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AEG
TELEFUNKEN
magnetophon

TECHNICAL INFORMATION

magnetophon 21

AEG



Analog professional
tape recorder for studio
and mobile operation,
with state of the art
microprocessor
technology

New technology in a proven concept: The M21

The M21 professional tape recorder (short for »magnetophon 21«) is designed for top quality master recording and reproduction in radio and television studios as well as in the recording industry and professional studios in general. AEG continues the great tradition of producing compact, portable, rugged, reliable studio tape recorders with this completely new development. The magnetophon 21 is a modern, professional system which is designed for ease of operation through the utilization of the most sophisticated technology currently available.

The M21 is an analog recorder which, along with other recording systems, is meant to ensure the continuity of a proven technique and, in addition, the meeting of both the present day demands and those of many years to come. By adding a compact unit for 1/4" tape to the professional M15A tape recorder system, AEG has rounded out its series of magnetophones in the master recorder class.

As a logical advancement in modern technology the M21 now offers microcomputer control and electronically controlled capstan and reels. The microcomputer enables tape transport and amplifier operation to be programmed, thus greatly increasing the system's range of applications.

The machine is available in mono, stereo or two-track configuration with A-wind (oxide coating inside) or B-wind (oxide coating outside).

Operation is possible with all standard reel mounts: DIN hubs with turntable for self-supporting tape packs, NAB reels or cine-type reels. NAB reels up to 12 1/2" diameter or self supporting tape packs of 300 mm diameter may be used. The minimum hub diameter for tape reels is 45 mm.

The compact, portable machine fulfills studio requirements for the tape transport mechanism and the amplifiers.

This tape recorder is equally at home in the studio or on location in mobile units. Since it is small and takes up little space the M21 is particularly suitable for installation in 19" racks and carrying cases and can of course be fitted into existing consoles. Installed in the Vario stand it is even possible to adjust height and angle for operation in a sitting or standing position. The recorder operates in any position between the horizontal and vertical. Particularly important for operation in mobile units: the M21 is ready for operation at -5°C after only 5 minutes of warm-up time.

For international operation, all tape equalizations are available: IEC (CCIR), NAB or proposed AES. The record and playback heads are available with 0.75 mm or 2 mm track separation. An accessory vu-meter unit with monitor loud-speaker and headphone jack is also available.



magnetophon 21
Operation in the radio studio ▲
in the editorial office ▲▲
in the archives ►
in film editing ►►

Universal in use for any kind of operation: The Facilities

Facilities

- Usual high standard of construction from AEG
- Compact professional tape recorder in 19" construction for 1/4" magnetic tape
- Latest technology
- Long life
- Studio and mobile operation
- Any operating position between vertical and horizontal
- Vario stand available which adjusts to optimize operation in a standing or sitting position and for more leg-room
- Ergonomic design for ease of operation featuring microprocessor driven mode-indication
- Microcomputer controlled tape transport and amplifier parameters
- CUE-/ZERO-Locator and REPEAT operation
- Maximum spool size 12 1/2" (3960 ft = 1200 m standard playtape)
- Easy tape loading
- Electronic tape timer
- Heads produced of amorphous metal (so called metallic glass) for maximum life and highest precision magnetic record head gap
- Capstan drive is an electronically controlled, brushless dc motor, locked to a crystal oscillator
- Built-in Varispeed $\pm 10\%$, usually inhibited during recording
- 4 tape speeds
- Extremely short starting time:
 - 0.2 seconds to nominal speed at 15 ips
- Short tape-speed change-over times due to special accelerating and braking the capstan drive circuitry.
- Capstan speed control consisting of:
 - frequency control for quick correction
 - phase control for constant speed maintenance
- Electronically controlled reel motor drive using dc motors and full-stop brake
- Variable speed wind in both directions. The selected wind speed is constant, i.e. independent of reel diameter.
- Editing without touching the erase and record heads
- Manually operable tape lifter for applying the tape to the playback head (for monitoring during winding) or for applying the tape to the record/erase head for fading into the recording
- Dump mode to the right and left
 - Spot erase with tension sensing lever locking
- Search facility button: the machine backtracks at playback speed and automatically returns to playback mode when the button is released
- Locking of tape tension sensing lever in the STOP position (with simultaneously reduced braking torque) optional
- Any of the 4 tape speeds may be combined with any equalization. Two of these combinations instantly available on the operating panel
- Extremely good low frequency response; wide heads with asymmetrical head poles for low contour resonanced
- High bias frequency (205 kHz) achieves about 2 dB lower modulation noise
- Separate level adjustors for internal level 0 dBm and external line level; any level between 0 dBm to +15 dBm.
- Input and output electronically balanced-to-ground



