June 1990, No. 29

SWISS SOUND

NEWS AND VIEWS FROM SWITZERLAND

STUDER REVOX

Editorial

# Among other things, about ourselves

**The news that STUDER REVOX has been sold to SAEG Refindus Holding Inc., a member of the MOTOR-COLUMBUS Group, has spread rapidly since the first official press release on March 12, 1990. It was also widely discussed at the information meeting specially for technical journalists on the following day during the AES Convention in Montreux. The sale – dated April, 2, 1990 – is now already history.**

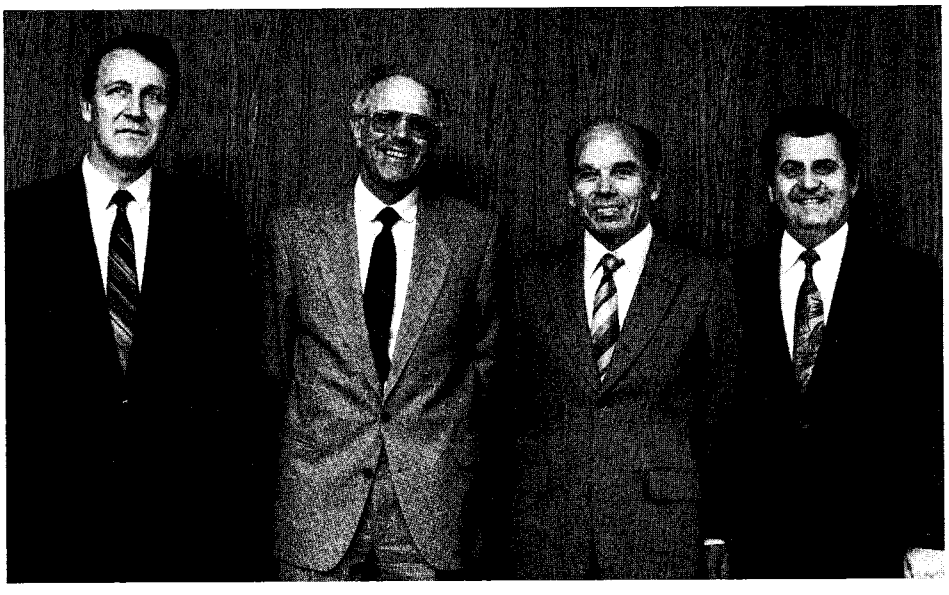
Press orientation on March 12, 1990 in Hotel Du Parc in Baden: Dr. Willi Studer and Dr. Erich Haag inform the press, radio and TV representatives.

For this reason I assume that SWISS SOUND readers have already been informed about the principal changes and that we should shed some light on some of the details.

Let us start with ourselves: As founder and proprietor of his company, Dr. Willi Studer was also the publisher of STUDER REVOX PRINT and SWISS SOUND. "Print" was conceived some 20 years ago as a bulletin for our employees written in German, whereas SWISS SOUND, a creation of STUDER INTERNATIONAL AG, now in its eighth year, is published as an international magazine for technical information in German and English with a circulation of almost 20,000 copies.

Mr. Studer had a keen personal interest in both these publications. Not only did he use them as a channel of communication with his employees, he also enlivened many issues with "spicy" editorials and showed great interest in each contribution. Typical of his commitment was that these publications were not only composed and edited but also produced in house, which means that typesetting, photo, reproduction and printing were also done on the spot.

In the name of the people involved in these publications I would like to take this opportunity to thank you, Dr. Studer, for making all these things possible. You built the foundation with great foresight, and we shall continue your work in the sound tradition you have established.



The new Board of Management of STUDER REVOX (from left to right): Dr. Leo Wehrli (President), Eugen Spörri, Hermann Stierli and Bruno Hochstrasser.

This tradition is of paramount importance and should apply not only to "by-products" such as publications. To this end certain prerequisites must be fulfilled, one of which is continuity in concepts, development and production. Concerning this aspect the conclusion of the official press release states:

> ... "The operational independence of STUDER REVOX will remain unchanged after this take-over."

And with respect to the management change it was said that:

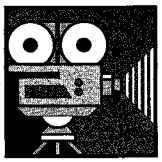
> "Overall management of the group, which was in the hands of Dr. Willi Studer up to now, will be taken over by a Board of Management formed by Dr. Leo Wehrli (President), Eugen Spörri, Bruno Hochstrasser and Hermann Stierli. New Chairman of the Board of Directors is Dr. Erich Haag, member of MOTOR-COLUMBUS Ltd. and Chairman of the Board of the SAEG Refindus Holding Inc."

The new Board of Management comprising of four longstanding employees from the senior management ensures this continuity, which is an important cornerstone. An new era has begun and the starting positions have been taken, but despite the undertaking of continuity, some changes in the future should be expected. However, we are accustomed to this, because, after all, the path from the tube-type equipment in 1948 to the processor-controlled digital electronics in a totally changed (audio)world has been anything but straightforward.

M. Sie

Marcel Siegenthaler

## Read in this issue:



Revox B215 for test cassette production

# Sound Check

**Continuous duty without loss of quality is frequently a key requirement of professional audio equipment. In order to maintain this high performance, the equipment is checked in regular intervals by the studio's own service team. For hi-fi equipment the requirements are considerably less demanding, but even then the user has the right to be informed about the condition of his system. For this purpose the German hi-fi magazine, AUDIO, has developed a relatively simple testing tool.**

With few exceptions, the purchase of audio measuring instruments and their correct utilization is the privilege of specialists. However, there is an alternative method: a listening test based on specially selected and produced recordings. Of course, this method cannot supply technical data but it can, with amazing accuracy, provide information on the quality of the reproduction.

The editors of AUDIO have drawn on their experience from many tests and created a 3-part test set (available also individually) based on a CD, a cassette tape, and an LP disc. In common to all three productions is a high-quality test program ranging from classical music to jazz and popular music. The fully digitally produced music examples as well as the digitally copied jazz selections have been selected in such a way that the strengths and weaknesses of a system can be quickly determined through a listening test. Because all three recording media contain the same music program without any sound modifications, also minor differences in the sound balance between CD player, turntable, and cassette recorder can be detected through A/B comparison by changing the source on the amplifier.

A test section recorded on all three recording media also helps to trace differences in the reproduction equipment. It contains selected test signals which enable the listener to quickly check whether all hi-fi components are interacting properly. These tests contain for example:

Separate test tone (1kHz, full modulation) for both stereo channels, for testing the cabling; a special noise signal for checking the phase, and a sweep signal for determining room resonances (speaker positioning).

Other test signals are used for checking the soundhead alignment of cassette recorders or for checking the nominal speed. Some of the tests are useful for checking the VU meters (burst signals). Wow and flutter can also be detected. For CDs a number of special test signals are available to check pitch and emphasis.

The valuable AUDIO soundcheck CDs and cassettes are supplied in a strudy wooden box.

All in all an effective test approach, from the cabling to the level adjustment and calibration. The media have been produced with state-of-the-art equipment. The cassettes are copied in an elaborate real-time process (normal tape speed, no high-speed copy). A high quality R-DAT recorder serves as the master machine to which several Revox B215 cassette recorders are connected. Due to their built-in HX Pro circuit, these units produce excellent dynamic values and have an ultra flat frequency response even in the presence of strong high-tone pulses recorded without Dolby (test signals).

Marcel Siegenthaler

The "first-class copying line" is equipped with Revox B215 cassette recorders.

