VIDEO MATRIX SWITCHER

CHEETAH 288X288XR
USING 144X144 MATRIX CARD

TECHNICAL ADDENDUM

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Chapter 1 INTRODUCTION

1.1 PURPOSE OF TECHNICAL ADDENDUM

This Technical Addendum (TA) addresses the 288 Input by 288 Output (288XR) Routing Switcher built by PESA utilizing our 144X144 Matrix Circuit Card Assembly (CCA). The high I/O density of the 144X144 matrix allows larger capacity systems occupying the same rack frame space requirements as previous Cheetah Generation 1 routers. The 288X288XR router is housed in a frame occupying 18 rack units (RU).

PESA's high density routers are all housed in chassis frames that offer a great deal of versatility and flexibility due to the modular concept of the component backplanes used to configure a system. When a Cheetah 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. A series of DIP switches and rotary switches on the various backplanes are 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.

It is assumed that the user has access to 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 items addressed in this TA, the hardware and components introduced and discussed in the Technical Manual apply to the 288X288XR switcher. Refer to the Technical Manual for system control panel connections and reference data for the Power Supply Module. Use this TA for all video connector rear panel layouts, video connection data, configuration switch settings and reference data for the 144X144 Matrix CCA.

The key difference between any series of Cheetah routers is the Matrix CCA and its associated backplane. Legacy Cheetah Generation I CH Series switchers are built around a 64X64 Matrix CCA that provides an array of 64 inputs and 64 outputs available on each card. Later Generation I frames incorporated a 128 input by 128 output matrix, offering double the crosspoint density on each card. Current medium and large frame Cheetah routers employ our 144 Input by 144 Output (144X144) multi-rate matrix CCA for SDI video signals. The larger array card allows for a 288 input by 288 output matrix backplane, occupying the same frame space as the previous 128 Backplane. Thus, denser array matrices are possible using the same rack space as the Generation I Series frames. A standard 288X288 matrix backplane consists of 4 144X144 Matrix CCAs, operating as two banks of two cards each. With a standard backplane each bank of two matrix cards shares input signals from the input buffer card and is essentially a 144 input by 288 output matrix. By routing a group of 144 inputs to each bank, the 288X288 backplane capacity is realized.

Incorporating the 144X144 Matrix CCA and the 288 Backplane into a standard Cheetah chassis frame accommodates the requirement for the 288X288 Routing Switcher addressed by this TA. A single 288 Backplane assembly, populated with four 144X144 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 288X288XR routing switcher.

Contained in this TA, as a supplement to the CH Series Technical Manual, is an introduction to the 144 Matrix CCA; plus specifications, layout drawings, DIP and rotary switch settings, and card slot identification peculiar to the 288X288XR system configuration.

1.2 144X144 VIDEO MATRIX (CROSSPOINT) CARD

As the name implies, the 144 X 144 multi-rate digital matrix card accepts up to 144 SDI video sources from the input buffer cards and provides up to 144 output channels to the output combiner cards. Two models of the 144X144 matrix card have been fielded – one card switches multi-rate SDI signals (SD and HD) up to 1.5Gbps, the second switches SDI signals (SD, HD and 3G) up to 3Gbps. 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 144 X 144 matrix card, as is the case with the 288X288XR 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 matrix card that provide a visual indication of the operational status of the card, these are identified by Figure 1-1. Table 1-1 lists the possible states and interpretation data for the LEDs.

Figure 1-2 is a block diagram of the 144 X 144 digital matrix card. Paragraph 1.3 presents a narrative description of the circuit functions shown on the block diagram.

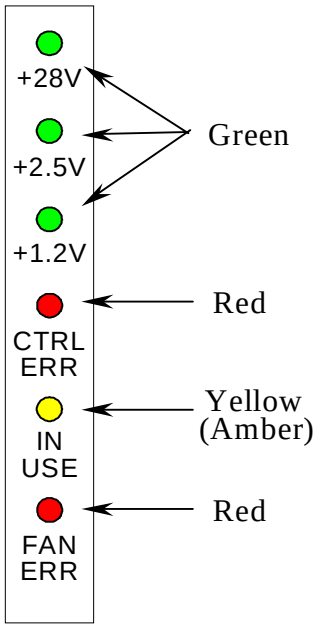


FIGURE 1-1 144X144 VIDEO CROSSPOINT MATRIX CARD LED INDICATORS

TABLE 1-1 144X144 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. .

1.3 FUNCTIONAL DESCRIPTION - 144X144 DIGITAL VIDEO MATRIX CARD

Refer to Figure 1-2 as we discuss the various circuit functions of this card. There are 144 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 144 input channels to any of its 144 output channels. Switching data for the crosspoint device is received from the on-board microcontroller circuitry. The crosspoint also contains 144 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.

