CGMeter Basic

Users Guide.

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Manual contents & design: Gaspar Espiell. V0.9

Welcome!

Congratulations on the purchase of your weight, balance & angle meter. Xicoy are dedicated to the design and production of electronic controllers to the highest standards of quality and reliability to bring you the customer the very latest next generation designs.

Features:

The Xicoy CGMeter Basic allows both weight and balance of aero models of more than 50kg (110lb) weight, being limited by the maximum weight on a single scale of 25kg. Each scale is made from tempered & anodized aluminum and has a resolution of 1g. The scales can be calibrated by the end user if necessary.

The system has a standard Wi-Fi server to where the user can connect any terminal (phone, tablet and computer) capable to connect to a Wi-Fi network and has a standard web browser to navigate through the CGmeter Web pages. Software is self-contained and it is not necessary to install any application to the terminal. The system has been tested with Android, IOS, Windows, Mac and Linux. Current software is available in English, French, German, Italian and Spanish.

Optionally the user can purchase an angle meter/laser pointer to measure the deflection angles of any surface with an accuracy of 0.1º.

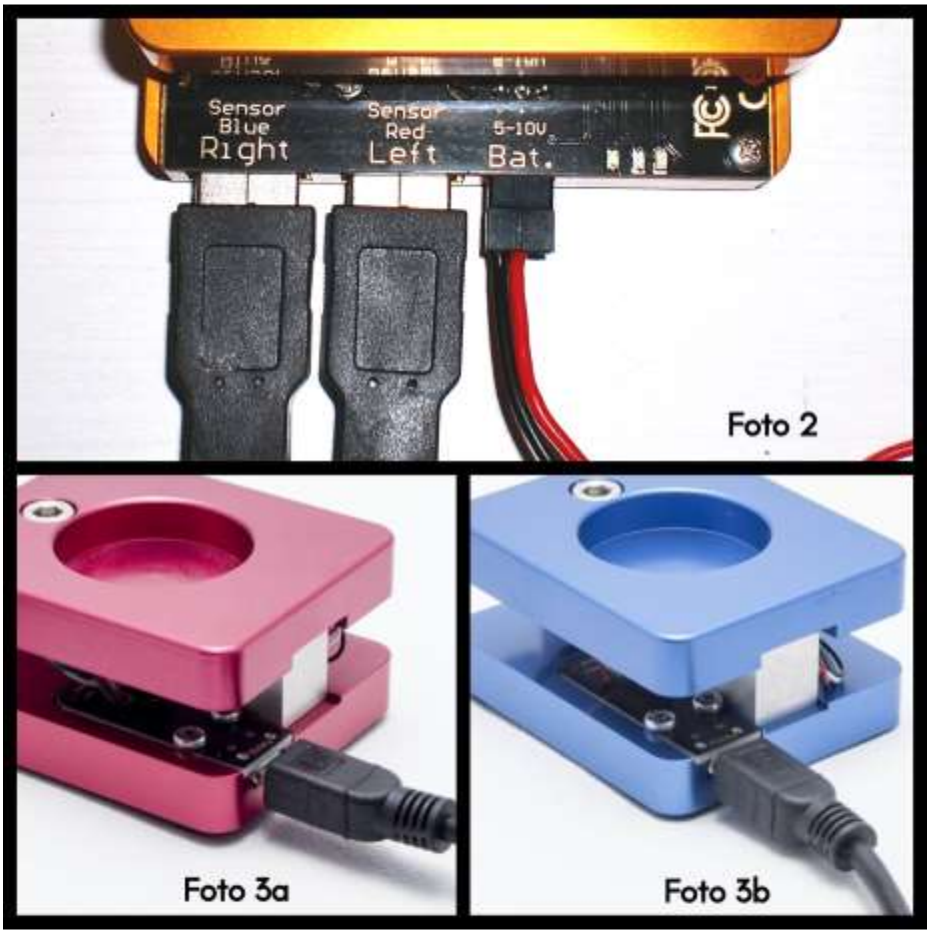
This module is FCC and CEE certified.

Measuring CG and Weight:

The system consists of 3 x digital weight sensors, to be placed under the wheels of the airplane. For easy identification, the RED unit should be placed under the LEFT wheel, BLUE unit under the RIGHT wheel and YELLOW unit under the nose/tail wheel. The Yellow is the main unit and has the Wi-Fi server plus control electronics.

