Description

The invention relates to a method of driving a display device comprising a ferro-electric liquid crystal between two supporting plates and a system of pixels arranged in rows and columns, each pixel being constituted by picture electrodes provided on the facing surfaces of the supporting plates, and a system of row and column electrodes, at least one row of pixels being selected via a row electrode during a line selection period, data signals being presented via the column electrodes, and the row of pixels, prior to selection, being brought to an extreme state by means of an auxiliary signal.

In this context an extreme state is to be understood to mean such a state that the pixel is substantially completely transmissive or non-transmissive. This state is determined by the nature of the ferro-electrid display device which will be described in greater detail hereinafter. The choice of the amplitude of the auxiliary signal is also decisive of the rate at which the liquid crystal switches to this extreme state.

The methods mentioned above are used, for example, in display devices for display screen or television uses. Notably for television uses and non-volatile memory display devices the use of ferro-electric liquid crystal materials seems to be attractive because much faster switching times can be realized therewith than with effects based on nematic liquid crystal materials.

Other advantages are that the viewing angle dependence is smaller (because generally a smaller thickness is used and because of the orientation of the molecules in faces parallel to the walls) and that the contrast is greater.

A method of the type mentioned in the opening paragraph is described in EP-A-0 197 242. In this method the presentation of data signals synchronously with a selection signal is preceded by so-called blanking pulses which must bring the liquid crystal to an initial state. In order to inhibit degradation of the ferro-electric material, the pulses used periodically reverse their sign.

The method described is used in a display device having a so-called passive matrix; the said signals (selection signals, data signals, blanking pulses) are directly presented to the row and column electrodes: The state of a pixel is determined by the line and data voltages. Since data voltages are presented to the column electrodes also when certain pixels are not selected, voltages, possibly in combination with cross-talk signals, may be produced so that the desired transmission state (in the example of EP-A-0 197 242 transmissive or non-transmissive) is not achieved or is lost.

The above-cited Patent Application proposes to solve this problem by providing the ferro-electrical effect with a certain threshold. Such thresholds cannot be realised or can hardly be realised in practice without contrast loss occurring in applications using larger numbers of lines. The said Patent Application also refers only to switching between the states "0" and "1"; the possibility of introducing grey scales is not dealt with in the description of the devices shown.

It is an object of the invention to provide a method of the type described in the opening paragraph in which the above-mentioned problems can be obviated as much as possible and with which grey scales can be realised.

To this end a method according to the invention is characterized in that during at least a part of the line selection period the pixels are connected via active switching elements to the column electrodes in order to present data signals to the pixels and in that the auxiliary signal is presented to the pixels via the same switching elements at an instant before the commencement of the line selection over at least a period which is equal to the switching period of the ferro-electric medium and which has such a duration and amplitude that the extreme transmission state is reached, whilst after the line selection period the pixels assume a transmission state which is substantially exclusively determined by the data signal presented.

In this respect the words "substantially exclusively determined by the data signal presented" are understood to mean that the voltage presented during the selection across the pixel and the capacitance associated therewith is maintained and may possibly vary to a slight extent due to the leakage currents, but that no measures are taken to generate a given voltage across the pixels during the non-selection period of the kind described, for example, in EP-A-0 176 763.

The invention is based on the recognition that notably grey scales can be obtained by causing the pixels to assume a relaxation state under the influence of the charge which is provided during selection of the pixels or the capacitances associated therewith, whilst the polarisation due to this charge is compensated, as it were, by a polarisation of opposite sign in the liquid crystalline material. This is found to take place because the dipoles associated with the ferro-electric liquid crystal molecules are reversed under the influence of the said charge and thus bring about the said compensation. The division of dipoles which are reversed need not be homogeneous; however, the fraction of reversed dipoles for one and the same voltage (with the selection period remaining the same) is invariably found to be substantially equal.

A method according to the invention for displaying grey scales is therefore characterized in

that the grey scale is determined by the duration and the amplitude of the data signal presented during the period when the row of pixels is selected for data display. In the case of equal selection periods the data voltage thus determines the grey scale.

It will be evident that where a compensation effect is concerned, the provision of a given voltage across the pixels are described in EP-A-0 176 763 does not lead to a stable final state (grey value) and neither does the use of a passive drive in which voltages are directly presented to the pixel via the data electrodes beyond the actual selection period.

