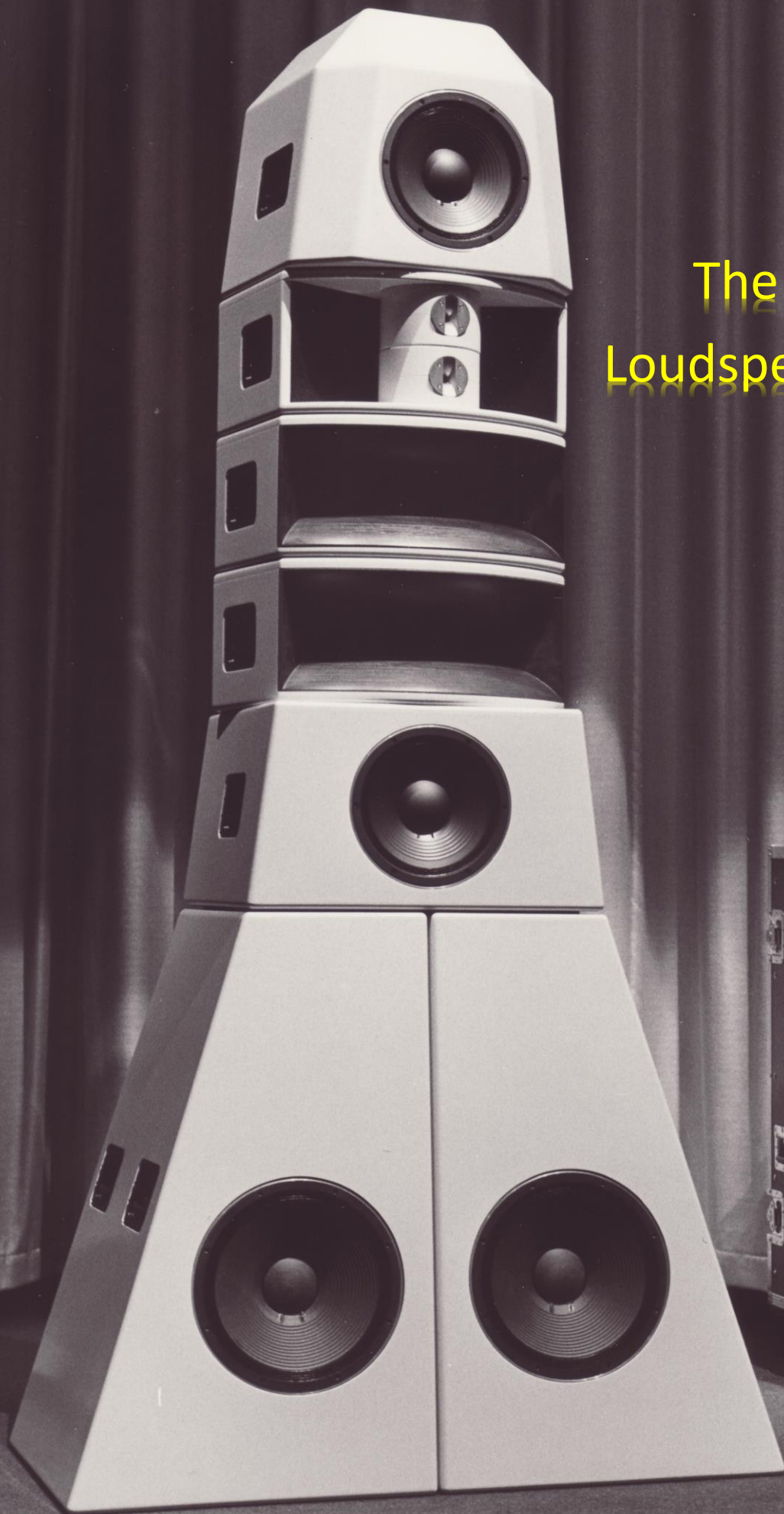


The Pioneer TAD  
Loudspeaker System



## The Pioneer TAD Loudspeaker System

### Introduction

**T**his is an extraordinary speaker system. Designed especially for delivering the highest quality audio. One of a kind. Custom built with professional drivers from **TAD - Technical Audio Devices**. It is tailor-made for presenting **recorded music** for a large audience. It was initiated by Pioneer in Sweden and designed by professional sound engineers to promote Pioneer products. It has gained success which has been stated in the international press. It is a two-channel stereo system which can be adapted to a variety of acoustical environments by using the DSP-based audio signal equipment.



With an exquisite design - like being brought from a 'Star Wars' movie – the speakers were designed with quality at any cost.

**This is NOT a Public Address (PA) System for live events.  
Its designed for playing recorded music to larger audiences**

It is especially designed for delivering the best HiFi experience in concert halls or auditoriums. Every part of the system has been designed to deliver the listeners an experience unheard of.

Examples of **international press coverage** can be seen in Annex 1.

## Background

This is how this sensational loudspeaker system came about: In the early 90's Pioneer launched a number of new up-market HiFi products they wanted to promote. The Pioneer HiFi loudspeaker line-up was naturally also designed for domestic use. To show the new potential of the HiFi amplifiers and CD-players, larger speakers were needed to perform for larger audiences. Pioneer had in mind of playing for audiences around 500 – 700 people.

Pioneer was, and still is, the owner of TAD (<https://www.technicalaudiodevices.com/>). This is a High End manufacturer, both of electronics, loudspeakers and speaker units. TAD's own excellent loudspeaker systems were however not designed for this application in mind – they were designed for control rooms and advanced domestic use.

The logo for Technical Audio Devices (TAD) consists of the letters 'TAD' in a bold, stylized, sans-serif font. The 'T' and 'A' are connected, and the 'D' is slightly separated.

TECHNICAL AUDIO DEVICES LABORATORIES, INC.