magnetophon 21
as a table model*



mounted on the 19" rack



*built into a Vario stand
for operation while sitting*



*built into a Vario stand
for operation while standing*

** The shown tape recorders are equipped with options.*

Logical functions for easy handling: The Features

Features

The M21 is an easily transportable, compact machine. It uses 1/4" tape with either A-wind or B-wind for mono, stereo or two-track configuration. There are function keys for mono, stereo (track 1 and 2), track 1, track 2. On request a vu-meter unit with headphone

jack and monitor loudspeaker is available.

The M21 allows the use of conventional standard and long play tapes, either in self-supporting tape packs, cine-type reels (min. hub diameter 45 mm) or NAB reels and hubs (max. reel diameter 12 1/2" \triangleq 3960 ft (1200 m) standard tape).

The functions rewind, fast forward, record, playback and stop may be operated directly or remotely (remote control unit for parallel operation optional).

In STOP position the record mode may be selected by pressing the record and start buttons simultaneously or by preselecting the record button and then pressing the start button (program switch). When the tape is running the mode may be switched to RECORD function by pressing the start and record buttons and off by pressing the start button followed by the stop button. Ramp control signals ensure that these processes (punch in and punch out) are click-free.

vu meter unit with ►
monitor loudspeaker
and headphone jack



NAB flanged reels
up to 12 1/2" diameter



◀ Electronic tape timer
and alphanumeric mode
selected indication



◀ Self-supporting tape
pack with turntable



◀ Cine-type
flanged reels

The recording signals may also be used for controlling a compander (tel-com, Dolby or dbx). Recording can be inhibited using the program switch to allow only playback mode.

Apart from these basic functions, additional features provide easy and versatile operation:

- Zero Locator - for returning the tape to counter position »zero«
- Cue Locator - for positioning the tape at a desired counter position previously stored in memory during either record or playback by pressing »Set Cue«
- Repeat (loop operation) for automatic repetition of playback between two preset counter positions. The first counter position is set with the »Set Cue« button and the second with the »Repeat« button
- Repeat (search facility): When the repeat button is pressed during replay the machine will rewind at search speed until the button is released, then the machine returns to the playback mode

- Varispeed: This button allows the tape speed to be continuously adjusted by +/-10% by means of a knob
- Lever for adjusting speed and direction of wind
- Edit operation
- Spot erase
Erasing of short sections of tape (spots) by moving the tape manually.

- Input
- Click-free switch-over from input to output monitoring
- Start position for short start-up time by pressing the STOP button after switching the machine on
- Unload
Tape lifts off the heads

Liquid Crystal Indicators:

- Electronic tape timer: 5 digit (hr/min/sec, negative sign below zero)
- Alpha-numeric indication of selected mode
- Level indication (optional) - vu-meter unit with monitor loudspeaker and headphone jack

Full provisions for cut-and splice-editing

- Tape marker (optional)
- Tape cutter with splicer (optional)
- Tape cutter in front of playback head with splicer (optional)
- Dump mode to the right and left

- Monitoring facility during wind and stop by pressing the EDIT button and advancing the tape lifter automatically or manually for appropriate to monitor volume setting
- Easy manual location of edit points
- Variable high-speed wind in both directions
- Constant search speed (controlled winding speed)
- Locking of tape tension sensor lever in the STOP position (optional)
- Spot erase

Perfect by new ideas: The Details

Details

The M21 may be used as is, or fitted into consoles, carrying cases, a Vario stand or a 19" rack. The Vario stand allows the working position of the recorder to be adjusted ergonomically for ease of operation in a sitting or standing position.

The entire M21 unit is mounted on a heavily ribbed, rigid, die-cast aluminum frame. The precision head assembly support points assure proper tape path. The head assembly is interchangeable without the need for readjustment. Tape transport and amplifier functions are microcomputer controlled.

All assemblies are easily accessible for maintenance.

