# TDM3000 ROUTING SWITCHER


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## About This Manual

This manual provides detailed instructions for the installation, operation, and maintenance of the PESA TDM3000 Routing Switcher.

### Warnings, Cautions, and Notes


**Warning statements identify conditions or practices that can result in personal injury or loss of life.**


**Caution statements identify conditions or practices that can result in damage to equipment.**


**Notes contain information important to the correct installation, operation, or maintenance of the equipment.**

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# Chapter 1 – Introduction

## 1.1 Overview

The PESA TDM3000 Switcher is a new switching design that accommodates a denser switching matrix than conventional crosspoint switches. This is accomplished by the Time Division Multiplex (TDM) module. When using TDM, much larger switchers can be compressed into a much smaller space, and with greater signal management flexibility.

TDM is an effective alternative solution to low bandwidth signals such as professional audio (both digital AES and analog), SMPTE Time Code, Port switchers (i.e. machine control and data communications), and telecom applications (such as voice lines and T1 switches). The TDM technologies allow several diverse signal formats to be routed within a common router hardware architecture.

The TDM module is capable of switching 1024 signals. It can detect signals, generate new signals, and analyze existing signals in the switcher using the Digital Signal Processing (DSP) access port to input and output data streams. Architecture of the TDM also injects DSP generated signals (such as test tones or time code), detects presence of signal, and analyzes signals coming into the switcher.

## 1.2 Common Feature Set

Each TDM3000 Switcher Frame has a common set of features including power supplies, control schemes, swappable modules, and chassis for 8RU, 16RU and 24RU sizes. The TDM3000 frame can be mounted in a standard 19” rack. Cooling fans on all chassis sizes provide airflow over internal components and maintain a low temperature within the chassis. The TDM3000 switcher is designed to grow by allowing the addition of more modules to the original chassis.

## 1.3 Customer Specific Feature Set

The chassis contains various functional blocks, including the processor module, crosspoint and/or TDM module, front mounted control module, plus a variety of I/O modules and signal processors. Two types of signal connectors are available on the different I/O modules—BNC or D-connectors.

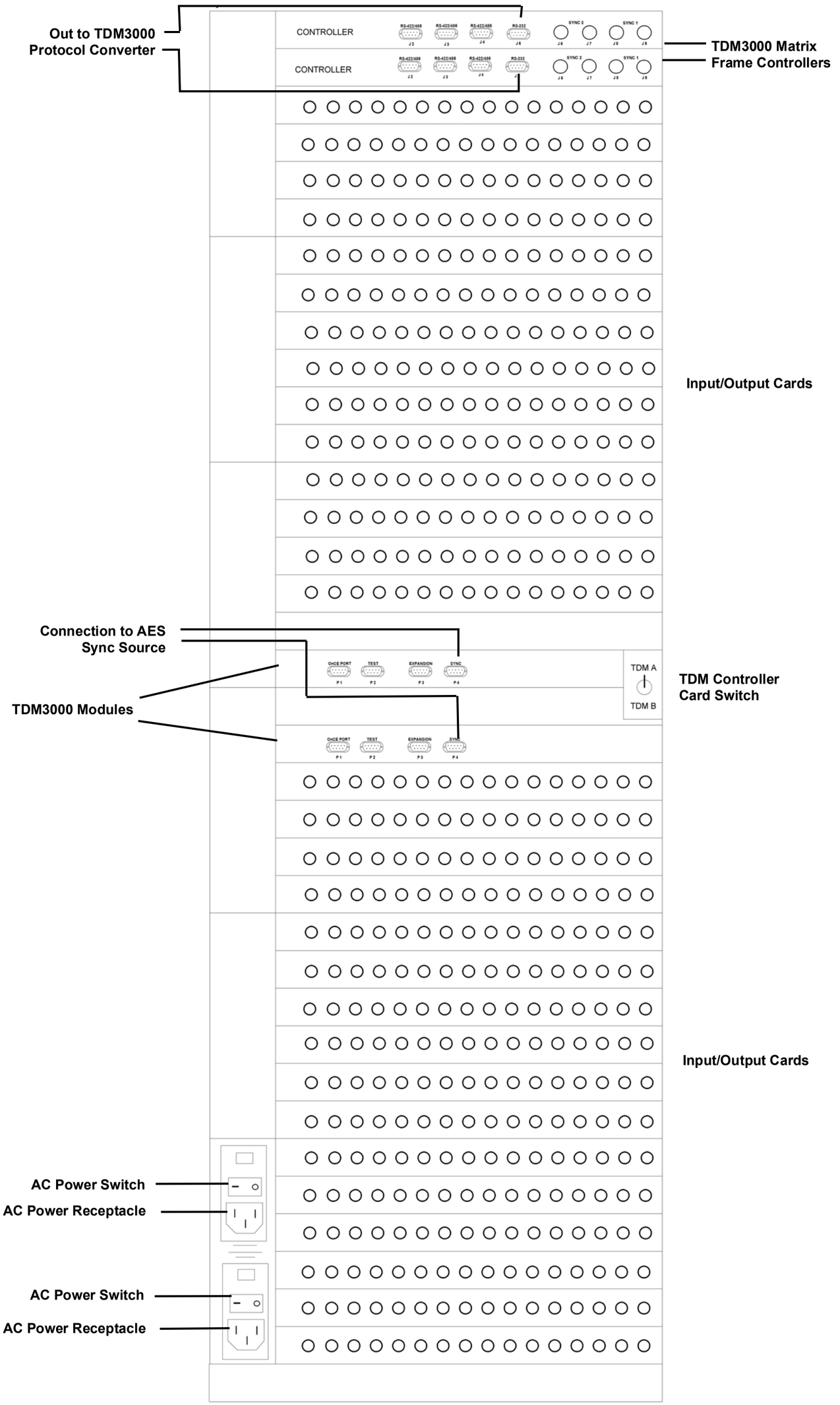



Figure 1. TDM 3000 Rear View

## 1.4 System Block Diagram

The analog input and output modules convert the audio signals to digital format (20-bit A-to-Ds at each analog input, 20-bit D-to-As at each analog output). The digital module will multiplex signals and send them to the TDM module. The TDM module utilizes a combination of serial to parallel conversion, multiplexing, parallel to serial conversion, data storing, and data recall. The heart of the system is a switching engine. The TDM router consists of input circuits, which are multiplexed and sent to the switching engine. The switching engine (of the TDM module) manipulates the data and then sends the data to the desired output circuits, which demultiplexes the data to individual lines.

The PESA TDM DSP does not care if the inputs and outputs are analog, synchronous AES, asynchronous AES, Time Code, or AC3. All of these can be mixed and synchronously switched in the same system with any input routed to any output.

