1.
3. Make sure the device is powered on.
4. Using a web browser on the computer, enter the device's IP address into the Location bar and press ENTER. The device web page interface should load. If the web page interface fails to load, double check the computer's network settings and physical Ethernet connections. In the event that the IP address of the device is unknown, refer to the [Unknown IP Address](#) troubleshooting section.

## 1.5.2 Network Settings

Network settings can be changed on the Config tab of the Web Page Interface. This includes DHCP enable, IP address, Netmask and Gateway settings. DHCP should only be used for assigning specific network settings from a central DHCP server or when assigned IP addresses can be determined, otherwise configuring the device via its IP address would be prevented if the IP address is unknown. After changing network settings, click the Save button and then click the Reboot button to restart the device. Refer to the [Config Tab - Network Settings](#) section for more details.

In the event that the device's IP address is unknown, refer to the [Unknown IP Address](#) troubleshooting section.

Refer to the [Network Planning](#) section for assistance with developing a network plan for multi-device applications.

## 1.5.3 Matrix Routing

The Routing tab of the Web Page Interface provides a convenient way to view and change the matrix routing state and is the default page shown.

A preset can also be recalled from this interface, by selecting one from the Load Preset drop down control.

Refer to the [Routing Tab](#) section for more details.

## 1.5.4 Labels

Labels can be assigned to video (and audio if applicable) sources and destinations. Labels can also be assigned to presets. Labels can be up to 8 characters in length. The default source labels use “Src” as a prefix, and the destination labels use “Dest” as a prefix (example: Src1). The presets are labeled “Startup” for Preset 0 and “PresetN”, where N is a number from 1 to 9, for the remaining presets.

The Labels Tab on the Web Page Interface can be used for modifying labels. Click the Save button to store any changes that are made. Refer the [Labels Tab](#) section for more details.

## 1.5.5 Presets

There are 10 stored matrix routing presets. Preset 0 is recalled on power up and by default routes source 1 to all destinations. All other presets default to “No Change” for all destinations, which when recalled will have no effect. Presets can assign a partial subset of destinations or all destinations as desired.

Presets can be modified on the Presets Tab of the Web Page Interface. Refer to the [Presets Tab](#) section for more details.

## 1.6 Network Planning

The default device settings can be used without change in applications with a single router and optionally one remote panel on the same Ethernet network. Larger installations or integration with existing IP LAN networks require some network planning.

**NOTE:** Matrix Switch Corporation can assist in planning and pre-configuring devices for specific application requirements at purchase time. Just ask a sales or customer service representative.

Manual IP address management is recommended, although a DHCP server can be a convenient option for centrally managing IP addresses by device MAC address, the net effect still being a fixed IP for each device. Consult your DHCP server documentation for information on assigning IP addresses by MAC address, if this option is chosen.

All devices which need to communicate with one another (routers, remote panels and computers) need to be physically connected to the same LAN or allow IP packet routing between networks if on separate LANs.

**SECURITY WARNING:** Matrix Switch Corporation devices are meant for installation in trusted LAN environments. In the event that remote device configuration or control is desired over public networks or the Internet, it is strongly recommended that some form of inter-network security is utilized, such as firewalls and encrypted VLAN or secure data tunnels. This is necessary to prevent undesired access to devices.

Devices on the same LAN need to be assigned unique IP addresses in the same IP subnet. Matrix Switch Corporation devices are configured by default to use IP addresses in the class C IP subnet 192.168.2.x. When integrating devices into an existing LAN network, unique IP addresses should be assigned from the applicable

network and the Netmask setting of the devices should be set to reflect the class (size) of the IP network (the default of 255.255.255.0 is for class C, which accommodates up to 254 addresses).

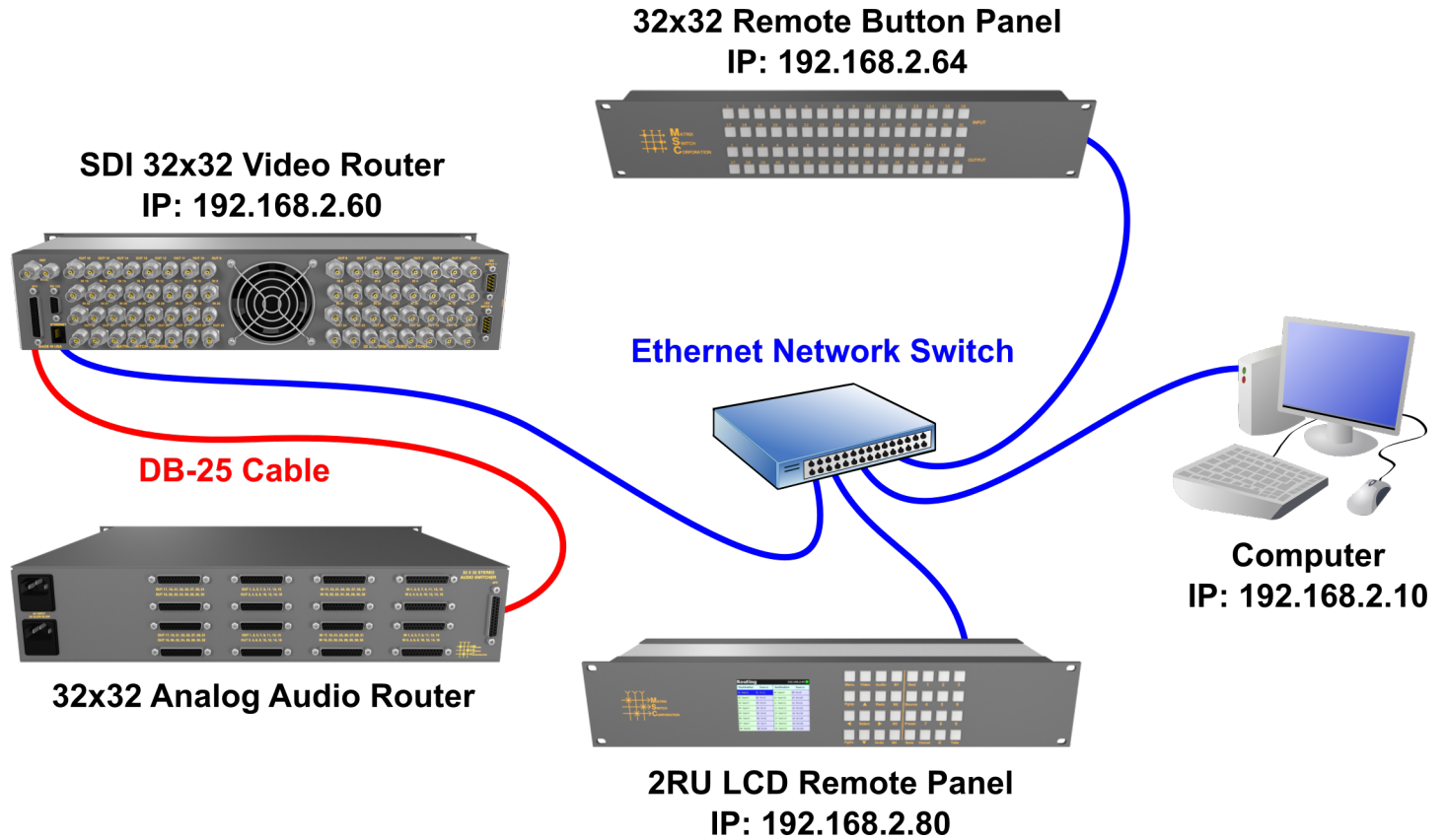
The Gateway setting is required to be set to the IP address of the network gateway on remote panels which will be accessing routers across network subnets, but this setting is otherwise not needed.

After assigning device network settings, including unique IP addresses, remote panels need to be assigned the correct IP addresses to their **Remote Router IP** setting of the router they will control.

Additional configuration changes may be required, depending on the application and are described in subsequent sections.

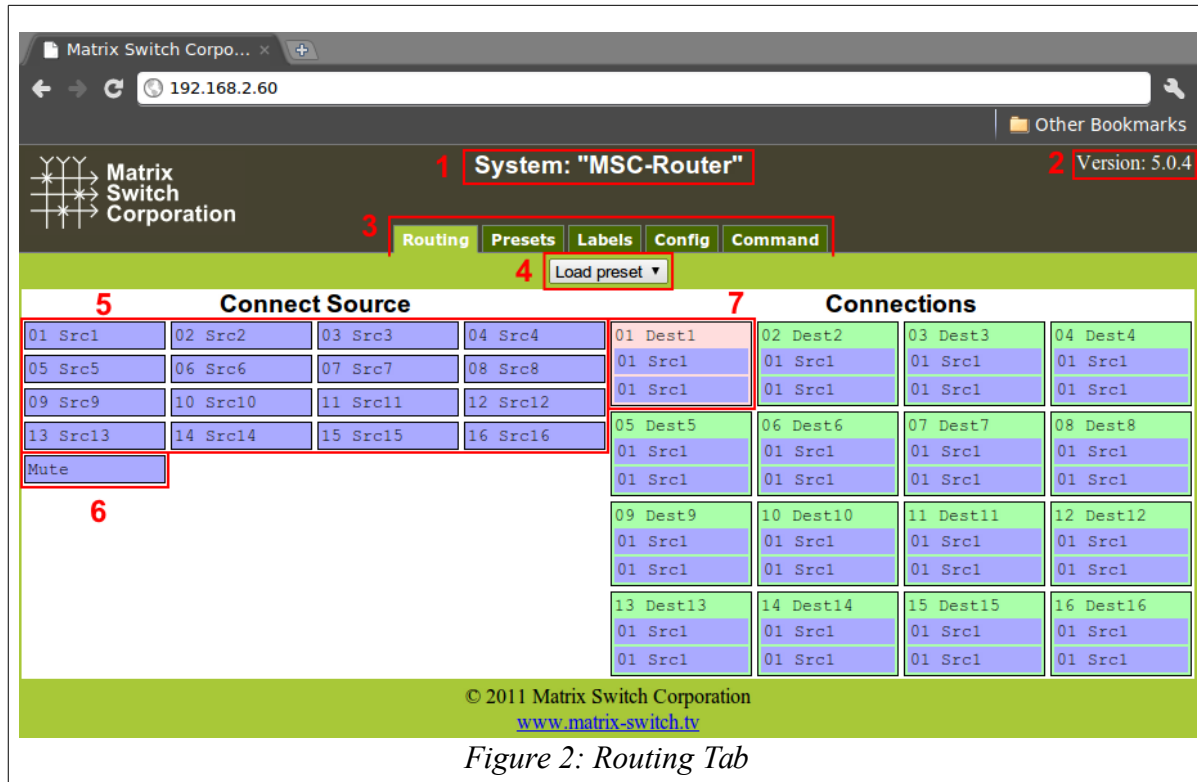
## 1.6.1 Installation Example

The following diagram is of a simple installation example consisting of a 32x32 SDI Video Router, with a secondary level 32x32 Analog Audio router connected via the AFV DB-25 interface, a 32x32 Remote Button Panel, a 2RU LCD Remote Panel and a Computer system.



## 2 Web page interface

### 2.1 Overview



All Matrix Switch Corporation Router and Remote Panel systems include a built in web page that can be used with standards compliant Javascript enabled web browsers, including but not limited to Firefox, Chrome, Safari and recent versions of Internet Explorer.

Figure 2 shows the Routing tab of a 16x16 switcher with 2 levels with numbered outlines to aid in further description below. The web page interface for other router systems is sized appropriately. Remote Panels show only the Config and Command tabs.

#### Numbered sections in Figure 2

1. System name (can be assigned on the Config tab)
2. System firmware series and version
3. Tab navigation
4. Preset load drop down selection
5. Source connect buttons
6. Mute button (may not be available on all switchers and levels)
7. Currently selected destination (destination name followed by currently connected source names for both levels).

### 2.2 Routing Tab

The right side of the Routing tab interface under the title “Connections” displays the current state of the routing matrix. Each destination is depicted as a box containing the destination number/label followed by one or more source numbers/labels of the currently connected sources for each level of the destination. The currently selected destination is highlighted in red (#7 in Figure 2). For multi-level systems either the destination or one of the levels can be individually selected for changing all levels or a single level.

The left side of the Routing tab under the title “Connect Source” (#5 in Figure 2) displays all the available sources and Mute (if available) to connect from.

## 2.2.1 Changing a connection

To change a routing connection, select the desired destination by clicking on the Destination label or an individual level source label (multi-level systems only). Then click on a Source button or Mute (if available) from the “Connect Source” section. The clicked source will be connected to the selected Destination for one or more levels (depending on if the Destination or a single level is selected).

## 2.2.2 Loading a preset

Presets store connection states for one or more Destinations. Loading a Preset on the Routing tab consists of simply clicking on the “Load preset” drop down selector (#4 in Figure 2) and selecting the desired preset, which is then loaded and applied to the current routing matrix. More information on Presets is contained in the following Presets tab section.

