CHEETAH 2 512X512
VIDEO MATRIX SWITCHER

Technical Addendum

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Chapter 1 INTRODUCTION

1.1 PURPOSE OF TECHNICAL ADDENDUM

This Technical Addendum (TA) addresses the Cheetah 2 512 Input by 512 Output (512X512) Routing Switcher built by QuStream Corp., and how it differs from a "standard" Generation I (CH Series) product. It is assumed that the user has access to PESA Technical Manual 81-9059-0570-0, Rev. A entitled ***Cheetah Series Video Matrix Switchers***. It is also assumed that the user has a good understanding of the structure of a routing switcher and the top-level function of the various Circuit Card Assemblies (CCAs) and other modules used in the frame. With the exception of the 128X128 Matrix CCA, the hardware and components introduced and discussed in the Technical Manual apply to the Cheetah 2 512X512 switcher. The 512X512 switcher is built using a Cheetah Generation I 41 RU frame, but incorporates the latest generation 128X128 Matrix Circuit Card Assembly (CCA). For the user who may be unfamiliar with the previous generation Cheetah Series, a brief background of the Generation I product and the differences this router introduces is presented in the following paragraphs.

Cheetah CH Series Routing Switcher Frames, currently referred to as Generation I Frames, offer a great deal of versatility and flexibility due to the modular concept of the component backplanes used to configure a system. When a Generation 1 Routing Switcher is built, a chassis frame of the proper size to accommodate the required number of CCAs, modules and other system components is fitted with backplane assemblies that interface the Input and Output CCAs (mounted through the rear of the switcher frame) with the Matrix CCAs, Power and Control components located internal to the switcher frame. Likewise, the Matrix CCAs and other internal components attach to dedicated backplanes for power and signal distribution. The various types of backplanes (I/O and Matrix) used to configure a system are interconnected. Each backplane, and its associated CCA(s) or module(s), may be loosely thought of as a "building block" for a particular switcher configuration. A series of DIP switches and rotary switches on the various backplanes are factory set to assign the "personality" to each of the system components. This scheme of assigning identification to the backplane and interface ports allows full interchangeability between like CCAs in the system.

Of particular interest to this TA is the Matrix CCA and its associated backplane. Cheetah Generation I Series switchers are built around a 64X64 Matrix CCA that provides an array of 64 inputs and 64 outputs available on each card. With the exception of the Generation I 64X (64X64) Switcher, all other Generation I frames in the CH Series use a 128 input by 128 output Matrix Backplane that supports and provides interface functions to four 64X64 Matrix CCAs. This backplane is referred to as the 128 Backplane. Using the Generation I 128 Backplane and 64X64 Matrix CCAs, the largest array size that can be configured in a single 41RU Frame is 512X512, 1024X256 or 256X1024.

As product technology evolved, PESA Engineers developed a 128 Input by 128 Output (128X128) Matrix CCA. This larger array card allows for a 128 input by 256 output Matrix Backplane, occupying the same frame space as the previous 128 Backplane. This backplane is referred to as the 128X256 Backplane and consists of two 128X128 Matrix CCAs. The 128X256 Backplane is the same physical size and footprint as the 128 Backplane. While technically not a Cheetah Generation I Series CCA, the 128 Matrix card is perfectly adaptable to the Generation I frames (128X and larger). Thus, denser array matrices are possible using the same rack space as the Generation I Series frames.

Incorporating the 128X128 Matrix CCA(s) and the 128X256 Backplane into the Generation I Frame easily accommodates the requirement for the 512X512 Routing Switcher addressed by this TA. Eight 128X256 Backplane assemblies, populated with 16 128X128 Matrix CCAs provide the required I/O capacity. Cheetah Power Supply Modules, the System Controller CCA(s) and Frame Controller CCA(s) are also used in configuring the 512X512 routing switcher.

Contained in this TA, as a supplement to the Cheetah Generation I Technical Manual, is an introduction to the 128 Matrix CCA; plus specifications, layout drawings, DIP and rotary switch settings, and card slot identification peculiar to the 512X512 system configuration.

1.2 128X128 VIDEO (CROSSPOINT) MATRIX CARD

The 128x128 Video Matrix Card selects one of 128 inputs to each of 128 outputs. Input signals from the input buffer cards are buffered to the input of a high-speed matrix. The output of the matrix is again buffered and sent to the output combiner cards. Figure 1-1 shows a typical digital video matrix card.

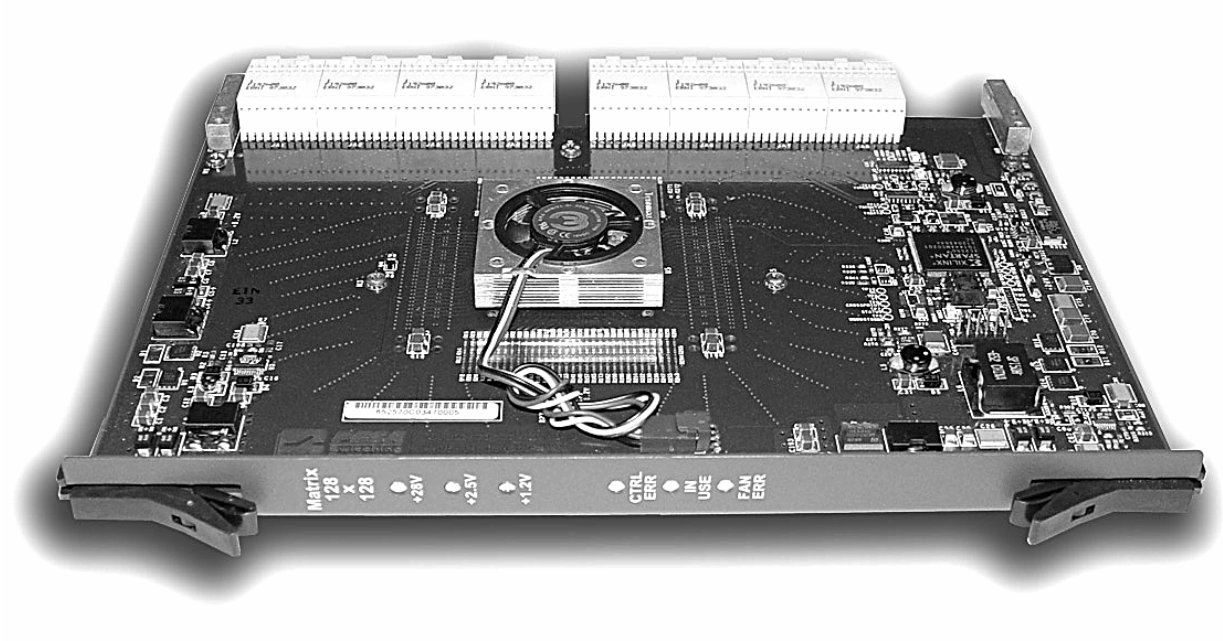


FIGURE 1-1 TYPICAL 128X128 DIGITAL VIDEO MATRIX CCA

1.2.1 128 Input X 128 Output Digital Video Matrix Card

As the name implies, the 128 X 128 digital matrix card accepts up to 128 SDI or HD video sources from the input buffer cards and provides up to 128 output channels to the output combiner cards. All switching is done by a special purpose device, controlled by commands from the matrix frame controller. Any input signal may be routed to any or multiple output channels of the card. When the I/O capacity of the switcher is greater than can be satisfied by a single 128 X 128 matrix card, as is the case with the 512X512 frame addressed by this TA, multiple matrix cards are used to meet the required capacity.