And additional advantage of the method according to the invention is that the ferro-electric liquid crystalline material does not need to have a threshold.

Preferably, the substantially non-transmissive (opaque) state is chosen as the extreme transmission state. This is favourable from the point of view to perception because only the maximum brightness is slightly affected, whereas contrast loss, which is more visible, occurs when selecting the transmissive state as the extreme transmission state.

The auxiliary signal can be realised in different manners, dependent on the switching elements used and the drive mode. In the case of a FET switch, bipolar transistor or another threepole switching element the auxiliary signal will generally be presented to the column electrode during a part of the line selection period amply before the relevant row of pixels is written, whilst the actual data is presented to another row of pixels during the second part of the line selection period.

The invention will now be described in greater detail with reference to the accompanying drawings in which:

Fig. 1 shows diagrammatically the structure of a liquid crystal display device based on a ferro-electric liquid crystal;

Fig. 2 illustrates the realisation of grey scales with reference to a single pixel;

Fig. 3 and Fig. 4 show the response to the device of Figure 1 driven by a method according to the invention;

Fig. 5 shows diagrammatically the influence of the value of the auxiliary signal;

Fig. 6 shows diagrammatically a device for use with a method according to the invention;

Fig. 7 shows diagrammatically the drive associated with the device of Fig. 6, and

Fig. 8 shows a modification of Fig. 7.

The Figures are diagrammatic and not to scale. Corresponding components are generally denoted by the same reference numerals.

Fig. 1 shows in a diagrammatic cross-section a display device 1 with a ferro-electric liquid crystal 2 as described, for example, in the Article by Clark and Lagerwall in "Appl. Phys. Lett." 36 (1980), 899 or in European Patent Application EP-A-0 032 362. The liquid crystal 2 is present between two flat transparent supporting plates 3 of, for example, glass or mica. A matrix of picture electrodes 4 is present on one of the supporting plates, and the picture electrodes 4 are driven, for example, via row electrodes and switching elements, whilst data signals are supplied via column electrodes. A counter electrode 5, which together with the picture electrodes 4 of the first matrix constitutes the pixels, is present on the other supporting plate. This counter electrode may be connected to a fixed or a variable voltage. Dependent on the drive mode used (for example, with MIMs or diode rings) the row electrodes may be provided on the one supporting plate and the column electrodes may be provided on the other supporting plate. The thickness of the liquid crystal layer 2 is approximately 2 µm.

If desired, the electrodes 4, 5 may be coated with orientation layers 6 or protective layers, whilst the device is furthermore provided with spacers 7 in order to obtain a uniform thickness of the liquid crystal layer. In the relevant example the display device also comprises a filter layer 8 with, for example separate colour filters for the colours red, green and blue, as well as polariser 9 and analyser 10. Furthermore the device comprises a light source 11 consisting of a lamp 12 and a diffusor 13 whilst the matrix 4 and the associated elements are driven via drive electronics 14.

Fig. 2a shows diagrammatically how a single pixel of such a display device is driven by means of an active switching element, in this example a thin film field effect transistor 15. A selection line 16 is connected to the gate of the field effect transistor, whilst data signals are presented to the data line 17 which is connected to the liquid crystal display element, diagrammatically shown in this embodiment by a capacitance 18, the other connection of which is (virtually) connected to ground.

Fig. 2b shows diagrammatically the state of a pixel when a given voltage is applied across this element represented by the capacitance 18. In this embodiment this voltage is applied in the form of a pulse to the data line 17, whilst the element 18 is selected via the selection line 16.

In the method according to the invention an auxiliary signal ("blanking") V_{b1} is first provided, which is negative in this example and brings the pixel to an extreme state with a transmission of substantially 0.

Due to this negative voltage pulse the first electrode 19 (which is connected to the transistor 15) becomes negative. By relaxation of the dipoles

21 associated with the molecules of the ferro-electric liquid crystal material these dipoles are directed in such a manner that the charge on the electrodes 19, 20 of the capacitance 18 is completely compensated or is compensated as much as possible. This results in all dipoles being identically directed (situation i in Fig. 2b) in the case of a sufficiently negative auxiliary voltage V_{b1}.

