

The multitude of different personal computers and monitors has had the result that differing drive modes have been established for the input signals needed by the monitors. Hitherto, this circumstance has prevented monitors of any type from being driven directly by the same personal computers. Rather, for each drive mode, a special adapter card has had to be used. In essence, the drive modes differ from each other by their line frequency, frame frequency, number of lines, the horizontal and vertical amplitudes as well as by their useable formats within the format of the screen.

The object of the invention is to provide a method which evaluates, from the signals of the personal computer intended for the monitor, the features specific to the drive modes in order to bring about an automatic matching of the monitor.

This object is achieved in a method in accordance with the first part of Claim 1 by the features given in the characterising part.

In the method according to the invention, the operating values for frequently recurring drive modes are stored. This can be effected for example by a preliminary setting-up using test signals and then, after this has ended, the operating values which have been obtained are transferred into the store provided therefor. The operating values are stored under addresses specific to the drive modes so that by selection of one of the addresses all the required operating values are accessible at the output of the memory. If the drive mode can be unambiguously determined successfully by evaluation of the horizontal and vertical synchronising signals of the personal computer, then the address assigned to this drive mode can be accessed and the drive mode can be set-up by means of corresponding control signals being applied to the horizontal and vertical deflection stages of the monitor. As the setting-up occurs immediately following the receipt of the horizontal and vertical synchronising signals, the time needed for the set-up is hardly noticed by the user. Due to this, it is actually possible to switch-over a monitor to another personal computer during operation without the user needing to concern himself as to whether this personal computer uses the same or another type of drive mode. In principle, the number of possible drive modes that can be automatically installed in the manner in accordance with the invention is unlimited. In practice however, it is dependent on the capacity of the memory which is provided for the storage of the operating values.

By means of the joint evaluation of the horizontal and vertical synchronising signals undertaken in accordance with a further development, even such drive modes that tally in one of the values can also be distinguished. One practical embodiment provides for the determination of the periodic time of the horizontal synchronising signals to be carried out by measurement of several periods and division by the number of the synchronising signals. In this manner, it is possible to achieve a high measure of accuracy without additional circuits being required despite the periodic frequency of the microprocessor having the same order of magnitude as the horizontal frequency.

It is particularly advantageous to let the control signals for the horizontal and vertical deflection stages of the monitor run via dynamic digital-analogue converters because in this way, control via the serial port of a microprocessor is possible. The disadvantage associated with this type of digital-analogue converters, that with deviations of the horizontal or vertical frequency from the conversion frequency, a flickering or an unevenly bright image is produced, can be overcome in that the dynamic digital-analogue converters are synchronised with the vertical frequency, in accordance with a preferred embodiment, by maintaining a constant number of steps in each period.

In order to permit an exact installation, which will not require subsequent correction, during the initial setting-up of the operating values or when taking a multi-mode type of monitor into use, a video test signal is provided. It is thus ensured that the whole dynamics of the digital-analogue converter is utilisable. As the video test signal is basically intended for the setting-up of the amplitude and phase of the horizontal and vertical deflection, a simple form of the test signal is sufficient for this. The only essential factor is that the corresponding markings occur at exactly laid down times so that a relationship occurs between the test signal visible on the screen and the issuing of the operating values.

It is particularly simple to generate bars which limit the useful area of the screen horizontally and vertically as test signals. For setting-up the geometry additional bars can be generated. In order to be able to effect this expediently in a microprocessor which is provided also for other tasks, the video test signals are generated as a serial data stream and taken from a serial port of the microprocessor. The data stream can be generated by a shift register which was loaded beforehand in a sub-programme corresponding to the intended screen pattern and is started after interruption of a main programme. The normal programme sequence may then be continued during the serial data

stream. It is sufficient that the video signal be freshly started in a sub-programme loop periodically after each horizontal synchronising signal.

Moreover, the invention relates to an apparatus for matching a multi-mode monitor to a personal computer.

As regards this, its object is to provide an apparatus which automatically installs one of several recurring drive modes by evaluation of features of the signal coming from the personal computer and intended for the monitor.

This object is achieved in an apparatus in accordance with the first part of Claim 17 by the features mentioned in the characterising part.

The microprocessor, together with the memory, permits the storage of all the necessary operating values for the drive modes in question and additionally is in a position to analyse the horizontal and vertical synchronising signals of the personal computer as criteria as to which operating values should be installed. This can be accomplished in that the values for the periodic time of the horizontal and vertical synchronising signals are stored in a memory and these values are compared with those measured by the personal computer. Upon equality, the memory locations which contain the predetermined operating values are then addressed and, by virtue of their addressing, cause control signals for the installation of the operating values in the horizontal and vertical deflection stages of the monitor.

