

Basic MitiGator+ Setup

Common Questions and Configuration
Issues Encountered with using the
EQMet MitiGator+ Seismic Switch

Application Note #76

Dennis Pumphrey

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Kinematics, Inc., 222 Vista Avenue, Pasadena, CA 91107. USA

Phone: + 1-626-795-2220 ■ Fax: + 1-626-795-0868

E-mail: support@eqmet.com

Website: www.eqmet.com

Kinematics SA, Le Tres 3, 1028 Preverenges, Switzerland

Phone: + 41-21-803-2829 ■ Fax: + 41-21-803-2895

E-mail: kmi_sa@bluewin.ch

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Introduction

The EQMet MitiGator+ Seismic Switch is an intelligent switch that is capable of detecting and acting on detected motion for the purposes of activating or shutting down related equipment.

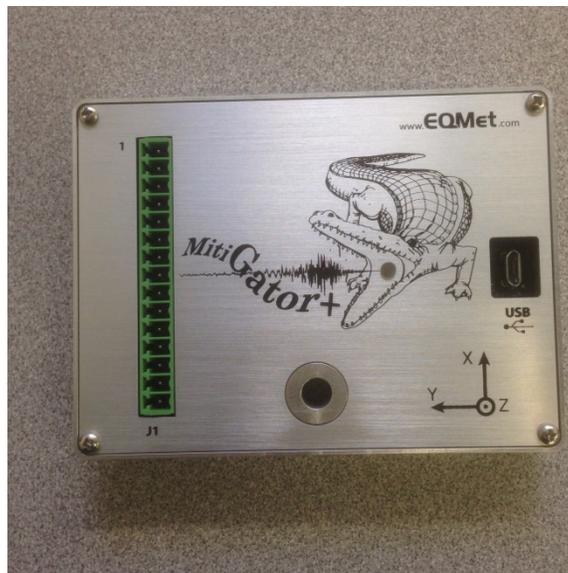
Often, those involved with setting up or configuring MitiGator+'s are unfamiliar with the use of such sensors. The purpose of this document is to help address the most common concerns and questions of those users.

For detailed reference material on the MitiGator+, see the *MitiGator+ User Manual* P/N 300996. This document is available for download from the EQMet web site at www.eqmet.com at downloads → downloads/support → downloads.

The MitiGator+ is available in two forms:

The MitiGator+ module

Intended mainly for OEM customers and Systems Integrators. In keeping with the needs of those users, wiring of the MitiGator+ for communication with a computer (for configuration purposes), reset buttons, and power supply (not included) is left to the user.



The MitiGator+-IND

A more complete pre-wired assembly that utilizes the same MitiGator+ module but includes a battery, battery charger, fuse, reset switch, 9 pin RS-232 connector, and a weather resistant box.



Common Basic Questions

What Independent Certification exists for the MitiGator+?

One question that often comes up from potential users of the MitiGator+ is that of independent certification.

The short answer is none. The MitiGator+ is not CSA, UL, or CE certified, although some distributors and 3rd systems integrators have undertaken specific certification at their own expense.

In addition to its general purpose design, the MitiGator+ is designed to be able to meet several common standards. The MitiGator+ should be able to meet the requirements of ASCE 25-97 (a gas shut-off standard), ASME A-17 (an ASME standard for elevators), and CA 3137H (a California standard for hospital elevators), although no certification tests have been performed and no certification obtained.

