The invention relates to a circuit arrangement in an optical playback device which is equipped with an optical scanning device which reads the data from an optical and/or magneto-optical recording medium and produces an optical and/or magneto-optical data signal.

A known recording medium of this type is the CD disc for example, in which a light-reflecting aluminium layer follows the light-transmissive layer, the aluminium layer having depressions, so-called pits which show the data stored on the CD disc. The data are readable from the CD disc with the aid of an optical scanning device, because the reflection characteristics of the light-reflecting aluminium layer depends on the pattern which the depressions form on the disc. Because of destructive interference less light is reflected by a depression, often also called a 'groove', than by a hill which is often also designated as a 'land'.

Therefore the optical scanning device recognises from the intensity of the light reflected by the CD disc, whether the scanned bit is a logic one or a logic zero for example.

Another optical recording medium of this type - known by the term magneto-optical disc - is described in the paper "Magneto-optical tests continue" in Funkschau 13, 20th June 1986 on pages 37 -41.

In contrast to a CD disc a magneto-optical disc does not have any pits. Behind the light-transmissive layer there is a magneto-optical layer on which data can be recorded and from which the data are readable. Initially it is explained how the data are written on to a magneto-optical disc.

The magneto-optical layer is heated with the aid of a laser beam focused on to the disc to a temperature which is close to the Curie temperature. Usually it is sufficient to heat up the magneto-optical layer only approximately up to the compensation temperature which is below the Curie temperature. An electromagnet is arranged behind the focal point on the disc and magnetises the region heated by the laser beam into one or other direction of magnetisation. Because, after switching off the laser beam, the heated point cools off again below the compensation temperature, the direction of magnetisation fixed by the electromagnet is maintained; it freezes in so to speak. In this way the individual bits are stored in domains of different directions of magnetisation. Here for example one direction of magnetisation of a domain corresponds to a logic one, while the opposite direction of magnetisation represents a logic zero.

Use is made of the Kerr effect to read the data. The

polarisation plane of a linearly polarised light beam is rotated about a measurable angle during reflection on a magnetised mirror. All according to which direction the mirror is magnetised so the polarisation plane of the reflected light beam is rotated to right or left. However, because the individual domains act on the disc like magnetised mirrors, the polarisation plane of a scanning light beam is rotated about a measurable angle to left or right according to the direction of magnetisation of the domain just scanned.

From the rotation of the polarisation plane of the light beam reflected by the disc the optical scanning device recognises which bit is present, a logic one or a logic zero. In contrast to a CD disc with pits, a magneto-optical disc can be erased and written on again almost as often as desired.

From German application P 37 32 875.1 a magneto-optical recording medium is known on which both data are stored in a magnetic layer and with the aid of pits.

In the German application P 37 32 874.3 a scanning device is described which can read data from a CD disc, and from a magneto-optical disc, and from the combination known from German application P 37 32 875.1 comprising a CD disc and a magneto-optical disc.

In order to obtain the data stored with the aid of the pits, as in a CD player, the light radiating through the disc or reflected by the disc is directed to at least two photodetectors. The data signal is produced from the sum of the output signals of the two photodetectors.

The data stored in the magnetic layer are converted into electrical signals, while the light radiating through the disc or reflected by the disc is divided up into two beams with the aid of a polarisation beam splitter, the polarisation planes of which are rotated into different directions as a result of the Kerr effect. The one light beam, the polarisation plane of which is rotated in the one direction, is directed on to a first photodetector, while the other light beam, the polarisation plane of which is rotated into the other direction, radiates on to a second photodetector. The data signal is obtained from the difference signal of the two photodetectors and reflects the data stored in the magnetic layer.

In order to obtain the data, stored both with the aid of the pits and the data stored in the magnetic layer, from the light radiating through the disc or reflected by the disc, the same two photodetectors can be used. In the one case the sum is formed

from their output signals, in the other case the difference.

Since, with the optical scanning device known from German application P 37 32 874.3 both CD discs and magneto-optical discs and the combination of an optical and a magneto-optical disc described in German application P 37 32 875.1 can be read, operation of the device is made easier for the user, if it automatically recognises which type of disc has been inserted.

In JP-A 61 23 7247 a circuit arrangement is described which recognises whether an optical or a magneto-optical disc is in the playback device.

The output of a first detector is connected to the first input of a differential amplifier and an adder. The output of a second detector is connected to the second input of the differential amplifier and the adder. When reading an optical recording medium, e.g. a CD, the signal changes at the output of the adder, but not at the output of the differential amplifier in dependence on the data stored on the recording medium. When reading a magneto-optical recording medium on the other hand the signal changes at the output of the differential amplifier,while the signal at the output of the adder remains constant. A decision circuit recognises from the level of the signal at the output of the differential amplifier and the adder, whether the data from an optical or a magneto-optical recording medium are being read. With the aid of a switch either the output of the differential amplifier or of the adder is connected to the input of a signal processing circuit.

It is therefore the object of the invention to provide a circuit arrangement which automatically recognises the type of an optical recording medium, independently of how the data signal playing back the data stored with the aid of pits and the data signal playing back the data recorded in the magnetic layer are produced.

The invention achieves this object by connecting that output of the optical scanning device at which the optical data signal can be tapped and which contains the data stored with the aid of the pits, to the first input of a first comparator via a high pass filter and a rectifier connected in series therewith and to the second input of a first comparator via a low pass filter, the output of said comparator being connected to a control processor.

