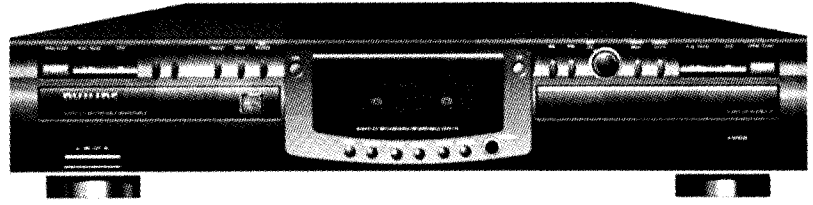


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Circuit Description



Concerning the third generation of Digital Audio Compact Disc Recordable and Rewritable (reference set is CDR775)

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After the publication of the basics of Compact Disc Recordable (4822 725 25242) with the applied Loader and IC's for the first and second CDR generation, now a new designed Loader, CD Mechanism and "chipset" is applied in the 3rd generation sets. With this publication you are informed about this actual situation.

In principle the Recording method and the Recording discs have not been changed, both have already been published in the first two chapters of above mentioned basic publication, now all efforts is given to explain the functioning of the 3rd generation Digital Audio Compact Disc Recording set. In this publication first of all the new features applied in these sets are described, then the functional blockdiagram is explained in detail. One chapter explains the Menu functions of the sets. Finally the description of the functioning of the Switch Mode Power Supply is given.

Personal notes



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The Digital Audio CD Recorder is offering more functionality, with applications like audio buffer, DLR, CDText and a lot of other integrated functions

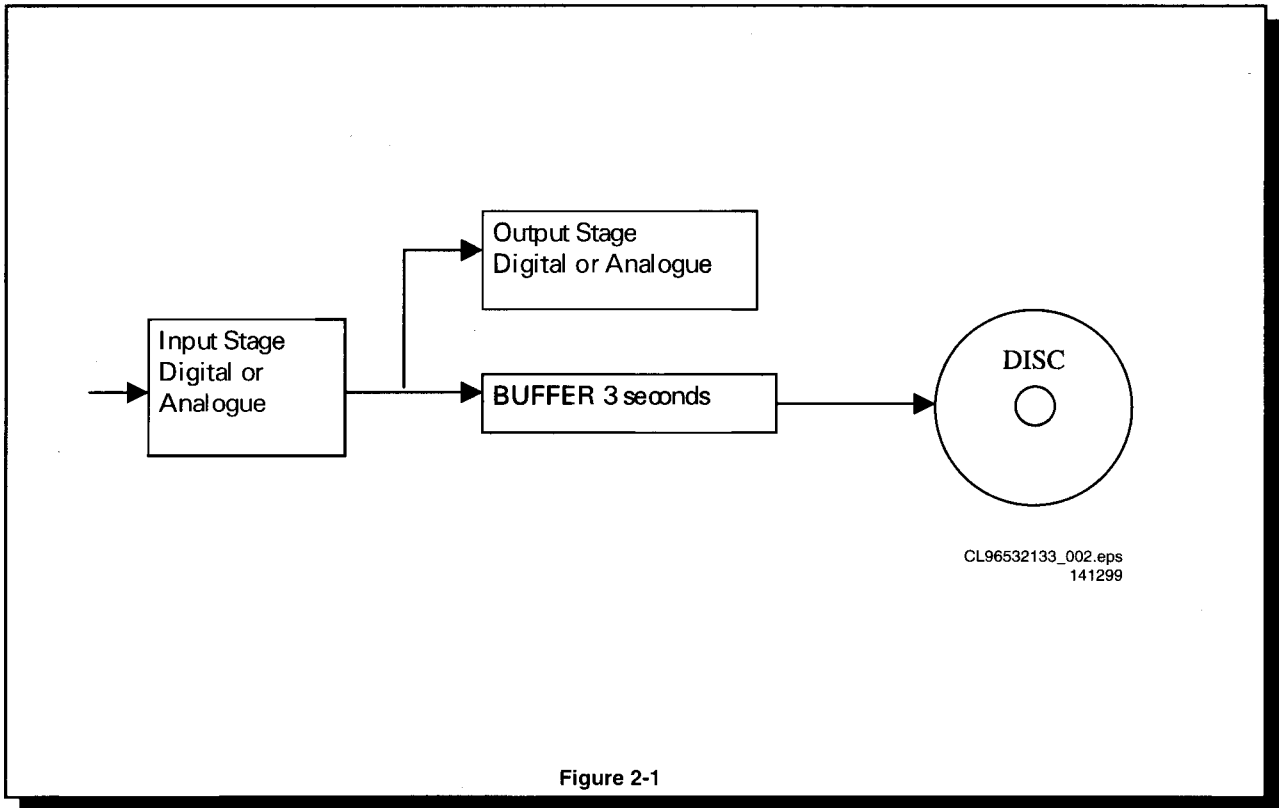
1. Audio buffer
2. Improved stop modes (in recording from a digital and an analogue source)
3. Synchronised start of recording also from ANALOGUE sources
4. Sample Rate Converter 11-56 kHz (DAB = 32 kHz; DAT = 48 kHz)
5. Direct Line Recording
6. Easy jog
7. CD Text input, (album name / artist for disc and per track; 60 char.)
8. Fading in and fading out.

