

PRINTING DEVICE AND RECORDING PAPER CONTROL

The present invention generally relates to printing devices operating in conjunction with host computers and more particularly to printers connected to a host computer that provide output in response to commands from the host computer. The invention further relates to point-of-sale type printers capable of printing on cut-sheet type paper.

A variety of small specialized printers have been developed and widely used with host computers and other apparatus for printing data associated with point-of-sale (POS) transactions. A common example of such a printer application is for a department store where such printers are used to generate a "tape" style purchase receipt on "recording paper" for a customer which lists the items purchased as well as taxes and other fees levied against the transaction and a total balance due. These printers are used as part of the so called cash or check-out "register" commonly seen throughout retail business. In addition to the recording paper, these printers are also generally required to generate a "journal" or "journal tape" on a roll of paper for permanently recording and verifying the transactions for the particular sales register.

The printing devices used for these kinds of transactions generally transported a recording paper material, typically from a roll of paper, along a preset paper path through a printing mechanism where a print head forms the output image. More recently, due to the nature of record keeping and the sales transactions themselves, single or "cut-sheet" paper has found use in sales transactions. Additio-

nal information, business logos, instructions, or terms and conditions of the sale are now included as part of the transaction receipt, or specialized transaction forms, such as for "credit" transactions, are used. Therefore, many POS printers are configured with an insertion or access slot to provide access for insertion of individual cut-sheet paper or forms into the paper path for the printing mechanism.

In any case, POS printers are currently configured to begin printing immediately, when a switch is activated by an operator, or after passage of a fixed time interval after it is determined that paper has been inserted into the mechanism, particularly cut-sheet paper. Since the time it takes to position recording paper in POS printers, and the like, varies according to operator skill or experience, this currently gives rise to two inefficient conditions. First, an operator may be required to wait until the end of an allotted elapsed time interval even after the recording paper is positioned within the printer. Second, once the recording paper is detected, regardless of whether or not correctly positioned, it is transported into or through the printer before being correctly positioned, often causing problems.

On the other hand, if a maximum wait time for insertion of recording paper is not set, the host computer will wait indefinitely until it receives information from the printing device regarding insertion of the recording paper, also resulting in lost time. At the same time, if an operator mistakenly sets the printer in a cut-sheet paper printing mode, it is sometimes necessary to turn off the power to the printer to escape this mode, which also resets other settings.

What is needed is a method and apparatus for setting and changing wait times for paper insertion, positioning, and transport which can flexibly account for the skill of the operator. Something is needed to optimize the allocation of time for POS paper insertion activities while facilitating host control through application of new transport control commands.

The invention is intended to solve these problems and its main object is to provide a printing device and a control method therefor allowing to optimize a wait time for recording paper positioning dependent on the skill of an operator.

This object is achieved with the present invention as claimed.

Preferred embodiments of the invention are subject matter of the dependent claims.

The printing device has a printing section with a print head for printing on cut-sheet type recording paper, and a paper transport mechanism for moving paper adjacent to and past the print head in the printing section. A paper detector is used to detect when recording paper is inserted in the printing device and a timing unit connected to the detector is used to measure a first time interval for recording paper positioning from the detector output. The length of the first time interval can be arbitrarily set to a value corresponding to the skill of a person intended to operate the printing device.

In a preferred embodiment of the invention at least two separate wait time intervals, namely a second time interval beginning with a print instruction, and said first time

interval beginning with detection of paper , can be set and are used to pause before printing is initiated. The second time interval is set to terminate when a predetermined amount of time for paper insertion has elapsed unless paper is detected, and the first time interval is set to terminate after another predetermined amount of time has passed after which printing commences.

By this constitution of the printing device the wait interval for recording paper insertion can be optimized.

In a specific embodiment of the invention user control of the cut-sheet paper wait time, i.e. at least the first time interval, can be facilitated by means of a control command.

The length of the time interval between recording paper insertion and transport can be selectively set, generally using host computer commands.

Another advantage of a preferred embodiment of the present invention is that it realizes efficient data transfer and optimization of commands by facilitating setting of the recording paper insertion wait time (length of second time interval) and the recording paper positioning time (length of first time interval) with the same command.

