basicCON 4115
LVDS Frame Generator

User Manual
(Translation of Original docu)
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1 Installation

1.1 Hardware Installation

Generally hardware installation for basicCON 4115 means connecting the cables for USB (or RS232), LVDS and power supply (see Hardware).

Please make absolutely certain that all of the installation procedures are carried out with your system switched off.

1.2 Driver Installation

For proper installation of the GOEPEL electronic USB drivers on your system, we recommend to execute the G-USB driver setup.
To do that, start the *G-USB-Setup-*.exe* setup program (of the supplied CD, "*" stands for the version number) and follow the instructions.

At present, the available device driver supports Windows® 2000/ 7/ and XP systems.

After driver and hardware installation, you can check whether the devices are properly embedded by the system (for example by means of the Windows® Device Manager):

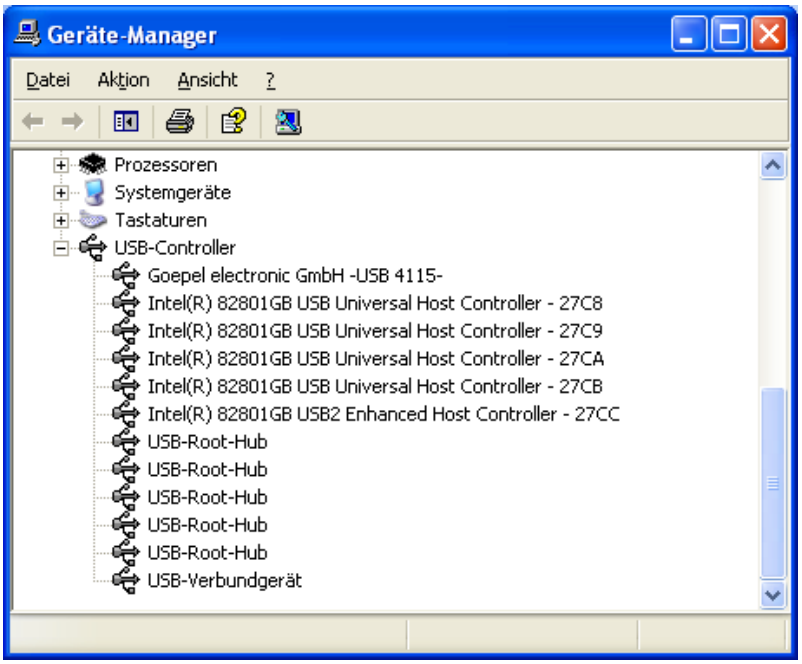

Figure 1-1:
Display of Device Manager

Please note that the Device Manager shows ALL USB controllers supported by this driver.

If required, your basicCON 4115 can also be controlled via the serial RS232 interface.
Then, the G-USB driver setup is not necessary, but the device can NOT be operated by the G-API.

2 Hardware

2.1 Definition

The basicCON 4115 LVDS Frame Generator is a GOEPEL electronic stand-alone device with USB 2.0 interface to be connected to a PC or laptop, in particular developed for applications out of complex test systems.

The basicCON 4115 is especially used in automotive technology to record and evaluate image data transferred by LVDS systems.

The basicCON 4115 device has the following features:

- LVDS data rates up to 3000Mbit/s
- Pixel clock frequency up to 33MHz
  with a color depth of 24 bits
- Maximal 1 Megapixel resolution
- USB 2.0 (if required also RS232) interfaces
- 4Mbyte SRAM working memory
- 32Mbyte Flash ROM image memory
- Changeable LVDS top-board
  Available types: MAX9209, MAX9213, MAX9247, DS90C241, DS90C385A, DS90UR905Q, DS90UB925Q and INAP125T24

  The APIX 2 link is effected by the INAP375T onboard transmitter
- Visualization of the controller states by eight (ten) LEDs on the front panel (see LED Indication)

The LVDS Frame Generator can store about 20 images in the bitmap format 800x480x24, and display them within less than one second.

Interleaving of two images for dual view displays is executed onboard in the microcontroller.

The images are stored in the flash ROM via the USB connection (if required also RS232 is possible), while the LVDS Frame Generator itself is operated via PC software.

