

TANDBERG
Series 100
Instrumentation
Recorder

The amount of data to be collected in nearly all fields of modern industry, engineering and research has created a need for an instrumentation tape recorder, which can store large amounts of data for later display and analysis. Until quite recently, such tape recorders were available at a cost that could only be justified in a limited number of applications. TANDBERG Series 100 Instrumentation Recorder fills this gap.

Weighing only 25 pounds, this unit has a performance equal to that of the most advanced instrumentation recorders for stationary use, and at a much lower price.

The recorder features 4 tracks of IRIG Standard FM recording on 1/4-inch tape at the speeds 7 1/2, 3 3/4 and 1 7/8 ips. Signal-to-noise ratio at 7 1/2 ips is better than 47 dB. The tape transport with capstan servo drive is of the well reputed TANDBERG quality. Figures for flutter are very low, and the S/N can be further improved with electronic flutter compensation. Track 4 can be used for data or voice recording alternatively. Overall factory calibration of the

system and standardized output voltage make operation simple and eliminate the need for tedious set-up procedures. A CRT monitor which displays the deviation of all four channels simultaneously, facilitates selection of appropriate input range. DC motor enables operation on line frequencies between 48 and 1000 Hz. Model 100 is designed for portability, and has carrying handles, that mounts flush with the cabinet when not in use.

Application of modern technology, integrated circuits and high quality components have enabled the design of this compact tape recording system of excellent stability and linearity.

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FEATURES

- RECORDING** Button interlocked with tape motion lever prepares all channels for record mode of operation.
- Separate record able/disable switches for each channel allow recording on one or more tracks as desired. Pilot lamps indicate channel not in use.
- ERASURE** Separate full-track erasure obtained by simultaneously depressing buttons ERASE and RECORD. Remanent signal on the tape after erasing is more than 70 dB below normal recording level. Recording can occur simultaneously.
- A separate degausser is therefore not needed.
- INPUT OFFSET** An uncalibrated offset control can be activated by OFFSET switch on each channel. A DC voltage twice the selected input range can then be balanced out.
- CAPSTAN SPEED CONTROL** The tape speed is sensed by a tachometer on the capstan shaft and compared against a fixed reference. The error voltage is amplified and applied to the motor to alter the motor torque as required to maintain constant tape speed.
- VOICE AND DATA CHANNEL** Channel 4 has three modes of operation: Data only, voice only and data interrupted by voice. When voice is recorded, the carrier is given a constant + 60 % deviation which serves as an indication of voice recording. In reproduce mode, data is normally fed to the output terminal. When voice (60 % deviation) is detected, the data output is automatically grounded and voice is reproduced through speaker or headphones.
- FLUTTER COMPENSATION** Channel 2 can be used for flutter compensation or data. When recording in flutter compensation mode, the data input is grounded, and the recorded carrier is modulated by flutter. In playback, output from the flutter channel is subtracted from the signal in the data channels, giving an improved signal-to-noise ratio at the data output.
- DATA CHANNELS** The overall gain of the FM record/reproduce system can be selected with the input attenuator, allowing full deviation for signals between ± 0.5 and $\pm 20V$.
- The CRT monitor is permanently connected to the output of the reproduce electronics. The output signal is ± 5 volts for full deviation.
- SIGNAL MONITOR** All four data reproduce output voltages are sampled sequentially and displayed on a switched beam CRT. This monitor aids the selection of correct INPUT RANGE. Because the system is calibrated, the attenuator setting alone determines the relationship between input and output voltages.
- COPYING** Inputs and outputs for copying or transmission of modulated carrier from one tape recorder to another, are provided on the rear panel.

TECHNICAL SPECIFICATIONS

GENERAL

MODES OF OPERATION:

ALTERNATIVE	CH 1	CH 2	CH 3	CH 4
1	FM	FM	FM	FM
2	FM	FM	FM	VOICE
3	FM	FLUTTER COMP	FM	FM
4	FM	FLUTTER COMP	FM	VOICE

POWER REQUIREMENTS:

115/230V \pm 10%, 48 - 1000 Hz, 28W.

