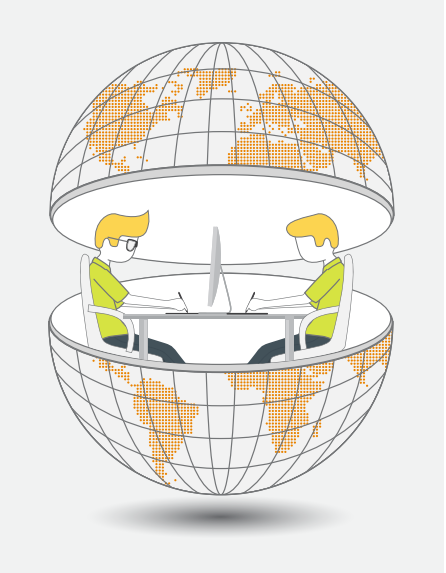
FIVE QUESTIONS TO ASK YOURSELF WHEN MEASURING OVER 50 G



When it comes to researching, developing, and testing products in harsh and complex environments, accelerometers can provide invaluable data.

In some industries, however, there can be challenges to collecting that data—especially when measuring at a high g-force. And since an accelerometer's application is only as good as its accuracy, you'll want to consider what contributes to those challenges before making decisions on what accelerometers you'll use.

INSIDE THIS REPORT, WE'LL EXAMINE FIVE QUESTIONS YOU CAN ASK YOURSELF WHEN PLANNING TO MEASURE OVER 50 G:

1. WHAT IS THE EXPECTED DYNAMIC RANGE YOU WILL BE MEASURING OR TESTING?
2. WHAT IS THE MEASUREMENT BANDWIDTH?
3. HOW WILL THE SENSOR BE MOUNTED DURING TESTING?
4. WHAT CONDITIONS WILL YOU BE CONDUCTING YOUR TEST IN?
5. WHAT MEASUREMENT PARAMETER (EG. ACCELERATION, VELOCITY, DISPLACEMENT) DO YOU NEED?

QUESTION 1:

WHAT IS THE EXPECTED DYNAMIC RANGE YOU WILL BE MEASURING OR TESTING?

Results of high g-force tests can be difficult to predict—and determining the necessary full-scale range of the sensor may require some careful consideration

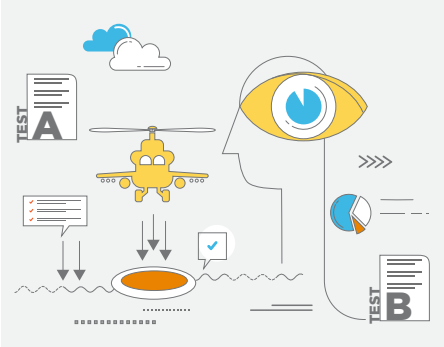
When using an accelerometer, you want to give yourself enough of a margin to ensure your test results are useable and the measurement range does not exceed the FS output of the accelerometer. If you don't, and your g-force is higher than your accelerometer's upper limits, you may end up clipping your signal and render your test results useless.

By best practice standards, you'll want to plan for your results to fall within 30-40% of the device's full-scale range, and never less than 10%.

If you run too low, your measurement resolution could be compromised.

QUESTION 2:

WHAT IS THE MEASUREMENT BANDWIDTH?

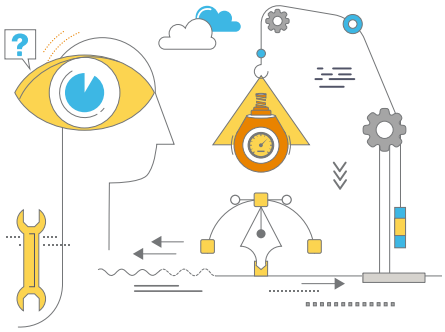


The measurement bandwidth you choose will depend on many factors, specifically the type of test and the impact surface.

If you're looking to measure a drop on a soft landing, for instance, a narrow bandwidth may be fine. But if you're looking to measure peak g's in high-impact tests, like munitions and automotive crashes, you'll need a wider bandwidth.

And that's where impact surface begins to play a role: If severe enough, high shock, metal-to-metal impacts can cause wider bandwidth accelerometers to break from resonance.

To combat this problem, a damped accelerometer can be used to prevent ringing and deliver accurate measurements.



> GUIDELINES FOR ADHESIVE MOUNTING ACCELEROMETERS

> GUIDELINES FOR SCREW MOUNTING ACCELEROMETERS

QUESTION 3:

HOW WILL THE SENSOR BE MOUNTED DURING TESTING?

As mentioned above, knowing the application is helpful in determining what type of accelerometer you'll need. But it's also important to know how you'll install the accelerometer, as well as where you'll place it.

These "how" and "where" questions help clarify considerations around design build and testing conditions.

For best results, accelerometers should be mounted rigidly to the apparatus. And while there are some materials, like cyanoacrylate that can be used to adhere an accelerometer to a device, most epoxies and glues should be avoided, as they'll serve as extra dampening agents and absorb energy before it can be registered by the accelerometer.

That type of "padding" will lead to inaccurate test results.

QUESTION 4:

WHAT CONDITIONS WILL YOU BE CONDUCTING YOUR TEST IN?

All accelerometers are compensated to a certain temperature range tolerance, so you'll need to know your testing conditions for an accurate reading.

But it's not just ambient temperature that's important. It's also the temperature of the device to which the accelerometer is being mounted, as well as any other environmental conditions that may be in play.

Conditions such as humidity, snow, altitude, and underwater submersion can play a role in determining what type of accelerometer will hold up best under the conditions it will be exposed to.

Though not weather related, another consideration is electromagnetic interference (EMI). This is particularly relevant when mounting, for example, to big motors in industrial plants and in Formula 1 racing applications.

To protect against EMI, accelerometers can be protected with voltage suppressors and internal shielding.

Regardless of conditions, knowing what they are—and picking the accelerometer that performs best in those conditions—is important. Because, in this situation, the risk isn't receiving inaccurate results; the risk is a failure of the device.

QUESTION 5:

WHAT MEASUREMENT PARAMETER DO YOU NEED?

While an accelerometer's function is to measure acceleration in g-forces, it can also be used to determine velocity and displacement.

If you're looking to measure either of those data points, you'll need a DC device.

While some believe piezoelectric accelerometers can be used to determine velocity and displacement, several studies have proven this is not true. The reason is the inherent characteristics of the piezoelectric crystal and the amount of time it requires to return to a true "0" reading.

Piezoelectric accelerometers can be used to determine peak acceleration, however the inherent zero shift caused by the PZT crystal will lead to inaccurate velocity and displacement results if any integration is performed on the output data.

CONCLUSION

At high g-forces, the collecting data for researching, developing, and testing has its own unique challenges.

Whether you're planning to use accelerometers in the lab (for shock, impact, or drop test measurements) or in the field (for measuring construction equipment, logging equipment, automotive crash tests or other applications), these questions will make sure your results are accurate, repeatable and linear.

> ACCELEROMETER BASICS

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