*Please note that the company TAD has not been involved in the design, construction, promotion or any other activity related to this loudspeaker system, except supplying the excellent speaker units.*

Pioneer in Sweden was eager to make a better market impact by presenting the Pioneer electronics with extremely well-built speakers. The company Mark Two Studioteknik in Sweden was engaged. Together with Pioneer, the Pioneer TAD Reference by Mark Two was designed ("The Pioneer TAD System"), constructed assembled together with the required electronic front end.

With Swedish design tradition in mind, the Pioneer TAD System was given a spectacular look, an ideal combination of form-follows-function. Also, black colour was ruled out – a brighter paint gave also the eye a positive experience! The paint is 'alabaster' - an original light, off-white colour from Porsche.

The Pioneer TAD System was on tour in Sweden during 1990 to 1995 and played at a number of demonstrations and concerts for customers interested in Pioneer HiFi components. It got international reputation, which can be seen at the end of this document. The premiere concert was held in Berwaldhallen, Stockholm in cooperation with the Swedish public broadcaster Sveriges Radio in order to promote high quality sound.

Then, it was put in its flight cases, transported to a warehouse and – forgotten! Due to Pioneer changing their logistic system twice, the warehouse location changed and the TAD System could not be found! Until 2015 that is! 20 years of storage in its flight cases it was re-discovered at a previous Pioneer warehouse in south of Sweden. In the warehouse all flight cases had been kept at room temperature for the full duration of its long-term storage!

The TAD system was then brought to Stockholm, Sweden for evaluation. All speaker units and equipment were measured and computer tested by the previous sound engineers at Mark Two Studioteknik. Not surprisingly, all speaker units but two were in mint condition (see comment below). No other speaker shows any degradation or time-ageing. The Pioneer TAD system was assembled and tested. Extensive listening tests were also performed to ensure that the quality was maintained.

A re-launch was decided upon - five concerts have been held with very good result in Stockholm. Music lovers and HiFi enthusiasts have been overwhelmed by the sound quality this Pioneer TAD System can deliver – even today. Please refer to **Annex 3 - Evaluation of Sound Quality**.



## Description

A thorough description of the complete Pioneer TAD System follows below. Each part and the design philosophy is outlined. The Pioneer TAD System has been used for presenting live recordings, high resolution audio and master files in concert halls for to more than 700 spectators. With 4 200 Watts of RMS output power available, these efficient loudspeakers can output any recording with sensational dynamics and clarity. It is designed to perform any music genre just as the producers and musicians intended.

Again, this is NOT a Public Address system! Musicians playing at live concerts on stage is a totally different ball game. For PA systems, a number of compromises must be taken into account, e.g. acoustic feedback problems with stage microphones. Speakers and directivity have to be carefully chosen to avoid the acoustical challenges with live musicians on stage.

The Pioneer TAD System is designed for presenting high fidelity stereo recordings with a wide soundstage. The acoustic design is a line source. This enables a wide horizontal audio distribution in the arena while minimising floor and ceiling reflections. Hence, the audience will enjoy the full audio spectrum wherever they are seated (within limits).



The system is modular so that it can be adjusted to the ceiling height of the room (you can run the system with only one low midrange unit + one high midrange/treble unit to be able to play in rooms with a maximum height of 240 cm).

All modules are equipped with heavy duty handles for easy of mounting and dismounting. The complete system is transportable using 15 special flight cases on wheels.

All parts included, loudspeakers and electronics, in the Pioneer TAD System are fully operational without “wear-and-tear” (See also page 12, section “High Treble”)

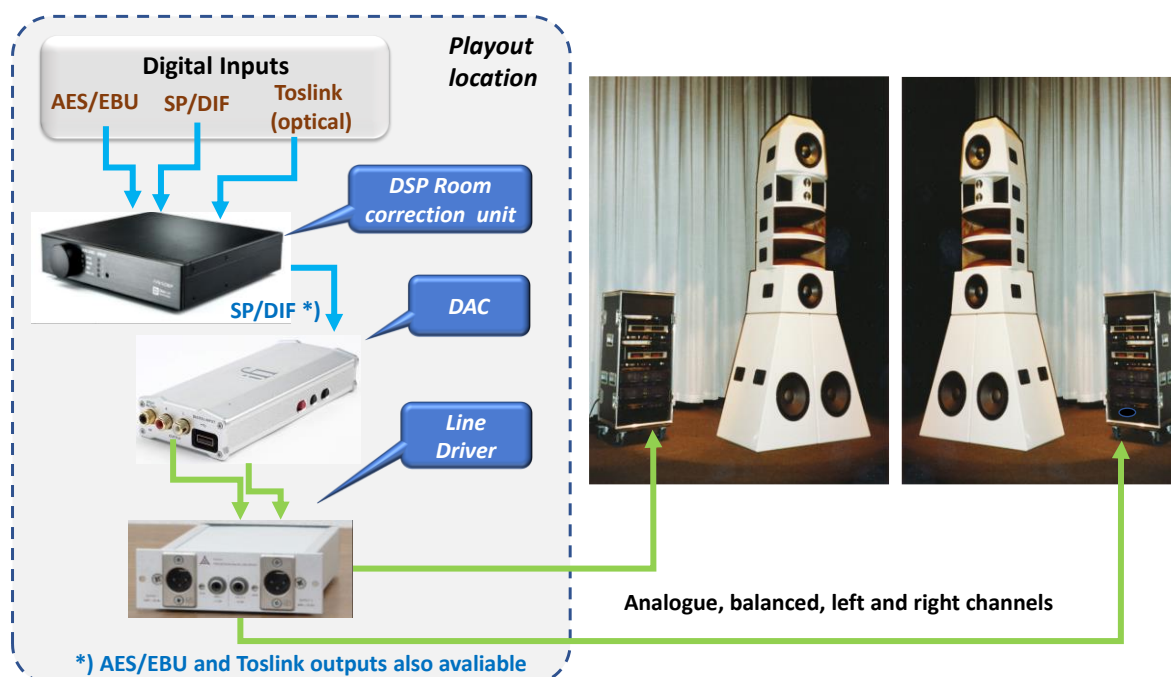
The Pioneer TAD System consist of

- **Two speaker columns**; each with seven modular enclosures. Ten loudspeaker units/channel
- **Two audio equipment rack cabinets** (flight cases) on wheels (x-over units, power amplifiers)
- **Audio signal processing equipment and cabling**
- **Extensive mains power wiring** to enable

installation at theatres, concert halls etc. All electronics are powered from the mains network (230 V AC, 50 Hz) and installed at CE standards