Figure 1 shows a first embodiment of the invention
Figure 2 shows the data signals of different recording media.

With reference to the embodiment depicted in Figure 1 the invention is first described and then explained with the aid of the data signals shown in Figure 2.

In Figure 1 the data signal HF which contains the data stored with the aid of the pits is supplied to the first input of a comparator V1 and V2 via a high pass filter H and a rectifier G connected in series therewith and to the second input of the comparator V1 via a low pass filter. There is a reference voltage UR at the second input of the comparator V2. The outputs of the two comparators V1 and V2 are connected to a control processor SP.

In Figure 2 data signal HF1 of a CD disc is depicted, the data signal HF2 of a magneto-optical disc and the data signal HF3 of a combination of both.

The data signal HF1 of a CD disc, on which data are stored with the aid of pits, is a high frequency signal, its mean value being approximately a d.c. level. Since there are no pits on a magneto-optical disc, the intensity of the light radiating through the disc or reflected by the disc is always approximately the same size. Therefore the signal HF2 of a magneto-optical disc, obtained from the sum of the output signals of two photodetectors, is approximately a d.c. signal.

In the recording medium known from the German application P 37 32 875.1 the sum signal of the output signals of two photodetectors is also a high frequency signal, but has a lower amplitude than with a CD disc, because the differences in intensity are also less with the reflected and/or radiated-through light as a result of a smaller pit depth.

It a CD disc is in the device, the data signal HF1 is a high frequency signal with a superimposed d.c. component. Therefore the level at the first input of the comparator V1 is greater than at its second input; the level too at the first input of the comparator V2 is greater than the reference voltage UR. The control processor SP recognises from the output signals of the two comparators V1 and V2, which in this case may have a high level for example, that the inserted disc is a CD disc.

If the combination of an optical and a magneto-optical recording medium is inserted into the device as known from German application P37 32 875.1, then the data signal HF3 is also a high frequency signal on to which is superimposed a d.c. component, but with a lower amplitude than with a CD disc. Therefore, the level at the first input of the comparator V1 is greater than at its second input; the reference voltage UR is selected however to

be so large that in this disc the level at the first input of the comparator V2 is smaller than the reference voltage UR at its second input. The control processor SP recognises from the output signal of the comparator V1, which has a high level, and from the output signal of the comparator V2, which has a low level, that a disc according to German application P 37 32 875.1 is in the device.

If a magneto-optical disc is to be read, the data signal HF2 does not have any high frequency components; because it is a d.c. signal, the levels at the first inputs of the comparator V1 and V2 are about zero. Because the level at the second input of the comparator V1 is now greater than the level at its first input the comparator V1 emits a signal with low level at its output. From this the control processor SP recognises that the user has sought out a magneto-optical disc. The signal at the output of the comparator V2 does not play any part in this decision. It can be "HIGH" or "LOW".

A second embodiment of the invention differs from the first in that the first input f the second comparator V2 is not connected to the output of the rectifier G, but to the output of the low pass filter T.

A CD disc or a magneto-optical disc is recognised in the same way by the second embodiment as in the first embodiment. With a disc according to the German application P 37 32 875.1, instead of the rectified HF component the superimposed d.c. component of the data signal HF3 is compared with the reference voltage UR in the comparator V2.

As already mentioned the data signal HF3 is a high frequency signal, on to which a d.c. component is superimposed, but with a lower amplitude than with a CD disc. Therefore the level at the first input of the comparator V1 is greater than at its second input; the reference voltage UR is selected to be so large however that with this disc the level at the first input of the comparator V2 is smaller than the reference voltage UR at its second input. The control processor SP recognises from the output signal of the comparator V1, which has a high level, and from the output signal of the comparator V2, which has a low level, that a disc according to the German Application P 37 32 875.1 is in the device.

## Patent Claims

1. A circuit arrangement in an optical playback device, which is equipped with an optical scanning device which reads the data from an optical and/or magneto-optical recording medium and produces an optical (HF) and/or magneto-optical data signal, characterised in that the output of the optical scanning device at which the optical data signal (HF) can be tapped, the latter containing the data stored with the aid of pits, is connected to the first input, via a high pass filter (H) and a rectifier (G) connected in series therewith, and to the second input, via a low pass filter (T), of a first comparator (V1), the output of the comparator being connected to a control processor (SP), in which the level of the signal at the output of the first comparator (V1) states whether it is a magneto-optical recording medium or not.

2. A circuit arrangement according to claim 1, characterised in that the output of a second comparator (V2), whose first input is connected to the output of the rectifier (G) and at whose second input there is a reference voltage (UR), is connected to the control processor (SP), in which the level of the signal at the output of the second comparator (V2) states, in the case where it is not a magneto-optical recording medium, whether it is an optical recording medium or a combination of an optical and a magneto-optical recording medium.

3. A circuit arrangement according to claim 1, characterised in that the output of a second comparator (V2), whose first input is connected to the output of the low pass filter (T) and at whose second input there is a reference voltage (UR), is connected to the control processor (SP), in which the level of the signal at the output of the second comparator (V2) states, in the case where it is not a magneto-optical recording medium, whether it is an optical recording medium or a combination of an optical and a magneto-optical recording medium.

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