## 2.3 Presets Tab

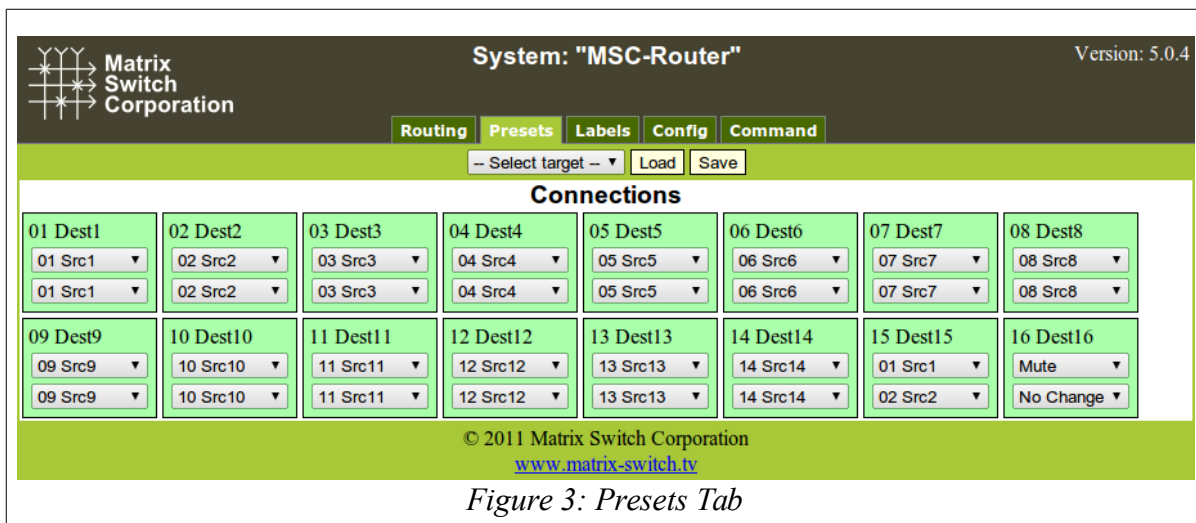


Figure 3: Presets Tab

Figure 3 depicts the Presets Tab which can be used to edit presets or perform batch matrix connection operations. Under the “Connections” title is shown the **Work Matrix**, which is a temporary area for working with matrix routing and loading to/saving from stored **Presets** and the current **Active Routing** state. For each Destination the Destination number and label is displayed followed by one or more drop down selection lists for each source level. The selection lists contain all available sources (listed by source number and label) and the special values **No Change** and **Mute** (the latter only if available for the given level). The **No Change** option indicates that the Destination for the given Level should not be changed from its current value, when the preset

is recalled, which allows for a subset of the routing matrix to be changed. **Mute** will output blank Video or silent Audio for the given Destination level and is not supported on all routers/levels.

### 2.3.1 Loading Work Matrix from a source target

The **Work Matrix** can be loaded from the current **Active Routing** matrix or a Preset. Simply select the desired source target from the “Select target” drop down list and click the **Load** button.

### 2.3.2 Saving Work Matrix to a target


The **Work Matrix** can be saved to one or more targets including the **Active Routing** matrix or a **Preset**. Simply select the desired destination target from the “Select target” drop down list and click the **Save** button. When saving to the **Active Routing** matrix, the connections defined in the **Work Matrix** will become immediately active for the current routing state, allowing for batch routing operations to be performed and executed simultaneously. Saving to a **Preset** will store the Work Matrix state to non volatile memory, which persists through device power cycles and can be recalled at a later time.

### 2.3.3 Usage scenarios

The flexibility of the Presets Tab interface allows for several useful scenarios, some of which are described below:

- **Batch connection operations** – To perform several connection operations all at the same time: make the desired connection changes to the **Work Matrix**, leaving all others as “No Change”, and then apply the changes to the **Active Routing** target by selecting it from the “Select target” drop down and clicking the **Save** button.
- **Store Active Routing matrix state to a Preset** – The entire **Active Routing** matrix state can be stored to a Preset by first loading it to the **Work Matrix**, followed by selecting the desired target Preset and clicking the **Save** button.
- **Editing an existing Preset** – Editing a Preset is done by loading it to the **Work Matrix**, making the desired changes and saving it back to the same Preset. All this is accomplished without changing the **Active Routing** matrix state.

## 2.4 Labels Tab



**Matrix  
Switch  
Corporation**

System: "MSC-Router"

Version: 5.0.4

Routing
Presets
Labels
Config
Command

Save

Blank secondary level names use primary names.

#	Src Video	Src Audio	Dest Video	Dest Audio	#	Preset
1	Src1		Dest1		0	Startup
2	Src2		Dest2		1	Preset1
3	Src3		Dest3		2	Preset2
4	Src4		Dest4		3	Preset3
5	Src5		Dest5		4	Preset4
6	Src6		Dest6		5	Preset5
7	Src7		Dest7		6	Preset6
8	Src8		Dest8		7	Preset7
9	Src9		Dest9		8	Preset8
10	Src10		Dest10		9	Preset9
11	Src11		Dest11			
12	Src12		Dest12			
13	Src13		Dest13			
14	Src14		Dest14			
15	Src15		Dest15			
16	Src16		Dest16			

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*Figure 4: Labels Tab*

Figure 4 shows the Labels Tab. Click on a field or use the tab key to step between fields. Label names are limited to 8 characters including spaces. Multi-level routers will have columns for Video and Audio Sources and Destinations. Single level routers will have a column for Source labels and one for Destination labels. On multi-level routers, secondary levels can be left blank to use the same label as the first level. Presets can also be assigned label names. Click the **Save** button to save changes that have been made.

## 2.5 Config Tab



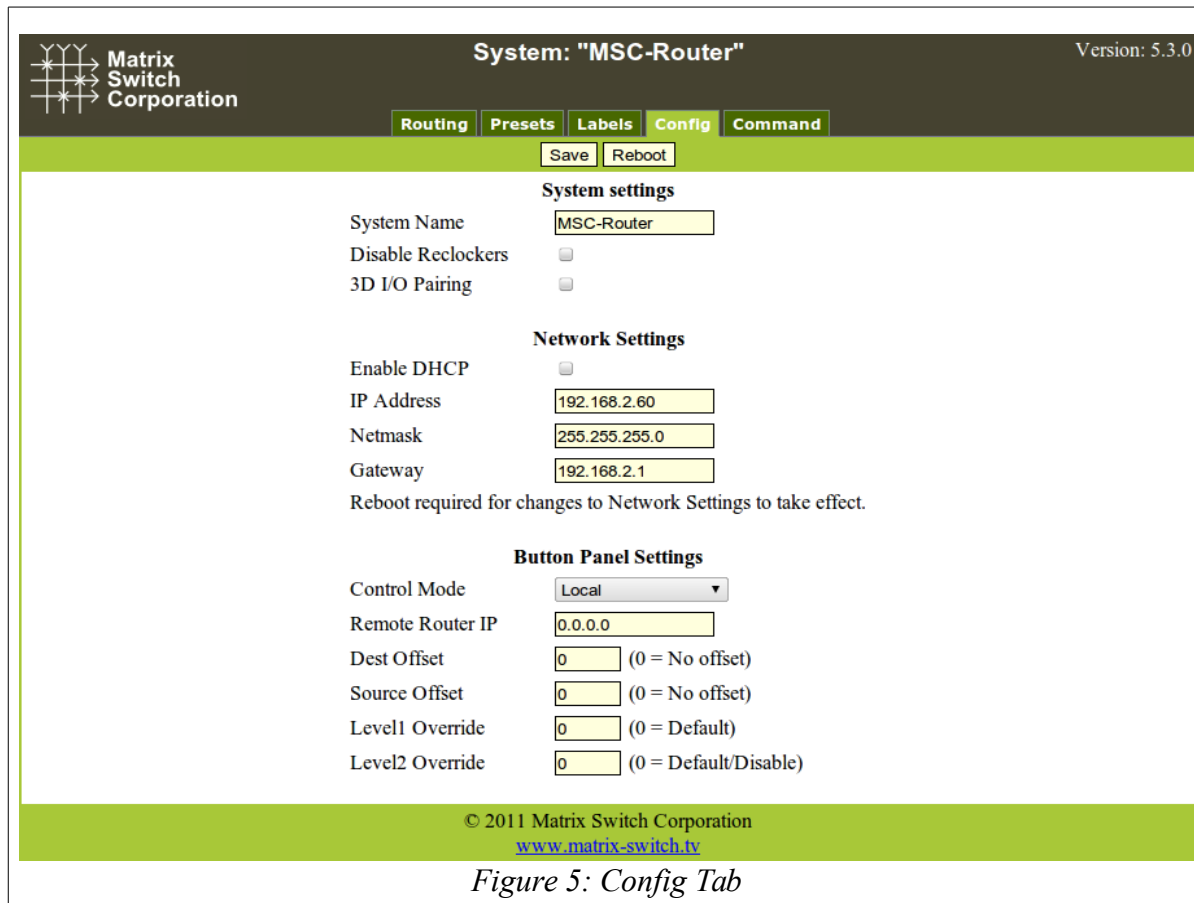


Figure 5 depicts the Config Tab as seen on a Router system beginning with Carina Series Firmware 5.3.0. Configuration fields vary depending on router features, firmware version and if the device is a Remote Panel.

**NOTE:** After changing any configuration settings click the **Save** button. All **Network Settings** changes require a Reboot of the device in order to take effect. After clicking **Save**, click the **Reboot** button to restart the device. Remember to enter a new IP address into your Web browser's Location bar, if the device's IP address has changed.

## 2.5.1 System Settings

- **System Name** – A descriptive name of the system (up to 15 characters), displayed at the top of the Web Page interface which is helpful when managing multiple systems.
- **Disable Reclockers** – Disable SDI reclockers (not supported by all Routers, added with Carina Series Firmware 5.3.0).
- **3D I/O Pairing** – Enable pairing of destinations/sources for two channel 3D support (only supported by Routers with 2 or more destinations, added with Carina Series Firmware 5.3.0).

## 2.5.2 Network Settings

**WARNING:** DHCP should only be enabled or the **IP Address** or **Netmask** changed if one has an understanding of TCP/IP network configuration. Once the save button is pressed and the system is rebooted any changes to DHCP enable, the IP Address or the Netmask shall result in having to access the web page with the

new settings. If there are Matrix Switch Corporation remote control panels which access the system which has been changed, they must also be reconfigured to use the new router IP address as well. See the [Network Planning](#) section for more helpful information on planning your network.

- **Enable DHCP** – Check this box to enable DHCP. Disables IP Address, Netmask and Gateway fields as these settings are obtained from the DHCP server.
  - **WARNING:** A DHCP server must be present on your network for this to function properly. Using DHCP allows for dynamic IP or fixed IP assignment from a central location (the DHCP server). Using this option is only recommended if using fixed IP assignment based on the device's MAC address or if there is a way to determine what IPs the devices get assigned. Otherwise it may become difficult to determine what IP address to use when accessing the Web Page or utilizing other Ethernet control interfaces.
- **IP Address** – The IP address of the system.
- **Netmask** – The system network mask.
- **Gateway** – The IP address of your network's Gateway, if applicable. Only necessary on systems which access other systems outside of your network (a remote panel which accesses a router on a different network for example).

### 2.5.3 Button Panel Settings

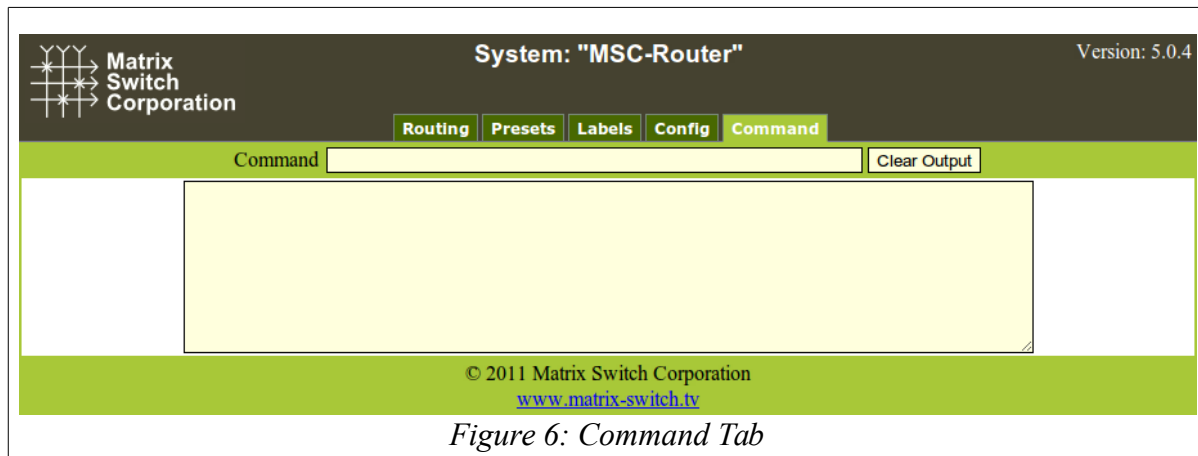
These settings control the operation of the device's button control panel interface (if applicable).

