



MS-400x Matrix Switch

Operating Manual

CPT-006-1410

Rev H

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Revision History
CPT-006-1410

Revision	Date	Summary of Changes
-		Original Issue
A	Jan 6, 2006	Added MS4001-4x4-LB-MW-P
B	June 19, 2006	Added MS-4001-32x32-HF, Ethernet
C	April 9, 2010	Added MS-4000-8x32-LB-FO, MS-4000-16x32-LB-FO, MS-4000-32x8-LB-FI, MS-4000-32x16-LB-FI
D	April 16, 2010	Added MS-4001-32x32-HF, Modifications to Firmware v1.9 to Added MS-4001-32x32-HF Addendum.
E	Sept 24, 2010	Added MS-4000-8x8-LB-FO Addendum. Added MS-4000-8x8-LB-FI Addendum.
F	August 28, 2012	Changing specs for Addendums regarding LB3 and Ethernet additions. Added MS-4001-16X6-XB-FO addendum.
G	October 15, 2012	Removed Maximum Input Signal Spec from L Band Units. Added 1dB Compression Point of 0dBm Min.
H	October 3, 2016	Added Ethernet port and Ethernet functionality to the MS-4001-12X6-KU-FO Switch section.

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SAFETY CONSIDERATIONS

General

Before operating this product, you must review all related documentation for familiarization with safety markings and instructions.

Safety Symbols and definitions



Operating Manual symbol. The product will be marked with this symbol when it is necessary to refer to the Operating Manual.



Electrical Hazard Warning. The product will be marked with this symbol when hazardous conditions such as high voltages could exist.



Protective Earth Ground. The product will be marked with this symbol at the location of the earth ground terminal.

WARNING	Warning denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a warning note until the indicated conditions are fully understood and met.
CAUTION	Caution denotes a hazard. It calls attention to a procedure that, if not correctly performed or adhered to, could result in damage to or destruction of the instrument. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.
CAUTION	Always use the three-prong AC power cords supplied with this product. Failure to ensure adequate grounding may cause product damage. When adapting to foreign AC mains connectors, a grounded line cord must be selected.
WARNING	The mains plug shall be inserted only in a socket outlet provided with a protected earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited.
WARNING	No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock do not remove covers.
WARNING	Before this instrument is switched on, make sure it has been properly grounded through the protective conductor of the ac power cable to a socket outlet provided with protective earth contact.
WARNING	There are many points in the instrument which can, if contacted, cause personal injury. Be extremely careful. Any adjustments or service procedures that require operation of the instrument with protective covers removed should be performed only by trained service personnel
WARNING	Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal can result in personal injury.
WARNING	If this instrument is used in a manner not specified by CrossPoint Technologies, the protection provided by the instrument may be impaired.
CAUTION	When removing a power supply drawer while the system is powered by the alternate drawer (hot-swapping), the power switch must be turned to its Off ("O") position before removing the thumbscrews to release the power supply drawer. Withdrawing a power supply while powered can damage the equipment.
CAUTION	When inserting a power supply drawer while the system is powered by the alternate drawer (hot-swapping), the power switch on the replacement power supply must be turned to its Off ("O") position before inserting the power supply drawer. Inserting a power supply with its switch On ("1") can damage the equipment.

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1 Introduction

CrossPoint Technologies Model MS-400x Matrix Switches are available in a variety of input/output configurations. The operation and remote control interfaces are identical for all devices. The MS-4000 series are solid state switches. The MS-4001 use mechanical RF relays as their switching element. The chassis size varies with the complement of switches installed. Frequency range is customer specified.

1.1 Applicability

This manual covers a family of Matrix Switches. The following models are included in this manual:

- MS-4000-16x16-LB3-FO
- MS-4000-16x16-LB3-FI
- MS-4000-32x32-IF-FO
- MS-4000-32x32-IF-FI
- MS-4001-10x6-XB-FO
- MS-4001-12x6-KU-FO
- MS-4001-4x4-LB-MW-P
- MS-4001-32x32-HF
- MS-4000-8x32-LB-FO
- MS-4000-16x32-LB-FO
- MS-4000-32x8-LB-FI
- MS-4000-32x16-LB-FI
- MS-4000-8X8-LB3-FO
- MS-4000-8X8-LB3-FI
- MS-4001-16X6-XB-FO

Detailed specifications and additional information specific to each model are found in the Appendix.

Other models are available for different frequency ranges or for different numbers of channels. The MS-400x can be optimized to your application.

1.2 Terminology

Matrix switches are specified in one of two ways. If the matrix is designed as “full fan out”, each input can be routed to all its outputs simultaneously. Each output has only one input at a time. If the matrix is “full fan in”, each output can sum all inputs simultaneously. Each input can only be assigned to a single output at a time.

These matrix configurations exhibit a “one to many” (fan out) or “many to one” (fan in) characteristic. The internal configuration of these two architectures are often a mirror image of one another.

2 Controls and Indicators

2.1 Front Panel

There may be different front panel heights, but the layout of the controls is always the same. The 1RU Matrix Controller front panel is shown here. All the indicators and controls are identified and explained below. More details on how to use these controls may be found in Section 4.

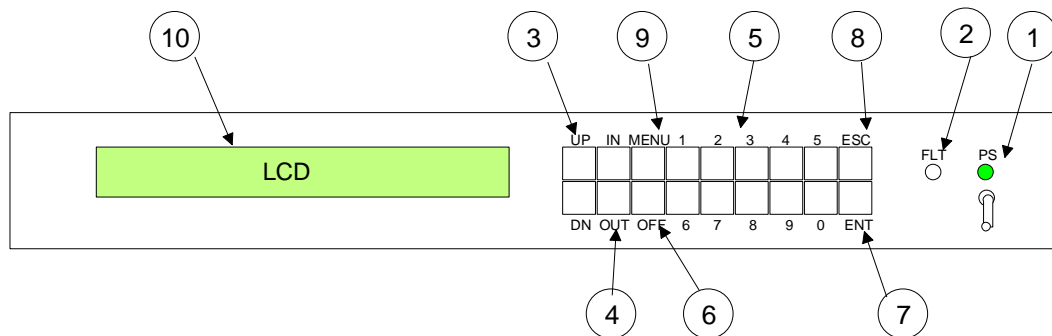


Figure 1 : Front Panel Controls and Indicators

Front Panel Controls and Indicators

Callout	Name	Description
1	POWER Indicator & Power switch	Illuminated green when power is on. Turns Red if a power supply problem is detected. Two LED's are present when there are redundant power supplies.
2	FAULT Indicator	Illuminated Red when any fault is detected in any chassis. This is a summary alarm indication
3	UP and DOWN	Used to cycle through the list of available inputs or outputs when in an Edit mode. Scrolls through Menu items when in MENU mode Incrementing/Decrementing rolls over/under at the extremes
4	IN and OUT	Press IN or OUT to enter the Edit mode, and change a switch connection.
5	Numeric keys	Enter matrix port numbers directly using these keys.
6	OFF key	Used to disconnect an output. This key can be used in Edit mode. Press Enter to accept the OFF (disconnect) condition.
7	ENTER key	Accept the current input or output, exit the Edit mode and return to the next higher menu level.
8	ESCAPE key	Cancel the current Edit session and return to the next higher menu level. No changes occur to matrix state.
9	MENU key	Move from the normal display to the various configuration and status menus.
10	LCD Display	For local status and control.

2.2 Rear Panel

Rear panels are customized to the different matrix configurations. Specific drawings found in the Appendix for each model that identify the connector reference numbers (“J numbers”).

3 Installation

The Matrix Switch mounts in a standard EIA rack. Internal fans provide cooling from side to side. Standard rack mounting will allow adequate clearance for the air vents on the sides. The unit does not require empty rack space above or below.

3.1 Connections

3.1.1 AC Power

The Matrix is provided with a standard detachable US AC line cord. However, the internal power supplies have universal voltage capability (220/110 VAC). Plug the equipment into an AC source of either 110 or 220 VAC.

3.1.2 Serial Port

The serial port is a dual purpose connector located on the rear of the Matrix. The connector is labeled CTRL. It provides RS-232 format signals as well as RS-422 signals. The chassis connector is a common 9 pin male D connector.

3.1.2.1 RS-232 Operation

RS-232 is recommended for cable lengths up to 50 feet between the computer and the matrix. Longer links can be accommodated reliably, but may require experimenting with slower baud rates, lower loss cable and better shielding.

The link can operate at four baud rates between 2400 and 19200 bits per second. The baud rate is selected by the front panel menus. The other communication parameters are fixed at 8 bit words, no parity and 1 stop bit. Set your remote computer interface to the same settings. Factory default is 19200 baud.

The serial interface does not support hardware or software flow control. Commands and responses are relatively short and flow control is not normally required. The command/response method assures that the host computer can sense if the Matrix is unable to accept more characters.

The RS-232 interface is pin compatible with standard PC serial ports, which use RS-574 pin assignments. To control the system from a PC, a “null Modem” cable is required. A Null Modem adapter can be used with a “straight through” cable, or a custom cable can be wired, following the diagram below.

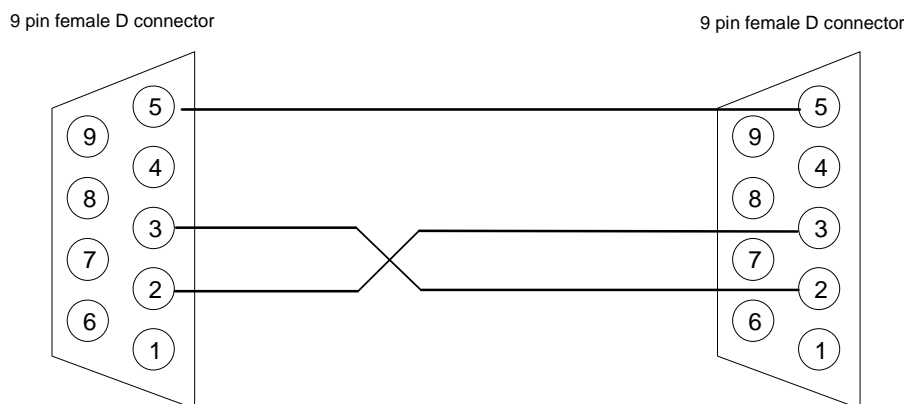


Figure 2 : PC to Matrix Chassis – RS-232

The Serial port connector (CTRL) pin assignments are:

Pin	RS-232 Applicability	RS-485 Applicability	Circuit Function	Direction
1		X	TxDatA _B	Output
2	X		Receive Data	Input
3	X		Transmit Data	Output
4		X	RxDatA _B	Input
5	X	(Shield)	Gnd	
6		X	TxDatA _A	Output
7			unused	
8			unused	
9		X	RxDatA _A	Input

3.2 RS-422 Remote Control Operation

RS-422 operation allows data communication over cables of up to 4,000 feet. Use RS-422 when the remote computer must be located far from the matrix chassis, or when ambient electronic noise levels are very high. The RS-422 standard uses balanced differential signaling, for significantly more reliable communication than RS-232. The drivers and receivers are RS-485 compliant, which makes them suitable for direct interface to full duplex RS-485 systems as well.

The link can operate at four baud rates between 2400 and 19200 bits per second. The other communication parameters are fixed at 8 bit words, no parity and 1 stop bit. Set your remote computer interface to the same settings. For long runs, a termination might be required to assure reliable communication at high baud rates. If you experience data integrity problems (parity errors, garbled data) try slower baud rates. If slower baud rates help, then try the faster rates with a 120 ohm terminating resistor across the receive data pins (RXA and RXB). Terminate each pair at its receiver. The terminations can be installed inside the back shells of the cable connectors. The actual resistance value may be adjusted to match the cable's characteristic impedance. A value of 120 ohms is typical for twisted shielded pairs.

The serial interface does not support hardware or software flow control. Commands and responses are relatively short and flow control is not normally required. The command/response method assures that the host computer can sense if the Matrix is unable to accept more characters.

The interface requires 2 twisted pairs of wires between the communicating devices. Shielding is recommended over the two pairs. For best performance and safety, do not ground the shield at both ends. Leave one end of the shield unconnected. If each pair is individually shielded, ground the shield at its source end (driven end) and leave it floating at its receiving end.

The suggested drawing below is for the RS-422 interface using 2 twisted shielded pairs. The computer side does not show pin numbers, as there are many forms of RS-422 connectors available. Notice the individual shields are grounded at opposite ends, and there is no ground continuity between the two devices (the two shields are assumed isolated from each other). In long runs, this serves to protect both devices from carrying ground currents, especially in the event of a power line fault in either device. If your cable has individual shields that are in intimate contact with each other, it may not be possible to avoid ground current flow down the cable shield.

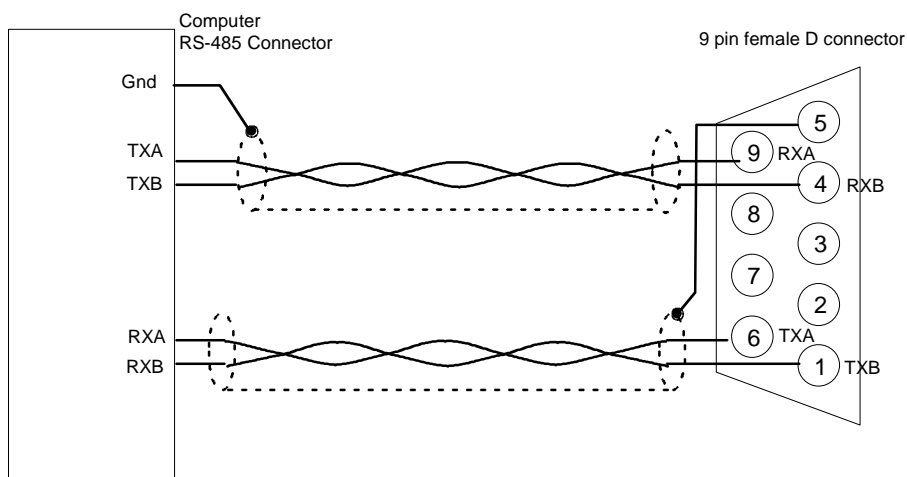


Figure 3 : Computer to Matrix RS-422 Wiring

A standard PC RS-232 port can be transformed to balanced operation using an “RS-232 to RS-422” or “RS-232 to RS-485” adapter device. These devices are available from a variety of sources. Some can be powered directly from the RS-232 handshake signals available at the PC connector. This type is recommended, as it does not require a separate power supply or transformer for operation.

Suggested sources for these adapters are B&B Electronics (www.bb-elec.com or 815-433-5100) and Black Box Network Services (www.blackbox.com or 877-877-2269).

4 Front Panel Operation

When all connections have been made, power up the Matrix. The matrix will power on in Local mode, so the front panel is enabled. After displaying the model number, and initializing itself, the matrix will set itself to the connection paths that existed when it was powered down.

The following sections discuss general operations. Detailed operating sequences appear after the general discussion

4.1 Remote and Local Modes

Manual operation is permitted whenever the matrix is in Local mode. The front panel can always be used to view the state of the matrix. But to make changes, the matrix must be placed into Local mode.

The remote computer can place the matrix in Remote mode, thereby disabling changes from the front panel. However, the matrix can be returned to Local mode using its front panel menus. The remote computer can also place the matrix into Local Lockout state. In Local Lockout state, the front panel is disabled and cannot be used. The remote computer must release the matrix from Local Lockout state before front panel control can occur. To allow recovery if the remote computer fails, the matrix can be power cycled. It will always release the Local Lockout and revert to Local state at power up. The matrix paths will be interrupted during this power cycle operation.

4.2 Setting Switches

To change the matrix connection in a fan in switch, first select the Input that is to be sent to a different output, by pressing the IN key. To change the matrix connection in a fan out switch, first select the Output that will have a new input assigned to it, by pressing the OUT key.

Pressing IN/OUT will change the LCD display to an edit mode. A blinking cursor will appear to indicate the Matrix is waiting for data. Use the numeric keys to specify the desired port, or use the UP and DOWN keys to increment/decrement through the available port numbers. When the display shows the desired port, press ENTER to confirm the choice. Pressing ESC will cancel the edit. At this point, no change has yet occurred to any connections.

Now press OUT for a fan in switch, or press IN for a fan out switch. The appropriate field will change to edit mode, with the blinking cursor. The text message for this field includes the notation SEL to indicate that this field is the one that actually makes RF changes. Changes made here are going to affect the actual paths through the switches. Use the OFF key to break the RF connection, or enter 0 as the selection. When the display shows the desired port, press ENTER to confirm the choice. Pressing ESC will cancel the edit. The new RF connections are established at this time.

As digits are entered, they scroll left, to the maximum number of digits allowed for the matrix. If an incorrect digit is typed, follow it by correct digits, allowing the erroneous digit to “fall out” of the left of the display area. Leading zeroes may be entered to flush erroneous digits. The ENT key accepts only the digits actually displayed. An entry of “0” is the same as pressing the OFF key

When the ENT key is pressed, the Matrix verifies that the number entered by the operator is within the valid range of the matrix. If the operator enters a number that is out of range for the matrix (e.g. typing in “9” for a 8x8 matrix), the operation is aborted, and the LCD displays the previous selection. No change occurs in the RF path. If the number is accepted, the change is

made to the RF path, and the display is updated. Any leading zeroes are removed and the cursor disappears

4.3 Using the Menus

The menu system provides screens for configuring certain internal parameters, such as serial interface baud rates. It also provides status information regarding internal fault monitoring. There are screens to restore the matrix to its default settings. Menus are multi-level hierarchies. The operator chooses a level and moves to the next lower level until the specific items are reached

The normal display is the Connection screen, showing the state of the RF matrix. Press the MENU key to change to the first menu heading. Use the UP/DOWN keys to scroll through the headings. Press ENT to move down into the multi-level menus. Press ESC to return to the next higher menu level.

Once a specific parameter is reached, the parameter can be changed by using the UP/DN keys to see the various options. When the desired value is displayed, press ENT to make that the current value of the parameter. Press ESC to abort, and return to the next higher level.

Certain parameters require that the matrix be reset. The reset operation occurs automatically, without powering off the matrix. The LCD will show "Resetting" followed by the normal initialization screen. The RF connection will be restored, typically without actually being broken. The reset operation occurs whenever a communication parameter is changed (RS-232, RS-422 or Ethernet)

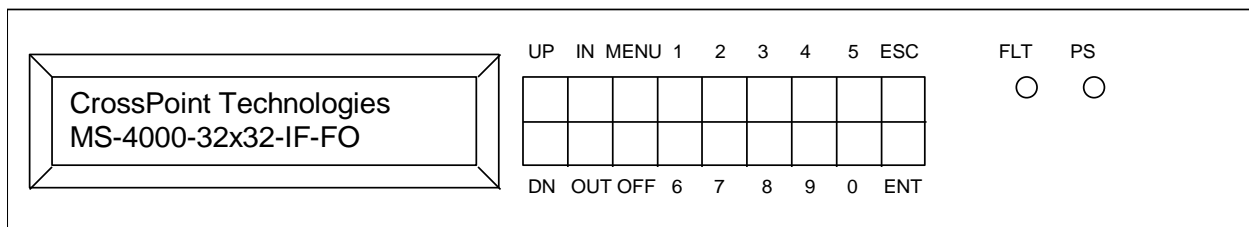
4.4 LCD screens and Menus

4.4.1 Menu Tree

- Startup Splash
- Connection Screen
 - Remote/Local Mode
 - BITE Status
 - Power Supply status
 - Internal communication status
 - Maintenance & Setup
 - Serial Options
 - RS232/RS422 Interface Selection
 - Baud Rate
 - Ethernet
 - DHCP enable
 - Static IP address set or DHCP address readback
 - Port
 - Static Net Mask
 - MAC (Hardware) address readback
 - System Network ID readback
 - Software Version
 - Set Defaults

4.4.2 Startup Splash

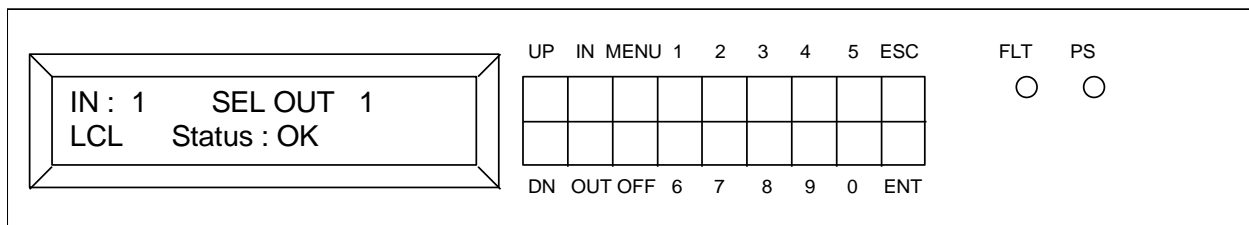
The splash screen is visible for 3 seconds after power on or reset. It gives the model number of the controller...



4.4.3 Connection Screen

Screen then goes to the Connection screen. This screen is visible whenever the user has not entered the Menu system. Connections can be changed from this screen if the Matrix is in Local (LCL) mode. Connections are restored to the state they were in at power down.

This screen can be accessed by pressing the ESC key several times in any other menus. The system will back out of menus until it reaches this display.



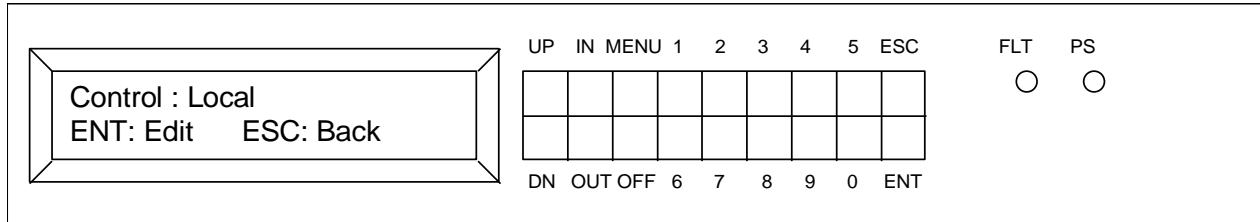
The sequence of keystrokes to make a connection will differ for Fan In vs. Fan Out switches. Fan Out switches allow each output to be connected to only a single input at a time, while allowing any input to be connected to multiple outputs simultaneously. Conversely, a Fan In matrix allows an input to be connected to a single output at a time, while an output can receive signals from many inputs simultaneously. The LCD display cannot easily show the multiple connections. Therefore, Fan Out switches are controlled by first specifying an output, and then selecting an input to route to that output. Fan In switches operate by first selecting an input and then selecting its single destination at an output.

The display above is from the 32x32-FO. The Output is noted as "SEL OUT" to reinforce the idea that the Output is being changed when a new selection is entered.

Begin by pressing the OUT key. The channel number can be entered using the numeric keys or by the UP/DN keys to scroll. Press ENT when complete. Pressing OFF will turn the RF path off completely. Entering an Input value of 0 will also turn the output OFF. After ENT is pressed, the blinking cursor will disappear, indicating that the connection has been made. If a number is entered that is out of range, the screen will revert to the previous Input, and no change in connection will occur. Pressing ESC will exit the Edit mode without making any changes.

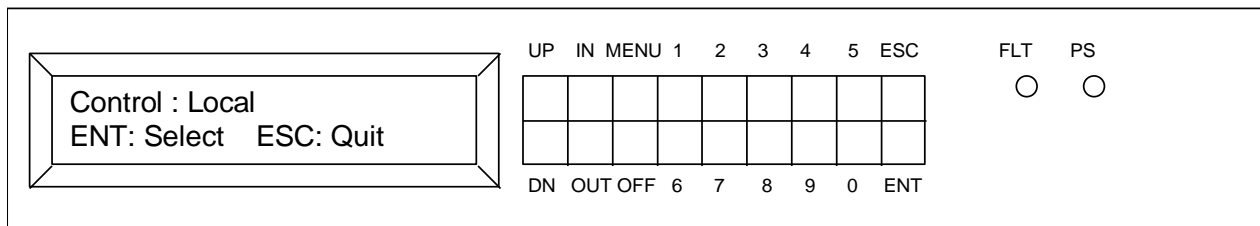
4.4.4 Remote/Local Control

From the connection screen, pressing MENU will bring up the first Menu heading. Scroll through the top level items using the UP/DN keys. Press ENT to step into a selection and view the current setting. Press ENT again to step into the list of choices. Choices are viewed by scrolling UP/DN. Press ENT to select a new parameter value. Press ESC to back up one level in the menu and abandon any changes. The first MENU screen will look like this:



The Matrix is in Local mode unless the remote computer has taken over the matrix. If the screen shows "Remote", front panel control is disabled. (Matrix settings can be viewed but not changed). When the system is in Remote mode, control can be acquired by pressing ENT to step into this menu item. Press UP or DN until the screen shows Local, as in the picture below. The bottom line instructs the operator to press ENT to confirm this change to Local mode. Pressing ESC will abandon the change, and back up one level to the top menu list.

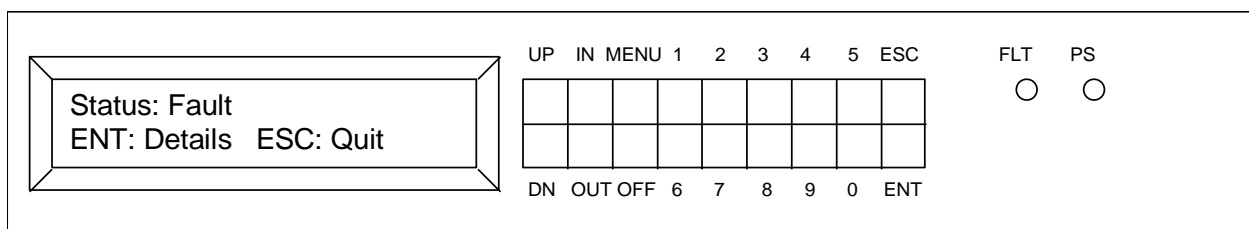
The system may also be in Local Lockout mode. In this mode, the remote computer has absolute control. This menu item cannot be used to regain control from a Local Lockout condition. The remote computer must place the Matrix into either Remote or Local modes or power must be cycled to release a Local Lockout.



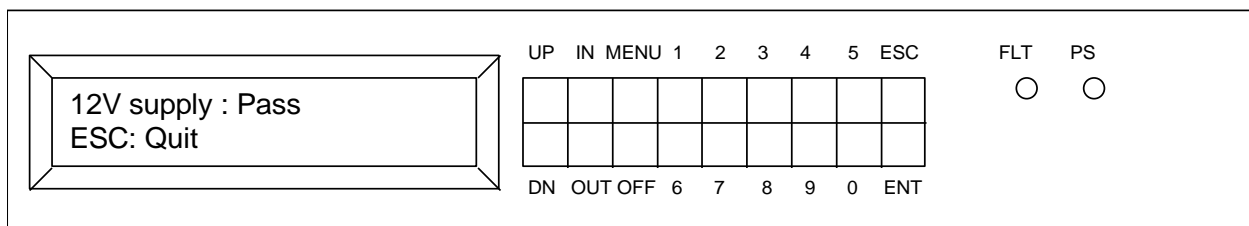
4.4.5 Status

The next top level Menu item, "Status", displays details from the built in test circuits. This example shows a Fault reported. The Red FLT lamp will be lit at all times when any fault is detected. If the problem is a power supply, the PS LED will be lit. Switches with redundant power supplies will have two LED's for this purpose. Press ENT to drop down and view details.

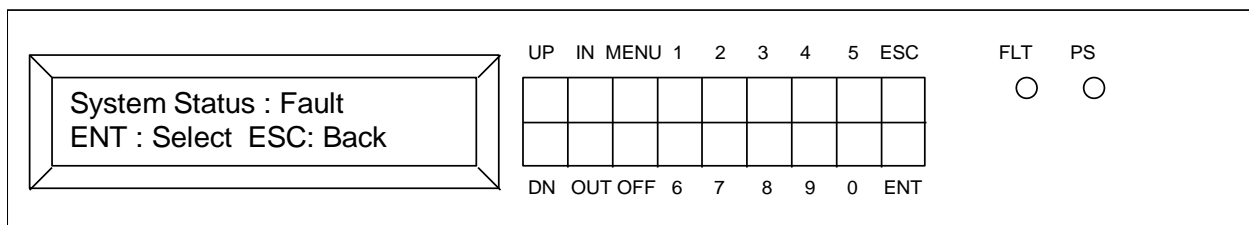
While in these menus, the screen is not updated dynamically. Changes to any fault status information are displayed once for that screen. To see the effect of changes, you must navigate out of that screen and re-enter to refresh the screen data.



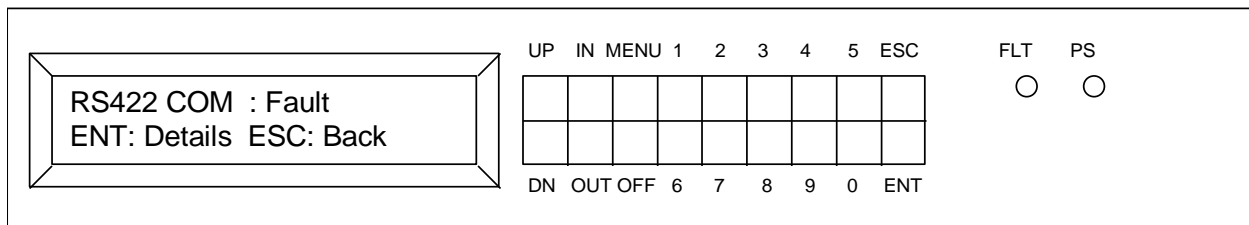
Use the UP/DN buttons to scroll through the various power supply voltages. A sample display is shown below:



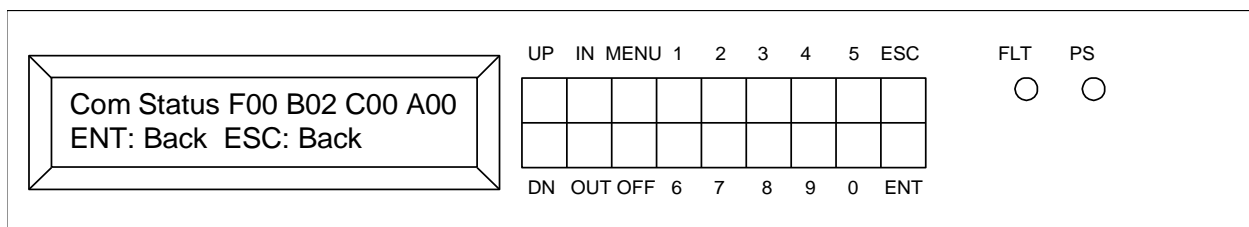
After scrolling through all the power supplies, the screen will show the internal communication status. This screen is as shown below. The message is "OK" if there are no faults.



Press Enter to see more details. The first screen is the internal RS422/485 communication state.



If a fault is present, there is an option to see details. Press Enter to get the next screen



These two fields show the communication between the master CPU and several other boards. The “F00” field is the Fault boards (power supply monitors). “F00” is the normal condition with no communication problems. If a Power supply fault board is not communicating properly, its appropriate bit is set. Multiple board failures result in multiple bits set in the hex ASCII string.

The MS-4000-16x16 and 32x32 switches have two of these Fault monitoring boards. Responses are listed below

Message	Fault board 1 – PSA 5,12, -5V	Fault board 2 – PSB 5, 2, -5V
F00	OK	OK
F01	Not communicating	OK
F02	OK	Not communicating
F03	Not communicating	Not communicating

The MS-4001 10x6, 12X6, and 16X6 have three of these boards.

Message	Fault board 1 – PSA 5,15V	Fault board 2 – PSB 5, 5V	Fault board 3 – PSA 28V, PSB 28V
F00	OK	OK	OK
F01	Not communicating	OK	OK
F02	OK	Not communicating	OK
F03	Not communicating	Not communicating	OK
F04	OK	OK	Not communicating
F05	Not communicating	OK	Not communicating
F06	OK	Not communicating	Not communicating
F07	Not communicating	Not communicating	Not communicating

Note that this fault does not have anything to do with power supply voltages, per se. However, if the main CPU cannot communicate with these boards, their voltage status will be reported with the last information that the CPU received.

The second item, “B02” is the state of the backplane controller communication. The 32x32 matrices have two backplane controllers. All other matrices have only a single backplane controller.

Message	Backplane Controller 1	Backplane Controller 2 (MS-4000-32x32 only)
B00	OK	OK
B01	Not communicating	OK
B02	OK	Not communicating
B03	Not communicating	Not communicating

The third item, “D00” is the state of the detector backplane communication, if the matrix has signal detection capability. The 32x32 matrices will have two detector backplanes. All other matrices have only a single detector backplane controller.

Message	Detector Backplane 1	Detector Backplane 2 (MS-4000-32x32 only)
D00	OK	OK
D01	Not communicating	OK
D02	OK	Not communicating
D03	Not communicating	Not communicating

The fourth item, "C01" is the state of the combiner controller communication. The MS-4001-32x32 matrices have one combiner controller installed. A 16x16 matrix or smaller has no combiner controller. The MS-4000 solid state switch matrix in its standard configuration does not have a combiner controller.

Message	Combiner Controller 1
COK	OK
C01	Not communicating

The fifth item, "A01" is the state of the Amplifier distribution boards. A MS-4001-32x32 has four of these boards installed when separate amplifier enclosures are provided.

Message	Amp Board 1, Amps 1-8	Amp Board 2, Amps 9-16	Amp Board 3, Amps 17-24	Amp Board 4, Amps 25-32
AOK	OK	OK	OK	OK
A01	No comm	OK	OK	OK
A02	OK	No comm	OK	OK
A03	No comm	No comm	OK	OK
A04	OK	OK	No comm	OK
A05	No comm	OK	No comm	OK
A06	OK	No comm	No comm	OK
A07	No comm	No comm	No comm	OK
A08	OK	OK	OK	No comm
A09	No comm	OK	OK	No comm
A0A	OK	No comm	OK	No comm
A0B	No comm	No comm	OK	No comm
A0C	OK	OK	No comm	No comm
A0D	No comm	OK	No comm	No comm
A0E	OK	No comm	No comm	No comm
A0F	No comm	No comm	No comm	No comm

If communication is lost with an Amplifier Distribution board, the amplifier pass/fail state and the associated power supplies in that chassis will be reported as their last known values.

After RS422 COM, scroll down to see the individual switch card status (or relay driver card status for MS-4001.)

Switch Card Status: Fault

ENT: Details ESC: Back

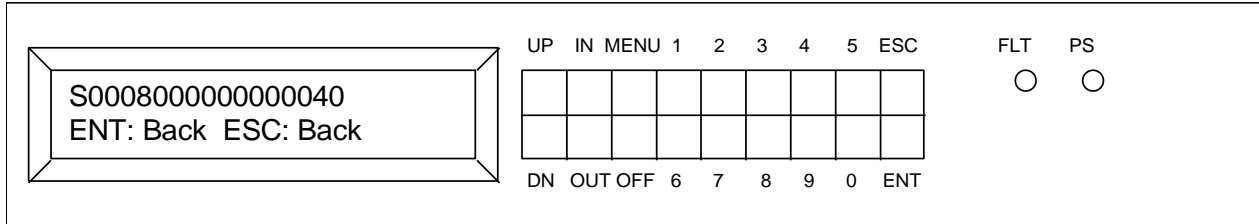
UPINMENU12345ESC

DNOUTOFF67890ENT

FLTPS

○○

Press ENTER to see details of the switch cards



This screen shows a long string of hex digits that indicate the communication status of each switch card in the matrix. The length of the string is 16 digits for the 32x32, and 16 digits for all other matrices.

Interpretation of the bits in this word is given below for each model

MS-4000-32x32-xx : using example S0008000000000040. The bold text "20" in the bottom card cage corresponds to the bit 3 being set in the hex digit "8". This card will carry inputs 17..32 for output 20. The bold text "7" in the Top card cage corresponds to the bit 2 being set in the hex digit "4". This card will carry inputs 1..16 for output 7. These examples indicate that the switch card in slots 20-bottom and 7-top are not communicating properly.

S (hex)	(binary)	Card cage	Bit 3	Bit 2	Bit 1	Bit 0
0 (MSB)	0000	Bottom	slot 32	31	30	29
0	0000		28	27	26	25
0	0000		24	23	22	21
8	1000		20	19	18	17
0	0000		16	15	14	13
0	0000		12	11	10	9
0	0000		8	7	6	5
0	0000		4	3	2	1
0	0000	Top	slot 32	31	30	29
0	0000		28	27	26	25
0	0000		24	23	22	21
0	0000		20	19	18	17
0	0000		16	15	14	13
0	0000		12	11	10	9
4	0100		8	7	6	5
0 (LSB)	0000		4	3	2	1

MS-4000-16x16-xx: using example S00000200. Notice that not all bits have meaning. The highlighted slot 7 corresponds to the bit 1 being set in the “2”. This example indicates that the switch card in slot 7 is not communicating properly.

S	Bit 3	Bit 2	Bit 1	Bit 0
0				
0				
0				
0				
0	Slot 1	2	3	4
2	5	6	7	8
0	9	10	11	12
0	13	14	15	Slot 16

MS-4001-10x6-xx, MS-4001-12x6-xx: using example S00000008. Notice that not all bits have meaning. The highlighted slot 3 corresponds to the bit 3 being set in the “8”. This example indicates that the relay driver card in slot 3 is not communicating properly.

S	Bit 3	Bit 2	Bit 1	Bit 0
0				
0				
0				
0				
0				
0				
0				
0			Slot 1	2
8	3	4	5	Slot 6

MS-4001-16X6-XB: using example S00000008. Notice that not all bits have meaning. The highlighted slot 3 corresponds to the bit 3 being set in the “8”. This example indicates that the relay driver card in slot 3 is not communicating properly.

S	Bit 3	Bit 2	Bit 1	Bit 0
0				
0				
0				
0				
0				
0				
0				
8	1	0	0	0

A display of S00000000 is the normal response with all relay driver cards operating properly.

