BASIC-Tiger® & Video

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1. Another display?

You need a display for almost every micro computer application outputting information. In the case of BASIC-Tiger® developers thought of a simple connection to a modern display at an early stage. We all know the Plug-and-Play-Lab LC display and the capabilities of the matching device driver LCD1.TDD. Wilke Technology versions which offer BASIC-Tiger® together with a graphic LC display and a touch screen are less known. We will discover new areas concerning data output in the present application note. BASIC-Tiger® is supposed to add additional information to an ordinary video signal. This technology is already used by TV sets, camcorders, video recorders, digital cameras and monitoring systems, which additionally overlay texts (time, date, camera setting etc.) on a common video screen. Yet – it is of much more interest to be able to determine the contents of the text to be displayed. We will develop an application which can add an arbitrary text to a running video signal. The video signal's source and its kind of display are irrelevant. Here are some possibilities:

Video source
Miniature CCD – Camera with video output
Video recorder
Digital camera with video output
Satellite receiver

Video display
TV set with video or SCART input
Video screen
Miniature video TFT screen

In this region the PAL system (TV) and the Composite FBAS signal are standardised. So our system has to be compatible with all standard components.

What can be done with such an On-Screen Display (OSD) controlled by BASIC-Tiger®? We can think of the following applications:

- Overlaying date, time, camera designation in a camera monitoring system
- Video title generator or general text input into a running video (subtitles)
- Monitoring experiments which require observing and recording measured values at the same time
- Optical display of parameters e.g. as a bar graph in a video image
- Depicting data of a GPS receiver in a video image (location display)
- Displaying direction specifications of a revolving and swivel-mounted monitoring camera

- Overlay adverts in a video image (shop windows etc.)
- Information systems of all kind
- Simply overlay greetings in the running TV program

We will learn how to implement those applications in the following sections.

2. Digital Text in an Analogue Video Signal – Some Basics

A standard video signal (VBS, CVBS) has always been analogue and has been adapted to the latest conditions during the development of television engineering (e.g. first black and white and later coloured). In Germany we have a 50 Hz frame rate as well as a television field frame which is made of 625 lines and – to make things sophisticated – is composed of two half fields. The compatibility with "old" standards respectively with old TV sets still in use has always been an important point in the course of new developments. Now we are facing two synchronisation brands which every transmitted TV picture has to contain and which tells the receiver when a new picture or a new line in a picture has to be begun with. Additional information which is supposed to be transmitted via the video signal has to orient itself towards the original video signal picture and line impulses.

Figure 1 schematically depicts the video signal (CVBS – Colour Video Blanking Signal) during a field repetition. Figure 2 shows the signal course, here e.g. a colour bar. Brightness values are "hidden" in the amplitude while colour information can be found in the phasing. Synchronisation impulses are negative; the colour burst is used for synchronising a line's colour system.

The line synchronising impulses have a frequency of 15,625 Hz, the picture synchronising impulses have a 50 Hz frequency. Both kinds of synchronising impulses have the same amplitude (blacker than black so to say). The picture synchronising impulses are actually also line synchronising impulses that differ, however, concerning their duration and sequence from "normal" line synchronising impulses. A line blanking pulse has a length of 9 % of a line's length; a frame blanking impulse is 25 lines long. The long frame blanking impulse is again a system of special synchronising impulses having a particular length and particular temporal sequence, which are different in fields 1 and 2 (see fig. 1).

