Non-contact making, scannable, rotating recording media such as a compact disc (CD) or a magneto-optic disc (MOD) for example, are suitable for the purpose of storing digital items of data, preferably digital audio or video items of data, in large quantities. These recording media preferably have a helically shaped track. During the recording or play-back mode, the recording medium rotates in a manner such that the track is led past a radially adjustable, scanning recording unit or scanning play-back unit (laser) at a constant track speed (the standard for a CD: 1.2 m/sec). A CLV system (Constant Linear Velocity) caters for the constant track speed in the recording or play-back device.

With previous recording methods, the digital items of data are recorded continuously from the beginning of the track up to the end of the track using a net data rate which, on each occasion, is fixed for the whole recording. This has the disadvantage that the corresponding items of data also have to be made continuously available for a recording of the items of data on the recording medium (this can be realised by means of master tapes). Since this is not always possible for the large storage capacity of such recording media, the individual recording of items of data is restricted.

For standard audio recording in the CD format, the data rate amounts to 1.4112 M Bit/sec (= 16 bits (per sample) * 44.1 kHz (standard scanning frequency for CDs) * 2 (for stereo)). Respective playing times of approximately 60 mins per recording medium are achievable with such a large net data rate (net data rate is the data rate which is required in order to store, transmit, etc, 1 second of sound information or 1 second of video information for example). In order to extend the recording time and thus the play-back time with an unaltered scanning frequency and for stereo recording, data reduction processes are known which do not record all of the 16 bits per sampling value at the output of the A/D converter. Here, one could mention for example, NIC (Near Instantaneous Companding), MSC (Multiple adaptive Spectral audio Coding), DPCM (Differential Pulse Code Modulation), ADPCM (Adaptive Differential Pulse Code Modulation) or delta modulation, with which data reduced sound recordings can be achieved without any grievous loss of quality vis a vis standard CD recordings whereby the playing time is extended by up to 4 hours per recording medium.

A method wherein items of data of a plurality of channels are recorded interlaced in a plurality of revolutions until all of the items of data together approximately exhibit the maximum physical data rate of the track is known from FR-A-2 261 586. The items of data are recorded with the net data rate.

The object of the invention is to ensure a data recording and/or scanning on a recording medium using freely selectable read and write access.

The object is achieved by the features specified in the first claim. Advantageous developments of the invention are apparent from the appendant claims.

Basically, the previously usual continuous recording of digital items of data is replaced by a burst-like recording wherein each data burst is continuously recorded by itself. Due to the burst-like recording of the items of data, each burst preferably forms a cluster on the recording medium. By a data burst, one means a predetermined amount of data e.g. one or more bits. Under a cluster, one comprehends the segment of a track which contains, in essence, one data burst. A recording using such clusters will be referred to hereinafter as a "cluster recording".

With this method of recording, it is of no consequence whether the data rate of the items of data that are to be recorded, in particular sound data items, is reduced by one or another data reduction process.

It is possible, with the help of the "cluster recording" described hereinafter, to effect, amongst others, the following modes of operation:

1. Data recording using freely selectable read and write access to the items of data even with different net data rates.
2. A long-play (> 1 hr) sound recording with the help of a sound data reduction process such as MSC for example.
3. An extremely long-play recording of speech (up to 84 hrs).

Preferably, the items of data are recorded, as for the standard CD recording format, with the unaltered scanning speed of 1.2 metre/sec and the scanning frequency of 44.1 kHz and thus the standard CD data rate of 1.411 Mbit/sec so that no changes are required to the CLV system and the equalising circuits of the usual previously used recording and play-back units.

Consequently, a recording of 1.411 Mbits on the recording medium, which were data reduced by means of an MSC process for example, does not contain items of information for only a one second sound recording as in the CD standard but rather, for approximately 4 seconds.

To this end, it is advantageous to provide the items of data that are to be recorded with an error protection code such as a cross-interleaved Reed-Solomon-Code (CIRC) for example, to interleave the data before the recording and to record the data on the recording medium by means of a channel code e.g. EFM code

(eight to fourteen modulation), whereby the items of data are structured into EFM frames by the EFM code. Each EFM frame preferably contains 24 bytes of useful data.

It is advantageous if the track of the recording medium is helical in shape and is pre-formatted with unambiguous position data, preferably, by means of the ATIP process. Each data burst and hence each cluster on the recording medium can thereby be individually accessed in order to erase the corresponding items of data for example, to write afresh or to read etc. Such a data recording using freely selectable read and write access has great advantages especially for computers. Only by virtue thereof, is an individual recording of sound data possible for example.

