KENWOOD

DIGITAL AUDIO EQUIPMENT

TEST & MEASURING INSTRUMENT

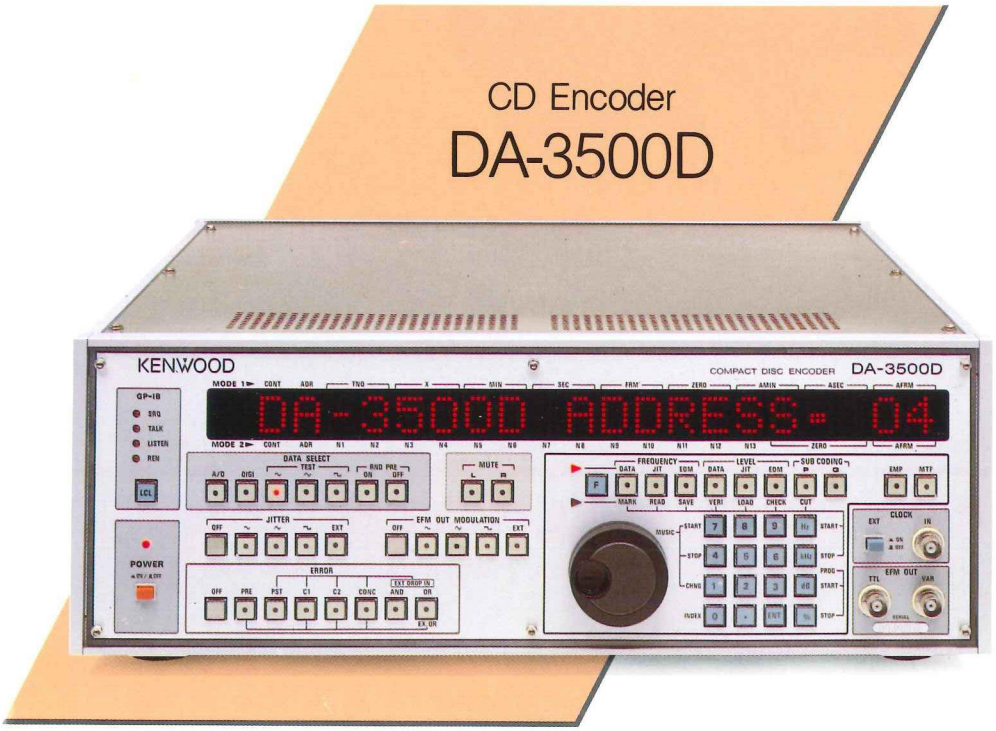
Generates Signals Equivalent to a CD Player Laser Pickup Output.

The DA-3500D Compact Disc (CD) encoder is a standard signal generator conforming to CD standards. It can be used to generate signals equivalent to signals from a CD player laser pickup. The DA-3500D generates an EFM signal fully compliant with CD standards for a variety of signal sources, performs CIRC processing, and by adding a complete subcode which includes R-W, provides comprehensive editing of CD lead-in data, making it a useful disc-cutting tool for CDs, CD-ROMs, CDVs, and LDs. In addition, it can generate a variety of signals required for CD player inspection and adjustment. It has a built-in GPIB interface, enabling remote control of functions, thereby making the DA-3500D usable in labor-saving automatic test systems for CD player manufacturing, inspection, and adjustment.

■A built-in R-W subcode adaptor enables processing of data sent from, for example, screen editing functions in accordance with CD standards.

■MTF approximation filtering, jitter modulation, AM modulation, and offset disturbances can be applied, enabling a faithful simulated generation of signals from the optical transmission system.

■High-accuracy, low-distortion 16-bit digital signals can be generated to enable measurement of CD player D/A converter and bandpass filter characteristics.



SPECIFICATIONS

Coding format	Conforms to Compact Disc standards (February 1985 edition)
Reference clock	
Frequency	8.6436MHz internal or external (TTL level), selectable
External input range	8.6435MHz ±1MHz
EFM signal outputs	Two provided
TTL level output	TTL level output (pulled up with 330Ω, pulled down with 330Ω)
Variable RF output signal	
Variable range	0 to 1Vp-p (75Ω load)
EMI signal source	Sine, triangle, squarewave, pseudorandom shift-register sequence, and external digital data inputs (2) Digital setting of frequency and level for sine, triangle, and squarewave signals.
Sine, triangle, and squarewave	
Frequency range Sine and squarewave	1Hz to 22.049kHz, in 1Hz steps
Triangle wave	1Hz to 11.024kHz, in 1Hz steps
Frequency stability	Governed by reference clock stability
Distortion	Digital distortion: 0.00015% max.
Variable output range	0 to 100%, in 1% steps and 0 to −84dB in 0.1dB steps down to −60dB and 1dB steps below −60dB
Level setting accuracy	0.004% or 0.1dB or better (to −60dB), or 1dB or better (to −84dB)
Maximum-length pseudorandom signal	
Number of bits	8 bits
Initialization	Preset settable on/off
Digital data input 1	
Input data format	8-bit units (by high-byte and low-byte sampling), positive logic, 2's complement
Digital data input 2	
Input data format	8-bit units (by high-byte and low-byte sampling), positive logic, 2's complement
Simulated error pattern generation Pre-errors (before EFM modulation)	
Error types	C1 correctable errors C2 correctable errors Concealed errors Burst errors by EXORing with the EXT. DROP-IN signal
Post-errors (after frame generation)	
Error types	C1 correctable errors C2 correctable errors Concealed errors Burst errors by AND-OR with the EXT. DROP-IN signal Errors by an arbitrarily settable error pattern (GPIB controlled)
Error pattern setting	108 frames in bit units
Jitter modulation	
Modulation index	0 to 7%
Modulation frequency range	10Hz to 9.99kHz
Modulation waveforms	Sine, triangle, squarewave, and external
External modulation sensitivity	7% at 2Vp-p
AM modulation	
Modulation index	0 to 100%
Modulation frequency range	10Hz to 9.99kHz
Modulation waveforms	Sine, triangle, squarewave, and external
External modulation index	100% at 2Vp-p
External modulation frequency range	DC to 50kHz
Offset	
Voltage	0 to ±0.5V (75Ω load, external input voltage: 0 to ±1V peak)
External input frequency range	DC to 50kHz
MTF approximation filter	
Selection	On/off switchable
Configuration	4th order elliptical approximation filter
Muting	Digital muting is possible on left and right channels independently.
Subcode output	Generation of CD, CD-ROM, CDV, and LD subcodes
R, W subcode	Can be externally input
Cutting	By connecting the DA-3500D to a disc cutter, it is possible to cut a disc in conformance with CD standards.
External control	All functions required for operation can be externally controlled via the GPIB (IEEE Std. 488-1978)
Power requirements	100/120/220/240V AC, 50/60Hz, approx. 100W
Dimensions	430 (W) × 149 (H) × 465 (D) mm
Weight	Approx. 12kg

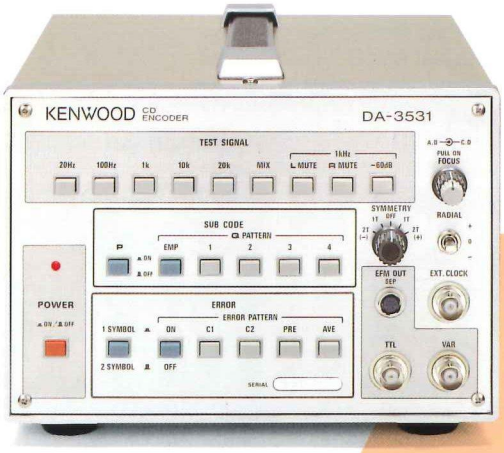
Ideal for Adjusting and Inspection of CD Players and R&D as well.

