

# ***Titan CPU08V***

## ***Channel Multiplexer***

*User Manual*



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## **Introduction**

The Titan CPU08V Channel Multiplexer allows you to connect multiple Titan Pods or Mini-Recorders to easily configure large channel-count test systems of up to 128 channels.

Device connections to the Titan CPU08V are made using industry-standard Ethernet cables, which provide communication, power and synchronization on a single cable, simplifying wiring and eliminating the need for extra equipment. Data can be recorded directly to an SD memory card or to a host PC, and network operation is possible via TCP/IP or UDP.

This manual is intended to provide the user with an overview of the Titan CPU08V, with complete features, specifications, set up procedures and operation. It contains important safety information as well.

## **Furnished Accessories**

The Titan CPU08V is shipped with the following items:

1. Titan CPU08V Channel Multiplexer
2. Power Adapter

## **Support**

Support for this product is available by contacting the factory during regular business hours (9am – 6pm EST) at 301-470-3278. Additional information can be found on our web site: <http://www.marslabs.com>

## General Guidelines and Warnings

### Electrostatic Discharge

Electrostatic Discharge (ESD) occurs when a static charge builds up on either yourself or the Titan hardware, and then you touch the hardware, which rapidly dissipates the static charge. The spark of the discharge can be so small that you don't feel it, but it can be significant enough to flaw a semiconductor. These flaws may generate an immediate failure, or, in most cases, cause a slight reduction in performance which will continue to degrade, eventually leading to failure of the hardware. When you feel a static shock, you are experiencing a minimum of 3,000 volts of electricity.

Even though the input connectors have protection to prevent ESD damage, it is good practice to always ground yourself and the Titan hardware while connecting and removing sensors.



*Always use approved ESD handling procedures to prevent ESD damage.*

### Grounding Titans

In general, grounding the Titan hardware to the test vehicle or test structure will usually reduce noise pickup.

All of the analog inputs of the Titan hardware have a return path to ground. However, it is very important that each sensor have only one return path to avoid ground loops. When testing a vehicle, often the vehicle chassis and Titan can have very large ground imbalances of one or two volts. In such situations, ground the sensors to Titan and use differential inputs across the sensor. A totally floating input (like a 9-Volt battery) must have one side grounded at the point where used, either grounded to Titan or connected to the vehicle chassis ground via a resistor (e.g. 10K ohm).

If there is a possibility that a floating sensor may be occasionally grounded, install a 10K ohm resistor from the minus input to Titan ground. When the sensor is floating, the 10K ohm resistance will reference it to Titan ground, and when it is grounded, the resistor will allow the direct minus input wire to reference the remote chassis ground.



### Specific Warnings

1. When using a power adapter with the Titan, always connect the adapter to the Titan before applying power. Never hot plug a Titan device under any circumstances - hot plugging may damage the device!
2. Under no conditions should the 12V and 5V lines on the Titan hardware be shorted together or connected directly to ground.

## **Guidelines for Wiring Sensors**

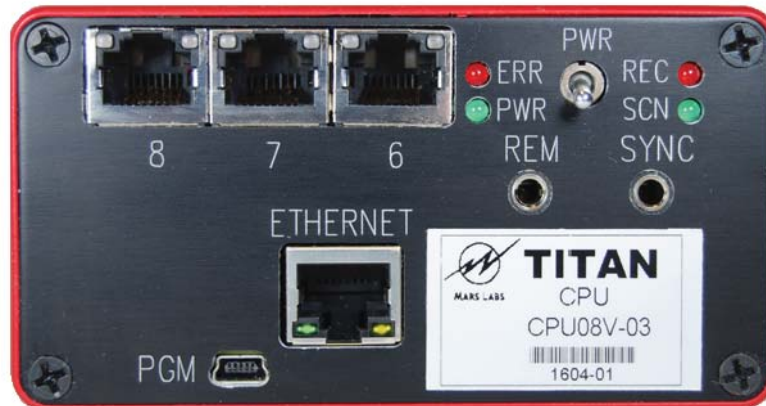
Observe the following guidelines when wiring and connecting sensors to the Titan hardware:

1. Observe polarity of sensor wires
2. Strain relieve all connections
3. Secure cables with wire ties and bundle cables where possible
4. Secure connectors by fastening to the Titan chassis
5. For Thermocouples, apply heat shrink to exposed wires
6. Double check all connections prior to connecting the cables to the Titan
7. Use only heavy gauge straight-through CAT-6 Ethernet cables with locking tabs when connecting to the Titan CPU08V Channel Multiplexer.
8. When routing cables, be aware of sharp edges and pinch points where cables can bind or be cut, introducing shorts in the wiring

# Operation

## Front Panel

The Titan CPU front panel incorporates LED status indicators, an Ethernet port, jacks for SYNC (synchronization) and REM (remote operation), three RJ-45 connectors for Titan Input Modules (ports 6 - 8), and a program (PGM) port.



## Panel Components

### Status Indicators

- ERR** – A red LED indicating an error condition when lit.
- PWR** – A green LED indicating that the Titan CPU is ON.
- REC** – A red LED indicating that the device is recording when lit.
- SCN** – A green LED indicating that the device is scanning when lit.

### Ethernet

An RJ-45 port that enables the Titan CPU to operate over an Ethernet network, or to connect to a PC using an Ethernet crossover cable.

### PGM

A mini-USB port for communicating with the device's internal processor.

### SYNC

An 1/8" Tip-Ring-Sleeve (TRS) connection that allows multiple CPUs to be synchronized for large channel-count configurations (>128 channels) when used with a Titan CPX Expander.

### REM

An 1/8" TRS connection that permits remote Start/Stop recording using an external switch.

### PWR

Applies power to the CPU and any connected Titan devices capable of being powered over the RJ45 connection.

## Rear Panel

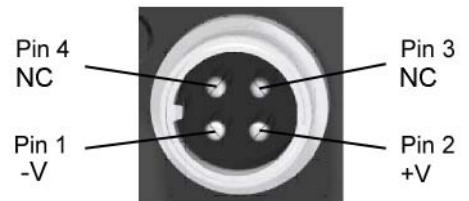
The Titan CPU08V rear panel incorporates five RJ45 connectors (ports 1 - 5), an Alarm Output, twin USB ports, and a 4-pin power connector:



## Panel Components

### Power Connector

The input power connector provides power to the Titan CPU08V and all Titan Input Modules. The power supply furnished with the CPU08V is sufficient to power the CPU and all connected devices. If you need to power the Titan CPU08V from your own source, observe the power connections shown.



**WARNING:** When using a power adapter with any Titan device, always connect the adapter before applying power. Never hot plug a device with an adapter under any circumstances - hot plugging may damage the device!

### Titan Input Module Ports

Eight RJ-45 ports provide the connections for Titan Input Modules. Any combination of Titan Mini-Recorders and Pods can be connected to these ports to provide a total of 128 analog channels, plus digital channels. Connections are made using standard straight-through Ethernet cables.

### USB

Two USB ports provide connections for standard USB devices. Although currently not implemented, these ports are intended to support the connection of USB mass storage devices to handle large data files.