It is of advantage to make the length of a cluster such that it corresponds to the integral multiple of an ATIP block and hence, to the integral multiple of an EFM frame. Consequently, the unambiguous relationship between an ATIP block and a cluster and between an EFM frame and a cluster is defined, which is something, that ensures, above all, that a cluster can be unambiguous addressed.

For improving an error free recording, the preceding cluster CL1 is preferably re-read before writing a cluster CL2 and, in the case of a faulty recording, the cluster CL1 is recorded afresh and the faulty cluster is marked in order to avoid a repetition and play-back of the faulty cluster during play-back of the recording medium.

The invention will be explained hereinafter in more detail with the aid of an example illustrated in the drawing.

Fig. 1 shows a a block circuit for recording a sound channel using MSC data reduction which is implemented in a recording device.

After filtering out the analogue signal by means of a low pass filter 1 and sampling by means of a 16 bit analoge/digital converter 2, 16 bits per sampling pulse are available at its output for further processing. These samples - arranged in respective blocks - are subjected to a Fourier transformation in a special computing means 3. For each block, the result is a set of 1024 spectral coefficients which could also be obtained for example, with a digital spectral analyser as is commonly used in the measuring field. The magnitudes and phase values are now multiply adaptively coded in an MSC coder 4 i.e. the significant coefficients are represented by a plurality of bits (up to 14) and transmitted, while only a few bits are used for less significant bits. Very small insignificant coefficients are set to zero and are not transmitted. The "saved bits" in such a case

are added to other significant coefficients which are then transmitted with corresponding precision.

After the MSC data reduction, the digital items of data quit the coder at 308.7 kHz and are supplied to a parallel-serial converter 5 whose output is connected to the data input of a buffer store 6. The read-out clock rate is 1.4112 MHz while the read-in clock rate of the buffer store amounts to 308700 Hz. A 7/32 frequency divider 7 caters for the conversion of the 1.4112 MHz clock rate to 308.7 kHz.

The buffer store is controlled by a control unit 8 which, amongst other things, compares the current position data item 14 on the recording medium 11 with the reference position data item. Only when at least as many items of data are stored in the buffer store 6 as are provided for in the set reference burst, does the buffer store signal "Data Ready" over the signal line 13. When the recording unit has reached its reference position, read out of the store is activated via "Output Control" and the corresponding data burst is read-out from the buffer store using the standard CD recording data rate of 1.4112 Mbit per second and provided with a CIRC error protection code (cross-interleaved Reed-Solomon-Code) in a Reed-Solomon-Coder 9 and subjected to an interleaving process (code spread). An interleaving store (not illustrated) is arranged in the coder 9 for the interleaving process. A diagram in Fig. 1 indicates the timing sequence for the processing and recording of digital items of data.

Because a non-contact making, scannable recording medium 11 such as the MOD may be subject to different physical defects, which can never be guaranteed to be avoided during the production of the discs, the audio signals that are to be recorded are coded in accordance with this special coding process. The items of data coded in the Reed-Solomon-Coder 9 are subjected to an EFM modulation (eight to fourteen modulation) in a modulator 10 and are recorded on the MOD with the help of this line code whereby the items of data are structured into EFM frames by the EFM modulation. This is also the format used on the compact disc.

The organisation of the recording is such that 24 bytes of useful data (= 6 stereo sampling values each having 16 bits) are always recorded in an EFM frame. However, as a result of the interleaving, the 24 bytes of data in a frame do not belong to adjacent samples of the items of user input data. The items of data appertaining to adjacent samples are scattered over approximately 110 successive frames. This improves the degree of error protection.

The scanning or the reproduction of the items of data on the recording medium is basically reciprocal to that of the recording.

The magneto-optic disc (MOD) 11 used here as a non-contact making, scannable, rotating recording medium exhibits a preformatted helical track which contains items of data for identifying an absolute position and for controlling the scanning unit. The preformatting is carried out using the ATIP (absolute time in pre-groove) method. To this end, the track is horizontally modulated i.e. using a frequency (22.05 kHz) which is proportional to the audio sampling frequency. This frequency also serves for synchronising a CLV servo in the recording unit and/or reproduction unit. For its part, this frequency is phase modulated by the ATIP data in a bi-phase format. The data rate that can thereby be achieved is relatively small but is sufficient for the recording of the items of absolute position data in the format described above.