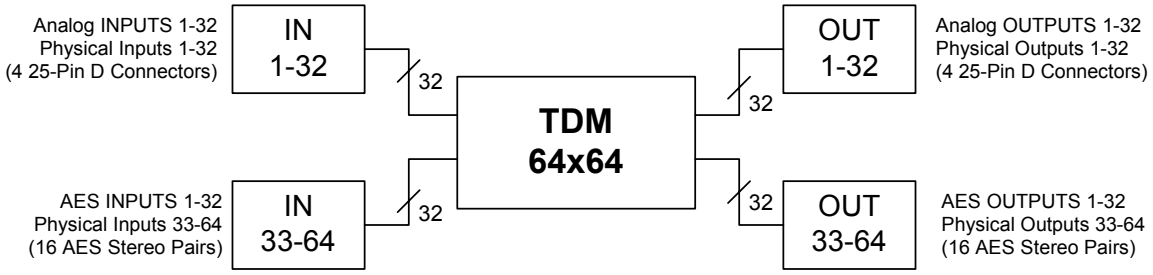



**Figure 2. TDM Signal Block Diagram**


**Each AES channel is equal to two analog channels.**

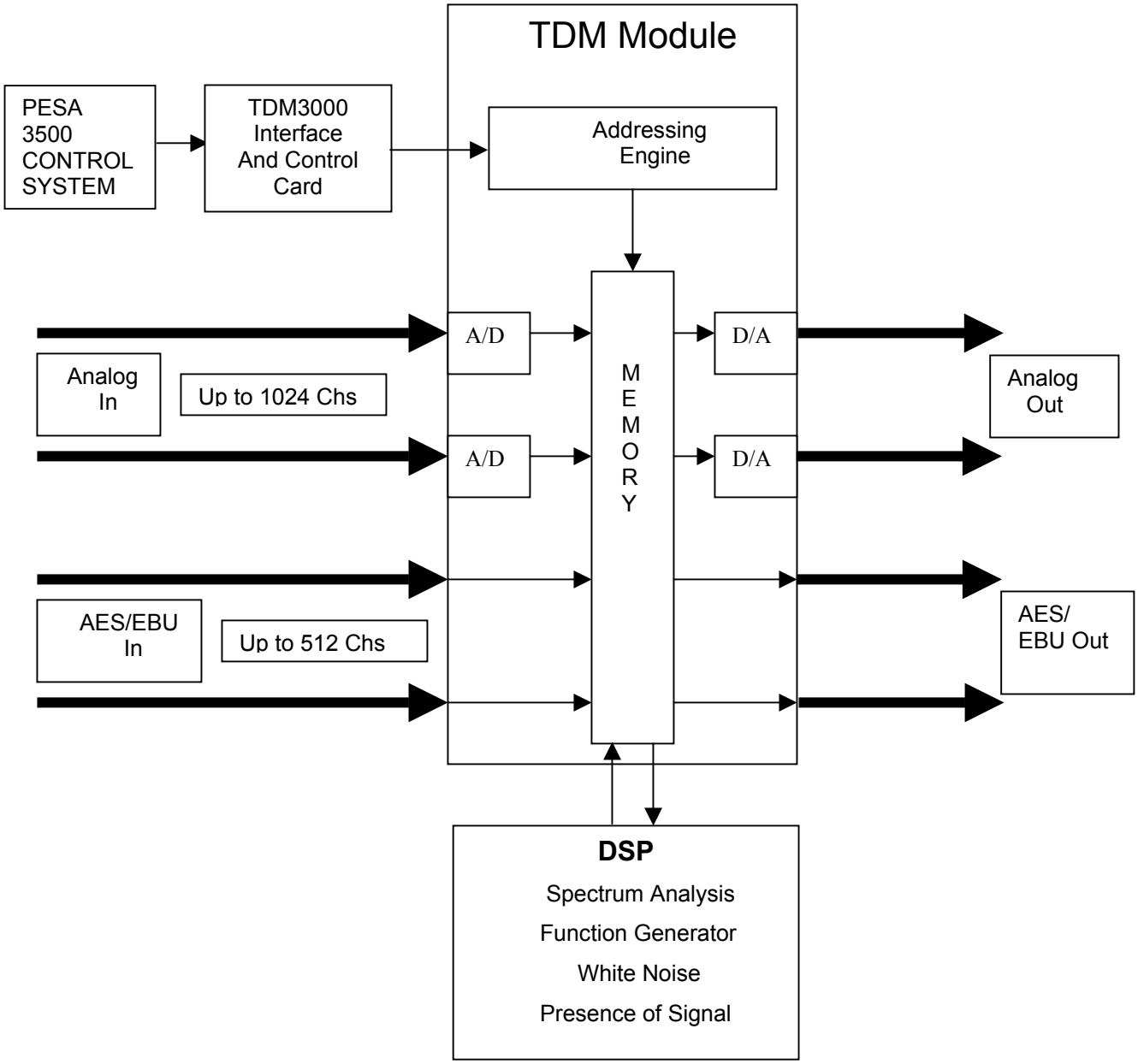



**Figure 3. Typical TDM3000 TDM Block Diagram**

## 1.5 Typical TDM3000 AES Crosspoint 256 x 256 Block Diagram

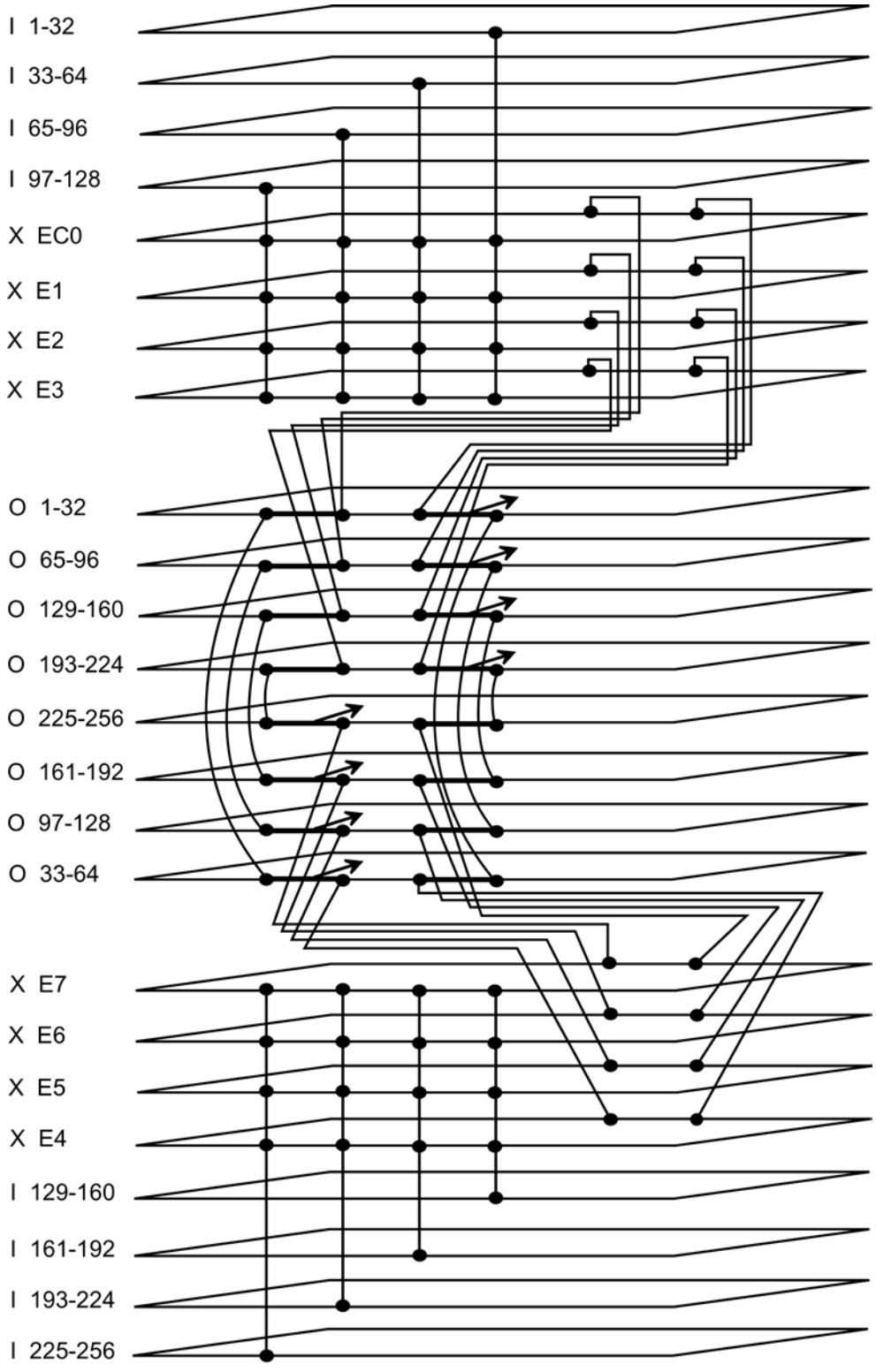



**Figure 4. Typical TDM3000 AES Crosspoint 256 x 256 Block Diagram**

## 1.6 Typical Configuration

A typical configuration for the TDM3000 consists of placing a protocol translator (the TDM3000 PRC Controller) between a 3500 family controller (i.e. 3500, 3500Plus, or the 3500Pro) and the TDM3000 frame controller. The AES Sync connects to the TDM module, and the Video Sync connects to the TDM3000 Matrix Frame Controller. See Chapter 2 for detailed information about cabling and connections.

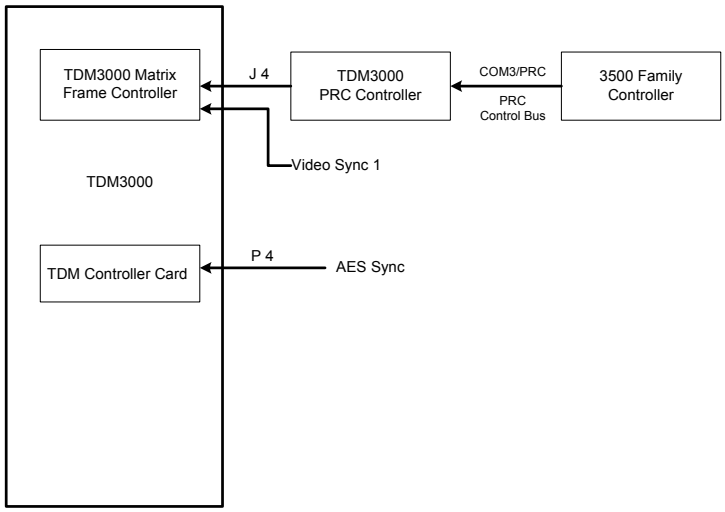



**Figure 5. TDM3000 Typical Configuration**

## 1.7 Specifications

### 1.7.1 Mechanical

Frame Height.....8RU 7" (74.4 mm), 16RU 14”
24RU 42" (106.6 mm)
Frame Depth.....21" (53.3 mm)
Frame Width.....17.25"/43.82mm (19" rack mount)
Frame Weight..... 30 lbs (13.61 kg) for each 8RU increment
Input Voltage..... 107-250 VAC 47-63 Hz
Input Connectors .....IEC
Power Requirements .....20-60 VA for each 4RU increment
Operating Temperature Range .....0 - 40˚C

### 1.7.2 Timecode

Connector Type..... 25-pin 'D'
Input Impedance.....600 ohms
Output Impedance .....50 ohms
Output Level.....2V p-p
Bandwidth ..... 240 kHz

### 1.7.3 AES/EBU

1AES/EBU channel.....carries 2 I/Os

### 25-Pin 'D' Connector

Input Level ..... 2 - 7V p-p
Input Impedance ..... 110 ohms
Output Level ..... 4.5 - 5V p-p
Output Impedance ..... 110 ohms

### BNC Connector

Input Level ..... 1V p-p
Input Impedance ..... 75 ohms
Output Level ..... 1V p-p
Output Impedance ..... 75 ohms

## 1.7.4 Control

Local Control ..... Optical Encoder, Momentary Push-Button w/LCD Display
Remote Port ..... RS-485, GPI
Clock Speed ..... 8 MHz
Analog Audio Connector Type ..... 25-pin 'D'

## 1.7.5 Inputs

Nominal Level ..... +4 dBµ (0 dBµ = 0.775 Vrms)
Maximum Level ..... +24 dBµ
Impedance ..... 12 K ohms, balanced
Common Mode Rejection ..... >70 dB @ 60 Hz, >60 dB @ 20 KHz

## 1.7.6 Outputs

Nominal Level ..... +4 dBµ
Maximum Level ..... +24 dBµ
Impedance ..... 600 ohms, balanced, either side groundable

## 1.7.7 System Performance

Voltage Gain ..... Unity +0.1 dB (High-Z Load)
Frequency Response ..... 20 Hz to 20 KHz ± 0.1 dB
-3 dB Bandwidth ..... 22 KHz
THD + N (20 Hz to 20 KHz) ..... >98 dB @ +28dBµ
Crosstalk (All Inputs On) ..... >100 dB @ 15 KHz
Dynamic Range (20 Hz to 20 KHz) ..... 110 dB

## 1.7.8 Machine Control

Differential Input ..... 0 to +5V
Connector Type ..... 9-pin 'D'
Data Rate ..... 38.4 K Baud @ approx 2.5% jitter
Signal Input ..... RS422/RS485

# Chapter 2 – Installation

## 2.1 General

If specified when ordered, the TDM3000 will be configured for the intended system at the factory. Before attempting to install any frame, matrix card, controller card, or power supply, read this section carefully.

## 2.2 Unpacking and Inspecting


**This equipment contains devices sensitive to electrostatic discharge (ESD). Use a grounded wrist strap and mat when handling the internal circuit cards to prevent ESD.**

Immediately upon receipt, inspect all shipping containers. Carefully unpack the equipment and compare the parts received against the packing list. If any parts appear to be missing or damaged, please contact PESA immediately. Contact information is on the front of this manual.

## 2.3 Choosing an Installation Location


**For safety reasons, this equipment must be located near the socket-outlet or power strip so that the AC line cord plugs are easily accessible.**

This equipment is designed for installation in a standard 19" equipment rack located in an environment conforming to the specifications in Chapter 1. Locate each unit as closely as possible to its associated equipment to minimize cable runs.

Consider the connection from this equipment to the supply circuit, and the effect that possible overloading can have on overcurrent protection circuits and supply wiring. Refer to nameplate ratings when addressing this concern.

## 2.4 Mounting in Equipment Rack


**Installation or removal of this equipment requires at least two persons in order to avoid possible personal injury or equipment damage. Install this equipment in such a manner as to avoid any tipping hazard from uneven loading of the rack.**


**Make sure that all power is disconnected before installing the frame into the rack.**


**Forced-air cooling is provided by fans inside this equipment. Do not block airflow around these fans. Replace all service panels and blank filler plates. Keep the door closed during normal operation.**

This equipment is designed for installation in a standard 19" equipment rack. Provide sufficient space behind the equipment racks to allow for control, signal, and power cables. Use all chassis mounting holes, and tighten mounting hardware securely.

A large system is shipped in two separate boxes. When removed from the shipping containers the two units must be connected together and internally wired to form one unit. This is accomplished by an opening in the bottom of one frame and the top of the other. These openings allow the cables to connect the two half of the frames together. When mounting the frames, place one frame above the other.

Install the equipment into the rack as follows:

1. Insert the chassis into the equipment rack and support the bottom of the chassis until all mounting hardware has been installed and properly tightened.
2. Install the bottom two chassis mounting screws.
3. Install the top two chassis mounting screws.
4. Install any remaining chassis mounting screws.
5. Tighten all of the chassis mounting screws until they are secure.

## 2.5 Connecting Equipment Cables

Follow these guidelines when connecting equipment cables.

1. Install the equipment in the rack before connecting cables.
2. Relieve strain on all cables to prevent connector separation.
3. Use as many cable ties as necessary to secure cables to the rack. This will minimize the amount of force transmitted to the equipment and help route cables away from hazardous areas.
4. Route cables away from physical traffic areas to avoid creating a safety hazard.
5. Bundle together any cables connected to a single input/output card and separate them from the other bundles with enough slack to create a service loop. This will permit individual card replacement without disruption to the other input/output cards.

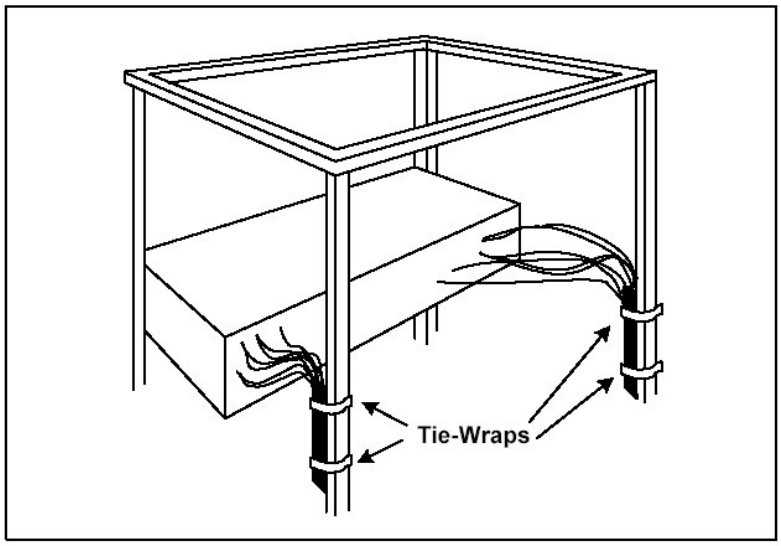



**Figure 6. Cables Attached to Supports**

## 2.6 TDM3000 Frame

The TDM3000 Switcher may be situated next to other electronic equipment provided it has adequate space for air circulation. The switcher can be mounted in a 19" equipment rack if desired. For safety reasons and signal quality, the rack must be mechanically grounded.

NOTE

**Units are shipped with a supply or set of supplies on AC circuit (receptacle on rear of frame). A second (redundant) supply or set of supplies may be ordered with the matrix switcher. A second AC circuit will be on the rear of the frame.**

AC power to the frame is distributed to the DC power supplies and then channeled to individual modules via the motherboard.

## 2.7 Power Supplies

The number of power supplies that are installed depends on the configuration of your system. All of the required power supplies will be installed and configured at the factory.

The power supplies used for the PESA TDM router are 115/230VAC auto-sensing, switching supply. All circuit modules receive DC voltage from a common bus. The AC circuit uses an EMI/RFI filter to inhibit noise interference to the circuitry. There are a variety of different types of supplies depending on the required configuration. Each supply unit contains two separate supplies. Two types of supplies are available: ++5VDC @ 12 Amps each and a ±15VDC supply at 4 Amps each. The supplies are AC auto-sensing for 115/230VAC 50/60 Hz. The DC outputs are diode 'OR'ed to one of two common DC buses in the frame.


**Matrix switchers are shipped from the factory with one supply or set of supplies installed unless a redundant power supply or set of supplies are ordered.**

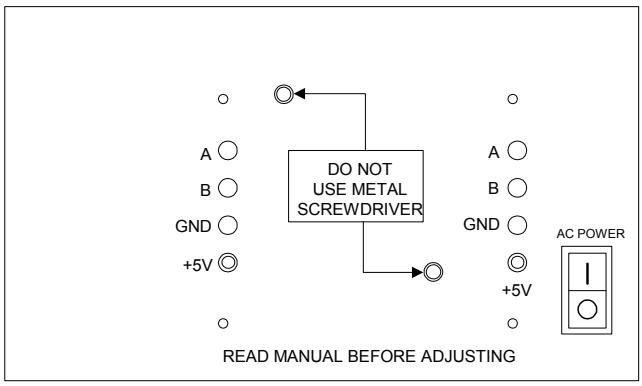



**Figure 7. +5V Power Supply Front View**

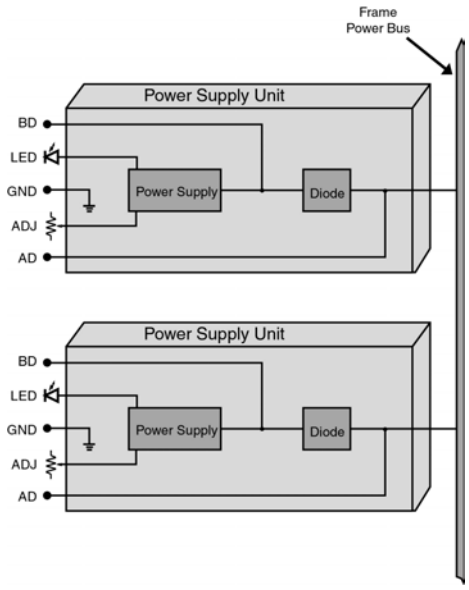



**Figure 8. Power Supply Side View**

The top power supply slot is labeled “1”, the next one is “2”, and so on. The LED labeled AC1 on the front of the unit indicates that the power supplies in the ODD slots are operational. The LED labeled AC2 indicates that the LEDs in the EVEN slots are operational.