There are six LEDs located on the front edge of each 128 x 128 matrix card that provide a visual indication of the operational status of the card, these are identified by Figure 1-2. Table 1-1 lists the possible states and interpretation data for the LEDs.

Figure 1-3 is a block diagram of the 128 X 128 digital matrix card. Paragraph 1.2.2 presents a narrative description of the circuit functions shown on the block diagram.

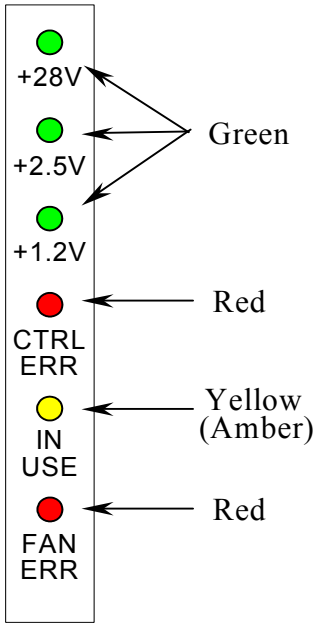


FIGURE 1-2 128X128 VIDEO CROSSPOINT MATRIX CARD LED INDICATORS

1.2.2 Functional Description – 128 X 128 Digital Video Matrix Card

Refer to Figure 1-3 as we discuss the various circuit functions of this card. There are 128 identical input channel paths provided. Video signals are derived from the output channels of the input buffer cards and routed to the inputs of the matrix card. As a signal enters the card it is routed to an Input Buffer stage, internal to the crosspoint device. This device contains the switching circuitry to deliver a signal on any of its 128 input channels to any of its 128 output channels. Switching data for the crosspoint device is received from the on-board microcontroller circuitry. The crosspoint also contains 128 output buffer stages, internal to the device, for isolation. Video from each device channel is available at the card edge connector where it is routed to the output combiner cards.

The On-Board Microcontroller is the interface between the matrix card and the frame control system. The microcontroller constantly monitors the status and health of the card and reports this data to the system frame controller. Commands from the frame controller are interpreted by the microcontroller circuitry and select the active inputs and outputs of the crosspoint device. Data indicating the status of the operating voltage rails is sent to the microcontroller by circuitry contained in the Voltage Regulator stage. The microcontroller also provides a visual indication of certain board functions by controlling the operating state of the status LEDs. Operating voltages necessary to power the matrix card circuitry are derived from on-board voltage regulator devices.

TABLE 1-1 128X128 VIDEO CROSSPOINT MATRIX CARD LED DESCRIPTIONS

LED	COLOR	STATUS	DESCRIPTION
+28V	Green	**ON**	Indicates that the +28Vpower is stable and within normal operating parameters.
		OFF	Indicates that +28V is not stable; power supplies are not working.
+2.5V	Green	**ON**	Indicates that the +2.5Vpower is stable and within normal operating parameters.
		OFF	Indicates that +2.5V is not stable; power supplies are not working.
+1.2V	Green	**ON**	Indicates that the +1.2Vpower is stable and within normal operating parameters.
		OFF	Indicates that +1.2V is not stable; power supplies are not working.
Ctrl Err	Red	**ON**	Indicates that a control error has occurred, or that a loss of receive clock from frame controller has been detected. A control error includes a bad CRC of the received data, incorrect number of words in the message being received, or corrupted data in the message being received. The LED will remain on until a message with a good CRC has been received.
		Blinking	Indicates a missing receive clock error.
		OFF	No alert conditions are present.
In Use	Yellow	**ON**	Indicates that a crosspoint on the matrix card is activated.
Fan ERR	Red	**ON**	Indicates a failure of the cooling fan on-board the crosspoint device. .

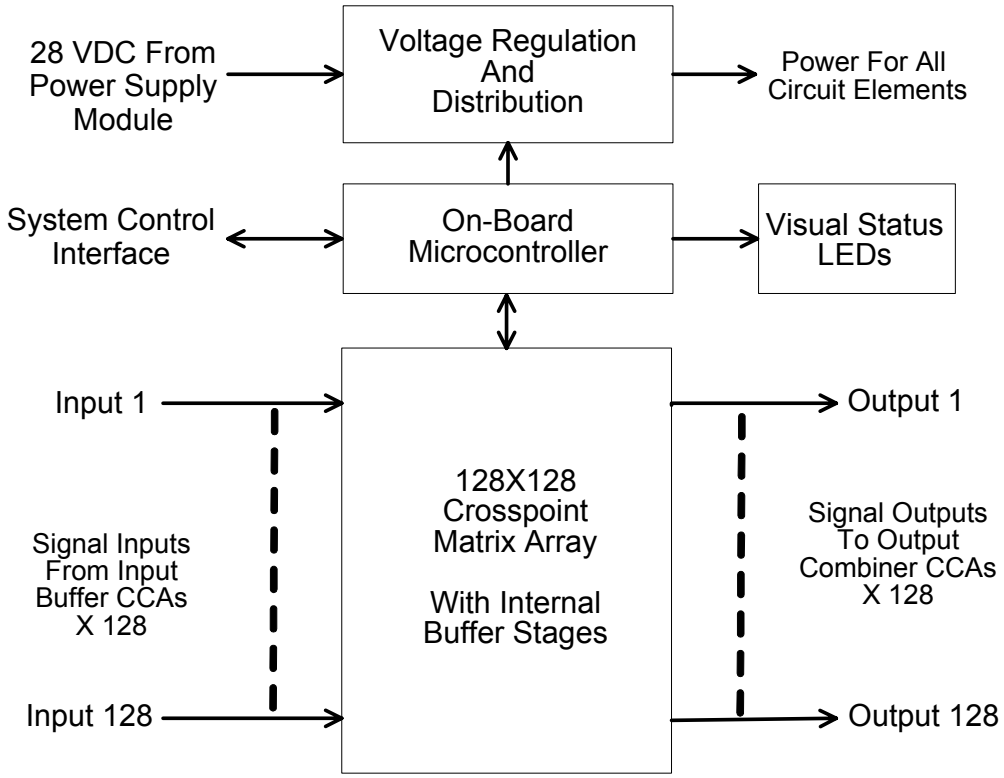


FIGURE 1-3 BLOCK DIAGRAM – 128 X 128 DIGITAL VIDEO MATRIX CARD

With the exception of the 128X128 Matrix CCA and the 128X256 Backplane, all other components used in the 512X512 switcher configuration are the same as the Generation I components discussed in the Cheetah Technical Manual referenced in the first paragraph of this addendum. Please refer to that manual for information on the Generation I components.