The DA-3531 is a standard signal generator capable of evaluation testing of CD players in accordance with CD standards. By major simplification and adaption of encoder circuitry, the DA-3531 provides high reliability and quality.

■Includes an MTF filter, enabling a signal equivalent to the output from a CD player laser pickup to be generated by simulation of the transmission characteristics of this signal.
■Designed with actual CD player test applications in mind, the DA-3531 has a variable symmetry function and laser pickup output directly connectable to a CD player. In addition, it simulates a variety of signal patterns at its pickup simulation output.
■Nine types of test patterns, 16 subcodes, and eight error patterns can be selected for use in a variety of tests and measurements.
■The nine types of test patterns are high-accuracy (16 bits), low-distortion signals, enabling testing of D/A converters and lowpass filters.

SPECIFICATIONS

Coding format	Conforms to Compact Disc standards
EFM signal outputs	Two provided (TTL level, variable RF output signals)
Test signals	Nine types (used in testing such as audio frequency response testing, emphasis function testing, L/R channel crosstalk testing, and IMD testing)
Error generation	C1 correctable errors, C2 correctable errors, errors concealed by pre-hold, and errors concealed by mean-value interpolation are generated. An external DROP-IN signal can be used to generate burst errors as well.
Subcodes	
P code	Switchable on/off from the front panel
Q code	Four types of patterns generated. Emphasis switchable on/off from the front panel.
External subcode	External input is possible of all P to W codes.
External clock	Three frequencies (8.6436MHz, 4.3218MHz, and 44.1kHz)
Laser-pickup simulation	DC bias addition, radial error, focus error
Transmission system simulation	MTF approximation filter, addition of offset
External control	All panel functions are externally controllable by means of 16 input lines.
Power requirements	90 to 132V/198 to 264V AC, 50/60Hz, approx. 35W
Dimensions	190 (W) × 128 (H) × 263 (D) mm
Weight	Approx. 3.2kg



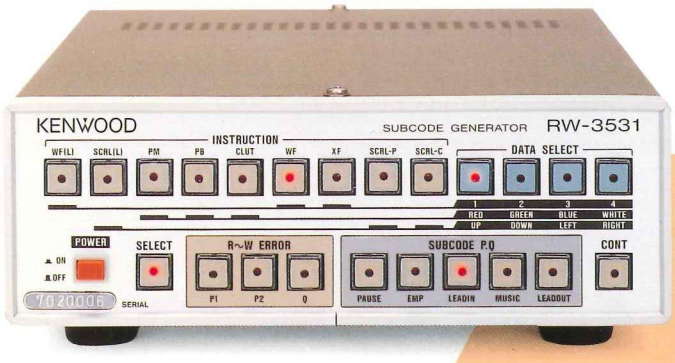
CD Encoder
DA-3531

The RW-3531 is a CD subcode generator which generates the R to W channel subcode data for graphics, in addition to the P and Q channels. By connecting it to the DA-3530/3531 CD encoder, it can be used in adjustment and inspection of the subcodes circuits of CD players.

■All eight P to W channel subcodes are generated, enabling use with not only normal CD players, but also with players that make use of the R to W channel graphic functions.
■For the P and Q subcodes, five types of subcode data for lead-in and lead-out program conditions are generated while varying TIME and ATIME.
■For R to W channel subcodes, patterns which use nine types of LINE and TV mode instructions are generated, and it is also possible to generate adjustable instruction transmission speed and errors.
■All front-panel switch functions can be externally controlled.

SPECIFICATIONS

Connectable devices	DA-3531 and DA-3530 CD Encoders
Coding format	Conforms to Compact Disc standards
Subcodes P to Q	
Pattern types	Five types: Lead-in, music pause, emphasis, lead-out
Time code	TIME and ATIME are added or subtracted at 75Hz.
Subcodes R to W	
Pattern types	Four types each of patterns for LINE mode and TV mode instructions are generated.
Channel number	Patterns can be generated for channels 0 to 15.
Scroll direction	Up, down, left, and right or upper-right, lower-right, upper-left, lower-left
Scroll amount	Five switchable steps: 1, 2, 3, 6, or 12 pixels/instruction
Instruction speed	Four switchable steps: 1, 2, 3, or 4 instructions/frame
Error generation	One- or two-symbol error can be generated with respect to the P sequence, and a one-symbol error can be generated with respect to the Q sequence.
Pattern repetition	Repeated pattern generation is possible by means of the CONT switch.
External subcodes	The P and Q subcodes of the DA-3530/DA-3531 can be selected by using the SELECT switch.
External control	Front-panel switch functions can be externally controlled.
Power requirements	100/120/220/240V AC, 50/60Hz, approx. 5W
Dimensions	190 (W) × 65 (H) × 260 (D) mm
Weight	Approx. 2.2kg



Subcode Generator
RW-3531

Analysis of LaserVision and CDV RF Signals.

These decoders generate RF signals which conform to Laservision and CDV standards. The source signals (picture FM, sound FM, CD EFM, and code data) included in the RF signal can be generated, enabling measurement and evaluation of these signals. These decoders consist of the DR-3555, which is capable of playback and measurement of all CD/LD/CDV signals, and the DR-3553, which performs playback and measurement of the CD EFM signal.

LD RF signal processing section (Dr-3555 only)

■The analog audio signal FM carrier is detected, and the audio signal is played back.
■The picture FM signal is played back.
■A digital time base corrector is provided as a means of performing picture signal time compensation.
■Playback of a 40-bit FM code and 24-bit biphase code is performed, and if there is an abnormality detected this is detected and recorded. The relationship to the Q subcode played back at the EFM processing section is monitored.
■The EFM signal contained in the video part RF signal of LDs and CDVs with digital sound can be separated, de-emphasized, and output. It can also be output as an EFM signal to a CD decoder.

EFM signal processing section

■Playback audio monitor
An 8-times-oversampling 18-bit D/A converter, lowpass filter, and emphasis circuit are provided internally, enabling monitoring of the audio signal. An auto mode which automatically switches emphasis on and off in accordance with the emphasis bit of the EFM signal is provided, in addition to manual override control of emphasis.
■P and Q code display
The following information can be displayed at all times, from the EFM signal and P and Q codes.
Track no.: Index, time, absolute time, control bit
Catalog no.: ISR code
■Data error measurement (music information)
The number of error frames generated each 1 second are measured for the following types of errors.
C1 errors: C1
C2 errors: C2
C2 noncorrectable errors: CU

Common processing section

■Trigger function
In making measurements of various errors, a trigger start and trigger stop function is provided to establish the starting position for measurement and the stopping position for measurement.
■Printout function
■GPIB interface

Screen output function

■Measurement screen output
Measurement data display on an internal display unit (electroluminescent panel)
■Video output (DR-3555 only)
The picture FM signal of the LD/CDV signal is demodulated and output.
■Graphic screen output (DR-3555 only)
Graphic playback output is made by means of the subcodes in the EFM signal.