An item of ATIP information can be continuously read during the writing and reading of the items of data on the recording medium and be passed onto the control unit 8 over the signal line 14. For the MOD, this is effected in that items of ATIP information are read with the help of the read/write unit (laser) and can then be evaluated via the track following device which is also operational during the writing and reading process.

The time portion on the storage medium which contains such an item of ATIP information will be called an ATIP block hereinafter. The format on the MOD is arranged such that 98 EFM frames are recorded or read during an ATIP block.

Thus, even previously unwritten locations of the pre-formatted track on a recording medium as heretofore described can be exactly found with the help of ATIP. Thereby, the precision is provided by the number of EFM frames i.e. here, exactly 98 frames. For an MOD having the format described and with a scanning speed of 1.2 m/sec (such as for a CD), an EFM frame has a length of 136.05 μsec and thus an ATIP block of 13.3 msec or 1/75 sec.

A search process for a particular ATIP (n) block always occurs such that the previously located ATIP (n-1) block is read. If this block is coded, it is known that the wanted block follows directly and can now be read or written.

The search process proceeds as follows:

1. Reading the current ATIP
2. Making a decision as to whether it is now sufficient to wait for up to one revolution or whether a jump is needed
3. Jump command for the mechanism
4. Read the ATIP for the target (possibly random)
5. Making a decision as to whether a fresh track jump is needed for correction purposes or just to wait for up to one revolution
6. Reading the ATIP until ATIP (n-1).

The wanted recording now occurs such that the digital items of data which are to be recorded are collected together, as explained above, in a buffer store 6 and are emitted burst-like from the latter using the standard recording data rate for CDs, i.e. 1.4112 Mbits/sec, for the recording. Each data burst in the buffer store is continuously recorded on the recording medium in a respectively associated cluster using a fixed number (each 98) of ATIP blocks and EFM frames. Thereafter, in accordance with the reduced net data rate, there is time for the new positioning. When the buffer store is again full, the writing device (laser optics and magnetic head) should just have arrived again at the end of the previously written cluster or, should be there shortly beforehand. In order to be able to achieve this, it is necessary for the number of frames per cluster to be greater than or equal to the product of the reduction factor K and the maximum number of frames per revolution (for CDs, outer, approximately 2220). For the MSC data reduction, the reduction factor K amounts to exactly 0.25 and the number of frames per cluster should therefore be at least somewhat greater than 555.

Because of the unambiguous addressability by ATIP, the length of a cluster is an integral multiple of the ATIP length.

If the recording breaks down at any point, then the CIRC coding section still contains items of data which appertain to those previously recorded due to the code spreading (interleaving) in the interleaving store which is contained in the Reed-Solomon-Coder 9). In this case, the coding section can be stopped and then starts again when writing the next cluster and thus writing the remaining items of data at the beginning of the next cluster.

This is not always easy to implement because a stoppage of the hardware is not always immediately possible and because the danger exists of not being able to place the items of data exactly together.

Consequently, a real cluster is not completely filled with useful data but rather, the coding of the useful data is stopped

beforehand in accordance with the interleaving length and then the interleaving store is just written with blanks at the end of the cluster.

In addition to the consequences resulting from the interleaving, one must be careful to switch over the scanning unit or the write/read unit from reading to writing at the beginning of the recording process for a cluster. However, this scanning unit (laser) cannot always effect this very quickly and precisely. Consequently, some data is frequently lost at the beginning of a cluster. Some blank data, here, 1 to 3 EFM frames, is therefore written at the beginning of a cluster.

In order to keep down the loss due to blank data at the beginning and, due to the blank writing of the interleaving store at the end, which occurs once in each cluster, a cluster is not necessarily therefore kept as short as possible. Because of the required organisation of a table of contents for the recorded data and the basically available flexibility of the recording medium, which is not of course removed by cluster recording, the length of a cluster is also not arbitrarily great.

For the MOD 13 using cluster recording, the following cluster length l_{CL} is defined here:

l_{CL} = 1176 EFM frames = 12 ATIP blocks = 0.16 sec.

The distribution within a cluster is as follows:

Number of EFM frames	Content
1	Link-frame
2	run-in
1029	Data
111	Interleaving
2	run-out
1	Link-frame
30	unused

This implementation leads to 24696 bits of useful data being recorded in a cluster which actually occupies the space of 28224 bits. The loss of storage capacity amounts to 1/8 = 12.5 %.

