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## **A LPT Bit Pattern Generator**

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### **1. Basics**

As an experienced BASIC-Tiger® user you know RS232 interfaces. Using a PC also the LPT interface (line printer) alias parallel port, printer port or Centronics interface is not new to you. Tiger-BASIC® offers device drivers which make this interface also usable for BASIC-Tiger®. The LPT interface's main task has always been to drive printers. But this will not be the topic of this application note. We will use the PC's LPT interface as a means for electronic experiments, which is supposed to save the electronics amateur (and anyone working with BASIC-Tiger®) a lot of work.

For instance when constructing a circuitry with a BASIC-Tiger® or develop a program for it, which is supposed to evaluate the information at an 8-bit port you are confronted with the problem of bringing 8 lines to each required level quickly. So you start building a small auxiliary circuit with 8 DIP switches, which e.g. can switch the level to high and switch the level to low by using pull-down resistors if the switch is open. This is quite time-consuming – let alone the effort of setting those 8 DIP switches...

What about comfortably handling all this via the PC? This would enable us to check programs or circuits quickly, to analyse the logic behaviour and also to save plenty of time in other areas outside the BASIC-Tiger® world. The LPT interface lends itself to take over those tasks.

In contrast to the RS232 interface, which is actually a fossil, the LPT interface has been through some considerable changes and enhancements in the course of time. Therefore it has become quite modern and it meets high speed and variability requirements – an up to date PC provided. One major advantage compared to the RS232 is the operation at ordinary TTL levels. We remember that the RS232 interface operates at +15 V and -15 V levels! In addition levels can be applied and evaluated statically. Serial interfaces are different – you cannot watch a whole byte without ruffle, with neither old RS232 nor latest USB interfaces. Thus the LPT interface operates similarly to a BASIC-Tiger® port. In the face of so many advantages you may expect a snag to it. There is one– this perfect PC data port can only be programmed by experts for electronic experiments. You will need a program (preferably under Windows®) which allows access to this port which was actually designed for printing.

#### **1.1. Facts worth knowing about the LPT interface**

At first the LPT interface was developed only for printer operation during the 70s. Even today virtually every PC has such a connection. Although there are 3 different connector systems, PCs usually only provide one 25-pin SUB-D socket (figure 1). The other connectors (fig. 2 and 3) have only been established on the printer's side.



Fig. 1 25-pin SUB-D socket  
(Type A, PC side)



Fig. 2 Centronics plug  
(Type B, printer side)



Fig. 3 Miniature Centronics  
plug (Type C, printer  
side)

When connecting please note the following. For the RS232 interface two connector standards have established. There is a 9-pin and sometimes also a 25-pin SUB-D connector, so confusions can occur! In contrast to the LPT interface which has a 25-pin socket (female), RS232 interfaces at the PC always have a plug (male). Whereas LPT interface's connector systems have maintained a certain consistency, the LPT interface's operational modes have been enhanced in the course of time. The following modes currently exist:

(Further very interesting information about the Centronics interface can be found on:

[http://ac16.uni-paderborn.de/arbeitsgebiete/messtech/elektro\\_grundlagen/schnitt/index.html](http://ac16.uni-paderborn.de/arbeitsgebiete/messtech/elektro_grundlagen/schnitt/index.html)

Some parts of this application note have arisen from this source. Note: German language)

#### The SPP mode (Standard Parallel Port)

- In this mode data are transmitted via an 8 bit port as it is done with the original Centronics port. In the so-called nibble mode data can be read back into the computer in addition.

#### The Byte mode (also called bidirectional mode or PS/2 mode)

- Byte mode's performance specifications and register allocations are identical with those of the SPP mode. The difference lies in the possibility to use data lines for transmitting and receiving data due to an additional set bit.

#### The EPP mode (Enhanced Parallel Port)

- Apart from the 8 bit bus this port has nothing in common with the original Centronics port any more. The EPP mode allows the transmission of both data and addresses as well as an interrupt handling. Here, instead of the software, the EPP hardware controls the handshake.

#### The ECP mode (Enhanced Capability Port)

- In addition to the features of the EPP mode, the ECP mode is able to compress data.

Die LPT interface's functionality can usually be set via the PC BIOS. However, the settings of the LPT interface have no effect on our project. We will simply output an 8 bit word and, if necessary, an impulse on an additional line.

## 2. The PC program "LPT01.TST"

Like in former application notes TestPoint® is again the basis for the runtime module "LPT01.TST", which is attached to this note. You can take another look at application note 31 "BASIC-Tiger® and PC programs" to make sure. Then start SETUP.EXE and follow the

installation instructions. Simply ignore the request to insert new discs. If everything goes right the program will report as follows:

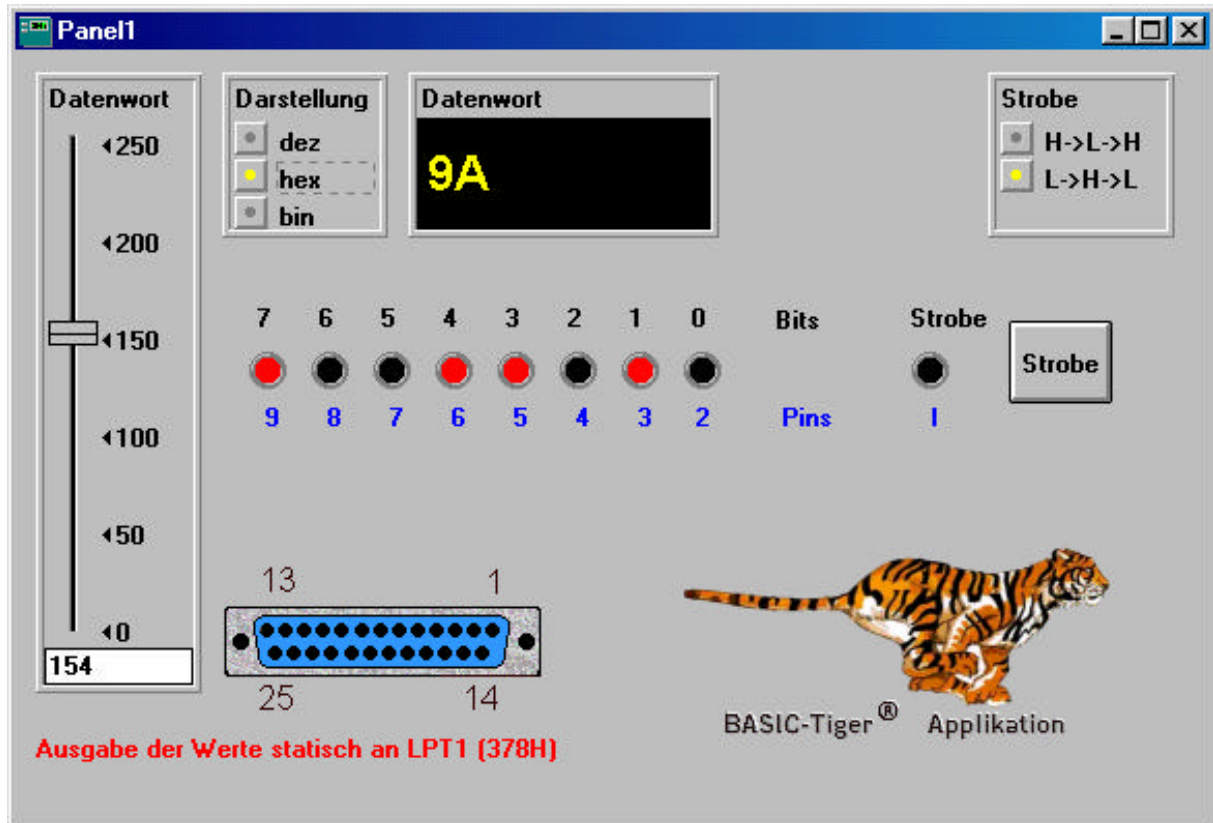


Fig. 4 TestPoint<sup>®</sup> Runtime module LPT01.TST operating

The program is mostly self-explaining, however, we will add some explanations. The program is based on a slide control that allows setting a value between 0 and 255 via the mouse. Right of the slide control there is an input field which allows choosing the numerative system of the given value (decimal, hexadecimal, binary) which is displayed on the right side next to it. This is not sensational yet – much more important is the fact that the value is transmitted to LPT1 as static bit pattern at once. The pins at the PC SUB-D socket (or at the 1:1 extension cable) belonging to the according bits (labelled in black) are displayed in blue. The type of counting is displayed on the left bottom.

So what about the right side? Here you will find a button “Strobe” which allows you to additionally send an impulse to the LPT port pin. You can choose between low or high idle levels. By pressing the button “Strobe” the idle level’s polarity is reversed for about 100 ms and then returns to its original position. Like this you can set off one single impulse via mouse click on this button – bounce-free! Both settings can be done independently.

Some more advice on the setting possibilities of the slide control:

- Keep it simple by using the mouse – aim at the control knob, press the left mouse button and slide.

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- The next procedure is more sensitive. After clicking the control knob, set the value using keys “up” and “down”, this allows setting in single steps. Please keep in mind that the slide control is deactivated when you actuate another control element in between. So first click the control knob again!
  - Enter value directly into the input field.

The presented tool may be simple, it is, however, a great help for the laboratory. It will help everytime you need a few bits for setting or testing a circuitry. The additionally available impulse is bounce-free and its polarity can be set. It can be used as e.g. a transfer impulse.

**Finally some security advice. The small program LPT01.TST operates LPT1 on a very low level. There are no checkups whatsoever, e.g. what is connected to LPT1, if there are short-circuits or if the device accepts these bit patterns etc. So please disconnect all devices possibly connected (also dongles, if applicable) before starting the experiment! Only connect your own circuitries to the control lines of LPT1 via protective resistors (e.g. 300Ω), to avoid damage to your PC in case of errors occurring. Data lines (pins 2 to 9) can drive quite a load, such as LEDs over 300 Ω directly - in contrast to the line (pin 1) which we use as a clock line. Please take all common ESD and EMC security precautions!**

Nevertheless – have fun experimenting with LPT1!