There are 16 128X128 Matrix CCAs used in the 512X512 configuration. A very basic sketch of the chassis layout is shown in Figure 1-4. This diagram identifies the location of the System Controller CCA(s), Frame Controller CCA(s), Power Supply Modules and the Matrix CCAs. Figure 1-5 provides a rear view of the rack frame with input and output connection points located.

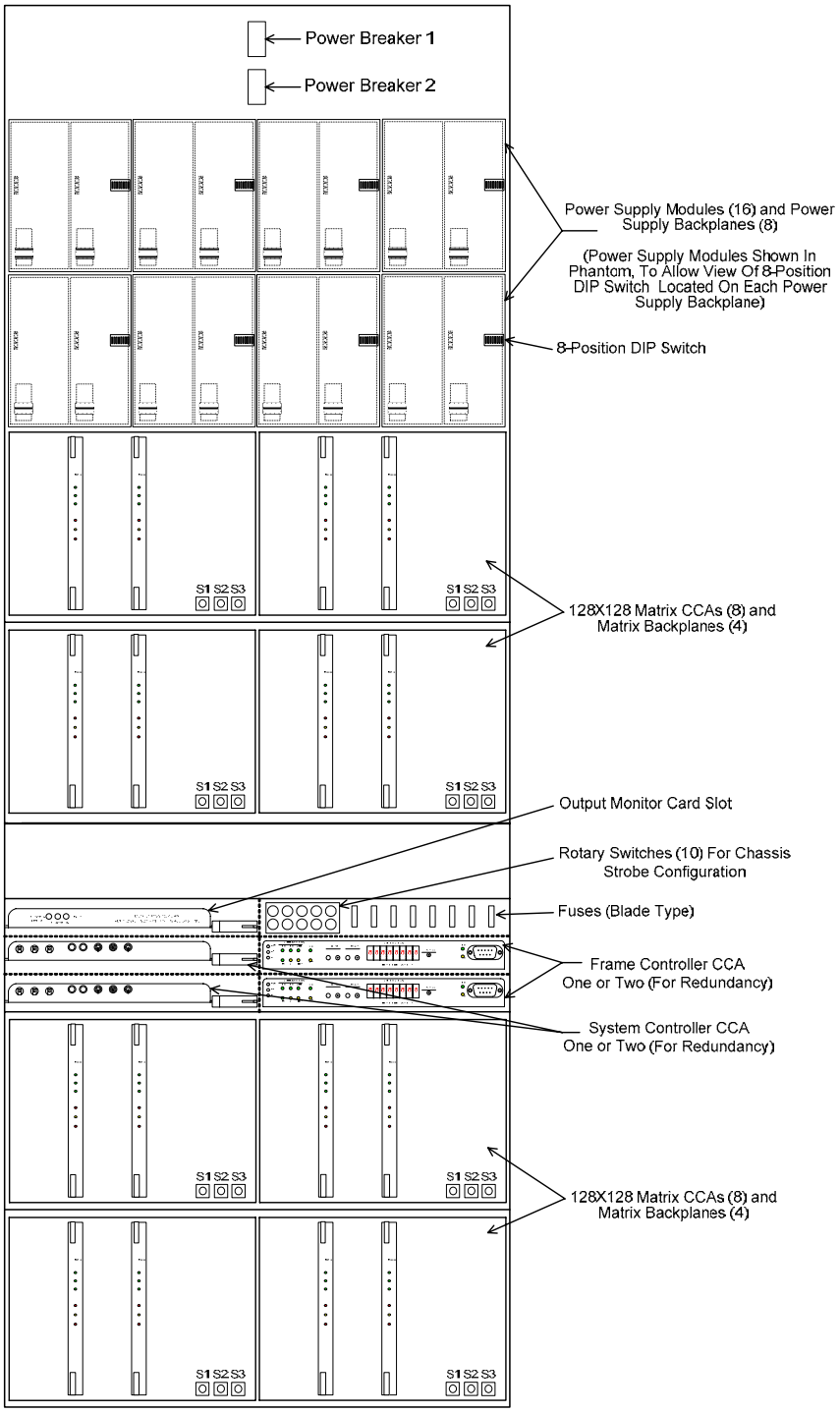
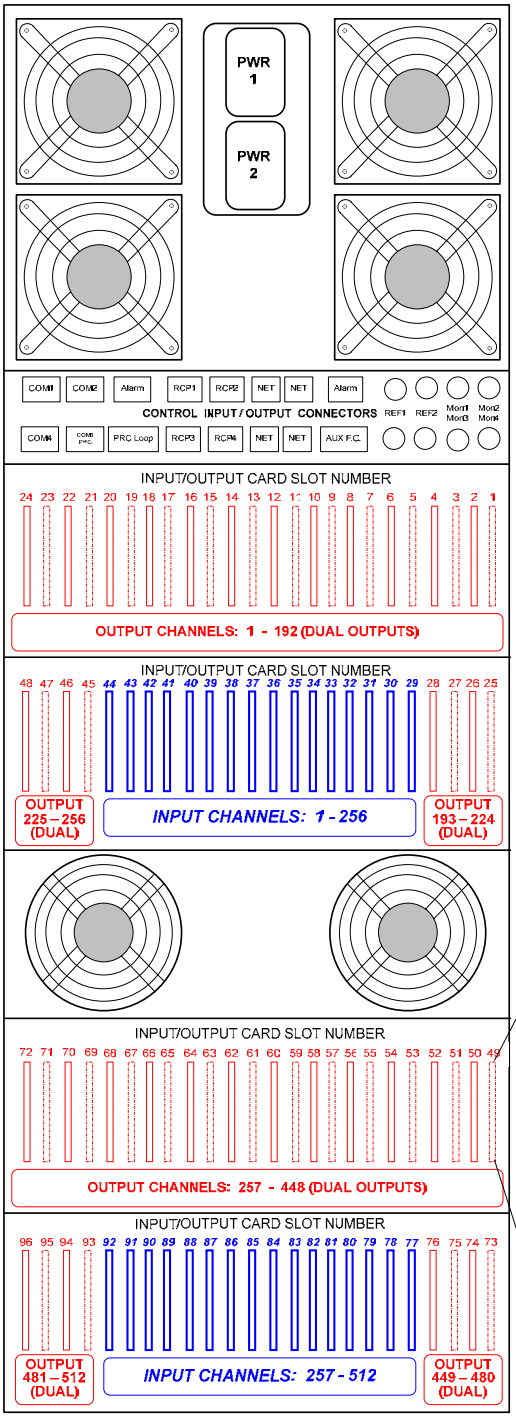