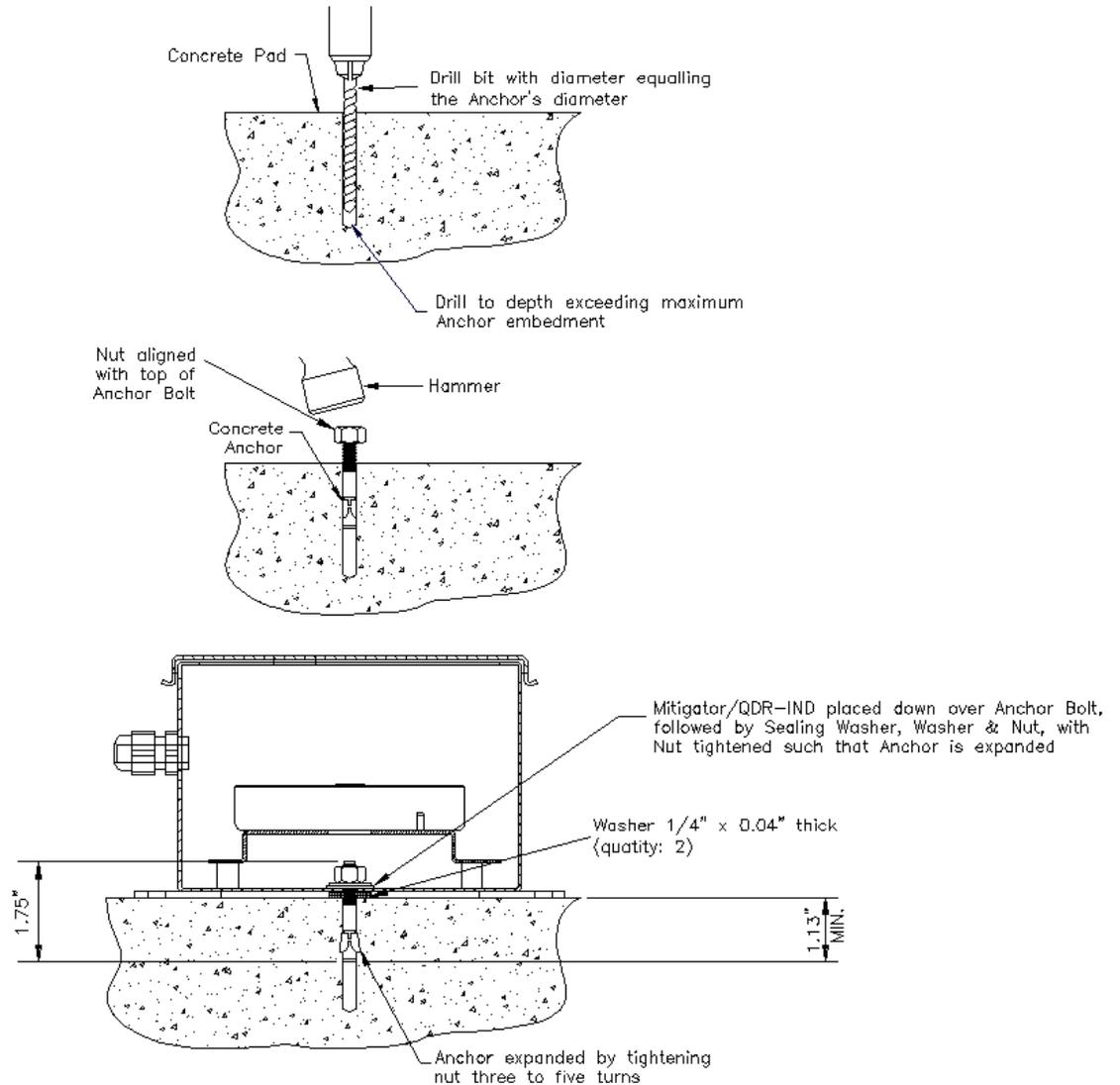
Why do I get False Triggers?

In my application of the MitiGator+, I seem to get a lot of false triggers. The unit triggers due to motion that we don't feel is important enough to trigger an alarm.

In the vast majority of cases, false triggers are due to improper mounting of the MitiGator+ or are due to inappropriate trigger levels.

Regarding mounting:

The MitiGator+ should be **mounted horizontally**, bolted into a concrete slab. It should normally not be mounted on a wall unless the wall is “substantial” (concrete or reinforced masonry) and any mounting “shelf” is substantial enough to not amplify ground vibrations that reach the sensor.



The MitiGator+ should be at ground level if at all possible.

Regarding trigger (sensitivity) levels:

The MitiGator+ is shipped with default settings, which use simple threshold triggering of 3% of g on all relays.

No single set of default settings will be good for all applications, so you'll probably have to adjust these settings. The levels may be changed to values between 1% and 50% of g.

See *Setting Trigger Levels*, which is a separate section below.

What is the Data Recording Format of the MitiGator+?

The MitiGator+ does not record files, so **there is no format**.

The MitiGator+ is a switch, and does not record the seismic activity that causes actuation of the switch. EQMet makes other products that are designed to record seismic events and which may be more suitable for an application that requires this functionality.

