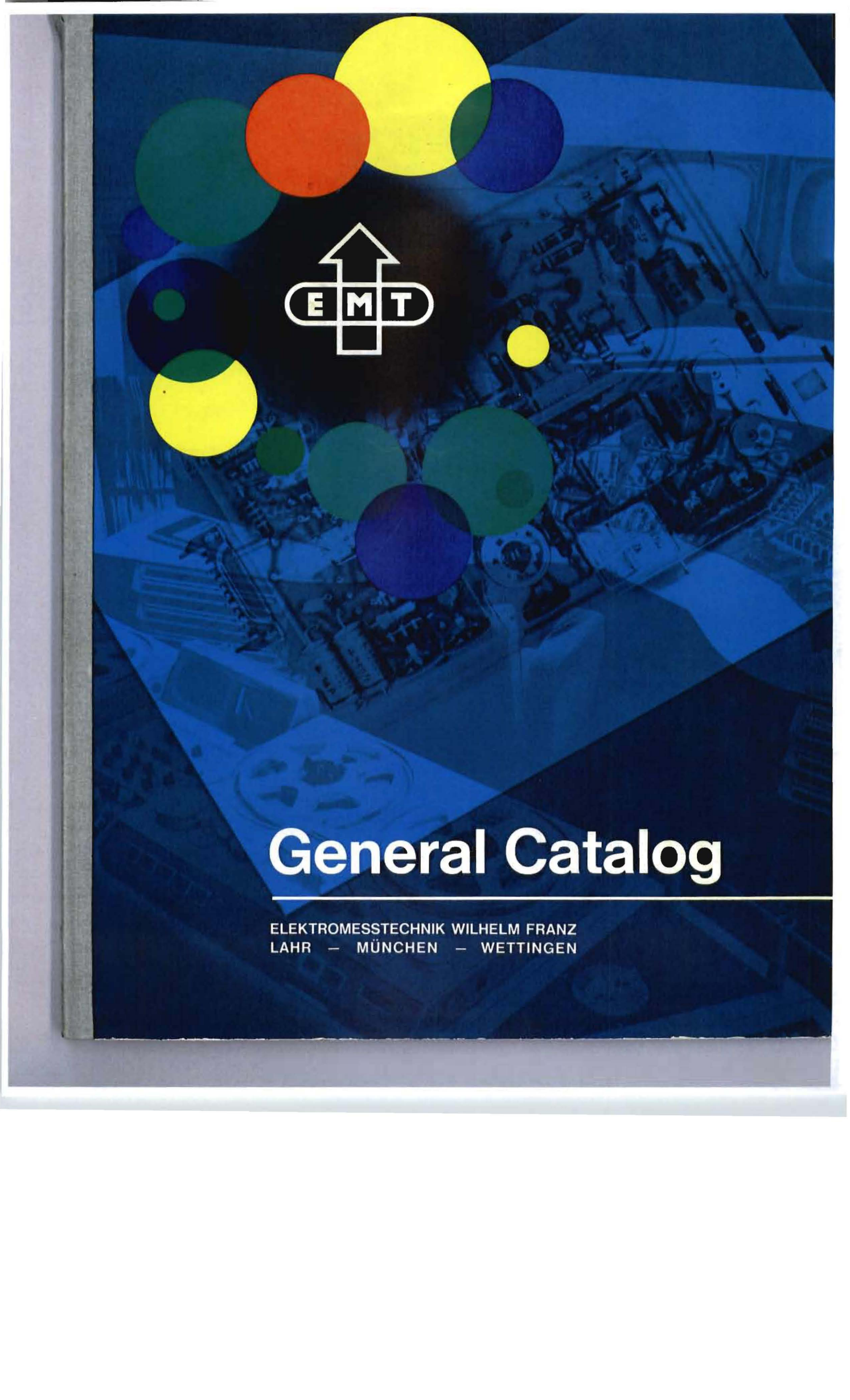


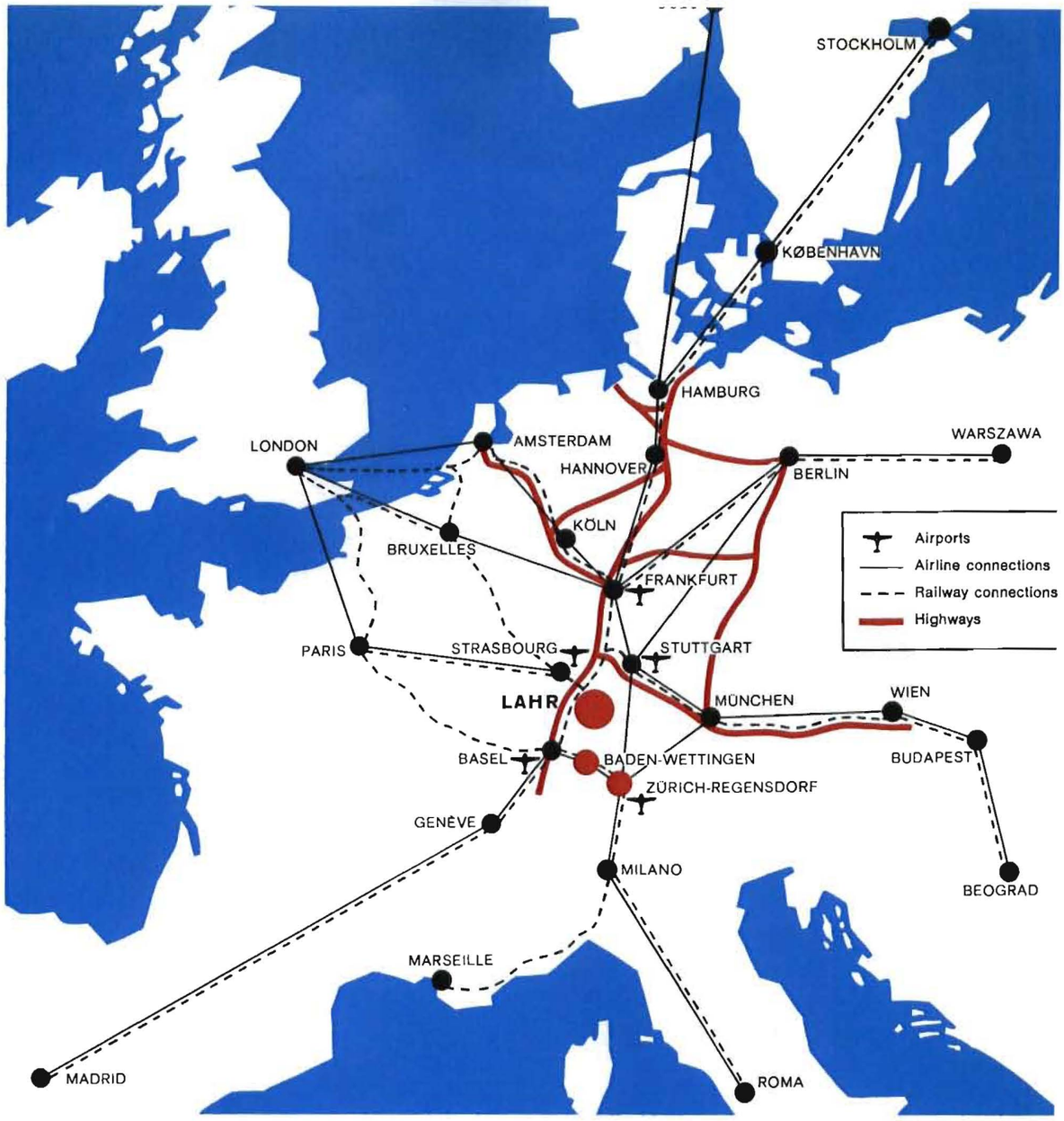
General Catalog

ELEKTROMESSTECHNIK WILHELM FRANZ
LAHR – MÜNCHEN – WETTINGEN

GENERAL CATALOG

June 1968

6	Time and Frame Coding System	EMT 400
	Vid-E-dit	Vid-E-dit
9	Professional studio sound equipment	
	Transistorized mixer	EMT 104
11	Audio frequency cables	Cables
12	Stereo monitor	EMT 159
	Polarity tester	EMT 160
	Audio oscillator	EMT 103
	RMS Millivolt meter	EMT 125
	Balancing input transformer for EMT 125	EMT 125/500
	Micro ohm meter	EMT 326



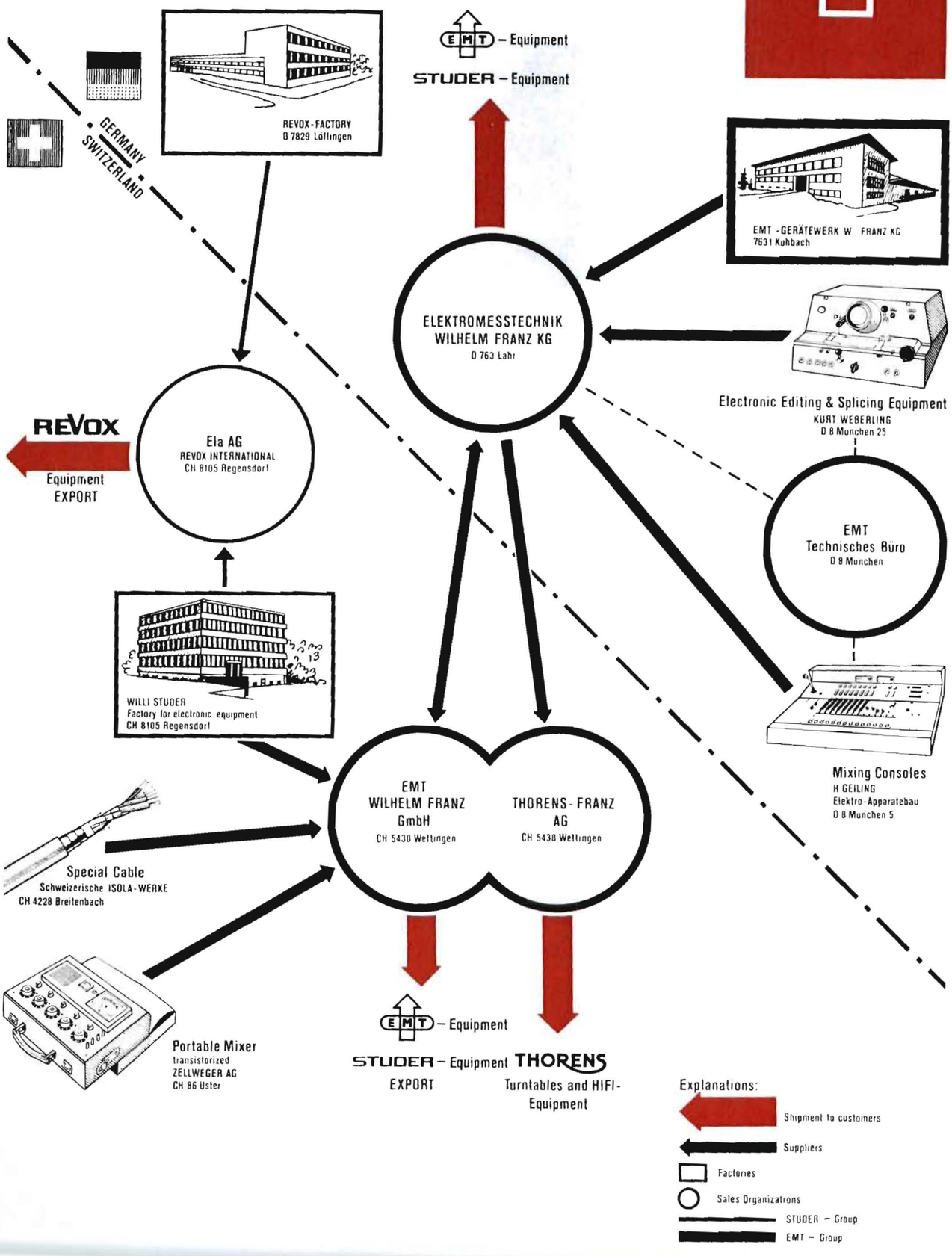
In 1942 the company ELEKTROMESSTECHNIK was founded in Berlin by MR. WILHELM FRANZ. It was two years later when the offices moved to Lahr/Baden, in the upper Rhine valley, at the outskirts of the Black Forest. Lahr can easily be reached via the North-South railway-line and the European Highway No. 4 (Autobahn) Hamburg-Frankfurt-Basel. The name EMT is well known to Broadcasting and Television Stations and the Film and Recording Industry through its high quality professional equipment sold throughout the world. Worldwide distribution and experienced representatives guarantee to EMT clients first rate service and assistance by experts.

EMT

EMT WILHELM FRANZ GMBH

SEMINARSTR. 92 · CH 5430 WETTINGEN (AG) SWITZERLAND · PHONE: BADEN-(056)60550 · CABLES: EMTFRANZWETTINGEN · TELEX:53682

Organizational chart and sales channels



Professional turntables

EMT 927
EMT 930

EMT 927
EMT 930 PROFESSIONAL

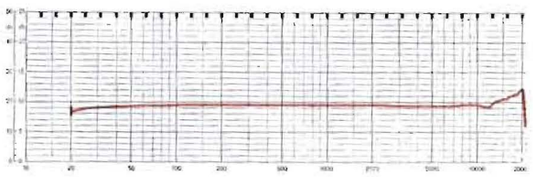
Turntable mechanism

The EMT professional turntables are designed for the exacting demands of professional studios. Their chief characteristics are:

- solid precision engineering
- sturdy and convenient operating controls
- special operating functions to suit studio requirements.

The heavy cast non magnetic turntable with its high moment of inertia ensures excellent wow and flutter characteristics over long periods of heavy duty operation. It runs extremely quietly because of the hardened precision made spindle, running in a special bearing. The turntable is brought to its nominal speed of rotation in less than one second by the low vibration, self starting, synchronous motor via a friction drive. The motors were specially developed for the EMT professional turntables and are made in our own factory. The shaft which is artificially aged, has three precision ground steps, for the three turntable speeds, and friction drives the rubber intermediate wheel. The intermediate wheel is controlled by the turntable speed selector switch and is retracted in the rest position. To render the machine foolproof the main switch locks the turntable speed selector switch when the turntable is running.
The turntable speed fine adjustment enables each of the nominal speeds to be set up accurately. The speed is checked by means of the stroboscopic divisions on the turntable rim which are illuminated by a pulse fed neon lamp which makes them appear very clear and sharp.

Pick up arms
Pick up cartridges



Type RMA 229 for studio record players EMT 930
Type RMA 297 for studio record players EMT 927.
The new S-shaped pick-up arms of the RMA series are statically as well as dynamically balanced and the mounting position of the studio record player is therefore uncritical.
The S-shaped tube of the pick-up arms of the RMA series ensures a low rumble level (stereo) and they are particularly insensitive to floor vibrations and acoustic feed-back (monitor loudspeaker).
The horizontal bearing of the pick-up arm runs in pivots free of play, a precision ball bearing forms the vertical bearing. An elastic link de-couples the counterweight from the pick-up arm tube.
The pick-up playing weight can be adjusted from 0 to 7 g by means of a precision adjustment ring on the counterweight which is easy to set. The pick-up cartridges can be exchanged rapidly: they are plugged into the pick-up arm and locked by turning a ring.

Pick up Cartridges

To fit the RMA pick-up arms EMT suplies the cartridges of the T-series:

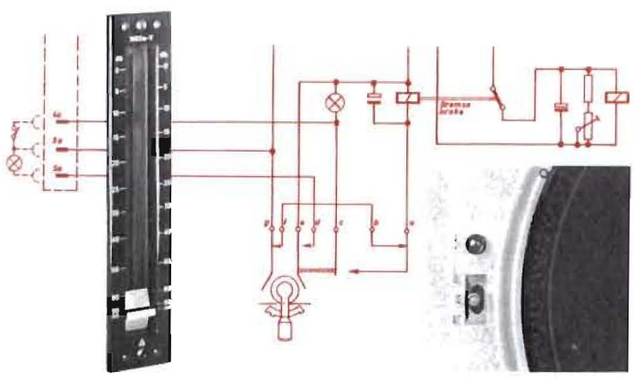
- TSD 15 for stereo records
- TMD 25 for micro-groove records
- TND 65 for standard groove records

The pick-up cartridges of the T series for the different types of grooves can be interchanged rapidly without re-setting the playing weight or rebalancing the arm. They are all fitted with diamond tips. The figure in the type number indicates the tip radius of the diamond in µ.
The EMT T-series cartridges comply with the latest gramophone record standards as regards the tip radii and the vertical trailing angle of 15°. Their quality meets the ultimate requirements of recording studios.
We shall be glad to send you technical details upon request.

TURNTABLES

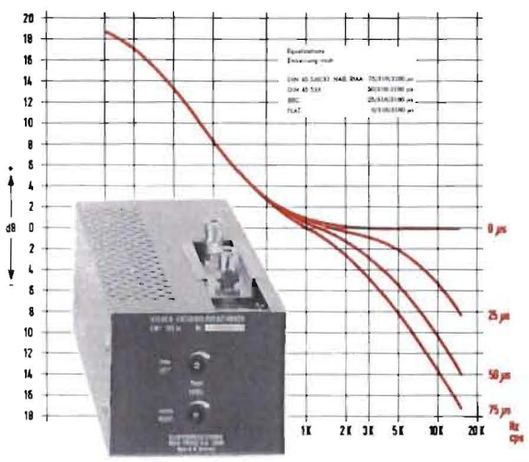
Proven
in studios
all over the world
for many years

Remote control



The remote control start-stop facility of the EMT studio record players revolutionises the possibilities in the production of programs with gramophone records. A light perspex auxiliary turntable rests on the heavy cast main turntable. It is linked to the main turntable with a slipping clutch and can be stopped by means of a brake while the main turntable continues running at the nominal speed of revolution. For the instantaneous start this electromagnetic brake is released by means of a switch. Due to its low mass the auxilliary turntable on which the record rests will revolve immediately. The run-up time, until sufficiently low wow-and-flutter figures are achieved, is less than 500 ms. During the run-up time, the signal output lines are muted thereby suppressing any starting howl or clicks. Only then is the signal line switched through by means of a relay without any click.
The turntable is turned backwards from the required starting point through a specific angle which is marked on the turntable rim and the required point on the record will then be under the cartridge at the moment that the relay ‚makes' the signal line.
The required passage is thereby started with complete accuracy without any undesirable noise.
Furthermore the remote control enables the machine which has been cued for a particular bar or a certain word to be remote started from a fader contact on the control desk.
The stand by condition of the machine is indicated on the control desk and the fader position on the control desk is indicated on the machine by pilot lamps.
The EMT studio record players contain the entire remote control circuitry and power supply for the remote control.

Equalizer amplifier



The equalizer amplifier has the purpose of amplifying the small output voltages from the dynamic pick-up cartridges to the standard studio line level. At the same time it equalizes the cutting characteristic of the record. The mono version of the EMT studio record players is equipped with the single channel equalizer amplifier EMT 155, the stereo version with the two channel equalizer amplifier EMT 155st. Both types of amplifiers exclusively use silicon-planar-transistors.
The amplifier cassette is plugged into the lower half of the machine and obtains its supply voltages from the power supply unit via a knife contact strip.
The equalization of the amplifier can be switched to the four internationally used cutting characteristics.
The stereo equalizer amplifier EMT 155st can also be used for mono operation – in conjunction with a mono cartridge. For this purpose the equalization selector switch of the EMT 155st has the additional switch position ‚MONO'.
Both the EMT 155 and the EMT 155st are equipped with a scratch filter. It provides a continuously variable attenuation of the groove hiss. The operating knobs for the equalization selector switch and the scratch filter are placed on top of the record player chassis and they are therefore accessible during operation. The gain control, which is pre-set once and for all is mounted on the front panel of the amplifier below the chassis.
The new equalizer amplifiers EMT 155 and EMT 155st have an exceptionally high signal to noise ratio and very low distortion which is largely independent of the load impedance. The output is designed to enable the amplifier to feed any of the internationally used line impedances and levels.

Technical Data of Equalizer Amplifier EMT 155 and 155 st

Equalization characteristics (can be switched during operation)	75/318/3180/µs	mono and stereo
DIN 45 536 / 37 NAB, RIAA		
DIN 45 533	50/318/3180/µs	mono
BBC	25/318/3180/µs	mono
FLAT	0/318/3189/µs	mono
Input Level		
EMT 155	10 mV	
EMT 155 st	1 mV	
Output Level matched load impedance 600 ohms	+ 15 db (4.4 V)	
Harmonic distortion (full load)		
40 cps	less than .4 %	
from 200 cps to 12 kc/s	less than .2 %	
Intermodulation distortion (full load) test frequencies 50 cps and 4 kc/s voltage ratio 4 : 1	better than 1 % (average value .5 %)	

Signal-to-noise ratio referred to 1.55 V output input matched with 200 ohms	
unweighted (r. m. s.)	better than 60 db
weighted (peak)	better than 70 db
Cross-talk figure (EMT 155 st) from 30 cps to 16 kc/s referred to 4.4 V output	better than 50 db
Scratch filter cutoff frequencies adjustable	treble attenuation (10 db/octave) from 2 kc/s to 20 kc/s
Supply of current	from the power supply of the professional turntables EMT 927 and 930

Technical Data of turntable mechanisme

	EMT 927	EMT 930
Turntable diameter	44 cm	33 cm
Turntable speeds	78, 45, 33⅓ r. p. m.	78, 45, 33⅓ r. p. m.
Wow and flutter at 33⅓ rpm measured with EMT 420A, weighted in accordance with DIN 45 507	max. ± .05 %	max. ± .075 %
Rumble referred to a peak velocity v=10 cm/s at 1 kc/s	Mono Stereo	Mono Stereo
unweighted	45 db 42 db	42 db 40 db
weighted in accordance with DIN 45 539	60 db 58 db	60 db 58 db
Mains voltages 50 c/s (special version 60 c/s)	117, 200, 220, 240 V	117, 200, 220, 240 V
Maximum power consumption	ca. 35 W	ca. 30 W
Dimensions	520 x 675 mm	390 x 490 mm
Seated depth	215 mm	175 mm
Weight	41 kg	23 kg

We supply the following professional turntables:

EMT 927	Professional Turntable, mono, turntable diameter 44 cm, chassis construction, prepared for stereo, three speeds: 33⅓, 45 and 78 r. p. m., equipped with transistorized mono equalizer amplifier EMT 155 and two pick-up cartridges.
EMT 927 A	Same as type 927, with additional optical groove indicator.
EMT 927 D	Professional Turntable, **special type,** laboratory machine for the recording industry, mono, prepared for stereo, turntable diameter 44 cm, with optical groove indicator, ratio 1 : 4, chassis construction, three speeds: 33⅓, 45 and 78 r. p. m. With glass auxiliary turntable, optically flat elastic centring spindle and centring cone, without stop/start arrangement. Equipped with transistorized mono equalizer amplifier EMT 155 and two pick-up cartridges EMT-OFS 25 and EMT-OFS 65.
EMT 927 st	Same as type 927, however with transistorized switchable stereo/mono equalizer amplifier EMT 155 st and one stereo pick-up cartridge EMT-TSD 15.
EMT 927 Ast	Same as type 927 st, with additional optical groove indicator.
EMT 927 Dst	Same as type 927 D, however with transistorized switchable stereo/mono equalizer amplifier EMT 155 st and one stereo pick-up cartridge EMT-TSD 15.
EMT 927–932 a	Twin Console, on castors, grey enamelled, for EMT 927 all types.
EMT 930	Professional Turntable, mono, turntable diameter 33 cm, with optical groove indicator, chassis construction, prepared for stereo, three speeds: 33⅓, 45 and 78 r. p. m., equipped with transistorized mono equalizer amplifier EMT 155 and two pick-up cartridges EMT-OFS 25 and EMT-OFS 65.
EMT 930 st	Professional Turntable, stereo, turntable diameter 33 cm, chassis construction, three speeds: 33⅓, 45 and 78 r. p. m., equipped with transistorized switchable stereo/mono equalizer amplifier EMT 155 st and one stereo pick-up cartridges EMT-TSD 15.
EMT 930–932 c	Twin Console, on castors, grey enamelled, for EMT 930 all types.

ELEKTROMESSTECHNIK WILHELM FRANZ KG

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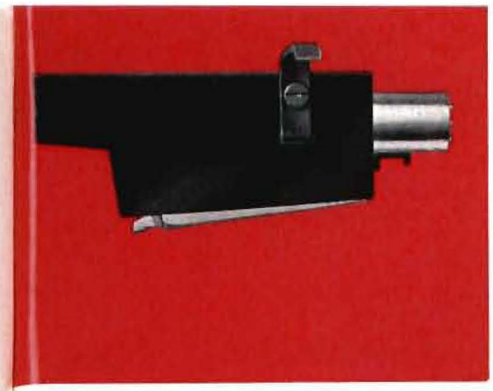

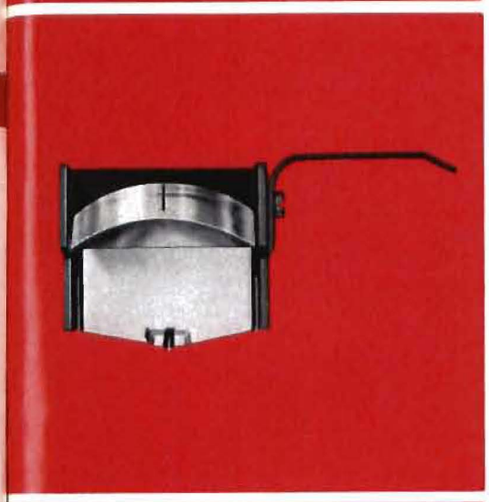

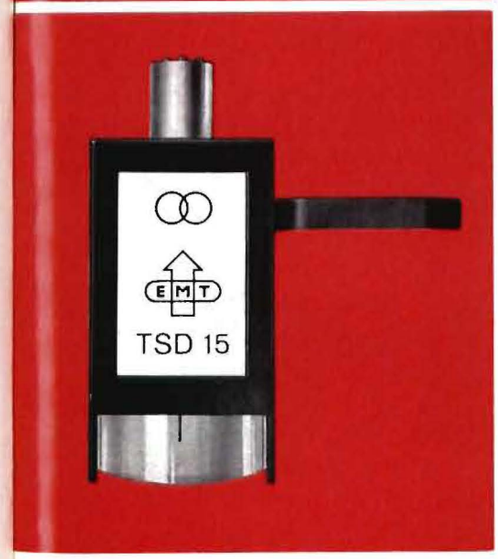

CARTRIDGES
TSD 15
TMD 25
TND 65

EMT Cartridges T-series

- Especially designed for professional use with studio turntables EMT 927 and 930.
- Precision made and stable die-cast light metal casing.
- Stylus carrier not exchangeable. This achieves constant precision of the geometry of the system: correct tracking angle, minimum crosstalk, level equality of channels etc.
  Replacement of diamond stylus for short periods is achieved by using a replacement pickup head.
- Large area magnifier with reflecting area provides a bright and large image for the accurate positioning of the pickup in the record grooves.
- Lever for guiding pickup arm can be removed by slackening a screw (balancing weight incorporated).
- Sealed packing ensures original works tested condition.
  With each pickup head the following is enclosed: guarantee card and respective original test strip with frequency response curve, measured values of the intermodulation distortion and crosstalk.

Technical Data

Type	TSD 15	TMD 25	TND 65
Application	Stereo Stereo grooves	Mono Micro grooves	Mono Standard grooves
Stylus	Diamond	Diamond	Diamond
Tip radius	15 µ	25 µ	65 µ
Playing weight	2—3 g	2—3 g	2—3 g
Output level at 1 kHz (for 1 cm/s recorded velocity)	0.15 mV ±2 db	0.15 mV ±2 db	0.15 mV ±2 db
Frequency range	20 Hz—20 kHz	20 Hz-—20 kHz	20 Hz—20 kHz
Frequency response 40 Hz—12.5 kHz	±2 db	±2 db	±2 db
Difference in output level between channels 40 Hz—12.5 kHz	max. 1 db	—	—
Cross talk at 1 kHz	min. 25 db	—	—
Frequency intermodulation (FIM)	max. 0.5%	max. 0.5%	max. 0.5%
Vertical tracking angle	15° (±2,5°)	15° (±2,5°)	15° (±2,5°)
DC-resistance	2 x 24 ohms	24 ohms	24 ohms
Compliance	12×10^{-6} cm/dyn	12×10^{-6} cm/dyn	12×10^{-6} cm/dyn
Equivalent mass at stylus tip	app. 1 mg	app. 1 mg	app. 1 mg

The above data can be obtained using the following test records:

Frequency response – test records DIN 45 541 or QR 2007 (Mono), and QR 2009 or LAB 008/009 (Stereo)

Distortion – test records DIN 45 542 Stereo and DGG 99 011 TM Mono

Distortion measurements correspond with test record DIN 45 542 Stereo with "reference level –6 db" full modulation (peak velocity 8 cm/s at 1 kHz) with test record DGG 99 011 TM Mono track 4: full modulation (peak velocity 12 cm/s at 1 kHz).

