

G SERIES

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Michael Otto
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Mikes, mixer and multitrack.
The nature of this classic studio combination has not changed in forty years.

And over time, the recorders have grown into great giants that dominate control rooms.

A tried and tested recording studio success scenario? Probably.

A way of working today and tomorrow? Hardly.

Future opportunities arise not only from new trends in music making but also from the ways that sound and vision production are now forever linked up.

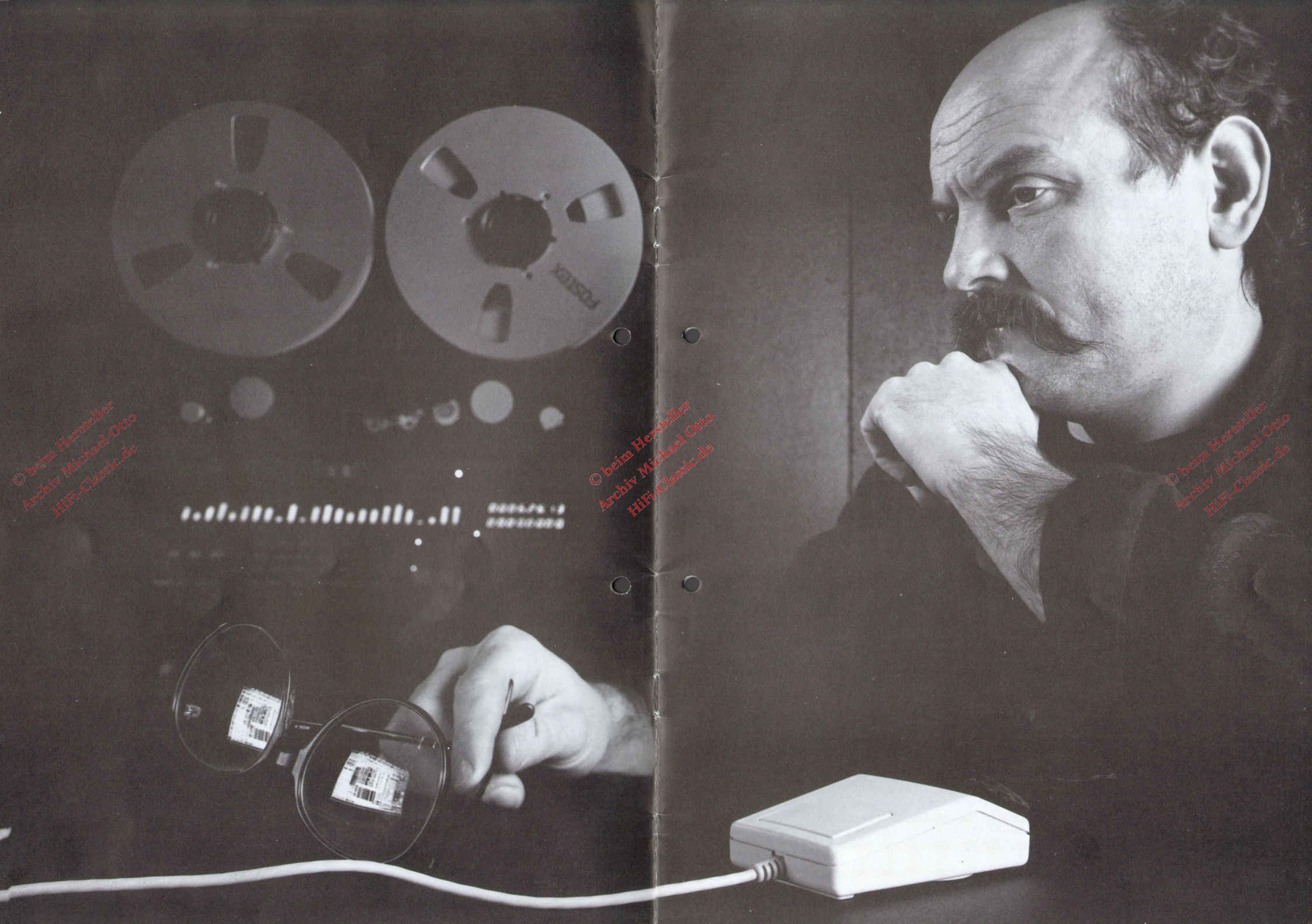
Computers have accelerated developments. Sequencing, synthesising and synchronising are all familiar and quite essential pro audio techniques. What's certain, is that multitracks must not only deliver outstanding audio quality, but also link and lock to the entire production system and process.

