SigmaBoss™

DUO1 User manual

READ THIS FIRST

Security is a strategy – not a product for sale. Please don't make the mistake of mindlessly delegating your precious metal buying decision to an electronic meter. The SigmaBoss DUO1 provides an estimation of conductivity, which can be faked with certain copper alloys. You can only be reasonably sure of alloy purity if you can verify **both the conductivity and density** of your sample.

V1.1 04/2021

Quickstart Guide

① Get the SigmaBoss app from the Google Play store (an iOS app is in the works). Alternatively, if you know how to install an apk on your Android phone, you can download it directly from our website.

② Put batteries in the device. You'll need 3×AA 1.5V – either alkaline or $LiFePO_4$. Note you can't use NiMH 1.2V batteries – the voltage will be insufficient to power the analog circuitry.

③ Turn on the SigmaBoss DUO1 device. Make sure the sensors are clear of anything conductive so they can calibrate correctly. The red light turns on to indicate that battery voltage is adequate, and blinks when calibration is complete.

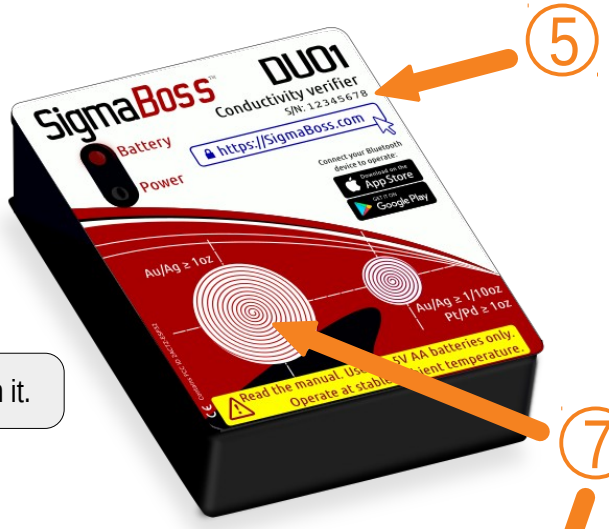
④ Grab your phone, enable bluetooth, open the app, and allow Bluetooth permissions when the app prompts. You'll need an internet connection to download the latest conductivity lookup table.

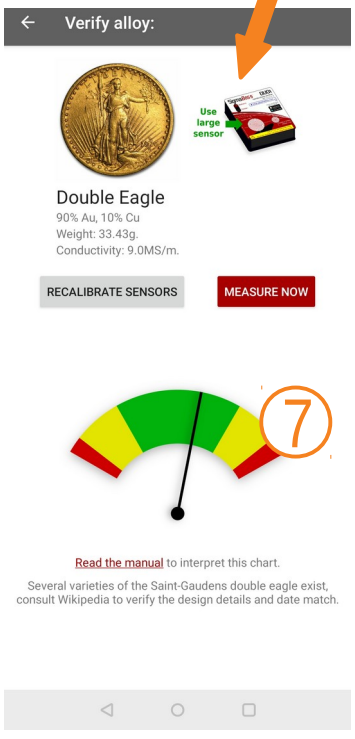
⑤ Enter the device serial number, then tap "Scan" in the app (your phone may take a few scan attempts to find and connect).

⑥ You're connected! Scroll and pick a coin to test by tapping on it.

⑦ Put your sample coin or bar on the appropriate sensor as indicated by the app (ensure it covers the sensor area completely!), and tap "measure". The gauge has a color-coded ranges of conductivity values, and the needle moves based on how many standard deviations the reading is from the mean for that coin (center of the green band). If your colored band is red, take a hard look at the sample – it has a high probability of being fake.

⑧ If you don't get the result you expect, it's worth testing a few times because the digital filtering and processing are prone to minor variations caused by electronic noise. You can also recalibrate by removing all samples from the sensors, and tapping "recalibrate sensors". Finally, remember that conductivity depends on temperature, and if your device wasn't calibrated at ambient temperature it will detect that its internal temperature has changed and will prompt you to recalibrate.





SigmaBoss DUO1 User Manual

The SigmaBoss DUO1 is a Bluetooth-enabled conductivity meter for precious metals. You control the device over Bluetooth using the companion app on your smartphone.

How does it work?

SigmaBoss devices work by inducing circulating currents in your precious metal sample, then measuring the currents and the magnetic coupling. The device then returns this data to your phone, where it's processed and converted to a conductivity reading.