In further aspects of the invention, a first and second timers are used to count the first and second wait time intervals, respectively. An interface unit is connected to a host computer to receive various predefined print commands and print data, and other data strings. A data analyzer interprets or decodes the received data and commands, at least one of which is a time setting command for setting one or more wait time intervals such as the recording paper

positioning time or interval. The wait time setting command typically comprises a command with two bytes of parameters one byte being a command parameter indicating the recording paper positioning time and the second byte being a command parameter indicating the recording paper insertion wait time.

A data storage or memory element is used for storing analyzed data which indicates the predefined time intervals as specified by the wait time setting command and provides this data to the timers for measuring the specified time periods. A print controller activates the first of the two timers after recording paper is detected, confirms the detection of the recording paper and paper position, and initiates paper transport and printing.

The paper transport mechanism has a transport section open-close mechanism configured to be electrically operated to open and close a recording paper transfer path and a recording paper transport roller means, and a recording paper transport controller to confirm the positioning of the recording paper, and then operates the transport section open-close mechanism, holding the recording paper so that it can be transported, and driving the recording paper transport roller.

The data storage or memory is configured as a first memory unit in which data defining the first time interval is stored, and a second memory unit in which data defining the second time interval is stored. The second memory unit data indicates the maximum time allowed for paper insertion. The first and second timers use the data from the first and second memory units to measure delay after paper insertion before commencing printing or transport and elapsed time for insertion of paper. A first activation ele-

ment starts the second timer at a preselected starting time and confirms whether or not the recording paper was inserted within the specified insertion wait time, and a second activation element starts the first timer after waiting for recording paper insertion so as to measure the elapsed recording paper insertion and positioning time. A calculation element can be used to calculate the time intervals based on stored parameters. A confirmation element checks whether or not recording paper has been inserted within the calculated wait time.

Using the invention, it is possible to set a length for both a wait time for insertion of paper and a desired time interval between when the recording paper is detected until transport commences, thus facilitating selection of the recording paper positioning time according to the skill of printer device operators in the POS field. Furthermore, where multiple cash registers are connected to a host computer, the recording paper positioning time can be set in advance for each individual cash register.

The novel features of the invention may be better understood from a review of the following description when taken in conjunction with the accompanying drawings, in which like numbers refer to like parts and in which:

FIG. 1 illustrates a function block diagram of one embodiment of the present invention;

FIG. 2 illustrates a flowchart of the recording paper positioning process used for the invention;

FIG. 3 illustrates a block diagram of a control circuit for a printing device mechanism constructed and

operating according to the principles of the invention;

FIG. 4 illustrates a simplified diagram of one embodiment of the printing device mechanism of the invention;

FIG. 5 illustrates a flowchart of the overall process followed by the control method of the present invention; and

FIG. 6 illustrates an embodiment of the command structure used to implement the invention.

The following embodiment of the present invention provides a method and apparatus for controlling selection of wait time intervals for recording paper insertion and positioning within a printing device. The printing device is configured to respond to commands and data from a host computer and allow selective control over these intervals for optimizing performance according to operator experience and other factors.

A simplified cross section of one embodiment of the mechanical portion of a printing device constructed and operating according to the principles of the invention is illustrated in FIG. 4. This embodiment has a mechanism capable of printing on at least two types of recording paper, i.e., roll paper and cut-sheet paper. Cut-sheet paper is indicated in FIG. 4 by the numeral designation 170 and roll paper is indicated by 171.

In FIG. 4, the mechanical portion of a printing device is shown using a print head 1, print wire pins 1a (only one is shown), and an ink ribbon 1b. A platen 2 is mounted opposite print wire pins 1a on a support member 5 so that it is

movable back and forth along the directions indicated by arrows A and B. This movement is accomplished by pivoting support member 5 about a shaft 5a using a plunger 15 connected to the support. A recording paper drive roller 3 and an opposing auxiliary roller 4 which is supported by said support member 5 are pressed together to provide friction feeding pressure on recording paper 170 disposed between the rollers. Plunger 15 and support member 5 form the principal constituent parts of a printing section open-close or engage-disengage mechanism, which opens and closes over the paper as appropriate. Along with drive and auxiliary rollers 3 and 4, respectively, this structure also constitutes a recording paper transport section 20 for the printing device.