The Fostex G24 and G16 Multitracks have been developed to spearhead these newest techniques.

Faster, quieter, and more responsive than ever before.



Fostex



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THE EVOLUTION OF A SAGACIOUS TRANSPORT

The number of tracks may define the limits of your multitrack technique, but the efficiency of the tape transport will determine just how quickly you can work your way through a session.

The G Series includes half and one inch transports for the sixteen and twenty four track versions.

But the design approach is the same.

BRAWN GROWS BRAINS

Early tape machines relied on systems of links and levers to control tape motion. The governing 'intelligence' was a set of timing relays, retarding changes in direction and braking to ensure nothing drastic ever happened to the tape.

Location was very much a hit and miss affair.

Today's engineers are not prepared to wait.

Hands-on experience with computers has raised expectations for studio 'hardware' to respond without apparent delay.

As far as tape transports are concerned, this implies a design which monitors every movement, 'computes', and then issues commands to individual components.

This same 'controller' must respond to front panel keys, and also communicate with a variety of external commanders or computers.

That is the basis for the rugged G Series transport.

MINIMISE TO MAXIMISE

In the research for a more responsive transport, the design principle of electronics controlling mechanics has been closely followed.

Fostex engineers replaced many traditional parts - particularly solenoids - with an innovative, cam based mechanism. This transforms the computer controlled rotation of a small but powerful motor to the exacting linear motion required to move tape lifters, pinch roller and brakes.

Thus, a total of four direct drive DC motors, mounted directly to a precision engineered rigid alloy plate, are the basis of this stable design.

It follows that in a design which has less moving parts, less power is needed to move the tape efficiently so a more compact power unit is possible. There's less heat and less weight. And less parts mean less likelihood of anything going wrong.

Throughout this entire tape transport benefits of such an innovative design approach are very apparent. An efficient and stable design that's both cost effective and keeps its tight specifications.

In the Fostex tradition.

TAPE PATH

Constant shuttling, spooling and fast searching. It could all put strain on the tape's elastic base film material.

Positive, yet very careful tape motion is essential.

The path employed for the G Series ensures constant tension in every mode. Sensor arms detect changes and constantly control the two direct drive reel servo motors. Failsafe safety measures, to protect tapes are also included. Band brakes ensure a smooth stop.

Reel motors are heavy duty DC ironless rotor type, producing strong torque yet consuming very little power. NAB spools lock down firmly with a one sixth turn of the reel clamp. From the supply reel tension arm sensor, the tape passes over a tacho roller, tape guides and heads, and emerges to the capstan, flutter roller, second tension arm and takeup spool.

Threading the G Series transports is very fast and straightforward.

All tape path components are rigidly mounted on the machined alloy plate, to ensure long term stability.

DIRECT DRIVE CAPSTAN

To ensure constant, accurate speed and rapid response in synchronised applications, the capstan motor drives the tape directly.

A quartz oscillator generates a reference frequency. The capstan motor itself generates another signal proportional to its speed. An error detection circuit within the feedback loop of the motor drive amplifier compares these two frequencies and varies the motor supply whenever a difference occurs. As this correction takes place, the two frequencies are locked together such that their phase relationship is identical. Even the slightest irregularity of the motor is detected and compensation results.

This is the frequency generated servo controlled phase locked loop motor. It's the textbook design for rock solid speed control.

And because it's inertia is lower, it responds and locks up faster with synchroniser or other control.