SPECIFICATIONS

Function

Configuration block	Units used	Processing functions	Measured items
A. Common processing section	System control Data analysis Error count	——	——
B. Picture signal processing section	RF interface FM demodulator Video TBC	Picture FM signal playback Audio FM signal playback Code data playback and display	Drop-out measurement Code data analysis
C. EFM signal processing section	EFM demodulator	Digital audio playback Q code data playback and display	Data error playback P an Q code data analysis
D. Subcode data picture processing section	Graphic control Video generator TV memory Line graphic playback	TV graphic playback Line graphic playback	Subcode data error measurement
E. CD-ROM/I signal processing section	CD-ROM interface CD-ROM ECC	CD-ROM/I data playback Header/subheader information playback and display	CD-ROM/I data error measurement

Power requirements	100/120/220/240V AC, 50/60Hz
Dimensions	426 (W) × 177 (H) × 410 (D) mm

Product Variations: DR-3555: A+B+C+D+E / DR-3553: A+C+D+E

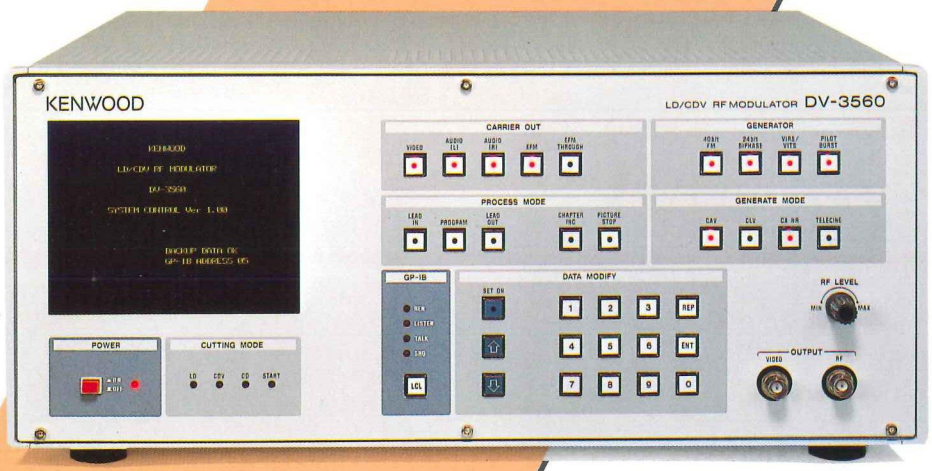
CD/LD/CDV Decoder
DR-3555
DR-3553

Generates an RF Signal Equivalent to an Optical-Disc Signal From a Variety of Sources.

The DV-3560 generates from a variety of source signals (composite video signal, stereo audio signal, CD EFM signal, and SMPTE time code) RF signals equivalent to those for Laservision and for optical discs based on the CDV standard. It can be used as a multipurpose generator for LD, CDV and CD cutting simulation. Also, the ability to select generation of a variety of modulation signals and arbitrarily set the control code generator makes the DV-3560 useful in development and checking of LD/CDV players as well.

■Accommodates CD, CDV, LD, and LD with digital audio, and provides in a single package source-signal pre-emphasis, modulation, mixing, and switching of these functions.
■The control signals that are part of the picture signal (40-bit FM code, white signal, and 24-bit bi-phase code) are automatically generated.
■The symmetry of the RF signal output can be varied.
■The time code reader required for code data generation is provided, as is the subcode reader required for generation of the Q code of the EFM signal, enabling monitoring of the time sequences of these signals.
■Insertion of the pilot burst conforming to Laservision standards into the vertical blanking area is possible, as is internal generation of the VITS and VIRS test signals.
■GPIB capability is provided.
■All editing data required for cutting simulation can be recorded, enabling a single DV-3560 to cover all phases of the process from development to completion.
■Each of the modulation signals (video, audio right channel, audio left channel, EFM) can be switched on and off independently, and the carrier level of each of the signals can be set as desired.
■Signals such as the VITS and VIRS signals, 40-bit FM signal, and 24-bit bi-phase signal can be switched on and off as required.
■CAV/CLV switching, CX NR on/off control, and telecine mode setting can be made manually.
■The process mode can be set as desired to simulate the lead-in area, program area, and lead-out area. In addition, it is possible to update the chapter number and to enable the picture-stopped condition.
■Status codes, user codes, and even editing point data can be input or changed from the front panel.

LD/CDV RF Signal Generator
DV-3560



SPECIFICATIONS

Output RF signal		
Output signal format		Four types: LD signal conforming to Laservision standards LD signal conforming to standards for Laservision with digital audio CDV signal conforming to CDV standards EFM signal (limiter output only) conforming to CD standards)
Frequency spectrum		LD with digital audio Main carrier (no modulation): 0dB
		Analog audio carrier: −15dB to −46dB
		EFM signal: −15dB to −46dB
		LD signal Main carrier (no modulation): 0dB
		Analog audio carrier: −15dB to −46dB
		CDV signal Main carrier (no modulation): 0dB EFM signal: −15dB to −46dB
Picture signal		
Input signal		
Input signal format		NTSC color composite video signal
Input level		VBS = 1Vp-p
Modulation characteristics		
Main carrier frequency (no-signal condition)		8.1MHz ±50kHz
Deviation		1.7MHz
		100% white level: 9.31MHz ±35kHz
		Pedestal level: 8.10MHz ±50kHz
		Sync level: 7.61MHz ±35kHz
Clipping		White clipping: +200 IRE
		Black clipping: +100 IRE
Video output monitor		
Output signal		Color composite encoded video signal conforming to Laservision standards
Output level		VBS=1Vp-p
Analog audio signal		
Input signal		
Input level		+4dBm (with 100% modulation and CX off)
Modulation characteristics		
Carrier frequency		Channel 1 (left): 2.301136MHz (146.25 f_H)
		Channel 2 (right): 2.812499MHz (178.78 f_H)
Deviation		±100kHz (with + 4dBm input and CX off)
Pre-emphasis		75μ ±1.5μs
Noise reduction		CX
Digital audio		
Input signal		
Input signal format		EFM signal conforming to CD standards
Input level		TTL
Modulation characteristics		
Lowpass filter		Reference: 0.5MHz
		Up to 1.6MHz: ±0.5dB
		2.3MHz and higher: −50dB or lower
Group delay		Reference: 0.5MHz
		Up to 0.5MHz: 0 ±20 ns
		0.8MHz: −50 ±20 ns
		1.4MHz: −350 ±75 ns
VIRS/VITS signal generator		
Generated patterns		Three types, conforming to FCC 73-699 and CCIR 473-4 standards
Video control codes		
Generated codes		40-bit FM code
		White flag
		24-bit bi-phase code
Output levels		Data 0: 0 IRE (+5 IRE, −0 IRE)
		Data 1: 100 IRE (+0 IRE, −5 IRE)
Generated data		
CAV mode:		Lead-in code, Lead-out code, Picture number code, Picture stop code, Chapter number code, Program status code, User code
CLV mode:		Lead-in code, Lead-out code, Program time code, CLV code, Chapter number code, CLV picture number code, Program status code, User code
Time code reader		
Input signal		SMPTE time code signal
Input level		0dBm
Subcode reader		
Input signal format		EFM signal conforming to CD standards
Detected data		Track number, Index number, Elapsed time, Absolute time, Control bit, Music number, ISR code, TOC information
GPIB		Conforms to IEEE-488 1978 standards
Data backup		Backup of edit times for approximately 7 days
Power requirements		100/120/220/240V AC, 50/60Hz, 70W
Dimensions		426 (W) × 177 (H) × 411 (D) mm

Used for Adjusting Azimuth and Servo System of CD Players.

Conventionally, in adjustment, inspection, and installation of CD player optical pickups, and in adjustment and inspection of CLV servosystems, reliance has been made on the subjective judgment of the operator in observing the eye pattern of the RF (HF) signal on a CRT screen. One of the objects of such subjective judgments has been the measurement of error rate as a barely useful secondary observation. The JW-3541 displays all measurement results in digital form, and provides a GPIB output to avoid operator-caused errors.

■The T bit length of the EFM signal (RF or TTL) selected as 3T, 4T, or 11T is collected continuously in virtually real time, and an internal computer is used to process this, providing X and Y outputs which can be connected to an X-Y monitor scope to enable observation of the T jitter distribution.

■The center value of the jitter distribution displayed on an external X-Y monitor scope can be indicated on an LED display with 1-ms resolution.

■Of the RF signal 3T to 11T, it is possible to measure the half-value of one-half cycle of the selected T.

