CHEETAH

VIDEO MATRIX SWITCHER

CHEETAH 384XR
USING 144X144 MATRIX CARD

TECHNICAL ADDENDUM

PESA

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Table Of Contents

List Of Figures

List Of Tables

Chapter 1   INTRODUCTION

1.1   PURPOSE OF TECHNICAL ADDENDUM

This Technical Addendum (TA) addresses the 384 Input by 720 Output (384XR) 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 384XR router is housed in a frame occupying 27 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 384XR 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.

The 384XR also introduces a special purpose matrix backplane, that differs from a standard backplane in that inputs are not shared between any of the matrix cards – allowing each to function as a stand-alone 144X144 matrix. The only visible difference between the two backplanes is the addition of two rotary switches used for system configuration. With the standard backplane, a single rotary switch located between the two matrix card slots of each bank determines the channel range of input signals applied to both cards, and a rotary switch for each card selects the channel range of output signals from its card. This special-purpose card provides an independent selector switch for setting both the input range and output range for each card.

Incorporating the 144X144 Matrix CCA(s), three standard 288 Matrix Backplanes and one special-purpose Matrix Backplane into the 27 RU frame accommodates the requirement for the 384X720 Routing Switcher addressed by this TA. In this application, four 288 Backplane "modules" are installed in the frame. Four 288 Backplane assemblies, populated with fifteen 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 384XR routing switcher.

Contained in this TA, as a supplement to the Cheetah Generation I 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 384XR system configuration.

1.2 144X144 VIDEO (CROSSPOINT) MATRIX CARD

The 144x144 Video Matrix Card selects one of 144 inputs to each of 144 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.
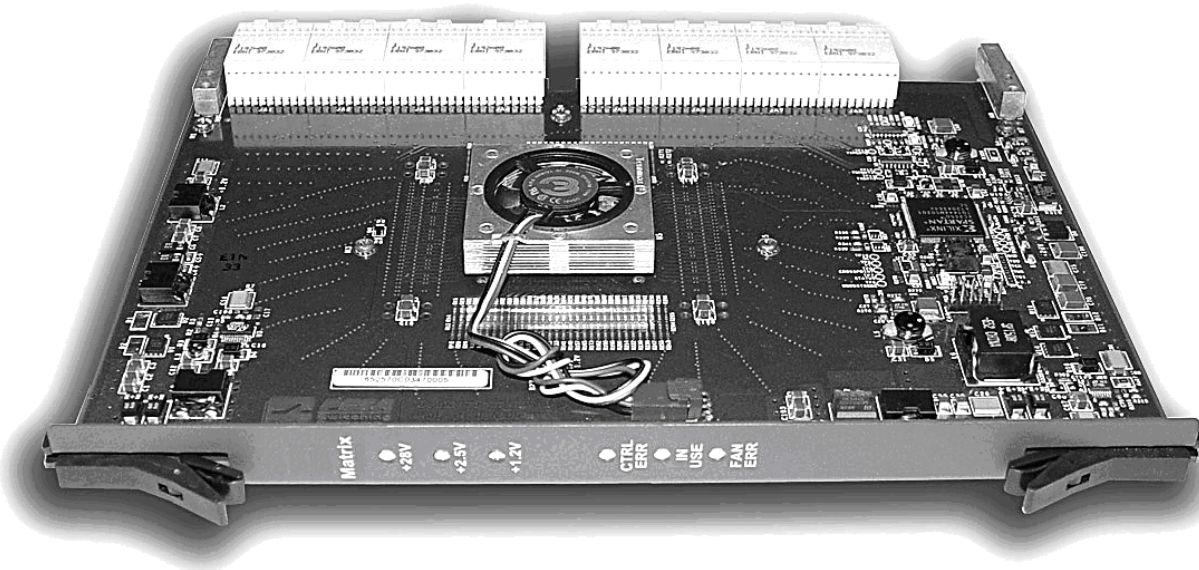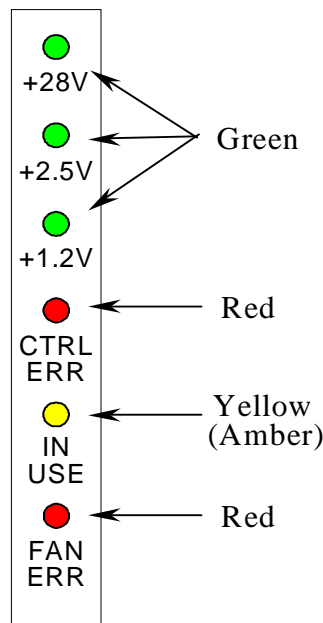

Figure 1-1   Typical Digital Video Matrix CCA

1.2.1   *144 Input X 144 Output Digital Video Matrix 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 384XR 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 144 x 144 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 144 X 144 digital matrix card. Paragraph 1.2.2 presents a narrative description of the circuit functions shown on the block diagram.

FIGURE 1-2   VIDEO CROSSPOINT MATRIX CARD LED INDICATORS

1.2.2   *Functional Description – 144 X 144 Digital Video Matrix Card*

Refer to Figure 1-3 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.