Each Relay driver card failure is reported as follows:

Slot 1	S00000001
Slot 2	S00000002
Slot 3	S00000004
Slot 4	S00000008
Slot 5	S00000010
Slot 6	S00000020
Slot 7	S00000040
Slot 8	S00000080
Slot 9	S00000100
Slot 10	S00000200
Slot 11	S00000400
Slot 12	S00000800

Each group of 4 slots has its failures added together to determine a HEX value to be reported.

Slots 1, 2, 3, and 4 Group 1

Slots 5, 6, 7, and 8 Group 2

Slots 9, 10, 11, and 12 Group 3

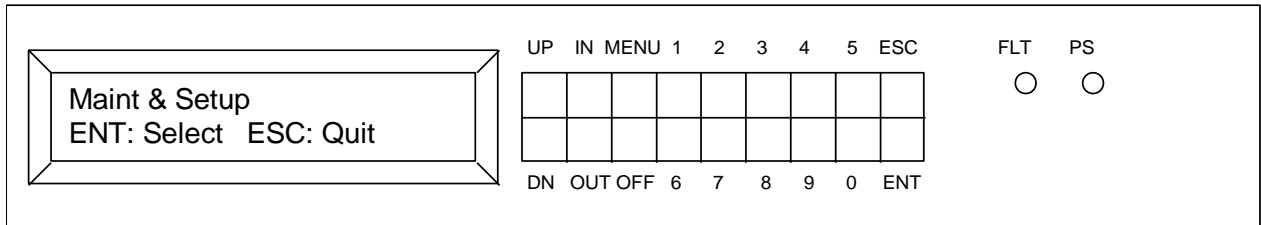
As an example, if S00000A13 being reported would show a failure of the Slots 1 and 2 (ex. 3), Slot 5 (ex. 1), and Slots 10 and 12 (ex. A)

Each Relay driver card function is as follows:

Slot 1	In 1-8 Out 1, also controls Out 1 2X1 Switch
Slot 2	In 9 -16 Out 1
Slot 3	In 1-8 Out 2, also controls Out 2 2X1 Switch
Slot 4	In 9 -16 Out 2
Slot 5	In 1-8 Out 3, also controls Out 3 2X1 Switch
Slot 6	In 9 -16 Out 3
Slot 7	In 1-8 Out 4, also controls Out 4 2X1 Switch
Slot 8	In 9 -16 Out 4
Slot 9	In 1-8 Out 5, also controls Out 5 2X1 Switch
Slot 10	In 9 -16 Out 5
Slot 11	In 1-8 Out 6, also controls Out 6 2X1 Switch
Slot 12	In 9 -16 Out 6

4.4.6 Maintenance & Setup

This top level menu item allows the setup of the serial port, and allows reading the software version identifier.



Press ENT to drop into the menu and scroll through the choices.

CAUTION

If any of the serial or Ethernet settings are changed, when the user navigates back to this top level menu item, the switch matrix will reset itself and begin using the new parameters. Switch matrix connections **will be interrupted** while this reset takes place, and will then be automatically restored. Reset typically takes less than 10 seconds, depending on network response times.

Serial Options

All serial communication settings are made from these menu items. Press ENT to drop into these items

<div>Serial Options</div> <div>ENT: Select ESC: Quit</div>	UP	IN	MENU	1	2	3	4	5	ESC	FLT	PS
										<input type="radio"/>	<input type="radio"/>
	DN	OUT	OFF	6	7	8	9	0	ENT		

The default RS232 mode is shown here.

<div>COM Mode: RS232</div> <div>ENT: Select ESC: Quit</div>	UP	IN	MENU	1	2	3	4	5	ESC	FLT	PS
										<input type="radio"/>	<input type="radio"/>
	DN	OUT	OFF	6	7	8	9	0	ENT		

Pressing ENT will allow scrolling through the other choices. RS422 and (future) Ethernet are selected from this menu. To select RS422, use UP/DN until the screen shows RS422. Press ENT to change the interface. Changing Serial mode parameters will cause the Matrix to reset itself automatically when the action is confirmed, and will be operational again in about 6 seconds.

<div>COM Mode: RS422</div> <div>Press ENT to Confirm</div>	UP	IN	MENU	1	2	3	4	5	ESC	FLT	PS
										<input type="radio"/>	<input type="radio"/>
	DN	OUT	OFF	6	7	8	9	0	ENT		

Similar menu choice selects baud rate. Factory default is 19200 baud.

<div>Baud Rate: 19200</div> <div>ENT: Edit ESC: Back</div>	UP	IN	MENU	1	2	3	4	5	ESC	FLT	PS
										<input type="radio"/>	<input type="radio"/>
	DN	OUT	OFF	6	7	8	9	0	ENT		

Press ENT to drop into the menu item and scroll through available choices. Press ENT to change the baud rate. Changing Serial mode parameters will cause the Matrix to reset itself automatically when the action is confirmed, and will be operational again in about 6 seconds

4.4.6.1 Software Version

This read only display shows the current installed version of firmware in the system controller.

<div>SW Version: v1.01</div> <div>ENT: Back ESC: Back</div>	UP	IN	MENU	1	2	3	4	5	ESC	FLT	PS
	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="radio"/>
	DN	OUT	OFF	6	7	8	9	0	ENT		

4.4.6.2 Ethernet Options

All Ethernet communication settings are made from these menu items. Press ENT to drop into these items

<div>Ethernet Options</div> <div>ENT: Select ESC: Quit</div>	UP	IN	MENU	1	2	3	4	5	ESC	FLT	PS
	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="radio"/>
	DN	OUT	OFF	6	7	8	9	0	ENT		

The default condition is for static IP addressing. Therefore, DHCP is off by default. The DHCP selection menu appears first because its state will have an effect on data items presented in later menus.

<div>DHCP: Off</div> <div>ENT: Edit ESC: Back</div>	UP	IN	MENU	1	2	3	4	5	ESC	FLT	PS
	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="radio"/>
	DN	OUT	OFF	6	7	8	9	0	ENT		

Pressing ENT will enter the DHCP edit mode. Then use the UP/DN keys to set DHCP ON or OFF as desired. Press ENT to accept the setting and return to this level of the menu. Press ESC to abort any change and leave the current value in place

The next menu item is the IP address screen. This screen shows either the static IP address assigned during setup (when DHCP is off) or it shows the address received from the DHCP initialization process if DHCP is enabled. If DHCP is enabled, but no address has been assigned, the screen will show an address of 000.000.000.000. In this case, communication with the matrix is not possible.

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> Addr: 192.168.001.053 ENT: Edit ESC: Back </div>	<div style="display: flex; justify-content: space-between; font-size: 0.8em;"> UP IN MENU 1 2 3 4 5 ESC FLT PS </div> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td></tr> <tr><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td></tr> </table> <div style="display: flex; justify-content: space-between; font-size: 0.8em;"> DN OUT OFF 6 7 8 9 0 ENT </div>																		

If DHCP is off, press ENT to manually set the IP address. Your network administrator will be able to help determine this address. The address must be manually typed using the numeric keys. Leading zeroes must be entered, as each field is a fixed 3 characters. Press ENT when done to accept the new address and return to the upper level menu. If DHCP is enabled, this screen is read-only.

The next menu item is the IP Port value. The default is Port 23, the standard port for Telnet services. If another port is desired, it may be set here. Ports in the full range 1..65535 are accepted. Leading zeroes are not required for this item.

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> Port: 23 ENT: Edit ESC: Back </div>	<div style="display: flex; justify-content: space-between; font-size: 0.8em;"> UP IN MENU 1 2 3 4 5 ESC FLT PS </div> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td></tr> <tr><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td></tr> </table> <div style="display: flex; justify-content: space-between; font-size: 0.8em;"> DN OUT OFF 6 7 8 9 0 ENT </div>																		

When using static addressing (DHCP Off), a network mask must be supplied. The next menu item allows this mask value to be entered. Like the IP address, leading zeroes are required because the number is broken into 4 fields, and a decimal point key is not available. Set the netmask according to the addressing system used in your network. Your Network Administrator will know what this value should be.

<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> Mask: 255.255.255.000 ENT: Edit ESC: Back </div>	<div style="display: flex; justify-content: space-between; font-size: 0.8em;"> UP IN MENU 1 2 3 4 5 ESC FLT PS </div> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td></tr> <tr><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td><td style="height: 20px;"> </td></tr> </table> <div style="display: flex; justify-content: space-between; font-size: 0.8em;"> DN OUT OFF 6 7 8 9 0 ENT </div>																		

If DHCP is On, this field is read only, and shows the last value entered manually, not the value in use on the network.

For system administration, it is often important to know the hardware MAC (Media Access Control) address. This address is assigned in silicon at the factory, and is globally unique among all Ethernet devices. The next menu item displays the MAC address of the matrix switch, and is read-only.

<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> MAC: 12:34:56:78:9A:BC ENT: Back ESC: Back </div>	UP IN MENU 1 2 3 4 5 ESC <table border="1" style="margin: 0 auto; width: 100px; height: 40px;"> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </table>																			FLT PS <input type="radio"/> <input type="radio"/>
	DN OUT OFF 6 7 8 9 0 ENT																			

In some networks the System Administrator will want to put a name for the switch into the IP routing tables. If DHCP is being used, the IP address can change dynamically, so it becomes difficult to find the matrix by its IP address. A name can be assigned, so that the matrix can be found by name-server techniques. To simplify this setup, the switch matrix creates a unique name for itself and registers this name with the local router during DHCP initialization. The name is always of the format "CPTI_" followed by the last 6 characters of its MAC address. (The first 6 characters of the MAC will always be the same for all CrossPoint products, so they add no uniqueness to the name). The CPTI_ header allows the matrix to be easily identified in a router table by the System Administrator, and matched to a specific switch matrix.

<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> Name: CPTI_78:9A:BC ENT: Back ESC: Back </div>	UP IN MENU 1 2 3 4 5 ESC <table border="1" style="margin: 0 auto; width: 100px; height: 40px;"> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </table>																			FLT PS <input type="radio"/> <input type="radio"/>
	DN OUT OFF 6 7 8 9 0 ENT																			

4.4.7 Set Defaults

This menu item erases all communication parameters, and sets the matrix to RS232, 19200 baud. All switches are set to their OFF condition (Failsafe models revert to failsafe condition). The Matrix resets itself and will be operational again in about 6 seconds.

<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> Set Defaults Press ENT to Confirm </div>	UP IN MENU 1 2 3 4 5 ESC <table border="1" style="margin: 0 auto; width: 100px; height: 40px;"> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </table>																			FLT PS <input type="radio"/> <input type="radio"/>
	DN OUT OFF 6 7 8 9 0 ENT																			

5 Remote Control

5.1 Interfaces

The matrix system may be controlled by serial port or by Ethernet (if installed). For serial control, a dumb terminal or terminal emulator program, such as HyperTerm (found on most PC's) provides a manual interface for simple command entry and status message readback. For Ethernet control, a Telnet program (or Hyperterm) provides similar capability across the network.

The matrix system does not echo characters as they are typed, so use the Local Echo feature of your program to see what you type. Every completed command returns either a copy of what was received, or an error code. This reply returns after the command has executed, signaling that the command was acted upon.

5.2 Protocol

All messages and responses over the User IO interface are ASCII strings. No binary data is transmitted over this interface. Commands consist of 2 ASCII characters and may require an optional parameter string. Commands are terminated by carriage return (hex 0D). Execution does not begin until the carriage return is received.

Multiple commands may be sent on the same line if separated by a semicolon (;). Incoming command strings are limited to 63 characters, including the carriage return. Outgoing responses are truncated if they would exceed 255 characters.

In most cases, a command mnemonic can be followed by an ASCII question mark ("?"). This form of the command will be interpreted as a status request and the current value associated with that command will be returned. The state of the device will not be altered by a status request.

Parameters are typically separated by commas. Certain commands can have multiple parameter sets which are separated by parentheses.

The 2 character mnemonics are case insensitive on receipt, but will be upper case in the response.

Transmit and receive operations are synchronous to one another. Incoming commands and status requests are executed in the order received. Responses are returned when the command is complete. All commands are echoed after completion as a verification to the remote computer. If the host computer does not wait for the response string, it should allow 250 msec between commands to ensure that it does not overrun internal buffers.

When input numbers or output numbers are required as parameters, they may omit leading zeroes. Up to 3 characters are accepted. The maximum matrix size is 999 x 999.

When parameters are out of range (e.g. an input number is higher than the number of installed inputs), those specific portions of the command are ignored. In commands which include lists of items, all items are processed unless an error is encountered. All items after an error are discarded, as well as the error itself. An error response is returned.

Command Set

5.2.1 Summary

Mnemonic	Description
AO	All Switches Open
AR	Amplifier Status Report (optional hardware required)
CE	Clear Last Error
CS	Internal Communication Status
DS	Report All switch positions
ER	Error Response
FB	Signal Path Connection Report (optional hardware required)
LE	Report Last Fault
ID	Identify Matrix
RD	Restore Defaults
RL	Remote/Local state
SC	Switch Close
SD	Signal Detector Report (optional hardware required)
SO	Switch Open
SZ	Matrix Size
TR	Test Report

NOTE: Refer to Addendum for commands specific to the MS-4001-32x32-HF Switch Matrix

5.2.2 Detailed Command and Status Formats**AO All Switches Open**

FORMAT: (1) AO

RESPONSE: (1) AO - if the matrix is not Failsafe type
(2) FS - if the matrix is a Failsafe type.

DESCRIPTION: Opens all switches in the matrix or sets them to their failsafe positions.

AR Amplifier Status Report (optional hardware required)

FORMAT: (1) AR
(2) AR?

RESPONSE: (1) same as format 2
(2) AR001P,002P,003P,004F,005P,.... ,032P
(3) ER003:AR

DESCRIPTION: When separate amplifier chassis are used, the system reports the health of the amplifiers with this command. Each amplifier is monitored by watching its DC current. If the current is either too high or too low, the amplifier is reported as failed. The response returns each channel number and a 'P' indicating Pass, or a 'F' indicating Fail. Response 3 is returned if the optional hardware is not installed

CE Clear Last Error After Reporting

FORMAT: (1) CE

RESPONSE: (1) CE0000

DESCRIPTION: Returns hex ASCII value (16 bits as 4 characters.) This is a bit mapped indication of the most recent fault information. After returning this value, the error bits are reset. CE0000 indicates there were no faults since last CE command. This command is identical to the LE command, except that LE does not clear the fault information after reporting it. See LE command for more detail on the meaning of the bits in the response.

CS Communication Status

FORMAT: (1) CS

RESPONSE: (1) CSFOK,BOK,DOK,COK,AOK,S0000000000000000
 (2) CSFOK,BOK,S0000000000000000
 (3) CSF01,B01,D01,C01,A01, S0000000000000000
 (4) CSF01,B01, S0000000000000000

DESCRIPTION: returns communication faults if any. Response 1 and 3 correspond to switches with signal detectors, combiner controllers and amplifier distribution boards installed. Responses 2 and 4 are returned from switches without signal detectors, combiner controllers or amplifier distribution boards. FOK indicates all PS fault boards are communicating properly. BOK indicates all the backplane controller boards are communicating properly. DOK, if present, indicates that detector backplanes are communicating properly. AOK, if present, indicates that the amplifier power distribution boards are communicating properly. COK, if present, indicates that the combiner controller boards are communicating properly.

If there are current faults, they will be returned in two hex digits as shown in response 3 and 4. The F01 and B01 (and D01, C01, A01 if their respective boards are installed) error messages can be interpreted according to the tables below. The S00... string shows communication failures to the switch cards or relay driver cards. These bits can be interpreted according to the tables in the front panel discussion of these faults. A matrix up to 32x32 returns 16 digits after the 'S'. A matrix that is 16x16 or smaller returns 8 digits after the 'S'.

The MS-4001-32x32-HF Matrices have three of these boards.

Message	Fault board 1 – PSA 5,15V	Fault board 2 – PSB 5, 5V	Fault board 3 – PSA 28V, PSB 28V
FOK	OK	OK	OK
F01	Not communicating	OK	OK
F02	OK	Not communicating	OK
F03	Not communicating	Not communicating	OK
F04	OK	OK	Not communicating
F05	Not communicating	OK	Not communicating
F06	OK	Not communicating	Not communicating
F07	Not communicating	Not communicating	Not communicating

Note that this fault does not have anything to do with power supply voltages, per se. However, if the main CPU cannot communicate with these boards, their voltage status will be reported with the last information that the CPU received.

The second item, “B02” is the state of the backplane controller communication. The 32x32 matrices have two backplane controllers. All other matrices have only a single backplane controller.

Message	Backplane Controller 1	Backplane Controller 2 (MS-4000-32x32 only)
BOK	OK	OK
B01	Not communicating	OK
B02	OK	Not communicating
B03	Not communicating	Not communicating

The third item, “D01” is the state of the detector backplane communication, if the matrix has signal detection capability. The 32x32 matrices have two detector backplanes if this feature is installed. A 16x16 matrix or smaller will have only a single detector backplane controller (if installed).

Message	Detector Backplane 1	Detector Backplane 2 (MS-4000-32x32 only)
DOK	OK	OK
D01	Not communicating	OK
D02	OK	Not communicating
D03	Not communicating	Not communicating

The fourth item, “C01” is the state of the combiner controller communication. The MS-4001-32x32 matrices have one combiner controller installed. A 16x16 matrix or smaller has no combiner controller. The MS-4000 solid state switch matrix in its standard configuration does not have a combiner controller.

Message	Combiner Controller 1
COK	OK
C01	Not communicating

The fifth item, “A01” is the state of the Amplifier distribution boards. A MS-4001-32x32 has four of these boards installed when separate amplifier enclosures are provided.

Message	Amp Board 1, Amps 1-8	Amp Board 2, Amps 9-16	Amp Board 3, Amps 17-24	Amp Board 4, Amps 25-32
AOK	OK	OK	OK	OK
A01	No comm	OK	OK	OK
A02	OK	No comm	OK	OK
A03	No comm	No comm	OK	OK
A04	OK	OK	No comm	OK
A05	No comm	OK	No comm	OK
A06	OK	No comm	No comm	OK
A07	No comm	No comm	No comm	OK
A08	OK	OK	OK	No comm
A09	No comm	OK	OK	No comm
A0A	OK	No comm	OK	No comm
A0B	No comm	No comm	OK	No comm
A0C	OK	OK	No comm	No comm
A0D	No comm	OK	No comm	No comm
A0E	OK	No comm	No comm	No comm
A0F	No comm	No comm	No comm	No comm

If communication is lost with an Amplifier Distribution board, the amplifier pass/fail state and the associated power supplies in that chassis will be reported as their last known values.

The last item is the state of the switch card communication. The bits in this hex ASCII message can be interpreted according to the table below, using a 32x32 matrix with an example response of "S0008000000000040". The leftmost bit is card 64, and the rightmost bit is card 1. Cards 1..32 are in the top card cage. Cards 33..64 are in the lower card cage.

Each bit in the hex response is shown with its respective output channel number. Each output requires two cards – one in the top cage and one in the bottom cage. The top cards process inputs 1..16 for their respective outputs. The cards in the bottom cage process inputs 17..32 for their respective outputs.

The bold text "20" in the bottom card cage corresponds to the bit 3 being set in the hex digit "8". This card will carry inputs 17..32 for output 20. The bold text "7" in the Top card cage corresponds to the bit 2 being set in the hex digit "4". This card will carry inputs 1..16 for output 7. These examples indicate that the switch card in slots 20-bottom and 7-top are not communicating properly.

S (hex)	(binary)	Card cage	Bit 3	Bit 2	Bit 1	Bit 0
0 (MSB)	0000	Bottom	slot 32	31	30	29
0	0000		28	27	26	25
0	0000		24	23	22	21
8	1000		20	19	18	17
0	0000		16	15	14	13
0	0000		12	11	10	9
0	0000		8	7	6	5
0	0000		4	3	2	1
0	0000	Top	slot 32	31	30	29
0	0000		28	27	26	25
0	0000		24	23	22	21
0	0000		20	19	18	17
0	0000		16	15	14	13
0	0000		12	11	10	9
4	0100		8	7	6	5
0 (LSB)	0000		4	3	2	1

The MS-4001-16X6-XB switch is unique in that 2 separate Relay Driver cards are used to make a switch connection: using example S00000008. Notice that not all bits have meaning. The highlighted slot 3 corresponds to the bit 3 being set in the "8". This example indicates that the relay driver card in slot 3 is not communicating properly.

S	Bit 3	Bit 2	Bit 1	Bit 0
0				
0				
0				
0				
0				
0				
0				
8	1	0	0	0

A display of S00000000 is the normal response with all relay driver cards operating properly.

Each Relay driver card failure is reported as follows:

Slot 1	S00000001
Slot 2	S00000002
Slot 3	S00000004
Slot 4	S00000008
Slot 5	S00000010
Slot 6	S00000020
Slot 7	S00000040
Slot 8	S00000080
Slot 9	S00000100
Slot 10	S00000200
Slot 11	S00000400
Slot 12	S00000800

Each group of 4 slots has its failures added together to determine a HEX value to be reported.

Slots 1, 2, 3, and 4 Group 1
 Slots 5, 6, 7, and 8 Group 2
 Slots 9, 10, 11, and 12 Group 3

As an example, if S00000A13 being reported would show a failure of the Slots 1 and 2 (ex. 3), Slot 5 (ex. 1), and Slots 10 and 12 (ex. A)

Each Relay driver card function is as follows:

Slot 1	In 1-8 Out 1, also controls Out 1 2X1 Switch
Slot 2	In 9 -16 Out 1
Slot 3	In 1-8 Out 2, also controls Out 2 2X1 Switch
Slot 4	In 9 -16 Out 2
Slot 5	In 1-8 Out 3, also controls Out 3 2X1 Switch
Slot 6	In 9 -16 Out 3
Slot 7	In 1-8 Out 4, also controls Out 4 2X1 Switch
Slot 8	In 9 -16 Out 4
Slot 9	In 1-8 Out 5, also controls Out 5 2X1 Switch
Slot 10	In 9 -16 Out 5
Slot 11	In 1-8 Out 6, also controls Out 6 2X1 Switch
Slot 12	In 9 -16 Out 6

DS Dump Switch States

FORMAT: (1) DS
(2) DS?

RESPONSE: (1) same as format (2)
(2) DS(xxx,yyy)(zzz,www)...

The responses are organized as (input, output). Pairs are enclosed in parentheses. A selection value of "0" signifies an no connection

DESCRIPTION: Dumps a list of all connections. This is a status request only. No changes to switches will occur.

EXAMPLES: DS(000,001) (005,002) (006,003) (005,004): from MS-4000-6x4-IF-FO . In the example, Output 1 is set to off (000), output 2 is set to input 005, output 3 is set to input 006, output 4 is set to input 005. Note that input 5 is sent to outputs 2 and 4.

ER Error Reply

DESCRIPTION: If the system detects an error in an incoming command, it will reply with ERxxx where the xxx is a numeric code indicating the error type. The offending command string may be appended after a colon.

EXAMPLE: sending a command "FG3" which is an unknown command will cause the system to reply with "ER001:FG". The list of possible error codes are:

Error Code	Description	Comments
ER001	Unrecognized command	
ER002	one or more parameters are incorrect	not used for numeric range errors
ER003	Command not applicable to this particular device	
ER004	one or more numeric parameters are out of range	
ER005	something wrong in how info is grouped (parens, semicolons, etc)	

FB Signal Path Connection Report (optional hardware required)

FORMAT: (1) FB
(2) FB?
(3) FB1,05

RESPONSE: (1) same as (2)
(2) FB001C,002X,003O,004C,.....,032C
(3) FB001C,005X
(4) ER003:SD

DESCRIPTION: Reports whether the selected path is complete to each output. Response with each channel number in fixed format of 3 digits, and trailing 'C' if the connection is present, or 'X' if the connection is not complete, or 'O' (oh) if the selected output is in the Off state. Format 3 queries specific channels only. Leading zeroes are not required for the incoming command, but will be placed in the response. Response 4 occurs if the optional signal detectors are not installed.

ID Device ID

FORMAT: (1) ID
 (2) ID?

RESPONSE: (1) same as (2)
 (2) IDCrossPoint Technologies MS-4001-32x32-HF (example)

DESCRIPTION: Returns ASCII string identifying the Switch Matrix model. May be used as a confirmation that the device is communicating.

LE Last Fault Query

FORMAT: (1) LE

RESPONSE: (1) LE0000

DESCRIPTION: Returns hex ASCII value (16 bits as 4 characters.) This is a bit mapped indication of the most recent fault information. LE0000 indicates there were no faults since power up. This query can be used if there is an intermittent fault. Faults are reported as current conditions. (See TR and CS queries) If a fault occurs briefly, it is usually an indication of a missed poll or checksum error on the internal communication links. These faults are recoverable and require no user interaction. However, to confirm that situation, the LE query can be used.

The response bit maps are model specific because of the different voltages used in each matrix. The MS-4000 32x2 and 16x16 share the same message mapping. The MS-4001 10x6 and 12x6 share a common mapping. These are shown below

MS-4000 32x32, MS-4000 16x16 using response example LE2000. Not all bits are assigned in each model. The example indicates that one of the switch cards failed to respond in time, or indicted a checksum error to an I²C message on the backplane. However, if there are no current faults, then the switch cards are all communicating successfully and require no action. Occasional, intermittent voltage faults usually indicate noise spikes that got through the filters to the A to D converter, and are also not significant.

LE	Bit 3	Bit 2	Bit 1	Bit 0
2		485 Com Fault (Fault boards, Backplane controllers)	I ² C Com Fault (Switch cards / Relay Driver cards)	-5V B
0	-5V A		12V B	12V A
0				
0		5V B	5V A	Battery

MS-4001 10x6, MS-4001 12x6 using response example LE4000. Not all bits are assigned in each model. The example indicates that one of the PS Fault cards or Backplane controller cards failed to respond in time, or indicted a checksum error to an RS-485 message on the internal communication link. However, if there are no current faults, then the cards are all communicating successfully and require no action. Occasional, intermittent voltage faults usually indicate noise spikes that got through the filters to the A to D converter, and are also not significant.

LE	Bit 3	Bit 2	Bit 1	Bit 0
4		485 Com Fault (Fault boards, Backplane controllers)	I ² C Com Fault (Switch cards / Relay Driver cards)	
0			12V B	12V A
0		28V B	28V A	
0		5V B	5V A	Battery

MS-4001-4x4-LB-MW-P using response example LE0080. Not all bits are assigned in each model. The example indicates that the 24V DC power supply has failed.

LE	Bit 3	Bit 2	Bit 1	Bit 0
0		485 Com Fault (Fault boards, Backplane controllers)	I ² C Com Fault (Switch cards / Relay Driver cards)	
0				
8		24V		
0			5V	Battery

RD Restore Defaults

FORMAT: (1) RD

RESPONSE: none

DESCRIPTION: restores defaults to all communication settings and **sets all switch paths to OFF condition**. Serial port will revert to RS232 at 19200 baud. Ethernet will revert to static addressing, (DHCP off) with a default address of 192.168.1.100, IP mask of 255.255.255.000 and port 23. The matrix will reset. No response is sent because of the reset operation.

CAUTION

When this command is executed, the switch matrix will reset itself and begin using the new communication parameters. All Switch matrix connections will be disconnected and remain so until new connections are assigned. Reset typically takes less than 10 seconds, depending on network response times.

CAUTION

The computer that sends this command may find it cannot communicate after this command because of the changes to the communication parameters. There is no other command to change serial or Ethernet settings remotely. To disconnect all switch settings without changing any communication parameters, use the AO command.

RL Remote or Local control

FORMAT: RL[R|L|K]
 RL?

Where R = Remote mode
 L = Local Mode
 K = Remote with Local lockout mode

RESPONSE: RL[R|L|K]

DESCRIPTION: Determines whether the device uses the local keyboard or the Host port for commands. In Remote mode, the local front panel keys are disabled, though the user can regain Local control by suing the proper menu. In Local mode, the keys are enabled. While in Local mode, the Host port can assert control by issuing the RLR command. This will place the device in Remote mode, and disable the keyboard. (Most recent device to request control gets control) If the Host computer sends RLK, the front panel is locked out. The Host computer must issue the RLL or RLR command to remove the locked state.

EXAMPLE: RLL places the Switch Matrix in local mode, enabling the front panel.

DEFAULT: Powers up in Local mode, regardless of how it was configured at power down. This allows manual recovery from the lockout condition (RLK).

SC Switch Close

FORMAT: (1) SC(xxx,yyy)(zzz,aaa)..
 (2) SCxxx? (fan in)
 (3) Scyyy? (fan out)
 Where xxx and zzz = input channel number in ASCII format
 Yyy and aaa = output channel number in ASCII format
 Notice that the parameters pairs are in (input,output) order regardless of the type of matrix (fan in or fan out). For a fan out switch, specifying an output connected to input 0 (0,yyy) is equivalent to issuing the SO command for that channel (SOyyy). The output will be disconnected from all inputs. Similarly, for a fan in switch, specifying an input connected to output 0 (xxx,0) is equivalent to issuing the SO command for that channel (SOxxx).

RESPONSE: (1) SC(xxx,yyy)(zzz,aaa)..
 (2) SC(xxx,yyy) A value of 0 indicates the input or output is unconnected (equivalent to SOxxx)

DESCRIPTION: This command connects a list of specified outputs to specified inputs.

SD Signal Detector Report (optional hardware required)

FORMAT: (1) SD
 (2) SD?
 (3) SD1,05

RESPONSE: (1) same as (2)
 (2) SD001P,002P,003P,004A,....,032P
 (3) SD001P,005P

DESCRIPTION: Reports whether signal power is detected at each output. Response with each channel number in fixed format of 3 digits, and trailing 'P' if power is present or 'A' if power is absent. Format 3 queries specific channels only. Leading zeroes are not required for the incoming command, but will be placed in the response.

SO Switch Open

FORMAT: (1) SOxxx,yyy
 Where xxx,yyy = comma separated list of output channel numbers in ASCII
 format (fan out) or a comma separated list of input channel numbers in ASCII
 format (fan in)

RESPONSE: (1) SOxxx,yyy

DESCRIPTION: This command disconnects specified outputs from all inputs. Equivalent to SC(xxx,0)(yyy,0) for fan out matrix or SC(0,xxx)(0,yyy) for fan in matrix

SZ Switch Size

FORMAT: (1) SZ
 (2) SZ?

RESPONSE: (1) same as (2)
 (2) SZxxx,yyy
 Where xxx = number of inputs and yyy = number of outputs.

DESCRIPTION: Returns the size of the matrix switch.

TR Report Test Results

FORMAT: (1) TR
 (2) TR?

RESPONSE: (1) same as (2)
 (2) TR"string"
 where
 "string" is an ASCII string composed of internal values and parameters,
 and is dependent upon the configuration of the matrix

DESCRIPTION: Returns test data (BITE) results. Return string will contain pass/fail indications for internal tests such as power supply voltages and switch cards.

EXAMPLE: Normal response might look like TR5V:P,BAT:P,12V:F. This response shows the 5V and Batteries both Pass internal monitoring, while the 12V supply failed. Redundant supplies will use an A or B designation to distinguish the status of the individual supplies. Most devices will return longer strings than this example.

MS4001-32x32-HF Response, with external amplifier chassis:

TRBAT:P,5V-A:P,5V-B:P,15V-A:P,15V-B:P,28V-A:P,28V-B:P,28V-C:P,28V-D:P,28V-E:P,28V-F:P

Appendix

Includes

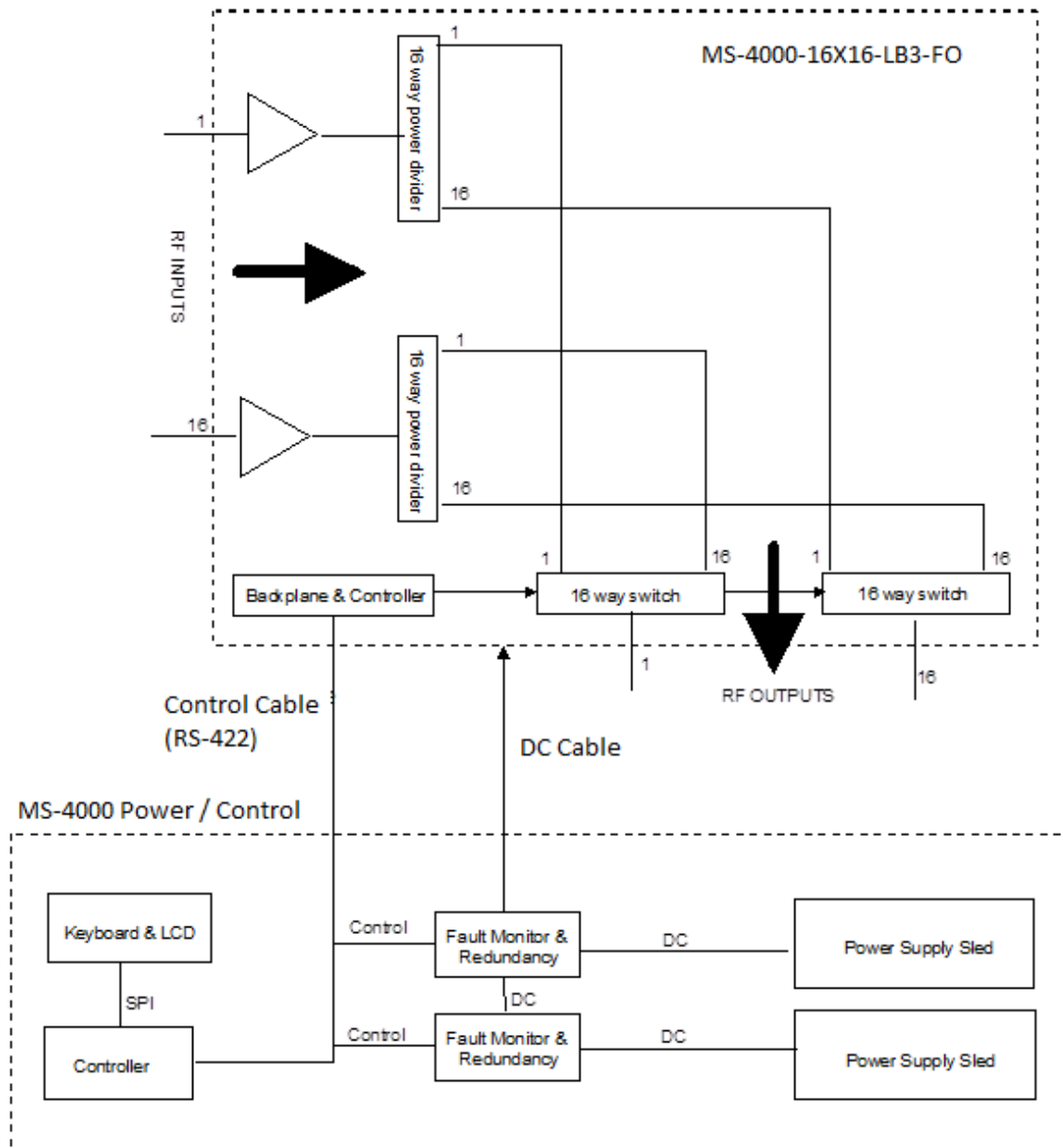
- Block Diagrams**
- Specifications**
- Panel Drawings**
- Connectors**
- Spares**

These configurations are covered in this Appendix.

