STUDER REVOX

SWISS SOUND

VIEWS AND NEWS FROM SWITZERLAND

A PUBLICATION BY STUDER REVOX

No. 14
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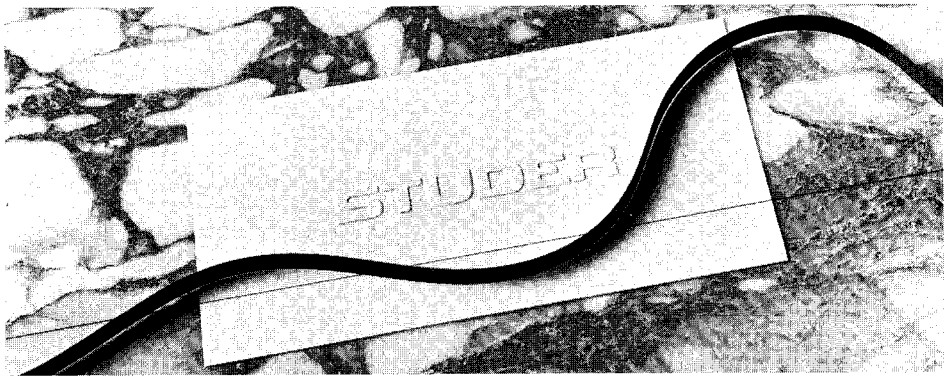
A word about the 1986 AES Convention in Montreux

In professional audio, only one major independent company still proudly carries its founder's name:



(taken from our company brochure)

and this is why we are particularly pleased that the AES Convention will once again be held in Switzerland – when a range of new and interesting STUDER products will be presented for the first time, in our home country. In this issue of SWISS SOUND, we shall start with a presentation of the Synchronizer System SC 4016, as realized at the Austrian Radio Company, ORF in Vienna.

1986 will therefore offer a great challenge; the introduction of new products and with it the expansion of our product range will strengthen our position in the professional audio field world-wide and consolidate it further. It is our greatest aim to maintain the interest of the end-user and produce long-lasting equipment. This philosophy we have followed in the past with great success.

You will no doubt remember the valve-type studio tape recorder C37, designed 26 years ago and still in daily operation in many markets. We are proud that spare parts supply for the C37 is still guaranteed – fifteen years after production of the C37 series has come to an end.

Based on the old philosophy, we are designing products today which meet the requirements of tomorrow, and form a basis for the continuation of success on the world market. In this connection, I would like to quote the founder of our company group, who states that "conscientous evaluation may keep one from being the first, but they are essential for being amongst the best when time is right" ...

Eugen Spörri

Synchronizing complex SK1 in the ORF center, Vienna

Synchronization in 3/4 time

"The new synchronizing complex SK1 in the ORF center, Vienna, will be commissioned on October 14, 1985 ... This project was completed in the amazingly short time of only 4 months ... The SK1 is currently the most modern synchronization installation for universal audio dubbing in all of Europe".

These introductory sentences have been taken from the ORF "TECHNIKUM", a continuation of information published by the technical management of the Austrian Broadcasting Company (ORF). The authors Harald Lessnig and Karl Tesarek, gave a detailed introduction of the project and its implementation under the heading "THE NEW SYNCHRONIZING COMPLEX SK1 IN THE ORF CENTER, VIENNA". And of course, we don't want to keep it a secret that STUDER made a significant contribution of this advanced synchronizing complex. With the permission of ORF we are reproducing the above report in a shortened version.

Functional specification:

- Audio post production of complex ENG productions for documentaries, features, and high-quality studio or OB van productions, also in stereo-phonic sound respectively two-track technique.
- Audio dubbing of 16-mm motion pictures.
- Synchronization of program material in foreign languages on video tape or film.
- Production of audio or music recordings for playback purposes or processing (mix-down) of music programs from other studios (2", 1/4" tapes).

Project history:

In the summer of 1970 three synchronization studios were put into service as part of the ORF center's first construction stage. These were the synchronization studios 1 and 2 and the premixing room. In accordance with the planning guidelines of 1968 they were designed for dubbing 16-mm films. Only the synchronizing complex 1 was also equipped for dubbing 35-mm films.

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The ultramodern synchronizing complex SK 1 in the ORF center, Vienna.

The age of the audio equipment, the trend to intensify the audio dubbing of video productions, as well as the partial displacement of films by ENG in conjunction with the single-camera picture dramaturgy traditionally used in film making made it necessary to modernize the audio complex based on a concept that takes account of the changed production structures.

As a result the new synchronizing studios SK 1 and SK 2 had to satisfy the following **requirements**

- Dubbing in **SEPMAG technique**, regardless of the recording method or format.
- Ability to read and process perforated **and** unperforated tapes equally well.

Analogously, picture media such as
- 16-mm film
- 3/4 video tape, U-matic high band.
- 1" video tape, format B.

shall be processable with equal ease.

- Each synchronizing complex shall contain a single coupling system for all of the mentioned picture and sound recording equipment. The operation of this equipment shall be logical and user-friendly.

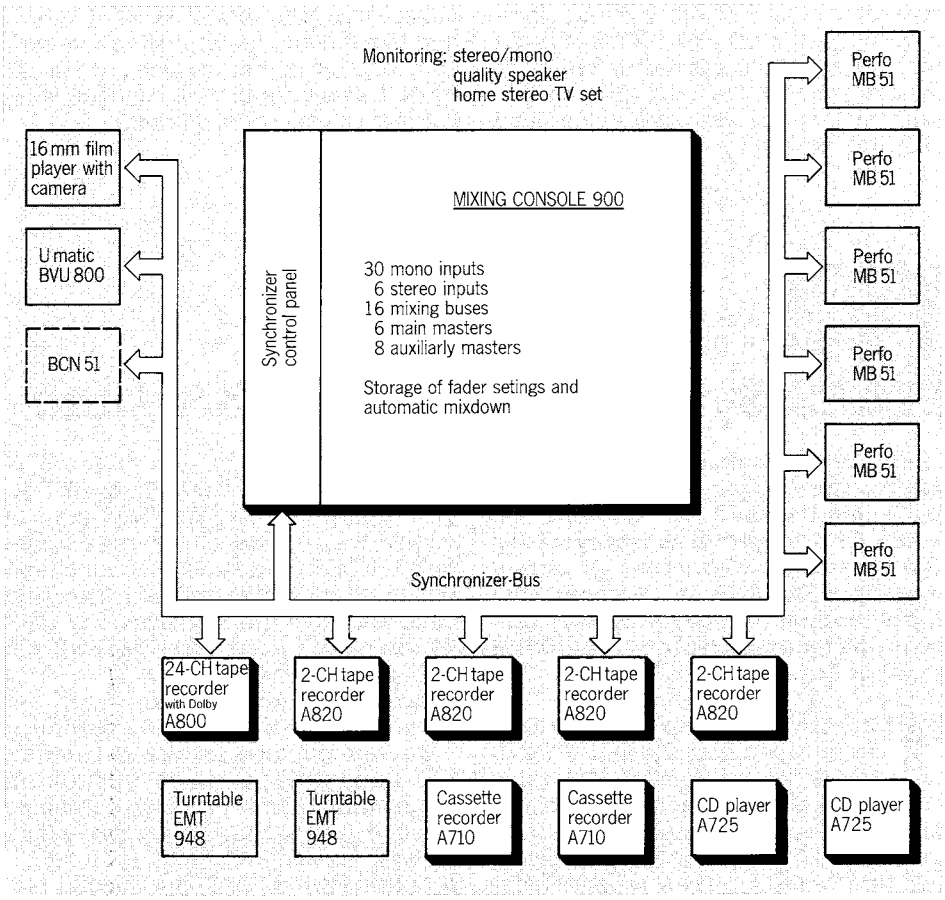
The synchronization system shall have adequate error compensation facilities that eliminate such problems as timecode dropouts encountered with the systems known todate.