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. .
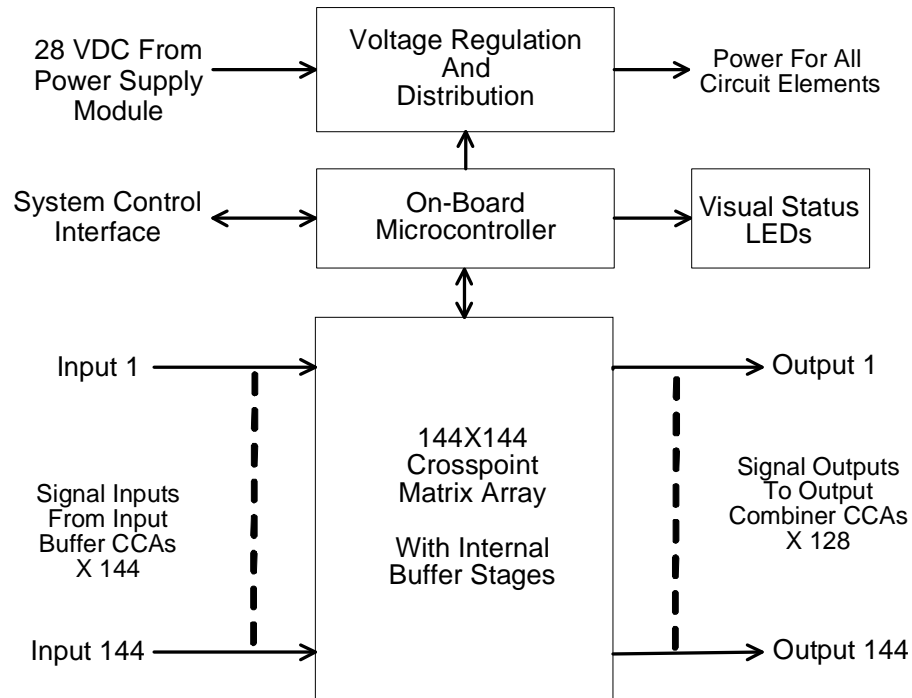
FIGURE 1-3   BLOCK DIAGRAM – 144 X 144 DIGITAL VIDEO MATRIX CARD

With the exception of the 144X144 Matrix CCA and the 288 Backplanes, all other components used in the 384XR 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 15 144X144 Matrix CCAs used in the 384X720 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.
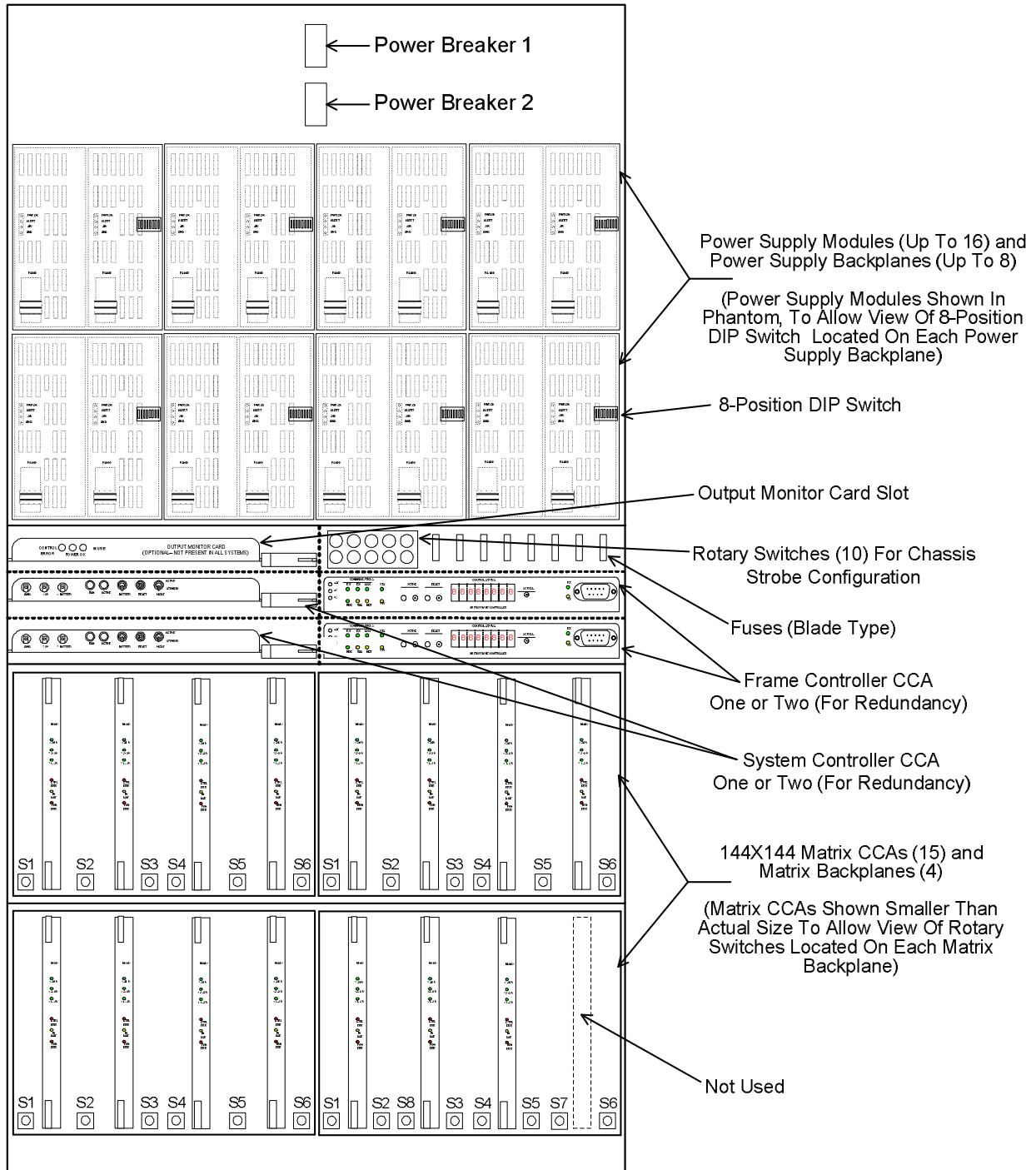
FIGURE 1-4   CHEETAH 384XR ROUTER CHASSIS (FRONT VIEW – DOOR OPEN)