Personal notes



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2.1 AUDIO BUFFER



The new DASP processing IC plus DRAM makes it possible to introduce an advanced audio buffer with a capacity of several seconds (0-3 sec.).

- No loss of music while starting a recording with synchronised start (CD Sync).
- Synchronised start per track is possible now and also a programmed disc can be copied in that programmed following order.
- Perfect positioning when jumping to next / previous track. Track increment will be positioned in exactly the same position as the original.
- Synchronised start of analogue input signals is possible with the application of the audio buffer.
- Better stop behaviour at analogue input signals is possible by using the audio buffer.
- Recording can be stopped within 3 seconds without 'damaging' the CD.
- When entering an SCMS track, no recording will be made of the first few seconds.

By applying the audio buffer it is possible to make perfect recordings without any loss of music at the start of a track. Above that all information available on the original disc will be duplicated at exact the same spot of the disc to be recorded to. By using this state-of-the-art technology, a perfect 'bit-for-bit' copying technique is applied.

Description of the functioning of the Audio buffer:

The audio (and track information) will pass through an audio buffer that continuously holds several seconds (0 to 3 seconds) in memory. In this way the recorder has enough time to

determine the status of the input signal (music versus no music, track increment, lead-out etc.), and will start the recording at the right moment. The music is taken from the buffer.



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2.2 Improved STOP modes

The first and second generation recorders (without audio buffer) have difficulties in detecting if the source has stopped. With the audio buffer this is no longer a problem, and it provides the opportunity to improve the stop behaviour. So now it is possible to have perfect stopping of recordings, also when analogue sources have been used as input.

This means there is no longer a 20 seconds silence at the end of the recording for detecting the input signal has been stopped. It also prevents the recorder stopping when the recorded music contains a very silent passage.

The possibility to stop a recording which has just started (within 3 seconds), without having anything recorded on the (CDR) - disc.

It provides the opportunity To be able to record properly from CD changers

The description of the improved stop mode:

The functioning can be compared with the functioning of the Audio buffer at recording start. However at the stop mode the decision is now taken at the input side of the signal. At any moment there is a signal stop, the contents of the buffer is still read out and then the recording stops at the correct moment.

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2.3 Analogue CD Sync.