Source: AUDIO 9/89
Ordering address:
Vereinigte Motor-Verlage
Spezial-Verkauf
P.O. Box 10 60 36
D-7000 Stuttgart 10

Tape Deck Technology of Multichannel Machines

# Precision Tape Guidance

**Smooth transport of a tape through the recorder is something only a layman takes for granted. The problem is that the tape is a fairly unstable medium and that the requirements in dynamic processes are extremely high. The author reports on the investigations which led to the technical refinement of the series A820 - A827 tape decks (1 and 2 inches tapes).**

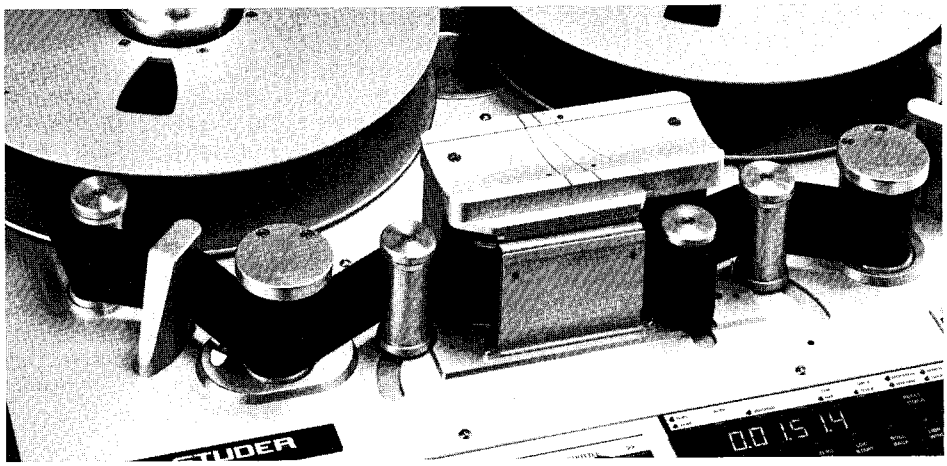


**Fig. 1:** "Visible" precision: the tape transport of a multitrack machine.

In multitrack machines that operate with 1 or 2 inch tapes, the requirements concerning tape transport precision are exceptionally high because the reproducibility of the results and the interchangeability of the recordings between individual machines is a basic specification in professional applications. Close attention must therefore be given to the precision of the track geometry (level stability and minimum cross talk). In view of the large track separation on the wide tape, the exact perpendicularity of the tape edges relative to the record head gap (phase error between far audio tracks) is also of crucial importance.

The precision with which a tape deck has to be built is in the magnitude of only a few µm (thousands of millimeters). Such tolerances are, of course, not directly observable. This means that neither the effective forces nor the µm are visible to the unaided eye. However, their effects on the tape movement, the soundheads, and he cross talk become readily apparent. It should be remembered that also the tape has different quality characteristics. These relate not only to the oxide coating but also the manufacturing tolerances of the substrate.

Many test series with different tape recorders and different tape qualities as well as the extensive experience in manufacturing and testing tape decks have demonstrated that noumerous criteria are relevant and that many conditions have to be satisfied in order to achieve optimum tape transport under worst-case conditions.

### Requirements for a professional tape deck

The requirements, criteria and conditions to be satisfied by tape deck design are approximately as follows (the sequence is arbitrary and does not represent any weighting, and some factors which may possibly be taken for granted are also mentioned):

- The idler and guide rollers must be positioned in such a way that the angle by which the tape wraps the soundheads is optimal.
- The tape should be moved across the rollers and heads at the correct height, i. e. without tilting movement and without damaging the edges.
- No fixed tape guidance elements should be located near the soundheads, and particularly not in front of the capstan drive, otherwise longitudinal oscillations (side band noise) can occur. The tape lift pin for the spooling function is wrapped only insignificantly by the tape. In play mode it therefore provides only additional stability.)
- In order to achieve high tape counter accuracy, the tacho roller must have a wear-resistant but non-scouring surface with good adhesion to the tape. In addition the roller must be optimized with respect to the inertia (mass/diameter) and friction ratio.
- To minimize the wow and flutter throughout its lifespan, the capstan shaft must be aged and manufactured within tolerances of µm.
- The pinch roller should not adversely affect the tape transport accuracy.
- The tape tension measuring device (tape tension sensors) must function accurately, from play speed to maximum spooling speed. This requires low inertia but a robust design.
- The rollers must be arranged in such a way that the tape can be easily threaded.
- The roller mounts should be designed in such a way that the machine can be easily converted (2"/1").
- All machine parts that come in contact with the tape must be exactly perpendicular to the tape path. This requires an absolutely flat base, i. e. a stable and precision-machined tape deck chassis.
- In order to minimize wow and flutter and phase fluctuations, all rollers must run true within a tolerance of a few µm. In addition they must be absolutely cylindrical so that the tape does not drift off the ideal path.
- Additional requirements to be satisfied by the mechanical components of a tape deck:

- Long life of the bearings and wearing parts.
- Minimal maintenance.
- Low-soiling materials for parts that come in contact with the tape.
- Easy to clean.

All of these criteria and constraints are reflected in the design of the A820 and A827 multichannel machines. But also past experience has been taken into consideration in order to maintain our position as leader in tape deck technology.

For example, particular attention has been given to the tape deck suspension so that the chassis is not subjected to bending strain. In order to achieve a neutral behavior of the pinch roller relative to the tape movement, a self-aligning bearing has been developed which uniformly distributes the pressure across the full tape width; also the pinch roller has been subdivided into four (two in 1" machines) roller segments each 1/2" wide.

In order to achieve gentle and accurate tape guidance, rollers with super-precision machined running surfaces and rims are used. The optimum rim angles have been determined through hundreds of test runs.

**Tape-related problems**

Although the tape deck is precision engineered in all details, the rest runs revealed irregularities in the tape transport when different tape types or even tapes from different batches of the same brand were processed. The measurements subsequently concentrated on the mechanical data of the tapes. Measurements on a vast range of tapes confirmed that the quality varies. The measurements were performed on an Olivetti measuring machine with optical scanning and electronic zero adjustment. For this purpose the linearity of 600 mm tape segments was checked by noncontacting inspection. Fig. 2 illustrates some of the amazing results with deviations that are not noticeable by the user.

Subsequent tests of "enforced" tape guidance failed. We discovered that stationary tape guidance elements in the head area are not suited because the tape/head contact deteriorates due to the deposition of abraded oxide particles and the related tape damage (Fig. 3).

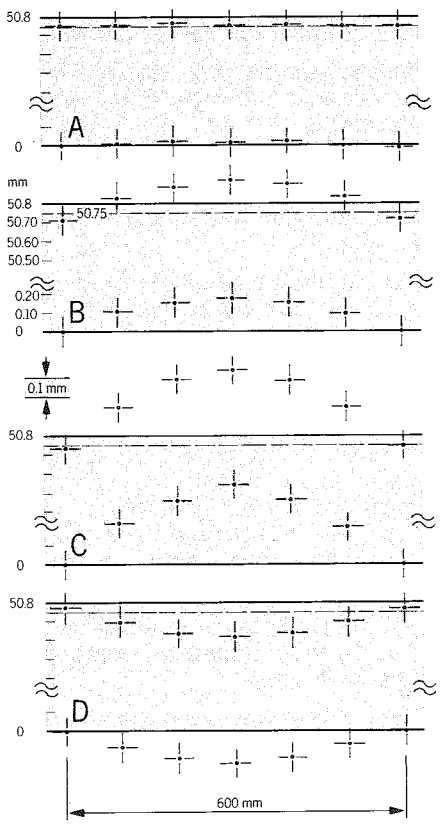



**Fig. 2:** Measuring results of unstressed 2" professional tapes on a Olivetti measuring machine with non-contact scanning. Fig. A shows a good tape, Figs. B to D are tapes that can produce tape transport problems.