CHEETAH 384XR FRAME - REAR VIEW

PWR 1

PWR 2

FAN   FAN

INPUT/OUTPUT CARD SLOT NUMBER

24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

OUTPUT CHANNELS: 1 - 384

INPUT/OUTPUT CARD SLOT NUMBER

48 47 46 45 44 43 42 41 40 39 38 37 36 35 34 33 32 31 30 29 28 27 26 25

INPUT CHANNELS: 1 - 384

INPUT/OUTPUT CARD SLOT NUMBER

72 71 70 69 68 67 66 65 64 63 62 61 60 59 58 57 56 55 54 53 52 51 50 49

OUTPUT CHANNELS: 385 - 720

COM1 COM2 Alarm RCP1 RCP2 NET NET Alarm   Mon1 Mon3 Mon2 Mon4
CONTROL INPUT / OUTPUT CONNECTORS   REF1 REF2
COM4 COM3 PRC PRC Loop RCP3 RCP4 NET NET AUX F.C.

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	17	257 - 272	57	513 - 528
2	17 - 32	18	273 - 288	58	529 - 544
3	33 - 48	19	289 - 304	59	545 - 560
4	49 - 64	20	305 - 320	60	561 - 576
5	65 - 80	21	321 - 336	61	577 - 592
6	81 - 96	22	337 - 352	62	593 - 608
7	97 - 112	23	353 - 368	63	609 - 624
8	113 - 128	24	369 - 384	64	625 - 640
9	129 - 144	49	385 - 400	65	641 - 656
10	145 - 160	50	401 - 416	66	657 - 672
11	161 - 176	51	417 - 432	67	673 - 688
12	177 - 192	52	433 - 448	68	689 - 704
13	193 - 208	53	449 - 464	69	705 - 720
14	209 - 224	54	465 - 480	70	Not Used
15	225 - 240	55	481 - 496	71	Not Used
16	241 - 256	56	497 - 512	72	Not Used

INPUT CHANNELS

<u>NOTE</u>
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	37	193 - 208
26	17 - 32	38	209 - 224
27	33 - 48	39	225 - 240
28	49 - 64	40	241 - 256
29	65 - 80	41	257 - 272
30	81 - 96	42	273 - 288
31	97 - 112	43	289 - 304
32	113 - 128	44	305 - 320
33	129 - 144	45	321 - 336
34	145 - 160	46	337 - 352
35	161 - 176	47	353 - 368
36	177 - 192	48	369 - 384

BNC Connector Numbering Detail

Top Connector (Lowest Channel
Number) On Connector Board
Channel 1, 17, 33, 49,....705

Bottom Connector (Highest Channel
Number) On Connector Board
Channel 16, 32, 48, 64,....720