- The 35-mm film format does not have to be taken into consideration.
- Tapes recorded in other production locations shall also be processable. In particular these are:
  - 1/4" tapes with/without time code
  - 2" tapes, 24 channels, with/without time code.
- The audio control room of the SK 1 with its 130 m² studio shall also be suited for music recordings with or without picture reproduction.
- Basically all state-of-the-art tools shall be cost-effective so that video and film productions can be dubbed quickly and economically.

Implementation:
The new concept totally eliminates optical projection, i.e. projection is exclusively based on video. In addition a monitor ring is installed in the studio.

Audio dubbing is predominantly performed with the aid of a U-Matic work cassette. A U-Matic BVU 800 is installed in the SK 1 for this purpose. A Film scanner Albrecht PB 51 and a BCN 51 (the latter only after mid 1986) are available for other formats.

The audio equipment comprises the following main groups:
- Audio mixer **STUDER 904**
- Connector and patch field
- Audio racks
- 4 tape recorders 1/4" **STUDER A 820**
- One 24-track tape recorder **STUDER A 800**
- 6 Cord units Albrecht MB 51
- Film scanner Albrecht PB 51
- 2 Studio turntables EMT 948



Block diagram of the balancing engineer's equipment SK 1.

The audio engineering equipment in SK 1 also comprises a complete phalanx of STUDER tape recorders.

- 2 Cassette recorders **STUDER A 710**
- 2 CD players **STUDER A 725**
- Monitor speaker Tannoy-Arden III
- Connector panels
- Line connections to the studio
- Intercom facility
- Power supply rack
- Effect machines

Audio mixer STUDER 904
Featuring:
36 inputs (6 stero and 30 mono)
16 busses
6 masters (connectible to the busses 1, 2, 3, 4, 15 and 16)
6 Mono aux masters, connectible pre or post the faders
2 Stereo aux masters, connectible pre or post the faders

The 36 inputs are equipped with VCA faders (voltage-controlled amplifiers) that permit not only variable grouping (each fader can assume the master or slave function in a group) but also computer-assisted mix-down.

The key benefit of computer-assisted mix-down is that the final mix-down can be performed fully automatically in a single operation at a time at which every individual mixing operation correspond already to the expectations. Up to this point the mixing result is recorded in the form of data material rather than audio modulation. An "Allison Programmer" is used for the computer-controlled mix-down.

The VCA faders can be switched to "Write" or "Read" for writing the data. Overwriting of data, i.e. for correcting the level of a specific fader, is possible in either mode. Normally two tracks of the 24-track tape recorder are used for storing the controller data of the program. However, these data can also be stored on one of the 1/4" tape recorders equipped with a time code track for synchronization.

Three inputs are available per input module:
- Microphone (for levels between –70 and +20 dBm)
- Line
- Tape (mix-down multitrack)

The first twenty input modules can be controlled remotely via a single push button and are concurrently switchable to "mix-down".

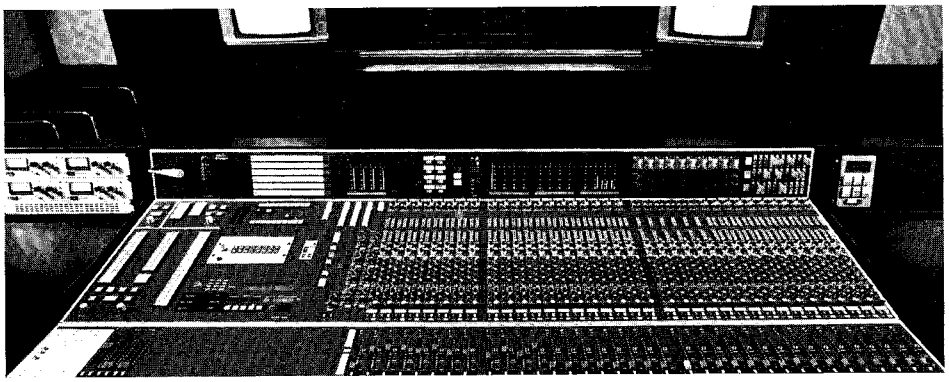
With the aid of the 8 aux masters it is, e.g. possible to make playback recordings with the audio mixer. The 24-track recorder with Dolby noise reduction can be fully integrated into the synchronizing system. In conjunction with the computer-supported mix-down modern synchronization techniques can be employed with this machine, particulary with respect to shorter production times.

Synchronization system
The Rotosyn system previously used for synchronous locking of the equipment in the SK 1 has been replaced by a **STUDER synchronizer** designed for use with the longitudinal SMPTE/EBU time code. This unit allows shuttling at speeds up to 30 times the nominal speed (previously this was only possible at nominal speed!).

The **STUDER SC 4016 system controller** is an intelligent control system. Together with the **STUDER TLS 4000 synchronizer** it is a flexible editing system which can control up to 16 machines connected to the bus. High flexibility is achieved because any recorder that forms part of the system can operate as the "master". The system also supports remote control of the tape transport (including CUE and SHUTTLE mode) for each individual machine connected to the system.

A STUDER novelty is the SOFT KEY concept which permits very simple operation of the system (Fig. 7).

Each of these 9 SOFT KEYS features an 8-character LED. The labelling of these keys changes automatically with every operating step. The LEDs turn on only for those keys which have been assigned a specific function in the step to be executed. As a consequence it was possible to design the operating panel with a minimum of keys. The user of the system is automatically prompted by the system by means of these SOFT KEYS.


STUDER audio mixer 904 with VCAs and built-in system controller SC 4016.

The six perfo tape units, the four 1/4" tape recorders, and the multitrack machine can be also be coupled to the following video sources:
- U-Matic BVU 800 P
- 16-mm Film scanner Albrecht BP 51

- BCN 50/51
  Connection to the ZMX is established via remote control panel. The SK 1 can be either a source or a consumer.

Technical data of the remodelled SK 1 studio with the totally new audio equipment

Dimensions:	12.8 m x 10.2 m
Floor space:	130 m²
Volume:	660 m³
Reverberation time:	0,9 seconds, optimized for music. Speech recording with movable audio partitions
Reverberation radius:	1,65 m
Staffing:	25 to 30 persons (temperature rise of 2°C with 50 persons)

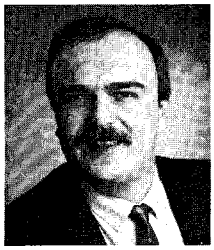
Musician's platforms of wood are available for 60 % of the studio floor space

- 3 fully equipped announcer stations
- 3 Video monitors
- 1 Video projector for producing large images on a permanently installed screen

Other planned modernizations in the ORF center

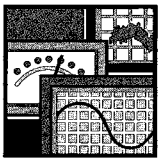
The synchronizing complex SK 1 is the first step in the modernization of the synchronization facilities. Modernization of the SK 2 is scheduled for March 1986, i.e. directly after work on the SK 1 has been completed.