A recording paper drive roller 8, in conjunction with an auxiliary roller 9 pressed against it, is also used for transporting recording paper 170. Auxiliary roller 9 is positioned so that it is supported by a support arm 10 that can be rotated along the direction of arrow C by being pivoted on a pivot point 10a by a plunger 16. Plunger 16, auxiliary roller 9, and support arm 10 form the principal components of a transport section open-close or engage-disengage mechanism, which in conjunction with drive and auxiliary rollers 8 and 9, constitutes a recording paper transport section 30. A recording paper guide plate 11 establishes a paper transport path 13 for recording paper 170.

Cut-sheet paper is generally divided into standard size validation cards and "slip paper" which can be easily copied or duplicated. A frame notch 12 is typically positioned along the periphery of validation cards for positioning, and generally has a structure that allows lateral

insertion, from the side of printing devices, for standard sized cards.

Also shown in FIG. 4, is a type of photosensor 6, having an optical axis 6a, for the recording paper detection element that detects insertion of recording paper, and a stop element or stopper 7 for assisting in the guiding and alignment of cut-sheet paper during insertion. Stop 7 is linked to plunger 16 and is disposed along paper path 13 so that it is movable across the paper path to selectively block or open and close the recording paper path.

Cut-sheet paper 170 is inserted from or along the direction indicated by arrow 22A and is considered positioned in recording paper path 13 when it strikes against stop 7. The presence of recording paper 170 in this position is detected by the fact it crosses or blocks optical axis 6a of photosensor 6, thus changing the amplitude of light received by a detector. When paper is detected, plunger 16 is retracted moving support arm 10 about pivot 10a, which closes recording paper transport section 30, and presses rollers 8 and 9 against opposite sides of recording paper 170. At this point, stop 7 is also moved out of recording paper path 13, typically using a series of lever arms or gears connected to plunger 16, which opens the recording paper path allowing recording paper 170 to be transported to a printing position by drive and auxiliary rollers 8 and 9. When recording paper 170 is transported to the printing position, plunger 15 is retracted to facilitate further recording paper transport by the drive and auxiliary rollers 3 and 4.

The cut-sheet paper is positioned by correctly pushing it against stop 7, when it is in the "pull-in" position across paper path 13. This allows accurate transport of the re-

recording paper. As previously mentioned, the time it takes to correctly position the recording paper differs among printing device operators according to their relative level of experience, among other factors, and there are cases in which problems arise if recording paper transport is begun immediately after insertion is detected. Therefore, the preferred embodiment of the present invention controls the printing device as described below.

As an alternative to cut-sheet paper, a roll paper holder 41 holds roll paper 171 which is ejected from the printing mechanism along the direction indicated by arrow 41B and dotted line 41A.

A block diagram of an exemplary controller found useful for controlling the printing device mechanism described above is presented in FIG. 3. In FIG. 3, a printing device mechanism 100 is shown using a print head 101, plungers 102 and 103, which correspond to 15 and 16 above, a motor 104 that serves as the drive source for recording paper transport, and a recording paper detector 105. A central processing unit (CPU) 60 performs general control of the entire printing device using a ROM 61 to store programs or instructions, etc., that analyze and execute all device and control commands sent from the host computer and are used as part of the control method for the invention. In addition, a RAM 62 is also connected to CPU 60 for temporarily storing data, along with a timer 63 for measuring certain prescribed time periods, and an interface or control command receiver 64 for receiving input print data and commands from the host computer.

Central processing unit 60 uses an I/O port 70 for communicating with various elements in the printing device which it is controlling. Exemplary elements connected to CPU 60

I/O port 70 include a print head controller 71, plunger controllers 72 and 73, a motor controller 74 and a recording paper detection circuit 75. Detection circuit 75 is also connected to the recording paper detector 105, which detects the presence or absence of recording paper in the transport path.

CPU 60 receives data from or through interface 64, and while analyzing this data, controls printing device mechanism 100 based on that data so that prescribed printing operations are executed. That is, CPU 60 prepares printer data, generally the letters and numbers to be printed, by interpreting input data and separates out commands from the print data.