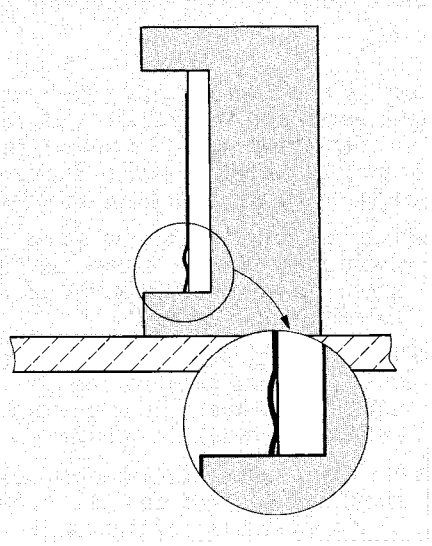


**Fig. 3:** The fixed "enforced" tape guidance causes problems due to abrasion and tape deformation that also adversely affect the heads.

The tape measurement showed that certain tapes have a sabre like curvature, i. e. the tape edges, measured in relaxed condition, do not have the same length and test runs showed that the upper and lower tape edge do not have the same tape tension. Various tapes consequently drifted from the ideal path.

**Solution: compensation of the tape tensions at the edges.**

Qur developement work thus concentrated on mastering these "external" faults as well. The solution is based on a compensating lever for the tape (edge) tension values. This compensating lever is located after the capstan shaft, supported in the center of the tape, and is moved by the tape transversely to the capstan direction (Fig. 4).

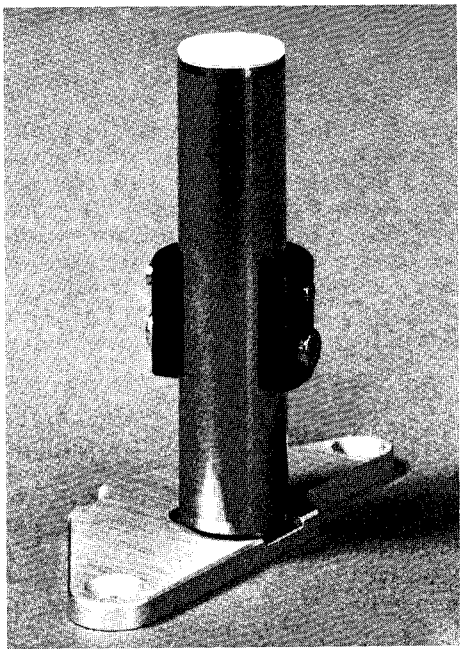


**Fig. 4:** The newly developed compensating lever even solves difficult problems with unsatisfactory tapes.

These transverse movements result from the different tape tensions on the tape edges. If, for example, the upper tape edge has less tension, the lower tape tension will increase so that the overall tape tension will be in balance. The lower tape edge with higher tape tension pushes the compensating lever backward and consequently pushes the upper section forward toward the tape (Fig. 5). This tilting movement of the compensating lever increases the tension on the upper tape edge.

**Eduard Gämperle (45)**
After his training as a machine mechanic and completion of his studies as a machine designer at ITA Zurich, he worked for several years in a company specialized in measurement and control technology. He then did an additional training in electronics. His first assignment after joining Studer in 1969 was in the field of tape transport mechanics for professional tape recorders. He has trained in audio measurement technology and had seven years of activity in the final inspection department.
Since 1980 he has been working in the development of professional tape recorders.

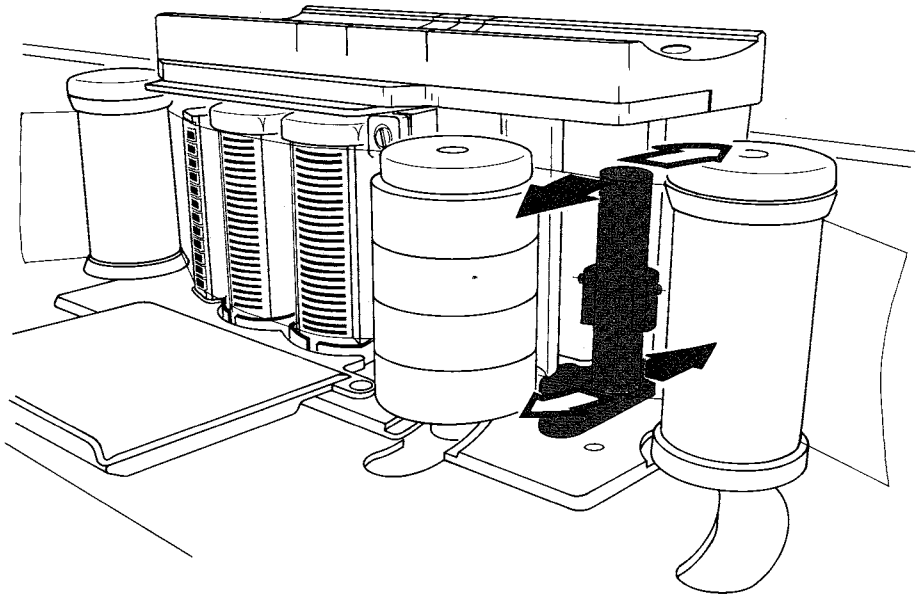


**Fig. 5:** The compensating lever fulfills its function through its pendular movement transversely to the tape. Differences in the tape tension on the edges are automatically compensated.

The tape tension forces on the edges are automatically compensated and the tape moves naturally in the ideal path.

The compensated tape tension produces a uniform tape/head contact of all tracks. It virtually eliminates uneven head wear and at the same time ensures high level stability of the signals encoded in the outer tracks.

The efficiency of these solutions has been proven in elaborate tests. The A820 and A827 Studer multitrack machines will thus function optimally with all professional tapes available on the market.

Eduard Gämperle

Co-author: Marcel Siegenthaler


Studer supplies its very first DASH Machine D820-48

# Power-play on 48 channels

A spectacular procedure in every respect, unparalleled in 40 years of the STUDER REVOX history:

- Studer supplies its very first digital multichannel DASH machine;
- it enables Studer to modify the exclusive position the leader of the DASH family holds;
- at the same time, Studer is also the sole manufacturer in the Western industry who has put such demanding project into serial production;
- the new flagship is transported per helicopter from Regensdorf Studer Revox headquarters to POWERPLAY Studios in Maur;
- last not least, the two audio pioneers – George Martin and Willi Studer – meet at POWERPLAY Studios.

The 19th of March was indeed the opening of a new era for POWERPLAY Studios. Proprietor Jürg Peterhans was the first customer worldwide to have ordered and received a Studer D820-48 DASH machine. Special delivery was made per helicopter, piloted by Heiri Zahnd, "company-owned" helicopter pilot and head of the forwarding department of Studer International AG.

D820-48 still in the air over the roofs of POWERPLAY Studios; seconds later, the crate is safely put down and the very first digital 48-channel Studer tape recorder has reached its destination.

The designer team of the D820-48 did not want to miss the occasion either and was there to watch the soft landing of "their" machine at close range.

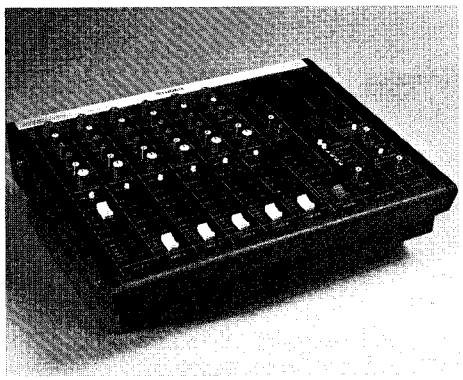
Finally, the official introduction was greatly enhanced by the fact that two famous names of the international audio scene were present – namely George Martin, internationally renowned not only as the producer of the Beatles, and Dr. Willi Studer, downright producer of professional audio equipment.