The dynamic digital-analogue converters provided for a conversion of the digital signals into analogue signals in accordance with a further development can be constructed very easily and, signalwise, allow themselves to be connected especially well to microprocessors having normal separate port.

Further developments and advantageous embodiments are apparent from the claims, the description and the drawing which illustrates one embodiment of the invention.

Fig. 1 shows in diagrammatic form the method sequence in accordance with one embodiment of the invention,

Fig. 2 shows a block circuit diagram of a circuit arrangement in accordance the invention.

The method sequence represented in the form of a flow diagram in Fig. 1 commences at Start 1. Following the Start 1, a decision is made at 2 as to whether the signal is being applied to the TTL input. If this is the case, the method is continued at 3 with the measurement of the horizontal and vertical frequency. If this is not the case, there is a switch over at 4 from the TTL input to the analogue input, and then at 5 it is checked as to whether the signal is being applied at the analogue input. If this is the case, the process continues with the method step mentioned under 3, if this is not the case, there is a switch over at 6 from the TTL input to the analogue input and a jump back to the decision at 2.

After the measurement of the frequencies at 3, the frequency is displayed at 7 and compared at 8 with stored operating values. It is now checked at 9 as to whether a pair of operating values were known. If this is the case, the corresponding memories are addressed at 10 and the content of the memory read-out. After a digital-to-analogue conversion of the stored data undertaken at 11, there follows at 12, the control of the horizontal and vertical deflection stages by corresponding analogue signals.

After the conclusion of these method steps, it is checked in an interrogation 13 as to whether the drive signal has altered. If this is the case, there is a jump back to the start and the just described method steps run through afresh. If the drive signal has not altered, the keyboard is thereafter scanned at 14 in order to take account of the desired values for brightness, contrast, horizontal and vertical amplitude and horizontal and vertical position. Subsequently it is checked at 15 as to whether a video test signal is wanted. If this is the case, a video test routine is called for at 16 and there is a jump back to 14 in order to alter the corresponding values via the keyboard. If a video test signal is not wanted, there is a jump back to 13.

If a pair of operating values is not recognised at 9, there is a branching to 17 where it is checked as to whether a storing of the new pair of horizontal and vertical frequency should be effected. If this is the case, a storing and a preparation of the memory locations for the deflection stage and the operating values is undertaken. If this is not the case, there is a jump to 13.

For the explanation of an apparatus in accordance with the invention reference will now be made to Fig. 2. The signals intended for the monitor are applied to inputs 22 and 23 of the apparatus 24 from the personal computers 20, 21 of which one 20

contains a TTL adapter card and the other 21 an analogue adapter card. The signals are passed from a change-over switch 24 and a signal converter circuit to a microcomputer 25. Video portions of the signal are also applied directly via a video stage 26 to a monitor 27. A control lead 28 leading from the microcomputer 25 back to the change-over switch 24 selectively enables TTL signals and analogue signals to be matched to the microcomputer 25 and the monitor 27. The microcomputer 25 includes a CPU 28, a ROM 29 and a RAM 30. Memory locations for the different drive modes are available in the RAM 30. These memory locations can be addressed and the contents of the memory then passed on to digital-analogue converters 31 to 37. The digital-analogue converters 31 to 37 provide control signals to a video stage 26 or a horizontal deflection stage 39 or a vertical deflection stage 40. Moreover, an indicator unit 41 as well as an input unit 42 are connected to the microcomputer 25. The horizontal and vertical amplitude, the horizontal and vertical position as well as brightness and contrast can be installed via the input unit 42. Furthermore, a video test signal can be activated. If any interest exists in retaining a pair of frequency values these may be stored in the RAM 30 via a memory control key. A personal computer having the corresponding drive mode can then be automatically matched to the monitor with the help of the pair of values of the horizontal and vertical frequency as for the other drive modes.

The signals intended for the monitor which are present at the input of the microcomputer 25 are evaluated by the microcomputer 25 as regards the periodic time of their horizontal and vertical synchronisation signals. This pair of values is compared with pairs of values stored in the RAM 30 and on recognition of equal pairs, the memory locations belonging thereto are addressed and thereafter read-out. The stored values representing the corresponding operating values are then converted by the digital-analogue converters 31 to 37 into corresponding control signals i.e. the control signals of the digital-analogue converter 31 determine the brightness and the contrast, those of the digital-analogue converters 32 and 35 the horizontal or vertical frequency, those of the digital-analogue converters 33 and 36 the horizontal and vertical amplitudes and those of the digital-analogue converters 34 and 37 the phase position of the horizontal and vertical deflection.