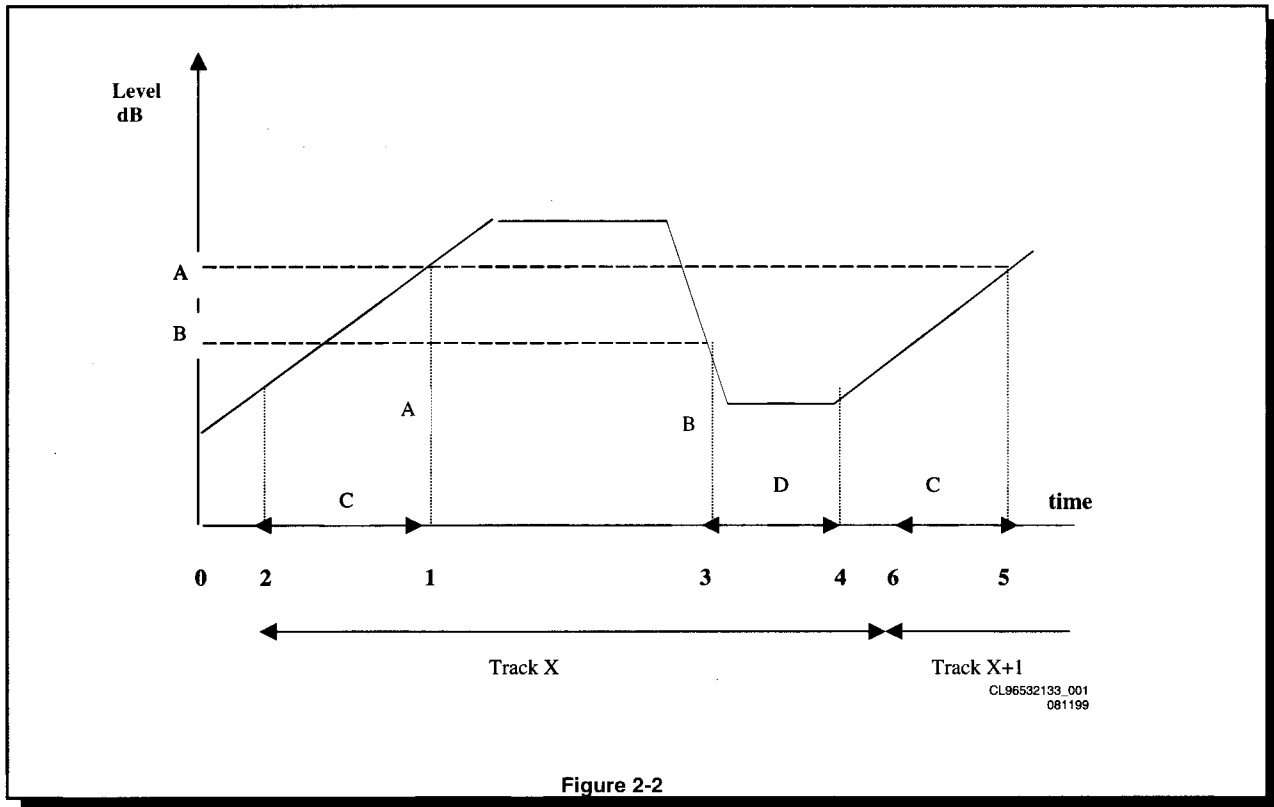


Figure 2-2

The synchronised start of a recording ensures that the recorder will only start when music is detected. This can be done with an analogue source or a professional (digital) source without subcode information as input.

Normally the digital information also contains the track start information. This information is used to start a digital recording. This kind of information is not available for analogue input signals. In this case, the input level is continuously measured with the help of the audio buffer. When the source has started, the recorder senses a significant change in the input level and starts recording (input level above -50dB). As the first seconds are still in memory (audio buffer), the recorder will calculate a certain period back in time and put this audio data on the disc. It is called a virtual start point. See next figure.

Explanation :

- 0 Auto start active
- 1 Track transition is detected when audio goes above value A
- 2 The actual recording of the audio track will start at point 2. A jump backwards is performed in the audio buffer" Time C" .
- Virtual start point
- 3 & 4 When audio goes below level B for a time D, a track increment is detected
- 5 When audio rises again above value A
- 6 The recording of the new audio track will start at point 6

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2.4 Sample Rate Converter (SRC)