Marcel Siegenthaler

Studer A779 – Professional small mixer

# Compact but powerful

**This report is based on the article "Revox C279 Mixing Console" in SWISS SOUND No. 17 in which the function and design of the individual models was described. Since the C279 was intended for use by amateurs, the A779 has been significantly modified and enhanced to make it suitable for professional applications.**



Studer A779 – the smallest mixer in our product line.

The reason for the growing interest in a professional version of the C279 is the extended application potential. In order to give the reader an impression of the capabilities of the Studer A779, some application examples are given below.

- Speaker studios in which lectures, interviews and small discussions are recorded.

Typical equipment configuration for such an application (in addition to the mixing console): two tape recorders, one or two additional audio sources (CD/turntable/cartridge), two to three microphones as well as monitor speakers.

- Control rooms in which tapes are edited for broadcasting.

Typical equipment: three tape recorders, possibly other audio sources, as well as monitor speakers.

- This mixing console is also well suited for OB applications, conferences, sports event coverages, discussions, religious broadcasts, recording and broadcast of soloist concerts, chamber music or choirs.

Typical equipment: depending on the application, one or two tape recorders, up to 6 microphones, monitoring via headphones or speaker.

- Or in the small local DJ studio or for film/video post production or as a submixer in multichannel productions or as a DJ mixer for small concert/lecture/halls
- or simply as a trouble shooter in everyday professional productions.

In order to cope with such a wide range of applications, the C279 mixing console had to be expanded. These expansions include two new modules (CONTROL MONITOR and INPUT/OUTPUT UNIT) as well as optional VCA control.

## Equipment design and module arrangement

The compact size has also been retained for the A779. An electronics extension unit with a height of 43 mm is mounted to the bottom of the A779. The lightly forward slanted professional mixing console is suited for desktop operation or with corresponding brackets also for 19" rack mounting.

### Principal technical data of the Studer A779

**Overload margins**

| | |
|---|---|
| Maximum input level: | |
| MIC: | 0 dBu |
| LINE bal., STEREO: | +20 dBu |
| AUX-RETURN, TAPE: | +26 dBu |
| Maximum output level: | |
| Unbalanced: | +20 dBu |
| Balanced: | +24 dBu |
| Balanced transformer: | +26 dBu |

**Frequeny responses**

| | |
|---|---|
| Treble, bass linear, 20 Hz ... 20 kHz: | ± 1 dB |
| Treble, boost/cut at 20 kHz: | ±15 dB |
| Bass, boost/cut at 20 Hz: | ±15 dB |

**Signal-to-noise ratios**

| | |
|---|---|
| MIC, relative to −60 dBu input voltage: | >63 dB |
| Line, relative to 0 dBu input voltage: | >90 dB |
| 6 x line: | >86 dB |

**Harmonic distorsions**

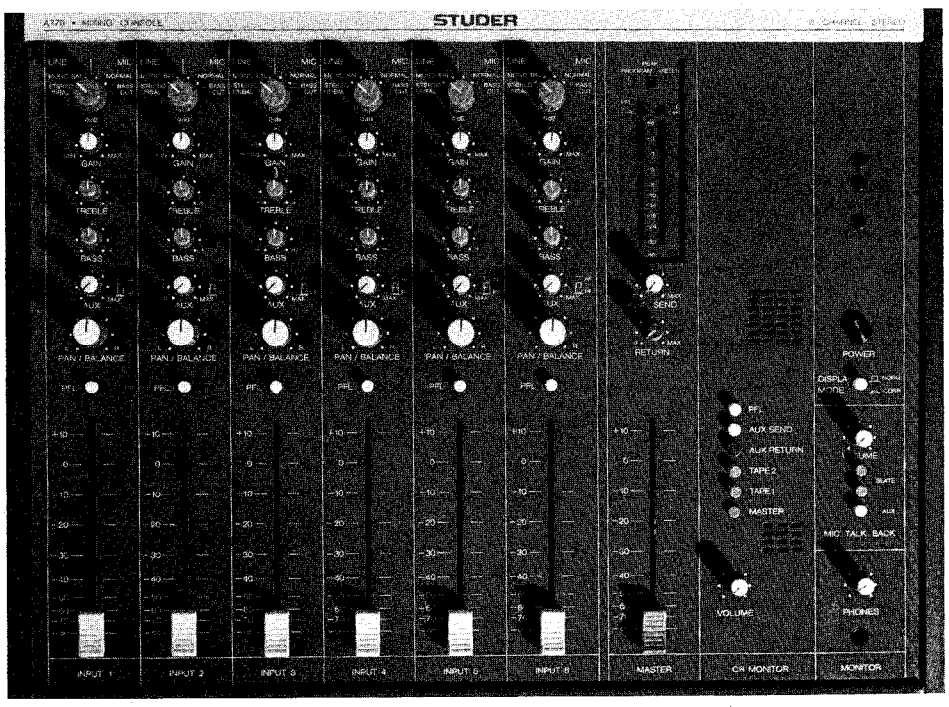
| | |
|---|---|
| Line, 0 dBu input voltage, 1 kHz: | >0.03% |
| MIC, −20 dBu input voltage, 1 kHz: | >0.03% |

**Crosstalk attenuation**

| | |
|---|---|
| Stereo crosstalk attenuation at 10 kHz: | > 50 dB |
| Swith-off attenuation channel fader at 10 kHz: | > 86 dB |
| Swith-off attenuation master fader at 10 kHz: | >100 dB |

**Dimensions**

| | |
|---|---|
| Basic unit (W x H x D) | 460 x 135 x 350 mm |
| Expansion unit (W x H x D) | 436 x 43 x 313 mm |




Perfectly adequate for many applications, but extremely easy to operate.

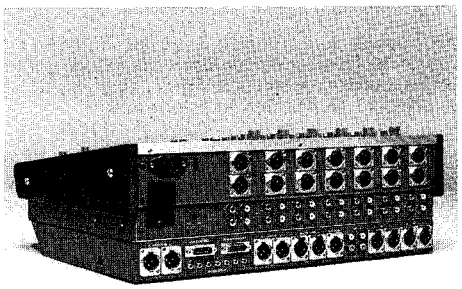
## Design and function of the supplementary electronics

The supplementary electronics is principally located on the input/output units as well as the control monitor unit. The existing circuit boards were modified to accomodate these new units.