Four fields are provided for specifying what portion of a router is controlled by the button panel interface. This provides added flexibility in defining what destinations and sources a panel controls. Some examples of use include, using multiple 16x1 Remote Panels (16 source, 1 destination) to control individual destinations of a 16x4 Router (16 source, 4 destination). Another usage scenario would be to have 2 separate panels control different levels of a Video/Audio Router.

- **Control Mode** – Set the matrix control mode (only present on Routers, added with Carina Series Firmware 5.3.0). Available options include:
  - **Local** - Button panel controls the router itself.
  - **Remote** - Button panel controls a remote router at the IP address set by the Remote Router IP field.
  - **Remote Sync** - Synchronize matrix crosspoint changes to another router at the IP address specified by the Remote Router IP field. Used for dual system 3D support.
- **Remote Router IP** – The IP address of the remote Router to control.
- **Dest Offset** – This setting determines what destination the button panel starts on. Defaults to 0 which means the control panel starts on destination 1. Setting this value to 8 for example would cause the first destination of the button panel to control destination 9.
- **Source Offset** – This setting determines what source the button panel starts on. Defaults to 0 which means the control panel starts on source 1. Setting this value to 8 for example would cause the first source of the button panel to control source 9. NOTE: If the currently active source cannot be represented on the control panel, no source button LED will light.
- **Level1 Override** – This setting determines the primary control level of the button interface. It defaults to 0 which is equivalent to level 1, usually a Video level. Setting this value to 2 for example would set the primary level to be level 2 (usually Audio).
- **Level2 Override** – This setting determines the secondary control level of the button interface. It defaults to 0, which if the Level1 Override is also 0 is equivalent to level 2, but if the Level1 Override is

a value other than 0, the secondary level control is disabled. Can only be assigned a non-zero value if Level1 Override is also non-zero. If set to 3 for example, the secondary level would be level 3.

## 2.6 Command Tab



*Figure 6: Command Tab*

The Command Tab (Figure 6) provides access to the Mascot protocol interface. Commands are typed on the Command text entry line followed by pressing the Enter key to execute them. The results will be displayed in the text area below the command line. Clicking the **Clear Output** button will clear all command output in the lower area.

See the section [Mascot Control Protocol](#) for more information.

## 3 Mascot Control Protocol

MASCOT (MAtrix Switch COrporation ProTocol) provides an ASCII text based command interface via several different transports to control and get status from Matrix Switch Corporation devices. This command protocol can be utilized for manual control or for integration with automation control systems.

### Mascot command interface options

- [Web Page Command Tab](#) – The most convenient user command interface, which can be accessed using a Web Browser on a Computer by the device's IP address.
- TCP/IP port 40 – A TCP/IP command interface is provided on port 40 which uses the device's Ethernet connector as a physical transport and can be accessed via a telnet application.
- RS-232 Serial Port – Serial can also be used with the configuration parameters: 9600 bps 8N1.

### 3rd Party support

The MASCOT protocol contains a subset of the basic ISIS Protocol command set and therefore some 3<sup>rd</sup> party equipment may work without modification using this protocol. For information about other third party control system manufacturers who support MASCOT, contact Matrix Switch Corporation.

## 3.1 Protocol Changes

As new commands are added or other changes occur, the MASCOT protocol version is incremented. The protocol revision can be obtained using the [MascotVer command](#).

### Protocol revision history

#### Mascot version 3.0

- Added [System Parameter](#) commands: [Get](#), [GetS](#), [Set](#), [SetA](#), and [SetS](#) commands.
- Current system parameters are defined in the [System Parameter Table](#), superseding many configuration commands.
- New commands for defining matrix I/O mapping: [MapDest](#), and [MapSrc](#) commands.
- New commands for panel/GPIO command macros and conditions: [PanelCmd](#), [PanelCmdEn](#), and [PanelCond](#).
- Commands now grouped into [Core Commands](#), [Configuration Commands](#), and [Miscellaneous Commands](#).

#### Mascot version 2.4 (Carina Series Firmware 5.6.3)

- Added [.MtxGroup](#), [PanelDis](#), and [PanelExtEn](#) commands.

#### Mascot version 2.3 (Carina Series Firmware 5.5.1)

- Added [Quit Command](#), [SysType Command](#) and [Vars Command](#) which have previously been supported on the MSC-GCP2U32 only.

#### Mascot version 2.2 (Carina Series Firmware 5.5.0)

- The [X Command](#) now accepts a 0 valued wild card destination to switch all destinations to a given source.

Mascot version 2.1 (Carina Series Firmware 5.3.0)

- New commands: [PairIO](#) – for paired I/O 3D support, [PanelOfs](#) – for defining remote panel I/O regions to control, [PanelRate](#) – to set remote panel refresh rate, [ReclkDis](#) – for disabling SDI reclockers and [RemoteSync](#) – for synchronizing two video router systems for 3D use.
- Added E12 “Unsupported command” error which is returned when a command is not supported by the current system or settings.
- Added support for Line Feed character as a command terminator (to be compatible with older firmware). Carriage Return should normally be used.
- Added “lock” (0x02) and “reclk” (0x04) to [MtxCfg Command](#) “flags” field.

## 3.2 Telnet Access

A telnet client can be used to access the command interface on TCP/IP port 40. Many operating systems come with a Telnet client or one can be easily obtained. To control a device using Telnet the IP address and TCP/IP port number will need to be supplied. This is typically added as arguments when executing the “telnet” command via your operating system's command prompt or run dialog. Here is an example command to connect to a device on the IP address 192.168.2.60 (press ENTER after the command):

```
telnet 192.168.2.60 40
```

Pressing the ENTER key after successfully connecting should display the command “>” prompt character.

## 3.3 Serial Access

Matrix Switch router systems come equipped with a serial port which can be used as another means of sending Mascot commands. Connect a Computer system to the device using a 9 pin RS-232 serial cable. Using this interface requires a serial terminal program, such as HyperTerminal on Windows. Configure the terminal software for 9600 bps 8N1. In addition Local Echo should be on in order to see what is typed. Pressing the Enter key once connected should yield the “>” prompt character.

## 3.4 Command Format

Commands consist of a command name, zero or more arguments separated by commas and a carriage return (CR, ASCII 13 - the Enter key on a keyboard). Optionally multiple commands can be combined by separating them with a '#' character and the command chain is terminated with a CR character. Spaces are not required between arguments, but can be optionally supplied for readability. A space is also not required between command names and their first argument, if the argument is numeric. Table 4 lists characters which have special meaning in MASCOT commands.

#	Multiple command separator, for chaining commands.
<CR>	Carriage Return (ASCII 13), indicates the end of a command or chain of commands, Enter key.
<BS>	Backspace character (ASCII 11), can be used to backspace characters in interactive command shells.
“	Used for double quoting string arguments.
'	Used for single quoting string arguments.

Table 4: Special Command Characters

## Command example

```
X1,1#X2,2#S<CR>
```

Connects Source 1 to Destination1 and Source 2 to Destination 2, followed by displaying the Active Routing matrix status. The <CR> is the Carriage Return character.

## 3.4.1 Command Names

Command names consist of one or more alphabetical characters and are case **insensitive**. For convenience with manual command entry they can also be matched using partial names. The first matching alphabetically sorted command is used (for example: 'H', 'He', 'hEL' or 'Help' can be used to execute the Help command). However, this feature should not be relied on with 3<sup>rd</sup> party integration, since a given partial command may execute a different command as new ones are added to the protocol.

## 3.5 Response Format

Most command responses consist of one or more values separated by newlines and ending with the '>' prompt character. **Newlines** consist of a Carriage Return/New Line (CR LF) pair of characters (ASCII 13 followed by ASCII 10).

### The Prompt '>'

A prompt character '>' is displayed each time a command or chain of commands is entered, to indicate readiness to receive additional commands. If an error occurs in response to a command, an error will be displayed prior to the prompt with the following format:

```
E00: Error message
>
```

00 will contain a 2 digit decimal error code.

Table 5 shows possible error codes which may be returned in response to commands.

Error #	Message	Description
E01	Token too long	A command name or string argument was too long.
E02	Invalid command	Invalid command name.
E03	Invalid argument	One or more invalid argument values.
E04	Invalid destination	Invalid matrix destination number.
E05	Invalid source	Invalid matrix source number.
E06	Invalid level	Invalid matrix level number.
E07	Invalid preset	Invalid preset number.
E08	Unterminated string	Double or single quoted string not terminated.
E09	Backspace limit reached	Devices have a limited backspace buffer size, if too many characters are backspaced and then more characters are appended, this error will occur.
E10	Buffer overflow	Data exceeds maximum buffer length.
E11	Serial receive overrun	One or more characters were lost on the serial interface.
E12	Unsupported command	Command is not supported by the system or current configuration. Firmware 5.3.0 and newer.
E13	I/O Error	A general I/O error occurred.

Table 5: Error Codes

## 3.6 Command Arguments

Command arguments are separated into two categories: numeric and string arguments. These are further explained in Table 6.

Numeric		String	
Decimal (123)	1 to 3 decimal digits	Unquoted	Commands with string arguments automatically interpret argument as string (spaces and commas not allowed).
Hex (0x3D)	0xNN where NN are 2 hex digits from 0-9, A-F or a-f	Double quoted	One or more characters surrounded by double quotes ("An Argument").
		Single quoted	One or more characters surrounded by single quotes ('An Argument').

Table 6: Basic Argument Types

Arguments are shown in the Help command output surrounded by square brackets '[Arg]' or parenthesis '(Arg)'. Square brackets indicate an optional argument and parenthesis indicate a required argument. Any optional argument specified requires that all prior optional arguments are also specified. Table 7 lists currently used command argument types.

Argument	Valid Range	Meaning
Boolean	0/1, T/F, True/False	Boolean true or false value.
Cmd	String	MASCOT command.
Cond	String	Condition statement. See <a href="#">PanelCond Command</a> .
Dest	1-N	Destination number (N = Count of destinations)
IP	D.D.D.D	IP address string argument, specified as 4 decimal numbers from 0 to 255 separated by periods.
Json	String	JSON formatted string, the structure of which depends on the command. The JSON string should be quoted in single quote characters when specifying a JSON value in a command.
Label	String	A string label argument, max of 8 characters.
Lvl	1-N	Level number (N = Count of system levels)
Netmask	D.D.D.D	Network mask string argument, specified as 4 decimal numbers from 0 to 255 separated by periods. Must be a valid IPv4 netmask.
Number		Numeric value. Valid values depends on command.
Preset	0-9	Preset number (preset 0 is special Startup preset)
Parameter		Parameter identifier. See <a href="#">System Parameters</a> .
Src	1-N or 0	Source number (N = Count of sources), 0 acts as mute (if supported).
String	String	A generic string argument (max length depends on the command).
Value		A general value. Value type depends on setting. See <a href="#">System Parameters</a> .

Table 7: Command Argument Types

## 3.7 System Parameters

MASCOT protocol version 3.0 adds commands for setting and querying configuration and other system parameters. These commands greatly simplify the MASCOT command set and supersede several configuration commands.

System parameter values can be set in Stored memory and/or Active memory. Stored values are loaded on system startup. Active values are the current control values of the running system, but won't be retained after a system restart if they differ from the Stored value.

Command	Arguments	Description
<a href="#">Get</a>	[Parameter]	Query Active parameter values.
<a href="#">GetS</a>	[Parameter]	Query Stored parameter values.
<a href="#">Set</a>	[Parameter][Value]	Set Active/Stored parameter value (depends on parameter).
<a href="#">SetA</a>	[Parameter][Value]	Set Active value of a parameter only.
<a href="#">SetS</a>	[Parameter][Value]	Set Stored value of a parameter only.

Table 8: System Parameter Commands

Parameter identifiers are represented as one or more alphanumeric words separated by periods, representing a



tree structure similar to file folders or directories. Table 9 below describes the columns in the [System Parameter Table](#).

<b>Parameter</b>	Parameter identifier consisting of one or more words separated by periods.
<b>Value</b>	Value type, see the <a href="#">Command Arguments</a> section for details.
<b>Access</b>	Parameter access. <b>R</b> for Readable settings, <b>W</b> for writable settings, or <b>RW</b> for both.
<b>Set</b>	Default parameter memory used with the <a href="#">Set Command</a> . <b>A</b> for Active, <b>S</b> for Stored, or <b>AS</b> for both. Commands which use only Stored memory require a reboot to become Active.

