

Kinematics MitiGator Seismic Switch

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Safety

Symbols & Terms

The following symbols may appear on Kinemetrics equipment or in this manual.



When you see this symbol, *pay careful attention*. Refer to the similarly marked, relevant part of this manual before servicing the instrument.



This symbol means a *low-noise earth ground*. The noted item should be grounded to ensure low-noise operation, and also to serve as a ground return for EMI/RFI and transients. Such a ground *does not work as a safety ground* for protection against electrical shock!



This symbol means an alternating current (AC) power line.



This symbol means a direct current (DC) power line derived from an AC power line.

These safety-related terms appear in this manual:

Note: statements identify information that you should consider before moving to the next instruction or choice.

Caution statements identify conditions or practices that could result in damage to the equipment, the software, or other property.

WARNING! statements identify conditions or practices that could result in personal injury or loss of life.

Specific Precautions

Follow the precautions below to ensure your personal safety and prevent damage to the MitiGator.

Power Source

Caution The MitiGator must be supplied with power from a 10-24V power supply that is safely grounded and meets all applicable local regulations. The MitiGator will be damaged if the power is connected with the wrong polarity.

User-Supplied Power/Charging System

WARNING! If you supply your own power/charging system, be sure that the system provides the correct voltage and current required by the MitiGator under all operating conditions. You are responsible for the safety of your charging system. Be sure you have supplied adequate grounding for all the equipment. If you supply your own batteries, follow the manufacturer's safety recommendations.

Do Not Operate in Explosive Atmosphere

WARNING! The MitiGator provides *no explosive protection* from static discharges or arcing components. *Do not* operate the equipment in an atmosphere where explosive gases are present.

Relays

WARNING! The MitiGator should never be used to switch AC power. It should always be used in conjunction with appropriate high-power relays.

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1. Introduction

This document describes the setup and operation of the Kinometrics MitiGator seismic switch, that will be described throughout this document as the MitiGator.

For the MitiGator, the following part numbers are used:

110600 - The MitiGator

302700 - This manual

302701 - MitiGator Boot Loader Firmware

302702 - MitiGator Seismic Switch Application Firmware

302703 - MitiGator Seismic Switch Firmware Package (includes 302701 and 302702)

System Overview

The MitiGator (KMI P/N 110600) is a small self contained seismic switch capable of detecting and reacting to seismic events. The MitiGator allows the definition of varying threshold levels, that in turn will cause the actuation of up to three relays. These relays may be used to cause alarms and/or the starting or stopping of involved processes.

In many control applications, the MitiGator will be used to control a second set of high-amp-capacity relays that are integral to the control system.

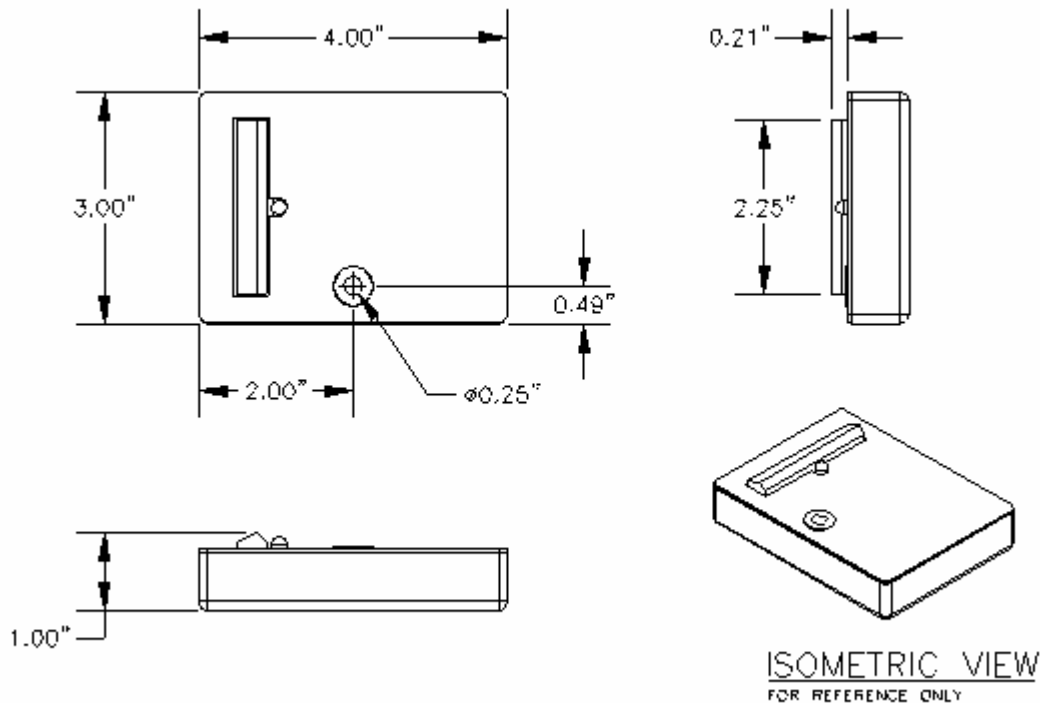


Figure 1 - MitiGator dimensions

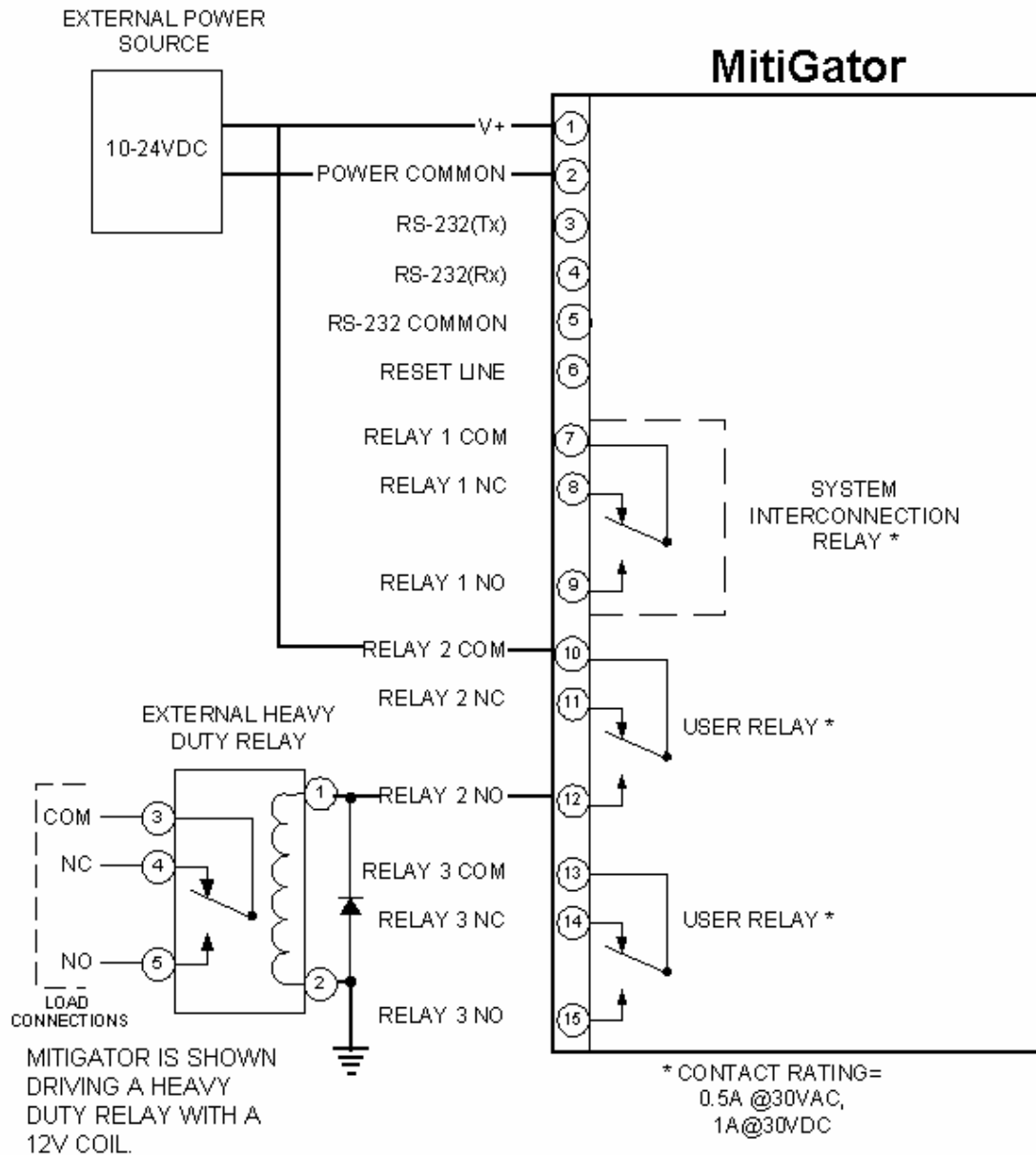


Figure 2 - External power and relay connections

Caution: Potential equipment damage. Clamping diodes should be added if the MitiGator is used for switching inductive loads such as relays.

If an inductive load generates spike voltages which exceed the absolute maximum rating, the spike voltage must be limited. Typical circuits are shown below for the MitiGator. D1 and D2 act as clamping diodes to reduce the spike voltage of the relay coils.