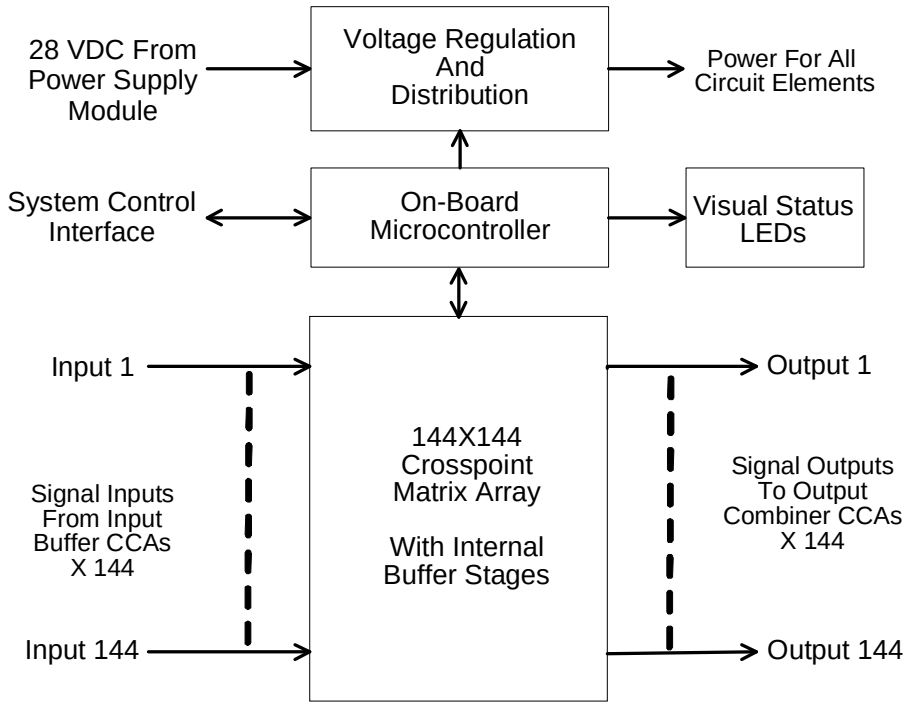


FIGURE 1-2 BLOCK DIAGRAM – 144 X 144 DIGITAL VIDEO MATRIX CARD

The Input CCAs and Output CCAs used in the 288X288XR switcher configuration are the same as the CH Series components discussed in the Cheetah Technical Manual referenced in Section 1.1 of this addendum. Please refer to that manual for information on these components.

There are four 144X144 Matrix CCAs used in the 288X288XR configuration. A very basic sketch of the chassis layout is shown in Figure 1-3. This diagram identifies the location of the System Controller CCA(s), Frame Controller CCA(s), Power Supply Modules and the Matrix CCAs. Figure 1-4 provides a rear view of the rack frame with input and output connection points located.