Cross talk – test record DIN 45 543

DIN: Beuth-Vertrieb GmbH, 5 Köln, Friesenplatz 16, W.-Germany
DGG: Deutsche Grammophon GmbH, 3 Hannover, Podbielskistr. 164, W.-Germany
QR: AS Brüel & Kjaer, Naerum, Donmark

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PE-805-3-U

Reverberation Unit

EMT 140

for stereo EMT 140 st

The Reverberation Unit

A device for the creation of artificial reverberation has been developed which replaces the traditional acoustic echo chambers used heretofore in broadcasting, television, film and recording studios. This device is the EMT-140 Reverberation Unit which, besides its ability to acoustically reproduce rooms of various sizes, is also able to increase the apparent distance between sound source and microphone. For this reason it is possible to use the Reverberation Unit with maximum success in any of the following situations:

- For dramatic presentations on radio and television as well as for film sound stages for imparting the impression of large halls, factories, churches, bathrooms, cellars and many others.
- For recording of popular dance music and jazz in which a vocalist or individual sections are to be recorded with an echo quality.
- To improve on the special effect in symphonic or church music, especially when it is written for performance in large halls but must, of necessity, be recorded in absorptive rooms.
- For adding echo to stereophonic music. For this purpose a special stereo reverberation unit was constructed and is available under the designation EMT-140 st. Its use provides additional accentuation of the stereophonic effect by emphasising the three-dimensional characteristics of the recording room.
- Besides these there are numerous other applications in theaters, opera houses, and concert halls. In situations such as these, artificial reverberation can be effectively employed to amplify the desired illusion in stage presentations, or can serve to increase the existing reverberation for certain musical offerings such as organ music.

An ideal device for natural echo addition

The Reverberation Unit EMT 140

Artificial reverberation is nothing new

Artificial reverberation or echo has been used for years. In dramatic performances it serves to create the effect of voices from another world or large halls while the field of popular recording has made the echo effect one of its most effective tools for separating instrumental sections from each other or for placing vocalists distinctly in front of the orchestra. Prior to stereophonic recording, echo helped immeasurably in presenting the illusion of three dimensional sound. The creation of a true echo with an infinite number of steadily decreasing reflections has, until recently, never been successfully achieved. The most difficult task of all, however, has been the adding of reverberation to stereophonic music recording.

Echo chambers are expensive:

Mostly because of limited space which can be assigned to echo chambers and the relating high rental costs for such space, most echo chambers to date have been of the fairly small size of up to 3000 cuft. Assuming that the loudspeaker employed in an echo chamber of such dimensions showed only a minor sensitivity loss towards the high frequency end, and the chamber itself were so well constructed acoustically as to have a decay time linear with respect to frequency, then the resulting mid and high frequency reverberation would be quite acceptable. For sound with predominant low frequency components, however, the density of the resonances in such a small chamber would become unpleasantly obvious. The result is usually an unnatural and metallic sound.

Adjustment of the decay time in acoustical echo chambers is practically impossible, or achievable only with considerable difficulty, and is hardly ever used. The illusion of changing decay time is sometimes created by varying the ratio of direct to reverberated sound.

In addition to all this, acoustical echo chambers are rather uneconomical to construct since their sound isolation characteristics have to be as good as that of the studio itself, while the electronics, the loudspeakers and microphones all have to be of highest quality and therefore expensive.

In search of a solution:

Numerous ways have been sought to arrive at a method for generating artificial reverberation in a more favorable and economical way. The best known of these attempts is the use of a tape loop device using several record and/or playback heads and employing positive feedback. They all, however, have the distinct disadvantage of producing discrete echoes which, quite contrary to echoes in a three dimensional room, follow in nearly constant intervals, while real echoes get ever denser with increasing time. The well-known "slap echo" results which is used oftimes as an electronic effect in popular music but falls short of the true reverberation mark. A further qualitative problem with such tape loop devices is the noise introduced by the tape itself, the necessity for changing tape loops and the often metallic coloration of the sound caused in part by the insufficient density of the resonant points in such a system.

Stereo reverberation - special problem:

As has been shown, the creation of usable artificial reverberation brings with it numerous difficulties. The extension of such reverberation, in an aurally correct manner, to the field of stereophonic music, presents even more vexing problems. The answer which lies close at hand is the use of two reverberation units; one in each of the two recording channels. This solution, however, brings with it a considerable increase in equipment and space requirement, and furthermore produces reverberation effects in which the two distinct reverberant signals can be clearly heard.

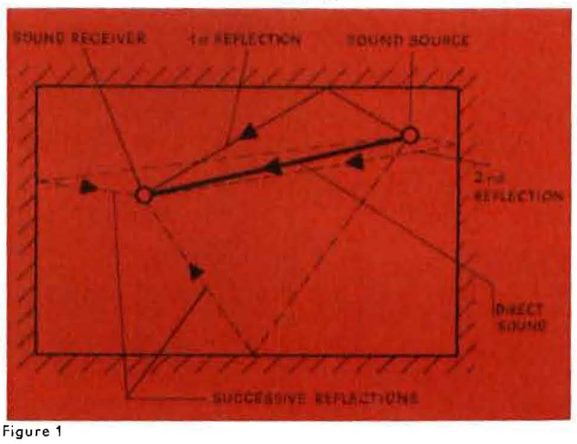

Figure 1

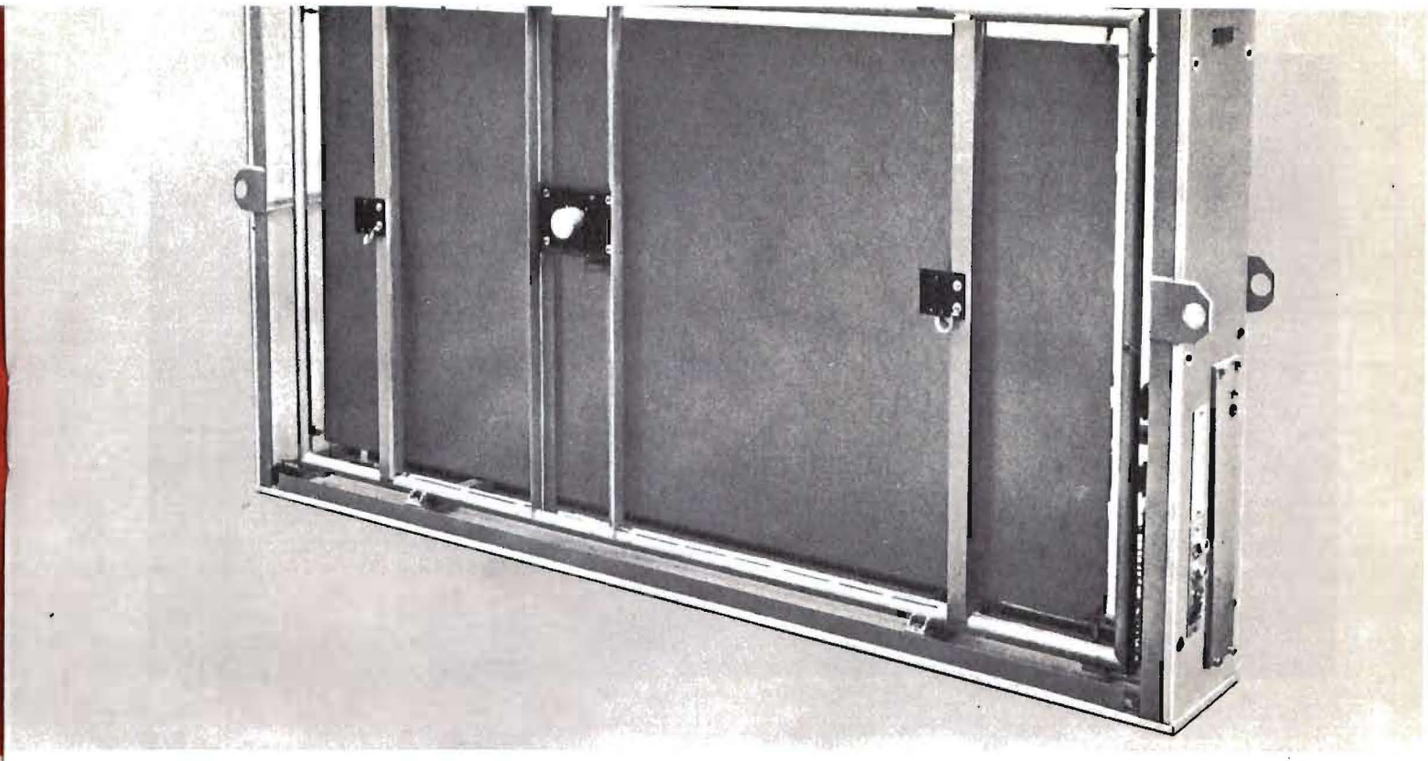

Figure 2 **Front view of the Stereo Reverberation Unit EMT 140 st. The steel reverberation plate is suspended in a welded tubular frame which in turn is shock mounted inside the wooden outer case. The two ceramic pickups are visible at different distances on either side of the driver Unit. The picture shows the wooden case without its side and top panels.**

How does reverberation come about?

A sound source located within a room generates sound waves which reach the ears of an observer within the room in several different ways:

a) directly; along the straightest, shortest way, and
b) indirectly; after one or more reflections from the existing walls, with commensurately longer running times and lesser intensity.

All of the reflected sound waves taken together are referred to as "echo". It depends primarily on the shape of the room, and the relative positions of sound source and observer. The length of time required for the intensity of the echo to diminish by 60 db; i. e. to 1/1000th of the sound pressure, is referred to as the decay time. Localization of the sound source is only possible by means of the direct sound. The echo, however, reaches the observer from a multitude of directions, in rapid succession, and in ever decreasing intensity. This makes determination of the directions from which these reflections come, impossible. The echo is, of course, made up of the same sound frequencies as the direct sound. The directional information, however, is statistically distributed.

A better way

The EMT-140 Reverberation Unit utilises the physical properties of metals to achieve its effect. It is a fact that a steel sheet which has been excited by an impulse setting up within it bending oscillations, will deliver reflections which increase in density with time. Reflections in a three-dimensional room, on the other hand, become more dense as a function of the square of the time. The human ear is unable to recognize the difference between these two operating modes.

Through the use of appropriate steel and critically chosen dimensions, it is possible to produce a plate which prosesses an adequate number of self resonances. The length and frequency response of the decay time produce an artificial reverberation effect, which is not possible to differentiate from that obtained from a three dimensional room.

It was at the Broadcast Technical Institute at Nurenberg, and later at the Institute for Broadcast Engineering in Hamburg, W. Germany, that the first reverberation plate using these principles was developed. Its main component is a steel plate which is suspended in a tubular steel frame. Parallel to this plate, another made of highly porous material is suspended in such a way as to permit it to be swung towards or away from the steel plate with an extreme distance ratio of about 1:30. This motion is controlled by means of a hand wheel, or it may be remote-controlled from the studio console itself and the particular reverberation time remotely indicated by an appropriate meter. The choice of plate material requires great care and takes into consideration its internal damping characteristics and the resulting reverberation time. The steel plate's losses are additively formed by the non-frequency dependent and frequency dependent parts which are caused by the heat conductivity loss of the bending modes. For high frequencies it is the former and for mid and low frequencies the latter effect which predominates. Since the phase velocity of the bending mode of the plate in the entire frequency range is smaller than the velocity of sound in air, the damping of the plate through the greatly reduced radiation of air borne sound may be neglected when compared to all of the other damping causes. Damping through heat conductivity is, through practically the entire audible frequency range, directly proportional to the frequency, and inversely proportional to the plate thickness.

Because of the need for great density of bending mode self-resonances and the sound qualities caused by it, the plate must of necessity be very thin. This requires a compromise between sound quality and decay time. As an optimum, a plate of cold drawn high quality steel approximately 3 ft. by 6 ft. × 1/64" thick, has been chosen. This produces a decay time at 500 cps of about 5 seconds dependent upon material properties and thickness.

The plate used must not only be completely undamped, but must also be extremely flat. Since the normal cold drawn steel sheets only live up to these demands in rare cases, the plates to be used must be chosen from a large number of rolling mill products, and must be tested by suspending them in their frames. Their final acceptability for this purpose can only be determined after extended suspension time.

The construction of the reverberation unit:

The steel tube frame which carries the steel plate has three transverse bridges, of which one mounts the magnet for the moving coil excitation system, while the other two are used for the two contact microphones and their connecting wires. The frame furthermore has the bearings for the damping plate arms mounting at the top and bottom, and is suspended by means of rubber shock mounts from the outside frame. Should the reverberation unit be exposed in its location to extreme mechanical noise interference, it can be further isolated by additional elastic suspension of the unit itself.

The Construction of the Reverberation Unit

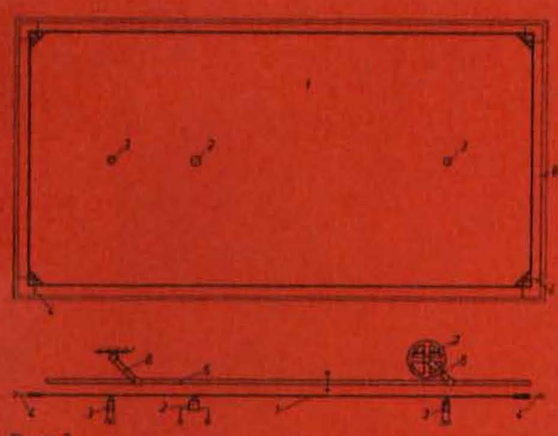

Figure 3

Schematic illustration of the Reverberation Unit.
1. Steel plate; 2. Dynamic driver unit; 3. Ceramic pickups; 4. Steel wire suspension clips; 5. Damping plate made of acoustically absorbent material; 6. Pivoting arms for purpose of varying distance between damping and steel plates (change of reverberation time); 7. Handwheel for reverberation time adjustment; 8. Welded tubular frame.

Operation of the driving system and microphone pick-offs

The steel plate is excited by means of a moving coil system. The sensing of the vibrations is accomplished by means of two contact microphones. Since these piezoelectric microphones are accelleration sensitive, their output rises for low frequencies up to 250 cps, stays constant to 900 cps and then falls at a rate inversely proportional to the frequency. The resonant frequency of these microphones lies beyond 20 kc and their capacitance is approxima tely 500 pf.

The damping plate for reverberation time variation

When the damping plate, which is constructed of absorptive material, is brought closer to the steel plate, its bending oscillations are increasingly damped and a shortening of the reverberation time results. The material which has proven most effective in this application is a stiff pressed fiberglass plate only 1/32" thick. This damping plate is so constructed as to be perfectly flat in spite of its great surface area and can therefore be brought to a distance of about 1/8" from the steel plate without touching the same. The minimum reverberation time reached at this distance is approximately 1 second at 500 cps.

Reverberation without coloration of the original sound

At 1000 cps the running time from drive coil to microphone is about 6×10^{-3} seconds, which equals the running time of a sound in air over a distance of only 6 feet. Because of the short running time of the flexing waves, the successive repetitions follow in rapid sequence. Their number grows as a function of time, and as a result one obtains, as with an acoustically pleasing three-dimensional room, none of the flutter and slap echoes of other artificial reverberation devices. This is true even for the shortest sound impulses!

The number of self-resonances per cycle is independent of frequency. In contrast to actual echo chambers, the reverberation plate has many more self-resonant points, which brings with it great adventages for reverberation at these frequencies

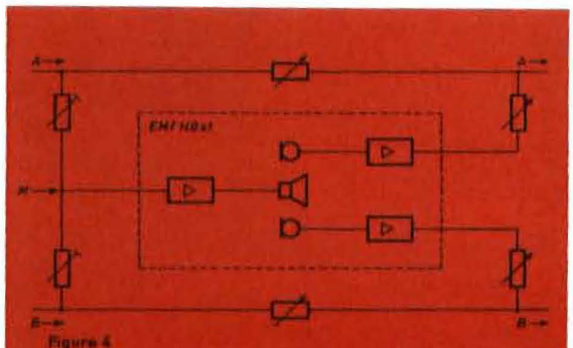

Figure 4

Block schematic of the operational components of the Stereo Reverberation Unit EMT 140st

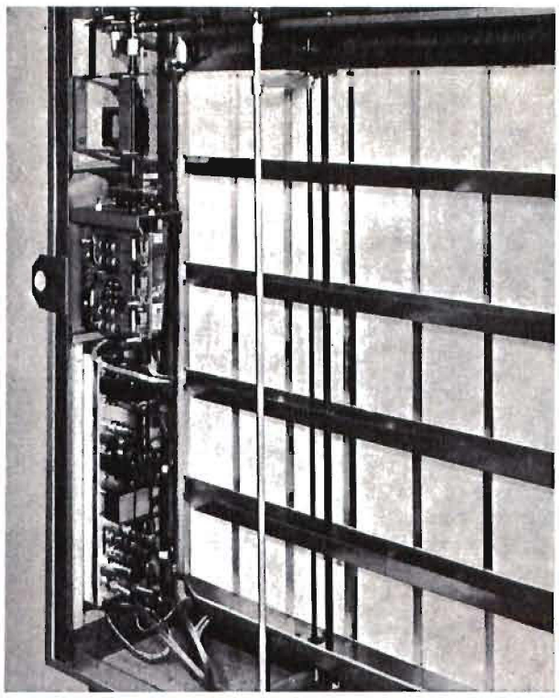

Figure 5

Rear view of the Reverberation Unit EMT 140. Mounted against the unit's narrow vertical side are the amplifier chassis at the bottom and the remote control section above.

The two signals obtained from the two contact microphones which are mounted at unequal distances from the driving coil are entirely incoherent; i. e. they have no relationship to each other. This fact is an all important prerequisite, for the two resulting stereo channels with echo must have between them a statistically distributed directional as well as informational content.
Since the reverberation plate contains a great number of resonant points, there is created on the plate an almost infinitely dense resonance spectrum, resulting in a frequency dependent phase displacement between the two pickup microphones. If, as an example, one feeds to the plate a sine wave tone of any frequency, one can obtain at the two microphones an infinite variety of phase relationships, of which four are of particular interest:

	Microphone 1	Microphone 2	Directional Impression
Phase	90°	0°	Echo seems to come from the right
Phase	0°	90°	Echo seems to come from the left
Phase	90°	90°	Echo seems to come from the center
Phase	90°	—90°	Echo seems to come from the sides.

Under the heading "Directional Impression" in the foregoing table, are given those directional impressions which would be created if the two microphones were standing in a room and the sound source would be moved. There are of course, besides the phase relationships given, an infinite further number which are entirely frequency dependent. If musical modulation is fed to the reverberation unit, therefore, all of the imaginable phase relationships will appear between the two microphones and the result is a statistical distribution and a resulting impression of echo coming from every possible direction within the room.

Reverberation for stereo as well:

For the addition of reverberation to stereophonic recordings, the reverberation unit must satisfy two separate conditions: For one, it must extract from the stereo signal its directional component, and secondly it may not, as a result, adversely affect the significant information content.
In order to achieve this end, use is made of the so-called "M" channel which is formed by the addition of the two signals according to the formula A + B = M.

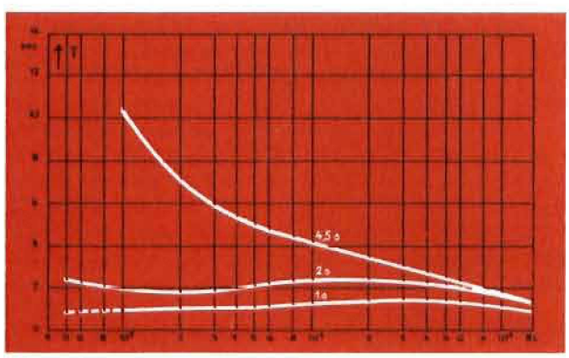

Figure 6

Reverberation times as a function of requency for various distances between reverberation and damping plate.

This is done by feeding part of the unreverberated output signal of channels A and B through isolation networks to a common buss. For compatibly recorded signals this addition of A and B into an "M" channel produces a proper monophonic signal containing all of the informational content of the stereo signals. This self same "M" signal can also be obtained by placing a single microphone in the recording studio center and feeding its output to the reverberation unit.

Frequency response of the reverberation system:

The frequency response of the reverberation time, without additional damping, corresponds approximately to that of an empty stone walled hall or church; i. e. about 5 seconds at 500 cps. Towards the low frequency end there is a rise and towards the high frequency end a decline (to about 1.5 seconds at 10 kc), just as is the case in actual rooms as a result of the sound absorption of the air.
When testing the overall frequency response using a slowly gliding pure tone, one gets the same pronounced intensity fluctuations as are obtained from a three dimensional room. According to the

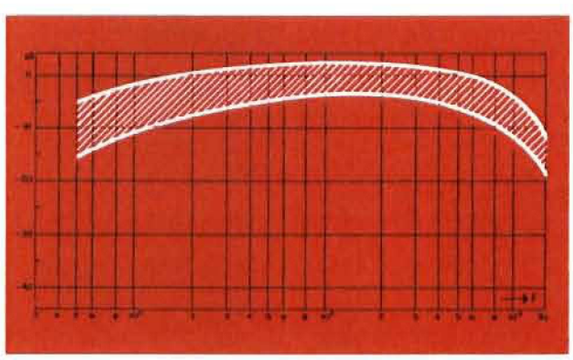

Figure 7

Tolerance range of the frequency response for the Reverberation Unit measured using a white noise generator with third octave filter or 25 cps warble tone generator for an adjusted 2 second reverberation time.

theory of Dr. Schröder, the statistical mean value of the difference between "peaks" (maxima) and "valleys" (minima) of the response curve is 10 db. Measurements of the reverberation unit confirm the veracity of this theory, both with respect to the number of maxima and minima within a defined frequency interval as a function of the reverberation time, and the wavering of the frequency response curve.

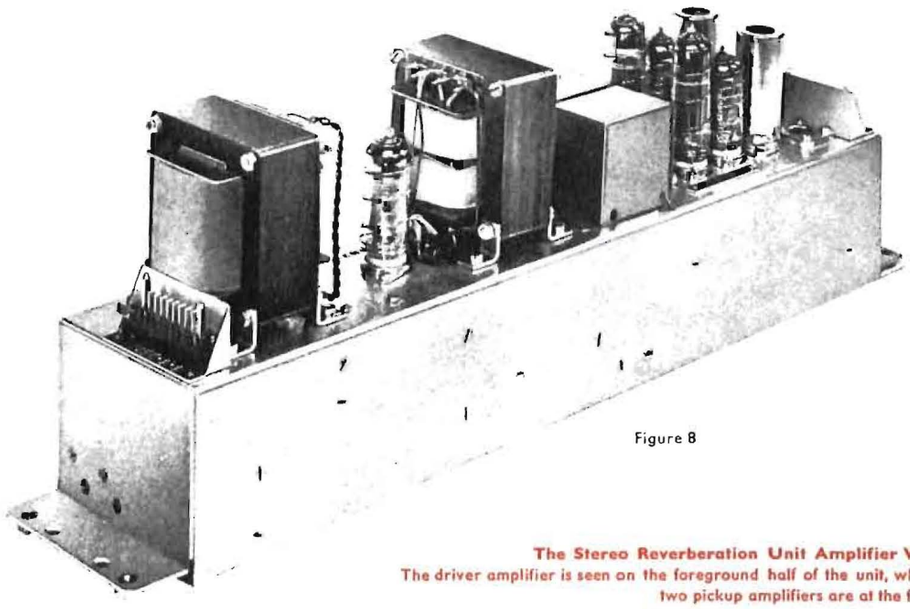

Figure 8

The Stereo Reverberation Unit Amplifier V-54st.
The driver amplifier is seen on the foreground half of the unit, while the two pickup amplifiers are at the far end.

Minimal distortion:

The level handling capabilities of the reverberation plate and amplifier were so chosen, that the third order harmonic distortion, to which the human ear is far more sensitive than the even order harmonics, would not exceed 0.6% for a peak input level of 1.55 Volts measured using white noise through a third octave band pass filter. This takes into consideration the statistical power distribution of sound modulation which drops normally towards the high frequency end of the spectrum.

The actual distortion produced by the plate itself at mid and high frequencies and moderately long reverberation time settings, is lower than that of the amplifier. At low frequencies, where the human ear is less sensitive, the distortion of the plate increases somewhat. When the maximum input level referred to above is not exceeded, no disturbing distortion is audible.

Installation in quiet surroundings prevents interference:

The Reverberation Unit is to be set up in a fairly quiet spot. For an ambient noise level of 50 db SPL, the interference noise produces at the output of the unit a level approximately equal to the self noise level of the unit. It would be most expedient to select a special room in which, however, more than one such Reverberation Unit may be operated simultaneously. This sort of room is also to be recommended to prevent inadvertent mechanical noise interference from external bumping or other mechanical contact. Reverberation Units placed next to each other do not interfere with each other since practically no sound is radiated to the outside of the unit. The actuating arms of the damping plate are not isolated from the tubular frame and yet adjustment of the reverberation time either by hand or remote control, even during modulation pauses, is not audible.

The signal to noise ratio:

The signal to noise ratio at the output terminals of the microphone amplifier as measured with a frequency of 300 cps and a reverberation time of 2 seconds and with the remote control motor not running, is greater than 60 db, when the direct sound channel level is mixed in at a level of –8 db. With the remote control motor running, this is reduced to about 45 db.

The amplifier as a single unit:

The excitation amplifier and pickup amplifier are a special development carrying the broadcast type designation V-54. The stereo model is designated V-54st and has two entirely separate pickup amplifiers; one for each contact microphone. Both amplifier types have identical dimensions. The input to the driver amplifier is balanced and floating with an impedance of 1000 Ohms.

The input level requirement follows the broadcasting standard of 1.55 Volts, equal to +6 dB referred to 0 = 0.775 Volts. The input transformer is fed to the first stage via a three position low frequency attenuating network. This stage (E 81 L/6686 tube) then feeds directly to the output transformer which in turn is connected to the driving coil. It is possible to check the coil driving voltage on a terminal strip directly behind the amplifier's cover panel.

The relatively low signal voltage delivered by the contact microphones is amplified by the pickup amplifier to the already mentioned standard line level. This is done through a four stage RC-coupled amplifier with parallel fed output transformer, using 2 EF 804 S and 1 E 80 CC 6085 tube. The output impedance is low, balanced and floating.

Remote control of Reverberation time from the studio console

Besides the normal construction, the EMT-140 Reverberation Unit is also available with remote control facilities. This is done by means of a motor built into the unit itself by means of which the damping plate distance from the steel plate may be continuously varied. A potentiometer coupled to the motor itself delivers a voltage for indication of the reverberation time on an indicating meter mounted on the console. The operating elements; i. e. the indicating meter and the two push buttons may be located at any distance from the unit, and these in turn operate the motor relays via a 24 Volt supply. By using the remote control possibility, the unit may be located in the most desirable locations such as a dry cellar, or quiet antiroom. It is furthermore possible to control the reverberation time of a single unit from many locations.

How is the reverberation unit delivered?

The reverberation plate and its associated amplifier system are built into a massive wooden case. For the manually operated unit, a hand wheel is provided for adjustment of the reverberation time. While it is possible to deliver and install the remote control components at a later date, this is connected with no small amount of installation work and it is therefore highly recommended that the choice of manual or remote control be made before the unit is purchased.

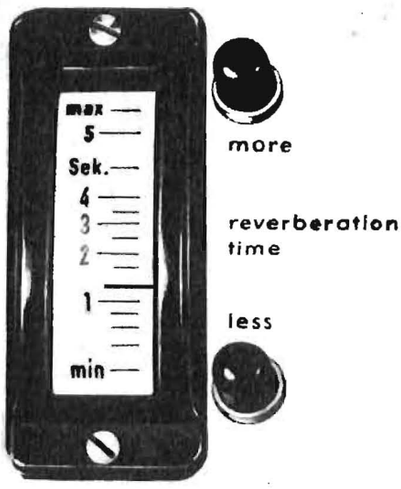

Figure 9

Operating group for the remote control feature. Shown installed in the studio console.

Special care during shipment:

Because of the large dimensions of the reverberation unit and the necessarily delicate suspension of the steel plate and damping plate, it is imperative that great care be exercised during shipment. On the part of the factory the greatest diligence is exercised with respect to packing and plain labelling of the proper lifting and carrying methods. After unpacking, the unit can be carried comfortably by four men. Four carrying rings at the ends of the unit permit insertion of carrying rods.

Connection of the Reverberation Unit

The full modulation level should be applied to the input of the reverberation unit's amplifier, and echo faders, level controls, and filters, if used, should all follow in the circuit. The reverberated signal from the unit is mixed with that of the direct channel transmission and the ratio of these two signals determines the illusion of distance between the sound source and microphone. Through use of a mixing control it is possible to maintain a constant overall level while changing the reverberation to direct sound ratio.

By proper connections it is possible to use the stereo reverberation unit for adding echo to both A-B as well as M-S-stereo recordings. The stereo unit may, of course, also be used for adding echo to monophonic recordings.

Technical data

Reverberation Time (measured at 500 cps): Adjustable between	1 and 4 seconds.
Accuracy of time scale division (re 500 cps)	± 8%
Frequency response at 2 seconds reverb. time	see curve, figure 7
Signal-to-noise ratio at output of unit referred to full output level, at 300 cps, 2 sec. reverb. time and —8 db of direct channel addition:	
remote control not running	> 60 db
remote control running	> 40 db
Input level for full modulation:	1.55 Volts (+ 6 dbm)
Input impedance:	> 1000 Ohms
Output level:	
(a) 300 cps	max. 1.55 Volts (+ 6 dbm)
(a) 1000 cps	max. 1.1 Volts (+ 3 dbm)
Usual direct channel mix-in level:	—6 to —10 db
Output impedance:	< 25 Ohms
Load impedance:	> 200 Ohms
Moving coil impedance of drive system	12.5 Ohms
Tube complement of V-54 Amplifier:	(1) E81L/6686; (2) EF804S; (1) E80CC/6085
Tube complement of V-54st Amplifier:	(1) E81L/6686; (2) EF804S; (2) E80CC/6085
Power Supply requirement:	110/220 Volts 50 cps; or 117 Volts 60 cps
Remote Control: (Available at additional cost); built-in servo motor with relay control; indicating instrument External voltage required:	24 Volts DC, 250 ma
Weight:	
Without remote control	374 lbs. (170 kg)
With remote control	418 lbs. (190 kg)
Dimensions:	7.5 ft. (2.4 m) long 1 ft. (0.34m) wide 4 ft. (1.32 m) high

Ordering Information:

Reverberation Unit; MONO; hand operated	EMT-140
Reverberation Unit; MONO; remote controlled	EMT-140FB
Reverberation Unit; STEREO; hand operated:	EMT-140st
Reverberation Unit; STEREO; remote controlled	EMT-140FBst
Remote Control for subsequent installation	EMT-140F
Operating panel alone	EMT-140B
Amplifier; MONO	V-54
Amplifier; STEREO	V-54st

World-wide patent protection:

The construction of the EMT-140 Reverberation Unit is already protected by many international patents:

Western Germany	1001011
Denmark	91041
England	827302
France	1159692
Netherlands	105 890
Austria	196145
Switzerland	347016
USA	2923369

Further patents have been applied for.