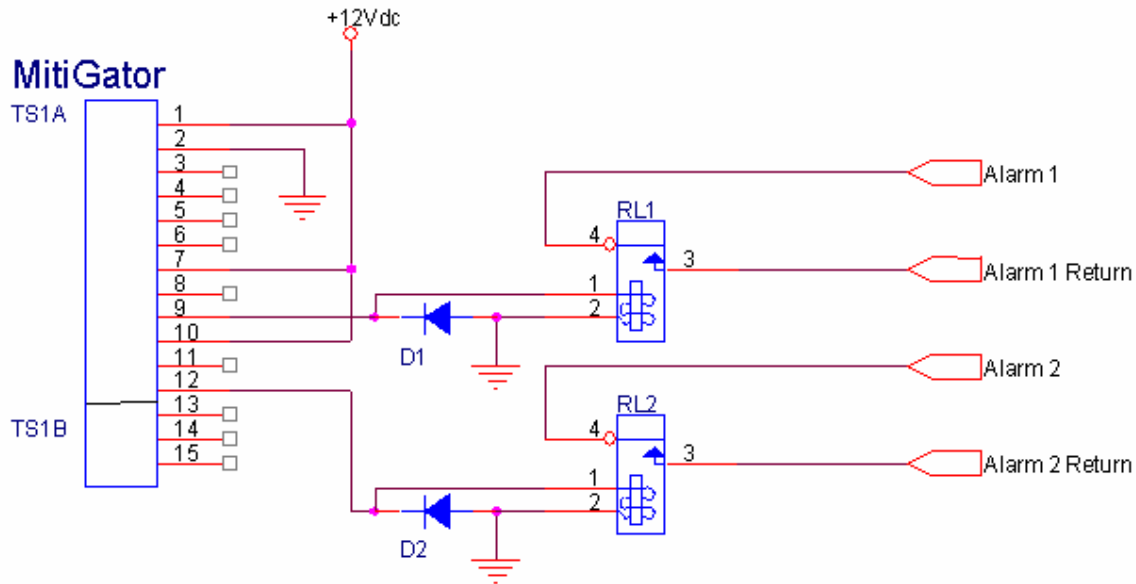


Figure 3 - Example application of clamping diodes

Even if spike voltages generated at the load are limited with a clamp diode, if the circuit wires are long, spike voltages will occur by inductance. Keep wires as short as possible to minimize inductance.

Typical Applications

Typical applications of the MitiGator include:

- Elevator Shutdown
- Industrial Machinery
- Earthquake Alarms
- Transportation Equipment
- Industrial Vibration Monitoring (custom firmware available on request)

User Filter Description

The MitiGator uses a pair of digital filters to process acceleration information to accurately determine whether or not to trigger the relays while at the same time rejecting false triggers caused by spurious input signals.

The plot below shows the frequency response of the standard MitiGator trigger filter. Due to sensor noise, the threshold can vary by 1-2 dB at trigger thresholds below 50 mg.

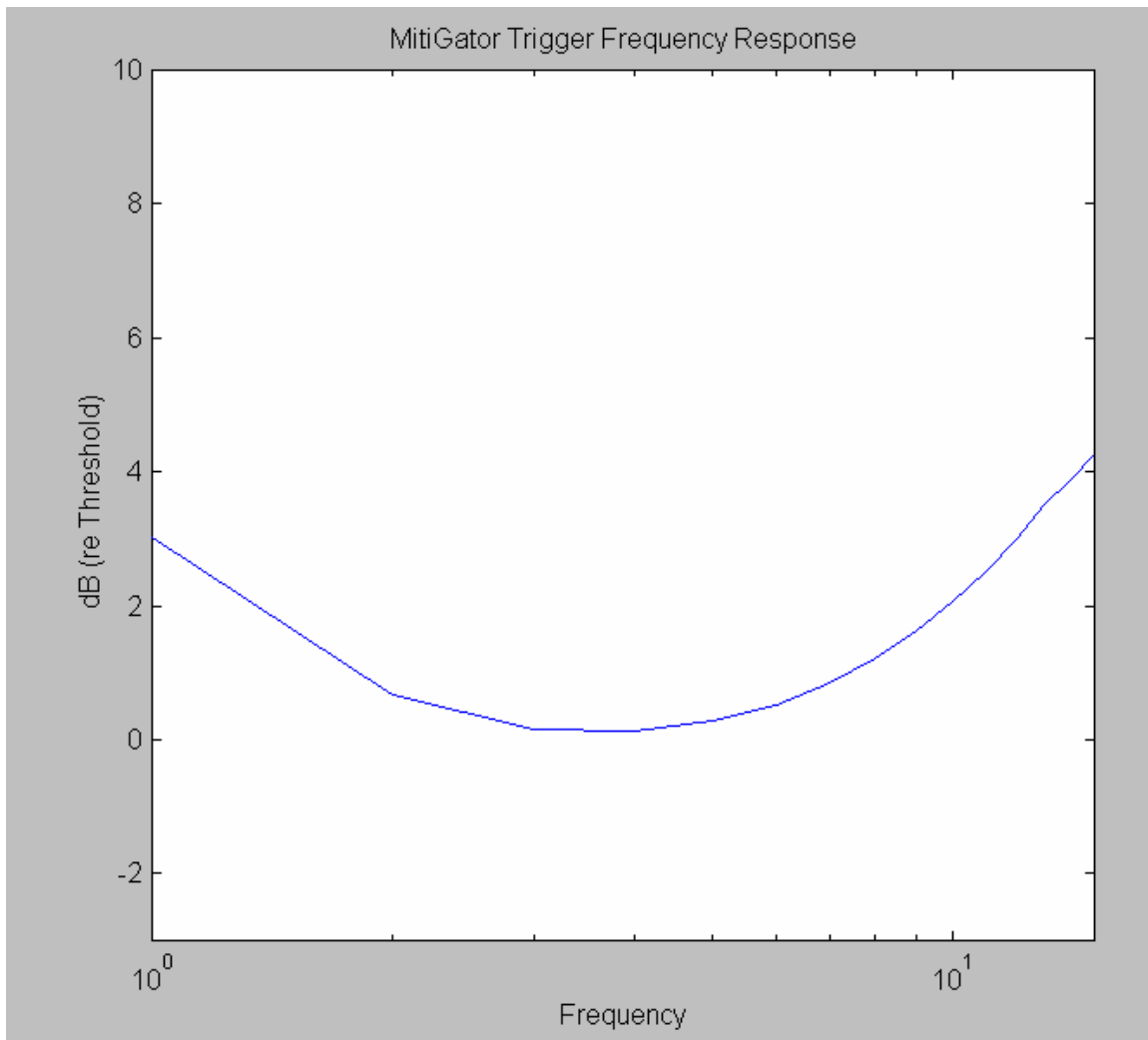


Figure 4 - MitiGator Frequency Response

The low frequency asymptote is 6 dB/octave. The high frequency asymptote is 18 dB/octave.

The basic stages of data through the MitiGator are as follows:

- Input Acceleration
- Analog filter to 33Hz
- Digitize at 512Hz
- Highpass filter to 23Hz
- Decimate by 3 to $512/3 = 171\text{Hz}$
- Bandpass filter to 1-15Hz
- Trigger detection

See FILTER command.

User Electronic Information

Power Requirements:

10-24V input

The MitiGator draws less than 100 mA from a 12 V supply with no relays engaged and less than 300 mA from a 12 V supply with all three relays engaged.

Relays:

Type	1 form C (Single Pole Double Throw)
Maximum Current	1 Amp
Maximum Voltage	30 Volts DC
Breakdown Voltage	500 Vrms
Contact Type	Gold-clad Silver
Minimum Life	100,000 cycles
Coil resistance	89 Ohms

Note: The MitiGator should never be used to switch AC power. It should always be used in conjunction with appropriate high-power relays.

Reset Line:

Connecting the reset line to power common will cause the MitiGator to reset. Pin 2 and Pin 6 should be connected by a normally-open switch. Closing the switch causes the unit to re-start.

The relays will revert to their normal configuration in the event of a power loss. It is important to use the MitiGator with this in mind. In most applications, of course, the device controlled by the MitiGator will lose power and cease to function at the same time.

Power Drop:

Should the unit detect a drop in power, it will attempt to avoid a total shutdown by shutting the relays down. The unit will go into a standby mode while it awaits a return of power.

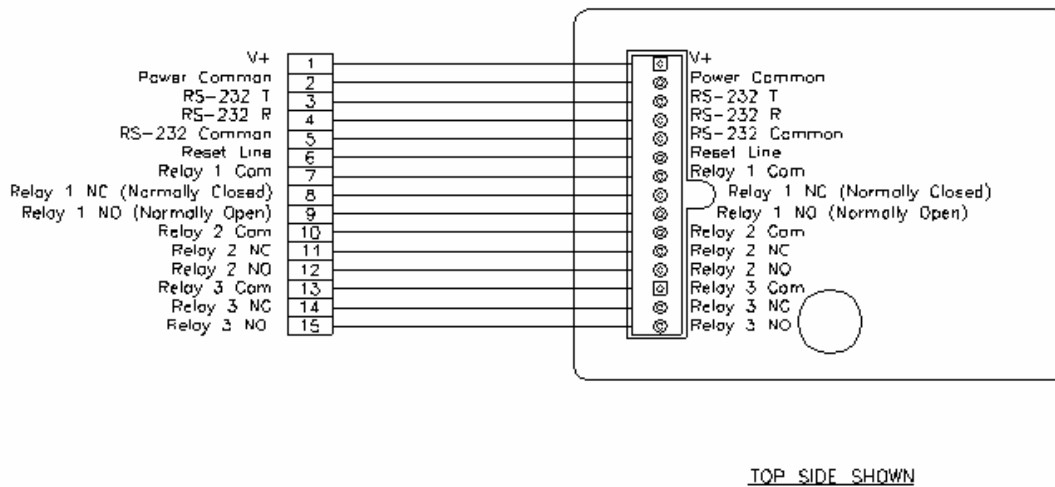


Figure 5 - MitiGator wiring diagram

Software relay control

The MitiGator is provided with up to three relays that can be used to control processes that require intervention in the event of seismic activity. The relays are single pole double throw (SPDT) relays with both a normally open and a normally closed connection. Each of the relays can be configured for the following options:

- Polarity: Normal or inverted (software)
- Usage: Threshold, threshold/fault, vector, vector/fault, power indicator, fault, heartbeat
- Hold time at trigger: In milliseconds
- Threshold: Set in percentage of g for X,Y,Z

At initial power on, all relays will be de-energized. Once the MitiGator application firmware is started and the self test is successfully completed, the relays will be set to the state indicated by the configured software usage and the software controlled polarity. When the usage condition is met (threshold exceedance, fault, etc) the relay will change state to the opposite condition. If a hold time is specified, the triggered condition of the relay will be held until the hold time elapses, and the relay will be restored to its initial condition.