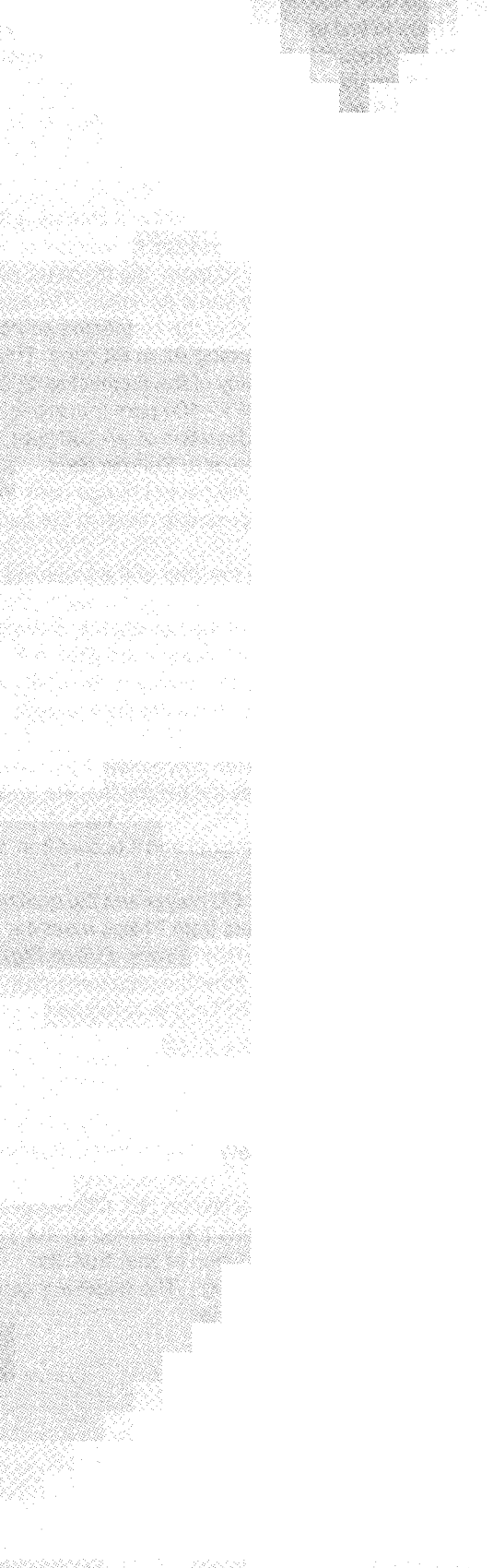
Recordings can be made from all kinds of digital sources (with sampling frequencies from 12 kHz till 56 kHz).

- the sampling rates of the various digital sources are:
 - CD44.1 kHz
 - MD44.1 kHz
 - DAB (Digital audio broadcasting) 32kHz or 48 kHz
 - DAT32 kHz or 44.1 kHz or 48 kHz
 - DCC44.1 kHz
- When you want to record from a source with a variable Sample Rate Converter. This input signal should be pitch-controlled.

The functioning of the Sample Rate Converter:

The input signal is sampled again with a frequency of about 68 MHz and reconstructed to give a signal with a sample frequency of 44.1 kHz (the CD-sample frequency).

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2.5 Direct Line Recording (DLR)

For the perfectionists among audio enthusiasts, Philips has added a technique to make true 'bit-for-bit' recordings from sources with a Sample Rate Frequency of 44.1 kHz +/- 100 ppm (CD and MD). In first and second generation sets, only the CDR880 is the CD Recorder from Philips which is equipped with the high-performance DLR technique. In all third generation sets DLR is introduced for all models. For more detailed information, see the below.

Direct Line recording (DLR)

There are two purposes for direct line recording.

The first one is to make a bit-to-bit copy without changing the bits of the original digital source. Connected to a digital source of a sample rate from 44.1kHz +/- 100ppm, the machine will automatically tune his crystal in the same deviation. The speed of the recorder will follow the speed of the connected source. Now it is making a direct line recording Bit to Bit copy. This however has it's limits. The accuracy of the connected digital source must be within the range of +/- 100 ppm (parts per million). If the source exceeds the deviation of +/- 100 ppm, the recorder will automatically switch over to Sample Rate Conversion. During a recording it will never change back to Direct Line Recording to avoid undesirable clicks in the audio signal.

The second reason is to eliminate the jitter of the incoming digital source (dejittering) . Imagine the source is within the standard (44.1 kHz +/-100 ppm) but the deviation is changing into a very high frequency. This will cause extra jitter in the write pattern of the recorder. Also the quality of the audio will be affected by this jitter. To prevent the extra jitter, a dejitter system has been implemented.