FIGURE 1-4 CHEETAH 2 512X512 ROUTER CHASSIS (FRONT VIEW – DOOR OPEN)



Quick Reference Chart
Input/Output Connector Channels By I/O Card Slot Number

OUTPUT CHANNELS

Input/Output Card Slot Number	Output Channels On Card	Input/Output Card Slot Number	Output Channels On Card	Input/Output Card Slot Number	Output Channels On Card
1	1-16 D	23	177-192 D	61	353-368 D
2	1-16	24	177-192	62	353-368
3	17-32 D	25	193-208 D	63	369-384 D
4	17-32	26	193-208	64	369-384
5	33-48 D	27	209-224 D	65	385-400 D
6	33-48	28	209-224	66	385-400
7	49-64 D	45	225-240 D	67	401-416 D
8	49-64	46	225-240	68	401-416
9	65-80 D	47	241-256 D	69	417-432 D
10	65-80	48	241-256	70	417-432
11	81-96 D	49	257-272 D	71	433-448 D
12	81-96	50	257-272	72	433-448
13	97-112 D	51	273-288 D	73	449-464 D
14	97-112	52	273-288	74	449-464
15	113-128 D	53	289-304 D	75	465-480 D
16	113-128	54	289-304	76	465-480
17	129-144 D	55	305-320 D	93	481-496 D
18	129-144	56	305-320	94	481-496
19	145-160 D	57	321-336 D	95	497-512 D
20	145-160	58	321-336	96	497-512
21	161-176 D	59	337-352 D		
22	161-176	60	337-352		

NOTE: "D" Indicates Dual Output Option Slot

INPUT CHANNELS

NOTE
Input Card Slots are indicated by **BOLD** outlines and ***BOLD ITALICS*** text on the figure and in this chart.

Input/Output Card Slot Number	Input Channels On Card	Input/Output Card Slot Number	Input Channels On Card	Input/Output Card Slot Number	Input Channels On Card
29	***1-16***	***40***	***177-192***	***83***	***353-368***
30	***17-32***	***41***	***193-208***	***84***	***369-384***
31	***33-48***	***42***	***209-224***	***85***	***385-400***
32	***49-64***	***43***	***225-240***	***86***	***401-416***
33	***65-80***	***44***	***241-256***	***87***	***417-432***
34	***81-96***	***77***	***257-272***	***88***	***433-448***
35	***97-112***	***78***	***273-288***	***89***	***449-464***
36	***113-128***	***79***	***289-304***	***90***	***465-480***
37	***129-144***	***80***	***305-320***	***91***	***481-496***
38	***145-160***	***81***	***321-336***	***92***	***497-512***
39	***161-176***	***82***	***337-352***		

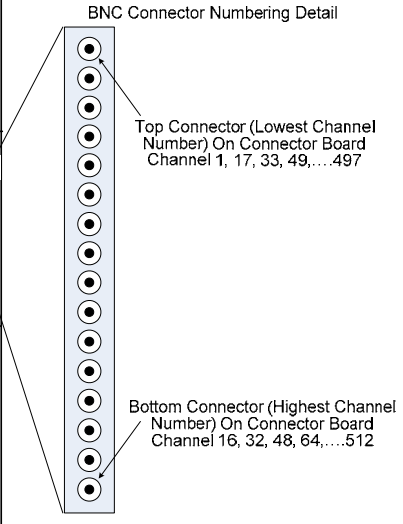


FIGURE 1-5: CHEETAH 2 512X512 ROUTER CHASSIS (REAR VIEW)

Chapter 2 INSTALLATION

2.1 INITIAL INSTALLATION STEPS

With the exception of the rear panel connector arrangement, all installation steps for the 512X512 Switcher are the same as for the Generation I product. Refer to the Cheetah Technical Manual referenced in the first paragraph of this addendum for initial unpacking, site preparation and installation steps.

Once the rack frame is mounted and all preliminary steps have been performed, connecting the video input and output signals and the sync reference pulse source is the next step. The rear panel arrangement of the 512X512 Switcher is different than that called out in any configuration shown in the Technical Manual. Refer to Paragraph 2.2 of this addendum when completing the video I/O connections for proper identification of the I/O connector locations and channel numbering scheme.

2.2 VIDEO I/O CONNECTION

All connections to the 512X512 router (other than video I/O) will be the same as outlined in the Cheetah Technical Manual. Follow the installation procedure identified in the technical manual when connecting power, sync reference and control cabling. When connecting video input and output signals follow the diagrams provided in this Technical Addendum. Figure 1-5 illustrates the entire rear panel of the router and features a quick reference guide to the input and output connector configuration. Figure 2-1 in this chapter provides a closer and more detailed view of the rear panel input and output connectors. Use these references when making video I/O connections to the 512X512 router.