Is my MitiGator+ Dead?

If your MitiGator+ doesn't seem to respond and you're not sure about the health and well-being of your MitiGator+, here are some simple troubleshooting tips to help understand what the truth is:

Lights on?

First thing to do is check the LED on the top of the MitiGator+. After initial power-on, the MitiGator+ will perform a self-test and will turn the LED green if the self-test is successful.

If the LED never comes on, turns red, or turns off and stays off, those are bad signs. You should probably go next to *Look for Messages*, below.

Shake it

If the LED lights up, the next thing to do is to shake the sensor gently and see that it reacts correctly. If the MitiGator+ is mounted properly and the thresholds set right it should be difficult to trigger it unless there's an actual earthquake.

Unbolt the MitiGator+ from its mounting and give it a gentle shake to cause it to trigger. How gentle you need to be depends on how the thresholds have been set.

Look for Messages

If the MitiGator+ does not seem to be functioning properly, you'll need to connect a computer to it in order to see the messages that the MitiGator+ displays during startup. See the section below on *Communicating with the MitiGator+*.

After your computer is properly connected and you can communicate with the MitiGator+, turn the power to the MitiGator+ off. Wait 5 seconds, and turn the power back on. Watch the messages that come from the MitiGator+. They should look something like this:

```
KMI MitiGator+ Application Code v2.1
```

```
S/N: 5012
```

```
>>
```

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

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

```
READY
```

The specific versions will vary. So don't worry if your MitiGator+ reports v2.2 instead of v2.1. What you're looking for are unusual messages. Faults, Errors, or other messages that lead you to believe there is a problem.

Check Sensor Output

Finally, if all else seems OK, you may want to check the sensor output of the MitiGator+. To do this, start by connecting the computer to the MitiGator+ and turning the power off and back on as indicated above. When the MitiGator+ displays “READY”, press the RETURN key. It will look like this:

```
>>
```

Type DIAG at the >> prompt as follows:

```
>> diag
```

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

And type AQDVM at the DIAG prompt:

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

AQDVM will continue to output scaled raw data values for each axis. Press Z to zero-correct the display, and you should see values typically less than 0.010g.

Tilting the sensor 90 degrees in various directions should range the sensor readings between +1.000g and -1.000g.

If you get the type of output described here, the sensor is operating correctly.

If you get no sensor output on some channels (all zeros all of the time), or if the MitiGator+ reboots or displays Fault or Error messages, there is a problem with the unit.

How Do I Detect Fault Conditions?

In many uses of the MitiGator+, it is desirable to not only detect seismic triggers, but also to detect fault conditions that can range from failure of the input power to internal failures of the MitiGator+ itself.

The MitiGator+ supports several methods of indicating alarms and faults, and each of the three MitiGator+ relays may be used to indicate various conditions. There are more options than can reasonably be covered here, but we'll cover a few basic examples. For details, see the *MitiGator+ User Manual*, P/N 300996.

Simple Trigger Detection

By default, this is the standard setting. Relays are set for the T function (threshold detect), with N (normal) relay polarity, and no hold-time reset. This means that the relay will energize when a seismic trigger occurs, and will stay energized until the alarm is cleared.

```
EDIT>> RELAY 1 N T 0
```

Power-Safe Seismic Trigger Detection

By setting the relay to I (inverted) relay polarity, the relay will energize after the MitiGator+ powers up and initializes. If a seismic trigger OR a power failure occurs, the relay will de-energize. Note that all relays have both Normally Open and Normally Closed contacts.

```
EDIT>> RELAY 1 I T 0
```

Automatic Alarm Reset

In some cases, it is desirable to have the relays automatically reset after a seismic alarm. To do this, set the relay hold time parameter to a non-zero value. The hold time is specified in milliseconds (0.001 seconds). So to get the relay to auto-reset after 30 seconds, set the hold time to 30000.

```
EDIT>> RELAY 1 N T 30000
```

Detecting Internal Faults

One of the relay settings is the F (fault) function. When set in this way, the relay will indicate faults including power on self-test failures, or failure of the seismic sensors which are monitored constantly. As with the T setting, relay output can be Normal or Inverted.

The relay hold time parameter will not cause automatic reset of the fault condition.