TEMPERATURE RANGE:

0 to + 55 degrees Centigrade, operating. - 40 to + 75 degrees Centigrade, nonoperating.

HUMIDITY:

10% to 95% (- 25 to + 40 degrees Centigrade), noncondensing.

VIBRATION:

0.1" displacement 5-18 Hz, 1.3 g, 18-200 Hz. Nonoperating.

SHOCK:

50 g max. (10-ms, half sine), nonoperating.

ALTITUDE:

15 000 ft., operating, 25 000 ft., nonoperating.

OPERATING POSITIONS:

Any.

WEIGHT:

Approx. 25 lbs, (11 kg).

DIMENSIONS:

Width 13" (330 mm). Height 9⁷/₁₆" (240 mm). Depth 10³/₄" (273 mm).

TAPE TRANSPORT

TAPE DRIVE:

Open loop.

BRAKES:

Mechanical brakes on both turntables activated by operating lever or instantaneous start/stop lever.

SPEED CONTROL:

Electronic servo controls capstan speed against fixed reference.

CAPSTAN DRIVE:

Transfer wheel coupling between DC motor and capstan.

TAPE REEL DRIVE:

Friction coupling to motor.

TAPE WIDTH:

1/4-inch.

TAPE SPEED:

7¹/₂, 3³/₄ and 1⁷/₈ ips, electrically switchable by rotary switch on control panel. FM carrier frequency and FM reproduce filter bandwidth automatically selected.

REEL SIZE:

7" reels with cover off, 5" reels with cover on.

WINDING TIME:

1800 ft. reel: 200 seconds, typical.

SPEED ACCURACY:

\pm 0.2%.

FLUTTER:

Measured in accordance with IRIG Standard Document 106-66.

Tape speed, ips	External filter	Flutter (% p-p)
7 ¹ / ₂	0.2-1 250 Hz	0.35
3 ³ / ₄	0.2- 625 Hz	0.40
1 ⁷ / ₈	0.2- 313 Hz	0.80

START AND STOP TIMES:

Less than 1 sec.

TAPE FOOTAGE COUNTER:

4-digit, with push-button reset.

HEADS:

One full-track erase head, one 4-track record head, and one 4-track reproduce head.

TAPE MOTION MODES:

Normal forward drive, fast forward, fast reverse and stop, selectable with operating lever.

A separate lever provides instantaneous start/stop in normal forward drive.

FM RECORD/ REPRODUCE

(All specifications at 25 degrees Centigrade unless otherwise indicated.)

FM system conforms with IRIG Standard Document 106-66 Intermediate Band.

INPUT SIGNAL LEVEL:

\pm 0.5V to \pm 20V for \pm 40% deviation in the following six calibrated ranges:
 \pm 0.5, \pm 1, \pm 2, \pm 5, \pm 10 and \pm 20V.

MODULATOR GAIN ACCURACY:
DEMODULATOR GAIN
ACCURACY:

\pm 1%.

\pm 1%.

DEVIATION MARGIN: 50%, i. e. carrier can be deviated to $\pm 60\%$. Some carrier feed-through occurs as deviation approaches minus 60%.

INPUT IMPEDANCE: 40 kohm/V, single ended.

DATA FREQUENCY RANGE AND SIGNAL/NOISE RATIO:

Tape speed ips	Center Carrier Frequency Hz	Passband Limits*		S/N** dB
		Lower Limit	Upper Limit	
7 1/2	13 500	DC	2 500	47
3 3/4	6 750	DC	1 250	45
1 7/8	3 375	DC	625	40

* Transitional Butterworth-Thompson response. Output at upper passband limit is within -1.5 ± 0.5 dB from reference level. (Reference level at 10% of upper passband limit.)