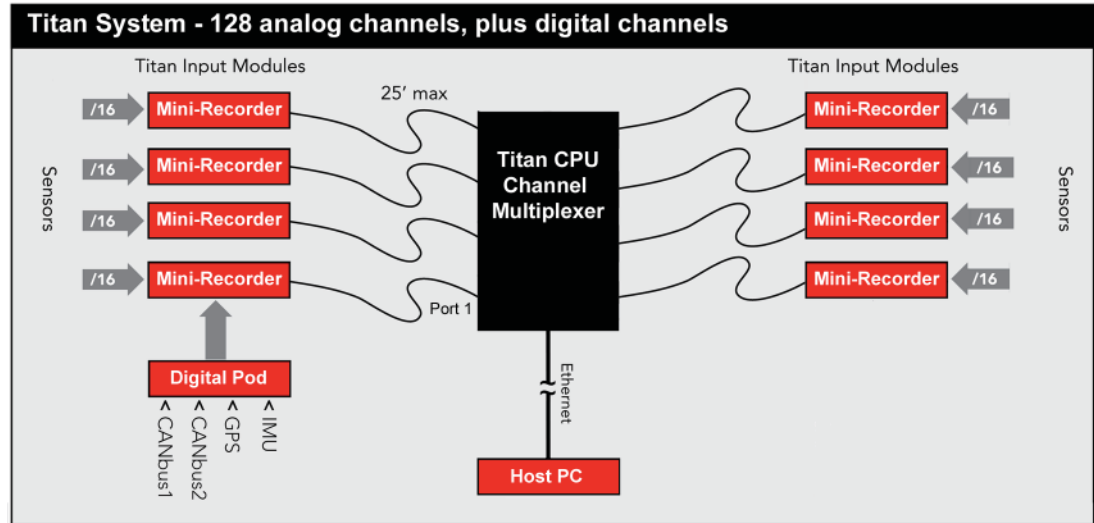
### Alarm Output

A female DB9 connector that provides Alarm (trigger) outputs.



## Connection Diagram

The diagram below depicts a large channel-count data acquisition system (128 analog channels, plus digital channels) using a Titan CPU08V and eight Titan Input Modules, one including a Digital Pod. Connections between the CPU and the Titan Input Modules are made using standard 'straight-through' CAT6 Ethernet cables.



**NOTES:** When using a Mini-Recorder with a Digital Pod in a CPU system, that Mini-Recorder must be connected to Port 1 on the CPU (a CPU configuration will only support one Mini-Recorder with a Digital Pod).

## Interface

### PGM (Mini-USB Port):

The PGM port supports standard USB devices via a mini-USB connection. The port provides a direct connection to the device's internal processor, allowing it to respond to manual commands such as resetting the IP address (see page 15).

### REM (Remote):

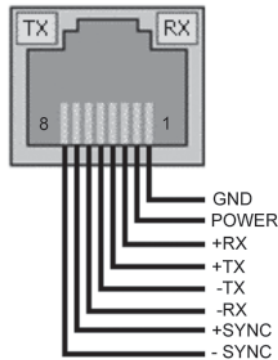
The REM jack permits the Titan CPU08V recording function to be started and stopped by means of an external switch. This function is implemented on an 1/8" Tip-Ring-Sleeve (TRS) jack, which provides connections for both an external switch and an LED to indicate the START/STOP status:

Tip - External Switch  
Ring - LED  
Sleeve - Ground

The CPU will start recording when a switch closure is made between the Tip and Sleeve contacts. When the switch is in the open position, recording will stop. If an LED is connected between the Ring and Sleeve contacts, it will be illuminated when the CPU is recording.

**NOTE:** When the Remote Switch is ON (i.e. recording) the Remote LED will blink mostly ON. When the Remote Switch is OFF the Remote LED will blink mostly OFF. The Remote Switch may be connected at any time. If the Remote Switch is ON when the connection is made, the CPU will begin recording immediately with the current test configuration.

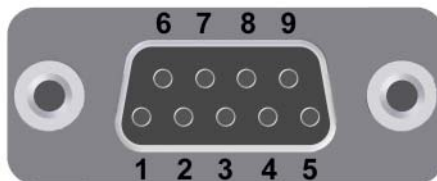
## Titan Input Module Ports



The Titan CPU08V has eight identical Titan Input Module Port connectors. LEDs integrated into these connectors indicate when a connected Titan Input Module is transmitting and receiving data. Titan Input Modules connect to these ports using industry-standard 'straight-through' Ethernet cabling, which provides power, sync and data connections on a single cable. The maximum recommended cable length from the Titan CPU08V to a Titan Input Module is 25'.