■An autocentering function keeps the center value of the jitter distribution at the center of the externally connected X-Y monitor scope screen at all times.

■Varying components of DC offset caused by AM modulation of the RF signal are eliminated, by an auto-offset function, enabling time measurement of the center value of the input signal amplitude at all times.

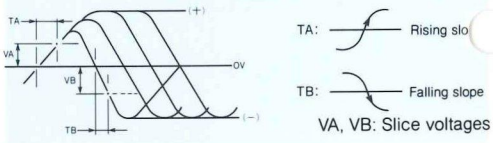
■It is possible to measure the rise time and fall time of the selected T of 3T to 11T of the RF signal.

■GPIB provided as standard.

SPECIFICATIONS

Variable input	
Input impedance	1MΩ, approx. 35pF
Input level range	For × 1 GAIN: 300mV to 3Vp-p (for 720kHz sinewave)
	For ×10 GAIN: 40mV to 300mVp-p (for 720kHz sinewave)
TTL input	
Input impedance	1MΩ, approx. 35pF
Input level range	+0.5 to +5V (peak) (for 720kHz sinewave)
Input withstand voltage	±10V (peak)
Measurement slope switching	Selectable as rising or falling edge
Input signal offset compensation function	With auto-offset on, the positive and negative peaks of the input signal are maintained as equal values.
Input signal level measurement	
Bits measured	3T to 11T, 2-digit D, switch setting
Measurement ranges and accuracy	
For × 1 GAIN	±(5% to ±5mV) with 100mV to 1500mV half wave sinewave input
For × 10 GAIN	±(5% to ±1mV) with 10.0mV to 150.0mV half wave sinewave input
Bits measured	3T to 11T
Slice voltage setting range	For × 1 GAIN: 50mV to 999mV For × 10 GAIN: 5.0mV to 99.9mV
Jitter measurement	Selection of 3T, 4T, or 11T
Measured bits and measurement range	3T: 694ns ±115ns 4T: 926ns ±115ns 11T: 2545ns ±115ns
Time width center value accuracy	3T and 4T: ±5ns, 11T: ±10ns
Display resolution	Effective display resolution for each resolution: 1ns: ±50ns – 49ns to +50ns 2ns: ±100ns – 99ns to 100ns 4ns: ±115ns
Center value display	By moving any arbitrary point within the measurement range to the center of the screen, the absolute time value of the point is displayed.
Displayed number of digits	3 or 4 (LED display)
Display resolution	1ns
Display accuracy	3T and 4T: ±5ns, 11T: ±10ns
Auto-center function	The peak value of data is automatically brought to the center of the display screen, and the absolute time value at that point is displayed as the jitter center value.
X- and Y-axis outputs	
X axis	Output level: 0 to +10V, sweep time: approx. 4ms
Y axis	Output level: 0 to +5V Resolution: 50 dots/V (255 dots full scale)
Power requirements	100/120/220/240V AC, 50/60Hz, approx. 70W
Dimensions	430 (W) × 149 (H) × 465 (D) mm
Weight	Approx. 11kg

Rise (fall) time measurement



CD Jitter Analyzer
DB-3541

Real-Time Measurement and Analysis of CD Player Jitter Distribution.

The DB-3545 is capable of real-time measurement and analysis of the jitter distribution of the eye pattern (multiple overlaid transmission waveform) which is used as a guide in evaluating CD player transmission quality. It processes this as the time frequency of occurrence of jitter, making it useful in adjustment and inspection of optical pickups and servosystems in CD players. The DB-3545 has a built-in CRT display, is compact and lightweight, and has an easy-to-use switch layout, making it a highly functional CD jitter analyzer for use in a variety of applications.

■ The 3T bit length is continuously captured in real time, and this is graphically converted at high speed by an internal microcomputer to generate a display of jitter distribution on a 5-inch CRT display screen.

■ Simultaneous with the jitter distribution display, the time at the maximum point on the jitter distribution is digitally displayed on the CRT screen, thereby minimizing reading errors.

■ By presetting go/nogo limits for the distribution data, it is possible to perform a go/nogo test, with the results being displayed along with the limit values, a convenient capability in production line inspection applications.

■ Measurement data is concentrated on the CRT display screen, minimizing the need to shift eyes during operation, thereby improving efficiency.

■ GPIB is provided as standard, enabling control of the DB-3545 and readout of data by a personal computer. This makes the DB-3545 suitable for centralized monitoring, and facilitates centralized handling of measurement data.

SPECIFICATIONS

RF input	
Input impedance	1 MΩ, 35pF
Input voltage range	60mVp-p to 3Vp-p (two switchable ranges, with 720kHz sinewave)
Input withstand voltage	±10V peak
Measurement slope	Rising or falling edge
Offset input	
Input resistance	20 kΩ
Input voltage range	±3V DC
Jitter measurement	
Measured 3T bits	694ns ±115ns
Effective CRT display range	694ns ±115ns
Display resolution	1ns
Time display (center/maximum value)	
Number of displayed digits	3 digits
Resolution	1ns
Display range	694ns ±115ns
Autocenter	
Pull-in range	694ns ±115ns
Area (distribution area calculation)	
Setting area	±115ns
Area criterion	
Criterion range	0 to 100%
Averaged distribution display	1 or 8 times
Monitor (for oscilloscope)	For × 1 GAIN: Output is made by amplifying an +8.5dB input signal. For × 10 GAIN: Output is made by amplifying a +28.5dB input signal.
GPIB	Conforms to IEEE Std. 488-1978
Power requirements	100/120/220/240V AC, 50/60Hz, approx. 40W
Dimensions	260 (W) × 150 (H) × 356 (D) mm
Weight	Approx. 7.6kg

Indispensable for Compact Disc Measurement Systems.

The DC-3510 is capable of converting an arbitrary analog signal to a digital signal in CD format for output to the DA-3500D.

SPECIFICATIONS

Sampling frequency	44.1kHz (governed by the DA-3500D's reference clock)
Number of quantizing bits	16 bits, linear quantization
Simultaneous L/R sampling	Completely simultaneous sampling of left and right channels
Conversion time	14.5μs max., including sample & hold time (each or both channels)
Data output	
Format	16 bits, 2's complement, positive logic
Transmission method	8-bit units, 16-bit format by high-byte and low-byte transmission
Output configuration	Open-collection, with photocoupler isolation (BVceo = 15V)
Analog section	
Input circuit	BNC connectors for left and right channels
Input frequency range	1Hz to 20kHz
Input impedance	33kΩ
Input voltage range	±1.414Vp-p (1V rms for sinewave input)
External connectors	
Input section	BNC-R connectors for both L and R channels.
Output section	50-pin micro-ribbon connectors (DDK model 57FE-40500-20S)
Power requirements	100/120/220/240V AC, 50/60Hz, approx. 50W
Dimensions	430 (W) × 149 (H) × 85 (D) mm
Weight	Approx. 7kg

Best for Compact Disc Cutting Systems.

The DT-3520 is an interface unit which links the DA-3500D to an audio processing, converting the serial data from the audio processor to parallel data. Its sampling frequency is based on the master clock of the DA-3500D, and it provides a 60Hz external sync signal to the VCR to ensure data transmission at synchronized speed.