- **16 professional flight cases** (one spare) on wheels for transport and storage of speakers, electronics and cables. All speaker modules have their own, dedicated flight case tailormade to its size and shape
- **Two dedicated podiums** equipped with six ball-bearing wheels for easy of positioning on stage

## Signal chain and processing units



The Pioneer TAD System signal chain is depicted above. The digital audio signal is connected to the **DSP Room Correction Device**, using **DIRAC Live** (<https://www.dirac.com/>), one of the world's most well-known room correction systems. Hence, the Pioneer TAD System can be installed in "any" acoustical environment and be tailored to that acoustics of that specific room/arena.

The digital audio signal is connected to a **Digital/Analogue (DAC) converter**. A SP/DIF connection is used. Any DAC with a SP/DIF, AES/EBU or Toslink input can be connected. The analogue outputs from the DAC (left, right channel) are then feeding the inputs of the **FM Acoustics Precision Line Driver**. This unit provides balanced, analogue signals for the left and right channels respectively, feeding the electronics in the rack cabinets on stage.

## Processing unit



### DSP Room Correction: mini-dsp DDRC-22D

There are four pre-sets for different room correction settings that can be installed. All are programmable. The Pioneer TAD System can then be adjusted to the acoustics of the specific concert hall used. Alternatively, tailored to any type of specific music that shall be reproduced. A digital level control is also included in the unit.

The DDRC-22D have digital inputs and outputs for **AES/EBU, SP/DIF and optical Toslink**. Please refer to: <https://www.minidsp.com/products/dirac-series/product-line-summary>.

## Digital/Analogue Converter - DAC



Based on listening test, the **iFi Micro iDSD USB DAC** was selected. This unit has a SP/DIF digital input and Line level analogue outputs. An output level control is also provided.

It is a very versatile DAC, also including a headphone output. Numerous digital formats can be handled. An in-depth video here:

<https://www.youtube.com/watch?v=zU5agnwq214>

## Line Driver



For connecting the DAC to the equipment on stage, the **FM Acoustics FM 214 Precision balanced Line Driver** is used. This ensures that even longer cable distances between the signal source/mixer are free from interference, hum and degradation. This unit has unbalanced inputs (RCA) and balanced outputs (XLR).

The FM 214 has a gain control for each channel (enabling +14 dBu); this is accessed via a screw driver from the front. One FM 214 unit is included incl. instruction manual.

A separate, small power supply unit is used for connecting to the mains network (230 V AC/50 Hz). Please refer to : <https://www.fmacoustics.com/company/heritage/fm-214-fm-216/>

## System configuration; filtering, amplification and speaker modules

The Pioneer TAD System was designed with active filtering in a 4-way configuration (see the picture “System architecture” below). The FM Acoustics Crossover Filter unit is using input modules for x-over frequency settings. Initially, these were chosen to be 200 Hz, 315 Hz, 800 Hz and 6.3 kHz respectively. These are then fixed settings. Tools for changing modules is included.

Note: To change x-over frequencies, modules have to be ordered from FM Acoustics, Switzerland.

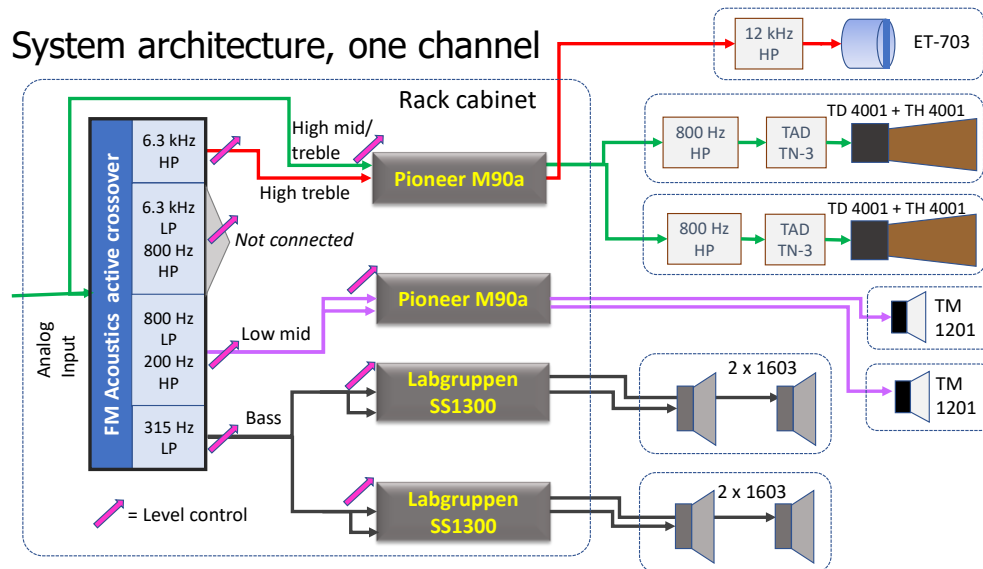
There is a slight overlap between the woofers and the low midrange units. In theory, the x-over LP and HP frequencies should be identical. From listening tests, it was clear that the small overlap gave a better integration between the two ranges, especially noticeable on voice reproduction.

When the Pioneer TAD System was thoroughly re-tested, it was obvious to utilize the midrange horn combination TD 4001+ TH4001 for a wider frequency range; 800 Hz – 20 kHz. These units provide a very wide horizontal coverage and an outstanding dynamic presentation.

