

"SERIAL PRINTER"

The present invention relates to a serial printer.

In the prior art, a serial printer incorporating a microprocessor is equipped with a watchdog timer as a countermeasure against run-away of the microprocessor. This watchdog timer is programmed to be cleared at a certain frequency when the microprocessor is in normal operation, but not when the microprocessor runs away. When a predetermined value is reached by the times, a malfunction is detected and the microprocessor is reset.

The watchdog timer of the existing serial printer is cleared in response to a clearing instruction of the program, when the microprocessor is in normal operation. When the number of clearing instructions is small, the watchdog timer may reach the predetermined value even in the normal operation of the microprocessor. The microprocessor may then be reset unnecessarily. When the number of clearing instructions is large, on the contrary, the watchdog timer may be cleared and thereby may not reset the microprocessor even if the microprocessor runs away. Thus, it is difficult to time the generation of the clearing instructions in the program. Consequently, it becomes impossible to say that run-away of the microprocessor will be accurately detected without fail.

An object of the present invention is to provide a serial printer, in which detection of run-away of a microprocessor is improved.

The present invention provides a serial printer, which detects run-away of a microprocessor by detecting the movement or position of the printing head.

According to the present invention, there is

provided a serial printer comprising a motor for driving a printing head, a microprocessor for controlling the motor, a signal generator controlled by the microprocessor for generating signals for actuating the motor, means responsive to the signals from the signal generator for monitoring the movement and/or the position of the printing head, and a detector operable to reset the microprocessor in response to an output from the monitoring means representing a malfunction.

Preferably, the monitoring means comprise a counter for monitoring the movement or position of a printing head by counting in response to the signals from the signal generators, and the detector detects a malfunction when the value of the counter reaches a predetermined value.

The present invention will be described further by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is a block diagram showing one embodiment of a two-way printer according to the present invention; and

Figure 2 is a block diagram showing another embodiment of a two-way printer according to the present invention.

In Figure 1, there is shown a printer having a carrier motor 1 for moving a printing head, and a microprocessor 2 for a variety of controls. A signal generator 3 including a timer controlled by the microprocessor 2 is provided for generating signals for driving the carrier motor 13, and a counter 4 counts or records the movement of the printing head in response to the output signals from the signal generator 3. This counter 4 is cleared at the end of each movement of the printing head. A latch circuit 5 latches a value which

is calculated by the microprocessor 2 on the basis of the count value of the counter 4. A malfunction detector 6 is provided for detecting a malfunction, when the count value of the counter 4 reaches a predetermined value, in order to reset the microprocessor 2. A printing head direction deciding circuit 7 serves for deciding the movement direction of the printing head.

The operation of the printer will now be described.

When the power supply (although not shown) is turned on, the carrier motor 1 is driven by the microprocessor 2 to move the printing head to a predetermined start position, e.g. the lefthand side of a piece of printing or recording paper, and the counter 4 and the latch circuit 5 are reset. Next, in response to a printing instruction, the microprocessor 2 sets the signal generator 3 with a predetermined timing value to start the counting. When the set timing value is reached, the signal generator 3 sends the output signal to the counter 4 and the microprocessor 2. In response to this output signal, the counter 4 increments its count value, and the microprocessor 2 drives the carrier motor 1 to move the printing head to the right by one step. The operation thus far described is repeated to accomplish rightwards printing. When this printing operation is completed, the counter 4 is caused by the microprocessor 2 to have its count value latched in the latch circuit 5 and then its contents are cleared.

In the present embodiment, rightwards movement of the printing head is set to be the plus direction, whereas leftwards movement is set to be the minus direction. In accordance with these definitions, the direction of movement of the printing head is decided by

the direction deciding circuit 7. When the rightwards movement is ended by the microprocessor 2, the count value of the counter 4 is added to the existing count value in the latch circuit 5, and this addition is newly
5 latched in the latch circuit 5. At the end of the leftwards movement, on the other hand, the count value of the counter 4 is subtracted from the existing count value of the latch circuit 5. For example, in the case that the printing head is moved to the right by 500
10 steps and then to the left by 300 steps, the microprocessor 2 calculates $500 - 300 = 200$, which is latched in the latch circuit 5. Thus, the position of the printing head is latched in the latch circuit 5.

When the microprocessor 2 runs away, and thus the
15 count value of the counter 4 reaches a predetermined value, namely when the movement of the printing head exceeds the distance from the lefthand extremity to the righthand extremity of the printer, a malfunction is detected by the malfunction detector 6 and the
20 microprocessor 2 is reset.

Figure 2 shows another embodiment of the present invention, which differs from the embodiment of Figure 1 only in that the carrier motor 1 is moved step-by-step by a drive circuit 8 each time the output signal is
25 supplied by the signal generator 3.

In the embodiments thus far described, a
malfunction is detected on the basis of the movement of the printing head.

Alternatively, however, a malfunction can also be
30 detected in terms of the value of the latch circuit 5.

Incidentally, the counter 4 may be an up-down counter for providing a count value representing the position of the printing head, whereby a malfunction may be detected when the value of the counter 4 exceeds a

predetermined value.

5 According to the present invention, the problem of selecting the timing for generating clearing instructions in the program in the known serial printer, wherein runaway of the microprocessor is detected by means of the watchdog timer, is eliminated and runaway of the microprocessor may be detected more reliably.

CLAIMS

1. A serial printer comprising a motor for driving a printing head, a microprocessor for controlling the motor, a signal generator controlled by the microprocessor for generating signals for actuating the motor, means responsive to the signals from the signal generator for monitoring the movement and/or the position of the printing head, and a detector operable to reset the microprocessor in response to an output from the monitoring means representing a malfunction.

2. A printer as claimed in claim 1 in which the monitoring means comprise a counter.

3. A printer as claimed in claim 2 in which the monitoring means further comprise a latch circuit for latching an output from the counter.

4. A printer as claimed in claim 2 or 3 in which the detector is arranged to reset the microprocessor when the count value of the counter reaches a predetermined value.

5. A printer as claimed in claim 3 in which the detector is arranged to reset the microprocessor when the contents of the latch circuit reach a predetermined value.

6. A serial printer comprising:

a carrier motor for driving a printing head;

a microprocessor for controlling the drive of said carrier motor;

a signal generator controlled by said microprocessor for generating a signal for the drive of said carrier motor;

a counter for counting the movement of said carrier motor in response to the output signal of said



signal generator; and

a malfunction detector for detecting a malfunction, when the value of said counter reaches a predetermined value, to reset said microprocessor.

7. A serial printer substantially as herein particularly described with reference to and as illustrated in Figure 1 or Figure 2 of the accompanying drawings.