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AUDIO DELAY UNIT

EMT 970

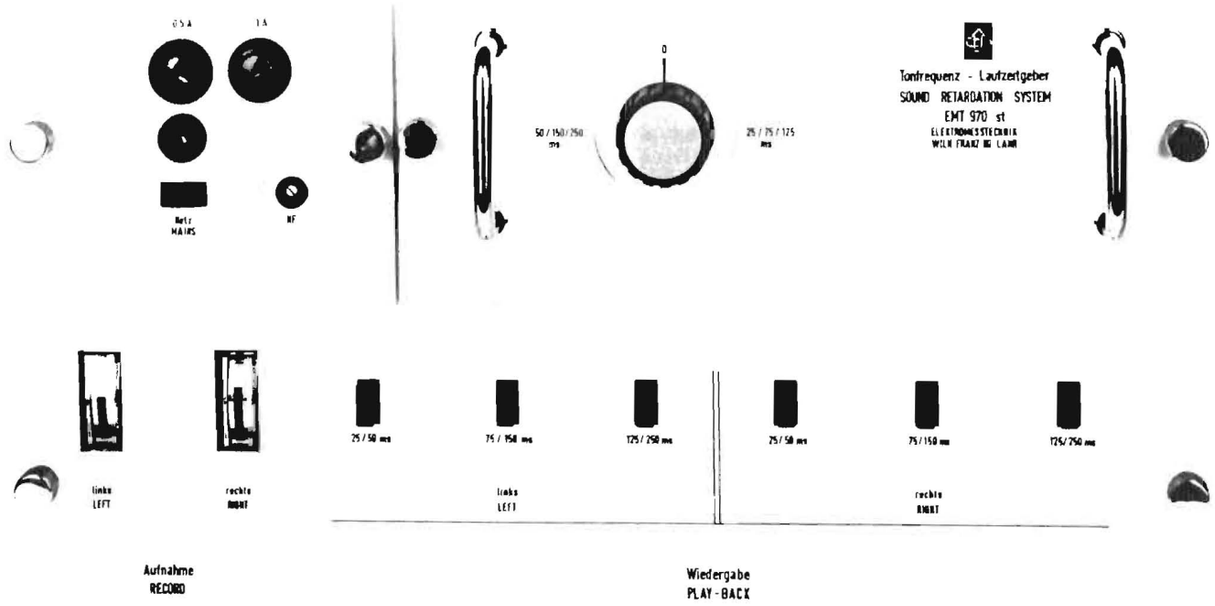
AUDIO DELAY UNIT
EMT 970

As the ideal transmission of sound with regard to volume, high fidelity and dynamics, is nowadays only restricted mainly by obstacles of a commercial nature, successful attempts have been made in the field of further improvement with a view to transmitting also three-dimensional components and directional parameters of the actual tone. This highlights the phenomenon of the effect of sound transmission time on the human ear.

The professional sound recording and reproduction technology now has to be in a position to manipulate transmission times. Audio Delay Unit EMT 970 is an instrument which makes it possible to delay secondary audio-frequency signals by given periods in relation to the primary signal. The transmission time settings have been specially chosen to suit applications in electro-acoustics and studio technology. They range from 25 to 250 milliseconds and thus correspond to the transmission time of sound in sound recording and reproduction methods, and are of significance as regards auralphysiological processes.

The ability of the Audio Delay Unit EMT 970 to produce or compensate sound transmission time opens up a whole series of interesting applications.

Technical description



The unit consists of a series of plug-in units contained within a single, stable frame. The stabilized power supply and mechanical plug-in units are in the top half of the unit, while the individual amplifier cards made of glass-epoxy are plugged into the lower half card carrier. All amplifiers are equipped exclusively with silicon planar transistors.

The mechanical system is constructed as follows:

An extremely thin, pliable and tensilized Mylar foil is stretched like a drum head over a rotating turntable-like ring. There are no splice gaps as may be found in endless tape loops. The foil is coated on its underside. Since the magnetic heads ride spring loaded on the uncoated, smooth Mylar surface, they practically do not wear, and above all make excellent and constant contact with the magnetic foil. A stationary anti-static cloth resting on the surface of the foil prevents any accumulation of dirt. The heads themselves are mounted on three points, are alignable and are mu-metal shielded. They are mounted on cast supports which are screwed to the deck of the mechanical unit which, with the main bearing, forms one stable assembly. The disk is rim driven by a friction idler not unlike a turntable, while a two step motor pulley permits a 2:1 change of rotational speed. The motor is fully mu-metal shielded.

SIGNAL PATH

The audio signal at the unit's input is fed via the record amplifier and record head to the magnetic drum. The signal then runs through an arc past three playback heads which results in three separate time delays. These delayed signals are each fed through individual equalized playback amplifiers to push buttons, by means of which they are selected to form an output buss. The playback amplifier outputs are further brought out to a multi-pin connector at the back of the unit to permit a variety of interconnections depending on the application intended. It is at this point that the unbalanced playback amplifier outputs may also be connected individually and unmixed to other units. In the case of the standard unit, these three playback amplifier outputs are combined and fed to the input of a line amplifier from whose line level output the delayed signals may be then fed to other facilities.

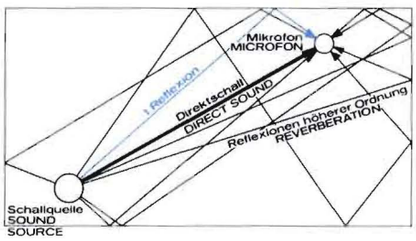
STEREO-VERSION EMT 970 st

In the stereo version of the unit there are two complete sets of amplifiers.

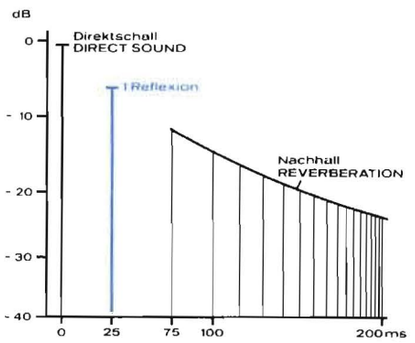
Applications

Delay of Reverberation and introduction of the first reflection

The acoustic impression an observer gains of a room is primarily dependent on the time sequence in which direct sound, first reflection, and reverberation appear. The greater the reverb delay with constant reverb decay time, the larger the acoustic impression of the room. Unfortunately this delay destroys the room's "transparency". Inserting the first reflection between direct sound and reverberation preserves, even for a large room, its acoustic "transparency". This first reflection gives information concerning the geometric dimensions of a room (i. e. long and narrow or very high), and within limits, even the treatment of its walls.



The greater the number of sound wave reflections, the longer is their delay compared to the direct sound. The time intervals between the individual reflections arriving at the microphone become ever shorter; in other words their density increases. At the same time these reflected sound waves lose energy, and this in turn results in an exponential loss of total sound level within the room as a function of time: reverberation results.



The sketch shows how the first reflection and reverberation are delayed compared to the direct signal and thereby forms the acoustical characteristic of a room.
Room reverberation is best created by the well known EMT 140 Reverberation Unit. Delaying its input using the EMT 970 Audio Delay Unit permits simulation of a particular acoustic enclosure.
The first reflection, which is also a determining factor in room character simulation, can likewise be generated by the EMT 970, by delaying the direct signal.

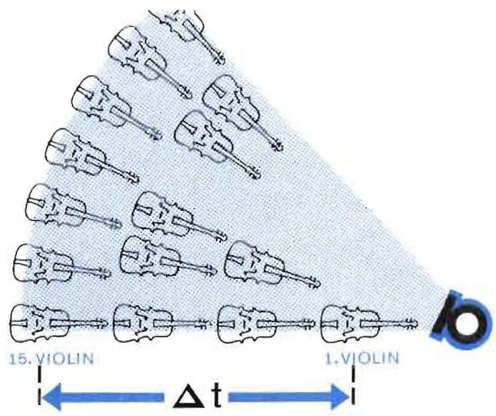
Effects

ECHO EFFECTS

Popular music production and certain effects in radio dramas oftimes require echo effects which may either consist of a single reflection or a number of diminishing echoes. Delay times of 125, 150 or 250 ms produce just such echo effects. To achieve such effects, the output signals of the particular playback amplifiers are fed through level controls which are adjusted to produce an exponential decay of the individual echoes.
To produce multiple repeating echoes, these controlled output signals are returned to the Delay Unit input, with the result that they theoretically decay exponentially indefinitely.

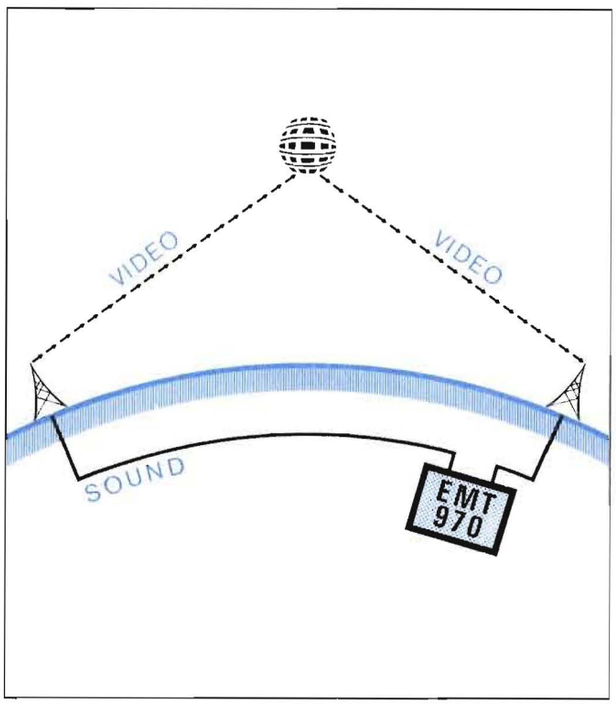
"ENLARGEMENT" OF A SMALL STRING GROUP

The output of the string microphone is fed through the minimum delay time of the EMT 970 and returned with greatly reduced level to the direct signal channel. This produces a certain "lack of precision" which is the typical hallmark of a large string section. When using a delay time of 25 ms there is no danger that the string sound will acoustically fall apart into two distinct signals.



Satellite transmissions

During TV transmissions beween continents, both video and audio signals are sent via satellite and arrive simultaneously at the receiving station. At times, when problems in audio transmission arise, undersea cables are used as an alternate feed. In such cases the audio signal arrives approximately 250 ms ahead of the video signal and must be delayed to bring the program back into synchronism. The EMT 970 Delay Unit is admirably suited to use for such delay purposes.

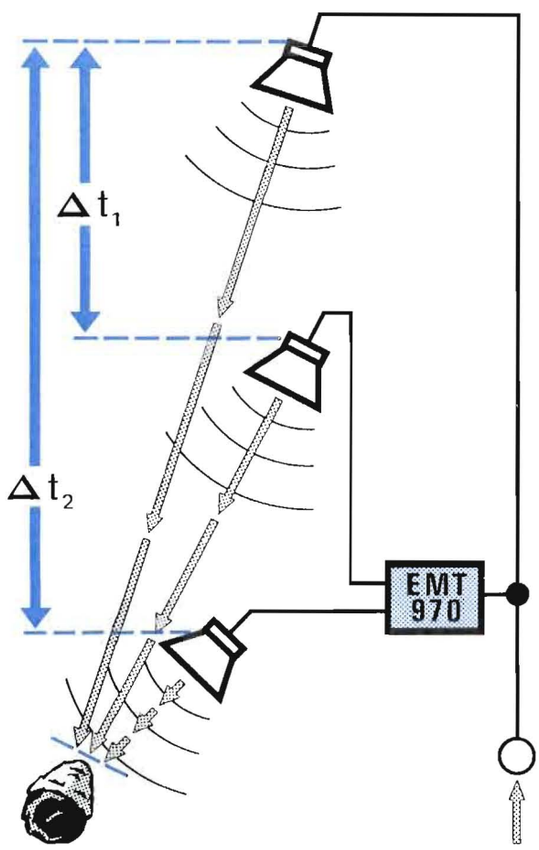


Foreign language dubbing of films

The dubbing of foreign language films produce problems of lip synchronizing the speaker with existing picture. Dependent on individual reaction time, this may produce word start delays of varying lengths which may easily be compensated by delaying the dubbed language via the EMT 970 Audio Delay Unit.
Similar problems are encountered in post-syncing of TV operas.

Loudspeaker installations in large halls and arenas

A very important application for the EMT 970 in electroacoustics is the improvement of intelligibility of loudspeaker and public address installations in large halls and outdoor arenas. The problem here is that sound reaches the listener, as a result of his widely varying distances from loudspeaker groups, at widely varying times. In certain cases multiple echoes are produced which seriously affect the quality and intelligibility of the performance.
The EMT 970 Audio Delay Unit is useful in compensating these disturbing sound delays. In so doing it makes use of a very unique property of human hearing: In the presence of two sound sources, we always localize the one whose wave front reaches our ears first, even if the second arrival, within about 35 ms time, is of higher intensity (Haas effect). By delaying the sound in a meaningful way to the speakers used to reinforce the original sound source, we can make the total sound picture clear and its origin unmistakably coincident with the live sound source.



Technical specifications

Head complement	1 erase head 1 record head 3 playback heads
Linear track speeds	90 cm/s and 45 cm/s (app. 35 and 17½ ips)
Delay periods	
at 90 cm/s	25 ms, 75 ms, 125 ms
at 45 cm/s	50 ms, 150 ms, 250 ms
Flutter content (weighted according to CCIR std)	
at 90 cm/s	max. ± 0.2%
at 45 cm/s	max. ± 0.4%
Level in stability	max. 1 dB
Frequency response	
at 90 cm/s	40 Hz – 16 kHz } +2 dB
at 45 cm/s	40 Hz – 12 kHz } –3 dB
Tot. Harm. Distortion	
at 1 kHz	max. 3%
at 250 Hz	max. 3%
Input	balanced & floating
Nominal level	+4 dBm, +6 dBm, +8 dBm
Level range	0.6 V – 9 V (+21 dBm)
Impedance	min. 2000 Ohms
Output	balanced & floating
Nominal level	+4 dBm, +6 dBm, +8 dBm
Max. level	+18 dBm at 600 Ohms
Impedance	approx. 30 Ohms

Stereo Channel Separation	
at 1 kHz	min. 40 dB
100 Hz – 10 kHz	min. 30 dB
Phase angle error	
at 10 kHz	max. 30°
Erase attenuation	min. 70 dB
S/N Ratio (unweighted)	
at 90 cm/s	min. 47 dB
at 45 cm/s	min. 47 dB
S/N Ratio (weighted)	
at 90 cm/s	min. 56 dB
at 45 cm/s	min. 58 dB
Bias oscillator freq.	65 kHz
Bias suppression at output	min. 40 dB
Magnetic field at 2" from unit	max. 15 mGauss
Acoustical noise directly at the unit	max. 40 Phon
Dimensions	
Rack width	19"
Panel height	10½"
Distance behind panel	max. 18"
Weight	
EMT 970 st	33.3 kg (73 lbs.)

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EMT

STUDER

C37

professional

MAGNETIC TAPE RECORDER

max. 12" spooling diameter for up to 3,300 ft of standard 1/4" tape

Tape Speeds 15 and 7 1/2 i. p. s.

Technical details

STUDER C 37

Input	balanced
Impedance between 30 cps and 15 kc/s	min. 15 k-ohm
Level, adjustable	.7 to 7 V
Output	balanced
Impedance between 40 cps and 15 kc/s	max. 25 ohms
Level, adjustable	.7 to 7 V into 200 ohms
Equalization	CCIR/NAB, switched
Frequency response via tape (with CCIR equalization) between 30 cps and 15 kc/s	+ 1, − 2 db at 15 i. p. s. + 1, − 2 db at 7½ i. p. s.

Wow and Flutter (Peak values measured with EMT 420A (CCIR Rec. 210 Doc 2153) Wow & Flutter Meter; RMS values measured with ACA meter)

	RMS 0.5-250 cps	RMS 0.5-6 cps
15 ips	± 0.04%	± 0.015%
7.5 ips	± 0.05%	± 0.025%
	PEAK unweighted	PEAK weighted
15 ips	± 0.08 %	± 0.05 %
7.5 ips	± 0.125%	± 0.075%

Distortion	
of the amplifiers	.1%
via tape at 1000 c. p. s.	2% at 200 mM

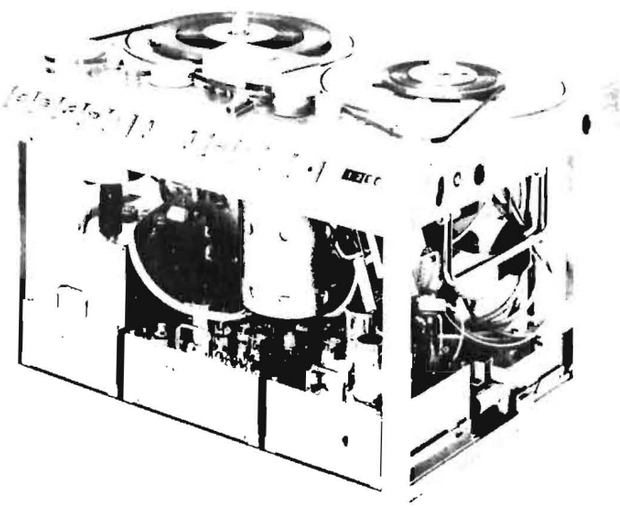
Signal-to-noise ratio, measured by means of the noise voltage meter S & H Rel 3 U 33 (broadcast designation J 77) with the machine running, referred to an output level of + 6 db.

	15 i. p. s.	7½ i. p. s.
R. M. S.	68 (62) db	64 (58) db
R. M. S. weighted	75 (61) db	70 (57) db
Peak	65 (60) db	61 (56) db
Peak weighted	73 (59) db	68 (54) db

The values in brackets are measured via tape with the machine switched to ‚record' with the input matched. In the case of stereo machines the signal-to-noise ratio is about 5 db less due to the narrower track width.

Phase angle error between the stereo channels at 10 kc/s	max 10°
Channel separation	min. 40 db
Oscillator frequency	80 kc/s
Stray magnetic field 2" from chassis	max. 50 mG

Tape speeds	15 and 7½ i. p. s. (equalization automatically switched with speed change)
Speed accuracy	max. ± .2%
Change of tape speed from a spooling diameter of 12" to 4" (tape slip)	max. .1%
Run-up time until permissible wow-and-flutter figures have been reached	1 second
Tape run after pressing ‚stop' button during normal running	app. 2"
Stopping time from fast wind	app. 2 seconds
Spooling time for 3,300 ft of standard tape	3 minutes
Reel diameters	max. 12" for 3,300 ft of standard tape, interchangeable centres for European, NAB and Cine spools.
Precision tape driven timing indicator	99 minutes 59 seconds, accuracy .3%
Elapsed time indicator operates when capstan motor is running	6 digits
Chassis dimensions	width 25.6" (650 mm) depth 20.6" (525 mm) Height below mounting plate 12.8" (325 mm) Height above mounting plate 3.9" (100 mm)
Weight (stereo version)	app. 172 lbs (78 kg)
Mains connections	22 V, 50 c. p. s., app. 250 W, other voltages and frequencies upon request
Versions	As chassis or in console

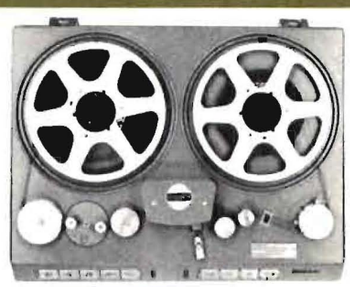


Points which matter:

This is a high quality machine.

Its performance matches its appearance. Measurements prove the excellent characteristics: the high signal-to-noise ratio for example or the low wow-and-flutter even after several thousand hours of operation with little servicing.

The C 37 maintains its performance; its quality is world famous.



This machine is easy to operate.

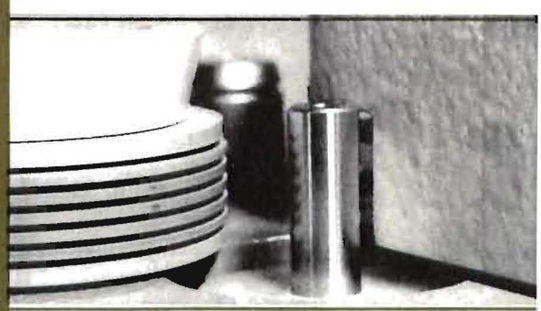
Although the engineering of a machine like this is necessarily complex, it is simple to handle. This is achieved by the clear and simple operating controls. One never needs to search. The large illuminated push buttons are clearly designated and readily accessible. A slight push is enough. With the C 37 one can concentrate entirely upon the recording.

This is why such emphasis has been laid on reliable and simple operating controls.

This machine is precision made.

The timing indicator measures the time on the tape to within a second, even after repeated fast winding. The electronic tape tension control will even compensate jerks due to bad splices in the tape. Due to the direct tape drive and the precision bearings, the wow-and-flutter is less than .05%. The special editing facilities enable precise cutting to within a syllable. The head-block can be interchanged without re-alignment.

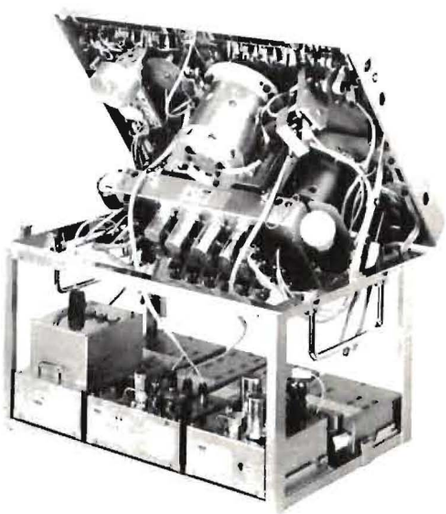
All this is the result of Swiss craftsmanship.



This machine is easy to service.

By lifting the deck-plate on its hinges all parts become easily accessible. The modular construction enables entire sub-assemblies to be replaced quickly. For example, the entire capstan assembly can be removed by undoing three screws and removing the pinch wheel. The motor is plugged in — no soldering. The amplifiers and the mains supply units can also be plugged in or removed instantly.

The designers of the C 37 have thought of servicing problems in advance.



This machine is proven.

It is clear and precise in its conception. The design is based on many years of experience.

The modular construction and the various pre-set adjustments enable the machine to meet all practical requirements. Every day hundreds of C 37s in studios all over the world are proving their reliability in continuous heavy duty use.

The C 37 is a machine one can rely upon.

Available versions:

Full track

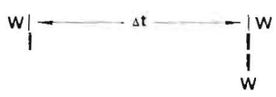
Stereo

Twin track

Pilot tone

Playback only

With advanced playback head (for traverse drive)



Three or four track versions on 1/2" or 1" tape

Further details about this in the catalogue J 37.

Available as chassis unit or in console version.

Back tension brake	Electrical, therefore not subject to wear. The brake torque is electronically controlled by means of a tape tension gauge.
Mechanical brakes	Operate in ‚stop' position and when braking from ‚fast wind' additionally to the electrical braking. Therefore very little wear.
Direct and simple tape drive	Therefore low wow-and-flutter, little servicing and a minimum of wear. A carefully engineered mechanical low-pass filter prevents the flutter from the motor from reaching the capstan. The machine runs very quietly and the capstan motor starts without ‚hunting' even under extreme temperature conditions.
Tape tension gauge	The tape tension gauge electronically controls the tape tension and maintains it constant from the beginning to the end of a large reel of tape.
Important operating voltages and currents	can be checked by means of built-in meter and selector switch. A pilot lamp immediately shows where a fuse has blown.

ELEKTROMESSTECHNIK WILHELM FRANZ KG

P.O. BOX 327 · 763 LAHR WESTERN GERMANY · TELEPHONE 2053 · TELEX 754934 · CABLES: MESSTECHNIK LAHRSCHWARZWALD

EMT WILHELM FRANZ GMBH

92 SEMINARSTRASSE · WETTINGEN (AG) SWITZERLAND · TELEPHONE BADEN 60550 · TELEX 53682 · CABLES: EMTFRANZ WETTINGEN

Professional
TAPE RECORDER
4 Full Tracks
1" Tape

Tape speeds 15" / sec. and 7 1/2" / sec.
Built in sync playback mixer amplifier.

STUDER

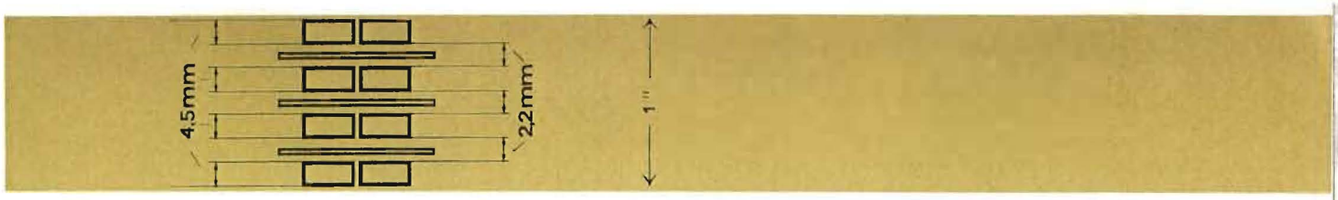
J 37-4-1

Technical Data

Width of tape	1"
Tape speeds	15 i. p. s. and 7 1/2 i. p. s. The speed change switch automatically selects the appropriate amplifier response characteristics.
Speed tolerance	± .2 % of nominal
Change in speed (tape slip) corresponding to change in spooling diameter from 12" to 4"	max. .2 %
Tape run after pressing stop button	less than 6"
Stopping time from "Rewind"	less than 4 sec.
Rewind time for 3,300 ft. (1.000 m) of standard tape	less than 3 minutes
Tape spools	max. 11 3/4" (300 mm) diameter for 3,300 ft. (1.000 m) of standard tape
Timing indicator, non-slip tape driven, counting forwards and backwards	99 minutes, 59 sec. accuracy .3 %
Elapsed time indicator (in hours)	Six figures, operates only when capstan motor is running

	15"/sec	7 1/2"/sec
Frequency response via tape (CCIR characteristic) ± 2 dB	30 Hz — 15 Hz	45 Hz —12 kHz
Frequency response via sync playback amplifiers + 2, — 3dB	30 Hz — 15 kHz	40 Hz —8 kHz
Signal-to-noise ratio measured with noise level meter S&H Rel 3U33, with machine running and referred to normal output level at 200 mM via play-back amplifier		
R. M. S.	65 (60) dB	60 (56) dB
R. M. S. weighted	76 (60) dB	70 (56) dB
peak	62 (56) dB	57 (52) dB
peak weighted	74 (57) dB	67 (53) dB
The figures in brackets are with the machine switched to „Record" with the input terminated. via sync playback amplifier		
R. M. S.	better than 50 dB	better than 50 dB
R. M. S. weighted	better than 60 dB	better than 66 dB
Wow and flutter (Peak, measured with EMT 420A in accordance with CCIR recommendations 210 Doc 2153 and DIN 45 507)		
unweighted	± .1%	± .15%
weighted	± .075%	± .1%

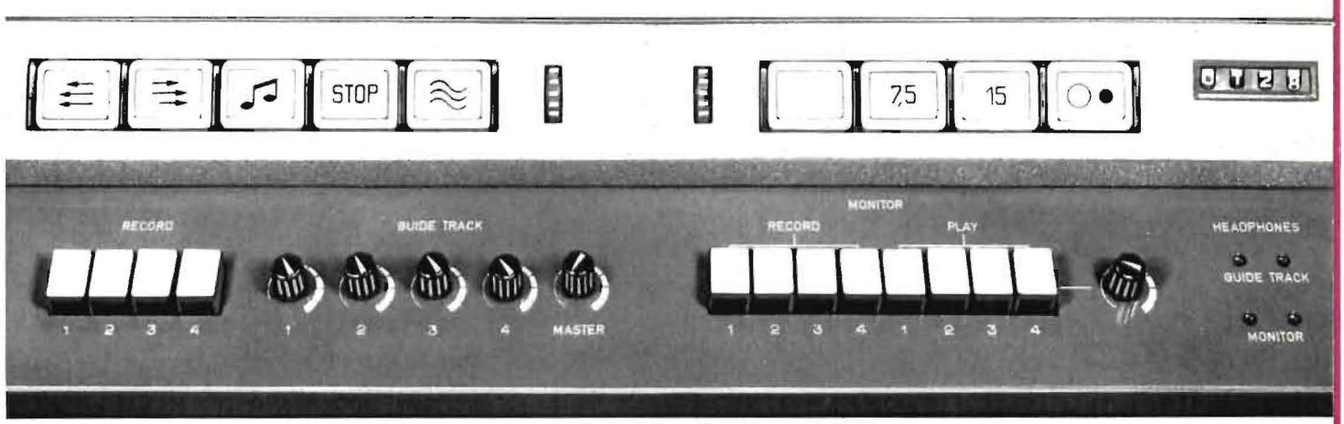
Number of tracks	4 full tracks
Track position	international, coating inside ("A" winding)
Track width	4.5 mm
Distance between tracks Every track can be erased and recorded separately	2.2 mm
Cross talk of two adjacent channels at 1.000 Hz	both channels recording: 45 dB only one channel recording: 50 dB
Distortion of the amplifiers via tape at 1.000 Hz	.1 % (at nominal level) 2 % at 200 mM
Interference field at 2" from console contour	max. 50 mG
Bias and erase oscillator frequency	80 kHz
Phase shift at 10 kHz in four channel stereo operation	max. 30°
Erase head	Ferrite
Record and replay heads	Vacodur (Alfenol) in all metal assembly for minimum wear
Inputs	Via attenuator .7 to 7 volts, symmetrical, effective input impedance greater than 15 k ohms between 30 Hz and 15 kHz
Outputs	Via attenuator .7 to 7 volts into 200 ohms symmetrical, output source impedance less than 25 ohms between 40 Hz and 15 kHz
Fuses	neon indicator or light bulb indicator type, will illuminate when fuse is blown
Valves and transistors	4 record amplifiers 2 × E 188 CC each 4 replay amplifiers 3 × E 188 CC each 1 × E 283 CC each oscillator 6 × E 188 CC 4 sync playback amplifiers 1 × E 188 CC each 1 × ECC 83 each sync playback mixer amplifier 2 × ECC 81 monitor amplifier 2 × ECC 81 power supply unit 2 × E 130 L 1 × E 283 CC 2 × E 188 CC 2 × 85 A 2 2 × ASZ 18 sync playback amplifier power supply 1 × EL 86 1 × ECC 83 1 × 85 A 2
Supply to built in stabilised mains units	220 volts, 50 Hz, 500 VA Other voltages and frequencies on request
Dimensions	27" × 25 1/2", height 40" (685 mm × 645 mm, height 1.020 mm)
Weight	app. 330 lbs (150 kg)



The J 37-4-1 records four tracks 4.5 mm wide and 2.2 mm apart onto 1" tape

Clear Lay-out

is a feature of everything in the J 37-4-1, starting with the control panel.
The large illuminated push buttons as well as all jacks and control knobs are laid out and marked clearly.
The push buttons operate self holding relays which may also be remote controlled e. g. from the mixing console.
The illuminated push buttons show the mode of operation even when the unit is remote controlled.
To facilitate cueing the fast forward and rewind buttons have two switch positions. If the button is depressed lightly, the tape is only spooled while the button is being held. This enables a certain point in a recording to be found quickly and easily. If the button is depressed fully, the tape will be wound until the stop button is being depressed, or to its end. During fast forward or rewind the tape is automatically lifted off the heads.
The track or tracks to be recorded are pre-selected by means of the illuminated push buttons in the sync playback control section. The machine is switched into record by simultaneously depressing the key marked with notes and the key with the high frequency symbol. During recording the pre-selector keys are electrically blocked. The tracks for the next recording can be pre-selected already without affecting the current recording.
The volume controls of the four sync playback amplifiers and the master control of the sync playback mixer enable the setting of the right level for tracking. When the "record" keys are not depressed the tracks of the record head are switched for replay to the input of the corresponding sync playback amplifiers. By means of two sets of four keys, the monitor amplifier can be switched to monitor any of the four tracks before or after record. Several tracks may be monitored simultaneously by depressing several keys at once. This can be done without cross-coupling the main input and output lines of the unit. The output level of the monitor amplifier can be set by means of the knob beside the keys. On the other side of this knob are the output jacks of the monitor and the sync playback mixer amplifier for plugging in earphones. A special potential divider gives approximately the same level into earphones with impedances from 5 to 5000 ohms.
The electronic tape tensions balance blocks the mains switch and the tape speed switch while the machine is running. The unit cannot be switched off until the tape is either removed or completely slackened.
In the same way the change in tape speed can only be effected when the tape is fully slackened. It is thus impossible to alter the tape speed accidentally while the machine is running.