Functional operations for the invention are illustrated in the block diagram of FIG. 1. In FIG. 1, data transferred to input interface 64 is analyzed or interpreted by a data analyzer 151 and the results stored in a preselected area or address range in RAM 62, acting as a transient memory unit, using a data storage controller 150. If time setting commands for either a cut-sheet paper positioning period or interval, or a recording paper insertion wait interval are contained in the input data, the interpreted interval values are also temporarily stored in RAM 62. When the input data contains instruction to print on cut-sheet paper, then the printer, or CPU 60, waits for insertion of recording paper before printing is commenced by CPU 60.

However, if a maximum time interval for waiting for recording paper insertion is set at this point by a time setting command, then the prescribed parameters or limits for this time interval are retrieved or read out by data storage controller 150 and converted to time data, start and stop times etc., by a timer controller 140 including a calcula-

tion element. A second timer 152 is then activated and set to count an interval based on this data. A recording paper detection unit 153 waits for, or seeks to detect, insertion of the recording paper while second timer 152 is activated and counting. When insertion of recording paper is detected, time interval data defining a paper positioning time and previously set by the wait time setting command are retrieved or recalled from data storage. This data is also converted to time data by timer controller 140, and then used to set prescribed time interval to be measured by a first timer 154.

Timer 152 measures the paper insertion wait time set by the host computer for cut-sheet paper insertion while timer 154 measures paper positioning time or pause interval set for starting operation. The parameters for these intervals are provided by the host computer, unless default values are used, and stored in RAM 62, along with other data as required, until needed. A timer or timing circuits built into CPU 60 is generally used for implementing the timers.

A recording paper positioning confirmation unit 155 confirms whether or not recording paper is correctly positioned after the preselected paper positioning time interval has elapsed, and if so printing control is transferred to printing mechanism controller 156. Printing mechanism controller 156 comprises a recording paper transport section open-close mechanism 157, recording paper transportor 158, and a printing controller 159, which act to sequentially transport and print data on cut-sheet paper 170. Otherwise, if no recording paper is detected after a time interval measured by second timer 152 elapses, then a warning indicator, light, buzzer, or similar annunciation or attention seeking element is activated or generated by error processor 160 to indicate a recording paper positioning

error to a printing device operator. At the same time, the error can be recorded as error detection data in memory along with operator identification or other relevant information to track historical efficiency patterns.

If no setting for wait time intervals is made by an appropriate command, a set of default values are provided which are then used. While similar to the previously discussed fixed intervals of the prior art, these periods represent settings that are flexible and can be readjusted or set using appropriate host computer commands, at any time.

The more complicated positioning process needed for recording paper 170 is not normally required for roll paper 171, and printing is executed directly from data analyzer 151 via printing controller 159.

A flowchart of the overall process steps executed by the control method of the invention is illustrated in FIG. 5, in relation to printing on cut-sheet paper. In FIG. 5, print instructions are received in a step 201, while print data is stored in RAM 62, substantially at the same time. Initialization of the printing device mechanism is then executed in step 202 and plungers 15 and 16 are extended to open the printing section and recording paper path in step 203. In a step 204, it is checked which of the printing modes is set, that is, which recording paper type is selected.

When slip mode is selected, the output level of detector 6 (Fig. 4) is checked to determine whether or not recording paper has been positioned in the printing mechanism (step 205). If paper is positioned in the printer, the optical beam used by the detector is blocked and the output of detector 6 changes accordingly. In the preferred embodiment,

interruption of the optical light source generates an "OFF" condition or state in detector 6. Therefore, the printer waits in the initial paper insertion mode until detector 6 switches OFF. After detector 6 switches OFF, plunger 16 is retracted in a step 206 and form stop or stopper 7 is released and moved out of paper path 13, thus allowing the recording paper to be transported.

Recording paper 170 is then transported in a step 207 to the printing section where the leading edge of the recording paper is positioned relative to the print head. Then, plunger 15 is retracted in a step 208, which closes the printing section and enables printing. At the same time that the print head is driven (printing) and recording paper is being transported (step 209), the point at which the end of slip or recording paper 170 passes the detector is determined (step 210). The length of paper that has passed the detector is measured. When detector 6 changes to an "ON" state, that is, paper 170 is no longer present in the optical path of the detector, a predetermined length of paper is transported through the printer until a predicted margin position is reached. The amount or length of recording paper required for a desired minimum remaining printing margin, blank line, is stored at a preselected address in memory, here RAM, and set in step 215 and is used in conjunction with the measured length of paper passing detector 6 to perform a calculation in synchronization with transport of the recording paper to determine when the margin is reached and printing should end. The printing device print head is driven using input print data and recording paper is transported in front of the print head until either the end of the print data or the printing margin is reached (steps 216, 217, 218). In a step 219, the recording paper is transported a prescribed amount and in a step 220 the printing operation is terminated.