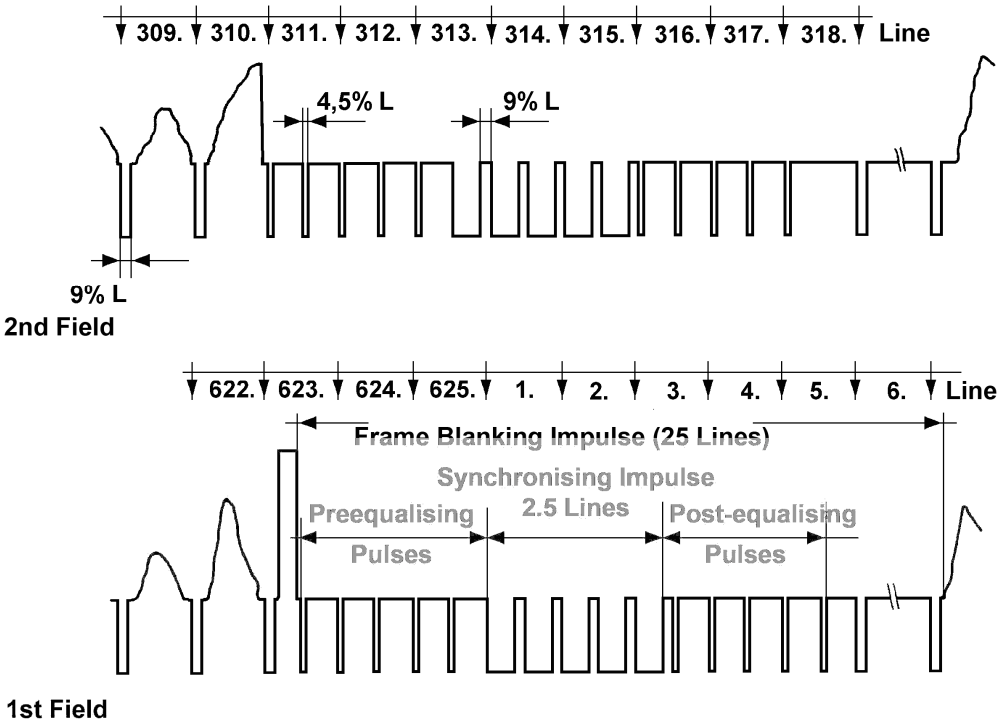

Fig. 1 Picture synchronising impulse sequence (both fields)

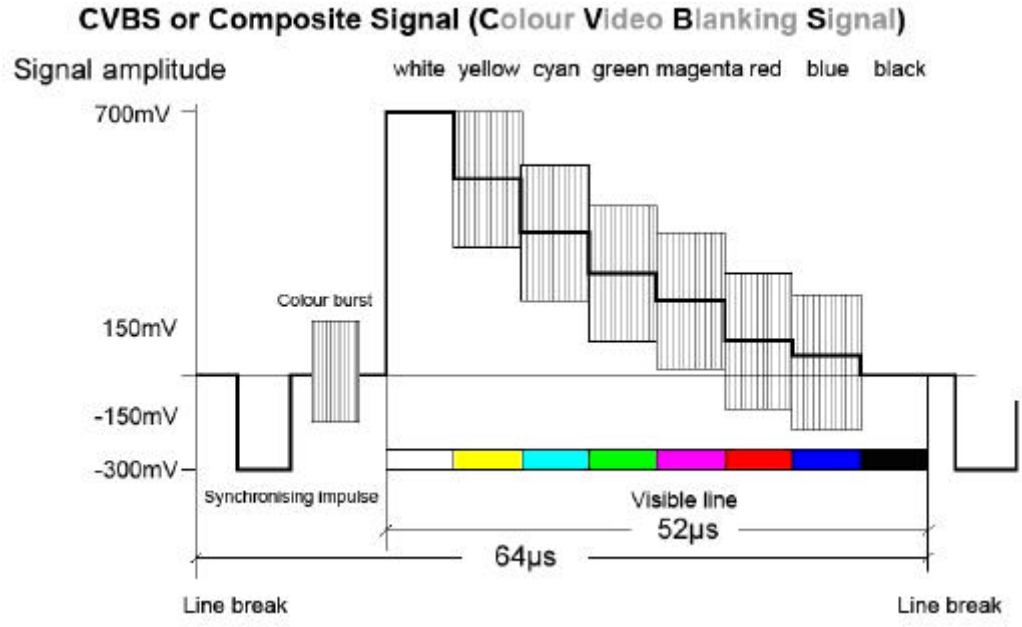

Fig. 2 Colour Video Blanking Signal (one line)

Our circuitry for overlaying extra characters has to be able to “perceive“ when a field is beginning (evaluating the field frequency). Then further information about the character’s

(respectively a pixel of it) vertical target position has to be gained from the line synchronisation impulse. From the temporal condition of a (visible) line which takes 54 µs in total, the horizontal position derivates. Every time an additional pixel is to be drawn the circuitry accesses the current pixel directly and changes its brightness and colour.

Further circuit parts are used for transmission of characters from the BASIC-Tiger® to our system, generating the single letters respectively characters, saving whole text pages etc.

With so many functionalities to be implemented finished ICs and assemblies come as a relief. We should mention components Fujitsu MB88303 and STMicroelectronics STV5730, which are convenient for feeding texts into a video signal. The following sections, however, only deal with the STV5730. A data sheet for this IC is available on the Internet.

Data sheet STV5730: http://us.st.com/stonline/books/toc/ds/99.htm

Anybody dealing with this IC will notice that it is possible to feed text directly into a video signal just using BASIC-Tiger® modules. This is because the STV5730 has a 3-wire serial interface which can be controlled directly by the BASIC-Tiger®. But we cannot do without a circuit board for the chip coming in a SO28 case and for additional HF circuitry.