## Alarm Output:

An inverted DB9F connector provides 8 trigger outputs according to the pinout shown.



Pin	Function
1	GND
2	Pin A
3	Pin B
4	Pin C
5	Pin D
6	Pin E
7	Pin F
8	Pin G
9	Pin H

**NOTE:** Trigger outputs are configured in the 'Recording and Triggers' screen in TCS. For more information consult the TCS User Manual. Additional information can be found in Mars Labs Application Note APN-1009 - "TCS Alarm Trigger Configuration".

## Connections

The Titan CPU08V can be operated directly from a host PC (via the PGM port) or over a network connection.

### Via a network:

1. If your CPU is configured with a unique IP address on the same subnet as your local network, you can simply connect it to your network. To make sure there are no IP address conflicts, it's a good idea to ping the address before connecting the CPU. To do this, open a command prompt (Start Menu -> Run: cmd) and enter "ping <ip address>".
2. Connect the Titan CPU08V to the network, but *do not* apply power.
3. Using standard CAT-5 or CAT-6 Ethernet cabling, make the connections to the Titan Pods/Mini-Recorders on the Titan CPU08V. Cable lengths should not exceed 25 feet. Continue until all Titan devices are connected.
4. Apply power to the Titan CPU08V. The Titan CPU will initialize and automatically detect all connected devices. The initialization period is typically about 90 seconds. Allow the initialization to complete before continuing.

**NOTE:** *Device detection takes place when the CPU starts up. If you connect or disconnect a pod after start-up, the CPU does not automatically re-query the devices. To re-query connected devices, use the supplied Titan Control Software ('TCS').*

5. If you have not already done so, install the TCS software according to the installation instructions in the TCS User Manual, and then follow the procedure in the manual to configure the Titan CPU08V device and Titan Input Modules. For information on changing the CPU IP address, see page 15.

## LED Operation

With power applied to the CPU, the front panel LED indicators will operate as follows:

**PWR** (Power) - The green PWR LED will illuminate and remain ON while power is applied.

**ERR** (Error) - The ERR LED will be lit if the CPU encounters an error during operation.

**SCN** (Scan) - The green SCN LED will illuminate when the CPU is scanning. It will fluctuate ON/OFF during initialization.

**REC** (Record) - The red REC LED will illuminate when the CPU is recording, either under control from TCS or from the Remote Switch.

## Remote Switch Operation

If a Remote Switch is connected to the CPU when power is applied, the Remote Switch LED will illuminate solid while the CPU initializes, and then begin blinking at a 1Hz rate afterwards.

With the Remote Switch connected, the CPU will attempt to start scanning and recording when the switch is in the ON position.

When the Remote Switch transitions from ON to OFF, the CPU will stop recording the current dataset, and then pause a few seconds before resuming scanning.

## Changing the IP Address

If the IP address of the Titan CPU is known, it can be changed using the Titan IP Address Programmer. The Titan IP Address Programmer is part of the Titan Service Pack, available on the Mars Labs Knowledge Base.

If the address is unknown or uncertain, it can be changed via the PGM port as described on the following page.

### Using the Titan IP Address Programmer -



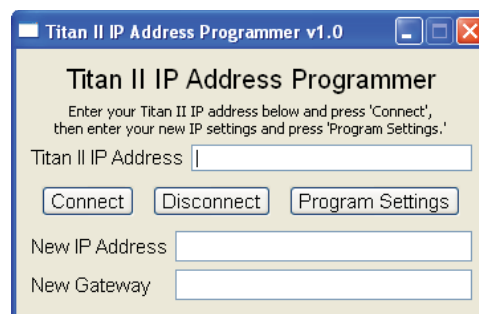
**NOTE:** The Titan IP Address Programmer changes configuration settings that are critical to the operation of the CPU. Incorrect or incompatible network settings can potentially cause the device to become unresponsive on the network. If you are uncertain about any of the network settings, leave them as default.