There are two knurled knobs in the centre of the control panel. The left hand one enables the tape to be lifted off the erase and record heads and replaced smoothly. The right hand one moves a shield in front of the replay head for screening against strong magnetic fields.

A single console
contains the tape deck, the amplifiers, the sync playback amplifiers, the power supply units and the operating controls.

All operating controls
are laid out clearly and conveniently on the desk portion of the console. All buttons and knobs are marked clearly.

Illuminated push buttons
show the mode of operation even when the machine is remote controlled thus facilitating quick and reliable handling.

Constant tape tension
over the entire length of the tape and independent of the spooling diameter is achieved by means of an electronic tape tension balance. This sensitive control ensures high speed stability and avoids tape stretch.

Four track heads
in a single all metal block made to highest precision limits, are the basis of the excellent quality of the J 37-4-1. All four gaps are exactly in line.

Sync playback
of the recorded tracks for tracking and similar requirements is achieved by using any of the four tracks of the record head for replay.

Four sync playback amplifiers
can be switched independently to the corresponding track of the record head. These amplifiers have separate volume controls.

Sync playback mixer amplifier
enables tracking and mixing of the sync playback tracks for multiple recording techniques.

Monitoring before and after recording
by means of the monitor amplifier with volume control. The track to be monitored can be selected by means of push buttons during recording.

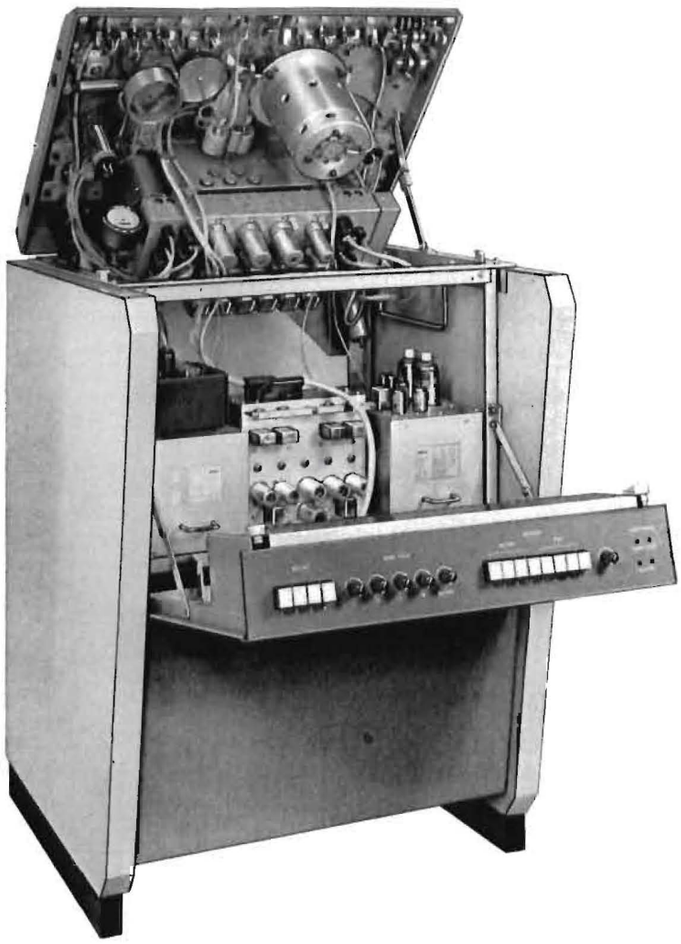
The high precision timing indicator
counts forwards and backwards during record, replay and rewind and is calibrated in minutes and seconds.

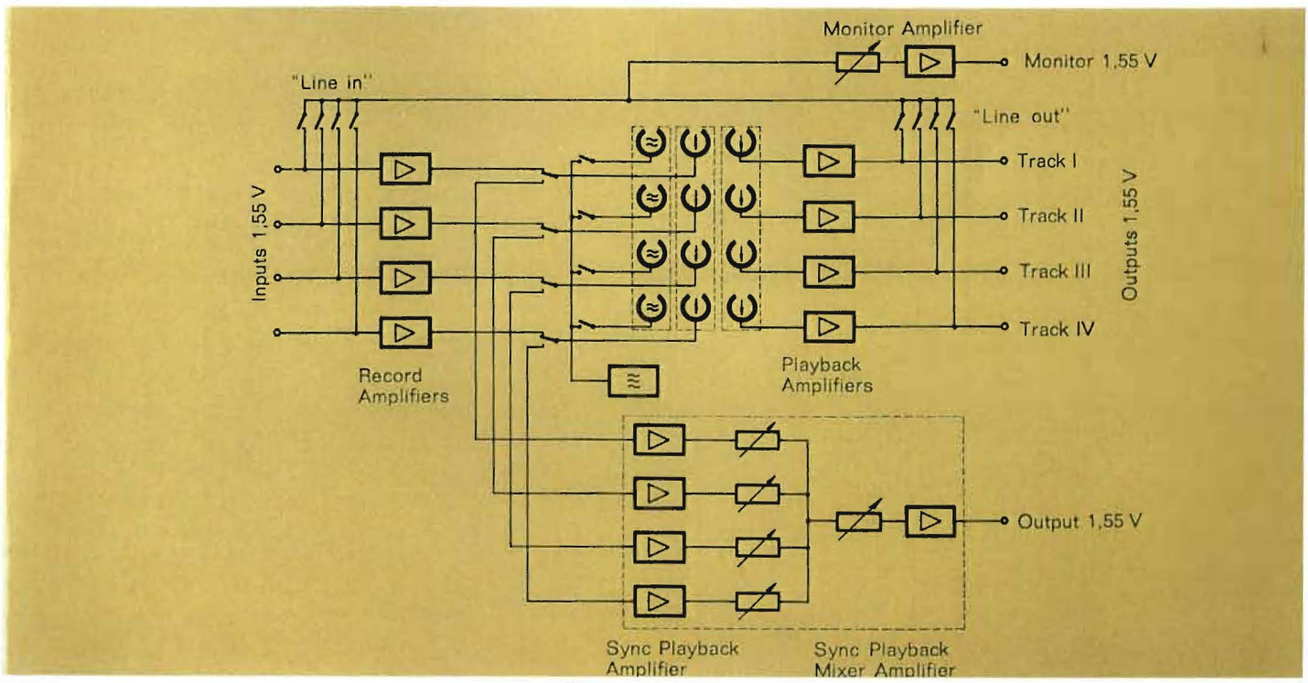
Speed stability and constant frequency response
are maintained over long periods of operation as all components and parts are intended for heavy duty professional use and the heads are made of Vacodur (Alfenol) which ensures negligible wear.

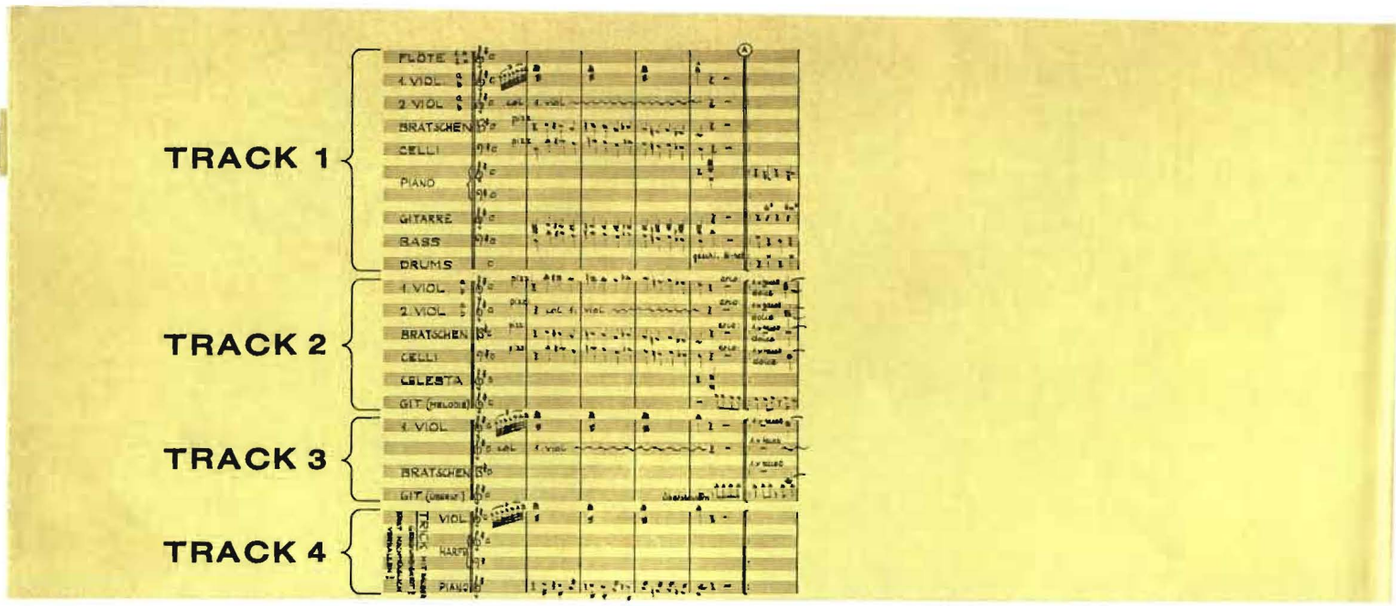
Plug-in construction
of the head block, amplifiers and power supply units permits quick replacement without soldering. The individual units are interconnected by means of plugs and sockets.

Quick and easy servicing
is a design feature of this unit to which special attention was given during development.

The rigidly cast deck plate forms the lid of the unit. The lid is hinged at the back and can be propped up by means of a lever, giving ready access to all parts of the deck mechanism for servicing. The front panel carrying the sync playback amplifiers and the control panel is also mounted on hinges and can be lowered, thus giving ready access to the sync playback amplifiers, as well as to the amplifiers and power supply units contained in the console.
Thus opened up, the unit is fully operational. This makes calibrating, servicing and fault finding very quick and easy.







Example of a score marked for the multiple recording of four groups of instruments on the four full-tracks of the J 37-4-1.
Further applications are the recording of electronic music, stereophonic recording and reproduction, multiple recordings for stage or screen and the recording of scientific data.

Order specification:

J 37-4-1
Professional 4 full-track tape recorder for 1" tape, in single console, containing:

1 control panel with faders and illuminated push buttons,
1 four channel sync playback mixer amplifier,
4 record amplifiers,
4 replay amplifiers,
1 stabilised power supply unit,
1 monitor amplifier.

Multi track studio tape recorders for ½" or 1" tape with three, six and eight tracks to customers' requirements can be supplied upon request.

Subject to technical alterations.

EMT WILHELM FRANZ GMBH
SEMINARSTR. 92 · CH 5430 WETTINGEN (AG) SWITZERLAND · PHONE: BADEN-(056)60550 · CABLES: EMTFRANZWETTINGEN · TELEX:53682

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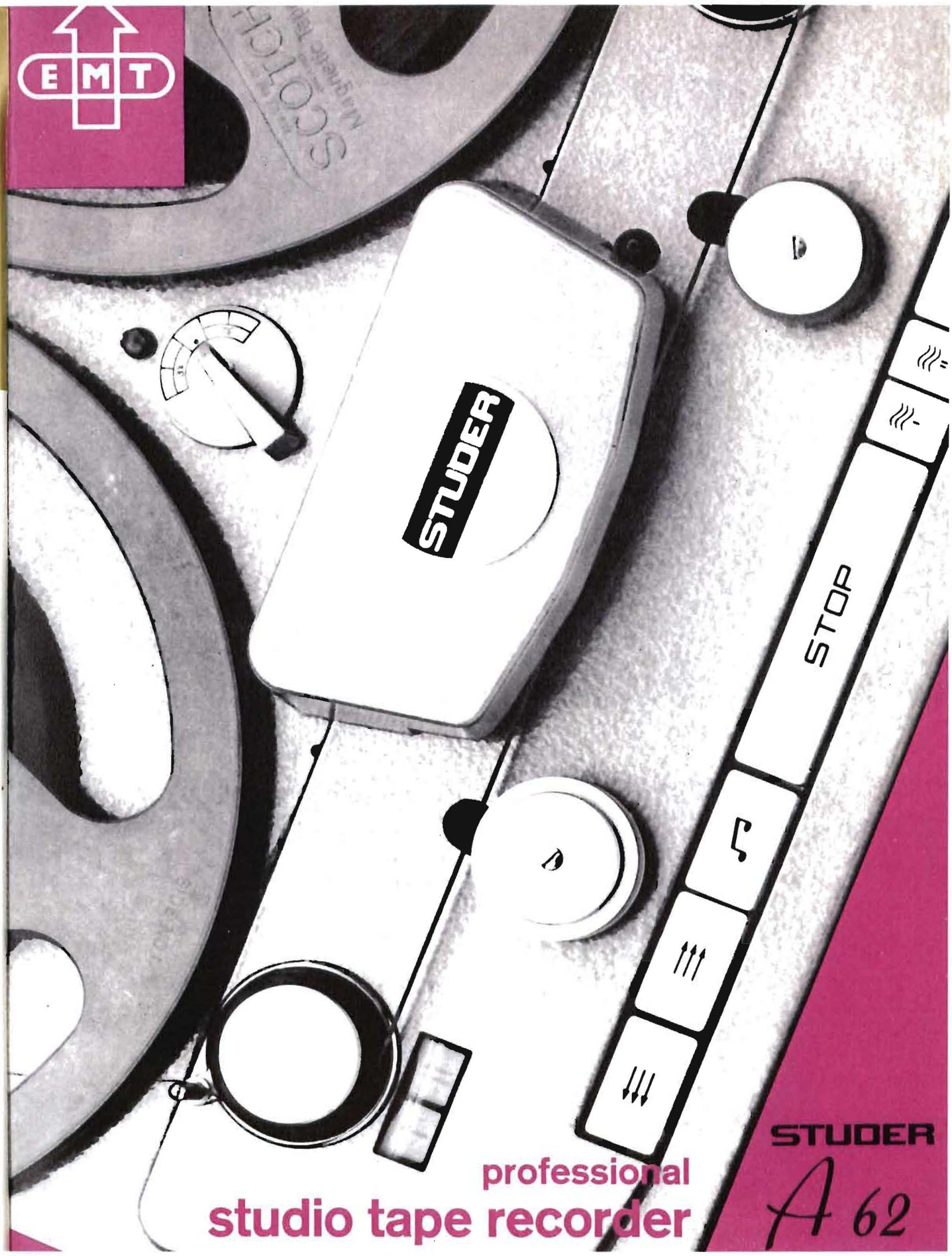
PE-806-3-U



EMT

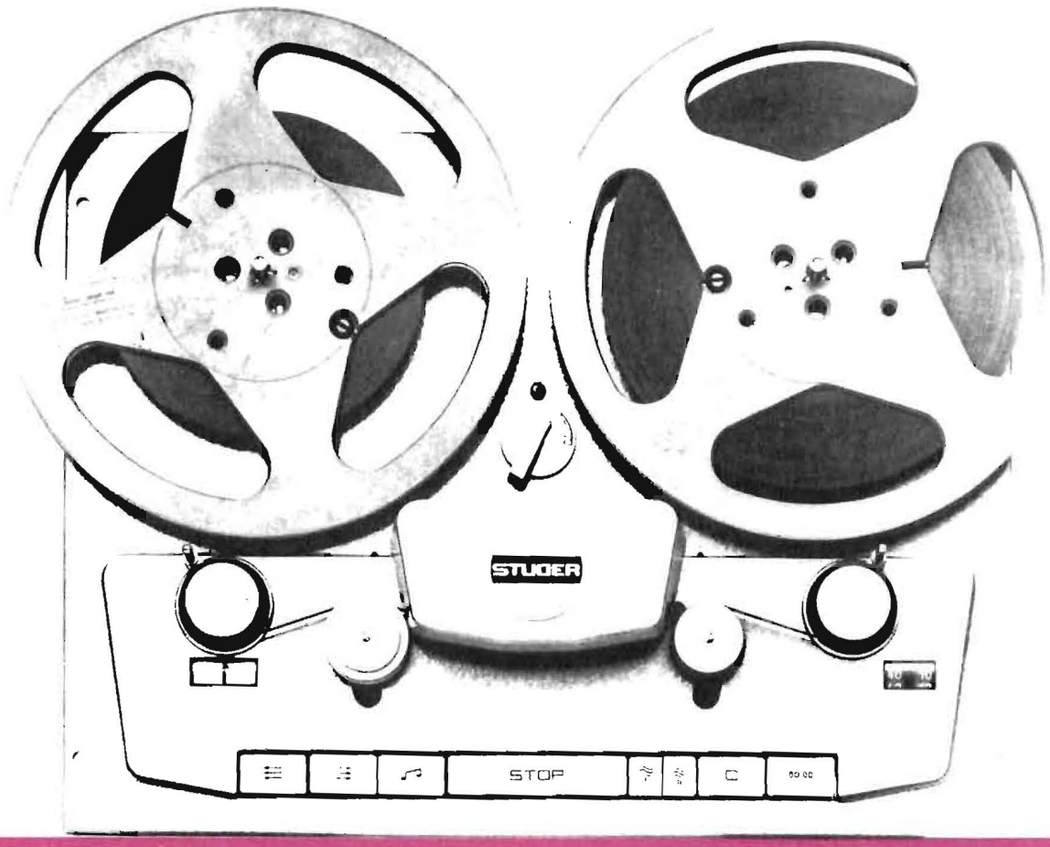
professional

studio tape recorder

STUDER

A 62

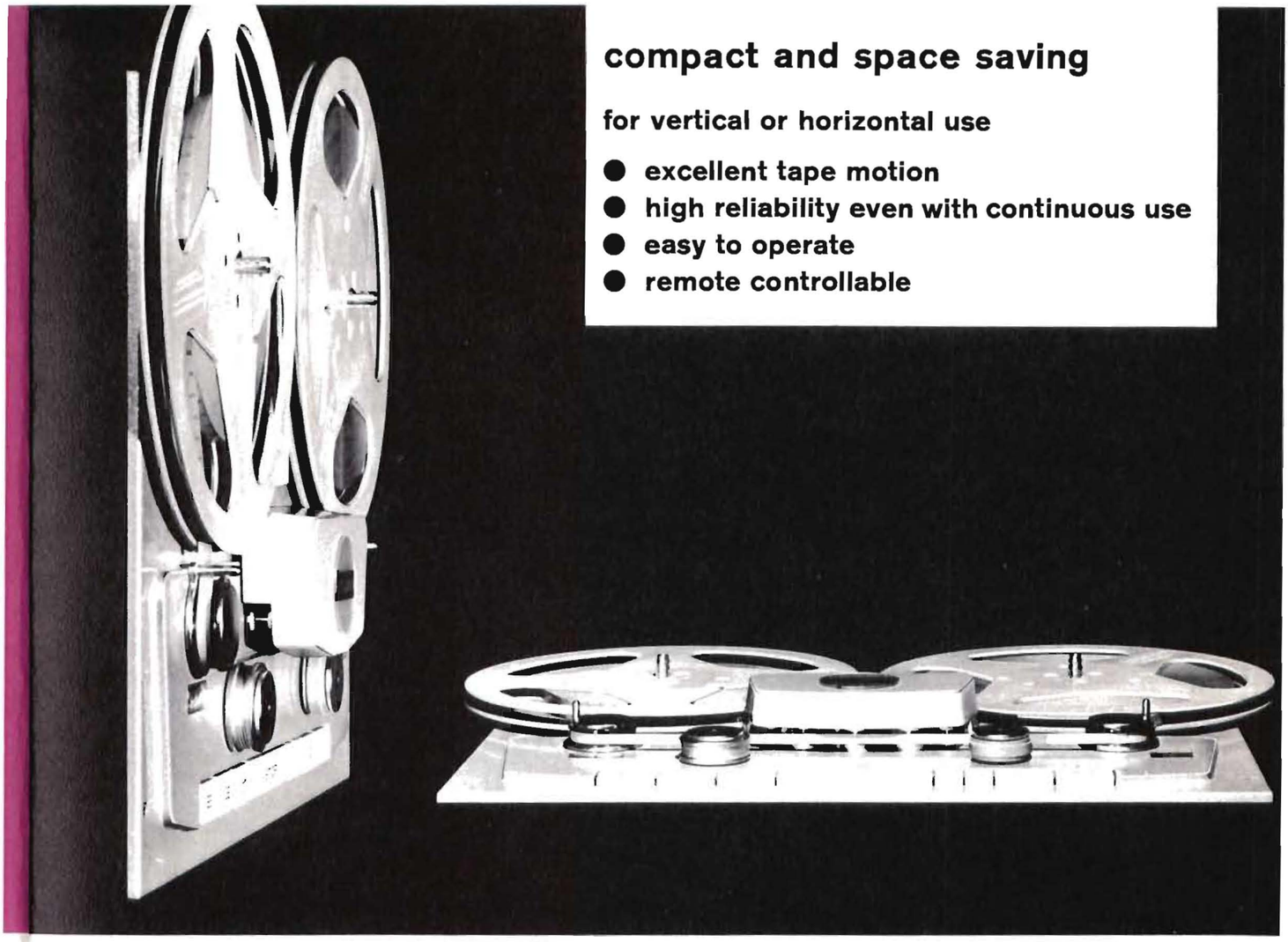
for studio use and sound truck installations



The professional studio tape recorder STUDER *A 62*

. . . is precision Swiss Made and of the highest quality. The modern design technique has rendered it highly compact and robust and therefore easily transportable. The tape tension is kept constant for all tape diameters by means of a newly developed forward regulating servo loop which adjust the hold back reel tension. The forward risis and oscillations. The left hand reeling motor braking tension is controlled as a function of reel rpm without the use of sensing levers or other facilities in contact with either tape or motor (pat. pend.)

All amplifiers and control units are on glass epoxy printed ciruit cards mounted in plug-in cassettes. The head assembly is likewise plug-in construction. This modular construction allows rapid switchover between mono and two track operation as well as easy access for servicing. Two viscous damped tape tension arms provide for smooth tape starts and stops. The left hand tape idler pulley acts as the machine stop in case of tape breakage, using an electronic method without microswitch or sensing arm. All operating modes are relay controlled and therefore remote controllable. The control buttons are conveniently located and require only very slight pressure to operate. The STUDER A–62 is completely self contained in only 14" of rack space and has a maximum power consumption of but 130 Watts. This is an important consideration in field use and broadcasting van installations. The A–62 may be mounted either horizontally or vertically in a standard 19" rack.



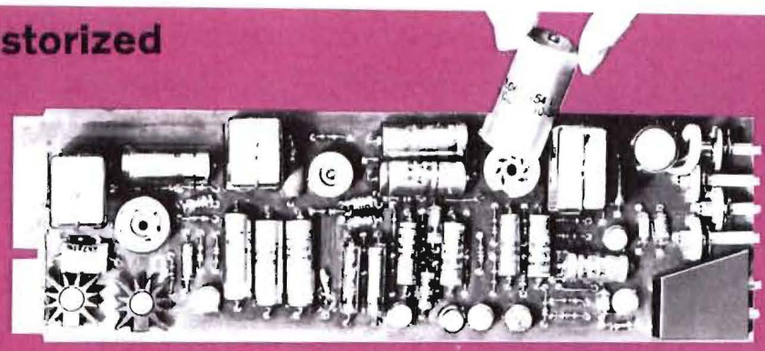
compact and space saving

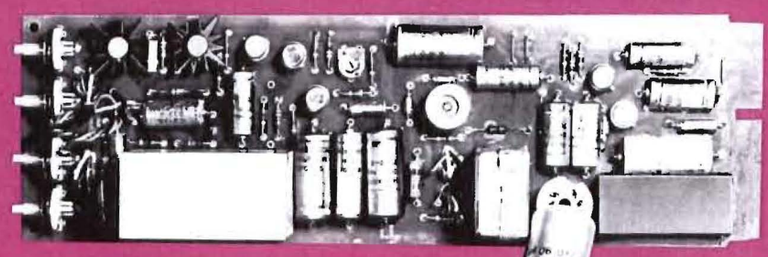
for vertical or horizontal use

- **excellent tape motion**
- **high reliability even with continuous use**
- **easy to operate**
- **remote controllable**

modular construction

fully transistorized





plug-in equalizers for all standards

SPECIFICATIONS

Tape speeds		7½ and 15 ips; the speed change switch also switches the equalization
Maximum reel diameter		10½" NAB standard reels
Frequency response via tape		at 15 ips: 30 Hz – 15 kHz +1 dB, –2 dB at 7½ ips: 40 Hz – 15 kHz +1 dB, –2 dB
Equalization		in accordance with either CCIR or NAB standards

	CCIR	NAB
at 15 ips	35 microsec.	50 microsec.
at 7½ ips	70 microsec.	50 microsec.

