

# User Manual

# CaM OrganAnalyzer

(Version 0.96, January 2024)

The screenshot displays the CaM OrganAnalyzer software interface. On the left is a table titled "Generator Levels (default)".

TG #	Strip #	Note	Factory	Ref	Level	Scaled	Distort	k2	k3	k4	k5	k6	k7
1	90	C1	68	69	1.6	1.6	.6	.5	.3	.1	.1	.1	.0
2	37	C#1	67	68	68	68	0	0	0	0	0	0	0
3	75	D1	66	67	67	67	0	0	0	0	0	0	0
4	22	D#1	65	66	66	66	0	0	0	0	0	0	0
5	60	E1	63										
6	7	F1	62										
7	45	F#1	62										
8	82	G1	60										
9	29	G#1	60										
10	67	A1	59										
11	14	A#1	59										
12	52	B1	58										
13	89	C2	15.6										
14	36	C#2	15.6										
15	74	D2	15										
16	21	D#2	14.7										
17	59	E2	14.1										
18	6	F2	13.6										
19	44	F#2	13.3										
20	81	G2	13										
21	28	G#2	12.7										
22	66	A2	12.2										
23	13	A#2	12										
24	51	B2	12										
25	86	C3	11										
26	33	C#3	11										
27	71	D3	11										
28	18	D#3	11										
29	56	E3	11										
30	3	F3	11										

The main interface includes a control panel with a "VALID" indicator, "Note Detected" status, "164.8 Hz" frequency estimate, "29" TG Number, "0 mV" TG Recorded Level, and "56" Solder Strip Number. It also features a "STOP" button and calibration instructions.

Two graphs are displayed: a "TG Level (mV)" plot showing measured levels (green dots) and reference levels (yellow dots) across TG numbers 1 to 90, and a frequency spectrum plot showing a peak at 164.8 Hz with distortion percentages of 6.8%, 21.2%, 4%, and 2.1%.

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Please read these instructions carefully before using the Organ Analyser.



Use a damp soft cloth for cleaning. Cleaning agents and solvents can attack lettering and surfaces.



Only suitable for indoor use. Do not use the device in a damp environment. Do not allow liquids to enter the device.

Consult our service in case of problems.



All information in this manual serves to describe components and does not constitute a guarantee for specific properties. We reserve the right to make technical changes.

## EG-Konformitätserklärung



The producer/distributor

**KEYBOARDPARTNER UG**

Entwicklung elektronischer Musikinstrumente

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hereby declares, that the product

**CaM Organ Analyzer**

has been designed, produced and examined in compliance with the DIN VDE 0580 standard and in accordance with the EU Low Voltage Directive.

Following directives, standards and guidelines have been used:

EMV-Richtlinie 2014/30/EU

Niederspannungsrichtlinie 2014/35 EU,

RoHS-Richtlinie 2011/65/EU: keine harmonisierten Normen für das Instrument recherchierbar

Langenhagen, January 2024

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Carsten Meyer / Geschäftsführer

# CaM Analyzer for Tonewheel Organs

The CaM Organ Analyzer was developed for the alignment and particularly easy measurement of Hammond tonewheel generators. The applications automatically determines the tone frequency and tonewheel number. This eliminates the cumbersome and error-prone entry in a spreadsheet; as is well known, the notes on the rear soldering strip of the tonewheel generators are a pick 'n' mix.

The measuring adapter is only suitable for organs with electromagnetic tone generation. Due to the high input sensitivity and the integrated terminating resistor (33 Ohm, as a replacement for the keyed tapering resistors), the adapter is **not suitable** for transistor or LSI generators.



Mechanical influences and ageing of the components, some of which are 70 years old, often result in an unbalanced sound with notes that are too loud or too soft. This also occurs when, for example, the filter capacitors have been replaced (recapping). Since the generator was done at the factory with the old capacitors, the levels of the upper octaves are no longer correct with the newer (and more narrowly tolerated) capacitors. Then a rebalancing of the generator (by carefully moving the magnetic bars) is necessary.

## Installation

Unpack the contents of the ZIP archive into an empty folder on your hard disk. The OrganAnalyzer.exe application does not require any further installation.

The free demo version can be used for about 20 minutes to try it out. Measured values cannot be saved. Purchase the software licence for full use in our web store.