This converts all jitter coming from the connected digital source into a maximum of 50 Hz. This gives the benefit that the 'writing jitter' is very stable.

What if you listen to a copy of an original and it occurs that you hear a difference?

This depends on the quality of your CD player and the quality of your original disc. The CD recorders from Philips meet the needs of the standard known as SPDIF (Sony Philips Digital Input Format) Every player should meet the requirements in the digital standard norm IEC958 I/II (SPDIF) to safeguard a good digital copying behaviour.

What is the advantage of DLR?

- A perfect copy of the source material (44.1 kHz), meaning a true 'bit-for-bit' recording.
- It makes a bit-for bit copy possible for HD- CD Recording
- To avoid digital information being transformed by the Sample Rate Converter. Elimination of jitter from the incoming digital source ('dejittering'). The result is a clear reproduction of the original material.

Personal notes

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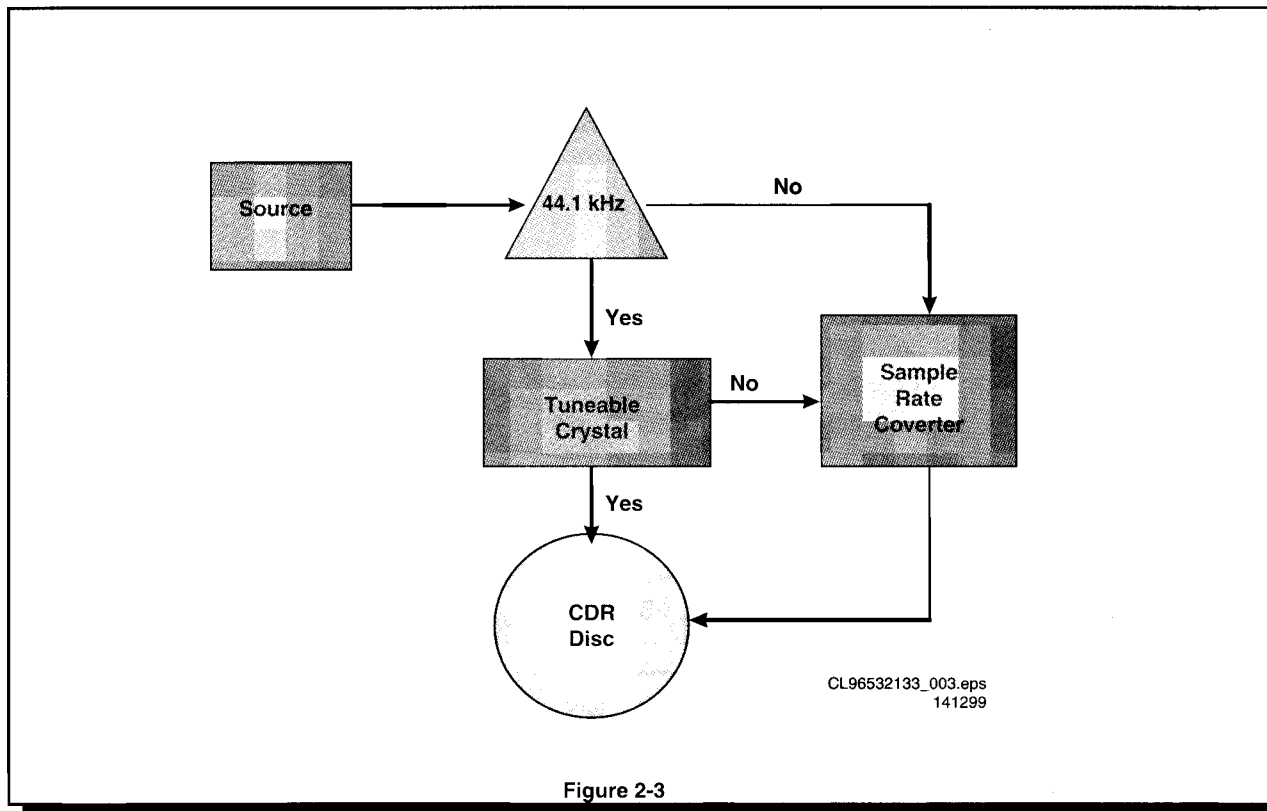