**FIGURE 1-5: CHEETAH 384XR 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 384XR 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 384X720 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 384XR 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 384XR router.
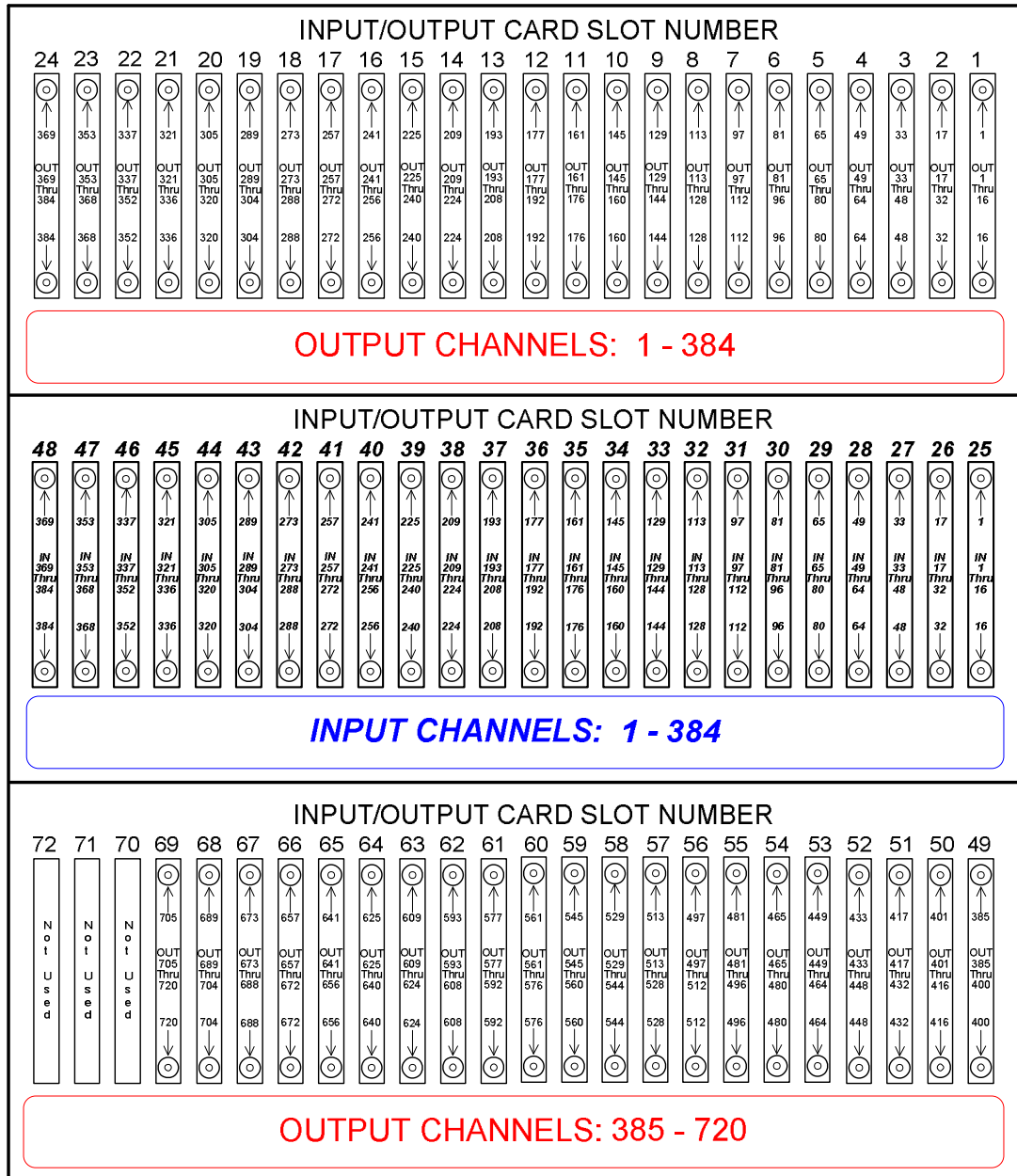
FIGURE 2-1: CHEETAH 384XR ROUTER INPUT/OUTPUT CONNECTOR ARRANGEMENT