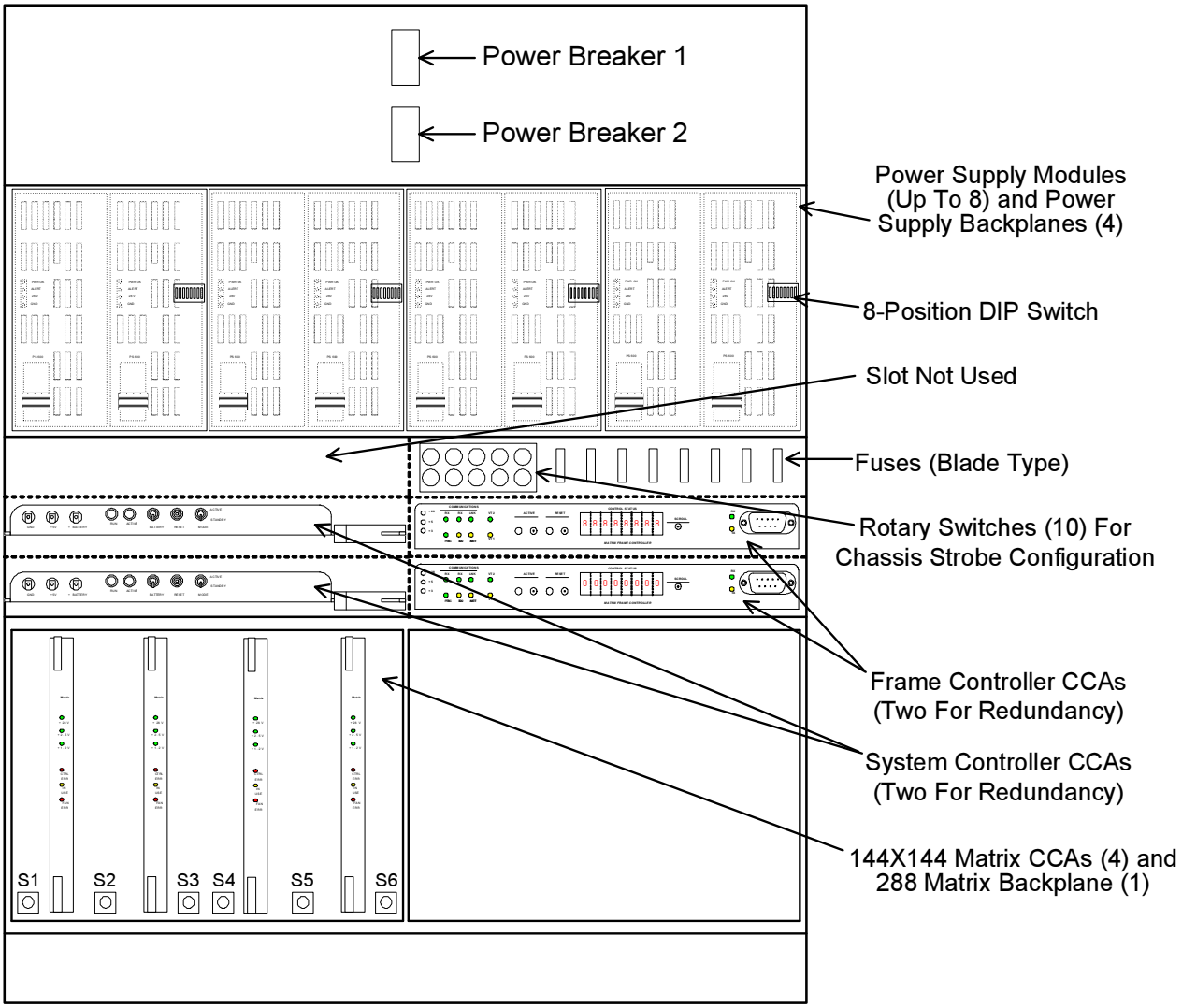
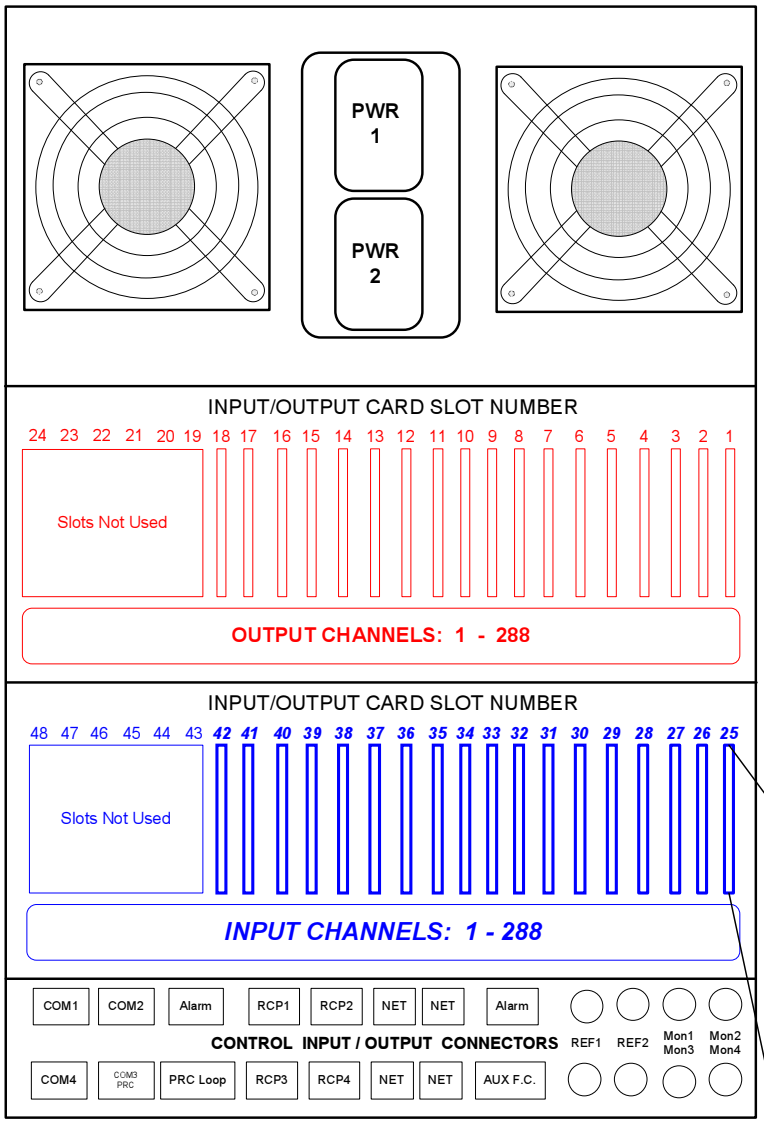


FIGURE 1-3 288X288XR ROUTER CHASSIS (FRONT VIEW- DOOR OPEN)



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
1	1 - 16	10	145 - 160
2	17 - 32	11	161 - 176
3	33 - 48	12	177 - 192
4	49 - 64	13	193 - 208
5	65 – 80	14	209 - 224
6	81 - 96	15	225 - 240
7	97 - 112	16	241 - 256
8	113 - 128	17	257 - 272
9	129 - 144	18	273 - 288

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
25	***1 - 16***	***34***	***145 - 160***
26	***17 -32***	***35***	***161 - 176***
27	***33 - 48***	***36***	***177 - 192***
28	***49 - 64***	***37***	***193 - 208***
29	***65 - 80***	***38***	***209 - 224***
30	***81 - 96***	***39***	***225 - 240***
31	***97 - 112***	***40***	***241 - 256***
32	***113 – 128***	***41***	***257 - 272***
33	***129 - 144***	***42***	***273 - 288***