Image 1

Electric connections



Connect the Blue and Red sensors to the yellow main unit using the leads supplied each sensor in its own socket. Connect a battery between 5 and 10 volt on the battery socket as per **picture 3a 3b**.

Connecting your terminal to the CGMeter:

Image 4

Inside the main unit there is a standard Wi-Fi server, like your home router. First step is to connect your terminal (phone/tablet/computer) to the Wi-Fi network exposed by the CGMeter.

Select the *XicoyCGMeter* network and connect to it. Ignore the message that warns that this server is not connected to Internet; we want to balance a plane, not to surf the web!

Image 5

Once your terminal is connected to the *XicoyCGMeter* network, then open the web browser and type “cg/”. Don’t forget the “/”, it is important (**Image 5, 6**).

Image 6

The browser will display the initial page where you can select the language. Touch the button of your preferred language, the setup finished!

The main page is divided in four sections. On first one there are all the measures done by the system. Next allow to entry the data from your plane, third allow managing the internet connection and last one allows the calibration of the sensors.

Basic operation

This instrument allows to do several measures, and to do so, it needs to know some data from your plane. Depending on your needs, some of the data is not necessary to be entered. We will describe step by step the measures that can be done, the data to be entered to do these measures and how to take these measures.

Measuring the weight:

Image 7

To measure the weight, it is not necessary to enter any data, but it is important to check and calibrate the sensors, especially if they have got mechanical stress, like transport or shock, if the temperature is significantly different since last calibration, or at least once per year. See the section of "*sensor calibration*" for details.

First place the scales and the plane over a flat and hard surface. Don't put the plane over the scales yet. First connect the battery, connect the terminal to the Wi-Fi server as described above (**Image 7**), and the touch the "Tare" (**Image 8**) button, to set all 3 scales to zero. If the ambient temperature is significantly different (i.e., the instrument has been inside a car in the sun and is hotter than ambient temperature), then wait few minutes so that the sensors equalize its temperature to avoid a measure drift later.

Image 8

Once the tare is complete and all 3 scales are at zero, place the plane over the scales. Check that the wheels are centered over the sensors and don't make any force sideways that could distort the measure of the real weigh, if landing gear has some play, it is easy to push one leg against the other, causing the scales to sit at angle and generating instability and errors.

Now you can read on the terminal the weight on each sensor and the total weight. All data is displayed in Metric and imperial units at same time.

Measuring the current CG position

OK, now we know the weight of our plane and we know that it weights a little more on left side that on right side. Now we can measure where the CG actually is.

First of all, and this is really IMPORTANT, the plane should be always placed in level flight. Not useful to balance the plane with its nose pointing up or down, when during in flight, the plane will not fly in the position you have balanced it.
If the plane you are balancing sits on the ground in nose up/ down attitude, then add some height under the sensors until the plane "looks" like it was flying. For extra accuracy you can measure the wing or tail incidence, but usually not necessary.

To calculate where the CG currently is, the instrument needs to know the weight on each scale, plus the distance between the centers of the scales.

There are different methods to take this measure accurately, like drawing lines on the table and centering the sensors over them. Our preferred method is described here, it doesn't require drawing lines on the table, but one should remember always that the measure we need is the distance between the CENTERS of the sensor under the nose/tail to the center of a line passing through the centers of the sensors under the mains.

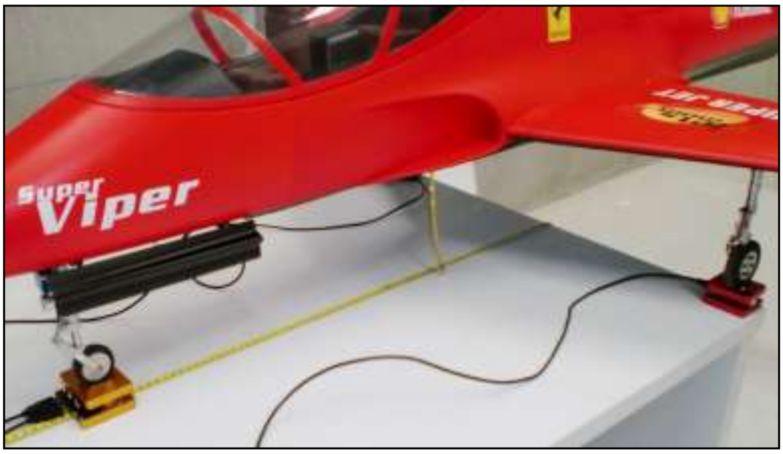


Image 9

We can use the edge of a table, or a line in the floor as reference point.