- MS-4000-16x16-LB3-FO
- MS-4000-16x16-LB3-FI
- MS-4000-32x32-IF-FO
- MS-4000-32x32-IF-FI
- MS-4001-10x6-XB-FO
- MS-4001-12x6-KU-FO
- MS-4001-4x4-LB-MW-P
- MS-4001-32x32-HF
- MS-4000-8x32-LB-FO
- MS-4000-16x32-LB-FO
- MS-4000-32x8-LB-FI
- MS-4000-32x16-LB-FI
- MS-4000-8x8-LB3-FO
- MS-4000-8x8-LB3-FI
- MS-4001-16x6-XB-FO

A. MS-4000-16x16-LB3-FO

Part Number: CPT-006-1210

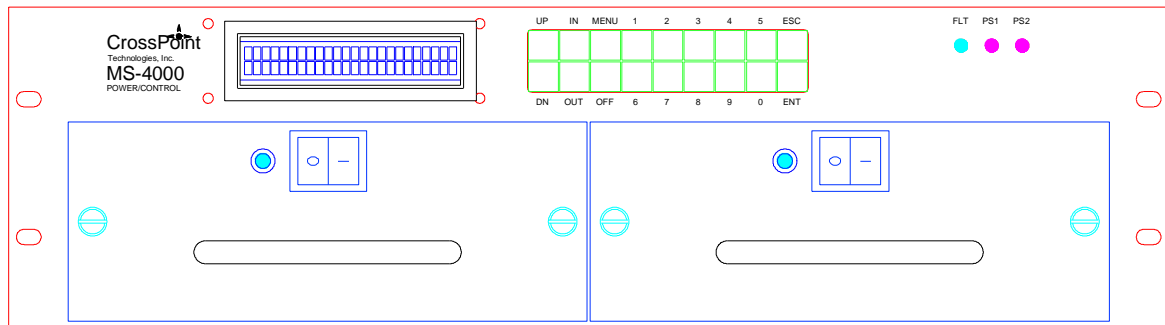


Block Diagram

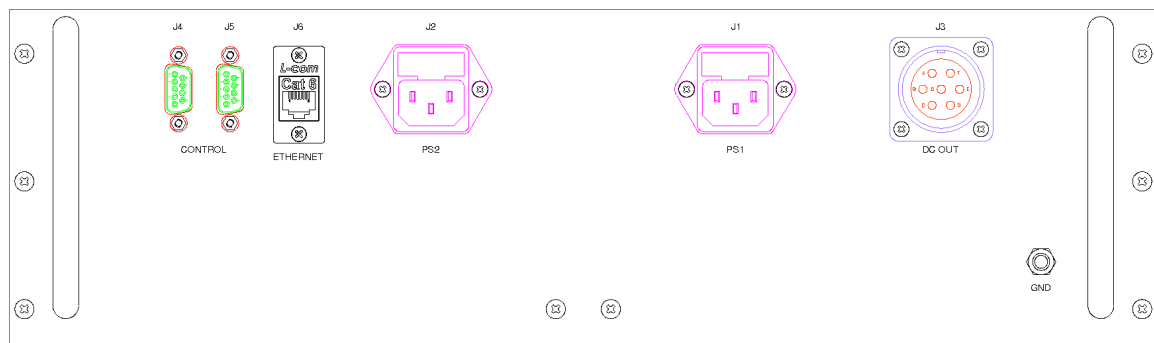
Specification	Conditions	Min	Typ	Max	Units
Frequency Range		950		2150	MHz
Gain		-2	0	+2	dB
Off-Isolation		50	60		dB
In-In Isolation		60	65		dB
Out-Out Isolation		55	60		dB
Impedance			50		Ω
VSWR			1.6	1.8	
1dB Output Compression		0	+3		dBm
NF			14	16	dB
IP3(input)		+14			dBm
Temperature (Op)		0		50	°C
AC Voltage		88		260	VAC
Power Consumption			200	400	W

Dimensions: 17 x 18 deep x 5.25 high (nominal) : 3 RU Switch
 17 x 18 deep x 5.25 high (nominal) : 3 RU Controller / PS
 Switch Type: Coaxial Relay
 Control: RS232 or RS422 selectable, and Ethernet
 Connectors: SMA-F in and out

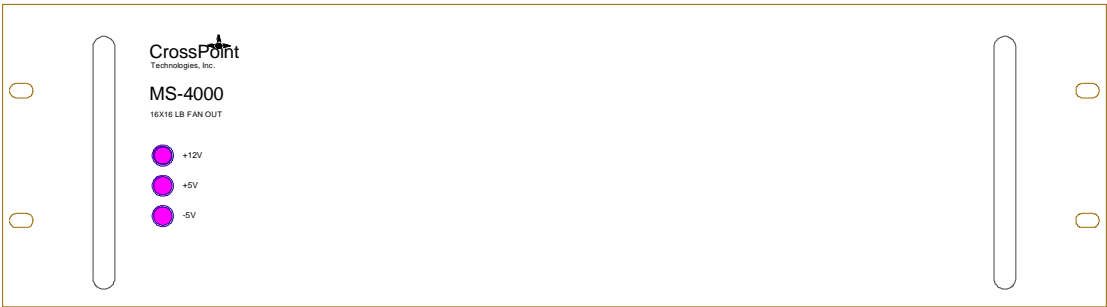
NOTE: MS-4000-16X16-LB-FO units shipped before 2012 covered the 950 MHz to 1750 MHz frequency range and did not include Ethernet control.



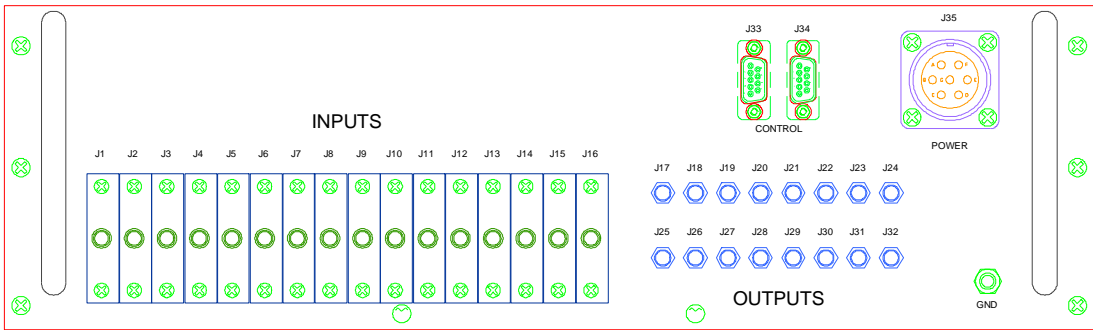
Front Panel – Power Supply / Controller



Rear panel – Power Supply / Controller



Front Panel - Switch



Rear panel - Switch

Connector List

Power / Control

Ref	Connector Type	Name
J1	IEC	AC Input (PS1)
J2	IEC	AC Input (PS2)
J3	7 Pin Circular	DC Out
J4	D9	Serial Control In/Out
J5	D9	Switch Chassis Control In/Out
J6	RJ45	Ethernet Control
	Stud	Ground

Switch

Ref	Connector Type	Name
J1	SMA-F	Input 1
J2	SMA-F	Input 2
J3	SMA-F	Input 3
J4	SMA-F	Input 4
J5	SMA-F	Input 5
J6	SMA-F	Input 6
J7	SMA-F	Input 7
J8	SMA-F	Input 8
J9	SMA-F	Input 9
J10	SMA-F	Input 10
J11	SMA-F	Input 11
J12	SMA-F	Input 12
J13	SMA-F	Input 13
J14	SMA-F	Input 14
J15	SMA-F	Input 15
J16	SMA-F	Input 16
J17	SMA-F	Output 1
J18	SMA-F	Output 2
J19	SMA-F	Output 3
J20	SMA-F	Output 4
J21	SMA-F	Output 5
J22	SMA-F	Output 6
J23	SMA-F	Output 7
J24	SMA-F	Output 8
J25	SMA-F	Output 9
J26	SMA-F	Output 10
J27	SMA-F	Output 11
J28	SMA-F	Output 12
J29	SMA-F	Output 13
J30	SMA-F	Output 14
J31	SMA-F	Output 15
J32	SMA-F	Output 16
J33	D-9	Serial Control
J34	D-9	Serial Control
J35	7 pin circular	DC Input
	Stud	Ground

Spares List

Power / Control (PL-CPT-006-1220)

Ref	Qty per	Recommended Spares Qty	Part Number	Description
A1A1	1	-	CPT-006-1230	Rabbit Carrier Board , Programmed
A1A2	1	-	CPT-012-1220	Key Board Assembly
A1A3	1	-	LCM-S02402DSF	LCD & Backlight Module
A1A4, A1A5	2	1	CPT-006-1228	Power Supply Sled Assy
A1A4A1, A1A5A1	2	1	GLC65-5	Power Supply, 5V
A1A4A2, A1A5A2	2	1	GPFC250-12	Power Supply, 12V
A1A4A3, A1A5A3	2	1	GSC20-5	Power Supply, 5V
A1A6, A1A7	2	1	CPT-006-1227	Power Supply Fault Board, 5V, 12V, -5V
A1A8, A1A9	2	1	P0007-ND	Fan, 12 VDC, 3.149 SQ

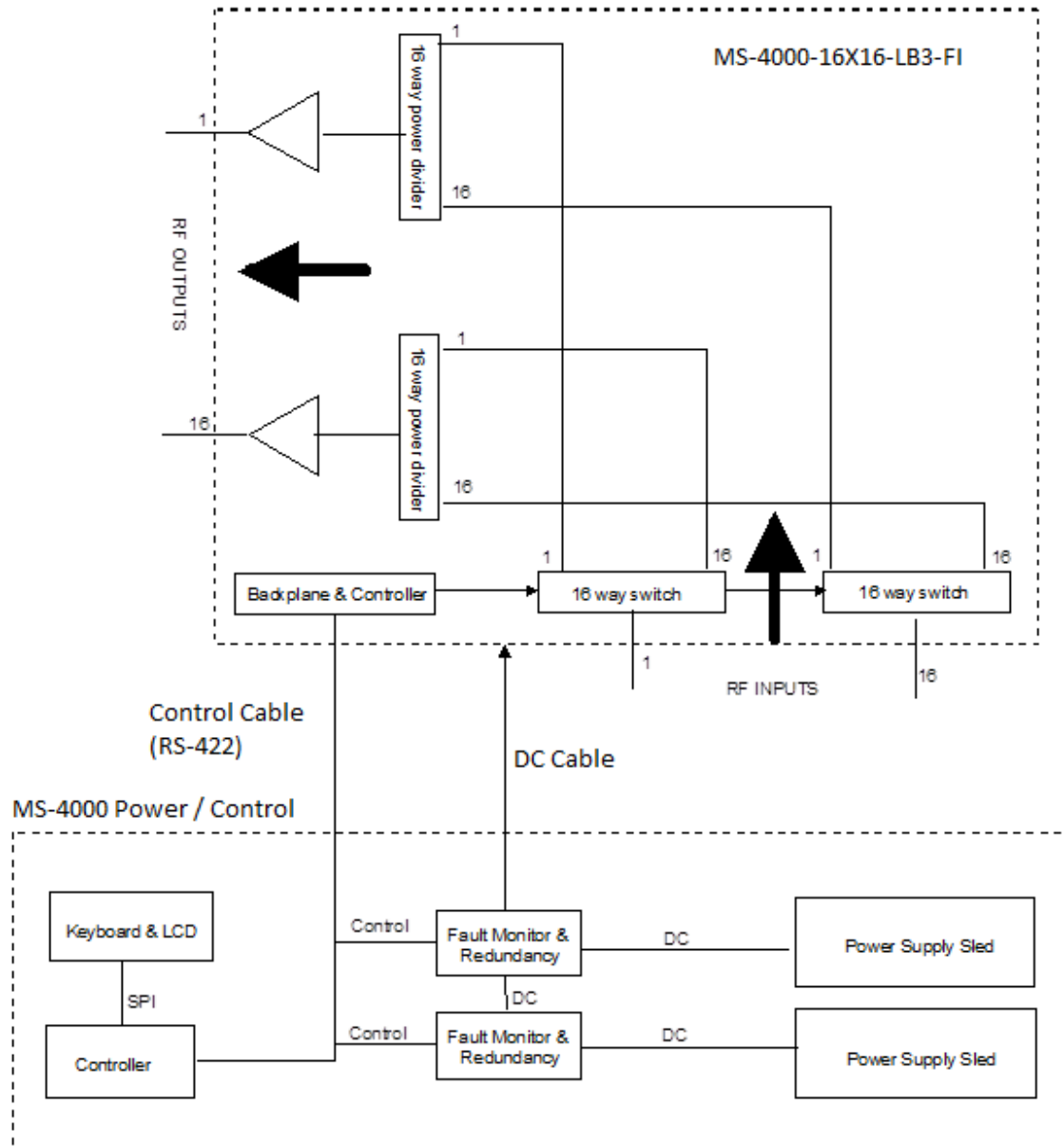
Switch (PL-CPT-006-1221)

Ref	Qty per	Recommended Spares Qty	Part Number	Description
A1A1	1	-	CPT-006-1245	Backplane Control Assy
A1A2	1	-	CPT-006-1225	Backplane Assy, 16 Slot
A1A3 – A1A18	16	2	CPT-006-1231*	16 Way Switch Assy, L Band, FanOut
A1A19 – A1A34	16	2	701-042-121	Amplifier Assy, Input, Incl Panels, L Band
A1A35 – A1A50	16	-	016-006-121	Power Divider Assy, 16 way, L Band
A1A51 – A1A53	3	1	P90997-ND	Fan, 12vdc,3.149 Sq

* CPT-006-1224 was used before 12-31-11

B. MS-4000-16x16-LB3-FI

Part Number: CPT-007-1210

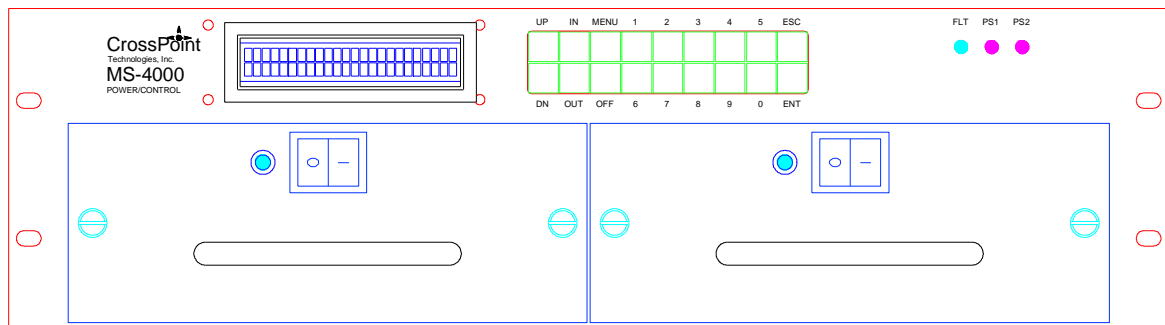


Block Diagram

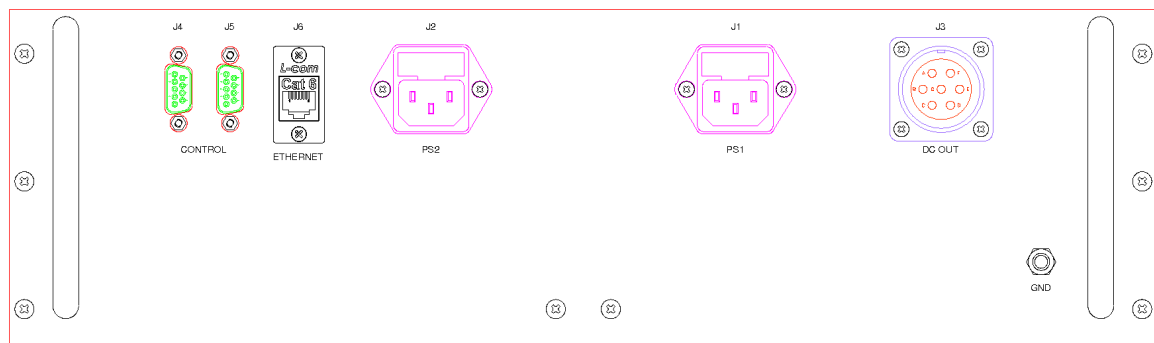
Specification	Conditions	Min	Typ	Max	Units
Frequency Range		950		2150	MHz
Gain		-2	0	+2	dB
Off-Isolation		50	60		dB
In-In Isolation		60	65		dB
Out-Out Isolation		55	60		dB
Impedance			50		Ω
VSWR			1.6	1.8	
1dB Output Compression		0	+3		dBm
NF			20	22	dB
IP3(input)		+14			dBm
Temperature (Op)		0		50	°C
AC Voltage		88		260	VAC
Power Consumption			150	200	W

Dimensions: 17 x 18 deep x 5.25 high (nominal) : 3 RU Switch
 17 x 18 deep x 5.25 high (nominal) : 3 RU Controller / PS
 Switch Type: Coaxial Relay
 Control: RS232 or RS422 selectable, and Ethernet
 Connectors: SMA-F in and out

NOTE: MS-4000-16X16-LB-FI units shipped before 2012 covered the 950 MHz to 1750 MHz frequency range and did not include Ethernet control.



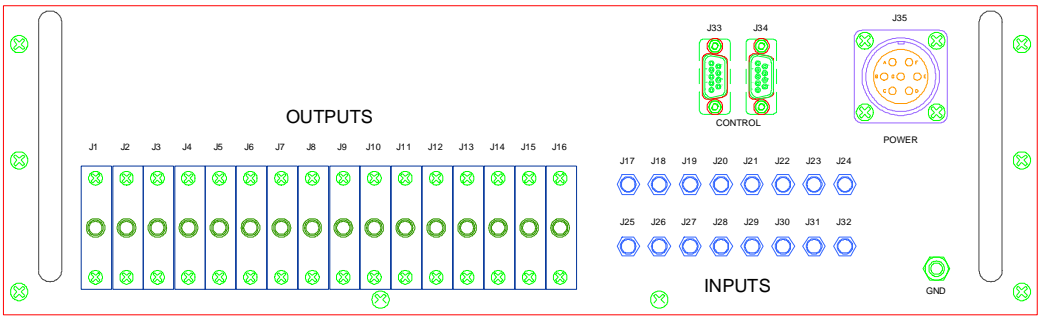
Front Panel – Power Supply / Controller



Rear panel – Power Supply / Controller



Front Panel –Switch



Rear panel – Switch

Connector List

Power / Control

Ref	Connector Type	Name
J1	IEC	AC Input (PS1)
J2	IEC	AC Input (PS2)
J3	7 Pin Circular	DC Out
J4	D9	Serial Control In/Out
J5	D9	Switch Chassis Control In/Out
J6	RJ45	Ethernet Control
	Stud	Ground

Switch

Ref	Connector Type	Name
J1	SMA-F	Output 1
J2	SMA-F	Output 2
J3	SMA-F	Output 3
J4	SMA-F	Output 4
J5	SMA-F	Output 5
J6	SMA-F	Output 6
J7	SMA-F	Output 7
J8	SMA-F	Output 8
J9	SMA-F	Output 9
J10	SMA-F	Output 10
J11	SMA-F	Output 11
J12	SMA-F	Output 12
J13	SMA-F	Output 13
J14	SMA-F	Output 14
J15	SMA-F	Output 15
J16	SMA-F	Output 16
J17	SMA-F	Input 1
J18	SMA-F	Input 2
J19	SMA-F	Input 3
J20	SMA-F	Input 4
J21	SMA-F	Input 5
J22	SMA-F	Input 6
J23	SMA-F	Input 7
J24	SMA-F	Input 8
J25	SMA-F	Input 9
J26	SMA-F	Input 10
J27	SMA-F	Input 11
J28	SMA-F	Input 12
J29	SMA-F	Input 13
J30	SMA-F	Input 14
J31	SMA-F	Input 15
J32	SMA-F	Input 16
J33	D-9	Serial Control
J34	D-9	Serial Control
J35	7 pin circular	DC Input
	Stud	Ground

Spares List

Power / Control (PL-CPT-007-1220)

Ref	Qty per	Recommended Spares Qty	Part Number	Description
A1A1	1	-	CPT-007-1230	Rabbit Carrier Board , Programmed
A1A2	1	-	CPT-012-1220	Key Board Assembly
A1A3	1	-	LCM-S02402DSF	LCD & Backlight Module
A1A4, A1A5	2	1	CPT-006-1228	Power Supply Sled Assy
A1A4A1, A1A5A1	2	1	GLC65-5	Power Supply, 5V
A1A4A2, A1A5A2	2	1	GPFC250-12	Power Supply, 12V
A1A4A3, A1A5A3	2	1	GSC20-5	Power Supply, 5V
A1A6, A1A7	2	1	CPT-006-1227	Power Supply Fault Board, 5V, 12V, -5V
A1A8, A1A9	2	1	P0007-ND	Fan, 12 VDC, 3.149 SQ

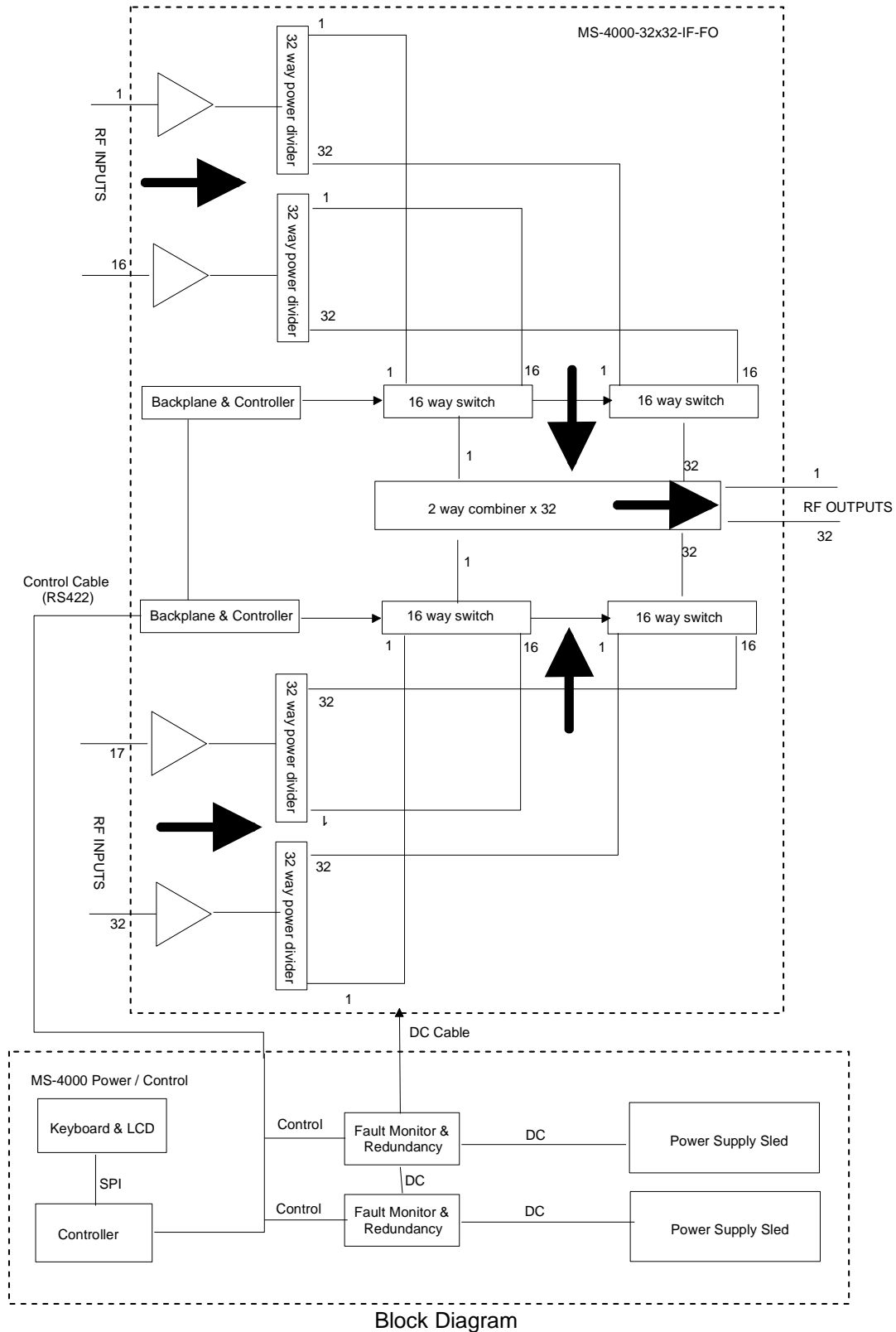
Switch (PL-CPT-007-1221)

Ref	Qty per	Recommended Spares Qty	Part Number	Description
A1A1	1	-	CPT-006-1245	Backplane Control Assy
A1A2	1	-	CPT-006-1225	Backplane Assy, 16 Slot
A1A3 – A1A18	16	2	CPT-007-1231	16 Way Switch Assy , L Band, FanIn
A1A19 – A1A34	16	2	701-042-122	Amplifier Assy, Output, Incl Panels, L Band
A1A35 – A1A50	16	-	016-006-121	Power Divider Assy, 16 way, L Band
A1A51 – A1A53	3	1	P90997-ND	Fan, 12vdc,3.149 Sq

* CPT-007-1224 was used before 12-31-11

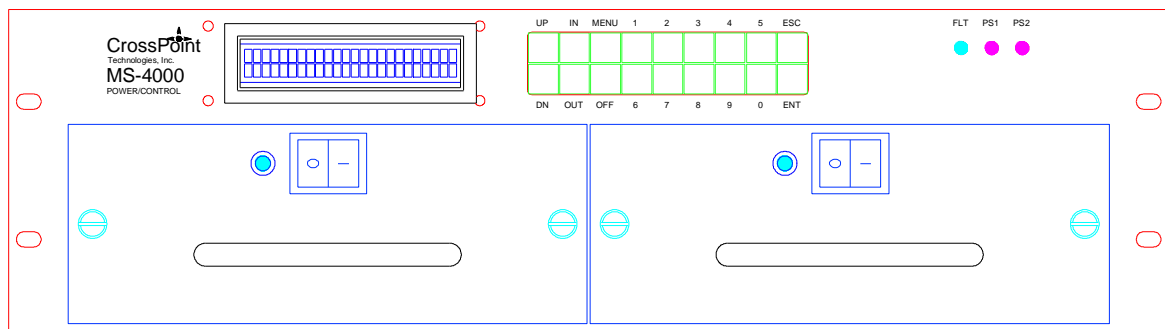
C. MS-4000-32x32-IF-FO

Part Number: CPT-008-1210

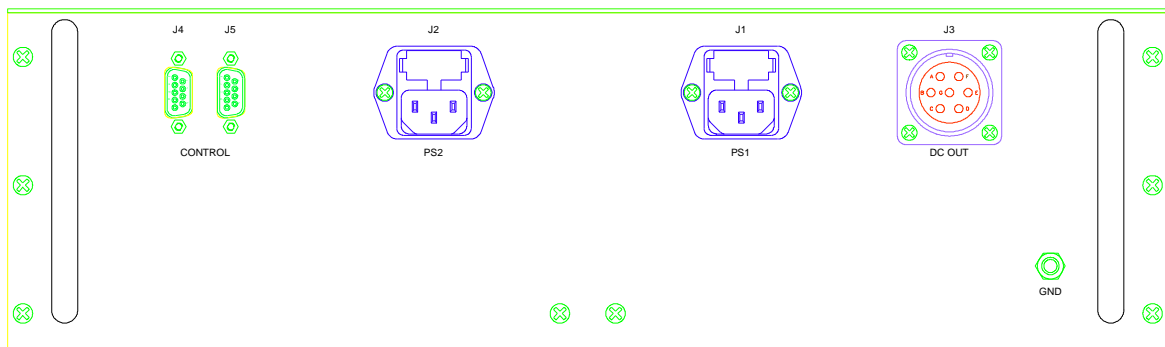


Specification	Conditions	Min	Typ	Max	Units
Frequency Range	Will pass 10-200	50		200	MHz
Gain		-2	0	+2	dB
Off-Isolation		55	60		dB
In-In Isolation		60	65		dB
Out-Out Isolation		55	60		dB
Impedance			50		Ω
VSWR			1.4	1.6	
Signal Level			-15		dBm
NF			11	18	dB
IP3(input)			+12		dBm
Temperature (Op)		0		50	°C
AC Voltage		88		260	VAC
Power Consumption			200	250	W

Dimensions: 17 x 22 deep x 12.25 high (nominal) : 7 RU Switch
 17 x 18 deep x 5.25 high (nominal) : 3 RU Controller / PS
 Switch Type: Coaxial Relay
 Control: RS232 or RS422 selectable
 Connectors: SMA-F in and out



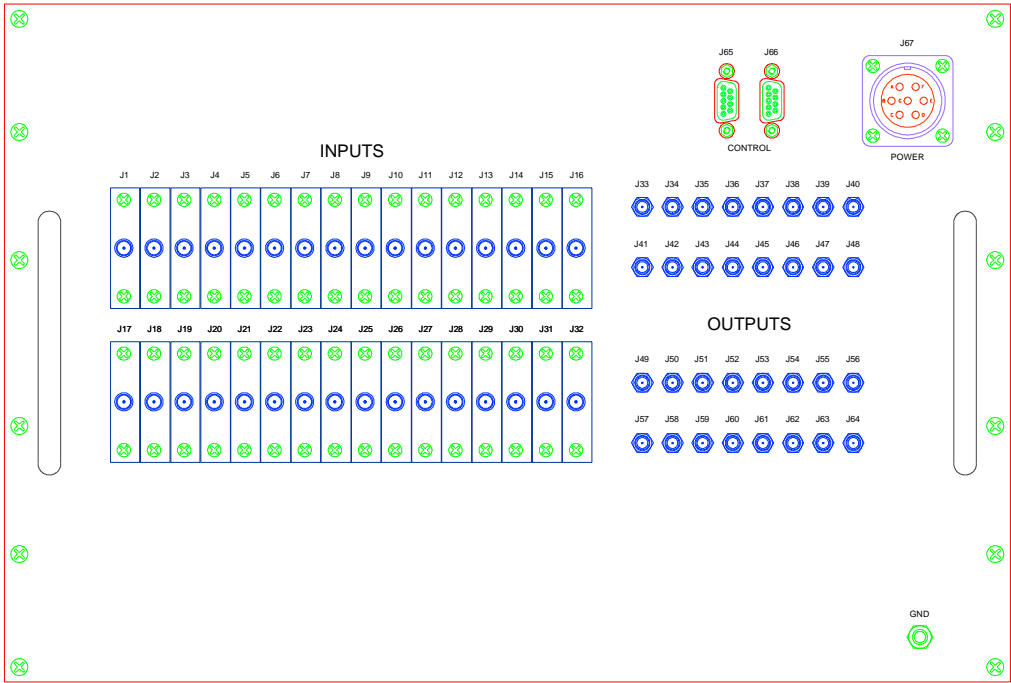
Front Panel – Power Supply / Controller



Rear panel – Power Supply / Controller



Front Panel - Switch



Rear panel - Switch

Connector List

Power / Control

Ref	Connector Type	Name
J1	IEC	AC Input (PS1)
J2	IEC	AC Input (PS2)
J3	7 Pin Circular	DC Out
J4	D9	Control In/Out
J5	D9	Control In/Out
	Stud	Ground

Switch

Ref	Connector Type	Name
J1	SMA-F	Input 1
J2	SMA-F	Input 2
J3	SMA-F	Input 3
J4	SMA-F	Input 4
J5	SMA-F	Input 5
J6	SMA-F	Input 6
J7	SMA-F	Input 7
J8	SMA-F	Input 8
J9	SMA-F	Input 9
J10	SMA-F	Input 10
J11	SMA-F	Input 11
J12	SMA-F	Input 12
J13	SMA-F	Input 13
J14	SMA-F	Input 14
J15	SMA-F	Input 15
J16	SMA-F	Input 16
J17	SMA-F	Input 17
J18	SMA-F	Input 18
J19	SMA-F	Input 19
J20	SMA-F	Input 20
J21	SMA-F	Input 21
J22	SMA-F	Input 22
J23	SMA-F	Input 23
J24	SMA-F	Input 24
J25	SMA-F	Input 25
J26	SMA-F	Input 26
J27	SMA-F	Input 27
J28	SMA-F	Input 28
J29	SMA-F	Input 29
J30	SMA-F	Input 30
J31	SMA-F	Input 31
J32	SMA-F	Input 32
J33	SMA-F	Output 1
J34	SMA-F	Output 2
J35	SMA-F	Output 3
J36	SMA-F	Output 4

Ref	Connector Type	Name
J37	SMA-F	Output 5
J38	SMA-F	Output 6
J39	SMA-F	Output 7
J40	SMA-F	Output 8
J41	SMA-F	Output 9
J42	SMA-F	Output 10
J43	SMA-F	Output 11
J44	SMA-F	Output 12
J45	SMA-F	Output 13
J46	SMA-F	Output 14
J47	SMA-F	Output 15
J48	SMA-F	Output 16
J49	SMA-F	Output 17
J50	SMA-F	Output 18
J51	SMA-F	Output 19
J52	SMA-F	Output 20
J53	SMA-F	Output 21
J54	SMA-F	Output 22
J55	SMA-F	Output 23
J56	SMA-F	Output 24
J57	SMA-F	Output 25
J58	SMA-F	Output 26
J59	SMA-F	Output 27
J60	SMA-F	Output 28
J61	SMA-F	Output 29
J62	SMA-F	Output 30
J63	SMA-F	Output 31
J64	SMA-F	Output 32
J65	D-9	Serial Control
J66	D-9	Serial Control
J67	7 pin circular	DC Input
	Stud	Ground

Spares List

Power / Control (PL-CPT-008-1220)

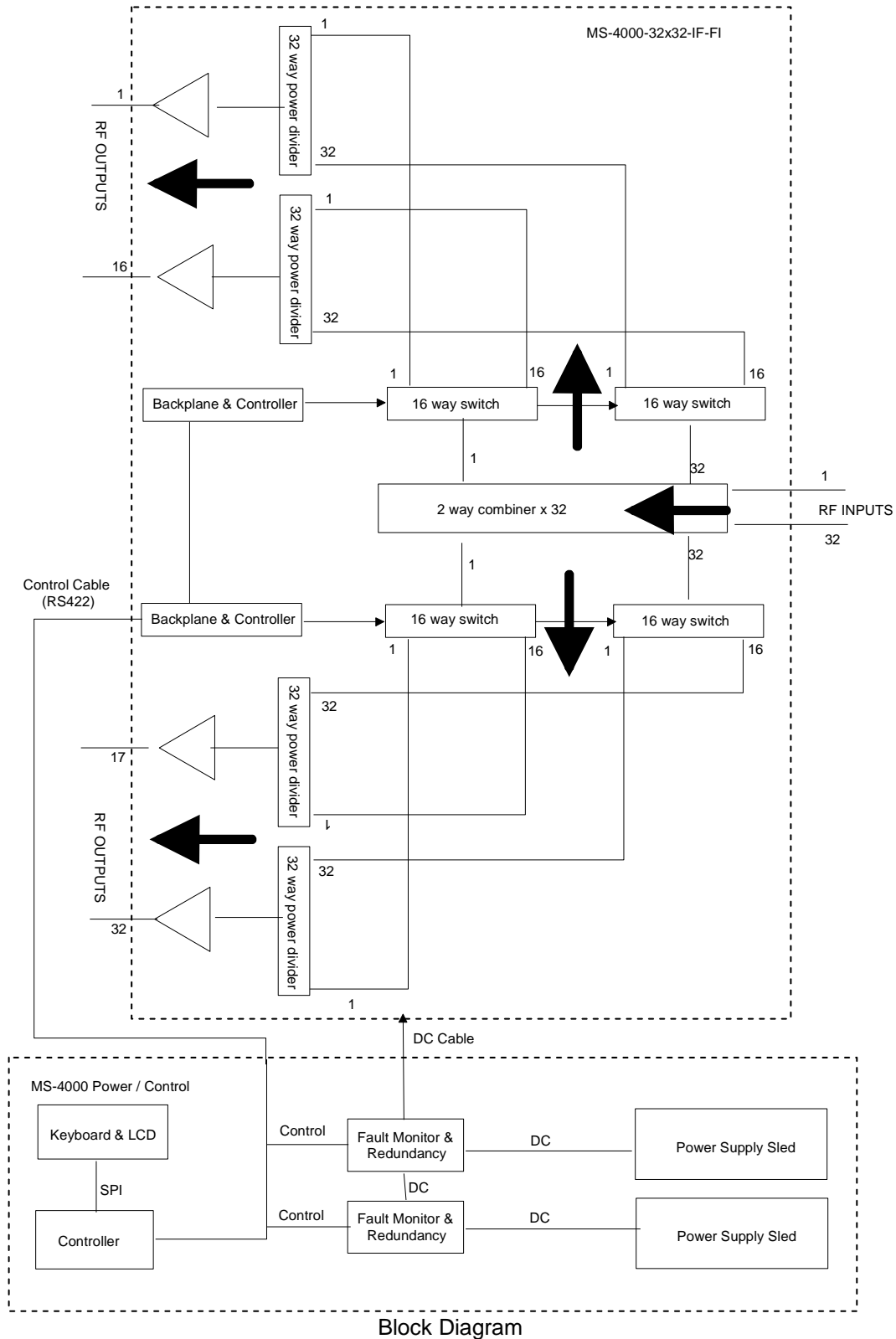
Ref	Qty per	Recommended Spares Qty	Part Number	Description
A1A1	1	-	CPT-008-1230	Rabbit Carrier Board , Programmed
A1A2	1	-	CPT-012-1220	Key Board Assembly
A1A3	1	-	LCM-S02402DSF	LCD & Backlight Module
A1A4, A1A5	2	1	CPT-006-1228	Power Supply Sled Assy
A1A4A1, A1A5A1	2	1	GLC65-5	Power Supply, 5V
A1A4A2, A1A5A2	2	1	GPFC250-12	Power Supply, 12V
A1A4A3, A1A5A3	2	1	GSC20-5	Power Supply, 5V
A1A6, A1A7	2	1	CPT-008-1227	Power Supply Fault Board, 5V, 12V, -5V
A1A8, A1A9	2	1	P0007-ND	Fan, 12 VDC, 3.149 SQ

Switch (PL-CPT-008-1221)

Ref	Qty per	Recommended Spares Qty	Part Number	Description
A1A1	2	-	CPT-008-1245	Backplane Control Assy
A1A2	2	-	CPT-008-1225	Backplane Assy, 32 Slot
A1A3 – A1A34	32	2	CPT-008-1224	16 Way Switch Assy, IF Band, FanOut , IF
A1A35 – A1A66	32	2	CPT-008-1226	Amplifier Assy, Input, Incl Panel
A1A67 – A1A108	32	-	PD-32-IF-CPT	Power Divider Assy, 32 way, IF
A1A109	1	-	CPT-008-1229	Power Combiner Assy, 2 way x 32, IF
A1A110 – A1A112	3	1	P90997-ND	Fan, 12vdc,3.149 Sq