Table 9: System Parameter Table Columns

## 3.7.1 System Parameter Table

Parameter	Value	Access	Set	Description
ctl.mascot.ver	String	R		Mascot version in the form MAJOR.MINOR (3.0 for example).
ctl.serial.baud	Number	RW	AS	RS-232 serial port baud rate in bits/second.
ctl.serial.log	Boolean	RW	AS	RS-232 serial port protocol log enable.
ctl.serial.proto	String	RW	AS	RS-232 serial port protocol selection (“mascot”, “svs”, etc).
ctl.serial2.baud	Number	RW	AS	RS-485 serial port baud rate in bits/second.
ctl.serial2.log	Boolean	RW	AS	RS-485 serial port protocol log enable.
ctl.serial2.proto	String	RW	AS	RS-485 serial port protocol selection (“mascot”, “svs”, etc).
mtx.serial	Number	R		Current matrix serial number, incremented on every routing change.
mtx.sync	Boolean	RW	AS	Keep current routing state stored to preset 0. Effectively retains last matrix routing state even after a restart or power cycle.
net.dhcp	Boolean	RW	S	Network interface DHCP enable.
net.gateway	IP	RW	S	Network gateway address.
net.ip	IP	RW	S	Network interface IP address.
net.mac	MAC	R		Network interface MAC address.
net.netmask	IP	RW	S	Network interface mask.
pnl.cmdEn	Boolean	RW	AS	Panel command macro enable.
pnl.ip	IP	RW	AS	Remote IP address for panel interface to control.
sys.arch	String	R		System architecture (“Pyxis”, “Carina”, “Lynx”, etc).
sys.firmware	String	R		Firmware series and version (“Pyxis 1.1.7” for example).
sys.name	String	RW	AS	System name identifier.

## 3.8 Core Commands

This section outlines commands considered to be core MASCOT protocol commands and consists of matrix routing, I/O label, preset, and other primary system commands.

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Command	Arguments	Description
<a href="#">DestNames</a>	[Dest][Lvl][Label]	Destination I/O names command.
<a href="#">E</a>	[0   1]	Matrix connection echo enable command.
<a href="#">Firmware</a>		System firmware version.
<a href="#">Help</a>		Command help reference.
<a href="#">MascotVer</a>		Mascot protocol version.
<a href="#">MtxCfg</a>	[0-7]	Current matrix config.
<a href="#">P</a>	[Preset]	Recall a preset.
<a href="#">PAdd</a>	(Preset)(Dest)(Src)[Lvl]	Add a connection to a preset.
<a href="#">PClr</a>	(Preset)	Clear a preset to “No Change” values.
<a href="#">PsetNames</a>	[Preset][Label]	Preset names command.
<a href="#">PSub</a>	(Preset)(Dest)[Lvl]	Subtract a connection from a preset.
<a href="#">PView</a>	[Preset]	View preset.
<a href="#">Quit</a>		Quit TCP/IP telnet session.
<a href="#">Reboot</a>		Reboot the system.
<a href="#">S</a>	[1]	Matrix routing status.
<a href="#">SrcNames</a>	[Src][Lvl][Label]	Source names command.
<a href="#">SysType</a>		System hardware series.
<a href="#">W</a>	[Preset]	Store current matrix routing to a preset.
<a href="#">X</a>	[Dest][Src][Lvl]	Perform a matrix connect operation.

### 3.9 Configuration Commands

Commands in this section are for system configuration and are not considered to be a core part of the MASCOT protocol. There may be implementation and support variations between different system types. Many of these commands have been superseded by [System Parameters](#) in Mascot protocol version 3.0.

Command	Arguments	Description
<a href="#">DHCP</a>	[0   1]	DHCP enable.
<a href="#">FrameIP</a>	[IP]	Remote router IP address the panel will control.
<a href="#">Gateway</a>	[IP]	Network gateway IP address.
<a href="#">IP</a>	[IP]	System IP address.
<a href="#">MAC</a>		MAC address.
<a href="#">MapDest</a>	[Dest][Dest][Lvl]	Matrix destination remap command.
<a href="#">MapSrc</a>	[Src][Src][Lvl]	Matrix source remap command.
<a href="#">MtxGroup</a>	[Number][Number]	I/O grouping command.
<a href="#">NetMask</a>	[Netmask]	Network mask.
<a href="#">PairIO</a>	[0   1]	I/O pairing enable. <b>Superseded by the MtxGroup command.</b>
<a href="#">PanelCmd</a>	[Button][Cmd]	Panel button/GPIO command macros.
<a href="#">PanelCmdEn</a>	[0   1]	Enable panel button/GPIO command macros.
<a href="#">PanelCond</a>	[Button][Cond]	Panel button/GPIO status conditions.
<a href="#">PanelDis</a>	[0   1]	Internal panel button interface disable.
<a href="#">PanelExtEn</a>	[0   1]	External panel interface enable (if available).
<a href="#">PanelOfs</a>	[Dest][Src][Lvl][Lvl]	Button panel destination/source offsets and levels to control.
<a href="#">PanelRate</a>	[Number]	Remote panel refresh rate.
<a href="#">SerBaud</a>	[Number]	Query or assign serial baud rate.
<a href="#">SysName</a>	[String]	System name.

<a href="#">Vars</a>		Query all system configuration variables.
<a href="#">WebPass</a>	(String)	Assign web password.

## 3.10 Miscellaneous Commands

These additional commands consist of those which are not commonly used, not considered to be a core part of the MASCOT protocol, and support is most likely to vary between system types and firmware versions.

Command	Arguments	Description
<a href="#">B</a>	(0   1)	Reboot system into Bootloader, typically used for software update. A 0 or 1 value is required and selects the Bootloader IP address. A value of 0 uses 192.168.2.59 and 1 uses configured system IP.
<a href="#">C</a>		Query system matrix info, which is displayed in the format DESTS,SRCS,LEVELS,FLAGS1,FLAGS2. <b>Superseded by the MtxCfg command.</b>
<a href="#">LockStatus</a>		Get video lock status and rate detection information (not all HD router systems are supported).
<a href="#">ReclkDis</a>	[0   1]	Disable SDI reclockers (not all SDI router systems are supported).
<a href="#">RemoteSync</a>	[0   1]	Query or assign remote router syncing. Useful for creating a 3D system out of 2 routers.

## 3.11 Command Reference

This section documents each MASCOT command in detail. Please note that command availability may vary between firmware series and versions. Details of availability are documented for each command.

### 3.11.1 B Command

**Carina series only**

The B command is used for rebooting the system into Bootloader for software updates. See the [Software Updates](#) section for details.

### 3.11.2 C Command

**Routers and MSC-GCP2U32 only**

**NOTE:** Superseded by the [MtxCfg Command](#).

The C command queries the matrix size. The response is in the format “Dests,Srcs,Levels,Flags1,Flags2”. Where “Dests” is the count of system destinations, “Srcs” is the count of sources and “Levels” is the number of system levels. The Flags1 and Flags2 fields are currently unused and will be 0.

**Example for a 16x16 system with 2 levels**

```
>C
16,16,2,0,0
>
```

### 3.11.3 DestNames Command

**Routers and MSC-GCP2U32 only**

Query or assign destination names. This command has 4 variations, described by the following table. Destination names are saved and recalled on power up.

Command	Description
DestNames	Query all destination names.
DestNames DEST	Query destination names for all levels of a given destination.
DestNames DEST, LEVEL	Query the name of a specific destination and level.
DestNames DEST, LEVEL, LABEL	Assign a label to a destination.

When querying names, labels are surrounded by double quotes and each level is separated by commas ',' (multi-level systems only) and each destination is separated by newlines. Secondary levels use empty strings to indicate that the label of the first level should be used.

## Examples

```
>DestNames
"Dest1","AudDest1"
"Dest2",""
"Dest3",""
"Dest4",""
>DestNames 1
"Dest1","AudDest1"
>DestNames 1,2
"AudDest1"
>DestNames 1,2,""
>
```

The first 3 example commands are query commands. The last assigns an empty string to the second level of the first destination (thereby indicating that the first level label should be used).

## 3.11.4 DHCP Command

**NOTE:** Superseded by the [net.dhcp System Parameter](#).

Query or assign DHCP enable. A value of 0 disables DHCP client support and will therefore use the manual values assigned via the IP, Netmask and Gateway commands. A value of 1 enables DHCP and will obtain the values for the IP address, Netmask and Gateway from your DHCP server. This value is saved and recalled on power up.

**WARNING:** A DHCP server must be present on your network for this to function properly. Using DHCP allows for dynamic IP or fixed IP assignment from a central location (the DHCP server). Using this option is only recommended if using fixed IP assignment by MAC address or if there is a way to determine what IPs the Matrix Switch Corporation systems get assigned. Otherwise it may become difficult to determine what IP address to use when accessing the Web Page or other control interfaces. In the event that the IP address or Netmask of a system is unknown, consult the [Unknown IP Address](#) section for this device.

Command	Description
---------	-------------

DHCP	Query DHCP enable.
DHCP 0   1	Set DHCP enable (0 to disable, 1 to enable)

## Examples to query and then enable DHCP

```
>DHCP
0
>DHCP 1
>
```

## 3.11.5 E Command

### Routers and MSC-GCP2U32 only

Query or assign matrix routing changes echo enable. A value of 0 disables this feature. A value of 1 will cause all matrix routing changes to be echoed in the form of an X command: “Xd,s[,l]”. Where 'd' is the destination number, 's' is the source number and 'l' is the optional level number. This is useful for diagnostic purposes or automation software which would like to receive synchronous matrix routing state updates.

**NOTE:** Enabling this feature may slow down the system significantly during excessive matrix routing changes (especially when enabled on a serial port interface). Also of note is that this option takes effect only while the system remains powered (serial port) or for the duration of the connection (TCP/IP telnet sessions). This command is not supported by the HTTP web command interface.

Command	Description
E	Query matrix echo enable.
E 0   1	Set matrix echo enable (0 to disable, 1 to enable).

## Examples to query and then enable matrix echo

```
>E
0
>E 1
>
```

## 3.11.6 Firmware Command

**NOTE:** Superseded by the **sys.firmware** [System Parameter](#).

Query the system firmware series and version.

### Example

```
>Firmware
Pyxis 1.1.7
>
```

## 3.11.7 FrameIP Command

**NOTE:** Superseded by the **pnl.ip** [System Parameter](#).

Query or assign the remote router IP address. Usually only used on Remote Panel devices or in conjunction with the [RemoteSync Command](#) to create a dual router 3D system. Sets the IP address of the Router system which the button panel will connect to and control (or which the router will synchronize to when using the RemoteSync command). This can also be enabled on Router systems with a local button panel to configure the Router's panel to control a different Router (set to 0.0.0.0 by default to disable remote control and control the Router device itself). This setting is saved and recalled on power up.

Command	Description
FrameIP	Query IP address of remote Router system to control.
FrameIP IP	Set IP address of remote Router system to control (use 0.0.0.0 on Router systems to disable remote control).

## Example to query and assign the remote Router IP

```
>FrameIP
192.168.2.60
>FrameIP 192.168.2.61
>
```

## 3.11.8 Gateway Command

**NOTE:** Superseded by the **net.gateway** [System Parameter](#).

Query or assign the network Gateway IP address. This is usually only needed on Remote Panel systems which control a Router device on a different network. This setting is saved and recalled on power up.

Command	Description
Gateway	Query IP address of network Gateway.
Gateway IP	Set IP address of network Gateway.

## 3.11.9 Get Command

### Protocol version 3.0

The Get command is used for querying values of currently Active system parameter values. See the [System Parameter Table](#) for a list of currently defined parameters. This command supersedes many individual configuration commands.

**NOTE:** This command queries Active values of parameters which may differ from values in Stored memory. Values in Stored memory are loaded at system startup and can be queried with the [GetS Command](#). See [System Parameters](#) for more details.

Command	Description
Get	Display all system parameter Active values. Output consists of one parameter per line with the parameter identifier separated by an equals '=' character and the value.
Get Parameter	Display the Active value of a single parameter or a subset of parameters under a given parameter node.

## Examples of querying all parameters, “mtx” parameters, and “net.ip” parameter.

```
>Get
ctl.mascot.ver=2.3
ctl.serial.baud=115200
ctl.serial.log=0
ctl.serial.proto=mascot
ctl.serial2.baud=115200
ctl.serial2.log=0
ctl.serial2.proto=mascot
mtx.serial=1
mtx.sync=0
net.dhcp=0
net.gateway=192.168.2.1
net.ip=192.168.2.60
net.mac=00:50:C2:8B:DF:FE
net.netmask=255.255.255.0
pnl.cmdEn=1
pnl.ip=0.0.0.0
sys.arch=Pyxis
sys.descr=
sys.firmware=Pyxis 1.1.7
sys.name=MSC-Router

>Get mtx
mtx.serial=1
mtx.sync=0

>Get net.ip
net.ip=192.168.2.60
>
```

### 3.11.10 GetS Command

#### Protocol version 3.0

Gets system parameter values in Stored memory. The [Get Command](#) can be used to query current Active values of parameters and can also be referenced for more details.

