

Titan CPU

Channel Multiplexer

CPU04 / CPU08 / CPU12

User Manual



Proprietary Notice

This information is furnished for installation, operation, test and maintenance purposes. The information is proprietary in nature and should be treated accordingly. The data shall not be released or used, duplicated or disclosed, in whole or in part, for manufacture or procurement without the written permission of **Mars Labs**.

Copyright

This Technical Manual is copyright © 2020. All rights reserved. Brief excerpts may be made from this manual for technical purposes, as long as they are referenced.

Although this manual is believed to be correct at the time of publication, **Mars Labs**, its employees, or agents involved in the preparation and publication of this manual do not accept any form of liability for its contents or any consequences arising from its use. People using the information contained in this manual should apply, and rely upon, their own skill and judgement to a particular issue which they are considering.

Titan CPU User Manual v1.1
Publication MNL 1057
October 2020



Mars Labs, LLC
29 C Street
Laurel, Maryland 20707
(301) 470-3278
www.marslabs.com

Table of Contents

Introduction	
Furnished Accessories	4
Support	4
General Guidelines	5
Operation	
Front Panel	6
Rear Panel	8
Connection Diagram	9
Interface	
REM (Remote)	10
Titan Input Module Ports	11
Connections	12
Changing the IP Address	13
LED Operation	14
Remote Switch Operation	14
Features & Specifications	15
Resetting the CPU File Index	16
Warranty & Repair	17
Notes & Known Issues	18

Introduction

The Titan CPU Channel Multiplexers allows you to connect multiple Titan Pods or Mini-Recorders to easily configure large channel-count test systems of up to 192 channels, plus digital channels.

Device connections to the Titan CPU 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 CPU Channel Multiplexer, with complete features, specifications, set up procedures and operation. It contains important safety information as well.

Furnished Accessories

The Titan CPU is typically shipped with the following items:

- PS24V6A-SM - 24V / 6A Titan Power Adapter
- Ethernet cabling (CAT6/CAT5)

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 Titan hardware. The static spark can be so small that you don't feel it, however, it can 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

Always connect the Titan Power Adapter to the Titan CPU **before** applying power. Never hot plug a Titan CPU under any circumstances as hot plugging may damage the device!

Operation

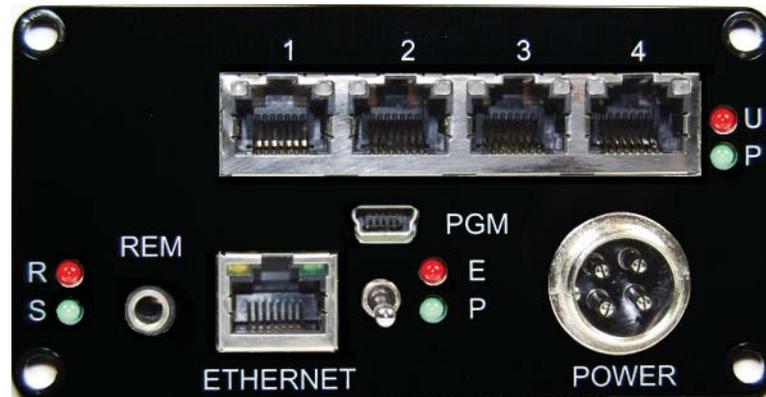
This user manual covers CPU04, CPU08, and CPU12 Channel Multiplexers. Functional descriptions of all Titan CPU Channel Multiplexer front and rear panels appear below.

Front Panel

The Titan CPU front panel incorporates a power connector and switch, LED status indicators, an Ethernet port, a Programming (PGM) port, and a jack for remote operation (REM). The CPU08 and CPU12 include four RJ-45 Input Module connectors (ports 1-4) with LED group indicators.



CPU04 Front Panel

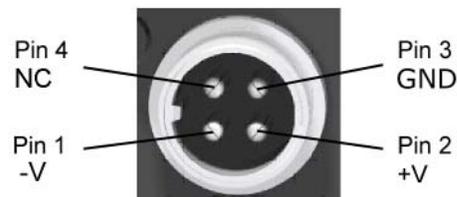


CPU08 and CPU12 Front Panel

Panel Components

POWER The 4-pin power connector provides the power input of the Titan CPU Channel Multiplexer.

*NOTE: The 24V, 6-amp Power Adapter furnished with the Titan CPU is sufficient to power the CPU and approximately eight Input Modules with no excitation. **If using the CPU12 with more than eight modules connected, or if excitation is to be applied, you will need to provide additional power either by powering some Input Modules separately with additional Titan power adapters or by providing power from another source. In the latter case, observe the power connection shown.***



For all test configurations, Mars Labs recommends powering input modules separately to avoid potential power issues.