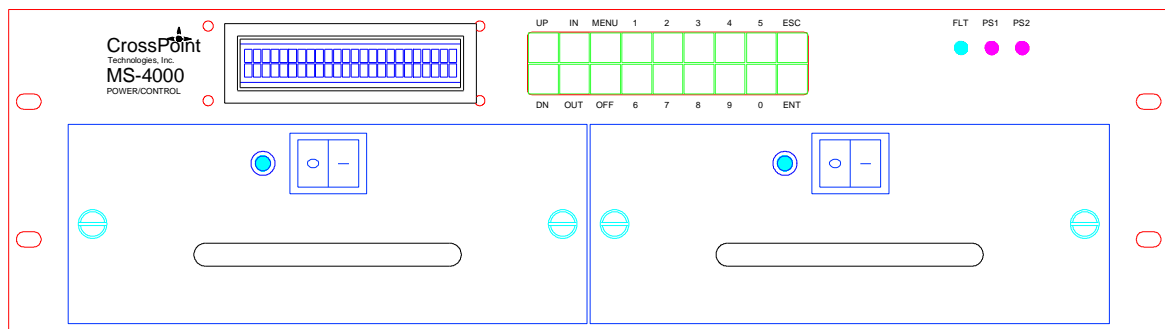
D. MS-4000-32x32-IF-FI

Part Number: CPT-009-1210

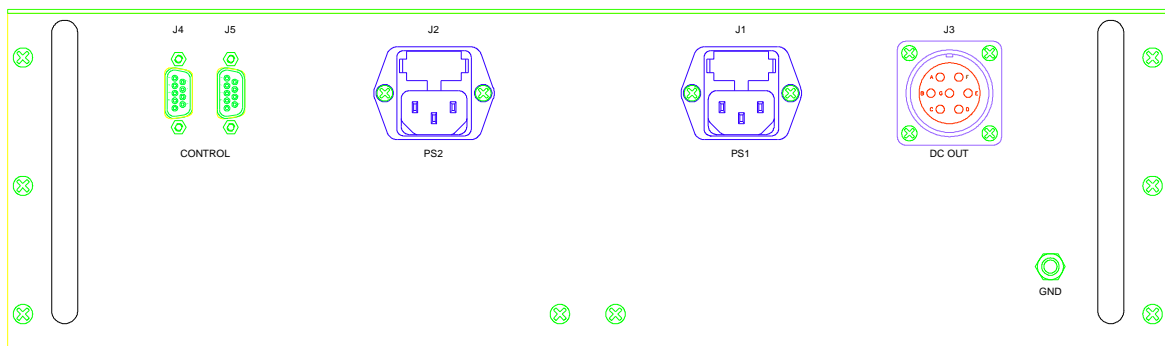


Specification	Conditions	Min	Typ	Max	Units
Frequency Range	Will pass 10-200	50		200	MHz
Gain		-2	0	+2	dB
Off-Isolation		55	60		dB
In-In Isolation		70	75		dB
Out-Out Isolation		55	60		dB
Impedance			50		Ω
VSWR			1.3	1.6	
Signal Level			-15		dBm
NF			23	25	dB
IP3(input)	5 MHz separation	+16	+20		dBm
Temperature (Op)		0		50	°C
AC Voltage		88		260	VAC
Power Consumption			200	250	W

Dimensions: 17 x 22 deep x 12.25 high (nominal) : 7 RU Switch
 17 x 18 deep x 5.25 high (nominal) : 3 RU Controller / PS
 Switch Type: Coaxial Relay
 Control: RS232 or RS422 selectable
 Connectors: SMA-F in and out



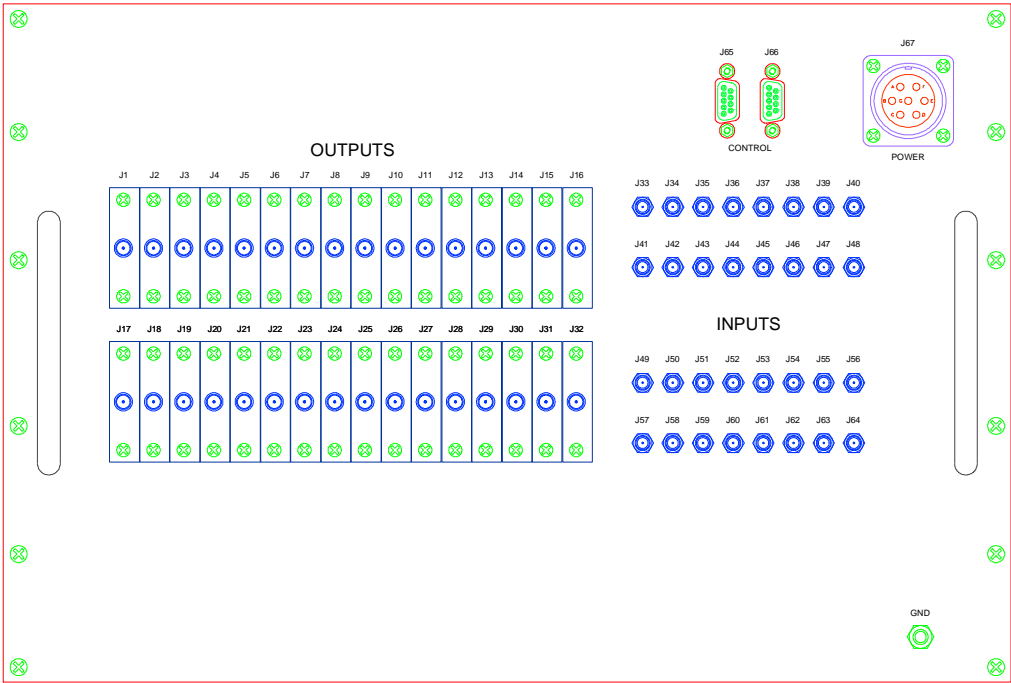
Front Panel – Power Supply / Controller



Rear panel – Power Supply / Controller



Front Panel - Switch



Rear panel - Switch

Connector List

Power / Control

Ref	Connector Type	Name
J1	IEC	AC Input (PS1)
J2	IEC	AC Input (PS2)
J3	7 Pin Circular	DC Out
J4	D9	Control In/Out
J5	D9	Control In/Out
	Stud	Ground

Switch

Ref	Connector Type	Name
J1	SMA-F	Output 1
J2	SMA-F	Output 2
J3	SMA-F	Output 3
J4	SMA-F	Output 4
J5	SMA-F	Output 5
J6	SMA-F	Output 6
J7	SMA-F	Output 7
J8	SMA-F	Output 8
J9	SMA-F	Output 9
J10	SMA-F	Output 10
J11	SMA-F	Output 11
J12	SMA-F	Output 12
J13	SMA-F	Output 13
J14	SMA-F	Output 14
J15	SMA-F	Output 15
J16	SMA-F	Output 16
J17	SMA-F	Output 17
J18	SMA-F	Output 18
J19	SMA-F	Output 19
J20	SMA-F	Output 20
J21	SMA-F	Output 21
J22	SMA-F	Output 22
J23	SMA-F	Output 23
J24	SMA-F	Output 24
J25	SMA-F	Output 25
J26	SMA-F	Output 26
J27	SMA-F	Output 27
J28	SMA-F	Output 28
J29	SMA-F	Output 29
J30	SMA-F	Output 30
J31	SMA-F	Output 31
J32	SMA-F	Output 32
J33	SMA-F	Input 1
J34	SMA-F	Input 2

Ref	Connector Type	Name
J35	SMA-F	Input 3
J36	SMA-F	Input 4
J37	SMA-F	Input 5
J38	SMA-F	Input 6
J39	SMA-F	Input 7
J40	SMA-F	Input 8
J41	SMA-F	Input 9
J42	SMA-F	Input 10
J43	SMA-F	Input 11
J44	SMA-F	Input 12
J45	SMA-F	Input 13
J46	SMA-F	Input 14
J47	SMA-F	Input 15
J48	SMA-F	Input 16
J49	SMA-F	Input 17
J50	SMA-F	Input 18
J51	SMA-F	Input 19
J52	SMA-F	Input 20
J53	SMA-F	Input 21
J54	SMA-F	Input 22
J55	SMA-F	Input 23
J56	SMA-F	Input 24
J57	SMA-F	Input 25
J58	SMA-F	Input 26
J59	SMA-F	Input 27
J60	SMA-F	Input 28
J61	SMA-F	Input 29
J62	SMA-F	Input 30
J63	SMA-F	Input 31
J64	SMA-F	Input 32
J65	D-9	Serial Control
J66	D-9	Serial Control
J67	7 pin circular	DC Input
	Stud	Ground

Spares List

Power / Control (PL-CPT-009-1220)

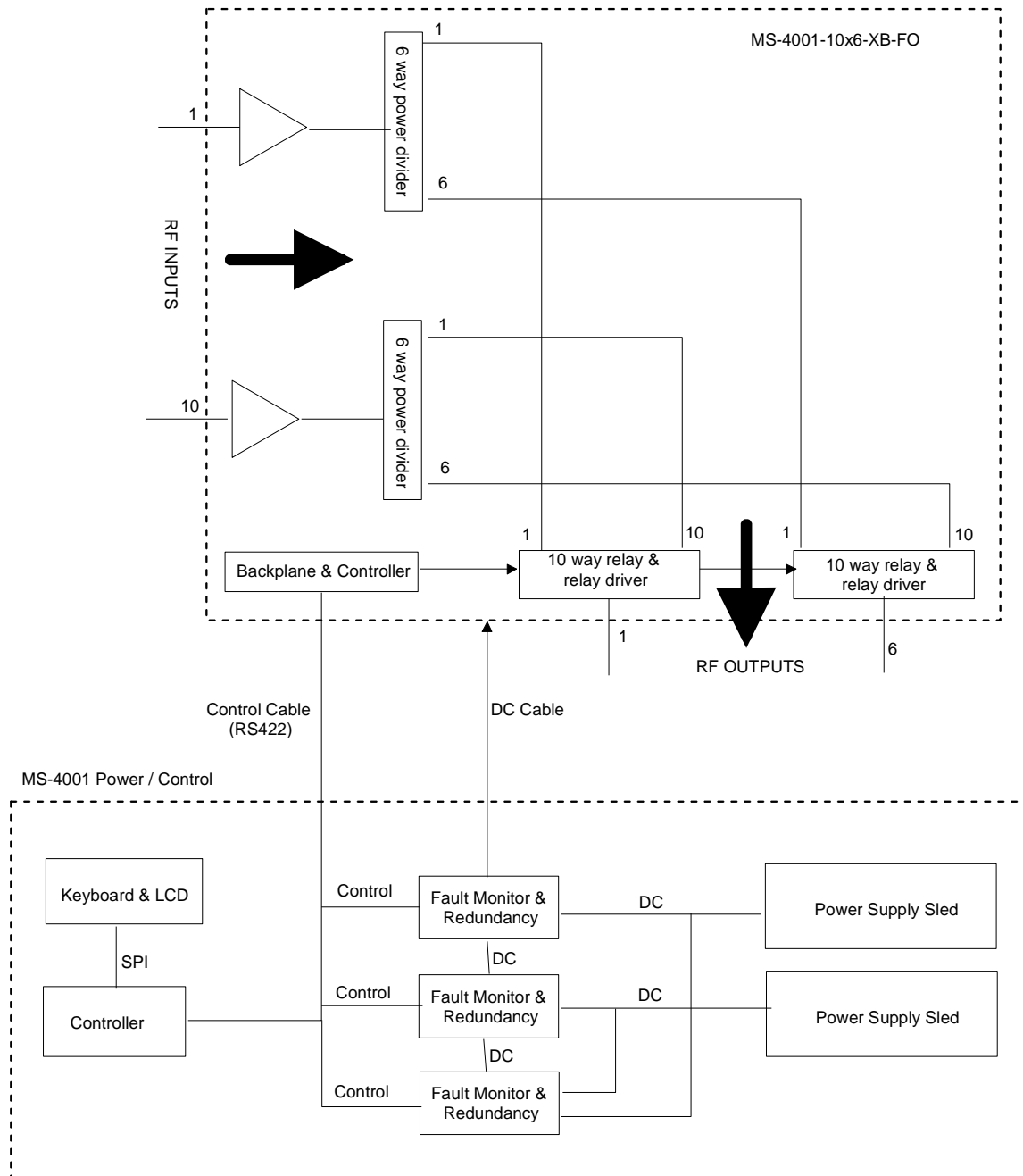
Ref	Qty per	Recommended Spares Qty	Part Number	Description
A1A1	1	-	CPT-009-1230	Rabbit Carrier Board , Programmed
A1A2	1	-	CPT-012-1220	Key Board Assembly
A1A3	1	-	LCM-S02402DSF	LCD & Backlight Module
A1A4, A1A5	2	1	CPT-006-1228	Power Supply Sled Assy
A1A4A1, A1A5A1	2	1	GLC65-5	Power Supply, 5V
A1A4A2, A1A5A2	2	1	GPFC250-12	Power Supply, 12V
A1A4A3, A1A5A3	2	1	GSC20-5	Power Supply, 5V
A1A6, A1A7	2	1	CPT-006-1227	Power Supply Fault Board, 5V, 12V, -5V
A1A8, A1A9	2	1	P0007-ND	Fan, 12 VDC, 3.149 SQ

Switch (PL-CPT-009-1221)

Ref	Qty per	Recommended Spares Qty	Part Number	Description
A1A1	2	-	CPT-008-1245	Backplane Control Assy
A1A2	2	-	CPT-008-1225	Backplane Assy, 32 Slot
A1A3 – A1A34	32	2	CPT-009-1224	16 Way Switch Assy, IF Band, FanIn
A1A35 – A1A66	32	2	CPT-009-1226	Amplifier Assy, Output, Incl Panel, IF
A1A67 – A1A108	32	-	PD-32-IF-CPT	Power Divider Assy, 32 way, IF
A1A109	1	-	CPT-008-1229	Power Combiner Assy, 2 way x 32, IF
A1A110 – A1A112	3	1	P90997-ND	Fan, 12vdc,3.149 Sq

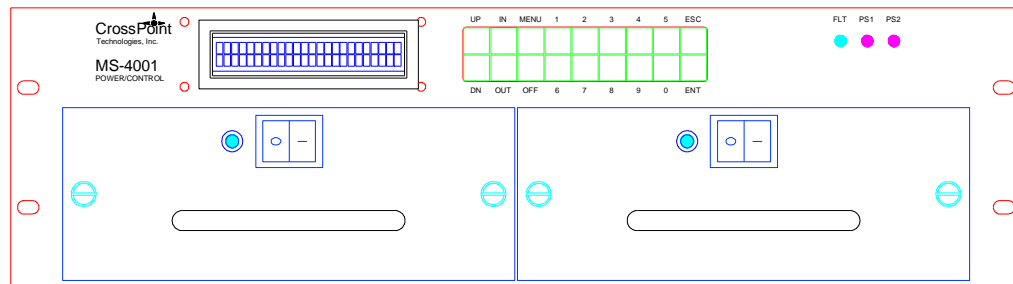
E. MS-4001-10x6-XB-FO

Part Number: CPT-010-1210

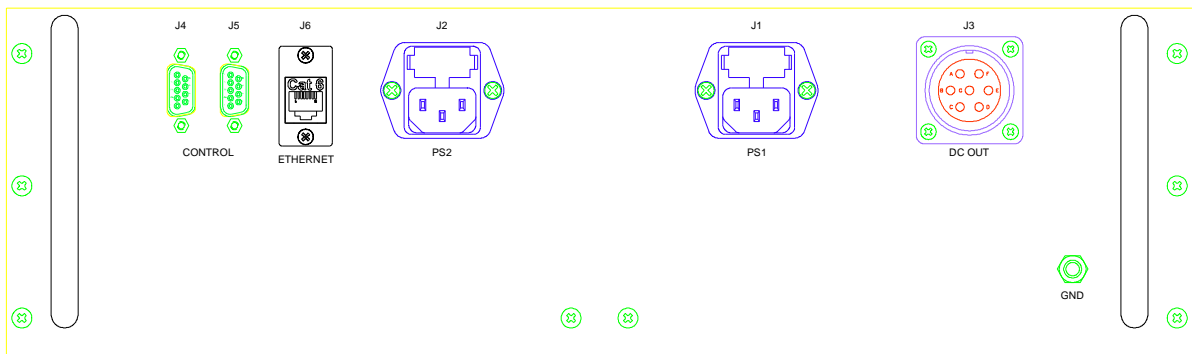
**Block Diagram**

Specification	Conditions	Min	Typ	Max	Units
Frequency Range		7.25		8.4	GHz
Gain		-2	0	2	dB
Off-Isolation		60			dB
Impedance			50		Ω
VSWR			1.4	1.6	
Signal Level			-15		dBm
NF				7	dB
IP3(input)		15			dBm
Temperature (Op)		0		50	°C
AC Voltage		88		260	VAC
Power Consumption				140	W

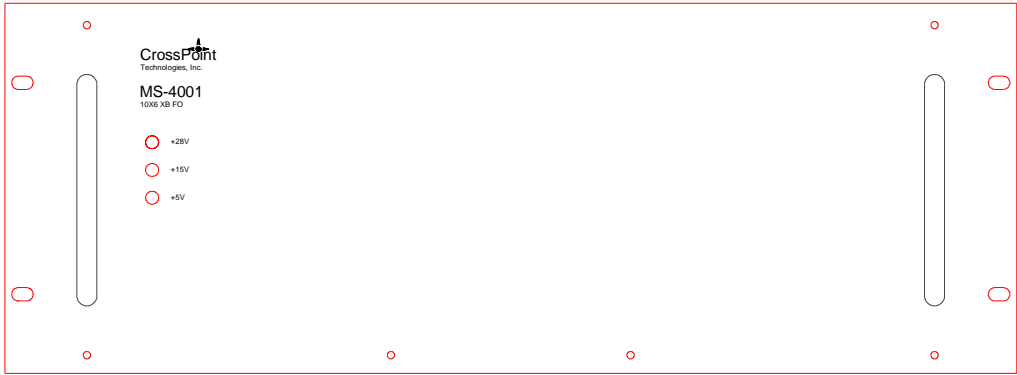
Dimensions: 17 x 18 deep x 7 high (nominal) : 4 RU Switch
 17 x 18 deep x 5.25 high (nominal) : 3 RU Controller/PS
 Switch Type: Coaxial Relay
 Control: RS232 or RS422 selectable
 Connectors: SMA-F in and out



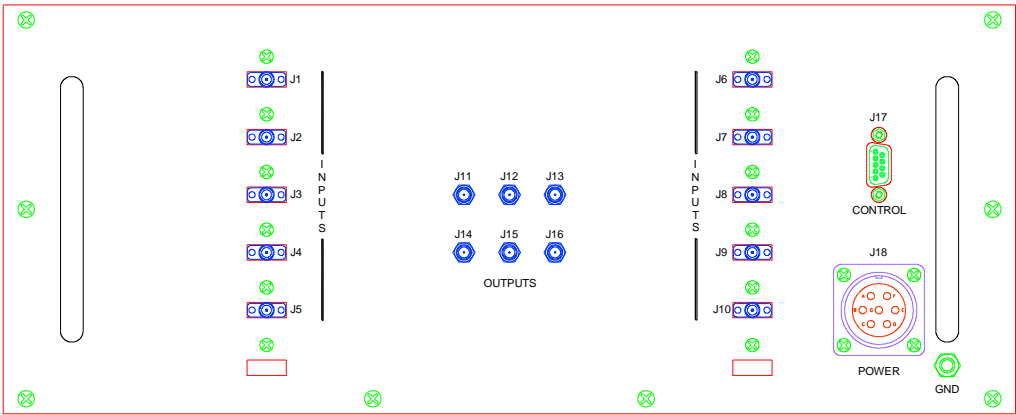
Front Panel – Power / Controller



Rear Panel – Power / Controller



Front Panel – Switch



Rear Panel - Switch

Connector List

Power / Control

Ref	Connector Type	Name
J1	IEC	AC Input (PS1)
J2	IEC	AC Input (PS2)
J3	7 Pin Circular	DC Out
J4	D9	RS-232/422 Serial Control In/Out
J5	D9	Switch Control In/Out
J6	RJ45	Ethernet Control
	Stud	Ground

Switch

Ref	Connector Type	Name
J1	SMA-F	Input 1
J2	SMA-F	Input 2
J3	SMA-F	Input 3
J4	SMA-F	Input 4
J5	SMA-F	Input 5
J6	SMA-F	Input 6
J7	SMA-F	Input 7
J8	SMA-F	Input 8
J9	SMA-F	Input 9
J10	SMA-F	Input 10
J11	SMA-F	Output 1
J12	SMA-F	Output 2
J13	SMA-F	Output 3
J14	SMA-F	Output 4
J15	SMA-F	Output 5
J16	SMA-F	Output 6
J17	D-9	Serial Control
J18	7 pin circular	DC Input
	Stud	Ground

Spares List

Power / Control (PL-CPT-010-1220)

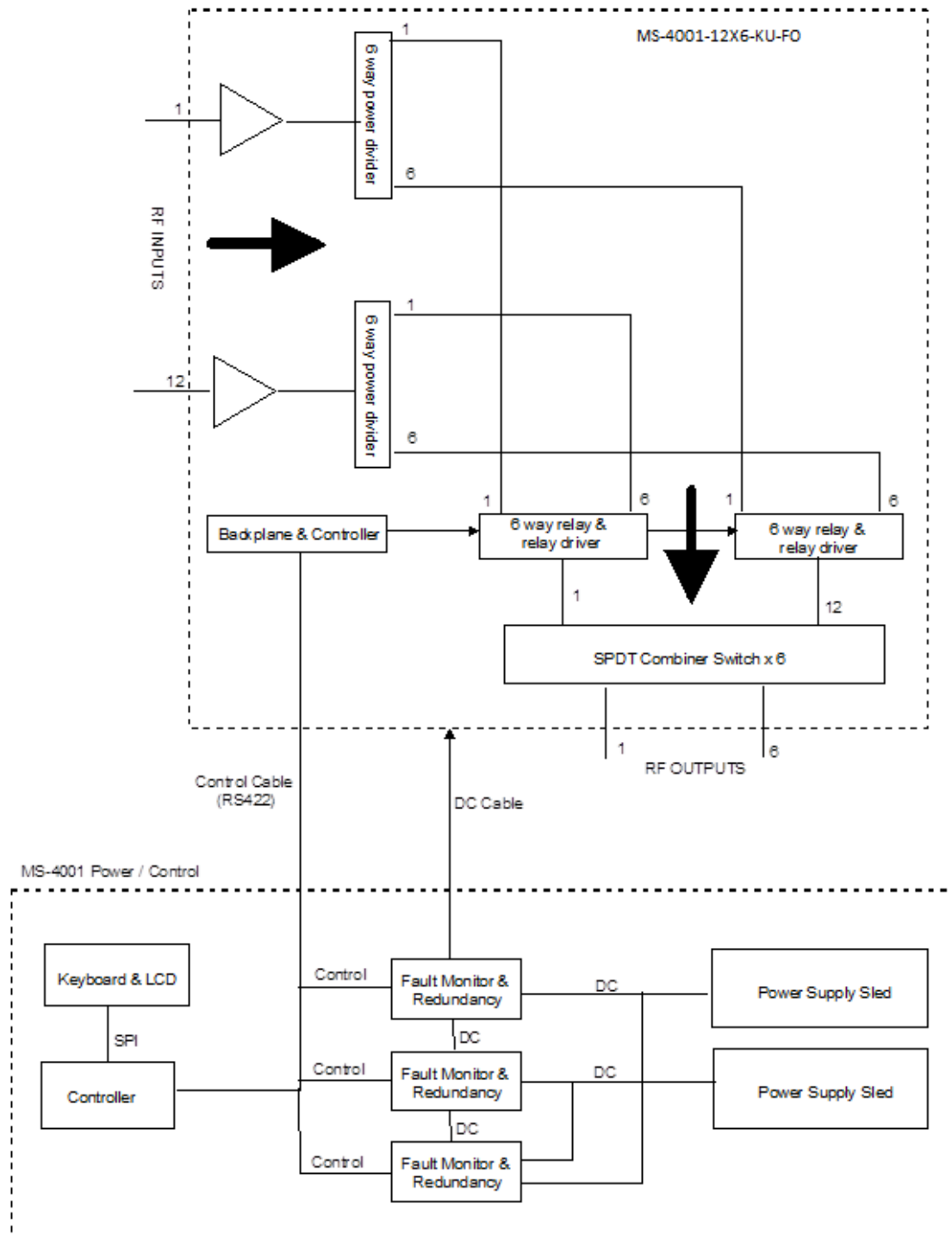
Ref	Qty per	Recommended Spares Qty	Part Number	Description
A1A1	1	-	CPT-010-1230	Rabbit Carrier Board , Programmed
A1A2	1	-	CPT-012-1220	Key Board Assembly
A1A3	1	-	LCM-S02402DSF	LCD & Backlight Module
A1A4, A1A5	2	1	CPT-010-1226	Power Supply Sled Assy
A1A4A1, A1A5A1	2	1	GSM7-5	Power Supply, 5V
A1A4A2, A1A5A2	2	1	GPFC160-15	Power Supply, 15V
A1A4A3, A1A5A3	2	1	GPFC160-28	Power Supply, 28V
A1A6, A1A7	2	1	CPT-010-1225	Power Supply Fault Board, 5V, 15V
A1A8	1	1	CPT-010-1231	Power Supply Fault Board, 28V
A1A9, A1A10	2	1	P0007-ND	Fan, 12 VDC, 3.149 SQ

Switch (PL-CPT-010-1221)

Ref	Qty per	Recommended Spares Qty	Part Number	Description
A1A1	1	-	CPT-006-1245	Backplane Control Assy
A1A2	1	-	CPT-006-1225	Backplane Assy, 16 Slot
A1A3 – A1A8	6	1	CPT-010-1224	Relay Driver Card
A1A9 – A1A14	6	1	10HS2L34	Coaxial Relay, 28V, SP10T
A1A15 – A1A24	10	1	CPT-010-1227	Amplifier Assy, Input,
A1A25 – A1A34	10	-	P815X-2	Power Divider, 8 way
A1A35 – A1A37	3	1	P90997-ND	Fan, 12vdc, 3.149 Sq

F. MS-4001-12x6-KU-FO

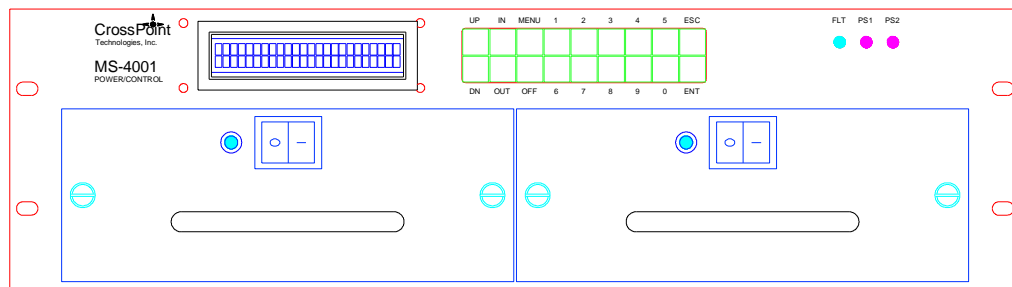
Part Number: PL-CPT-011-1210



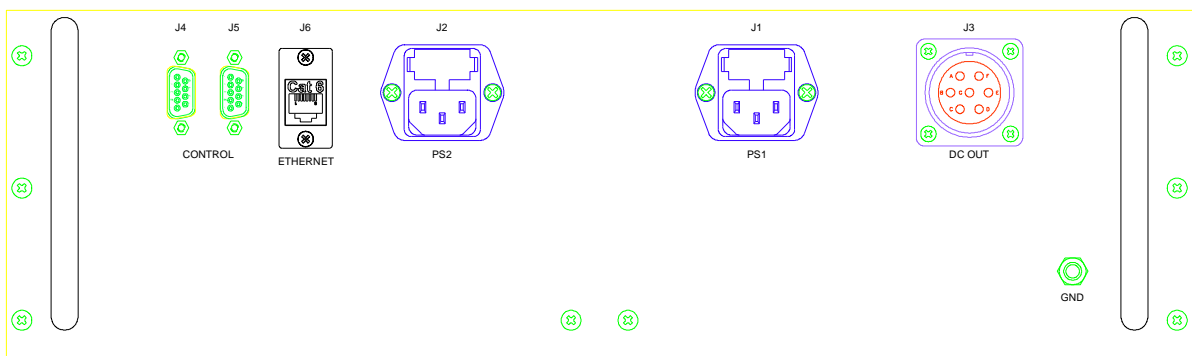
Block Diagram

Specification	Conditions	Min	Typ	Max	Units
Frequency Range		10.25		14.5	GHz
Gain		-2	0	2	dB
Off-Isolation		60			dB
Impedance			50		Ω
VSWR			1.4	1.6	
Signal Level			-15		dBm
NF				7	dB
IP3(input)		15			dBm
Temperature (Op)		0		50	°C
AC Voltage		88		260	VAC
Power Consumption				140	W

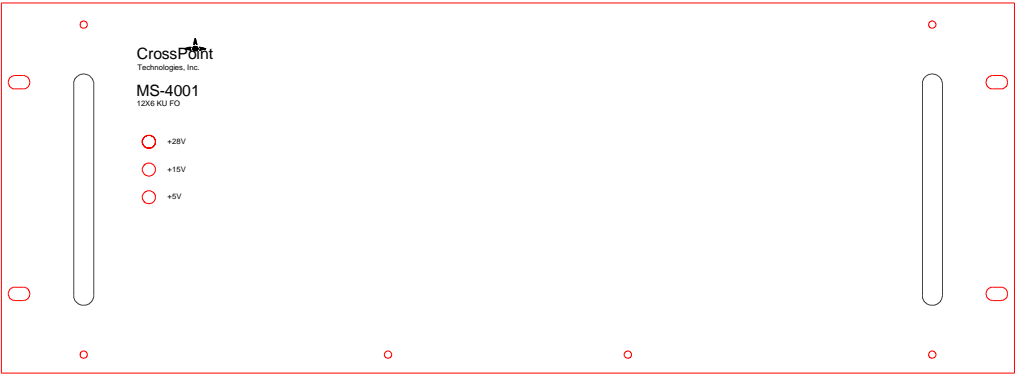
Dimensions: 17 x 18 deep x 7 high (nominal) : 4 RU Switch
 17 x 18 deep x 5.25 high (nominal) : 3 RU Controller / PS
 Switch Type: Coaxial Relay
 Control: RS232 or RS422 selectable, and Ethernet
 Connectors: SMA-F in and out



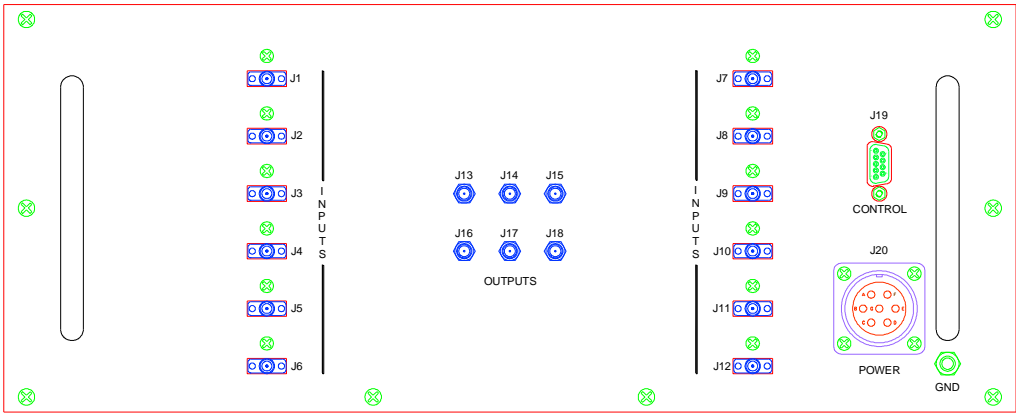
Front Panel – Power / Controller



Rear Panel – Power / Controller



Front Panel - Switch



Rear panel - Switch

Connector List

Power / Control

Ref	Connector Type	Name
J1	IEC	AC Input (PS1)
J2	IEC	AC Input (PS2)
J3	7 Pin Circular	DC Out
J4	D9	RS-232/422 Control In/Out
J5	D9	Switch Chassis Control In/Out
J6	RJ45	Ethernet Control
	Stud	Ground

Switch

Ref	Connector Type	Name
J1	SMA-F	Input 1
J2	SMA-F	Input 2
J3	SMA-F	Input 3
J4	SMA-F	Input 4
J5	SMA-F	Input 5
J6	SMA-F	Input 6
J7	SMA-F	Input 7
J8	SMA-F	Input 8
J9	SMA-F	Input 9
J10	SMA-F	Input 10
J11	SMA-F	Input 11
J12	SMA-F	Input 12
J13	SMA-F	Output 1
J14	SMA-F	Output 2
J15	SMA-F	Output 3
J16	SMA-F	Output 4
J17	SMA-F	Output 5
J18	SMA-F	Output 6
J19	D-9	Serial Control
J20	7 pin circular	DC Input
	Stud	Ground

Spares List

Power / Control (PL-CPT-011-1220)

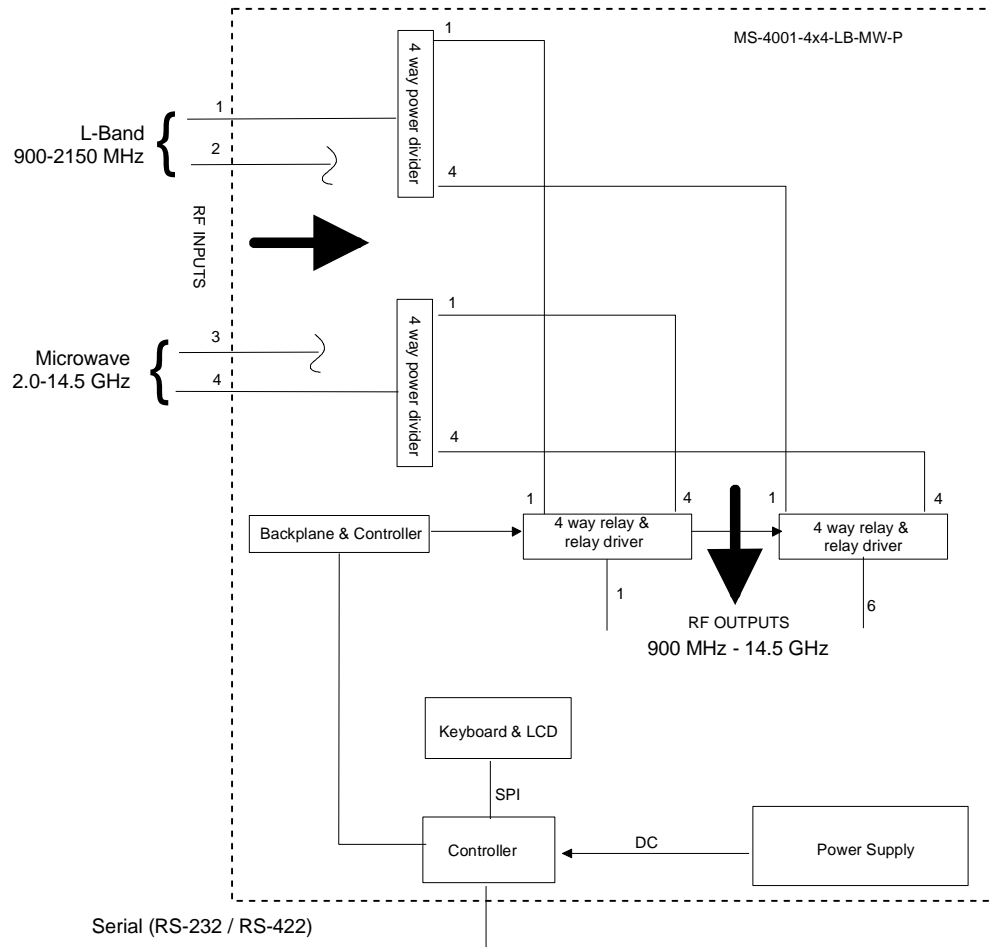
Ref	Qty per	Recommended Spares Qty	Part Number	Description
A1A1	1	-	CPT-011-1231	Rabbit Carrier Board , Programmed
A1A2	1	-	CPT-012-1220	Key Board Assembly
A1A3	1	-	LCM-S02402DSF	LCD & Backlight Module
A1A4, A1A5	2	1	CPT-010-1226	Power Supply Sled Assy
A1A4A1, A1A5A1	2	1	GSM7-5	Power Supply, 5V
A1A4A2, A1A5A2	2	1	GPFC160-15	Power Supply, 15V
A1A4A3, A1A5A3	2	1	GPFC160-28	Power Supply, 28V
A1A6, A1A7	2	1	CPT-010-1225	Power Supply Fault Board, 5V, 15V
A1A8	1	1	CPT-010-1231	Power Supply Fault Board, 28V
A1A9, A1A10	2	1	P0007-ND	Fan, 12 VDC, 3.149 SQ

Switch (PL-CPT-011-1221)

Ref	Qty per	Recommended Spares Qty	Part Number	Description
A1A1	1	-	CPT-006-1245	Backplane Control Assy
A1A2	1	-	CPT-006-1225	Backplane Assy, 16 Slot
A1A3 – A1A8	6	1	CPT-010-1224	Relay Driver Card
A1A9 – A1A20	12	1	6IT2L34	Coaxial Relay, 28V, SP6T
A1A21 – A1A26	6	1	2S2A31	Coaxial Relay, 28V, SPDT
A1A27 – A1A38	12	1	CPT-011-1227	Amplifier Assy, Input,
A1A39 – A1A50	12	-	P816K-1	Power Divider, 8 way
A1A51 – A1A53	3	1	P90997-ND	Fan, 12vdc,3.149 Sq