** R.M.S. Ratio measured without flutter compensation with $\pm 40\%$ deviation at 10% of upper passband limit.

PULSE RESPONSE:

Tape speed ips	Rise and fall time (μ sec)	Max. overshoot (%)
7 1/2	150	5
3 3/4	300	5
1 7/8	600	5

FLUTTER COMPENSATION:

Slide switch on control panel selects one of two modes: (1) Data only and (2) Flutter compensation.

OUTPUT VOLTAGE:

± 5 V peak for full deviation.

OUTPUT IMPEDANCE:

Less than 1 ohm, single ended.

OUTPUT CURRENT:

Maximum ± 20 mA peak at ± 5 V peak.

LINEARITY:

0.2% departure from best straight line through zero.

CALIBRATION VOLTAGE:

A 0.5V calibration voltage is available on the rear panel. Accuracy $\pm 0.2\%$.

MONITOR:

A time multiplexed CRT monitor connected to the outputs displays the instantaneous deviation of each channel.

OUTPUT MODE:

REPRODUCE is the normal operating mode.

PRERECORD implies a direct connection between record and reproduce electronics, enabling monitoring of input signals. This mode is established whenever tape motion is stopped regardless of switch position, or by setting switch in **PRERECORD**.

DRIFT:

After 5 minutes warm-up time:

RECORD: $\pm 0.01\%$ of carrier frequency per degree Centigrade.

REPRODUCE: $\pm 0.01\%$ per degree Centigrade referred to carrier frequency.

$\pm 0.2\%$ of carrier frequency including offset due to different input range settings.

MODULATOR OFFSET:

$\pm 0.2\%$ referred to carrier frequency, i.e. ± 25 mV.

DEMODULATOR OFFSET:

DISTORTION:

Total harmonic distortion less than 1% at 10% of upper passband limit.

CROSSTALK:

-48 dB, measured with input connected to ground and on adjacent channel recording a signal at 10% of upper passband limit and $\pm 40\%$ deviation.

VOICE RECORD/ REPRODUCE

Channel 4 has 3 record modes controlled by VOICE CHANNEL switch on front panel and by push-button switch on microphone.

MODE	VOICE CHANNEL switch	Microphone switch
Data only	INTERRUPT	Unoperated, or no microphone connected
Voice only	CONTINUOUS	Inactive
Data interrupted by voice	INTERRUPT	Depressed for voice recording

In reproduce, data or voice is automatically selected, and data output is grounded during voice reproduction.