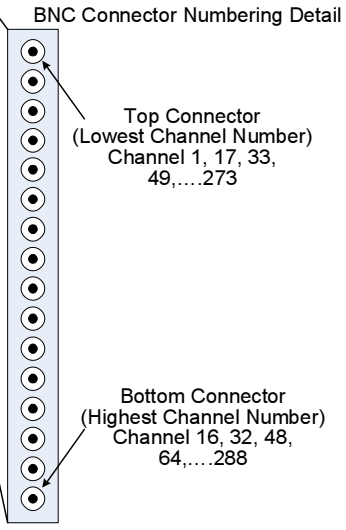


FIGURE 1-4: 288X288XR ROUTER CHASSIS (REAR VIEW)-

Chapter 2 INSTALLATION

2.1 INITIAL INSTALLATION STEPS

All installation steps for the 288X288XR router are the same as for the Cheetah CH 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. 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 288X288XR router are 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 1-4 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 288X288XR router.

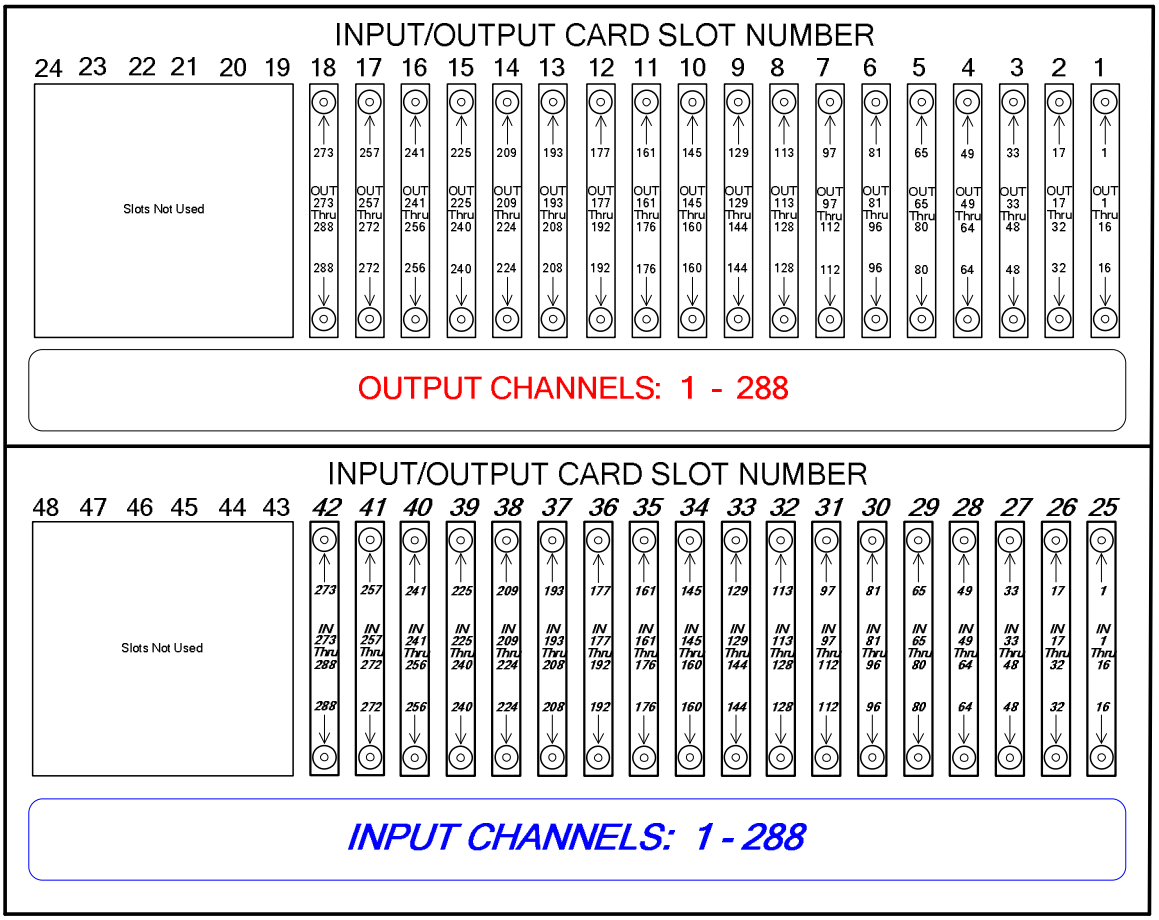


FIGURE 2-1: 288X288XR ROUTER INPUT/OUTPUT CONNECTOR ARRANGEMENT

Chapter 3 REFERENCE DATA

3.1 REFERENCE DATA INTRODUCTION

This section of the TA provides the user with reference data peculiar to the 288X288XR configuration of the Cheetah Matrix 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 is a diagram (Figure 3-1) showing the input and output channel assignments of all 4 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 288X288XR ROUTER

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)