Command	Description
GetS	Display all system parameter Stored values. Output consists of one parameter per line with the parameter identifier separated by an equals ‘=’ character and the value.
GetS Parameter	Display the Stored value of a single parameter or a subset of parameters under a given parameter node.

### 3.11.11 Help Command

Display command reference information.

### 3.11.12 IP Command

**NOTE:** Superseded by the **net.ip** [System Parameter](#).

Query or assign the system IP address. This setting is saved and recalled on power up.

**WARNING:** Maintaining the ability to access a device's web page and for Remote Panel devices to be able to communicate with Routers requires that the IP address is known, valid and systems are configured to be on the same IP network. In the event that the IP address of a system is unknown refer to the [Unknown IP Address](#) section for this device.

Command	Description
Ip	Query IP address of the system.
Ip IP	Set IP address of the system.

### Example querying and assigning the IP address

```
>IP
192.168.2.60
>IP 192.168.2.61
>
```

## 3.11.13 LockStatus Command

### Routers only

Query the video lock status and video rate of a Video Router's outputs. This command is only supported on some Router systems. Unsupported systems will return an "Unsupported command" error on version 2.1 and newer protocol versions and blank output on older versions.

Command	Description
LockStatus	Displays Video lock status and rate detection for outputs. Format is one decimal number per output (0: Unlocked, 1: SD, 2: HD).

### Example for a 16x4 system (SD, HD, Unlocked, Unlocked)

```
>LockStatus
1,2,0,0
>
```

## 3.11.14 MAC Command

**NOTE:** Superseded by the **net.mac** [System Parameter](#).

Query system Ethernet MAC address.

Command	Description
MAC	System Ethernet MAC address in hh:hh:hh:hh:hh:hh where each hh is a pair of hex digits.

### Example

```
>MAC
00:50:C2:8B:DF:FE
>
```



## 3.11.15 MapDest Command

### Routers only – Protocol version 3.0

Query or assign matrix destination mappings. Destination mappings provide a means to remap logical destinations to different physical destinations for an added level of convenience when allocating and defining system I/Os.

Command	Description
MapDest	Display destination matrix map. Only destinations are shown which have been remapped. One destination number per line is shown separated by a colon ':' and the destinations which are substituted for each level separated by commas.
MapDest Dest	Display mapping of a single destination.
MapDest Dest1 Dest2	Assign a destination mapping on all levels for Dest1 to physical Dest2.
MapDest Dest1 Dest2 Level	Assign a destination mapping on a single level for Dest1 to physical Dest2.

### Examples

```
>MapDest
1:4,4
2:3,2
>MapDest 1
1:4,4
>
>MapDest 1, 5
>
>MapDest 1, 6, 2
>
```

The examples above are for a 2 level router. The first example queries the entire destination map, which shows that destination 1 is remapped to physical destination 4 on both levels and destination 2 is remapped to destination 3 on the first level and destination 2 on the second level. The second example queries the mapping for a single destination. The third example maps destination 1 to physical destination 5 on all levels. The fourth example maps destination 1 to physical destination 6 on the second level only.

## 3.11.16 MapSrc Command

### Routers only – Protocol version 3.0

Query or assign matrix source mappings. Source mappings provide a means to remap logical sources to different physical sources for an added level of convenience when allocating and defining system I/Os.

Command	Description
MapSrc	Display source matrix map. Only sources are shown which have been remapped. One source number per line is shown separated by a colon ':' and the sources which are substituted for each level separated by commas.

MapSrc Src	Display mapping of a single source.
MapSrc Src1 Src2	Assign a source mapping on all levels for Src1 to physical Src2.
MapSrc Src1 Src2 Level	Assign a source mapping on a single level for Src1 to physical Src2.

## Examples

```
>MapSrc
1:4,4
2:3,2
>MapSrc 1
1:4,4
>
>MapSrc 1, 5
>
>MapSrc 1, 6, 2
>
```

The examples above are for a 2 level router. The first example queries the entire source map, which shows that source 1 is remapped to physical source 4 on both levels and source 2 is remapped to source 3 on the first level and source 2 on the second level. The second example queries the mapping for a single source. The third example maps source 1 to physical source 5 on all levels. The fourth example maps source 1 to physical source 6 on the second level only.

## 3.11.17 MascotVer Command

**NOTE:** Superseded by the **ctl.mascot.ver** [System Parameter](#).

Query Mascot protocol version. This is useful for software which interacts with a device using the Mascot protocol and wants to discover what protocol version is in use. The returned value is either an integer such as "2" or major and minor version numbers separated by a period, such as "2.3".

## Example

```
>MascotVer
2.3
>
```

## 3.11.18 MtxCfg Command

**Routers and MSC-GCP2U32 only - Protocol Version: 2.0**

Query matrix configuration. This command replaces the C command and provides the ability to query the matrix dimensions, labels, current matrix state and preset data. The information to return is specified by the sum of the flags values listed in the following table:

Flag	Information	Fields in JSON data
1	Return names (Destination, Source and Preset).	destNames, srcNames and psetNames

2	Return matrix routing state.	state
4	Return preset routing data.	psetData

The returned data is JSON formatted data (see [www.json.org](http://www.json.org) for details).

If no arguments are specified then a simple format is returned consisting of an array of arrays (one per level) with 3 integer numbers specifying the destination count, source count and flags of the level. The flags value is the sum of one or more values from the Flags table below.

## Flags

Name	Value	Description
mute	1	Mute support.
lock	2	Video lock status query support
reclk	4	Reclocker disable support.

## Example

```
>MtxCfg
[[8,8,3][4,8,0]]
```

The example above is simple output (no arguments) for a matrix with 2 levels, the first has 8 destinations, 8 sources and supports mute and lock status query ( $1 + 2 = 3$ ). The second level has 4 destinations, 8 sources and does not support mute, lock status query or reclocker disable.

If an argument is specified (0-7), then a more descriptive JSON structure is returned, of the following form (newlines and spaces added as a visual aid, but are not necessarily part of the response):

```
{
  "version" : 1,
  "status" : "STATUS",
  "levels" :
  [
    {
      "name" : "NAME",
      "type" : "TYPE",
      "destCount" : DEST_COUNT,
      "srcCount" : SRC_COUNT,
      "flags" : "FLAGS",
      "destNames" : [ "NAME", "NAME", ... ],
      "srcNames" : [ "NAME", "NAME", ... ],
      "state" : [ SRC, SRC, ... ],
      "psetData" : [ [ SRC, ... ], [ SRC, ... ], ... ]
    },
    ...
  ],
  "psetNames" : [ "NAME", "NAME", ... ]
}
```

**Table of information on values in capital letters above:**

Label	Description
STATUS	Matrix status: OK, UPDATING, DISCONNECT or ERROR. Returned if the matrix is OK, updating (from a remote router for example), one or more remote routers disconnected or a general error (remote router in error status for example) respectively.
NAME	Descriptive name of a level, destination, source or preset (8 chars or less).
TYPE	Level type: VIDEO, AUDIO, HD, VGA, 3G, ANALOG or AES. Used for general video, general audio, HD video, VGA video, 3G HD video, analog audio or AES digital audio respectively.
DEST_COUNT	Count of destinations for the level.
SRC_COUNT	Count of sources for the level.
FLAGS	A space separated list of flag keywords indicating support for various features, as defined by the Name column in the Flags table above.
SRC	Source values for matrix state and preset data. Values start from 1, 0 represents mute and -1 represents "No Change" (for preset data only).

**Example** - Newlines and spaces added to response as a visual aid.

```
>MtxCfg7
{
  "version" : 1,
  "status" : "OK",
  "levels" :
  [
    {
      "name" : "Level1",
      "type" : "VIDEO",
      "destCount" : 4,
      "srcCount" : 4,
      "flags" : "mute",
      "destNames" : [ "Dest1", "Dest2", "Dest3", "Dest4" ],
      "srcNames" : [ "Src1", "Src2", "Src3", "Src4" ],
      "state" : [ 1, 2, 3, 4 ],
      "psetData" :
      [
        [1,2,3,4], [1,1,1,1], [-1,-1,-1,-1], [-1,-1,-1,-1],
        [-1,-1,-1,-1], [-1,-1,-1,-1], [-1,-1,-1,-1], [-1,-1,-1,-1],
        [-1,-1,-1,-1], [-1,-1,-1,-1]
      ]
    },
  ],
  "psetNames" :
  [
    "Startup","Preset1","Preset2","Preset3","Preset4",
    "Preset5","Preset6","Preset7","Preset8","Preset9"
  ]
}
```

The example output above is a typical response for a 4x4 Video router. Current matrix routing is “straight through”, 10 presets are defined (1st is straight through, 2nd is mapped all to source 1, and all other presets have not been assigned (No Change). Note that future protocol versions may support more than 10 presets and therefore may return information for more or less than 10 presets for the psetData and psetNames arrays.

## 3.11.19 MtxGroup Command

### Routers only - Protocol Version: 2.4

Query or assign I/O grouping. This setting is saved and recalled on power up.

The I/O grouping feature is used to combine multiple inputs and outputs. Combined grouped inputs and outputs then behave as if they were a single I/O, which changes the size of the router matrix accordingly (matrix size divided by group count), and matrix routing changes update the grouped I/Os simultaneously. Group counts are assigned on a per level basis, allowing for different I/O grouping for separate levels (for example separate video and audio levels). Real world examples of I/O grouping include: dual channel 3D video and combining multiple audio channels (4 AES digital audio streams for example).

Command	Description
MtxGroup	Query current I/O grouping.
MtxGroup LEVEL1	Set level 1 I/O grouping (0 or 1 disables grouping).
MtxGroup LEVEL1, LEVEL2	Set level 1 and level 2 I/O grouping (0 or 1 disables grouping).

### Example querying and assigning I/O grouping

```
>MtxGroup
1,1
>MtxGroup 2,4
>MtxGroup
2,4
>
```

The first example MtxGroup command shows that I/O grouping is disabled on both levels of a 2 level system. The second command configures the system for dual I/O grouping on level 1 and quad I/O grouping on level 2. On an example 16x16 two level router this would result in an 8x8 matrix on level 1 and a 4x4 matrix on level 2.

## 3.11.20 NetMask Command

**NOTE:** Superseded by the **net.netmask** [System Parameter](#).

Query or assign the system network mask value. This value is related to the IP address of the system and is used for IP communications over the Ethernet network. This setting is saved and recalled on power up.

**WARNING:** Maintaining the ability to access a device's web page and for Remote Panel devices to be able to communicate with Routers requires that the IP address is known, valid and systems are configured to be on the same IP network. In the event that the IP address or Netmask of a system is unknown, consult the [Unknown IP Address](#) section for this device.

Command	Description
NetMask	Query network mask value.
NetMask NETMASK	Set network mask value.

## Example querying and assigning netmask

```
>NetMask
255.255.255.0
>NetMask 255.255.255.192
>
```

## 3.11.21 P Command

### Routers and MSC-GCP2U32 only

Recalls a preset. Each Router system contains 10 presets numbered 0 through 9 which can store the entire matrix routing state or one or more single destination connections. Preset 0 is recalled on system power up.

Command	Description
P PRESET	Recall a preset.

## Example to recall preset 1

```
>P 1
>
```

## 3.11.22 PAdd Command

### Routers and MSC-GCP2U32 only

Preset add command. Adds a connection to a preset. This can be used to incrementally create a preset without changing the active matrix routing. 0 can be used for SRC for Mute (if supported). This command stores preset information which is retained and available through system power cycles.

Command	Description
PAdd PRESET, DEST, SRC	Add a connection of SRC to DEST on PRESET for all levels.
PAdd PRESET, DEST, SRC, LEVEL	Add a connection of SRC to DEST/LEVEL on PRESET.

## Example

```
>PAdd 1,2,3
>PAdd 1,3,0,2
>
```

The first command adds a connection from Source 3 to Destination 2 in Preset 1. The second command Mutes Destination 3 on Level 2 in Preset 1.

## 3.11.23 PairIO Command

### Routers only - Protocol Version: 2.1

**NOTE:** Superseded by [MtxGroup Command](#).

I/O pairing is used for pairing destinations/sources for 3D support. When activated a router will appear to have half the number of physical destinations and sources. A given matrix crosspoint change will cause 2 destinations to be changed. Each odd destination/source is paired with the next highest even number destination/source. This option is stored and recalled on power on. When enabling this feature on a 4x4 video router for example, it would appear as a 2x2 3D router where destination 1 & 2 are paired and 3 & 4 are paired, likewise for sources. This setting is stored and recalled on power up.