Capstan drive

- Electronically controlled with crystal oscillator reference; unaffected by ac mains frequency variations; for four tape speeds.
- Brushless dc motor; direct drive for minimum wear and disturbance with low torque variations and with integral tach-generator
- Loading a tape will start the capstan motor. The motor stops at tape run-off.
- Continuously variable speed control within $\pm 10\%$ of the nominal speed
- Capstan speed control consisting of:
frequency control with high loop gain for quick correction

phase lock loop (PLL) for constant speed

- Short change-over times when changing tape speeds due to rapid braking and accelerating of the capstan motor

Tape path

- High precision tape path to minimize phase fluctuations in stereo mode
- Constant tape tension assured by tape tension controls both right and left. Tension remains constant, independent of reel size.
- Low tape strain, no tension peaks
- Tight, self-supporting tape packs
- Easy-to-handle lock mount for hubs
- Exchangeable mounts for all standard hubs and reels



High precision tape path



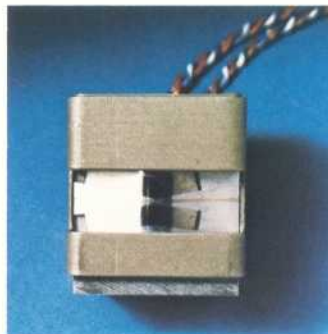
Direct drive
DC capstan motor

Tape transport control

- Control module with 8085 microprocessor, EPROMS for software and RAMS as working memory
- Smoothly acting, illuminated push-buttons for the basic functions with fourfold redundant gold-plated contacts; protected against inadvertent actuation
- Long-lasting rubber diaphragm push-buttons for the tape transport functions with optimum action. Buttons protected against dirt and liquids.
- Contactless tape tension sensing using differential solid-state sensors
- Low inertia and low friction tape tension sensor.
- Tape tension control on both sides of the capstan with additional fixed guide roller making it independent of reel diameter
- Direct current reel motors
- Speed control for constant wind speed
- 7 step, bidirectional wind speed lever. Contactless with a Gray coded optically-scanned disk.
- Automatic instant stop by mechanical brakes at tape run-out or ac mains failure
- Auxiliary remote control for the tape transport functions

Head assembly

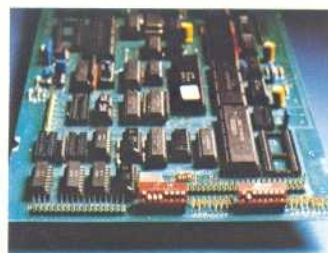
- Head assemblies are interchangeable without the need for mechanical realignment
- Long life precision finish record and playback heads (produced of amorphous metal) obviating need for realigning adjustable azimuth; good low frequency response due to unsymmetrical head poles (especially at 30 and 15 ips)
- High precision tape guides
- Flutter idlers ahead of the erase head, between erase head and record head and between playback head and capstan to eliminate longitudinal tape oscillation
- Highly effective, open-front head cover for easy tape loading and editing



Magnetic head produced of amorphous metal

Amplifiers

- Separate level, equalization and bias adjusters accessible from the front, switchable for 2 tape speeds with associated equalizations or 2 equalizations with 1 tape speed or 2 types of tape (bias and frequency response) with 1 tape speed
- Electronically balanced, transformerless inputs and outputs (transformers optional)
- High headroom reserve for the recording and playback amplifiers for future magnetic tapes up to 2000 nWb/m
- High bias frequency (205 kHz) achieves about 2 dB lower modulation noise
- Click-free switch-over from input to output monitoring with ramped signal voltages
- Separate level adjusters for internal level 0 dBm and external level 0 dBm to +15 dBm. Dynamic range remains high regardless of selected working level
- Inputs and outputs electronically balanced to ground



Minimum maintenance

- Rigid, die-cast frame ensures high structural stability
- Long life heads
- Easy access to all components, easily removable guide rollers, head assembly and pressure roller
- Hinge-mounted amplifier and tape transport magazine; easily removable printed circuit boards
- Running time counter for regular maintenance scheduling
- Easily accessible fuses and indicator lamps



Hinge-mounted amplifier and tape transport electronics

Microcomputer control board

Performance for professional requirements: The Specifications

Specifications

Tape transport

Motor

3-motor tape transport:

1 electronically controlled, brushless crystal oscillator reference dc motor for direct capstan drive

2 electronically controlled dc reel motors

Tape speeds

3.75 / 7.5 / 15/30 ips (all machines so equipped)