The basicCON 4115 with the INAP375T APIX 2 transmitter can also receive control data via uplink data streams (but no RGB or audio signals).
The communication channels, transferring additionally data in both directions, are controlled by the PC via an integrated SPI data interface.

Transferring the image data to the display as well as the additional data takes place via the LVDS standard.

Figure 2-1: basicCON 4115

Compared with Figure 2-1, the LVDS Frame Generators in the APIX 1 and APIX 2 versions offer additionally one input and one output for DUT power supply (see Power supply) as well as in the APIX 2 version four LEDs (presently two of them without any function) for the status display of the APIX 2 link (see LED Indication):

Figure 2-2: basicCON 4115/ APIX 2

At the device's rear side you find the following connections:

Figure 2-3: basicCON 4115 – Rear view

- Banana sockets for power supply (left)
- DC socket for the AC adaptor plug (center)
- RS232 socket for the serial interface (top right)
- USB-B socket for the USB 2.0 interface with USB standard assignment (below right)

Please refer to chapter Power supply for more information.

2.2 Technical Specification

2.2.1 Dimensions

(width x height x depth):

- basicCON 4115: 126 mm x 51 mm x 183 mm

2.2.2 Properties

Symbol	Parameter	min.	typ.	max.	Unit	Remarks
I_{SS}	Supply current		350	500	mA	
V_{SExt}	External supply voltage	8	12	25	V	
$V_{DUT\ In}$	Supply voltage for test object		12		V	Only for APIX versions
$I_{DUT\ In}$	Input current for test object			3	A	Only for APIX versions
V_{LVDS}	Differential LVDS output voltage	±50	±500		mV	Depends on the transmitter
I_{LVDS}	Differential LVDS output current		±40		µA	Depends on the transmitter
Z_{LVDS}	LVDS input impedance		100		Ω	
f_{LVDS}	LVDS data rate	120		3000	Mbit/s	Depends on the transmitter

Please use the supplied USB cable to connect a basicCON 4115 stand-alone device to the PC's USB interface.
Other cables may be inapplicable.

2.3 Display Timings

To control different displays, the basicCON 4115 LVDS Framegenerator generates signals according to the patterns shown in Figure 2-4 and Figure 2-5.
The Timing values can be parameterized according to Table1.

By the LVDS serializer this data is serialized and transferred to the display.