LED Status Indicators

- R** – A red LED indicating the recording status.
- S** – A green LED indicating that the Titan CPU is scanning.
- E** – A red LED indicating an error condition within the Titan CPU.
- P** – A green LED indicating that the Titan CPU is ON.

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.

REM

An 1/8" TRS connection that permits remote Start/Stop recording.

PGM

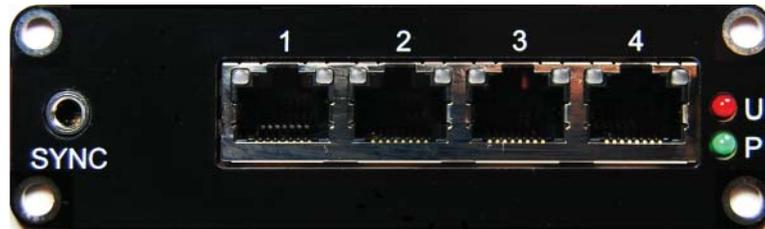
A mini-USB port for communicating with the device internal processor.

LED Port Indicators (CPU08/CPU12)

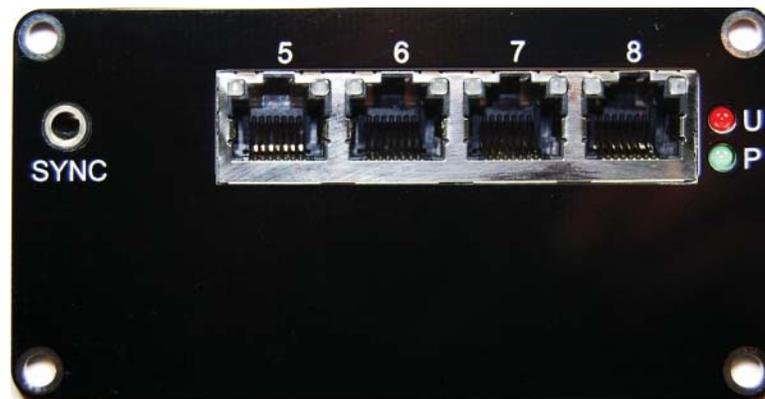
Green (P) - When lit, indicates that a four-port group is powered and active.
 Red (U) - When lit, indicates that a four-port group is providing power to the RJ45 ports.

Rear Panel

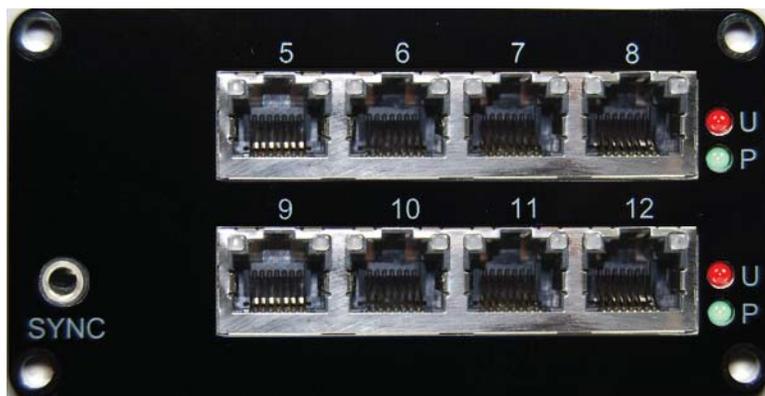
The rear panel on all three Titan CPUs incorporate RJ-45 Input Module connectors, LED indicators for each four-port group, and a Sync jack.