For example: To connect to a relay such that a contact closure will interrupt a given process in the event of seismic activity, connect to the normally closed contact. Then, set the software of that relay to inverted. This will cause the software to energize the relay on startup, causing the relay to open. In the event of seismic activity the MitiGator will reverse the state of the relay causing it to close. The relay will also revert to its normally closed (de-energized) state in the event of power failure. The command to set relay 1 to inverted would look like:

```
EDIT>> relay 1 I T 0
```

Another example: To set the MitiGator up such that relay 1 would be used to detect motion in the X axis, relay 2 in the Y axis, and relay 3 in the Z axis, the THR command would be used. In this example, we assume that all threshold levels are the same at 2.0% of g. The commands to set thresholds in this manner would look like:

```
EDIT>> thr 1 2.0 0 0  
EDIT>> thr 2 0 2.0 0  
EDIT>> thr 3 0 0 2.0
```

Fault Detection

The MitiGator provides several options allowing you to create a more robust final system. Selection and use of these options is very application specific and is left to the user.

NOTE: If you choose not to implement one or more of these fault detection options, your system may not alert you to problems that will cause improper operation of the MitiGator.

Fault detection options include:

- Relay outputs configured to indicate presence of power
- Relay outputs configured to indicate self test fault or a failed seismic sensor
- Relay outputs configured to provide a heartbeat signal
- Relay outputs configured to provide combined fault status and trigger indication
- Redundant relay outputs

Implementation of some of these options will require additional circuitry to properly process the additional outputs. In other cases, your application may allow you to obtain significant information from a single relay output.

For example, a relay set to indicate combined fault status and trigger information that is also configured for inverted polarity would allow you to detect loss of power, failed self test, a failed seismic sensor, or a seismic trigger - although the single output will not provide enough information to determine which.

See the RELAY command for further details.

LED

The MitiGator includes an LED that is used to indicate presence of power, results of the MitiGator self test, or indication of a detected seismic event.

LED ON indicates presence of power, a completed and successful self test, and no seismic event currently detected.

LED OFF indicates lack of power, a failed self test, or a failed seismic sensor detected.

LED flashing indicates a detected seismic event.

Clear switch

The MitiGator is provided with a clear switch, that consists of a set of contacts that if closed will cause a user selected action to take place. The clear switch can be defined by the user as causing a seismic event clear or a system reset.

If configured for system reset, closing the clear switch will cause the MitiGator to perform a complete system reset by restarting the application code at the bootloader. The system will redisplay the bootloader banner, wait the specified time for user intervention, and will then enter the MitiGator application firmware that begins with a self test.

If configured for seismic event clear, closing the clear switch will cause the relays to be restored to their configured startup state, the LED to stop flashing and return to the ON state, and any seismic event detection messages to cease. When the clear switch is used to clear an alarm, the messages displayed to the console will look something like the following:

```
TRIGGER: X0.032g Y0.021g Z0.003g
TRIGGER: X0.032g Y0.021g Z0.003g
TRIGGER: X0.032g Y0.021g Z0.003g
TRIGGER: X0.032g Y0.021g Z0.003g
Reset alarm
```

Communication port

The MitiGator is equipped with a three wire RS-232 serial port that can be used for communication with and control of the MitiGator. The port is configured for 8 data bits, 1 stop bit, no parity and is initially set up at 38400 baud.

The port can be used to check or change the configuration of the MitiGator, as well as for downloading new firmware. Normal operation of the MitiGator does not require connection of the port.

Changing configuration parameters requires use of a computer or dumb terminal capable of interacting with the port at the specified baud rate. If using a computer to communicate with the MitiGator, most standard communications programs such as ProComm or HyperTerminal are suitable.

Downloading firmware to the MitiGator requires use of the KMICON communications program, that is supplied in the MitiGator distribution. This program runs under Windows 95, Windows 98, or Windows NT. See separate section on KMICON toward the end of this document.

Displaying peaks

When the system is triggered due to a threshold or vector detect, the MitiGator will display the peak values detected in g. The peak values for each channel that have been detected since the time of the system trigger will be sent to the RS-232 port every 1 second until the alarm condition is cleared. The reported peaks will be of the form:

```
TRIGGER: X0.032g Y0.021g Z0.003g
```

The peaks are displayed in the channel order X, Y and Z.

Power up

When power is applied to the MitiGator, the LED will be turned off and all relays will set to their initial power up condition (de-energized). The MitiGator will begin executing the MitiGator bootloader firmware, that will produce a sign-on message similar to the following:

```
KMI MitiGator Relocatable Boot Loader v1.0
```

```
Enter <SPACE> to enter Boot Loader menu  
Press any other key to run the application program  
.....
```

If the user presses the SPACE bar, the MitiGator will enter the bootloader menus, allowing access to bootloader functions. See the section on the bootloader for further details.

If the user presses any key other than the SPACE bar, or if no key is pressed and the ten second timeout is allowed to expire, then the MitiGator will begin execution of the MitiGator application firmware. The application firmware will produce a sign-on message similar to the following:

```
KMI MitiGator Relocatable Boot Loader v1.0
```

```
Enter <SPACE> to enter Boot Loader menu  
Press any other key to run the application program  
.....  
Starting application code...
```

```
KMI MitiGator Application Code v1.1
```

```
S/N: 5012
```

```
>>  
Trigger initializing. Please wait.
```

```
Trigger initializing. Please wait.
```

```
READY
```

At this point, the MitiGator will perform a diagnostic self test. If the self test fails, a message will be produced describing the results of the self test, and any relays configured to indicate faults will be set as specified. If the self test fails, the LED will remain OFF.

If the self test succeeds, the relays will be set to their configured initial states - that may not be the same as the initial power up states - this depends on the software selected polarity for each relay. The LED will be turned on, indicating a successful self test.

At this point, the MitiGator will begin operating as a seismic switch and will control the state of its relays based upon the configured usages and thresholds.

The messages "Trigger initializing. Please wait." occur during initial startup of the MitiGator or after editing MitiGator parameters using EDIT mode. The message indicates that the digital filters are being initialized before use. This process takes between five and ten seconds. Completion of the trigger initialization is indicated by the "READY" message.

NOTE: When attempting to startup the application firmware, the MitiGator bootloader will check the application portion of the FLASH memory to check if a valid application program appears to be present. If the application program is not valid, then a message will be displayed and the bootloader will enter the bootloader menus. The display in this case would look something like the following:

```
KMI MitiGator Relocatable Boot Loader v1.0

Enter <SPACE> to enter Boot Loader menu
Press any other key to run the application program
.....
WARNING: There is no valid application code to start!
>>
```

Power down

Powering down the MitiGator is not complicated. For the most part, the power can simply be removed. All firmware and programs are stored in FLASH memory, so they are not volatile and will be retained.

Care should be taken NOT to power off the MitiGator during the process of updating the FLASH memory. Updating the FLASH memory occurs only under the following conditions:

- When exiting the parameter editor of the MitiGator application firmware, the parameters that may have been changed are written back to FLASH memory. This operation takes place very quickly (in under one second) so the risk of interruption is small. Should the parameters become corrupted, the MitiGator will default to factory default parameters.
- When downloading new firmware for the MitiGator bootloader or application code. This is done from the bootloader's NEWBOOT or NEWAPP commands. In both cases, the new code is first downloaded to RAM, verified, and IF SUCCESSFUL the affected FLASH memory areas will be erased and reprogrammed. Although downloading can take minutes, the process of reprogramming the FLASH takes less than five seconds.

NOTE 1: Should the bootloader reprogramming be interrupted, the consequences are serious. If the bootloader FLASH sector is corrupted, the MitiGator will be unable to locate usable code at startup and will fail to start. If this occurs, the MitiGator will be unresponsive at startup, despite proper connection of power and/or communications. Special care should be taken to not disrupt programming of the bootloader sector or the units may need to be returned to Kinometrics for repair.

NOTE 2: Should the application reprogramming be interrupted, the bootloader may detect this upon trying to start the application firmware. If it does, the MitiGator will display a message and enter the bootloader menus so you can correct it. However, if the bootloader is unable to detect the errors, it will repeatedly enter the faulty application code, crash, and restart the bootloader - that will again crash and restart the bootloader. You can interrupt this loop by pressing the SPACE bar at the appropriate time to enter the bootloader menus.

Software Overview

The MitiGator is designed to begin operating automatically, shortly after application of power. Normally once set up, no user intervention is required in order for the MitiGator to function normally. Even during setup only the RELAY and THR commands are generally used for most applications. See the following subsection on RELAYS for some examples. Refer to the detailed descriptions of the various setup options if the application requires a more complex setup.

Once power is applied, the firmware will begin running a program called a "bootloader". The bootloader is a program that will allow for intervention by the user in order to perform diagnostics and/or to download new firmware to replace the bootloader or to replace the MitiGator application firmware.

After power is provided, the bootloader firmware will identify itself by presenting the bootloader banner. The user will be instructed to press the SPACE bar to enter the bootloader menus, or to press any other key to start the MitiGator application firmware. If the user does nothing (as is the normal case in unattended startup) then the MitiGator application firmware will be automatically started after approximately ten seconds.

Memory Organization

The MitiGator memory is divided into two major divisions - RAM and FLASH. The RAM is used to hold working variables and data needed for the operation of the MitiGator firmware, and the FLASH memory is used to hold non-volatile data and the firmware itself.

128kb of RAM is supplied with the MitiGator. The first 64kb is used to hold normal working variables of the firmware, and the second 64kb is used for larger data buffers for specific tasks that the MitiGator needs to perform. During bootloader operation, the bootloader relocates itself from the FLASH into the first 64kb of RAM, using the second 64kb of RAM as a buffer for holding newly downloaded firmware. This relocation of the bootloader is necessary because as the FLASH memory is updated, it cannot be used for execution of the bootloader.

FLASH memory is provided as either one or two banks of 512kb. The first bank of 512kb of FLASH, called the Code FLASH, is used to hold the MitiGator bootloader, parameters, and application firmware. The FLASH memory is organized into sectors as follows:

Sector -1	32kb Parameter sector for holding MitiGator parameters.
Sector 0	32kb Bootloader sector for holding MitiGator bootloader.
Sector 1-7	64kb Application sectors for holding MitiGator application firmware.