QUEUING CONVENIENCE

Features have been incorporated with professional editing in mind.

a. The need for a hum shield has been totally eliminated in the G Series as the cam mechanism does not create spurious magnetic fields common to older style solenoid transports.

There's excellent working access to the heads, for ease of marking and maintenance.

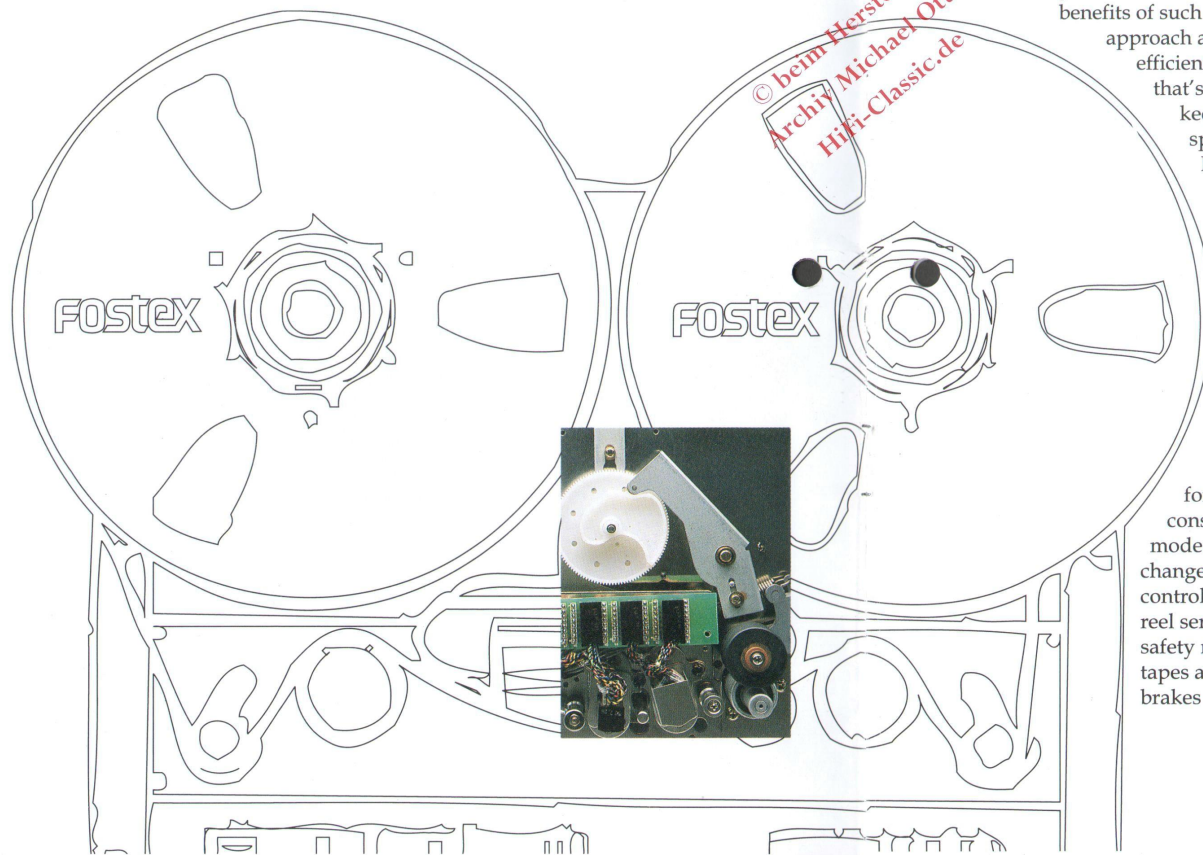
b. The head cover hinges readily upwards for even better head access.

c. If the 'edit' button is pressed, the cueing dial becomes active permitting the tape to be 'jogged' at slow or fast speed to the search position.

d. Positive locking NAB hubs, permit easy grip for shuttling during editing.

e. A spot erase functions make pin-point editing much easier and faster. Tracks are selected to the 'record ready' mode, and the tape is manually shuttled with the 'erase' button pressed.

