

Air Force *Zero*

P r e s e n t a t i o n

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Air Force Zero

Our Path to the Air Force Zero

Recent years have seen hundreds of analog turntables released and this has been a major trend in the audio industry. What does this phenomenon mean?

One of the major reasons is a backlash from the excessive transition from analog to digital audio. Especially for high resolution formats in the early days, there were a number of cases reported where sound quality of such formats even affected human health. Around then there was already a serious demand for high quality analog decks from some audiophiles.

With this growing trend in the market, we started research & development of authentic analog turntables about a decade ago. Striving toward a goal of developing a turntable delivering the highest performance of the present day and installed into the minimum size, we finally launched our first analog turntable, the Air Force One in 2012. This product proved to be hugely successful, a turning point in analogue reproduction, and spread out to far more users across the world than we first imagined.

Since then we have continued development and launched an extensive line of turntables to meet more demands from the market. Now we have a full product range from the Air Force One Premium, Air Force Two Premium, Air Force III Premium to Air Force V.

In parallel to the development and releases of these models was going a project to bring our dream of the absolute ultimate reference turntable to reality. The goal of the project was to develop a truly groundbreaking product building on our expertise and knowledge and incorporating new ideas and insights. To achieve this goal, the project had to be cost-no-object and it had to have whatever technologies would be best suited for the turntable no matter how much it would cost.

We are pleased to announce it is finally complete, after it took one year longer than initially planned. The sheer result is a beast weighing 330 kg and measuring 902 (W) × 677 (D) × 335 (H) mm.

Technical features of the Air Force Zero Motor

The first task was to find a motor to drive this gigantic system. By pursuing every avenue, we finally found some high quality synchronous motors manufactured for tape recorders by the renowned German manufacturer, Papst. These motors proved to be most suitable for our aim, which opened the door to the success of the Air Force Zero project.

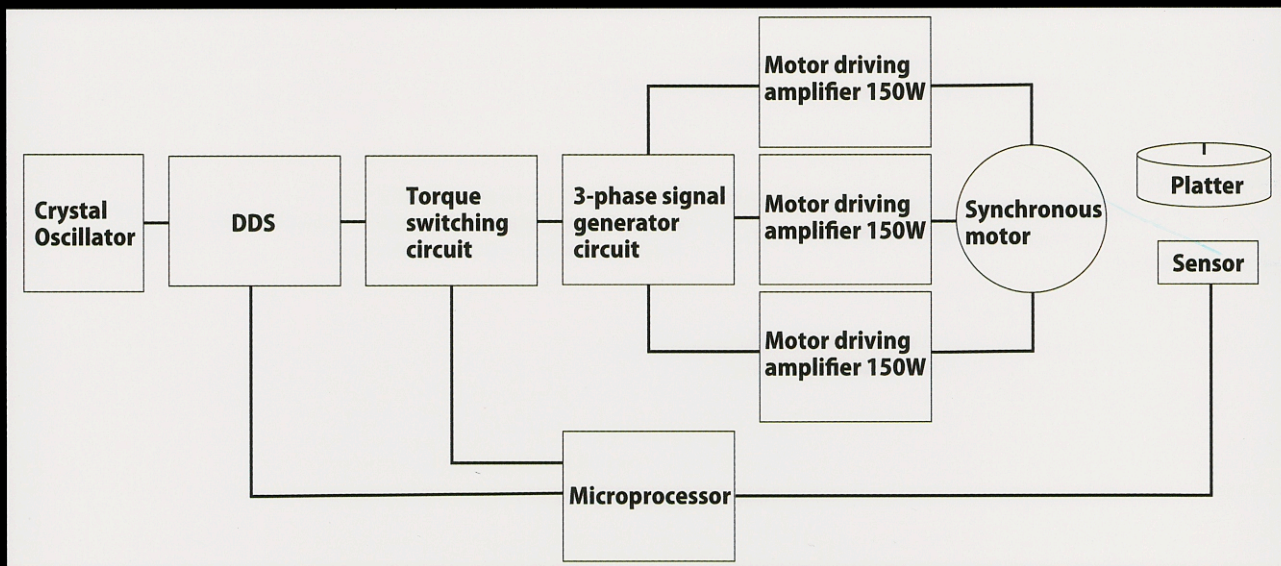
Next step was to review and modify the Papst motors so that they could work optimally for the world's best turntable system. Building on the 3-phase, 12-pole synchronous AC large torque motor, we developed a customized air bearing driving motor with flywheel technologies.