The second bank of 512kb of FLASH memory is reserved for future expansion of the MitiGator, probably for storage of seismic event waveforms. This bank, called the Event FLASH, will generally not be included in most versions of the MitiGator hardware. The organization of the Event FLASH is similar to that of the Code FLASH in that it consists of two 32kb sectors and seven 64kb sectors.

The MitiGator-IND Version

The -IND version of the MitiGator provides a convenient enclosure and backup battery power for the basic modular units. The enclosure is intended for use in control rooms and other indoor environments. The IND enclosures should never be used outdoors, in corrosive environments, or in other hostile environments. For these applications, contact Kinemetrics for a custom enclosure.

The pair of 6-V batteries provided with the IND are rated at 1 Amp-hour and connected in series to provide the required 12V. These provide up to 6 hours of backup power for the MitiGator. This will be reduced somewhat if the relays are engaged. With all three relays engaged, the unit will have at least 3 hours of backup power.

Input Voltage 100 - 240VAC, 0.5A
Frequency 50/60Hz
Output 13.8VDC, 1.1A
Indoor use only.
Charger dimensions: 2"W X 3.5"L X 1.25"H
Input cord length: 6ft
Output cord length: 6ft

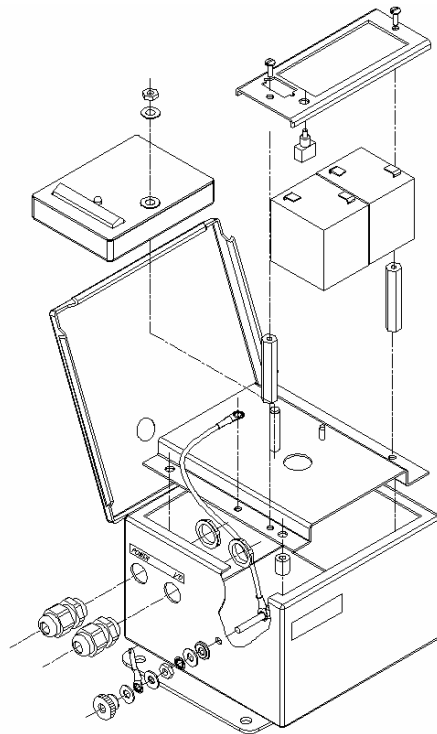


Figure 6 - MitiGator-IND Enclosure

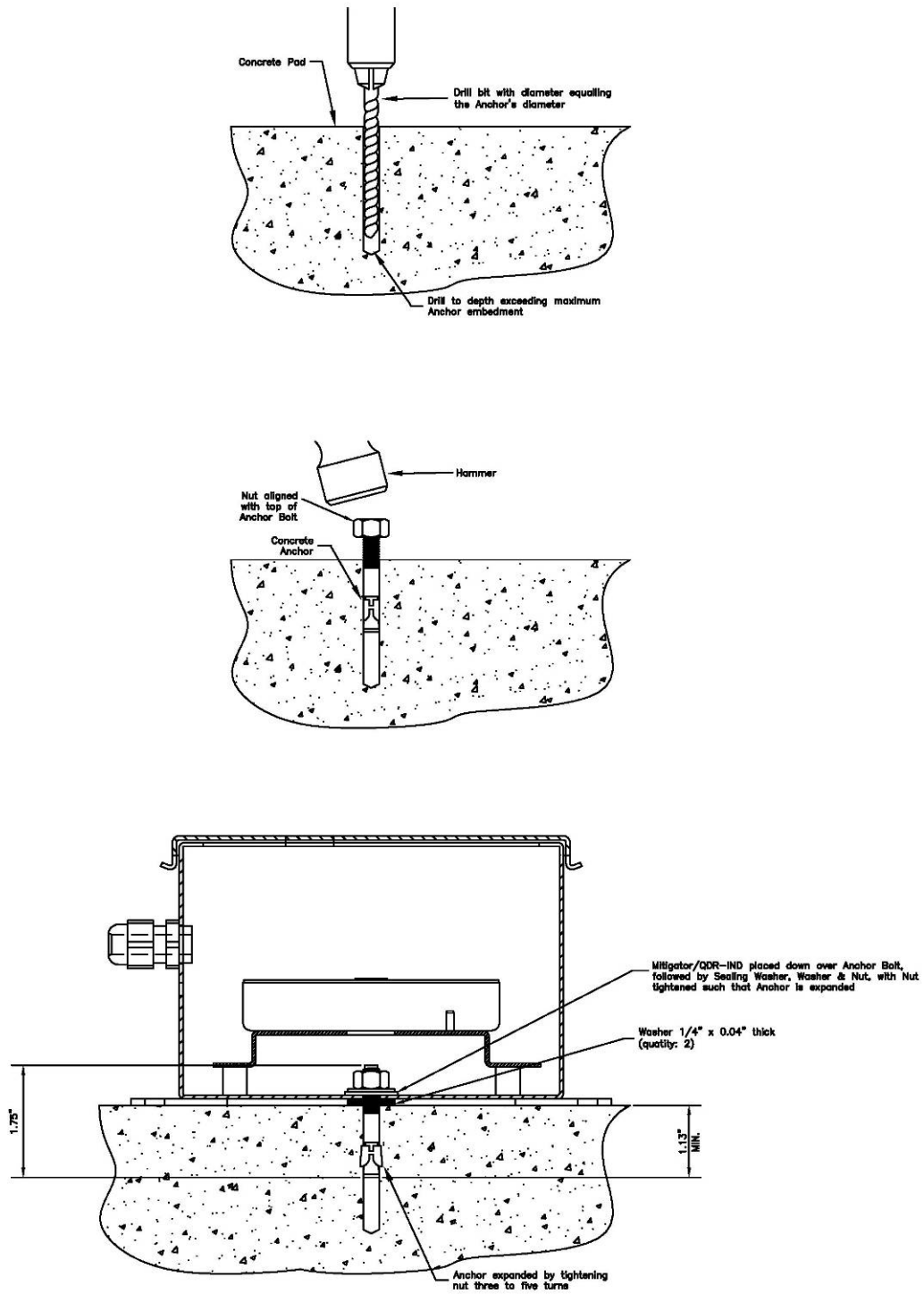


Figure 7 - MitiGator-IND Mounting

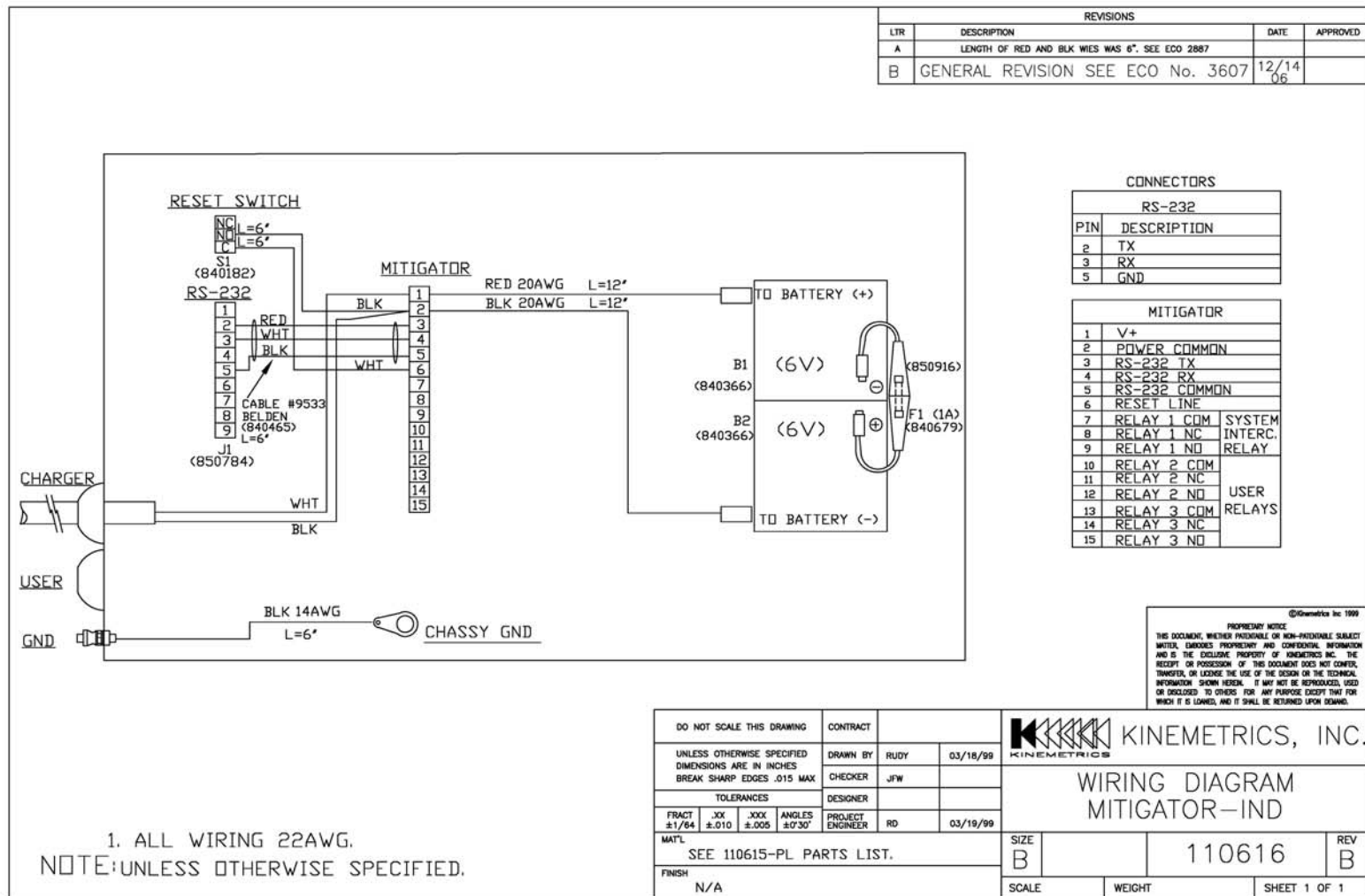


Figure 8 - MitiGator-IND Wiring Diagram

Commands

The MitiGator can be controlled and configured using a command based interface via the RS-232 port. The prompt that is displayed to indicate that the MitiGator is ready to receive and act on user commands is two right angle brackets, as shown:

```
>> HELP
```

At this command prompt, you can type MitiGator commands, that are further described in this section.