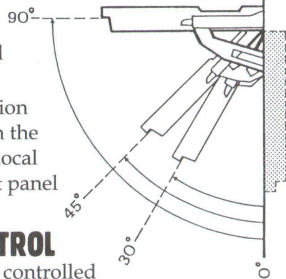
Clicks, coughs and breathing noises can be eliminated with matchless precision.



THE MOST POWERFUL REMOTE EVER BUILT INTO A MULTITRACK

For manual operation, the front panel can be positioned at a 30° or a 45° angle, and for alignment, the panel can be raised to a 90° angle for easy access. The entire front panel section is removable as a self-contained remote unit, so you can control all functions from your working position. An optional remote extension cable (Model 8546) allows operation from up to ten feet from the transport, and it includes a filler panel to protect calibration and alignment settings.

A duplicate set of motion control keys is located on the right of the machine for local operation when the front panel unit is remote.



SYSTEM CONTROL

The G Series transport is controlled by a master CPU assembly, which is located at the rear of the machine.

Motion and tension sensing, servo control, tachometer and audio switching all interface to a central microprocessor. Proprietary Fostex software provides the 'intelligence' for the recorder.

It ensures the operator can move quickly while keeping tape safe.

In the first place this system control is addressed by the front panel keypads to perform all of the functions described so far.

There's also a 'second level' mode which allows multi-function operation of individual command keys. So you can verify the software version of the transport and optional sync card, check total elapsed tape time, and perform other keystroke commands.

However, the G Series is designed to work within the music and post production facilities of today. And in that respect the multitrack has become the 'slave' to production systems under the command of central editor, sequencer or other computer based control.



METERING

Twelve segment LEDs, for easy readability, show levels for each track. This display is fully programmable via the keyboard under four modes:

Permanent, when the highest peak of each channel will be held continuously, until an even higher level is registered or the display is reset.

Normal, when the display functions as a normal peak level meter.

Temporary, when the levels of the highest peaks are held for about one second on the display.

Calibration mode, when the sensitivity of the meter around zero is increased to show level changes as small as one half of a dB.

OPTION KEY AREA

Three keys and their associated LEDs command the 8330 synchroniser board when it is installed.

TRACK SAFE/READY SELECT

These individual buttons select the tracks to be entered into the record ready state. The track selected to this can be changed to put monitor.

The associated LED indicator in record ready state shows alternate red and green lights. Then, if record is entered via the master safe/ready key or record button, it lights in red.

PRE-ROLL

This function stops the tape automatically at a position, which is adjustable up to 59 seconds, ahead of the zero or specified memory point.

Whether during rehearsal or recording, this gives you a run-in to your cue point, making it far easier to achieve perfect timing.

DISPLAY

Between them, the Memory and Tape Time displays give instant read-outs of all the information you need for fast, accurate operation memory points, tape position, tracks recording, etc.

The displays can also be read alphanumerically and can present error messages, to warn you when the transport is not operative or if you are trying to store incorrect data.

Furthermore, when the second level of control is addressed by the keyboard, messages relating to every aspect of the recorder's setup are shown.

LOCATE

You can locate either by time value or by memory position point and all memory points are quickly and easily verified or changed.

Up to ten stored cue points can be accessed. You can even access negative time cues (before the 0 reference).

AUTOPLAY AUTORETURN

When used with Locate or Locate zero. Autoplay causes the tape to play back automatically when a specified memory point or the zero position is reached.

Combined with Autoreturn, it gives you 'shuttle play' - the continuous repetition of a designated section of tape for rehearsal, listening back, etc.

MOTION CONTROL

Each of the familiar set of five motion control buttons has an associated LED.

Secondary features are also available. If either fast wind button is pressed, it will reduce the speed to approximately play speed for easy cueing. Stop is normally in a 'fast start' position. If the button is depressed for more than half a second the drive is disengaged.

ZONE LIMITS

With this feature, you can set start and end points for a specific section of tape, within which all the transport functions will be limited. For example, high speed rewind will automatically stop at the zone's start point.