To activate your licence, open the About dialogue box by clicking on the *About* menu item. Enter your name as indicated in your invoice and the number of the order with which you purchased the CaM Organ Analyzer including licence or the licence separately. Then click on the *Get from Server* button. If there is an Internet connection, the licence key is automatically inserted and the license is activated.

If you do not have an Internet connection and know the licence number, you can insert it in the Licence Key field and click on the *Activate* button. The application is now activated for full use..

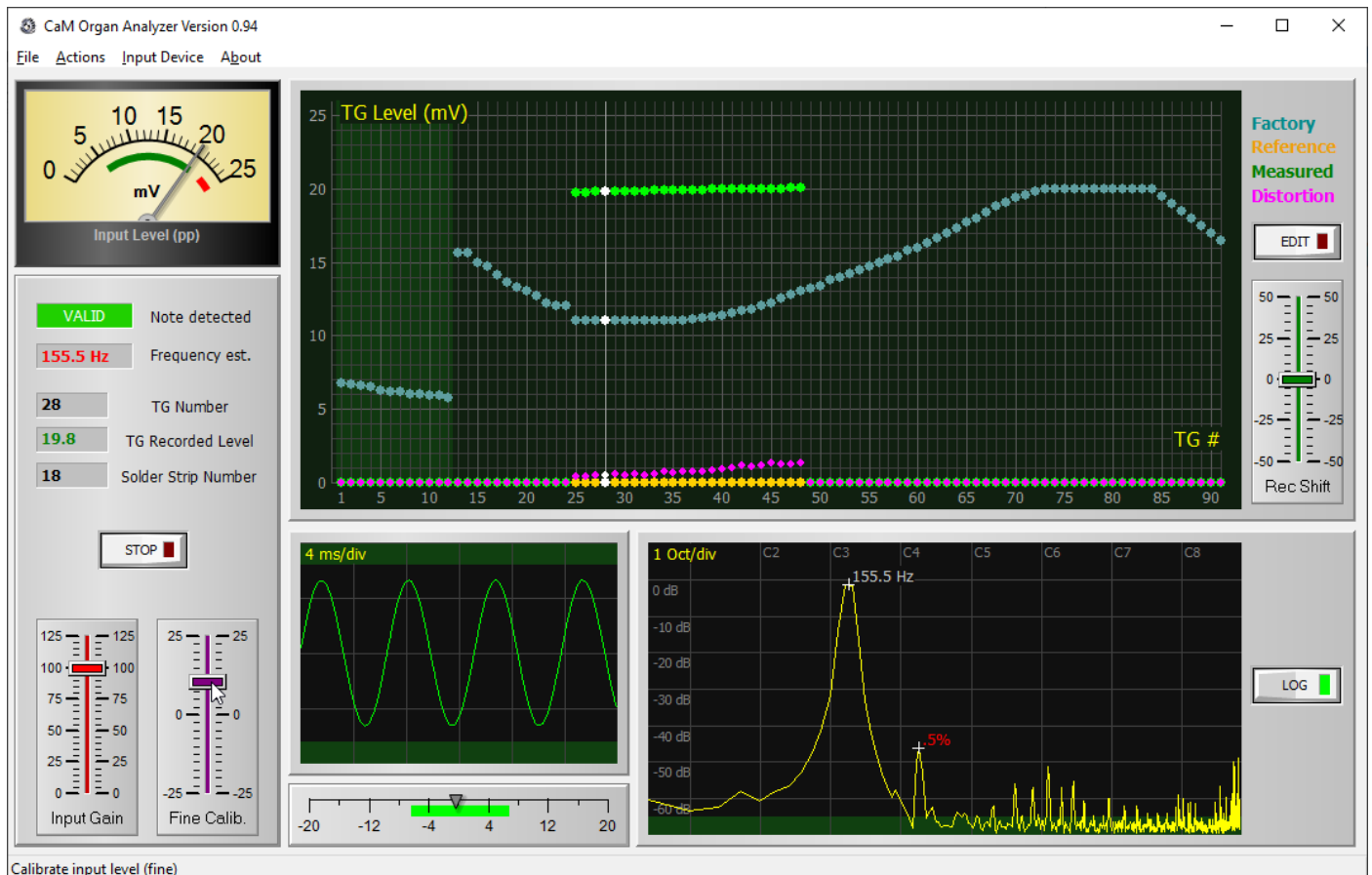
Connect the OrganAnalyzer measurement adapter to a free USB port on your PC using the USB extension cable. The measurement adapter is supplied with power via USB. The socket on the extension cable is a bit stiff, make sure the plug is fully inserted. In the measuring adapter, a red LED should now light up and a second LED should flash.