When driving at a voltage of the value V_1, which is slightly positive, the electrode 19 acquires a slightly positive charge so that some of the dipoles 21 are reversed. This continues until the positive charge has been compensated; domains 23 at which the dipoles are reversed in a region between the two electrodes 19, 20 (situation ii in Fig. 2b) may be formed in the liquid crystal.

At a slightly larger voltage V_2 more and larger domains 23 will be produced (situation iii in Fig. 2b). In this reversal process the surface roughness of the wall may also play a role.

If, in the case of, for example, situation ii in Fig. 2b the voltage pulse of the value V_1 is repeated without any further measures, as is conventional practice notably in video applications, the electrode 19 will again acquire a slightly positive charge. Since it is compensated again by the reversal of some of the dipoles 21 the number of reversed dipoles 21 increases. As a result the domains 23 increase in umber and size.

The presence of these domains, where the transmission is no longer 0, determines the grey value of the relevant pixel. Without special measures, notably in TV applications, this grey value is thus not constant, in the case of an equal data signal because the domains 23 incease when the voltage pulse is frequently presented. Also in the case of changing data signals the grey value of the pixels is dependent on their history.

However, in the method according to the invention a row of pixels, prior to the actual selection taking place, is brought to an extreme state (for example that of situation i in Fig. 2b) by means of the auxiliary signal V_{b1} before the actual data signal is presented. This is effected timely enough to cause the dipoles in this row of pixels to relax to the associated initial state. Since a charge effect is concerned in this case, the value of the auxiliary signal V_{b1} is also dependent on the period during which this auxiliary signal is presented. Since the domains 23 do not grow, now the transmission state, notably the grey scale of the pixels, is not exclusively determined by the data signal which has been presented.

This is further shown with reference to Fig. 3 for a single pixel in which the signals V_2, V_1, V_{sel} present to the data lines during selection are each preceded by an auxiliary signal V_{b1} so that the associated transmission levels are indeed exclusively determined by these signals.

Fig. 4 shows how a given grey value is reached by using this method if a pixel is driven with a voltage pulse having a voltage value V_p and a pulse width of the order of 16-64 µsec., whilst an auxiliary signal (blanking) having a voltage value of V_{b1} and a pulse-width of the same order is presented in advance.

The auxiliary signal is then located so far before the drive signal that the extreme transmission state can be reached. Fig. 4a diagrammatically shows the voltage variation with respect to time of the drive signals, whilst in Figure 4b the squares 22 diagrammatically show the transmission of the associated pixels for some voltages. In the relevant example in which V_{b1} ischosen to be -6V, there is no transmission for $-6V < V_p < 0V$, a small transmission for $V_p = 2V$, almost complete transmission for $V_p = 4$ and complete transmission for $V_p = 6V$. The squares 22 actually have a size of 10 µm x 10 µm so that the domains 23 are not separately visible but are observed as an intermediate transmission state (grey value, colour level).

With the aid of active drive and using an auxiliary signal bringing the pixels to an extreme transmission state ("blanking") it is possible according to the invention to realise grey levels in large display devices based on the ferro-electric liquid crystal materials, because the actual ferro-electric cells switch between black and the zero-order double refractive white. In this embodiment use is made of the ferro-electric material ZLI 3234 (Merck) with a thickness of 2 µm of the cell.

As already stated the auxiliary signal must be presented for a certain period t_d. This period t_d is itself a function of the value of the auxiliary signal as is shown in Fig. 5. In the region indicated by "+" in Fig. 5 the device operates as described above; in the region indicated by "-" the grey values vary because not all dipoles are directed during the presentation of the auxiliary signal. Fig. 5 shows the relationship between t_d and $|V_{b1}|$ for a fast switching ferro-electric liquid crystal material (line a) and for a slightly slower switching material (line b).

In the embodiments shown the pixel in the extreme state is substantially opaque. This is chosen because this is more pleasant from the observer's point of view, whilst the loss of light output is small. In conventionally used TV systems the line selection period is approximately 64/µsec. and the number of lines is approximately 600. Most ferro-electric display elements switch in less than 500 µusec so that most eight lines are temporarily non-transmissive. The maximum loss of brightness is then smaller than 1.25 % and this is even less for faster ferro-electric materials.