Entering an invalid command will result in a message:

```
>> PARAM
<PARAM not a valid command>
>>
```

Entering an invalid parameter list, or a parameter out of range will result in various messages, such as:

```
>> cmd -1
<Value must be in range 1 to 9999>
>> cmd one two
<Usage: cmd counter>
>>
```

NOTE: The CMD example command is not a real command.

In most cases, if a command is accepted without error, no specific response is provided. Instead, you will be presented with another prompt.

The HELP command will list the available commands at any level. See the HELP command for more detail.

EDIT

The EDIT command places the application firmware into a mode that allows the user to edit various MitiGator parameters. Upon entering EDIT mode, a copy is made of the parameters so that they may be viewed and altered without affecting the current operation of the MitiGator.

Upon exiting EDIT mode, the copy of the parameters is either discarded or is used to replace the active parameters and is also written to the parameter sector of the FLASH memory. There are two commands used to exit EDIT mode:

QUIT will exit EDIT mode without saving the altered parameters. Resulting message:

```
>> edit

[EDIT MODE]
EDIT>> sn
Serial Number: 5012
EDIT>> quit
Parameter edit has been aborted.
>>
```

EXIT will save the modified parameters to FLASH memory and exit EDIT mode. Resulting message:

```
>> edit

[EDIT MODE]
EDIT>> sn 5012
EDIT>> exit
Parameters have been updated.
>>
```

A complete list of EDIT mode commands is given in the Configuration section.

HELP

The HELP command provides an abbreviated command list that summarizes the available commands. The result of the HELP command is a list of all available commands in that mode, followed by a brief explanation of the purpose of the command. HELP for the MitiGator application firmware is as follows:

```
>> help
EDIT: Edit mode for altering parameters
HELP: Displays command help summaries
LOCK: Locks restricted functions
SETUP: Display Data Sheet
SYSRESET: System reset
TEST: Self Test as performed at power up
UNLOCK password: Unlocks restricted functions
VER: Displays system version
>>
```

An identical HELP mechanism is provided for EDIT mode and for the DIAG mode of the MitiGator bootloader. See the HELP commands for those modes for a list of HELP details.

LOCK

The MitiGator application firmware provides a mechanism for password protecting certain commands. This prevents casual alteration of important data. The password can be changed for those customers who require the ability to alter these critical parameters.

The LOCK command relocks the password protected commands without restarting the MitiGator application code.

See UNLOCK.

SETUP

The SETUP command causes the MitiGator to display a data sheet containing current setup of the MitiGator parameters as follows:

```
>> setup

KMI MitiGator Application Code v1.5

S/N: 174

Baud rate: 38400

Current calibration values: Y:523, Z1:530, X:516, Z2:514

Low voltage threshold: 9.0

Relay parameters:
  Relay 1: N T 0
  Relay 2: N T 0
  Relay 3: N T 0

Trigger filter type: 0 (Standard)

Reset usage: 1 (Reboot)

Thresholds:
  Relay 1: X2.0%g Y2.0%g Z2.0%g
  Relay 2: X2.0%g Y2.0%g Z2.0%g
  Relay 3: X2.0%g Y2.0%g Z2.0%g
>>
```

The data sheet displayed indicates current firmware version, serial number, baud rate, calibration values, low voltage threshold, relay usage and setup, use of the reset switch input, and current threshold settings.

This data sheet may be captured to a text file using the ESC capture mode feature of KMICON or may be captured as an image using the "Print Scrn" feature of a PC and then pasted into an e-mail or document.

See EDIT.

SYSRESET

The SYSRESET command causes the MitiGator to restart the firmware by re-executing the bootloader. The user then has the opportunity to intervene and perform bootloader specific functions, or to allow restarting of the MitiGator application firmware.

See Power-up.

TEST

The TEST command causes the MitiGator to re-execute the system self test as performed at power up. This test runs automatically when the MitiGator application firmware is started.

When the self test is run, the LED is turned off, and the following items are checked:

- Clear switch should be cleared
- Battery voltage is checked against the specified threshold
- RAM is tested for errors

If an error is detected, a message indicating the failure will be displayed and the LED will remain off. If no error is detected by the self test, the LED will be turned on at the end of the test to indicate success. The self test process takes approximately four seconds.

No message is displayed if the self test succeeds.

See Power-up.

UNLOCK

The UNLOCK command allows the user to unlock password protected commands so that they can be used to alter critical parameters. The UNLOCK command takes one argument, that is the MitiGator password.

If the password is entered incorrectly, the command will be rejected with a message and the commands will remain locked. For obvious reasons, the password is not listed in this manual.

See LOCK.

VER

The VER command displays the system banner, that includes the version number of the application firmware in use, as well as the MitiGator serial number. For example:

```
>> ver
```

```
KMI MitiGator Application Code v1.1
```

```
S/N: 5012
```

```
>>
```

NOTE: There is also a VER command in the MitiGator bootloader, that will display the system banner, and thus the version number, of the bootloader.

See Power-up.

Configuration

The MitiGator application firmware includes an EDIT mode that allows the user to alter the MitiGator's operating parameters. After entering the EDIT command, the firmware will make a copy of the current parameters for display and alteration within EDIT mode.

Some of these commands may be password protected, and as such may require use of the UNLOCK command in order to access them. Upon entering the EXIT or QUIT commands, EDIT mode will be terminated - with or without saving the modified parameters to FLASH memory.

While in EDIT mode, command entry behaves identically to when the MitiGator is not in EDIT mode, except that the prompt is changed to the word EDIT followed by two right angle brackets, as follows:

```
[EDIT MODE]  
EDIT>>
```

The following commands are included in EDIT mode.

BAUD

The BAUD command determines the communications speed of the RS-232 port when entering commands, downloading firmware, or displaying data.

If entered with no parameters, the BAUD command will cause the current baud rate to be displayed.

If entered with the parameter, the BAUD command accepts a baud rate value that can be 38400, 19200, 9600, 4800, 2400, or 1200.

The modified baud rate will take effect immediately, so the user must change the baud rate on the terminal interface software used on the computer side in order to continue communicating with the MitiGator. The modified baud rate will affect the MitiGator application code as well as the bootloader - even though the baud rate cannot be changed in the bootloader.

The default baud rate is 38400 baud.

See Communications port.

CALIBRATE

The CALIBRATE command determines the full scale calibration values for each of the four accelerometer channels of the MitiGator.

Upon entering the CALIBRATE command, the user will be shown the current values of the full scale values for each channel. After confirming that a recalibration is desired, the user will be guided through an eight step process of turning the MitiGator so that each sensor is oriented positive and negative in order to obtain the range of each sensor. Upon EXITing EDIT mode, the updated parameters will be stored in FLASH memory.

The CALIBRATE sequence appears as follows:

```
EDIT>> calibrate
Current calibration values: Y:487, Z1:498, X:506, Z2:503,

Recalibrate (Y/N)? y
Position Y positive

Position Y negative

Position Z1 positive

Position Z1 negative

Position X positive

Position X negative

Position Z2 positive

Position Z2 negative

Calibration values: 488, 498, 508, 503,

Enter YES to accept: YES

New calibration values ACCEPTED
EDIT>>
```

The default full scale values are 500 counts for all channels.

This command is password protected.

See also THR command.

DEF

The DEF command is used to set MitiGator defaults. Setting MitiGator defaults will not affect baud rate, serial number, calibration, or password. Example:

```
EDIT>> def mtg
This command will default most MitiGator parameters

Are you SURE you want to do this (Y/N)? y
EDIT>>
```

At this time, four default options are available:

DEF MTG restores the defaults for a standard MitiGator, using threshold triggering and the standard MitiGator trigger filter with threshold values of 3.0%g.

DEF ASCE2597 restores the defaults for a MitiGator configured to meet ASCE 25-97, an ASCE standard for gas shutoff devices, including use of vector triggering and the ASCE specific trigger filter with threshold values of 17.5%g.

DEF ASMEA17 restores the defaults for a MitiGator configured to meet ASME A17.1, an ASME standard for elevators, using vector triggering and the standard MitiGator trigger filter with threshold values of 7.5%g.

DEF CA3137H restores the defaults for a MitiGator configured to meet California Code 3137, a California code of regulation for hospital elevators, using vector triggering and the standard MitiGator trigger filter with threshold values of 30.0%g.

WARNING: You should contact a California Registered Professional Engineer before using the CA3137H setting.

Command syntax: DEF (MTG/ASCE2597/ASMEA17/CA3137H)

EXIT

Upon exiting EDIT mode, the copy of the parameters is either discarded or is used to replace the active parameters and is also written to the parameter sector of the FLASH memory.

EXIT will save the modified parameters to FLASH memory and exit EDIT mode. Resulting message:

```
EDIT>> exit
Parameters have been updated.
>>
```

FILTER

The FILTER command is used to select between the standard MitiGator trigger filter and the filter as used to meet the ASCE 25-97 gas shutoff standard. Example:

```
EDIT>> filter 0
EDIT>> filter
Filter type: 0 (Standard)
EDIT>>
```

At this time, two options are available:

- Type 0 - Standard MitiGator trigger filter
- Type 1 - Trigger filter used to meet ASCE 25-97

Command syntax: FILTER n

Edit mode HELP

The EDIT mode has a help mechanism that operates identically to the HELP command of the MitiGator application firmware, with the exception that the actual commands available in EDIT mode are different.