Before running the Address Programmer:

- Connect the CPU to your Ethernet network.
- Set your computer to a static IP address that uses the same subnet as the CPU IP address.
- Power on the CPU and verify that you can connect to it using TCS.
- Make a note of the IP address for use in the next section.

### PROCEDURE

- Launch the Titan II IP Address Programmer:



- Enter the current IP address of the CPU in the 'IP Address' field, and then click 'Connect'
- Enter the new IP address in the field in the lower half of the window, and verify that it is correct. Click 'Program Settings' to program the new settings, and then wait for the CPU to reboot.
- After the CPU reboots, verify the new settings by clicking 'Connect' to re-populate the programmer fields.

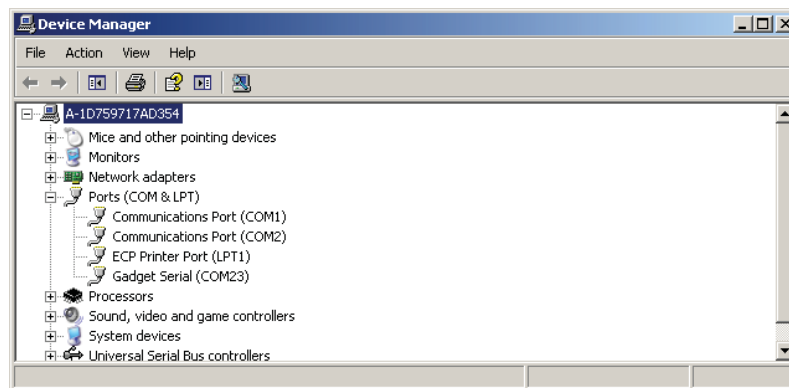
- When finished, click 'Disconnect' and close out of the Programmer window.
- Record the new IP Address for future reference.

### Via the PGM port -

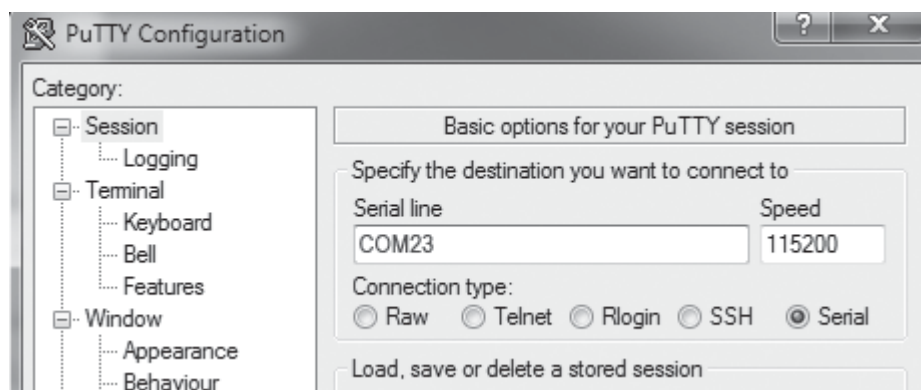
Remove power to the Titan CPU and disconnect any connected Titan devices. Connect the PC to the CPU's PGM port using a mini-USB cable (this connection will provide power to the CPU; the device will take approximately one minute to initialize before you can continue). Note that you may also need to install a driver if the 'Found New Hardware' window appears. The driver is located in C:\Program Files\MarsLabs\TCS3\Drivers\Gadget Driver, and is also found on the TCS installation CD-ROM. You can also obtain the driver online:

<http://www.kernel.org/doc/Documentation/usb/linux-cdc-acm.inf>

Follow the Windows prompts to install the driver. With the Gadget Driver installed and the CPU connected, open the Windows Device Manager, select 'Ports (COM & LPT)' and make note of the Gadget Serial port connection:



Close the Device Manager window and open a terminal emulator program (PuTTY is the preferred terminal emulator program - a copy can be found on the installation disc). Connect to the CPU PGM port using a Serial connection. Enter the Gadget Serial port number (COMxx) in the 'Serial Line' field:



**NOTE:** For serial connections to USB, the speed setting is not relevant and can be ignored.

In the terminal window, enter the command “RESET\_IP” <ENTER>. This command will reset the IP address to a default value of 192.168.10.50.