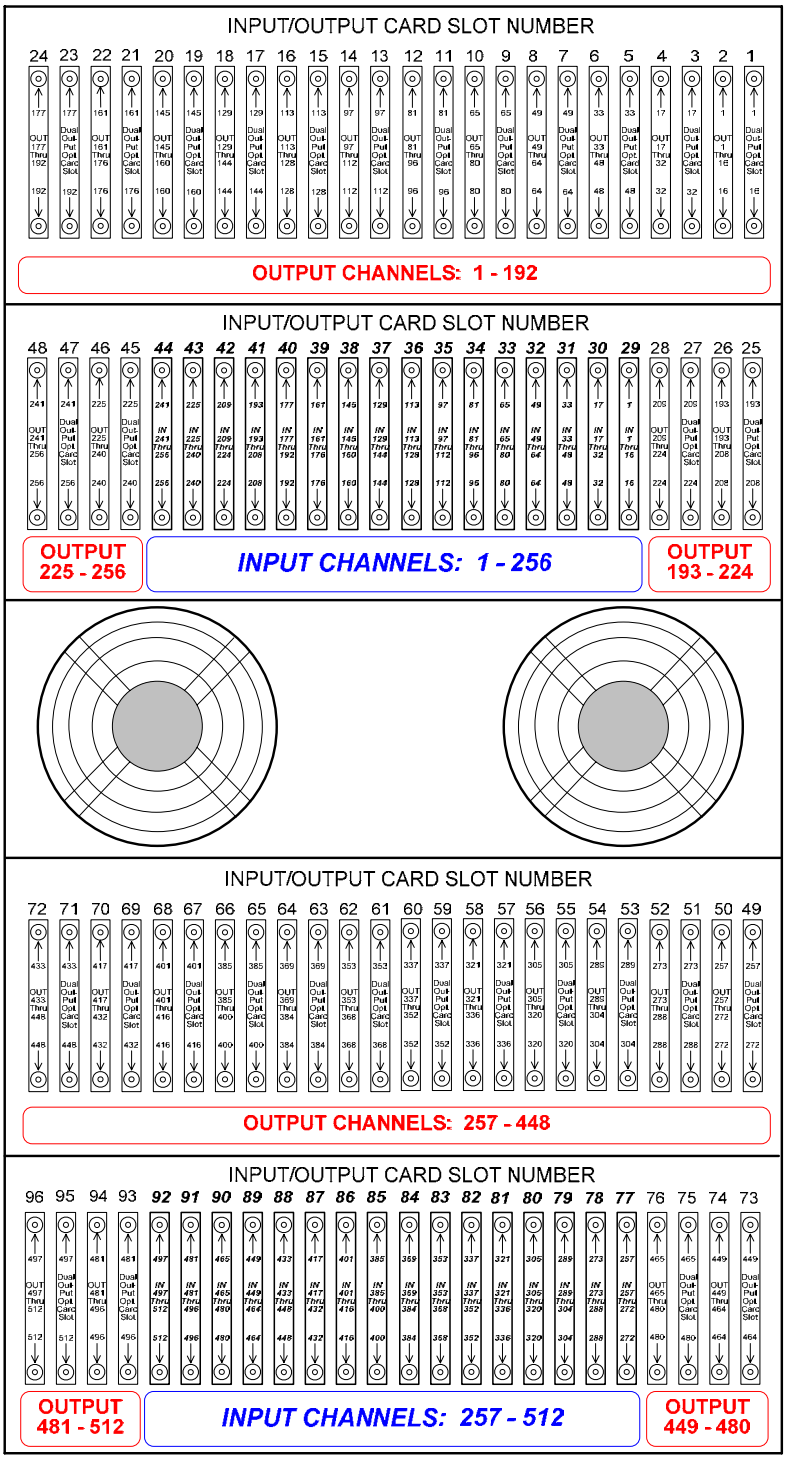


FIGURE 2-1: CHEETAH 2 512X512 ROUTER INPUT/OUTPUT CONNECTOR ARRANGEMENT

Chapter 3 REFERENCE DATA

3.1 REFERENCE DATA INTRODUCTION

This section of the TA provides the user with reference data peculiar to the 512X512 configuration of the Cheetah 2 Switcher. In the following paragraphs you will find information that will prove useful in the event that system maintenance or repair should ever be required. Included are a diagram (Figure 3-1) showing the input and output channel assignments of all 16 matrix crosspoint CCAs, plus setting information for all DIP and rotary switches used to configure the switcher.

3.2 DIP SWITCH/ROTARY SWITCH SETTINGS FOR THE 1024X512 SYSTEM

There are numerous switches used in configuring the Cheetah Matrix Switcher for any particular input/output matrix combination. Switch settings define the operational parameters for the various CCAs and modules used in the switcher and assign the "personality" to each group of backplanes and their associated CCAs. Using the switch configuration scheme prevents any "card specific" functions, settings or jumpers and allows any input, output, or matrix CCA or power supply module to be "hot swapped" on the fly with any other card or module, of the same type. These switches are all preset at the factory and should never need any maintenance or adjustment. This information is provided as a reference so that in the event any switch setting should inadvertently be changed, it can be restored to its correct setting.

Switches are of two type: rotary or DIP. A small screwdriver can be used to make adjustments to the rotary switches. The tip of a small screwdriver or other small pointed object may be used to select the ON or OFF position of the DIP switches. Please note that the DIP switches are very small and each switch section is very delicate and can easily be damaged. Use extreme care if it is ever necessary to change the position of any section of the DIP switches.

The following paragraphs discuss the configuration switch settings listed below:

- Chassis Level Codes (Strobes) Rotary Switch Settings (Paragraph 3.2.1)
- Chassis Power Supply Backplane DIP Switch Settings (Paragraph 3.2.2)
- Chassis Input/Output Backplane DIP Switch Settings (Paragraph 3.2.3)
- Chassis Matrix Backplane Rotary Switch Settings (Paragraph 3.2.4)

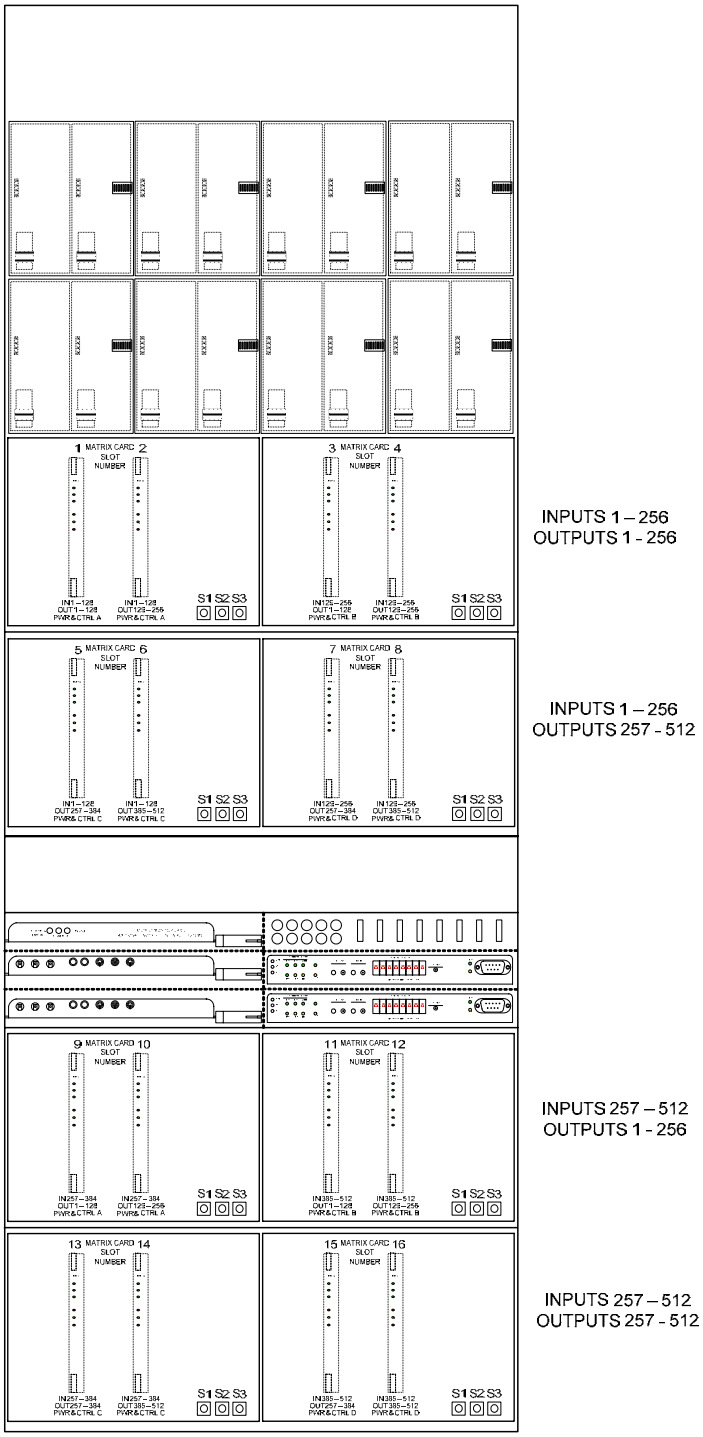


FIGURE 3-1: 128X128 MATRIX CROSSPOINT CCA I/O CHANNEL ASSIGNMENTS

3.2.1 Chassis Level Codes (Strobes) Rotary Switch Settings

Chassis Level Codes (Strobes) assign operational parameters to the switcher frame. There are ten rotary switches, located just above the frame controller card(s), used to set the chassis level code and other frame operational characteristics. Proper setting positions for these ten switches are shown in Figure 3-2.