SPECIFICATIONS

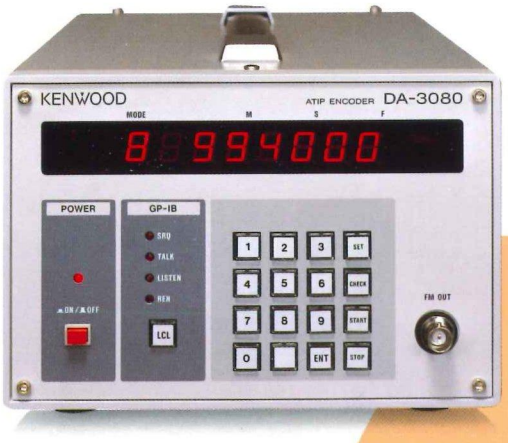
Connectable processor	PCM digital audio processor
Input section	
Format	16-bit serial data by synchronized sampling
Number of inputs	Two channels (left and right), parallel input
Input level	TTL
Input impedance	75Ω
Sampling frequency	44.1kHz, 50% duty cycle
Buffer memory capacity	512 words
Output section	
Data transmission method	8-bit units, 16-bit format by high-byte and low-byte transmission
Data format	16 bits, 2's complement, positive logic (for EIAJ format input)
Output level	TTL level, pulled-up with 330Ω and pulled down with 390Ω internally)
Input	Input section consists of two systems of connected units. The two systems are selected by using a switch on the rear panel.
System 1	25-pin D-sub connector (JAE Model DB-25S)
System 2	2-1. World Sync: BNC-R connector 2-2. L Data: BNC-R connector 2-3. R Data: BNC-R connector
Power requirements	100/120/220/240V AC, 50/60Hz, approx. 35W
Dimensions	430 (W) × 149 (H) × 465 (D) mm
Weight	Approx. 6kg

Generates a Wobble Signal Including ATIP Information.

The DA-3080 generates a wobble signal which includes the ATIP (Absolute Time in Pre-Groove) information as specified in the Blue Book and Orange Book, and in the case of the Blue Book and Orange Book Part I, the ATIP time information is output from the set starting time to the set stopping time. In the case of the Orange Book Part II, in addition to the ATIP information, in the portion corresponding to the specified lead-in, the preset optimized power, lead-in starting time, and last lead-out starting time in accordance with the standards can be output.

SPECIFICATIONS

Applicable standard	February 1988 edition of the Blue Book and September 1989 edition of the Orange Book
Wobble signal	22.05kHz ±1kHz
FM deviation	1kHz
ATIP starting time	00H00S00F to 99H59S74F
Special information	Optimum power: 00 to 111
	Lead-in starting time: 00H00S00F to 99H59S74F
	Last lead-out starting time: 00H00S00F to 99H59S74F
Sync signal	Internal 8.6436MHz (crystal oscillator) or external
External sync signal	CMOS level 8.6436MHz signal, input load: 1 CMOS load
Sync signal output	CMOS level 8.6436MHz signal, maximum drivable load: 10 CMOS loads
Wobble signal output	FM modulated 22.05MHz ±1kHz signal, output level: 1Vp-p max
	Output impedance: 50Ω
	Modulation distortion: 1% max.
Display	Mode: 1 digit
	ATIP: 6 digits
	Red LED display
Remote control	Via GPIB
Power requirements	90 to 264V AC, 50/60Hz, approx. 10W
Dimensions	190 (W) × 145 (H) × 385 (D) mm
Weight	Approx. 4.5kg



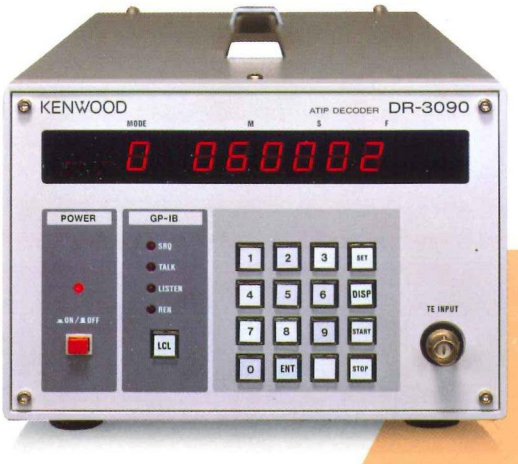
ATIP Encoder
DA-3080

Decodes a Wobble Signal Including ATIP Information.

The DR-3090 is an ATIP decoder which decodes a wobble signal which includes the ATIP (Absolute Time in Pre-Groove) information conforming to confidential CD information in the Blue Book (February 1988 edition) and Orange Book (September 1989 edition) by inputting the tracking error signal.

SPECIFICATIONS

Wobble signal input	Input level: 50mV to 5Vp-p
	Input impedance: Approx. 10kΩ
	Input frequency: 22.05kHz ±1kHz
External clock input	44.1kHz, TTL level
External signal sync	44.1kHz, TTL level
Display	7 digit LED display
Remote control	Via GPIB
Power requirements	85 to 264V AC, 50/60Hz, approx. 12W
Dimensions	190 (W) × 145 (H) × 385 (D) mm
Weight	Approx. 4.5kg



ATIP Decoder
DR-3090

DAT Deck Development/Inspection and Test Tape Generation Conforming to DAT Signal Format.

The DA-5730A is a standard signal generator capable of performing evaluation testing of equipment such as R-DAT decks and decoder ICs which process signals formatted in conformance with the IEC DAT cassette system standards. External input or internally generated outputs are synced to the 33Hz head-switching signal, and three types of R-DAT format signals can be generated: R-DAT deck simulated head signal, simulated signal after waveform equalization, and CMOS level signal after slicing.

■Accommodates the 48kHz, 32kHz, and 44.1kHz DAT modes. For each mode 17 types of sinewave signals are provided, in high-precision, low-distortion digital form, enabling testing of D/A converters and lowpass filters.

■The data errors, sync errors, and parity errors required for a variety of testing and measurement can be generated in the Main and Sub areas.

■Subcodes include selection of five internal types, or an externally applied input.

■It is possible to switch between the ID1 (emphasis), ID5 (track pitch), and ID6 (digital copy) of the Main ID. In particular, ID6 accommodates SCSM, with switching possible between three codes: 00, 10, and 11.

■The frame address in the Main ID is counted up for each frame.

■By directly inputting the output of the DA-5730A to the record amplifier of the DAT deck, it is possible to generate a high-quality test tape.

■A memory backup function is provided, so that key setting conditions are held even when power is switched off.

■In the external sync mode, the internal reference clock (9.408MHz) is replaced by an externally input clock signal.
Burst errors and external disturbance can be applied externally.

■GPIB is provided as standard, enabling not only control of front-panel switch functions, but access to the DA-5730A frame memory as well, which makes possible external generation of subcodes, main data, and error patterns.

SPECIFICATIONS

Coding format	Conforms to the IEC DAT cassette system standards
Applicable modes	48kHz, 32kHz, 44.1kHz
Audio test signal	Sinewave
Frequencies	33.33Hz, 100.00Hz, 1.000kHz, 10.00kHz, 20.00kHz (when 15.00kHz/32kHz selected)
Level	L-ch muting, R-ch muting, −60dB (with 1.000kHz selected)
Frequency stability	±5 ppm
Distortion	Better than the 16-bit-precision quantization
Subcodes	Selection of five internally generated subcodes and an externally generated subcode input

No	ID Data	Pack	Cont	Pno(Hex)	Pack Mode
No.1	0000	000	0000	000	———
No.2	0000	111	0100	0AA	Program Time
No.3	0000	111	1100	008	Absolute Time
No.4	0000	111	1100	088	Running Time
No.5	0000	111	0010	0EE	Date