Input impedance (30 Hz to 15 kHz)	more than 20 kOhms; balanced & floating
Input sensitivity	Adjustable between 200 mV and 4.4 V (–10 dBm – +15 dBm)
Output impedance (30 Hz to 15 kHz)	less than 50 Ohms balanced & floating
Output level	Adjustable 700 mV to 4.4 V into 200 Ohms or more

Wow & Flutter

	7½ ips	15 ips
measured to DIN 45507: weighted	max. ±0.1 %	max. ±0.05 %
measured to NAB std.-unweighted	max. ±0.1 %	max. ±0.05 %

Signal-to-noise ratio (via tape)

Measured from peak recording level to unweighted noise level using 3M type 201 tape

at 15 ips	66 dB full track	61 dB half or two track
at 7½ ips	64 dB full track	59 dB half or two track

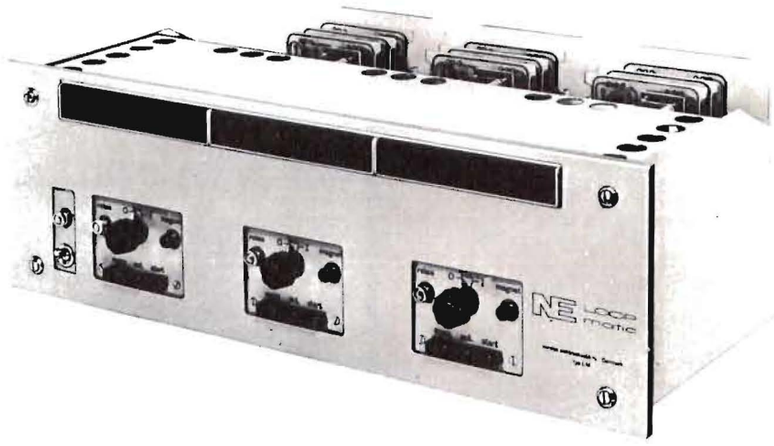
Power required		110, 117, 125, 150, 220, 250 V 50 or 60 Hz as ordered max. 130 Watts two track recording
Dimensions	Rack mount	19" w. x 14" h. x 8.6" behind panel; height above deck: 2"
	Portable	21" w. x 15.5" d. x 13" h. lid closed
Mounting position		horizontal or vertical
Weight	Rack mounting	61.7 lbs. (28 kg)
	Portable	83.8 lbs. (38 kg)

EMT WILHELM FRANZ GMBH

Automatic tape recorder

WITH RAPIDLY INTERCHANGEABLE ENDLESS LOOP STEEL CASSETTES FOR USE IN THE STUDIO AND FOR BROADCASTING PROGRAMME DURATION: 20 SECONDS TO 15 MINUTES

LOOPmatic



The LOOPMATIC cassette tape recorder is specially designed and built for professional use in broadcast, television and film studios. It can be successfully used, wherever certain parts of a programme have to be repeated several times or where it is essential that they should be available instantly and correctly cued. As it can be remote controlled, the machine needs to be prepared only but does not require an operator at the material time.
This is very desirable both for the production of programmes and for the transmission of programmes in many cases and constitutes another step towards automatic programming.

A few practical examples show instances where the LOOPMATIC system has proven to be invaluable:

- For playing signature tunes at the beginning or end of serial programmes.
- For inter al signals or station identification. It will reproduce bells and xylophones clearly and without wow.
- For the occasional reproduction of archive tapes with pre-selection and release from the control desk, e. g. for noise effects, hit tunes, etc.
- For news flashes, weather and road reports and police messages which have to be repeated periodically, in particular if they have to be transmitted at different times over different wave lengths.
- As emergency signal source at the transmitter for bridging gaps in the event of programme failure and for automatic announcements of apology for any breakdowns in transmission (possibly via remote control).
- For transmitting call signs for establishing radio and television transmission lines with automatic switch-over to the tone generator.

The unit is available for mono and stereo operation.

TECHNICAL DATA

Tape speed	7½ i. p. s.
Playing time	min. 20 sec. max. 15 min.
Maximum number of times a tape loop may be played	app. 5000 times
Run-up time until permissible wow and flutter figures are reached	max. .1 sec.
Stopping time	max. .2 sec.
Tape run on	max. 4 cm (1½")
Wow and flutter weighted in accordance with DIN 45 507	
Recorded on studio tape recorder	max. ±.1 %
Recorded and played back on Loopmatic	max. ±.15 %
Frequency response via tape between 40 c/s and 15 kc/s, CCIR equalization (70µs)	+ 1, –2 db
Mains supply	220 V, 50 c/s 30 W per unit
other voltages and frequencies on request	

	MONO (LU 004)	STEREO (LU 005)
Signal to noise ratio via tape referred to + 6 dbm output level and 200 mM on tape:		
Signal to noise ratio (peak)	min. 52 db	min. 50 db
Signal to noise ratio (peak, weighted)	min. 56 db	min. 54 db
Output	balanced	balanced
Output impedance between 40 c/s and 15 kc/s	max. 20 ohms	max. 40 ohms
Level (adjustable .5 – 2 V)	1.55 V (6 dbm)	1.55 V (6 dbm)
Load impedance	min. 200 ohms	min. 600 ohms
Output voltage	max. 6.2 V	max. 6.2 V
Distortion		
Amplifier at 1.55 V (+ 6 dbm) into 600 ohms (40 c/s to 16 kc/s)	max. .2 %	max. .4 %
Via tape at 1 kc/s and 200 mM	2 %	2 %

Remote control facilities:

START-contact (e. g. fader contact)
pilot lamp 'standby' – pilot lamp 'operational'
Connections via three core cable

LOOPmatic

The Loopmatic equipment is in modular construction. The rack-mounting chassis can hold up to three units with tape transport and amplifier cards.

Three basic models are available:

LC 01	Triple chassis for DIN racks with 520 mm panel width. Dimensions 520 x 168 x 330 mm
LC 01–K	as above, but in robust case for portable use.
LC 02	Triple chassis for ASA racks with 19" panel width. Dimensions 480 x 220 x 330 mm

The chassis units are supplied complete with mounting frames and counter plugs.

LC 03	Separate case for bench mounting one loop unit.

The above basic construction can be equipped optionally with the following units:

LU 004	Mono playback
LU 005	Stereo playback
LU 011	Mono record
LU 012	Stereo record (in preparation)

The loop units for stereo record require double width and can therefore only be mounted in the triple chassis together with one playback unit.

Each loop unit contains a capstan drive which is mounted in a rigid cast frame, fibre glass re-inforced plug-in amplifier cards with silicon transistors and the photo-electric automatic start and stop mechanism. All connections are brought out together on one contact strip.

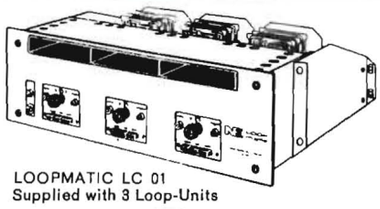
The loop units are easily interchangeable. The operating controls are accessible through a cut-out in the front panel.

LOOP CASSETTES

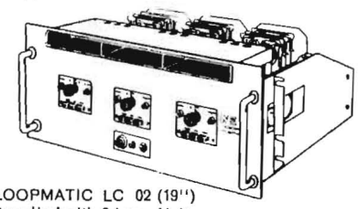
The studio quality of the LOOPMATIC could only be achieved by means of a special construction of the cassettes. Each cassette has its own rubber pressure roller so that only the lubricant of its own tape is deposited on the rubber wheel. The steel construction and the simple robust design render these cassettes very reliable in operation. The cassettes can be supplied for playing times of

30 sec., 1 min., 3 min., 9 min., 15 min.

Tapes of different lengths of pre-recorded tapes can be loaded into the cassettes without any special difficulties. However, only specially lubricated tape should be used.



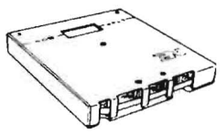
LOOPMATIC LC 01
Supplied with 3 Loop-Units



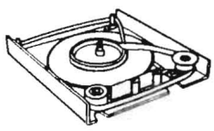
LOOPMATIC LC 02 (19")
Supplied with 3 Loop-Units

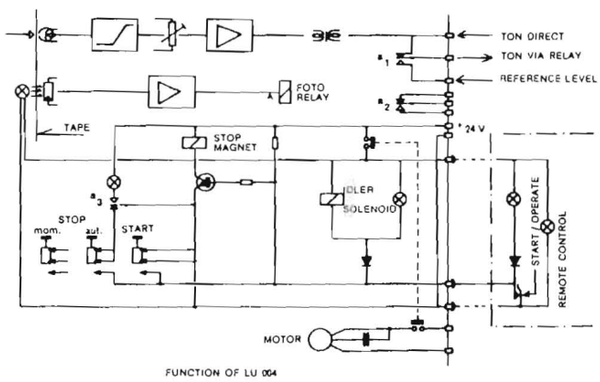
LOOP-BENCH-MODEL LC 06
Supplied with 1 Loop-Unit

LOOP-UNIT



LOOP-CASSETTE





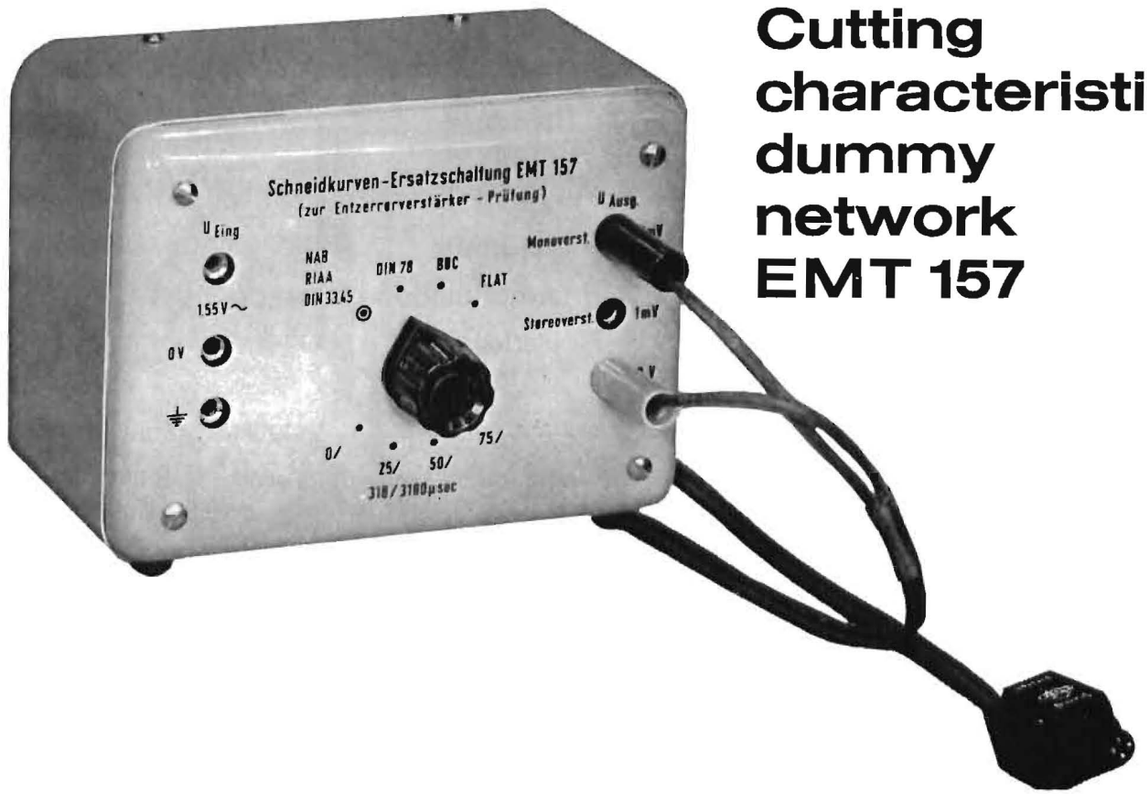
FUNCTION OF LU 004

EMT WILHELM FRANZ GMBH

SEMINARSTR. 92 · CH 5430 WETTINGEN (AG) SWITZERLAND · PHONE: BADEN-(056) 60550 · CABLES: EMTFRANZWETTINGEN · TELEX: 53682

Print No. PE 806 - 2 - Pe
Printed in Germany

This unit enables disc playback amplifiers to be tested very quickly, conveniently and accurately.

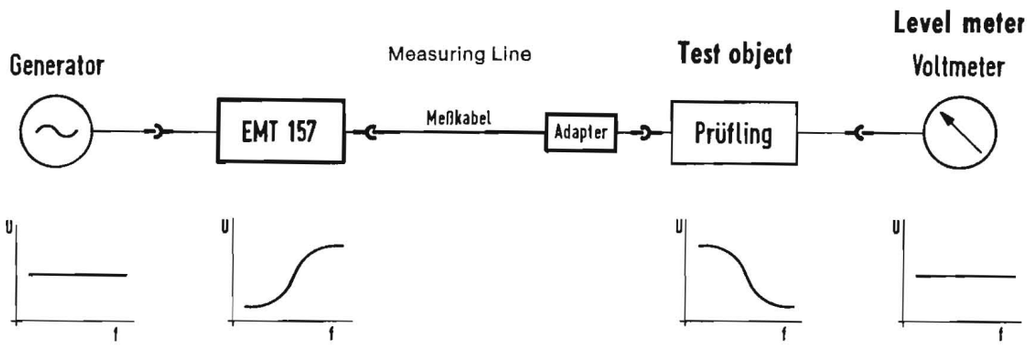


Cutting characteristic dummy network EMT 157

- No test records
- Amplifier can stay in turntable
- Equalizer characteristics are not necessary
- No complicated dB-calculations. Minimum of errors.

04-20-Pe

Function



With a constant input voltage this unit produces an output voltage which varies with frequency in the same way as the output of a pick-up cartridge from a frequency test record. It thereby simulates the cutting characteristic of a disc.

The following measurements are very simplified by the Cutting characteristic dummy network EMT 157:

Frequency response
Harmonic distortion
Cross - talk
Phase shifts
Intermodulation distortion
Noise level

IMPROVED ACCURACY AND RELIABILITY IN OPERATION

As the generator output is kept constant, all attenuator and setting errors are eliminated. Deviations in frequency are of minor consequence and scale errors in the voltmeter on the output no longer matter as the reading remains virtually constant.

The whole transmission chain from the pick-up head connections to the output of the equalizer amplifier is included in the measurement. The possibilities of calculating errors in dB and other mistakes like overdriving the amplifier are reduced to a minimum.

CONSIDERABLE TIME SAVING IN MEASUREMENTS

The input level is set up once and for all for the entire measurement and the tedious 'point by point' measurement is dispensed with.

A very good idea of the performance of an amplifier can be obtained by sweeping the generator once through the frequency range. Deviations from a given reference value can be read off directly. No comparison with the calculated curve is necessary.

The EMT 157 can be connected very easily by means of an adapter in lieu of the pick-up cartridge. The amplifiers can therefore remain in the turntable.

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801-2-PE-U

EMT 205
Track Indicator

People who daily handle recorded tapes are aware of the problems which arise through variations in track position. Different tape recorders vary because of different national standards and particular designs. Furthermore, there are different forms of operation such as mono, stereo, two- and more channel recording and there are, of course, possibilities of errors due to faulty adjustment or wear on the record heads.

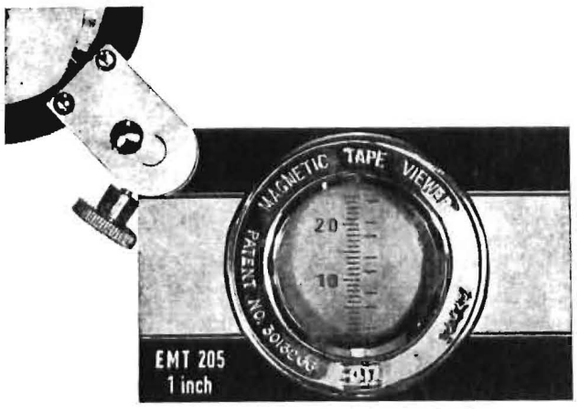
In this confusing situation, the operator is always faced with the question: does the position of the recorded track on the tape correspond with the position of the playback head? Even a slight discrepancy in the track position can have a noticeable effect on the quality of reproduction.

The EMT Track Indicator enables this problem to be solved quickly and reliably. It enables one to see the position of the recorded track directly.

One method to make the magnetic field of a ferro-magnetic substance indirectly visible is the well-known experiment with iron filings, which will align to the magnetic field lines of a strong magnet. The information stored on magnetic tapes, however, produces only a very weak remanent flux and consequently only microscopically small iron particles will align to it. The 3-M Company's Tape Viewer* uses such fine ferro-magnetic particles which can move freely in the space between a glass plate and a thin, anti-magnetic metallic base plate. The base plate of the Tape Viewer* is placed on the emulsion side of the tape. Through gentle tapping, the particles will align with the magnetic field of the tape.

The Track Indicator EMT 205 (fig.), in conjunction with the tape viewer*, enables the dimensions of the recording to be checked accurately and even measured. The EMT Track Indicator is at present available with 1/4" or 1" grooves for tapes with these standard widths.

At the base of this groove, a reference tape is fixed. This tape has magnetic marking lines to show the track position and in the case of the 1" version it is also equipped with a millimetre scale (fig).



If the tape to be tested is laid in the groove and the Tape Viewer* placed on top of it, the recorded signal of this tape and the magnetic markings in the reference tape both become visible. The groove, of course, holds the tape accurately in position.

To facilitate accurate readings, a magnifying glass with adjustable height is fixed to the track indicator. The track position can be checked very conveniently against the positioning lines and the width of the track can be measured by means of the scale. Any error in the height or track width of the record head can be seen easily, and the effects of magnetised components in the tape path or an erased track (in the case of a multi-track recording) become immediately obvious.

The process is simple and reliable as it enables one to verify the track position "with one's own eyes".

* The Tape Viewer No. 600 of the 3-M Company is NOT supp lied with the EMT 205 and can only be obtained from the MINNESOTA MINING & MANUFACTURING CO. LTD.

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PE-805-1-U

EMT 420 A
Wow and flutter meter

In accordance with DIN 45507

Octave filter
EMT 421A

EMT 420 A

For the measurement of wow and flutter on record players, tape recorders and film transport mechanisms, and frequency intermodulation distortion in record reproduction.

Frequency fluctuations — in sound engineering, generally referred to as 'wow and flutter' — are a trouble associated with all sound recording and reproducing machines. They are heard as whining (wow) or as a rough quality in the sound (flutter). They are caused by mechanical faults in the drive mechanism. With careful design, and at a price, they can be kept sufficiently low for the purpose but they can never be eradicated completely. The wow and flutter component is therefore one of the measures of the quality of a drive mechanism.

The wow and flutter meter EMT 420 A enables even the smallest frequency fluctuations which occur with high quality professional equipment to be measured accurately. The measurement is weighted in accordance with the subjective disturbance value in accordance with the generally valid weighting curve which is laid down in DIN 45 507 and in the OIRT recommendations. The instrument can also be switched to read linear (unweighted).
Built-in tone generator for recording the test frequency. Provisions for connecting high speed pen recorder.

The octave filter EMT 421 A is a band pass filter with six switchable pass bands and very steep cut-off and may be connected to the EMT 420 A. It enables the component frequencies of the wow and flutter to be filtered out separately. In this way it is possible to ascertain which part in the drive mechanism is causing the trouble.

Geometrical pick-up distortions are one of the worst problems in record reproduction. A measure of these distortions is the so-called frequency intermodulation factor (FIM). As these distortions are due to phase modulation, they represent a form of frequency modulation and they can therefore be measured very conveniently by means of the wow and flutter meter EMT 420 A. The test record DIN 45 542 provides the frequency pair 3 kc/s + 300 c/s for such measurements whereby the 3 kc/s signal will be more or less phase modulated with 300 c/s depending on the quality of the pick-up system. The centre frequency of the discriminator in the EMT 420 A can be switched to 3 kc/s by pressing a button.

● **For the manufacturer: Production testing** ● **In the studio: Regular testing of all drive mechanisms**

TECHNICAL DATA EMT 420 A

Test tone oscillator output	3150 c/s
a. output voltage	app. .775 V
source impedance	300 ohms
b. output voltage	app. 50 mV
source impedance	200 ohms
Measuring input for test tone, switchable	3150 c/s / 3000 c/s
Tuning of the discriminator frequency for variations in test tone frequency	± 3 %
a. input voltage	.1 — 1 V
input impedance	300 k-ohm
b. input voltage	30—300 mV
input impedance	30 k-ohms
Measuring range, switchable	± .1/.3/1/3/10 %
additional range	± .03 %
Reading of wow and flutter	± %-peak reading
Frequency response of the wow and flutter indication switchable to	
a. weighted in accordance with DIN 45 507	Peak at 4 c/s, cut-off above at app. 6 db/octave below at app. 10 db/octave
b. linear (—3 db)	.5 . . . 300 c/s above that 15 db/octave cut-off.
c. via external filter matching impedance	app. 6000 ohms
Slip measurement in the frequency range	± % frequency deviation 0 . . . .2 c/s
Calibrating controls	input voltage frequency deviation centre frequency peak reading
Connections for pen recorder or oscilloscope in the range	0 . . . 200 c/s
output voltage	app. 3 or 6 V peak to peak.
load resistance	greater than 100 k-ohm
AC mains	
50 or 60 c/s	110-117-125-220-240 V
power consumption	app. 80 VA
Dimensions of the front panel (B 7) — (also suitable for rack mounting)	270 x 375 mm
unit in housing	312 x 415 x 245 mm
Weight in housing	app. 16.5 kg (35 lbs)

TECHNICAL DATA EMT 421 A

Band pass filter EMT 421 A with six switchable octave pass bands particularly suitable for analysing the frequency components in wow and flutter. (This unit is not part of the EMT 420 A and must be ordered separately).

Octave pass bands, switchable	cut-off frequencies 5 . . . 10 c/s 10 . . . 20 c/s 20 . . . 40 c/s 40 . . . 80 c/s 80 . . . 160 c/s 160 . . . 320 c/s
Insertion loss in the middle of the pass band, referred to linear response in the EMT 420 A	0 db
Attenuation at the cut-off frequencies	app. 3 db
Slope of attentuation referred to centre frequency	app. 18 db/octave
Input matching	app. 6000 ohms } contained
Output matching	app. 6000 ohms } in filter
Dimensions:	
front panel (complements EMT 420 A to size A 7)	270 x 115 mm
unit in housing	312 x 140 x 240 mm
Weight in housing	app. 8.8 kg (20 lbs)

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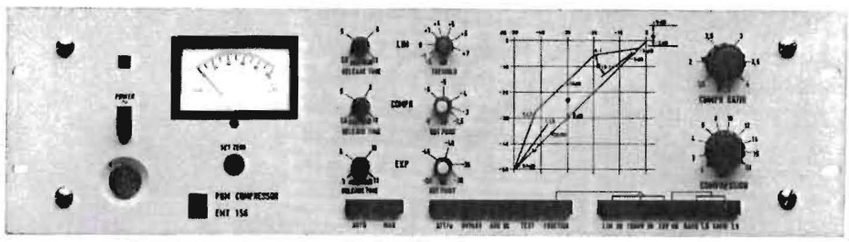
PDM-COMPRESSOR EMT 156

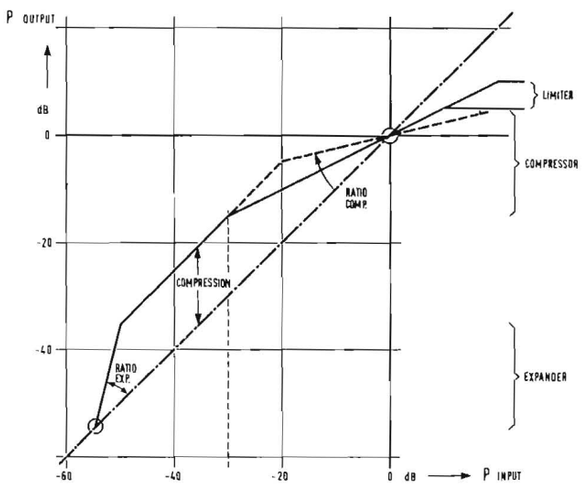


The pulse-duration-modulation (PDM) which is used in the compressor EMT 156 is a new method in this field. It provides an elegant technical solution to the problem of controlling the compressor characteristics. The PDM compressor EMT 156 is therefore particularly adoptable to the varying demonds in practical operation. It can according to requirements work as compressor, limiter or a combination of the two. The range of possible variations of its characteristics in the three above mentioned functions is shown in the diagram 'stotic chorac-teristics'.

Furthermore, the recovery time can be made short, long or o function of the programme material. A further speciol feature of the PDM compressor is that it avoids the usual rise in background hiss during signal pouses

FUNCTIONS	VARIABLE CHARACTERISTICS
Limiter	Limiting threshold
Compressor	Threshold of compression Compression ratio Compression Expansion threshold for low levels Expansion ratio for low levels
Limiter and compressor	As under limiter and compressor
External control	The gain becomes a function of an external DC voltage

0 db gain amplifier



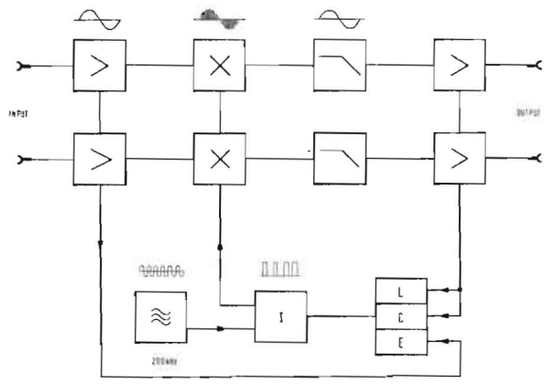
TYPICAL APPLICATIONS

LIMITER:
Protection of AM-transmitters and to achieve a higher average modulation of the transmitter during news bulletins (Range). In general with speech to prevent transient overload.
Special effects in radio plays and for protecting lines and amplifier systems.

COMPRESSOR:
Equal and simultaneous compression and limitation of both channels in stereo systems.
For archieving a 'dense' sound in particular with dance music. Far increasing the range of AM-transmitters and for compensating tone sources with different apparent loudness for special effects.

PRINCIPLE OF OPERATION

The input signal goes via a pre-amplifier to a modulator X where it is cut up by means of a 200 kc/s square wave with variable mark-space ratio. The subsequent low-pass (integrator) re-assembles the signal into its original shape. But its level is now a function of the mark-space ratio of the control signal, in other words it depends on whether the multiplier was cutting wide or narrow sections aut of it. The control signal is derived from the output via a logarithmic amplifier and after rectification the time constants are formed as well as the functions: Limiting, Compression, and Expansions. The DC-voltage corresponding to these functions now controls the mark-space ratio in the information unit J (pulse-duration-modulation) of the 200 kc/s pulse signal which cuts the input signal up in the modulatar as described above.



VERSIONS

19" rack mounting (ASA) with one audio amplifier system mono, with twa audio amplifier systems stereo.

PROVISIONAL TECHNICAL DATA

Input	
Level	+6 db
Impedance	10 k-ohm
Output	
Level	+6/+12/+18 db
Impedance	37.5/150/600 ohms
Limiter	
Threshold	adjustable from +4 . . . +12 dbm
Attack time for 10 db over modulation	app. 50 μs
Overload margin on input	+20 dbm

Compressor	
Compression	adjustable from 0 . . . 20 db
Compression ratio	adjustable from 1:1 . . . 1:3
Attack time	app. 3 ms
Recovery time	short, long or automatic
Amplifier	
Frequency response, 30 c/s . . . 15 kc/s	± 1 db
Distortion at 1 kc/s in static condition	max. .5 %
Gain control through external voltage	0 . . . . —30 db
Suppression af the of the 200 kc/s carrier	min. 70 db
Dimensions	483 x 133 x 310 mm deep

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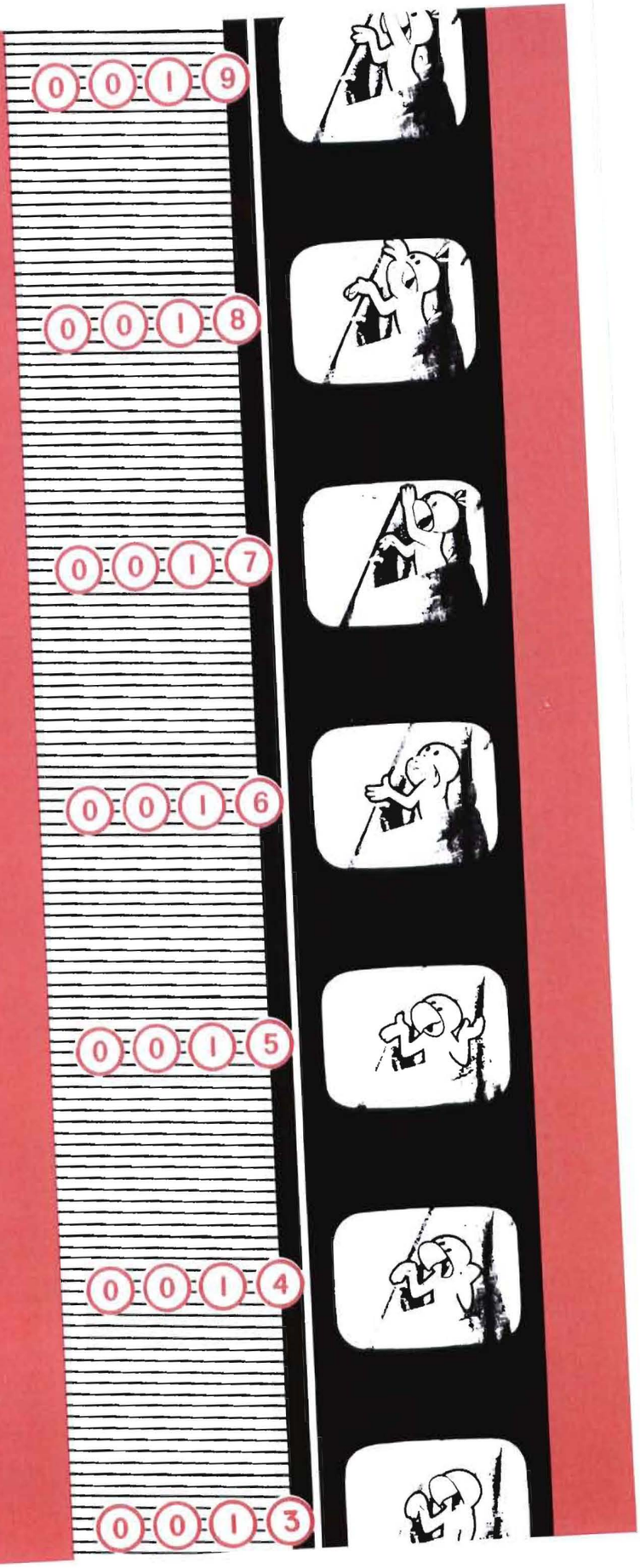

EMT 400

TIME AND FRAME CODER SYSTEM

for magnetic
video and sound recording

THE TAFCO-SYSTEM EMT 400 CAN

EITHER

put time pulses in minutes and seconds onto video tapes or sound recordings. This recorded time scale not only provides a digital indication of the running time but can furthermore trigger any time dependent operation during the transmission. The TAFCO system EMT 400 therefore offers a variety of interesting applications in programming and forms an ideal basis for the automatic operation of broadcasting stations.