Command	Description
PairIO	Query current value of I/O pairing configuration.
PairIO 0   1	Enable or disable I/O pairing (0: disable, 1: enable)

## Example

```
>PairIO
0
>PairIO 1
>
```

The first command queries the current state of I/O pairing, the second enables it.

## 3.11.24 PanelCmd Command

### Protocol Version: 3.0

Query and assign panel button/GPIO command macros. This system provides a means to easily implement custom functionality in response to a panel button press or GPIO auxiliary port contact closure (button or switch to ground). Panel buttons and GPIO pins are specified by numeric ID.

Panel buttons are numbered beginning with ID number 1. Panel button order depends on the panel, but generally has the top left button as button 1, followed by number 2 in the lower left corner, number 3 in the top second column, continuing to alternate between top and bottom rows till the last button (lower right hand corner).

GPIO auxiliary pins start with ID number 65 for GPIO pin 1.

**NOTE:** Panel commands must be enabled with the [PanelCmdEn Command](#) or by setting the pnl.cmdEn [System Parameter](#) to activate them.

Command	Description
PanelCmd	Query all assigned panel button/GPIO commands.
PanelCmd Button	Query a single panel button/GPIO command.
PanelCmd Button Command	Assign a panel button/GPIO command. Assigning a blank command to a button or GPIO pin will clear the command (two consecutive single or double quotes represents an empty string).

## Examples

```
>PanelCmd
1 P0
2 P1
65 P0
>PanelCmd 1
1 P0
>PanelCmd 66,"P1"
>PanelCmd 66,""
>
```

The first example above queries the currently assigned panel/GPIO commands, which shows that button number 1 and 2 have P0 and P1 commands assigned respectively, which recalls preset 0 and preset 1, and GPIO pin 1 (GPIO pins start at 65) will recall preset 0. The second command queries the panel command for button 1. The third command assigns the command "P1" to GPIO pin 2 (ID 66). The fourth command clears the command assigned to GPIO pin 2.

## 3.11.25 PanelCmdEn Command

**Protocol Version: 3.0**

**NOTE:** Superseded by the **pnl.cmdEn** [System Parameter](#).

Query and assign panel button/GPIO command macro and condition subsystem enable. This command is used to enable or disable button and GPIO commands and conditions. See [PanelCmd](#) and [PanelCond](#) commands for more details.

Command	Description
PanelCmdEn	Query panel button/GPIO command and conditions enable.
PanelCmd 0   1	Enable or disable panel button/GPIO command and conditions (0: disable, 1: enable).

## Examples for querying and enabling panel command/conditions

```
>PanelCmdEn
0
>PanelCmdEn 1
>
```

## 3.11.26 PanelCond Command

**Protocol Version: 3.0**

Query and assign panel button/GPIO status and indicator conditions. Panel button/GPIO conditions are a counterpart to [Panel Commands](#) and provide a means to easily implement custom status to light panel buttons or change logic states on output GPIO pins. Panel buttons and GPIO pins are specified by numeric ID.

Panel buttons are numbered beginning with ID number 1. Panel button order depends on the panel, but generally has the top left button as button 1, followed by number 2 in the lower left corner, number 3 in the top second column, continuing to alternate between top and bottom rows till the last button (lower right hand corner).



**NOTE:** Condition statements are not currently fully defined and at the moment consists of only a matrix preset matching condition, which is specified as “Pn” where n is the preset number. For example P0 would cause the assigned button LED to light or GPIO to become a logic high value if the current matrix state matches preset 0. A future revision will add support for a more robust conditional instruction language.

GPIO auxiliary pins start with ID number 65 for GPIO pin 1.

**NOTE:** Panel commands and conditions must be enabled with the [PanelCmdEn Command](#) or by setting the pnl.cmdEn [System Parameter](#) to activate them.

Command	Description
PanelCond	Query all assigned panel button/GPIO conditions.
PanelCond Button	Query a single panel button/GPIO condition.
PanelCond Button Condition	Assign a panel button/GPIO condition. Assigning a blank condition to a button or GPIO pin will clear the condition (two consecutive single or double quotes represents an empty string).

## Examples

```
>PanelCond
1 P0
2 P1
67 P0
>PanelCond 1
1 P0
>PanelCond 68,"P1"
>PanelCond 68,""
>
```

The first example above queries the currently assigned panel/GPIO conditions, which shows that button number 1 and 2 have P0 and P1 conditions assigned respectively, which lights the button LEDs when the current matrix routing matches preset 0 or preset 1 respectively, and GPIO pin 3 (GPIO pins start at 65) will output a logic 1 if the matrix matches preset 0. The second command queries the panel condition for button 1. The third command assigns the condition “P1” to GPIO pin 4 (ID 68). The fourth command clears the condition assigned to GPIO pin 4.

## 3.11.27 PanelDis Command

### Protocol Version: 2.4

Query or assign internal button interface panel disable setting. This setting is stored and recalled on power up.

Command	Description
PanelDis	Query internal panel disable setting.
PanelDis 0   1	Assign internal panel disable setting (0: enable, 1: disable)

## Examples

```
>PanelDis
0
>PanelDis 1
>
```

The first command queries the current panel disable setting (0: enabled). The second command disables the internal panel interface.

## 3.11.28 PanelExtEn Command

### Carina series only - Protocol Version: 2.4

Query or assign external button interface panel enable setting (if applicable – not all router devices have an external panel interface). This setting is stored and recalled on power up.

Command	Description
PanelExtEn	Query external panel interface enable setting.
PanelExtEn 0   1	Assign external panel interface enable setting (0: disable, 0: enable)

### Examples

```
>PanelExtEn
0
>PanelExtEn 1
>
```

The first command queries the current external panel interface setting (0: disabled). The second command enables the external panel interface.

## 3.11.29 PanelRate Command

### Protocol Version: 2.1

For changing remote button panel refresh rate. When a button panel is configured to control a remote router the current connection status is refreshed at regular intervals. This command can be used to increase or decrease the rate, which is saved and recalled on system power up. The default refresh rate is 5 seconds. This value is stored and recalled on power up.

Command	Description
PanelRate	Query current panel refresh rate (in seconds).
PanelRate RATE	Set remote panel refresh rate in seconds.

### Examples

```
>PanelRate
5
>PanelRate 1
>
```

The first command queries the current panel refresh rate, which returns 5 (default). The second command sets the refresh rate to be 1 second.

## 3.11.30 PClr Command

### Routers and MSC-GCP2U32 only

Clear a preset. For Preset 0 this sets all Destinations to Source 0. Other Presets are assigned “No Change” to all Destinations. This command stores preset information which is available through system power cycles.

Command	Description
PClr PRESET	Clear a preset.

### Example to clear preset 1

```
>PClr 1
>
```

## 3.11.31 ProtoSer Command

### Carina series only

**NOTE:** Superseded by the **ctl.serial.proto** and **ctl.serial2.proto** [System Parameters](#).

Query or assign the serial protocol. The only available option is currently the case insensitive value "Mascot", however additional control protocols may be added in the future. Value is stored and recalled on power up.

Command	Description
ProtoSer	Query the protocol used on the serial port.
ProtoSer PROTO	Assign the protocol used on the serial port (the only valid value is currently "Mascot").

### Examples

```
>ProtoSer
Mascot
>
```

## 3.11.32 PsetNames Command

### Routers and MSC-GCP2U32 only

Query or assign preset names. Preset names are stored and recalled on power up.

Command	Description
PsetNames	Query all preset names.
PsetNames PRESET	Query a single preset name.
PsetNames PRESET, LABEL	Assign a preset label.

When querying names, labels are surrounded by double quotes and separated by newlines.

## Examples

```
>PsetNames
"Startup"
"Preset1"
"Preset2"
"Preset3"
"Preset4"
"Preset5"
"Preset6"
"Preset7"
"Preset8"
"Preset9"
>PsetNames 1
"Preset1"
>PsetNames 1,"MyPreset"
>
```

The first 2 example commands are query commands. The last assigns "MyPreset" to Preset 1.

## 3.11.33 PSub Command

### Routers and MSC-GCP2U32 only

Preset subtract command. Removes a connection in a preset by setting a Destination or Destination/Level to "No Change". This can be used to incrementally create a preset without changing the active matrix routing. This command changes preset data which is stored and persists through power cycles.

Command	Description
PSub PRESET, DEST	Remove any existing connection to DEST in PRESET for any level.
PSub PRESET, DEST, LEVEL	Remove any existing connection to DEST/LEVEL in PRESET.

## Example

```
>PSub 1,2
>PSub 1,3,2
>
```

The first command removes any connection to Destination 2 in Preset 1. The second command removes any connection to Destination 3/Level 2 on Preset 1.

## 3.11.34 PView Command

### Routers and MSC-GCP2U32 only

View presets. Displays the content of one or all presets.

The format of the returned output is "1:S1[,S2] 2:S1[,S2] ..." where the 1: and 2: are incrementing destination values, followed by one or more source values (depending on the number of system levels).

## Special source values

- '-' indicates "No Change", which causes no changes to the given Destination/Level.
- 0 indicates "Mute"

Command	Description
PView	Display all presets.
PView PRESET	Display a single PRESET.

## Example on a 16x4 system with 2 levels

```
>PView 1
1:1,1 2:2,2 3:6,7 4:0,-
>
```

The above example shows that Preset 1 would cause Destination 1 to be connected to Source 1 for both levels, Destination 2 to be connected to Source 2 for both levels, Destination 3 to be connected to Source 6 for Level 1 and Source 7 for Level 2 (break away) and Destination 4 to be Muted for Level 1 and "No Change" would be made for Level 2.

## 3.11.35 Reboot Command

Instructs the system to reboot, which is done after a brief delay. Ensures that all outstanding data writes are written to non-volatile memory, prior to the reboot.

## 3.11.36 ReclkDis Command

### Routers only - Protocol Version: 2.1

Command for disabling or enabling SDI reclockers. Not all router systems support this option. Value is saved and recalled on power up.

Command	Description
ReclkDis	Query current value of reclocker disable.
ReclkDis 0   1	Enable or disable reclockers (0 or 1 respectively).

## Examples

```
>ReclkDis
0
>ReclkDis 1
>
```

The first command above queries the current reclocker disable value which returns 0 (the default, reclockers enabled). The second command disables the reclockers.

## 3.11.37 RemoteSync Command

### Routers only - Protocol Version: 2.1

Command to enable syncing matrices of two router systems. Usually used for creating a 3D matrix from two router systems, which will result in one router controlling the left 3D channels and the other router controlling the right channels. When enabled, this option synchronizes matrix crosspoint changes to the router IP address assigned with the [FrameIP Command](#). This command should only be enabled with one of the two routers (the primary router). This value is stored and recalled on power up.

Command	Description
RemoteSync	Query current value of remote router syncing.
RemoteSync 0   1	Enable or disable remote router syncing (1 or 0 respectively).

### Examples

```
>RemoteSync
0
>RemoteSync 1
>FrameIP 192.168.2.61
>
```

The first command in the above examples queries the current value of the remote sync option, which returns 0 (disabled, the default). The second command enables remote syncing and the final command sets the IP address of the router to sync (secondary router).

### 3.11.38 S Command

#### Routers and MSC-GCP2U32 only

Query the current matrix routing state. Source values for all levels of every destination are shown. This command without an argument is equivalent to the [X Command](#) with no arguments. If an argument value of '1' is supplied, then the matrix state is displayed with labels. The state of each destination is displayed, one per line, in the format:

"DestNLvl1": "SrcLvl1", "DestNLvl2": "SrcLvl2", ...

#### Example

```
>S1
"Dest1": "Src4", "Dest1": "Src4"
"Dest2": "Src3", "Dest2": "Src3"
"Dest3": "Src2", "Dest3": "Src2"
"Dest4": "Src1", "Dest4": "Src4"
```

The example above is output from a two level (Video and Audio for example) 4x4 matrix with sources routed in reverse order, except destination 4, which has a 2nd level break away which is routed from source 4.

### 3.11.39 SerBaud Command

**NOTE:** Superseded by the **ctl.serial.baud** and **ctl.serial2.baud** [System Parameters](#).

Query or assign the RS-232 serial port baud rate. The default value is 115200. This value is stored and recalled on power up.

Command	Description
SerBaud	Query the current serial port baud rate.
SerBaud BAUD	Set the serial port baud rate.

## Examples

```
>SerBaud
115200
>SerBaud 9600
>
```

The first example command queries the serial baud rate value which is the default of 115200 and the second command sets it to 9600 baud.

## 3.11.40 Set Command

### Protocol version 3.0

The Set command is used for assigning values to system parameters. See the [System Parameter Table](#) for a list of currently defined parameters. This command supersedes many individual configuration commands.

**NOTE:** This command may set Active and/or Stored parameter values. Behavior depends on the parameter and is defined in the [System Parameter Table](#). Values in Stored memory are loaded at system startup. See [System Parameters](#) for more details.