## Input/output unit

The design of the input/output circuit boards is based on a type of funtion groups which comprise the following elements:

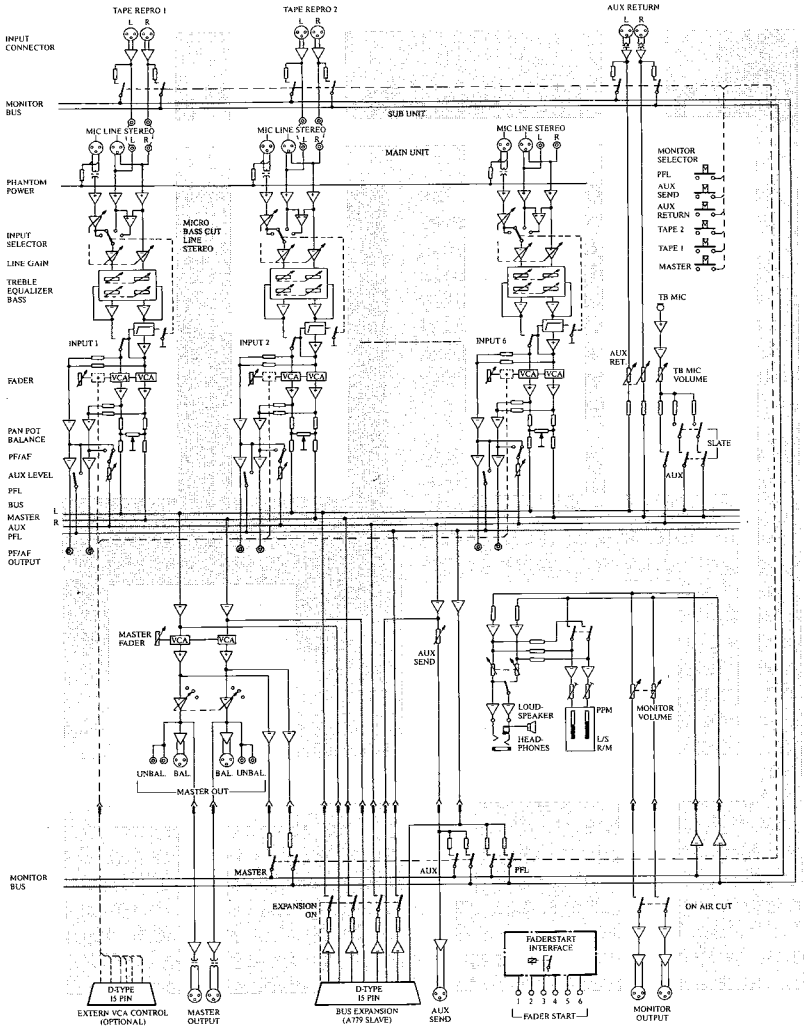
- Balanced and floating stereo power output (MASTER), particularly required for OB applications.
- Two electronically balanced stereo inputs (TAPE 1 + TAPE 2) for expanding the connection facilities so that the console can be used for control room and production studio applications.
- Expansion of the AUX RETURN to a transformer balanced stereo input so that stereophonic reverberation and effect units can also be inserted. Of course, also an additional source (e. g. a stereo input line) can be connected here.
- Electronically balanced AUX SEND channel.
- Bus expansion (master bus/aux bus/ PFL bus) for master/slave operation of two interconnected mixers. The connection between the mixers is established by means of an insulated bus expansion cable (15-pin, D-connector).



Professional connector panel.

## CR monitor

The monitoring section of the small mixer has been considerably redesigned. The CR MONITOR UNIT contains a monitor potentiometer and the push buttons for selecting six sources (MASTER / AUX-SEND / AUX-RETURN / TAPE 1 / TAPE 2 / PFL) for additional stereo monitoring.




Studer A779, block diagram.

It should also be mentioned that all selector switches in the audio path are implemented electronically with FETs in order to prevent switching clicks and contact problems.

The audio electronics for source selection (monitor bus) as well as the elctronics for the monitor output are located on the input/output board. The monitor output can be programmed in such a way that it is switched off when the microphone is open (disk jockey mode).

## Input unit

The following enhancements have been made to the input unit:

- A calibration mark has been provided on the gain potentiometers.

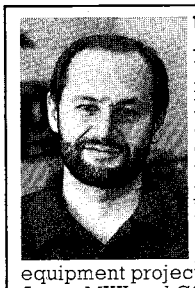
This mark identifies the 0 dB gain across the entire mixer when the LINE INPUT is used and the input and master faders are in the 0 dB position.

- Expansion of the FADER range to +10 . . . −70 dB.

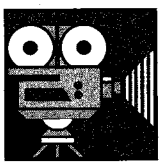
## VCA option

The VCA option (external remote control of the VCAs) opens new fields of application. For audio postproduction in TV studios a video editor of the series BVE900 or BVE9000 can be connected directly via a 15-pin D-connector (VCA control). But also external level potentiometers and cough or talk buttons can be connected here.

Ueli Leeger



**Ueli Leeger (33)**
After four years of basic training as a machine mechanic he continued his studies in 1979 with a 3-year course in electrical engineering at Juventus, in Zurich. In 1982 he joined the Revox development group of Willi Studer AG. After participation in various hi-fi equipment projects (Revox B251, B285, Agora MKII and C279) he was promoted to project manager for the Studer A779 mixer.



Studer Radio Studio Technology

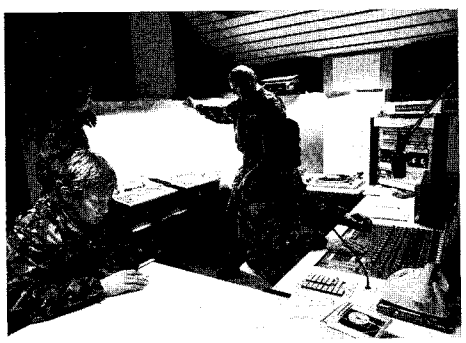
# Top Secret Radio "under ground"

**Radio studios can frequently be found in ordinary houses, sometimes in prestigious buildings too, while others are only accessible after a security check by heavily armed guards. The following brief report provides some information, although in limited form, on a very special radio studio complex.**

For good reasons, the responsible government agency is not interested in talking, much less publicizing about this installation. Even those few specialists who work in this studio, are bound to observe strict secrecy and normally cannot even be found there. And on those few occasions where they are in the studio they have difficulties recognizing each other because they all wear identical clothing. This they call camouflage.

As you rightly suspected this is a military installation . . . in Switzerland. There are valid reasons why I cannot say more about its location: this secret installation is located neither in a garrison nor a military academy, and even less in a flying fortress because as a defensive nation Switzerland has no need for such fortresses. But a fortress it is. One that cannot be shot down because it is hewn into very hard rock and hidden from the eye (camouflaged).

But don't attempt to go and search for it yourself because in Switzerland there is an awful lot of hard rock suitable for non-civilian construction!



Members of the armed forces, technical specialists in civilian life, at work in one of the production and transmission control rooms.

Specialists from Studer work sometime "between evening and morning" e. g. in the control room. – Who can recognize them?

Responsible for this radio studio is the "Press and Radio Department" (APF) of the Swiss Federal Ministry of Justice and Police. Its function is to provide Switzerland with radio information in times of crisis when normal radio studios are no longer operable. For this purpose a complete infrastructure has been developed, established, and continually modernized to the latest state of the art over the past decades. A basic distinction is made between mobile and fixed systems. The latter also include various transmitters for FM, AM and shortwave broadcasts.

For on-the-spot coverage the "mobile" systems are based on vehicles comparable to OB vans and are equipped for maximum flexibility and autonomy. In extreme situations they can even produce their own programs. Most of the audio equipment in these vehicles is supplied by Studer.

In the "fixed" system the emphasis is on the requirement of providing a substitute for the civilian production and transmission network. In a highly federalistic country such as Switzerland where programs are broadcast in four languages (excluding foreign services), the skill requirements on the militia troops, consisting principally of specialists of the SRG (Swiss Radio and Television Company) and related industrial enterprises are very demanding.

Broadcasts are generally announced and moderated by familiar voices. Illustrated is a popular Swiss radio reporter and TV quiz master working on a Studer 962 in disk jockey mode.

An important aspect are the technical facilities which in emergency situations must perform reliably in continous operation. The air-conditioned radio complex in the rocks consists of several studios with corresponding transmission and production control rooms where among other things the most modern Studer mixing consoles, tape recorders, cassette recorders and CD players are installed. This installation is also equipped with a central control room, editorial rooms with the latest transmission equipment, archives and an infrastructure that makes autonomous life under ground bearable.

