

KENWOOD

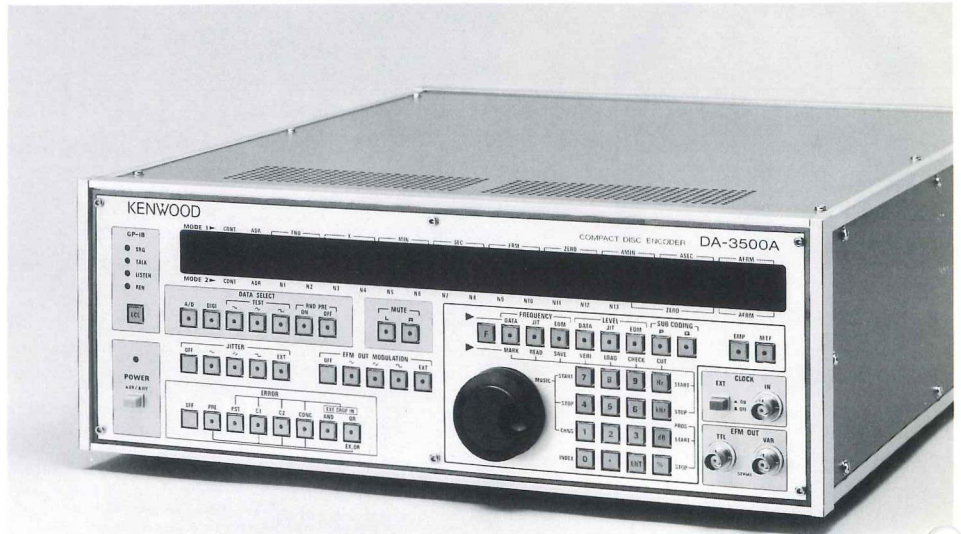
Compact Disc  
Test Instruments  
CATALOG

KENWOOD CORPORATION



# Generates Signals Equivalent to a CD P

CD Encoder  
**DA-3500A**  
GP-IB



The DA-3500A Compact Disc Encoder is a CD format reference signal generator. It generates signals that are equivalent to a CD player laser pickup output.

The DA-3500A generates EFM signals for every type of signal source that are completely compatible with CD standards, performs CIRC processing and adds complete subcodes that include R-W codes. This gives the DA-3500A all the functions needed to edit lead-in data for discs. In addition to its highly useful functions as a

disc-cutting tool, the DA-3500A generates all the test signals needed in the inspecting and adjusting of CD players. External control of all functions through the internal GP-IB interface means automatic, energy-saving production, inspection and adjustment of CD players and functional testing of CD ICs.

★ Uses the internal R-W subcode-adaptor to perform arithmetic/logic operations, which conform to CD standards, on data from the screen editor.

★ Since the DA-3500A uses its MTF approximation characteristic filter and applies jitter modulation, AM modulation and offset disturbance, it can generate a complete set of simulation signals, including those for the optical transmission system.

★ The DA-3500A generates highly precise, low-distortion, 16-bit digital signals for measuring D-A converter and bandpass filter characteristics in CD players.

R-W subcode-adaptor  
**RW-3500**

Inserting the RW-3500 into the DA-3500 option slot allows the RW-3500 to interleave and parity-add R-W data that conform to

CD standards. The RW-3500 sends that data from a screen editor, used with the PC-100 (NEC personal computer), or from another device, to the DA-3500 subcode section.

★ Use of a peak format written in image-data-send time, called TIME PACK, permits image data received from an external source to be sent at any time.  
★ Contains two bank memories (32K bytes

each) that allow data to be written from an external source and, simultaneously, data to be transferred to the DA-3500 subcode section.

★ Since this adaptor will also receive data from personal computers other than screen editors using the PC-100, it can be used to create software and hardware as prescribed by the data format and timing chart.

**ACCESSORIES:**

Instruction manual 1 copy  
50-pin connector (Amphenol type) 1 pc

# layer Laser Pickup Output.

## SPECIFICATIONS

<b>CODE FORMAT:</b>	Conforms with Compact Disc Standards (February 1985 edition)
<b>SYNCHRONOUS SIGNALS:</b>	
CLOCK Frequency:	8.6436MHz internal or external (TTL LEVEL) switching
External Input Range:	8.6436MHz $\pm$ 1MHz
<b>RF SIGNAL OUTPUT:</b>	RF signal output, 2 systems
TTL Level Output Pins:	Output by positive logic TTL level (Pull-up 330 $\Omega$ , Pull-down 330 $\Omega$ ) for jitter modulation only
Variable Output RF Signal Output Pins:	Variable range: 0 to 1Vp-p (with 75 $\Omega$ load)
<b>EFM SIGNAL SOURCE:</b>	Sinewave, triangular wave, square wave, M-series pseudorandom signal and external digital data input.
	Two systems.
	Digital setting of frequency and level for sine, triangular and square waves.
Sine, Triangular and Square Waves:	
Frequency Range:	Sine and square waves: 1Hz to 22.049kHz, set in 1Hz steps. Triangular wave: 1Hz to 11.024kHz, set in 1Hz steps.
Frequency Stability:	Based on standard clock stability
Rate of Distortion:	Digital distortion of 0.0015% or less.
Output Variable Range:	0 to 100% set in 0.1% steps and 0 to -84dB set in 0.1dB steps down to -60dB, set in 1dB steps at less than -60dB.
Level Setting Accuracy:	0.004% or no greater than 0.1dB (to -60dB), or no greater than 1dB (to -84dB).
M-Series Pseudorandom Signal:	
Random data:	8 bits
Initialization:	Can be PRESET ON/OFF
Digital Data Inputs 1:	
Input Data Format:	8-bit units (by high-byte, low-byte sampling) positive logic 2's complement
Uses:	For DC-3510 A-D converter photoisolation input and other uses
Digital Data Input 2:	
Input Data Format:	8 bit-units (by high-byte, low-byte sampling) positive logic 2's complement
Uses:	For DT-3520 digital I/O input and TTL level input
Pseudo Error Pattern Generation:	
Pre-Error (Before EFM Modulation)	
Error Type:	C1 correctable errors C2 correctable errors Corrected (concealed) error External burst errors due to EX-OR operations on drop-in signals.
Post Error (After Frame Generation):	
Error Type:	C1 correctable errors C2 correctable errors Corrected (concealed) errors External burst errors due to AND/OR operations on drop-in signals, Errors due to optionally set error patterns (under GP-IB control).
Error Pattern Set:	Segments of 108 frames divided in bit units.