Fig. 6 shows diagrammatically a device for use

with a method according to the invention. This device comprises a matrix 24 of ferro-electric liquid crystal pixels 25 at the area of crossings of selection lines 16 which select thin film transistors 15 and data lines 17 to which auxiliary signals and data signals are presented. The auxiliary signal in this device is obtained, for example, via a voltage source 26 supplying a voltage V_{b1}. During a part of the line selection period, for example, half this period, the voltage V_{b1} is presented via multiplexers 27 and during the other half data signals are presented from a shift register 28 to the data lines 17. Substantially simultaneously with the change of the voltage on the data lines the selection of the row of pixels changes because, via multiplexers 29, either a first line selection circuit 30 selects the line to which the auxiliary signal is presented or a second line selection circuit 31 selects the line of picture elements to be written. The line selection circuits are, for example, shift registers which select a subsequent line after each line selection period, whilst the selection of the line to be written is effected, for example, 6 line selection periods after the auxiliary signal has been presented to this line.

In the relevant embodiment in which the lines are written one after the other a band of 5 lines 32 without information then precedes, as it were, the lines 33 which have just been written, whilst the lines 34 still comprise information from the previous frame (Fig. 7). The device is driven by a drive circuit 38 which is shown diagrammatically; if necessary, this circuit 38 may also supply the auxiliary signal which is indicated by means of the broken line 35.

In a similar device in which interlacing is used a band of eight lines 32e, for example, in the even field precedes the just-written lines 33e of the even field. The lines 34e comprise information from the previous even field, whilst the information of the lines 40 is determined by the previous odd field (Fig. 8).

The invention is of course not limited to the examples shown, but several variations are possible within the scope of the invention.

For example, as already stated, the row and column electrodes may be provided on different substrates. Different switching elements such as, for example, MIMs and diode rings may be used; if necessary, the counter electrode 5 may then also be in the form of a matrix of pixels. Instead of the transmission mode the device may alternatively be driven in the reflection mode.

Claims

1. A method of driving a display device comprising a ferro-electric liquid crystal between two supporting plates and a system of pixels arranged in rows and columns, each pixel being constituted by picture electrodes provided on the facing surfaces of the supporting plates, and a system of row and column electrodes, at least one row of pixels being selected via a row electrode during a line selection period, data signals being presented via the column electrodes,and the row of pixels, prior to selection being brought to an extreme state by means of an auxiliary signal, characterized in that during at least a part of the line selection period the pixels are connected via active switching elements to the column electrodes in order to present data signals to the pixels and in that the auxiliary signal is presented to the pixels via the same switching elements, the auxiliary signal being presented at an instant before the commencement of the line selection over at least a period which is equal to the switching period of the ferro-electric medium and which has such a duration and amplitude that the extreme transmission state is reached and in that after the line selection period the pixels assume a transmission state which is substantially exclusively determined by the data signal presented.

2. A method as claimed in Claim 1 for displaying grey scales, characterized in that the grey scale is determined by the duration and the amplitude of the data signal presented during the period when the row of pixels is selected for data display.

3. A method as claimed in Claim 2, characterized in that the row of pixels is selected for data display during half a line selection period and the voltage level of the data signal determines the grey scale.

4. A method as claimed in any one of the preceding Claims, characterized in that pixels in the extreme transmission state are substantially opaque.

5. A method as claimed in any one of the preceding Claims, characterized in that during a part of the line selection period pixels are selected via a selection voltage on a first row electrode while simultaneously the data signals are presented to the column electrodes and in that during the other part of the selection period pixels are selected via a second row electrode whilst simultaneously the auxiliary signal is presented to the column electrodes.

6. A display device comprising a ferro-electro-

with a method according to the invention. This device comprises a matrix 24 of ferro-electric liquid crystal pixels 25 at the area of crossings of selection lines 16 which select thin film transistors 15 and data lines 17 to which auxiliary signals and data signals are presented. The auxiliary signal in this device is obtained, for example, via a voltage source 26 supplying a voltage V_{b1}. During a part of the line selection period, for example, half this period, the voltage V_{b1} is presented via multiplexers 27 and during the other half data signals are presented from a shift register 28 to the data lines 17. Substantially simultaneously with the change of the voltage on the data lines the selection of the row of pixels changes because, via multiplexers 29, either a first line selection circuit 30 selects the line to which the auxiliary signal is presented or a second line selection circuit 31 selects the line of picture elements to be written. The line selection circuits are, for example, shift registers which select a subsequent line after each line selection period, whilst the selection of the line to be written is effected, for example, 6 line selection periods after the auxiliary signal has been presented to this line.