In the same manner as in the slip mode, the printer device pauses in validation mode until recording paper has been positioned in a step 211, and once it has been positioned, plunger 15 is retracted in a step 212. In this embodiment step 7 has a structure that it is pushed away when a validation card is inserted and so does not require retraction of plunger 16. It does not regulate validation cards when inserted from the top or side of the printing mechanism, which also allows their easy removal. Normally, control over positioning of the leading edge of the recording paper is not required in validation mode. Validation cards use dimensions that automatically align or position an appropriate printing region of the card adjacent to the print head when the paper is inserted all the way to the bottom of notch 12, and transport is only executed by the amount of the recording paper transport code contained in the print data. In steps 213 and 214, delivery of print data to the print head and recording paper transport are repeated or continued until detector 6 switches ON. The remaining steps of the validation mode process are the same as in those of the slip mode.

A flowchart for steps 205 and 211 of FIG. 5, as used in the recording paper positioning process of the invention, are described in further detail in FIG. 2. As seen in FIG. 2, after a print instruction, initialization of the printing device mechanism is executed and wait interval timer is started in step 301 to measure the maximum time to wait for insertion of recording paper. This is the activation of the second timer 152 discussed above.

The paper insertion detector is checked and its status confirmed in a step 302 to see if it has entered the OFF state, thus, indicating insertion of recording paper. Once

the detector is checked in sub-step 303 of step 302, an OFF state or condition for the detector is confirmed by checking its status again in a step 305, but after a delay time of several milliseconds has been implemented in step 304. These delay time and confirmation steps are used to prevent printer device mis-operation due to transient detector noise or errors which briefly and incorrectly indicate paper insertion. After the status of the detector is confirmed as OFF, i.e., insertion of recording paper is confirmed, another timer is activated or operated in a step 307. This is the activation of the first timer described earlier. After lapse of the time interval measured by the timer in step 307 reconfirmation of existence of the recording paper (by means of paper detector 6) is executed in step 308 to establish that the recording paper has been positioned. Step 308 allows for confirmation prior to commencement of paper transport. Steps 303 to 308 are repeated until either paper detection is confirmed in step 308 or the wait time exceeds the time as prescribed in step 301.

After recording paper positioning is completed, control of the printing device mechanism begins, and the open-close mechanism for the recording paper transport section is operated and moved to the closed position in a step 309. The recording paper is then transported to a printing position with a leading edge appropriately positioned in a step 310 adjacent to the print head. When the recording paper is positioned in the desired printing position, the prescribed printing operations are then executed in a step 311. When validation paper is used, the leading edge positioning process for the recording paper (see step 310) is not executed.

When the wait time exceeds the time as prescribed in step 301, printing is disabled and the appropriate warning mes-

sage or indication provided, or other system action taken (step 312), to warn a printing device operator of an error in processing.

During operation of the above timers, a sufficient period of time is allocated for an operator to correctly position recording paper in the prescribed recording paper position of the printing mechanism. The length of this wait period is conveniently set by preselected commands from the host computer.

An example of a command structure found useful for implementing the present invention is shown in FIG. 6. In FIG. 6, a command 401 for setting a wait interval or period of time for insertion of the recording paper and an appropriate pause or period of time before recording paper transport occurs or printing begins after insertion, i.e., recording paper positioning time, is shown. It should be noted that a single command or different commands can be used to set these two intervals.

The command code structure of command 401 is preferably sub-divided into at least three portions. The first portion of command 401 is "ESC f", which indicates the type of command. That is, what the remainder of the parameters in the command are being provided for or what operation they are associated with. In the preferred embodiment, "ESC f" is defined or interpreted as a cut-sheet paper wait time setting command, and when this code is read by the command analyzer, it is interpreted as both a recording paper insertion wait time and positioning time setting command.