## TRANSMISSION SIMULATION SYSTEM:

	Applies jitter modulation, AM modulation, MTF approximation filter and DC offset to RF signals for the simulation of transmission circuits.
Jitter Modulation:	
Modulation Factor:	0 to 7%
Modulation Frequency Range:	10Hz to 9.99kHz
Modulation Waves:	Sinewave, triangular wave, square wave and external
External Modulation Factor:	7%/2Vp-p
AM Modulation:	
Modulation Factor:	0 to 100%
Internal Modulation Frequency Range:	10Hz to 9.99kHz
Modulation Waves:	Sinewave, triangular wave, square wave and external
External Modulation Factor:	100%/2Vp-p
External Modulation Frequency Range:	DC to 50kHz
Offset Addition:	
Added Voltage:	0 to $\pm$ 0.5V (75 $\Omega$ load; external input voltage, 0 to $\pm$ 1V peak)
External Input Frequency Range:	DC to 50kHz
MTF Approximation Filter:	
Filter Selection:	Can be turned ON and OFF
Filter Type:	4th order approximating elliptical filter
<b>MUTING:</b>	Right and left channels can be digitally-muted, independently.

## SUBCODE CONFIGURATION:

P and Q Subcode Test Patterns:	PROM contains variable test patterns for P and Q subcodes.
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R-W Subcodes:	Can be externally input
<b>CUTTING:</b>	By connecting the DA-3500A to a disc cutter, it can cut discs in CD standard format.
<b>READ-OUT:</b>	20-digit display by 5 $\times$ 7 dot matrix LEDs.

<b>EXTERNAL CONTROL:</b>	Can externally control all functions required for operations through the GP-IB (IEEE Std 488 1978) interface.
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<b>DIMENSIONS:</b>	430(W) $\times$ 149(H) $\times$ 465(D) mm
<b>WEIGHT:</b>	Approx. 12kg

<b>POWER REQUIREMENTS:</b>	100/120/220/240V AC, 50/60Hz Approx. 100W
<b>ACCESSORIES:</b>	Instruction manual 1 copy Power code 1 pc Cable (CA-41) 2 pcs Cable (CA-43) 1 pc 50-pin connector (Amphenol type) 1 pc Spare fuse

**Options:**  
**CB-2420P** GP-IB Cable



# Indispensable for Compact Disc Measurement Systems.

A-D Converter

## DC-3510



The DC-3510 will convert any analog signal to CD format and send it to the DA-3500A.

### SPECIFICATIONS

**SAMPLING FREQUENCY:** 44.1kHz (frequency-divided from DA-3500A's basic clock).

**NUMBER OF QUANTIZED BITS:** 16 bits, linearly quantized.

**L/R SIMULTANEITY:** Completely simultaneous sampling for both L/R channels.

**CONVERSION SPEED:** 14.5 $\mu$ s maximum including sample-and-hold time.

**DATA OUTPUT:**

Data Format: 16-bit, 2's complement, positive logic.

Data Transfer Method: 8-bit units, 16-bit configuration by high-byte, low-byte transfer.

Output: Open-collector output by photo-coupler (BV<sub>ceo</sub>=15V)

**ANALOG SECTION:**

Input Circuits: L and R channels connected by BNC-R connector.

Input Frequency Range: 1Hz to 20kHz

Input Impedance: 33k $\Omega$

Input Voltage Range: 1.1414Vp-p (for 1Vrms sinewave)

**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) 430(W) x 149(H) x 465(D) mm

**DIMENSIONS:**

**POWER REQUIREMENTS:** 100/120/220/240V AC, 50/60Hz Approx. 100W

**WEIGHT:** Approx. 7kg

**ACCESSORIES:** Instruction manual 1 copy  
Power code 1 pc  
50-pin connector (Amphenol type) 1 pc  
Spare fuse

# Best for Compact Disc Cutting Systems.

Digital I/O Unit

## DT-3520



The DT-3520 Digital I/O Unit is the interface unit for connecting the DA-3500A to the PCM audio processor. It converts serial data from the audio processor into parallel data. Taking the reference for sample frequencies from the DA-3500A master clock, a 60Hz, sync signal is externally applied to the VTR to synchronize data transmission speed.

### SPECIFICATIONS

**CONNECTED UNIT:** PCM digital audio-processor

**INPUT SECTION:**

Input Format: 16-bit serial data synchronized to sampling.

Number of Inputs: Two (L and R) channels, parallel input.