A further consequence of this special selection indicated above is that the clock rate of the reduced useful data has a simple relationship with the "normal CD" clock rate:

1/4 * (1-1/8) = 7/32

The gross data rate that can be recorded is reduced by cluster recording, as wanted, to 1/4, but, because of the 1/8 loss, only a net 7/32 of the standard data rate is available.

Thus, in the previously mentioned case, the achievable net data rate is:

7/32 * 1.4112 Mbit/sec = 308.7 kHz/sec.

This corresponds to the specification of a quantisation using 3.5 bits/sample which is something that is easily possible with modern data reduction methods such as here, MSC. In addition, because of the simple division ratio of 7/32, a simple synchronisation of external, data-reduced sources with the recording medium is possible with the construction described.

In summary therefore, cluster recording means that the useful items of data are not recorded as with the normal CD format in a continuous sequence of 7350 EFM frames per second each having 24 usable bytes. Instead, the recording occurs in clusters, which of themselves of course consist of a continuous sequence of a particular number of EFM frames, but between the clusters, the recording is not continuous. As a result of this, each cluster can be freely selected for accessing for reading and, in particular, also for writing without the information recorded in the previous or later located clusters being interfered with.

In addition, because of the sufficiently long gaps, no special measures are required for rapid lifting and dropping movements of the laser for the freely selectable writing access to a cluster.

Following the writing of a cluster, there ensues a pause which is used for the purposes of positioning at the beginning of the next cluster. In order to find the beginning of the next cluster, the ATIP blocks at the end of the next cluster are decoded. Consequently, it is possible to effect the positioning such that the whole of the last cluster is read once more before the immediately next one is again written. Recording errors can hereby be determined in order, as a consequence therefrom of too high a number of errors, to totally break off the recording process or at least to give a warning to the user.

In pursuance of the error detection, there is then provided an error correction. To this end, the items of data of the last cluster are received in the buffer store. For the error correction, two strategies are conceivable:

Firstly, to position afresh at the beginning of the faulty cluster and then to write its items of data once more. The items of data of the following cluster follow directly thereafter. However, time is needed for the positioning so that the pause between two writing cycles is possibly not great enough for

positioning, reading the correction, a new positioning and writing the correction.

Because a recording error may also be connected with a defective location on the recording medium, it is better, in the case of an error, to repeat the writing of the items of data in the faulty cluster in the following cluster and to then write the actual following items of data in the cluster following thereupon. The faulty cluster is then marked so that it can be easily jumped over during the read out.

The marking is effected in the table of contents UTOC (User table of content) of the recording medium or in a special cluster at the beginning and end of the currently occurring continuous cluster recording. It is also possible to mark (e.g. another synchronisation word) the following cluster which was rewritten for the purposes of correction such that an error in the preceding cluster is indicated thereby. This means however, that during the reproduction, a cluster will always have to be read in advance.

Data recordings by computers on the basis of an operating system such as MS-DOS for example occur in blocks of 1024 bytes. If a cluster corresponding to the above statement is displayed, then forthwith, 24 blocks having 1024 useful bytes, possibly with additional bits for error protection, have to be recorded in a cluster having at least 1029 usable EFM frames. Since the addressability is also given, cluster recording is thus also suitable for data recording in a computer.

Because of the piece-by-piece-like recording for the period of 0.16 secs and the ensuing pause of 0.48 secs up to the recording of the following cluster, a positioning strategy is provided since it cannot be assumed that the laser will be located exactly at the beginning of the next cluster after the expiry of the pause.

One possible strategy, which is explained hereinafter, should clarify the logical sequence but an implementation deviating herefrom is equally possible.

The items of data at 308.7 kBit/sec, which are delivered by the MSC coder 4 of the sound data reduction process, are portioned in in the buffer store 6 or an exchange buffer as mentioned above. The write-in clock rate is 308 700 Hz and the read-out clock rate is 1411200 Hz. The length of the two buffers is 197568 bits = 24696 Bytes in each case.

The writing of the first cluster is begun during ATIP (n). The writing process has finished after the writing of 1143 EFM frames. After the now ensuing waiting time of 0.48 sec has

expired, the exchange buffer indicates "Data ready". There now follows a search process for the block at ATIP (n+12). A maximum of 4 tracks inwardly have to be jumped over for this purpose. In addition, a waiting time of a maximum of one revolution may be necessary. The next cluster can now be written, and so on.

Up to 400 msec are available for the whole of the positioning process. The positioning has to be definitely finished within this time.