In the relevant embodiment in which the lines are written one after the other a band of 5 lines 32 without information then precedes, as it were, the lines 33 which have just been written, whilst the lines 34 still comprise information from the previous frame (Fig. 7). The device is driven by a drive circuit 38 which is shown diagrammatically; if necessary, this circuit 38 may also supply the auxiliary signal which is indicated by means of the broken line 35.

In a similar device in which interlacing is used a band of eight lines 32e, for example, in the even field precedes the just-written lines 33e of the even field. The lines 34e comprise information from the previous even field, whilst the information of the lines 40 is determined by the previous odd field (Fig. 8).

The invention is of course not limited to the examples shown, but several variations are possible within the scope of the invention.

For example, as already stated, the row and column electrodes may be provided on different substrates. Different switching elements such as, for example, MIMs and diode rings may be used; if necessary, the counter electrode 5 may then also be in the form of a matrix of pixels. Instead of the transmission mode the device may alternatively be driven in the reflection mode.

Claims

1. A method of driving a display device comprising a ferro-electric liquid crystal between two supporting plates and a system of pixels arranged in rows and columns, each pixel being constituted by picture electrodes provided on the facing surfaces of the supporting plates, and a system of row and column electrodes, at least one row of pixels being selected via a row electrode during a line selection period, data signals being presented via the column electrodes,and the row of pixels, prior to selection being brought to an extreme state by means of an auxiliary signal, characterized in that during at least a part of the line selection period the pixels are connected via active switching elements to the column electrodes in order to present data signals to the pixels and in that the auxiliary signal is presented to the pixels via the same switching elements, the auxiliary signal being presented at an instant before the commencement of the line selection over at least a period which is equal to the switching period of the ferro-electric medium and which has such a duration and amplitude that the extreme transmission state is reached and in that after the line selection period the pixels assume a transmission state which is substantially exclusively determined by the data signal presented.

2. A method as claimed in Claim 1 for displaying grey scales, characterized in that the grey scale is determined by the duration and the amplitude of the data signal presented during the period when the row of pixels is selected for data display.

3. A method as claimed in Claim 2, characterized in that the row of pixels is selected for data display during half a line selection period and the voltage level of the data signal determines the grey scale.

4. A method as claimed in any one of the preceding Claims, characterized in that pixels in the extreme transmission state are substantially opaque.

5. A method as claimed in any one of the preceding Claims, characterized in that during a part of the line selection period pixels are selected via a selection voltage on a first row electrode while simultaneously the data signals are presented to the column electrodes and in that during the other part of the selection period pixels are selected via a second row electrode whilst simultaneously the auxiliary signal is presented to the column electrodes.

6. A display device comprising a ferro-electro-

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optical display medium between tow supporting plates, a system of pixels arranged in rows and columns, in which each pixel is constituted by picture electrodes provided on the facing surfaces of the supporting plates, and a system of row electrodes and column electrodes for driving the pixels, characterized in that the column electrodes are connected to outputs of multiplex circuits switching the column electrodes between data signals to be displayed and an auxiliary signal which is applied in order to bring the liquid crystal element to an extreme state and in that the device comprises a drive and synchronisation circuit which, simultaneously with a selection voltage on a row of pixels to be displayed, causes data signals to appear on the column electrodes via the multiplex circuit and, which, simultaneously with a selection voltage on a different row of pixels provided with data signals at a later stage, causes an auxiliary signal to appear on the column electrodes, which signal has a sufficient duration and amplitude to bring a pixel to an extreme state.

7. A display device as claimed in Claim 6, characterized in that the other row of pixels is provided with data signals at least 1 line selection period later and at most 2 line selection periods later.

8. A display device as claimed in Claim 6 or 7, characterized in that the multiplex circuits provide the column electrodes with data voltages during half a line selection period and with the auxiliary signal during the other half line selection period.