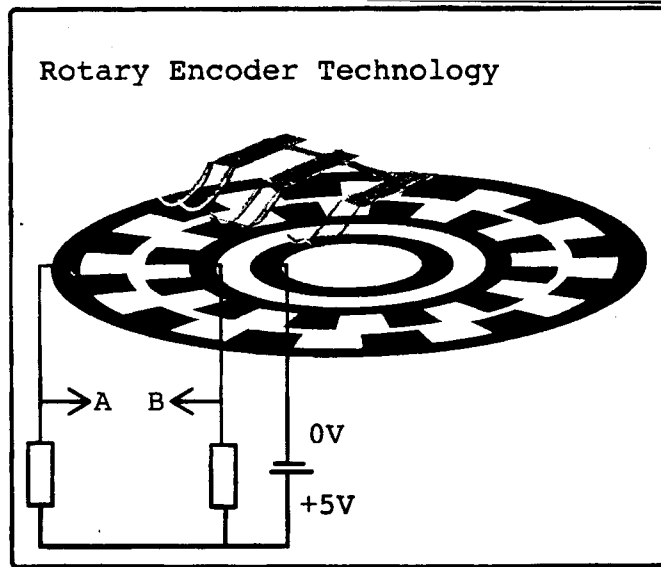
Figure 2-3

Description of the functioning of the Direct Line Recording:

When a signal of 44.1 kHz is detected, the Sample Rate Converter is by-passed and the digital bitstream is recorded directly to the destination disc.
 To be able to make a 'bit-for-bit' copy, it is essential that the source information flow has the same speed as information flow to the destination disc.
 Therefore the input frequency (speed of the source disc) is measured. A tuneable crystal accurately controls the speed of the destination disc and keeps the speed within the limits of max. +/-100 ppm (parts per million). If the speed deviates too much, the Sample Rate Converter is activated.
 To avoid audio disturbance, the recorder will never switch back to DLR during a recording.

Personal notes

2.6 Easy jog knob



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Figure 2-4

Rotary operation

The easy jog knob incorporates a whole heap of user control possibilities in just one knob. Without the knob being operated it will maintain the high level. Turning the knob clockwise briefly connects pin B to GND followed by pin A. (pin B low level before pin A) Turning the knob anti-clockwise briefly connects pin A to GND followed by pin B. The pulses created this way arrive at the display controller (see fig 2-5). The first pulse to arrive tells the controller the direction of the rotation. Counting the pulses reveals the amount of rotation. Combining and decoding this information, the display controller will execute the appropriate task.

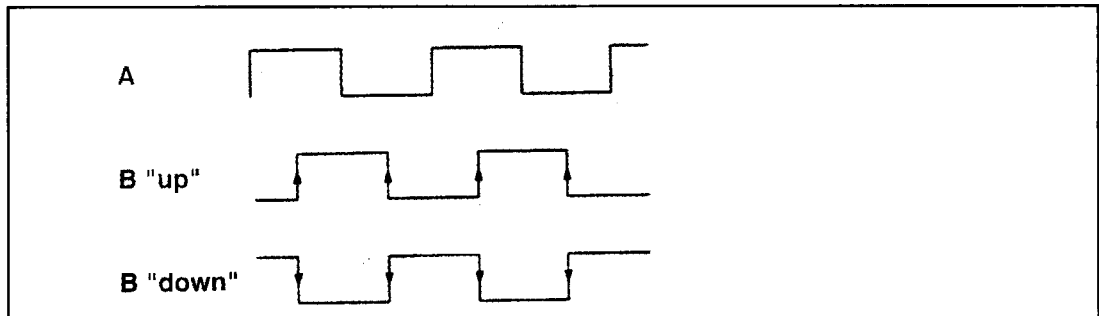
Pin 1 till 3 of the easy jog is in use for the rotary operation.