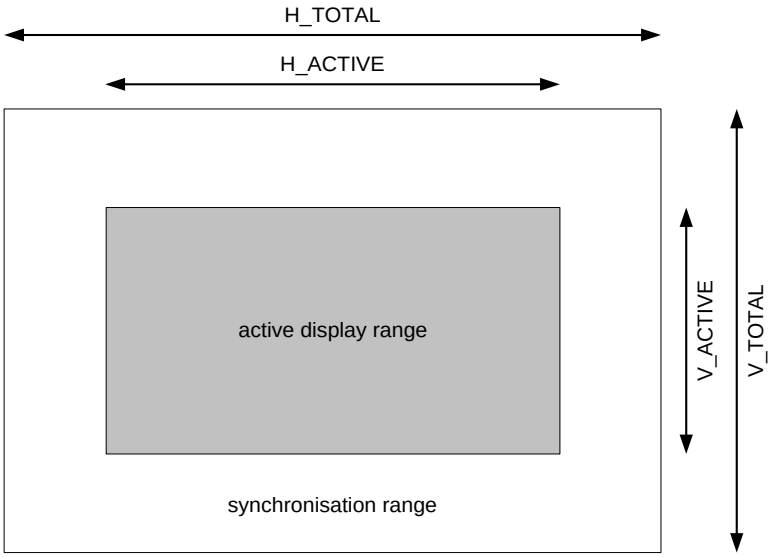

Figure 2-4: Display Timings 1

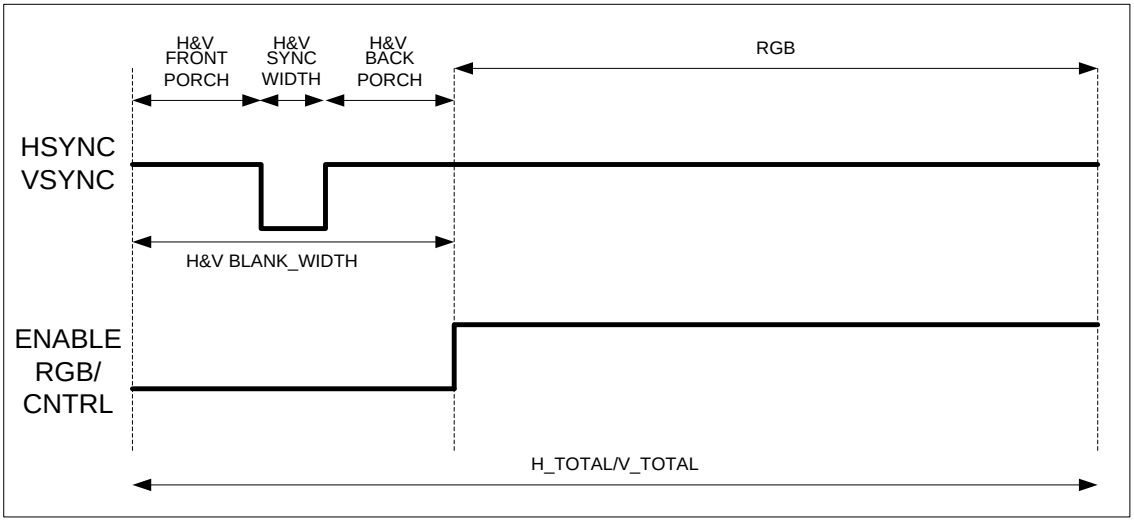

Figure 2-5: Display Timings 2

	Signal	Default	Unit	max.	Remarks
1	H_TOTAL	1056	clocks	2000	
2	H_BLANK_WIDTH	256	clocks	1000	Time for the control data transmission (must be greater than H_FRONT_PORCH + H_SYNC_WIDTH)
3	H_SYNC_WIDTH	128	clocks	998	
4	H_FRONT_PORCH	40	clocks	998	
5	V_TOTAL	521	lines	2000	
6	V_BLANK_WIDTH	41	lines	1000	Must be greater than V_FRONT_PORCH + V_SYNC_WIDTH
7	V_SYNC_WIDTH	2	lines	998	
8	V_FRONT_PORCH	9	lines	998	
9	Pixel clock frequency	33.00	MHz	33	Three available frequencies: 14 MHz 20 MHz 33 MHz

Table 1: Input parameters

H_ACTIVE results from H_TOTAL – H_BLANK_WIDTH
V_ACTIVE results from V_TOTAL – V_BLANK_WIDTH

H_BACK_PORCH results from
H_BLANK_WIDTH – H_FRONT_PORCH – H_SYNC_WIDTH

V_BACK_PORCH results from
V_BLANK_WIDTH – V_FRONT_PORCH – V_SYNC_WIDTH

Only during the H_BLANK_WIDTH time control data is sampled. That means, that H_FRONT_PORCH + H_SYNC_WIDTH must be less than H_BLANK_WIDTH.

V_ BLANK_WIDTH must be greater than
V_FRONT_PORCH + V_SYNC_WIDTH
otherwise the image is read wrongly from the memory.

2.4 Construction

2.4.1 Serializers

basicCON 4115 devices are delivered with a built-in LVDS transmitter (serializer).

The following serializers are available or planned to be used:

LVDS Serializer	Properties	Remarks
MAX9247	18 bits color depth, 9 bits control	Transmitter for basicCon 4120
MAX9209	18 bits color depth, 3 bits control	4-channel LVDS
MAX9213	18 bits color depth, 3 bits control	4-channel LVDS
DS90C241	21 bits color depth, 3 bits control	Transmitter for basicCon 4120
DS90C385A	24 bits color depth, 3 bit control	5-channel LVDS
DS90UR905Q	24 bits color depth, 3 bits control	Transmitter for basicCon 4120
DS90UB925Q	24 bits color depth, 3 bit control	Transmitter for basicCon 4120
INAP125T24	24 bits color depth, 3 bits control	Transmitter for basicCon 4120
INAP375T	24 bits color depth, 3 bits control	APIX2 link

2.4.2 Assembly

For all basicCON 4115 variants (except of the APIX 2 variant), the Serializer and the LVDS connector (for the variant for APIX 1 also the connector for the DUT power supply) are mounted on the LVDS top-board.