**NOTE:** In it's default state, PuTTY will not echo back the characters entered in the terminal window. To turn local echo on, select 'Terminal' in the PuTTY Configuration window and then set both Line discipline options to 'Force On'.

You can also use the terminal emulator change the IP address. In the terminal window, enter the command:

CHANGE\_IP xxx.xxx.xxx.xxx/yy <ENTER>

This command will reset the IP address to the entered value “xxx.xxx.xxx.xxx”. The value “/yy” corresponds to the desired subnet mask (see note 1 below). Note that there is no error checking using this command - the string of characters that appears after the 'CHANGE\_IP and up to the carriage return <ENTER> simply becomes the new IP address. After changing or resetting the IP address, power cycle the CPU to have the change take effect. To confirm the change, reconnect in TCS using an Ethernet connection.



*In the event that an invalid IP address entry is made, recovery is done by reconnecting to the device using PuTTY and using either the RESET\_IP or CHANGE\_IP command as described above. You could also reset the address by first using the RESET\_IP command to restore the address to a known state, and then use the IP Address Programmer to program a new address; the difference being that the IP Address Programmer takes the subnet mask value into account, whereas the CHANGE\_IP command requires you to enter the correct value.*

**NOTES:**

1. The range of valid entries for “/yy” is 0-31. For example, a value of ‘/24’ corresponds to a subnet mask of 255.255.255.0. For the value that corresponds to your company/organization, consult with your IT department.
2. After changing the IP address you should make note of it for future use.
3. USB Power is not sufficient to operate the CPU with modules connected. For normal operation, connect to a Titan Power Adapter or other external power source.



# Features and Specifications

## Key Features

- Connects multiple Titan Input Modules to create large channel-count recording systems
- Isolated power supply accepts voltages of 11–32 VDC.
- Records data directly to an SD memory card (non-removable) or to local host PC
- Network interface allows remote operation via TCP/IP or UDP
- Compact size and low weight make the CPU suitable for in-vehicle applications
- Remote control jack for cabled Start/Stop control
- Auto Start / Auto Record modes
- Simplified user interface allows for easy operation under difficult operating conditions

## Specifications

Recording Media:	32GB SD Memory Card (non-removable)
Number of Titan Modules supported:	Up to eight 16-channel Titan Input Modules (128 channels total)
Sample Rates:	<p>For Mini-Recorders w/Analog Inputs only:</p> <p>Up to 8192 s/s with 8 modules (16 channels/Pod)</p> <p>10K s/s with 8 modules (13 channels/Pod max)</p> <p>For Mini-Recorders w/Analog Inputs with one or more GPS:</p> <p>5000 s/s with 8 modules (16 channels/Pod)</p> <p>When a Mini-Recorder includes a Digital Pod, the max sample rate of the CPU system is limited by the configuration of that device*:</p> <p>2500 s/s max (for Digital Input + 16 Analog channels)</p> <p>5000 s/s max (for Digital Input + 8 Analog channels)</p> <p>8192 s/s max (for Digital Input + 4 Analog channels)</p>
Power Requirements:	<p>11–32 VDC</p> <p>Approximately 4W for CPU</p> <p>(add 4W for each Titan Input module)</p>
PC Operation:	Via network
Dimensions / Weight:	13.3 cm x 10.6 cm x 5.6 cm (L x W x H) / 500g

\* The sample rate limitation when a digital pod is included in a system is due to the 3M baud rate limit of the RJ45 port connection (FTDI), not the CPU itself.

## Warranty

**Mars Labs** warrants all their manufactured equipment to be free from defects in material and workmanship. **Mars Labs** liability under this warranty is limited to servicing or adjusting any equipment returned to the factory for that purpose, and to replace any defective parts thereof. The warranty remains effective for 365 days following delivery to the original purchaser. During this time, equipment will only receive repair when the original purchaser prepays all return transportation charges, and **Mars Labs** finds to its satisfaction that the equipment is indeed defective.