## 2.8 Frame Cabling

A large system is shipped in two separate boxes. When removed from the shipping containers the two units must be connected together and internally wired to form one unit. This is accomplished by an opening in the bottom of one frame and the top of the other. These openings allow the cables to connect the two half of the frames together. When mounting the frames, place one frame above the other. Once the two frames have been mounted into a rack, complete the different types of cabling that attach the two frames together. They are:

- Power Supply Grounding Cable
- Power Supply Bus Cable
- TDM Output Cabling

### 2.8.1 Power Supply Grounding Cable

To complete the power supply grounding cabling, follow the steps listed:

1. The motherboard on each frame has a grounding (green 18 gauge) cable connected at one end, and a connector at the other end. Simply plug the two connectors together,
2. Assure that there is a solid connection. Refer to Figure 9.

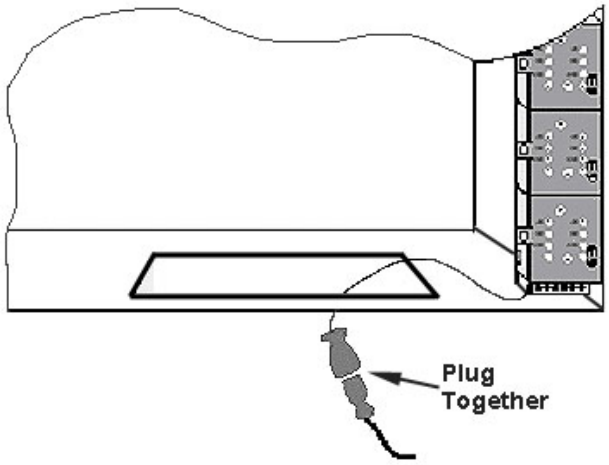



**Figure 9. Power Supply Grounding Cable**

### 2.8.2 Power Supply Bus Cable

To complete the power supply bus cabling, follow the steps listed:

1. There is one 16 pin (blue) ribbon cable which connects the two power supply motherboards together. The cable was shipped with one connector attached to the top portion of the motherboard in the lower frame.
2. Remove the bottom power supply in the upper frame. This is necessary to plug the connector into the receptacle.
3. Attach the loose end of the ribbon cable to the bottom portion of motherboard in the upper frame. The cable plugs in behind the last power supply location of the upper frame. Refer to Figure 10 for the location.

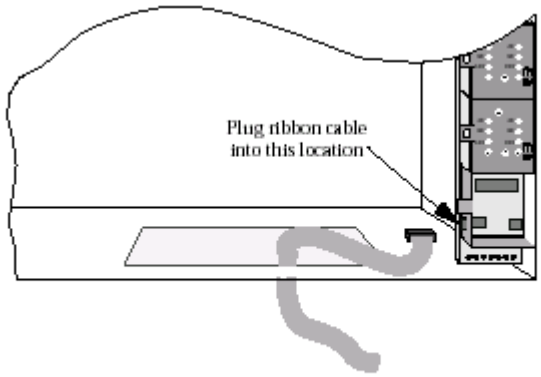



**Figure 10. Power Supply Bus Cable**

Replace the previously removed power supply cover and secure tightly.

### 2.8.3 TDM Output Cabling

The two TDM modules are totally interchangeable. They each have four dual input connectors and four dual output connectors. The connectors that are mounted on the front of the module are connected to ribbon cables that have two 100-pin connectors. The connectors that sit behind the front mounted connectors are interconnected with a single looping cable.

All output modules have one bank of a 100-pin TDM cable attached to them. There are four such output cables in large systems. One cable has one 100-pin connector attached, two cables have two 100-pin connectors attached. These cables allow all output modules to interconnect to both TDM modules.

Each TDM cable has a total of eight (20-pin) banks plus the 100-pin connector(s).

- The first output TDM cable is for all Analog outputs and two Time Code outputs.
- The second TDM cable is used for Time Code expansion and the first six AES output modules.
- The third TDM cable is used for AES outputs.
- The forth TDM cable is used for the last four AES output modules, Machine Control outputs and the Local Satellite module.

These four cables need to be interconnected to both TDM modules. To complete the output cabling, follow these steps:

1. Locate the four TDM output cables attached to the Analog outputs, Time Code outputs and AES outputs. Run the four 100-pin cables through the opening in the bottom of the output frame.
2. Dress the cables up through the bottom of the frame that houses the TDM modules and input modules.
3. Plug the 100-pin connectors, labeled J7, into J7 of both TDM modules.
4. Plug the 100-pin connectors, labeled J6, into J6 of both TDM modules.
5. Plug the 100-pin connector, labeled J9, into J9 on the bottom side of the lower TDM module.
6. Plug the 100-pin connector, labeled J8, into J8 on the bottom side of the lower TDM module.
7. Plug the fifth bank of the 4th TDM output cable into J2 of first Machine Control module.
8. Plug the sixth bank of the 4th TDM output cable into J2 of the third Machine Control module.
9. The seventh and eighth backs of the 4th TDM output cable plug into J9 and J10, respectively, of the Local Satellite module.


**Designated 'J' numbers are labeled on the cables and the TDM modules.**

## 2.9 Frame Power

Power to the frame is provided by modular AC cords. The unit has an AC circuit, (two if redundant) having an IEC EMI/RFI noise filter (with fuse) and power switch. Insure that the power switch (located on rear of chassis) is in the 'OFF' position before connecting the AC cord to AC source. If a redundant system was ordered, there will be two AC circuits, and two power cords. Two separate grounded AC circuits are recommended for true redundant AC operation.

## 2.10 Powering up the Switcher


**Be sure to follow these steps exactly when applying power to your switcher. Failure to do so may cause damage to the power supplies.**

1. Ensure that the AC power switches, located on the rear bottom left of the chassis, are in the OFF position.
2. Ensure that the DC power switches, located inside the chassis, are in the ON position. (Refer to your Custom Configuration Rack drawings for the exact number, locations, and types of DC power supplies included with your system.)
3. Connect the AC power cord to the AC power plug on the switcher, then to the AC power source. If a redundant system was ordered, two AC power cords are included and will need to be connected in the same manner. Two separate grounded AC sources are recommended for true redundant AC operation.
4. Power up the switcher by toggling the AC power switch(es) to ON. Check that all fans inside the frame are running and that the AC Power LEDs (AC1 and AC2) on the control window of the frame door are on. Two green LEDs on each DC power supply inside the switcher door should also be on.
5. After the AC connection(s) have been made, apply power to the appropriate AC circuits using the power switches. Check that all fans are running and that the power-on LEDs (AC 1 & 2) on the front panel indicate power is on appropriate AC circuits. Refer to the following figure.

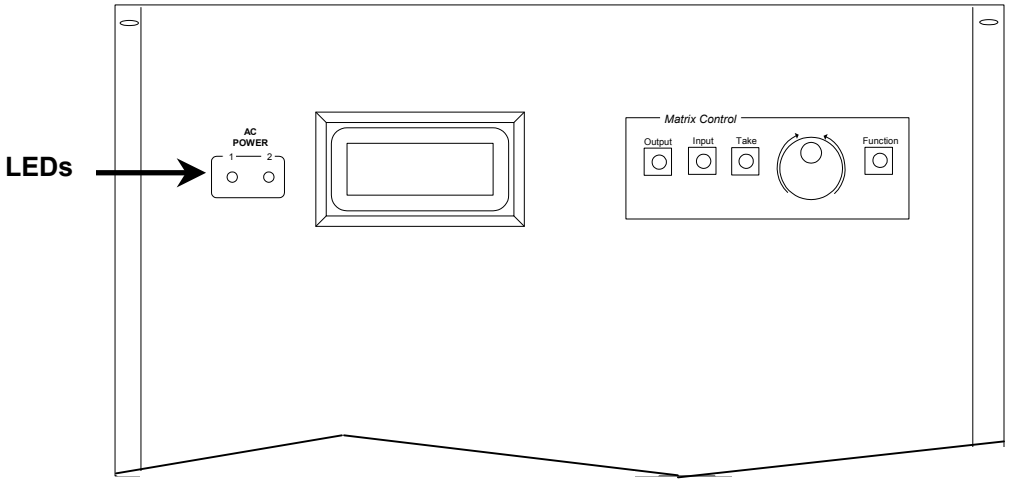



**Figure 11. Front Panel Power LEDs**

## 2.11 AC fuses

AC fuses are inside the AC switch housing. After unplugging all AC power cords to the frame, insert a flat head screwdriver in the tab on the top of the switch housing to open the housing. Two 3.15A 250V fuses are held inside two small plastic fuse cases with arrow labels. (For a few very large routers the fuse value may be as high as 6A.) When replacing the fuse cases, be sure to match the fuse case arrows' orientation with the orientation of the arrows on the AC switch housing.


**DC Power Supplies should always be left ON ! Please note that the DC power supplies inside the frame should never be used to turn the entire frame on or off. They should always be left in the ON position except when removing them for troubleshooting or repair purposes.**

## 2.12 Modules

The TDM3000 Audio Router is a switching design developed to accommodate a denser switching matrix than conventional crosspoint switchers. Complicated motherboard architecture and crosspoint modules are not needed in TDM3000.

The TDM3000 switcher utilizes Time Division Multiplex (TDM) circuitry to route up to 1024x1024 channels. Virtually any type of audio signal in any combination of throughput can be accommodated.

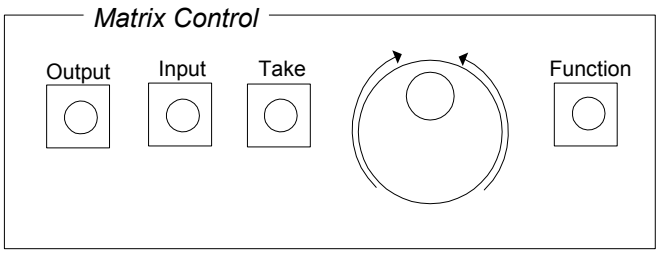
The TDM module fits into the standard TDM3000 frame providing the backbone for the following audio modules:

- AES (Asynchronous) Input and AES (Asynchronous) Output Modules
- Analog Audio Input and Analog Audio Output Modules
- Machine Control (RS-422) I/O Module
- Timecode Input and Timecode Output Modules

The following sections describe the available modules.

### 2.12.1 Matrix Control

The Matrix Control is located on the door of the switcher. The TDM3000 local control scheme uses a combination of front-mounted momentary pushbuttons and a rotary optical encoder for quick, straightforward switching. An LCD allows viewing of all switch operations. Additional functions such as I/O identifier labels and polling are included in the unit's firmware. For more information about how to use the Matrix Control, see 33.




## 2.12.2 TDM3000 Matrix Frame Controller Cards

The Matrix Frame Controller Cards provides the control commands dictated by firmware and user input which is in turn distributed through either a 1RU single or dual TDM interface unit. The TDM interface is then tied to either a 3500PLUS or 3500PRO control system.

The Matrix Frame Controller Cards read and write data to and from system modules via a parallel bus on the frame motherboard. Each output and crosspoint module has a unique address, specified by a DIP switch on the module. The Controller module communicates with system modules by sending the address on the bus to specify a module and then reading from, or writing to, the appropriate module. The significance of different addresses is programmed in the Controller firmware.

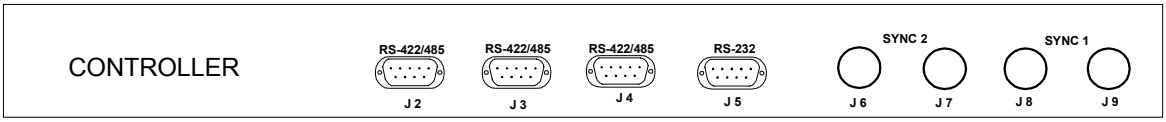



**Figure 12. TDM3000 Matrix Frame Controller Card**

The Controller module is the communication control hub allowing for the control interface to the 3500 family of PESA control systems. By utilizing a 1RU interface unit, the TDM communicates via the RS-485 bus. Connect the RS-485 cable(s) to J4 (the RS-485 port) on the matrix switcher Using 9-pin 'D' male connectors, cable TDM interface unit to the matrix switcher's Controller module.

The looping sync input on the back of the Controller module may be used if synchronized switching is required. It is recommended that these BNCs be terminated if loop-through is not needed.


**J2 and J3 are used for Protocol translation and future development.**

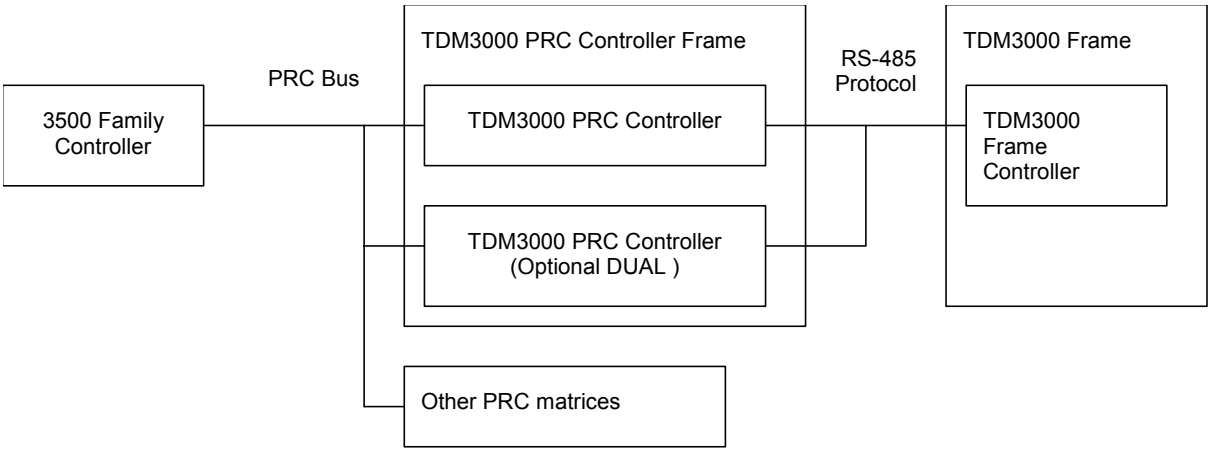



**Figure 13. TDM3000 Configuration**

### 2.12.2.1 Controller Communication Ports' Pinouts

The following table lists how the 9-pin 'D' connectors are wired on the Controller module for 3 different communication formats:

**Table 1. Controller Serial Connector Pinouts**

| **RS-422 (not used)** | | **RS-485** | | **RS-232 (not used)** | |
|---|---|---|---|---|---|
| Pin # | Function | Pin # | Function | Pin # | Function |
| 2 | Receive + | 2 | 485 + | 1 | DCD |
| 3 | Transmit + | 5 | Ground | 2 | Receive |
| 5 | Ground | 7 | 485 - | 3 | Transmit |
| 7 | Receive - | | | 5 | Ground |
| 8 | Transmit - | | | 7 | RTS |
| | | | | 8 | CTS |

### 2.12.2.2 J2 and J3

J2 and J3 of the Controller module allow the selection of RS-422 or RS-485 for protocol translation. The corresponding 4-position DIP switches, S5 and S6 on the Controller module, need to be set properly. See the RS-422 and RS-485 switch setting examples below.