OR

allocate a four digit number to each full frame thus enabling the location of video and audio accurately at any stage. This permits cuts, cross fades, dropping in of sound effects, etc. to be carried out quickly and accurately. The TAFCO system can save a great deal of routine work in the production department and enables the preparation of news and current affairs programs in the short time available without difficulty. It makes the technical work in the production of television programs simpler and more accurate and permits work on takes with the same single frame accuracy as is possible with film.

In the last few years video tape recording has not only reached the quality of film as intermediate storage but has surpassed it by virtue of its practical advantages. Greater clarity, the absence of shake and even gradation are points in favor of the "magnetic picture". The immediate availability of the recording and the possibilities of making camera corrections and cuts during the recording are decisive advantages which have become indispensible in television production. With all these advantages, however, one basic fault of the VTR process cannot be overlooked: the recorded picture and its physical limits are not directly visible when the tape is not running. This is the cause of considerable difficulties and inaccuracies in the inevitable editing of video recordings which do not arise with film.

In anticipation of these problems, two auxiliary tracks were provided for in the original track lay-out for video tapes: the control track which records electrical perforations equivalent to film perforations and marks the interval between frames, and the cue track which can record information for the editor. While the recording of the video and control tracks is laid down by rigid international standards (European and U.S. standards) to insure interchangeability, every television station is free whether or how to use the cue track. Consequently there is a wide range of ideas regarding the use of this cue track and a variety of practical methods for editing, which range from simple marks with a china-marker (in such cases the cue track is often used as an additional sound track) and the recording of pulses, to the recording of numbers. These methods appear crude and simple although they are really based on usage and experience. Upon critical examination they prove cumbersome, inaccurate and time wasting and they are scarcely adequate for meeting modern production requirements.

The TAFCO system uses absolutely reliable coded four digit numbers which are recorded on the cue track and which can either be allocated to the individual frames or mark a time scale with the accuracy of a master clock on the final tape. The digital process and the use of semi-conductors make this system as accurate and reliable as an electronic computer.

And this is how the TAFCO system works

In conjunction with existing video and audio recording systems:

During the recording, four digit figures are recorded in coded form on the cue track of the video tape or on the pilot tone (sync) track of an ordinary tape – either as 8756th individual frame numbers (i.e. 8756th frame of a take) or as a time indication (i.e. 36 min 48 sec in the case of edited tape for transmission in the "record cue only" mode of operation). Special markers can be recorded additionally as cue marks or for initiating switching operations.

During playback the recorded numbers are decoded and shown on the indicator units EMT 403 and 404 in digital form. The coder can be synchronized with the vertical sync pulse. The accuracy of the time indications therefore corresponds with that of a master clock.

There is a variety of ways in which the frame numbers or time markings may be used: from the monitoring of the transmission time to the automatic initiation of processes at certain times of frame numbers which can be pre-selected in a memory.

These processes may be for production purposes, such as the automatic and fully synchronous dropping in of effects, video dubbing and electronic editing, or they may have to do with the running of the program, such as advanced warning systems, automatic fading to slide projectors, starting and stopping of telecine projectors, etc.

All that is necessary, therefore, is to connect the TAFCO system to the cue input and output of any VTR.

Modifications to the video and sound channels of existing systems are not necessary for the operation of the TAFCO system, since only DC control lines have to be connected.

The control elements can be placed in a central position or wherever is most suitable for the particular application. The operation of the TAFCO system consists merely of pressing the "programming" buttons, and the control of the program then takes place more or less automatically. Operating errors are virtually eliminated through the use of interlocking relay connections.

The read-out panels EMT 404 are installed in all places within the broadcasting system from which the elapsed time of the program is to be monitored.

The TAFCO system consists of the following units:

EMT 401 The coder which generates the frame counting and clock pulses and codes them for recording on tape.

EMT 402 The decoder which decodes these pulses and operates the digital indicator. The decoder also incorporates a memory for storing important numbers (for example cuts), and coincidence circuits for triggering control functions.

EMT 403 The indicator unit with four digit read-out for the pre-selection memory and a second four digit read-out for the running numbers.

EMT 404 The remote indicator unit with four digit indication of the running numbers.

EMT 405 The control unit for selecting the various program functions.

The coder and decoder use standard studio levels (such as +6 dbm) and impedances (10 kOhm input and max. 20 Ohm output, both balanced).

In the basic version the TAFCO system can be supplied without the coder EMT 401. This enables operational experience to be gained with the combination of the TAFCO system and the particular television installation and to decide on the final version that will be most suitable.

In this basic version of the system the coded numbers for frame numbering or timing are supplied by a pilot tone controlled sync tape recorder thus enabling simple operation without the "number generator", the coder EMT 401.

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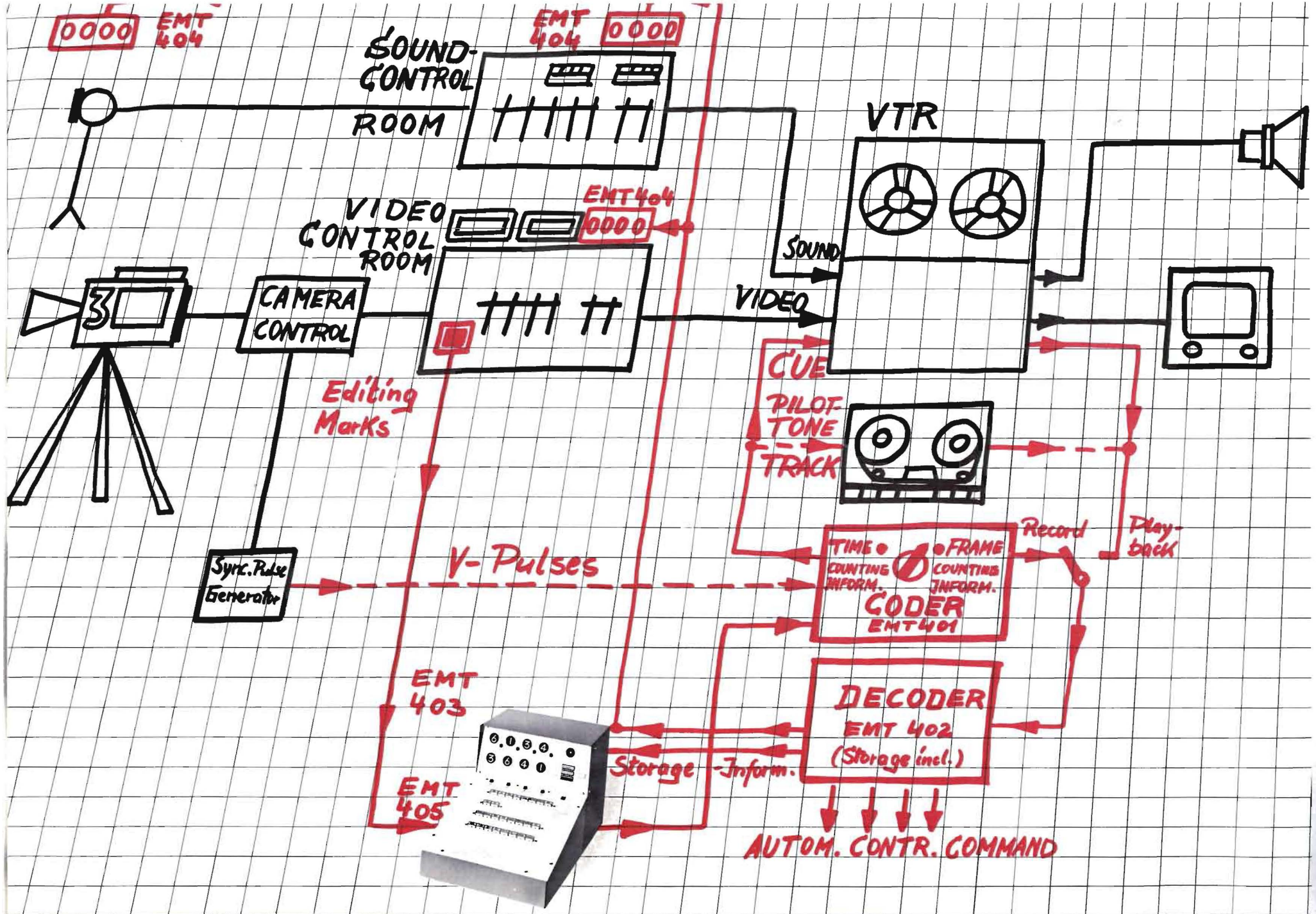


Applications of the TAFCO system EMT 400

The possible applications of the TAFCO system EMT 400 are as manifold as the methods of television production and programming. The producers' ability to clearly mark certain scenes, cuts, camera changes or even unforseen climaxes in unscripted recordings during the recording, allows the subsequent editing of the recorded materials to be speeded up considerably. The TAFCO system EMT 400 can therefore be used with particular advantage for the production of sports programs, where there is considerable time pressure between recording and transmission.
The TAFCO system in conjunction with the SepMag process (sound recording on separate pilot tone synchronised tape recorder) enables a "hard" cut previously unobtainable. In such a case the video as well as the sound tape contain the coded numbers, so that the audio can be dubbed to the sound track of the video tape after editing automatically, simply by electronically adding the known constant start, stop and head displacement times of the machines involved.

Some examples of the application of the individual frame numbering:

VTR recording of television plays with subsequent sound and video editing in dual system.

Marking of camera takes during a VTR recording.

For determining the frame number corresponding to a certain passage in the sound. For dropping in a non-synchronous effect such as a shot, bang or other noise from the sound effects library.

Automatic sync start of an edited ¼ inch recording.

Automatic location of a cut or splice with corresponding frame number.

Edit free continuation of an interrupted recording.

For previewing the overlap of two video tapes before splicing.

Some examples of the application of time marks:

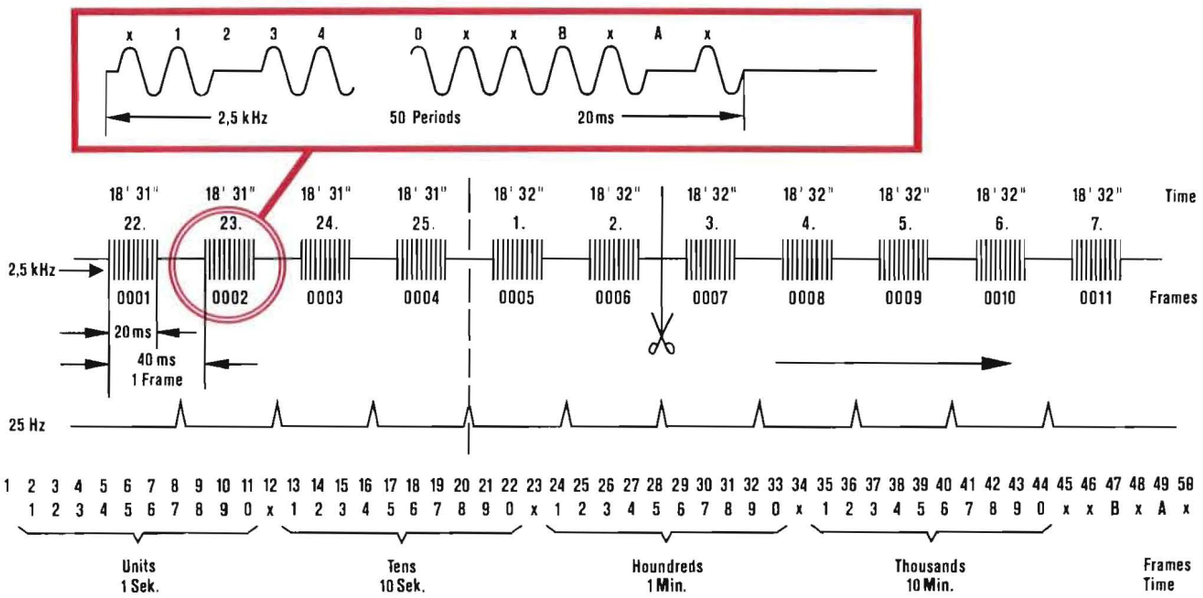
VTR recording for transmission without intervening editing such as pre-recording of a quiz program with live audience, interviews, etc.).
Broadcast using automatic cueing of selected excerpts located during fast forward wind (i.e. for current events).
Determination of timings for subsequent music scoring (exact total time, and accurate location of special cues where the incidental music must sync exactly with the picture).
Upon final approval of a production: subsequent recording of the running time on the video tape (cue record only).
Automatic programming of transmitters (automatic start and stop of magnetic video recordings, telecine projectors, video slide projectors, automatic fades, etc.) by means of previously stored time figures.
In film production it is possible to record the coded numbers on a magnetic edge track.
Subsequent synchronisation of a VTR production in another language.

The Vid-E-Dit video tape cutting and splicing unit (see separate brochure) is equipped with a rotating head for scanning the coded numbers on the cue track so that the frame number can be checked with absolute accuracy on the oscilloscope of the Vid-E-Dit before cutting.
The TAFCO system also provides a variety of possibilities in the field of sound recording such as automatic programming, running time control on tape or cues for radio dramatic productions.

Principle of Operation

The diagram shows the form in which the coded numbers are recorded on the magnetic tape. To each full frame (duration 40 ms) corresponds a tone burst (duration 20 ms) of 50 cycles at 2.5 kHz. The position in each group of ten cycles where one cycle is blanked, corresponds to the number in question. The first four groups of ten cycles which are separated from each other by one full cycle, form the four digit number. The cycles number 47 and 49 can carry special markers. Up to 9,999 full frames can be numbered. This corresponds to a take of nearly seven minutes. The running time of the electric clock of 99 minutes, 59 seconds, is sufficient for a standard reel of VTR tape.

For individual frame numbering, the blanked cycle jumps every complete frame (i. e. every 40 ms) to the next number. For timing on the other hand the same number is recorded for 25 successive frames and only then – after a full second – does the number change. Furthermore the minute digit advances, of course, only after the "59" position of the second digits.
If the coded signal is passed through a low pass filter the fundamental frequency of 25 Hz is obtained, which may be used, after frequency doubling, as a pilot tone sync signal for a simultaneously running tape recorder.



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PE 803 - 3 - Pe
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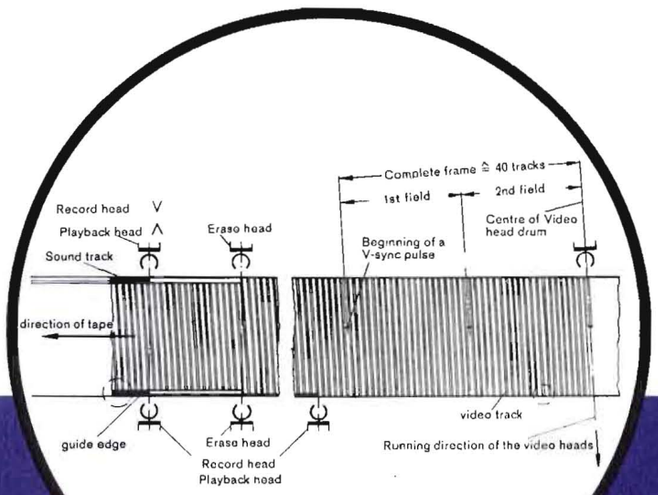
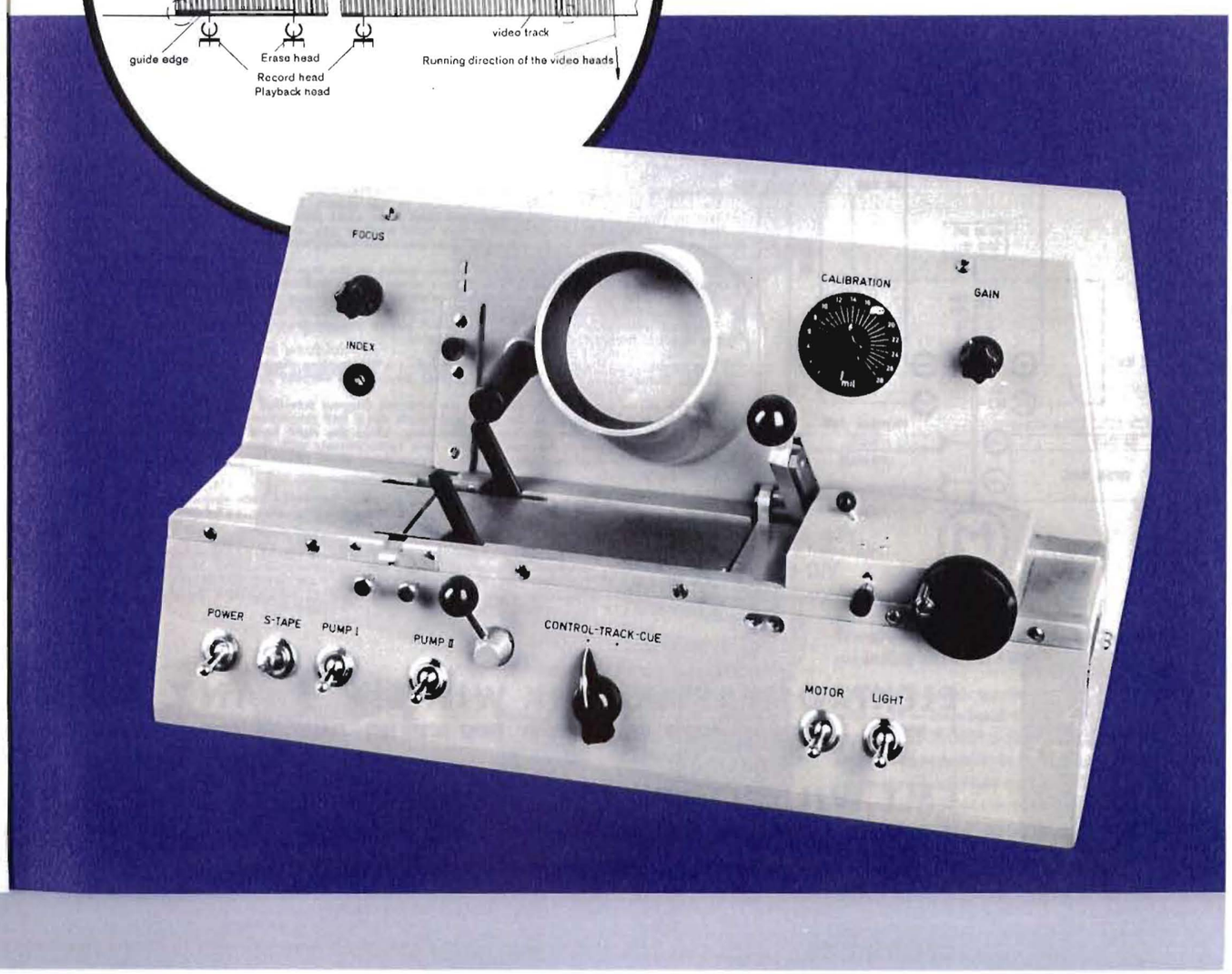
VID-E-DIT

For the accurate cutting and splicing of video tapes.





The VID-E-DIT

considerably facilitates the heretofore cumbersome task of VTR editing.

The VID-E-DIT

effects major time savings in the editing process.

The VID-E-DIT

determines the cutting point electronically thereby assuring that the splice will fall accurately into the blanking area between adjacent frames.

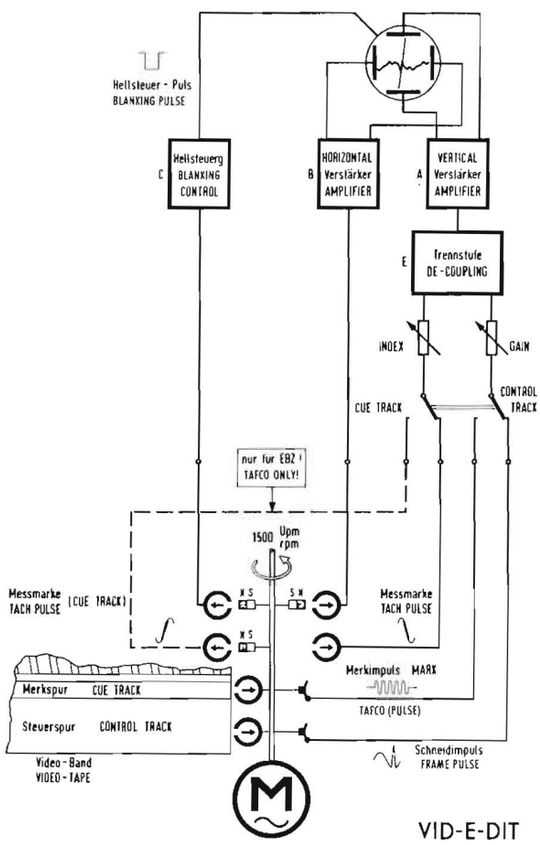
The VID-E-DIT

produces completely interference free permanent splices.

The VID-E-DIT is a precision piece of equipment for the editing of video tapes. The unit enables the following three operating processes:

1. The searching for and accurate locating of the desired cutting point. This is achieved by scanning the cue and frame pulses which are recorded on the CUE and CONTROL tracks, and displaying them on a cathode ray screen.
2. The cutting of the tape which is securely held in a precision guide groove, using a rigid guillotine type blade.
3. The splicing of the two tape ends using standard VTR splicing tape dispensed from a built in container. For this purpose the two tape ends are held securely to the bed by means of suction. The splice point may be illuminated from either below or above as required. Two special knives trim the splicing tape ends in line with the tape edge.

A calibrating control permits adjustment of the relative distance between edit pulse and video track to allow for those VTR's which do not conform to the SMPTE location standard for edit pulses. This calibration control is marked in mils (0.001"). Precision adjustments may also be made in the tape bed width and the knife angle. This brochure lists the 50 Hz VTR standard dimensions and frequencies. The VID-E-DIT may also be ordered conforming to the 60 Hz SMPTE standard.



VID-E-DIT
Operation

Operation

The control or cue track of the video tape placed in the bed of the VID-E-DIT may be scanned by means of two magnetic heads mounted on the circumference of a drum. This drum is driven by a synchronous 4-pole motor on which are also mounted three permanent magnets. This assures that no phase angle error between the heads and the magnets will be produced regardless of the motors rotational speed. The shaft speed at 50 Hz power line is 1500 and at 60 Hz 1800 rpm.

A video tape control track carries a 250 Hz sine wave signal on which an editing pulse is superimposed every full frame. At 25 frames per second, every tenth sine wave peak is therefore interrupted by an editing or frame pulse. In spite of its high degree of distortion caused by recording without bias, this frame pulse can be clearly recognized due to the magnifying effect of the VID-E-DIT system.

A slight wrap of the tape around the scanning drum produces a scanning length of about 3 mm. One cycle of the 250 Hz control frequency has a length of 1.6 mm at 15 ips tape speed; therefore two complete cycles are visible at any one time on the oscilloscope screen. A crank mechanism permits the tape to be transported past the scanning drum until the frame pulse becomes visible on the screen.

The cue pulses which are recorded on the CUE TRACK (generally tone pulses) are scanned by means of a second drum head. The cue pulses are recorded by the producer for marking the cutting point. A track selector switch enables the cue track or the control track to be selected. Both signals can be adjusted by means of the „GAIN" control to the optimum height on the screen.

The rotating permanent magnets induce a sinusoidal voltage in ordinary magnetic playback heads mounted in close proximity to the motor. The voltages obtained from the two heads shown near the bottom of the adjacent diagram are used as tach pulses. The head on the right delivers the tach pulse in conjunction with the control track scan, while the one on the left is associated with the cue track or the TAFCO pulses. This latter head is only supplied if the VID-E-DIT is to be used in conjunction with the individual Time and frame coding system TAFCO EMT 400.

The rotating heads which scan the magnetic tracks on the tape are 180° out of phase relative to the corresponding fixed heads. The signals which are scanned from the tape and the tach pulses therefore alternate. The sinusoidal tach pulse is so much larger than the screen of the oscilloscope that only the central portion of the curve is visible which appears as a steep straight line. The track selector switch feeds the relevant pulses through the „INDEX" control which enables the slope of the tach mark shown to be adjusted.

The control track or cue track signal is mixed in a de-coupling stage with the corresponding tach pulse. These two signals suitably amplified provide the vertical deflection of the cathode ray.

The two permanent magnets shown in the adjacent diagram mounted most distant from the drive motor M, induce a pulse in the two fixed heads every half revolution. The voltage from the left hand head controls the oscilloscope blanking, while the right hand head provides horizontal deflection. In this way the oscilloscope runs synchronously with the scanning drum regardless of any possible rotational inaccuracies – something which power line blanking and deflection would not guaranty.

The oscilloscope beam is therefore deflected and blanked twice each revolution of the motor shaft. As a result the tape scan image and the tach pulse image alternate with a frequency of 25 Hz.

The knob marked „Calibration" permits the right hand pickup head (it provides the tach pulse) to be mechanically displaced in an angular sense. Result is the horizontal displacement of the tach pulse on the screen. A frame pulse which had been previously aligned to coincide with the tach pulse would therefore have to be re-positioned by transporting the tape using the crank mechanism. This effectively alters the knife-to-frame-pulse distance and therefore allows for correction of VTR head assemblies which deviate from the standard.

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EMT WILHELM FRANZ GMBH

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PRINT NO.
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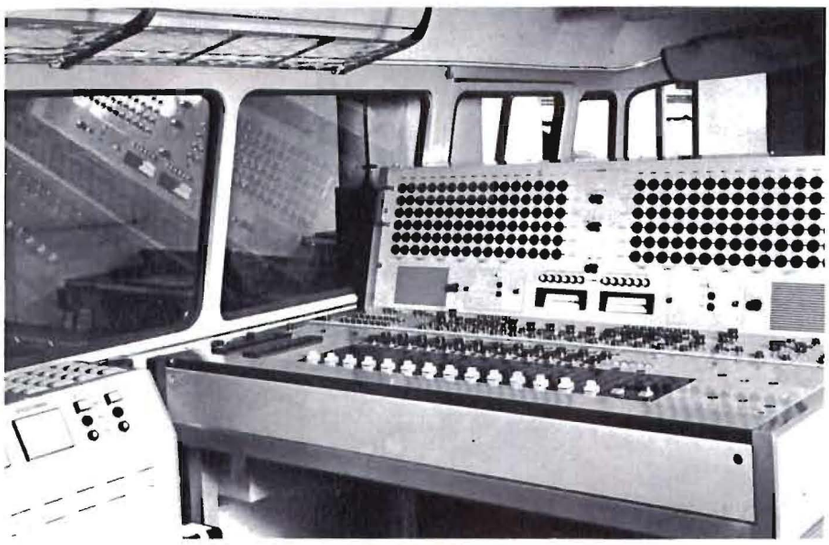
Professional Studio Sound Equipment



Control position in an O. B. Van

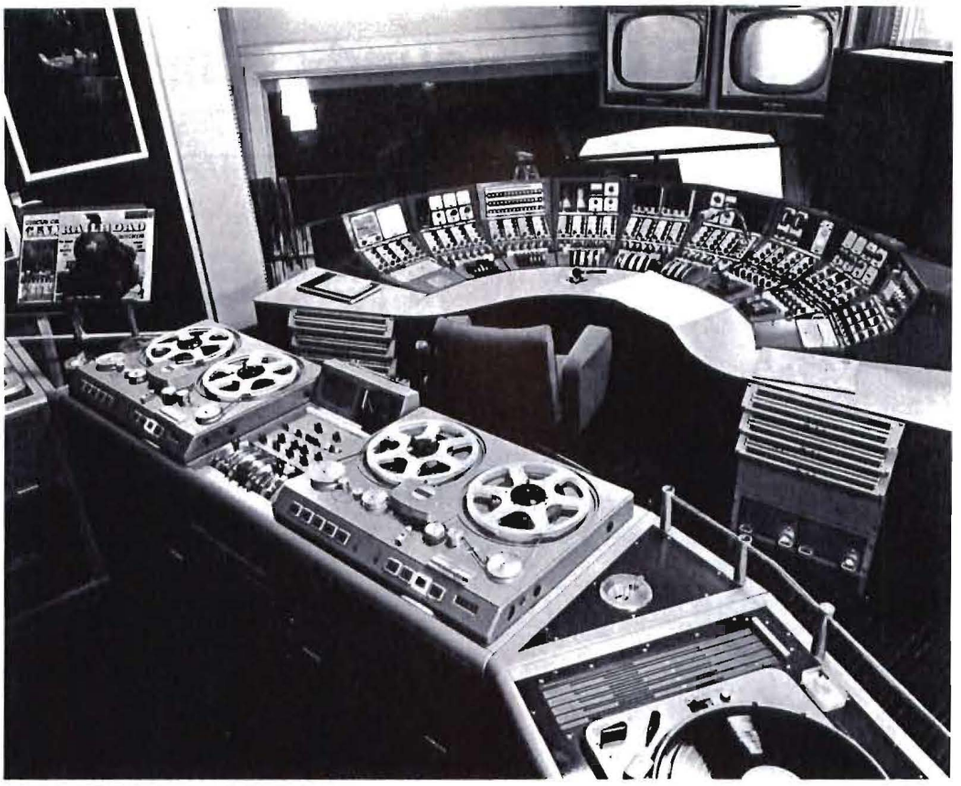
We supply O. B. Vans for every application and in all sizes especially adapted to the individual requirements. The mixer with four-purpose amplifiers shown in the illustration has twelve microphone inputs – two of them radio mikes – and two group channels. The outputs can be switched to a transmission line or to the VHF link. The programme can be recorded by means of the two built-in STUDER tape recorders. The complete installation can be operated from the mains or up to two hours from the battery supply.