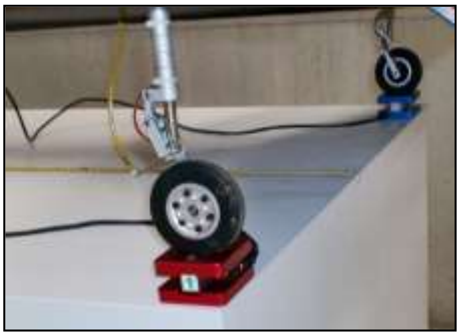


Image 10

Then we can use a measuring tape placed as per the pictures 9 and 10.

Image 11

Remember that we need to know the distance between the centers of the sensors, and with this procedure we are measuring the distance between the edges of the sensors.

We should take in to account the offset between the center of the scale and the edge of the scale.
The sensors, if placed as per the above pictures (**Images 10, 11**) have an offset of 25mm.

Reading on the tape, in the above example we see that the edge of the sensor under the nose wheel is at 720mm. So its center is at 720 + 25 =745mm from the edge of the table.

The edges of the sensors under the main wheels are flush to the edge of the table, so the center is at 25mm from the edge of the table.

Then 745 – 25 = 720mm, this is the distance between the centers of the sensors that we must enter in the app to calculate the current position of the CG.

Now touch the "Data Entry" tab in the app (**Image 12**). This will show a form to enter the data.

First optionally you can enter the name of the model. Not necessary, but could help in to remember to what model belong the settings currently in use.

Next you should choose the configuration of the landing gear.

And finally, you can enter the value we have just measured. You can enter in mm or in inches; the app does the conversion automatically.

Click on the "Submit" button on the bottom of this page, the settings will be stored and the measures page automatically displayed.

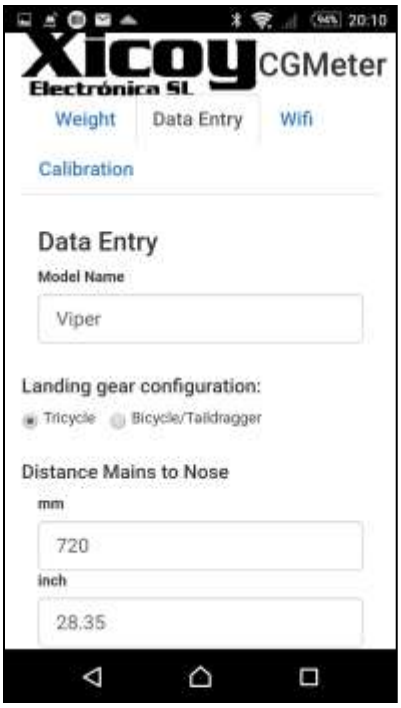


Image 12

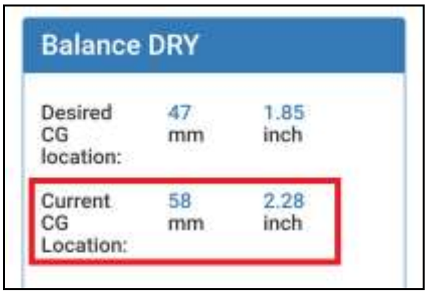


Image 13

Scrolling down on this page, you will find the balance section. With the data provided so far, the instrument is only capable of to calculate where the current CG of the plane is.

In our example (**Image 13**), we can see that our Viper has currently its CG located at 58mm in front of the center of the main sensors, or at 58+25=73mm from the edge of the table.

Now we want to know a little more, we want to know if the plane is well balanced, nose heavy or tail heavy. To have the CGMeter helping in this measure, we need to feed it with more data. It needs to know where the CG should be located as per the drawings of the plane designer/manufacturer (**Image 14**).

