

Case Study (Europe): Theatre Baden, Austria

Theatre Baden Chooses Xilica Digital Processors For Theatres New Sound System

The Innovative Sound-Reinforcement Concept of Theater Baden

Every successful sound-reinforcement concept starts with selecting the most appropriate speakers and components for the specific applications at hand. The speakers are the key to maximum quality – especially where hardware budget constrains apply. First, a fundamental decision has to be made: Will all speakers be from the same vendor?

Perhaps even factory matched systems? Or rather not? Advantages of the single-vendor approach include “commercial safety” and the knowledge that all pieces fit together. On the other hand, no single vendor worldwide offers the best speakers for each application. This is particularly true for special applications.

Even factory-matched systems can only be adapted to an “average” of all conceivable applications; moreover, they are excessively expensive. With stationary installations, however, calibration and adaptation to the application at hand as well as to the local building acoustics are required anyway, spoiling the benefits of factory-matched systems.



Therefore, Theater Baden opted for an open system based on HD und Studt Akustik speakers. The 4-channel amplifiers from LAB Gruppen’s C series support remote monitoring, *and the 8-channel Xilica Audio Design XD and XP Series digital processors provide speaker system management and remote-control options.* LAB Gruppen and *Xilica* are renowned manufacturers offering a considerably better range in their respective areas of specialization – at a reasonable price.

With the project at hand, the first and foremost decision was on the left and right portal speakers. The purpose of those speakers is to support and amplify the vocal performance in a way that the audience does not perceive the speakers themselves. This applies to musical, operettas, and drama use – not all vocalists and actors produce volumes sufficient to fill a hall. At the same time, the audience’s aural perception gets worse by and by in the course of the show, resulting in increased volume expectations.

When using speakers to support vocal performances, directionality plays an important role for the sonic naturalness of the audience’s perception. Vertical directionality requires to mount the speakers on the performers level; this is exactly what needs to be avoided when using dynamic speakers – otherwise, feedback could not be prevented properly when using a large number of wireless microphones. In this regard, broadband magnetostats offer one critical advantage: Their directivity is entirely uniform without any side lobes causing early feedback.

The performers with their wireless microphones often enter the proscenium and sometimes move directly in front of those speakers. Very large speaker versions (50" or 75") output the full vocal-frequency range – without crossover, compression, and a horn. Dynamic 6" speakers are used only for the low-frequency range below 250Hz. This setup achieves a feedback threshold that is about 10 dB higher than that of dynamic speakers – regardless of whether individual cabinets or a line array are used. The higher maximum level of dynamic speakers cannot be utilized in this application since the feedback threshold defines the achievable maximum.



Each side portal houses a stack comprising 1 HD L190 unit (75" magnetostat) at the bottom followed by 1 HD L365 unit (3 × 6.5" woofer) and 2 HD L132-A3 units (50" magnetostat plus 3 × 6.5" woofer) at the top. *Active crossovers incorporated in the Xilica processors feed those systems.* The entire stack has an overall height of 6.7 meters, offering an appropriate extension of the cylindrical wave over the entire vocal-frequency range (at just –3dB). The magnetostat at the bottom is placed on the stage floor, so voice radiation starts on the listeners' ear level. This ensures correct vertical directionality, in particular, for the front seating. In addition, the magnetostats and woofers are vertically distributed in a way that the latter ones are not positioned on the ear level of listeners in the lateral front boxes.

The 120 degree radiation angle of the magnetostat turns the familiar sweet spot into a large area ranging from the front third of the stage far into the auditorium. This ensures appropriate horizontal directionality for the listeners. Even the most expensive seats (front/center stalls), which are often neglected when dynamic speakers are used, are now covered appropriately. In addition, this approach considerably improves the monitoring conditions in the front area of the stage.

Already the first performance – West Side Story – proved that a large radiation angle is by no means a source of early feedback; it is rather the design of dynamic speakers that produces extensive side lobes in their directivity pattern. There are numerous causes such as crossovers operating in the critical vocal range, etc.

The speaker lines (arrays) are just 236 mm in width and therefore hardly obstruct the audience's or lighting technicians' view. At the top of each portal side, one Studt S1514 II (15"/1.4") located at a height of 7 meters supports the stack to ensure coverage of the gallery. This is because the gallery seating is located a few meters higher than the top end of the portal.

Speakers with a minimum vertical radiation angle of 60° were needed for setting up the center cluster to ensure coverage of the stalls and the balcony. Theater Baden opted for a pair of Studt S1214 II (12"/1.4"). In addition, four compact Studt S8010 (8"/1") units are used for covering the upper circle and the gallery. Studt use only the best chassis available for their speakers; this happens quite rarely nowadays because the majority of manufacturers considers this an area for cutting costs or prefers using obsolete designs for "compatibility" purposes. The integrated passive crossovers are a class of their own, too. All of those features make Studt systems the perfect choice when it comes to acquiring high-quality speakers at reasonable costs.

