The invention relates to a compact disc player in which the starting times of at least part of the program blocks contained in the contents list of a compact disc can be stored in a memory and in which, from among all the program blocks of the compact disc, several can be selected and assembled into a program in any sequence.

A description of what data are in principle stored on a compact disc and how the compact disc player handles them is given in the article "Assembling of a compact disc program" in "Funkschau", 15, 18.7.1986.

Every compact disc contains a contents list in which are stored data providing information on the number of program blocks stored on the disc, their starting times and the overall playing time of the disc. The individual program blocks are usually musical pieces, but spoken text, for example, or various sound tracks for the dubbing of films or slides, can also be involved. Although up to 99 program blocks can be stored on a compact disc, a compact disc containing music generally comprises only 10 to 20 different musical pieces.

On the insertion of a compact disc into a compact disc player, the starting times of the individual program blocks, e.g. of the various musical pieces, are read out of the contents list and read into a memory of the compact disc player. The most expensive players are equipped with a memory with 99 memory locations, while between 15 and 30 memory locations approximately are provided for units in the medium price range. The stored starting times make it possible for the compact disc player to keep the access times short by deliberate jumps from one program block to another.

Because, as already mentioned, compact disc players containing music usually comprise only some 10 to 20 musical pieces, a memory capacity of 15 to 30 memory locations is sufficient in most cases.

Luxury compact disc players offer the hi-fi enthusiast the possibility of selecting, from among all the musical pieces stored on a compact disc, certain desired ones and assembling them into a program in any sequence. This facility however calls for additional storage space for the storing of the musical pieces assembled into the program. Because storage space is expensive, this facility is reflected in the price of the equipment.

The object of the invention is therefore to design a compact disc player which makes it possible, without additional expenditure on storage, to select desired program blocks and assemble them into a program.

The invention achieves this object by the fact that the starting times of the program blocks are stored in sequence in the memory, that the numbers of the m program blocks assembled into a program are written into the memory in reverse sequence starting with the last memory location and that any memory locations already occupied by starting times are overwritten.

One way of achieving this object for a compact disc player with a memory in which can be stored the starting times of program blocks stored on the compact disc is for the starting times of the m program blocks assembled into the program to be stored in the memory as a combined block of m consecutive memory locations and for the m memory locations which have thereby become free to be occupied by the starting times which occupied, prior to the creation of the program, the memory locations now filled with the starting times of the m program blocks assembled into the program.

Figure 1 shows the layout of the memory in a first exemplifying embodiment;

Figure 2 shows the layout of the memory in a third exemplifying embodiment;

Figure 3 shows the layout of a memory with 99 memory locations.

Figure 1 shows a memory with 16 memory locations. The compact disc inserted into the compact disc player is to contain, for example, 20 musical pieces. After the insertion of the compact disc into the unit the starting times T1 to T16 of the first 16 musical pieces are first of all read into the memory S. The listener now wishes, for example, to hear the 19th, the 8th, the 14th, the 3rd and the 5th musical piece in this sequence and therefore programs the microcomputer of the compact disc player with these musical pieces. The microcomputer thereupon causes the numbers P19, P8, P14, P3 and P5 of these five musical pieces to be written into the memory S in this sequence starting from the rear with the last memory location. The memory locations 12, 13, 14, 15 and 16 are therefore now occupied by the numbers P5, P3, P14, P8 and P19. Because the starting times T12 to T16 previously stored in the memory locations 12 to 16 are now erased, the access times to the musical pieces 12 to 16 undergo a slight increase.

In a second exemplifying embodiment the writing of the numbers P19, P8, P14, P3 and P5 into the memory S starts not with the last, but with the last but one memory location, so that the starting time T16 occupies the last, the 16th memory location. The numbers P19, P8, P14, P3 and P5 are written into the memory locations 15, 14, 13, 12 and 11. This has the advantage that in the case of jumps to musical pieces coming after the 16th musical piece a jump is first of all made deliberately to the 16th musical piece and from there in steps to the desired musical piece. The access times are thereby reduced.