The HELP available for EDIT mode is as follows:

```
EDIT>> help
BAUD baudrate: Sets serial port baud rate
CALIBRATE: Calibrates sensor channels
DEF type: Defaults most MitiGator parameters
EXIT: Exits edit mode saving parameters
FILTER type: Select trigger filter type
HELP: Displays edit command help summaries
LOWVDC voltage: Sets low voltage threshold
PASSWORD password: Enter new system password
QUIT: Quits edit mode NOT saving parameters
RELAY n polarity usage holdtime: Set relay 'n' parameters as follows:
    polarity=N (normal) or I (inverted)
    usage=T (threshold), TF (threshold/fault), V (vector), VF (vector/fault),
    P (power), F (fault), H (heartbeat)
    holdtime=hold time in MS (0=infinite)
RESET usage: Set reset line usage: 0=Reset alarm, 1=Reboot
SN n: Set serial number to 'n'
THR n Xthr Ythr Zthr: Set thresholds for relay 'n' for X, Y, Z
    as %g (0=unused)
EDIT>>
```

LOWVDC

The LOWVDC command specifies the level at which the MitiGator will determine that the input voltage level is too low for reliable operation, and will perform a software commanded power down.

After the power down, the LED will be turned off, the relays will revert to their default power on condition (de-energized) and the firmware will wait for restoration of power at least 0.5Vdc above the shutdown level for a period of two seconds.

If entered with no parameters, the LOWVDC command will display the current value of the Low Voltage Threshold parameter.

If entered with the parameter, the LOWVDC command accepts a Low Voltage Threshold value in volts DC. This value can range from 5Vdc to 30Vdc.

The low voltage sequence looks similar to the following:

```
LOW POWER: Voltage input 9.5Vdc
LOW POWER: Voltage input 9.4Vdc
LOW POWER: Voltage input 9.3Vdc
LOW POWER: Voltage input 9.2Vdc
LOW POWER: Voltage input 9.1Vdc
LOW POWER: Voltage input 9.0Vdc
LOW POWER: Voltage input 9.1Vdc
LOW POWER: Voltage input 9.4Vdc
LOW POWER: Voltage input 9.5Vdc
LOW POWER: Voltage input 9.7Vdc
LOW POWER: Voltage input 9.8Vdc
LOW POWER: Voltage input 9.8Vdc
LOW POWER: Voltage input 9.9Vdc
POWER restored. System re-initializing.
```

```
Trigger initializing. Please wait.
```

```
Trigger initializing. Please wait.
```

```
READY
```

NOTE: Because a low voltage level will cause the MitiGator to shut down and can make it difficult to communicate with the MitiGator, be careful not to set the low voltage alert level too high.

The default voltage threshold value is 9.0Vdc.

See Power down.

PASSWORD

The PASSWORD command allows you to change the MitiGator password that is used to password protect critical parameters.

Since the password is entered as a parameter, it is recommended that the password NOT contain spaces, tabs, or other specialized characters. The password may be a maximum of 11 bytes in length (12 including the internally required terminating NULL).

The password may contain alphabetic or numeric characters, as well as most special characters like *, %, or \$. The password is case sensitive, so "abc" is not the same as "ABC".

This command is password protected.

See LOCK and UNLOCK

QUIT

Upon exiting EDIT mode, the copy of the parameters is either discarded or is used to replace the active parameters and is also written to the parameter sector of the FLASH memory.

QUIT will exit EDIT mode without saving the altered parameters. Resulting message:

```
EDIT>> quit
Parameter edit has been aborted.
>>
```

RELAY

The RELAY command is used to determine how relays behave, and under which conditions they are changed. The RELAY command may be entered with or without parameters.

If entered with no parameters, the RELAY command will cause the current settings of the RELAY parameters to be displayed as follows:

```
EDIT>> relay
Relay parameters:
  Relay 1: N T 5000
  Relay 2: N T 6000
  Relay 3: N T 7000
EDIT>>
```

If entered with parameters, the RELAY command accepts four parameters, that are:

- The relay number - ranging from 1 to 3
- The state - N for Normal, I for Inverted. If normal, the 'set' state will be relay energized, and the 'unset' state will be relay de-energized. If inverted, the 'set' state will be relay de-energized, and the 'unset' state will be relay energized.
- The usage - T for Threshold, TF for Threshold/Fault, V for Vector, VF for Vector/Fault, P for Power, F for Fault, H for Heartbeat.

T usage will cause the relay to set when the corresponding threshold is exceeded.

TF usage will cause the relay to set when the corresponding threshold is exceeded or when a fault is detected. Note that fault indication is not subject to automatic reset by the hold time parameter.

V will cause the relay to be set when the total vector (acceleration in any direction) exceeds the threshold.

VF will cause the relay to be set when the total vector (acceleration in any direction) exceeds the threshold or when a fault is detected. Note that fault indication is not subject to automatic reset by the hold time parameter.

P usage will cause the relay to set when power is detected.

F usage will cause the relay to set when the self test is detected as successful. A failed seismic sensor will be indicated as a fault.

H usage will cause the relay to alternate between set and unset - unless a fault is detected.

- The hold time - Once triggered due to a threshold or vector trigger, the hold time specifies the amount of time in milliseconds that the relay remains set before being cleared again. If the hold time is zero, then the relay will remain set until the clear switch is activated, clearing the alarm.

NOTE 1: For vector detection usage, the MitiGator will compute the vector sum of the acceleration and compare it against the threshold. This means for example that if the threshold is set for 0.020g, that movement on an almost 45 degree angle along any two axes of 0.014g in both directions and a small movement in the third axis would be enough to trigger the system. This allows the MitiGator to trigger based upon the total vector of acceleration in ANY DIRECTION. The following calculations would be used:

$$\begin{aligned} & \text{SQRT}((X * X) + (Y * Y) + (Z * Z)) \\ &= \text{SQRT}((0.014 * 0.014) + (0.014 * 0.014) + (0.005 * 0.005)) \\ &= \text{SQRT}(0.000196 + 0.000196 + 0.000025) \\ &= \text{SQRT}(0.000417) \\ &= 0.0204205... \end{aligned}$$

NOTE 2: When using vector detection, all threshold values of the relay must be set to the same non-zero value.

The default settings are normal polarity, vector triggering, and hold time of zero for all relays.

See THR command.

RESET

The RESET command is used to determine the behavior of the MitiGator when the Clear Switch is pressed. The Clear Switch can either be used to clear a pending seismic alarm, or to cause reset and reboot of the MitiGator.

If entered with no parameters, the RESET command will display the currently defined function of the Clear Switch as follows:

```
EDIT>> reset
Reset usage: 0 (Reset alarm)
EDIT>>
```

If entered with the parameter, the RESET command specifies the action of the Clear Switch when it is pressed. 0 indicates that the Clear Switch should clear any pending seismic alarm, while 1 indicates that the MitiGator should be completely reset and rebooted.

The default value is 0 - Clear switch resets alarm.

See Clear Switch and Displaying peaks

SN

The SN command is used to set the serial number of the MitiGator. The serial number may be any number in the range 0 through 99999.

If entered without a parameter, the SN command will display the current serial number of the MitiGator. For example:

```
EDIT>> sn
Serial Number: 5012
EDIT>>
```

If entered with a parameter, the SN command will set the serial number of the MitiGator to the value specified.

The default serial number (before setting at factory) is 0.

This command is password protected.

See VER, PASSWORD, LOCK and UNLOCK commands

THR

The THR command sets the threshold levels for each channel and for each relay as a percentage of g.

NOTE: Although the MitiGator has four sensor channels, two vertical channels are combined to improve the behavior of the Z channel. The THR command, therefore, specifies thresholds for X, Y, and Z.

If entered without parameters, the THR command will display the current settings of the relay thresholds. For example:

```
EDIT>> thr
Thresholds:
  Relay 1: X2.0%g Y2.0%g Z2.0%g
  Relay 2: X2.0%g Y2.0%g Z2.0%g
  Relay 3: X2.0%g Y2.0%g Z2.0%g
EDIT>>
```

If entered with parameters, the THR command specifies the current settings as a percentage of g for each axis for the specified relay. Threshold values may range between 0 (unused) and 50%.

NOTE 1: If any one channel exceeds the specified threshold, then that relay will be considered triggered and will be set accordingly.

NOTE 2: When using vector detection, all threshold values of the relay must be set to the same non-zero value.

The default thresholds are 3.0% of g on all axes.

See RELAY and CALIBRATION commands.

Bootloader

The MitiGator bootloader is the first part of the firmware executed after power is applied.

See Power up section for details.

During the startup of the bootloader, the user is given an opportunity to jump quickly into the application firmware, do nothing and end up in the application firmware after a ten second timeout, or press the SPACE bar and enter the bootloader menus. The bootloader will also revert to the bootloader menus if it determines that the application firmware is corrupted.

The bootloader consist of a set of commands, outlined in the following sections, that provide a number of maintenance and diagnostic capabilities. The basic mechanisms of using the bootloader menus and commands are identical to those of the MitiGator application firmware. See Commands (application firmware) section for details.

The bootloader specific commands are as follows.

DIAG

The DIAG command places the MitiGator bootloader firmware into a mode that allows the user to utilize various diagnostic functions.

When in DIAG mode, the command prompt will be changed to DIAG followed by two right angle brackets, as follows:

```
[DIAG MODE]
DIAG>> HELP
```

QUIT will exit DIAG mode.

A complete list of DIAG mode commands is given in the Diagnostic commands section.

Bootloader HELP

The bootloader has a help mechanism that operates identically to the HELP command of the MitiGator application firmware, with the exception that the actual commands available in the bootloader are different.

The HELP available for the bootloader is as follows:

```
>> help
DIAG: Diagnostic mode
HELP: Displays command help summaries
NEWBOOT: Download new Boot Loader
NEWAPP: Download new Application
SYSRESET: System reset
VER: Displays system version
>>
```

NEWBOOT

The NEWBOOT command is used to download a new version of the MitiGator bootloader. The image file is to be in Motorola S record format, and needs to be downloaded using the KMICON support software.