Harald Lessnig, Engineer
Karl Tesarek



Harald Lessnig, Planning Engineer at the department of Sound Technique at the Austrian Broadcast Corporation (ORF) in Vienna. Studies at the Polytechnic School of Engineering. Joins Eumig in Audio development. Since 1982 at ORF, special field of magnetic tape recorders, magnetic tapes, compander and synchronizing systems. Responsible Project Engineer at the ORF synchronizing studios SK 1 and SK 2 as of 1983.

Karl Tesarek, with Austrian Broadcasting Corporation (ORF) since 1957, Department of Television and Picture Sound Technique. After practice in measuring technique and planning, group manager of the film processing department since 1968. Responsible for the entire post production field of video and film within ORF since 1982.



The audio jigsaw puzzle

STUDER audio components

When the 900 series mixing consoles were developped, the need for modular audio devices such as line amplifiers, microphone amplifiers, limiters, power amplifiers, etc. arose very quickly. It was a must to achieve our goal: to create versatile mixing consoles easy adaptable to customers' specifications.

Based on the well-known EURO PC Board, we developped a complete line of audio modules which have been installed in many 900 mixing consoles. Later, we completed this line with the sub-card system which is an EURO PC Board on which 4 sub modules of any kind can be fitted.

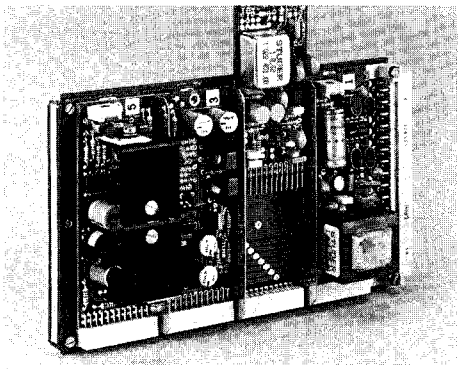
Some equipment such as the 40 W Power Amplifier, the Balancing Unit or the best-seller Telephone Hybrid are already taking advantage of this technology.

These modules are now available as single parts for those customers who want to create their own audio systems.

The list below shows the full line of EURO PC Boards and Subcards with all necessary installation accessories such as 19" frames, connectors, etc.

Studer EURO PC Boards

- Audio Generator
- Line Amplifier/Balancing Amplifier with or without transformers
- Distribution Amplifier 1 in / 4 out
- Line Equalizer (3 band)
- 5 W and 40 W Power Amplifier
- Limiter (2 channels)
- Microphone Amplifier
- Phono Preamplifier, stereo
- Relays, monitor switching
- Relays, transistor driven
- Audio transformer unit
- Power Supply and Voltage Stabilizers

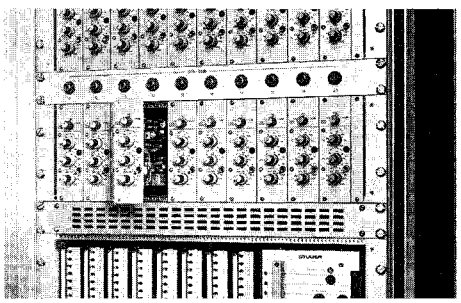


Mother board (EURO size) with 4 subcards.

- Telephone Hybrid
- Relay card for Telephone Hybrid (2 lines)

Sub Cards

- Sub-cards mother board
- High Level Output Amplifier
- High Level Input Amplifier with transformer input
- Zero-ohm Input Amplifier (Summing Amplifier)
- High Level Input Amplifier with transformerless input
- Loudspeaker Amplifier
- Microphone Preamplifier
- Relay unit
- 1900 Hz Signal Generator and Decoder
- Voltage Controlled Amplifier (VCA)
- Limiter Voltage Processor (for VCA)
- Punched Breadboarding Card for own designed circuits

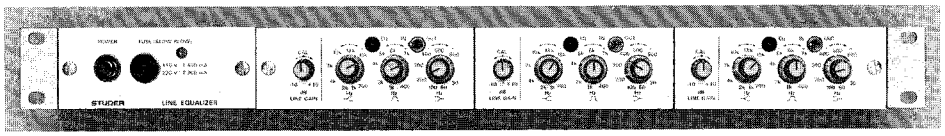


3U/19" Frames with Line Equalizers and Line Amplifiers.

19" Frames and Accessories

- 1U frame with power supply for 3 EURO PC Boards
- 3U frame for 8 EURO PC Boards and 1 power supply
- Connector kit
- Filler and ventilation panels

Detail information is available on request which will show that with the STUDER Audio Components, no problem remains without solution. The three following examples are taken from



1U/19" Frame with three horizontal Line Equalizers.

practice and the solutions given are working somewhere in the world.

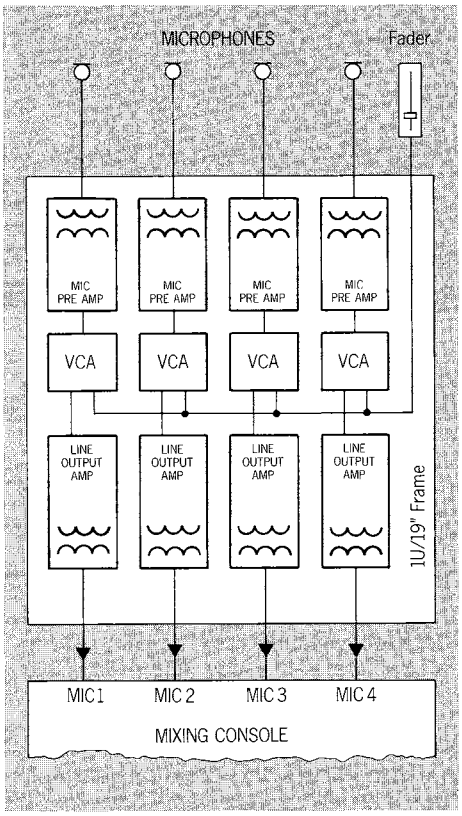
Example 1

In a Master Control Room, the incoming PTT Lines show a poor frequency response and must be equalized.

Solution: The Line Amplifier/Equalizer can be used, built into a 3U-19" frame (max. 10 vertical units) or in a 1U-19" frame (max. 3 horizontal units). Thanks to its input and output transformer, this module also works as an Isolation Amplifier

Example 2

In a radio studio, the moderator wants to control the level of all microphones of its guests together with his own microphone. But at the same time, the operator in the control room must be able to balance the levels separately.

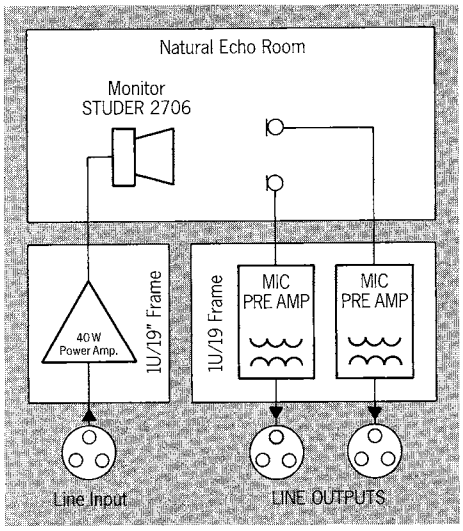


Solution: The 4 microphones are fed to the mixer through a 19" frame containing 4 microphone pre-amplifiers, 4 VCA amplifiers and 4 line output amplifiers (subcards). The VCAs are controlled by a fader located on the studio table. The balance can be made for each microphone on the mixing console while the moderator can control the levels by means of its fader, this without changing the balance.