NOTE

**IMPORTANT NOTE on DIP switches:**
**The 'OFF' position represents a logical '1' and the 'ON' position represents a logical '0'.**

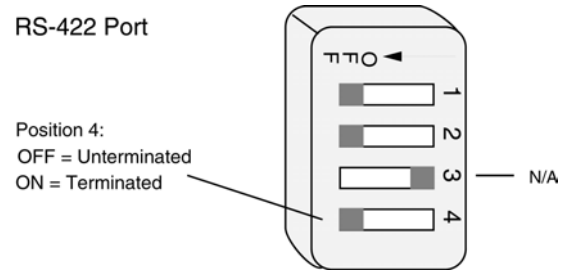



**Figure 14. RS-422 DIP Switch Setting**

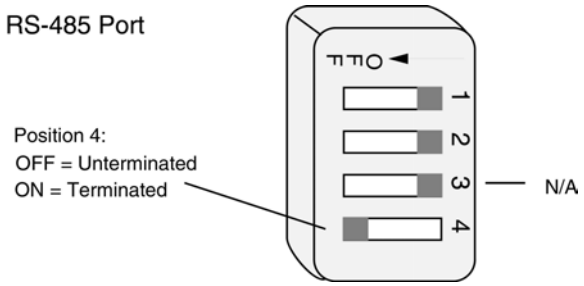



**Figure 15. RS-485 DIP Switch Setting**

### 2.12.2.3 J4

Connect the RS-485 cable(s) to J4 (the RS-485 port) on the matrix switcher using 9-pin 'D' male connectors, cable TDM interface unit to the matrix switcher's Controller module (refer to Table 2 for the J4 pinout). A looping cable is required for connecting two or more panels in series. The last panel in series must be terminated by setting the 4-position DIP switch, S4, on the Controller module. Apply power to the remote panels using an AC power adapter (included with each remote panel).

**Table 2. RS-422 / RS-485 Port Selection**

| DIP Switch Position (S4) | RS-422 | RS-485 |
|---|---|---|
| 1 | OFF | ON |
| 2 | OFF | ON |
| 3 | N/A | N/A |
| 4 | OFF = Unterminated<br>ON = Terminated | OFF = Unterminated<br>ON = Terminated |

### 2.12.2.4 J5

S3 of the Controller module allows the selection of Data Terminal Equipment (DTE) or Data Communication Equipment (DCE) through the RS-232 port, J5. To select DTE or DCE, refer to the following figures for the appropriate DIP switch setting.

**Table 3. RS-232 Function Selection**

| DIP Switch Position (S3) | DTE | DCE |
|---|---|---|
| 1 | ON | OFF |
| 2 | OFF | ON |
| 3 | ON | OFF |
| 4 | OFF | ON |

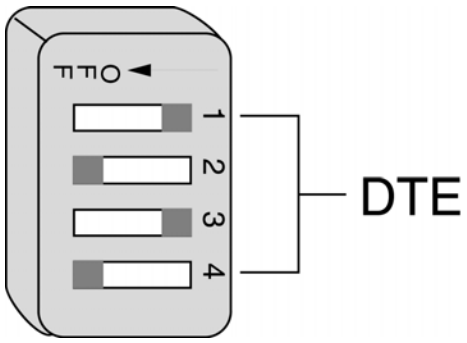



**Figure 16. DTE DIP Switch Setting**

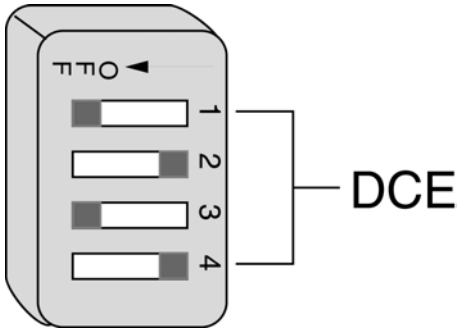



**Figure 17. DCE DIP Switch Setting**

NOTE **If the computer is not communicating with the router after selecting a RS-232 function, try selecting the other function.**

### 2.12.2.5 RS-232 Serial Communications Protocol

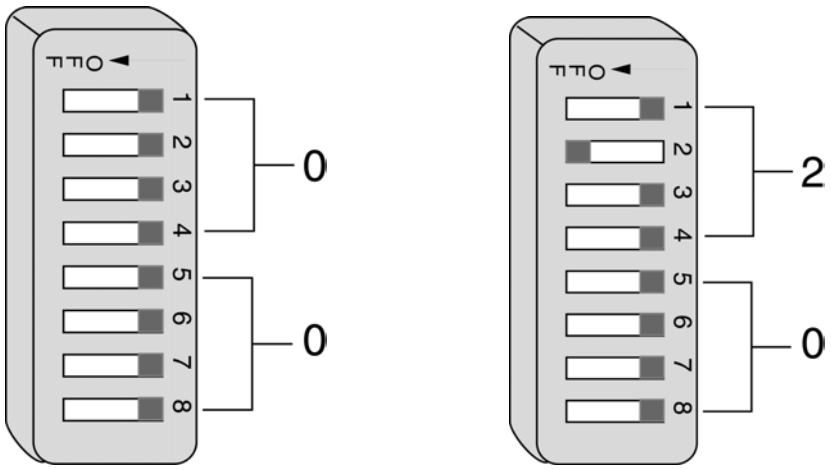
- 9600 Baud
- No Parity
- 1 start bit
- 1 stop bit
- 8 data bits

## 2.12.3 Dual Controllers

When a system is equipped with dual Controllers, they are interconnected by a 16-pin ribbon cable and both are connected to the LCD. An eight pin DIP switch determines which module functions as the Master Controller and which one is the Slave Controller. If the Master Controller fails, the Slave Controller then controls the system. When the Master Controller is then replaced with another module, the new Master Controller would control the system.

### 2.12.3.1 Dual Controller System Dip Switch Setting

An 8-position DIP switch is used in a dual Controller system to engage the Master or Slave mode.




**Master Processor DIP Settings** **Slave Processor DIP settings**

**Figure 18. Master and Slave Processor DIPswitch Settings**

### 2.12.4 TDM Module

The TDM module is a standard size, utilizing the control circuitry via the B-bus (part of the backplane control scheme) and programmable logic device to obtain control information from the interface control processor module. Make sure the cards are either at the top or the bottom of the frame.

TDM signals are routed to and from audio I/O boards to the TDM module. This allows for a very large number of input and output lines to be routed to the switching circuits with minimum cabling requirements. The input and output lines, or signals, have an overall bandwidth of 1.5 to 3 Mbs.

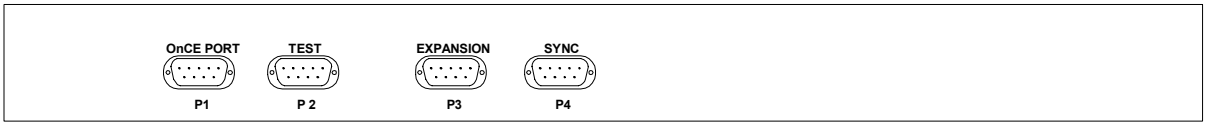



**Figure 19. TDM Module**

#### 2.12.4.1 P1 and P3

OnCE (P1) and EXPANSION (P3) ports are for engineering use only.

#### 2.12.4.2 P2

TEST (P2) is for manufacturing use only.

#### 2.12.4.3 P4

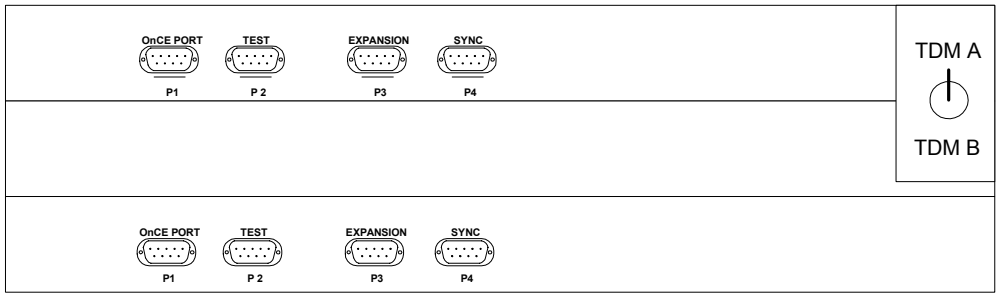
SYNC (P4) is mainly used in AES applications. Use this to connect to a AES sync source. You should always connect to a sync course. The following table summarizes its pinout.

**Table 4. P4 (Sync Port) Pinout**

| Pin # | Function |
|---|---|
| 1 | AES Out + |
| 2 | Ground |
| 3 | AES In – (100 ohm Balanced) |
| 4 | AES In – (Direct) |
| 5 | Driver Disable (Active Low) |
| 6 | AES Out – |
| 7 | AES In + (110 ohm Balanced) |
| 8 | Ground |
| 9 | Ground |

### 2.12.4.4 TDM Module Switch

The two TDM modules are interconnected to all input and output modules. Each TDM module has a 2-pin header (JP1) on the bottom side of the module. This 2-pin header is connected to a toggle switch that is mounted on the inside of the frame. The toggle switch determines which TDM module is being activated. To change from one TDM module to the other TDM module, change the position of the toggle switch. Just set the switch to either "A" or "B" to select the correct module. It's also recommended to do a soft reset of the switcher.




## 2.12.5 TDM Input and Output Modules

The input/output (I/O) boards contain a total of 32 channels (either input or output) or a combination of 16 input plus 16 output channels, depending on the board type.

The I/O boards use, but are not limited to, Analog to Digital (A/D) converters, Digital to Analog (D/A) converters, differential analog drivers and receivers, data line drivers and receivers (RS-422), SMPTE Time Code drivers and receivers, wave shaping circuits, and data synchronizers.

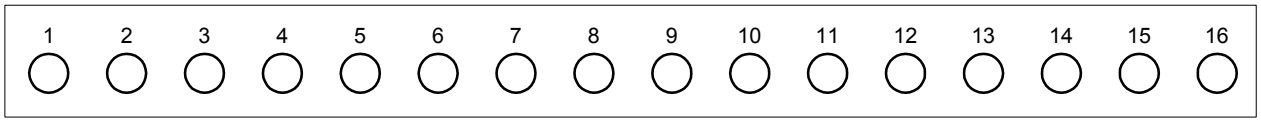



**Figure 20. AES Input/Output (16 BNC Connectors)**


**Figure 21. AES Input/Output (25 pin 'D' Connectors)**

### 2.12.5.1 AES (Asynchronous) Input and AES (Asynchronous) Output Modules

Each AES Input or AES Output module supports 16 AES / EBU inputs or outputs. They are available in either BNC or 25-pin 'D' connectors.

Since each AES signal is comprised of two signals, the AES signal can be split into two audio channels. Thus, an AES signal can be converted into 2 channels for stereo output or 2 mono inputs could be combined into one AES signal.

### 2.12.5.2 AES Input Module

The input module contains 32 BNC connectors or four 25-pin 'D' connectors and the corresponding input circuitry required for 20 Mbs AES/EBU data transfer. The conditioned data is transferred to a crosspoint module via data cables. The module is powered by regulated +5VDC entering at J100. Final noise filtering is accomplished on-board using capacitors and inductors in a filter configuration. At the input the balanced signal is terminated with a 120 resistor. The signal is then AC coupled into the quad receiver ICs (IC1A-H) where it is converted from balanced to single-ended. These signals are then fed to the switching matrix module via J101 and ribbon cable.

### 2.12.5.3 AES Output Module

The output module contains 32 BNC connectors or four 25-pin 'D' connectors and the corresponding output circuitry required for 20 Mbs AES/EBU data transfer. The data received from the crosspoint module via data cables is converted and buffered from a single-ended signal to a balanced signal and presented to the 'D' output connectors. The module is powered by regulated +5VDC entering at J100. Final noise filtering is accomplished on-board using capacitors and inductors in a filter configuration.

The unbalanced signals are received from the crosspoint module via data cables. The exclusive OR gates (IC24A-IC27H) outputs produce balanced signals which are buffered by output drivers IC20A-IC23H). The signals from the output drivers are then AC coupled to the output 'D' connectors.

### 2.12.5.4 AES Crosspoint Module

The crosspoint module contains the 128 x 64 crossbar IC and support circuitry required to switch 5V p-p board-level digital data signals @ 20Mbs. Conditioned data received from the input module(s) is switched to the desired output(s) via ribbon data cables.