2 speeds may be selected on the front panel from the 4 speeds available

Varispeed

all tape speeds are continuously adjustable within a range of $\pm 10\%$

Deviation of average speed from nominal speed

max. 0.2%

Wow and flutter

peak weighted (DIN 45507, IEC Publ. 386, ANSI) measured using EMT 424 with 3300 ft (1000 m) standard tape on European tape hub per DIN 45515

at 30 and 15 ips max. $\pm 0.04\%$

at 7.5 ips max. $\pm 0.06\%$

at 3.75 ips max. $\pm 0.1\%$

Tape slip max. 0.1%

Tape width

6.3 mm (1/4 inch)

Hub diameter

max. 12 1/2" \triangleq 3960 ft (1200 m) standard tape

\triangleq 5940 ft (1800 m) long play tape

min. 45 mm

Tape coating

inside (A-wind) or outside (B-wind): alternative models

Applicable hubs and reels

European type hub per DIN 45515, 3 7/8" (100 mm) diameter

(with turntable for self-supporting tape packs)

or

Cine-type reels per DIN 45514, min. 1 3/4" (45 mm) core diameter

(with reel locking mechanism)

or

NAB reels, 4 1/2" (114 mm) core diameter

(with adapter)

Starting time at 15 ips and 3300 ft (1000 m) tape

to attainment of nominal speed: 0.2 sec

to attainment of $\pm 0.1\%$ wow and flutter: 0.5 sec

Fast wind time

max. \leq 100 sec for 3300 ft (1000 m) tape (variable wind speed)

Stopping time

(out of fast wind with full 3300 ft (1000 m) spool)

stop max. 3 sec

end of tape max. 3 sec

Spooling tape tension

1 N (3.6 oz_{force})

Electronic tape timer

5-digit LCD indicator in hours, minutes and seconds for all tape speeds, with negative sign below zero

Tape timer error

max. 0.3%

Timer overshoot after tape end run-off

max. 1 sec

Tape transport and amplifier control

microcomputer with 8085 microprocessor

Mode selection indication

alpha-numeric, 16-digit LCD

Remote control interface

rewind, fast forward, record, playback, stop, fader contact, enable fader contact

1 reserve software-defined

serial interface (optional)

Record and playback electronics

Equalization

at 30 ips	17.5 μ s (prop. AES) or 35 μ s (old DIN)
at 15 ips	35 μ s (CCIR) or 50+3180 μ s (NAB)
at 7.5 ips	70 μ s (CCIR) or 50+3180 μ s (NAB)
at 3.75 ips	90+3180 μ s (NAB) or 50+3180 μ s (NAB-EE)

(all equalizations combined, switchable)

2 speed/equalization combinations are selectable at the operating panel

Input

electronically balanced (differential input circuit)
(optional floating with input transformer)

Input level

adjustable from 0 dBm to +12 dBm
(max. 24 dBm)

Input impedance

min. 10 k Ω between 20 Hz and 20 kHz
(min. 5 k Ω between 30 Hz and 16 kHz with input transformer)

Output

electronically balanced (differential output circuit)
(optional floating with output transformer)

Output level

adjustable +4 dBm to +12 dBm
(at 200 nWb/m), max. output level +24 dBm

Output impedance

max. 40 Ω between 20 Hz and 20 kHz
(max. 40 Ω between 30 Hz and 16 kHz with output transformer)

min. load impedance:

150 Ω up to +18 dBm

200 Ω up to +24 dBm

Erase/bias frequency

205 kHz with crystal reference

Overall characteristics

These data refer to modern tapes such as 3M226, Ampex 456, BASF LGR50, Agfa PEM 468 or equivalent.

Frequency response

at 30 ips:	30 Hz ... 20 kHz	± 1.5 dB
	40 Hz ... 18 kHz	± 1 dB
at 15 ips:	20 Hz ... 20 kHz	± 1.5 dB
	30 Hz ... 18 kHz	± 1 dB
at 7.5 ips	20 Hz ... 16 kHz	± 1.5 dB
	20 Hz ... 14 kHz	± 1 dB
at 3.75 ips	20 Hz ... 10 kHz	± 1.5 dB
	20 Hz ... 8 kHz	± 1 dB

Signal-to-noise ratio

RMS, A-weighted according to DIN 45633 (IEC Publ. 179), referred to 1020 nWb/m and NAB equalization