Example 3

A natural echo room with one loudspeaker and two microphones must be assigned to different control rooms of a recording studio complex. Furthermore, the echo room is located on another floor and therefore not easily accessible.

Solution: Two microphone pre-amplifiers (EURO CARD) are mounted into a 1U-19" frame which is located in one of the control rooms. A mono 40 W power amplifier feeds the loudspeaker in the echo room while the signals of both microphones come back to the microphone pre-amplifiers. The high-level



signals (Loudspeaker feed and Microphone-return) are available on a patch panel and can be assigned to any control room.

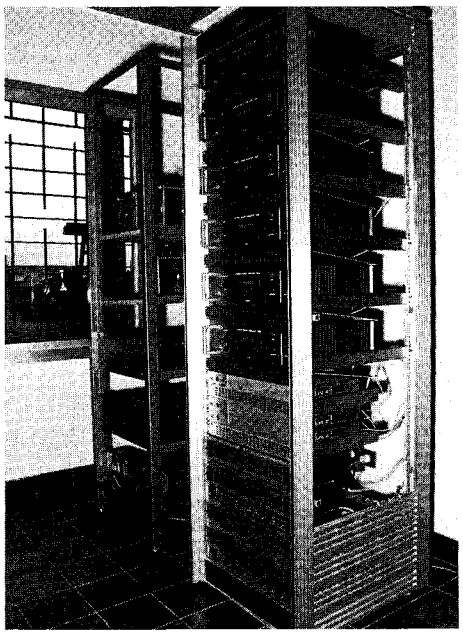
Jean Pascal Ruch

News from Africa

Christiana Studio in Benin

In November 1985, a new 24-channel recording studio was inaugurated in Cotonou, Capital of Benin, West Africa. Christiana Studio was realized on a turnkey basis by Studer International AG. It is equipped with one STUDER A80 VU-24 MK IV and two A80 VU-2 track type recorders.

The mixing console is a Harrison MR3-36, and the large number of auxiliary and effect equipment includes STUDER A710 cassette recorder, Dolby multichannel, and 2-channel noise reduction system, digital reverberation, harmonizer, noise gates and limiter-compressors. In addition, several



In a separate room, a rack contains all STUDER power amplifiers.

music instruments are at the disposal of the studio musicians.

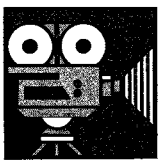
For control room and studio, UREI 815B loudspeakers are driven in bi-amplification by 6 STUDER A68 power amplifiers. The same applies for the cutting room, for an identical sound ratio at the control room; the cutting room is also equipped with a Neumann VMS 70 cutting lathe.

Engineering and installation are "STUDER produced" as well. As the system was completely wired and tested in Regensdorf, three weeks only were needed to complete the installation at the Cotonou premises; switched-on, the system worked perfectly at first go.

A few words about SATEL (Societé Africaine des Techniques Electroniques), the company behind this project: The new recording studio is not the sole activity of this dynamic company. For years, SATEL has been known in West Africa for the excellent quality of its services; many African records have been cut and pressed at SATEL. A cassette duplication plant will be put into operation in a few weeks. However, Mr. Bernard Dohounzo, owner and managing director of the company, did not limit his company's activities to the music only; an assembling and manufacturing plant produces various electronic equipment, including record players and television sets.

African music, becoming more and more popular in the Occident, will no doubt benefit from these new complex production facilities.

Jean-Pascal Ruch

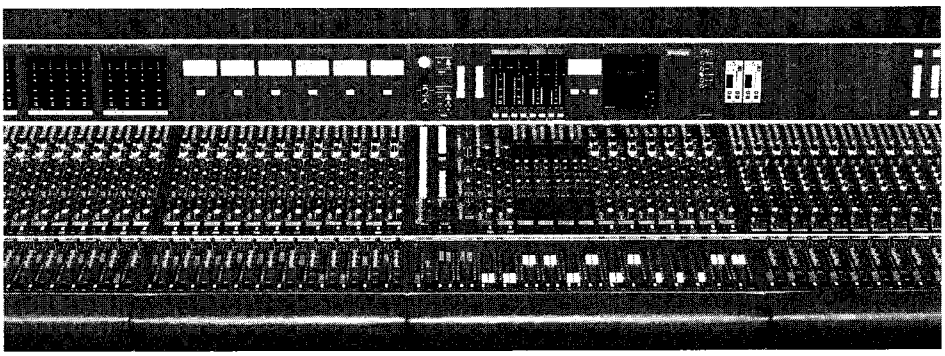


Studer Series 900 Audio mixing console

Audio Equipment in Theatres and Convention Centres

With the trend being towards increased technical support for performance on stage or during convention activities, audio equipment of equal complexity as found in broadcasting and recording studios has been used in theatres and convention halls for years already.

While installations for the theatre are mainly designed to play sound effects or to re-enforce certain voices, choirs, soloists or individual musical instruments, the systems in convention centres are generally applied to amplify speaker voices. In most cases it is also desirable to make simultaneous recordings. In addition, the audio consoles of large installations are also used to feed the original sound simultaneously to radio and television networks. In both cases, theatres and convention centres, consoles with 16 to 24 inputs and 8 to 16 outputs are used. In accordance with a recommendation of the Theatre Standards Committee, the in- and outputs of all insertion points should be of the transformer equipped and balanced variety with XLR type connections.



The input units on such a console conform to those on a standard recording console, with pre- and past-fader signal taps, pan-potentiometers, complex and switchable filters and click-free selection of master faders, plus a direct output (+ 6 dBu) after the fader, so as not to occupy a master output for single source replays.

On newer installations, the VCA-fader finds increased use, which makes it possible to form sub-groups, while it has also been found convenient to have compression available in the input channels already. In many cases, the master faders are equipped with switchable limiters which can be linked-up for stereo work. Signal levels are monitored with bar-graph indicators as a rule, because they provide better indicating accuracy in comparison with meters.

All inputs and master channels, as well as outgoing signal feeds, can be listened into by means of a prelistening button fo correct cueing. Command paths must provide for the possibility to talk into the master outputs and all outgoing signal lines, as well as for intercommunication with the producer and the stage manager. The monitor selector panel permits switching of various program sources or master channels to the monitor speakers. Automatic attenuation of monitor levels, when commands are given, is of necessity.

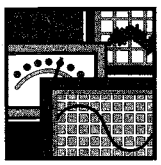
To make the adjustments possible which are required when difficult acoustic conditions have to be matched, the signal generator should provide several fixed frequencies and, in addition, white and pink noise as well.

Critics may say that such extensive technical versatility is in disproportion to its practical value. This, however, can be contradicted as follows:

Producers and artists of renowned houses are not prepared to accept equipment which is short of being perfect. In an artistically perfect scene with excellent lighting of the stage no one wiill accept Parzifal bells that sound as if they were coming from a tin can.

STUDER audio consoles of the 900 series are in continuous use in theatres, opera houses and convention centres, proving that they satisfy all requirements with ease.