This modern broadcast mixer is used by radio BEOGRAD for live broadcasts as well as for the production of music programmes and radio plays in two or four channels. Special features of the mixer are the direction controls, the telephone simulator, etc. The unconventional arrangement of the cross-bar distributor enables convenient switching of all incoming and outgoing signal lines.

Transistorised control desks for the disc recording studio of FINAVOX in HELSINKI

The control desk works in conjunction with a 1" – four track tape recorder STUDER J 37 and several C 37 stereo recorders. It is fitted with NEUMANN transistor amplifiers and has four output channels, several stereo direction controls and various other special facilities.

EMT Equipment in Studios



This illustration shows a glimpse behind the scenes of television. It shows the sound control room for television productions in „STUDIO B" of ATV in London.

As in this studio of the Austrian Broadcasting Organisation, EMT studio record players EMT 930, studio tape recorders STUDER C 37 and the 1" four track tape recorders STUDER J 37 can be found in studios all over the world.

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EMT 104

Portable Mixer
Fully Transistorised
Battery and
Mains Operated

EMT 104

THE PROFESSIONAL PORTABLE MIXER FOR USE OUTSIDE THE STUDIO

Studio quality

- 4 MICROPHONE INPUTS SWITCHABLE TO DYNAMIC MICROPHONE, CONDENSER MICROPHONE OR LINE
- BASS CUT FILTER
- PRE-FADE-LISTENING BUTTON
- INTERNAL ORDINARY OR RE-CHARGEABLE BATTERIES. BUILT-IN CHARGING UNIT.

High reliability

- PEAK PROGRAM METER
- TWO LINE OUTPUTS + 6 dbm AND 4.4 V
- SWITCHABLE COMPRESSOR WITH COMPRESSION INDICATION
- POWER SUPPLY FROM MAINS, INTERNAL BATTERIES OR EXTERNAL BATTERY.

Technical details

Inputs:			four, balanced floating, gain to 4.4 V output:
Each input switchable to:	Dynamic microphone		94 dB gain
	Dynamic microphone with bass cut		94 dB gain
	Condenser microphone		73 dB gain
	Condenser microphone with bass cut		73 dB gain
	Line		22 dB gain
Input impedance:	microphone input	30 Hz – 15 kHz	min. 1 k-ohm
	line input	30 Hz – 15 kHz	min. 3 k-ohm
Input balance:	30 Hz – 15 kHz		min. 60 dB
Outputs:			Two, balanced, floating
		A 1	4.4 V (+15 dBm)
		A 2	1.55 V (+ 6 dBm)
Output impedance:	30 Hz – 15 kHz		max. 50 ohms
Output balance:	30 Hz – 15 kHz		min. 35 dB
Frequency response:	30 Hz – 15 kHz		±1 dB
Distortion:	100 Hz – 5 kHz at 4.4 V output with 300 ohm load		max. .8 %
Noise voltage:	referred to input		–126 dBm rms
Noise voltage, weighted:	referred to input, weighted		–117 dBm peak
Peak program meter:	time required to reach 90 % F. S. D.		app. 10 ms
	decay period from 0 to –30 dB		app. 2 sec.
Monitor loudspeaker:			160 mW upon request 1.7 W into ext. 8 ohm speaker
Built-in oscillator:	Frequency		1 kHz ±10 %
	Distortion		max. 1.5 %
Automatic volume control:			
Compression:	threshold (output 1)		+16 dBm
	threshold (output 2)		+7 dBm
	compression ratio		20 dB : 5 dB
	Maximum range		30 dB
	attack time		less than 5 ms
	recovery time after a + 20 dB pulse		app. 2 sec.
Limiting:	threshold		+18 dBm
	limiting ratio		30 dB : 0 dB
	maximum range		30 dB
	attack time		0 sec.
Permissible ambient temperature:			–20° C to +50° C
Dimensions:			335 x 246 x 118 mm (13.5" x 10" x 4¾")
Weight: (operational including batteries)			9.8 kg (22 lbs.)

THE MIXER EMT 104

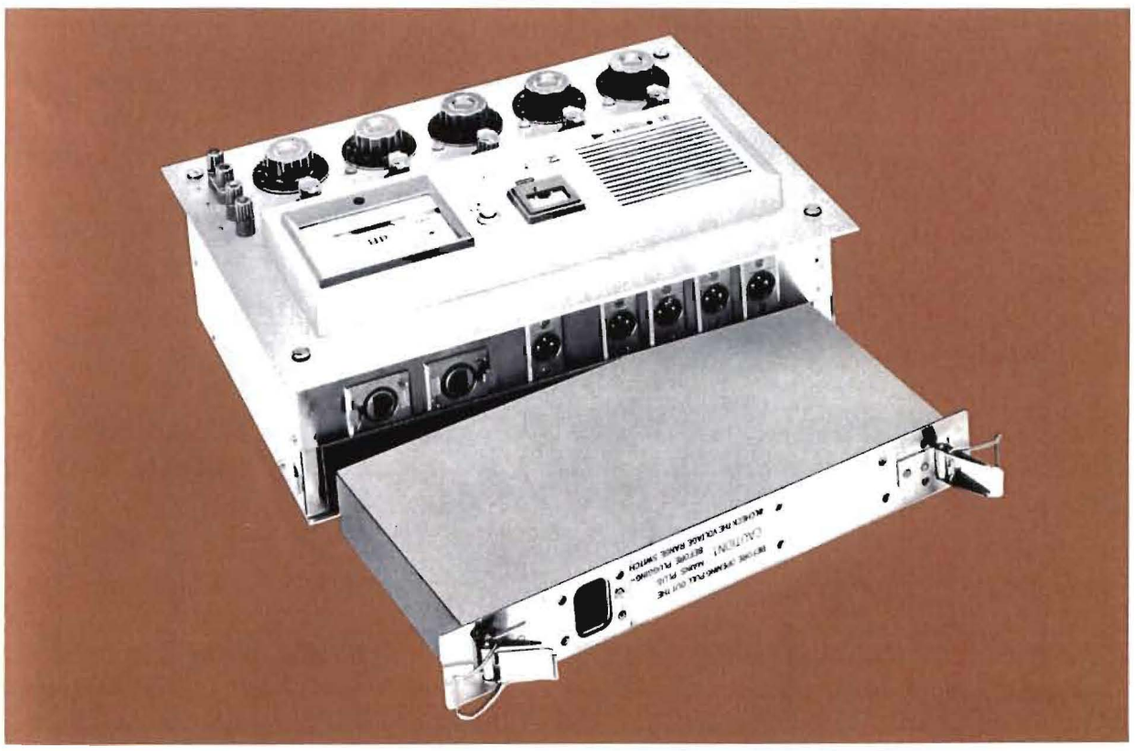
was specially developed for outdoor recordings and location work. It can be carried like a suitcase but is equally suitable for installing in small Outside Broadcasting Vans. As it uses semi-conductors throughout the mixer is light and portable. It provides all the necessary facilities which are required for location recordings or transmissions.

The four inputs, each with its own fader are suitable for dynamic and condenser microphones or for line inputs. The four microphone channels are equipped with switchable bass cuts. Each channel is furthermore equipped with a pre-fade listening button which enables each channel to be monitored via the built-in monitor amplifier. If none of the buttons are pressed the sum signal will be monitored. At additional cost the unit can be supplied with a more powerful monitor amplifier capable of providing 1.7 Watts to an external loudspeaker. Up to three mixers can be linked together in which case 12 inputs will be available on one master fader. The unit is equipped with a compressor/limiter which can be switched in or out of circuit, an oscillator and a monitor loudspeaker with its own volume control.

In spite of its small dimensions the mixer EMT 104 enables recordings and transmissions with full studio quality and ensures the necessary reliability for professional operation. The entire design and construction of the mixer EMT 104 is strictly intended for professional use.

Due to its transistorised construction the current consumption is extremely low. The internal power pack is made up of 12 ordinary or NiFe accumulator cells. An automatic charging unit is built into the mixer. It enables float charge operation so that the unit will continue to work in the case of mains failure. The maximum operating time with fully charged accumulators is approximately 10 hours, with ordinary cells about 8 hours. Furthermore an external DC-source of 15–24 V may be used as power supply. When used in small Outside Broadcasting Vans it is therefore possible to use the car battery as power supply.

All operating voltages for the individual stages of the mixer are stabilised. This ensures the reliable functioning of the mixer even with partially discharged batteries.



Rear View

Battery box, withdrawn

The charger and the battery box are constructed as a plug-in unit. This plug-in unit can be withdrawn from the mixer for charging the batteries externally without removing the microphone and line output connections.

The input selector switch enables each of the four inputs to be set to:

Dynamic microphone, flat,
Dynamic microphone with bass cut,
Line,
Condenser microphone with bass cut,
Condenser microphone, flat.

The settings are clearly marked with symbols.

The input fader and the corresponding pre-fade-listening button are situated directly in front of the input selector switch. This arrangement prevents any confusion during operation and shows the switch settings at a glance. The clear layout of all the operating controls facilitates work with this mixer.

The mixer input enables up to three mixers EMT 104 to be connected in parallel. In this way up to 12 inputs are available which can either all be controlled by means of one master fader or they may be fed as two groups to the third mixer. This facility of combining them enables the mixer EMT 104 to meet all operational requirements.

The compressor which can be switched in or out of the circuit and the additional limiter stage for clipping excessive peaks together with a meter showing the degree of compression are aids to the engineer which are generally only found on large studio mixers.

The level meter is a peak meter with a very short attack time (10 ms); a loudspeaker with its own volume control and on/off switch is provided for monitoring. These optical and acoustical monitoring arrangements enable an optimum output level to be maintained at all times. The connections of the 4.4 V output are duplicated with terminals on the front panel enabling cables without plugs to be connected directly. A pair of earphones may be connected across these terminals for monitoring the output with the monitor loudspeaker switched off.

The 1 kHz oscillator enables line levels to be set up accurately and provides a signal source before the beginning of the transmission. The level of the tone can be adjusted by means of the master fader.

The construction of the unit is particularly robust. A solid nickel plated metal case houses the measuring instruments and the sub-assemblies which are built-up in modular construction on printed circuit cards and therefore very accessible and easy to service.

The input and output connections are made at the back of the unit by means of 3-pole CANNON connectors.

The unit may be operated horizontally or vertically.

It may be mounted in a suitable cut-out in a table.

For portable use the mixer is also available in a leather carrying case.

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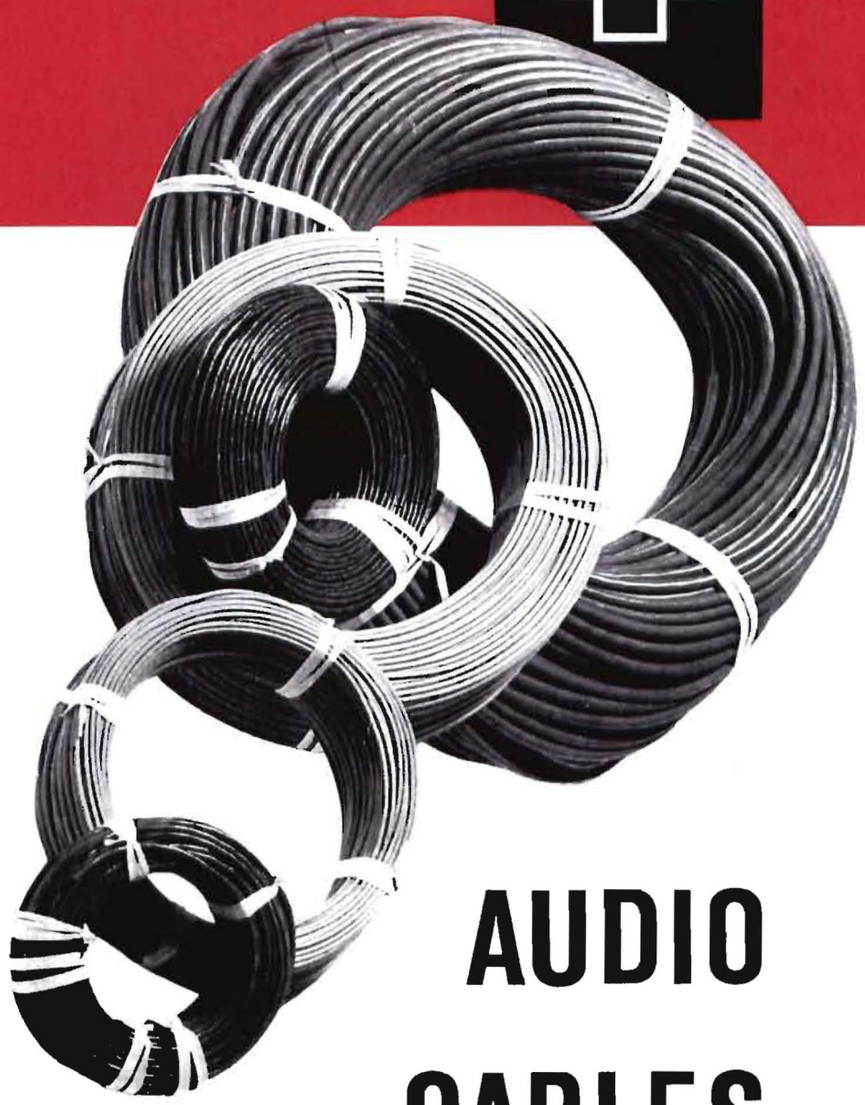

AUDIO CABLES

for Studio Application with superior high-frequency shielding

Printed in Germany
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Special Audio Cables

In addition to our line of professional audio equipment we have supplied high quality cables for many years. With the introduction of new techniques in telecommunications and associated fields, such as radar, highly directional RF transmitters, pulse modulation etc., new problems with regard to low level audio lines have arisen and more effective shielding has been demanded. It was only natural that this would call for a complete revision of the design of the common shielded audio cable. The specially developed double layer Reusen shield provides effective shielding from any electrical interference up to the megacycle range. Cable capacity was held low through the use of high quality insulating materials and the wire gauge used in the various types is selected so as to be best suitable for the intended application.

Special Cables for Sound Studio Applications; effective high-frequency shielding			
Cross section			
Description and Use		Audio cable with Perlon rip thread for simplified removal of outer jacket.	Audio cable, highly flexible, extra thin.
Type	**EMT**	**2111**	**2112**
Number of conductors		2	2
Cross-section of conductor	mm^2	0.22	0.06
Conductor make-up, number x ∅	mm	7 x 0.2	15 x 0.07
Number of Reusen layers		2	2
Outside diameter	mm	4.7	3.2
Loop resistance for 100 meters (100 ft.)	Ohm	18 (5.5)	63 (19.2)
Operational capacity per meter (p. ft.)	pF	70 (21.3)	75 (22.9)
Weight of 100 m (328 ft.)	kg	3.6	1.6
Weight of 100 ft.	lb	2.4	1.1

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Audio cable and mains (AC power) cable.

2121
2
0.72
42 x 0.15
2
6.5
5.4 (1.6)
100 (30.5)
7.0
4.7

Microphone cable with two steel re-enforcement strands, highly flexible.

2202
2
0.24
30 x 0.1
2+2
5.9
15 (4.6)
65 (19.8)
6.6
4.4

Audio cable, two shielded pairs, highly flexible.

With two steel re-enforcement strands esp. suitable for mobile installations.

4113	4126
4	4
0.06	0.24
15 x 0.07	30 x 0.1
2	2
5.7	7.3
63 (19.2)	15 (4.6)
75 (22.9)	80 (24.4)
3.8	4.5
2.5	3

Condenser microphone cable, highly flexible, with steel core.

6209
4 +2
0.15 0.50
37 x 0.07 133 x 0.07
2+2
6.5
25 (7.6) 7.5 (2.3)
80 (24.4)
9.0
6

Twin-microphone and signal cable with three steel re-enforcement strands esp. suitable for mobile installations.

8203
2+ 2+4
0.16
41x 0.07
3 x 2+2
8.6
25 (7.6)
100 (30.5)
11.6
7.8

nicrophone
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Audio cable with solid conductors for fixed installation, with Perlon rip thread.

Coaxial cable of especially low capacitance, for use in high impedance circuits.

Stranded steel suspension cable for microphone winch installations.

5-
pairs, individually shielded, recommended for mobile as well as for fixed installations.
10-

5-
pairs, individually shielded, for fixed installations.
10-

8203	2510	1700	1919	9224	9225	9622	9623
2+ 2+4	2	1	1	10	20	10	20
0.16	0.19	0.05	–	0.24	0.24	0.19	0.19
41x 0.07	1 x 0.5	1 x 0.3	14 x 0.2	30 x 0.1	30 x 0.1	1 x 0.5	1 x 0.5
3 x 2+2	2	braid	–	5 x 2+2	10 x 2+2	5 x 2+2	10 x 2+2
8.6	4.1	4.5	1.8	11.5	16.1	9.8	13.5
25 (7.6)	20 (6.1)	80 (24.4)	–	15 (4.6)	15 (4.6)	18 (5.5)	18 (5.5)
100 (30.5)	75 (22.9)	35 (10.7)	–	81 (24.7)	81 (24.7)	71 (21.6)	71 (21.6)
11.6	2.4	2.2	0.7	25.7	52	20	36.2
7.8	1.6	1.5	0.5	17.2	34.9	13.4	24.3

able, highly
, extra thin.

2112

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Shielding

The commonly found form of shielding in audio cables, such as copper braid or some type of metal foil is effective up to 100 kHz only. The shielding efficiency, defined as coupling resistance, deteriorates rapidly above this frequency, indicating that no useful purpose is being served by the shield at extremely high frequencies. To meet today's stringent requirements, audio cables must be effectively shielded against high frequency interference up into and through the VHF-range. The coupling resistance of regular shields, referred to its DC value, remains constant up to approx. 0.1 MHz, then – due to the influence of inductive components – it begins to rise steadily. With the newly developed Reusen shield, the coupling resistance droops at low frequencies and by nature of its low inductance and the control over the skin effect which could be gained, its rise starts at very much higher frequencies. The end result is an extremely wide frequency band within which exceptionally low values of coupling resistance can be realized.

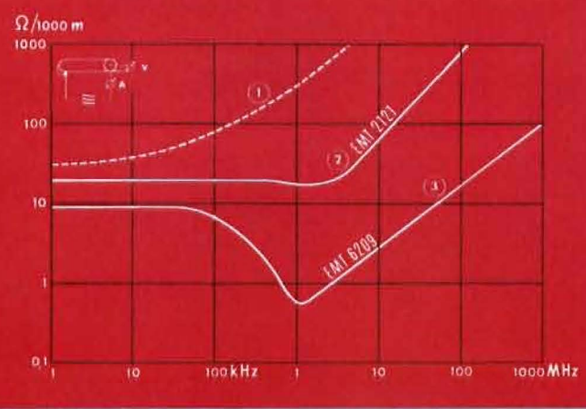
Two types of shielding – depending on the effectiveness required – have been developed:

a) Single-stage Reusen shield, consisting of two layers of closely spaced copper wires, helically wound in opposite direction. This is effective up to 50 MHz, which is 100 times the frequency that could be reached with the normal wire braid.
b) The double-stage Reusen shield, which consists of four layers in the above described form. Together the four layers of the Reusen shield are effective up to and even beyond 500 MHz.

Practical experience has shown that for lines carrying audio levels of 500 mV and more, the single-stage shield is fully adequate; only low level and microphone lines should be equipped with the double-stage Reusen shield. To fully realize the shielding qualities of these cables it is recommended that only plugs and connectors with similar characteristics be used such as for example the various connectors available from AMPHENOL-TUCHEL ELECTRONICS GmbH. When using the cable EMT 6209 equipped with these connectors, a reduction of the high frequency interference by more than 50 dB can be measured as compared to the results obtained with other high quality, but conventionally shielded cables. In contrast to the techniques used up to now, with the Reusen shield all shielding layers are to be connected together on both ends of any cable. This is done for maximum shielding efficiency in the RF range which simultaneously results in shielding properties at low frequencies far superior to those of the old common braid or foil type shield. The above graph shows behavior of the coupling resistance of various types of audio cables. The characteristics obtained with ordinary type shielding are indicated by curve 1. Curves 2 and 3 show the values achieved with the single and double stage Reusen shield respectively, which are used in the new EMT audio cables.
Where extremely efficient shielding is required, a coupling resistance of 100 ohms per 3300 feet (100 meter) is permissible. As the graph shows, regular cables are well shielded up to 100 kHz only, whereas EMT cables can still be used effectively in interference fields up to 10 MHz or 1000 MHz respectively.

Constructional features

Careful consideration has been given to the widely varying requirements at different applications of the various cable types, resulting in a product of optimum characteristics for the intended service. Special care has been taken to keep mechanical or electrical noise from being generated in cables which are subjected to much flexing, as in most mobile hookups. To increase the tensile strength of microphone cables, insulated steel strands form a part of these cables, thus allowing them to be freely suspended over great lengths or to be used in microphone winch installations.



Ohms/1,000 meters (3,280 feet)

Coupling resistance of audio frequency cables as a function of the interfering frequency.

1. Regular cable which no longer meets today's requirements.
2. A modern EMT cable for high level application, EMT Type 2121 (single stage shielding).
3. A modern EMT microphone cable, Type EMT 6209 (double stage shielding).

The outer jacket

Flexibility, the prime requisite of cables used under widely varying temperatures and good resistance to wear are characteristic features of the PVC-jacket used on these cables. Rubber - because of its limited life and the undesirable side effects caused by the sulphur which it contains - is no longer used for such applications. The jacket is of a dull light grey which blends well with the colors of other equipment and minimizes reflections when used in television and motion picture studios. A Perlon rip thread is used in some types for fast and clean removal of the cable jacket to any desired length.

The insulating material

A decisive factor in determining the cable capacity is the quality of the insulating material used. A new special plastic compound of polyethylene base has been developed, and this has such outstanding qualities that cables produced with this compound as insulating material have a measured capacity which is only one third of what could previously be achieved. In addition this material is considerably more resistant to heat so that it will not flow, or flow back during soldering.
The colors selected for the insulation on the individual leads in two-conductor cables are grey and black. A variety of colors is used in multi-conductor cables to assist in lead identification.

Solid and stranded conductors

are available, depending on the type of service for which the cable is intended. The wires are not tinned in order to extend the life of the copper strands in applications where the cable is subjected to much flexing. Special treatment of the copper and the type of insulating material used make it possible to prevent any oxydation of the wires and satisfactory solder flow is thus assured.

The wire gauges which are available are selected under consideration of the nominal values specified by broadcasting corporations. Particular care is taken to keep cable capacitance as low as possible and to obtain small outside diameters while retaining effective shielding properties.

Special versions

Cable EMT 8203 is a type which has been designed for use in location service and on remote pickups. Two individually shielded pairs allow two microphones to be connected. In addition there are four conductors under a common shield and these may be utilized to run monitor-, telephone- and signal-lines to the pickup site.
The type EMT 1700 is a coaxial cable of an amazingly low capacity per foot despite its very small outside diameter. This is a cable specially suitable for use in high impedance circuits.

Installation

We do not recommend the use of knives or wire strippers with cutting blades for removing the insulation from these cables. To assure optimum quality in a wiring job, the insulation should be burned off, using a thermal wire-stripper. Suitable equipment is available through us and your inquiries are invited.
The shielding is very easy to remove and it actually requires less time than working with the common copper braid.
We reserve the right to make design changes as technical progress may warrant.

EMT WILHELM FRANZ GMBH
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PE 810 · 5 · Pe
Printed in Germany

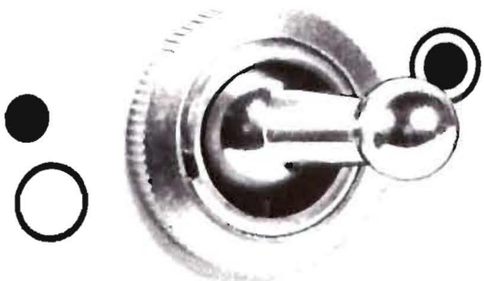
STEREO MONITOR
EMT 159

Pause
INTERVAL IN TRANSMISSION

Rechts fehlt
RIGHT NO RESPONSE

Links fehlt
LEFT NO RESPONSE

Seite fehlt
NO SIDE RESPONSE



Verpolt
CHANGED POLES

Stereo-Monitor EMT 159

For the operational monitoring of stereo programmes at any point of the programme chain:

IN THE STUDIO · IN REPEATER STATIONS AND SWITCHING CENTRES · AT THE TRANSMITTER

The continuous monitoring of the stereophonic character of programmes with conventional methods is very tedious, costly and furthermore subjective. The decision whether there is a fault in the transmission depends in the end on the reliability and skill of a person, not only with direct listening but also in the case of measuring processes involving meters or cathode ray oscilloscopes. The continuous monitoring of stereo transmissions in this way involves an unreasonable strain and is unreliable since the concentration of any man must falter with time. The stereo monitor EMT 159 overcomes these human failings. In particular this unit enables the personnel in repeater stations, switching centres and at the transmitter to keep a reliable check on the stereo characteristics of the signal without involving additional work. Warning lights will show the following faults in a stereo programme without the need to lift a finger:

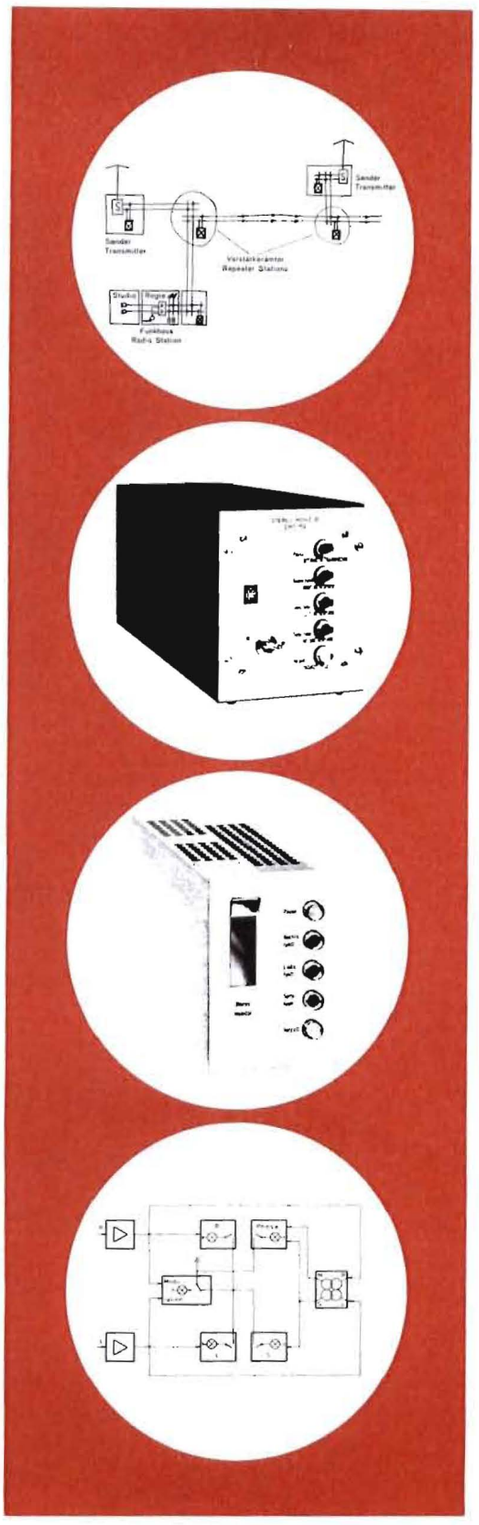
	Colour of the lamp
1. No signal	Yellow
2. No signal in right-hand channel	Green
3. No signal in left-hand channel	Red
4. No difference signal	Blue
5. One channel out of phase	White

Since each colour corresponds to a specific fault, the indication is clear and unmistakable and the monitoring, therefore, simple.
The indication can furthermore be repeated on an external light panel and furthermore coupled with an acoustic warning signal. This enables for instance the simultaneous monitoring of several stereo programmes continuously and reliably without anyone having to concentrate on them all the time. The stereo monitor will indicate immediately if the stereo character of a programme has been lost. But it can also monitor two mono signals e. g. as a check at the transmitter and for checking tape copying systems the stereo monitor can be used advantageously.
The unit contains no mechanical contacts. It uses transistors and diodes exclusively.
A delay mechanism on the lamps prevents false alarms due to short pauses or very quiet passages. The delay periods and the triggering threshold have been determined in accordance with statistical sampling of programme material.

The stereo monitor is available in two versions:

Bench unit EMT 159
with mains switch on the front panel, mains cable (with plug) and plug and socket connection at the back of the unit.

Twin cassette EMT 159 K
Mechanical locking on the front panel, all connections via multi-pin plugs on the back of the unit. Without mains switch.
In one frame for standard racks in accordance with DIN 41 490 up to five twin cassettes can be housed.