The major features of the Air Force Zero Motor are:

1. High precision rotation with virtually zero wobble due to the combination of high precision metal bearing and air bearing
2. Enormous inertia generated by flywheel effect
3. Extremely high S/N ratio achieved by the air bearing
4. New driving electronic circuitry designed for stable and precise rotation of low vibration

During a steady state rotation, the driving amplifiers perform smooth rotation without the servo, while the servo will be engaged during the startup process or if the speed is changed by an external force. These technologies results in an exceptional level of rotational precision for a belt-drive turntable.

The block diagram of the driving system:



1. Crystal Oscillator

Reference clock oscillator that provides clock signal to stabilize rotation frequencies for the motor.

2. Direct Digital Synthesizer (DDS)

This functions as synthesizer to divide input clock signal according to the values of frequencies determined by the microprocessor, converting high frequencies to low frequencies so that they will work with the motor. Almost any value of frequencies can be output and precise control of the rotation is possible.

3. Torque Switching Circuit

This circuit is to switch the voltage for the motor in order to quickly increase the rotation torque to a rated speed during a startup or when shifting the rotational speed of the platter. When a rated speed is achieved and the rotation speed is locked up, the torque will be decreased in order to reduce vibrations even further.

4. 3-phase Signal Generator Circuit

This circuit makes sure to phase shift the input signal by 120 degrees with accuracy to generate 3 phase AC output for the 3-phase motor.

5. Motor Driving Amplifiers

The three 150W power amplifiers for respective three phases are to powerfully drive the synchronous motor.

6. Synchronous Motor

The motor is an 3 phase AC motor operating in synchronization with an accurate 3 phase frequency generated with the 3 phase signal generator circuit. A more common power system for the motors has AC power phase shifted with capacitors. In the latter case, it is very difficult to provide an output AC signal with accuracy phase shift due to aging and errors in the capacitors etc. which will lead to a decrease in torque and an increase in vibration.

7. Sensor

It detects the speed of the platter and transmit the information to the microprocessor.

8. Microprocessor

It controls the motor driving mechanism so that an extremely high precision rotation will be achieved.

Control Mechanism for Motor Rotation.

By using a specific rotation speed of the motor stored in advance, the DDS sets a corresponding frequency value and the motor performs a high torque rotation at this stage. The microprocessor computes the difference between the rotating speed detected by the sensor and the target speed and transmits a speed control signal to the DDS, which in turn controls the rotation to achieve the target speed. The indication of "LOCK" blinks on the display during this process. Once an accurate rotation of the platter is reached, "LOCK" turns lit on the display. At the same time, the microprocessor gives a command to apply low torque and deactivate the DDS while monitoring the rotation, because not much more force beyond inertia is required for a steady rotation. If the rotation speed is changed for any reason, "LOCK" will blink on the display and the microprocessor will use the DDS to correct the speed. Once the accurate speed is achieved, "LOCK" will light up on the display and the rotation is kept in a steady state without the need to control the speed.

Technical features of the Air Force Zero Main Unit

Unlike the Air Force One, which we developed with a few conditions to meet, we set no limitations in designing the Zero. However, at the beginning of this project, we had a few guidelines for designing as listed below:

- 1) The size of the entire system to be up to that of the classic EMT927 (In fact the size is larger as it turns out)
- 2) The weight of each component to be kept within the limit our suppliers could handle in processing.
- 3) To be fitted with both 10 inch and 12 inch tonearms.
- 4) To develop a platter as large as 40 cm in diameter.

Most exceptionally, the main system weighs 330 kg. It is actually much more than we initially expected. This is an absolutely colossal system.

Platter Base

The Platter Base (35 kg, extra super duralmin) serves as a hub for the air suspension system. This Platter Base has four massive blocks composing the air suspension system mounted on it, and where two tonearms can be fitted. The Platters are made of different alloys and placed on the Platter Base. The air suspension system successfully eliminates vibrations that could transmit from the Platter Base to the tonearm and record surface by having the center of gravity much lower than the supporting point. This concept was key to our design, opposed to a theory that weight acts solely as a barometer to record players as some people believe.

Base Frame

The Platter Base sits on a 100 kg Base Frame made of SUS stainless steel . This Base Frame, which has an enhanced speed of oscillatory convergence with special surface treatment, supports the total weight of 230kg of the Platters, Air Suspension System and Platter Base.