3.2.2 Chassis Power Supply Backplane DIP Switch Settings

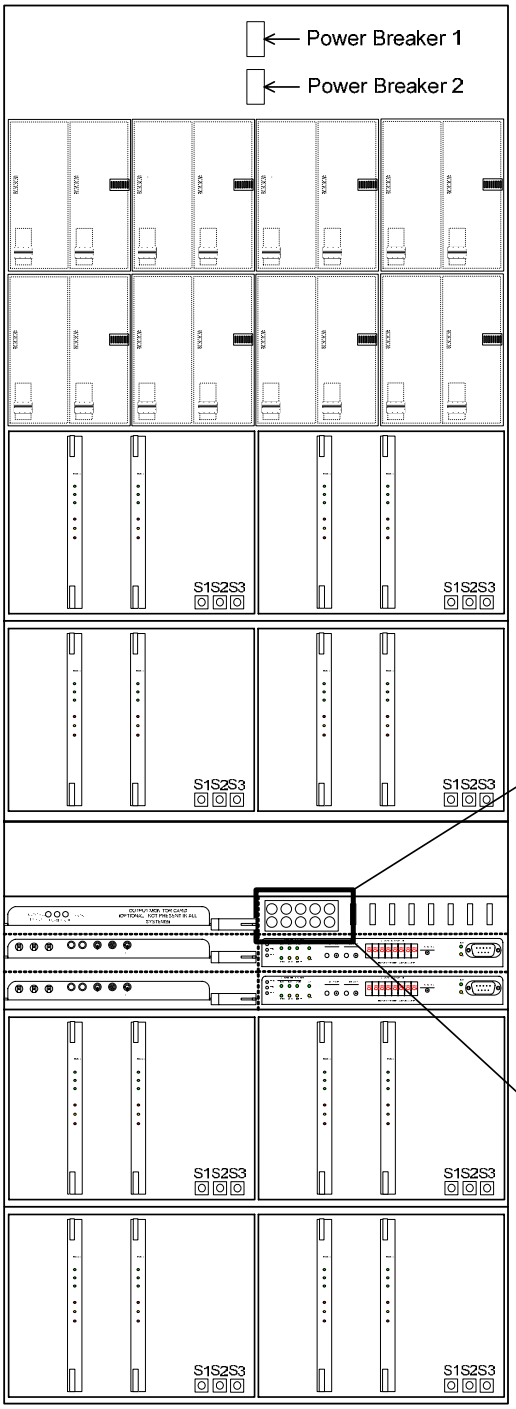
Each Power Supply Backplane provides slots for up to two power supply modules. Located on the right side of each backplane is an eight position DIP switch used to assign identity data to the power supply module(s) installed on the backplane. Removing the power supply module installed on the right-hand side of the backplane allows access to this DIP switch. Proper setting positions for each switch section in the DIP package are shown in Figure 3-3. In this figure, the power supply modules are shown in dotted lines in order for the switch locations to be visible.

3.2.3 Chassis Input/Output CCA Backplane DIP Switch Settings

Each Input/Output CCA Backplane provides slots for up to four input or output CCAs. An eight-position DIP switch, located on the lower right-hand side of each backplane, assigns a unique identity to each backplane card. Among other functions, this switch setting allows the controller circuitry to assign the input or output channel number range to each I/O CCA – thus allowing any I/O card on the rear panel to be "hot swapped" with a card of like type. Proper setting positions for each switch section in the DIP package are shown in Figure 3-4. I/O CCAs must be removed from the backplane to gain access to the DIP switch. Figure 3-4 illustrates switch location and card slots on the backplanes with no I/O CCAs installed.

3.2.4 Chassis Matrix Backplane Rotary Switch Settings

Each Matrix CCA Backplane provides slots for up to four 128X128 matrix crosspoint CCAs. There are six rotary switches located along the bottom edge of each backplane. Settings of these switches assign a unique identity to each matrix backplane and the set of matrix CCAs installed in it. These settings allow the controller circuitry to assign the input and output channel number range to each matrix backplane and each matrix CCA. Figure 3-5 shows the location of each of the six switches on each backplane board. The matrix card image used in this figure is smaller than actual size to allow the backplane components to be shown. Setting positions for each switch are provided in Table 3-1 and listed by individual backplane boards.



Switch	*Description*	*Setting*
S1	Level (MSB – Most Significant Bit)	According to Customer Configuration
S2	Level (LSB – Least Significant Bit)	
S3	Output (MSB)	
S4	Output (LSB)	
S5	Input (MSB)	
S6	Input (LSB)	
S7*	Frame (MSB)	0
S8*	Frame (LSB)	B
S9	Network	3
S10	Monitor	0

*NOTE: The setting of Switches S7 and S8 assign the "frame type" parameter to the switcher. In this configuration, the frame is a "Type 11."