This allows exchanging the serializer if required. In such a case, please contact our Support department (ats_support@goepel.com).

2.4.3 Power supply

Power supply with 8..25 VDC (and approx. 300 mA quiescent current at 12V) is effected via the two ext. Power Supply banana females (red = plus/ blue = minus, see Figure 2-3).

These females are used to supply the internal logic. In addition, the blue female is connected with the GND connections of the USB and LVDS interfaces.

Alternatively, the DC socket right to the females can be used for power supply.
This DC socket has the following characteristics:

- Opening diameter 5.6 mm
- Center pin diameter 2.0 mm
- Outside ground
- Inside 8-25V

Please use the ext. Power Supply females OR the DC socket for power supply.

The INAP125T24 and INAP375T serializers have an LVDS connector with an additional power supply connection to supply the display or the test object.
This power supply is effected via the two Power DUT In banana sockets (red = plus/ blue = minus), located left on the front panel.

2.4.4 Addressing

Addressing several basicCON 4115 devices is effected exclusively via their serial numbers: The device with the LEAST serial number has always device number 1.

2.4.5 LVDS Interface

LVDS is a serial broadband transmission standard, becoming more and more important in automotive technology to transfer video data.

Data is transmitted differential on two signal lines with very low voltage and current, and frequencies more than 1GHz up to 3GHz. Therefore, appropriate connectors and cables are strongly required for failure-free transmission.

LVDS Serializer and LVDS connector are mounted on the pluggable LVDS top-board (to be able to adapt these components to different displays very fast).

The used serializer and the deserializer at its counterpart are decisive for proper operation of a LVDS interface. The LVDS connection does only operate properly in the case that all members use compatible components.

For this reason, please specify the pixel clock frequency of the receiver with your order.

The following connector is used for the MAX9247, DS90C241, DS90UR905Q and DS90UB925Q top-boards:

D4S20A-40ML5-Z of Rosenberger company

Pinout:

1 – LVDS–	**2** – NC	**3** – LVDS+	**4** – GND	**Shield** – GND

The DS90UR905Q top-board can be made compatible to the DS90UR906Q, DS90UR124 and DS90C124 serializers by configuration. For compatibility to the above mentioned serializers, their assignment must comply with the DS90UR905Q data sheet.

The DS90UB925Q top-board can be made compatible to the DS90UB926Q and DS90UR906Q serializers by configuration.
For compatibility to the above mentioned serializers, their assignment must comply with the DS90UB925Q data sheet.

The MAX9209 and MAX9213 top-boards are operating with four LVDS channels (3x RGB data, 1x clock).
Therefore they have the following 10-pole connector:

GT17V-10DP-DS(70) of Hirose company

Pinout:

1 – LVDS Clk+	**2** – LVDS Clk–	**3** – GND	**4** – GND
5 – LVDS 0+	**6** – LVDS 0–	**7** – LVDS 1+	**8** – LVDS 1–
9 – LVDS 2+	**10** – LVDS 2–	**Shield** – GND	

The DS90C385A top-board is operating with five LVDS channels (4x RGB data, 1x clock).
Therefore it has the following 36-pole connector:
MDR N10236-52B3PC of 3M

Pinout:

1 – LVDS 0–	**2 –** LVDS 1–	**3 –** LVDS 2–	**4 –** LVDS Clk–
5 – LVDS 3–	**6 –** GND	**7 –** NC	**8 –** NC
9 – NC	**10 –** NC	**11 –** NC	**12 –** NC
13 – NC	**14 –** NC	**15 –** NC	**16 –** NC
17 – NC	**18 –** NC	**19 –** LVDS 0+	**20 –** LVDS 1+
21 – LVDS 2+	**22 –** LVDS Clk+	**23 –** LVDS 3+	**24 –** NC
25 – NC	**26 –** NC	**27 –** NC	**28 –** NC
29 – NC	**30 –** NC	**31 –** GND	**32 –** NC
33 – NC	**34 –** NC	**35 –** NC	**36 –** NC
Shield – GND			

For the INAP125T24 APIX 1 transmitter top-board and the INAP375T APIX 2 onboard transmitter, the following connector is used:
99S20D-40MA5-D of Rosenberger company

Pinout:

1 – LVDS Out–	**2** – LVDS In+	**3** – LVDS Out+	**4** – LVDS In–
5 – V Out+	**6** – V Out–	**Shield** – GND	

The APIX 1/ APIX 2 configurations can be adapted if required.
Default configuration: 500Mbit/s bandwidth, 24 bit color depth, rising pixel clock frequency edge and dedicated upstream channel.