Command	Description
Set	List all parameter identifiers which can be set, one per line.
Set Parameter Value	Set a parameter's Active and/or Stored value (depends on parameter).

### Examples of listing all writable parameters and setting the “net.ip” parameter.

```
>Set
ctl.serial.baud
ctl.serial.log
ctl.serial.proto
ctl.serial2.baud
ctl.serial2.log
ctl.serial2.proto
dbg.i2cAckFails
dbg.i2cArbLosses
dbg.i2cBusErrors
dbg.i2cOVERRUNS
dbg.i2cTimeouts
dbg.i2cResets
mtx.sync
net.dhcp
net.gateway
net.ip
net.mac
net.netmask
pnl.cmdEn
```

```

pnl.ip
sys.descr
sys.name
sys.type

>Set net.ip 192.168.2.60
>

```

## 3.11.41 SetA Command

### Protocol version 3.0

The SetA command is used for setting system parameter Active values only. Values set with this command will take effect immediately, but will not be retained through a system restart.

**NOTE:** Some parameters may not be assignable in Active memory. Such parameters must be set in Stored memory followed by a system restart to activate the changes. See [System Parameters](#) for more details.

Command	Description
SetA	List all parameter identifiers which can be set in Active memory, one per line.
SetA Parameter Value	Set a parameter's Active value.

## 3.11.42 SetS Command

### Protocol version 3.0

The SetS command is used for setting system parameter Stored values only. Values set with this command will not take effect until the system is restarted.

**NOTE:** Some parameters may not be assignable in Stored memory, for example if it does not make sense to recall a value on start up. See [System Parameters](#) for more details.

Command	Description
SetS	List all parameter identifiers which can be set in Stored memory, one per line.
SetS Parameter Value	Set a parameter's Stored value.

## 3.11.43 SrcNames Command

### Routers and MSC-GCP2U32 only

Query or assign source names. This command has 4 variations, described by the following table. Source names are stored and recalled on power up.

Command	Description
SrcNames	Query all source names.
SrcNames SRC	Query source names for all levels of a given source.
SrcNames SRC, LEVEL	Query the name of a specific source and level.
SrcNames SRC, LEVEL, LABEL	Assign a label to a source.



When querying names, labels are surrounded by double quotes and each level is separated by commas ',' (multi-level systems only) and each source is separated by newlines. Secondary levels use empty strings to indicate that the label of the first level should be used.

## Examples

```
>SrcNames
"Src1","AudSrc1"
"Src2",""
"Src3",""
"Src4",""
>SrcNames 1
"Src1","AudSrc1"
>SrcNames 1,2
"AudSrc1"
>SrcNames 1,2,""
>
```

The first 3 example commands are query commands. The last assigns an empty string to the second level of the first source (thereby indicating that the first level label should be used).

## 3.11.44 SysName Command

**NOTE:** Superseded by the **sys.name** [System Parameter](#).

Query or assign system name. The system name is provided for convenience when managing multiple Matrix Switch Corporation systems. This value is stored and recalled on power up.

Command	Description
SysName	Query system name.
SysName STR	Set system name (up to 15 characters).

## Example for querying and assigning system name

```
>SysName
MSC-Router
>SysName "MyRouter"
>
```

## 3.11.45 SysType Command

**Protocol Version: 2.3**

**NOTE:** Superseded by the **sys.arch** [System Parameter](#).

Query the system series type, which is currently defined as one of the following values:

Value	Series name
0	Carina
1	Lupus

2	Lynx
3	Hydra
4	Pyxis

**NOTE:** This command was not added until version 2.3 of the Mascot protocol. On previous versions, this command is available on the MSC-GCP2U32 LCD panel but not other Matrix Switch Corporation systems. When determining the system type, if executing the command returns an Invalid Command error, the system series can be assumed to be Carina.

Command	Description
SysType	Query the system hardware series.

## Examples

```
>SysType
E01: Invalid command
>SysType
2
>
```

The first example command shows the response that would be received on a Carina series system with older firmware not supporting the SysType command, the second example is what might be returned by an MSC-GCP2U32 LCD panel.

## 3.11.46 Vars Command

### Protocol Version: 2.3

Display all system configuration variables. Useful in serial terminal or telnet sessions to view all configuration values.

Command	Description
Vars	Display all system configuration parameters. Note that variables consisting of JSON data simply show the string JSON, to keep the output concise. The output consists of one line per variable, with the variable name followed by an equals '=' and then the value (not quoted).

## Examples

```
>Vars
DefaultProfile=1
DHCP=1
DNSPri=0.0.0.0
DNSSec=0.0.0.0
Firmware=1.5.1
Gateway=192.168.2.1
IP=192.168.2.80
```

```
Mac=00:00:00:00:00:00
MascotVer=2
MtxProfiles=JSON
Netmask=255.255.255.0
Profile=1
SerBaud=115200
SerProto=Mascot
SysName=MSC-Panel
SysType=2
>
```

The example above shows a typical output of the Vars command for an MSC-GCP2U32 LCD panel.

## 3.11.47 W Command

### Routers and MSC-GCP2U32 only

Write current matrix routing state to a preset. Recalling the preset later will restore the routing matrix to the same state. This command modifies preset data which persists through power cycles.

Command	Description
W PRESET	Write current matrix routing state to PRESET.

### Example to save state to preset 1

```
>W 1
>
```

## 3.11.48 WebPass Command

Assign a web password to password protect the web page interface. The serial and TCP/IP port Mascot protocol control is not protected by this password. This value is stored and recalled on power up.

Command	Description
WebPass STR	Set web page password (blank to disable)

### Examples of setting and clearing web page password

```
>WebPass SeCr3t
>WebPass ""
>
```

## 3.11.49 X Command

### Routers and MSC-GCP2U32 only

Query or make changes to the matrix routing state. This command comes in several variations described by the following table.

Command	Description
---------	-------------

## MSC-2HD1632S+DC Product Manual

X	Query complete routing state (equivalent to S Command).
X DEST	Query connected sources for DEST for all levels.
X DEST, SRC	Connect SRC to DEST for all levels.
X DEST, SRC, LEVEL	Connect SRC to DEST/LEVEL.

When querying connection state, sources for each level are separated by commas (multi-level systems only) and are displayed for each destination and separated by newlines.

The value 0 can be used for DEST to switch all destinations to a given source. A level may also be specified to isolate switching a single level of all destinations. **(Protocol Version 2.2)**

The value 0 can be used for SRC to Mute a destination (if supported for a given level).

### Examples

```
>X
1,1
2,2
3,8
0,4
>X 3
3,8
>X 3,4
>X 4,0,2
>
```

In the above examples the first command queries the matrix routing state (typical of a 16x4 system for example), the second command queries destination 3 only, the third command connects source 4 to destination 3 on all levels and the fourth command mutes destination 4 level 2.

### Command stacking

Command stacking is especially useful for the X command, since it allows for several connections to be performed at the same time.

### Example

```
>X1,4#X2,3#X3,2#X4,1
>
```

The above would connect source 4 to destination 1, source 3 to destination 2, source 2 to destination 3 and source 1 to destination 4 for all levels.

## 4 Software Updates

The procedure for updating software (also called firmware) on Matrix Switch Corporation devices is determined by the hardware series. The hardware series can be most easily determined by looking at the top right hand corner of the web page interface, which will indicate the hardware series (Carina, Pyxis, Lynx, Lupus, etc) and the version of the firmware.

It is recommended that software updates are only performed in order to resolve an issue or gain a desired feature. While the software update procedures have been designed to be resistant to failure, there is still a risk of a device becoming inoperable in the event that an update is interrupted. Consult the Troubleshooting section for information on device recovery in the event this occurs.

### 4.1 Software Update on Carina Series Devices

There are two basic methods of performing a software update: Power On Software Update (**POSU**) and Command Software Update (**CSU**). Both methods use the TFTP protocol over the device's Ethernet port.

CSU is recommended if the device is on a different IP network than the default 192.168.2.x and the update computer's IP is already configured on that network. POSU is needed if the device's software gets corrupted (due to a failed update attempt) or if sending a Mascot command to the device is problematic.

#### Software update method comparison

- POSU uses a fixed update IP address of 192.168.2.59 whereas CSU uses the device's configured IP address.
- POSU should be available even if a device's firmware gets corrupted from a previous update attempt, whereas CSU will likely no longer be possible.
- POSU has a shorter TFTP “update time window” of 5 seconds and the TFTP transfer has to occur within this period after power cycling the device. This means the PC needs to be in close proximity of the device, remote power control be possible or coordination with someone to power cycle the device when initiating the TFTP transfer. Because of the shorter update window, a cross over Ethernet cable is not recommended, due to potential delay in the physical Ethernet link becoming active.
- CSU requires an extra step of a Mascot command being sent to the device.

#### 4.1.1 Software Update Requirements

To perform a software update, the following is required:

1. A computer connected to the same Ethernet network as the device being updated.
2. A TFTP client program installed on the computer. See [TFTP Software](#) section for details.
3. The device to update with its Ethernet port connected to the same network as the PC.
4. A firmware file image for the device from Matrix Switch Corporation. The file name is of the form MSC-Carina-Firmware-x.x.x.hex, where x.x.x is the version number.
5. See [Upgrading from version 4.x.x or older firmware](#) if applicable.

#### 4.1.2 Power on Software Update

This method requires that a TFTP transfer is initiated immediately after powering up the device.

**NOTE:** A cross over cable is not recommended for this update method, due to the probability that the delay of the physical Ethernet link becoming active exceeds the TFTP update time window. Please use a network switch and connect the PC and device to it.

### Steps for executing a Power On Software Update:

1. Ensure that the [Software Update Requirements](#) are met.
2. Configure the PC for the IP address 192.168.2.58 or another unique IP on the same 192.168.2.x IP network (except 192.168.2.59). Make sure that no other system on the network is using 192.168.2.59 or the IP assigned to the PC.
3. Prepare the TFTP program to transfer the firmware file to the device, but do not initiate the transfer yet. See the section [TFTP Software](#) for details.
4. Power on the device (power cycle it if it is already on).
5. Immediately after powering on the device, initiate the TFTP transfer (hit ENTER on the tftp command, etc), there is only a 5 second time window to initiate the transfer.
6. If the transfer does not complete successfully within 30 seconds, retry from step 3.

### 4.1.3 Command Software Update

This method uses the device's already assigned IP address and the execution of a Mascot command to initiate the software update. If the IP is unknown, use the [Power On Software Update](#) method or refer to the [Unknown IP Address](#) section.

**NOTE:** The software update time window is 30 seconds for this method, so a cross over cable should be OK, but if in doubt, make sure there is an Ethernet switch between the device and update PC.

### Steps for executing a Command Software Update:

1. Ensure that the [Software Update Requirements](#) are met.
2. Configure the PC for a unique IP address on the same IP network as the device (if not already). Make sure that there are no IP conflicts with the PC or device.
3. Prepare the TFTP program to transfer the firmware file to the device, but do not initiate the transfer yet. See the section [TFTP Software](#) for details.
4. Power up the device being updated, if not already operating.
5. Use one of the following methods to send a Mascot command to the device:
  - If the device already contains version 5 firmware (mid year 2011), connect to the device's web page interface by using a web browser, entering it's IP address into the browser's Location bar and pressing ENTER. Navigate to the command tab, where the command will be typed into the text entry field at the top.
  - Use a telnet client to connect to port 40 on the device. For many command line telnet clients (Windows XP, Mac OSX, Linux, etc) this can be accomplished by opening up a command terminal and typing the following command (replace 192.168.2.60 with the actual IP of the device): "telnet 192.168.2.60 40". Once connected press ENTER and make sure a ">" prompt character is displayed (indicating that a valid connection has been established). The software update command can then be typed in the telnet session.
  - If the device is a Matrix Switch Corporation router, then you can connect a serial cable between it and the PC. Use a terminal program, such as Hyperterm, and configure the serial settings for 9600

Baud 8N1 (8 data bits, No parity, 1 stop bit). Press ENTER to confirm the connection (a '>' prompt character should be displayed). The software update command can then be typed in the serial connection window.

- If you are unable to establish a Mascot command connection, use the [Power On Software Update](#) method.
- 6. Type the Mascot command “B1” followed by ENTER, utilizing one of the above Mascot connection methods.
- 7. A few seconds after entering the above command, initiate the TFTP transfer (hit ENTER on the tftp command, etc), there is a 30 second time window to initiate the transfer.
- 8. If the transfer does not complete successfully within 30 seconds, retry from step 3.