So you can isolate the chorus or middle eight or any part of the track you wish to concentrate on. When you want the entire tape to be a zone, thus preventing the ends from coming off the reels, you just enter the length of the tape you are using via the keyboard. It will then compute the necessary zone limit points and program itself.

PITCH CONTROL

This knob adjusts tape speed over a range of $\pm 12\%$. A pushbutton switch engages this function and an LED flashes to warn the operator of non-standard speed.

The exact speed deviation accurate to one tenth of a percent can be displayed for precise setting.

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MULTITRACK WITH ALL THE CONNECTIONS

In the classic studio environment, the multitrack's front panel is the control centre for the session.

However, in today's production applications, it's more likely that the multitrack will come under the command of a master sequencer or edit controller. These techniques progress each day. The design of the G Series has anticipated these developments.

The industry standard protocol for synchronising recorded signals is SMPTE timecode. This is exploited in various ways for music and video editing.

Fostex has long experience of synchronising techniques. Our 4000 Series products are well established in the recording business. Now that expertise has been incorporated into the G Series.

INTEGRATED SYNCHRONISER CAPABILITY

An optional plug-in circuit board (Model 8330) is all it takes for fully integrated SMPTE synchronisation - the operating controls are already on the front panel. MIDI control is also interpreted.

The G Series can now synchronise simply by chasing external timecode. A single feed of SMPTE signal is all that's necessary to lock-up the transport. LED's indicate lock and the main displays can be set to show offset time, etc.

A transport link brings about many further benefits. Not only does the synchroniser benefit from extra motion information, but also the front panel controls can 'take over' the second machines functions.

FOR TOMORROW'S APPLICATIONS

Never before has a multitrack been so ready to integrate into time-locked production systems.

Whether it's a single SMPTE timecode connection or full control of every function, the G Series is the multitrack which makes the link effortlessly. In that respect the multitrack has become the 'slave' to production systems under the command of central editor, sequencer or other computer based control.

At the same time, the G Series multitracks satisfy every operational requirement of the workaday studio. Utterly reliable and with the enhanced quality of Dolby S, they represent a prudent investment for the music and post production facilities of today.



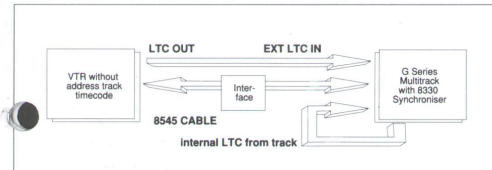
MUSIC LINK

In the studio, the multitrack is expected to lock to MIDI as well as SMPTE timecode.

Firstly, with the inclusion of the 8330 synchroniser, transport functions can be controlled directly by a MIDI keyboard or sequencer. MIDI IN, THRU, AND OUT connectors are provided.

Moreover, this interface also supports MTC (Midi Time Code) - the extension of MIDI 'language' which enables sequencers to interface directly with tape machines.

Using software such as Steinberg's Cubase or Cubeat the sequencer and multitrack run as one, in perfect sync. The multitrack becomes 'invisible'. Audio tracks appear like MIDI tracks on the screen. You run the sequencer and command every function on the G Series by just pointing and clicking a mouse.



Industrial VTR outputs time in play mode only (such as Sony VO-5600/5800/5850, JVC BR-8600 etc. This also works for audio recorders as masters for which there's the Fostex 4030 interface (MCI, Studer, Tascam Otari, etc.) The 8545 cable plugs into the 'transport control' socket on the back of the G Series.

COMPUTER INTERFACE

The 8330 option also has an industry standard, 9-pin RS-422 serial COMMUNICATION port, which can be connected to an external computer or video editor for complete system integration.

This allows the G Series to work directly with existing hardware using the same protocols for control.

Both E to E preview and insert edit operations are supported. During this operation, the G Series will

resolve to composite video references or station timecode if available.

The advantages of will be felt particularly in applications where multitrack can enhance the audio capability of an edit suite, or where material recorded using multitrack format needs to be laid back or used within the VT editing.