The fault detection function may be a dedicated relay, or you may combine it with Threshold and/or power failure detection by using the TF setting.

```
EDIT>> RELAY 1 N TF 0
```

What is the Calibration Interval of the MitiGator+?

The MitiGator+ uses a MEMS silicon sensor. Strictly speaking, there are no mechanical parts, so **field recalibration is neither required nor recommended.**

For customers whose policies demand a periodic calibration, the unit should be returned to EQMet as special equipment is required to perform the calibration.

Even though periodic calibration is not required, as with all sensing devices, it's a good idea to periodically check to make sure the switch is still operating properly. To do this, follow the *Check Sensor Output* procedure described above.

Communicating with the MitiGator+

You communicate with the MitiGator+ using a serial (RS-232) connection. On a PC this is commonly called a COM port.

You can also communicate with the MitiGator+ via USB using the USB Device Driver available on our web site that presents the MitiGator+ to your Windows™ PC as a virtual COM port.

Communicating with the MitiGator+ should only be necessary for the following reasons:

- To change the setup of the MitiGator+ - for example to change trigger (sensitivity) levels, or how the relays respond to various conditions.
- To perform periodic checks or diagnostics of the unit (see *Check Sensor Output*, above).
- To check the peak trigger level detected by the MitiGator+ (only possible if the relay hold time has been set to zero so that the unit does not automatically clear the alarm).

NOTE that a computer connection to the MitiGator+ is NOT necessary for normal operation of the MitiGator+.

First of all, plug the cable into the PC and into the MitiGator+, and make sure the MitiGator+'s power is on.

- If you have a MitiGator+-IND, this is a standard 9 pin serial cable that you can get at any computer store. It is not supplied with the MitiGator+.
- If you have a MitiGator+ module only, this cable is one that you must make yourself. Only three wires are required (Transmit, Receive, and Ground). You can make this cable by purchasing a standard 9 pin serial cable and cutting and stripping one end of the cable. For wiring instructions, see the *MitiGator+ User Manual* P/N 300996.

Next, start your communications software on the PC. This can be any standard terminal program such as PuTTY or HyperTerminal™. The MitiGator+ is configured for 38400 baud with no flow control. At this point you should be able to communicate with the MitiGator+ by typing commands as described in the *MitiGator+ User Manual* P/N 300996.

```
>> 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
>>
```

If you can't communicate with the MitiGator+, check the cable wiring as this is the most common problem.

Setting Trigger Levels

The MitiGator+ is shipped with default settings, which use simple threshold triggering of 3% of g on all relays.

No single set of default settings will be good for all applications, so you'll probably have to adjust these settings. The levels may be changed to values between 1% and 50% of g.

The MitiGator+ convention is to enter and display threshold levels as % of g. For example, to trigger when the peak g level exceeds 0.050g, enter the threshold as 5.0 (% of g).

The TRIGGER peak and the AQDVM levels reported are in actual g, not percentage levels.

Consult the *MitiGator+ User Manual* P/N 300996 for details on the setup options.

How do I Know What Level to Set?

Trigger levels that are appropriate for your use will vary significantly depending on the structures (buildings, etc) that are involved, the site geology, and environmental noise such as people and machinery.

The best way to address all of the factors involved is to hire a civil engineer who can tell you what is appropriate for your specific situation.

Short of that, you can use the MitiGator+ to determine the common noise level at the site, and adjust the MitiGator+ Trigger level accordingly. This can loosely be called a site survey. The procedure is as follows:

Physically mount the MitiGator+ the way that you intend it to be used.

Set up your computer to communicate with the MitiGator+ as described in the section *Communicating with the MitiGator+*, above.

Enter EDIT mode by typing the EDIT command at the >> prompt:

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

Type the THR and RELAY commands and make note of the current settings:

```
EDIT>> thr
Thresholds:
  Relay 1: X3.0%g Y3.0%g Z3.0%g
  Relay 2: X3.0%g Y3.0%g Z3.0%g
  Relay 3: X3.0%g Y3.0%g Z3.0%g
EDIT>> relay
Relay parameters:
  Relay 1: N T 0
  Relay 2: N T 0
  Relay 3: N T 0
EDIT>>
```

Now, set the threshold level of the first relay to a very low trigger level (0.2% of g), and set the relay for a hold time value of zero:

```
EDIT>> thr 1 0.2 0.2 0.2
EDIT>> relay 1 N T 0
```

NOTE that the trigger levels you are entering are as % of g.

