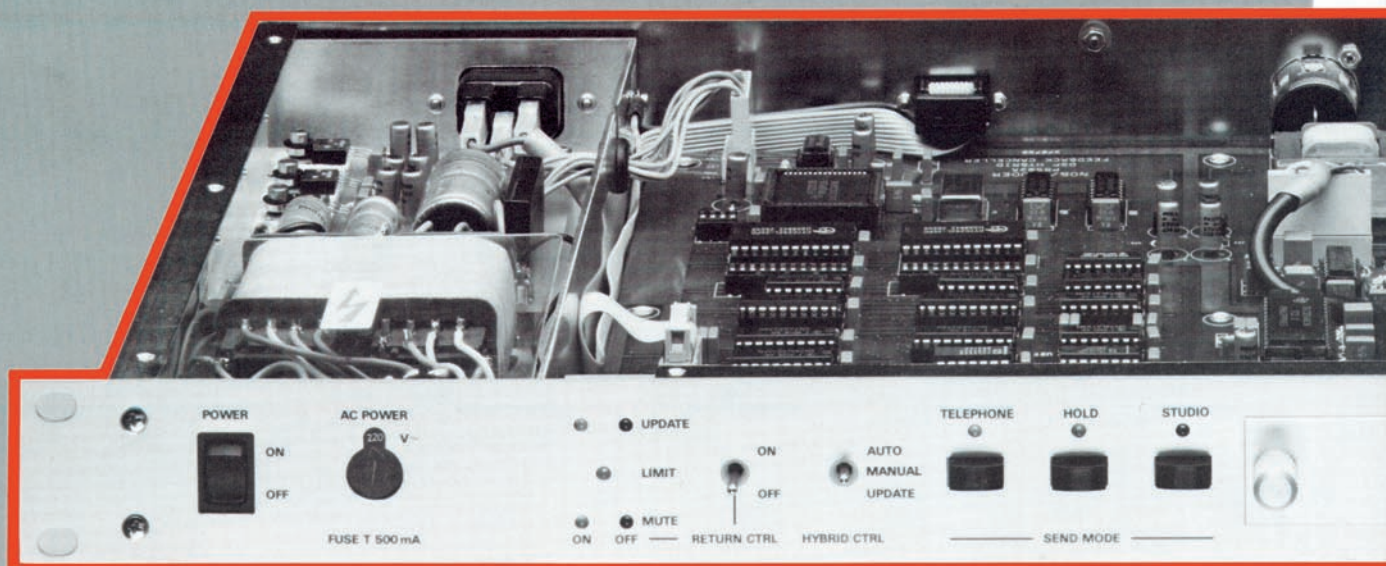


STUDER

PROFESSIONAL AUDIO EQUIPMENT



DIGITAL TELEPHONE HYBRID

For an intelligible link...



State of the art. For inserting telephone conversations into a radio program, special interfaces are required for adapting the signals supplied by 2-wire telephone lines to the mixing console. On the studio side, these interfaces appear as a dual studio amplifier, but on the telephone side as a telephone set; for this reason these units are often referred to as telephone hybrids. For adaptation to the telephone line, a complex resistance is used. The better this adaptation, the better the suppression of the crosstalk between the transmit and receive side. In today's state of the art, the line adaptation is usually performed automatically. However, the alignment is exact at only a few points of the frequency spectrum which means that small misalignments remain; the existing technology is nevertheless able to satisfactorily handle direct lines of different lengths and characteristics. Concerning the telephone trunks the situation has significantly changed during the past years. The introduction of carrier frequency lines and glass fiber cables between the exchanges frequently shortens the length of the direct lines to a few kilometers. Since radio studios are usually located in larger cities, the distance to the first converter is sometimes very short. For this reason the effect of conventional hy-

- Digital telephone hybrid with self-converging filter algorithms for suppressing line echoes.
- Excellent results achievable with a large number of coefficients.
- Manual or automatic alignment of the echo suppression.
- Additional echo suppression also in the studio branch.
- Switchable to 4-wire applications such as ISDN connections or general echo suppression functions.

brid circuits is often limited to local exchange lines only.

Digital filters. With modern signal processors it is possible to implement echo suppression circuits in the form of digital filters. The corresponding algorithms are also effective beyond the local exchange line and are able to suppress echoes that originate from a long-distance subscriber and which are e.g. transmitted via the TF lines. The principal difference between analog and digital hybrids is that analog units combat the cause of the line echo (through line adaptation) while digital units suppress the echo itself (by suitable filtering), in which case the cause of the echo is irrelevant.

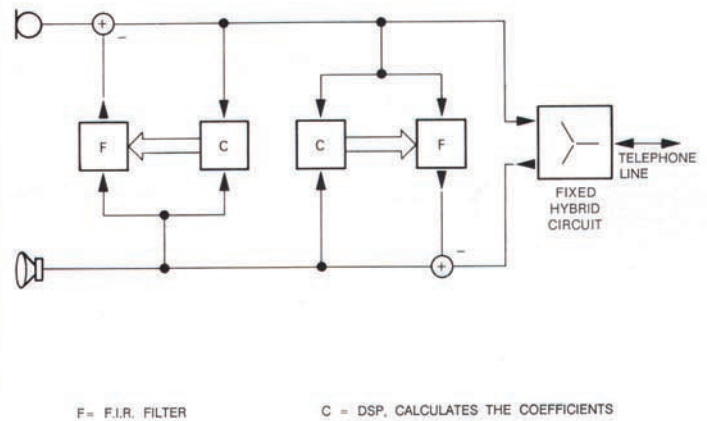
...between the moderator and the listener

STUDER digital telephone hybrid. The block diagram shows a balanced arrangement of two function blocks; each block is implemented with a microprocessor type TMS 320. By comparing the send and receive signal, the signal processor [C] detects overemphases in the frequency response and readjusts the filter [F] in such a way that these errors disappear. The accuracy of this process depends on the number of filter coefficients; with 128 for the telephone side and 96 for the studio side the STUDER hybrid is very powerful.