Main ID subcode settings	
Emphasis (ID1)	00:Off
	01: 50/15μs
Track pitch (ID5)	00: Normal track mode
	01: Wide-track mode
Digital copy (ID6)	00: Permitted
	01: Prohibited
	11: One permitted
Simulated error pattern generation	
C1-1S	C1 correctable errors of one symbol (Main data, Sub1/2 data parts)
C1-2S	C1 correctable errors of two symbols (Main data, Sub1/2 data parts)
C2-1S	C2 correctable errors of one symbol (Main data part)
	C1 noncorrectable errors of three symbols (Sub1/2 data parts)
C2-2S	C2 correctable errors of two symbols (Main data part)
	C1 noncorrectable errors of six symbols (Sub1/2 data parts)
Pre & Sub	Errors concealed by preprocessing hold (Main dat part)
	All errors (Sub1 data part)
Ave & Sub2	Errors concealed by all interpolated values (Main data part)
	All errors (Sub2 data part)
Sync errors	Continuous 1/5/10/20/40-block continuous sync error pattern (Main data part)
	1/2/4/6/8-block continuous sync pattern error (Sub1/2 part)
Parity errors	1/5/10/20/40-block continuous parity error pattern (Main data part)
	1/2/4/6/8-block continuous parity pattern error (Sub1/2 part)
Burst errors	A burst error (low level) is generated in the DAT format signal output.
Data format signal output (EIM signal)	
Digital output	CMOS level
RF output	1V max., output impedance: 50Ω
Head status output	CMOS level, 33Hz
Bit clock output	9.408MHz, output impedance: 50Ω
Head status input	CMOS level, 33Hz, syncing range: 1Hz to 66Hz
External clock input	TTL level, input impedance: 50Ω
Drop input	For burst errors (CMOS level)
Offset input	Voltage: 0 to ±3.0V, frequency: DC to 1MHz
GPIB	Conforms to IEEE Std. 488-1978
Power requirements	90 to 264V AC, 50/60Hz, approx. 15W
Dimensions	190 (W) × 140 (H) × 350 (D) mm
Weight	Approx. 5.5kg

R-DAT Encoder
DA-5730A

Format Signal Coding Conforming to R-DAT Design Standards.

The DR-5750A is an R-DAT decoder which decodes a signal formatted in accordance with the R-DAT recommended design standards established by the R-DAT Conference, measures and displays various errors and, which can display ID codes as part of the decoding process. Evaluation of R-DAT decks and tape quality is done in terms of tape drive, endurance, physical characteristics, and electrical characteristics for tape performance, and in terms of tape drive (including servosystem electrical characteristics), endurance, and head electrical characteristics for the mechanical head assembly. Evaluation of the electrical characteristics of tape and head is normally done by evaluating the playback signal. The deck is evaluated by measuring the playback signal to enable an overall evaluation, including the recording system and playback system front end. The DR-5750A makes measurements, treating the playback signal as digital data, making it ideal for evaluation of R-DAT decks.

Measurements are possible of Mode I to IV and software application formatted signals conforming to the R-DAT Conference engineering specifications, and automatic selection to switch measurement modes automatically, depending upon the ID 2 to 5 including in the PCM ID.

■A 5-inch CRT display is provided, enabling condition settings while viewing the display screen, and providing display of various errors and all ID codes.

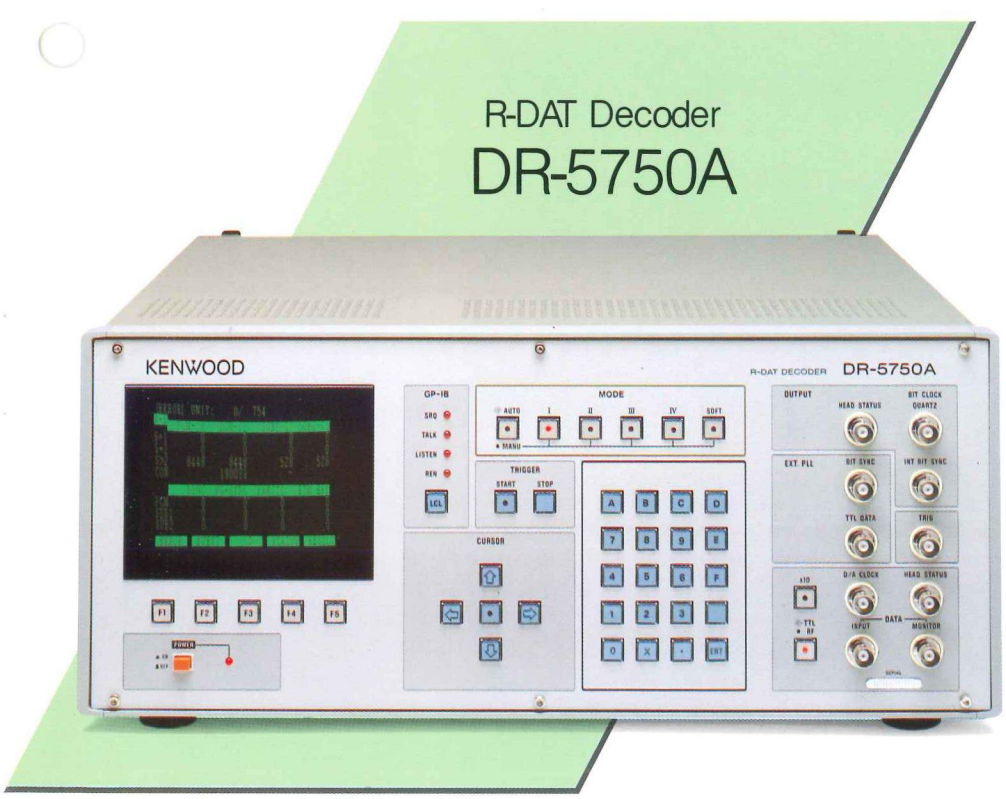
■Error measurement data measurement separately for tracks A and B, and for PCM, Sub 1, and Sub 2, the measured data being stored in memory for statistical handling after measurements are completed.

■In measurement of random errors, measurement and display is made of sync errors, 10/8 switching errors, C1 errors, C2 errors, parity errors, and concealed errors, with subcodes being displayed as well.

■In burst error measurement, a burst error is defined as an error block not correctable by C1 processing, the burst error length (number of blocks) is set, and measurement is performed for each track.

■Measurement data (up to 42,588 data) for only the case in which a burst error occurs are stored in memory, display is made of the relative track number of the occurrence from the start of the measurement and the block address at which the error occurred, and it is further possible to display a burst list, burst map, and histogram.

■GPIB is provided as standard.



SPECIFICATIONS

Inputs and outputs	
Inputs	
Data input	RF input and TTL input are switch selected.
	RF input: Signal input after the equalizer
	Input voltage: 300mVp-p to 3Vp-p or 30mVp-p to 300mVp-p
	Input resistance: 1MΩ ±10%
	Input capacitance: 35pF max.
	TTL: NRZI signal input after the slicer
Head status	A/B head-switching signal input (TTL level, input at all times)
D/A clock	D/A output time base external input (50Ω)
	Mode I: 9.408MHz
	Mode II: 6.272MHz
	Mode III: 4.704MHz
	Mode IV: 9.408MHz
	Software: 8.6436MHz
External triggering	Error count trigger input (TTL)
Bit sync (EXT. PLL)	BIT SYNC CLOCK is input when using external bit synchronization.
TTL data (EXT. PLL)	An NRZ signal is input when using an external bit sync PLL.
DC offset input	A DC offset voltage is input to maintain symmetry of the signal input at the DATA INPUT connector.
Outputs	
Bit clock quarts	Internal 9.408MHz QUARTZ oscillator
Int bit sync	9.408MHz bit clock output extracted from the input signal
Head status	33Hz output signal used in A/B head switching
Data monitor	Monitor output for the signal input at the DATA connector
Video out	CRT composite video signal output
Digital out	Parallel decoded digital output
Header out	W1, W2, parity output after 10-to-8 conversion
Demod I/O	Input/output of signal before ECC
DC offset monitor	Monitor output for the DC offset signal; used to check symmetry
GPIB	Conforms to IEEE Std. 488-1978
Power requirements	100/120/220/240V AC, 50/60Hz, approx. 120W
Dimensions	426 (W) × 177 (H) × 411 (D) mm
Weight	Approx. 14.5kg

R-DAT Mechanism and Tape Evaluation by Real-Time Error Rate Measurement.