Input Level: TTL level

Input Impedance: 75 $\Omega$

**SAMPLING FREQUENCY:** 44.1kHz Duty cycle 50%

**BUFFER MEMORY CAPACITY:** 512 words

**OUTPUT SECTION:**

Data Transfer Method: 8-bit units, 16-bit configuration by high-byte and low-byte transfer.

Data Format: 16-bit, 2's complement, positive logic (with EIAJ format input)

Output Level: TTL level, pull-up 330 $\Omega$ , pull-down 390 $\Omega$ , internal.

**INPUT CONNECTOR:** 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

**DIMENSIONS:** 430(W) x 149(H) x 465(D) mm

**POWER REQUIREMENTS:** 100/120/220/240V AC, 50/60Hz Approx. 100W

**WEIGHT:** Approx. 6kg

**ACCESSORIES:** Instruction manual 1 copy  
Power code 1 pc  
50-pin connector (Amphenol type) 1 pc  
Spare fuse



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

## CD Encoder

# DA-3531

The DA-3531 CD encoder is reference signal generator that conform to CD standard and is used in evaluation testing of CD players. The circuits in this CD encoder has been simplified throughout and made more efficient overall to provide high reliability and top-grade performance.

- ★ For production use, such as in CD player testing, the DA-3531 can be connected directly to CD players for symmetrically variable functions and output from laser pickup. It provides pickup simulator output for simulating all player signal patterns.
- ★ You can select from nine test pattern types, 16 subcode types and eight error pattern types usable in a variety of tests and measurements.
- ★ The 16-bit precision and low distortion of the nine test pattern signals provide encoder performance fully adequate for testing D-A converters and lowpass filters.

## SPECIFICATIONS

<b>CODE FORMAT:</b>	Conforms with CD standards		
<b>TESTING SIGNALS:</b>	Use for testing audio frequency band characteristics, emphasis functions, crosstalk between left and right channels, IMD, etc.		
Frequency	L-ch level	R-ch level	
20.000Hz	100%	100%	
100.000Hz	100%	100%	
1.0000kHz	100%	100%	
1.0000kHz	-60dB	-60dB	
1.0000kHz	0%	100%	
1.0000kHz	100%	0%	
10.000kHz	100%	100%	
20.000kHz	100%	100%	
250Hz+8kHz	100%	100%	

**ERROR PATTERNS:**  
Internally Generated Errors:  
Generates the following error patterns for



1-symbol errors and 2-symbol errors  
C1 correctable errors  
C2 correctable errors  
Errors corrected by pre-hold  
Errors corrected by mean interpolation  
Errors caused by External drop-in signal (burst errors):  
AND: EFM signal at a low level generates an error.  
OR: EFM signal at a high level generates an error.

**SUBCODES:**  
Internally Generated Subcodes:  
P Code: Select using ON/OFF on front panel.  
Generates 4 types of subcode patterns.  
Q Code: Select emphasis using ON/OFF on front panel.  
R-W subcode set in zero mode.  
Externally Input Subcodes:  
Can input all P-W subcodes externally by TTL level signals.

**CLOCK:**  
Internal Clock: 4.3218MHz (generated by a crystal oscillator)  
External Clock: Can be externally input as a TTL level signal.

### LASER PICKUP SIMULATION:

Simulates these four Parameters:  
1) DC bias addition  
2) Radial error  
3) Focus error  
4) Simulate-pickup format  
Add voltage 0 to ±1V (DC to 1MHz)

**OFFSET INPUT:**  
**EXTERNAL CONTROL:** Externally controls all panel functions over 16 input lines.

**POWER REQUIREMENTS:**  
High: 90 to 130V AC  
Low: 198 to 264V AC, 50/60Hz, approx. 25W

**DIMENSIONS:** 190(W) × 128(H) × 263(D) mm

**WEIGHT:** Approx. 3.2kg

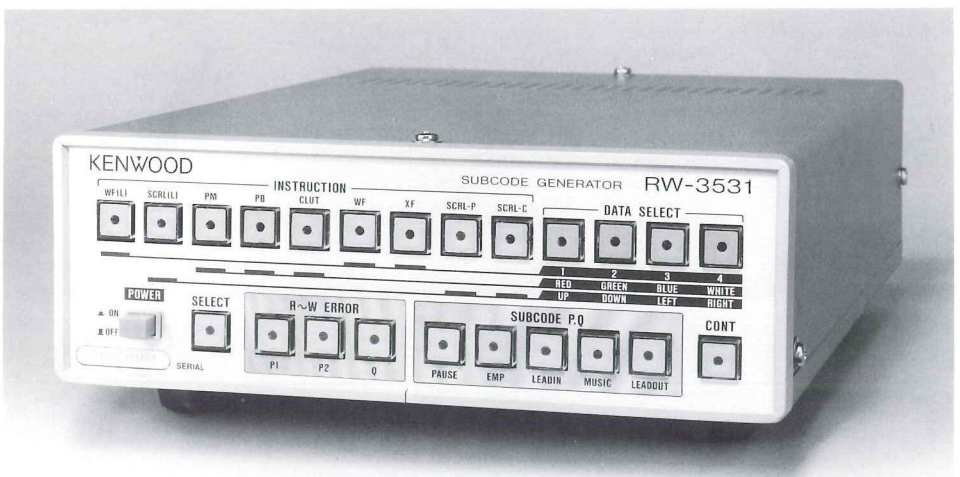
**ACCESSORIES:**  
Instruction manual 1 copy  
Power code 1 pc  
Cable (CA-41) 1 pc  
Cable (CA-43) 1 pc  
Plug 1 pc  
Spare fuse

## Subcode Generator

# RW-3531

The RW-3531 is a compact disc R thru W subcode generator which can be connected to the DA-3531 CD Encoder to perform inspection and adjustments on CD players with R thru W subcode graphic functions.