Marcel Siegenthaler

PQ subcode editor LHH 3055

# PQ editing or how to create a CD timetable

**The enormous storage capacity of the compact disc provides ample space for an electronic contents list, for text information, and even for graphics. Of particular interest here are the so-called «PQ» subcode data, the control data for the CD player. The author describes the operating principle of the «PQ» subcode editor LHH 3055».**

The PQ subcode editor – a development of the joint venture Studer and Philips CD Systems AG – is used for determining and processing the required auxiliary information for the CD master tape. The digital audio data are supplemented with the TC addresses (time code) representing the start and end of each selection. When the CD is played, these data are read for locating the desired selections (tracks).

## What are PQ data?

In addition to the digital audio data, the CD contains also control and display information. For this purpose each second is subdivided into 75 sectors, also referred to as CD frames (Fig. 1). Many professional CD players (such as the Studer A730) display this information. Each of these frames is further subdivided into 98 subframes and each subframe comprises 24 audio symbols (bytes), 8 parity symbols, and one C+D symbol (Control and Display bytes). This control byte, comprising the data «P» to «W» (8 bits) is referred to as the CD subcode.

The «P» bit is a so-called pause bit. The bits «R» to «W» are reserved for text and graphics and used only for special applications.

The 98 Q-bits of each frame (sector) or 1/75th of a second contain complete information on the:

Track number, index number, track time and absolute time in minutes, seconds, and frames, as well as information on emphasis, digital copyright, etc. The track time and the absolute time of the subcode are those times which are displayed directly on a CD player without any computations.

## How does the PQ subcode get on the CD?

The source is the digital master tape containing the desired sequence of selections and pause lengths. This information is recorded on a U-matic cassette or a DASH tape. The master tape must contain a continuous time code (30 frames/s).

Based on this time code the TC addresses for the starting, intermediate, and ending times are now set and verified.

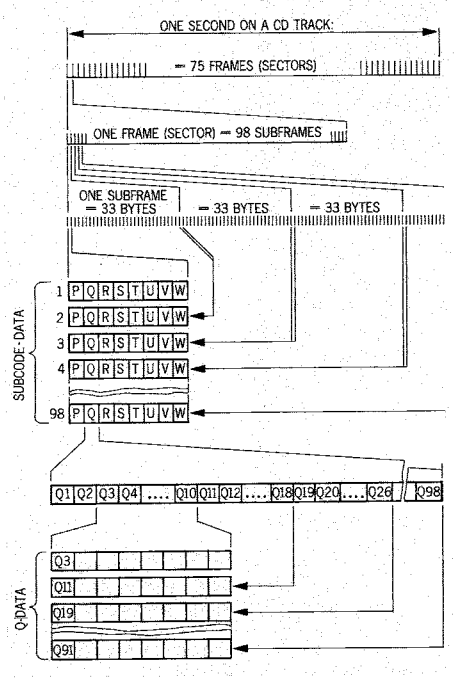
The «contents information» or time code addresses can be compared with a timetable or the contents table of a book. They are written in the form of auxiliary information as PQ cue code data on the master tape: in the case of the U-matic cassette on the analog track 1, or on the DASH tape on the AUX track. Depending on the number of TC addresses (tracks, index, text) the recording of the PQ cue code data for the contents list may take from several seconds to several minutes. The resulting tape is now called the «Tape Master».

To produce the actual CD from the tape master, a glass master must first be created from which the molds for the plastic injection molding machine are manufactured via intermediate stages.

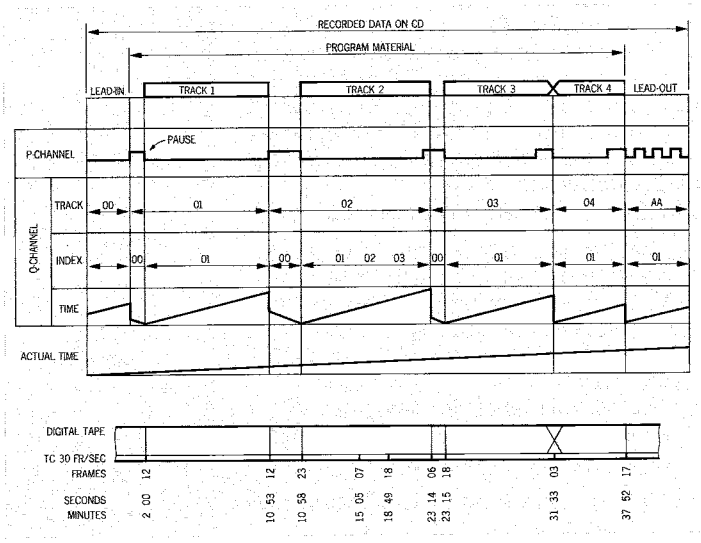
To create the glass master, the subcode generator first reads the PQ cue code data. The sequence control for the mastering is responsible for the synchronous start of the tape master and the subcode generator. In this process the PQ cue code data are converted to a CD subcode. Together with the audio symbols the glass master is then described in a frame structure.

## How are the PQ data determined?

Preliminary remark: Fig. 2 illustrates the structure of a tape master with the corresponding track assignment. A track always begins with index 1; index 0 is reserved for the preceding pause. Up to 99 tracks with up to 99 indices each can be set.




◁ **Fig. 1:** The 98-bit PQ data words are embedded in the subframes.




▷ **Fig. 2:** This diagram shows the position of the PQ data relative to the audio tracks of a CD.

According to the CD specifications (red book), it is not mandatory for a CD to start with track 1. However, this should always be the case because there are some CD players on the hi-fi market which cannot play back a CD that does not start with track 1.

Procedure: The first selection is searched on the tape master. Eminently suited for this purpose is a digital reel-to-reel machine with PDM code tracks (e. g. Studer D820X). The TC addresses for the start and end can be determined either through manual cueing or at normal play speed. Even more efficient is an electronic editing station (e. g. Digital Editor 4003 – see SWISS SOUND No. 25) which can determine the TC addresses of the tracks and indices already during the edit operation.

The TC address for the start of a track should be selected according to musical criteria. A small pause between the index address (starting point for the player) and the modulation start should be maintained: at least 0.6 s for track 1 and at least 0.3 s for tracks 2 to 99.

Reason: even if the CD player does not position accurately, the start of the music selection will not be clipped and a small pause is generally preferred.

## Operating principle of the PQ editor LHH 3055

The PQ editor (Fig. 3) is based on a personal computer with special hardware and software. This computer is responsible for controlling the tape recorder, for reading the time code and the PQ cue code data, as well as for generating them.

The software is menu-driven and offers function keys and special text editing capabilities. After the PQ editor is powered up the MAIN MENU is displayed (Fig. 4).

The menu line «Input new PQ data» opens an empty input field. After the title (header) has been completed with information on the CD title, label, etc., the TC addresses can be determined consecutively.

There are three input possibilities:

a) The TC address is entered numerically, e. g. based on a TC list.
b) With a data transfer command the TC address is loaded directly from the tape, e. g. in the PLAY or STOP func tion.
c) The TC address is determined by an electronic edit point (e. g. with a digital editor DE4003), and read in.

Each line containing a TC address can be supplemented with a text.