The block illustrated on the right is used for echo suppression on the telephone line. A fixed bridge circuit is used for coarse line adaptation with nominal termination impedances; this results in a preliminary echo suppression and considerably shortens the time for the convergence process.

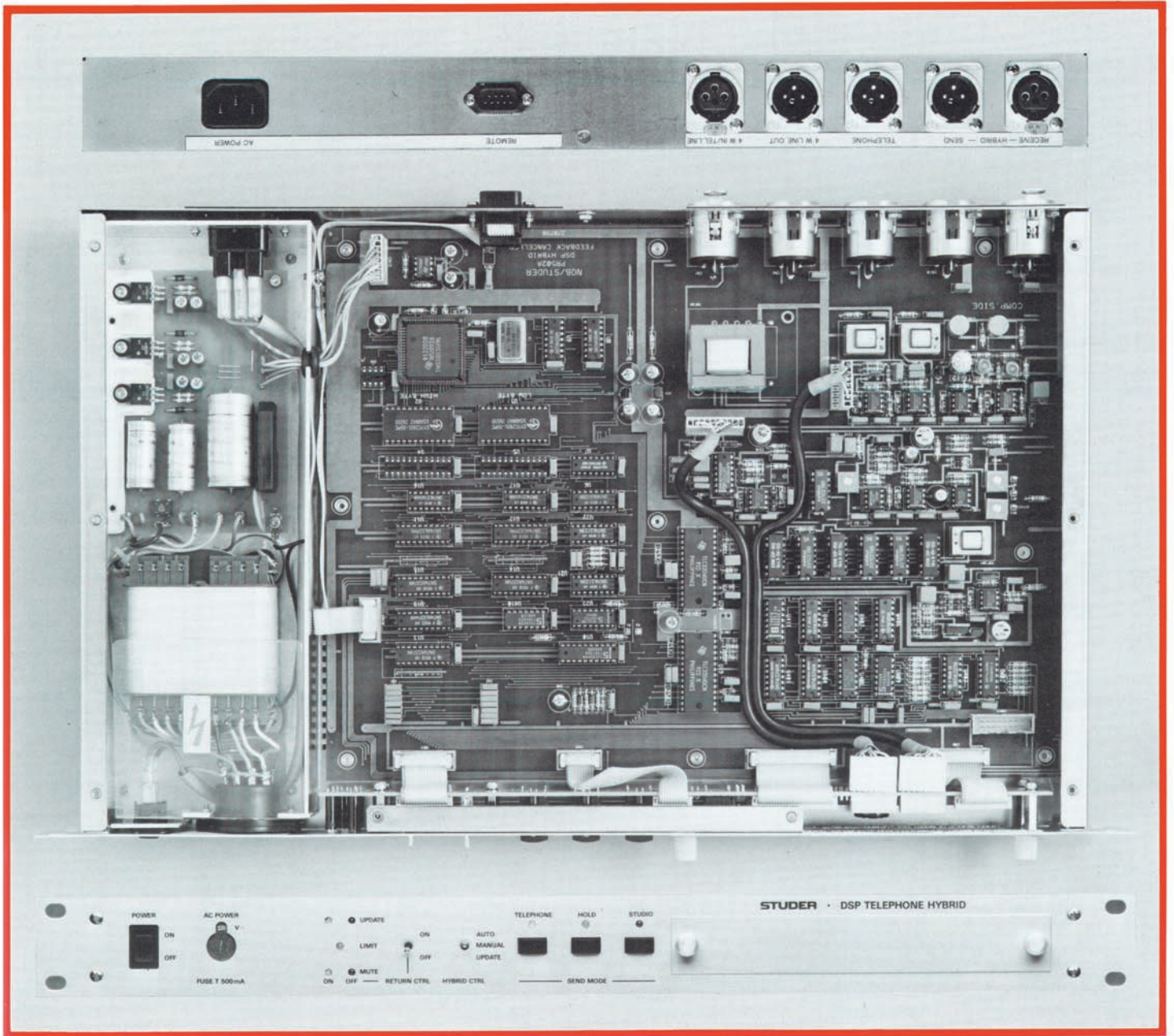
The left-hand block (with 96 coefficients) is used for echo suppression in the studio; it reduces the feedback between the headphones and the speaker's microphone. This feedback is likely to occur when the caller's signal is so weak that the gain in the receive path has to be strongly increased. Because of the highly efficient echo suppression, it is even possible to insert telephone conversations through speakers. Both signal processors function independently of each other. The filter optimization functions either continually and automatically while a signal is present (and thereby corrects also the changing feedback conditions, caused e.g. by the body movements of the moderator), as a one-shot, manually, by analyzing a transmitted noise burst with a duration of less than one second.

The digital telephone hybrid can be used in "radio" or "TV" mode. In "radio" mode the moderator talks to the calling party through the same microphone that also feeds the program, and he listens through the headphones or the speaker. In "TV" mode the moderator uses his own telephone set to talk to the calling party, but the program (and the reference signal input of the telephone hybrid) is fed via an invisible microphone.



Dial tones or ringing signals can either be passed through or suppressed. The digital telephone hybrid can also be switched to 4-wire mode in which case 240 coefficients are available. For this reason this unit is suited not only for a wide range of future ISDN applications but also general echo suppression.

The digital telephone hybrid and the single-channel power supply unit are put in a 1 HU 19" housing.



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