Figure 2 shows the layout of the memory S for an exemplifying embodiment with which shorter access times are achieved than with the first exemplifying embodiment. Let the compact disc and the program assembled by the listener be the same as before. In contrast to the previous exemplifying embodiment, instead of the numbers P19, P8, P14, P3 and P5 being stored in the memory S directly after one another, only every other memory location is occupied by a number, so that two numbers are always separated by a memory location containing a starting time. The last memory location, in this exemplifying embodiment

...e 16th memory location, is occupied by the starting time T16. The following layout of the memory locations is therefore obtained. Memory locations 1 to 6 are occupied by the starting times T1 to T6 of the first six musical pieces. In memory locations 8, 10, 12, 14 and 16 are stored the starting times T8, T10, T12, T14 and T16 of the musical pieces 8, 10, 12, 14 and 16, while memory locations 7, 9, 11, 13 and 15 are occupied by the numbers P5, P3, P8 and P19 of the musical pieces assembled into the program. If e.g. the scanning system is to jump to the 14th musical piece, it first jumps deliberately to either musical piece 13 or 15 and from there in a likewise deliberate forwards or backwards jump to the 14th musical piece.

In cases where the scanning system jumps to musical pieces coming after the 16th musical piece, for example to the last, the 20th musical piece, the scanning system first of all jumps ...eliberately to the 16th musical piece and from there moves ahead in several jumps up to the 20th musical piece.

The access time is shorter than with the exemplifying embodiment of Figure 1, since deliberate jumps cannot be made with this exemplifying embodiment. Instead, the scanning system has to move forward in several steps, starting from memory location 11, up to the 14th and 20th musical pieces.

If e.g. only 10 musical pieces are stored on the compact disc, despite the fact that the memory S has 16 memory locations, and only 4 musical pieces are selected by the listener to form a program, memory locations 13 to 16 are occupied by the numbers of the four selected musical pieces, memory locations 1 to 10 are occupied by the starting times of the 10 musical pieces, while memory locations 11 and 12 are empty. In such cases the access times are not increased at all by the programming.

In sub-claim 2 a solution is given for a compact disc player ...hose memory comprises exactly the same number of locations as there are musical pieces stored on a compact disc. Because, as already mentioned, up to 99 musical pieces can be stored on a compact disc, the memory S has a capacity of 99 memory locations.

On the insertion of the compact disc into the unit, the contents list of the compact disc is read, and the starting times T1 to T99 of all 99 musical pieces are stored in the memory S. For example, the musical pieces 4, 10, 99 and 8 are to be selected in this sequence to form a program. After the inputting of the program by the operator the starting times T4, T10, T99 and T8 are brought out of their memory locations 4, 10, 99 and 8 and written into memory locations 1, 2, 3 and 4; their contents, the starting times T1, T2 and T3, are written into the empty memory locations 8, 10 and 99.

The detailed procedure, for example, is such that first of all the starting time T1 is brought out of memory location 1 and stored in an intermediate memory location. The starting time T4 is brought out of memory location 4 and written into memory location 1. Then the starting time T1 is brought out of the

intermediate memory location and written into memory location 4. The starting time T2 is now brought out of memory location 2 and written into the intermediate memory location. The empty memory location 2 is occupied by the starting time T10. The starting time T2 is brought out of the intermediate memory location and written into memory location 10. The starting time T3 is brought out of memory location 3 and stored in the intermediate memory location. The starting time T99 is thereupon brought out of memory location 99 and written into memory location 3. The starting time T3 is brought out of the intermediate memory location and written into memory location 99. The starting time T1 is brought out of memory location 4 and written into the intermediate memory location. The starting time T8 is brought out of memory location 8 and written into memory location 4. Finally the starting time T1 is also brought out of the intermediate memory location and written into memory location 8.

The 4 starting times T4, T10, T99 and T8 belonging to the program can e.g. also be written into memory locations 96, 97, 98 and 99 and their contents, the starting times T96, T97, T98, stored in the empty memory locations 4, 8 and 10.

In this exemplifying embodiment all the starting times are always stored in the memory S. The access times therefore do not increase when a musical program is created.

In all exemplifying embodiments it is advisable to mark by means of a program pointer the boundary in the memory S between the part in which the starting times of the musical pieces assembled into a program are stored, and that in which their numbers are stored. Because, however, the microcomputer of the compact disc player knows how many musical pieces have been programmed by the operator, it can also determine by counting of the memory locations where the starting times are located, and where the numbers of the musical pieces assembled into the program are located.