Chapter 3   REFERENCE DATA

3.1   REFERENCE DATA INTRODUCTION

This section of the TA provides the user with reference data peculiar to the 384XR configuration of the Cheetah Routing 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 15 matrix crosspoint CCAs, plus setting information for all DIP and rotary switches used to configure the switcher.
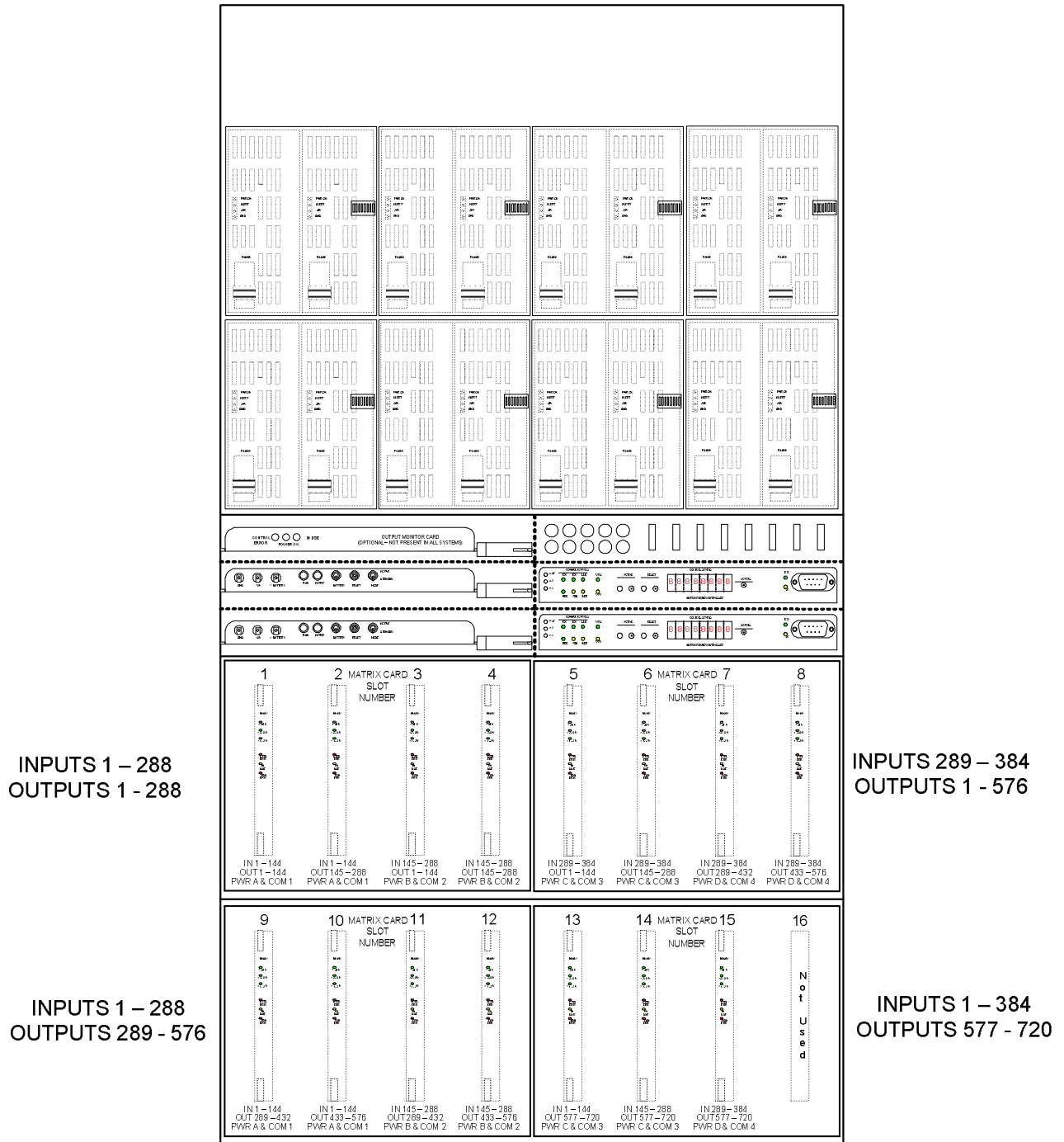
3.2   DIP SWITCH/ROTARY SWITCH SETTINGS FOR THE 384XR ROUTER

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)

INPUTS 1 – 288
OUTPUTS 1 - 288

INPUTS 289 – 384
OUTPUTS 1 - 576

INPUTS 1 – 288
OUTPUTS 289 - 576

INPUTS 1 – 384
OUTPUTS 577 - 720

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.
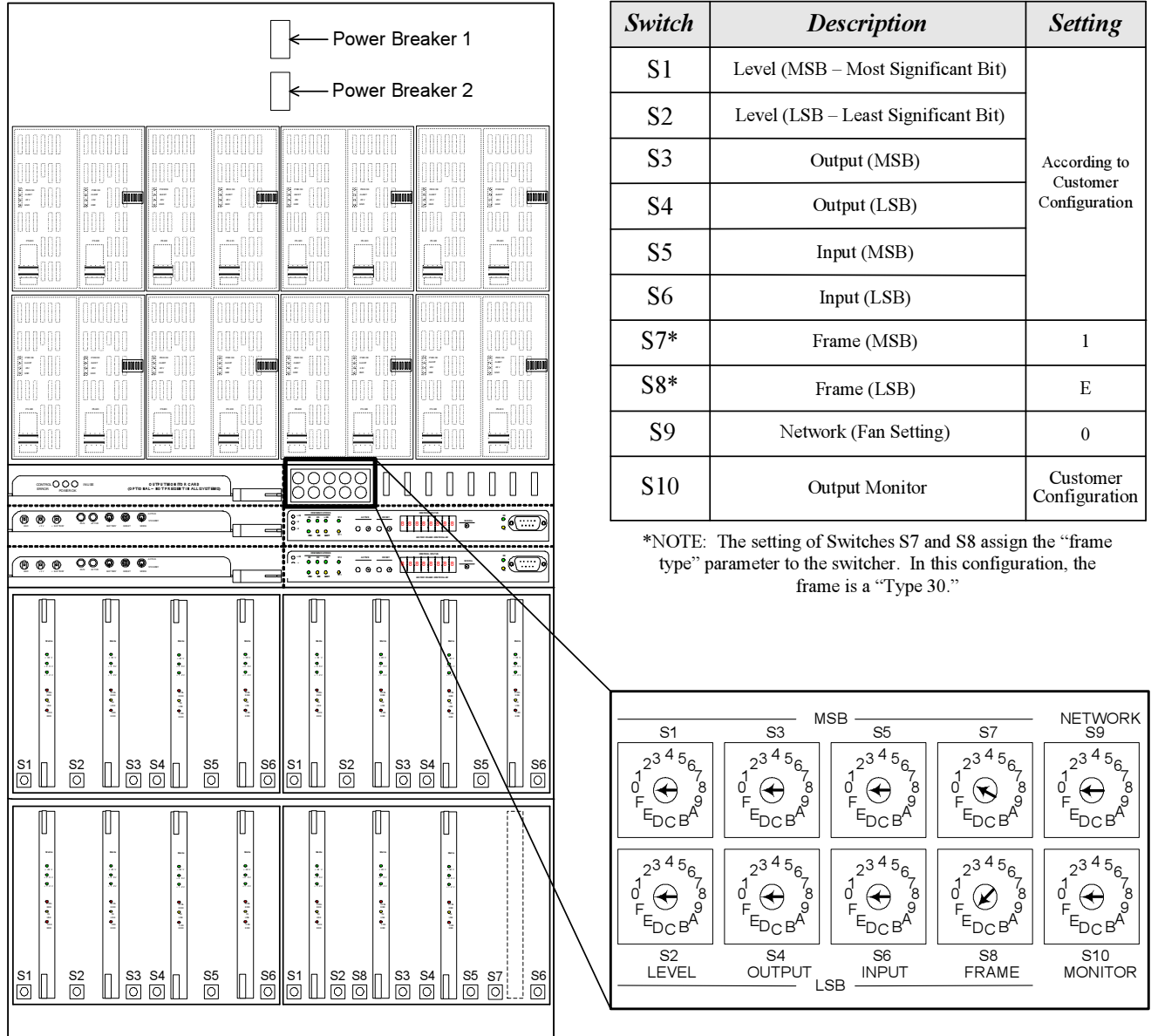
3.2.3   *Chassis Input/Output CCA Backplane DIP Switch Settings*