It is capable of generating patterns using instructions for the nine R thru W subcodes and can generate Q and Q string errors as well. The instruction-transmission speed and scroll instruction step can be varied in four and five steps, respectively. For subcodes P and Q, five types of patterns can be generated. Front-panel switch functions can be remotely controlled.



## SPECIFICATIONS

<b>APPLICABLE ENCODERS:</b>	DA-3531
<b>CONNECTOR USED:</b>	14-pin Microribbon (Amphenol type 57-30140 or equivalent; provided with the RW-3531)
<b>R THRU W SUBCODE DATA GENERATION:</b>	
No. of Patterns:	For each of different instructions, four types of patterns are generated. (For WRITE FONT and XOR FONT, one pattern is generated which includes the channel number 0 thru 15.)
Transmission Speed:	The instruction-transmission speed can be selected as one of four levels in the range 1 to 4 instruction/frame. (1 instruction/frame is the maximum speed; the setting

is made using a rear-panel rotary switch.)  
The scroll instruction can be set as one of five levels (1, 2, 3, 6 or 12 pixels/step). (The setting is made using a rear-panel rotary switch; a setting of 12 pixels/step is taken as 6 pixels/step.)  
**Error Generation:** For P parity series data, 1- and 2-symbol errors are generated. For Q parity series data, 1-symbol errors are generated.  
**Other Pattern-Generation Functions:** The CONT switch can be used to repeat generation of patterns.  
**SUBCODE P AND Q DATA GENERATION:** Five patterns (PAUSE, EMPHASIS,

LEAD-IN, MUSIC (PROGRAM) and LEAD-OUT) are generated.  
**OTHER FUNCTIONS:** The SELECT switch can be used to select the internal P and Q subcode pattern generator of the DA-3531 encoder. In this mode, the R thru W subcodes are in the ZERO mode. Front-panel switch functions can be remotely controlled.

**POWER REQUIREMENTS:**  
100/120/220/240V AC, 50/60Hz Approx. 5W  
**DIMENSIONS:** 190(W) × 65(H) × 260(D) mm  
**WEIGHT:** Approx. 2.2kg  
**ACCESSORIES:**  
Instruction manual 1 copy  
Cable (14-pin) 1 pc  
Spare fuse

Options: OP-10 Remote Terminal with Cable



# Used for Adjusting Azimuth and Servo

## CD Jitter Analyzer

# DB-3540



The DB-3540 measures and analyzes eye-pattern jitter distribution, a criterion for CD player transmission quality, in close to real time. It analyzes jitter in terms of frequency to time. Thus, the data analyzed is completely objective and not dependent on human judgement. The DB-3540 is a universal jitter analyzer which can be used in any area from research and development of CD player optical pickups and servo systems to the production processes of adjustment and inspection.



## SPECIFICATIONS

### INPUT SECTION:

**VAR Input:**  
 Input Impedance: 1M $\Omega$ , approx. 35pF  
 Input Level Range:  
 At  $\times 1$  GAIN: 300mV to 3Vp-p (for a 720kHz sinewave)  
 At  $\times 10$  GAIN: 30mV to 300mVp-p (for a 720kHz sinewave)  
**TTL Input:**  
 Input Impedance: 100k $\Omega$ , approximately 35pF  
 Input Level Range: +0.5V to 5V (peak) (for a 720kHz square wave)  
 Input Withstanding Voltage:  $\pm 10$ V peak

### MEASUREMENT PIT LENGTH AND MEASUREMENT RANGE:

Measured Pits and Measurement Range:  
 3T: 694ns  $\pm 115$ ns  
 4T: 926ns  $\pm 115$ ns  
 11T: 2545ns  $\pm 115$ ns

Precision of Time Width Median Value:  
 3T and 4T are 5ns, 11T is 10ns

### MEASUREMENT SLOPE:

Selectable as rising edge to falling edge or falling edge to rising edge.

Zero Level Detection Error: 3mV

### INPUT SIGNAL OFFSET:

Measurement Range:  
 0 to  $\pm 100$ mV (For  $\times 1$  GAIN)  
 0 to  $\pm 10$ mV (For  $\times 10$  GAIN)  
 $\pm (10\% + 5$ mV) or less

### DISPLAY RESOLUTION:

Display Resolution: Selectable as 1ns, 2ns or 4ns

### GO/NO GO:

Measurement Range: 0 to 100%  
 Setting Error: 2.5% or less (includes 0.5% potentiometer error)  
 Time Width Set:  $\pm (0$  to 50) steps

Resolution at 1ns 0 to  $\pm 50$ ns  
 Resolution at 2ns 0 to  $\pm 100$ ns  
 Resolution at 4ns 0 to  $\pm 200$ ns  
 $\sigma$  Value Display Error: 5.5% or less (includes 2.5% meter error)  
 Result Read-Out: Displayed by red and green LEDs.

### MEDIUM VALUE DISPLAY:

Number of Displayed Digits:  
 Display Resolution:  
 Display Precision:  
 3T and 4T:  
 11T:  
 Display Range:

Move any point in the measurement range to the center of the CRT to display the absolute time at any given moment.

Displays three or four digits by seven-segment LEDs.  
 1ns

$\pm 5$ ns or less (within rated input)  
 $\pm 10$ ns or less (within rated input)  
 From logical mean of each channel pit  
 At 1ns resolution:  $\pm 95$ ns  
 At 2ns resolution:  $\pm 190$ ns  
 At 4ns resolution:  $\pm 380$ ns

### AUTO CENTER:

Pull-In Range:

Automatically pulls in the peak point of the data to the center of the CRT.