	30	15	7.5	3.75	ips
					(510 nWb/m)
full track	79	77	75	66	dB
stereo (30 mil \triangleq 0.75 mm track separation)	75	73	71	62	dB
two-track (80 mil \triangleq 2 mm track separation)	74	72	70	61	dB

Quasi-peak, weighted according to CCIR 462-2, referred to CCIR equalization

	30	15	7.5	3.75	ips
full track (320 nWb/m)	56	55	54	51	db
stereo (510 nWb/m)	56	55	54	51	db
two-track (510 nWb/m)	55	54	53	51	dB

The choice for different demands: The Options

Total harmonic distortion

referred to 400 nWb/m (i.e. 6 dB above vu operating level)
max. 0.5% at 30 ips
max. 0.8% at 15 ips

Crosstalk rejection

measured at 1 kHz in accordance with DIN 45521
stereo version (30 mil \triangleq 0.75 mm track separation):
min. 50 dB
two-track version (80 mil \triangleq 2 mm track separation):
min. 60 dB

Erase attenuation

min. 85 dB at 1 kHz

AC mains

100, 110, 120, 200, 220 or 240 V (+5% / -10%) (by changing solder connections)
50 or 60 Hz

Power consumption at nominal voltage

160 VA
max. 250 VA

Ambient temperature

+5°C to +45°C
cold start (-5°C) ready for operation after 5 minutes

Operating positions

any horizontal to vertical

Dimensions, weights

	Height mm	Width mm	Depth mm	Weight kg
Chassis	277+50 (11"+2") (262,5*)	483 (19")	525 (20.6")	45 (100 lbs)
Carrying case (approx.)	405 (16")	510 (20.1")	600 (23.6")	14.8 (33 lbs)
Console 700	920 (36.2")	730 (28.7")	600 (23.6")	42 (92.4 lbs)
Vario stand	1262 (49.7)	664 (26")	850 (33.5")	32 (70.4 lbs)

(max. dimensions)

* when installed in console 700 the height is the same as that of the M15A, namely 252.2 mm (10")

Model options

1/4 inch design for tape coated inside (A-wind) or outside (B-wind). By interchanging both the head assembly and amplifiers (adjusted together) the versions are convertible without additional realignment.

Model	M21-1	M21-S	M21-2
Technical features	mono	stereo	two-track or stereo
		track sep. 30 mil 0.75mm	track sep. 80 mil 2mm
	A-wind B-wind	A-wind B-wind	A-wind B-wind
Amplifiers			
Record-playback amplifier BG-AW13	1	2	2
Head assembly			
Full-track erase head	●	●	
two-track erase head			●
Full-track record and playback heads	●		
Stereo record and playback head with 30 mil (0.75 mm) track sep.		●	
Two-track record and playback heads with 80 mil (2mm) track sep. (\triangleq stereo with 80 mil (2 mm) track separation)			●
Track selector active			●
Equalization selector *	●	●	●
Mono-stereo selector		●	●
Tape speeds (selectable)			
3.75/7.5ips	●	●	●
7.5/15ips	●	●	●
15/30ips	●	●	●
7.5/30ips	●	●	●
15/3.75ips	●	●	●
30/3.75ips	●	●	●

* Equalization selection only possible on machines with only one of the tape speeds 3.75, 7.5, 15 or 30 ips

Accessories (optional)

Tape marker
Tape cutter with splicer
Tape cutter in front of playback head with splicer
Tape lifter
Spot erase with tension sensing lever locking
Light barrier tape sensor
Input and output transformers
NAB hub lock

Function preselection switches (on BG-SB12)

With each of the DIP-switches S2 and S3 a tape speed (2 of 4) may be combined with their assigned equalization. Equalization selection or tape type selection or head assembly selection is possible, if the same tape speed but different equalizations are selected on the two programming switches.

Apart from the tape speed and equalization (tape type) record preselection, record inhibit and other software options may be selected.