The module is powered by regulated +5VDC entering at J100. Final noise filtering is accomplished on-board using capacitors and inductors in a filter configuration.

The digital data signals arrive at the crosspoint array (IC102) from the input module(s) via connectors J102 and J104. After the switch command is sent to IC100, the signal is then sent to the desired output(s) on the output module(s) via connectors J103 and J105.

Switching information is received from the processor module via J101 and is decoded using IC100 and IC101 PLD ICs. The decoded data is transferred to the crossbar IC control buffers which cause the actual switch connection to occur. The matrix module address is system set using the DIP switch (SW100).

### 2.12.5.5 Analog Audio Input and Analog Audio Output Modules

Analog Audio Input and Analog Audio Output modules receive and transmit signals via four 25-pin ‘D’ connectors for 32 channels per board.

#### 2.12.5.6 Analog Input Module

There are 32 inputs on each input module, with the inputs entering the board via four 25-pin 'D' female connectors. Three signal lines are used for each channel:

- positive differential
- negative differential
- ground

The input signal goes from the connector to differential line receivers, then to the DAC. Power for the input module is derived from the + 5 volt supply obtained from the backplane. Each input module is identical with different silkscreened metal to indicate which input range it's associated with.

#### 2.12.5.7 Analog Output Module

The output of the DAC goes to an op amp then to a differential line driver and then to the board edge connectors, via four 25-pin 'D' female connectors. Power for the output module is derived from the + 5 volt supply obtained from the backplane. Each output module is identical with different silkscreened metal to indicate which output range it's associated with.

#### 2.12.5.8 Machine Control (RS-422) I/O Module

The Machine Control module has 16 input and output ports (via 16 ESD protected 9-pin 'D' connectors) on the same module.

#### 2.12.5.9 Timecode Input and Timecode Output Modules

The SMPTE Timecode Input and Output modules accept and generate Timecode signals up to 100 times normal Timecode rates (such as those utilized in the fast shuttle mode of a VTR). The Timecode modules can take balanced and/or unbalanced inputs and send balanced and/or unbalanced outputs. These modules use a 25-pin 'D' connector to interface to the outside world.

### 2.13 Signal Connections

For uniform, quality signal transfer, the use of appropriate high-grade cables and connectors are recommended. All equipment signals that will be connected to the TDM3000 Switcher must have compatible I/O configurations.

Input and output channel numbers are indicated on the metal trays that house the modules. If applicable, labels with the physical numbering of signals have been affixed to the back of the switcher near the I/O connectors.

## 2.14 Cabling

### 2.14.1 Internal Frame Cabling

There can be two to eight identical TDM Internal Cables for a typical switcher (at least one input cable and one output cable). Each cable has one 100-pin connector (J9) and eight 20-pin connectors (J1 thru J8). The 100-pin connector plugs into the TDM Module. The eight 20-pin connectors each use 12 conductors (wires) of the ribbon cable, except Bank 1 (the first one) has 16 conductors. The 20-pin connectors plug into all other types of PESA TDM modules. Table 5 shows the correct internal pin outs for the (100-pin) TDM ribbon cable.

**Table 5. Interconnect Cable**

| Bank 1 | | Bank 2 | | Bank 3 | | Bank 4 | | Bank 5 | | Bank 6 | | Bank 7 | | Bank 8 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| J1 | J9 | J2 | J9 | J3 | J9 | J4 | J9 | J5 | J9 | J6 | J9 | J7 | J9 | J8 | J9 |
| 1 | 85 | 1 | 73 | 1 | 61 | 1 | 49 | 1 | 37 | 1 | 25 | 1 | 13 | 1 | 1 |
| 2 | 86 | 2 | 74 | 2 | 62 | 2 | 50 | 2 | 38 | 2 | 26 | 2 | 14 | 2 | 2 |
| 3 | 87 | 3 | 75 | 3 | 63 | 3 | 51 | 3 | 39 | 3 | 27 | 3 | 15 | 3 | 3 |
| 4 | 88 | 4 | 76 | 4 | 64 | 4 | 52 | 4 | 40 | 4 | 28 | 4 | 16 | 4 | 4 |
| 5 | 89 | 5 | 77 | 5 | 65 | 5 | 53 | 5 | 41 | 5 | 29 | 5 | 17 | 5 | 5 |
| 6 | 90 | 6 | 78 | 6 | 66 | 6 | 54 | 6 | 42 | 6 | 30 | 6 | 18 | 6 | 6 |
| 7 | 91 | 7 | 79 | 7 | 67 | 7 | 55 | 7 | 43 | 7 | 31 | 7 | 19 | 7 | 7 |
| 8 | 92 | 8 | 80 | 8 | 68 | 8 | 56 | 8 | 44 | 8 | 32 | 8 | 20 | 8 | 8 |
| 9 | 93 | 9 | 81 | 9 | 69 | 9 | 57 | 9 | 45 | 9 | 33 | 9 | 21 | 9 | 9 |
| 10 | 94 | 10 | 82 | 10 | 70 | 10 | 58 | 10 | 46 | 10 | 34 | 10 | 22 | 10 | 10 |
| 11 | 95 | 11 | 83 | 11 | 71 | 11 | 59 | 11 | 47 | 11 | 35 | 11 | 23 | 11 | 11 |
| 12 | 96 | 12 | 84 | 12 | 72 | 12 | 60 | 12 | 48 | 12 | 36 | 12 | 24 | 12 | 12 |
| 13 | 97 | 13 | — | 13 | — | 13 | — | 13 | — | 13 | — | 13 | — | 13 | — |
| 14 | 98 | 14 | — | 14 | — | 14 | — | 14 | — | 14 | — | 14 | — | 14 | — |
| 15 | 99 | 15 | — | 15 | — | 15 | — | 15 | — | 15 | — | 15 | — | 15 | — |
| 16 | 100 | 16 | — | 16 | — | 16 | — | 16 | — | 16 | — | 16 | — | 16 | — |
| 17 | — | 17 | — | 17 | — | 17 | — | 17 | — | 17 | — | 17 | — | 17 | — |
| 18 | — | 18 | — | 18 | — | 18 | — | 18 | — | 18 | — | 18 | — | 18 | — |
| 19 | — | 19 | — | 19 | — | 19 | — | 19 | — | 19 | — | 19 | — | 19 | — |
| 20 | — | 20 | — | 20 | — | 20 | — | 20 | — | 20 | — | 20 | — | 20 | — |

## 2.14.2 Analog and Time Code Input Cabling

**Table 6. Analog and Time Code Input Cables**

| TDM J3 | Inputs | Inputs |
|---|---|---|
| Cable 1 J9 | Analog J5 | T/C J5 |
| Bank 1 | 1 — 32 | |
| Bank 2 | 33 — 64 | |
| Bank 3 | 65 — 96 | |
| Bank 4 | 97 — 128 | |
| Bank 5 | | 1 — 32 |
| Bank 6 | | 33 — 64 |
| Bank 7 | | 65 — 96 |
| Bank 8 | | 97 —128 |


**Cabling information listed in this manual lists cables that may or may not be connected in the system. They are listed as reference for future expansion.**

## 2.14.3 AES Input Cabling

**Table 7. AES Input Cables**

| TDM J2 | Inputs | TDM J5 | Inputs |
|---|---|---|---|
| Cable 2 J9 | AES J2 | Cable 3 J9 | AES J2 |
| Bank 1 | 1 — 16 | Bank 1 | 129 — 144 |
| Bank 2 | 17 — 32 | Bank 2 | 145 — 160 |
| Bank 3 | 33 — 48 | Bank 3 | 161 — 176 |
| Bank 4 | 49 — 64 | Bank 4 | 177 — 192 |
| Bank 5 | 65 — 80 | Bank 5 | 193 — 208 |
| Bank 6 | 81 — 96 | Bank 6 | 209 — 224 |
| Bank 7 | 97 — 112 | Bank 7 | 225 — 240 |
| Bank 8 | 113 — 128 | Bank 8 | 241 — 256 |

## 2.14.4 Machine Control Cabling

**Table 8. Machine Control and Satellite Input Cables**

| TDM J2 Cable 3 J9 | Inputs M/C J1 | Inputs Satellite |
|---|---|---|
| Bank 1 | | |
| Bank 2 | | |
| Bank 3 | | |
| Bank 4 | | |
| Bank 5 | 1 — 16 | |
| Bank 6 | 33 — 48 | |
| Bank 7 | | J9 |
| Bank 8 | | J10 |

NOTE **There are no TDM cables connected to M/C inputs 17 – 32 or 49 – 64. This is accomplished by M/C interconnect cables.**

NOTE **To allow for Machine Control consistency, some physical inputs were not used.**

## 2.14.5 Analog and Time Code Output Cabling

**Table 9. Analog and Time Code Output Cables**

| TDM J7 Cable 5 J9 | Outputs Analog J5 | Outputs T/C J5 | TDM J6 Cable 6 J9 | Outputs T/C J5 |
|---|---|---|---|---|
| Bank 1 | 1 — 32 | | Bank 1 | 65 — 96 |
| Bank 2 | 33 — 64 | | Bank 2 | 97 — 128 |
| Bank 3 | 65 — 96 | | Bank 3 | |
| Bank 4 | 97 — 128 | | Bank 4 | |
| Bank 5 | 129 — 160 | | Bank 5 | |
| Bank 6 | 161 — 192 | | Bank 6 | |
| Bank 7 | | 1 — 32 | Bank 7 | |
| Bank 8 | | 33 — 64 | Bank 8 | |

NOTE **Banks three thought eight of the sixth TDM cable are used for AES outputs.**

## 2.14.6 AES Output Cabling

**Table 10. AES Output Cables**

| TDM J6 | Outputs | TDM J9 | Outputs | TDM J8 | Outputs |
|---|---|---|---|---|---|
| Cable 6 J9 | AES J3 | Cable 7 J9 | AES J3 | Cable 8 J9 | AES J3 |
| Bank 1 | | Bank 1 | 97 — 112 | Bank 1 | 225 — 240 |
| Bank 2 | | Bank 2 | 113 — 128 | Bank 2 | 241 — 256 |
| Bank 3 | 1 — 16 | Bank 3 | 129 — 144 | Bank 3 | 257 — 272 |
| Bank 4 | 17 — 32 | Bank 4 | 145 — 160 | Bank 4 | 273 — 288 |
| Bank 5 | 33 — 48 | Bank 5 | 161 — 176 | Bank 5 | |
| Bank 6 | 49 — 64 | Bank 6 | 177 — 192 | Bank 6 | |
| Bank 7 | 65 — 80 | Bank 7 | 193 — 208 | Bank 7 | |
| Bank 8 | 81 — 96 | Bank 8 | 209 — 224 | Bank 8 | |


**Banks five through eight of the seventh TDM cable are used for M/C and Satellite outputs.**

## 2.14.7 Machine Control Cabling

**Table 11. Machine Control and Satellite Output Cables**

| TDM J8 | Outputs | Outputs |
|---|---|---|
| Cable 8 J9 | M/C J2 | Satellite |
| Bank 1 | | |
| Bank 2 | | |
| Bank 3 | | |
| Bank 4 | | |
| Bank 5 | 1 — 16 | |
| Bank 6 | 33 — 48 | |
| Bank 7 | | J5 |
| Bank 8 | | J6 |


**There are no TDM cables connected to M/C inputs 17 – 32 or 49 – 64. This is accomplished by M/C interconnect cables. Refer to Machine Control Interconnect Cabling on page 28.**


**To allow for Machine Control consistency, some physical inputs were not used.**

### 2.14.8 Machine Control Interconnect Cabling

Every two Machine Control modules are interconnected by two 20-pin ribbon cables. Refer to Table 12 for the locations of the interconnections between M/C module 1-16 and M/C module 17-32). See Table 13 for the locations of the interconnections between M/C module 33-49 and M/C module 49-64.

**Table 12. Machine Control 1-16 and 17-32 Interconnect Cabling**

| M/C (1-16) | M/C (17-32) |
|---|---|
| Input J3 | Input J1 |

| M/C (1-16) | M/C (17-32) |
|---|---|
| Output J4 | Output J2 |

**Table 13. Machine Control 33-48 and 49-64 Interconnect Cabling**

| M/C (33-48) | M/C (49-64) |
|---|---|
| Input J3 | Input J1 |

| M/C (33-48) | M/C (49-64) |
|---|---|
| Output J4 | Output J2 |

## 2.15 Pinouts

### 2.15.1 Machine Control Pinouts

The Machine Control input and output modules use a female 9-pin 'D' connector. The connector is wired to be bi-directional. If the direction line (pin 5) is high, pins 3 and 8 are outputs and pins 2 and 7 are inputs. If the direction line (pin 5) is low, pins 3 and 8 are inputs and pins 2 and 7 are outputs.


**To allow for Machine Control consistency, some physical inputs are not used.**


**The direction line (pin 5) is ESD protected. The direction line is controlled internally through software control. Pin 5 is not normally used for external control. If external control is used, pin 5 should be left unconnected.**

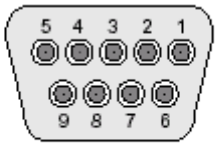



**Figure 22. 9-Pin 'D' Connector**

**Table 14. Pinouts for Machine Control Inputs/Outputs**

| Direction Line pin 5 | + Input Pin | – Input Pin | + Output Pin | – Output Pin | Ground |
|---|---|---|---|---|---|
| High | 7 | 2 | 3 | 8 | 1, 4, 6, 9 |
| Low | 3 | 8 | 7 | 2 | 1, 4, 6, 9 |

## 2.15.2 AES/EBU and Analog Pinouts

Both the AES/EBU and analog input and output modules use a female 25-pin 'D' connector, (see Figure 16) for receiving and transmitting balanced digital audio signals to and from the matrix.