In R-DAT system evaluation, measurement of the error rate is one of the most important factors. The DR-5755 is capable of measuring the C1/C2 block error rate by inputting the NRZI signal (CMOS or TTL level) from the R-DAT deck after PCM equalization. With this capability, the DR-5755 is ideal for production-line evaluation of R-DAT systems and tapes.

■For tape media manufacturers: Developmental and production inspection and quality control of materials.
■For the recorded-tape manufacturer: Incoming inspection of blank tapes for the production line, shipping/quality inspection, and use in production engineering R&D.
■For mechanism manufacturers: New head and cylinder R&D, and production/ shipping inspection and QC.
■For deck manufacturers: Deck R&D, production mechanism incoming inspection and deck final inspection and QC.

■The NRZI signal is provided with a high-impedance, low-capacitance probe, thereby minimizing influence on the deck.
■Display is possible either error rates for tracks A and B separately, or the average error rate.
■Display is possible of main or sub data.
■A go/nogo test is possible with respect to an arbitrarily set error rate (main C1 only).
■Measurement time can be set as one of two values (Slow: 3s, Fast: 1.2s).
■Functions and other settings are backup up in memory even when power is switched off.
■Input signal monitor connectors are provided.
■Front-panel switch functions can be remotely controlled by means of a remote control connector.
■A printer output for a Centronics printer is provided to enable recording of measurement results.

SPECIFICATIONS

Mode

Function		No. of measured frames	Display interval(s) (sec)	Error rate measurement limit	Remarks
Main/ Sub	Fast/ Slow				
Main	Fast	40	1.2	C1 2.0×10^{-4} C2 2.2×10^{-4}	Main data measurement
Main	Slow	100	3.0	C1 7.8×10^{-5} C2 8.9×10^{-5}	Main data measurement
Sub	Slow	100	3.0	6.3×10^{-4}	Sub data measurement

Display	
Error rate display	CH-A, CH-B separate display: The error rates for Track A and Track B are displayed separately.
	A+B display: If the A+B key is set to on, the average of the Track A and Track error rates will be indicated at the CH-A display position, with the CH-B display blanked.
	Limit display: If the SET key is set to on, the Main C1 error rate limit value is indicated at the CH-B display position.
	Area display: If the SET key is pressed while holding down the UP key, the area setting value will be indicated at the CH-B display position.
Go/nogo display	Lights when either the Main C1 error rate for Track A or Track B exceeds the set limit value.
C2 display	When error rate is measured, this lights when a C2 processed block is encountered.
Go/nogo display	A go/nogo comparison is possible be setting an arbitrary error rate value.
Inputs	
NRZI	The NRZI signal after PCM equalization is input using the accessory probe.
×10 mode	Level: CMOS or TTL
	Input impedance: 10MΩ, 30pF max.
	Maximum input withstand voltage: ±100V
×1 mode	Level: 0.3V to 1V
	Input impedance: 1MΩ, 250pF max.
	Maximum input withstand voltage: ±10V
33Hz	Head switching pulse sginal is input.
	Level: CMOS or TTL
	Input impedance: CMOS (HC04 equivalent)
Outputs	
Monitor	NRZI input signal monitor connector
Monitor	33Hz input signal monitor connector (HC04 equivalent)
Printer	Error rate is printable on a printer connected at this connector.
Area	Area signal monitor connector
Power requirements	100/120/220/240V AC, 50/60Hz, approx. 11W
Dimensions	190 (W) × 140 (H) × 350 (D) mm
Weight	Approx. 4.6kg

R-DAT Error Rate Counter
DR-5755

Tape-Path Evaluation by Envelope Flatness Measurement.

In the production of R-DAT systems, it is essential that the tape path be adjusted to achieve the desired track linearity. In previous tape path adjustment, the RF signal from the deck was monitored on an oscilloscope while the tape guides were adjusted for a flat envelope. Reading the flatness from an oscilloscope screen, however, is a labor-intensive task, and is subject to operator-caused variation. The DE-5760 identifies the minimum and maximum values from the RF signal, calculates (minimum/maximum) × 100% using a microcomputer, and provides a virtually real-time display of this value. Thus, by quantizing the shape information about the RF signal, the above problems are solved.

■Measurement of the maximum and minimum values for each track and calculation of the amount of warp, the results being used to determine the tape path condition.
■The DE-5760 has go/nogo comparison function consisting of an OK LED that light when the envelope flatness value exceeds an arbitrary % value on a meter displaying above 50%, a LEFT and RIGHT LED which indicate left and right slope if the value is below that setting, as well as an RF signal monitor, making it ideal for use on the tape drive mechanism adjustment line.

■Measurement is possible of the envelope flatness of head A and head B separately.
■It is possible to measure the average output level for one track separately for head A and head B, and to calculate the ratio of these values, enabling a go/nogo test of a drum assembly.
■The interface using a high-impedance signal-input pod, thereby minimizing the influence on the deck. An IC clip cable can be attached to the pod, enabling exchange with the cable fabricated for the test pins on your particular DAT deck.

SPECIFICATIONS

Mode	Envelope meter display	Comparison LED display
A	Track A envelope flatness a/b*100%	Rising right, rising left comparison LEFT OK RIGHT
B	Track B envelope flatness c/d*100%	Rising right, rising left comparison LEFT OK RIGHT
A:B	Ratio of output level between tracks A and B Ave. A/Ave. B*100% (A<B) Ave. B/Ave. A*100% (A>B)	Which track's RF level is higher A<B or A>B

Envelope meter section	
Indication range	50 to 100%
Indication accuracy	±5%
Input signal (using special pod)	
Green IC clip	RF signal
Blue IC clip	Head status signal
RF signal	
Input frequency range	100kHz to 5MHz
Input level range	100 mV to 1Vp-p
Input impedance	1MΩ ±5%
Input capacitance	10 pF max. (at the pod input connector)
Maximum input withstand voltage	10V (DC + AC peak)
Head status signal	
Input level	CMOS level
Maximum input withstand voltage	10V (DC + AC peak)
Output signals	
RF signal	Output level: Input level ±10% (when terminated with 50Ω) Output impedance: 50Ω
33Hz	Output level: Head status signal (4Vp-p) + sampling point signal (1Vp-p)
Power requirements	100/120/220/240V AC, 50/60Hz, approx. 8W
Dimensions	190 (W) × 140 (H) × 350 (D) mm
Weight	Approx. 4.6kg

R-DAT Envelope Meter
DE-5760

R-DAT Deck Servo and Tape Drive System Jitter Analysis.

In R-DAT, in which high-density recording is done, because of the need for wideband recording, the relative speed between the tape and the head is increased by rotating the head at high speed (2000 rpm). Adjacent-track protection is provided not by guard bands, but by an azimuth system, such as is done in video cassette recorders.
The tracks are inclined at an angle of 6°22′ with respect to the tape, and the servosystem operates to rotate the head drum to maintain proper position during tape drive, with the capstan motor servo operating to maintain proper track angle.
In the R-DAT deck, delay in this system appears as jitter in the data. It is possible to properly evaluate the behavior of the servosystem which changes constantly with time by observing the jitter distribution in real time. Therefore, evaluation of a tape transport, including the R-DAT deck, is possible by analyzing this jitter distribution.

■By inputting the RF signal from the R-DAT deck equalizer amplifier and the head-switching signal, it is possible to measure in almost real time the reversal time jitter for each head for data bit length selected from 0.8T to 3.2T, the resulting distribution being displayed.
■A 5-inch CRT screen is provided for display of measured jitter distributions, time of the maximum jitter, and number of measurements.
■PCM data from head A or head B is measured continuously, enabling measurement every 300Hz without distinction of head and display of the head switching signal (33Hz) time display jitter distribution.
■An autocenter function keeps the peak jitter value point in the center of the CRT at all times. (The pull-in range is the specified data bit length ±53 ns.)
■An averaging function takes an average of a specified number of jitter distributions, thereby reducing CRT display flicker and providing an easy-to-view distribution display.
■GPIB is provided as standard.