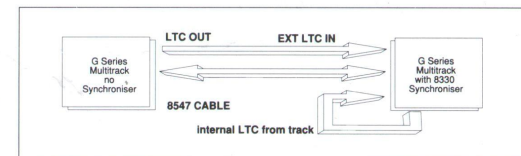
TIMECODE CONNECTION

Installing the 8330 board, integrates all the functions of a masterful synchroniser. INT LTC OUT is the output from the on-board timecode generator. The settings of this are via the keyboard. INT CODE IN is used to link to whichever of the local tracks is being used for timecode. EXT CODE IN/LOOP are the sockets which accept external timecode. An internal wideband reader means that the 8330 can follow timecode even during fast wind modes.

REMOTE POSSIBILITIES.

The circular 12 pin on the back panel accepts the connector from the front panel controller (extended) when it is used as a remote.

The second multipin marked ACCESSORY 1 carries full function control, tally-backs, and tachometer data for proprietary synchronisers. It interfaces directly to the Fostex 4030 and 4035 synchroniser products.



G Series without 8330 sync card and G Series with 8330 sync card. If both recorders have 8330 card, then only the time code connection is necessary because the 8330 outputs time code in fast wind modes. The 8547 cable connects from the 'Accessory 1' port on the first machine to the 'transport control' port on the G Series with the 8330.

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TRANSPARENT RECORDINGS WHICH SURPASS EXPECTATIONS

The responsiveness of the transport is complemented by impeccable audio. The remarkable new Dolby S-type noise reduction system, incorporated in both these G Series multitracks for the first time, fulfills the expectations of engineers anticipating 'noise-free' master recordings.

But the innovation in the audio circuits of the G Series does not stop at audio quality. Great care was taken at the design stage to ensure that channel status could be switched and seen with ease. With such attention to detail it's not surprising that these recorders offer unique operating advantages.

The tape record/playback amplifiers are built on double sided, glass fibre circuit boards. The latest surface mount technology has been employed to achieve such high component density and such a compact assembly

These boards are inserted into a 'card frame', presenting a full complement of lineup controls for easy access at the front of the recorder.

Fewer wired connections, and the use of ribbon cabling internally ensure that reliability and accessibility are improved.



DOLBY LABORATORIES PRINCIPLE OF LEAST TREATMENT

Providing noise reduction on silence is not all that difficult.

For many years, conventional compressors have been around which dramatically reduce noise between selections on tape or record. Yet it is just as important to have noise reduction while there is music playing.

While music will mask noise part of the time, there are times when it won't. A bass note won't hide tape hiss - no matter how loud it is - the ear hears both.

Wide band compressors turn down the volume during quiet

passages and back up again on louder music - and the noise at the same time. A burst of noise will accompany the bass note - audible if no music at higher frequencies hides it.

The problem is called noise modulation. It means that with any wide band compressor, the noise level is constantly shifting up and down with changes in music level.

What is more, when sounds are rich in transients, often full band tracking cannot cope at all.

The ideal noise-reduction system, on the other hand, would act wherever signals fall below a certain threshold, even when there are loud signals elsewhere in the spectrum.

Ideally, with a loud rap on a bass drum, there would be no record boost on the drum itself. But there would be full boost,

and therefore effective noise reduction upon playback, over the rest of the spectrum.

The application of constant gain wherever there are no high level signals (even in the presence of such signals elsewhere in the spectrum) is termed "the principle of least treatment".

The major benefit of adhering to this principle is a better recording system, virtually free of noise modulation. Moreover, the fact that high-level signals have little effect on low level signals has significant additional advantages in the real world, where encoded recordings are subject to decoding errors.

ACTION SUBSTITUTION

At the higher frequencies where tape noise predominates, Dolby S-type combines both fixed and

SILENT OPERATION

The performance specifications speak for themselves.

FETs at the first stage preamplifier for Sync/Repro head optimise the head loading and so the signal to noise ratio at this critical point. Headroom amounting to ten times the normal operating level is maintained throughout the audio path. Whilst the magnetic tape medium itself will 'saturate' considerably below this, high overload capacity in all the associated amplifiers reduces the chance of unpleasant 'clipping' noises if signal levels get somewhat out of hand.