The jitter center displays the absolute time of the peak point at that moment.  
 At 1ns resolution:  $\pm 115$ ns  
 At 2ns resolution:  $\pm 115$ ns  
 At 4ns resolution:  $\pm 115$ ns  
 Adjusts the interval from one measurement to the next. Continuously variable to approx. 100ms.

### HOLD OFF:

Hold Off Duration:

### X AND Y AXIS OUTPUT:

X Axis:  
 Output Level: 0 to +10V  
 Sweep Time: Approx. 10ms

Y Axis:  
 Output Level: 0 to +10V  
 Resolution: 25 dots/V (255 dots fullscale)

### POWER REQUIREMENTS:

100/120/220/240V AC, 50/60Hz Approx. 70W  
 430(W) $\times$ 149(H) $\times$ 465(D) mm

### DIMENSIONS:

### WEIGHT:

### ACCESSORIES:

Approx. 11kg  
 Instruction manual 1 copy  
 Power code 1 pc  
 Cable (CA-41) 1 pc  
 Cable (CA-43) 2 pcs  
 Spare fuse

**Options:**  
**CB-2420P** GP-IB Cable



# System of CD Players.

## CD Jitter Analyzer DB-3541



The conventional method of adjusting, inspecting and mounting CD player optical pickups and adjusting and inspecting CLV servo systems calls for visual observation of RF (HF) signals on a CRT and requires subjective human judgement. One means of eliminating the subjective nature of this process is to measure the error rate and then go through the difficult procedure of indirectly evaluating results.

The DB-3541 eliminates human error by digitally displaying and outputting all results over the GP-IB interface.



### SPECIFICATIONS

#### INPUT SECTION:

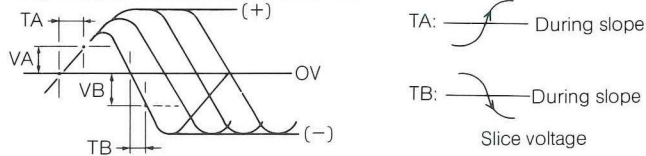
- VAR Input:
  - Input Impedance: 1MΩ, approx. 35pF
  - Input Level Range:
    - At×1 GAIN: 300mV to 3Vp-p (for a 720kHz sinewave)
    - At×10 GAIN: 30mV to 300mVp-p (for a 720kHz sinewave)
- TTL Input:
  - Input Impedance: 1MΩ, approx. 35pF
  - Input Level Range: +0.5V to 5V (peak) (for a 720kHz sinewave)
  - Input Withstanding Voltage: ±10V peak
  - Switching Measurement Slope: Selectable as either rising or falling edge.
  - Function for Correcting Input Signal Offset: AUTO OFFSET=ON equalizes each input signal's positive and negative peak value (mean value).

#### MEASURING INPUT SIGNAL LEVEL (half-wave peak):

- Symmetry Pits: 3T to 11T 2-digit D, SW set
- Measurement Range and Precision:
  - At×1 GAIN: 100mV to 1500mV half-wave
  - In Sinewave Input: Within (5%+5mV)
  - At×10 GAIN: 10.0mV to 150.0mV half-wave
  - In Sinewave Input: Within ±(5%+1mV)

#### MEASURING RISE (FALL) TIME (rise time):

Fig. 1 shows measurement of TA or TB.



- Symmetry Pits: 3T to 11T. Use selection SW with level.
- Slice Voltages and Setting Range (R.T. Sampling Level):
  - At×1 GAIN: 50mV to 999mV
  - At×10 GAIN: 5.0mV to 99.9mV
  - 3-digit Digital switch setting

#### MEASURING JITTER:

- Switch used to select 3T, 4T and 11T
- Measured Pits and Measurement Range:
  - 3T: 694ns ±115ns
  - 4T: 926ns ±115ns
  - 11T: 2545ns ±115ns
- Precision of Time-Width Median:
  - 3T and 4T are 5ns, 11T is 10ns
- Display Resolution: 1ns, 2ns and 4ns selected by switch
- Effective Display Range: The effective CRT display ranges corresponding to each resolution are shown below.

#### MEDIAN DISPLAY:

- The absolute value at any moment can be displayed by moving any point in the measurement range to the center of the CRT.
- Number of Displayed Digits: Three or four-digit display by seven-segment LEDs.
- Display Resolution: 1ns
- Display Precision:
  - 3T and 4T: ±5ns or less (in rated input)
  - 11T: ±10ns or less (in rated input)

#### AUTO CENTER:

- The jitter center shows the absolute time of the peak point at that moment.
- Pull-In Range:
  - At 1ns resolution: ±115ns
  - At 2ns resolution: ±114ns
  - At 4ns resolution: ±112ns
- HOLDOFF: Adjusts the interval from one measurement to the next. Continuously variable to approx. 100ms.