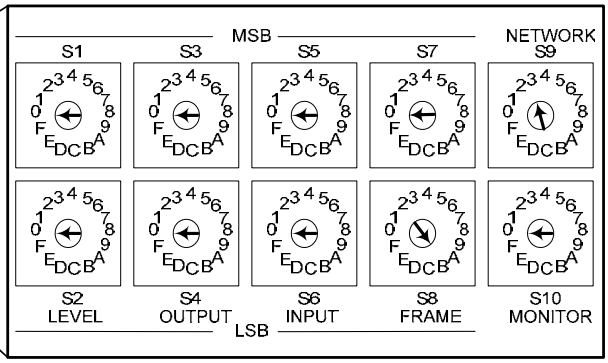


FIGURE 3-2: CHASSIS AND LEVEL CODE SWITCH SETTINGS

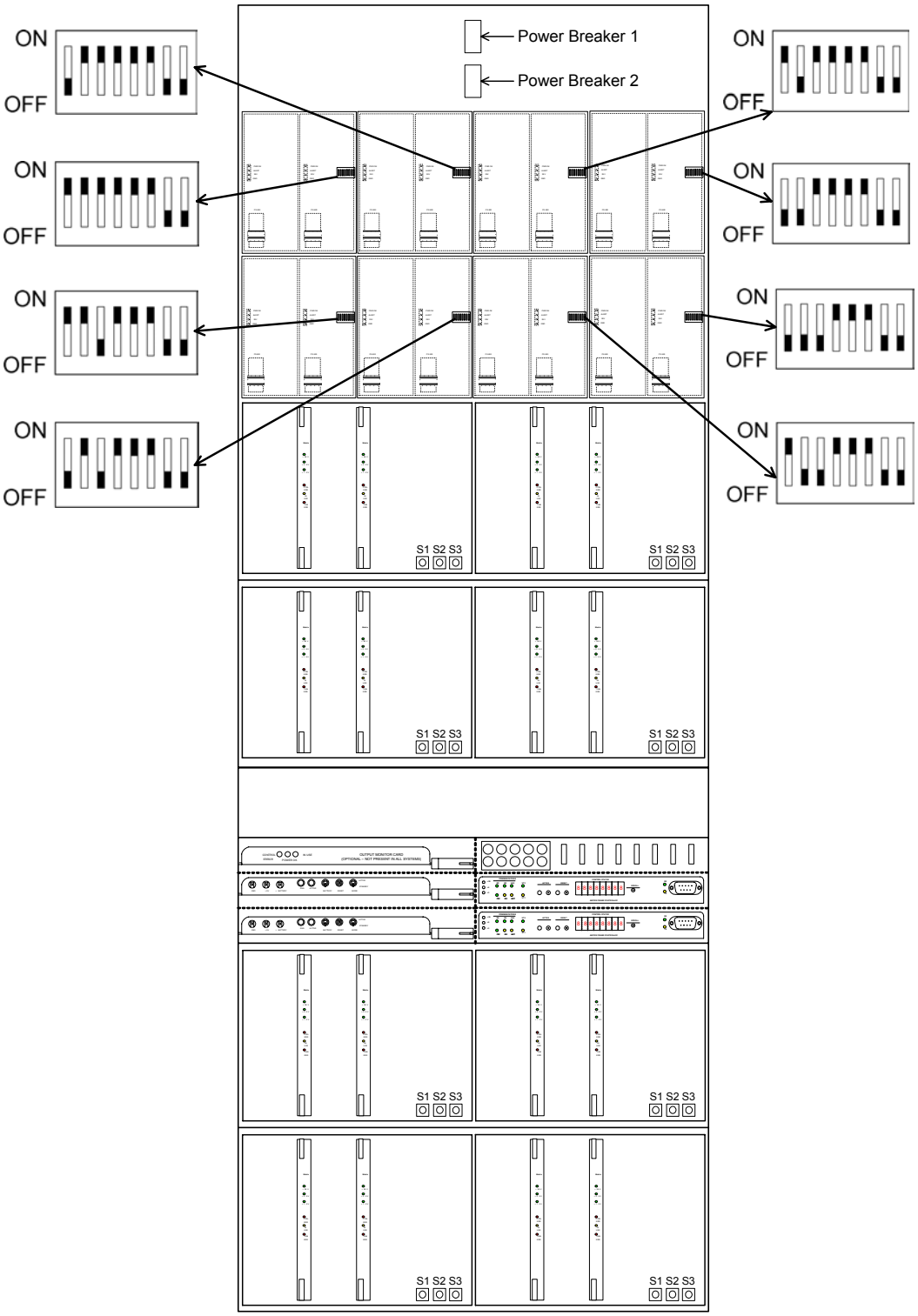


FIGURE 3-3: 512X512 POWER SUPPLY BACKPLANE DIP SWITCH LOCATIONS AND SETTINGS (FRONT VIEW)