It can be assumed that a jump to the next inner adjacent track can be executed with a high degree of certainty. Consequently, the following further strategy is possible:

The writing of the first cluster is begun during ATIP (n). The writing process has finished after the writing of 1143 EFM frames. Immediately thereafter, there is a jump inwardly of one track and a search process for ATIP (n+12) is started. This is repeated until such time as the buffer store 6 indicates "Data ready". The writing process of the second cluster then begins with the next discovery of ATIP (n+12). After the ending of this writing process, another track jump inwardly occurs and a search process for ATIP (n+24) is effected, and so on.

It is advantageous with this strategy, that just one track has to be jumped each time although of course, this process takes place more frequently. The recording of the next cluster can begin at the latest one revolution after "Data ready".

If one initially executes a search process for ATIP (n) after writing the first cluster, i.e. after the beginning of the cluster that has just been written, then the items of data that have just been written can be read for checking purposes. An evaluation of the errors that have arisen can be initiated by suitable measures, thus for example, by warning signals or a display of the error rate.

In the event that non-correctable errors are determined during the check reading, a cluster that has been found to be subject to error at ATIP (n) can be re-written at ATIP (n+12). This is recorded in suitable manner in the UTOC (User table of content) so that the faulty cluster at ATIP (n) can be jumped over during the reproduction. The buffer store 6 is suitably constructed, as a cyclic triple exchange buffer for example, for implementing the write repetition described in the case of error.

The previous method is not tied down to a data reduction of data and a specific method of data reduction such as here, MSC. Likewise, a recording and reproduction using non-reduced items of data and/or using data rates reduced by other methods of data reduction can be carried out on a recording medium.

A further possibility for the recording or reproduction of the items of data would be to record or to read the data rate, which was reduced by means of MSC, in burst-like manner on the recording medium with the help of the buffer store and then, after a certain recording time or reproduction time, to put-in a pause of triple that time. The recording medium can be 25 % filled in this manner in one run. When one has reached the end, one can jump back to the beginning during a 3/4 pause and fill a further 25 % of the disc in a second run or to read etc. This demands a difficult organisation of the disc contents. The recording medium then contains either just a normal programme or just a data reduced programme. The defined jump from the end to the beginning of the track is critical.

Another basic possibility, independently of the previously described solutions, would be to reduce the scanning speed in correspondence with the reduction factor. For a same wavelength on the recording medium, this would automatically result in a quarter of the recording data rate and quadruple the playing time for a reduction factor of 1/4. The CLV system would however, have to be switchable. Moreover, the equalising circuits for the signals coming from the recording medium would only receive signals having a quarter of the normal frequency and consequently they would have to be switchable. A mixture of "normal" recordings with data reduced recordings on a disc is only then possible if a rapid switching of the CLV by the factor one quarter or four is possible.

The invention is likewise usable for a recording and/or reproduction of digital items of data on a magnetic tape using PCM signals or for a recording on a DAT tape (digital audio tape) in a DAT recorder. The organisational structure of a DAT recording can be specified in equivalent manner to the previously described method with only small alterations.

Claims

1. Method for the recording and/or reproduction of digital items of data having a net data rate, preferably audio and/or video items of data, on a scannable, especially rotating recording medium which has at least one track in which the items of data are recorded in burst-like manner during the recording and from which the items of data that were recorded in burst-like manner are scanned again during a reproduction, characterised in that, each burst of data that is to be recorded on the recording medium, or each burst of data that is recorded on the recording medium, is recorded on the recording medium in a segment of the track - hereinafter also referred to as a cluster - independently of its net data rate using a predetermined physical write-data-rate, or is read-out from the recording medium using a predetermined physical scanning-read-data-rate, that the net data rate is smaller then the predetermined write-data-rate or the scanning-read-data-rate, that the items of data of a burst are buffer stored in the recording and/or reproduction device by using a buffer store (6) for the conversion of the net data rate of the data which is to be recorded into the write-data-rate or for the conversion of the scanning-read-data-rate into the net data rate of the items of data which are to be reproduced and that, after the writing or reading of these items of data onto or from the recording medium, there is a pause from reading or writing and that during the pause following the reading or writing of a cluster or burst, the scanning/recording or reproduction unit is positioned at the beginning of the following cluster or burst.

2. Method in accordance with Claim 1, characterised in that, the net data rate of the data which is to be recorded is reduced by using a data reduction process.

3. Method in accordance with Claim 1 or 2, characterised in that, a data burst is always recorded on the recording medium with the same physical recording-data-rate or write-data-rate independently of its net data rate.