CPU04 Rear Panel



CPU08 Rear Panel



CPU12 Rear Panel

Rear Panel Components

SYNC

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

Titan Input Module Ports

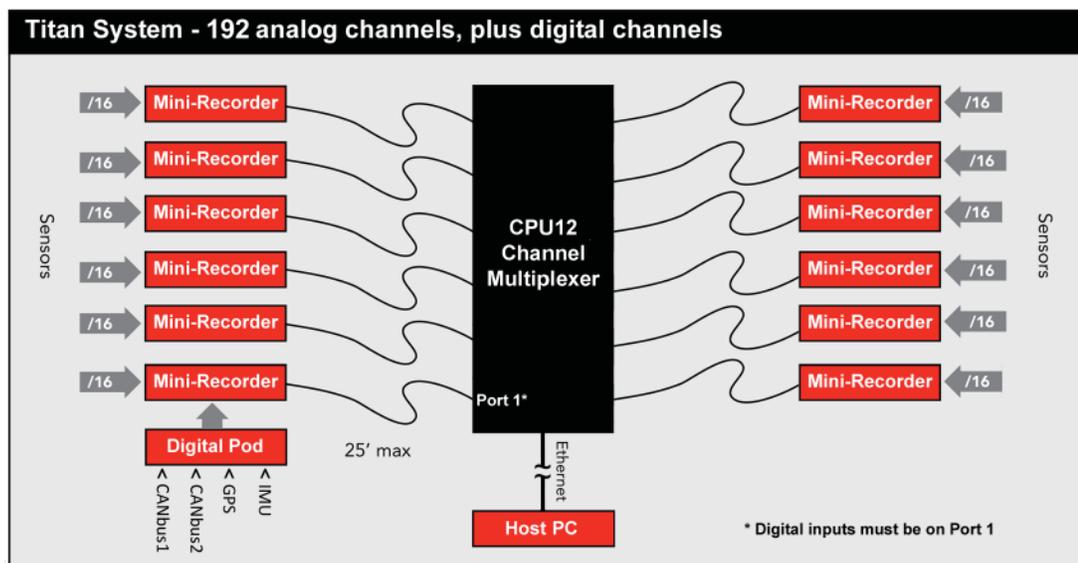
Multiple RJ-45 style ports provide the connections for Titan Input Modules. Any combination of Titan Mini-Recorders and Pods can be connected to these ports to provide up to 192 analog channels plus digital channels (CPU12). Connections are made using Ethernet CAT6 cables.

LED Port Indicators

Green (P) - When lit, indicates that a four-port group is powered and active.
Red (U) - When lit, indicates that a four-port group is providing power to the RJ45 ports.

Connection Diagram

The diagram below depicts a large channel-count data acquisition system (192 analog channels, plus digital channels) using a Titan CPU12 and twelve Titan Input Modules*, one of which includes a Digital Pod. Connections between the CPU and the Titan Input Modules are made using standard 'straight-through' CAT6 Ethernet cables. The maximum recommended cable length from the Mini-Recorder to the CPU is 25 feet (7.6 meters).



* When more than eight Titan Input Modules are connected and powered from the CPU, you will need to provide separate power to the additional modules. See power note on page 7.

Interface

REM (Remote):

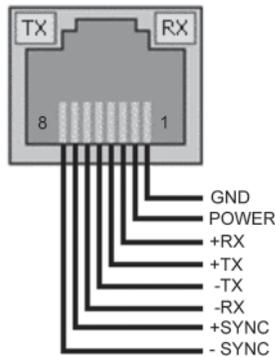
The REM jack permits the Titan CPU recording function to be started and stopped by means of an external switch. This function is implemented on an 1/8" Tip-Ring-Sleeve (TRS) jack, which provides connections for both an external switch and an LED to indicate the START/STOP status:

- 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 CPU has twelve 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 CPU to a Titan Input Module is 25'.

This page intentionally left blank

Connections

The Titan CPU can be operated directly from a host PC via a direct Ethernet connection or over a local area network connection.

Via a local arear network (LAN):

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>", and verify that the ping is unsuccessful. If there is a response, then the CPU IP address will need to be changed. For information on changing the CPU IP address, see page 15.
2. Connect the Titan CPU to the network, but *do not* apply power to the CPU.
3. Using standard Ethernet cabling, make the connections to the Titan CPU. Use Cat6 Ethernet cable for connections to input modules and Cat5 cable for connection to the LAN. Cable lengths to connected input modules should not exceed 25 feet. Continue until all connections are made
4. Apply power to the Titan CPU. 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 CPU device and Titan Input Modules.

Via direct Ethernet connection:

1. If you are making a direct connection between the Titan CPU and a PC, you will need to reconfigure the PC with a static IP address on the same subnet as the CPU.

To determine the correct static IP address for the PC, obtain the IP address of the CPU (the IP address is marked on the device). Use the same first three octets of this address, but set the last octet to a different number. For example, if the CPU is configured for “192.168.10.51”, you could set the PC to “192.168.10.61”.

For instructions on changing the PC IP address, refer to:

<https://support.microsoft.com/en-us/help/15089/windows-change-tcp-ip-settings>

2. With the static address changed on the PC, and with no power applied to the Titan CPU, plug an Ethernet cable into the Ethernet port on the CPU and then connect the other end to the Ethernet port on the host PC.
3. Follow steps 3-5 as described in the ‘Via a Network’ section on the previous page.