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2.6 Easy jog knob



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Figure 2-5

Push button operation

This button of the easy jog knob, is connected to the key matrix lines and thus the operation is identical to all other displayboard keys. Without being pressed, pin 4 of the easy jog maintains the low level, pin 5 the high level. When pressed the scanning signal goes through the closed contact of pins 4 and 5, and can be checked at both pins.

Menu and Input level controller

With the easy jog knob functions the user can apply the menu controller, the input level controller and the next or previous function. All these controls are important. The easy jog, in particular, makes the controlling of the CD Recorder quicker and more intuitive by rolling through the tracks of a CD or the choice and selection of tasks.

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2.7 CD Text editing (input, playback)

(Notice: CD-text input from original disc and automatically recorded, is only valid for doubledecks like CDR775!)

The new CD Text feature offers users the option of identifying the disc while playing. However, creative users will be able to find several other applications for this feature (e.g. you can give personal names to songs, or if you have recorded your own voice the 'artist name' can also show the performer's name). What can be done with this feature?

- **PLAYBACK:** Title and artist names of the disc and tracks appear on the display.
- **INPUT:** The disc/track titles and artist names can be added in the stop mode or during recording, independently of the tracks being recorded.
- **RECORDING:** In the double decks CD Text recording is possible. In that set CD Text is copied via an internal connection from the original, if not protected by the disc itself (only valid for doubledecks like: CDR775).
- **EDITING:** Text can always be edited for a CD-RW disc, and this can also be done for CD-R as long as the disc is NOT finalised.

Text input is easy, by using the menu plus the easy jog control or by using the remote control.

The user can select the album title, artist title, track titles or track artists to make a text of max. 60 characters. The text will be stored in the memory of the CD Recorder until the disc is finalised. During finalising of the disc, the text is written to the Table Of Contents (TOC).

As long as the disc is not finalised, the user is still able to change the text (for both CD-R and CD-RW discs!).

For CD-RW discs, the text can always be changed.

CD TEXT INPUT

Text input is very flexible and convenient:

The text menu is active in both **STOP** mode and **RECORDING** mode.

- **STOP mode:** When a CD-R(W) disc with recorded audio tracks is in the recorder, text for the recorded tracks can be added.
- **RECORDING mode:** Text for 99 tracks can be added completely independently of the track being recorded at that time. This also applies even if the actual recording has not (yet) been made. When the recording has stopped, the text for the recorded audio tracks will be stored. (If auto finalise was active and the text input menu is still open, the auto finalise function is disabled.)

TEXT MEMORY / HANDLING

As the CD Text is part of the Table Of Contents, all text will stay in the CD Recorder's memory until that disc is finalised. (The text can therefore still be edited as long as the disc is not finalised.)

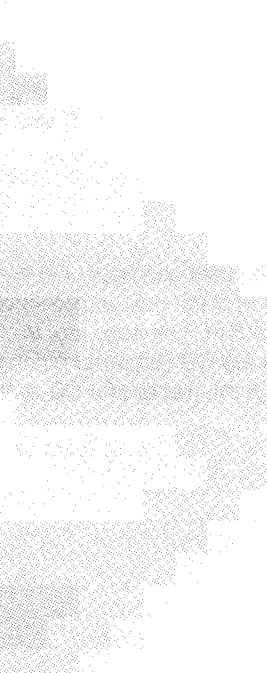
The memory can contain text for approximately 50 discs, each with 20 tracks. (If only a disc title and artist name is used, text for more than 100 discs can be stored.)

To prevent users from structurally not finalising discs, the recorder will show a flashing message 'UNFINALISED' every time the tray opens, together with the percentage of the memory which is used (TEXT MEMORY xx%).

CD TEXT MEMORY FULL

Although the memory capacity is more than sufficient, a **MEMORY FULL** message may sometimes be displayed. The user then has two options: either finalise a couple of discs, or delete the text for some discs. The stored text for every unfinalised disc can be reviewed or deleted by using the menu (**MEMORY VIEW** function).