A first parameter 402 is illustrated by the letter "m" and indicates a desired setting for the recording paper insertion wait time and, for example, is typically set in incre-

ments of one minute each. Therefore, in this embodiment parameter 402 is set as a total of m minutes. A second parameter 403 is illustrated by the letter "n" and indicates a desired setting for the paper insertion interval, i.e., the wait interval from when insertion is detected until transport of, or printing on, the recording paper begins, and, for example, is set in increments of one-tenth second each. Therefore, in this embodiment parameter 403 is set as a total of $n \cdot 0.1$ seconds. In this embodiment, if m is set equal to 5 and n is set equal to 10, then the wait times for cut-sheet paper insertion is 5 minutes and starting operation is 1 second, respectively.

However, those skilled in the art will readily recognize that other time intervals as best suited to particular application or hardware can be used within the teachings of the present invention. The intervals indicated by these parameters are determined by criteria established in advance by the calculation element, connected to or part of the CPU, and are measured using the appropriate timer. Preferred default values for these parameters are $m = 0$, infinite wait time, and $n = 10$.

The times indicated by the parameters m and n in the wait time setting command are interpreted or detected by data or command analyzer 151 and temporarily stored by memory controller 150 in RAM 62 for later retrieval by the corresponding timers. These command parameters are typically each configured using one byte of information for a two-byte command parameter length, but two or more bytes can be used as desired.

As described above, using the inventive configuration allows selection of two or more recording paper insertion times, thus facilitating establishment of wait intervals

according to operator experience and contributing to improved work efficiency. The ability to tailor wait times according to operator experience makes them extremely useful. Furthermore, since this positioning time is settable or selected by a host computer command, it is also settable independently for each site; e.g., it can be set according to the experience of register operators in locations where there are many registers lined up in a row, such as in a supermarket.

Setting the minimum and maximum recording paper insertion wait times, allows the host computer to perform other operations without having to wait indefinitely for insertion of the recording paper, even if not inserted, thus improving the operating efficiency of the computer when many POS terminals are controlled by one host computer. In addition, when insertion of the recording paper is late or delayed, warnings can be generated and other processing performed while a response is pending. The recording paper insertion wait and recording paper positioning times can both be set with the same command, thus offering greater convenience in program control by a host computer.

Since the wait time for cut-sheet paper can be controlled by a control command, even if a user enters the cut-sheet paper mode by mistake, if a wait time for cut-sheet paper has been set, the mode can be escaped from after the set time elapses by sending a control command from the host computer. No operator switch operation is required to restart operation, and even if the cut-sheet paper is inserted incorrectly, if a wait time for starting operation has been set, the paper can be re-inserted correctly before the set time elapses.

What has been described is a new technique for controlling a printing device such as a POS-type printer which allows more efficient use of wait intervals for paper insertion and transport.

The foregoing description of a preferred embodiment was presented for purposes of illustration and description. It is not intended to be exhaustive nor to limit the invention to the precise form disclosed, and many modifications and variations are possible in light of the above teaching. For example, other time intervals may be selected or the timers implemented using software generated timers or delay elements instead of a timer built into the CPU. The embodiment was chosen and described to best explain the principles of the invention and its practical application to thereby enable others skilled in the art to best utilize the invention in various embodiments and with various modifications as are suited to the particular use contemplated.

**Claims:**

1. A printing device comprising
printing means (1, 101) for printing on recording
paper (170, 171);
paper detection means (6, 105, 153, 75) for detecting
the presence or absence of paper inserted into the printing
device;
paper transport means (20, 30) for moving paper adja-
cent and past said printing means;
timing means (63, 154) connected to said detection
means, paper transport means and printing means for star-
ting paper transport and printing when a first time inter-
val for recording paper positioning has elapsed after re-
cording paper has been detected; and
means (150, 151) for variably setting the length of
said first time interval.
2. The printing device of Claim 1 further comprising
means (140) responsive to a print instruction for
producing an error signal if no recording paper is detected
within a second time interval that defines the maximum wait
time for recording paper insertion.
3. The printing device of Claim 2 further comprising
means (150, 151) for variably setting the length of
said second time interval.
4. The printing device of Claim 1, 2 or 3 wherein
said timing means comprises at least a first timer (154)
configured to count said first time interval and a second
timer (152) configured to count said second time interval.