G. MS-4001-4x4-LB-MW-P

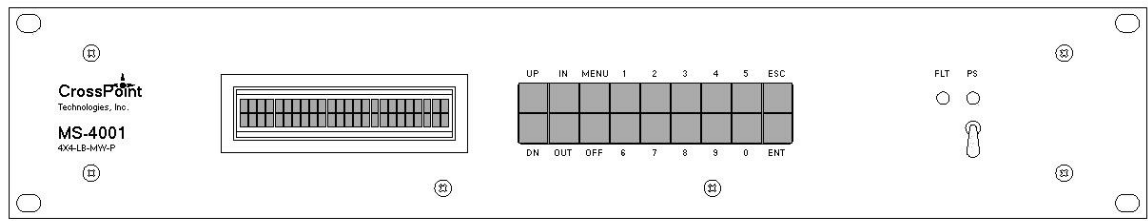
Part Number: PL-CPT-018-1210



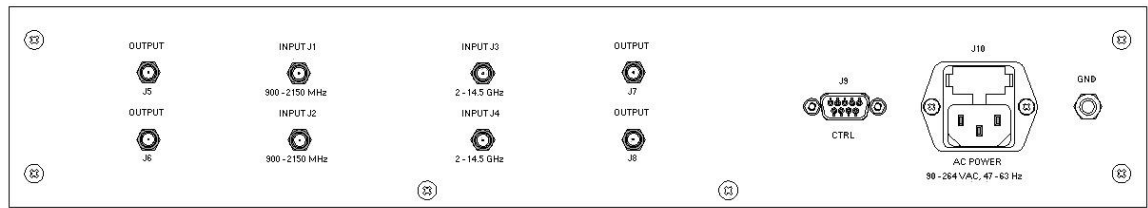
Block Diagram

Specification	Conditions	Min	Typ	Max	Units
Inputs 1 and 2 to any output					
Frequency Range		900		2150	MHz
Insertion Loss					dB
Off-Isolation		60			dB
Impedance			50		Ω
VSWR					
Inputs 3 and 4 to any output					
Frequency Range		2		14.5	GHz
Insertion Loss					dB
Off-Isolation		60			dB
Impedance			50		Ω
VSWR					
Common					
Temperature (Op)		0		50	$^{\circ}\text{C}$
AC Voltage		90		264	VAC
Power Consumption				140	W

Dimensions: 17 x 15 deep x 3.5 high (nominal) : 2 RU Switch & Controller
 Switch Type: Coaxial Relay
 Control: RS232 or RS422 selectable
 Connectors: SMA-F in and out



Front Panel



Rear Panel

Connector List

Ref	Connector Type	Name
J1	SMA-F	Input 1 (900 – 2150 MHz)
J2	SMA-F	Input 2 (900 – 2150 MHz)
J3	SMA-F	Input 3 (2.0 – 14.5 GHz)
J4	SMA-F	Input 4 (2.0 – 14.5 GHz)
J5	SMA-F	Output 1 (900 MHz – 14.5 GHz)
J6	SMA-F	Output 2 (900 MHz – 14.5 GHz)
J7	SMA-F	Output 3 (900 MHz – 14.5 GHz)
J8	SMA-F	Output 4 (900 MHz – 14.5 GHz)
J9	D9M	Serial Interface
J10	IEC	AC Input
	Stud	Ground

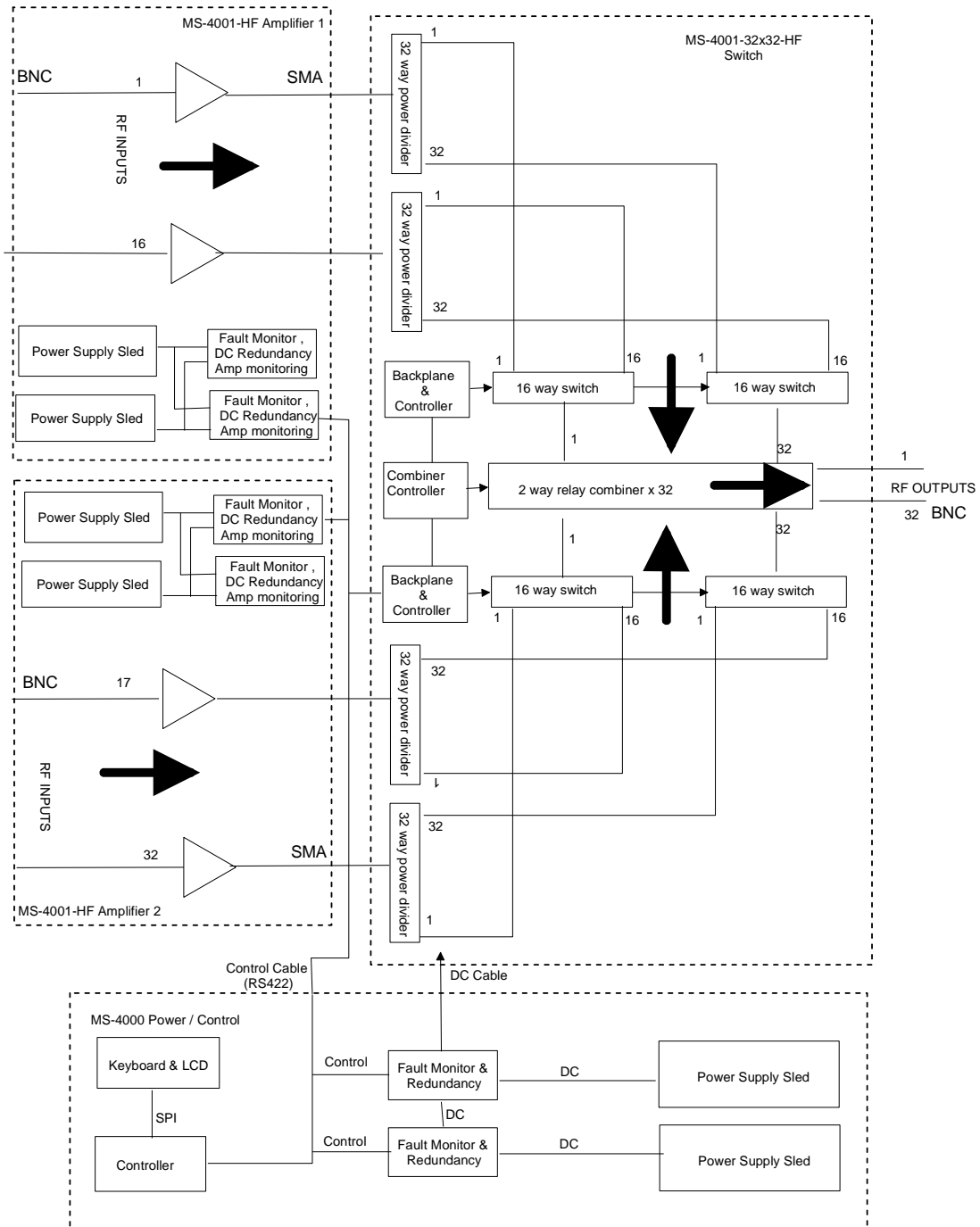
Spares List

(PL-CPT-018-1220)

Ref	Qty per	Recommended Spares Qty	Part Number	Description
A1A1	1	-	CPT-018-1224	Rabbit Carrier Board , Programmed
A1A2	1	-	CPT-012-1220	Key Board Assembly
A1A3	1	1	GLC110-524	Power Supply, 5V, 24V
A1A4	1	-	LCM-S02402DSF	LCD & Backlight Module
A1A5	1	-	CPT-006-1245	Backplane Control Assy
A1A6	1	-	CPT-006-1225	Backplane Assy, 16 Slot
A1A7- A1A10	4	1	CPT-010-1224	Relay Driver Card
A1A11- A1A14	4	1	4IT2L34	Coaxial Relay, 28V, SP4T
A1A15- A1A16	2	-		Power Divider, 2 way
A1A17- A1A18	2	-		Power Divider, 2 way

H. MS-4001-32x32-HF

Part Number: CPT-025-1210



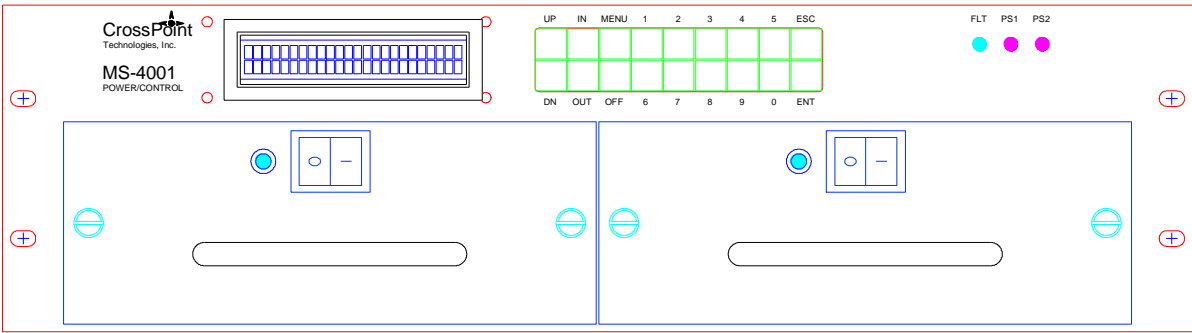
Block Diagram

Specification	Conditions	Min	Typ	Max	Units
Frequency		1.5		32	MHz
Switch Gain		-1	0	+1	dB
Gain Flatness		-1		+1	dB
Noise figure				10	dB
Maximum input signal w/o damage				+27	dBm
1 dB compression point		+8			dBm
OPIP 2 nd order		+68			dBm
OPIP 3 rd order		+32			dBm
Nominal impedance			50		Ω
Isolation			+12		dBm
Input / Input		60			dB
Input / Output		60			dB
Output / Output (different input)		60			dB
Output / Output (same input)		36			dB
VSWR				1.5:1	
Out of band rejection	1 MHz	10			dB
	35 MHz	10			dB
	>40 MHz	20			dB
Dimensions	depth			23	inches
	height			22	RU
	width				

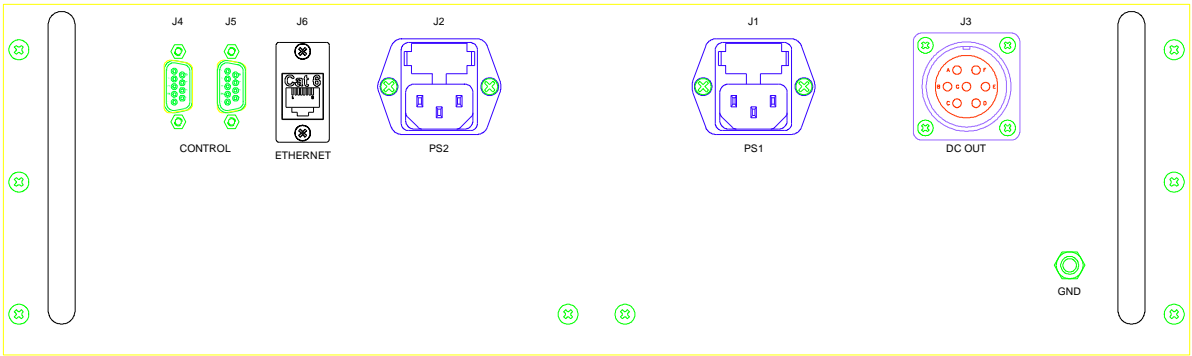
Dimensions:
 17 x 22.5 deep x 12.25 high (nominal) : 7 RU Switch
 17 x 18.5 deep x 5.25 high (nominal) : 3 RU Controller / Power Supply
 17 x 21 deep x 10.5 high (nominal) : 6 RU Amplifier 1
 17 x 21 deep x 10.5 high (nominal) : 6 RU Amplifier 2

Switch Type:
 Control:
 Connectors:
 Intra-chassis Cables provided:

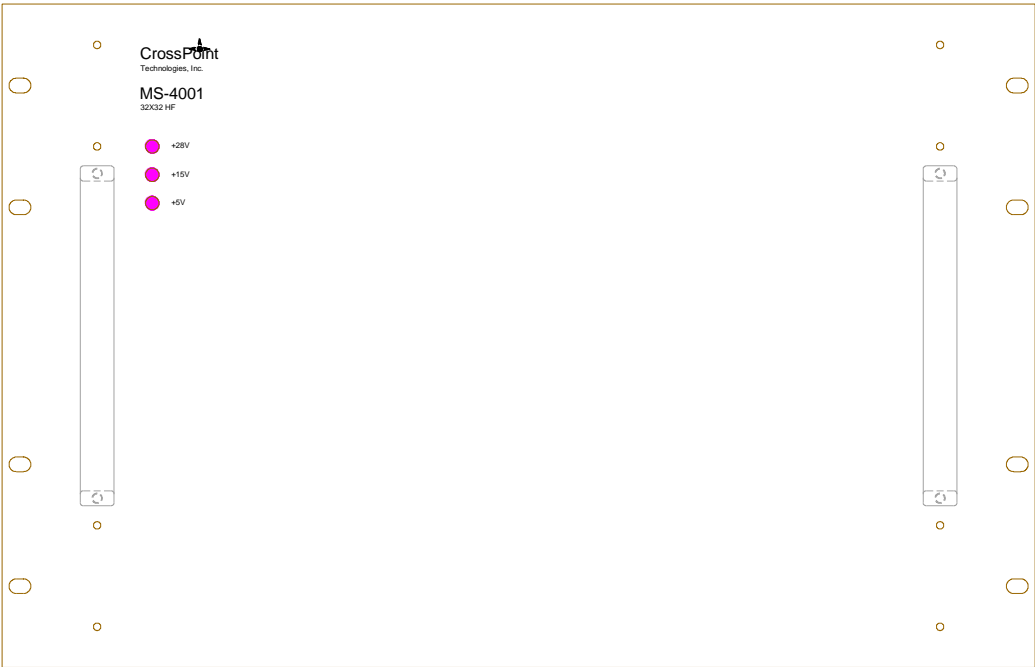
mechanical Relay
 RS232 or RS422 selectable, Ethernet 10 Base-T
 BNC-F in and out (intra-chassis HF cables are SMA, provided)
 DC power cable, 3 inter-communication cables, 32 RF cables (SMA-SMA), 6 US line cords.



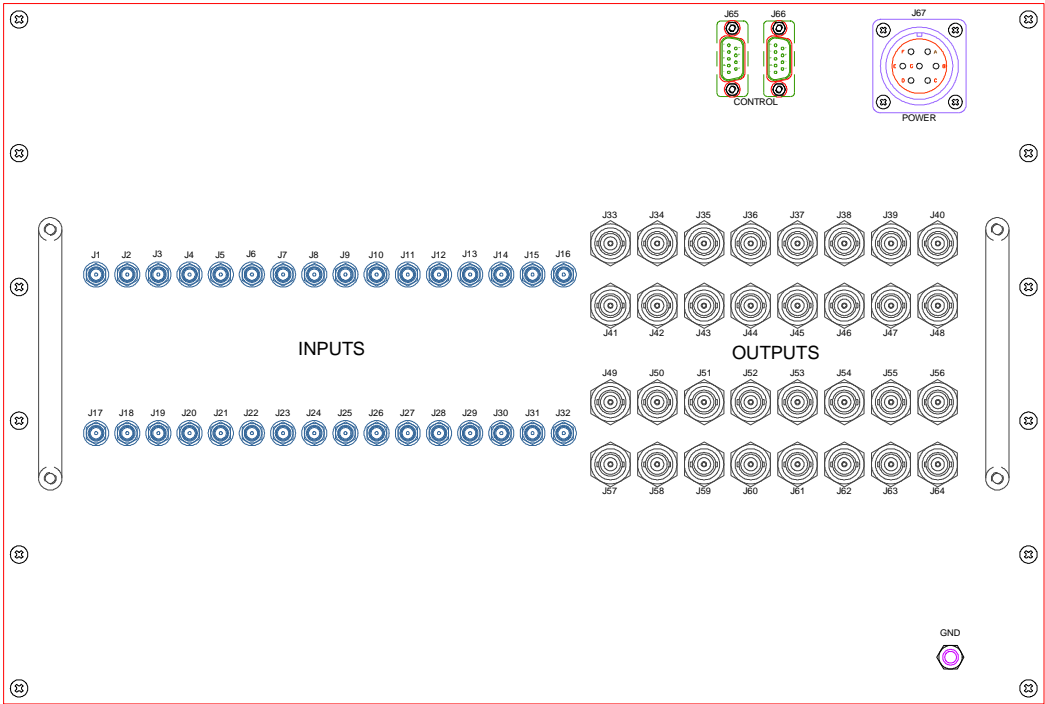
Front Panel – Power Supply / Controller



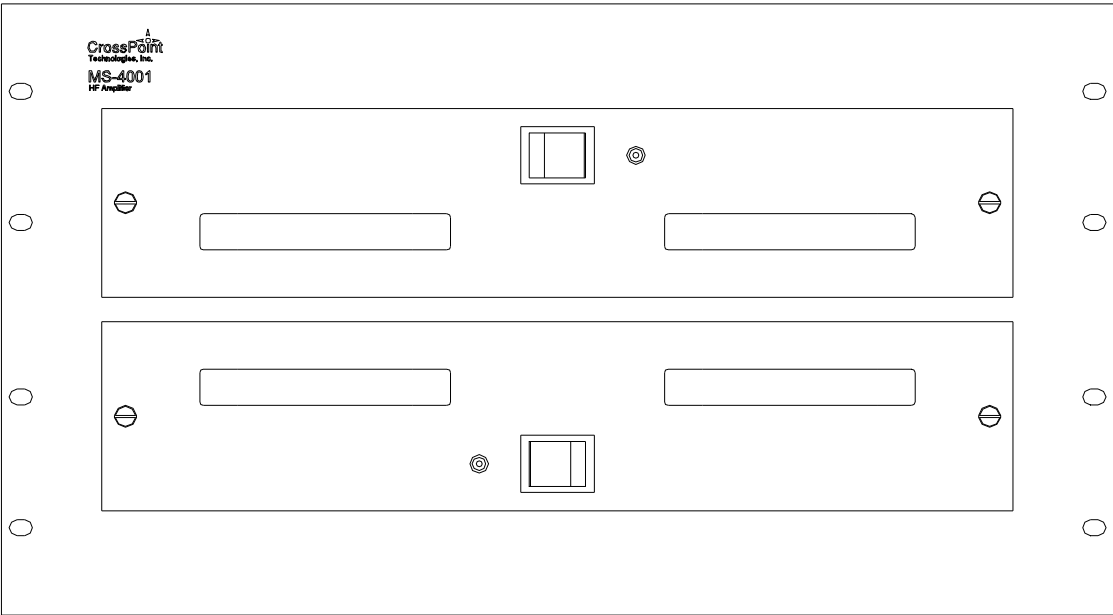
Rear panel – Power Supply / Controller



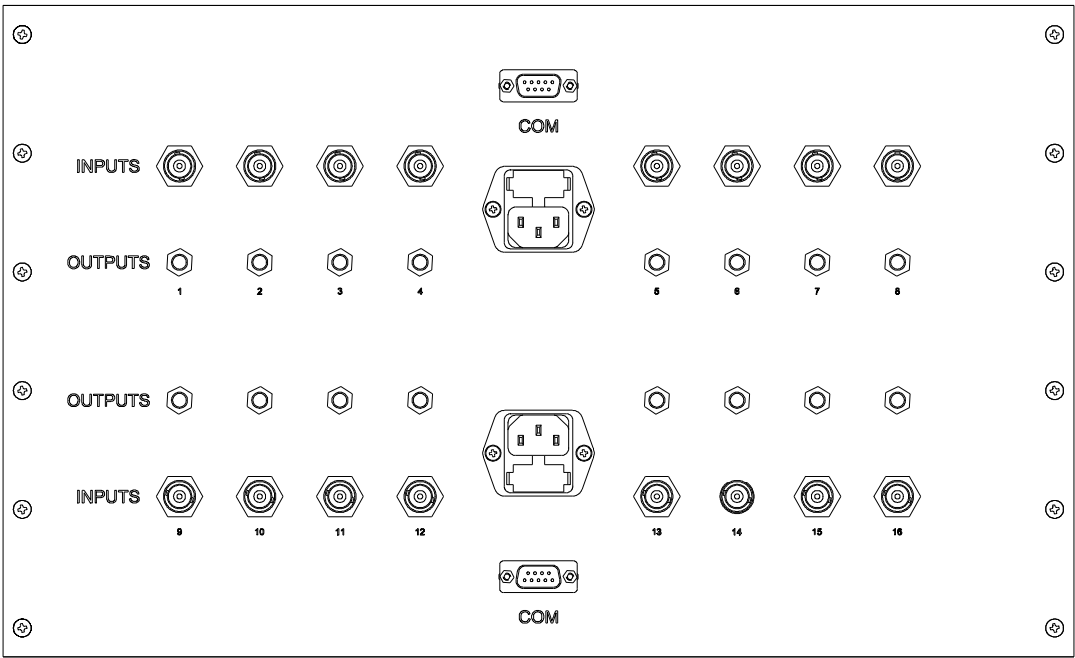
Front Panel - Switch



Rear panel - Switch



Front Panel – Amplifier 1 & Amplifier 2



Rear Panel – Amplifier 1 & Amplifier 2

Connector List

Power / Control

Ref	Connector Type	Name	Intra-chassis Connections
J1	IEC	AC Input (PS1)	
J2	IEC	AC Input (PS2)	
J3	7 Pin Circular	DC Out	Switch J67
J4	D9-M	User Serial Control In/Out	
J5	D9-M	Control In/Out	Switch J65
J6	RJ45	Ethernet	
	Stud	Ground	

Switch

Ref	Connector Type	Name	Intra-chassis Connections
J1	SMA-F	Input 1	Amplifier 1 J17
J2	SMA-F	Input 2	Amplifier 1 J18
J3	SMA-F	Input 3	Amplifier 1 J19
J4	SMA-F	Input 4	Amplifier 1 J20
J5	SMA-F	Input 5	Amplifier 1 J21
J6	SMA-F	Input 6	Amplifier 1 J22
J7	SMA-F	Input 7	Amplifier 1 J23
J8	SMA-F	Input 8	Amplifier 1 J24
J9	SMA-F	Input 9	Amplifier 1 J25
J10	SMA-F	Input 10	Amplifier 1 J26
J11	SMA-F	Input 11	Amplifier 1 J27
J12	SMA-F	Input 12	Amplifier 1 J28
J13	SMA-F	Input 13	Amplifier 1 J29
J14	SMA-F	Input 14	Amplifier 1 J30
J15	SMA-F	Input 15	Amplifier 1 J31
J16	SMA-F	Input 16	Amplifier 1 J32
J17	SMA-F	Input 17	Amplifier 2 J17
J18	SMA-F	Input 18	Amplifier 2 J18
J19	SMA-F	Input 19	Amplifier 2 J19
J20	SMA-F	Input 20	Amplifier 2 J20
J21	SMA-F	Input 21	Amplifier 2 J21
J22	SMA-F	Input 22	Amplifier 2 J22
J23	SMA-F	Input 23	Amplifier 2 J23
J24	SMA-F	Input 24	Amplifier 2 J24
J25	SMA-F	Input 25	Amplifier 2 J25
J26	SMA-F	Input 26	Amplifier 2 J26
J27	SMA-F	Input 27	Amplifier 2 J27
J28	SMA-F	Input 28	Amplifier 2 J28
J29	SMA-F	Input 29	Amplifier 2 J29
J30	SMA-F	Input 30	Amplifier 2 J30
J31	SMA-F	Input 31	Amplifier 2 J31
J32	SMA-F	Input 32	Amplifier 2 J32

Ref	Connector Type	Name	Intra-chassis Connections
J33	BNC-F	User Output 1	
J34	BNC -F	User Output 2	
J35	BNC -F	User Output 3	
J36	BNC -F	User Output 4	
J37	BNC -F	User Output 5	
J38	BNC -F	User Output 6	
J39	BNC -F	User Output 7	
J40	BNC -F	User Output 8	
J41	BNC -F	User Output 9	
J42	BNC -F	User Output 10	
J43	BNC -F	User Output 11	
J44	BNC -F	User Output 12	
J45	BNC -F	User Output 13	
J46	BNC -F	User Output 14	
J47	BNC -F	User Output 15	
J48	BNC -F	User Output 16	
J49	BNC -F	User Output 17	
J50	BNC -F	User Output 18	
J51	BNC -F	User Output 19	
J52	BNC -F	User Output 20	
J53	BNC -F	User Output 21	
J54	BNC -F	User Output 22	
J55	BNC -F	User Output 23	
J56	BNC -F	User Output 24	
J57	BNC -F	User Output 25	
J58	BNC -F	User Output 26	
J59	BNC -F	User Output 27	
J60	BNC -F	User Output 28	
J61	BNC -F	User Output 29	
J62	BNC -F	User Output 30	
J63	BNC -F	User Output 31	
J64	BNC -F	User Output 32	
J65	D9-M	Serial Control	Power Ctrlr J4
J66	D9-M	Serial Control	Amplifier 1 J35
J67	7 pin circular	DC Input	Power Ctrlr J3
	Stud	Ground	

Amplifier 1

Ref	Connector Type	Name	Intra-chassis Connections
J1	BNC -F	User Input 1	
J2	BNC -F	User Input 2	
J3	BNC -F	User Input 3	
J4	BNC -F	User Input 4	
J5	BNC -F	User Input 5	
J6	BNC -F	User Input 6	
J7	BNC -F	User Input 7	
J8	BNC -F	User Input 8	
J9	BNC -F	User Input 9	
J10	BNC -F	User Input 10	

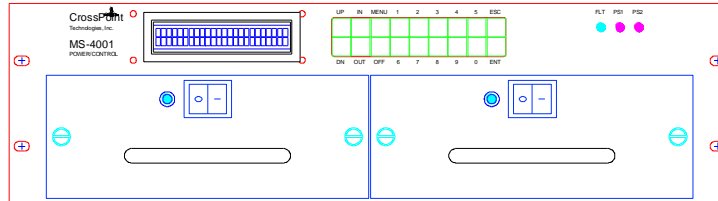
Ref	Connector Type	Name	Intra-chassis Connections
J11	BNC -F	User Input 11	
J12	BNC -F	User Input 12	
J13	BNC -F	User Input 13	
J14	BNC -F	User Input 14	
J15	BNC -F	User Input 15	
J16	BNC -F	User Input 16	
J17	SMA-F	Output 1	Switch J1
J18	SMA-F	Output 2	Switch J2
J19	SMA-F	Output 3	Switch J3
J20	SMA-F	Output 4	Switch J4
J21	SMA-F	Output 5	Switch J5
J22	SMA-F	Output 6	Switch J6
J23	SMA-F	Output 7	Switch J7
J24	SMA-F	Output 8	Switch J8
J25	SMA-F	Output 9	Switch J9
J26	SMA-F	Output 10	Switch J10
J27	SMA-F	Output 11	Switch J11
J28	SMA-F	Output 12	Switch J12
J29	SMA-F	Output 13	Switch J13
J30	SMA-F	Output 14	Switch J14
J31	SMA-F	Output 15	Switch J15
J32	SMA-F	Output 16	Switch J16
J33	IEC	AC Input (PS1)	
J34	IEC	AC Input (PS2)	
J35	D9-M	Control In/Out	Power Ctrlr J66
J36	D9-M	Control In/Out	Amplifier 2 J35

Amplifier 2

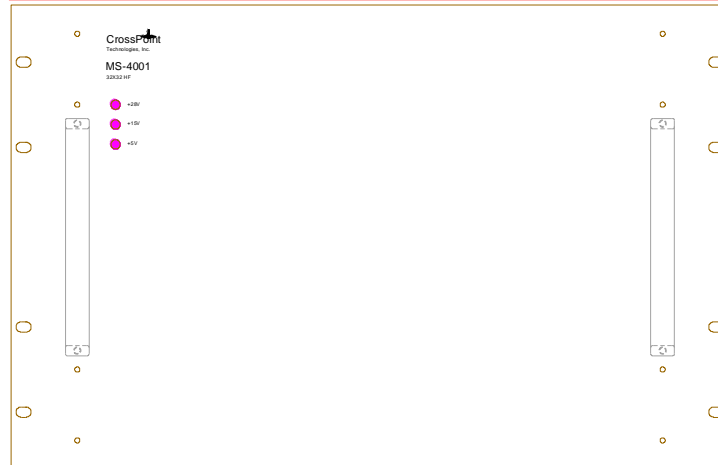
Ref	Connector Type	Name	Intra-chassis Connections
J1	BNC -F	User Input 1	
J2	BNC -F	User Input 2	
J3	BNC -F	User Input 3	
J4	BNC -F	User Input 4	
J5	BNC -F	User Input 5	
J6	BNC -F	User Input 6	
J7	BNC -F	User Input 7	
J8	BNC -F	User Input 8	
J9	BNC -F	User Input 9	
J10	BNC -F	User Input 10	
J11	BNC -F	User Input 11	
J12	BNC -F	User Input 12	
J13	BNC -F	User Input 13	
J14	BNC -F	User Input 14	
J15	BNC -F	User Input 15	
J16	BNC -F	User Input 16	
J17	SMA-F	Output 1	Switch J17
J18	SMA-F	Output 2	Switch J18

Ref	Connector Type	Name	Intra-chassis Connections
J19	SMA-F	Output 3	Switch J19
J20	SMA-F	Output 4	Switch J20
J21	SMA-F	Output 5	Switch J21
J22	SMA-F	Output 6	Switch J22
J23	SMA-F	Output 7	Switch J23
J24	SMA-F	Output 8	Switch J24
J25	SMA-F	Output 9	Switch J25
J26	SMA-F	Output 10	Switch J26
J27	SMA-F	Output 11	Switch J27
J28	SMA-F	Output 12	Switch J28
J29	SMA-F	Output 13	Switch J29
J30	SMA-F	Output 14	Switch J30
J31	SMA-F	Output 15	Switch J31
J32	SMA-F	Output 16	Switch J32
J33	IEC	AC Input (PS1)	
J34	IEC	AC Input (PS2)	
J35	D9-M	Control In/Out	Amplifier 1 J36
J36	D9-M	Control In/Out	