Technical data

Inputs	two, balanced. One each for left and right-hand channel, connection to MS channels via external sum-and-difference network.
Input level	+ 6 db (1.55 V) peak programme level
Input impedance between 40 c/s and 10 kc/s	2.5 k-ohm, each channel
Ambient temperature	+ 5° C to + 50° C permissable
External pilot lamp supplies	five, 12 V at max. 100 mA
Mains voltage	switchable 100 . . . 125 V 50/60 c/s 200 . . . 250 V 50/60 c/s
Power consumption	8 W with one pilot lamp on.
Dimensions	
Bench unit	140 x 112 x 265 mm
Cassette unit	cassette size II (134 x 94 x 256 mm)
Weight	app. 2.8 kg (6 lbs)

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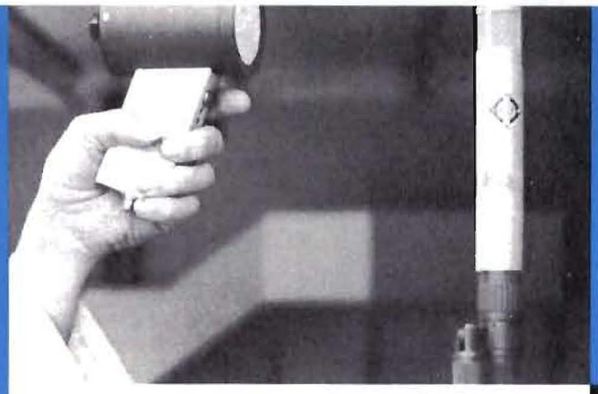
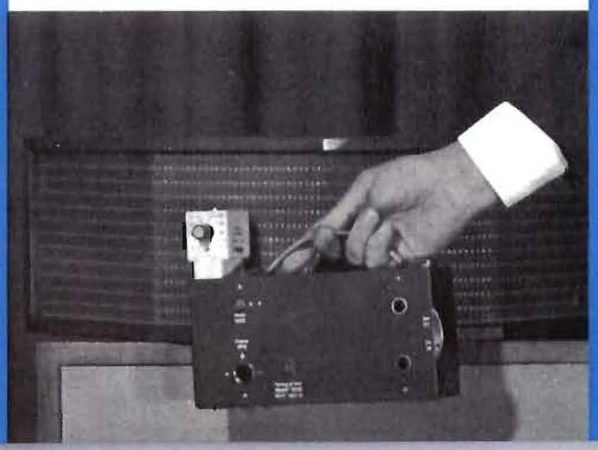
Printed in Germany

PE 802 - 1 - Pe

New test unit
for
Studio application
and
Audio engineering



Polarity Tester EMT 160



2-1-Pe

The Polarity Tester EMT 160

is the first instrument of its kind which enables polarity testing in electro-acoustical systems **reliably, quickly** and **easily.**

How important is correct polarity?

If an acoustic event is picked up simultaneously by several microphones, their output voltages will be coherent, i. e. correspond with each other as regards wave form and phase relationship. If two or more coherent signals are combined out of phase – i. e. with wrong polarity – they will more or less cancel each other. The question of polarity is therefore at least as important as the right level.

When does right polarity matter?

It matters when two or more such coherent signals are going to be mixed together. It is basicly irrelevant whether the mixing is going to take place electrically or acoustically. In practice this means that every mixing of incorrectly poled microphones will produce certain cancellations.
In stereo recordings the effect of wrong polarities is even more serious because the special effect is destroyed and the stereo character will be lost.

How can a polarity error be traced in operation?

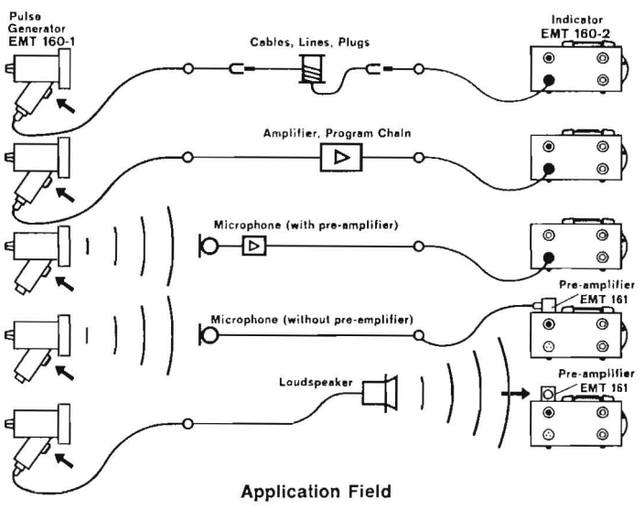
Conventional methods are either too costly, too time consuming or have only limited application. The EMT polarity tester is specially conceived for the requirements of studios and in production testing. The process does not rely on complex scientific considerations and it therefore enables moderately skilled personnel to obtain reliable results.
The principle is as follows:
A steep pulse of definite polarity is fed into the system. The digital polarity indication at the output of the system is not affected by the shape of the pulse nor by overload of the system nor the transient response. It depends solely on the polarity of the pulse and is therefore reliable.

What can be effectively tested with the polarity tester EMT 160?

Everything which could be out of phase in an installation: from a simple plug and cable to mixers and the most complicated studio programme chain.
The EMT polarity tester offers its greatest advantages in the testing of microphones and loudspeakers. For the testing of microphones an acoustical pulse is produced, for testing loudspeakers it receives the acoustic pulse via a microphone.
Even immediately before a recording session all the microphones which have already been set up can be checked for their polarity quickly and reliably as a final check without altering their position.

How is the polarity tester EMT 160 used?

The unit consists of two parts. The sender which is held in the hand like a pistol and triggered produces an acoustic or electric pulse at one of four different levels. The indicator which is connected to the output of the system under test indicates the polarity by means of a green or red light. For transport and for testing the unit within itself the sender can be pushed into a recess in the indicator.
The pre-amplifier EMT 161 is plugged into the same recess. It contains a microphone for direct test of loudspeakers and it increases the sensitivity of the indicator unit sufficiently to test dynamic microphones directly without microphone pre-amplifier.



Application Field

Technical details

1. Pulse Generator EMT 160–1

Acoustic pulse (pressure pulse positive)	300 µbar at 2" distance
Electric pulses	9 V , 1 V , 100 mV , 1 mV
Power supply	9 V Microdyn battery (built in)

2. Indicator EMT 160–2

Nominal input voltage	1.55 V (+ 6 db)
Minimum input voltage	200 mV RMS
Maximum input voltage	100 V RMS
Input impedance	app. 10 k-ohm
Input	unbalanced, floating
Switching and blocking time	less than 1 sec
Transistors	11, silicon planar transistors in all critical positions.
Diodes	2
Temperature range	–10° C to + 50° C
Green indicator lamp	polarity right
Red indicator lamp	polarity wrong
Power supply	2 flat batteries 4.5 V (built-in)

3. Pre-amplifier EMT 161

Gain continuously variable	10 db to 50 db
Input unbalanced	for direct connection of dynamic microphones
Input impedance	10 k-ohm
Output impedance	1.8 k-ohm
Power supply	from the indicator
Average sensitivity of the built-in microphone	90 V/µbar.

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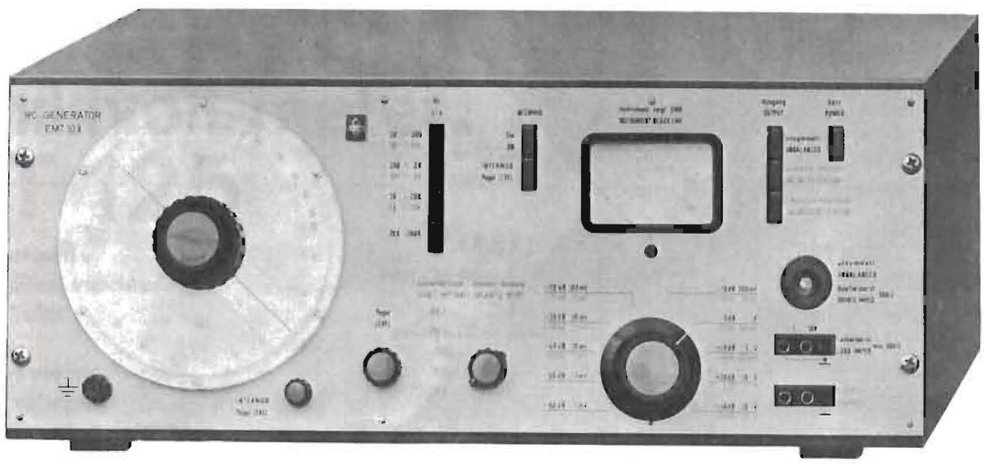
RC-GENERATOR EMT 103



The RC-Generator EMT 103 produces sine waves – balanced or unbalanced to ground – with very little distortion and is therefore particularly suitable for measurements of harmonic – and intermodulation distortion. The intermodulation distortion is a much better measure of the subjective disturbance factor than the harmonic distortion. It is for this reason that intermodulation distortion measurements are being carried out and used more and more.

The EMT RC-Generator considerably simplifies these measurements because it produces the complete compound signal – with variable level ratio and virtually free of inherent intermodulation distortion – with a balanced and an unbalanced output.

The low impedance outputs can supply any voltage from 200 µV to 30 V (1.5 W into 600 ohms) with great accuracy and the voltage can be measured by means of the built-in level meter. The range of levels available is therefore over 100 db.

The high frequency-stability of the generator enables repeatable measurements in the steep cut-off regions of filters, even when the mains voltage is fluctuating.

The precision frequency scale is furthermore calibrated with the new 'standard frequencies for acoustic measurements' as recommended by the ISO and laid down in DIN 45 100.

805-10-Pe

Frequency range switchable in four ranges	20 c/s . . . 200 c/s 200 c/s . . . 2 kc/s 2 kc/s . . . 20 kc/s 20 kc/s . . . 200 kc/s* * only unbalanced
Output unbalanced (I) (20 c/s . . . 200 kc/s) level adjustable in 10 db steps from level continuously variable lowest level which can be set up conveniently frequency response	 −60 db . . . +30 db (1 mV . . . 30 V) −70 db (200 μV) ± .2 db (40 c/s . . . 50 kc/s) ± .5 db (20 c/s . . . 200 kc/s)
Source impedance Noise voltage in the − 60 db level range	600 ohms max. 20 μV
Output balanced (II) (20 c/s . . . 20 kc/s) level adjustable in 10 db steps from level continuously variable lowest level which can be set up conveniently frequency response	 −60 db . . . +10 db (1 mV . . . 3 V) −70 db (200 μV) ± .2 db
Source impedance switchable Noise voltage in the − 60 db level range	600/200/75/60/30 ohms max. 20 μV
Output unbalanced, direct (20 c/s . . . 200 kc/s) level continuously variable from Source impedance power output into 600 ohms	 1 V . . . 30 V app. 12 ohms 1.5 W max.
Error in reading the level meter	± 3 % f. s. d.
Error in attenuator	< ± .2 dB at 1 kc/s
Error in frequency	< 1 % below 50 cycles ± 2 cycles
Drift after one hour of operation at room temperature for ± 10 % mains voltage fluctuations	 max. 5×10^{-4} per day max. 2 c/s at 1 kc/s
Distortion with the meter at full scale deflection measured at output I and II	 max. .5 % at 30 c/s max. .15 % at 200 c/s − 20 kc/s
Intermodulation measurements in accordance with DIN 45 403 Upper frequency (f_h) Lower frequency (f_l) Level ratio of the frequencies can be adjusted by means of two separate potentiometers to Inherent intermodulation distortion	 max. 200 kc/s (preferable 4 kc/s) 50 c/s or 60 c/s respectively 4 : 1 ($f_l : f_h$) max. .1 %
Mains voltage	240 V/220 V 125 V/117 V/110 V
Power consumption	app. 80 VA
Dimensions	483 x 197 x 277 mm deep
Weight	app. 15 kg (33 lbs)

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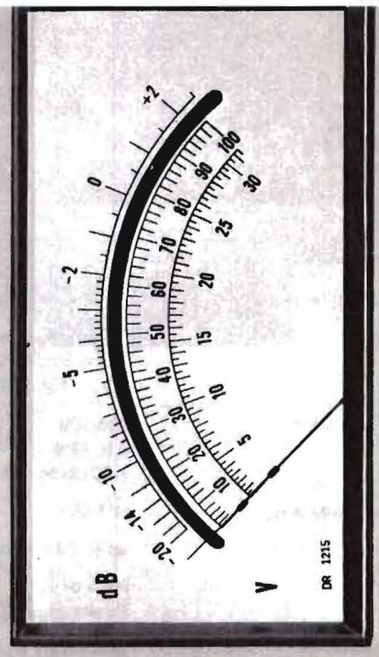
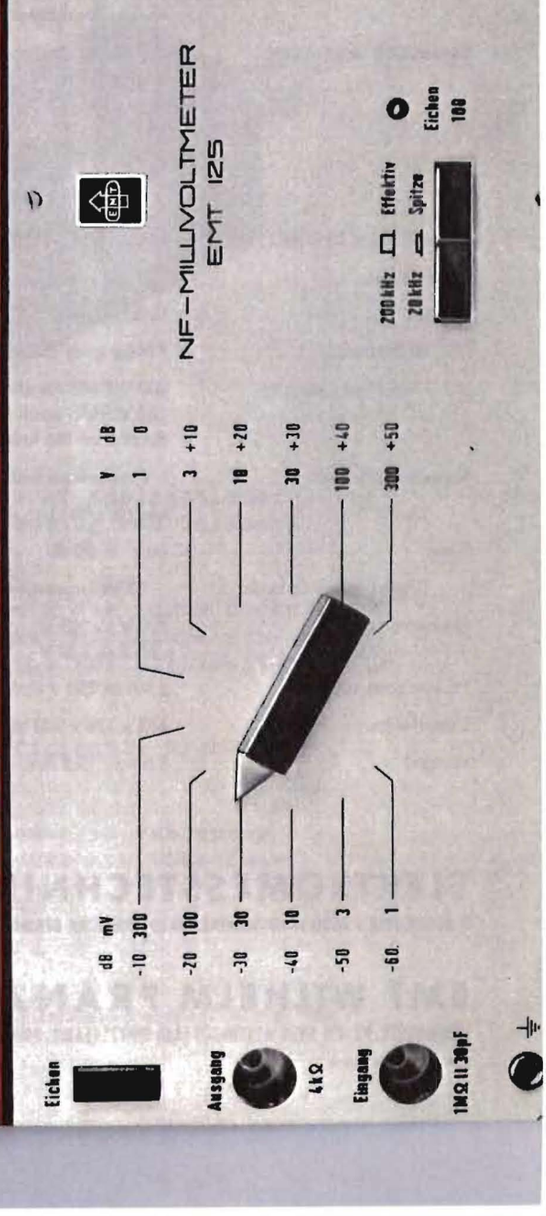




Transistor LF millivolt-meter EMT 125

Fully transistorised
Protected against overloading and RF strayfields.
High stability
Calibration by means of reference voltage
Additional measuring output, independent of meter reading

Measuring range: 100 μV to 300 V
−80 db to +52 db

Frequency range 200 kc/s or 20 kc/s, selectable.
RMS or peak reading, selectable.

Germany

TECHNICAL DATA

Frequency range
switchable in four ranges

Output unbalanced (I)
(20 c/s . . . 200 kc/s)
level adjustable in 10 db steps from
level continuously variable
lowest level which can be set
up conveniently
frequency response

Source impedance
Noise voltage in the – 60 db level range

Output balanced (II)
(20 c/s . . . 20 kc/s)
level adjustable in 10 db steps from
level continuously variable
lowest level which can be set
up conveniently
frequency response

Source impedance switchable
Noise voltage in the – 60 db level range

Output unbalanced, direct
(20 c/s . . . 200 kc/s)
level continuously variable from
Source impedance
power output into 600 ohms

Error in
reading the level meter

Error in attenuator

Error in frequency

Drift
after one hour of operation at room
temperature
for ± 10 % mains voltage fluctuations

Distortion
with the meter at full scale deflection
measured at output I and II

Intermodulation measurements in accordance with DIN 45 403
Upper frequency (f_h)
Lower frequency (f_l)
Level ratio of the frequencies can be
adjusted by means of two separate
potentiometers to
Inherent intermodulation distortion

Mains voltage

Power consumption

Dimensions

Weight

ELEKTROMESSTECHNI
P. O. BOX 1520 · 7630 LAHR/SCHWARZWALD · WESTERN GERM.

Transistor LF millivolt-meter EMT 125

This fully transistorised volt-meter has been specially developed for the testing and servicing of audio frequency equipment. It is a high precision instrument for accurate measurements on audio frequency equipment and on electro-acoustic devices.

Unlike valve volt-meters, the EMT millivolt-meter is equipped with silicon-transistors throughout. It has, however, the same overload capacity as a high quality valve-volt-meter and does not require servicing. It has a high degree of stability and is not subject to aging. The power consumption from the mains is extremely low and consequently the temperature rise is negligible. The unit can therefore be connected to the mains continuously and is always ready for operation.

The modern, flat housing is space-saving and permits several units to be placed on top of one another. All connections, push-buttons and switches as well as the meter are mounted on the front panel of the unit and are clearly marked.

The two-colour meter scale is clearly divided in volts and in decibels enabling all values to be read directly. The 0 db point corresponds to .775 V

Measuring ranges:

The entire measuring range of the instrument is divided into
12 ranges with full scale deflections of

1 mV – 3 mV – 10 mV – 30 mV – 100 mV – 300 mV;
–60 db –50 db –40 db –30 db –20 db –10 db

1 V – 3 V – 10 V – 30 V – 100 V – 300 V.
0 db +10 db +20 db +30 db +40 db +50 db

The lowest scale reading is 100 µV or –80 db.

The frequency response of this unit goes up to 200 kc/s. A built-in low-pass filter can be switched in by pressing a push-button limiting the frequency response to 20 kc/s.

Measuring modes:

The EMT LF millivolt-meter is suitable for measuring wave forms which deviate substantially from a sinus wave such as are frequently encountered in audio engineering. By means of a push-button, the unit can be switched to measure
RMS
or Peak

For **RMS readings** according to DIN 45 402 and with a pulse frequency of 200 c/s, the unit achieves at –1 db a
pulse duty of 1 to 10: at full scale deflection

The instrument may be used as a **peak reading** volt meter for the measurement of noise voltages. The facility of reducing the upper frequency limit from 200 to 20 kc/s, permits measurements of the audio frequency range only. RF noise voltages and RF pick-up or leakages above 20 kc/s are filtered out and cannot affect the measurement.

Noise and stray high frequency components cannot spoil any measurements in this switch position. This enables for instance measurements on tape recorders to be taken without any fear of bias leakage leading to erroneous readings.

Furthermore, the unit may be used as a

Measuring amplifier. The maximum possible gain is 60 db in the 1 mV range; it falls by 10 db per range. The output voltage is 1 V at full-scale deflection with the output terminated with 4 k-ohms.

When the instrument is used as a measuring amplifier, the meter is not disconnected and the load on the output will not influence the meter reading.

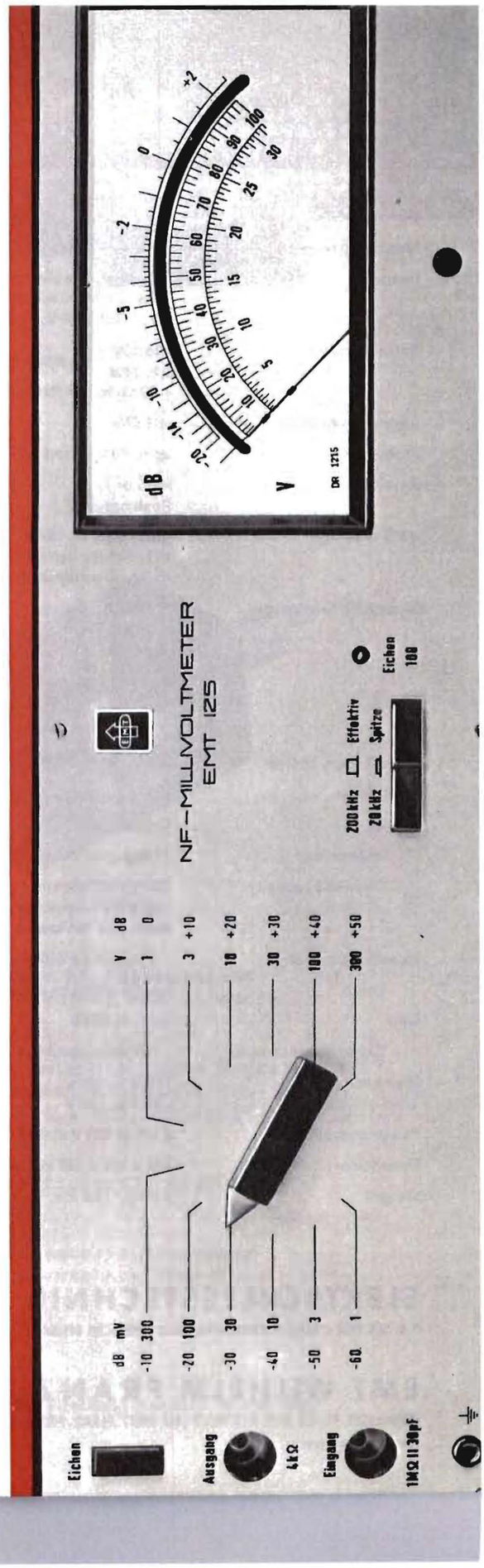
Connections:

Co-ax sockets are provided on the left-hand side of the front panel for connecting the test leads. These sockets will also accept 4 mm Banana-plugs.

Calibration:

An internal stabilised reference voltage is provided, enabling very accurate calibration of the instrument.

Technical Details Overleaf.



Technical Details EMT 125

Measuring range:	1 mV to 300 V full-scale deflection –60 to +52 db
Ranges:	Switched in twelve ranges with full-scale deflection of: 1 mV, 3 mV, 10 mV, 30 mV, 100 mV, 300 mV 1 V, 3 V, 10 V, 30 V, 100 V, 300 V
Scale divisions:	0 to 100 0 to 31.6 for millivolts and volts –20 db to +2 db (0db = .775 mV)
Absolute accuracy:	±1.5%
Frequency ranges:	up to 20 kc/s and up to 200 kc/s
Reading:	RMS or Peak optional
RMS reading:	pulse-duty 1 : 10 (according to DIN 45 402) at full-scale deflection, rising inversely proportional to the scale deflection.
Measuring tolerances:	For RMS readings 10 c/s to 250 kc/s: ± .5 db 20 c/s to 200 kc/s: ± .2 db Peak reading: 20 c/s to 200 kc/s: ± .5 db with low pass filter (20 kc/s) 20 c/s to 20 kc/s: ± .5 db
Cut-off slope of filter:	17 db/octave
Calibration:	built-in stabilised reference voltage source.
Input:	Unbalanced
Impedance.	1 Meg-ohm in parallel with 30 pF
Overload capacity:	600 V RMS for short periods on all ranges. 100 V RMS continuous from low impedance source on the lowest range.
Measuring output:	1 V maximum with 4 k-ohm resistive load
Load:	has no effect on meter reading
Gain:	max. + 60 db
Signal-to-noise ratio:	83 db unweighted
Mains voltages:	190 V to 266 V 95 V to 130 V switched
Power consumption:	6 VA at 220 V and 50 c/s
Dimensions:	432 x 135 x 230 mm deep
Weight:	5.6 kg / 12.3 lbs.

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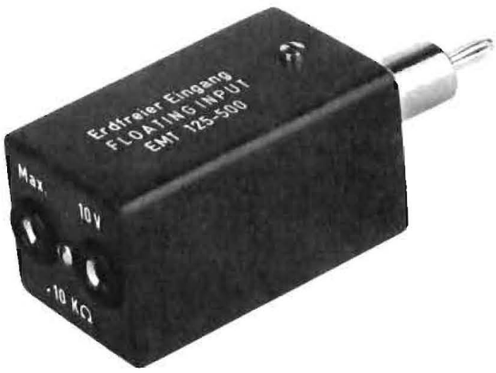
PE 802-1-Pe

EMT 125/500
INPUT TRANSFORMER

Floating and balanced input
for Audio-Millivoltmeter EMT 125



This input transformer extends the range of applications of the LF-Millivolt-meter EMT 125 to floating and balanced inputs.

The transformer can be simply plugged into the input socket. Is has no lead attached to it und its neat miniature construction matches the modern design of the EMT Millivoltmeter.

The input impedance of 10 k-ohms is sufficiently high for all normal balanced measurements.

The transformation ratio of the transformer is extremely accurate and no corrections to measurements are therefore necessary.

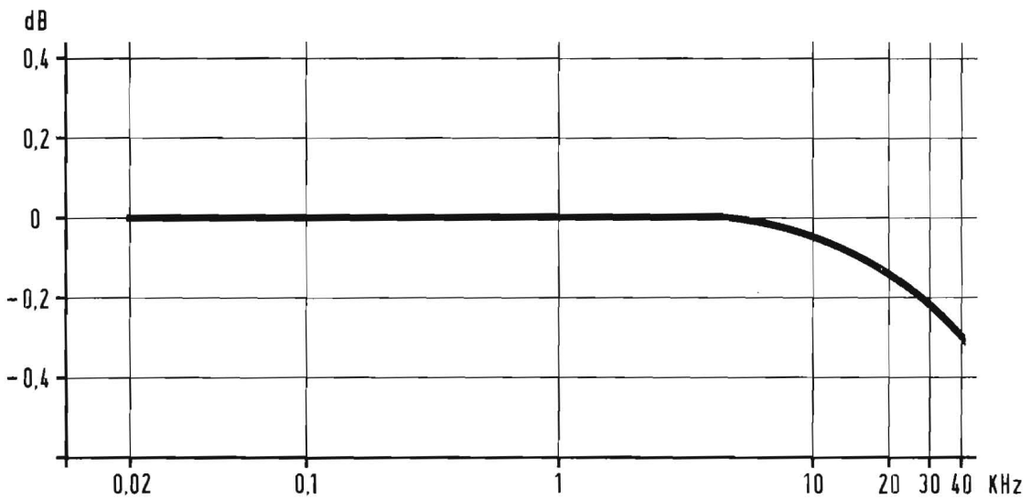
for technical data please see reverse side.

1-Pe

04-20-Pe · Printed in Germany · PE-802-1-U

TECHNICAL DATA

Input	balanced
Out-of-balance attenuation (according to DIN 45 404)	60 db at 1 kc/s 40 db at 15 kc/s
Input impedance	10 k-ohms ± 20%
Input voltage	max. 10 V r.m.s.
Frequency response between 20 c/s and 20 kc/s for source impedance of max. 600 ohms	+ 0 - 0.2 db
Transformation ratio	1 : 1
Deviation from transformation ratio	max. ± 1%



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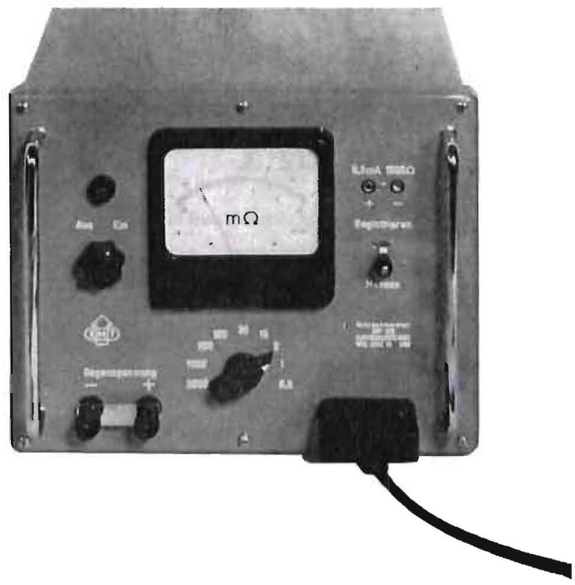
MICRO-OHMMETER EMT 326

Measuring range
from 10 $\mu\Omega$
to 3000 mΩ
IN 9 MEASURING RANGES



APPLICATIONS

Speedy and exact measurement of low-ohmic resistances such as, those of all types of contacts, ground resistances, line resistances, copper resistances of electrical machines, transformers etc.

Especially suited to the measurement of the internal resistances of batteries. The terminal voltage is compensated by a counter e. m. f. generated within the unit.

Because of its high degree of stability, the ease and speed of operation, the clear read-out and its robust design, the EMT 326 Micro-ohmmeter can be applied most successfully to production line measurements. It has an output connection for a level recorder.

OPERATING PRINCIPLE

A constant alternating current source produces a voltage drop across the device under test, which is passed on by the measuring amplifier to current connection a dual moving coil instrument. The voltage path of this instrument is connected to a DC voltage proportional to the power lin AC, so that mains voltage fluctuations are compensated without affecting the indication.

The two test leads – which are available for either small or large test objects – are equipped with special double clamping terminals. Separate contacts are used for supplying the measuring current and obtaining the measured potential so that contact resistance at the clamps is of no significance. Both test leads are connected to the micro-ohmmeter via a multi-pin connector and is therefore easily interchangeable.

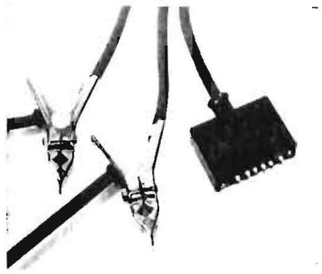
805-10-Pe

The
light weight test leads EMT 326 L

are designed especially for measurements of small test objects. The miniature test clamps can be attached easily and securely to the point under test.

The
heavy weight test leads EMT 326 M

are intended for measurements of batteries and larger objects. The rigid and strong test clamps of these test leads are designed especially for connection to storage batteries.



Please order the specific test leads required for the EMT 326 micro-ohmmeter.

Light weight test leads	Order EMT 326 L
Heavy weight test leads	Order EMT 326 M

Technical data — EMT 326

Meter	Dual moving coil instrument
Meter Scale	Two sets of graduations, full scale deflection 3 and 10, zero point at left
Measurement extremes	10 micro-ohm to 3000 milli-ohm
Measurement Ranges	0.3 - 1 - 3 - 10 - 30 100 - 300 - 1000 - 3000 milli-ohm
Accuracy	Approx. 5% in the bottom third of scale Approx. 2.5% in the upper thirds
Recorder connection	0.5 mA across 1000 Ohm

Load on object under test	
Max. voltage drop	7.5 mV at full deflection
Max. measuring current (ranges 3 - 1 and 0.3 mΩ)	2.25 A at full deflection
Open circuit voltage	6.3 V
Max. permissible DC potential of unit under test	
Continuous	4 V
Short duration	8 V
for higher voltages compensation battery may be connected	
Power supply	220/110 V 50/60 Hz, 15 VA
Dimensions	310 x 220 x 250 mm 12.2 x 8.7 x 9.8 inches
Weight	10 kg (22 lbs)

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