To start the download of a new bootloader, enter the NEWBOOT command, and confirm that you really want to download new firmware. Once confirmed, press the F1 key within KMICON and enter the filename of the bootloader image file to be downloaded. The bootloader downloading process should end up looking something like the following:

```
>> newboot
This will replace the boot loader image in flash memory.

Are you SURE you want to do this (Y/N)? y
Transmit new Boot Loader image now.
FileName of S record file: MTGBL100.IMG
S123000000C01010FFFE0000040004040408040C041004140418041C042004240428042CC7
S1230020043004340438043C044004440448044C045004540458045C046004640468046C9C
S1230040047004740478047C048004840488048C049004940498049C04A004A404A804AC7C
S123006004B004B404B804BC04C004C404C804CC04D004D404D804DC04E004E404E804EC5C
:
:
S12372E86C6F636B2074696D65207365742074657374000D0A5B44494147204D4F44455D95
S12373080020697320612070726F74656374656420636F6D6D616E640055736167653A20AC
S11F7328002000206E6F7420612076616C696420636F6D6D616E64003C003E008A
S9030000FC
File transfer successful!
Erasing flash code sector...
Programming flash code...
.....
Flash memory has been updated...
Rebooting...
```

If the download process fails due to a bad image file, inability to find the image file, or communications problems, the programming (updating of the FLASH memory) will be skipped. No change will result from the failed download.

After a successful download and FLASH programming, the MitiGator will reboot.

NOTE: Should the bootloader reprogramming be interrupted, the consequences are serious. If the bootloader FLASH sector is corrupted, the MitiGator will be unable to locate usable code at startup and will fail to start. If this occurs, the MitiGator will be unresponsive at startup, despite proper connection of power and/or communications. Special care should be taken to not disrupt programming of the bootloader sector or the units may need to be returned to Kinometrics for repair.

See KMICON

NEWAPP

The NEWAPP command is used to download a new version of the MitiGator application firmware. The image file is to be in Motorola S record format, and needs to be downloaded using the KMICON support software.

To start the download of a new application firmware, enter the NEWAPP command, and confirm that you really want to download new firmware. Once confirmed, press the F1 key within KMICON and enter the filename of the MitiGator application image file to be downloaded. The application firmware downloading process should end up looking something like the following:

```
>> newapp
This will replace the application image in flash memory.

Are you SURE you want to do this (Y/N)? y
Transmit new Application image now.
FileName of S record file: MTG110.IMG
S22401000000C11010FFFFE0000040004040408040C041004140418041C042004240428042CC4
S224010020043004340438043C044004440448044C045004540458045C046004640468046C9A
S224010040047004740478047C048004840488048C049004940498049C04A004A404A804AC7A
S22401006004B004B404B804BC04C004C404C804CC04D004D404D804DC04E004E404E804EC5A
:
:
S224014EC6636F6D6D616E640055736167653A20002000206E6F7420612076616C69642063D3
S224014EE66F6D6D616E64003C003E0A004B4D49004D544720312E30004D544720312E300097
S224014F064E6F20706172616D6574657220626C6F636B202D2064656661756C742070617207
S212014F26616D657465727320757365642E0087
S9030000FC
File transfer successful!
Erasing flash code sector...
Programming flash code...
.....
Flash memory has been updated...
Rebooting...
```

If the download process fails due to a bad image file, inability to find the image file, or communications problems, the programming (updating of the FLASH memory) will be skipped. No change will result from the failed download.

After a successful download and FLASH programming, the MitiGator will reboot.

NOTE: Should the application reprogramming be interrupted, the bootloader may detect this upon trying to start the application firmware. If it does, the MitiGator will display a message and enter the bootloader menus so you can correct it. However, if the bootloader is unable to detect the errors, it will repeatedly enter the faulty application code, crash, and restart the bootloader - that will again crash and restart the bootloader. You can interrupt this loop by pressing the SPACE bar at the appropriate time to enter the bootloader menus.

See KMICON

Bootloader SYSRESET

The SYSRESET command causes the MitiGator to restart the firmware by re-executing the bootloader. The user then has the opportunity to intervene and perform bootloader specific functions, or to allow restarting of the MitiGator application firmware.

See Power-up.

Bootloader VER

The VER command displays the system banner, that includes the version number of the bootloader firmware in use. For example:

```
>> ver  
  
KMI MitiGator Relocatable Boot Loader v1.0  
  
>>
```

NOTE: There is also a VER command in the MitiGator application firmware, that will display the system banner, and thus the version number, of the application firmware.

See Power-up.

Diagnostic commands

The MitiGator bootloader contains a number of diagnostic commands that cover a wide range of capabilities, from factory testing through items of interest to some MitiGator users. Most of these diagnostic commands will be of no interest to the typical MitiGator user.

In particular, those diagnostic commands beginning with an X are reserved for factory use on future versions of the MitiGator and related products. If used, they will very likely cause the MitiGator to reset and restart.

The diagnostic commands available are as follows.

AQDVM

The AQDVM command displays the current values of the XYZ axes. The values are displayed in g for the XYZ axes with the two internal Z axis channels combined and averaged as would be done during actual live operation.

AQDVM defaults on start up to removal of the current offset, since the raw data values output by the sensors include a significant offset that must be removed by offset subtraction or another method of mean removal.

The AQDVM function will continue until one of the following types of keys are pressed:

- "Z" will cause the next sample read from each channel to be treated as zero, so that future displayed samples are offset by this value. "Z" is useful in checking for sensor drift.
- "C" will clear the offset value previously set by "Z".
- Any other key will terminate AQDVM.

The AQDVM display appears as follows:

```
DIAG>> aqdvms
Reading Sensor samples - Z to zero, C to clear offset
... any other key to stop.
X: +0.000g      Y: +0.002g      Z: -0.001g
```

```
DIAG>>
```

BAT

The BAT command displays the value of the battery monitor. The displayed value is updated once per second, and displays the detected voltage in Vdc. The voltage can theoretically range from 0Vdc to 40Vdc.

The BAT command will continue to monitor and display the current battery voltage until a key is pressed. The Battery voltage test display looks as follows:

```
DIAG>> bat
Battery Voltage. Press any key to stop
VDC: 14.02
VDC: 14.02
VDC: 14.02
VDC: 14.02
VDC: 14.02
DIAG>>
```

CLKLOK

The CLKLOK command displays the current state of the internal CPU clock lock test. The CPU is able to detect whether or not the CPU clock has locked to the supplied frequency.

The CLKLOK command will continue to monitor and display the state of the CPU clock lock test until a key is pressed. The CPU clock lock test display looks as follows:

```
DIAG>> clklok
Checks CPU Clock lock. Any key to stop.
Locked
Locked
Locked
Locked
DIAG>>
```

CSW

The CSW command is used to indicate the current state of the MitiGator clear switch. The switch input is scanned periodically, and when the state changes between pressed and released, a message is displayed.

The CSW command will continue to monitor and display the state of the clear switch until a key is pressed. The clear switch test display looks as follows:

```
DIAG>> csw
Reading Clear Switch. Press any key to stop
Switch released
Switch pressed
Switch released
Switch pressed
Switch released
DIAG>>
```

CSAPP

The CSAPP command performs a checksum on the MitiGator application firmware sector. The computed checksum is displayed something like the following:

```
DIAG>> csapp
Checksum: 0x8BEE
DIAG>>
```

CSBL

The CSBL command performs a checksum on the MitiGator bootloader firmware sector. The computed checksum is displayed something like the following:

```
DIAG>> csbl
Checksum: 0x8074
DIAG>>
```

DGSEQ

The DGSEQ command performs a canned diagnostic sequence means to help determine that most of the MitiGator hardware is functioning normally.

This test command is intended primarily for internal Kinometrics testing. Unless you have access to the reset switch for the 4th and 5th parts of the test sequence, it is recommended that this command not be used by the end user as the test sequence will wait "forever" for the switch to be put into the expected states.

After entering the DGSEQ command, the following sequences are performed:

- Performs a RAM test on the upper RAM segment (11 times)
- Computes the checksum of the bootloader FLASH sector
- Computes the checksum of the application FLASH sector
- Checks to make sure the clear switch is cleared

- Checks to make sure the clear switch is set
- Cycles the LED 20 times
- Cycles each relay 20 times
- Checks and reports battery voltage 10 times

The diagnostic sequence display looks as follows:

```
DIAG>> dgseq
Testing RAM...
Loop: 1, errors: 0, 0
Loop: 2, errors: 0, 0
Loop: 3, errors: 0, 0
Loop: 4, errors: 0, 0
Loop: 5, errors: 0, 0
Loop: 6, errors: 0, 0
Loop: 7, errors: 0, 0
Loop: 8, errors: 0, 0
Loop: 9, errors: 0, 0
Loop: 10, errors: 0, 0
Loop: 11, errors: 0, 0
Boot Loader Checksum: 0x8074
Application Checksum: 0x8BEE
Waiting for switch to clear...
Waiting for switch to be pressed...
Cycling LED...
Cycling Relay 1...
Cycling Relay 2...
Cycling Relay 3...
Checking battery voltage.
VDC: 13.98
VDC: 14.02
VDC: 14.02
VDC: 14.02
VDC: 14.02
VDC: 14.02
VDC: 14.02
VDC: 14.02
VDC: 14.02
VDC: 14.02
VDC: 14.02
Diagnostic Sequence Completed - No errors detected
DIAG>>
```

Diag mode HELP

The DIAG mode has a help mechanism that operates identically to the HELP command of the MitiGator application firmware, with the exception that the actual commands available in DIAG mode are different.

The HELP available for DIAG mode is as follows:

```
DIAG>> help
AQDVM: Sensor input test
BAT: Battery Voltage test
CLKLOK: CPU Clock lock test
CSW: Clear Switch test
CSAPP: Compute checksum of Application
CSBL: Compute checksum of Boot Loader
DGSEQ: Canned DIAG sequence
HELP: Displays DIAG command help summaries
LED state: Turn LED ON (1) or OFF (0)
QUIT: Quits DIAG mode
RAM: RAM memory test (word based)
RMS: Noise test via RMS (RETURN when done)
SMPGET channel: Collect sensor samples
SMPSND filter: Upload samples for channel
RELAY relay# state: Turn relay ON (1) or OFF (0)
XCODE: Extended code/param flash test
XEVENT: Event flash test
XRCLK: Clock time read test
XTEMP: Temperature sensor test
XTIME mmddyyhhmmss: Clock time set test
DIAG>>
```

LED

The LED command is used to turn on or off the LED for testing.

Entering a parameter of 0 turns the LED off, while entering a parameter of 1 turns the LED on.

Diag mode QUIT

QUIT will exit DIAG mode, and return to the bootloader menus.