It can measure gold and silver through 1.5mm thick plastic packaging on the large sensor, and 1mm plastic packaging on the small sensor. Some low-conductivity gold alloys, as well as platinum and palladium, may have trouble reading through thick plastic at the top of this range (the induced current may be too low). You will always get a more precise reading if you can place the sample bare on the sensor without packaging.

The SigmaBoss DUO1 can read slabbed coins through their packaging, but please note that slab cases maintain the coin a significant distance from the sensor, so the coin in question must be large and thick enough to induce sufficient current that the device sensor can "perceive" it. Smaller, thinner coins (such as fractional gold alloys) will likely not register, as their conductivity is so low and they are so small that they don't induce sufficient current.

If your coin is not yet in the list on the app, you can select a coin of identical alloy. Beware however, that for fractional alloys (eg 90% gold), trace contaminants in up the remaining fraction may cause conductivity to vary, especially in old gold.

The SigmaBoss DUO1 can read gold coins as small as 1/10 ozt, but note that coins must cover the sensor area entirely. It's not suited for testing jewelry, as you need a relatively flat, solid mass of metal in close proximity to the sensor so currents can circulate without being impeded by holes, links, and ornamentation.

Care and maintenance

The sensor is very sensitive to changes in conductivity, and you'll probably know that one of the big factors that changes conductivity is heat. When the device starts, it measures a calibration value of the sensor, and If you keep it in your pocket, and then take it out and try to measure as it cools down from body temperature to ambient air temperature, it won't return a consistent reading and will constantly require recalibration until it reaches a stable temperature.

Your device is a sensitive analog instrument; store it in a cool dry place.

Avoid getting scammed

When buying, as well as testing with your SigmaBoss device, consider:

- Do I trust the source? APMEX is a lot less likely to sell fake Perth mint bars than some guy in a parking lot.

- Does the counterparty have a good reason for selling? If they're trying to fleece you with fakes or fence stolen coins, and you choose to play that game, you'll likely lose your money. Why do business with someone seeking to defraud you? If you doubt their story, walk away.
- Is the price too low, especially for gold? No-one sells gold without looking at the spot price, and no-one looks at the spot price and then chooses to sell for several hundred dollars less "for a quick sale". Selling fakes on Craigslist under spot because the guy "doesn't have time to go to the local coin shop" is a common scan.
- Testing with a magnet. Gold, silver, and their alloys are not magnetic, but many fakes are iron alloy.
- Are they selling minted bars and won't remove them from the assay packaging? Gold-plated brass or iron bars are the most common fake bullion, because the vendor counts on you not being able to test the weight and dimensions. It's a mug's game to determine if gold is real by how nice the packaging is.
- If you're buying government bullion, get a known good sample from a reliable source. It's easy to tell if the American Silver Eagle in your left hand is fake when you have a real one in your right.

Troubleshooting

- If the device's LED does not turn on, this means the battery voltage is too low and the batteries must be replaced.
- If the coin is small, farther away (due to thick plastic packaging), or has low conductivity (such as a gold-copper alloy), the induced currents will be small and harder to measure. For example, a 1/10 American Gold Eagle coin is approximately one-quarter as conductive as 9999 gold, and in a graded plastic slab case the sensor would not be register it. Use a thin PVC flip case to protect small coins while measuring instead.
- The app should update the alloy lookup table automatically, but if it complains about an out-of-version database (or similar error) when it's loading, try deleting the app data to force it to reload the latest metal lookup table, and also update the app in the App Store in case the data structure has changed. In the Android settings menu, select "*Apps & notifications*", select the SigmaBoss app in the list of recent apps, select "*Storage & cache*", then "C*lear storage*", then restart the app (while connected to the internet).
- When the app scanning with bluetooth, it automatically tries to connect to closest Sigmaboss device (as measured by bluetooth signal strength). Don't use two SigmaBoss devices in close proximity.
- Only one connection between one SigmaBoss device and one phone is permitted at a time. Multiple phones/devices won't connect with each other at the same time.
- An internet connection is required for the app (as the latest alloy lookup table and coin images is downloaded from the sigmaboss server, as well as periodic updates to the app)
- Bluetooth can be somewhat temperamental, as the 2.4Ghz Bluetooth spectrum is shared with WiFi, and Android's bluetooth implementation has quite a few (undocumented) quirks. We won't get into the sordid details here, but if your phone and SigmaBoss device are having trouble connecting after several attempts, toggle the power on the SigmaBoss device, and deactivate then reactivate bluetooth on your phone.
- If you're still having trouble with your device, send us an email to support@sigmaboss.com and we'll be happy to help.