If the fault has been caused by misuse or abnormal conditions of operation, normal service charges will prevail. In this case, an estimate will be submitted before work is started. **Mars Labs** must authorize any warranty returns.

**Mars Labs** reserves the right to make changes in the design of its instruments without incurring any obligation to make the same changes on equipment previously purchased.

This warranty will be void if unauthorized alterations or modifications are found which impede the repair or testing of the equipment.

## Receipt of Equipment

The equipment should be tested as soon as it is received. If the equipment is damaged in any way, a claim should be obtained by the claim agent, and this report should be forwarded to **Mars Labs**.

**Mars Labs** will then advise the customer of the disposition to be made of the equipment and arrange for repair or replacement. When referring to this equipment for any reason, the model number, serial number and purchase order number should be included.

## Malfunction

If the unit fails to operate, or any fault develops, **Mars Labs** should be notified, giving full details of the difficulty, including model number and serial number. Upon receipt of this information, **Mars Labs** will provide service data and shipping instructions.

This warranty is expressly in lieu of all other obligations or liabilities on the part of **Mars Labs**, which neither assumes nor authorizes any person to assume for it any other liability in connection with the sale of its equipment. Contact:

Mars Labs  
29 C Street  
Laurel, MD  
20707  
(301) 470-3278  
email: [support@MarsLabs.com](mailto:support@MarsLabs.com)

## Notes & Known Issues

Additional information about the CPU not covered elsewhere:

### **Error Indications:**

If a Titan Input Device (Mini-Recorder or Pod) stops sending data for any reason, the CPU08V will stop recording/stop scanning and display an error (ERR LED will be ON).

### **CPU08V Power Loss/Data Loss:**

1. In the event of a power loss while recording remotely to the CPU08V, data loss is limited to 10 seconds maximum.
2. If the CPU08V loses power while scanning, all independently-powered Titan Input Devices (Mini-Recorders or Pods) must be power-cycled in order to re-synchronize the system.

### **CPU08V Remote Recording:**

The CPU08V does not automatically handle Pod configuration changes made since the last remote recording, e.g., if Pods are swapped between ports, or if a Pod is removed and used for another test, and then reconnected to the CPU. If a change occurs between tests, connect [F1] to TCS and run a short test to reconfigure the CPU and all connected devices prior to resuming remote recording, i.e., make sure the test you set up matches the hardware configuration.

### **Remote Switch Operation:**

If the Remote Switch is connected to the CPU08V and switched ON, the CPU will attempt to record repeatedly even if no pods are connected or an error condition exists. Each attempt will generate a small data file on the CPU. These files are invalid.

### **Mini-Recorder/Pod Reconfiguration**

When a Mini-Recorder or Pod is connected to the CPU08V, the baud rate on the COMM port is reset to 3Mbits. Remote recording functionality on Mini-Recorders is also disabled (this includes both the front panel switch and the REM jack on the Mini- Recorder). The default baud rate and remote recording capability is restored on Titan Mini-Recorders after disconnecting from the CPU and running a test on the device directly from TCS.

### **Power Cycling in Monitor Mode:**

Monitor Mode is not supported when the CPU power is cycled. If the CPU is power-cycled in Monitor Mode, it may interrupt and stop the scan on connected devices. To prevent this if you must power cycle the CPU, disconnect all attached devices from the CPU (the devices will continue scanning). With all devices disconnected from the CPU, cycle CPU power and allow the CPU to initialize; the Scan (SCN) LED will go out when initialization is complete (approximately one minute). Reconnect the devices in the correct order back into the CPU.

### **Using a Mini-Recorder with a Digital Pod:**

When using a Mini-Recorder with a Digital Pod, that Mini-Recorder must be connected to Port 1 on the CPU08V. The CPU08V only supports one Mini-Recorder with a Digital Pod.