5. The printing device of any of Claims 1 to 4, further comprising:

an interface (64) connected to a host computer for receiving various commands from a set of predefined commands, print data, and other data strings therefrom, said set of predefined commands including at least one time setting command for setting the length of at least said first time interval;

analyzing means (151) for interpreting received data and commands;

memory means (62) for reading and storing analyzed data indicating the length of at least said first time interval as specified by a time setting command and providing said data to said timing means for measuring the time period specified by the stored data; and

control means (140, 155) for operating the timing means, for confirming detection of the recording paper and paper positioning, and for initiating paper transport and printing.

6. The printing device of Claim 5 in combination with claim 3 or 4 wherein the lengths of said first and second time intervals are set by a single time setting command.

7. The printing device of Claim 6 wherein said memory means (61, 62) comprises:

first memory means (62) for reading data defining the length of said first time interval as specified by the time setting command and storing it;

second memory means (62) for reading data defining the length of said second time interval as specified by the time setting command and storing it; and further comprising:



first timer means (154) for measuring elapsed time based on the data stored in the first memory means;

second timer means (152) for measuring elapsed time based on the data stored in the second memory means;

first activation means (140) for starting the second timer means and for confirming whether or not the recording paper was inserted within said specified second time interval for recording paper insertion; and

second activation (140) means for starting the first timer means.

8. The printing device of any of Claims 6 to 7 wherein:

said time setting command comprises a two-byte length command parameter;

said analyzing means (151) is configured to interpret one byte as a command parameter indicating the length of said second time interval as the wait time for recording paper insertion and the second byte as command parameter indicating the length of said first time interval for recording paper positioning; and

said memory means (62) stores the interpreted parameters.

9. The printing device of any of Claims 5 to 8 further comprising

calculation means (140) for calculating said first time interval or said first and second time intervals, respectively, based on the stored parameters; and

confirmation means (140, 155) connected to the paper detection means (6, 105, 153) for checking whether or not recording paper (170) has been inserted within said time interval or time intervals calculated by the calculation means from the start of waiting for recording paper insertion.



10. The printing device of any of the preceding Claims wherein said paper transport means has a transport section open-close mechanism (15, 16) to open and close the recording paper path (13) and a recording paper transport roller means (3, 4, 8, 9), and a recording paper transport control means (60) for confirming the positioning of the recording paper and then operating the transport section open-close mechanism, holding the recording paper so that it can be transported, and driving the recording paper transport roller.

11. A method of controlling printing on cut-sheet type paper in a printing device, comprising the steps of:

- a) selecting the length of at least a first time interval for paper positioning;
- b) detecting the presence or absence of paper inserted in the printing device;
- c) measuring said first time interval beginning with detection of paper; and
- d) initiating paper transport through a printing section that prints data on the paper after passage of said first time interval.

12. The printing control method of Claim 11 further comprising the steps of

- e) selecting the length of a second time interval that defines the maximum time period allowed for paper insertion;
- f) detecting the presence or absence of paper inserted in the printing device while measuring said second time interval; and
- g) producing an error signal when no paper is detected within said second time interval.



13. The printing control method of Claim 11 or 12 further comprising the steps of:

h) confirming the presence or absence of recording paper after said first time interval has elapsed; and transporting the recording paper for printing when it is determined that paper is present.

14. The printing control method of claim 13 wherein steps b), c) and h) are repeated when no paper is detected as being present in step h).

15. The printing control method of any of Claims 11 to 14

wherein step a) comprises:

receiving various predefined commands, print data, and other data strings from a host computer, at least one command being a time setting command for setting the length of at least said first time interval;

interpreting the received data and commands;

storing interpreted data indicating the length of at least said first time interval as specified by a time setting command; and

wherein step c) comprises:

measuring a first time period specified by the stored data.

16. The printing control method of Claim 15 in combination with claim 12 wherein said step of storing comprises the steps of:

storing data defining the length said first time interval as specified by the time setting command in a first memory location;

storing data defining the length of said second time interval as specified by the time setting command in a



second memory location; and further comprising the steps of:

- starting a second timer for measuring elapsed time for insertion of paper based on the data stored in the second memory location;

- detecting whether or not paper is inserted during said second time interval and, if so

- starting a first timer for measuring elapsed time based on the data stored in the first memory location upon paper detection.