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.
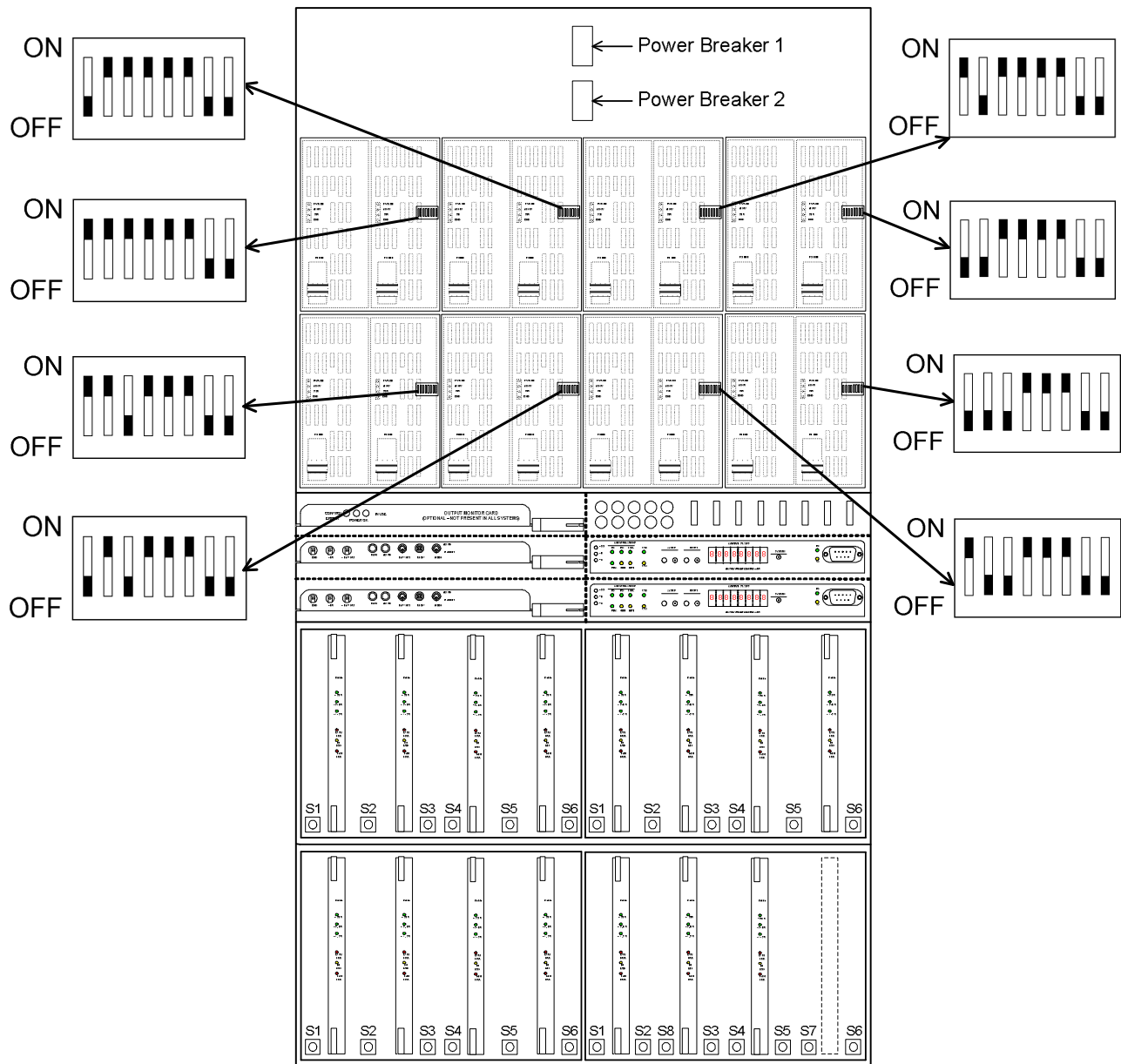
3.2.4   *Chassis Matrix Backplane Rotary Switch Settings*

Your 384XR 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.