Changing the IP Address

The Titan CPU IP address can be changed using the Titan CPU IP Address Programmer application, which is available as a part of the Titan Service Pack. The Titan Service Pack can be obtained from the Downloads page on the Mars Labs website (www.marslabs.com).

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 red ERR LED will illuminate while the CPU is initializing, and will extinguish after initialization has completed (about 40 seconds). 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.

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 but continue scanning.

Features and Specifications

Key Features

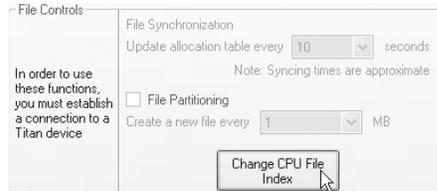
- Connects multiple Titan Input Modules to create large channel-count recording systems
- Isolated power supply accepts voltages of 11–32 VDC.
- Records data directly to an SD memory card (non-removable) or to local host PC
- Network interface allows remote operation via TCP/IP or UDP
- Compact size 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

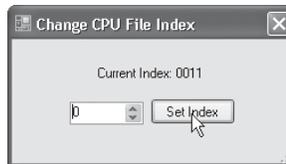
Recording Media:	Non-removable 32GB SD Memory Card
Number of Titan Modules supported:	<p>CPU04 - Up to four 16-channel Titan Input Modules (64 analog channels total, plus digital channels)</p> <p>CPU08 - Up to eight 16-channel Titan Input Modules (128 analog channels total, plus digital channels)</p> <p>CPU12 - Up to twelve 16-channel Titan Input Modules (192 analog channels total, plus digital channels)</p>
Sample Rates:	<p>CPU12 - Supports up to 5000 samples/sec with 12 modules (192 channels total, plus digital channels) Supports up to 8192 samples/sec with 8 modules (128 channels total, plus digital channels)</p> <p>CPU08 - Supports up to 8192 samples/sec with 8 modules (128 channels total, plus digital channels)</p> <p>CPU04 - Supports up to 10K samples/sec with 4 modules (64 channels total, plus digital 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 or crossover Ethernet cable
Dimensions / Weight:	<p>CPU04 - 17.9 cm x 10.6 cm x 5.6 cm (L x W x H) / 400g</p> <p>CPU08 - 13.3 cm x 10.6 cm x 5.6 cm (L x W x H) / 450g</p> <p>CPU12 - 17.9 cm x 10.6 cm x 5.6 cm (L x W x H) / 600g</p>

Resetting the CPU File Index

The CPU remote recording index (AKA 'File Index') always increments based on the value of the last recorded test, and keeps incrementing, even if all recorded test files are deleted. Since there may be occasions where it is desirable to reset the index, TCS (versions 3.0.4 and higher) include a button for this purpose. The button is located in the 'File Controls' pane on the Recording & Triggers screen:



Clicking on the button produces a selection window that allows you to set the index value to any value from 0000 to 9999. To set the value, use the increment/decrement controls or manually enter the desired value in the number field:



The index value can also be reset by issuing a manual command in the TCS Manual Command window (function key F10 in the Configuration tab). For example, to reset the value to zero, enter the command:

```
SET_FILE_NUM 0000
```

Note: Using either method described above, after resetting the index to zero, TCS will display a '?' in the CPU Device Index field until a new remote recording is made.

Related ICD Commands:

SET_FILE_NUM

Syntax: SET_FILE_NUM <VALUE><CR>

Summary: Sets the file index of the CPU to the specified value.

Valid Inputs: <VALUE> = A four digit number from 0000 to 9999

Ex. Response: ACK, ERROR

GET_FILE_NUM

Syntax: GET_FILE_NUM <CR>

Summary: Returns the file index of the CPU

Valid Outputs: From '0000' to '9999'

Ex. Response: <VALUE>

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

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 CPU will stop recording/stop scanning and display an error (the ERR LED will be ON).

CPU Power Loss/Data Loss:

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

CPU Remote Recording:

The CPU does not automatically handle Pod configuration changes made since the last remote recording (for example, 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 to TCS and run a short test to reconfigure the CPU and all connected Pods prior to resuming remote recording.

Remote Switch Operation:

If the Remote Switch is connected to the CPU 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 CPU, 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 running a test directly from TCS.



*Mars Labs, LLC
29 C Street
Laurel, Maryland 20707
(301) 470-3278
www.marslabs.com*