Therefore, the High treble units (ET-703) were “offloaded” by acting as “super tweeters”, filling in above 12

## The Pioneer TAD System – Description and Specification

kHz only. The Pioneer TAD System could then also handle higher SPL levels than its original configuration. Extensive listening test also showed that this configuration was quite an improvement. **Measurements** can be found in **Annex 2**. The solution chosen was to utilize passive HP filtering at 800 Hz + TAD TN3 correction network for the TD 4001/TH 4001 combination. Likewise, the High Treble units were using the 6.3 kHz active filtering + 12 kHz passive filtering.



The x-over filter has level controls for all ranges. Moreover, all outputs can be controlled by individual limiters to protect the speaker units. In the configuration above, only the High treble range has this limiter activated.

## Rack cabinets



- ← Storage area for loudspeaker cables
- ← Pioneer M90a amplifiers
- ← Labgruppen SS1300 amplifiers
- ← FM Acoustics 234 crossover network

The power amplifiers and crossovers are mounted in professional 19-inch rack cabinets on wheels. Excellent ventilation is secured for all unit during operation. All electronics are connected; signal source, loudspeakers + mains wiring. The loud-speaker cables are contained within each rack cabinet units during transport.

The front is protected with a tinted glass panel to avoid un-authorized changing of the settings of the units. The glass panel can be easily disconnected if needed. At transport, front and back is fully covered with the flight case panels.

All electronic units in each rack is connected to a common mains connection plinth, which is connected to 230 V AC, 50 Hz.



## Crossover Network



Extreme care was taken to select the very best, analogue crossover filter. 2 x **FM Acoustics 236 / 4L Linear-Phase Crossover** (<https://www.fmacoustics.com/>) are used here. This is a 4-channel active crossover filter, hand-built in Switzerland with the highest standards. Discrete components throughout – no IC-circuits. Selected for optimum sound quality and coherence. Gaussian filtering with very steep filter slopes at 36 dB/octave are used for best phase and transient response. Levels for each channel, switchable limit and threshold functions. Fixed crossover modules with excellent audio performance.

### Crossover frequencies:

- Woofer 200 Hz LP
- Low midrange: 315 Hz HP, 800 Hz LP
- High Midrange/treble: 800 Hz HP, 6.3 kHz LP
- High Treble: 6.3 kHz HP.

Note: The x-over frequencies above was used for the original version. Any change requires new x-over modules from FM Acoustics. Please refer to Section “**System Configuration**” for the updated version.

## Power amplifiers

Dedicated amplification is used for the loudspeaker units. All power amplifiers have output displays and protection circuits to safeguard the operation.



- Woofer amplifiers: **4 x SS-1300 power amplifiers** from **Labgruppen**, Sweden. Please refer to: ([https://www.labgruppen.com/brand/labgruppen/our-story#googtrans\(en|en\)](https://www.labgruppen.com/brand/labgruppen/our-story#googtrans(en|en))).  
Output Power: 2 x 325 W/8 Ohm, 0.1% THD (20 Hz - 20 kHz). Weight: 9 kg. Each amplifier has



## The Pioneer TAD System – Description and Specification

recently been upgraded by the designer with an improved Switch-mode Power Supply for even better sound performance and low energy consumption. These amplifiers were chosen to have enough headroom and dynamic capabilities even at high SPLs. In total, there are four SS-1300 power amplifiers for the woofer sections



- Low midrange: **PIONEER M90a** Reference Power Amplifier, see picture above. Power output: 2 x 200 W/8 Ohm 0.003% THD (20 Hz – 20 kHz). Weight: 23 kg. Please refer to: <https://audio-database.com/PIONEER-EXCLUSIVE/amp/m-90a-e.html>
- High midrange/treble and super treble: **PIONEER M90a** Reference Power Amplifier. One channel driving two midrange units and one channel for one/two tweeter units. With an efficiency of 110 dB/W for the midrange/horn combination and 107 dB/W for the super treble units, one stereo power amplifier can deliver more than enough of power with outstanding dynamic headroom. In total, there are four Pioneer M90a power amplifiers

## Speaker units

The Pioneer TAD System is a 2-channel modular system in a 4-way configuration. The two columns contain bass, low midrange, high midrange/treble and super-treble. The **loudspeaker enclosures** are acoustically “dead” by an optimized 3-layer construction (board – acoustic compound – board). Professionally assembled with layers of Antiphan D1D dampening compound material. All enclosure parts were made using a power press exceeding 100 tons to make sure all parts of the enclosures have a minimum of vibration even at the highest playback volumes. Each enclosure also has internal bracing where needed.

- The loudspeaker columns consist of **loudspeaker modules** that are easily stackable on each other. Special fixations ensure that all modules are safely attached. The modules will be in practice “glued” together even at high SPL output
- **Minimizing audio diffraction** is achieved due to careful design of the modules. By having all frequency ranges separated by individual enclosures – minimum interference between loudspeaker modules is also achieved
- **All bass units and lower midrange units** are made of **heavy duty diecast aluminium alloy frames** ensuring non-resonant structures. Each unit is protected with detachable, steel grids
- **The upper midrange/treble exponential horn combination + high treble horns** are using **beryllium** diaphragms, one of the most rigid material known for loudspeaker diaphragms
- The **four upper modules** can be individually turned horizontally to optimize the acoustical coverage of the audience in concert halls requiring special attention

## The Pioneer TAD System – Description and Specification

- **All speaker units are easily accessible.** All modules can be easily dismantled, e.g. in case of repair. Panels and assemblies are attached with HEX-screws

### Woofers



The bass section of each channel consists of 4 x 16-inch **TAD 1603** drivers per channel in a isobaric construction. (Product info: (<https://www.technicalaudiodevices.com/lf-units/>)). The outer bass unit in each module is mounted in a sealed enclosure. Right behind is an identical TAD driver mounted in a bass reflex enclosure. Large, circular openings are used enabling laminar air flow even at high sound pressures. By this construction, both units are working in acoustical series configuration for improved low bass performance. Four bass enclosures with eight woofers in total ensures dynamic, deep bass. This is also enhanced by two woofer modules being located both close together and close to the floor.