Wolfgang Timmermann



Demodulation of frequency-modulated signals

De-mo-du-la-tion

Tuners and receivers that carry the brand name REVOX belong to the worldwide small group of top premium products. However, such ratings can only be achieved if, in addition to the exceptional operating convenience, outstanding circuit designs are developed, optimized, and implemented also in the receiver sections. Based on the FM demodulator the author attempts to clarify lesser known mechanisms while simultaneously pointing to their historical development in REVOX receiver sections.

Propagation of ultrashort waves

Electric waves in the meter band are used for FM (frequency modulation) broadcasts. For each station transmitting in the FM range from 87.5 to 108 MHz, a radio-frequency bandwidth of 200 kHz is available in which an audio spectrum of 15 kHz can be combined with a frequency deviation of 75 kHz. The range of FM transmitters is relatively small which means that two transmitters that are located only several hundred kilometers apart can utilize the same frequency without mutual interference. The signals are normally transmitted directly from the transmitter to the receiver antenna. But quite often there are several propagation paths, due to mountain slopes or other obstacles which reflect the ultrashort waves. Since the lenght of these various propagation paths varies, a receiving antenna picks up several waves with different delay times.

FM receiver – explained in simple terms

Fig. 1 contains a simplified block diagram of a FM receiver. The RF signal is taken from the antenna to the selective RF amplifier. With the aid of the tunable local oscillator, the subsequent mixer stage converts the signal to an intermediate frequency (IF) of 10.7 MHz. In the IF section the wanted transmitter signal is properly selected by suited filters and input to the limiter. In the multistage limiting amplifier, the IF signal is clipped to a constant amplitude. From the frequency-modulated IF signal, the audio signal or the MPX signal respectively is recovered in the demodulator. This signal is split into the analog audio signals L and R in the subsequent stereo decoder.

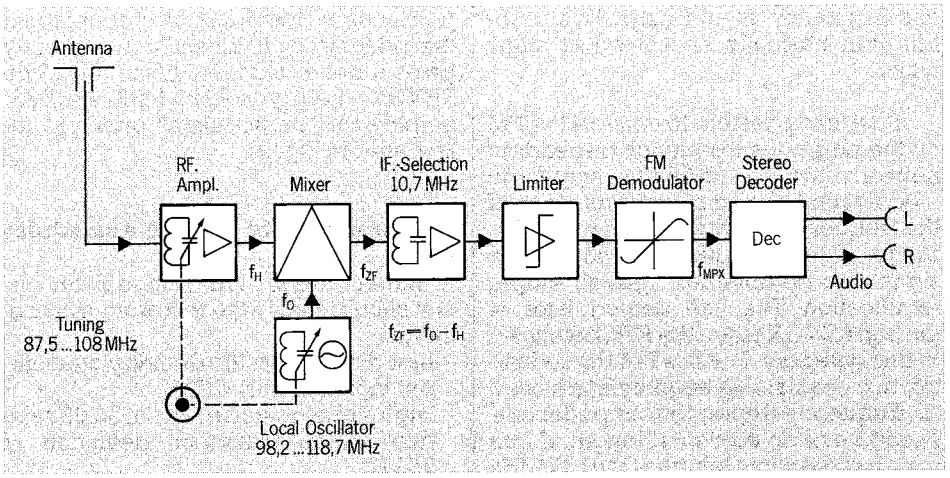


Fig. 1

Instantaneous frequency

For our purposes the RF amplifier, mixer stage, and IF amplifier can be considered as sufficiently linear assemblies. If more than one signal is present, the resulting signal corresponds to the sum of the individual signals.

This is not the case with nonlinear systems such as the limiter and FM demodulator. Here it no longer suffices to look at each individual signal separately; instead of adding the individual signals, the mathematical vector sum must be taken into consideration because the instantaneous frequency of this resultant can under certain conditions be far outside of the range in which the instantaneous frequency of the individual signals remains. It seems appropriate here to quickly explain the term "instantaneous frequency". The term "frequency" refers to the number of periods per second of an alternating cycle of unchanged amplitude and periodicity. This means that a process in which the parameters such as amplitude and phase change over time does not have a frequency, but it can be split into a sum of frequencies. The spectral separation of the frequency-modulated signal corresponds to a spectrum which contains not only the carrier frequency but also bands on both sides, spaced in multiples of the modulation frequency. The instantaneous frequency thus represents the time-dependent process and has nothing to do with the spectrum of the occurring frequencies.

Parasitic noise

The reception of frequency-modulated signals is normally also accompanied by unwanted signals at the input of the limiter-demodulator system.

These unwanted signals are caused by distant transmitters operating on the same frequency, or by the reception of reflections from the selected transmitter. Since these signals are in the wanted channel, they are not influenced by band-pass filters in the IF section. Analytical investigations show that for a parasitic signal that is only little weaker than the wanted signal, strong amplitude fluctuations and large instantaneous frequency peaks may occur. Through strict amplitude limitation and linear processing of these peaks in a wide-band limiter-demodulator system, audible noise can be suppressed and reduced to the lowest physically possible level. The suppression of a parasitic that is only little weaker than the wanted signal is referred to as the capture effect.

Parasitic signals from strong transmitters on adjacent channels can frequently not be adequately suppressed by IF band-pass filters and also invade the limiter-demodulator system. Theoretic investigations have shown that with ideal limitation and a linear demodulation characteristic that reaches far into the adjacent channel, no audible noise occurs as long as the parasitic signal is a little weaker than the wanted signal.

Various FM demodulator types

The function of the FM demodulator is to transform into an audio signal the change in the instantaneous frequency that carries the information. A linear relation between the demodulator output signal and the change in the instantaneous frequency should exist. This problem can basically be solved in many ways.

First, it is possible to convert the FM on the edge of a frequency-dependent network into an additional amplitude modulation. If the amplitude response of the frequency is proportional within the range of the frequency deviation, the signal can be obtained through simple rectification. The line demodulator of the first REVOX tuner, the A76, belonged to this category. For this FM demodulator, two coaxial line segments are used as frequency-dependent impedances. These have an electrical lenght of one eighth of the wave length of the 10.7 MHz carrier with one line being open at the end and the other short circuited. Both are connected in series to an ohmic resistance corresponding to the caracteristic impedance ZW of the line. The individual voltages on the line segments are rectified, the difference gives the output signal of the demodulator (this arrangement is illustrated in Fig. 2).

In another method the linear phase relationship between two voltages is used and these are demodulated with mutually opposed phasing. This quadrature FM demodulator, as used in television sets, employs this principle. FM demodulation is also posssible by means of pulse counting. A pulse with a constant amplitude and duration is generated as each FM oscillation passes through zero. The mean value of this pulse train, integrated over short intervals, produces the demodulated audio signal. An arrangement with a delay line can be used for pulse shaping. Such a line has the electrical length of one or three quarters of the wave length of the 10.7 MHz carrier. The second version produces a demodulator output signal that is higher by 10 dB and consequently gives a better signal-to-noise ratio. The REVOX tuners type A720, B760, and B261 employ this demodulator principle (illustrated in Fig. 3).