4. Method in accordance with Claim 1, 2 or 3, characterised in that, each data burst is recorded on the recording medium using the standard CD recording parameters or standard CD recording data rate of 1.4112 Mbit/sec.

5. Method in accordance with any of the preceding Claims, characterised in that, each data burst is provided with at least one address data item for the position on the recording medium and/or each data burst is provided with at least one address data item for the position of the succeeding data burst.

5. Method in accordance with any of the preceding Claims, characterised in that, the items of data which are to be recorded are provided with an error protection code, preferably a cross-interleaved Reed-Solomon-Coder (BIRC) error protection code, and/or, that the items of data which are to be recorded are subjected to an interleaving process (code spread), and/or, that the items of data are recorded on the recording medium by means of channel code, preferably an EFM code (eight to fourteen modulation) which structures the items of data into respective EFM frames wherein each DFM frame preferably contains 24 bytes of useful data.

6. Method in accordance with any of the preceding Claims, characterised in that, the previously written cluster is read before the writing of a cluster and/or the recording is repeated in a following cluster in the event of a defective recording of a cluster and/or that the defective cluster is marked.

7. Recording medium, preferably a magneto-optic disc (MOD) or compact disc (CD) including at least one track for the recording of digital items of data, especially audio and/or video items of data, which are recorded by a method in accordance with any of the Claims 1 - 6, characterised in that, each data burst has an address data item for the position on the recording medium and/or an address data item for the position of the succeeding data burst.

8. Recording medium in accordance with Claim 7, characterised in that, the track is helical in shape, and/or that the helical track of the recording medium is pre-formatted and contains items of data for identifying an absolute position on the recording medium.

9. Recording medium in accordance with Claim 8, characterised in that, the helical track is pre-formatted by means of an ATIP (absolute time in pre-groove) method and/or each position data item that was pre-formatted by the ATIP method forms an ATIP block whose length preferably corresponds to the recording length of 98 EFM frames and/or that the length of a cluster corresponds to the integral multiple of an ATIP block length, preferably to 12 times the ATIP block length.

10. Recording medium in accordance with either of the Claims 8 and/or 9, characterised in that, the helical track is horizontally modulated, preferably, that it is horizontally modulated using a frequency f_{prop} which is proportional to the standard audio CD scanning frequency (44.1 kHz).

11. Recording medium in accordance with any of the Claims 7 - 10, characterised in that, the number of EFM frames per cluster is greater than or equal to the product of the reduction factor

K of the reduction process and the maximum number of frames per revolution m_{max} of the rotating recording medium and/or that a cluster consists of at least 555 EFM frames, preferably of 1176 EFM frames.

12. Recording medium in accordance with Claim 14, characterised in that, the 1176 EFM frames of a cluster are composed of three EFM frames for the run-in, 1029 EFM frames for the useful items of data, 110 FM frames for the blank writing of the interleaving store, 34 EFM frames remaining unused or being for the run-out.

13. Recording device and/or reproduction device for the recording of a non-contact making, scannable, rotating recording medium (11) in accordance with any of the Claims 7 - 12 and/or for carrying out the method in accordance with any of the Claims 1 - 6, characterised in that, a buffer store (6), which is controlled by a control unit (8) and is used for storing the items of data of a burst, is provided in the recording and/or reproduction device, that the read-in clock rate of the buffer store is different from the read-out clock rate, that the read-out clock rate is greater than the read-in clock rate during the recording and that the read-in clock rate is greater than the read-out clock rate during the reproduction, that, after the writing or reading of these items of data onto or from the recording medium, there is a pause from reading or writing and that during this pause the scanning / recording or reproduction unit is positioned at the beginning of the following cluster or burst.

14. Recording device in accordance with Claim 13, characterised in that, the items of data delivered by a coder (4) from the data reduction process are positioned in the buffer store (6) whereby the buffer store (6) is preferably constructed as a cyclical triple exchange buffer.

15. Recording device in accordance with Claim 13 or 14, characterised in that, the frequency f_{prop}, which is proportional to the standard audio CD scanning frequency, is phase modulated in the bi-phase format by the items of data, that the recording or scanning unit can be switched from reading to writing at the beginning of the recording process for a cluster.

16. Recording device in accordance with any of the preceding Claims 13 -15, characterised in that, the recording device contains a coder and/decoder for the data reduction or de-reduction of the data, that the coder (MSC) reduces the net data rate of the items of data which are to be recorded using a data reduction process and the decoder restores the data reduction that was carried out.