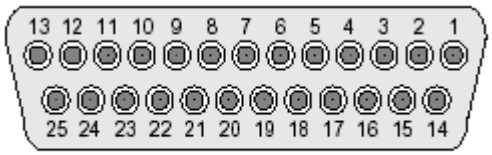



**Figure 23. 25-Pin ‘D’ Connector**

The first 32 pinouts are shown in Table 15. The pattern is repeated for each 32 inputs or outputs.

**Table 15. Pinouts for Inputs/Outputs**

| Signal | Pin No | Conn. | Signal | Pin No | Conn. | Signal | Pin No | Conn. | Signal | Pin No | Conn. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1+ | 25 | J1 | 9+ | 25 | J2 | 17+ | 25 | J3 | 25+ | 25 | J4 |
| 1- | 12 | J1 | 9- | 12 | J2 | 17- | 12 | J3 | 25- | 12 | J4 |
| 2+ | 11 | J1 | 10+ | 11 | J2 | 18+ | 11 | J3 | 26+ | 11 | J4 |
| 2- | 23 | J1 | 10- | 23 | J2 | 18- | 23 | J3 | 26- | 23 | J4 |
| 3+ | 22 | J1 | 11+ | 22 | J2 | 19+ | 22 | J3 | 27+ | 22 | J4 |
| 3- | 9 | J1 | 11- | 9 | J2 | 19- | 9 | J3 | 27- | 9 | J4 |
| 4+ | 8 | J1 | 12+ | 8 | J2 | 20+ | 8 | J3 | 28+ | 8 | J4 |
| 4- | 20 | J1 | 12- | 20 | J2 | 20- | 20 | J3 | 28- | 20 | J4 |
| 5+ | 19 | J1 | 13+ | 19 | J2 | 21+ | 19 | J3 | 29+ | 19 | J4 |
| 5- | 6 | J1 | 13- | 6 | J2 | 21- | 6 | J3 | 29- | 6 | J4 |
| 6+ | 5 | J1 | 14+ | 5 | J2 | 22+ | 5 | J3 | 30+ | 5 | J4 |
| 6- | 17 | J1 | 14- | 17 | J2 | 22- | 17 | J3 | 30- | 17 | J4 |
| 7+ | 16 | J1 | 15+ | 16 | J2 | 23+ | 16 | J3 | 31+ | 16 | J4 |
| 7- | 3 | J1 | 15- | 3 | J2 | 23- | 3 | J3 | 31- | 3 | J4 |
| 8+ | 2 | J1 | 16+ | 2 | J2 | 24+ | 2 | J3 | 32+ | 2 | J4 |
| 8- | 14 | J1 | 16- | 14 | J2 | 24- | 14 | J3 | 32- | 14 | J4 |
| GND | 1,4,7,10 | J1 | GND | 1,4,7,10 | J2 | GND | 1,4,7,10 | J3 | GND | 1,4,7,10 | J4 |
| GND | 13,15,18 | J1 | GND | 13,15,18 | J2 | GND | 13,15,18 | J3 | GND | 13,15,18 | J4 |
| GND | 21,24 | J1 | GND | 21,24 | J2 | GND | 21,24 | J3 | GND | 21,24 | J4 |

# Chapter 3 - Operation

## 3.1 Operation

## 3.2 Downloading to the Main Frame

Your router is installed with custom code, the SRE, which gives the router its operating instructions. Included in the SRE are details such as the number of software levels, level architecture, and how the modules are configured. If you need to reload the SRE, please consult the service department for installation instructions. The contact information for the service department is listed on the front of this manual.

## 3.3 Matrix Control Modes

Use the Matrix Control options to browse the switcher status.

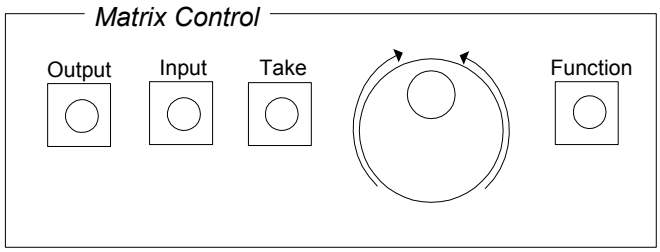



**Figure 24. Matrix Control**

### 3.3.1 Browse Mode

This mode is used to browse the switcher status. Modifications are not allowed in this mode. Upon power up, the system initializes itself and comes up in the Browse mode. Turning the rotary knob in a clockwise or counter-clockwise manner will increment or decrement the output channel number displayed in the first line of the display. The second line shows the associated input channel number. In the TDM3000, Terminal control from the front panel is not required. Control changes, edits, or modifications must go through the 3500 Control system.

Unless otherwise programmed, the default alpha-numeric name is the channel number.

The display looks like this:

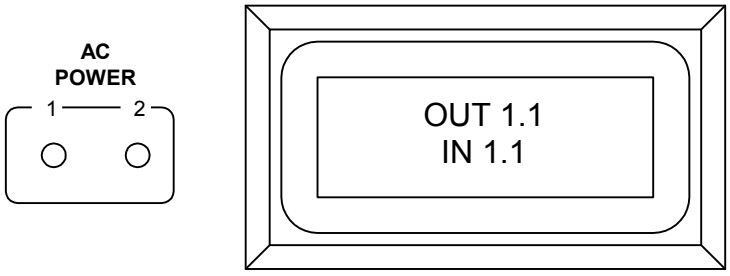



**Figure 25. LEDs and Display**

### 3.3.2 Soft Reset

A soft reset is the safe way to reset the switcher so that preset settings (such as alpha-numeric names and crosspoint settings) are not lost. A soft reset initiates a power cycle. A slight glitch in audio and video may be observed. Simultaneously press OUTPUT and TAKE on the control panel to commence a soft reset.

### 3.3.3 Hard Reset


**Do NOT initiate a hard reset unless advised to do so by PESA technical support.**

A hard reset will cause presets and alpha-numerics saved in the control panel to be lost. A hard reset is accomplished by stepping through the FUNCTION button on the control panel until Full Reset is displayed, and then selecting TAKE. The resulting default status of the router is:

- All alpha-numeric names default to the channel number independent of the level number. (One digit channel names begin with a space)
- All output channels are routed to input channel 1
- Panel memory 1 is set on diagonal mapping: (Input channel ‘n’ goes to Output channel ‘n’ for all possible ‘n’s)
- Panel memory locations 2 – 8 are mapped such that Input channel 1 goes to all outputs

## 3.4 Control and Operation

The TDM3000 router is considered a part of the router system, which includes a control system and control panels. Please refer to your 3500 controller documentation for setup and configuration instructions. Control panels for the 3500 family of controllers each have their own specific manual for setup instructions.

### 3.4.1 Switch and Jumper Settings

This section describes the switch and jumper settings for the initial TDM3000 PRC controller. This is the version that uses the 81-9065-2295-0 controller card and runs in single mode only.

#### 3.4.1.1 Jumper Settings

J10: Connect 2-to-4 and 6-to-8

J13: Connect 2-to-3

### 3.4.1.2 DIP Switch Setting

The S2 switch indicates where the 3500 controller is going to find the TDM3000 matrix on the PRC matrix bus. S2 is the only one that needs to be configured. Disregard all other DIP switches.

The Base PRC Address indicates the strobe on the PRC control bus that corresponds to the first TDM matrix.

**Table 16. S2 Dip Switch Settings**

| Base PRC address | Pos 1 | Pos 2 | Pos 3 | Pos 4 |
|---|---|---|---|---|
| 0 | OFF | OFF | OFF | OFF |
| 1 | ON | OFF | OFF | OFF |
| 2 | OFF | ON | OFF | OFF |
| 3 | ON | ON | OFF | OFF |
| 4 | OFF | OFF | ON | OFF |
| 5 | ON | OFF | ON | OFF |
| 6 | OFF | ON | ON | OFF |
| 7 | ON | ON | ON | OFF |
| 8 | OFF | OFF | OFF | OFF |
| 9 | ON | OFF | OFF | OFF |
| 10 | OFF | ON | OFF | OFF |
| 11 | ON | ON | OFF | OFF |
| 12 | OFF | OFF | ON | OFF |
| 13 | ON | OFF | ON | OFF |
| 14 | OFF | ON | ON | OFF |
| 15 | ON | ON | ON | OFF |

The TDM3000 PRC can control either 1 or 2 TDM3000 matrices. The first matrix is at the PRC strobe dictated by the PRC base address. The second matrix is located on the next strobe above that.

**Table 17. Number of TDM Matrices to Control**

| Number of Matrices to Control | Pos 5 | Pos 6 | Pos 7 |
|---|---|---|---|
| 2 | OFF | OFF | OFF |
| 1 | ON | OFF | OFF |

All other DIP switch settings for Pos 5, 6, and 7 are reserved.

DIP switch positions 8 and 9 are reserved.

Continual Matrix Refresh causes the TDM3000 PRC controller to continually refresh the TDM3000 matrix crosspoints in the background.

**Table 18. Continual Matrix Refresh**

| Continual Matrix Refresh | Pos 10 |
|---|---|
| OFF | OFF |
| ON | ON |

### 3.4.2 Cable Connections

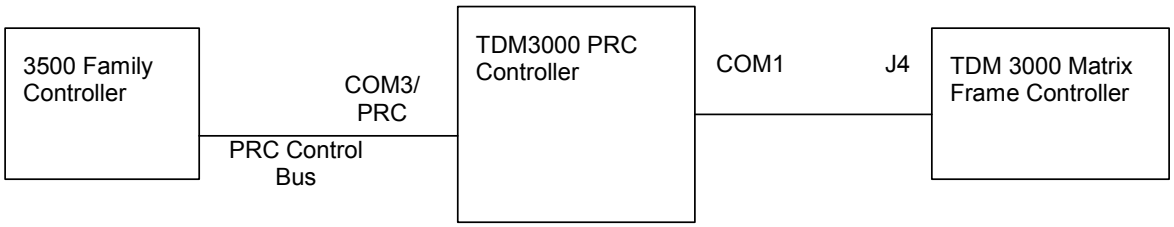



**Figure 26. Cable Connections Between TDM3000, TDM3000 PRC Controller, and 3500 Controller**

Either a PRC or a COM3/PRC connector can be used to connect the TDMPRC controller to the PESA PRC bus. Cable 81-9028-0567-0 is used to connect the TDM3000 PRC controller to the TDM3000 frame controller.

### 3.4.3 Wiring diagram for TDM3000 PRC Controller to TDM3000 Matrix Cable

**Table 19. TDM3000 PRC Controller to TDM3000 Matrix**

| TDM3000 PRC Ctlr (COM1) | TDM3000 – J4 (P2 on the frame controller) | |
|---|---|---|
| 9 Pin D Female | 9 Pin D Male | |
| 8 | 2 | TX+ |
| 3 | 7 | TX- |
| 5 | 5 | GND |

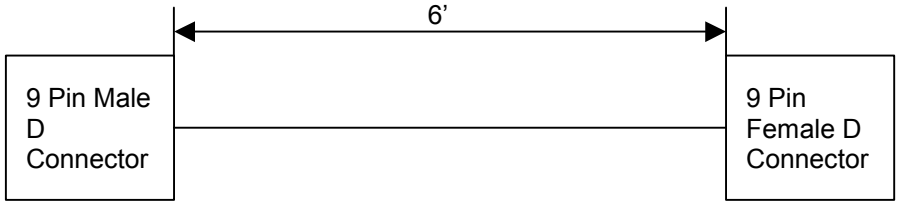



**Figure 27. Wiring Diagram for TDM3000 PRC Controller to TDM3000 Matrix Cable**

### 3.4.4 DIP Switch Settings

These are the DIP settings required for operation of the TDM3000 PRC controller.

#### 3.4.4.1 Operational Mode (Switch S1)

**Table 20. Operational Mode (Switch S1)**

| | Pos 8 | Pos 7 | Pos 6 | Pos 5 | Pos 4 | Pos 3 | Pos 2 | Pos 1 |
|---|---|---|---|---|---|---|---|---|
| Standard Operation | X | X | X | X | OFF | OFF | OFF | OFF |
| Diagnostics Test | ON | ON | ON | ON | ON | ON | ON | OFF |
| Forced NVRAM Clear and System Reinitialization | ON | ON | ON | ON | ON | ON | ON | ON |

**Table 21. On-line Diagnostic Settings (Switch S1)**

| | Pos 8 | Pos 7 | Pos 6 | Pos 5 |
|---|---|---|---|---|
| Enable PRC display on diagnostic port (COM4) | **ON** | X | X | X |
| Disable PRC display | OFF | X | X | X |
| Enable Error display on diagnostic port (COM4) | X | **ON** | X | X |
| Disable Error display | X | OFF | X | X |
| Enable Crosspoint Take Report on diagnostic port (COM4) | X | X | **ON** | X |
| Disable Crosspoint Take Report | X | X | OFF | X |
| Enable Switch Refresh | X | X | X | **ON** |
| Disable Switch Refresh | X | X | X | OFF |

### 3.4.4.2 PRC Strobe Selection (S6)

This switch indicates the PRC strobe that is used to allow a PESA control system to control the TDM3000 matrix.

The Base PRC Address is the first PRC address that the TDM3000 PRC controller responds to.

**Table 22. Base PRC Address**

| Base PRC Address | Pos 4 | Pos 3 | Pos 2 | Pos 1 |
|---|---|---|---|---|
| Strobe 0 | OFF | OFF | OFF | OFF |
| Strobe 1 | OFF | OFF | OFF | ON |
| Strobe 2 | OFF | OFF | ON | OFF |
| Strobe 3 | OFF | OFF | **ON** | ON |
| Strobe 4 | OFF | **ON** | OFF | OFF |
| Strobe 5 | OFF | **ON** | OFF | ON |
| Strobe 6 | OFF | **ON** | **ON** | OFF |
| Strobe 7 | OFF | **ON** | **ON** | ON |
| Strobe 8 | **ON** | OFF | OFF | OFF |
| Strobe 9 | **ON** | OFF | OFF | ON |
| Strobe 10 | **ON** | OFF | **ON** | OFF |
| Strobe 11 | **ON** | OFF | **ON** | ON |
| Strobe 12 | **ON** | **ON** | OFF | OFF |
| Strobe 13 | **ON** | **ON** | OFF | ON |
| Strobe 14 | **ON** | **ON** | **ON** | OFF |
| Strobe 15 | **ON** | **ON** | **ON** | ON |

The Number of TDM3000 Matrices Controlled indicates whether the controller is controlling one or two TDM3000 controllers at a time.