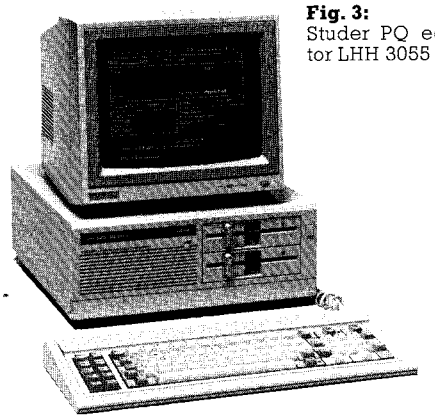


**Fig. 3:** Studer PQ editor LHH 3055

```
                    MAIN MENU

                Read  PQ data
                Write PQ data
                Input new PQ data
                Edit existing PQ data
                Print PQ data
                System parameters
                Directories
                Return to DOS


          File : B:SWSOUND.PQD     is loaded

          Title: The Example

 Advice : Save your data frequently on floppy
```

**Fig. 4:** Main menu for selecting the editing functions

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Studer and Philips CD systems A.G.

Date: 12.2.90   Page:        Mast.-Ident.: 12345678-123-STI

Title: The Example                                Label: PQ-Hits
       with the S&P Group

LP.-No.: 1001                     Bar-code No.: 9876543210987

Headroom (dB): 2.5 Recording : DDD | Set-No.:        Set-Content:

Tape(s) from: Digit Studio         | Order Source:  The Digital Voice
Mastering: S. Supersound           | Planned release date: 18. 05. 90
Checking : C. Critical             | Initial Order: 270190/EG
PQ-Coding: P. Q. Editor            |
```

| Track T - X | Track or Index Content | P E | ISRC-code | SMPTE mm ss ff |
|---|---|---|---|---|
| 1 0 | Pause | N | COMP01234500 | 2 0 12 |
| 1 1 | Happy PQ Song Track 1 | | | 2 2 25 |
| 2 0 | Pause | Y | FRANK0987650 | 10 53 12 |
| 2 1 | Track 2 with Index 1 | | | 10 58 23 |
| 2 2 | with Index 2 | | | 15 5 7 |
| 2 3 | with Index 3 | | | 18 49 18 |
| 3 0 | Pause | N | COUNT1234567 | 23 14 6 |
| 3 1 | Track 3 | | | 23 15 18 |
| 4 0 | no Pause | N | LASTS6543210 | 31 33 3 |
| 4 1 | last Track 4 | | | 31 33 3 |
| | Start LEAD-OUT: | | | 37 52 17 |

**Fig. 5:** Window «Input new PQ data». The third column is reserved for flags (emphasis, copy prohibited, CD-ROM). Information according to the ISRC code (International Standard Recording Code) can be entered in the fourth column.

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Studer and Philips   CD systems A.G.

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Title: The Example                                Label: PQ-Hits
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Mastering: S. Supersound           | Planned Release Date: 18. 05. 90
Checking : C. Critical             | Initial Order: 270190/EG
PQ-Coding: P. Q. Editor            |
```

| Track T - X | Track or Index Content | PE | ISRC-CODE | Playing-RIT-Time MM SS FF | SMPTE Ref. MM SS FF |
|---|---|---|---|---|---|
| 1 0 | PAUSE Pause | N | COMP01234500 | 0 2 13 | 2 0 12 |
| 1 | Happy PQ Song Track 1 | | | 8 50 17 | 2 2 25 |
| 2 0 | PAUSE Pause | Y | FRANK0987650 | 0 5 11 | 10 53 12 |
| 1 | Track 2 with Index 1 | | | 0 0 0 | 10 58 23 |
| 2 | with Index 2 | | | 4 6 14 | 15 5 7 |
| 3 | with Index 3 | | | 7 50 25 | 18 49 18 |
| | Total Track Length | | | 12 15 13 | |
| 3 0 | PAUSE Pause | N | COUNT1234567 | 0 1 12 | 23 14 6 |
| 1 | Track 3 | | | 8 17 15 | 23 15 18 |
| 4 0 | PAUSE no Pause | N | LASTS6543210 | 0 0 0 | 31 33 3 |
| 1 | last Track 4 | | | 6 19 14 | 31 33 3 |
| | Start LEAD-OUT: | | | | 37 52 17 |
| | Total Program Length | | | 35 49 22 | |

REMARKS

1 Clipping at 12'26"
2 Edit at 37'44" audible

**Fig. 6:** The PQ editor supplies comprehensive lists (mastering order) concerning the CD data.

A REMARKS menu is available for entering comments concerning the master tape (e. g. clipping at 12'26") etc.

The text lines «Track content», «ISRC code» (International Standard Record Code), and «Remarks» are not encoded on the CD but are very useful for the editor. The information in columns 1, 3 and 5 (track/index, emphasis and TC) are used as PQ cue code data.

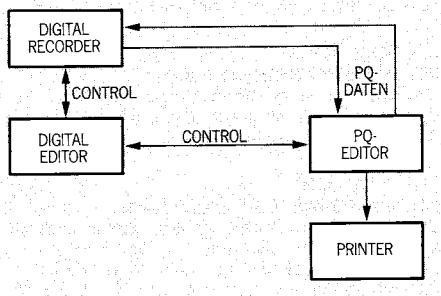



**Fig. 7:** Typical system configuration for PQ-editing.

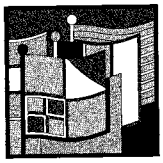
Each TC address can be verified. The function «Check TC» verifies that the TC address is set correctly relative to the modulation. The tape is parked 15 seconds before the TC address. When the tape is played, the time coincidence can be checked with graphical support on the screen. If necessary the existing TC address can be corrected by means of a trim function or by entering a new time so that the address will be positioned correctly.

Already during the editing operation but also when the menu «Input new PQ data» is terminated, the PQ cue code date are checked for conformity with the «Red Book» standards. In the event of an error a plain-text error message is output.

When all verifications have been completed, the data are written on tape or a floppy disk. The diskette is an excellent medium for saving the data during the edit operation. The data recorded on the tape correspond to the specifications for CD master tapes and can for example be read also by a Sony PQ editor. The data can be reread from the tape master or diskette at any time, be it for corrections or for printing the mastering order.

Due to its menu-driven operation, the Studer PQ editor LHH 3055 is an easy-to-use, reliable tool for creating and/or verifying tape masters with great efficiency.

Simon Egli



Right on success

# Studer worldwide

## Hungary

Thomson Video Equipment (TVE and Studer as a consortium received an order from MTV for supply of a complete range of video and audio equipment and its installation in the new television production center in Obuda. It is one of the largest orders MTV has ever placed within the compass of their modernization programme. The contract for the supply of the entire audio part, amounting to Sfr. 3,6 million, was signed on January 9, 1990.

Layout work for this production center started 1981; today, the construction of the building has practically been finished and is ready for immediate occupation. Two identical production studios as well as one each audio and video post production studio have been planned. Three studios will be equipped with Studer 990 mixing consoles.

This center will be established in order to increase national production and also meet all requirements in the

Ratification of contract by MTV Budapest, Studer and Thomson in January 1990.

domain of art performances. The execution of the MTV order is a remarkable challenge for the TVE-STUDER consortium, especially as regards the observance of all project deadlines: The opening date of the center has been scheduled for December 1, 1990.

E. Hermann

## Indonesia

Studer supplies 116 tape recording machines of the popular A807 class to the broadcast house of RRI (Radio Republic Indonesia) in Jakarta. The equipment was ordered for a turnkey project a renowned Britisch mixing console manufacturer and general contractor carries out for RRI. Larger numbers of cassette recorders Studer A721 and CD players A730 are also part of the supply.

The tape recorders will be used to equip the various studios of the RRI broadcast building which was totally destroyed in a large fire in 1985. Financing will be effected with British aid; the broadcast house is bound to be put into full operation in the course of this year.