Then QUIT the EDIT mode to save the new values:

```
EDIT>> QUIT
>>
Trigger initializing. Please wait.
Trigger initializing. Please wait.
READY
```

The MitiGator+ should trigger almost immediately, and will stay triggered:

```
TRIGGER: X0.002g Y0.021g Z0.003g
TRIGGER: X0.002g Y0.021g Z0.003g
TRIGGER: X0.002g Y0.021g Z0.003g
TRIGGER: X0.002g Y0.021g Z0.003g
... and so on ...
```

At this point, you can disconnect the PC from the MitiGator+ (but leave the MitiGator+ powered on). The MitiGator+ when left in this mode will report the peak (highest) values seen until the unit is reset. If higher values occur in a few seconds – or tomorrow - they will be remembered and reported continuously in this manner.

We recommend that you get a good sample of the vibration at the site. This means you should leave the MitiGator+ in this “peak gathering” state for a few days – preferable for a week or more. Obviously, if there’s an earthquake during that time the test is invalid and must be repeated, but otherwise you are measuring the “cultural noise” at the site.

When you come back, reconnect your PC, and you should see continued peak values being reported:

```
TRIGGER: X0.022g Y0.071g Z0.033g
TRIGGER: X0.022g Y0.071g Z0.033g
TRIGGER: X0.022g Y0.071g Z0.033g
TRIGGER: X0.022g Y0.071g Z0.033g
... and so on ...
```

These values will undoubtedly be higher than the values when you left it. That is because the highest values seen are being remembered. Make a note of these values.

Determine your new trigger levels. Usually you want to use the same values for X and Y – so pick the greater of the two. You can use a different value for Z. Give yourself a little margin – say 1.2 times the values seen during the survey, and you have your new values.

Re-enter EDIT mode. The TRIGGER messages will continue to display. Ignore them. Enter the new values you have determined. With the example above, X=0.022, Y=0.071, so the highest value seen was 7.1%. The margin of 1.2 times 7.1 gives a new trigger level of 8.5%. A similar process is used for Z.

```
EDIT>> THR 1 8.5 8.5 4.0
```

Enter appropriate values for all three sets of relays if you are using all relays. Even if you are not using all relays, we recommend setting unused relays equal to or greater than the largest level used.

Now type QUIT, and the MitiGator+ will reinitialize itself with the new values.

```
EDIT>> QUIT
```

```
>>
```

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

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

```
READY
```

How do I Change Relay Behavior?

The MitiGator+'s three relays can be set to indicate various conditions, including seismic trigger, vector seismic trigger, power failure, internal sensor failure, and heartbeat. To change the relay settings, set up your computer to communicate with the MitiGator+ as described in the section *Communicating with the MitiGator+*, above.

Enter EDIT mode by typing the EDIT command at the >> prompt:

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

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 0
  Relay 2: N T 0
  Relay 3: N T 0
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 after the MitiGator+ initializes.

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, the relay will remain set until the clear switch is activated, clearing the alarm.

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

Are There Standard Setup Values?

Well, yes and no. As should be clear by now, not one set of parameters fits all applications. However, there are pre-determined sets of defaults that may make good starting points for some applications.

These are selected using the DEF command that is available from the EDIT mode:

```
EDIT>> def mtg
```

This command will default most MitiGator+ parameters

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

```
EDIT>>
```

All relays are set for the same trigger levels, N (normal) relay polarity, and no hold time automatic reset. T (threshold) or V (vector) triggering will depend on the set of defaults chosen.

At this time, four default sets 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.

What if I have Other Questions?

If you have further questions regarding the MitiGator+, we refer you to the *MitiGator+ User Manual*, P/N 300996.

If your questions are still not answered, please send e-mail to support@eqmet.com, we take all Technical Support inquiries seriously and respond to them as quickly as we can. We find that this system works well for Technical Support inquiries in most cases as it allows us to direct the inquiries to available knowledgeable personnel. We also find that writing down the question in the e-mail helps clarify the question. Making Technical Support efficient and a satisfactory process helps us keep the prices of products like the MitiGator+ low – which benefits everyone.