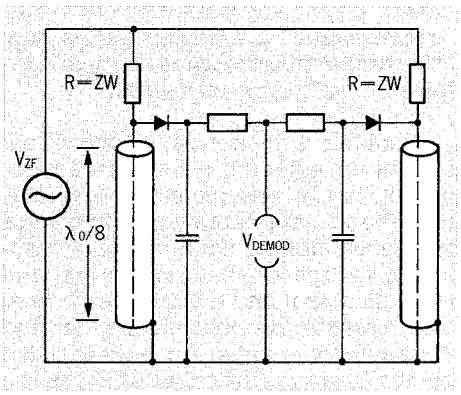


Fig. 2

Requirements of the FM demodulator

A state-of-the-art FM demodulator circuit should satisfy the following requirements:

- Low distortion in the demodulated output signal of only 0.03 %
- High signal-to-noise ratio of 90 dB relative to the maximum deviation of 75 kHz

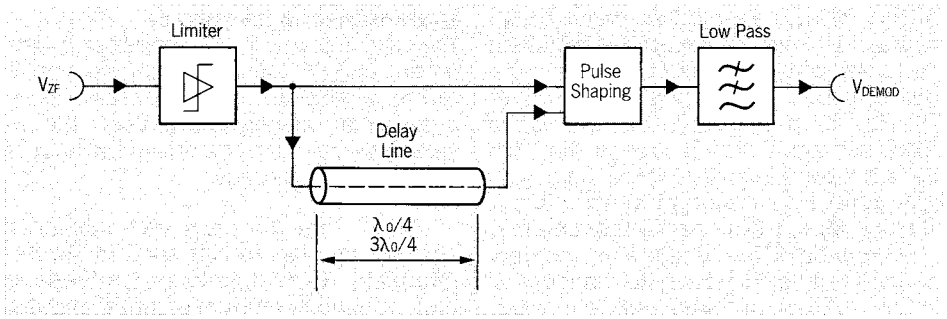


Fig. 3

- Excellent linearity of the demodulated characteristic in the range of the adjacent channel, and finally
- Large limiter-demodulator bandwidth for achieving a low capture ratio of only 0.2 dB.

In the first REVOX tuner A76, the line demodulator attained a signal-to-noise ratio of 70 dB, a remarkable achievement for its time; the pulse counting demodulator of the B261 achieved the excellent value of 80 dB. Today's target specifications call for 90 dB which means that new circuit design concepts have to be implemented. The new phase lock loop (PLL) FM demodulator of the B285 receiver fulfills all of the foregoing requirements in an ideal manner.

Phase lock loop (PLL) demodulator

The simplified block diagram of a PLL FM demodulator is illustrated in Fig. 4. This back-coupled system comprises a phase comparator stage, a low-pass loop filter, and a voltage-controlled oscillator (VCO). The VCO is now rated in such a way that its instantaneous frequency is linearly dependent on the applied control voltage. The IF signal from the limiter is multiplied in the phase comparator stage by the output signal from the VCO. The subsequent low-pass filter suppresses the high-frequency content in the output voltage of the phase comparator stage. The resulting signal on the output of the low-pass filter is fed back to the VCO as the control voltage.

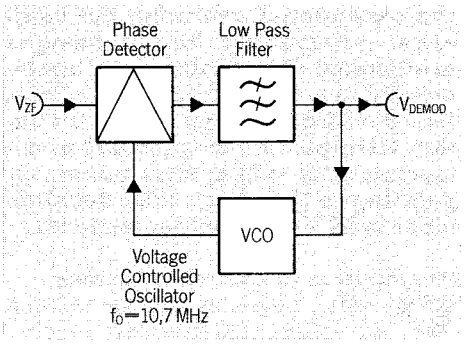


Fig. 4

If the PLL is laid out correspondingly, the instantaneous VCO frequency locks with the instantaneous IF frequency. In this locked condition, also referred to as modulation tracking, the instantaneous VCO and IF frequency are exactly following each other. Provided the VCO control characteristic is linear, the FM-demodulated information is now supplied by the VCO control voltage.

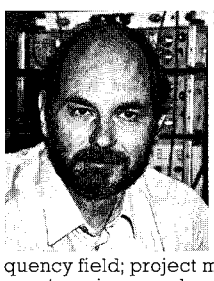
Implementation of a PLL FM demodulator

The key problem in the development of a PLL FM demodulator is the implementation of a linear characteristic for the voltage-controlled oscillator. In such a VCO the instantaneous frequency is controlled via variable-capacitance diodes in the oscillator circuit. But variable-capacitance diodes are not linear, voltage-dependent components, neither is the influence of the oscillator circuit capacitance linear on the latter's resonance frequency. An analytical investigation of these problems surprisingly yields useful design specification because the two nonlinearities can be played off against each other. If the bias of the variable-capacitance diodes is selected correspondingly and if a suitable fixed capacitor is connected to these diodes in parallel, a control characteristic that is highly linear throughout a wide range is achievable. Figure 5 illustrates a simplified diagram of this arrangement.

The temperature stability of the oscillatory circuit by itself is not adequate. A high-quality, active bias with careful temperature compensation for the variable-capacitance diodes results in a high oscillator stability and also allows the center tuning signal to be derived from the VCO control voltage.

In the interest of rapid control, the VCO control voltage must be supplied with low impedance. A push-pull arrangement for the oscillator circuit makes this possible in a location that is largely free of high frequencies. An integrated phase comparator stage with subsequent loop filter/low pass as well as a fast DC opamp with balanced input are added to complete this high-quality PLL FM demodulator.

Ernst Mathys



Ernst Mathys (49) studied telecommunications at the Engineering School of Zurich (ATZ), and joined the WILLI STUDER company back in 1959. After his graduation (1965) in electrical engineering, responsible for development in the audio and radio frequency field; project manager for REVOX tuners/receivers, and group manager for REVOX electronic equipment.

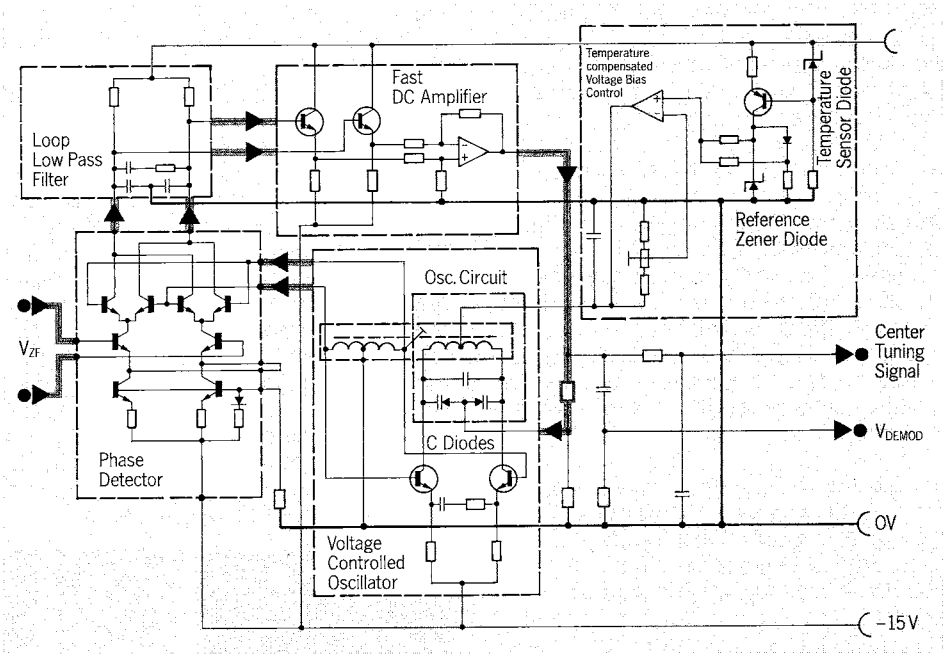
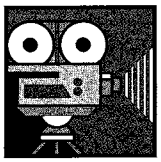


Fig. 5



Ultramodern information and broadcasting complex of the Radio DRS Studio in the Swiss Federal capital, Bern

Continuity studio with 900 multiplex technology

Some 20 years ago, the Radio Studio Bern of the Swiss Radio and Television Broadcasting Company (SRG) has been assigned the specific task of providing information on current events. This led to the expansion of the information department and the installation of the required technical equipment. During the past year the broadcasting complex comprising the information production service and the switching room has been remodelled in the existing building and refurnished with advanced equipment.