Revendications

1. Procédé pour la commande d'un dispositif d'affichage comportant un cristal liquide ferroélectrique entre deux plaques de support et un système d'éléments d'image disposés en rangées et en colonnes, chaque élément d'image étant constitué par des électrodes d'image disposées sur la surface située en vis-à-vis des plaques de support, et un système d'électrodes de rangée et de colonne, au moins une rangée d'éléments d'image étant sélectionnée par l'intermédiaire d'une électrode de rangée pendant une période de sélection de ligne, des signaux de données étant présentés par l'intermédiaire des électrodes de colonne et avant la sélection, la rangée d'éléments d'image est portée à un état extrême à l'aide d'un signal auxiliaire, caractérisé en ce que lors d'au moins une partie de la période de sélection de ligne, les éléments d'image sont connectés par l'intermédiaire d'éléments de commutation actifs aux électrodes de colonne afin de présenter des signaux de données aux éléments d'image et en ce que le signal auxiliaire est présenté aux éléments d'image par l'intermédiaire des mêmes éléments de commutation à un moment situé avant le début de la sélection de ligne sur au moins une période qui est égale à la période de commutation du milieu ferro-électrique et qui présente une durée et amplitude telles que l'état de transmission extrême est atteint, alors qu'après la période de sélection de ligne les éléments d'image acquièrent un état de transmission qui est pratiquement uniquement déterminé par le signal de données présenté.

2. Procédé selon la revendication 1 pour l'affichage d'échelles des gris, caractérisé en ce que l'échelle des gris est déterminée par la durée et l'amplitude du signal de données présenté pendant la période pendant laquelle la rangée d'éléments d'image est sélectionnée pour l'affichage de données.

3. Procédé selon la revendication 2, caractérisé en ce que la rangée d'éléments d'affichage est sélectionnée pour l'affichage de données pendant la moitié d'une période de sélection de ligne et le niveau de tension du signal de données détermine l'échelle des gris.

4. Procédé selon l'une des revendications précédentes, caractérisé en ce que les éléments d'affichage dans l'état de transmission extrême sont pratiquement opaques.

5. Procédé selon l'une des revendications précédentes, caractérisé en ce que pendant au moins une partie de la période de sélection de ligne, des éléments d'affichage sont séléctionnés par l'intermédiaire d'une tension de sélection sur une première électrode de rangée alors que simultanément les signaux de données sont présentés aux électrodes de colonne et en ce que lors de l'autre partie de la période de sélection, des éléments d'affichage sont sélectionnés par l'intermédiaire d'une deuxième électrode, alors que simultanément, le signal auxiliaire est présenté aux électrodes de colonne.

6. Dispositif d'affichage comportant un milieu d'affichage électrooptique entre deux plaques de support, un système d'éléments d'affichage disposé en rangées et en colonnes, dans lequel chaque élément d'affichage est constitué

par des électrodes d'image disposées sur les surfaces situées en vis-à-vis des plaques de support, et un système d'électrodes de rangée et d'électrodes de colonne pour la commande des éléments d'affichage, caractérisé en ce que les électrodes de colonne sont connectées à des sorties de circuits multiplex assurant la commutation des électrodes de colonne entre des signaux de données à afficher et un signal auxiliaire appliqué afin de porter l'élément à cristal liquide à un état extrême et en ce que le dispositif comporte un circuit de commande et de synchronisation qui, simultanément avec une tension de sélection sur une rangée d'éléments d'affichage à afficher, provoque l'apparition des signaux de données sur les électrodes de colonne par l'intermédiaire des circuits multiplex et qui, simultanément avec la tension de sélection sur une rangée differente d'eléments d'affichage munis de signaux de données dans un stade ultérieur, provoque l'apparition d'un signal auxiliaire sur les électrodes de colonne, lequel signal présente une durée et une amplitude suffisantes pour porter un élément d'affichage à un état extrême.

7. Dispositif d'affichage selon la revendication 6, caractérisé en ce que l'autre rangée d'éléments d'affichage est munie de signaux de données après au moins une et au maximum deux périodes de sélection de ligne.

8. Dispositif d'affichage selon la revendication 6 ou 7, caractérisé en ce que les circuits multiplex munissent les électrodes de colonne de tensions de données pendant la moitié d'une période de sélection de ligne et du signal auxiliaire pendant l'autre moitié de la période de sélection de ligne.