Personal notes



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2.8 Automatic Fade-in / Fade-out

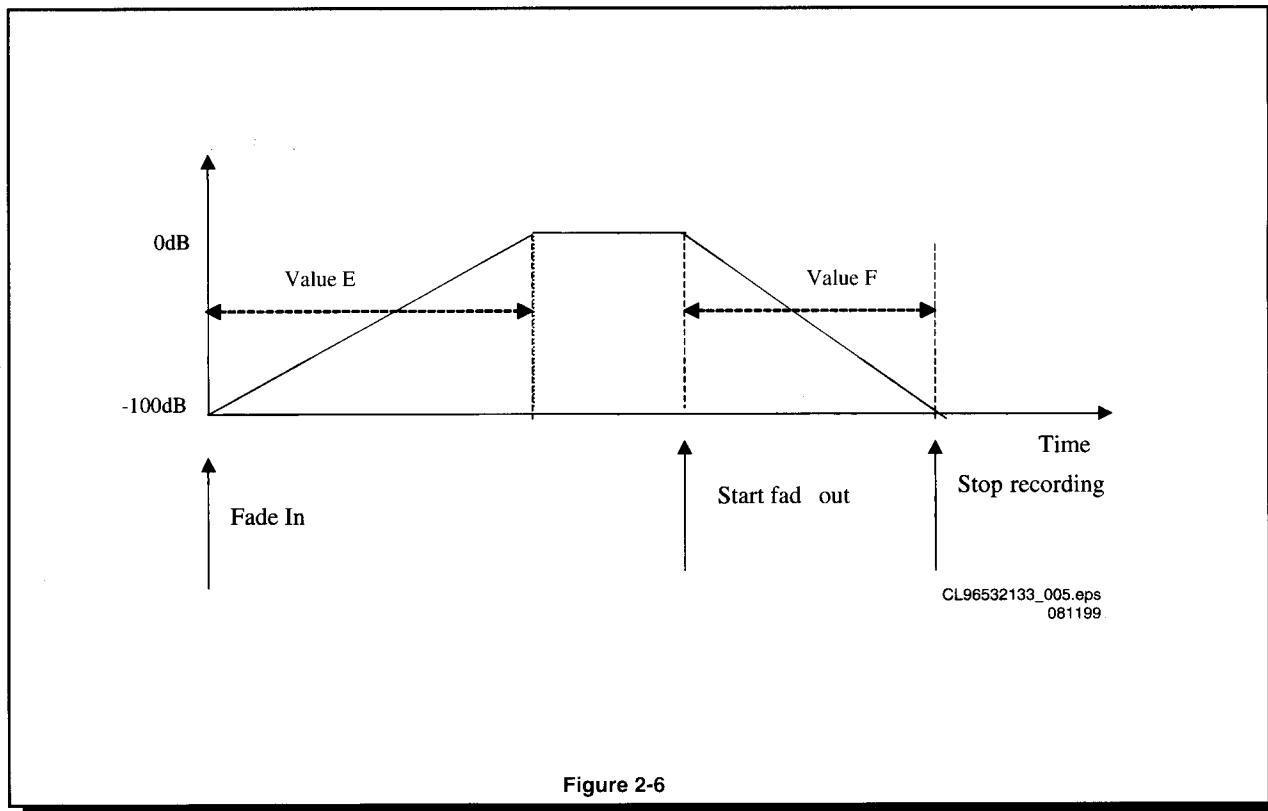


Figure 2-6

The automatic Fade-in / Fade-out function is only available in CDR950.

Fading makes a smooth start and stop of the audio signal possible, when recording parts of music. This is a more sophisticated recording feature.

When user wants to make a recording where the start or end of the music is not well defined (e.g. a song from a live concert, or a recording from the radio).

When a recording starts, the signal is automatically ramped-up to the adjusted recording level. When Stop is pressed, the signal gradually fades down to silence. This feature, as well as the start and/or stop time, can be set via the menu option of CDR950. A label in the display shows that the 'Fade function' is enabled or disabled.

In all other 3rd generation sets fading in and fading out can be done manually via the input level adjustment with the easy jog knob.

Notice: The changed recording level will be kept for all next recordings! So to be sure for a new recording at 0dB level, first of all control via easy jog the input recording level. This level is corrected as well with analogue input signals as digital.

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