The subdued acoustics in the new area, the pleasant beige and blue colors, the soft lighting as well as the accumulation of display terminals and computer keyboards strongly contrast with the usual image of an information and broadcasting complex. The concept which has been planned, developed, and implemented over many years for the radio studio in the Swiss capital, Bern, has been accepted as a model for other studio projects.

The cooperation between specialists from the Swiss PTT, audio engineers, the technical management and information specialists as well as the architects appear to have functioned well. The result is a bijou even by international standards.

A new concept

In addition to the introduction of stereophonic sound systems in all areas, the main goal of the remodelling operation was to achieve utmost flexibility in the new broadcasting and information complex. Mixed operation, i.e. control room/studio or studio/control room, is possible in all versions: autonomous disk jockey mode of the moderators in the studios (on DJ systems), conventional broadcasting (control room/studio), mixed broadcasting, broadcasting with insertion of blocks in disk jockey mode etc. Because of the high flexibility of switching technology, vacant studios can be readily used also for productions.

Due to the required stereo line pairs and the use of 4-conductor lines, a line

triplet is used internally (source side) for all inputs (left, right, feedback). As a result, source-related through-connection is possible with a single command via the computer-controlled ODILOG matrix made by STR. For flexible and straightforward simultaneous transmission from various OB sites, high-level stereo inputs with a separate multiplex output are used on the audio production console. Not only can the lines be through-connected from the continuity rooms without the assistance of control room personnel, but also complex sequences can be programmed and recalled instantaneously by pressing a button.

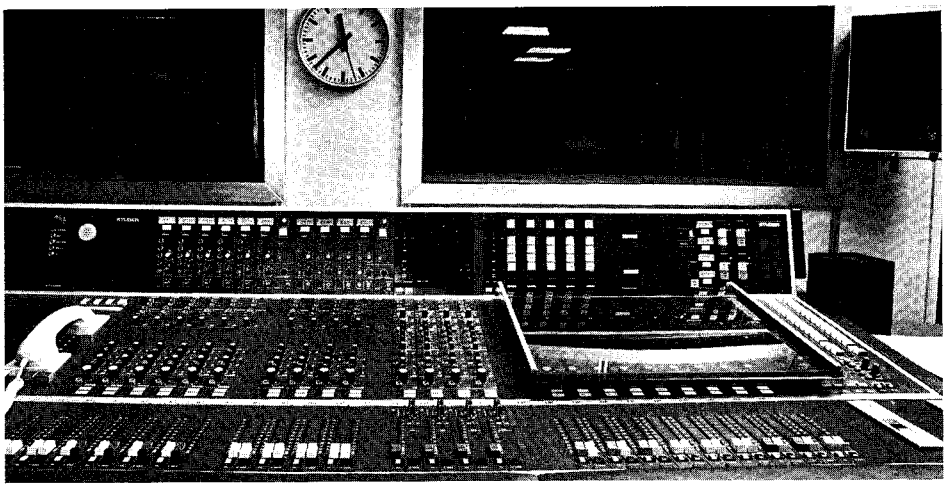
An additional novelty are the announcer's and speaker's studios with the newly designed "Disk Jockey" (DJ by Unitronic) mixing consoles for autonomous broadcasting by the moderator.
All audio production consoles (continuity and DJ) are equipped with two separate output lines:
- Transmission line: direct line to the transmission distributor with permanentely looped in line limiter.
- Output line: decoupled master with On/Off-switchable limiter to the master distributor (simultaneous internal recording path).

Broadcasting complex
The broadcasting complex comprises two stereo continuity rooms with one announcer's and one speaker's studio each. Most rooms have visual contact with each other.

Each STUDER 900 mixing console in the continuity room is equipped with 10 line inputs (2 groups with 6 and 4 inputs) and one multiplex output. Each input module also features 2 switchable-selectable inputs for lines directly from the main distributor or telephone amplifier (Studer telephone hybrid). With 4 additional microphone and 9 high-level inputs for peripheral equipment (tape and cassette recorders, turntables, CD players and jingle devices) as well as comprehensive equipment for monitoring (displays for modulation level, phasing and time), intercom, and telephone, all facilities are available for efficient operation even under hectic conditions.

Announcer's and speaker's studio
For autonomous on-air operation in disk jockey mode, both the announcer's and the speaker's studio are equipped with disk jockey systems. These consist of a 19" electronics rack with built-in distributor panel and a VCA-fader.

New information production complex
The new information complex is equipped with two continuity rooms and one studio each as well as three editing booths with STUDER A810 tape recorders. The control rooms are equipped with STUDER 900 mixing consoles. Each of these features 8 line inputs with multiplex outputs. Three VCA controllers are available for remote control from the editing booths. The left-hand side of the console accommodates all necessary operating, control, telephone and intercom modules, as is the case for the continuity rooms. The input side of both audio mixers is connected to a common matrix (information distributor) which permits flexible connection of the common sources to the consoles and the editing booths.



Three STUDER B67 tape recorders are used for automatically logging all incoming telephone and line transmissions. A 19" rack with equipment such as PR99 and A710 is available for reproducing or copying any tape format.

The selected concept increases the information production flexibility and capacity by providing autonomous workstations for the program staff without the need for additional personnel in the audio production.

Editing booth
The editing booths are equipped with STUDER A810 tape recorders. The consoles feature remote controls, level meters, intercom and monitoring facilities built into the panels. In addition each booth is equipped with a telephone hookup with its own subscriber number, a desk, and a typewriter. These editing booths are designed in such a way that the program staff can make line and telephone recordings without any outside assistance. Preliminary discussions, waiting for a connection (e.g. telephone lines to foreign countries) or long transmissions can be handled without audio engineers and without tying up the mixing console. The program staff is also able to edit the report in preparation for the final broadcast and to write the accompanying texts.

Switching room
The switching room basically fulfills the following functions:

- Through-connection of incoming and outgoing PTT lines.
- Setup of connections within the building
- Accommodation of central equipment (e.g. central monitoring bay with STUDER A726 FM monitor tuner).

The switching room also serves as an interface for matching all incoming and outgoing lines to the internal studio level (+ 6 dBm).