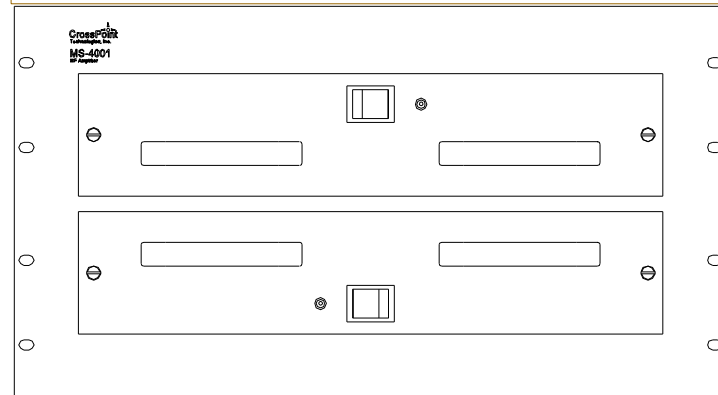
Rack Elevations

MS-4001-32x32-HF System
Rack elevation, Front

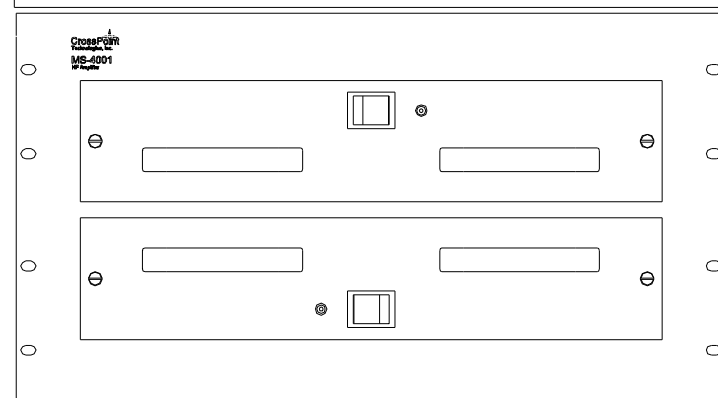
Power / Controller
CPT-025-1210
3 RU



HF Switch
CPT-025-1221
7 RU

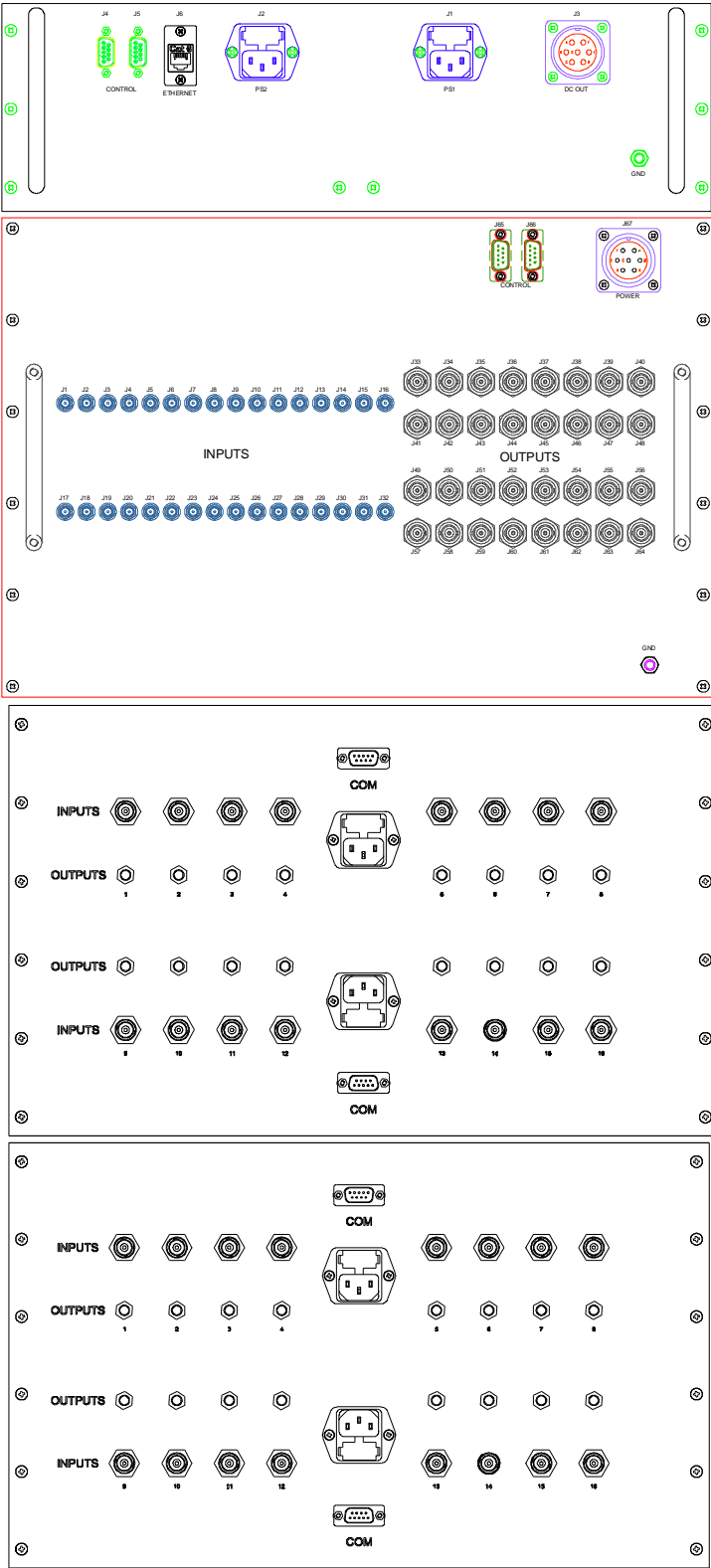


HF Amplifier 1
CPT-025-1222-1
6 RU

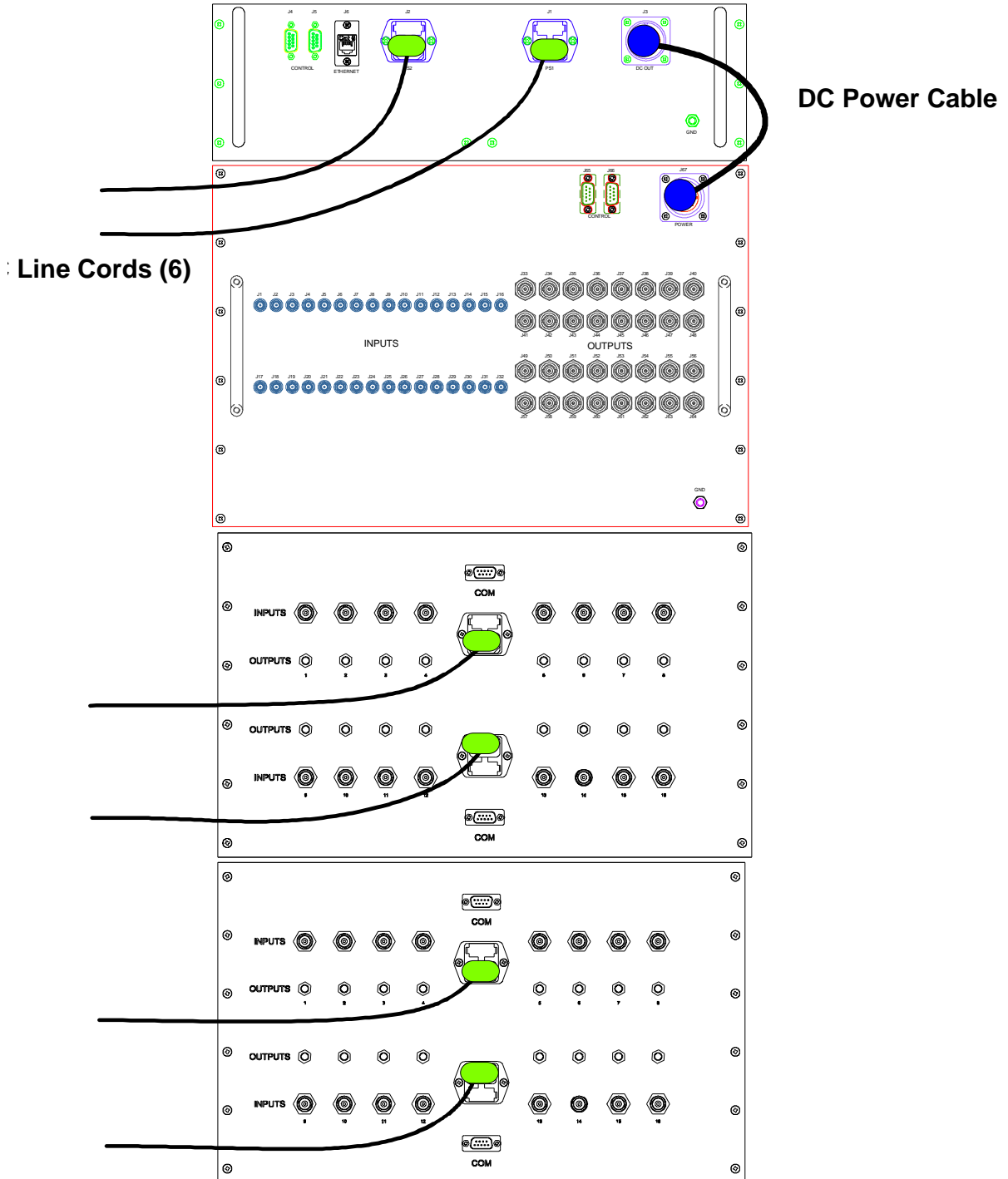


HF Amplifier 2
CPT-025-1222-2
6 RU

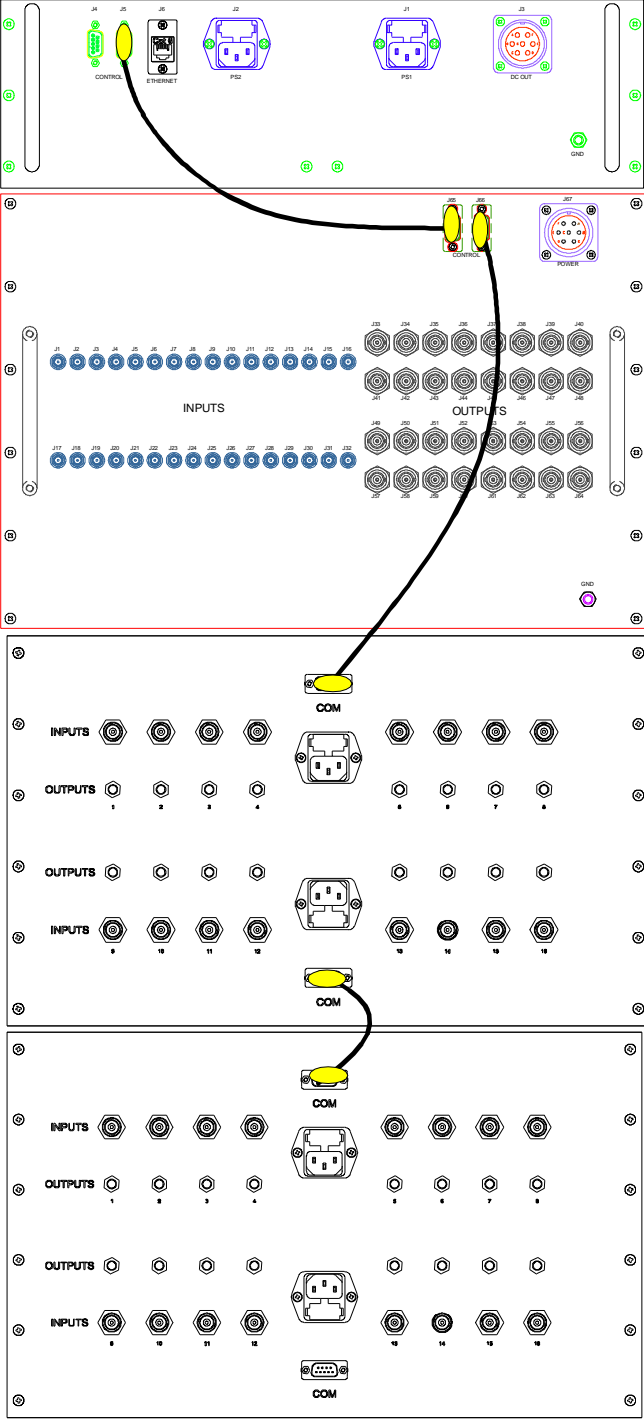
Rack elevation, Rear



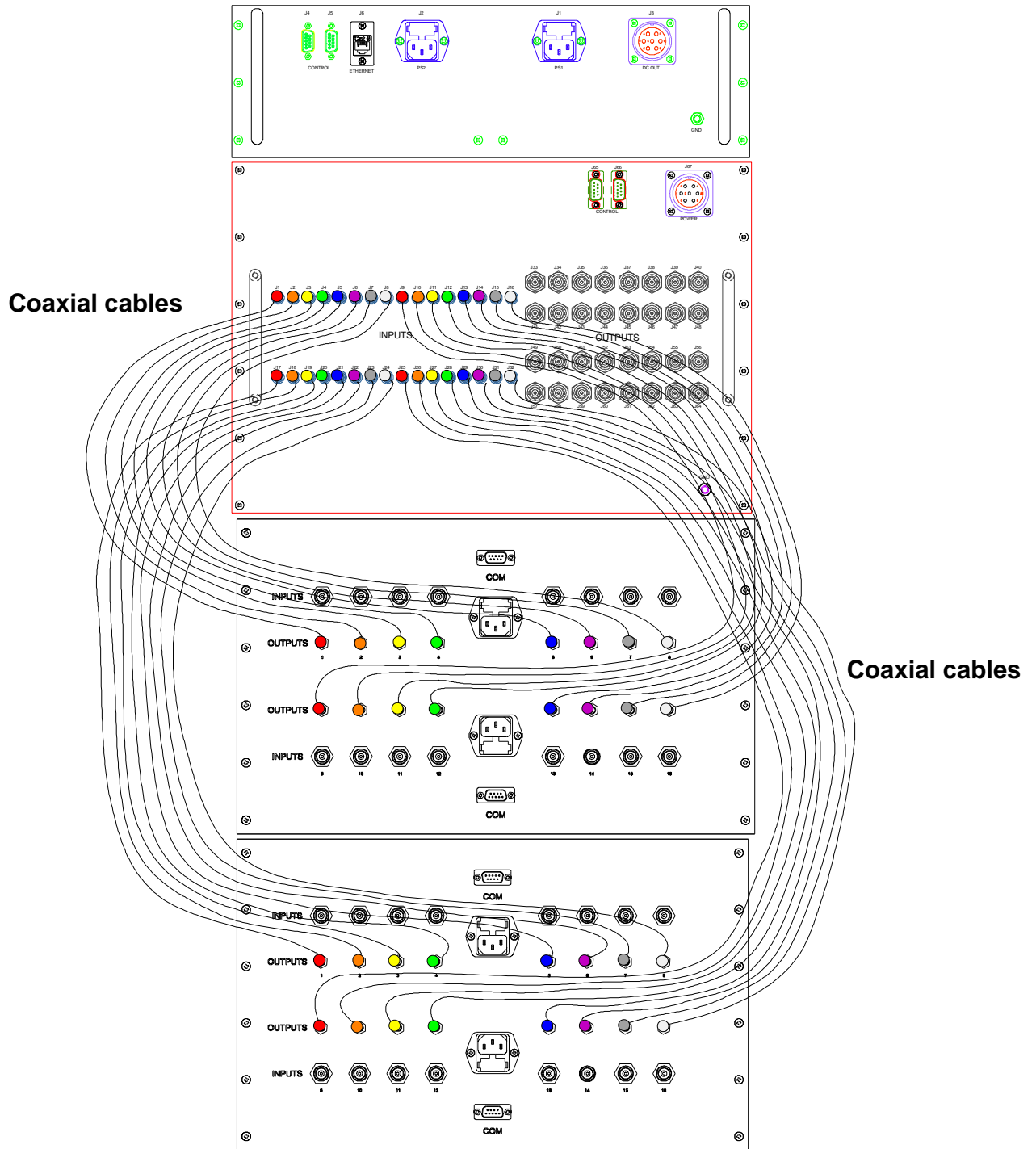
Installation Wiring Diagrams

MS-4001-32x32-HF System
Rack elevation, Rear

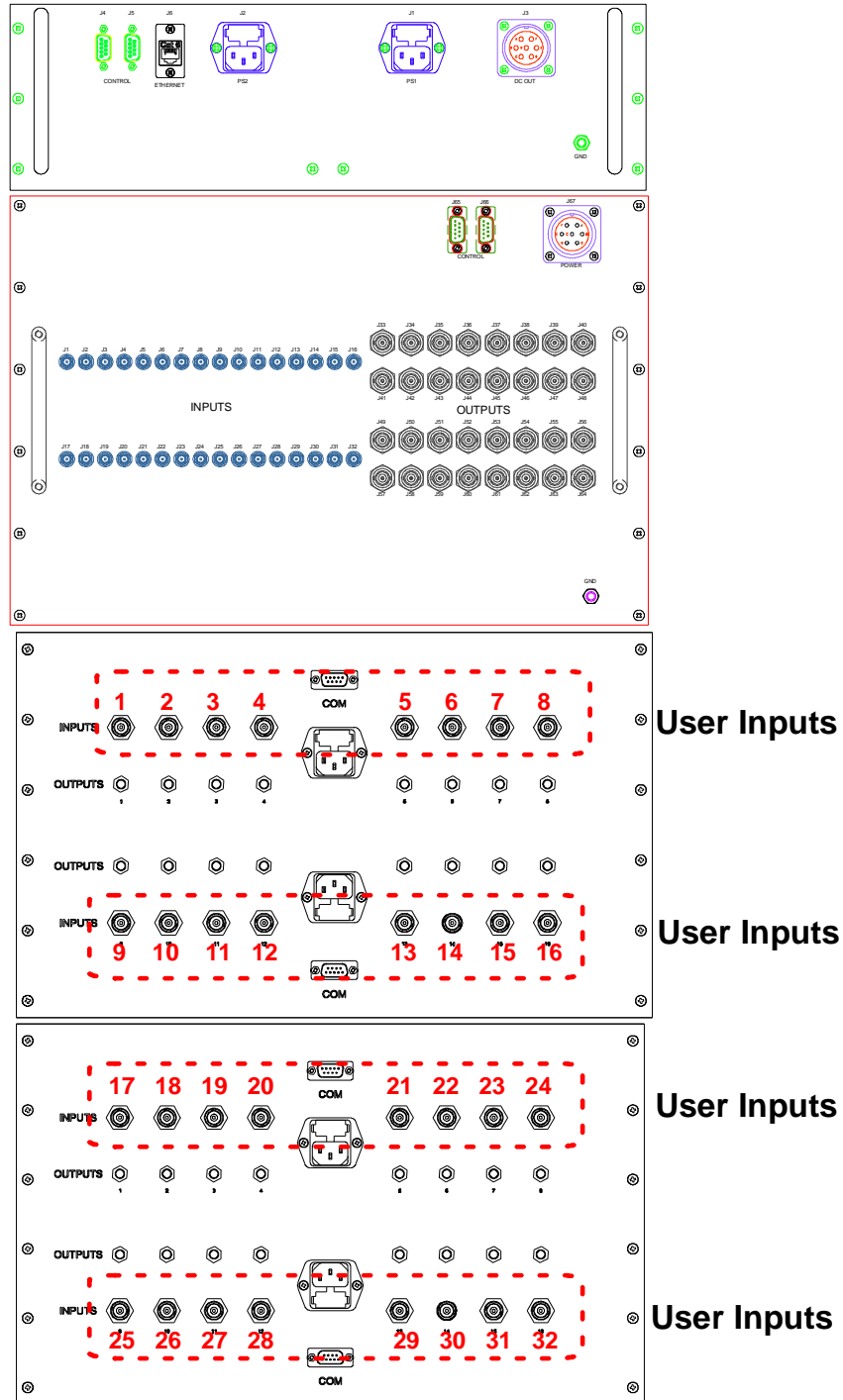
MS-4001-32x32-HF System
Rack elevation, Rear



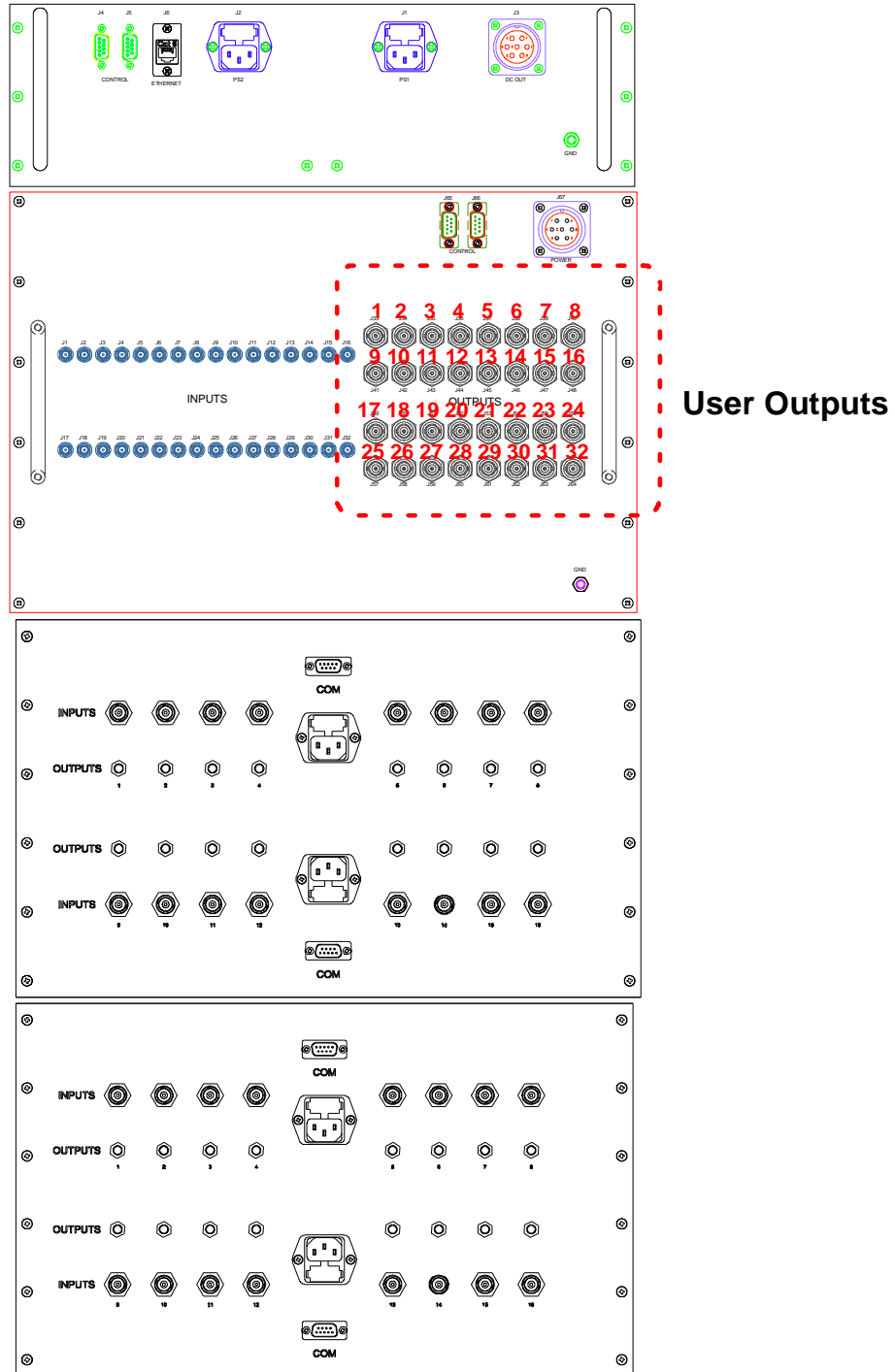
MS-4001-32x32-HF System
Rack elevation, Rear



MS-4001-32x32-HF System
Rack elevation, Rear



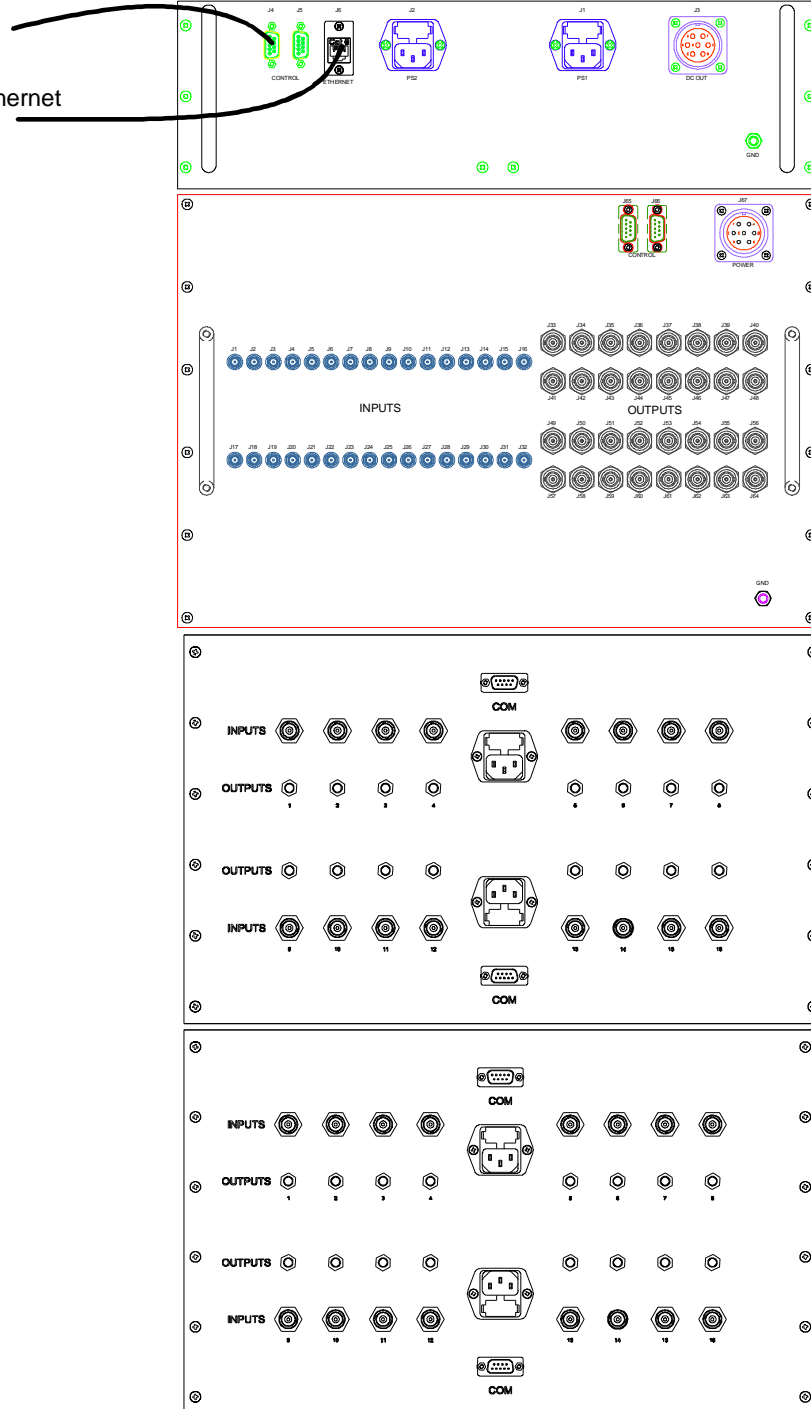
MS-4001-32x32-HF System
Rack elevation, Rear



MS-4001-32x32-HF System
Rack elevation, Rear

User Serial (RS-232 or RS-422)

Ethernet



Modifications to MS4001-32x32-HF Firmware v1.23

The MS4001-32x32-HF Switch Matrix received updated firmware to accomplish several new functions. There were a few changes to the front panel menus, but the majority of the new functionality is accessed via the Ethernet or serial ports. The limitations of the LCD and keyboard made it too difficult to provide some of these functions at the front panel.

New functions and changes:

- Allow the user to disable or enable individual amplifiers for each channel, so that faults are not sensed in channels where the amp is unused or bypassed. This allows customization of the gain for different application settings. This setting does not alter the physical amplifier, nor does it provide bypass switching around the amplifier, it only disables fault reporting for that channel, whether or not an amplifier is installed. This function is accomplished via the Ethernet/serial ports only.
- Modified the Restore Defaults function so that Ethernet and serial settings are not changed when executing this function. This applies to the menu selections on the front panel, and to the Ethernet/serial port. The new Enable/Disable feature for the amplifier fault detection is also not affected by this Restore Defaults function. A new LCD menu item appears that will allow resetting just the Ethernet and serial conditions to the factory defaults. This feature is not available remotely.
- There are instances where the Matrix becomes unresponsive to the network. This was fixed by enabling a TCP keep-alive function in the network firmware.
- Provide two levels of fault information for the amplifiers. Hard failures and marginal failures are reported individually via the Ethernet/serial ports. The LCD display still shows only a single fault indication per amplifier. Disabled amplifiers do not participate in the fault decisions, and will not create alarms.

Changes to Menu

In the Menu | Maint & Setup area, the Restore Defaults menu item looks the same as it did in previous versions. However, it will not affect the Ethernet and serial port settings. The unit will still perform a reset when this function is executed.

The next menu item after the Restore Defaults is now Restore Comm. Selecting this function will reset the Ethernet and serial ports only (not the rest of the matrix) to their factory defaults. Those default conditions are:

Ethernet

DHCP: On

Default Address (ignored because DHCP is on): 192.168.1.100

Default Mask (Ignored because DHCP is on): 255.255.255.0

Default Port: 23 (Telnet standard)

Serial

Default Interface: RS232

Default Baud: 19200

(Serial communications are always 8 bits, no parity, 1 stop bit)

In the menu Status | Amplifier Status area, the display now shows both the summary fault status for each enabled channel, and also the enabled/disabled status of each amplifier. These are hex

displays, with a single bit for each channel. Channel 1 is the LSB (right side) of each value. The fault bit is a 1 to indicate a fault, An All zeroes display is the un-faulted condition for the system. For the enable/disable bits, a 1 indicates the amplifier is enabled and participates in fault decisions.

For example, if the amplifiers 2, 12 and 22 are disabled, and amplifier 3 and 32 have faults (either hard or marginal), the display would read:
 “80000004 Ena: FFDFF7FD”

Amplifier Status HEX value table

The table below shows the association between the amplifiers and the position of each reported value.

Pos7	Pos6	Pos5	Pos4	Pos3	Pos2	Pos1	Pos0
Amps29-32	Amps25-28	Amps21-24	Amps17-20	Amps13-16	Amps9-12	Amps5-8	Amps1-4

Amp29 = 1	Amp25 = 1	Amp21 = 1	Amp17 = 1	Amp13 = 1	Amp9 = 1	Amp5 = 1	Amp1 = 1
Amp30 = 2	Amp26 = 2	Amp22 = 2	Amp18 = 2	Amp14 = 2	Amp10 = 2	Amp6 = 2	Amp2 = 2
Amp31 = 4	Amp27 = 4	Amp23 = 4	Amp19 = 4	Amp15 = 4	Amp11 = 4	Amp7 = 4	Amp3 = 4
Amp32 = 8	Amp28 = 8	Amp24 = 8	Amp20 = 8	Amp16 = 8	Amp12 = 8	Amp8 = 8	Amp4 = 8

Values are reported in HEX for the cumulative value of each Position.

Examples:

F is reported in position 4, this would tell us that all 4 amps #17, 18, 19, and 20 have a failure.

E is reported in position 7, this would tell us that amps #30,31 and 32 have a failure.

C is reported in position 0, this would tell us that amps #3, and 4 have a failure.

8 is reported in position 5, this would tell us that amp #8 has a failure.

5 is reported in position 7, this would tell us that amps #31, and 29 have a failure.

0 is reported in any position, this would tell us that all 4 associated amps are passing.

Amps which are disabled will never display a fault, even if the amp truly has a fault. Since the Enable/Disable status is not reset during Restore Defaults, it is important to make sure the Enable/Disable status of each channel is kept current if the system configuration is changed.

Ethernet & Serial changes.

All these changes are accessible over either serial or Ethernet ports. New commands are listed, along with the modifications to existing commands.

New commands

AC Read Amplifier Current

FORMAT: (1) AC?

RESPONSE: (1) AC(xxx,yyy)(zzz,www)...

The responses are organized as (amplifier, current in mA). Pairs are enclosed in parentheses.

DESCRIPTION: Allows read back of the operating current of all amplifier channels. All channels will indicate a current, even if they have been disabled by the AE command. Unpowered amplifiers may indicate a few mA due to A/D converter noise.

EXAMPLES: AE(000,N) (005,N) (006,F) (012,N)...(032,N): . In the example, Amplifier 1 is enabled (oN), amplifier 5 is enabled, amplifier 6 is disabled, amplifier 12 is disabled, etc. All 32 channels are returned as a single message if AE? Is issued. Otherwise, the response includes only the channels found in the incoming message.

AE Enable / Disable Amplifiers

FORMAT: (1) AE?
 (2) AE (00,N)(01,F)(22,N)
 (3) AEA (All)
 (4) AEN (None)

RESPONSE: (1) same as format (2)
 (2) AE(xxx,yyy)(zzz,www)..
 The responses are organized as (amplifier, Enable/disable). Pairs are enclosed in parentheses. The Enabled state (oN) is indicated by 'N'. The Disabled state (oFf) is indicated by 'F'
 (3) AEALL – All amplifiers are enabled
 (4) AENONE – All amplifiers are disabled.

DESCRIPTION: Allows user to enable or disable individual amplifier channels from participating in fault decisions. In systems where the amplifiers are not installed (or bypassed) for certain channels, this command can be used to stop false failure indications caused by uninstalled or unpowered amplifiers. Formats 3 and 4 affect all 32 amplifiers, turning them all on or off. This may be useful as a starting point for manual setup.

EXAMPLES: AE(000,N) (005,N) (006,F) (012,N)...(032,N): . In the example, Amplifier 1 is enabled (oN), amplifier 5 is enabled, amplifier 6 is disabled, amplifier 12 is disabled, etc. All 32 channels are returned as a single message if AE? Is issued. Otherwise, the response includes only the channels found in the incoming message.

Modified commands

AR Amplifier Status Report

FORMAT: (1) AR
 (2) AR?

RESPONSE: (1) same as format 2
 (2) AR001P,002H,003M,004D,005P,.... ,032P

DESCRIPTION: When separate amplifier chassis are used, the system reports the health of the amplifiers with this command. Each amplifier is monitored by watching its DC current. If the current is either too high or too low, the amplifier is reported as failed. There are two levels of failure : hard failures are indicated when current is significantly different from nominal. Marginal failures are indicated when current is slightly out of range, but the amplifier is likely still operating close to its specified performance level.

The response returns each channel number and a 'P' indicating Pass, 'H' indicating a Hard failure, 'M' indicating Marginal failure, or 'D' indicating disabled. The example above shows amplifier 1 passes, amplifier 2 has a hard failure, amplifier 3 has a marginal failure and amplifier 4 is disabled.

RD Restore Defaults

FORMAT: (1) RD

RESPONSE: none

DESCRIPTION: Sets all switch paths to OFF condition, and Initializes the matrix parameters. The Ethernet and serial parameters are NOT changed. The Amplifier Enable/Disable configuration is not changed. The Matrix will reset and will need about 5 seconds before it becomes responsive to external commands.

Spares List

Power / Control (PL-CPT-025-1220)

Ref	Qty per	Recommended Spares Qty	Part Number	Description
A1A1	1	-	CPT-025-1230	Rabbit Carrier Board , Programmed
A1A2	1	-	CPT-006-1222	Key Board Assembly
A1A3	1	-	LCM-S02402DSF	LCD & Backlight Module
A1A4, A1A5	2	1	CPT-010-1226	Power Supply Tray Assy
A1A4A1, A1A5A1	2	1	GSM-28-5	Power Supply, 5V
A1A4A2, A1A5A2	2	1	GPFC160-15	Power Supply, 15V
A1A4A3, A1A5A3	2	1	GPFC160-28	Power Supply, 28V
A1A6, A1A7	2	1	CPT-010-1225	Power Supply Fault Board, 5/15V
A1A6, A1A7	1	1	CPT-010-1231	Power Supply Fault Board, 28V
A1A8, A1A9	2	1	P0007-ND	Fan, 12 VDC, 3.149 SQ

Switch (PL-CPT-025-1221)

Ref	Qty per	Recommended Spares Qty	Part Number	Description
A1A1	2	-	CPT-006-1245	Backplane Control Assy
A1A3	1	-	CPT-008-1225	Backplane Assy, 32 Slot, Upper
A1A4	1	-	CPT-020-1225	Backplane Assy, 32 Slot, Lower
A1A5 – A1A36	64	2	CPT-025-1224	16 Way Relay Switch Assy, HF
A1A37 – A1A78	32	-	PD-32-IF-CPT-025	Power Divider Assy, 32 way, IF
A1A79	1	-	CPT-025-1251	Power Combiner Assy, 2 way x 32, HF
A1A80	1	-	CPT-025-1252	Combiner controller Assy
A1A80 – A1A82	6	1	P90997-ND	Fan, 12vdc,3.149 Sq

Amplifier (PL-CPT-025-1222-1, PL-CPT-025-1222-2) [1 of each per system]

Ref	Qty per	Recommended Spares Qty	Part Number	Description
A1A1- A1A2	2	-	CPT-025-1250	Amp Power Distribution Assy
A1A3 – A1A4	2	1	CPT-025-1223	Power Supply Sled, HF Amplifier

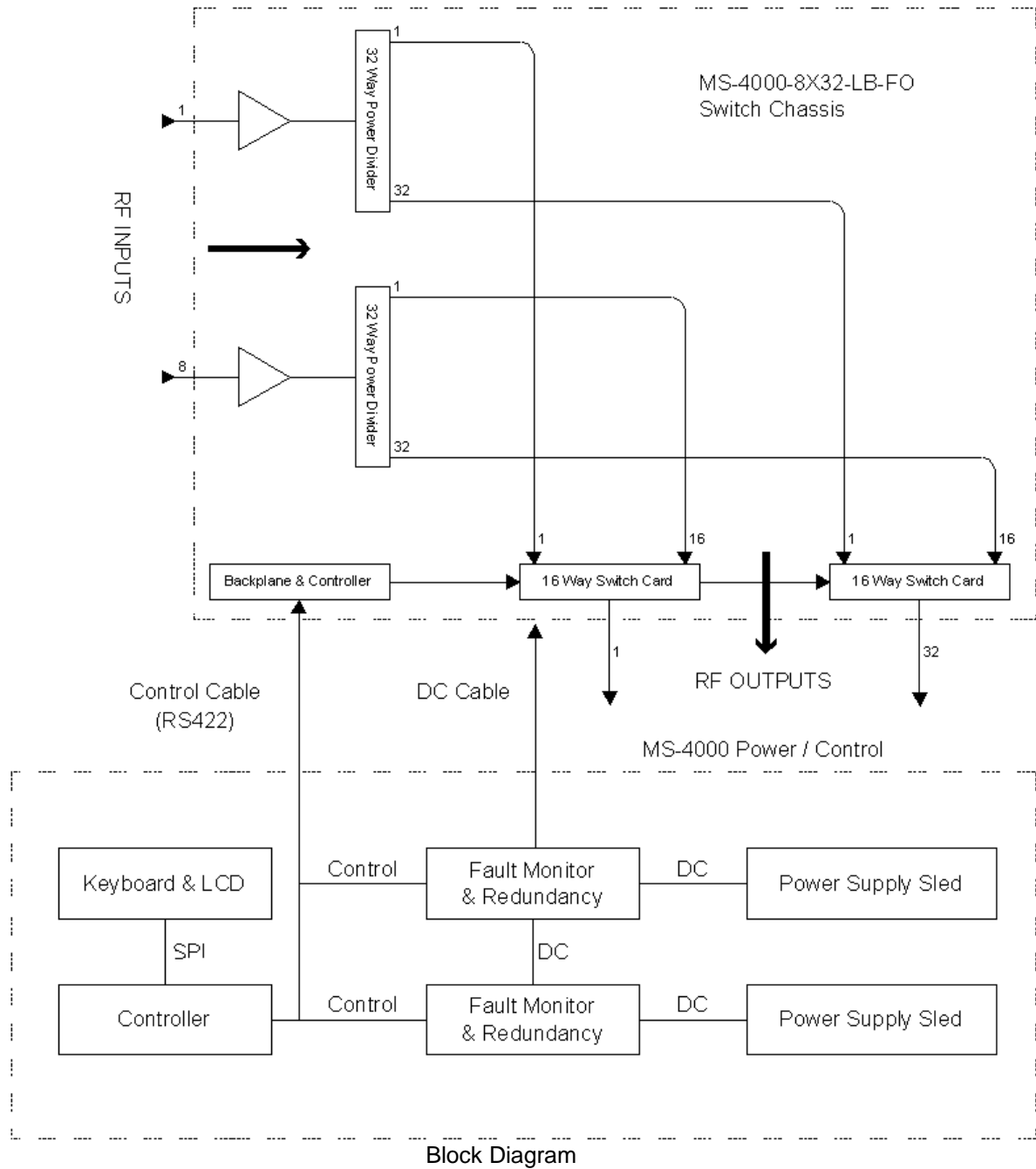
Ref	Qty per	Recommended Spares Qty	Part Number	Description
A1A5 – A1A20	16	1	CPT-025-12xx	Amplifier Module, HF
A1A3A1, A1A4A1	2	1	VP-F1412005	Power supply, 28V
	8	1	PDxxxxx-ND	Fan, 24vdc, 3.149 Sq

External Cables

Ref	Qty per	Recommended Spares Qty	Part Number	Description
	64	2		Coaxial cable, SMA-SMA, 6'
	1	-		DC Power cable
	3	-		Inter-communication cable
	6	-		Line cord, US

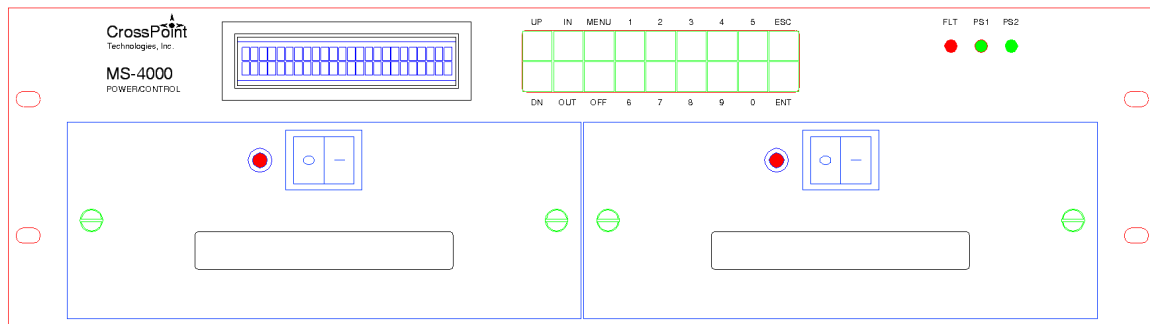
I. MS-4000-8x32-LB-FO

Part Number: CPT-048-1210

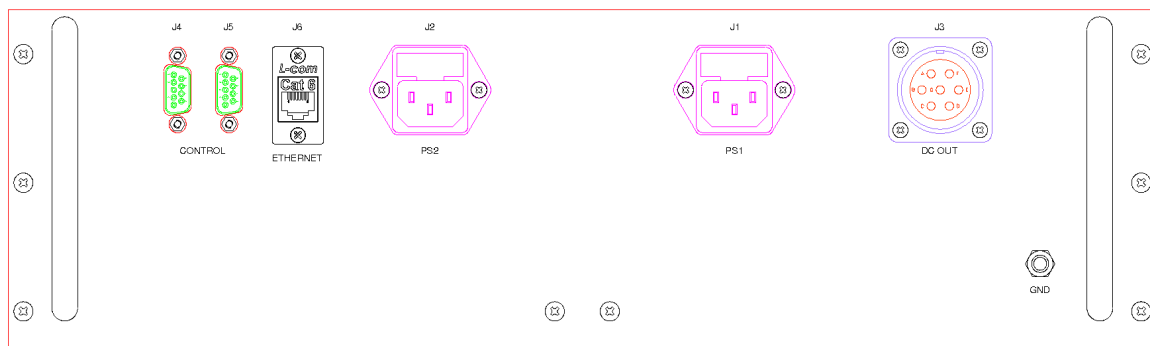


Specification	Conditions	Min	Typ	Max	Units
Frequency Range		950		2150	MHz
Gain		-2	0	+2	dB
Off-Isolation		55	60		dB
In-In Isolation		60	65		dB
Out-Out Isolation		55	60		dB
Impedance			50		Ω
VSWR			1.6	1.8	
1dB Output Compression		0	+3		dBm
NF			16	18	dB
IP3(input)		+14			dBm
Temperature (Op)		0		50	°C
AC Voltage		88		260	VAC
Power Consumption			150	200	W

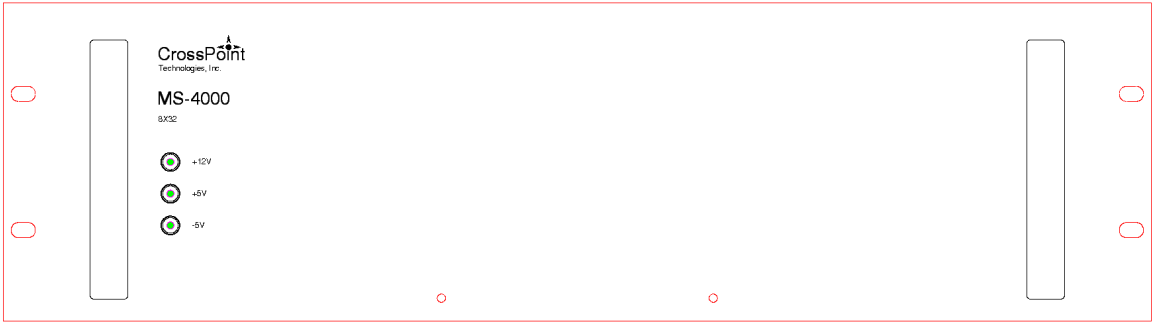
Dimensions: 17 x 20 deep x 5.25 high (nominal): 3 RU Switch
 17 x 18 deep x 5.25 high (nominal): 3 RU Controller / PS
 Switch Type: Coaxial Relay
 Control: RS232 or RS422 selectable & Ethernet
 Connectors: SMA-F in and out