A finished module (Lechner CCTV) is much easier to handle. It only requires both video signals (original signal in and signal plus text out) as well as a serial RS232 interface. Communication between the RS232 interface and the OSD chip STV5730 is ensured by the module's own micro processing unit AT89C4051. Naturally the module can be controlled not only by the BASIC-Tiger®, but also by the PC or other sources. Information about the finished OSD module 1232 is also available on the Internet.

On- Screen Display 1232: http://www.lechner-cctv.de/elektron.htm

Now you can choose if you want to proceed on a chip level or a module level. In the first case you will spend a lot of effort on the hardware, but you are able to access all STV5730 specialities (e.g. text colour choice). In the second case the hardware is virtually finished, possibilities to display on screen, however, are slightly restricted. Still the author chose using the OSD module 1232. We will demonstrate in the following sections how the components involved can be connected on hardware and software side.

3. The Lechner CCTV OSD 1232 Module

The module uses 7 – 15 V (ca. 60 mA) DC voltage and therefore matches CCD cameras and TFT displays typically used in monitoring systems which are operated with 12 V. Both BNC sockets "video in" and "video out" deliver video levels at 1 V_{SS} and are adapted to 75Ω. The RS232 interface is a 9-pole SUB-D socket. Connection parameters are 1200 baud, 8 data bits, no parity and one stop bit.

Figures 3 and 4 show photos of the module. The STV5730 chip is located on the back side of the circuit board. On the front side you can see the micro processing unit as well as a RS232 levels converter.

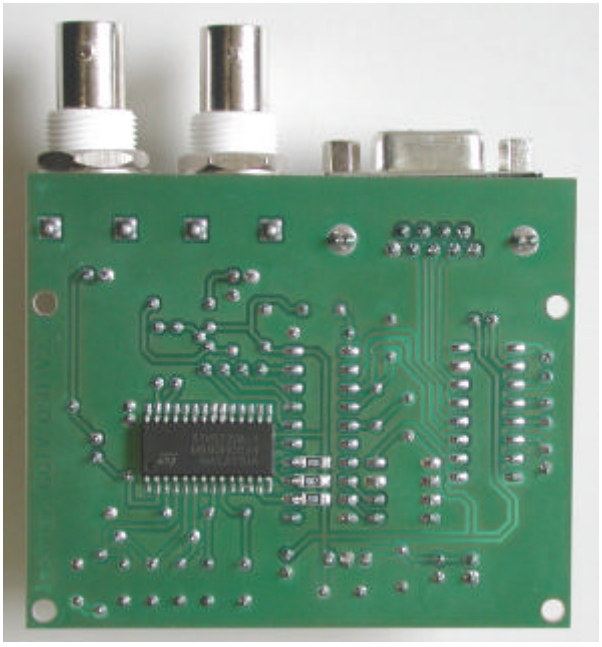

Fig. 3 OSD 1232 conductor side with STV5730

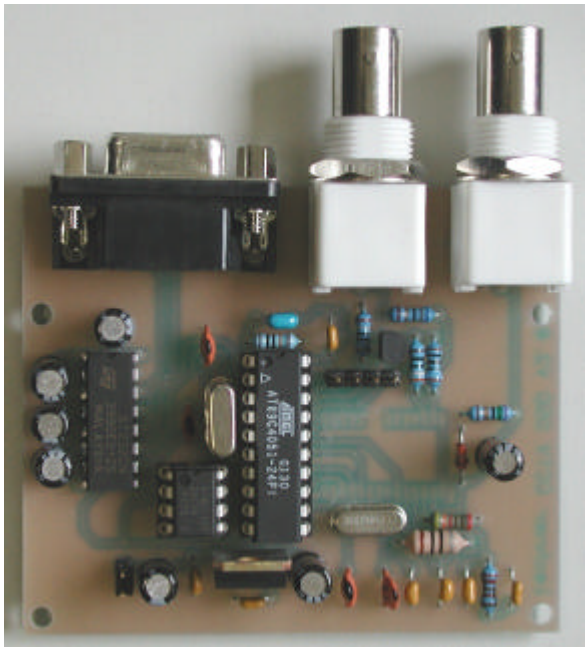

Fig. 4 Component side

A sample for a complete video system is shown in fig. 6: A small CCD miniature colour camera, our OSD module and a small TFT monitor for video signals. The whole thing is of course controlled by the BASIC-Tiger®. The demo programs OSD_UHR.TIG and OSD_TEXT.TIG presented in the following section offer some options for additionally displaying information on a video screen.