RAM

The RAM command will perform a RAM test on the upper bank of MitiGator RAM. This test walks a pattern through the RAM looking for the ability to store data and retrieve the correct value, as well as looking for intercell crosstalk.

The RAM test will run repeatedly until a key is pressed, and reports errors in terms of the number of total errors (including storage and retrieval errors), and a separately reported number of intercell crosstalk errors.

The RAM test display looks as follows:

```
DIAG>> ram
RAM test started. Press any key to exit
Loop: 1, errors: 0, 0
Loop: 2, errors: 0, 0
Loop: 3, errors: 0, 0
Loop: 4, errors: 0, 0
DIAG>>
```

RMS

The RMS command collects 8000 samples each from all four sensor channels at 512 samples per second. This operation is performed continuously, with the values from each set of readings displayed at the end of each cycle. When the user enters a RETURN key to terminate the test, the peak RMS values detected are displayed in counts and g. The System RMS is displayed in g as XYZ with the two physical Z axes channels combined and averaged as would be done during actual live operation.

The samples are stored in RAM so they can be collected quickly, and can be scanned to compute the RMS of the sensor.

The LED will flash quickly during the test.

The RMS display looks as follows:

```
DIAG>> rms
Checks RMS noise level. RETURN to stop.
0.0025g    0.0028g    0.0029g    0.0024g
0.0026g    0.0029g    0.0028g    0.0024g
0.0025g    0.0027g    0.0029g    0.0024g
0.0025g    0.0027g    0.0022g    0.0024g
0.0024g    0.0027g    0.0023g    0.0030g
0.0025g    0.0028g    0.0022g    0.0024g
Peak RMS[0] = 1.343 counts, 0.0026g
Peak RMS[1] = 1.521 counts, 0.0029g
Peak RMS[2] = 1.528 counts, 0.0029g
Peak RMS[3] = 1.584 counts, 0.0030g

System RMS:
X: 0.0022g, Y: 0.0024g, Z: 0.0025g
DIAG>>
```

The RMS process will run until terminated by user input.

SMPGET

The SMPGET command collects 8000 samples from the given sensor channel (1-4) at 512 samples per second. The samples are stored in RAM so they can be collected quickly, and can then be uploaded separately using the SMPSND command.

There is no particularly interesting display for SMPGET.

The SMPGET process takes approximately 16 seconds to complete.

SMPSND

The SMPSND command uploads samples previously collected with the SMPGET command. A parameter indicates whether or not the samples should be filtered using the MitiGator trigger filter (1) or transmitted without modification (0).

Samples are uploaded without using any protocol, and can be captured using the capture feature of KMICON. Samples are formatted as PWM waveform percentage similar to AQDVM.

SMPGET and SMPSND are useful in collecting samples for frequency analysis and digital filter design during MitiGator testing.

The SMPSND output looks something like as follows:

```
DIAG>> smpsnd 0
44.766
44.730
44.676
44.690
:
:
44.727
44.716
44.716
DIAG>>
```

RELAY

The RELAY command is used to turn on or off the specified relay for testing.

The RELAY command accepts two parameters. The first parameter is the relay number (1-3), and the second parameter is the state. 0 turns the relay off, while a 1 turns the relay on.

XCODE

The XCODE command erases and writes a test pattern to the parameter and application firmware FLASH memory sectors. The purpose of the test is to assure that the flash sectors are operating correctly.

NOTE: The XCODE command will erase the MitiGator parameter and application firmware FLASH sectors. After confirmation, this action cannot be undone.

XEVENT

The XEVENT command erases and writes a test pattern to the extended FLASH memory sectors used as event storage. The purpose of the test is to assure that the flash sectors are operating correctly.

NOTE: The XEVENT command will erase the MitiGator/QDR extended FLASH sectors used as event storage. After confirmation, this action cannot be undone.

NOTE: The XEVENT command will not function with most MitiGator hardware, as they are not equipped with the necessary hardware to support the command. Use of this command will most likely cause a reset and reboot of the MitiGator.

XRCLK

The XRCLK command reads and displays a previously set clock value (previously set using the XTIME command). The clock value will be read and displayed based upon the 1pps heartbeat interrupt from the clock hardware, and will in turn read and display the clock's current date and time.

The XRCLK command will display the clock value once per second repeatedly until a key is pressed to stop it. The XRCLK display looks as follows:

```
DIAG>> xrclk
1PPS Clock test. Outputs clock count each time a
clock interrupt is received. Press any key to stop.
09/16/98 17:09:23
09/16/98 17:09:24
09/16/98 17:09:25
09/16/98 17:09:26
09/16/98 17:09:27
DIAG>>
```

NOTE: The XRCLK command will not function with most MitiGator hardware, as they are not equipped with the necessary hardware to support the command. Use of this command will most likely cause a reset and reboot of the MitiGator.

See XTIME.

XTEMP

The XTEMP command reads and displays the value of the temperature sensor hardware and displays the value in degrees C.

XTEMP will displays values repeatedly until a key is pressed to stop it. The XTEMP display looks as follows:

```
DIAG>> xtemp
Temperature Sensor. Press any key to stop
TEMP: 31.5
TEMP: 32.0
TEMP: 31.5
TEMP: 31.5
TEMP: 31.5
DIAG>>
```

NOTE: The XTEMP command will not function with most MitiGator hardware, as they are not equipped with the necessary hardware to support the command. Use of this command will most likely cause a reset and reboot of the MitiGator.

XTIME

The XTIME command is used to set the clock to the given value. The clock date and time can be read back using the XRCLK command. There is no particularly interesting display from the XTIME command.

The parameter passed to the XTIME command is the current date and time, formatted as mmddyyhhmmss. Hours are specified as 24 hour values (0-23). Time of the clock is set immediately as soon as the RETURN is pressed - there is no separate synchronization step.

January 17, 1998 at 13:52:15 (1:52pm) would be specified as 011798135215

NOTE: The XTIME command will not function with most MitiGator hardware, as they are not equipped with the necessary hardware to support the command. Use of this command will most likely cause a reset and reboot of the MitiGator.

See XRCLK.

Distribution

The MitiGator firmware and support software is distributed on a CD, or may be downloaded from the Kinometrics web site.

The distribution consists of the following components:

- MTGBLxxx.IMG - MitiGator bootloader image file
- MTGxxx.IMG - MitiGator application image file
- README.1ST - MitiGator change history
- 302700.PDF - This manual in Adobe PDF format
- KMICON.EXE - KMI Console program executable for Windows 95, 98 or NT. See separate sections on KMICON in this document, and instructions for downloading new firmware to the MitiGator.
- The Adobe Acrobat reader

KMICON utility

The KMICON program is used to provide a simplistic Monitor Mode interface to COM ports COM1 thru COM20.

KMICON is provided as a standalone internal KMI testing program, and is bundled with the KMI MitiGator firmware distribution. It is provided as a separate package because although any standard terminal emulation program would be sufficient for basic interface with the MitiGator, special software was required to support downloading of new firmware to the MitiGator.

KMICON assumes that an Operating System driver has been used to map the hardware to the device names COM1 through COM20 - it does not attempt to communicate directly with the hardware.

KMICON Installation

As provided as a bundled part of the KMI MitiGator distribution, KMICON.EXE should be manually copied from the distribution into your system path (On NT, we recommend C:\Winnt\system32).

You start KMICON by typing the command "KMICON" from a Command Prompt window.

KMICON Operation

Once the program has been started, you will see a version number, such as:

KMI Terminal Window v1.3

Followed by:

COM port (Enter '2' for COM2):

At this point, enter the COM port number for COM ports 1 thru 20. For example, if you want COM2, enter '2' and press RETURN.

Next you will see:

Baud rate (9600 for 9600 baud):

Now, enter the baud rate you wish to use. The number is entered directly, such as 9600 for 9600 baud. Available choices include: 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600. Enter your choice and press RETURN.

The system will now confirm your settings:

The baud rate is 9600 on COM2
<ESC> toggles capture mode (to C:\temp\capture.log)
<F1> allows for S record file transfer (from given filename)

You are now connected to and communicating with the specified COM port. Whatever you type will be sent to the MitiGator, and whatever is echoed or written to the COM port by the MitiGator will be displayed on the KMICON window.

KMICON Capture Mode

Capture mode provides the ability to save the results of a KMICON session to a file C:\temp\capture.log. Before using the capture mode, be certain that the C:\temp directory exists.

Pressing ESC the first time will result in the message:

Capture mode ON

From this point on, any incoming characters in this port, that are displayed on the KMICON window, will also be written to the C:\temp\capture.log file.

To complete the capture function so that you may use the captured results, press ESC again, that will result in the message:

Capture mode OFF

KMICON S Record File Transfer

Once the MitiGator is expecting a file transfer to occur, select the KMICON window and press F1 on the keyboard. You will be asked for the filename to be transferred as follows:

FileName of S record file:

Enter the path and filename of the file to be transferred, and press RETURN. KMICON will display the S records as they are transmitted, including any retransmissions due to error recovery. At the end of the file transfer, your screen should look something like the following:

```
>> newapp
This will replace the application image in flash memory.

Are you SURE you want to do this (Y/N)? y
Transmit new Application image now.
FileName of S record file: MTG110.IMG
S22401000000C11010FFFE0000040004040408040C041004140418041C042004240428042CC4
S224010020043004340438043C044004440448044C045004540458045C046004640468046C9A
S224010040047004740478047C048004840488048C049004940498049C04A004A404A804AC7A
S22401006004B004B404B804BC04C004C404C804CC04D004D404D804DC04E004E404E804EC5A
:
:
S224014EC6636F6D6D616E640055736167653A20002000206E6F7420612076616C69642063D3
S224014EE66F6D6D616E64003C003E0A004B4D49004D544720312E30004D544720312E300097
S224014F064E6F20706172616D6574657220626C6F636B202D2064656661756C742070617207
S212014F26616D657465727320757365642E0087
S9030000FC
File transfer successful!
Erasing flash code sector...
Programming flash code...
.....
Flash memory has been updated...
Rebooting...
```

KMICON Session Termination

KMICON is terminated by closing the DOS command window. On Windows 95, 98 and NT, this is done by clicking the "X" in the upper right-hand corner of the window, or typing CTRL-C.

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