### Lower midrange



Extreme care was taken to handle the lower midrange spectrum. These speaker units were designed by TAD using advanced optical laser and extensive listening tests.

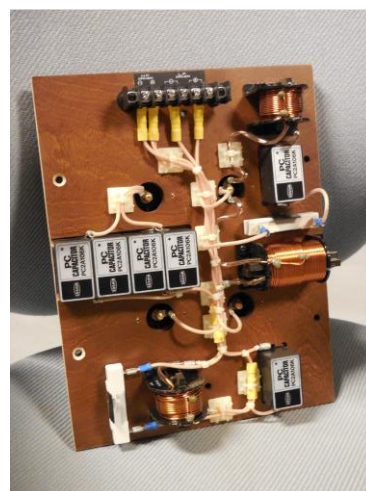
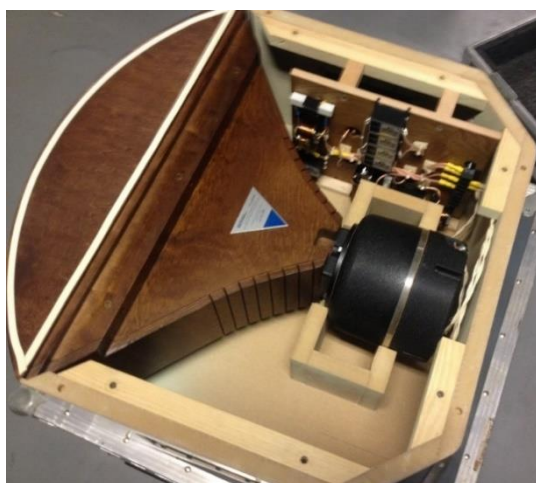
2 x 12-inch **TAD TM-1201** midrange drivers with polymer graphite membrane. This powerful 12-inch unit weighs 11 kgs (!) and has a ruler flat frequency response in the midrange. Moreover, a unique design for lowest distortion and natural sound obtaining a remarkable efficiency of 100 dB/W.

## The Pioneer TAD System – Description and Specification



Separate, aperiodically damped enclosures are used for optimum performance. Two “resistive ports/vents” are located on the back of each enclosure. This can be compared to the shock absorbers of a car – controlling the damping of the loudspeaker at its resonance. This results in two controlled impedance peaks and an improved mid bass audio performance. Four low midrange units are used in in total.

### Upper midrange/treble



*TAD TH-4001 + TD-4001 Horn/driver mounted in its enclosure and TAD TN-3 correction filter*

The upper midrange and treble frequency spectrum are handled by 2 x **TAD TH-4001** exponential horn + **2 x TAD TD-4001** drivers per channel. These extremely well-built exponential horns are delivering outstanding clarity. The TD-4001 is equipped with a 4-inch (100mm) voice coil and beryllium diaphragm, one of the strongest and most exclusive materials known for loudspeaker use.

**TD-4001** - Please refer to: <https://www.technicalaudiodevices.com/pro-hf-units/>

The TH-4001 stabilized dispersion horn is using a hyperbolic design enabling both high sensitivity over a wide range and directional control. Each horn is handcrafted in maple. The TD-4001 driver has an efficiency of 110 dB/W which enables use of HiFi power amplifiers with moderate power output. The horn/driver combination itself weighs in excess of 24 kg – this also contributes to stability at any power level.

**TH-4001** - Please refer to: <https://audio-database.com/PIONEER-EXCLUSIVE/unit/th-4001-e.html>

Each driver/horn combination is equipped with a dedicated **TAD TN-3** frequency correction filter. This filter has three purposes; correcting the frequency response, linearizing the impedance and protecting the driver from very low frequency signals.

## High Treble



For the very highest frequencies, **TAD ET-703 compressor super tweeters** (<http://www.hornstudio.de/703.pdf>) with beryllium diaphragm are used. They have a frequency range of 5 000 – 45 000 Hz and an efficiency of 107 dB/W/m. Frequency response and transient characteristics are excellent.

Each tweeter can be turned horizontally for optimized audio coverage. They are totally independently movable. The design eliminated early reflections and ensures a wide distribution of the highest frequencies. These are used as “super tweeters” as described in the Section “System Configuration”, whereas the high midrange/ treble horn covers the full

spectrum from 800 Hz – 20 kHz. By adding the compressor super tweeters, the loudspeaker system ensures wide horizontal coverage even at the very highest frequencies. The compressor super tweeters are active above 12 kHz.

Unfortunately, one ET-703 high treble horn in each module is faulty. TAD has a replacement diaphragm named **SXE-503**, which can be replaced without the need for special tools. We have, however, not been able to repair these. However, at these very high frequencies, the SPLs needed are limited in music material.

## Signal Cabling

- Line level cables are used with a balanced (XLR) and unbalanced (RCA) configuration in the rack cabinets. Additional cabling (2 x 25 m XLR) is supplied, if analogue signal format is utilized from the signal source/mixer
- Speaker cables are of professional grade (Linear Crystal Oxygen Free Copper – LC-OFC) and connected to the loudspeaker units with NEUTRIC SPEAKON (bass, lower midrange) and gold plated NEUTRIC XLR (High midrange/treble and super-treble) connectors. The woofer and lower midrange units are using PREFER LC 425 cables and the other speakers are using KLOTZ cabling
- Internal cabling in the loudspeaker enclosures are also using LC-OFC cables of professional grade
- Each loudspeaker connector (XLR, SPEAKON) is identified by a unique colour marking to minimize the risk of misconnection

## Mains Power connection

To ensure a stable connectivity to the mains network (230V AC, 50 Hz), robust cabling is included for the supply to the electronic components. The TAD system can be connected to:

- 230 V AC, 50 Hz directly to suitable main outlets (16A min/channel)
- 400 V AC/ 32 A 3-phase connections
- 400 V AC 64 A 3-phase connections

For the 400V connections, dedicated cabling is included as well as a heavy duty, “mains power plinth”.