FAQ

What's the difference between a SigmaBoss device and an XRF meter?

An XRF meter ionizes a metal sample using X-rays, causing the sample to emit radiation at certain frequencies. Each element radiates a unique, different spectrum. By measuring the radiation, you can surmise the composition of the alloy. However, XRF meters only penetrate a few microns thick – shallow enough that plated brass won't be detected.
A SigmaBoss device induces and measures electrical currents in a metal sample, and penetrates a few milimeters, deep enough to detect brass, tungsten, et cetera cores.

What instrument should I use to verify a really thick bar all the way through?

To measure deep within thick bars, the correct instrument to use is an ultrasound machine. Though some Sigma device manufacturers claim 10+mm measuring depth at very low frequencies, it's really an empty boast as for bars that valuable you would want to use the correct instrument for the job, and an ultrasound machine can visualize aberrations all the way through the bar. Only then can you be confident that the thick bars don't have altered cores.

Is the serial number important?

Yes, it allows us to track the firmware and manufacturing batch, as well as serving as an important anti-counterfeiting measure (the firmware can't be copied and loaded onto clone devices as the serial number won't match the hardware).

What personal and usage information do you store of my device or app?

None. We don't know what metals you verify or how frequently you verify them. Obviously, when it comes to security of your precious metals, we think your use of your SigmaBoss device is your own private business.
The Google Play store collects anonymous bug reports, so we know if the app crashes unexpectedly.

Explain the conductivity gauge?

The color bands represent the typical range of measurement values on known good samples of that alloy. 70% of correct conductivity measurements fall in the green range, and ~99% will fall in either the yellow or green bands.

Why doesn't the meter report conductivity in MS/m?

We deliberately don't do this because we feel it implies calibration to a conductivity standard (instead of calibration against known good samples of). Also, the meter measures a transformed value of change in impedance of the sensor and not "conductivity" directly, and the relationship between these two quantities requires a polynomial regression. The variance in measurements would be roughly 10x greater for the upper range of conductivity values (silver and copper) compared to gold alloys, and it would confuse people who didn't understand this.

Why does my reading vary on the same bar/coin?

Rather use expensive high-precision analog components to measure electrical properties (and individually calibrate each meter), we keep costs down using smart digital signal processing algorithms (that can self-calibrate) for the same functionality. When it comes to measuring something as sensitive as minute changes in magnetic

field, this can be prone to minor amounts of electrical noise. So, while you get great bang for your buck, and the average reading will be true, there is minor variation in the individual readings.

We feel that it's an acceptable trade-off for a specialized analog instrument, and it also allows you to avoid maintenance costs (physical properties of the precision analog components change with age, so need to be periodically sent back to the manufacturer for recalibration).

Why do I get an incorrect value for "Coin1" when measuring on the "Coin2" setting?

The app needs to know what alloy it expected to measure so that it can compensate for variations in magnetic coupling between the coin and the sensor (due to the physical dimensions of the coin). Some coins have different coupling algorithms, so using Coin2's algorithm on Coin1 could result in an incorrect value.

Will there be ads in the app?

Yes. Software is a perpetual liability – it requires an engineer to push updates every few months to maintain compatibility with newly released phones and new versions of Android/iOS. You don't want to be sold a device that depends on an app without a concrete plan for the app's maintenance! This is why we'll eventually show unobtrusive ads within the app, which will pay the software developer's wages to maintain and improve the app.

I think the packaging of minted bars shouldn't be damaged, but you advocate removing bars to verify weight and dimensions. How do I reconcile this?

The heart of the matter is an emotional sense of destroying "premium" by removing bars from assay packaging. Ask yourself if it's an investment (where you're trying to make money reselling at a higher price via a repeatable process), or an emotional purchase (where you get to feel like a dragon hording shiny treasure!). Either is cool, but your answer probably determines your perspective on wanting mint condition packaging.

We've seen Perth mint and Pamp fakes get increasingly sophisticated over the years – the packaging has become good enough that you have to be a true expert to distinguish the latest Chinese fake packaging. The next logical step is high-copper cores with identical conductivity to gold. For this reason we advocate verifying density where possible.