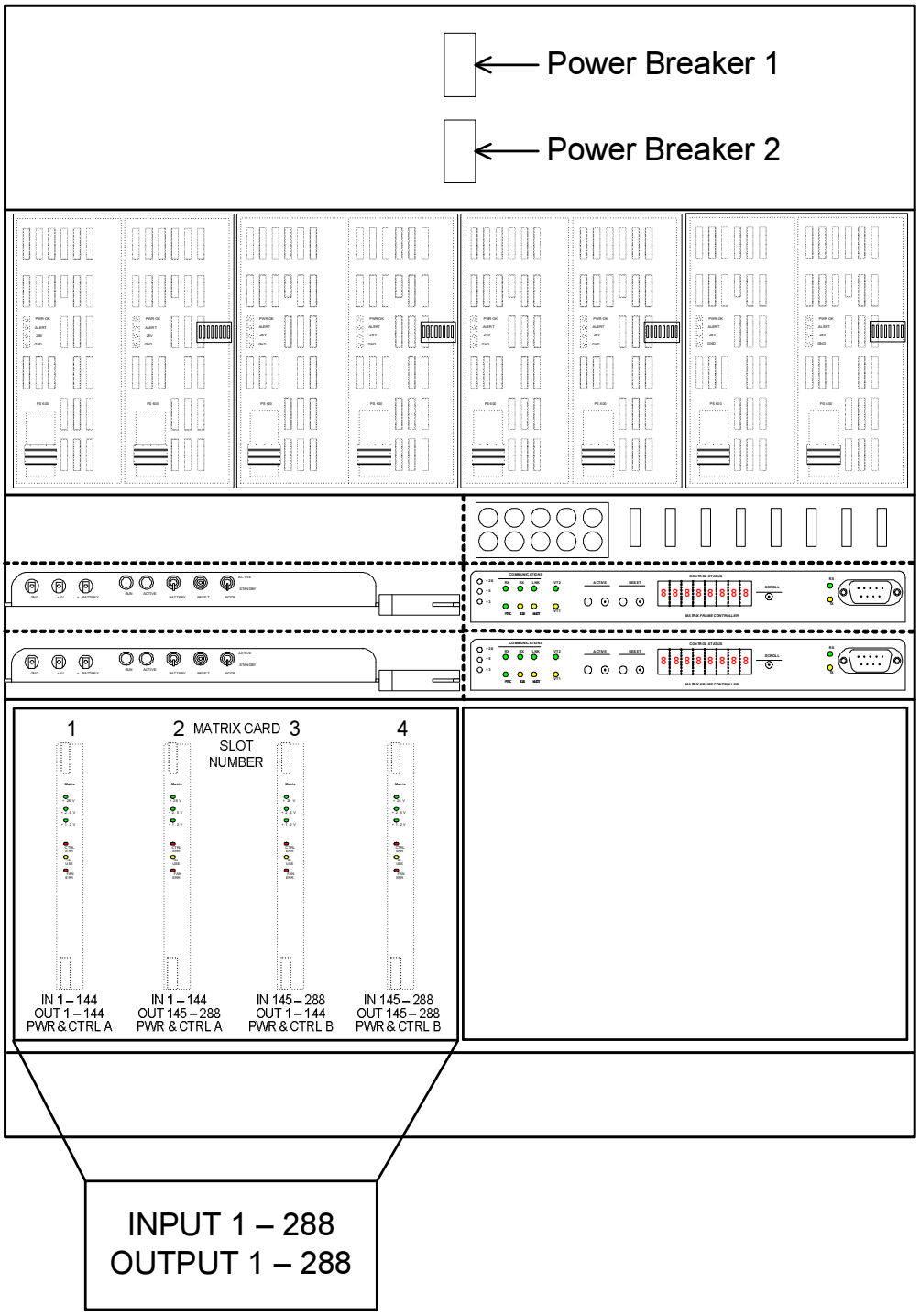


FIGURE 3-1: 144X144 MATRIX CROSSPOINT CCA I/O CHANNEL ASSIGNMENTS

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

Your 288XR router is equipped with one of two possible model variants of the 288X288 matrix backplane. Regardless of variant, each Matrix CCA Backplane provides slots for up to four 144X144 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, and the location of the backplane model part that identifies the variant. 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, for each model variant of the backplane, are provided in Table 3-1 and listed by individual backplane boards.

Chassis Level Codes (Strobes) Rotary Switch Settings

The following settings are factory default settings and should not be readjusted in the field.

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)	1
S8*	Frame (LSB)	D
S9	Network (Fan Setting)	0
S10	Output Monitor	Customer Configuration

*NOTE: The setting of Switches S7 and S8 assign the "frame type" parameter to the switcher. In this configuration, the frame is a "Type 29."