Claims

1. Method for the matching of a multi-mode monitor to a personal computer, characterised in that, operating values for the horizontal and vertical frequency, the horizontal and vertical amplitude, as well as for horizontal and vertical position of several frequently recurring drive modes are stored under addresses specific to the drive mode, that horizontal and vertical synchronisation signals of the personal computer provided for the control of the monitor are evaluated by an evaluating circuit (microcomputer 25) and that the drive mode assigned to the synchronisation signals is determined, the addresses specific to the drive mode are called-up and the control signals appertaining to a drive mode are communicated to the horizontal and vertical deflection stages of the monitor for the installation of the operating values.
2. Method in accordance with Claim 1, characterised in that, the periodic time of the horizontal and vertical synchronisation signals provided by the personal computer is measured, that the measured pairs of values are compared with predetermined pairs of values assigned to one of the selectable drive modes and that upon equality with one of these pairs of values the addresses specific to the drive mode assigned to these values are called-up.
3. Method in accordance with Claim 1, characterised in that the horizontal and vertical synchronisation signals of the personal computer provided for the control of the monitor are compared and evaluated with comparison values by an an evaluating circuit (microcomputer 25).
4. Method in accordance with Claim 3, characterised in that the periodic time of the horizontal synchronisation signals is effected by measurement of several periods and division by the number of the synchronisation signals.
5. Method in accordance with Claim 3 or 4, characterised in that, the comparison values are stored in an initial evaluation of the horizontal and vertical synchronisation signals.
6. Method in accordance with any one or more of Claims 1 to 5, characterised in that, additional operating values for the horizontal and vertical synchronisation signals as regards their phase angles are likewise stored under the addresses specific to the drive modes.



7. Method in accordance with any one or more of Claims 1 to 6, characterised in that, the control signals fed to the horizontal and vertical deflection stages of the monitor from the memory pass through serial digital-analogue converters.

8. Method in accordance with Claim 7, characterised in that, the cycle of the digital-analogue conversions is synchronised with the vertical frequency.

9. Method in accordance with Claim 7, characterised in that, the number of steps occurring in one period of the vertical synchronisation signals is kept constant for the digital-analogue conversion of the signals at the digital-analogue converters.

10. Method in accordance with any one or more of Claims 2 to 9, characterised in that, the periodic time of the vertical synchronisation signals serves as the time basis for the measurement of the periodic time of the horizontal synchronisation signals.

11. Method in accordance with any one or more of Claims 1 to 10, characterised in that, for the issuing of the control signals for the installation of the operating values, a video test signal is generated which is formed by horizontal and vertical bars which represent the boundaries of the useable area of the screen of the monitor.

12. Method in accordance with Claim 11, characterised in that, for the issuing of the control signals for the installation of the image geometry, additional vertical and/or horizontal bars are produced within the useable area of the screen.

13. Method in accordance with Claim 11 or 12, characterised in that, additional horizontal and/or vertical synchronisation signals are generated.

14. Method in accordance with any one or more of Claims 11 to 13, characterised in that, the video test signal serving for the production of the bars is taken from a serial port of a microprocessor as a serial data stream.

15. Method in accordance with Claim 14, characterised in that, the video test signal is started afresh in a sub-program loop, in particular in a serial interruption (serial interrupt) of the sub-program loop, periodically after each horizontal synchronisation signal.



16. Method in accordance with Claim 14 or 15, characterised in that, the program sequence is interrupted at the time point of the starting of the video test signal and is continued thereafter.

17. Apparatus for the matching of a multi-mode monitor to a personal computer, characterised by, a memory (RAM 30) for recording operating values for the horizontal and vertical frequency, the horizontal and vertical amplitudes, as well as for the horizontal and vertical positions of several frequently recurring drive modes, an evaluating circuit (microcomputer 25) for the evaluation of horizontal and vertical synchronisation signals provided for the control of the monitor, an addressing circuit (microcomputer 25) for the addressing of the memory containing the evaluated drive modes as well as by a control circuit for the installation of the operating values from stored values on the horizontal and vertical deflection stages of the monitor.

18. Apparatus in accordance with Claim 17, characterised in that, the serial port of a microcomputer (25) as well as parallel ports serve as output for the control signals and that serial, especially dynamic digital-analogue converters are present in the signal paths for the installation of the operating values on the horizontal and vertical deflection stages of the monitor.