Tonearm Bases

Two titanium tonearm bases are provided as standard. Also tungsten tonearm bases are available as optional. Almost any 9 inch or 10 inch or 12 inch tonearms can be fitted with the exception of non-standard lengths.

Platters

The Platters are designed for the highest level of vibration absorption by combining different alloys. For example, the top layer is made of titanium with surface hardening treatment applied to produce hardness equivalent to hard metal alloy.

More importantly, these five layers of platters are held as one with air suction similar to vacuum LP hold-down. This solution allows us to avoid metal fittings which could induce mechanical stress.

Air Bearing

The five platters float to the height of 10 μ m and rotate in absolute silence as one unit. To make this possible, the Platter Base surface is precision machined with a tolerance of less than 8 μ m at its circumference.

Air Suspension System

The AF Zero has an Air Suspension System consisting of four blocks providing insulation and absorbing low frequency vibrations at the four corners.

This air suspension module is uniquely developed by TechDAS and air is supplied to from an electric pump to the air suspension modules.

Power Supply / Air Pump Units

The system comes with three Power Supply / Air Pump Units of the same dimensions.

Unit 1/3: containing Air pump for floating the platter, main power circuitry, and air condensers

Unit 2/3: containing Air pump for floating of the rotor and flywheel of the motor, 3 driving amplifiers, and sub power circuitry

Unit 3/3: containing Air pump for vacuum disc hold-down, air pump for air suspension, and sub power circuitry

Air Force Zero Rack (optional)

This Air Force Zero Rack system is exclusively developed and manufactured to deliver the best sound quality and performance of the Air Force Zero. It is made by Artesania Audio, a Spain-based high end rack company renowned across the world.

The system consists of two racks.

Rack 1/2: for Air Force Zero, Power Supply Unit 3/3

Rack 2/2: for Phono equalizer Amplifier (not included in the Air Force Zero system) and Power Supply Units 1/3 and 2/3

TechDAS Air Force Zero SPECIFICATIONS

MAIN UNIT

Base Frame: 100 kg, stainless steel

Platter Base: 35 kg, extra super duralumin

Platters: 100kg in total

Bottom platter: 33 kg, ø 40cm, forged Stainless Steel SUS 316L

Second platter: 20 kg, ø 31cm, forged Stainless Steel SUS 316L

Third platter: 20 kg, ø 31 cm, cast Gunmetal

Fourth Platter: 20 kg, ø 31 cm, forged Stainless Steel SUS 316L

Top Platter: 7 kg, ø 31 cm, Titanium with special surface hardening treatment

Total moment of inertia: 16,000 kg/cm square

Drive system: Belt-drive, polished and nonflexible polyurethane fiber belt

Drive Motor: 3-phase 12-pole AC synchronous motor manufactured by Papst, Germany (1000/5001)

During a startup and adjustment of the rotation, high torque rotation

In a steady-state rotation, non servo, low torque, ultra low vibration

Rotation speed: 33 1/3 rpm / 45 rpm, precise speed adjustment function

Wow & Flutter: below 0.03%

Suspension: Air suspension, air charged by an electric air pump built-in in Power Supply Unit

Main Unit Dimensions including Motor: 902 (W) x 677 (D) x 335 (H) mm

Distances between center point of base frame feet:

front left foot - front right foot 674mm / rear left foot -rear right foot 722mm

front left foot - rear left foot 461mm / front right foot -rear right foot 442mm

Total weight of Main Unit including Motor: 330kg (Power Supply / Air Pump Units are not included)

POWER SUPPLY / AIR PUMP UNITS

Unit 1/3: 430 (W) x 365 (D) x 205 (H) mm, 15 kg

Unit 2/3: 430 (W) x 365 (D) x 205 (H) mm, 13kg

Unit 3/3: 430 (W) x 365 (D) x 205 (H) mm, 10kg

ACCESSORIES INCLUDED

2 x Titanium Tonearm Bases (Tungsten Tonearm Base available as optional),

1 x TechDAS Disc Stabilizer, 1 x Platter Cover

Air Force Zero RACK SYSTEM (Optional)

Set of 2 racks with turntable platform and shelves:

Rack 1/2: 905 (W) x 675 (D) x 790 (H) mm

Rack 2/2: 790 (W) x 610 (D) x 790 (H) mm

Other items available as optional:

Tungsten top platter: 26kg, ø 31cm / Tungsten tonearm base / Tungsten Disc Stabilizer



Designed and manufactured by TechDAS
TechDAS is the brand of genuine highend audio produced by STELLA Inc.
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