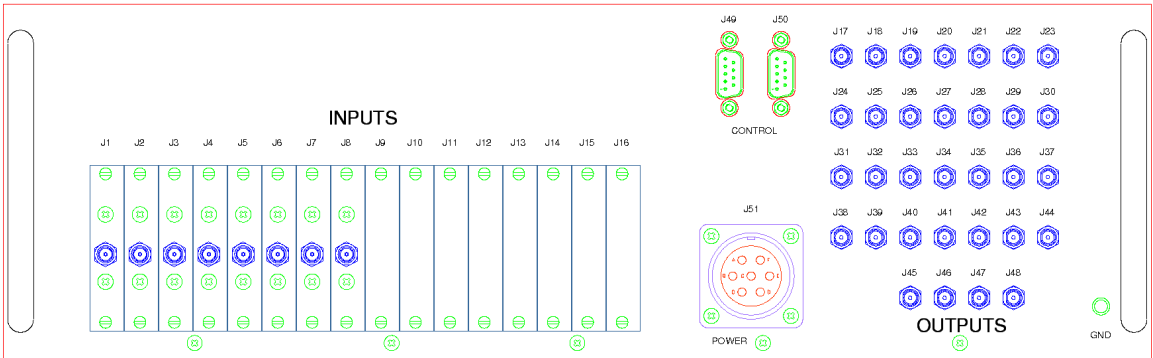
Front Panel – Power Supply / Controller



Rear Panel – Power Supply / Controller



Front Panel - Switch



Rear Panel - Switch

Connector List

Power / Control

Ref	Connector Type	Name
J1	IEC	AC Input (PS1)
J2	IEC	AC Input (PS2)
J3	7 Pin Circular	DC Out
J4	D-9	Control In/Out
J5	D-9	Control In/Out
J6	RJ-45	Ethernet Control
GND	Stud	Ground

Switch

Ref	Connector Type	Name
J1	SMA-F	Input 1
J2	SMA-F	Input 2
J3	SMA-F	Input 3
J4	SMA-F	Input 4
J5	SMA-F	Input 5
J6	SMA-F	Input 6
J7	SMA-F	Input 7
J8	SMA-F	Input 8
J9		Not Used
J10		Not Used
J11		Not Used
J12		Not Used
J13		Not Used
J14		Not Used
J15		Not Used
J16		Not Used
J17	SMA-F	Output 1
J18	SMA-F	Output 2
J19	SMA-F	Output 3
J20	SMA-F	Output 4
J21	SMA-F	Output 5
J22	SMA-F	Output 6
J23	SMA-F	Output 7
J24	SMA-F	Output 8
J25	SMA-F	Output 9
J26	SMA-F	Output 10
J27	SMA-F	Output 11
J28	SMA-F	Output 12
J29	SMA-F	Output 13
J30	SMA-F	Output 14
J31	SMA-F	Output 15
J32	SMA-F	Output 16
J33	SMA-F	Output 17
J34	SMA-F	Output 18
J35	SMA-F	Output 19
J36	SMA-F	Output 20
J37	SMA-F	Output 21

Ref	Connector Type	Name
J38	SMA-F	Output 22
J39	SMA-F	Output 23
J40	SMA-F	Output 24
J41	SMA-F	Output 25
J42	SMA-F	Output 26
J43	SMA-F	Output 27
J44	SMA-F	Output 28
J45	SMA-F	Output 29
J46	SMA-F	Output 30
J47	SMA-F	Output 31
J48	SMA-F	Output 32
J49	D-9	Serial Control
J50	D-9	Serial Control
J51	7 pin circular	DC Input
GND	Stud	Ground

Spares List

Power / Control (PL-CPT-048-1220)

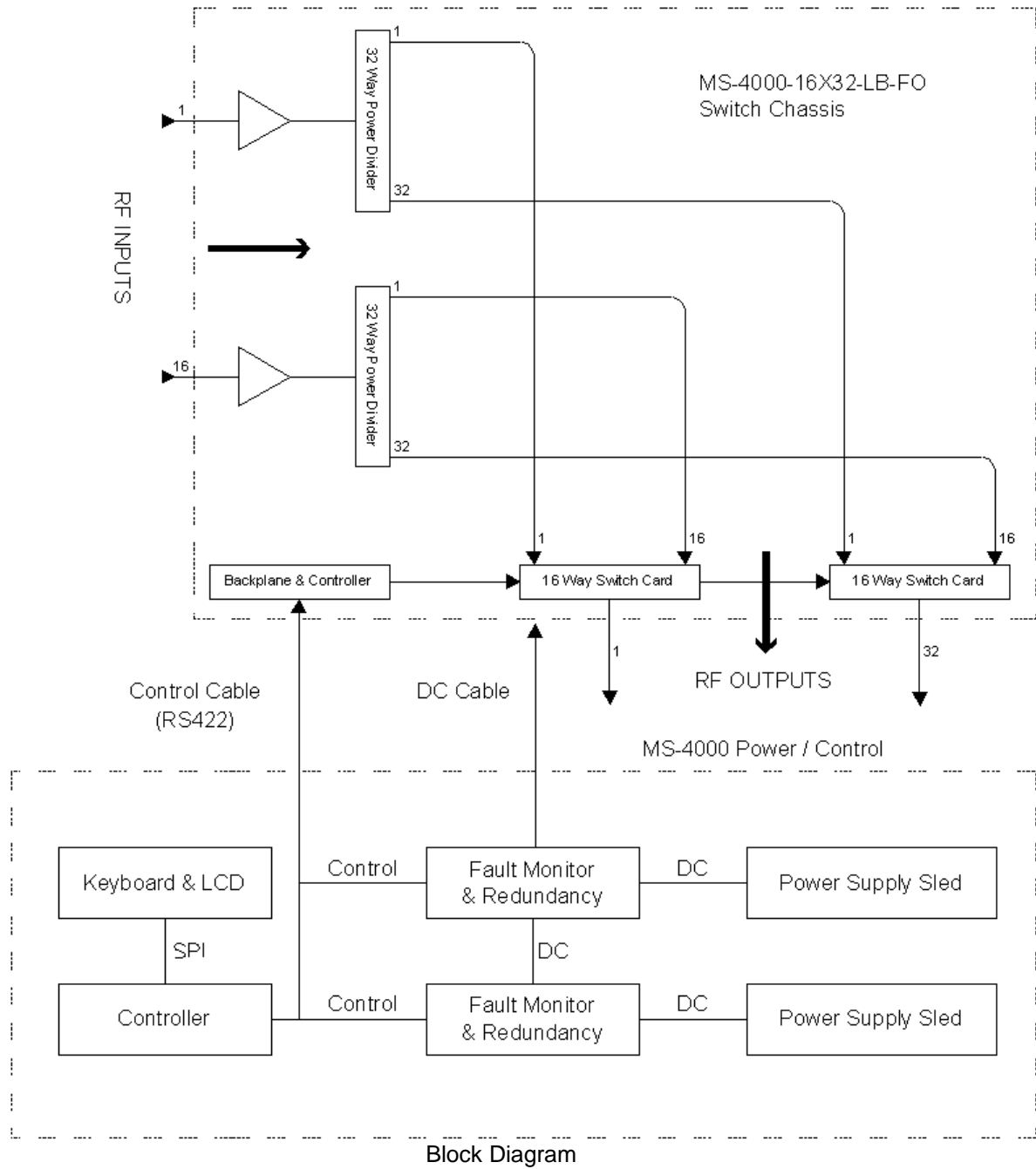
Ref	Qty per	Recommended Spares Qty	Part Number	Description
A1A1	1	-	CPT-048-1230	Rabbit Carrier Board, Programmed
A1A2	1	-	CPT-006-1222	Key Board Assembly
A1A3	1	-	LCM-S02402DSF	LCD & Backlight Module
A1A4, A1A5	2	1	CPT-006-1228	Power Supply Sled Assy
A1A4A1, A1A5A1	2	1	GLC65-5	Power Supply, 5V
A1A4A2, A1A5A2	2	1	GPFC250-12	Power Supply, 12V
A1A4A3, A1A5A3	2	1	GSC20-5	Power Supply, 5V
A1A6, A1A7	2	1	CPT-006-1255	Power Supply Fault Board, 5V, 12V, -5V
A1A8, A1A9	2	1	CPT-006-4016	Fan, 12 VDC, 3.149 SQ, Incl Cable

Switch (PL-CPT-048-1221)

Ref	Qty per	Recommended Spares Qty	Part Number	Description
A1A1	1	-	CPT-006-1245	Backplane Control Assy
A1A2	1	-	CPT-008-1225	Backplane Assy, 32 Slot
A1A3 – A1A18	16	3	CPT-049-1224	16 Way Switch Assy, L Band, Fan Out
A1A19 – A1A34	16	2	AM-LB3-CPT-049	Amplifier Assy, Input, Incl Panels, L Band
A1A35 – A1A50	16	-	PD-32-CPT-049-LB3-SMB	Power Divider Assy, 32 way, L Band
A1A51 – A1A53	3	1	CPT-006-4016	Fan, 12 VDC, 3.149 SQ, Incl Cable

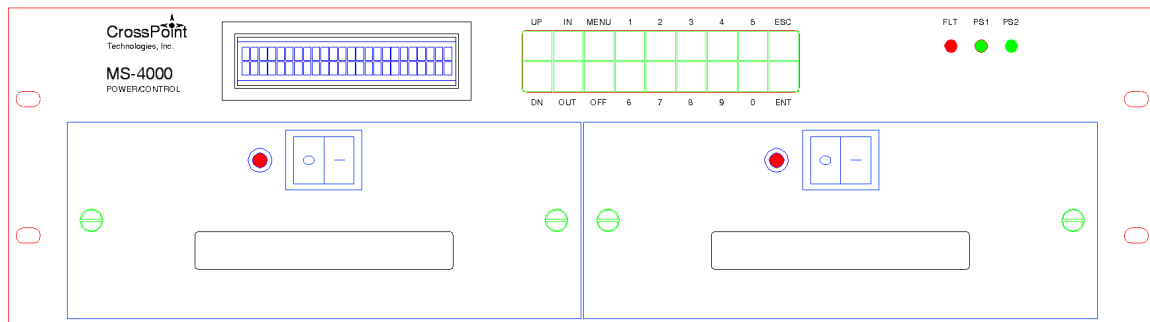
J. MS-4000-16x32-LB-FO

Part Number: CPT-049-1210

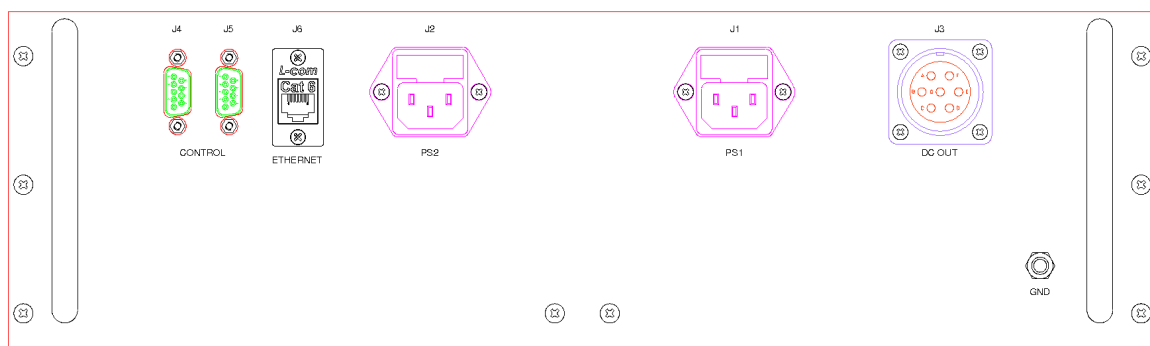


Specification	Conditions	Min	Typ	Max	Units
Frequency Range		950		2150	MHz
Gain		-2	0	+2	dB
Off-Isolation		55	60		dB
In-In Isolation		60	65		dB
Out-Out Isolation		55	60		dB
Impedance			50		Ω
VSWR			1.6	1.8	
1dB Output Compression		0	+3		dBm
NF			16	18	dB
IP3(input)		+14			dBm
Temperature (Op)		0		50	°C
AC Voltage		88		260	VAC
Power Consumption			150	200	W

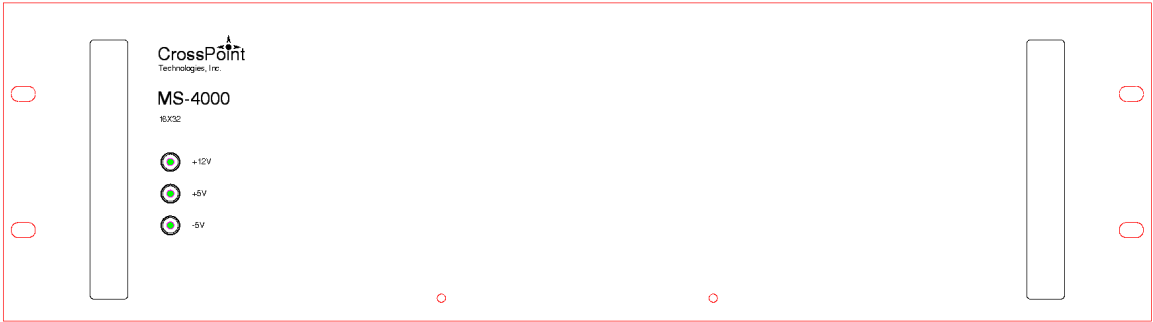
Dimensions: 17 x 20 deep x 5.25 high (nominal): 3 RU Switch
 17 x 18 deep x 5.25 high (nominal): 3 RU Controller / PS
 Switch Type: Coaxial Relay
 Control: RS232 or RS422 selectable & Ethernet
 Connectors: SMA-F in and out



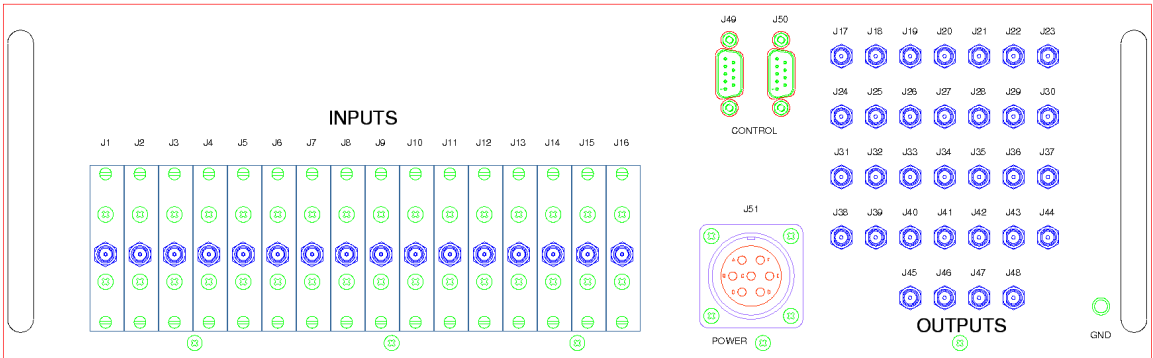
Front Panel – Power Supply / Controller



Rear Panel – Power Supply / Controller



Front Panel - Switch



Rear Panel - Switch

Connector List

Power / Control

Ref	Connector Type	Name
J1	IEC	AC Input (PS1)
J2	IEC	AC Input (PS2)
J3	7 Pin Circular	DC Out
J4	D-9	Control In/Out
J5	D-9	Control In/Out
J6	RJ-45	Ethernet Control
GND	Stud	Ground

Switch

Ref	Connector Type	Name
J1	SMA-F	Input 1
J2	SMA-F	Input 2
J3	SMA-F	Input 3
J4	SMA-F	Input 4
J5	SMA-F	Input 5
J6	SMA-F	Input 6
J7	SMA-F	Input 7
J8	SMA-F	Input 8
J9	SMA-F	Input 9
J10	SMA-F	Input 10
J11	SMA-F	Input 11
J12	SMA-F	Input 12
J13	SMA-F	Input 13
J14	SMA-F	Input 14
J15	SMA-F	Input 15
J16	SMA-F	Input 16
J17	SMA-F	Output 1
J18	SMA-F	Output 2
J19	SMA-F	Output 3
J20	SMA-F	Output 4
J21	SMA-F	Output 5
J22	SMA-F	Output 6
J23	SMA-F	Output 7
J24	SMA-F	Output 8
J25	SMA-F	Output 9
J26	SMA-F	Output 10
J27	SMA-F	Output 11
J28	SMA-F	Output 12
J29	SMA-F	Output 13
J30	SMA-F	Output 14
J31	SMA-F	Output 15
J32	SMA-F	Output 16
J33	SMA-F	Output 17
J34	SMA-F	Output 18
J35	SMA-F	Output 19
J36	SMA-F	Output 20
J37	SMA-F	Output 21

Ref	Connector Type	Name
J38	SMA-F	Output 22
J39	SMA-F	Output 23
J40	SMA-F	Output 24
J41	SMA-F	Output 25
J42	SMA-F	Output 26
J43	SMA-F	Output 27
J44	SMA-F	Output 28
J45	SMA-F	Output 29
J46	SMA-F	Output 30
J47	SMA-F	Output 31
J48	SMA-F	Output 32
J49	D-9	Serial Control
J50	D-9	Serial Control
J51	7 pin circular	DC Input
GND	Stud	Ground

Spares List

Power / Control (PL-CPT-049-1220)

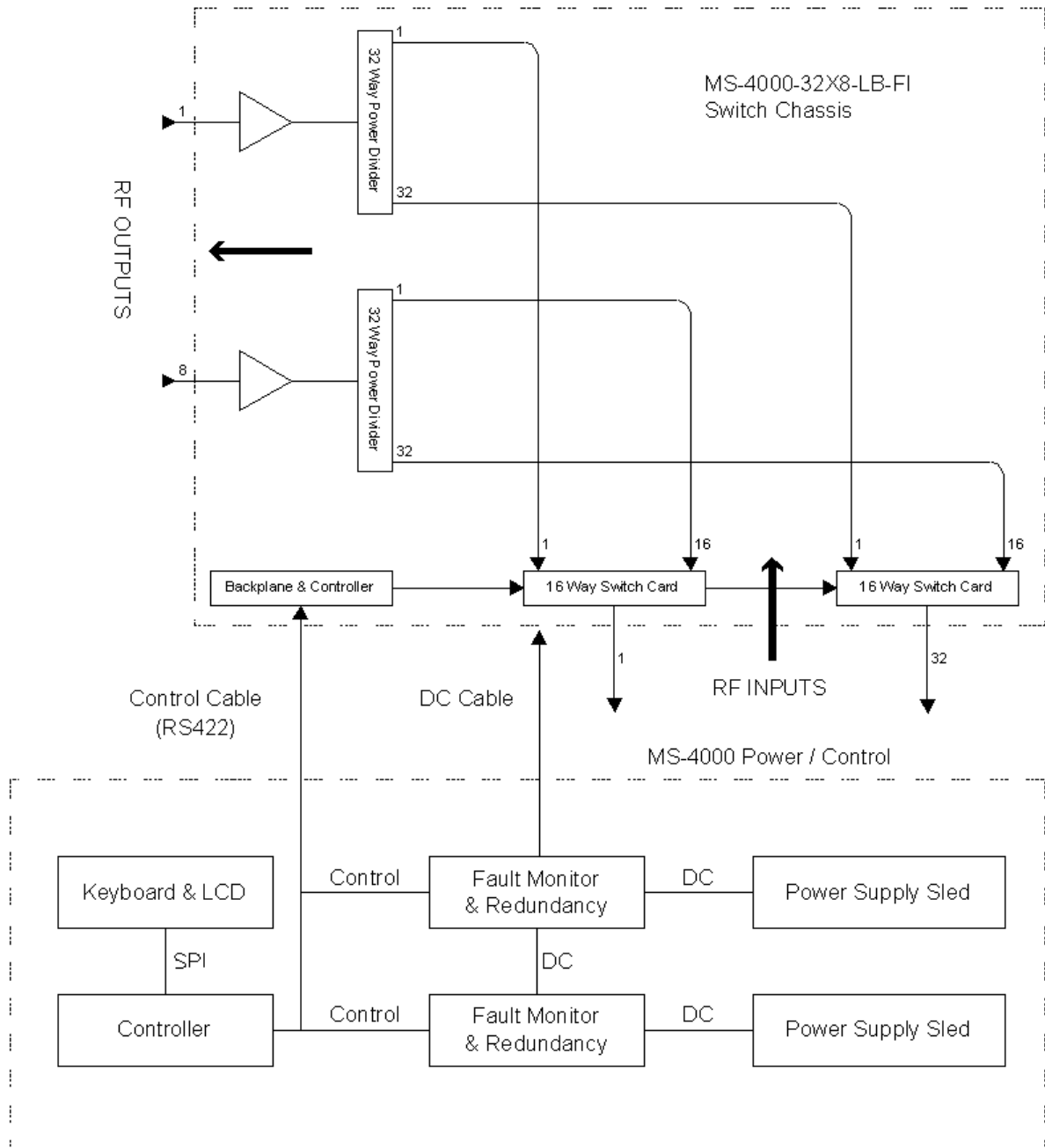
Ref	Qty per	Recommended Spares Qty	Part Number	Description
A1A1	1	-	CPT-049-1230	Rabbit Carrier Board, Programmed
A1A2	1	-	CPT-006-1222	Key Board Assembly
A1A3	1	-	LCM-S02402DSF	LCD & Backlight Module
A1A4, A1A5	2	1	CPT-006-1228	Power Supply Sled Assy
A1A4A1, A1A5A1	2	1	GLC65-5	Power Supply, 5V
A1A4A2, A1A5A2	2	1	GPFC250-12	Power Supply, 12V
A1A4A3, A1A5A3	2	1	GSC20-5	Power Supply, 5V
A1A6, A1A7	2	1	CPT-006-1255	Power Supply Fault Board, 5V, 12V, -5V
A1A8, A1A9	2	1	CPT-006-4016	Fan, 12 VDC, 3.149 SQ, Incl Cable

Switch (PL-CPT-049-1221)

Ref	Qty per	Recommended Spares Qty	Part Number	Description
A1A1	1	-	CPT-006-1245	Backplane Control Assy
A1A2	1	-	CPT-008-1225	Backplane Assy, 32 Slot
A1A3 – A1A18	16	3	CPT-049-1224	16 Way Switch Assy, L Band, Fan Out
A1A19 – A1A34	16	2	AM-LB3-CPT-049	Amplifier Assy, Input, Incl Panels, L Band
A1A35 – A1A50	16	-	PD-32-CPT-049-LB3-SMB	Power Divider Assy, 32 way, L Band
A1A51 – A1A53	3	1	CPT-006-4016	Fan, 12 VDC, 3.149 SQ, Incl Cable

K. MS-4000-32x8-LB-FI

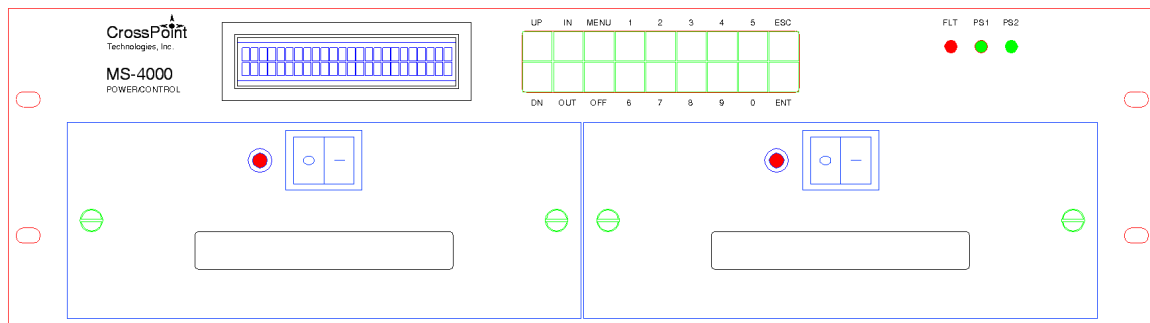
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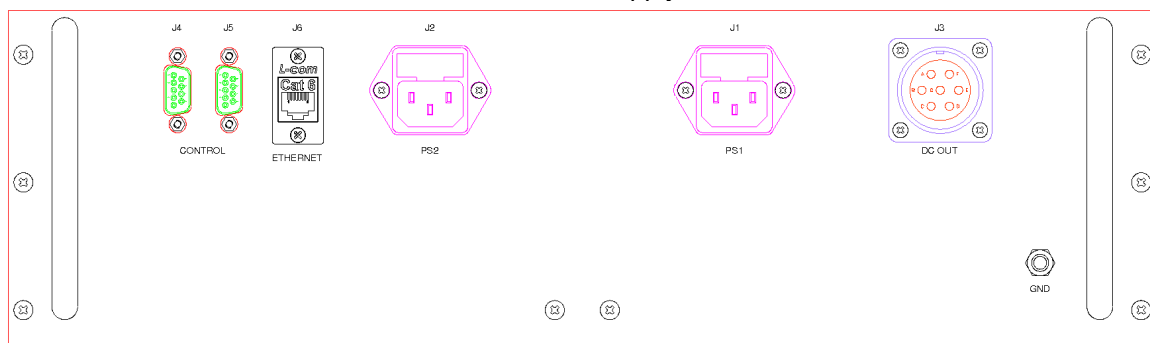
Block Diagram

Specification	Conditions	Min	Typ	Max	Units
Frequency Range		950		2150	MHz
Gain		-2	0	+2	dB
Off-Isolation		55	60		dB
In-In Isolation		60	65		dB
Out-Out Isolation		55	60		dB
Impedance			50		Ω
VSWR			1.5	1.8	
1dB Output Compression		0	+3		dBm
NF			24	26	dB
IP3(input)		+14			dBm
Temperature (Op)		0		50	°C
AC Voltage		88		260	VAC
Power Consumption			200	400	W

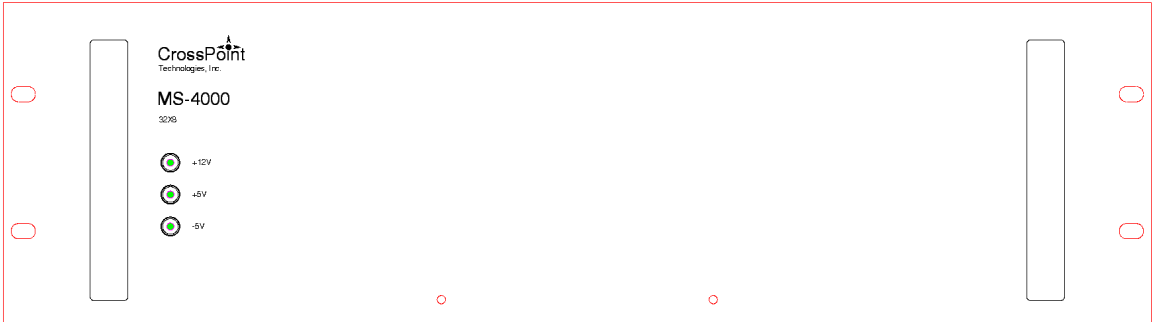
Dimensions: 17 x 20 deep x 5.25 high (nominal): 3 RU Switch
 17 x 18 deep x 5.25 high (nominal): 3 RU Controller / PS
 Switch Type: Coaxial Relay
 Control: RS232 or RS422 selectable
 Connectors: SMA-F in and out



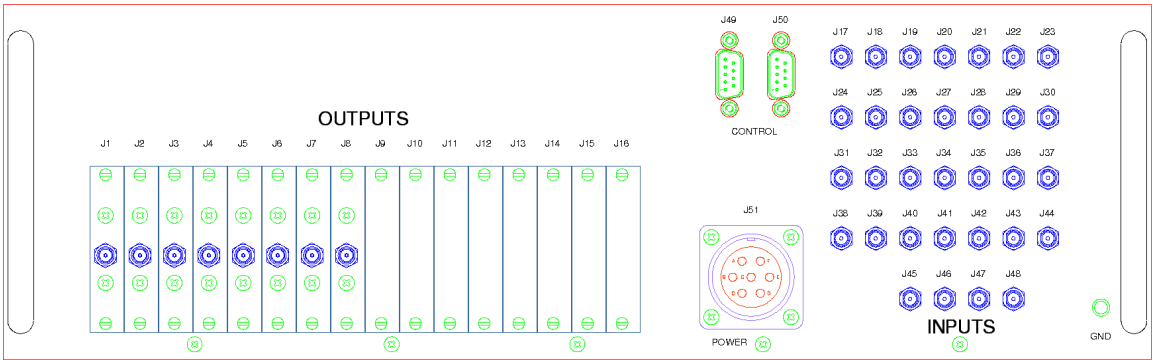
Front Panel – Power Supply / Controller



Rear Panel – Power Supply / Controller



Front Panel – Switch



Rear Panel – Switch

Connector List

Power / Control

Ref	Connector Type	Name
J1	IEC	AC Input (PS1)
J2	IEC	AC Input (PS2)
J3	7 Pin Circular	DC Out
J4	D-9	Control In/Out
J5	D-9	Control In/Out
J6	RJ-45	Ethernet Control
GND	Stud	Ground

Switch

Ref	Connector Type	Name
J1	SMA-F	Output 1
J2	SMA-F	Output 2
J3	SMA-F	Output 3
J4	SMA-F	Output 4
J5	SMA-F	Output 5
J6	SMA-F	Output 6
J7	SMA-F	Output 7
J8	SMA-F	Output 8
J9		Not Used
J10		Not Used
J11		Not Used
J12		Not Used
J13		Not Used
J14		Not Used
J15		Not Used
J16		Not Used
J17	SMA-F	Input 1
J18	SMA-F	Input 2
J19	SMA-F	Input 3
J20	SMA-F	Input 4
J21	SMA-F	Input 5
J22	SMA-F	Input 6
J23	SMA-F	Input 7
J24	SMA-F	Input 8
J25	SMA-F	Input 9
J26	SMA-F	Input 10
J27	SMA-F	Input 11
J28	SMA-F	Input 12
J29	SMA-F	Input 13
J30	SMA-F	Input 14
J31	SMA-F	Input 15
J32	SMA-F	Input 16
J33	SMA-F	Input 17
J34	SMA-F	Input 18
J35	SMA-F	Input 19
J36	SMA-F	Input 20
J37	SMA-F	Input 21

Ref	Connector Type	Name
J38	SMA-F	Input 22
J39	SMA-F	Input 23
J40	SMA-F	Input 24
J41	SMA-F	Input 25
J42	SMA-F	Input 26
J43	SMA-F	Input 27
J44	SMA-F	Input 28
J45	SMA-F	Input 29
J46	SMA-F	Input 30
J47	SMA-F	Input 31
J48	SMA-F	Input 32
J49	D-9	Serial Control
J50	D-9	Serial Control
J51	7 pin circular	DC Input
GND	Stud	Ground

Spares List

Power / Control (PL-CPT-046-1220)

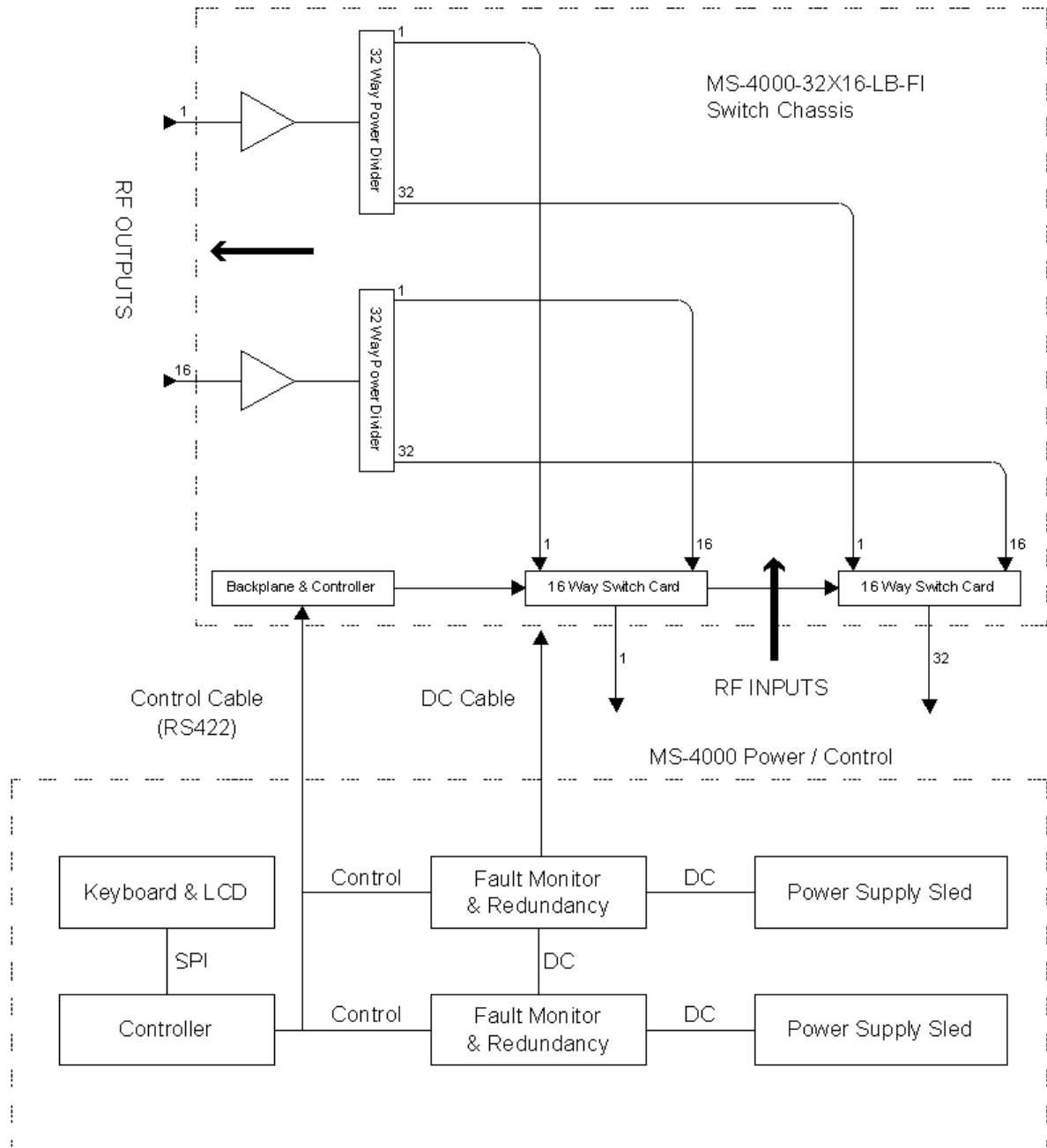
Ref	Qty per	Recommended Spares Qty	Part Number	Description
A1A1	1	-	CPT-046-1230	Rabbit Carrier Board, Programmed
A1A2	1	-	CPT-006-1222	Key Board Assembly
A1A3	1	-	LCM-S02402DSF	LCD & Backlight Module
A1A4, A1A5	2	1	CPT-006-1228	Power Supply Sled Assy
A1A4A1, A1A5A1	2	1	GLC65-5	Power Supply, 5V
A1A4A2, A1A5A2	2	1	GPFC250-12	Power Supply, 12V
A1A4A3, A1A5A3	2	1	GSC20-5	Power Supply, 5V
A1A6, A1A7	2	1	CPT-006-1255	Power Supply Fault Board, 5V, 12V, -5V
A1A8, A1A9	2	1	CPT-006-4016	Fan, 12 VDC, 3.149 SQ, Incl Cable

Switch (PL-CPT-046-1221)

Ref	Qty per	Recommended Spares Qty	Part Number	Description
A1A1	1	-	CPT-006-1245	Backplane Control Assy
A1A2	1	-	CPT-008-1225	Backplane Assy, 32 Slot
A1A3 – A1A18	16	2	CPT-047-1224	16 Way Switch Assy , L Band, FanIn
A1A19 – A1A34	16	2	AM-LB3-CPT-047	Amplifier Assy, Output, Incl Panels, L Band
A1A35 – A1A50	16	-	PD-32-CPT-049-LB3-SMB	Power Divider Assy, 32 way, L Band
A1A51 – A1A53	3	1	CPT-006-4016	Fan, 12 VDC, 3.149 SQ, Incl Cable

L. MS-4000-32x16-LB-FI

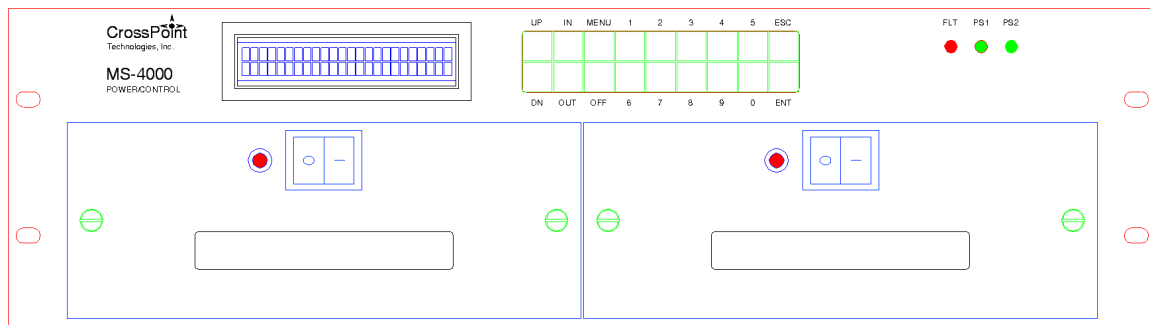
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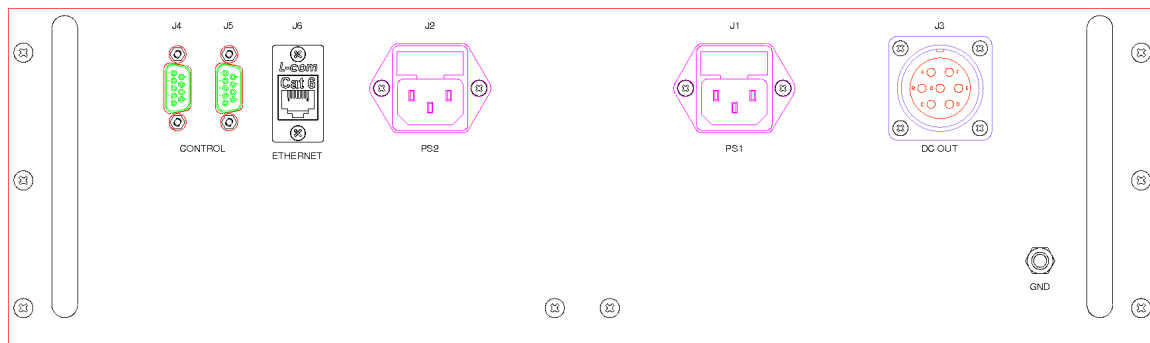
Block Diagram