Ever increasing demands for silent performance include silent entry and exit from the record mode. A delay circuit between the 'turn off' of the erase current and the record bias prevents a 'blank' section access the distance from the record head to the record head at the 'punch-out' position. This is a feature mandatory far demanding audio and video post production applications.

Audio switching is electronic and click free and achieved with electronic or mechanical latching DC control switches. There are no switch contacts to corrode and affect in the signal path. Sync switching is fully automatic and there's one touch logic for all record and monitor select functions.

HEAD ASSEMBLY

Essentially, tape heads are precision transducers which transform high quality audio to a magnetic field - and then back again.

High-hardness permalloy is employed, with a core design which reduces head bump effects to less than 1dB. As a result, the low frequency compensation

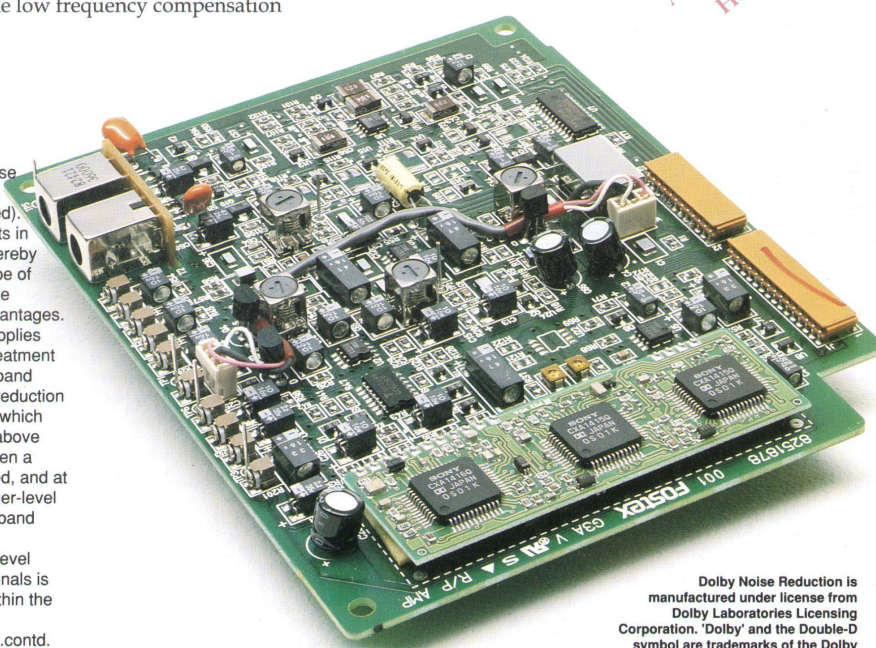
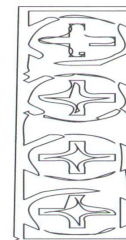
sliding bands (at low frequencies, where noise is far less significant, a fixed band alone is used). This combination results in action substitution, whereby advantages of each type of action are realised while minimising their disadvantages.

Action substitution applies the principle of least treatment to the noise reduction band itself. It minimises the reduction in record compression which occurs at frequencies above higher-level signals when a fixed band alone is used, and at frequencies below higher-level signals when a sliding band alone is used.

The effect of higher-level signals on low-level signals is therefore minimised within the noise reduction band.

.....contd.

METER CAL
REC CAL
REC LVL (NR ON)
REC LVL (NR OFF)
TALK CAL
REPEL EQ
REC LVL
REC EQ
EAS LVL
DIAS LVL
OWS ADJ
ERS ADJ



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(equalisation) needed is less severe, Less correction in the circuitry means a cleaner signal path and results in clearer bass signal.

Crosstalk has also been minimised through careful and experienced design. The figure is only 55dB at 1kHz. - easily matching that of conventional machines using tape of twice the width.

The precision staggered erase head reduces fringing effects whilst ensuring complete erasure of all of the signal between tracks.