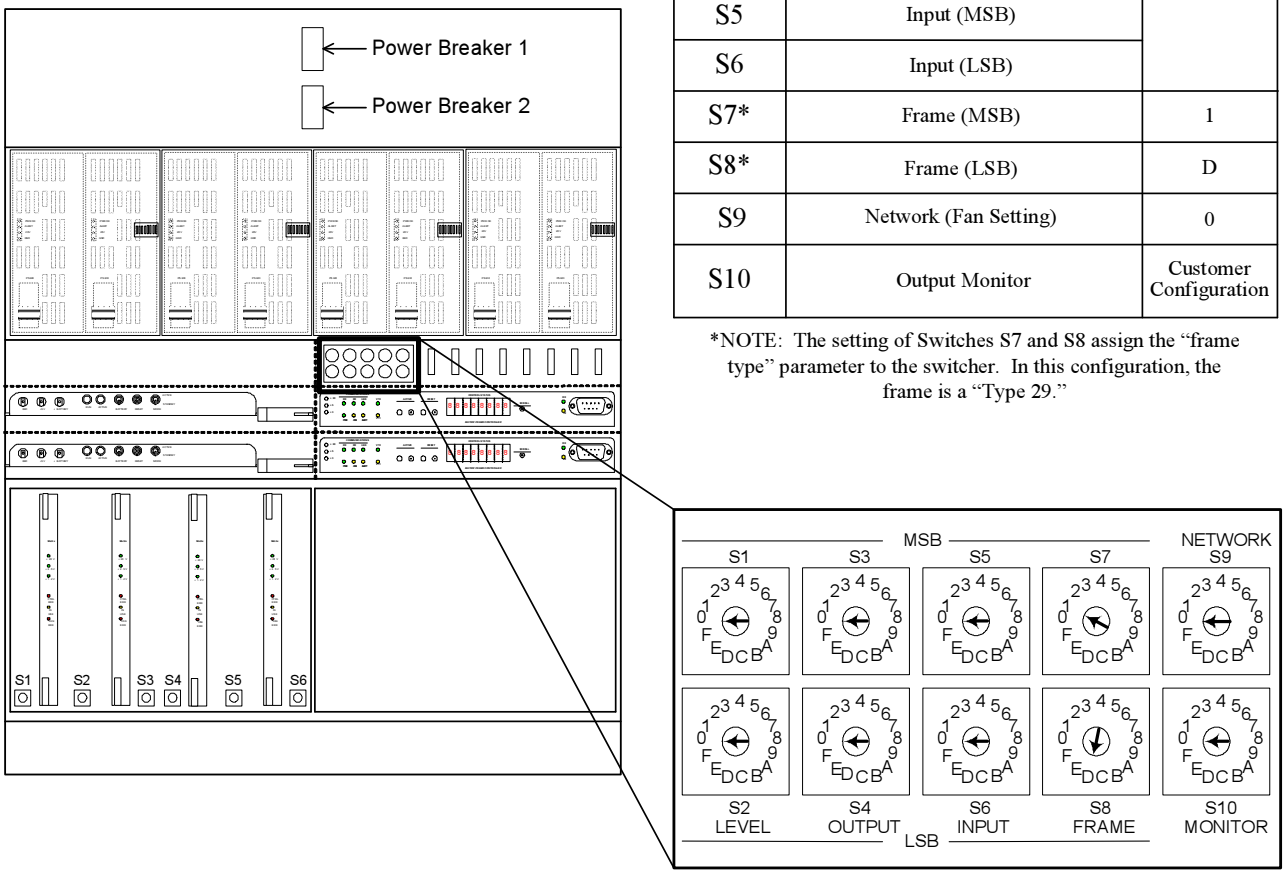


FIGURE 3-2: Chassis and Level Codes Settings

Chassis Power Supply Backplane Dipswitch Settings

The following settings are factory default settings and should not be readjusted in the field.