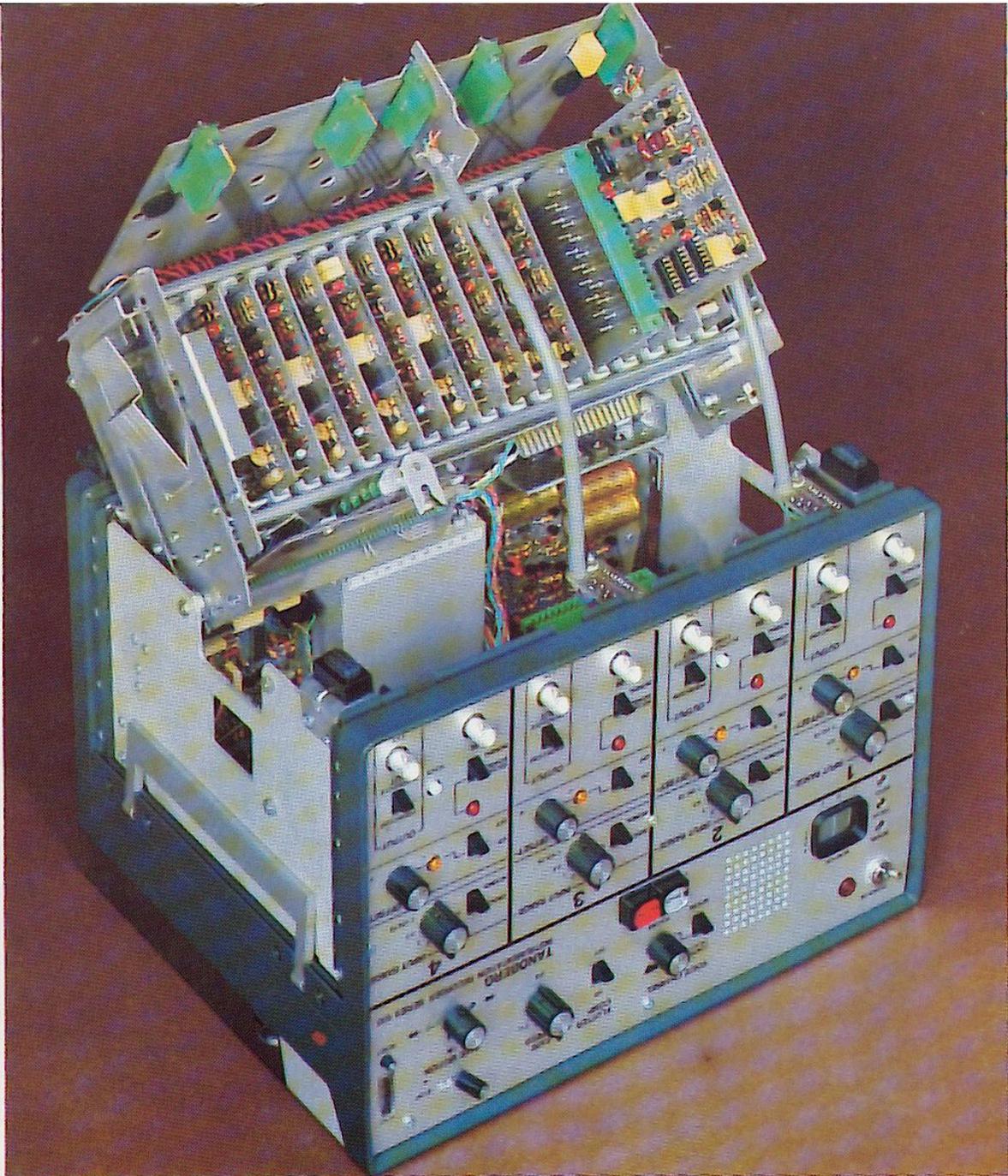
Voice reproduction is inhibited during recording, or with switch in interrupt.

Microphone input: For 200 ohm dynamic microphone.

Record level: Automatic level control.

Reproduce level: Adjustable with separate voice channel VOLUME.

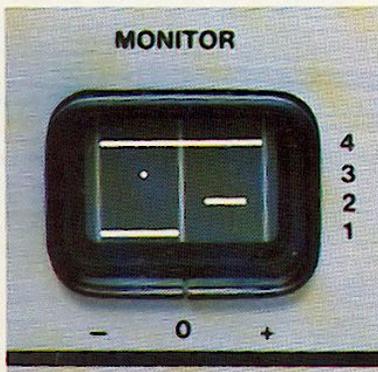
Monitoring: Built-in speaker, headphone jack.



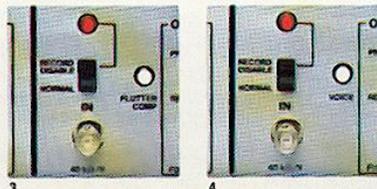
SERVICEABILITY

For ease of maintenance, the main electronics assembly containing plug-in circuit boards, can quickly be pulled out and tilted into a stable position for servicing.

- 1. **MONITOR**
CRT monitor displays deviation of all four channels simultaneously making selection of appropriate input range easy.
- 2. **INPUT OFFSET**
INPUT OFFSET centres input signal for optimal dynamic range.
- 3. **FLUTTER COMPENSATION**
Easy-to-use electronic flutter compensation for improved signal-to-noise ratio.
- 4. **VOICE CHANNEL**
Built-in voice channel for comments.
- 5. **CARRYING HANDLES**
Designed for portability.



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