## Flight Cases and podiums

The complete Pioneer TAD System is transportable. Each loudspeaker module has its own, dedicated flight case. Two flight cases for the installed electronics; front and rear sides are easily removed before operation. All cases are marked for easy identification of which module it shall protect. The flight cases are of rugged, professional design with heavy duty handles and wheels for ease of transport.

All 16 flight cases stored together occupies 9 square meters of floor space. If needed, the smaller flight cases can be put on top of the bigger ones, decreasing the required floor space to 6 square meters.



Moreover, each loudspeaker column has its own, separate podium for ease of positioning on stage. Each podium is equipped with six roller bearing wheels, where four wheels can be locked. A dedicated divider (see picture) ensures that the columns are correctly positioned on the podiums. There is no risk that the columns will move during operation.

The podiums are heavy duty made of birch plywood and covered with black cloth. Two handles enable easy transport. Also used for cable assembling on stage.

## Dimensions and weight

Detailed dimensions of each module are found in **Annex 4**.

### Loudspeaker columns, each channel:

- Total height, seven modules installed: approx. 292 cm (approx. 310 cm incl podium)
- Total height, five modules installed (two modules omitted; one upper midrange/treble + one high treble unit): 230 cm. This is suitable if room ceiling height is limited to 250 cm
- Total weight, seven modules; 406 kg

### Audio equipment rack; each channel

- Total weight: approx. 100 kg

### Total System weight:

- Approx. 1012 kg

## Documentation

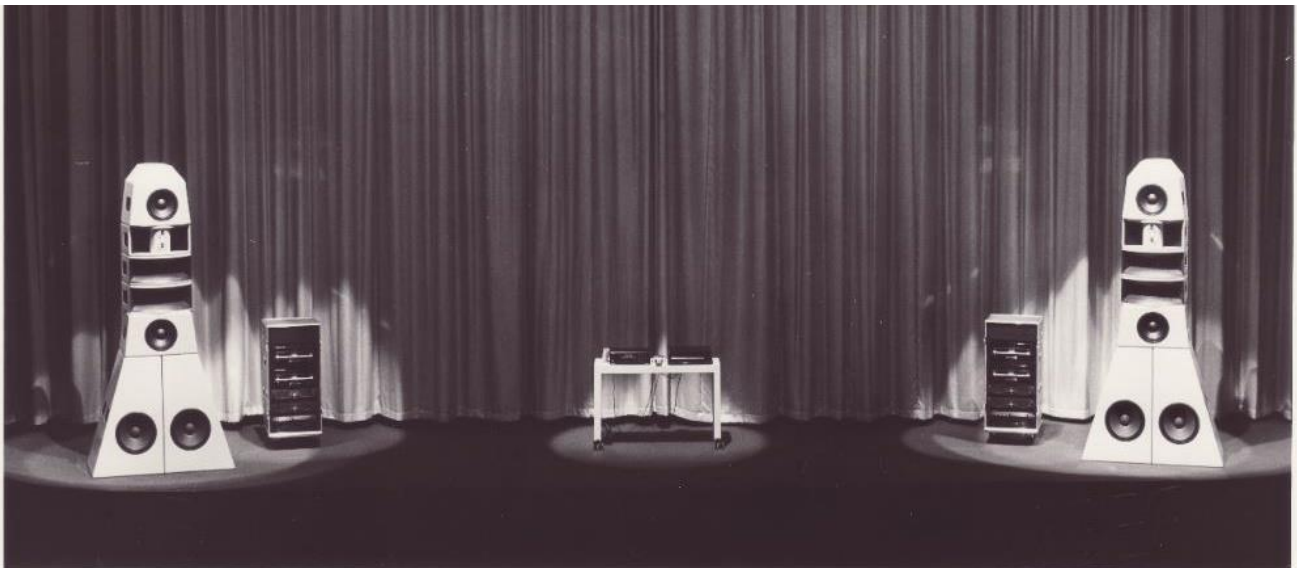
Documentation will be provided describing the system components. There are copies or original TAD product specifications of the speaker elements, the FM Acoustics active crossover and power amplifiers from Labgruppen and Pioneer.

The original construction drawings of each loudspeaker modules will also be supplied.

Information is also provided of the flight cases. Individual numbering facilitates easy identification for packaging of the modules.

## Support

For the prospect customer, we are enabling support for transport, installation, putting into operation and any questions the new user may reasonably have. The support needed may vary depending on the buyer's needs. Hence, this item must be agreed among the parties.



## Development Potential

Successfully operating the Pioneer TAD System, we believe that there are some areas of development potential. Some ideas:

- The “front-end” can e.g. utilize a digital mixer fed with Hi-resolution files from a library/HD-drive
- The electronics in the rack cabinets can be totally “digitized”. DSP-controlled amplifiers can be “tailored” to each loudspeaker module. Each rack cabinet can be equipped with its own D/A converter, digital crossover network and DSP units
- The two-channel configuration can be extended to more audio channels, depending on the application; multichannel configuration is one option

## Contact

For interest or more information, see below:

### Audio Concept

Södra Agnegatan 29, 112 29 Stockholm

Tel: 0046 8 650 72 50 Fax: +46 8 650 9150

info@audioconcept.se [www.audioconcept.se](http://www.audioconcept.se)