Claims

1. Compact disc player, in which the starting times (T1, T2, ..., Tn) of at least part of the program blocks contained in the contents list of a compact disc can be stored in a memory (S) whose memory capacity is insufficient for the maximum number of program blocks and in which, among all the program blocks of the compact disc, several can be selected and assembled into a program in any sequence, c h a r a c t e r i z e d i n t h a t the starting times (T1, T2, ..., Tn) of the program blocks are stored in sequence in the memory (S), that the numbers (P1, P2, ..., Pm) of the m program blocks assembled into a program are written into the memory (S) in reverse sequence and that any memory locations already occupied by starting times are overwritten.

intermediate memory location and written into memory location 4. The starting time T2 is now brought out of memory location 2 and written into the intermediate memory location. The empty memory location 2 is occupied by the starting time T10. The starting time T2 is brought out of the intermediate memory location and written into memory location 10. The starting time T3 is brought out of memory location 3 and stored in the intermediate memory location. The starting time T99 is thereupon brought out of memory location 99 and written into memory location 3. The starting time T3 is brought out of the intermediate memory location and written into memory location 99. The starting time T1 is brought out of memory location 4 and written into the intermediate memory location. The starting time T8 is brought out of memory location 8 and written into memory location 4. Finally the starting time T1 is also brought out of the intermediate memory location and written into memory location 8.

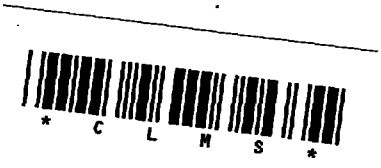
The 4 starting times T4, T10, T99 and T8 belonging to the program can e.g. also be written into memory locations 96, 97, 98 and 99 and their contents, the starting times T96, T97, T98, stored in the empty memory locations 4, 8 and 10.

In this exemplifying embodiment all the starting times are always stored in the memory S. The access times therefore do not increase when a musical program is created.

In all exemplifying embodiments it is advisable to mark by means of a program pointer the boundary in the memory S between the part in which the starting times of the musical pieces assembled into a program are stored, and that in which their numbers are stored. Because, however, the microcomputer of the compact disc player knows how many musical pieces have been programmed by the operator, it can also determine by counting of the memory locations where the starting times are located, and where the numbers of the musical pieces assembled into the program are located.

Claims

1. Compact disc player, in which the starting times (T1, T2, ..., Tn) of at least part of the program blocks contained in the contents list of a compact disc can be stored in a memory (S) whose memory capacity is insufficient for the maximum number of program blocks and in which, among all the program blocks of the compact disc, several can be selected and assembled into a program in any sequence, c h a r a c t e r i z e d i n t h a t the starting times (T1, T2, ..., Tn) of the program blocks are stored in sequence in the memory (S), that the numbers (P1, P2, ..., Pm) of the m program blocks assembled into a program are written into the memory (S) in reverse sequence and that any memory locations already occupied by starting times are overwritten.



2. Compact disc player, in which the starting times (T1, T2, ..., Tn) of all the program blocks contained in the contents list of a compact disc can be stored in a memory S whose memory capacity is sufficient for the maximum number of program blocks and in which, from among all the program blocks of the compact disc, several can be selected and assembled into a program in any sequence, characterized in that the starting times of the m program blocks assembled into the program are stored in the memory S as a combined block of m consecutive memory locations and that the m memory locations which have thereby become free are occupied by the starting times which occupied, prior to the creation of the program, the memory locations now filled with the starting times of the m program blocks assembled into the program.

3. Compact disc player according to claim 1, characterized in that the writing into the memory (S) of the numbers (P1, P2, ... Pm) of the m program blocks assembled into the program starts with the last memory location.

4. Compact disc player according to claim 1, characterized in that the writing into the memory (S) of the numbers (P1, P2, ... Pm) of the m program blocks assembled into the program starts with the last but one memory location, so that the last, the n-th, memory location is occupied by the starting time Tn.

5. Compact disc player according to claim 1, 3 or 4, characterized in that during the writing-in of the numbers (P1, P2, ... Pm) of the m program blocks assembled into a program only each k-th memory location occupied by a starting time is overwritten.

6. Compact disc player according to claim 5, characterized in that a k value of two is selected.

7. Compact disc player according to claim 2, characterized in that the m starting times of the program blocks assembled into a program occupy the first m memory locations of the memory (S).

8. Compact disc player according to claim 2, characterized in that the m starting times of the program blocks assembled into a program occupy the last m memory locations of the memory (S).