Restart the Organ Analyser app when the measuring adapter is connected. After the connection has been established, the first LED also flashes.

# Calibration

Set the toggle switch to the REF position. If your measuring adapter does not have a toggle switch, connect the measuring cables to the measuring adapter: the black plug (ground) in socket GND, the red plug in socket PROBE. Connect the red alligator clip for calibration to the REF terminal.

Select the adapter box in the *Input Device* menu; it is displayed as a microphone input (USB PnP Sound Device).



An oscillogram with a sine wave is now displayed in the main window. Set the *Input Gain* slider to 100, *Rec. Shift* to 0 and adjust *Fine Calib.* so that the measurement instrument at the top reads exactly 20 mV.

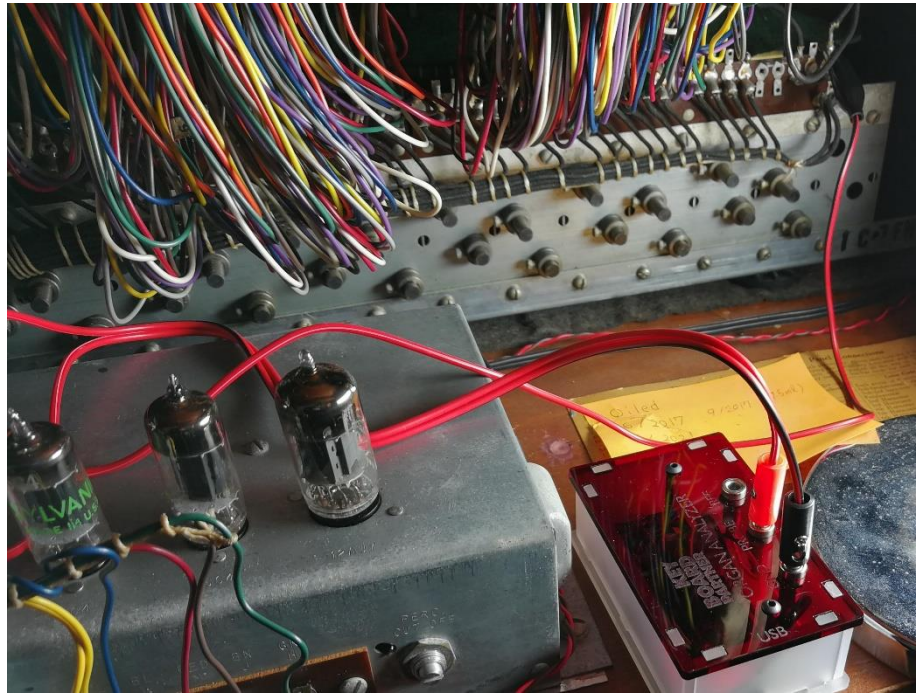
You can use the Organ Analyzer app also on a Mac (see section [CaM Organ Analyzer on Mac](#)). When using the app under CrossOver, you must first adjust the input level of the USB PnP sound device in the system settings of the Mac so that the level of the sine wave is displayed approximately as high as in the picture above.

The calibration socket REF delivers a number of notes with exactly 20mV level (peak-to-peak,  $V_{pp}$ ). In the graph, the levels are plotted as green dots; the measured notes should be exactly at 20mV. This concludes the adjustment; CaM Organ Analyzer will remember the settings until the next time the app is started.

# Measurement of a tonewheel generator

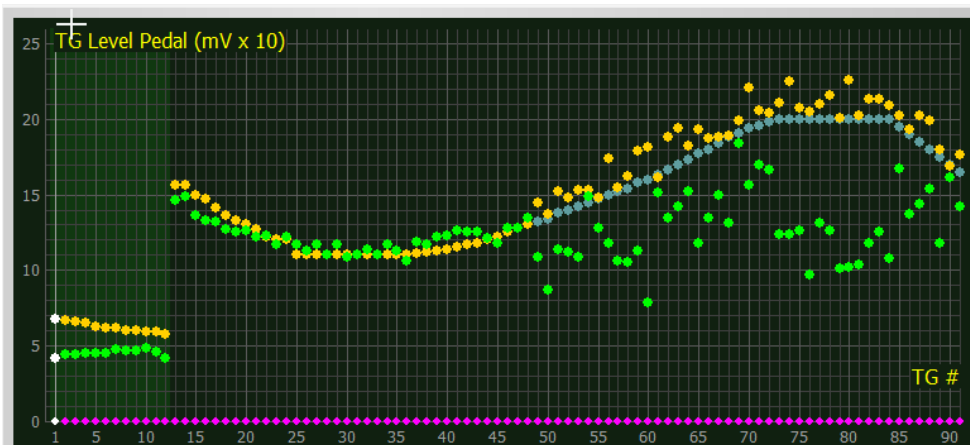
The measurements are carried out with the generator running. The measuring cables are supplied as twin cables; pull the cables apart so that you can easily reach all generator connections (96-pin soldering strip at the rear).