#### HOLDOFF:

HoldOff Duration:

#### X AND Y AXIS OUTPUT:

- X Axis:
  - Output Level: 0 to +10V
  - Sweep Time: Approx. 4ms
- Y Axis:
  - Output Level: 0 to +10V
  - Resolution: 50 dots/V (255 dots fullscale)

#### POWER REQUIREMENTS:

- 100/120/220/240V AC, 47 to 63Hz Approx. 70W
- 430(W)×149(H)×465(D) mm
- Approx. 11kg

#### DIMENSIONS:

#### WEIGHT:

#### ACCESSORIES:

- Instruction manual 1 copy
- Power code 1 pc
- Cable (CA-41) 1 pc
- Cable (CA-43) 2 pcs
- Spare fuse

**Options:**  
CB-2420P GP-IB Cable



# Ideal for Playback and Error Measurement of EFM Signals Including Graphics Information.

CD Decoder  
**DR-3550A**  
GP-IB



The DR-3550A CD Decoder is an EFM signal reference player that conforms to CD standards. It functions for playback music data in the EFM signal and to playback R-W codes, which are the error measurements and screen data.

- ★ A 5-inch CRT display is provided to enable not only real-time monitoring of subcode information and data but a static display of R-W (LINE, TV mode).
- ★ The starting and ending time of the measurement may be set as desired and measurement may be terminated auto-

- matically upon detecting the lead-out.
- ★ In addition to music information error measurement, the DA-3550A can perform SUBCODE error measurement (including R-W) and, when an error occurs, can record the absolute time of the occurrence.

## SPECIFICATIONS

**INPUT SIGNALS:** RF EFM signal (30mV to 1Vrms, 1MΩ) TTL EFM signal

**CLOCK MODES:** Internal clock mode  
External clock mode (44.1kHz)

**PLAYBACK AUDIO MONITOR OUTPUT:** L and R analog signals (emphasis automatic selectable)

**P, Q CODE DISPLAY:** The following data is derived from P and Q codes. Track No., index, time, absolute time, control bit catalog No. and ISR code.

**DATA ERROR MEASUREMENT (music data):** Displays the number of frames generated in one section for the following states.  
Number of C1 errors  
Number of C2 errors  
Number of C2 corrections

**BURST ERROR DETECTION:**  
**(C1 continuous errors of 2 symbols or more):** Number of continuous errors that can be set (1 to 16 frames)  
Records up to 128 generated locations (absolute time)

**TRACK JUMP DETECTION:** Records up to 32 generated locations.

**TRIGGER FUNCTION:** Automatically triggered by the absolute time that has been set.  
Manually triggered by start switch.

**R-W CODE GRAPHICS PLAYBACK FUNCTION:** TV graphics mode  
Line graphics mode

**R-W CODE CORRECTION FUNCTION:** Switching between 2-symbol, 1-symbol and uncorrected codes.

**GRAPHIC PROCESSING SPEED:** 3.3ms/instruction

**DATA-ERROR MEASUREMENT (R-W codes):** Displays the number of packs in the following states that have been generated in one second.  
Number of parity Q errors generated.  
Number of parity P errors generated.  
Number of 2-symbol parity P errors corrected.  
Number of parity P errors that cannot be corrected.

**INVALID INSTRUCTION DETECTION:** Records up to 32 generated locations.

**CHANNEL MATCHING:** 16 channels can be independently set by panel switch.

**RECEIVED CHANNEL DETECTION:** Records existing channel numbers in sequence of appearance.

**PICTURE OUTPUT:**  
TV Graphics: Analog RGB output (0.7Vp-p/75Ω) at 21-pin RGB connector (EIAJ standard: TTC-003).  
Line Graphics: TTL-RGB output at 8-pin square connector.  
Text Display: Displays settings and measurement results on built-in 5-inch display.  
View Display: Displays TV and line graphics on a monochromatic gray scale of the built-in 5-inch display.

**GP-IB INTERFACE:** Outputs all panel functions and measurement data.

**RESTRUCTURE PARAMETERS:** Parallel input pins for graphics signal R-W codes. Pins for error graph output during code correction of music and screen data.

**POWER REQUIREMENTS:** 100/120/220/240V AC, 50/60Hz Approx. 40W

**DIMENSIONS:** 426(W) × 177(H) × 410(D) mm

**WEIGHT:** Approx. 10.5kg

**ACCESSORIES:** Instruction manual 1 copy  
Power code 1 pc  
Cable (CA-41) 1 pc  
Cable (CA-43) 1 pc  
Spare fuse

Options:  
CB-2420P GP-IB Cable



# Tests the Graphics Mode of the R-W Subcodes.

Subcode Test Disc

## CD-T03

The CD-T03 test disc conforms to the Sony-Philips confidential information (RED BOOKLET) issued in December, 1983 and the license agreement of March 7, 1985. It is chiefly used in performing a graphics mode test in accordance with the specifications for the R-W SUBCODE. It also enable a simultaneous audio output signal characteristics test to be performed, a digital signal source providing a variety of signals covering the total range of 1Hz to 22.049kHz have been recorded on the disc as well.



**This disc provides the following recorded signal sources.**

★ **Graphics.**

All recorded graphics have been digitally generated in pixel units using a computer. 16 levels of R, G and B colors have been mixed.

★ **Sound Signal.**

These signals have been generated by a totally digital signal generator and recorded with the maximum 16-bit amplitude as 0dB.

★ **Listening Test.**

This source is recorded using a sampling frequency of 44.1kHz as a 16-bit PCM signal.

## CD Player Configuration and Operating Principal.

This section will serve to describe the configuration and operation of a CD player.

### ★ RF Amplifier

The RF Amplifier is used to derive the quadrature RF signal which includes the focus information from the laser pickup, the FOCUS signal and the TRACKING signal (and the difference between the leading and trailing spots for three-beam systems).

### ★ Pick-Up Servo

This section performs laser pick-up focusing and pit tracking using the FOCUS and TRACKING signals which are part of the RF signal.

### ★ Bit Detector

This section establishes RF signal symmetry and converts the RF signal to a logic signal.