Compact yet powerful speakers were required for transverse installation below the balustrade under the balcony. Since those speakers were placed far to the outside, the tweeters needed to be arranged towards the center. In addition, the speaker cabinets had to be sloped in order to fit perfectly into the space at the balustrade ceiling. This was necessary not only for optical reasons but also for meeting preservation requirements. The perfect solution was a mirrored Studt S1514 II version. Although mirrored speaker cabinets are quite useful, for example, for power monitoring on stage, and are therefore much sought after, only a few vendors actually offer them. Again, specialization is the key.

Mobile 21" subwoofers can be placed as necessary below those systems on the left and the right. These Studt S121S units are mainly used for musical productions; however, when used in combination with the four 15" subwoofers located at the dome, they are as well capable of producing earthshaking sound effects. In addition, the dome houses six extra special-FX speakers. Two more HD L132-A3 magnetostats mounted on a swivel bracket are used as mobile stage wedges. They are supplemented by a number of Studt S1214 systems and small 8" co-ax speakers. Four Studt S1514 units are suspended on each side at the front and the rear for use as stage monitors. Some additional co-ax speakers are used for monitoring in the orchestra pit.

All power amplifiers come from the C series by LAB Gruppen. These are 2-U units featuring four channels and the Nomad Link remote-monitoring system. The setup allows for configuring a highly compact amplifier rack with comparably low space requirements. For many years, LAB has successfully employed high-power switched-mode power supplies with high efficiency and reliability; their use allows for reducing power consumption to as low as a third compared to analog power supplies. Fortunately, this not only cuts power costs bill but also significantly reduces heat dissipation. It allows Theater Baden to operate their amplifier room without an air-conditioning system.

The Nomad Link remote-monitoring system has proven highly reliable and economical and also provides a number of useful features, for example, a solo function. The gain of all amplifiers is fixed to 26 dB; the only exception are those amps driving the 21" subwoofers – they are set to 32 dB. Another useful feature are the front-panel encoders. They can be set in small increments and can also be hidden behind a cover to prevent undesired "improvements" by unauthorized persons. Certainly, LAB Group products do not come cheap; however, having had a closer look, the price is definitely reasonable.

The same is true for the digital processors by Xilica. The 1-RU units provide 8 inputs and 8 outputs, a matrix, and all signal-processing functions required for speaker calibration. 4 x XD-8080 processors (with extra AES/EBU I/O) and 3 x XP-8080 processors are accommodated in just 9 rack units of height (processors 7RU / vent panels 2RU).



Again, enclosures and power supplies are significant cost factors of devices. This means, for example, that units featuring just 2 inputs have relatively high space requirements and their operation is basically uneconomical. 8 inputs per unit are desirable from the operator's point of view, too – for example, when controlling the integrated matrix. The same is true for signal processors available today. The amplifier rack has a total of 38 units in height and accommodates 56 digital-controller paths providing comprehensive signal processing plus 13 power amplifiers with a total nominal power of 36.8 kW.

The engineer at the audio control room can operate the *Xilica digital processors* over an Ethernet line. Moreover, with the addition of a low cost wireless router, wireless remote operation is possible too: Perform calibration of the system simply using your laptop and evaluate and tweak any speaker combination from anywhere in the auditorium. Being able to hear and assess the effects of your adjustments immediately is just a great way of working leading to according results. In addition, all processes are sped up – this cannot be appreciated enough considering the notoriously tight schedules.

In terms of THD&N and sound quality, digital processors by Xilica Audio Design are in a class of their own. The sonic transparency of the output signal, which is maintained even when the processor is under full load, is a key characteristic. When comparing the system to much more expensive products by the competition or by renowned system vendors, it always gave the impression of pulling away a blanket from in front of the speakers.



The benefits of magnetostats had already been well-known at Theater Baden, so these were a key requirement; however, in the course of procurement, the sonic qualities and the great benefits of broadband magnetostats especially for use on the left and right sides of the portal became obvious. These benefits include high feedback stability and optimum coverage of the expensive front seating.

When comparing the quotes, it soon became clear that factory-matched systems were much more expensive without offering additional benefits. On the contrary, it turned out that amplifiers and digital processors by specialized vendors offer better specifications at a considerably lower price. Moreover, a larger variety of available speakers allows for better solutions meeting highly specific requirements. In any case, the system needs to be calibrated onsite and must be adjusted to the acoustics of the local environment. This requires much theoretical and hands-on experience but definitely results in perfect audio quality at highest feedback stability. Or as Jörg Humer, the Theater's in-house audio engineer, puts it; "I now love going to the Theater in the morning and listening to music all day long."



Xilica Audio Design would like to thank Theatre Baden and everyone involved in this wonderful sound system design and installation for their trust and support of Xilica digital processor solutions.

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