Switch	Description	Setting
S1	Level (MSB – Most Significant Bit)	
S2	Level (LSB – Least Significant Bit)	
S3	Output (MSB)	According to Customer Configuration
S4	Output (LSB)	
S5	Input (MSB)	
S6	Input (LSB)	
S7*	Frame (MSB)	1
S8*	Frame (LSB)	E
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 30."

FIGURE 3-2: CHASSIS AND LEVEL CODE SWITCH SETTINGS

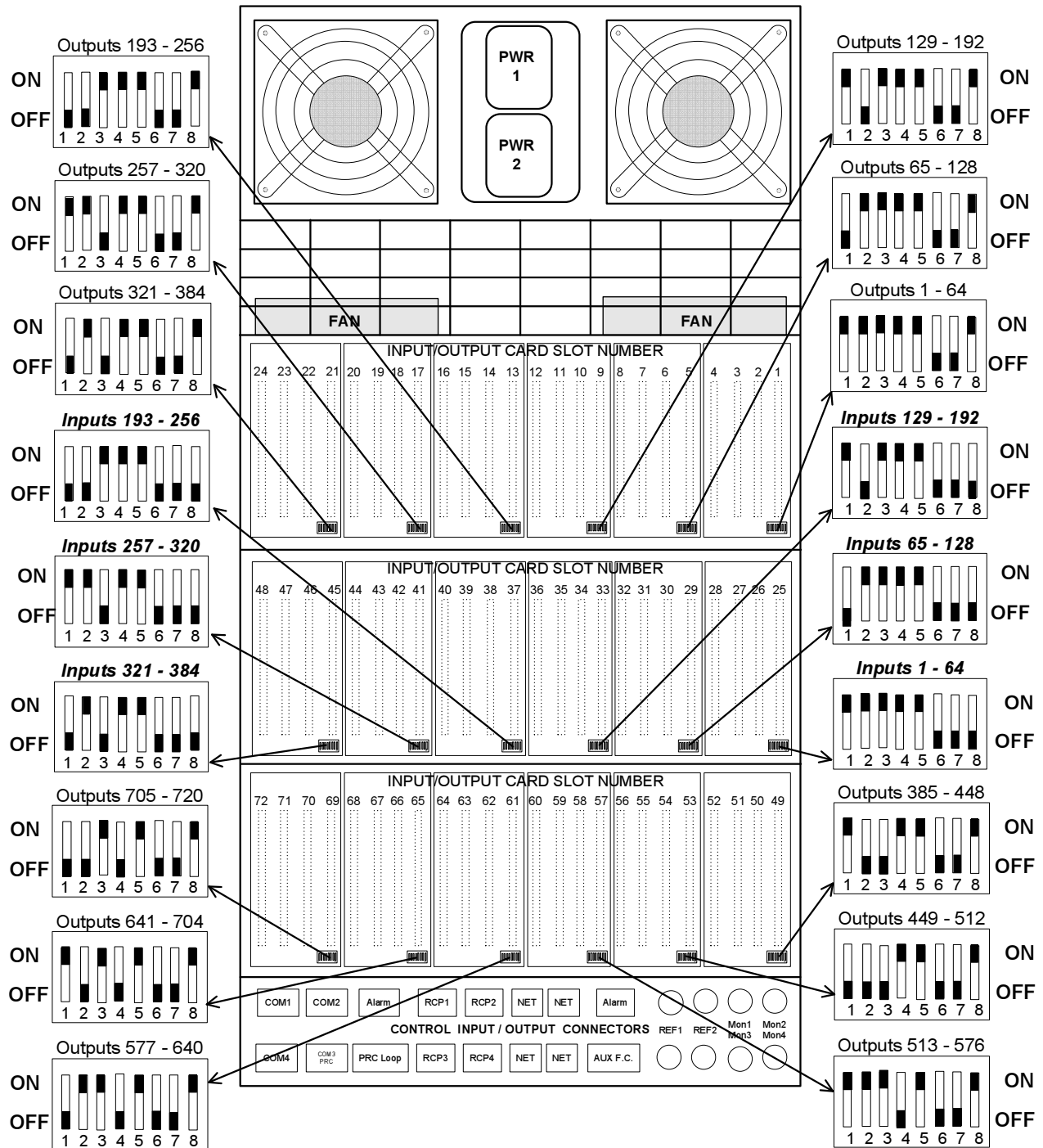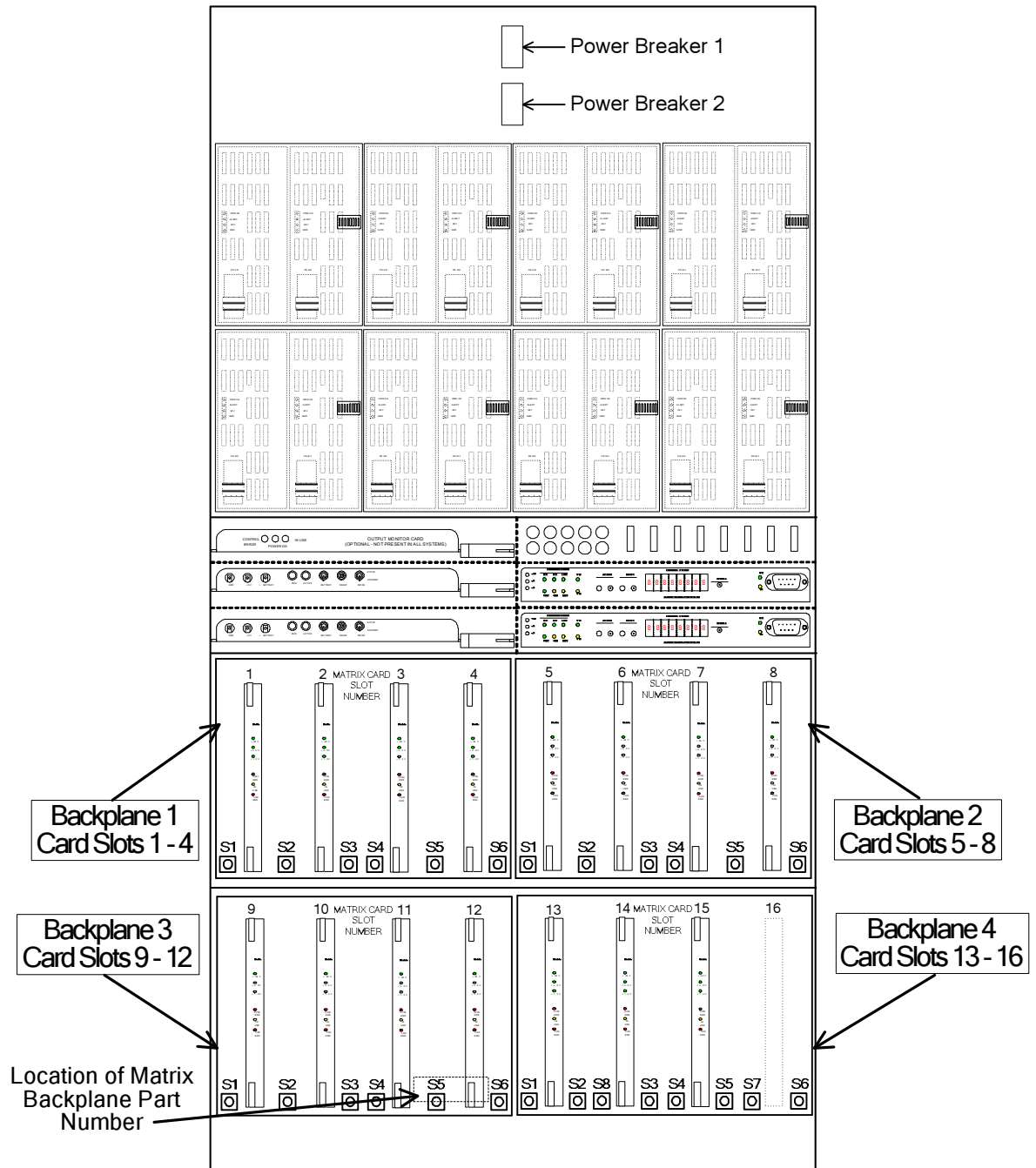**FIGURE 3-3: 384XR POWER SUPPLY BACKPLANE DIP SWITCH LOCATIONS AND SETTINGS (FRONT VIEW)**