### ★ Clock Generator

This circuit section generates a 4.3218MHz transmission clock from the EFM signal using a PLL.

### ★ Sync Detector

This section extracts the (11 bit+11 bit+2 bit) FRAME sync signal (7.35kHz) from the RF signal using the generated CLOCK. This signal is used as the timing reference for signal processing.

### ★ CLV Servo

Since compact discs are recorded using a constant linear velocity, it is necessary to

constantly change the spindle motor rpm to compensate for the varying disc radius. The spindle motor servo is controlled so that the FRAME sync signal is always 7.35kHz.

### ★ DE-EFM

This section restores the original 8-bit data from the 14-bit (EFM) data converted from the 8-bit data recorded onto the disc.

### ★ Error Correction

Even when random reading errors caused by disc defects and damage or burst errors occur, the compact disc system is designed to eliminate as much as possible any adverse effects on the playback signal. The error correction process consists of determining whether or not an error in data exists, making a calculation based on the data before and after the error and actually correcting or interpolating for the erroneous data.

### ★ Channel Separation

Since recorded data is dispersed throughout the disc, the left and right channels are not separated. The left and right channel data must, therefore, be separated using the sync signal to establish the proper timing relationships.

### ★ D-A Converter

At the digital-to-analog converter, the left channel and right channel data are converted to analog signals by sampling at a given

frequency.

### ★ Low-Pass Filter

This 20Hz low-pass filter is used to eliminate the aliasing noise which occurs according to information theory.

### ★ Sub-Decoder

The 8-bit "CONTROL & DISPLAY" symbol which follows the FRAME sync pattern is termed the SUBCODE. These 8 bits (Bits P-W) are extracted and decoded according to the disc format. The P signal is used for information between musical selections and the Q signal is used for time and emphasis information. R-W are graphics signals.

### ★ Control & Display

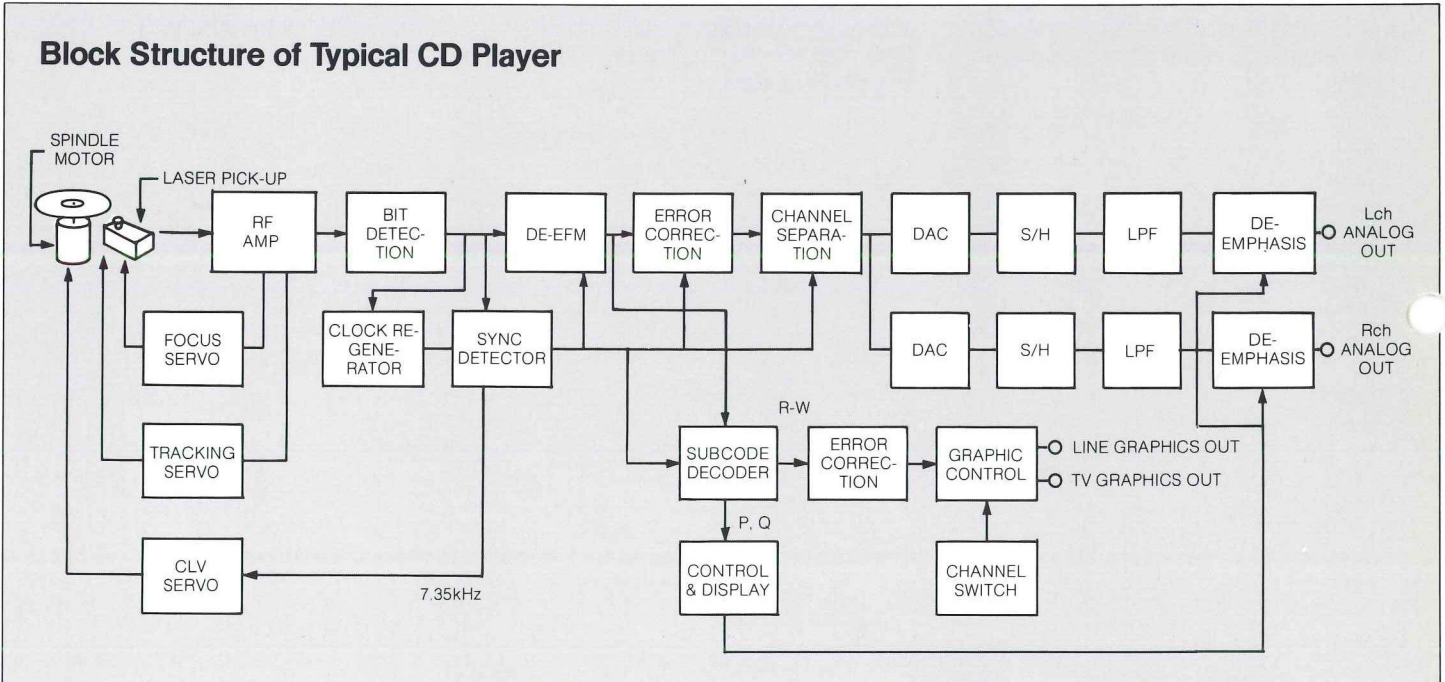
These are unique operating features of the CD player, and consist of storage of disc contents according to the lead-in data, display of processing times, display of absolute time, random access and trick play.

### ★ Error Correction (R-W)

The 8 (R-W) bits of the SUBCODE consist of graphics data and these bits have an inherent error correcting capacity as well. This is done by means of bits P and Q and a CRC (Cyclic Redundancy Code).

### ★ Graphics Control

The LINE graphics signal and TV graphics signal are separated and instructions for the various modes are executed.