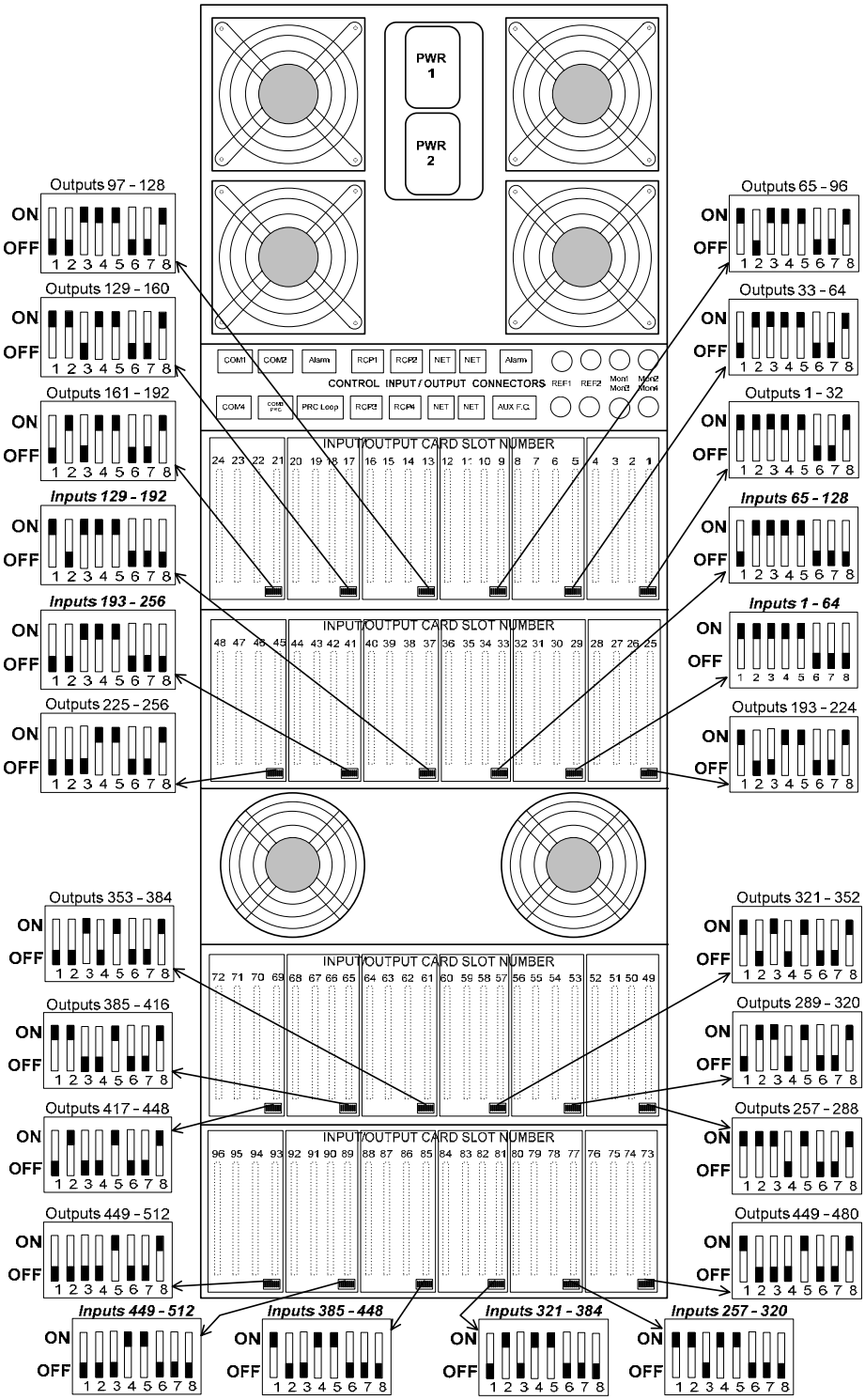


FIGURE 3-4: Input/Output Backplane DIP Switch Settings

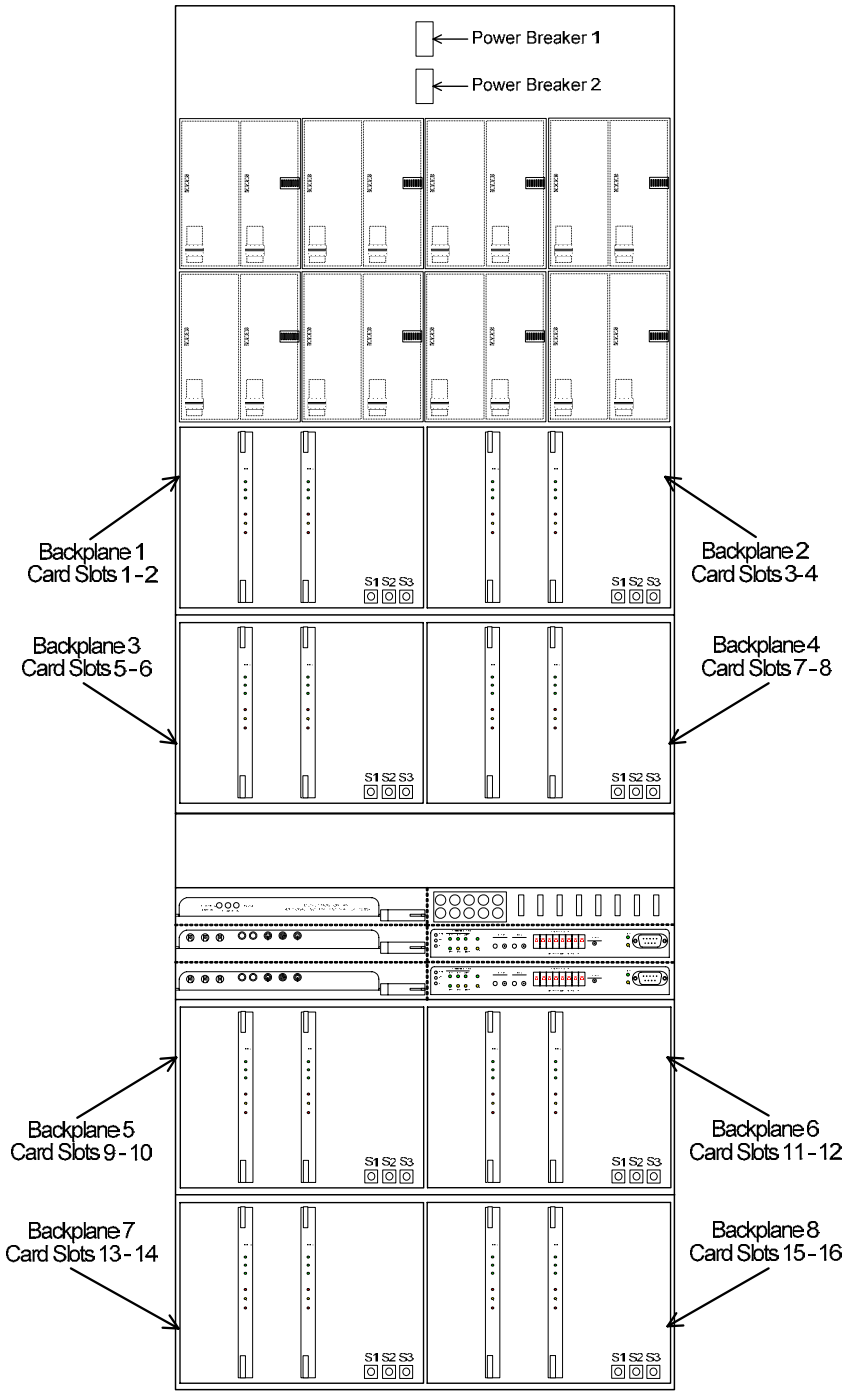


FIGURE 3-5: Matrix Backplane Rotary Switch Locations

TABLE 3-1 MATRIX BACKPLANE ROTARY SWITCH SETTINGS.

MATRIX BACKPLANE 1 CARD SLOTS 1 - 2		
SWITCH	*SETTING*	*I/O*
S1	0	Outputs: 1 – 128
S2	0	Inputs: 1 – 128
S3	1	Outputs: 129 – 256

MATRIX BACKPLANE 2 CARD SLOTS 3 - 4		
SWITCH	*SETTING*	*I/O*
S1	0	Outputs: 1 – 128
S2	1	Inputs: 129 – 256
S3	1	Outputs: 129 – 256

MATRIX BACKPLANE 3 CARD SLOTS 5 - 6		
SWITCH	*SETTING*	*I/O*
S1	2	Outputs: 257 – 384
S2	0	Inputs: 1 – 128
S3	3	Outputs: 385 – 512

MATRIX BACKPLANE 4 CARD SLOTS 7 - 8		
SWITCH	*SETTING*	*I/O*
S1	2	Outputs: 257 – 384
S2	1	Inputs: 129 – 256
S3	3	Outputs: 385 – 512

MATRIX BACKPLANE 5 CARD SLOTS 9 - 10		
SWITCH	*SETTING*	*I/O*
S1	0	Outputs: 1 – 128
S2	2	Inputs: 257 – 384
S3	1	Outputs: 129 – 256

MATRIX BACKPLANE 6 CARD SLOTS 11 - 12		
SWITCH	*SETTING*	*I/O*
S1	0	Outputs: 1 – 128
S2	3	Inputs: 385 – 512
S3	1	Outputs: 129 – 256

MATRIX BACKPLANE 7 CARD SLOTS 13 - 14		
SWITCH	*SETTING*	*I/O*
S1	2	Outputs: 257 – 384
S2	2	Inputs: 257 – 384
S3	3	Outputs: 385 – 448

MATRIX BACKPLANE 8 CARD SLOTS 15 - 16		
SWITCH	*SETTING*	*I/O*
S1	2	Outputs: 257 – 384
S2	3	Inputs: 385 – 512
S3	3	Outputs: 385 – 448