## Annex 1 - Press coverage



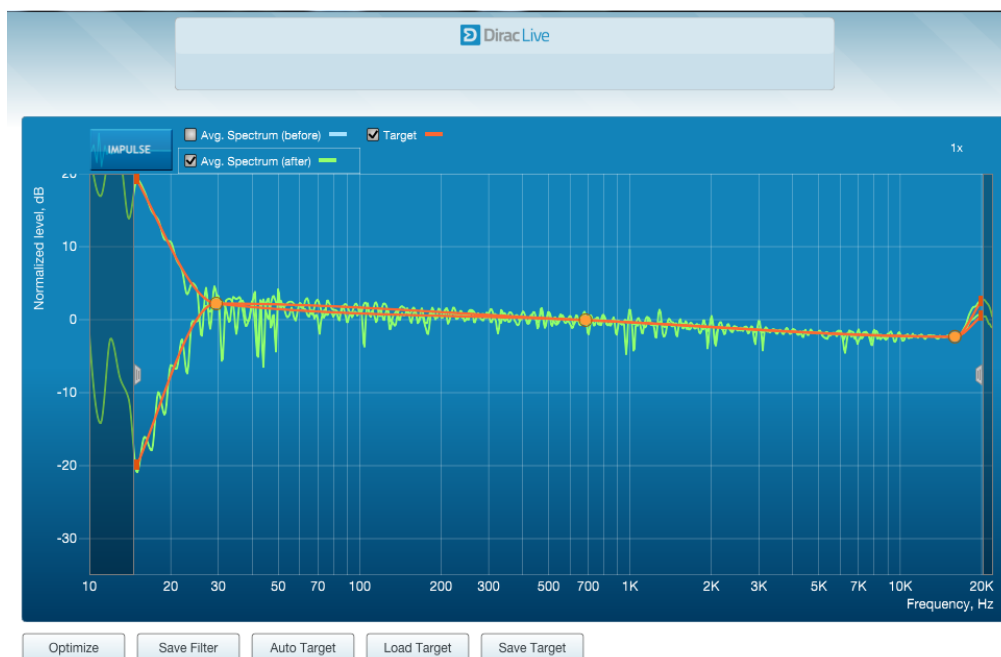


## Annex 2 – Measurements

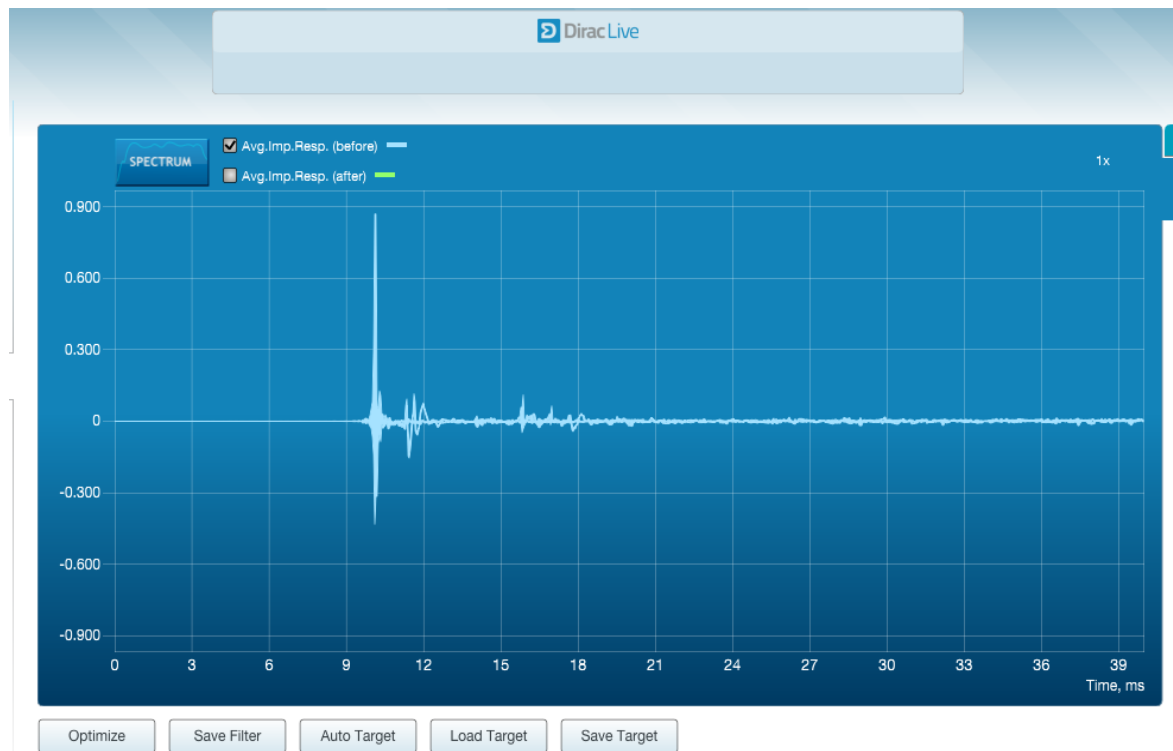
Measurements performed by Mr Victor Gunnarsson/DIRAC (<https://www.dirac.com/>) on the Pioneer TAD System at the concert hall “Musikaliska” in Stockholm, Sweden. This concert hall presents a very lively and challenging acoustic environment. The DIRAC Live solution together with Pioneer TAD successfully made it possible to reproduce outstanding clarity, which was confirmed by the audience.