### 4.2 Software failsafe recovery procedure

In the event the device software becomes inoperable and a regular software update cannot be performed, due to a failed software update or abnormal data corruption, this section can be consulted for the applicable software recovery procedure. Prior to following this procedure, please check the following, in the event that the issue is not related to software functionality:

- Ensure the proper power supply is being used and is connected to a good power source.
- Check that applicable power indicators/panel buttons are lit and device hardware appears to be otherwise in working order.
- If network communication with the device is not working, ensure network cabling and interconnect hardware is functioning, ensure the proper IP address is being used to connect to the device, is unique on the network, and that the system being used to connect to the device has a unique IP on the same network subnet. Consult the [Unknown IP address](#) section for details on recovering from an unknown IP address.

After checking that these conditions are met, the following procedure can be used to recover from a corrupted firmware issue, depending on the system type.

Carina series systems require that the [Power on Software Update](#) procedure is used if the normal system firmware is inaccessible. Please consult that section for additional details.

### 4.3 TFTP Software

There are many different options for TFTP client programs, the choice of which depends on what operating system you are using on the computer being used to perform the TFTP transfer from. The following sections list some options for various operating systems.

#### 4.3.1 Windows

Windows XP has a TFTP client installed and enabled by default. For newer versions of Windows the TFTP client must be enabled using the following procedure:

1. Navigate to **Start → Control Panel → Programs and Features**.
2. Click **Turn Windows features on or off** on the left side of the interface
3. Scroll to the **TFTP Client** option in the list and check the check box next to it.
4. Click **OK**

To use the tftp utility on Windows:

1. Copy the firmware image file to the Desktop.
2. Open a windows command prompt (**Start** → **Run** and type “**cmd**” followed by the ENTER key).
3. Change to the directory where the firmware image is with the command “**cd Desktop**” followed by the ENTER key.
4. Type the following command to prepare the TFTP transfer (but don't hit ENTER yet):

```
tftp -i 192.168.2.59 put MSC-Carina-Firmware-x.x.x.hex
```

5. Make sure to replace 192.168.2.59 with the device's IP address if the update procedure being used utilizes the device's assigned IP and replace MSC-Carina-Firmware-x.x.x.hex with the correct version number of the file.
6. Pressing ENTER will initiate the TFTP transfer. Make sure to perform the necessary actions to prepare the system for an update, prior to attempting the transfer.
7. The TFTP program will indicate if the transfer was successful or not.

### 4.3.2 Mac OS X

Mac OS X comes with a tftp client. It is accessed from the Terminal application.

To use the tftp application on Mac OSX:

1. Copy the firmware file to somewhere easily accessible from the Terminal application, for example your home directory at /Users/your\_user\_name/
2. Open a terminal: Applications -> Utility -> Terminal
3. Use 'cd' commands to change to the location of the firmware file, for example '**cd /Users/your\_user\_name/**' followed by the ENTER key.
4. Execute the tftp command with the IP address of the device (make sure to use the device's configured IP if the update method being used utilizes the devices IP address):

```
tftp 192.168.2.59
```

5. Execute the following commands from within the tftp program, pressing ENTER after each line, except the last one, to prepare the TFTP transfer:

```
binary  
put MSC-Carina-Firmware-x.x.x.hex
```

6. Make sure to replace MSC-Carina-Firmware-x.x.x.hex with the correct version number of the file.
7. Pressing ENTER after the put command will initiate the TFTP transfer. Make sure to perform the necessary actions to prepare the system for an update, prior to attempting the transfer.
8. The TFTP program will indicate if the transfer was successful or not.
9. If the transfer failed (timed out, etc), retry the **put** command or quit the application (type 'quit' and ENTER) and start over from step 4.



## 4.3.3 Linux

The tftp application can easily be installed with your distributions package manager from a terminal, below are some example commands for various distributions.

### Commands for installing tftp on different Linux distributions:

- Ubuntu: `sudo apt install tftp-hpa`
- Fedora: `yum install tftp`
- Suse: `smart install tftp`

### Using the tftp application on Linux:

1. Copy the firmware file to somewhere easily accessible from the Terminal application, for example the Desktop.
2. Open a Terminal command line application (**CTRL-ALT-T** will do this on many desktop environments).
3. Use 'cd' commands to change to the directory where the firmware file is located, for example (if the firmware file is on your desktop) '**cd ~/Desktop**' followed by the ENTER key.
4. Execute the tftp command with the IP address of the device (make sure to use the device's configured IP if the update method being used utilizes the devices IP address):

```
tftp 192.168.2.59
```

5. Execute the following commands from within the tftp program, pressing ENTER after each line, except the last one, to prepare the TFTP transfer:

```
binary  
put MSC-Carina-Firmware-x.x.x.hex
```

6. Make sure to replace MSC-Carina-Firmware-x.x.x.hex with the correct version number of the file.
7. Pressing ENTER after the put command will initiate the TFTP transfer. Make sure to perform the necessary actions to prepare the system for an update, prior to attempting the transfer.
8. The TFTP program will indicate if the transfer was successful or not.
9. If the transfer failed (timed out, etc), retry the **put** command or quit the application (type 'quit' and ENTER) and start over from step 4.

## 5 Troubleshooting

This section contains information on frequent issues and ways to troubleshoot them.

### 5.1 Unknown IP address

In the event that the IP address of a device is unknown, the following procedure can be used to retrieve it:

A computer with an RS-232 serial port is required. If you don't have access to a computer with an RS-232 serial port, a USB to RS-232 adapter is an easy way to add one. Connect the RS-232 serial port to the DE-9 pin female connector on the router device. Start up a serial terminal application (such as Hyperterminal on Windows), configure it for the correct system serial port with the following settings: 9600 bps, 8 data bits, no parity and 1 stop bit (8N1). Make sure the router device is powered on and allow for adequate time for it to boot up. Press the ENTER key in the serial terminal application once connected and a '>' prompt character should be displayed. Type the following commands (pressing ENTER after each one) to get the IP address and netmask:

```
ip
netmask
```

### 5.2 No Ethernet link when connected to network switch

This device utilizes a 10 BaseT Ethernet interface. In the event that the device is connected to a network switch and no physical link is established, please try the following:

1. Ensure that the Ethernet cable is good (try it with another known good Ethernet device or swap the cable for a known good cable).
2. Ensure proper power supply is being used for the system (18-50 VDC (28VDC Nominal))
3. If the switch is a managed switch, try forcing 10 BaseT for the Ethernet port the device is connected to, instead of rate auto detection.

### 5.3 Unexpected reboots

If the device is rebooting unexpectedly (detectable on routers when the routing state gets reset to preset 0), make sure the correct power supply is being used with the device (18-50 VDC (28VDC Nominal)).

## 6 Reference

### 6.1 Specifications

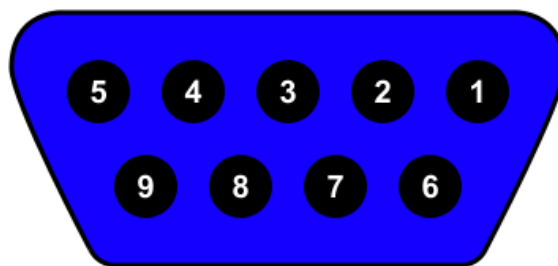
Physical		Control Specifications	
Size	19"W x 3.5"H x 6"D	Serial RS232	9600 bps 8N1
Rack Size	2RU	Ethernet	10 BaseT
Weight	8 lbs	Local Panel Interface	Status Only
Power	18-50 VDC (28VDC Nominal)	Remote Panel Support	Yes
Power Connector	MS3112E8-2P		
Storage Temp	-10 Through +50 Deg C		
Operating Temp	0 Through +40 Deg C		
Humidity	0 Through 90% Non-Condensing		
Warranty	2 Years Parts & Labor		
SDI Video			
Connector type	BNC		
Data Types	SMPTE 259/292/424		
Data Rates	19 Mbit/s through 3.0 Gbit/s		
Re-clocking Data Rates	270 Mbit/s, 1.485 Gbit/s, 2.97 Gbit/s		
Input/Output Return Loss	> 15dB @ HD, > 12dB @ 3G		
Input Level	800 mV P-P +/- 20%		
Input Impedance	75 Ohms +/- 1%		
Cable equalization (1694A coax)	400m @ SD, 140m @ HD, 120m @ 3G		
Output Level	800 mV P-P +/- 5%		
Output Impedance	75 Ohms +/- 1%		
Output Jitter	< 0.2 UI		
Reference Signal			
Connector Type	Analog BNC with pass-through		
Format	NTSC, PAL and Tri-level sync		

### 6.2 Serial Interface Pinout

An RS-232 serial port is provided for system control. This interface uses serial signals with 8 data bits, No Parity, and 1 Stop Bit (8N1). The standard DE-9 pin configuration is used for a DCE device for the RX, TX and

Ground lines. A straight through cable should be used when connecting between a computer's RS-232 serial interface and the device. This interface can be used up to 115.2 Kbits/sec.

Pin #	Name	Function
1,4,6,7	NC	Not Connected
2	TX	RS-232 Transmit
3	RX	RS-232 Receive
5	GND	Ground



*DE-9 Pin Numbers*

## 6.3 Glossary

- **Active Routing** – The current routing state of a Router's Matrix.
- **Destination** – A Video or Audio destination (output from a Router device). Numbered starting from 1.
- **Input** – Synonymous with Source.
- **IP** – Stands for Internet Protocol. Base protocol of the Internet which can also be used on LANs. This protocol uses 4 byte addresses (IPv4) written in "quad dot" format, which is four decimal numbers separated by periods (192.168.2.60 for example).
- **LAN** – Stands for Local Area Network. Refers to a single local Ethernet network, usually consisting of a single IP subnet.
- **Level** – Router devices may contain multiple Video and Audio levels. Level numbers start from 1.
- **Mascot Protocol** – An abbreviation of **MA**trix **SW**itch **CO**rporation **proT**ocol. An ASCII text based protocol for interfacing to Matrix Switch Corporation devices.
- **Matrix** – Used when referring to a Router's entire routing state.
- **Mute** – When supported, a destination can be muted, which for video means the output is turned off and for audio means it is silenced.
- **Output** – Synonymous with Destination.
- **Preset** – Matrix Switch Corporation Router devices provide 10 presets which store matrix Routing connections. When a preset is "recalled" zero or more matrix connections are changed based on the content of the Preset. Numbered starting from 0. Preset 0 is special in that it is recalled on system startup.
- **Remote Panel** – Matrix Switch Corporation Remote Panels connect to Router devices for remote control with touch buttons.
- **Router** – A Video/Audio Routing device routes one or more sources to one or more destinations (not to be confused with a Network router, which is referred to as a Network Switch in this manual).
- **Simple Panel** – A Matrix Switch Corporation Remote Panel which has buttons only.
- **Smart Panel** – A Matrix Switch Corporation Remote Panel which comes equipped with an LCD screen interface.
- **Source** – A Video or Audio source (input to a Router device). Numbered starting from 1.
- **TCP** – Stands for Transport Control Protocol. This protocol is used by Matrix Switch Corporation devices for remote panel control, the MASCOT network interface and the web page interface.

## 7 Matrix Switch Corporation Warranty

MSC provides the following limited warranty with its products:

1. MSC warrants that the equipment it manufactures is free from defects in material and workmanship.
2. This warranty begins on the day the product is shipped from MSC and shall be in effect for two years.
3. If the product is found to be defective, MSC shall at its option:
  - a) Provide free replacement parts.
  - b) Repair the unit at MSC's facilities.
  - c) Repair the unit at the customer's location.
  - d) Exchange the product for a product of the same type.

MSC shall make every reasonable effort to support critical emergencies by supplying no-cost loan equipment while the defective unit is being repaired.

4. Customer bears the cost of shipping products returned to MSC under this warranty; however, MSC shall bear the cost of shipping repaired products or replacement parts to the customer.

5. Any customer returning a product for repair shall first obtain from MSC a Return Material Authorization (RMA) number which shall be placed on the outside of the shipping package.

6. This warranty does not apply if the product has been damaged by accident, abuse, misuse, misapplication or modification.

EXCEPT AS SET FORTH ABOVE, NO OTHER WARRANTIES ARE EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. MSC EXPRESSLY DISCLAIMS ALL EXPRESS OR IMPLIED WARRANTIES NOT STATED HEREIN. IN THE EVENT THE PRODUCT IS NOT FREE FROM DEFECTS AS WARRANTED ABOVE, THE PURCHASER'S SOLE REMEDY SHALL BE REPLACEMENT OR REPAIR AS PROVIDED ABOVE. UNDER NO CIRCUMSTANCES WILL MSC BE LIABLE TO THE PURCHASER OR ANY USER FOR ANY DAMAGES INCLUDING INCIDENTAL OR CONSEQUENTIAL DAMAGES, EXPENSE, LOST PROFITS, LOST SAVINGS OR OTHER DAMAGES ARISING OUT OF THE USE OF, OR INABILITY TO USE THE PRODUCT, EVEN IF MSC HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

To the extent this warranty conflicts with local law, local law shall only apply to such conflict.

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