**Table 23. Number of TDM3000 Matrices Controlled**

| Number of Matrices | Pos 5 |
|---|---|
| 2 Matrices | **OFF** |
| 1 Matrix | **ON** |

The PRC Switch Refresh indicates whether the TDM3000 should provide and an internal refresh of switch status. This should be set in conjunction with position 5 of switch S1.

**Table 24. PRC Switch Refresh**

| Number of Matrices | Pos 10 |
|---|---|
| Disable Refresh | **OFF** |
| Enable Refresh | **ON** |


**Positions 6, 7, 8 and 9 of switch S6 should be in the OFF position.**

### 3.4.4.3 Reserved DIP Switches

The following DIP switches are reserved for future operation and must be set as follows:

**Table 25. S2 Dip Switch Settings**

| | Pos 8 | Pos 7 | Pos 6 | Pos 5 | Pos 4 | Pos 3 | Pos 2 | Pos 1 |
|---|---|---|---|---|---|---|---|---|
| Standard Operation | OFF | OFF | OFF | OFF | OFF | OFF | OFF | ON |

**Table 26. S4 Dip Switch Settings**

| | Pos 4 | Pos 3 | Pos 2 | Pos 1 |
|---|---|---|---|---|
| Standard Operation | OFF | OFF | OFF | **OFF** |

### 3.4.5 Internal Signal Mapping

The TDM3000 comes with 7 internally generated signals that may be taken to any output. These inputs are available from input 1025 to input 1031. For a convenience to the user, these signals can be made to overlap other input addresses to assist in building configurations in the PESA control system. For example, a 256x256 matrix can have these inputs reside at inputs 257-263.

The internal signals that are available are:

**Table 27. Available Internal Signals**

| Input # | Signal Description |
|---|---|
| 1025 | Silent |
| 1026 | 1KHz High level tone +10DB |
| 1027 | 1KHz Mid level tone +4DB |
| 1028 | 1KHz Low Level tone -10DB |
| 1029 | White noise High |
| 1030 | White noise Mid |
| 1031 | White noise Low |

**Table 28. Mapping table for the inputs. (S3)**

| Input Range map | Pos 6 | Pos 5 | Pos 4 | Pos 3 | Pos 2 | Pos 1 |
|---|---|---|---|---|---|---|
| 1025-1031 | OFF | OFF | OFF | OFF | OFF | OFF |
| 1-7 | OFF | OFF | OFF | OFF | OFF | **ON** |
| 17-23 | OFF | OFF | OFF | OFF | **ON** | OFF |
| 33-39 | OFF | OFF | OFF | OFF | **ON** | **ON** |
| 49-55 | OFF | OFF | OFF | ON | OFF | OFF |
| 65-71 | OFF | OFF | OFF | **ON** | OFF | **ON** |
| 81-87 | OFF | OFF | OFF | **ON** | **ON** | OFF |
| 97-103 | OFF | OFF | OFF | **ON** | **ON** | **ON** |
| 113-119 | OFF | OFF | ON | OFF | OFF | OFF |
| 129-135 | OFF | OFF | **ON** | OFF | OFF | **ON** |
| 145-151 | OFF | OFF | **ON** | OFF | **ON** | OFF |
| 161-167 | OFF | OFF | **ON** | OFF | **ON** | **ON** |
| 177-183 | OFF | OFF | **ON** | ON | OFF | OFF |
| 193-199 | OFF | OFF | **ON** | **ON** | OFF | **ON** |
| 209-215 | OFF | OFF | **ON** | **ON** | **ON** | OFF |
| 225-231 | OFF | OFF | **ON** | **ON** | **ON** | **ON** |
| 241-247 | OFF | ON | OFF | OFF | OFF | OFF |
| 257-263 | OFF | **ON** | OFF | OFF | OFF | **ON** |
| 273-279 | OFF | **ON** | OFF | OFF | **ON** | OFF |

| Input Range map | Pos 6 | Pos 5 | Pos 4 | Pos 3 | Pos 2 | Pos 1 |
|---|---|---|---|---|---|---|
| 289-295 | OFF | **ON** | OFF | OFF | **ON** | **ON** |
| 305-311 | OFF | **ON** | OFF | ON | OFF | OFF |
| 321-327 | OFF | **ON** | OFF | **ON** | OFF | **ON** |
| 337-343 | OFF | **ON** | OFF | **ON** | **ON** | OFF |
| 353-359 | OFF | **ON** | OFF | **ON** | **ON** | **ON** |
| 369-375 | OFF | **ON** | ON | OFF | OFF | OFF |
| 385-391 | OFF | **ON** | **ON** | OFF | OFF | **ON** |
| 401-407 | OFF | **ON** | **ON** | OFF | **ON** | OFF |
| 417-423 | OFF | **ON** | **ON** | OFF | **ON** | **ON** |
| 433-439 | OFF | **ON** | **ON** | ON | OFF | OFF |
| 449-455 | OFF | **ON** | **ON** | **ON** | OFF | **ON** |
| 465-471 | OFF | **ON** | **ON** | **ON** | **ON** | OFF |
| 481-487 | OFF | **ON** | **ON** | **ON** | **ON** | **ON** |
| 497-503 | ON | OFF | OFF | OFF | OFF | OFF |
| 513-519 | **ON** | OFF | OFF | OFF | OFF | **ON** |
| 529-535 | **ON** | OFF | OFF | OFF | **ON** | OFF |
| 545-551 | **ON** | OFF | OFF | OFF | **ON** | **ON** |
| 561-567 | **ON** | OFF | OFF | ON | OFF | OFF |
| 577-583 | **ON** | OFF | OFF | **ON** | OFF | **ON** |
| 593-599 | **ON** | OFF | OFF | **ON** | **ON** | OFF |
| 609-615 | **ON** | OFF | OFF | **ON** | **ON** | **ON** |
| 625-631 | **ON** | OFF | ON | OFF | OFF | OFF |
| 641-647 | **ON** | OFF | **ON** | OFF | OFF | **ON** |
| 657-663 | **ON** | OFF | **ON** | OFF | **ON** | OFF |
| 673-679 | **ON** | OFF | **ON** | OFF | **ON** | **ON** |
| 689-695 | **ON** | OFF | **ON** | ON | OFF | OFF |
| 705-711 | **ON** | OFF | **ON** | **ON** | OFF | **ON** |
| 721-727 | **ON** | OFF | **ON** | **ON** | **ON** | OFF |
| 737-743 | **ON** | OFF | **ON** | **ON** | **ON** | **ON** |
| 753-759 | **ON** | ON | OFF | OFF | OFF | OFF |
| 769-775 | **ON** | **ON** | OFF | OFF | OFF | **ON** |
| 785-791 | **ON** | **ON** | OFF | OFF | **ON** | OFF |
| 801-807 | **ON** | **ON** | OFF | OFF | **ON** | **ON** |
| 817-823 | **ON** | **ON** | OFF | ON | OFF | OFF |
| 833-839 | **ON** | **ON** | OFF | **ON** | OFF | **ON** |
| 849-855 | **ON** | **ON** | OFF | **ON** | **ON** | OFF |
| 865-871 | **ON** | **ON** | OFF | **ON** | **ON** | **ON** |
| 881-887 | **ON** | **ON** | ON | OFF | OFF | OFF |

| Input Range map | Pos 6 | Pos 5 | Pos 4 | Pos 3 | Pos 2 | Pos 1 |
|---|---|---|---|---|---|---|
| 897-903 | **ON** | **ON** | **ON** | OFF | OFF | **ON** |
| 913-919 | **ON** | **ON** | **ON** | OFF | **ON** | OFF |
| 929-935 | **ON** | **ON** | **ON** | OFF | **ON** | **ON** |
| 945-951 | **ON** | **ON** | **ON** | ON | OFF | OFF |
| 961-967 | **ON** | **ON** | **ON** | **ON** | OFF | **ON** |
| 977-983 | **ON** | **ON** | **ON** | **ON** | **ON** | OFF |
| 993-999 | **ON** | **ON** | **ON** | **ON** | **ON** | **ON** |


**Positions 7 and 8 are not used and should be in the OFF position.**

# Chapter 4 – Maintenance and Repair

## 4.1 Maintenance

## 4.2 Power Supply Alignment

Power supplies were tested and aligned at the factory before shipment. Before attempting to adjust power supplies, please contact the factory for assistance.


**Never use a metal device when adjusting power supplies.**

If it becomes necessary to adjust the power supplies on site, refer to one of the following adjustment procedures. A metal screwdriver should never be used.

The TDM power supply system consists of distributed multiple power supplies. Each power supply unit (visible inside the frame) has two high current switching power supplies internally. These supplies are auto sensing for AC inputs of 110 or 220 volt, 50 or 60 cycle.

For redundant power supply applications each DC output is diode connected to a main power bus on the power distribution board in the frame. Refer to the following figure.

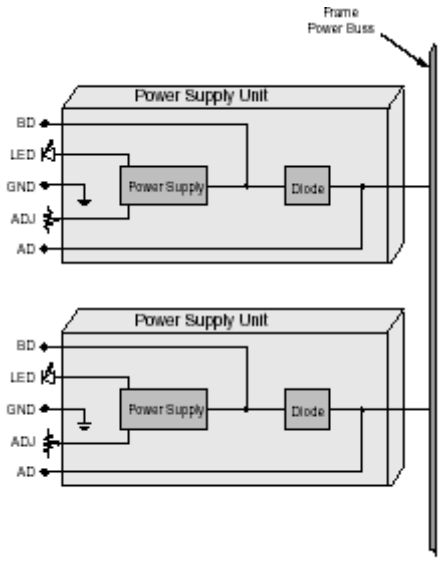



**Figure 28. Power Supply Units**

The TDM frames are arranged in 8 RU building blocks with each 8 RU section holding up to four power supply units. The 8 RU sections can be kept separate, or connected together, as determined by the load requirements. This is set at the time of order at the factory and is not easily modified after installation.

Each power supply unit has test points on the front for each of the two individual supplies. A test point before the diode (B), a test point after the diode (A), and a test point for ground (GND). There is also access to the internal adjustment for each supply output voltage.

## 4.3 Single Power Supply Adjustment

To adjust a single power supply, use a Digital Volt Meter (DVM) and adjust the output to the desired voltage by measuring between ground and the 'A' Test Point.

## 4.4 Multiple Supply Adjustment

In a multiple supply application all the supplies load share; that is each supply provides some percentage of the current. Turning up or down the voltage of one of the supplies will only increase or decrease its share of the total load current. To measure a supply's relative percentage of the total load current, use a DVM to measure the voltage across its diode. By measuring and recording this value with each supply, the voltage and load sharing can be adjusted to any desired value.

## 4.5 Cleaning or Replacing Frame Fans

The fan filters within the matrix frame can be cleaned as required. The fans can also be replaced if necessary. Each four rack unit section has two fans. The section that houses the AC connector(s) have the fans accessible from the side, all other fans are accessible from the rear of the frame. To clean fan filters or replace the fans, refer to one or both of the following sections:

### 4.5.1 Front Cleaning or Replacement

To clean the fan filters or replace the fans, follow these steps:

1. With the front door of the frame open, note the large fan(s) on the left side of the frame. Each eight rack unit section has two large fans (except the 24 RU frame only has four).
2. Identify the fan(s) to be cleaned and/or replaced.
3. Remove the guards/covers over the fan that is to be cleaned or changed. They simply pop off the filter. The filter is now accessible for cleaning.
4. To change a fan, unplug the fan connector for the frame wiring.
5. Remove the four screws that attach each fan to the frame, and discard the fan if replacing it.
6. Install the new fan with the previously removed screws.
7. Plug the fan connector into frame wiring.
8. Replace the guards/covers on fan. It simply snaps on.
9. Insure that all four sides are completely secure.

NOTE **If fans were not purchased from the factory, it will be necessary to attach a two pin connector on the wire ends of the fan. This will allow the fan to plug into the frame wiring.**

### 4.5.2 Side Cleaning or Replacement

To clean the fan filters or replace the fans follow these steps:

1. Locate the AC connector on the rear of the frame (on the lower left hand side). Turn power off (if possible).
2. Remove the two screws that attach the fan housing to the frame. Refer to the following figure.

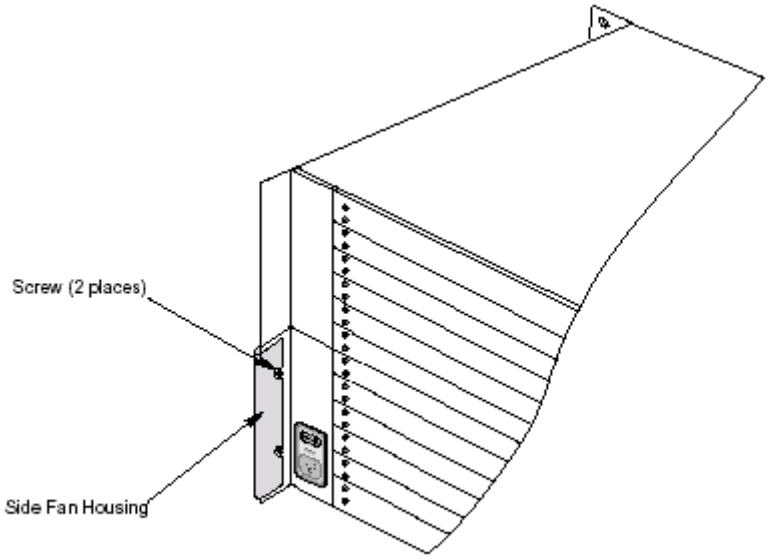



**Figure 29. Side Fan Removal**

3. Carefully slide the housing forward, and lift out.
4. Unplug the fan before removing the filter or fan.
5. Remove the four screws that attach the fan to the housing. The filter is now removable for cleaning.
6. If fan replacement is necessary, remove the four screws that attach each fan to the fan housing and discard the old fan.
7. Reverse the process for installing new fans.