**Fig A2-1:** Average DIRAC measurement from five different microphone positions in the audience area.



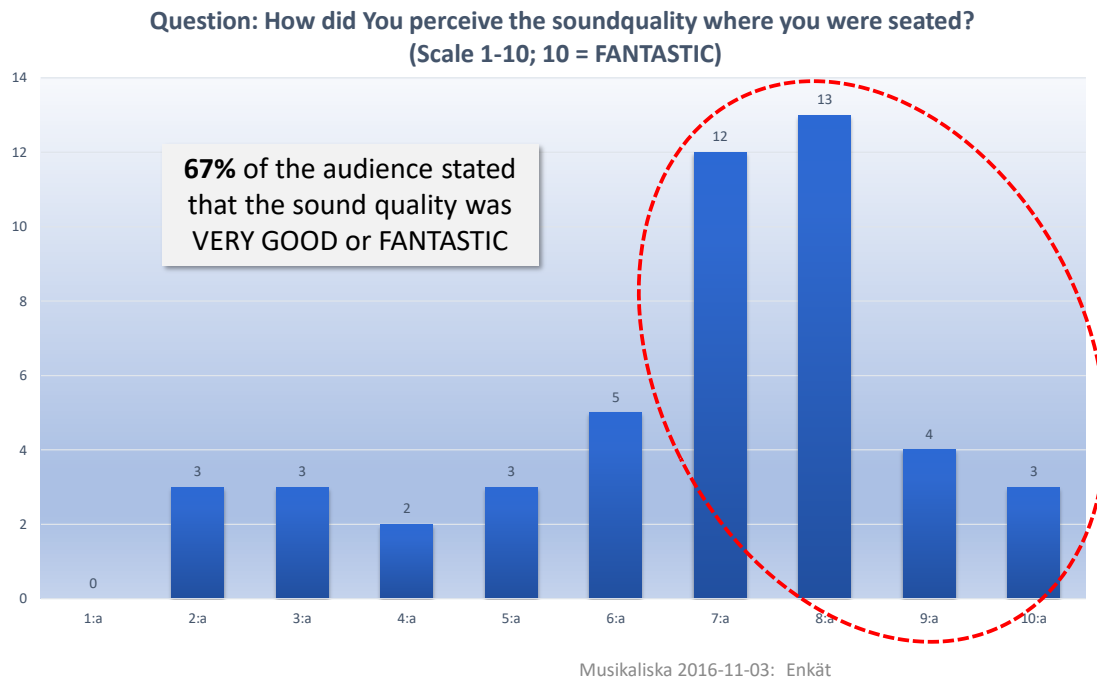
**Fig A2-2:** RED: Target response using DIRAC Live DSP. Average DIRAC measurement from five different microphone positions in the audience area. GREEN: Frequency response after DIRAC processing.



**Fig A2-3:** Impulse response of the Pioneer TAD System.

## Annex 3 – Evaluation of Sound quality

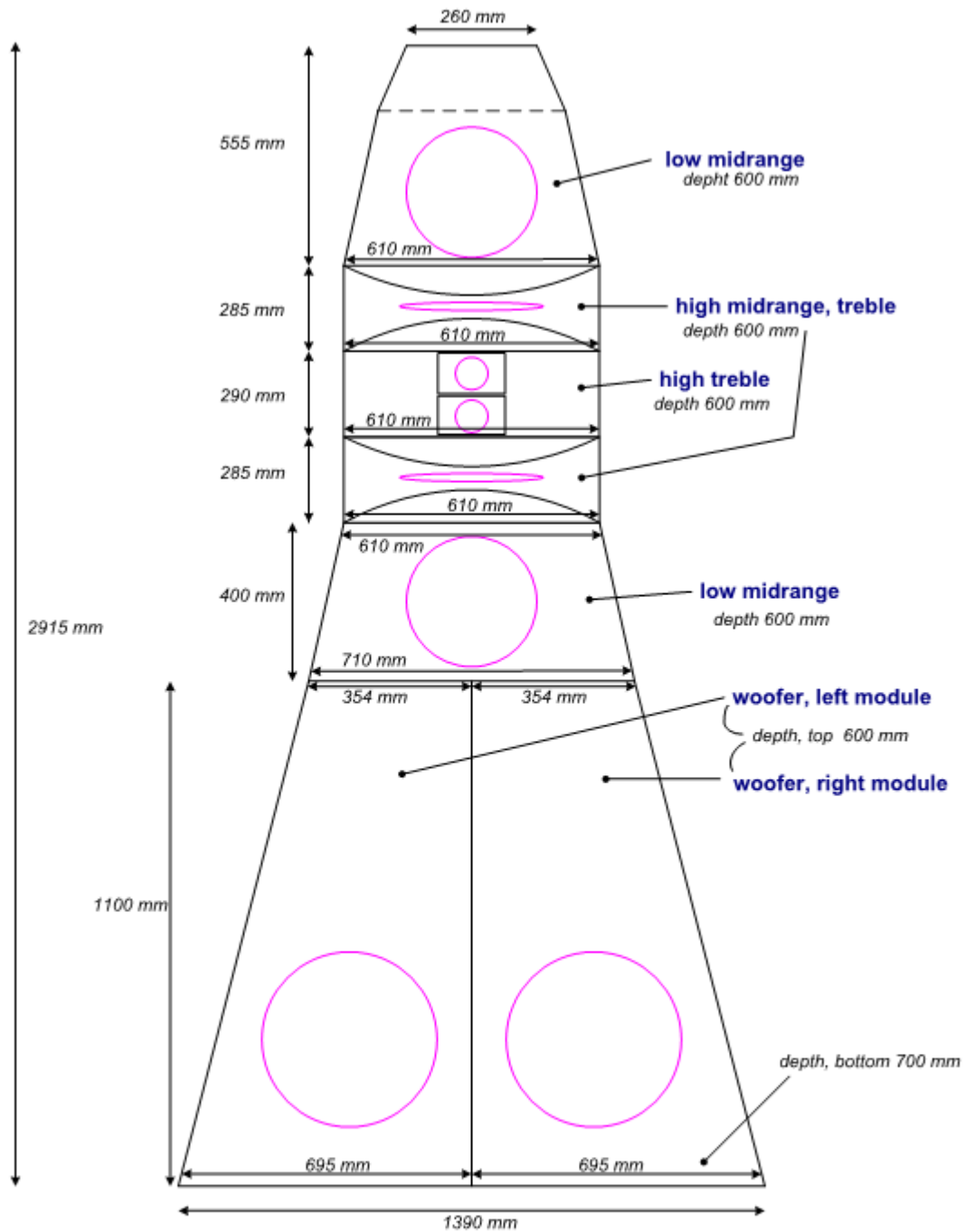
### Perceived Sound Quality



At a concert performed at Musikaliska, a survey of the sound quality was performed. The audience was presented with a variety of music material, mostly high-resolution files from L2/Norway, Linn and HD Tracks.

As can be seen from the results above, more than 2/3 of the respondents was very impressed by the sound quality performed by the Pioneer TAD System - despite installed in a very challenging acoustical environment.

## Annex 4 – Dimensions



TAD Reference - dimensions

Mark Two