Auxiliary units (optional)

vu meter unit with monitor loudspeaker and headphone jack
Remote control
Parts kit for desk
Vario stand
Hand rest
Tape shelf
19" rack
Mounting kit for 700 console
Carrying case



Tape marker (optional)

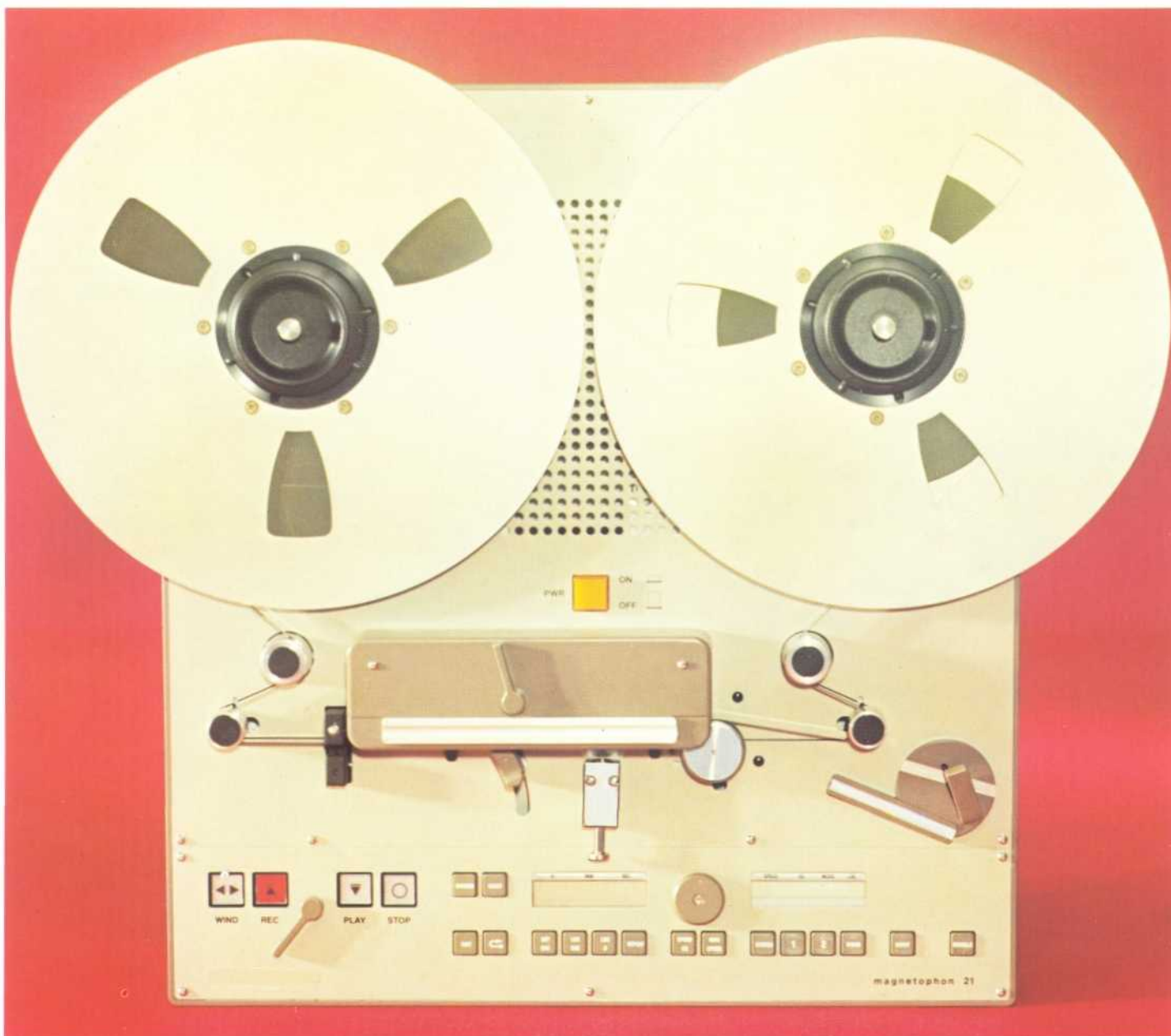


Tape cutter in front of playback head and splicer (optional)



*magnetophon 21
with vu-meter
unit mounted
on the Vario stand
with hand rest
(optional)*

**Easy to use
in all functions:
The Operating Panel**



Operating panel

Push-button function

Fast wind
Record
Playback
Stop

Push-button designation (from left to right)



WIND REC PLAY STOP

Unloading tape from heads



Rewind at search speed



Setting the tape timer to 0



Editing



Tape speed/equalization switch-over



Setting of Cue



Search to Cue



Search to Zero



Loop operation



Variable tape speed



Mono



Stereo (track 1 and 2)



Track 1



Track 2



Input to Output



Function enabling button:
tape speed/equalization
switch-over, vari-speed,
mono, stereo, track 1, track 2,
input