For actual operation your BASIC-Tiger® has to contain an integrated RS232 interface or you use the Plug-and-Play-Lab. When using the latter please notice that both partners (OSD-1232 and Plug-and-Play-Lab) contain 9-pole SUB-D sockets. This makes sense for operating the OSD-1232 via a PC, when operating via the Plug-and-Play-Lab you will need a connection piece with two SUB-D plugs, on which both pins 5 on both sides are connected directly and pins 2 and 3 are crossed, all other contacts remain unoccupied (fig. 5).

One more thing about the serial interface of the BASIC-Tiger®: We chose SER1 for our programs, because it is already used for downloading the program in every construction. So always connect SER1 to the OSD module via the adapter according to figure 5!

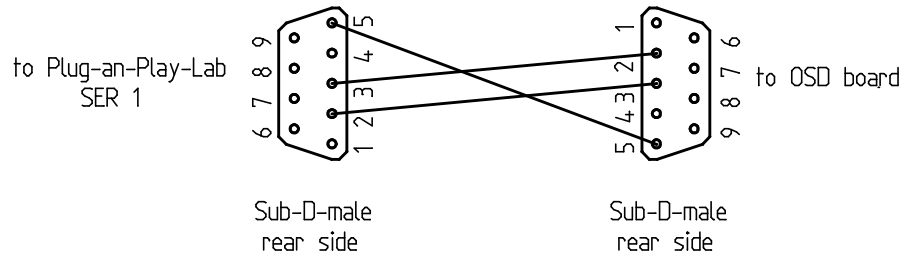

Fig. 5 RS232 Connection piece (2 9-pole SUB-D males)

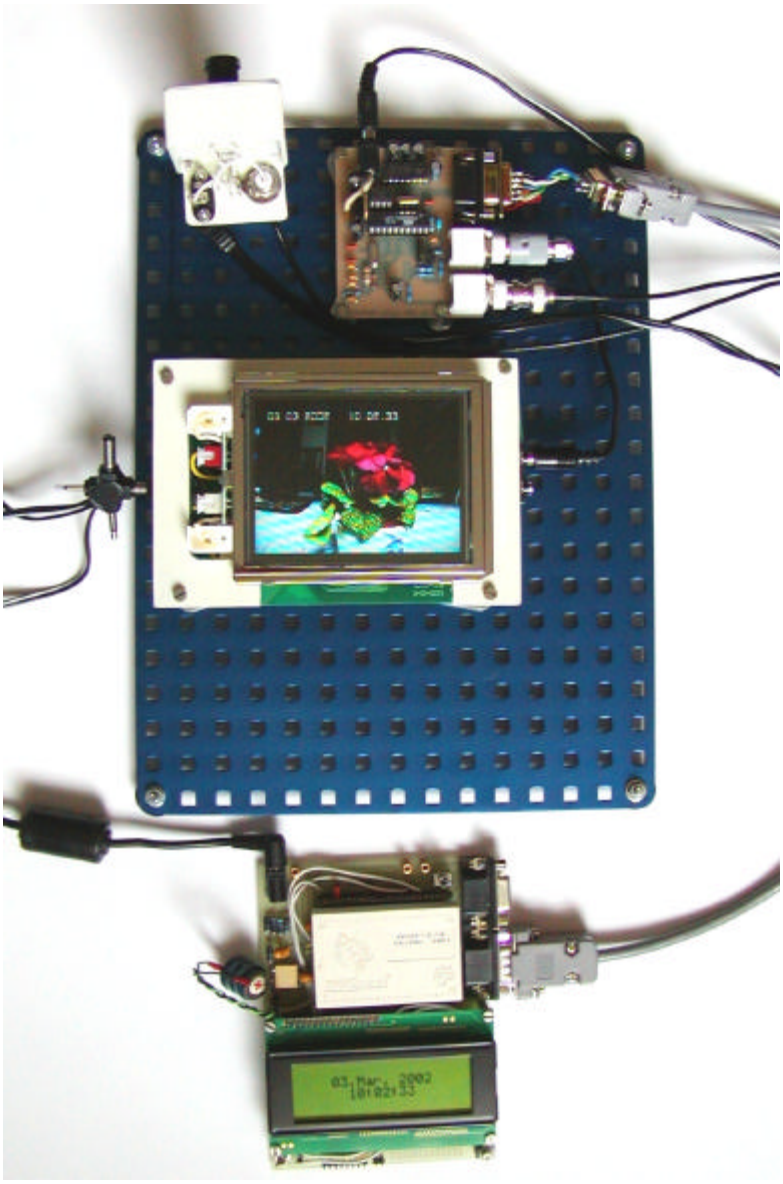

Fig. 6 A complete video system including camera, OSD module, screen and text overlay via BASIC-Tiger®

4. Demo Programs OSD_UHR.TIG and OSD_TEXT.TIG

In this application note we included two BASIC-Tiger® demo programs so you can kick off right away. They present different possibilities to overlay additional information into a video signal.