SPECIFICATIONS

Input section	
RF signal	The output of the playback head equalizer amplifier is input.
Input impedance	1MΩ, 35pF max.
Input ranges	150mV to 5Vp-p, in three ranges.
	0.5V range: 0.15 to 0.5Vp-p
	1.5V range: 0.5 to 1.5Vp-p
	5V range: 1.5 to 5.0Vp-p
Measurement slope switching	Head-switching signal (TTL level): 33Hz head-switching signal is input.
	Fan-in: 1 TTL load
Offset input	A DC offset voltage can be applied to the input RF signal zero-crossing comparator.
Input impedance	200Ω ±10%
Input range	8Vp-p max. (RF signal (p-p) + Offset value)
Frequency range	DC to 3.2Hz (−3dB point)
PCM data	Head A or head B is switch selected, and measurement is made of the distribution of the T (0.8T/1.6T/2.4T/3.2T) selected by the DATA bit (T) of the output of that head. If in the measured data there is one location with a frequency that reaches 255, the T distribution for that head in the range ±53ns is displayed on the CRT screen.
Measurement range	0.8T: 106ns ±53ns
	1.6T: 213ns ±53ns
	2.4T: 319ns ±53ns
	3.2T: 425ns ±53ns
Center value display	By moving an arbitrary point in the measureme... range to the center of the CRT, the absolute time value at that point can be displayed.
Number of displayed digits	3 digits
Display resolution	1ns
Display range	±53ns from the theoretical center of each data bit
Averaging	When displaying the jitter distribution on the CRT screen, a specified number of distributions are taken and averaged, with new data replacing old data as it is taken.
Spectrum	The head jitter is measured every 300Hz without distinction of the head for the data bit selected by DATA BIT (T) (0.8T/1.6T/2.4T/3.2T), the resulting value being displayed on the CRT screen. The GPIB can be used to store from 1 to 1023 of these values and read the values back. The CRT indicates the data distribution for both head A and head B.
33Hz	The 30-ms head-switching signal is measured and displayed on the CRT screen. The CRT provides a dot display of a total of 1023 measurements over the range 30ms ±1ms, with a display resolution of 20μs. The GPIB can be used to store from 1 to 1023 of these values and read the values back.
Autocenter function	For PCM data, the peak point in the distribution is automatically kept at the center of the CRT screen, with the absolute time at this point being displayed as the jitter center value.
Holdoff	It is possible to adjust the time from the end of one measurement to the beginning of the next over the range 30ms to 1.6 s.
Power requirements	100/120/220/240V AC, 50/60Hz, approx. 10...
Dimensions	426 (W) × 177 (H) × 411 (D) mm
Weight	Approx. 13.5kg

R-DAT Jitter Analyzer
DB-5740

Electrical Characteristics Measurements of DATs and Digital Audio Amplifiers Using Digital Data.

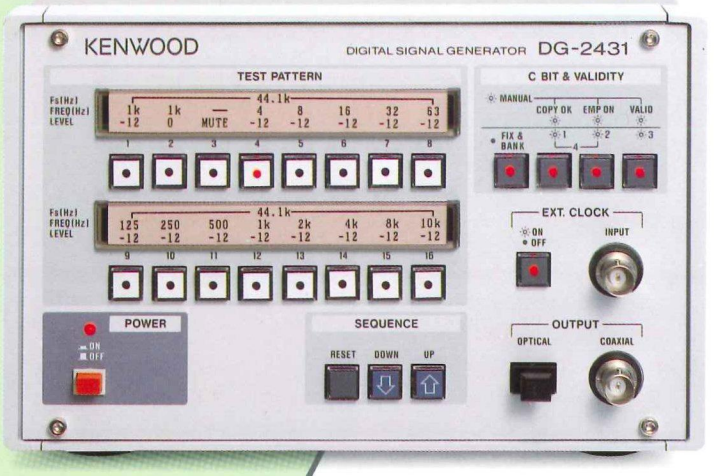
The DG-2341 is a digital signal generator based on the digital audio interface standard, which is extremely powerful in development and inspection applications for R-DAT decks for the SCMS (Serial Copy Management System) and for digital audio amplifiers. It generates digital test patterns in conformance with EIAJ CP-2302 (DAT recorder measurement tape recording) sinewaves. These test patterns have three sampling frequencies (48kHz, 44.1kHz, and 32kHz), and can be set to any frequency in the range 1 to 65,535Hz.

■Four groups of 16 test patterns can be generated, for a total of 64 test patterns.
■The settings for each of these test patterns (sampling frequency, pattern frequency, level, C bit, and U bit) are made by means of a user ROM on the rear panel, enabling the user to set any desired pattern.
■The C bit emphasis bit and copy bit of the digital audio interface format, and the parity flag can be changed manually and independent of the contents of the user ROM. To accommodate SCMS, the copy bit can be automatically reversed.
■Signals consist of serial data, as well as coaxial and optical outputs conforming to the digital audio interface format, enabling easy connection to digital audio equipment.
■The optical output level is variable. Serial data is available as a coaxial output only.
■An UP/DOWN RESET key can be used to sequentially switch the output pattern. The sequence of output test patterns is established by the user ROM contents, enabling four groups of any sequence of up to 256 steps of test patterns to be programmed by merely changing the ROM contents.
■Front-panel key operations can be remotely controlled from a rear-panel remote control connector.
■The sampling frequency (Fs) can be varied by inputting an external clock signal (128 × Fs) at the EXT CLOCK connector, enabling a operational check of the PLL at the receiving end.

SPECIFICATIONS

Sampling frequencies	48kHz, 44.1kHz, 32kHz
Number of quantizing bits	16 bits, 2 channels
Frequency	1Hz to (sampling frequency/2)Hz, settable in 1Hz steps
Output variable range	0 to 100% (0 to 32,768Hz)
Distortion	Lower than the 16-bit-precision quantizing error
Waveform types	Sinewave and squarewave
Maximum number of patterns	64
Frequency stability	Governed by internal time base oscillator and external clock
Pattern setting method	Set by means of a rear-panel user ROM.
Item setting	Test signal frequency: 0 to 65,535Hz
Test signal level	0 to 32,768Hz
Waveform type	Sinewave and squarewave
Muting	L, R, L+R
C bits	192 bits set by individual bits
U bits	192 bits set by individual bits
SCMS	Copy bit reversal frequency setting
User bit reversal frequency	Approx. 1Hz to 15Hz
Output format	(A) EIAJ CP-340 Audio Interface Standard (channel status type II form I)
	(B) Serial data (LSB first)
Output connectors	
Coaxial output connector	For (A) and (B): BNC receptacle
Output interface level	75Ω, 0.5Vp-p (into 75Ω load)
Optical output connector	(A) only: TOSLINK TOTX172
External clock input	Sampling frequency × 128 is input.
Input connector level	BNC receptacle, CMOS level (5V)
Bit clock, Fs, Fs/2, Fs/4 outputs	
Output connector, levels	BNC receptacles, CMOS level (5V)
Remote control connector	36-pin Microribbon type, for front panel function control
Power requirements	100/120/220/240V AC, 50/60Hz, approx. 3W
Operating temperature	0 to 55°C
Dimensions	212 (W) × 133 (H) × 411 (D) mm
Weight	Approx. 3.7kg

Digital Signal Generator
DG-2431



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1990. 11.30 U-0907 (SE10) Printed in Japan.