# CD Cutting System

This section will serve to describe the process of cutting a compact disc and the operation of the various equipment used.

★ **Time Code Generator**

This section generates the lead-in information, lead-out information and P and Q signals in real time.

★ **Graphic Editor**

This section uses the Q information from the ENCODER to generate the R-W SUBCODE which comprise GRAPHICS information. It alone generates the TV graphics mode and LINE graphics mode pictures.

★ **PCM VCR/VTR**

This section generates the master tape which

serves as a sound source from PCM recorded digital data.

★ **Audio Processor**

This section extracts from the VIDEO signal (from the VCR or VTR) digital data and the required recording control signals (e.g., EMPHASIS signal).

★ **Digital Interface**

This section formats the various signals from the AUDIO PROCESSOR to match the ENCODER.

★ **Encoder**

This encoder performs the processing necessary to format music data from the SUBCODE and digital I/O data which include graphics

information, and performs synchronization and DSV calculations to derive the complete CD signal.

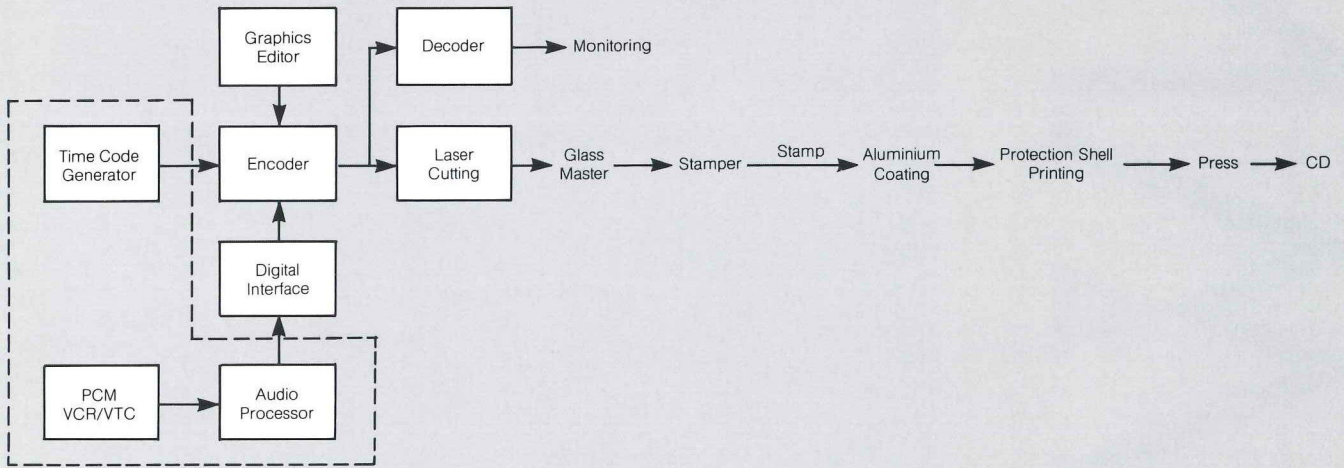
★ **Decoder**

The decoder serves as a real-time monitor during the cutting process and monitors all recorded data while measuring errors during recording.

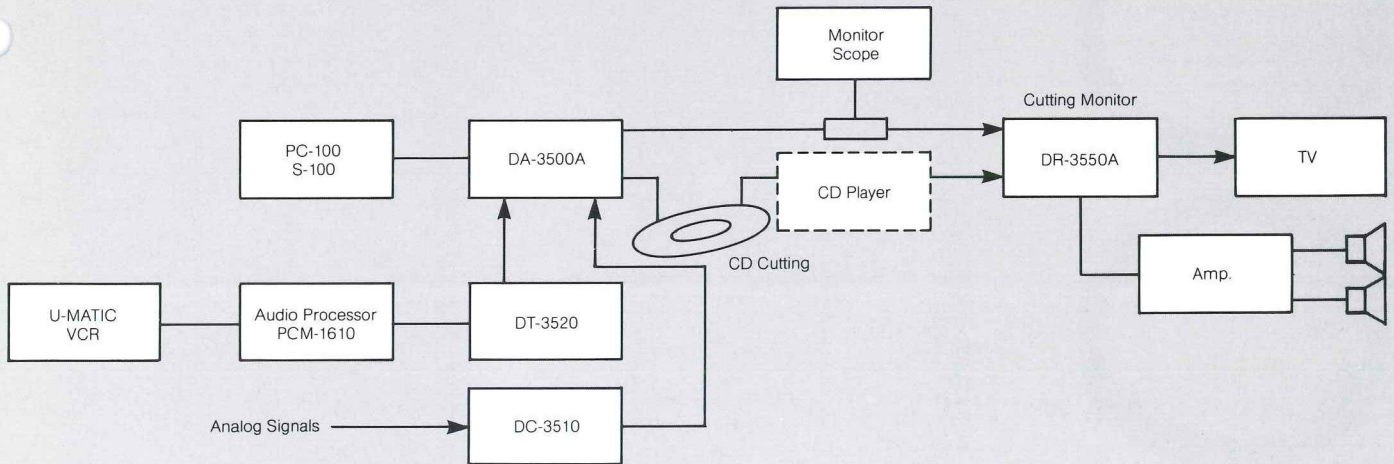
★ **Laser Cutter**

This device uses a laser modulated by the on/off switching of the EFM signal from the ENCODER to record data onto the glass master onto which an aluminum layer has been sputtered.

## CD Cutting Process



## CD Cutting System



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\*Specifications and design subject to change without notice for improvements.