1.1. OSD_UHR.TIG

The program is based on the complex clock program from the application note "PC time in BASIC-Tiger®". Here time is taken over from the PC and entered into the internal BASIC-Tiger® clock. BASIC-Tiger® then displays the time independently. We included some more lines which control the OSD module. Since we use the OSD module's direct mode only few commands are required:

Control character OSD	ASCII character	BASIC-Tiger®	Effect
CTRL + c	03	CHR$(3)	Clear display and switch to direct mode
CTRL + a	01	CHR$(1)	Top left position
ENTER	13	CHR$(13)	Line breaks
CTRL + v	22	CHR$(22)	Identification äöüÄÖÜ on
All characters			Enter ASCII text directly

The text, i.e. current time and date as well as additionally colons and full stops are rewritten on the display every second. Please note some particularities when operating:
First of all the program checks whether the BASIC-Tiger® module contains a RTC. Then it is checked whether the internal clock has stored a year higher than 2000, which indicates that the clock still works correctly (the clock starts in the year 1980, if the power-on reset is carried out without a buffer battery!). If the time is not correct, the program expects a transmission of time and date from the PC – this takes place using the PC program TICO.EXE (have another look at application note "PC time in BASIC-Tiger®"!). Connect BASIC-Tiger® (SER1) to the COM port of your PC, start TICO.EXE and transmit the time to BASIC-Tiger®. If BASIC-Tiger® displays the correct time, the first step was successful. Now you can disconnect the serial cable from your PC and plug it to the OSD module via an adapter (fig. 5). After taking over time the program OSD_UHR.TIG automatically switches the SER1 baud rate from 9,600 to 1,200 baud, since the OSD module works with this transmission rate. If everything goes right the video screen displays the current time and date.
Time and date is, of course, only one possibility of overlaying text into the video signal. You can as well display analogue input values, a camera designation or anything else.

1.2. OSD_TEXT.TIG

Something completely different is offered by the option of page memorisation, which is included in the OSD module. By using the integrated micro processing unit in the OSD module 1232 you can save and display by command 8 ready-made text pages with 9 lines and

28 characters per line each. This is proper for advertising purposes, for displaying manuals etc. First of all the BASIC-Tiger® program OSD_TEXT.TIG displays the "old" 8 text pages, then deletes them and enters the "new" text into the respective memory page. Afterwards the 8 pages are displayed for 5 seconds each and then the next page is invoked. These are the most important commands:

Control character OSD (keys)	ASCII character	BASIC-Tiger®	Effect
CTRL + d	04	CHR$(4)	Delete currently set memory page
CTRL + n...u	14 - 21	CHR$(14...21)	Invoke and display memory pages 1-8
CTRL + a	01	CHR$(1)	Top left position
ENTER	13	CHR$(13)	Line breaks
CTRL + v	22	CHR$(22)	Identification äöüÄÖÜ on
All characters			Enter ASCII text directly, text is saved

There is not much to say about operating. Just load the program and plug the PC connection cable to the OSD module via the adapter as described in section 4.1. The text to be displayed by the module is contained in the program's source code in 8 string variables which you can customise to your requirements to a large extend.
Once the text is transmitted the OSD module, being in the page memory mode, can do without the BASIC-Tiger®. The text pages are stored in the Flash of the module controller and thus are memorised even in the case of a black out. Using a button (or an impulse) at the module's F2 or F3 connection you can display the previous or next page.

By the way, if you got the impression that this is a bit complex, we would like to give the following advice: The OSD module 1232 is equipped with a small micro processor. If requested the company Lechner-CCTV offers differently programmed OSD modules, alternative controllers or simply different download software (for AT89C4051 DIY programmers). One version offers, in contrast to the standard version, 9,600 baud and direct positioning (line, column) of a string with up to 28 characters. This is the better choice for time-critical applications and for an easier handling. If this is still not enough challenge for you, you can also try controlling the STV5730 directly by BASIC-Tiger®; this will offer you the full functionality.

Now that you caught fire and want to get started bringing texts into video signals there is one problem left: The STV5730 is no longer produced! And there is no new let alone compatible product. Also other producers have difficulties with OSD chips for video applications – which is obviously due to the fact that all potential (industrial) users implement such OSD functions into their highly-integrated chips, which is again problematic for us! However, Lechner-CCTV can still support us with a whole range of modules and STV5730 circuits.

Enjoy experimenting!