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 - 4			MATRIX BACKPLANE 2 CARD SLOTS 5 - 8		
SWITCH	*SETTING*	*I/O*	*SWITCH*	*SETTING*	*I/O*
S1	0	Outputs: 1 – 144	S1	0	Outputs: 1 – 144
S2	0* , 8**	Inputs: 1 – 144	S2	2* , A**	Inputs: 289 – 384
S3	1	Outputs: 145 – 288	S3	1	Outputs: 145 – 288
S4	0	Outputs: 1 – 144	S4	2	Outputs: 289 – 432
S5	1* , 9**	Inputs: 145 – 288	S5	2* , A**	Inputs: 289 – 384
S6	1	Outputs: 145 – 288	S6	3	Outputs: 433 – 576

MATRIX BACKPLANE 3 CARD SLOTS 9 – 12			MATRIX BACKPLANE 4 CARD SLOTS 13 – 16		
SWITCH	*SETTING*	*I/O*	*SWITCH*	*SETTING*	*I/O*
S1	2	Outputs: 289 – 432	S1	4	Outputs: 577 – 720
S2	0* , 8**	Inputs: 1 – 144	S2	0	Inputs: 1 – 144
S3	3	Outputs: 433 – 576	S8	1	Inputs: 145 – 288
S4	2	Outputs: 289 – 432	S3	4	Outputs: 577 – 720
S5	1* , 9**	Inputs: 145 – 288	S4	4	Outputs: 577 – 720
S6	3	Outputs: 433 – 576	S5	2	Inputs: 289 – 384
			S7		Not Used
			S6		Not Used

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