Schedule
December 1984
- Completion of the construction work
- Delivery of the technical infrastructure
- Start of the recabling work

January 1985
- Start of the installation work, Continuity rooms, studios

July/August 1985
- Practical training

October - December 1985
- Phased commissioning of the new installation

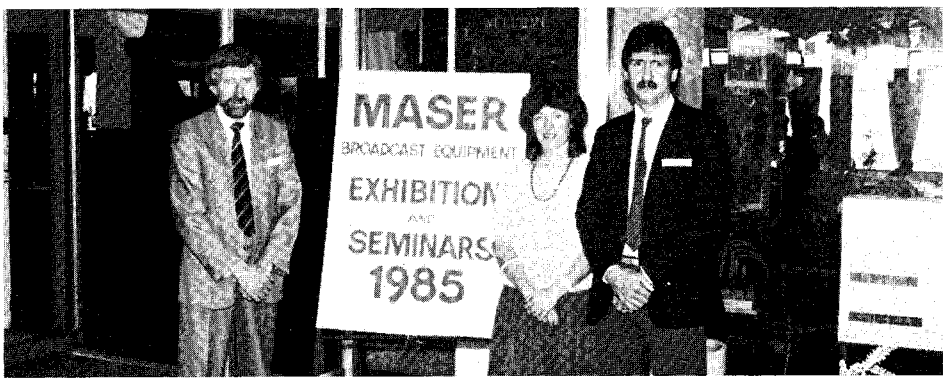
From January 1986
- Adaption of the existing complexes to the new facilities

In summarizing we can say that the key benefit of the new complex installations are the more flexible facilities offered by the new continuity consoles and the high degree of interlinkage between all studios and equipment. Or in other words: continuity multiplex technology and computer switching technology combined with fresh ideas and a flair for design are predestined to make Bern a new center of attraction for decisionmakers in the broadcasting field.

Bernhard Kohler
Marcel Siegenthaler

Expansion is the word...

STUDER REVOX in New Zealand



Hotel and Exhibition entry, f.l.t.r. Tony Carman, Valerie and Gareth Jones.

The country, with 3.23 million inhabitants and 60 million sheep, can be reached from Australia in less than three flight hours; from Europe, it would take two and a half days to reach N.Z. by plane. The country side reminds one of Switzerland. Auckland – "the City of Sails" has 800.000 residents and an exciting business life; it nearly out-classes Wellington, the Capital City.

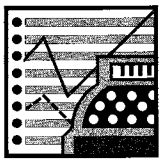
Business contacts for STUDER REVOX are maintained by MASER BROADCAST SYSTEMS LTD., Auckland. Customers are government radio and television companies such as a Television New Zealand (TVNZ) with two channels and Radio New Zealand (BNZ) maintaining four networks, as well as ten private AM and five FM stations, all entertaining the country. N.Z. is at the point of introducing private television – just like Switzerland! So there is something going on "on the far green islands" as regards television activities.

In October 1985, MASER BROADCAST SYSTEMS LTD. have invited more than 20 European and Overseas manufacturers to introduce their range of products to an interested and professional N.Z. customership. Parallel to the exhibition, a seminar was held where exhibitors had the opportunity to inform their guests on their equipment in all detail.

Professional end-users in N.Z. have for the first time seen STUDER REVOX and a wide range of other products in a complex exhibition within the idyllic surroundings of the "White Heron Regency Hotel" that offers a magnificant view of "the worlds largest yacht harbour". Because of a steadily growing market, the event offered an excellent chance to confer interesting information to interested parties. The opening of the exhibition was honored by the presence of the New Zealand Minister of Broadcasting.

We pass on our best wishes for good success to our representatives, Gareth and Valerie Jones and their dedicated team.

Paul Meisel



Right on success

Studer worldwide

Finland

Yleisradio Helsinki

The Finnish broadcasting company has ordered 15 more STUDER A810 broadcast recorders and two STUDER 902 mixing consoles. The latter will be operated in two large television OB-Vans. Additionally, Yleisradio have received 10 STUDER A725 CD-Players in the last few months.

England

British Broadcasting Corporation (BBC)

A total of 90 A810 broadcast recorders have been ordered by the BBC; 60 of these models were specially designed A810 editing machines.

Holland

Nederlandse Omroep Stichting (NOS)

Eleven STUDER TLS 4000 Synchronizers were supplied to NOS for operation with STUDER A810 broadcast recorders. The Dutch radio corporation has furthermore ordered two more STUDER Mixing Consoles 902/903; there are now seven mixing consoles of the 900 series in operation at NOS.

Czechoslovakia

Československá televize

In September 1985, 14 STUDER A810 broadcast recorders together with 14 TLS 4000 were taken over by CS Television who now operate 23 TLS 4000 synchronizers at their premises.

Training courses on professional STUDER equipment

10.03. – 14.03.86	
STUDER A80 RC/A80 VU, Tape Rec.	Spanish
10.03. – 14.03.86	
STUDER 961/962, Mixing Consoles	English
STUDER A810, Tape Recorder	English
03.04. – 04.04.86	
STUDER A710, Cassette Recorder	German
STUDER A725, CD-Player	German
07.04. – 11.04.86	
STUDER A810, Tape Recorder	German
STUDER TLS 4000, Synchronizer	German
14.04. – 18.04.86	
STUDER A820, Tape Recorder	German
STUDER 961/962, Mixing Consoles	German
21.04. – 26.04.86	
STUDER A820, Tape Recorder	English
STUDER A812, Tape Recorder	English
28.04. – 30.04.86	
STUDER TLS 4000, Synchronizer	English
STUDER SC 4008/16, Syst. Controllers	English
STUDER 961/962, Mixing Consoles	English
12.05. – 16.05.86	
STUDER 900, Mixing Consoles	English
STUDER 961/962, Mixing Consoles	English
12.05. – 16.05.86	
STUDER A810, Tape Recorder	French
STUDER TLS 4000, Synchronizer	French
20.05. – 23.05.86	
STUDER 900, Mixing Consoles	French
29.09. – 03.10.86	
STUDER 900, Mixing Consoles	Arabic
STUDER 961/962, Mixing Consoles	Arabic
06.10. – 10.10.86	
STUDER A810, Tape Recorder	Arabic

The courses are not fully booked yet. Each course takes 8 – 12 people and demands reasonable knowledge of electronics.
Course fee is sFr. 110.– per day.

REVOX Training Courses in 1985/86

Several technical training courses for REVOX equipment were again held throughout 1985. To meet the requirements of an ever-increasing product range – a few oldtimers still included – three weeks training is necessary and, as the occasion requires, in either German, English, French or Italian language.

A total of 44 technicians have participated in 9 courses. In addition, product-orientated seminars were held in France, Greece, Italy, Spain and South Africa.

For 1986, the following training courses have been planned to take place in Regensdorf:

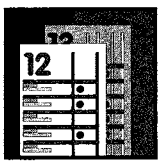
	German	English	French
HiFi 1	10 – 14/2	17 – 21/3	7 – 11/4
HiFi 2	17 – 21/2	10 – 14/3	14 – 18/4
884	26 – 30/5	9 – 13/6	21 – 25/4

Training covers:

HiFi 1: B77, B215, PR99 MKII, B791, B795
HiFi 2: Agora B, B261, B285, B286, B251, B225, and IR
884: Teachers Desk Electronics, Cassette Recorder, B795 and R88

Bruno Baronio

PR99 Seminar in Spain with participants of Radiocadena Espanola.



Forthcoming events

1986 March 4 – 7
80th AES Convention, Montreux

1986 April 13 – 16
NAB Convention, Dallas

1986 June 12 – 14
SIBC, Seoul

1986 June 24 – 27
Sound & Vision 86, SMPTE, Sydney

1986 June 25 – 27
APRS, London

For further information please contact

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