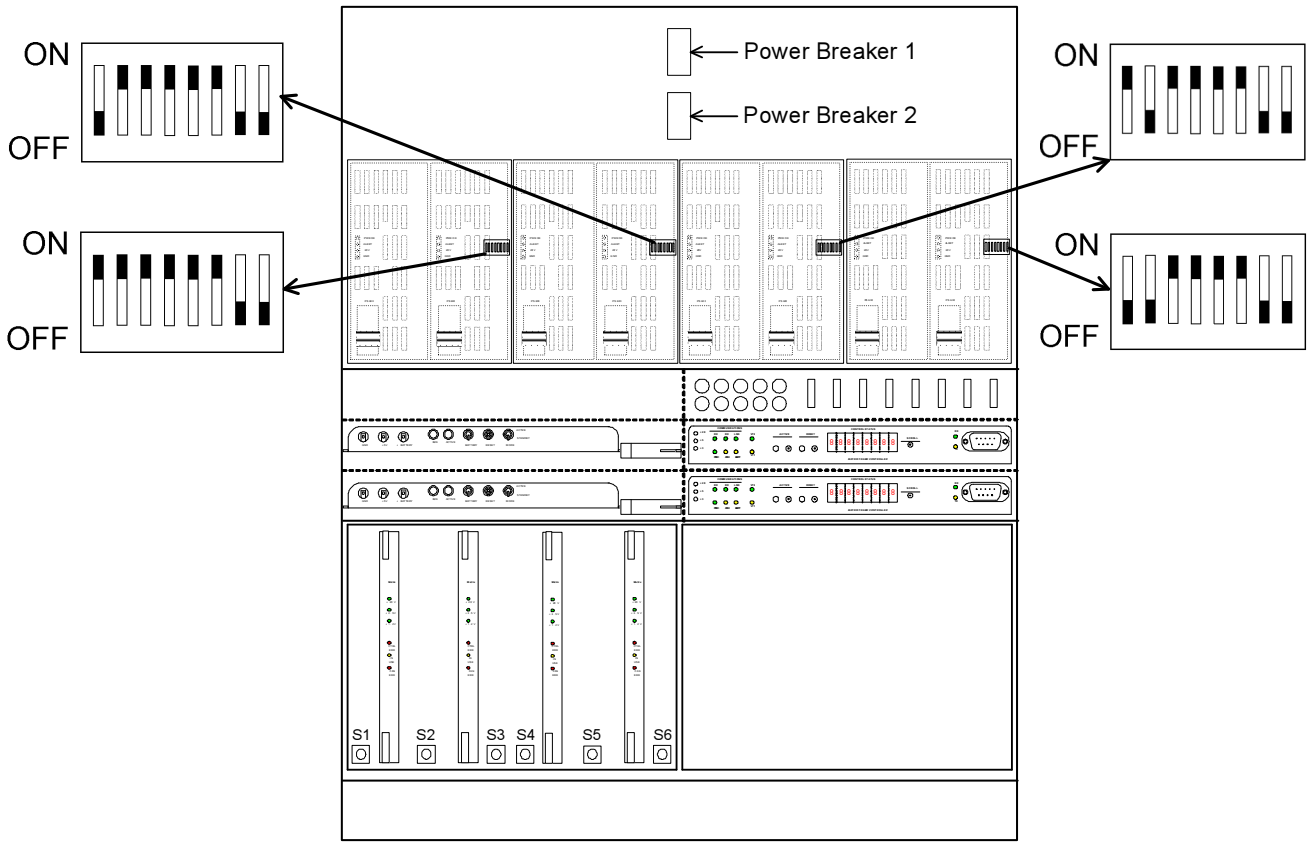


FIGURE 3-3: Power Supply Backplane Dipswitch Settings (viewed from the front)

Chassis Input/Output Backplane Dipswitch Settings

The following settings are factory default settings and should not be readjusted in the field.

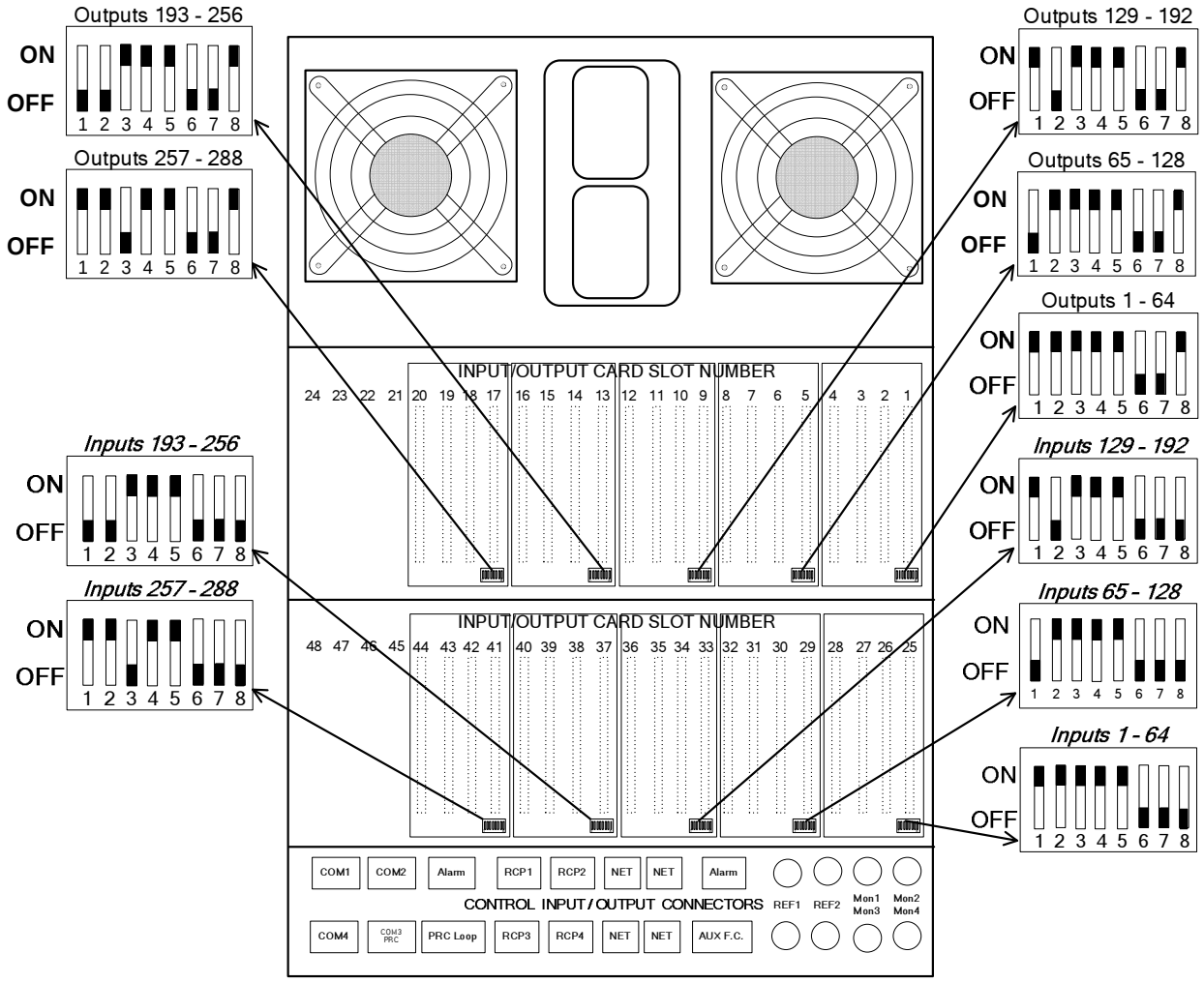


FIGURE 3-2: Input/Output Backplane Dipswitch Settings

Chassis Matrix Backplane Rotary Switch Settings

The following settings are factory default settings and should not be readjusted in the field.