Follow the indications of the drawing of the plane to locate the spot where the CG should be placed, and mark it on the plane belly for ease localization.

Image 14

Once we have the CG position marked in the plane, it's time to measure the distance from the CENTER of the main sensor to the desired CG location.

This measure should be done with the plane in the same position as when later we will check the balance. Levelled in flight position and if the gear compress under the weight of the plane, we must assure that always we will have the same degree of compression, to avoid changes in these distances.

We propose two methods to do accurately this measure, depending if you own our laser/angle meter module.

Measure using the laser

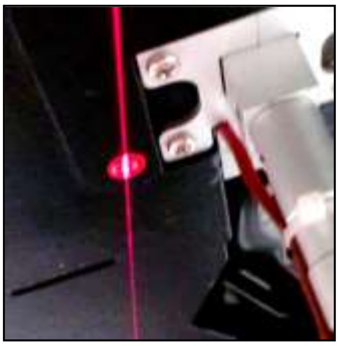


Image 15

Image 16

Place the laser module close to the measuring tape, and move it until the line is centered to the mark of the CG. Annotate the measure 72mm on the picture 16.

Measure using gravity

Don't worry if you don't own the laser module, using the gravity the measure is easy to do too. You just need three "high technology" components. Adhesive tape, sewing thread and something heavy and pointed like an eyebolt.

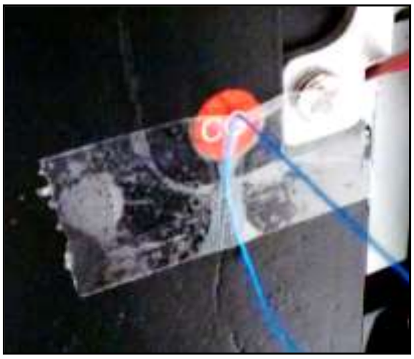


Image 17

Image 18

Stick the sewing thread on the center of the CG mark using adhesive tape (**Image 17**), and annotate the measure (72mm on the picture 18).

Accuracy is similar in both cases, and more than enough for our application, but when using the laser module, checks that it seats flat over the table, as if it is not absolutely levelled, it can cause wrong readings. And when using the gravity, check that the table is levelled. In both cases check that the sensor and the measuring tape are correctly aligned to the reference used, that is the edge of the table in this example.

Now we know that the manufacturer recommends that the CG of our plane be located at 72mm from the edge of the table. The CGMeter needs to know the distance from the CENTER of the sensor to the recommended CG location. So we should remove the 25mm of offset, like we did previously. 72-25=47mm.

Click on "Data Entry" tab and enter the measured distance, 47mm in our example, to the "Distance Mains to CG" form.

Image 19

Touch the "Submit" button to send this data to the CGMeter and return to the measures screen.

Now check that the plane is sitting comfortably over the sensors, that is levelled and sensors had been zeroed recently, then scroll to the balance section on the CGMeter App (**Image 20**).

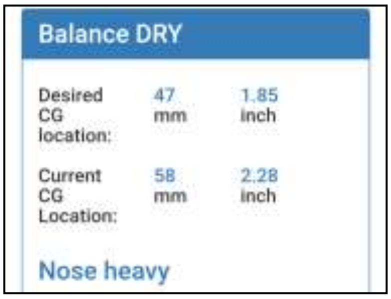


Image 20

Now we see that the recently data we just entered (47mm) is displayed as "desired" CG location, but the CGMeter is measuring that the current CG on the plane is at 58mm , 11mm forward than should be, thus the "Nose heavy" indication is displayed.

At this point, if you are still in build phase of the plane, it is a very good idea to move the items around (batteries, valves, etc) so that you can achieve to have the plane in balance without the need of adding extra weight. Just move the items around and you will see how the CG changes in real time, so in few minutes, you can have located the best position for the internal items.

If the plane is already finished, or there isn't any possibility to balance it, other than adding/removing ballast, no worries, the CGMeter will help in to achieve the final balance quickly.

Now you should decide from where you will add or remove weight. In our example we have decided to replace the battery on the nose. Now we must measure the distance from the center of the sensors under the main wheels to the place we want to remove weight, using the laser or gravity procedures already described. In our example, the measure is of 695mm from the edge of the table, deducting the 25mm of the sensor width, the measure from center of the main wheels to the center of the battery is 670mm. So we enter this value in the Distance from mains to correction point in the data entry tab (**Image 21**).