Connect the black alligator clip to the ground connection of the generator (soldering strip on the far right or generator cover made of brass sheet). Touch the red alligator clip to the first connection on the left of the 95-pole generator soldering strip.



An oscillogram of the voltage output should now be visible, as well as a spectrum with individually plotted harmonics (overtones). In the fields below the measuring instrument, the level, generator and soldering lug number are displayed.

Level and total harmonic distortion are entered in the diagram. Now connect the red cable to all 91 soldering lugs of the generator one after the other; a measuring period of 2 seconds per tone is sufficient. CaM OrganAnalyzer automatically determines frequency and tonewheel number and enters the corresponding levels in the diagram.



The light blue dots indicate the idealized original calibration of the generator ex works, the yellow ones the levels of a reference organ (default: also factory calibration). A deviation of 10% from the ideal level was also found in brand-new organs.

By the way, the linear scaling of the Y-axis makes the level differences appear much larger than they are to the ear. Only when the level is reduced from, for example, 20 mVpp to about 6.3 mVpp do most people perceive a halving of the loudness. However, the perceived loudness also depends on the volume and the tone frequency.

## Generator alignment

In case of larger deviations, a recalibration of the generator tone that is too loud or too soft is advisable. Leave the red cable connected and find the corresponding magnet rod with the help of the Hammond Service Manual. By loosening the clamping screw (4mm spanner width) and carefully moving the magnetic rod, the level can be adjusted. For the upper notes, a shift of a few tenths of a millimetre is often enough, so be careful!

For this work you need a sure instinct and, if necessary, some de-oxid spray (i.e. WD-40), because the magnetic rods are often rusted in their sleeves. On many organ models, you can only reach the bars on the opposite side by removing the manuals. We expressly advise amateurs not to do this work!

Due to ageing of the capacitors, higher notes are often consistently too soft; then a replacement of the generator capacitors (recapping) is necessary before recalibration. Only the old yellow wax paper capacitors, which were used until about 1962, are affected. The newer polypropylene capacitors (dark red) are not affected by ageing, here replacement is usually unnecessary.

## Saving the measured values

Generator Levels (default) ✖

File Actions

TG #	Strip #	Note	Factory	Ref	Level	Scaled	Distort	k2	k3	k4	k5	k6	k7
25	86	C3	11	11	19.5	19.5	.44	.43	.02	.02	.03	.05	.06
26	33	C#3	11	11	19.5	19.5	.41	.39	.02	.02	.04	.06	.08
27	71	D3	11	11	19.5	19.5	.48	.45	.04	.08	.06	.06	.1
28	18	D#3	11	11	19.6	19.6	.55	.52	.04	.04	.06	.07	.11
29	56	E3	11	11	19.6	19.6	.5	.47	.04	.05	.06	.08	.1
30	3	F3	11	11	19.6	19.6	.5	.47	.04	.05	.06	.09	.08
31	41	F#3	11	11	0	0	0	0	0	0	0	0	0
32	78	G3	11	11	0	0	0	0	0	0	0	0	0
33	25	G#3	11	11	0	0	0	0	0	0	0	0	0
34	63	A3	11	11	0	0	0	0	0	0	0	0	0
35	10	A#3	11	11	0	0	0	0	0	0	0	0	0
36	48	B3	11	11	0	0	0	0	0	0	0	0	0
37	85	C4	11.1	11.1	0	0	0	0	0	0	0	0	0
38	32	C#4	11.2	11.2	0	0	0	0	0	0	0	0	0
39	70	D4	11.3	11.3	0	0	0	0	0	0	0	0	0
40	17	D#4	11.4	11.4	0	0	0	0	0	0	0	0	0
41	55	E4	11.5	11.5	0	0	0	0	0	0	0	0	0
42	2	F4	11.7	11.7	19.8	19.8	1.06	1.06	.08	.05	.06	.03	.03
43	40	F#4	11.8	11.8	19.8	19.8	1.08	1.06	.12	.08	.07	.04	.09
44	84	G4	12	12	19.8	19.8	1.22	1.21	.11	.07	.07	.05	.03
45	31	G#4	12.2	12.2	19.8	19.8	1.3	1.3	.05	.04	.03	.04	.02
46	69	A4	12.5	12.5	19.8	19.8	1.22	1.22	.04	.03	.02	.02	.01
47	16	A#4	12.8	12.8	19.8	19.8	1.28	1.28	.05	.03	.04	.02	.02
48	54	B4	13	13	19.8	19.8	1.4	1.4	.05	.05	.03	.02	.02
49	91	C5	13.2	13.2	0	0	0	0	0	0	0	0	0