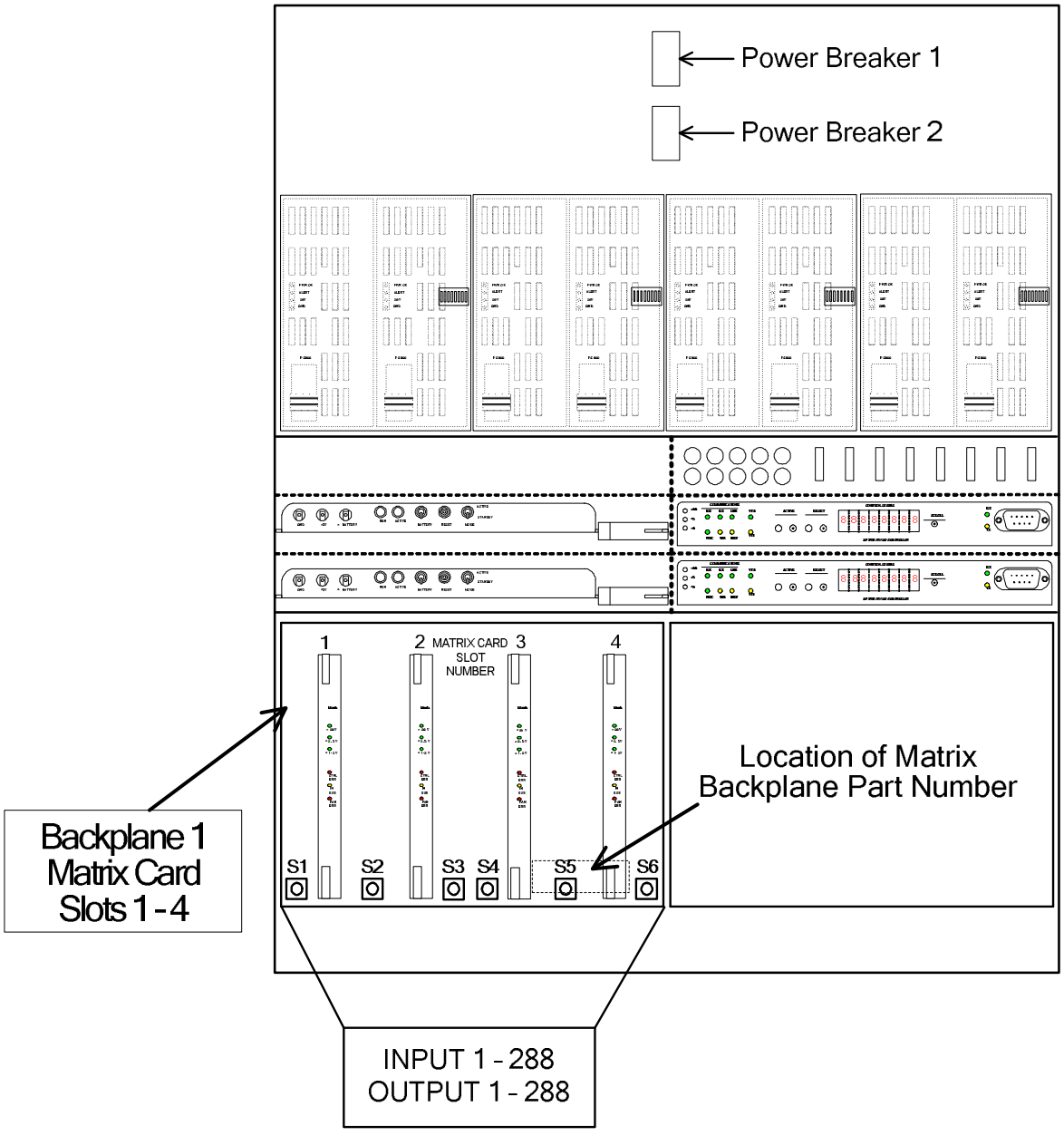


FIGURE 3-3: Matrix Backplane Rotary Switch Locations

TABLE 3-1: MATRIX BACKPLANE ROTARY SWITCH SETTINGS.

MATRIX BACKPLANE 1 CARD SLOTS 1-4		
SWITCH	***SETTING***	***I/O***
S1	0	Outputs: 1-144
S2	0* , 8**	Inputs: 1-144
S3	1	Outputs: 145-288
S4	0	Outputs: 1-144
S5	1* , 9**	Inputs: 145-288
S6	1	Outputs: 145-288

*Switch setting applies to matrix backplane part number 81906528590
** Switch setting applies to matrix backplane part number 81906532580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