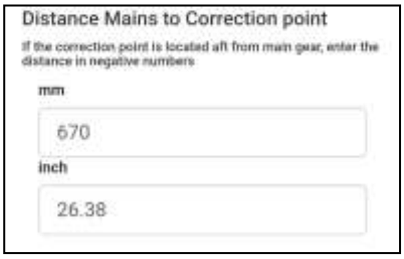


Image 21

In the case that the correction point is located in the tail, aft from main gear, then you should enter the distance in negative numbers.

Now we have a bit more of info from the CGMeter.

Image 22

We know that our plane is nose heavy, and that we must remove 101 grams from the correction point located in the nose.

Image 23

Replacing the battery by another 110g lighter, balance is achieved. No need to fight for 1mm difference, as we will see in next page, the fuel plays a large difference.

Wet balance

All the measures in previous pages had been done with the fuel tank empty, as is normal practice for the manufacturers of model airplanes to define the recommended CG position with the plane "Dry". The CGMeter allows showing the CG drift when the plane is fueled, but to have this information, we must feed it with the appropriate data.

On the "Data Entry" tab, you must enter the fuel capacity in ml or US oz., and the distance from the center of the main wheels to the center of the fuel tank, measured using same procedure as the CG.

Touch the Submit button to store the settings and check the balance with the full tank (**Image 24**).

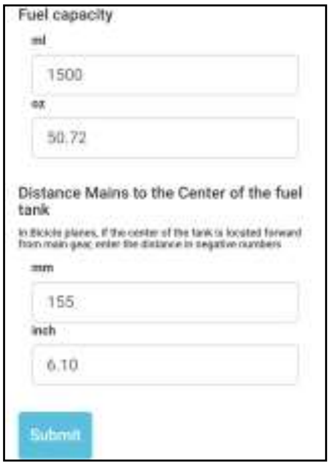


Image 24

Image 25

As you can see in the screen shot, in this particular plane the CG moves forward 18mm when the tank is full. So there is no point in to fight for to achieve a less than 2 mm distance of the balance point, when the fuel slosh will cause changes of 10 times higher.

Measuring the angles: (Option)

If you own the laser module, it includes an angle meter to be used to measure and adjust the deflection angles of the surfaces.

The inclination angle is displayed in degrees, and can be zeroed. By entering the width of the control surface, the app calculates the height of the tip from the measured angle.

Also the battery voltage and runtime is displayed (**Image 26**).

Image 26

Sensor calibration

The sensors come calibrated from factory, but can be easily recalibrated if needed. Procedure is simple, but you need a reference weight, recommended to be over 1 kg (2lb).

To measure the exact weight of the plane is important that the sensors be calibrated with a good reference weight, but for to measure the CG it is important that all 3 sensors be calibrated with same reference. If you don't have a calibrated weight available, but find that each sensor measure different to the others using same test weight, the best is to do the calibration procedure with a non-calibrated weight, but same for the 3 sensors. For example, you can use a 1 liter water bottle. Once all 3 sensors calibrated with the same water bottle, the measures of CG will be correct. The measures of weight will have a drift, if the bottle weight 1025 gram in place of 1000g, the weight of the plane will have an error of 2.5%, but the CG will be perfect.

Go to "Calibration" tab and enter the weight of the calibration weight to be used, in grams or pounds (Image 27).

Next follow the instructions on the screen. It is important to do the calibration in same order as displayed in the screen, and do always all 3 sensors on same sessions, to minimize differences and keep the measure of the CG accurate.

Image 27

Disposal

Electrical equipment marked with the cancelled waste bin symbol must not be discarded in the standard household waste; instead it must be taken to a suitable specialist disposal system.
In the countries of the EU (European Union) electrical equipment must not be discarded via the normal domestic refuse system (WEEE - Waste of Electrical and Electronic Equipment,directive 2002/96/EG). You can take unwanted equipment to your nearest local authority waste collection point or recycling centre. There the equipment will be disposed of correctly and at no cost to you.
By returning your unwanted equipment you can make an important contribution to the protection of the environment.