Paul Meisel

## France

In September last year, Studer France S.à.r.l. has fitted the Master Control Room of TF1, first chain of French television companies, with Studer audio equipment. The set-up of the new studio has been highly commended by the professional press. Main feature of the studio is the Studer mixing console 963 with 48 inputs, 8 masters and 4 outputs, specially modified to work with a direct adjustable auxiliary output per channel and switched via a crossbar for the various n-1 applications.

The different machines and all other equipment are arranged around

an additional Studer 963 mixing console with 14 inputs, 4 group and 4 master outputs so that a total of 62 outputs is available. The range of studio equipment is completed by 3 tape recording machines Studer A807, 2 CD Players Studer A730 and an EMT 984 turntable.

RTL, largest broadcast station in Europe with the highest quota of listeners in the French-speaking territories, broadcasts on medium wave from Luxembourg with a 2000 kW transmitter. A few years ago, this was complemented by some 100 FM-transmitters

covering the entire French territory. Their programmes are transmitted via satellite from Paris.

Choosing the equipment for its principal studio, RTL have fully confided in Studer products. Center of the control room is the Studer 905 mixing console, the largest model ever supplied to France. This impressive mixing console offers no less than 32 Mono-A and 10 Stereo-A inputs, 8 group and 2 master outputs with a LED bargraph VU meter per output as well as 4 additional AUX outputs. Remarkable features are the built-in crossbar and remote control facilities for the tape recording machines. The light wood finish RTL have chosen for the console adds to its attractive design.

RTL have also replaced the renowned Studer A80 broadcast recorders by their successor models A812; the Studer CD player A730 and EMT 984 turntable were further integrated in the system.

Oldrich Mikoska, Paris

Korea

KBS (Korean Broadcasting System), one of the largest broadcasting companies in Korea, have placed an order with Studer for the supply of mixing consoles 900, tape recording machines A807 and CD players A730, worth Sfr. 1,3 million. Delivery is made from March to May 1990. The mixing consoles of the 900 series will be operated in various radio production facilities (broadcasting, post production and sound recording in concert halls and auditorium).

Daesan International, Inc., Seoul, exclusive Studer Revox distributor for Korea, is carrying out further projects with other radio companies new in the market, which partly cover the complete furnishing of their new broadcast buildings. In the mixing console field, the Studer 960 technique has precedence – a series that was already successfully introduced many years ago. In addition, the on-air mixing console Studer 970 was also selected by several broadcast companies. In the tape recorder domain, Korean broadcasters have chosen the versions Studer A807, A810 and A812 which continue the success of their predecessors; for music productions, the multichannel machines Studer A820 and A827 were selected.

Studer highly values the claim that Korean users lay to an excellent quality. The acknowledgement of Studer equipment in this important market has no doubt added to the high standard of performance in the areas of broadcasting and recording in Korea.

Paul Meisel

## Studer Training courses

**Timetable**

| | |
|---|---|
| 9.00 h – 16.30 h | Mo (first day of course) |
| 8.30 h – 16.30 h | Tue – Thu |
| 8.30 h – 16.00 h | Fr (last day of course) |

18. – 20. 6. 1990 Deutsch
**A725 / A727 / A730 CD-Spieler**
Anwendung, Schaltungserklärungen, Laufwerkfunktionen, Fehlerbehebung.

21. 6. 1990 Deutsch
**A721 Kassettengerät**
Anwendung, Schaltungserklärungen, Laufwerkfunktionen, Fehlerbehebung.

25. – 29. 6. 1990 Deutsch
**TLS 4000 / SC 4008 / SC 4016 Synchronisationssysteme**
Funktionen und Bedienung, Anwendungen, Schaltungserklärungen.

27. – 30. 8. 1990 Deutsch
**960-963 / 970 Mischpulte**
Anwendung, Bedienung der Module, Schaltungserklärungen, Einmessvorgang, Fehlerbehebung.

27. – 31. 8. (4. 9.) 1990 English
**D820X – PCM Electronics and Application**
Basics of Digital Tape Recorder, DASH Format, AES/EBU Format, Operation, Application, Explanation of the PCM electronics and their alignment.
**– Transport** 3. – 4. 9. 1990
Transport electronics, adjustment and explanation to the mechanical and electronical groups.
**Attention:** For participants who are familiar with the A820 1/4" transport it is not necessary to take part at the D820X transport on 3rd and 4th September 1990.

10. – 14. 9. 1990 Français
**A812/A820 Magnétophone**
Fonction du transport de bande, ports démontage/réassemblage et alignement du transport de bande, explications des circuits, recherche des pannes.
**Attention:** Il s'agit d'un cours combiné qui exige la présence pendant toute la semaine.

17. – 20. 9. 1990 Français
**A807 Magnétophone**
Fonction du transport de bande, ports démontage/réassemblage et alignement du transport de bande, explications des circuits, recherche des pannes.

22. – 29. 10. 1990 Français
**A820/A827 MCH Magnétophone multipiste**
Fonction du transport de bande, ports démontage/réassemblage et alignement du transport de bande, explications des circuits, recherche des pannes.
**Attention:** Il s'agit d'un cours combiné qui exige la présence pendant toute la semaine.

30. 10. – 2. 11. 1990 English
**TLS 4000 / SC 4008 / Evertz 7100**
TLS 4000: 30. – 31. 10. 1990 (2 days); SC 4008: 1. 11. 1990 (1 day); Evertz 7100: 2. 11. 1990 (1 day).
System set up, configuration, operation, block-diagram

18. + 19. 10. 1990 English
**Dyaxis**
Operation, applications, on site service, trouble shooting, working with the Apple Macintosh

5. – 9. 11. 1990 English
**A812/A820 Tape Recorder**
Tape deck features, ports, disassembling/assembling and alignment of tape deck, explanation of various circuits, trouble shooting.
**Attention:** This is a combined course therefore it is essential to take part the whole week.

8. + 9. 11. 1990 English
**Dyaxis**
Operation, applications, on site service, trouble shooting, working with the Apple Macintosh

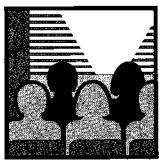
12. – 16. 11. 1990 English
**D820-48 MCH**
Overview, Features, Operation, Explanation of tape deck and audio assemblies, trouble shooting.

13. – 16. 11. 1990 English
**961-963/970 Mixing Consoles**
Description of basic modules 961/962, circuit explanation, Alignment, Differences between 963/970, Trouble shooting.

19. – 27. 11. 1990 English
**A820/A827 MCH Tape Recorder**
Tape deck features, ports, disassembling/assembling and alignment of tape deck, explanation of various circuits, trouble shooting.
**Attention:** This is a combined course therefore participation during the whole week is required.

27. – 30. 11. 1990 English
**A721 / A727 / A730 Cassette Recorder/CD-Players**
A721 (1 day); A727 (1 1/2day); A730 (1 1/2day)
Features, ports, explanation of circuits, transport alignment.

3. – 6. 12. 1990 English
**A807 Tape Recorder**
Tape deck features, ports, disassembling and alignment of tape deck, explanation of various circuits, trouble shooting.



## Revox Training courses

**HiFi I**
Tape recorders (B77, PR99 MKIII) – cassette recorder – turntable – mixing console – IR-applications
10. 9. – 14. 9. 1990 English
8. 10. – 12. 10. 1990 German/French

**HiFi II**
Active loud speakers – multiroom- and AV-concept – tuner-amplifier – CD player
17. 9. – 21. 9. 1990 English
15. 10. – 19. 10. 1990 German/French

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