The CaM Organ Analyzer enters the measured values not only in the diagram, but also in the *Levels* table column of the *Generator Levels* window. Save the values with *Export Scaled Levels (Text)* in the *File* menu.

## Loading a reference organ

If you have measured a good sounding organ, you can load the measured values as a reference (yellow column, yellow dots in the diagram) to match another organ to the same values. Select *Import Reference Levels (Text)* from the *File* menu.

## Working with the table

In the table window, further import options are available: You can load or save the entire table (as an .hxa file), load a new reference table (yellow column/points) different from the factory calibration), as well as a tapering created with the *HX3 Tapering Editor* (.hxx file).

The data of individual columns (*Import Reference Column*, *Import Level Column*, *Export Scaled Levels Column*) contain only numerical values for the generator notes together with a heading as ASCII text. Such a table can also be imported again with the *HX3 Tapering Editor* in order to emulate the levels of a measured reference organ and load them into HX3 as tapering. To do this, select the column to be imported (1955, 1981, 1972, Recapped) in the *HX3 Tapering Editor* and then click on *Import Strip Levels Column (Text)* in the *File* menu of the Tapering Editor.

When importing data from external sources (e.g. Excel table column), note that a decimal point must be used here and that the levels are given as peak values (millivolts Vpp, as measured with an oscilloscope).

Files from the *HX3 Tapering Editor* contain four columns (1955, 1961, 1972 and Recapped), of which only one column at a time can be loaded as the current level (green Levels column and green measurement points). This is done with *File -> Import HX3 Generator -> xxx Generator Cap Set*.

Should an imported table have been measured with another device or manually, it may deviate from the correct values by a certain factor due to a constant measurement error; this is the case, for example, if no 33-ohm terminating resistor was used as a load. You can then scale the table and the green trace with the *Rec Shift* slider (the usually little deviating notes 25 to 37 can serve as a reference point). Otherwise, this slider should always be set to 0.

# CaM Organ Analyzer on Mac

The CaM Organ Analyzer app is compatible with Codeweavers' Windows runtime environment **CrossOver**. CrossOver also works on Apple processors. The trial version runs for 14 days free of charge. Steps:

1. Click on "New bottle" in the CrossOver menu "Bottle".
2. Name the bottle, select the type Windows 10 and create it.
3. Right-click on the bottle, select "Open c: drive" and copy the OrganAnalyzer folder to "Program Files".
4. Connect the measurement adapter via USB. Click on "Run Command", select "OrganAnalyzer.exe" and click on "Start".
5. Click on "Save command as starter" to create an icon of the application in the CrossOver window. In future you can start the Organ Analyzer with a double click.

Of course, you can also set up a complete Windows environment on the Mac, for example with the help of **Apple Boot Camp** or in a virtual machine such as **Parallels Desktop**, **VMware Fusion** or the free **VirtualBox** from Oracle.

For the VirtualBox, please note: The USB connection must be assigned in the Devices menu of VirtualBox. Each time the HX3 device is restarted, the USB connection is interrupted and must be reassigned because VirtualBox does not automatically restore it..

KeyboardPartner has successfully tested the function on a MacBook Air from 2018 with CrossOver under MacOS 11.4 and 12.0.1 as well as with Windows 10 under Apple Boot Camp. On an older Mac mini, the level of the USB PnP Sound Device could not be adjusted. No empirical findings are yet available for the other environments.

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