Sync quality is as good as playback - full frequency response for dubbing or bouncing the audio tracks,

Each element in the audio path, from heads, through amplifiers and switching to the outputs, is designed to provide the very highest integrity signal path and offer the easiest operation.

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STAGGERED-ACTION COMPRESSION

Dolby S-type provides more than 20 dB of noise reduction at high frequencies.

Providing that much noise reduction using conventional techniques would subject low level signals to an unduly high compression ratio. Therefore, with Dolby S-type, compression is provided by two separate and staggered stages operating at different signal levels and introducing comparatively gentle compression ratios.

This technique was first pioneered in Dolby C-type NR and further refined in Dolby SR.

SOUND IMPROVEMENTS.

In addition to noise reduction that does not get in the way of the music, Dolby S-type incorporates two further improvements pioneered in the Dolby SR system.

Antisaturation consists of high-frequency shelving networks which operate at high signal levels; complementary networks restore flat response at playback. The shelving significantly reduces high-frequency losses and distortion caused by tape saturation, significantly extending headroom.

Spectral skewing consists of networks which roll off the extreme low and high ends of the spectrum in the encoder; and complementary networks which restore flat response in

the decoder. The networks reduce the dependency of the system's action on signals at the extreme ends of the spectrum, thereby reducing decoder mistracking as the result of response errors introduced by the recorder in those regions.

Such errors include those caused by variations among tape formulations even within the same nominal category, and by head-azimuth variations between the machine on which a tape is recorded and those on which it is played back. While spectral skewing results in some loss of NR effect at those extremes, the ear is so insensitive to noise at the extremes that the benefits far outweigh the theoretical noise reduction loss.

SPECIFICATIONS

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In items with double specifications, the former is for the G24S and the latter for the G16S;

Tape	1 inch (25.4mm), 1/2 inch (12.7mm),
Format	24 track, 24 channel, 16 track, 16 channel
Head	2 heads (Erase, Rec/Play)
Reel Size	10.5" (270mm) NAB Hub
Tape Speed	15 ips, (38cm/S) ± 0.2%
Pitch Control	±12% normal speed
Line Input	-10dBV (0.3V) load 30kOhm, unbalanced
Line Output	-10dBV into load > 10kOhm, unbalanced
Calibration	referenced to 320 nWb/m of tape flux
Equalisation	15 ips; IEC-1 (∞ + 35 µsecs)
Wow & Flutter	±0.05% peak wtd., (IEC/ANSI) 38cm/S,
Starting time	Less than 0.5 sec
Fast Wind Time	140 secs. for 2500 ft. (740m) of tape.
Freq Response	40Hz - 18KHz, at 15 ips ±3dB
S/N Ratio	88dB/86dB CCIR ARM wtd, for 38cm/S, ref 3% T.H.D. level (10dB above 0dB) at 1 KHz (w/ built in Dolby S)
T.H.D.	Less than 1% at 1KHz, 0VU
Erasure	Better than 70dB at 1kHz
Crosstalk	Better than 55dB at 1kHz
Powering	220V/240V, 50Hz, 195W,170W 120V, 60Hz, versions
Mechanical	482(W) x 488(H) x 230(D) mm.,
Weight	35kg., 32.5kg.

Accessories for use with Fostex G Series Multitracks

- Model 8151 Foot switch
- Model 8546 Extension cable
(for controller, with dress panel)
- Model 8545 Synchroniser cable
(Anti-EMI connector on one end)
- Model 8547 Synchroniser cable
(Anti-EMI connector on both ends)
- Model 8330 Synchroniser card
(installed inside G24S/G16S)



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FOSTEX CORPORATION, 3-2-35 Musashino, Akishima, Tokyo, Japan 196

FOSTEX CORPORATION OF AMERICA, 15431 Blackburn Avenue, Norwalk, CA90650, USA

FOSTEX (UK) Ltd. Jackson Way, Great Western Industrial Park, Southall, Middx UB2 4SA. Great Britain