For the connection, use only STP cables with 100Ω impedance and corresponding connector.

When connecting the cables, please pay attention to connect the wire pairs always to LVDS+ and LVDS– each.

2.4.6 LED Indication

The LEDs 1..8 arranged near to the LVDS connector show the current operating state of the basicCON 4115 Frame Generator, LED 9 and LED 10 (if applicable) show the transfer status of the APIX 2 link:

LEDs **4** ¡ **8** ¡ **12** ¡ **3** ¡ **7** ¡ **11** ¡ **2** ¡ **6** ¡ **10** ¡ **1** ¡ **5** ¡ **9** ¡		
1	From FPGA	FPGA firmware loaded
2	From FPGA	LVDS firmware initialized
3	From FPGA	Send image memory data
4	From FPGA	Send data to display
5	From µC	Read Bootloader/ Flash memory
6	From µC	Write Bootloader/ Flash memory
7	From µC	USB/ RS232 data reception
8	From µC	USB/ RS232 data transmission
	Only for APIX 2 devices:	
9	From transmitter	APIX 2 link reset
10	From transmitter	APIX 2 link status
11		Not used
12		Not used

2.5 Delivery Notes

The basicCON 4115 LVDS Frame Generator can be delivered in the following variants with the following accessories (please specify the pixel clock frequency with your order):

- basicCON 4115.10 with MAX9247 top-board
- basicCON 4115.20 with MAX9209 top-board
- basicCON 4115.30 with MAX9213 top-board
- basicCON 4115.35 with DS90C385A top-board
- basicCON 4115.60 with DS90C241 top-board
- basicCON 4115.70 with INAP125T24 APIX 1 top-board
- basicCON 4115.80 with DS90UR905Q top-board
- basicCON 4115.85 with DS90UB925Q top-board
- basicCON 4115.90 with INAP375T APIX 2 serializer onboard

- ST 4115.10 MAX9247 top-board
- ST 4115.20 MAX9209 top-board
- ST 4115.30 MAX9213 top-board
- ST 4115.35 DS90C385A top-board
- ST 4115.60 DS90C241 top-board
- ST 4115.70 INAP125T24 APIX 1 top-board
- ST 4115.80 DS90UR905Q top-board
- ST 4115.85 DS90UB925Q top-board

- CAB USB 1m USB cable “Premium”

3 Software

3.1 G-API Programming

The G-API (GOEPEL API) is the C-programming user interface for GOEPEL electronic hardware under Windows®.

It provides a wide, hardware independent command set for CAN, LIN, K-Line, MOST, FlexRay, LVDS, ADIO and Diagnostic services.
No matter whether a PXI/ PCI, USB and Ethernet device is used, the commands remain the same.

The hardware abstraction introduced with the G-API gives the test application parallel access to the hardware, allowing one application to access multiple hardware interfaces; as well as multiple applications can access the same hardware interfaces in parallel.

Another feature introduced by the G-API is the asynchronous hardware access. This means no blocking execution for pending firmware commands. The command acknowledgement is provided via callback mechanism.

With the HardwareExplorer GOEPEL electronic provides a hardware configuration and management tool, offering users an easy way to manage their hardware configurations and identifying specific hardware interfaces by logical names. Using logical interface names in the application saves from rebuilding the application when porting it to another interface or controller board, as the interface can be easily reassigned in the HardwareExplorer.
Furthermore the HardwareExplorer provides a simple means of testing the interaction between hardware and software by executing the integrated self-tests.

Please consult the G-API documentation for further information. This documentation and the installation software are located in the *G-API* folder of the supplied Product CD.