Patentansprüche

1. Verfahren zur Ansteuerung einer Wiedergabeanordnung mit einem ferroelektrischen Flüssigkristall zwischen zwei Trägerplatten sowie mit einem System reihen- und spaltenweise gegliederter Bildelemente, die je durch Bildelektroden auf den einander zugewandten Oberflächen der Trägerplatten gebildet werden, sowie mit einem System von Reihen- und Spaltenelektroden, wobei während einer Zeilenselektionszeit mindestens eine Reihe von Bildelementen über eine Reihenelektrode selektiert wird, während über die Spaltenelektroden Datensignale angeboten werden und die Reihe von Bildelementen vor der Wahl mittels eines Hilfssignals in einen Extremzustand gebracht wird, dadurch gekennzeichnet, daß während wenigstens eines Teils der Zeilenselektionszeit über aktive Schaltelektroden die Bildelemente mit den Spaltenelektroden verbunden werden, damit den Bildelementen Datensignale angeboten werden und über dieselben Schaltelemente den Bildelementen das Hilfssignal angeboten wird, wobei das Hilfssignal zu einem Zeitpunkt angeboten wird, der um mindestens eine Zeit entsprechend der Schaltzeit des ferroelektrischen Mediums vor dem Anfang der Zeilenselektion liegt und eine derartige Dauer und Amplitude aufweist, daß der extreme Übertragungszustand erreicht wird und nach der Zeilenselektionszeit die Bildelemente einen Übertragungszustand einnehmen, der nahezu ausschließlich durch das angebotene Datensignal bestimmt wird.

2. Verfahren nach Anspruch 1 zum Wiedergeben von Grauskalen, dadurch gekennzeichnet, daß die Grauskala durch die Dauer und die Amplitude des angebotenen Datensignals während der Zeit, daß die Reihe von Bildelementen für Datenwiedergabe selektiert ist, bestimmt wird.

3. Verfahren nach Anspruch 2, dadurch gekennzeichnet, daß die Reihe von Bildelementen während der Hälfte der Zeilenselektionszeit für Datenwiedergabe selektiert ist und der Spannungspegel des Datensignals die Grauskala bestimmt.

4. Verfahren nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, daß Bildelemente in dem extremen Übertragungszustand nahezu lichtundurchlässig sind.

5. Verfahren nach einem der vorstehenden Ansprüche, dadurch gekennzeichnet, daß während eines Teils der Selektionszeit mittels einer Selektionsspannung an einer ersten Reihenelektrode Bildelemente selektiert werden, während gleichzeitig den Spaltenelektroden die Datensignale angeboten werden und während des restlichen Teils der Selektionszeit über eine zweite Reihenelektrode Bildelemente selektiert werden, während gleichzeitig den Spaltenelektroden das Hilfssignal angeboten wird.

6. Wiedergabeanordnung mit einem fertoelektrooptischen Wiedergabemedium zwischen zwei Trägerplatten, mit einem System reihen- und spaltenweise gegliederter Bildelemente, die je durch Bildelektroden auf den einander zugewandten Oberflächen der Trägerplatten gebildet werden, sowie mit einem System von Reihen- und Spaltenelektroden zur Ansteue-

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rung der Bildelemente, dadurch gekennzeichnet, daß die Spalteneleketroden an Ausgänge von Multiplexschaltungen angeschlossen sind, welche die Spaltenelektroden zwischen wiederzugebenden Datensignalen und einem Hilfssignal schalten, das zugeführt wird um das Flüssigkristallelement in einen Extremzustand zu bringen, und daß die Anordnung eine Ansteuer- und Synchronisationsschaltung aufweist, die gleichzeitig mit einer Selektionsspannung an einer wiederzugebenden Reihe von Bildelementen über die Multiplexschaltung Datensignale an den Spaltenelektroden erscheinen läßt und gleichzeitig mit einer Selektionsspannung an einer anderen reihe von Bildelementen, die später mit Datensignalen versehen wird, an den Spaltenelektroden ein Hilfssignal ausreichender Dauer und Amplitude um ein Bildelement in einen Extremzustand zu bringen, erscheinen läßt.

7. Wiedergabeanordnung nach Anspruch 6, dadurch gekennzeichnet, daß die andere Reihe von Bildelementen um minimal 1 und um maximal 2 Zeilenselektionszeiten später mit Datensignalen versehen wird.

8. Wiedergabeanordnung nach Anspruch 6 oder 7, dadurch gekennzeichnet, daß die Multiplexschaltungen den Spaltenelektroden während einer halben Zeilenselektionszeit mit Datenspannungen und während der anderen halben Zeilenselektionszeit mit dem Hilfssignal versehen.