### 4.5.3 Rear Cleaning or Replacement

To clean the fan filters or to replace the fans, follow these steps:

1. Locate the AC connector on the bottom left side of frame. Turn the power off (if possible).
2. Identify the fan(s) to be cleaned and/or replaced. Locate the fan housing on the rear of the frame. Each eight rack unit section has a rear fan housing unit (except where the AC connector is located). The following figure illustrates one rear fan housing location.

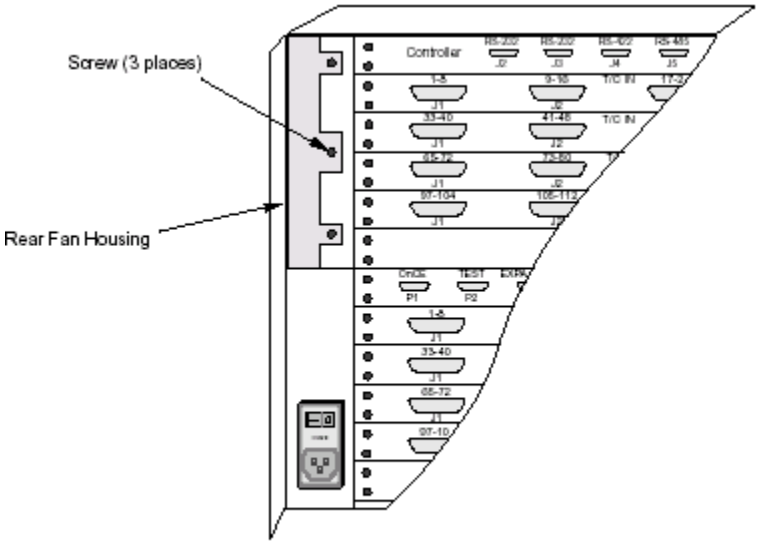



**Figure 30. Rear Fan Removal**

3. Remove the three screws that attach the fan housing to the frame.
4. Carefully slide the housing from the frame.
5. Unplug the fan before removing the filter or the fan.
6. The fan guards simply pop off. The filter is now accessible for cleaning.
7. If fan replacement is necessary, remove the four screws that attach each fan to the fan housing, and discard the old fan.
8. Reverse the process for installing new fans.

## 4.6 Module Replacement Procedures

Be sure and read the entire instructions before starting with the actual procedures.

### 4.6.1 Removing a Module

To remove a module from the switcher, follow the steps listed below:

1. Unless the switching matrix must remain on, turn off all power switches and unplug the AC power cord(s) on the rear of the unit.
2. Open the front door of the unit and identify the module to be removed. Release the cable connector latches at the module headers and unplug all connected cables at that module only. If the module to be removed is a Crosspoint module, complete Step 5 through Step 7. For all other types of modules complete steps Step 3 and Step 4.
3. Move to the rear of the unit and remove all cabling connected to the module being removed. If required, label the cables to insure that they are reconnected at the proper location.
4. Remove the four screws that hold the module tray to the switcher frame sides (two screws at each end of the module tray). Slide the module out towards the rear. If necessary, assist removal by pushing the module from the front.
5. Remove the two screws holding the cable inspection cover to the Crosspoint module tray. Remove the cover.
6. Release cable connector latches located under the cover and unplug all connected cables at the module.
7. Remove the four screws that hold the module tray to the switcher frame sides (two screws on both sides of the module tray). Slide the module out to the rear. If necessary, assist removal by pushing the module from the front.

### 4.6.2 Replacing a Module


**To replace a module in the switcher, complete the steps listed in Removing a Module.**

After the module is removed, follow the steps listed:

1. Install the module into the frame, insuring the module tray (and not the circuit board) slides into the guides on both sides of the frame.
2. When fully inserted into the frame the modules plug into a common bus inside the frame. Insure that the plugs are properly seated after being inserted.
3. Attach the module tray to the frame using the four previously removed screws.
4. Connect the cables that had been previously disconnected from the module. Visually check both the front and the rear of the module that all internal and external cabling to the module is correct.
5. Plug in 115 VAC power cables to the unit and turn the power switch(es) on.


**If replacing a TDM module, it is required to do a soft reset of the switcher.**

### 4.6.3 Adding a Module


**Make sure that all required cables, both internal and external, are easily accessible before completing these steps.**

To add a module to your system do the following:

1. Unless the switching matrix must remain on, turn off all power switches and unplug the AC power cord(s) at the modular AC plugs on the rear of the unit.
2. Remove the blank panel(s) at the rear of the frame in the location where the module(s) will be added. Remove the four screws that hold the blank to the frame (two screws on each side).
3. Install the module into the frame, insuring the module tray (and not the circuit board) slides into the guides on both sides of the frame.
4. When fully inserted into the frame the modules plug into a common bus inside the frame. Insure that the plugs are properly seated after being inserted.
5. Attach the module tray to the frame using the four previously removed screws.


**If a 'hot swap' is required on any module in the matrix, a 'soft start' is required after the module is replaced to insure that the processor recognizes the newly replaced module. The 'soft start' is initiated from the local control panel by pressing both the OUTPUT and TAKE buttons simultaneously.**


**If adding a TDM module, it is required to do a soft reset of the switcher.**

6. Attach all cabling after the module is properly installed (especially during a 'hot swap'). Visually check both the front and the rear of the module to ensure that all internal and external cabling to the module is correct.
7. Plug in 115 VAC power cables to the unit and turn power switch(es) on.

### 4.6.4 Adding or Replacing a TDM Module

Verify that all cables going to and coming from the TDM are in place and securely fastened. When adding or replacing a TDM module, a soft reset of the switcher is required.

### 4.6.5 Internal TDM Cabling

The number of internal TDM cables needed in a switcher depends upon customer requirements. For every switcher that uses a TDM module, two to eight identical TDM internal cables are included (at least one input cable and one output cable). Each cable has one 100-pin connector and eight 20-pin connectors. The 100-pin connector plugs into the TDM module. The eight 20-pin connectors plug into the other TDM modules. Each uses 12 wires of the ribbon cable, except Bank 1 (the first one), which uses 16 wires.

The following table lists the pin numbering for internal TDM ribbon cables.

**Table 29. TDM Internal Ribbon Cable Pin Numbering**

| Bank 1 | | Bank 2 | | Bank 3 | | Bank 4 | | Bank 5 | | Bank 6 | | Bank 7 | | Bank 8 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| J1 | J9 | J2 | J9 | J3 | J9 | J4 | J9 | J5 | J9 | J6 | J9 | J7 | J9 | J8 | J9 |
| 1 | 85 | 1 | 73 | 1 | 61 | 1 | 49 | 1 | 37 | 1 | 25 | 1 | 13 | 1 | 1 |
| 2 | 86 | 2 | 74 | 2 | 62 | 2 | 50 | 2 | 38 | 2 | 26 | 2 | 14 | 2 | 2 |
| 3 | 87 | 3 | 75 | 3 | 63 | 3 | 51 | 3 | 39 | 3 | 27 | 3 | 15 | 3 | 3 |
| 4 | 88 | 4 | 76 | 4 | 64 | 4 | 52 | 4 | 40 | 4 | 28 | 4 | 16 | 4 | 4 |
| 5 | 89 | 5 | 77 | 5 | 65 | 5 | 53 | 5 | 41 | 5 | 29 | 5 | 17 | 5 | 5 |
| 6 | 90 | 6 | 78 | 6 | 66 | 6 | 54 | 6 | 42 | 6 | 30 | 6 | 18 | 6 | 6 |
| 7 | 91 | 7 | 79 | 7 | 67 | 7 | 55 | 7 | 43 | 7 | 31 | 7 | 19 | 7 | 7 |
| 8 | 92 | 8 | 80 | 8 | 68 | 8 | 56 | 8 | 44 | 8 | 32 | 8 | 20 | 8 | 8 |
| 9 | 93 | 9 | 81 | 9 | 69 | 9 | 57 | 9 | 45 | 9 | 33 | 9 | 21 | 9 | 9 |
| 10 | 94 | 10 | 82 | 10 | 70 | 10 | 58 | 10 | 46 | 10 | 34 | 10 | 22 | 10 | 10 |
| 11 | 95 | 11 | 83 | 11 | 71 | 11 | 59 | 11 | 47 | 11 | 35 | 11 | 23 | 11 | 11 |
| 12 | 96 | 12 | 84 | 12 | 72 | 12 | 60 | 12 | 48 | 12 | 36 | 12 | 24 | 12 | 12 |
| 13 | 97 | 13 | - | 13 | - | 13 | - | 13 | - | 13 | - | 13 | - | 13 | - |
| 14 | 98 | 14 | - | 14 | - | 14 | - | 14 | - | 14 | - | 14 | - | 14 | - |
| 15 | 99 | 15 | - | 15 | - | 15 | - | 15 | - | 15 | - | 15 | - | 15 | - |
| 16 | 100 | 16 | - | 16 | - | 16 | - | 16 | - | 16 | - | 16 | - | 16 | - |
| 17 | - | 17 | - | 17 | - | 17 | - | 17 | - | 17 | - | 17 | - | 17 | - |
| 18 | - | 18 | - | 18 | - | 18 | - | 18 | - | 18 | - | 18 | - | 18 | - |
| 19 | - | 19 | - | 19 | - | 19 | - | 19 | - | 19 | - | 19 | - | 19 | - |
| 20 | - | 20 | - | 20 | - | 20 | - | 20 | - | 20 | - | 20 | - | 20 | - |

### 4.6.6 TDM Input and Output Connector Locations

The number of input and output connectors needed on a TDM module increases when a switcher routes more than 512 I/Os. A “Heavy” TDM module can accommodate up to 1024 signals whereas the “Lite” TDM module can only process 512 or fewer I/Os.

**Table 30. Input and Output Connector Locations: Heavy and Lite TDMs**

| Bank # | I/O Range | INPUT Connector Locations: "Lite" or "Heavy" TDMs | OUTPUT Connector Locations: "Lite" or "Heavy" TDMs |
|---|---|---|---|
| Bank 1 | 1 - 32 | J3 | J7 |
| Bank 2 | 33 - 64 | J3 | J7 |
| Bank 3 | 65 - 96 | J3 | J7 |
| Bank 4 | 97 - 128 | J3 | J7 |
| Bank 5 | 129 - 160 | J3 | J7 |
| Bank 6 | 161 - 192 | J3 | J7 |
| Bank 7 | 193 - 224 | J3 | J7 |
| Bank 8 | 225 - 256 | J3 | J7 |
| | | | |
| Bank 1 | 257 - 288 | J2 | J6 |
| Bank 2 | 289 - 320 | J2 | J6 |
| Bank 3 | 321 - 352 | J2 | J6 |
| Bank 4 | 353 - 384 | J2 | J6 |
| Bank 5 | 385 - 416 | J2 | J6 |
| Bank 6 | 417 - 448 | J2 | J6 |
| Bank 7 | 449 - 480 | J2 | J6 |
| Bank 8 | 481 - 512 | J2 | J6 |


**Only "Heavy" TDMs use connectors J4, J5, J8, and J9 to allow for an I/O range of greater than 512 signals.**

**Table 31. Input and Output Connector Locations: Heavy TDMs Only**

| Bank # | I/O Range | INPUT Connector Locations: "Heavy" TDMs ONLY | OUTPUT Connector Locations: "Heavy" TDMs ONLY |
|---|---|---|---|
| Bank 1 | 513 - 544 | J5 | J9 |
| Bank 2 | 545 - 576 | J5 | J9 |
| Bank 3 | 577 - 608 | J5 | J9 |
| Bank 4 | 609 - 640 | J5 | J9 |
| Bank 5 | 641 - 672 | J5 | J9 |
| Bank 6 | 673 - 704 | J5 | J9 |
| Bank 7 | 705 - 736 | J5 | J9 |
| Bank 8 | 737 - 768 | J5 | J9 |
| | | | |
| Bank 1 | 769 - 800 | J4 | J8 |
| Bank 2 | 801 - 832 | J4 | J8 |
| Bank 3 | 833 - 864 | J4 | J8 |
| Bank 4 | 865 - 896 | J4 | J8 |
| Bank 5 | 897 - 928 | J4 | J8 |
| Bank 6 | 929 - 960 | J4 | J8 |
| Bank 7 | 961 - 992 | J4 | J8 |
| Bank 8 | 993 - 1024 | J4 | J8 |

## 4.7 PESA Customer Service

Contact information for the Customer Service Department appears on the front cover of this document.

## 4.8 Repair

Before attempting to repair this equipment, consult your warranty documents and/or PESA's Customer Service Department. Unauthorized field repairs may void your warranty.


**The power supply assemblies in this equipment should only be serviced by qualified service personnel using appropriate equipment.**


**Consult PESA Customer Service before attempting to repair any of the cards in this equipment**

### 4.8.1 Replacement Parts

Only parts of the highest quality have been used in the design and manufacture of this equipment. If the inherent stability and reliability are to be maintained, replacement parts must be of the same high quality. Contact PESA's Customer Service Department before installing any parts not purchased from PESA.

### 4.8.2 Return Material Authorization (RMA)

Before returning any equipment for service or replacement, contact PESA's Customer Service Department for an RMA number. Contact information for the Customer Service Department appears on the front cover of this document.