Specification	Conditions	Min	Typ	Max	Units
Frequency Range		950		2150	MHz
Gain		-2	0	+2	dB
Off-Isolation		55	60		dB
In-In Isolation		60	65		dB
Out-Out Isolation		55	60		dB
Impedance			50		Ω
VSWR			1.5	1.8	
1dB Output Compression		0	+3		dBm
NF			24	26	dB
IP3(input)		+14			dBm
Temperature (Op)		0		50	°C
AC Voltage		88		260	VAC
Power Consumption			200	400	W

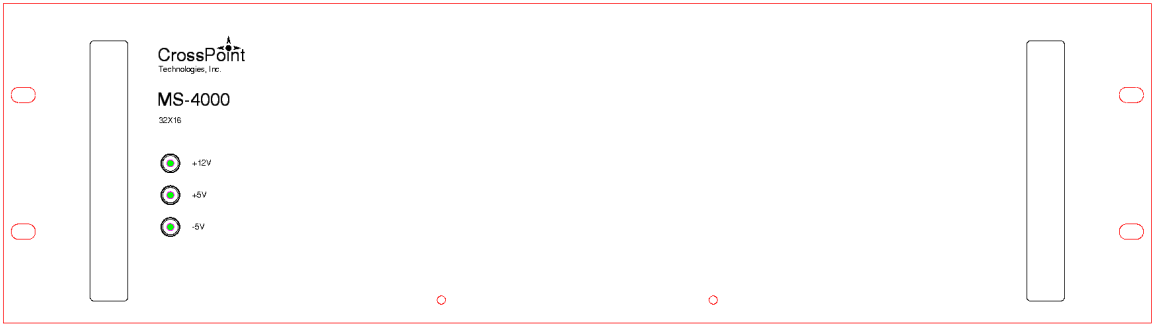
Dimensions: 17 x 20 deep x 5.25 high (nominal): 3 RU Switch
 17 x 18 deep x 5.25 high (nominal): 3 RU Controller / PS
 Switch Type: Coaxial Relay
 Control: RS232 or RS422 selectable
 Connectors: SMA-F in and out



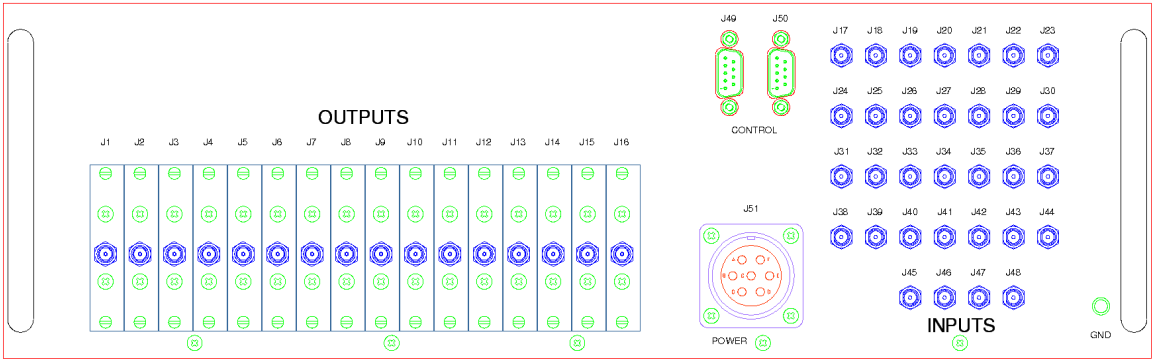
Front Panel – Power Supply / Controller



Rear Panel – Power Supply / Controller



Front Panel –Switch



Rear Panel – Switch

Connector List

Power / Control

Ref	Connector Type	Name
J1	IEC	AC Input (PS1)
J2	IEC	AC Input (PS2)
J3	7 Pin Circular	DC Out
J4	D-9	Control In/Out
J5	D-9	Control In/Out
J6	RJ-45	Ethernet Control
GND	Stud	Ground

Switch

Ref	Connector Type	Name
J1	SMA-F	Output 1
J2	SMA-F	Output 2
J3	SMA-F	Output 3
J4	SMA-F	Output 4
J5	SMA-F	Output 5
J6	SMA-F	Output 6
J7	SMA-F	Output 7
J8	SMA-F	Output 8
J9	SMA-F	Output 9
J10	SMA-F	Output 10
J11	SMA-F	Output 11
J12	SMA-F	Output 12
J13	SMA-F	Output 13
J14	SMA-F	Output 14
J15	SMA-F	Output 15
J16	SMA-F	Output 16
J17	SMA-F	Input 1
J18	SMA-F	Input 2
J19	SMA-F	Input 3
J20	SMA-F	Input 4
J21	SMA-F	Input 5
J22	SMA-F	Input 6
J23	SMA-F	Input 7
J24	SMA-F	Input 8
J25	SMA-F	Input 9
J26	SMA-F	Input 10
J27	SMA-F	Input 11
J28	SMA-F	Input 12
J29	SMA-F	Input 13
J30	SMA-F	Input 14
J31	SMA-F	Input 15
J32	SMA-F	Input 16
J33	SMA-F	Input 17
J34	SMA-F	Input 18
J35	SMA-F	Input 19
J36	SMA-F	Input 20
J37	SMA-F	Input 21

Ref	Connector Type	Name
J38	SMA-F	Input 22
J39	SMA-F	Input 23
J40	SMA-F	Input 24
J41	SMA-F	Input 25
J42	SMA-F	Input 26
J43	SMA-F	Input 27
J44	SMA-F	Input 28
J45	SMA-F	Input 29
J46	SMA-F	Input 30
J47	SMA-F	Input 31
J48	SMA-F	Input 32
J49	D-9	Serial Control
J50	D-9	Serial Control
J51	7 pin circular	DC Input
GND	Stud	Ground

Spares List

Power / Control (PL-CPT-047-1220)

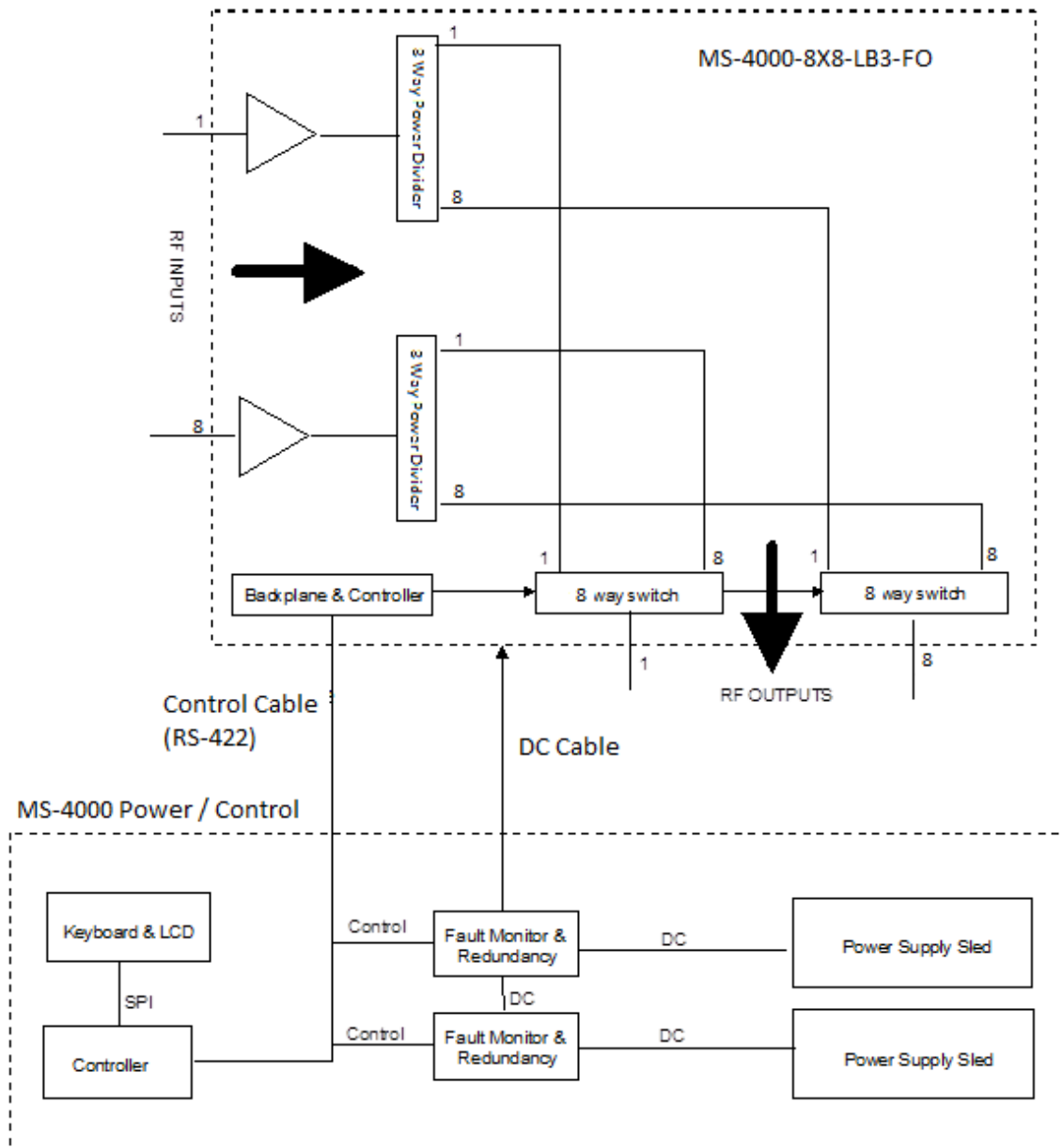
Ref	Qty per	Recommended Spares Qty	Part Number	Description
A1A1	1	-	CPT-047-1230	Rabbit Carrier Board, Programmed
A1A2	1	-	CPT-006-1222	Key Board Assembly
A1A3	1	-	LCM-S02402DSF	LCD & Backlight Module
A1A4, A1A5	2	1	CPT-006-1228	Power Supply Sled Assy
A1A4A1, A1A5A1	2	1	GLC65-5	Power Supply, 5V
A1A4A2, A1A5A2	2	1	GPFC250-12	Power Supply, 12V
A1A4A3, A1A5A3	2	1	GSC20-5	Power Supply, 5V
A1A6, A1A7	2	1	CPT-006-1255	Power Supply Fault Board, 5V, 12V, -5V
A1A8, A1A9	2	1	CPT-006-4016	Fan, 12 VDC, 3.149 SQ, Incl Cable

Switch (PL-CPT-047-1221)

Ref	Qty per	Recommended Spares Qty	Part Number	Description
A1A1	1	-	CPT-006-1245	Backplane Control Assy
A1A2	1	-	CPT-008-1225	Backplane Assy, 32 Slot
A1A3 – A1A18	16	2	CPT-047-1224	16 Way Switch Assy , L Band, FanIn
A1A19 – A1A34	16	2	AM-LB3-CPT-047	Amplifier Assy, Output, Incl Panels, L Band
A1A35 – A1A50	16	-	PD-32-CPT-049-LB3-SMB	Power Divider Assy, 32 way, L Band
A1A51 – A1A53	3	1	CPT-006-4016	Fan, 12 VDC, 3.149 SQ, Incl Cable

M. MS-4000-8x8-LB3-FO

Part Number: CPT-084-1210

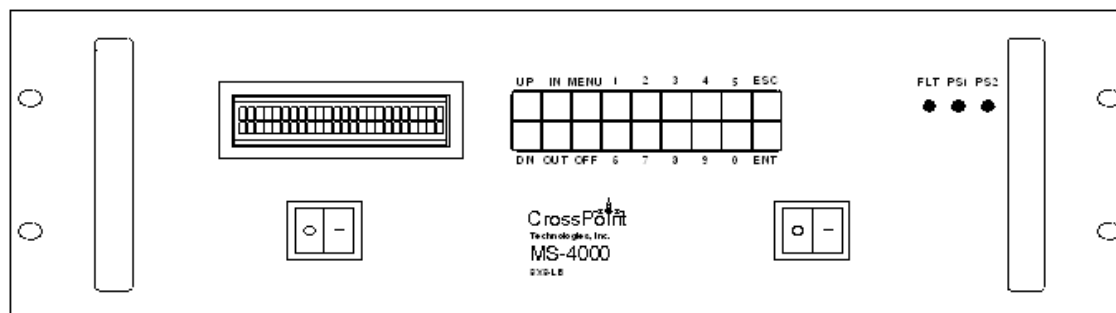


Block Diagram

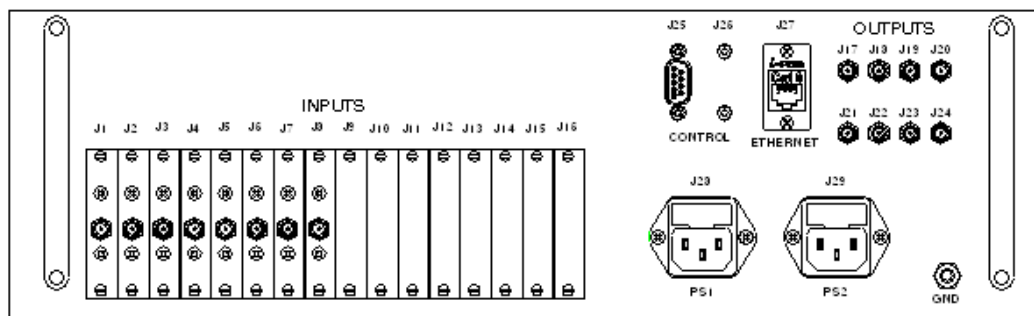
MS-4000-8x8-LB3-FO

Specification	Conditions	Min	Typ	Max	Units
Frequency Range		950		2150	MHz
Gain		-1	1	+3	dB
Off-Isolation		55	60		dB
In-In Isolation		60	65		dB
Out-Out Isolation		55	60		dB
Impedance			50		Ω
VSWR			1.5	1.8	
1dB Output Compression		0	+7		dBm
NF			15	17	dB
IP3(output)		+12			dBm
Temperature (Operating)		0		50	°C
AC Voltage		88		260	VAC
Power Consumption			125	175	W

Dimensions : 19"W x 20"D x 5.25"H (3RU)
 Switch Type : Solid State
 Control : Remote: Ethernet, RS232 or RS422 selectable
 Local: Front panel display and keypad
 Connectors SMA-F in and out



Front Panel –Switch



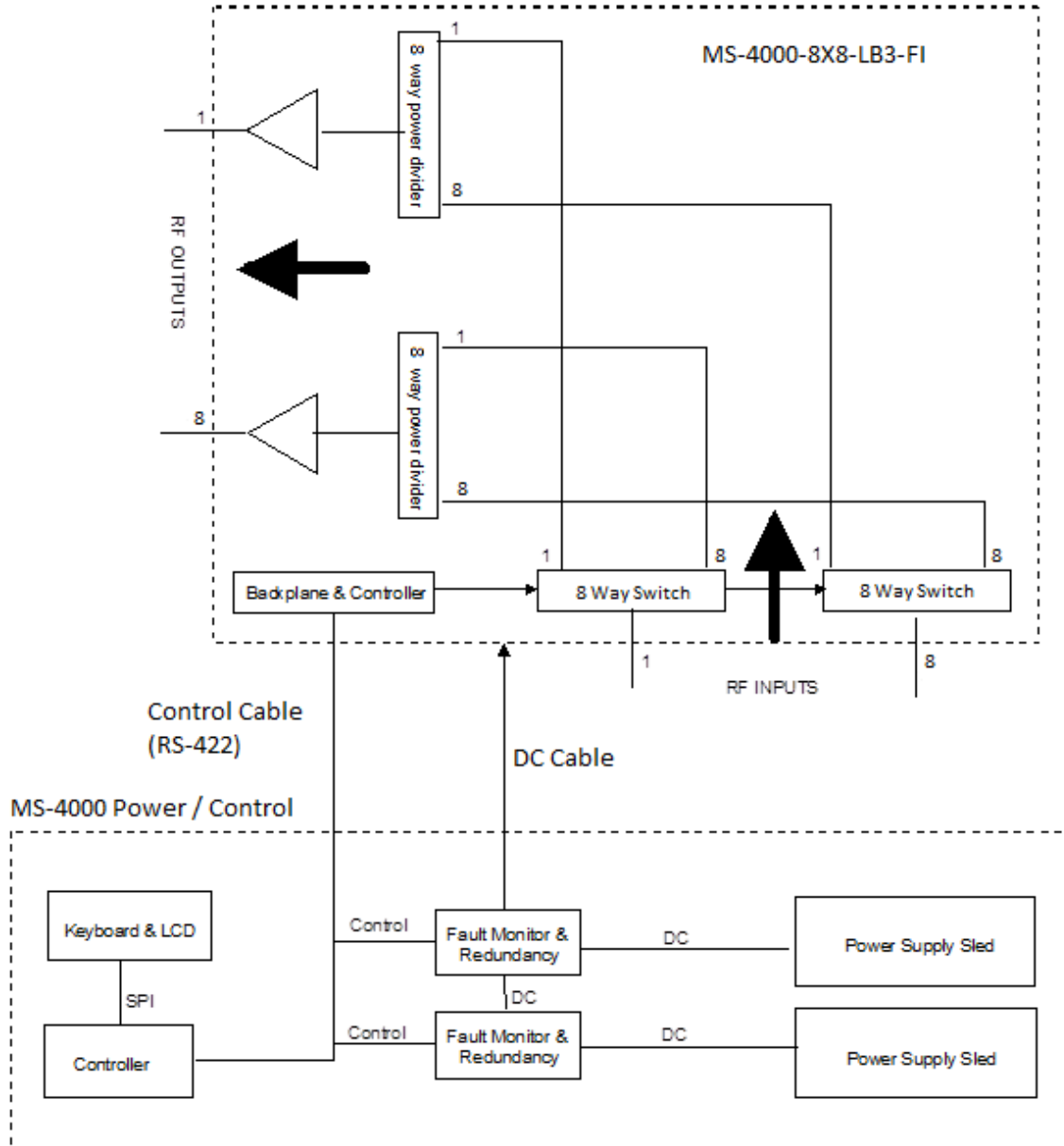
Rear Panel – Switch

Connector List

Ref	Connector Type	Name
J1	SMA-F	Input 1
J2	SMA-F	Input 2
J3	SMA-F	Input 3
J4	SMA-F	Input 4
J5	SMA-F	Input 5
J6	SMA-F	Input 6
J7	SMA-F	Input 7
J8	SMA-F	Input 8
J9	NA	NA
J10	NA	NA
J11	NA	NA
J12	NA	NA
J13	NA	NA
J14	NA	NA
J15	NA	NA
J16	NA	NA
J17	SMA-F	Output 1
J18	SMA-F	Output 2
J19	SMA-F	Output 3
J20	SMA-F	Output 4
J21	SMA-F	Output 5
J22	SMA-F	Output 6
J23	SMA-F	Output 7
J24	SMA-F	Output 8
J25	D-9	Serial Control
J26	NA	NA
J27	RJ-45	Ethernet Control
J28	IEC	AC Input (PS1)
J29	IEC	AC Input (PS2)
GND	Stud	Ground

N. MS-4000-8x8-LB-FI

Part Number: CPT-085-1210

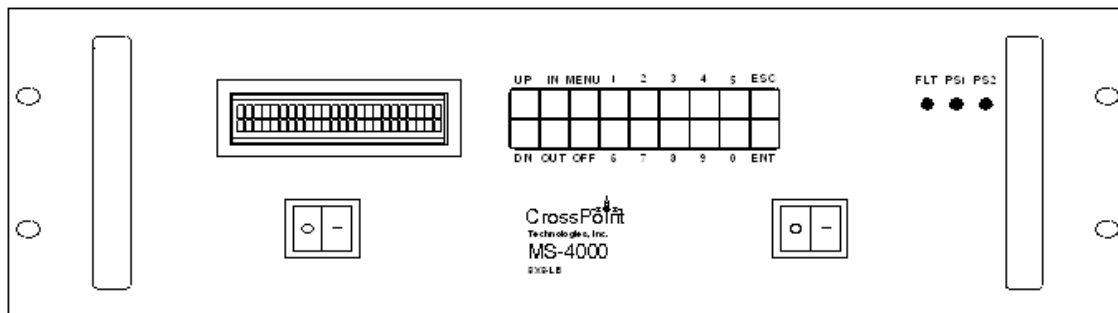


Block Diagram

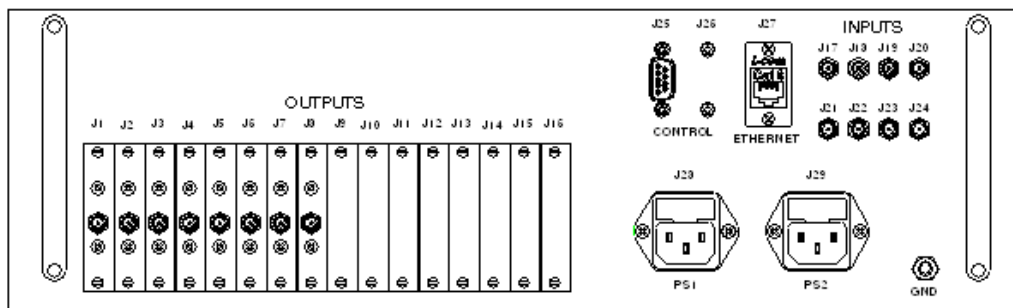
MS-4000-8x8-LB3-FI

Specification	Conditions	Min	Typ	Max	Units
Frequency Range		950		2150	MHz
Gain		-1	1	+3	dB
Off-Isolation		55	60		dB
In-In Isolation		60	65		dB
Out-Out Isolation		55	60		dB
Impedance			50		Ω
VSWR			1.5	1.8	
1dB Output Compression		0	+4		dBm
NF			23	25	dB
IP3(input)		+12			dBm
Temperature (Operating)		0		50	°C
AC Voltage		88		260	VAC
Power Consumption			125	175	W

Dimensions : 19"W x 20"D x 5.25"H (3RU)
 Switch Type : Solid State
 Control : Remote: Ethernet, RS232 or RS422 selectable
 Local: Front panel display and keypad
 Connectors SMA-F in and out



Front Panel – Switch

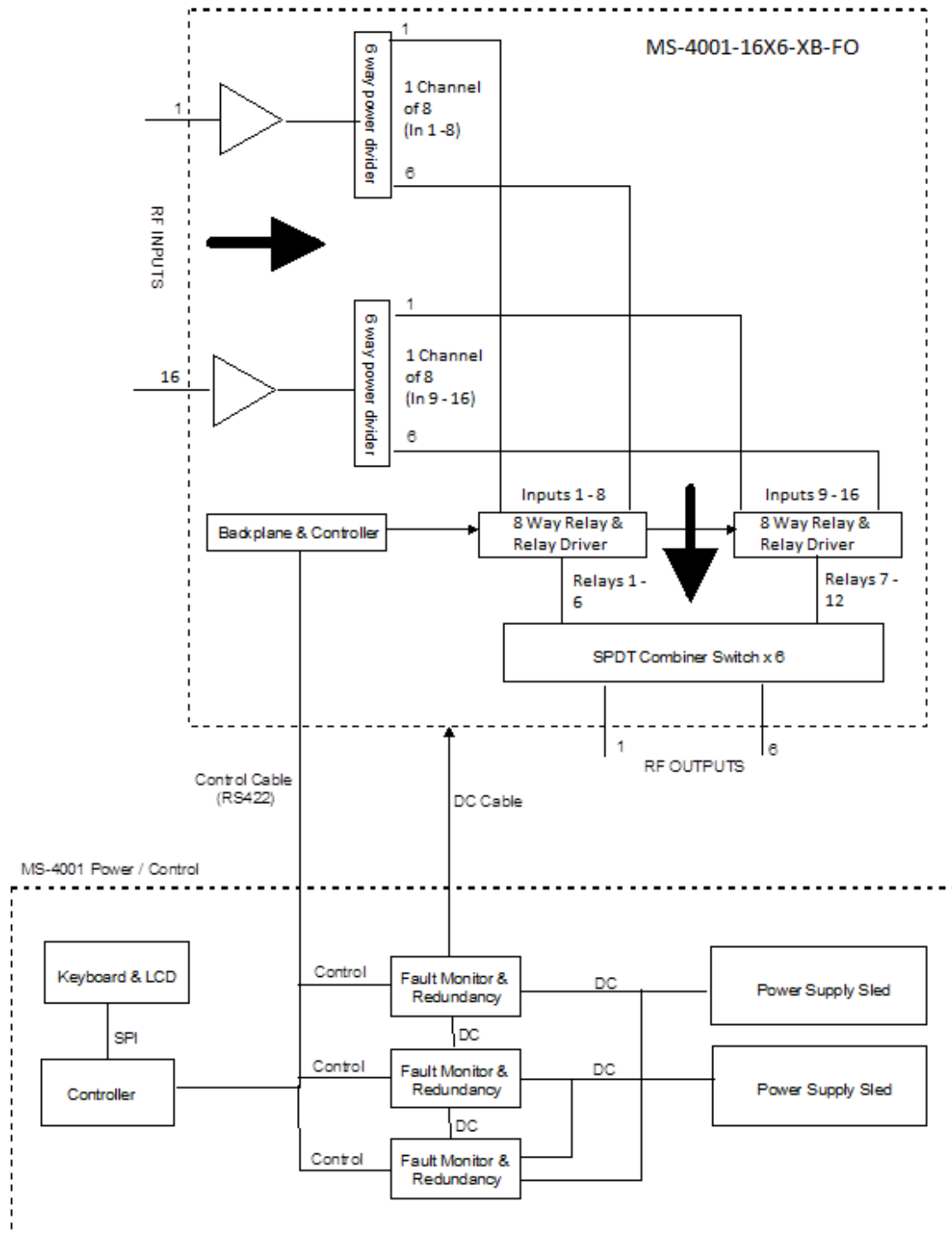


Rear Panel – Switch

Ref	Connector Type	Name
J1	SMA-F	Output 1
J2	SMA-F	Output 2
J3	SMA-F	Output 3
J4	SMA-F	Output 4
J5	SMA-F	Output 5
J6	SMA-F	Output 6
J7	SMA-F	Output 7
J8	SMA-F	Output 8
J9	NA	NA
J10	NA	NA
J11	NA	NA
J12	NA	NA
J13	NA	NA
J14	NA	NA
J15	NA	NA
J16	NA	NA
J17	SMA-F	Input 1
J18	SMA-F	Input 2
J19	SMA-F	Input 3
J20	SMA-F	Input 4
J21	SMA-F	Input 5
J22	SMA-F	Input 6
J23	SMA-F	Input 7
J24	SMA-F	Input 8
J25	D-9	Serial Control
J26	NA	NA
J27	RJ-45	Ethernet Control
J28	IEC	AC Input (PS1)
J29	IEC	AC Input (PS2)
GND	Stud	Ground

O. MS-4001-16x6-XB-FO

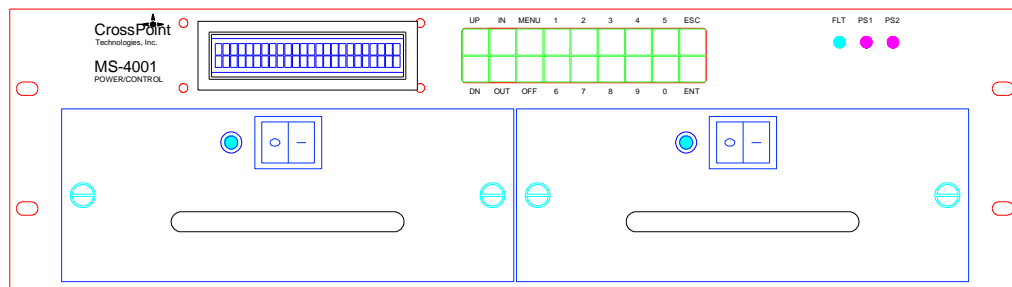
Part Number: PL-CPT-128-1210



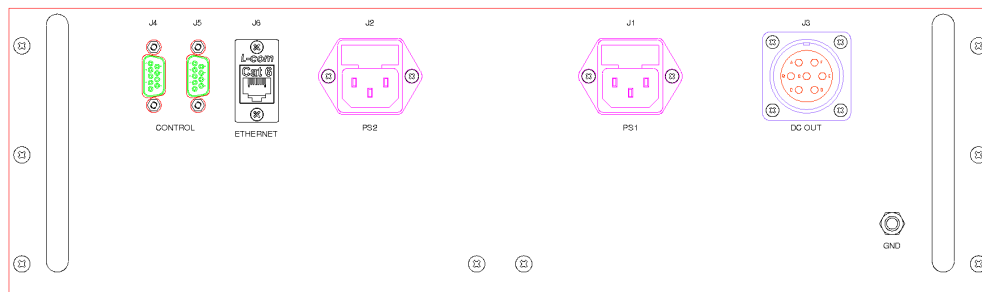
Block Diagram

Specification	Conditions	Min	Typ	Max	Units
Frequency Range		7.25		8.4	GHz
Gain		-2	0	2	dB
Off-Isolation		60			dB
Impedance			50		Ω
VSWR			1.4	1.6	
Signal Level			-15		dBm
NF				7	dB
IP3(input)		15			dBm
Temperature (Op)		0		50	°C
AC Voltage		88		260	VAC
Power Consumption			175		W

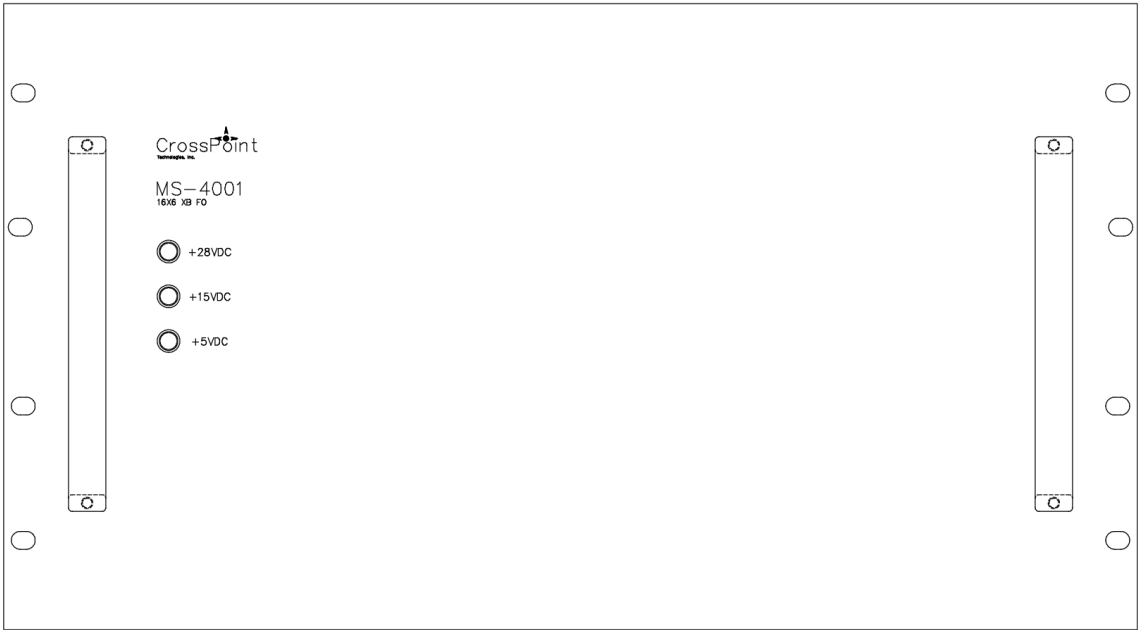
Dimensions: 17 x 18 deep x 7 high (nominal) : 4 RU Switch
 17 x 18 deep x 5.25 high (nominal) : 3 RU Controller / PS
 Switch Type: Coaxial Relay
 Control: RS232 or RS422 selectable, and Ethernet
 Connectors: SMA-F in and out



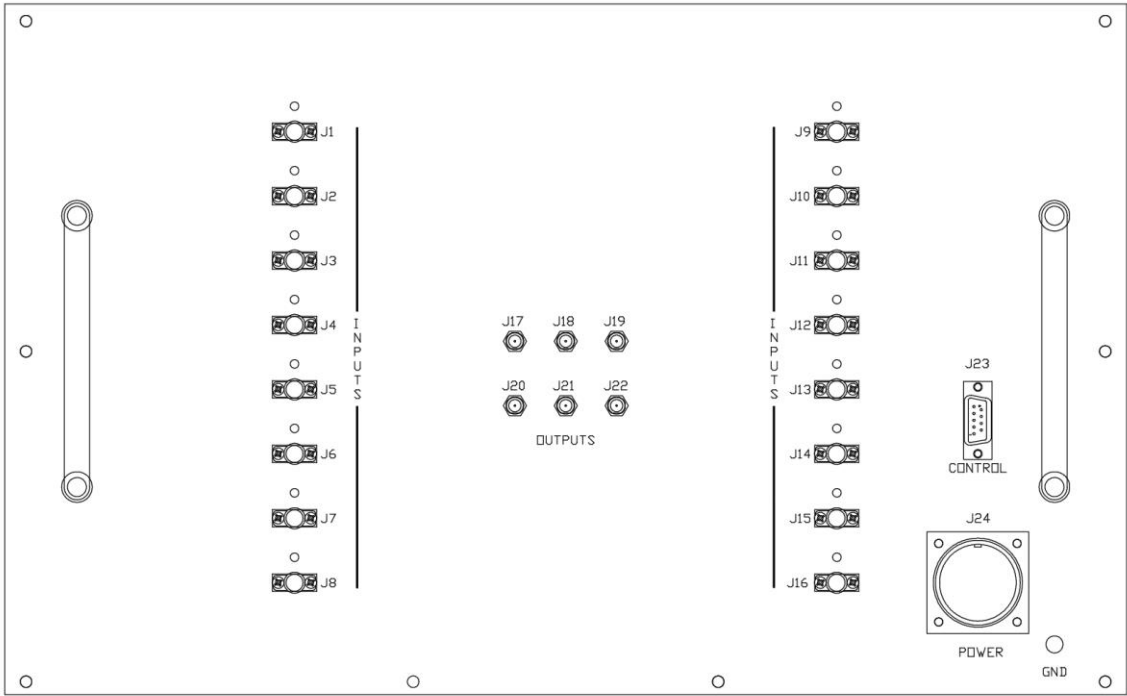
Front Panel – Power / Controller



Rear Panel – Power / Controller



Front Panel - Switch



Rear panel - Switch

Connector List

Power / Control

Ref	Connector Type	Name
J1	IEC	AC Input (PS1)
J2	IEC	AC Input (PS2)
J3	7 Pin Circular	DC Out
J4	D9	Serial Control In/Out
J5	D9	Switch Chassis Control In/Out
J6	RJ45	Ethernet Control
	Stud	Ground

Switch

Ref	Connector Type	Name
J1	SMA-F	Input 1
J2	SMA-F	Input 2
J3	SMA-F	Input 3
J4	SMA-F	Input 4
J5	SMA-F	Input 5
J6	SMA-F	Input 6
J7	SMA-F	Input 7
J8	SMA-F	Input 8
J9	SMA-F	Input 9
J10	SMA-F	Input 10
J11	SMA-F	Input 11
J12	SMA-F	Input 12
J13	SMA-F	Input 13
J14	SMA-F	Input 14
J15	SMA-F	Input 15
J16	SMA-F	Input 16
J17	SMA-F	Output 1
J18	SMA-F	Output 2
J19	SMA-F	Output 3
J20	SMA-F	Output 4
J21	SMA-F	Output 5
J22	SMA-F	Output 6
J23	D-9	Serial Control
J24	7 pin circular	DC Input
	Stud	Ground

Spares List

Power / Control (PL-CPT-128-1220)

Qty per	Recommended Spares Qty	Part Number	Description
1	-	CPT-128-1231	Rabbit Carrier Board , Programmed
1	-	CPT-006-1222	Key Board Assembly
1	-	LCM-S02402DSF	LCD & Backlight Module
2	1	CPT-010-1226	Power Supply Sled Assy
2	1	GSM28-5G	Power Supply, 5V
2	1	GPFC160-15-G	Power Supply, 15V
2	1	GPFC160-28G	Power Supply, 28V
2	1	CPT-010-1225	Power Supply Fault Board, 5V, 15V
1	1	CPT-010-1231	Power Supply Fault Board, 28V
2	1	CPT-006-4017	Fan, 12 VDC, 3.149 SQ

Switch (PL-CPT-128-1221)

Qty per	Recommended Spares Qty	Part Number	Description
1	-	CPT-006-1245	Backplane Control Assy
1	-	CPT-006-1225	Backplane Assy, 16 Slot
12	1	CPT-128-1224	Relay Driver Card
12	1	8HT2L34LA	Coaxial Relay, 28V, SP8T
6	1	2S2A31LA	Coaxial Relay, 28V, SPDT
12	1	CPT-010-1232	Amplifier Assy, Input,
12	-	P815X-2	Power Divider, 8 way
5	1	1608KL-05W-B50- LOO	Fan 24V 40X20MM