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Deutche Thomson-Brandt GmbH
P.O. Box 1307
Hermann-Schwer-Str. 3
7730 Villingen-Schwenningen

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PATENT APPLICATION

Servo control loop

The invention relates to a servo control loop for an optical scanning device for focusing a light beam onto a recording medium or for guiding the light beam along the data tracks on the recording medium, which reflects the light beam onto a plurality of photodiodes from whose output signals a servo signal is produced by subtraction, which servo signal has a high-frequency oscillation superimposed on it because of the data which are recorded on the recording medium.

A CD player is equipped, for example, with two servo control loops, one focusing control loop and one tracking control loop. In the case of a CD player which scans the recording medium, the compact disc, using the so-called three-beam method, the light beam from a laser is directed at the disc by means of lenses and a prismatic beam splitter. An optical grating is located in the beam path in order that the light beam produced by the laser is split into the main beam and the diffracted beams.

The main beam is reflected from the disc onto a four-quadrant photodetector having four photodiodes A, B, C and D, while the diffracted beam of order +1 is reflected onto a photodiode E, and the diffracted beam of

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order -1 is reflected onto a photodiode F. The focusing error signal FE = (AS + BS) - (DS + CS) for the focusing control loop is formed from the output signals AS, BS, CS and DS from the photodiodes A, B, C and D of the four-quadrant photodetector. The tracking error signal TE = ES - FS for the tracking control loop is produced from the output signals ES and FS from the photodiodes E and F. Both the focusing error signal and the tracking error signal have undesirable high-frequency elements superimposed on them because of the data recorded on the disc, which elements exacerbate the focusing and tracking control.

It is thus the object of the invention to design a servo control loop according to the precharacterizing clause of Claim 1 such that high-frequency superimpositions in the servo signal no longer have a disturbing effect on control.

The invention achieves this object in that the high-frequency oscillations are short-circuited by means of a capacitor before subtraction.

Figure 1 shows an arrangement comprising a four-quadrant photodetector and the photodiodes of a tracking control loop

Figure 2 shows a circuit arrangement for producing the focusing error signal according to Claim 2

Figure 3 shows a circuit arrangement for producing the focusing error signal according to Claim 3

Figure 4 shows a circuit arrangement for producing the tracking error signal according to Claim 4

Figure 5 shows a circuit arrangement for producing the tracking error signal according to Claim 5

Figure 6 shows the focusing error signal in the prior art

Figure 7 shows the tracking error signal in the prior art

Figure 1 shows the arrangement, which is normal in CD players, of the four-quadrant photodetector onto which the main beam L is reflected from the disc, the

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photodiode E onto which the diffracted beam of order +1 L1 is reflected, and the photodiode F onto which the diffracted beam of order -1 L2 is reflected. The four-quadrant photodetector and the photodiodes E and F are seated on a common carrier.

The example of the circuit arrangement shown in Figure 2 is used to explain how the focusing error signal FE for a focusing control loop is produced.

Figure 6 illustrates the focusing error signal in the prior art. This has a sinusoidal waveform and has a high-frequency oscillation superimposed on it, which exacerbates focusing control.

In the case of the focusing control loop according to the invention in Figure 2, one electrode of each of the four photodiodes A, B, C and D, which electrodes are connected to one another, is connected to a voltage U. The other electrodes of the photodiodes A, C are connected to one input of a differential amplifier V, while the other electrodes of the photodiodes B and D are connected to the other input of the differential amplifier V. A capacitor K, which short-circuits the high-frequency superimpositions in the output signals of the photodiodes A, B, C and D, is provided between the two inputs of the differential amplifier V. The focusing error signal FE therefore no longer contains any high-frequency superimpositions which disturb and exacerbate control.

In the case of the focusing control loop which is illustrated in Figure 3, the anodes of the diodes A, B, C and D [sic] are connected to earth via in each case one capacitor K1 and K2. The capacitor K between the inputs of the differential amplifer V is thus no longer necessary.

Figure 7 shows the sinusoidal error tracking signal TE in the prior art, which likewise has high-frequency oscillations superimposed on it, in the same way as the focusing error signal.

The circuit arrangement illustrated in Figure 4

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is used to explain how the tracking error signal TE is produced.

A voltage U is applied to one of the electrodes of each of the photodiodes E and F, while a capacitor K is provided between the other electrodes, which are connected to the inputs of a differential amplifier V. While, in the same way as in the case of the arrangement in Figure 2, the capacitor K short-circuits the high-frequency elements in the output signals from the photodiodes, the tracking error signal TE no longer contains any high-frequency superimpositions which exacerbate tracking control in the prior art.

Instead of having to provide the capacitor K between the two photodiodes E and F, the anodes of the two photodiodes E and F are connected to earth, via in each case one capacitor K1 and K2, in the case of the tracking control loop which is illustrated in Figure 5.

The invention is suitable for optical recording and replay apparatuses which focus a light beam onto a recording medium by means of a focusing control loop and guide the light beam along the data tracks on the recording medium by means of a tracking control loop. CD players, video-disc players, DRAW disc players and magneto-optic apparatuses should be mentioned as examples.

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Patent Claims

1. Servo control loop for an optical scanning device for focusing a light beam onto a recording medium or for guiding the light beam along the data tracks on the recording medium, which reflects the light beam onto a plurality of photodiodes (A, B, C, D, E, F) from whose output signals a servo signal is produced by subtraction, in that the output signals are supplied to a differential amplifier (V) which produces the servo signal, which has a high-frequency oscillation superimposed on it because of the data which are recorded on the recording medium, characterized in that either a capacitor (K) is connected between the inputs of the differential amplifier (V), or in that one electrode of each of the photodiodes (A, B, C, D, E, F) is connected to earth via in each case one capacitor (K1, K2).

2. Servo control loop according to Claim 1, characterized in that said servo control loop is a focusing control loop, in that the light beam is reflected from the recording medium onto a four-quadrant photodetector having four photodiodes (A, B, C, D), in that a voltage (U) is applied to one electrode of each of the four photodiodes (A, B, C, D), said electrodes being connected to one another, in that the other electrodes of in each case two photodiodes (A, C and B, D respectively) are connected to one another, and in that a capacitor (K) is connected between the junction points of the said other electrodes.

3. Servo control loop according to Claim 1, characterized in that said servo control loop is a focusing control loop, in that the light beam is reflected from the recording medium onto a four-quadrant photodetector having four photodiodes (A, B, C, D), in that a voltage (U) is applied to one electrode of each of the four photodiodes (A, B, C, D), said electrodes being connected to one another, in that the other electrodes of in each case two photodiodes (A, C and B, D respectively) are connected to one another, and in that the said other

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electrodes are connected to earth via in each case one capacitor (K1, K2).

4. Servo control loop according to Claim 1, characterized in that said servo control loop is a tracking control loop, in that the diffraction beam of order +1 (L1) is reflected from the recording medium onto a first photodiode (E), and in that the diffracted beam of order -1 (L2) is reflected onto a second photodiode (F), in that a voltage (U) is applied to that electrode on each of the two photodiodes (E, F) which electrodes are connected to one another, and in that a capacitor (K) is connected between the other electrodes.

5. Servo control loop according to Claim 1, characterized in that said servo control loop is a tracking control loop, in that the diffraction beam of order +1 (L1) is reflected from the recording medium onto a first photodiode (E), and in that the diffracted beam of order -1 (L2) is reflected onto a second photodiode (F), in that a voltage (U) is applied to that electrode on each of the two photodiodes (E, F) which electrodes are connected to one another, and in that the other electrodes are connected to earth via in each case one capacitor (K1, K2).

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