PHYTEC Messtechnik GmbH

Application Note

How to use phyCAM camera modules with the phyBOARD-SUBRA-i.MX6 SBC

Revision History

Version	Changes	Author	Date
A0	Initial Release	H. Fendrich	20.03.2014
A1	Completely revised.	H. Fendrich	19.12.2014

Content

1   Overview

The i.MX6 Microcontroller supported more then 1 camera interface (see figure 1).

figure 1: Block Diagram Camera Interfaces of i.MX6 Controller (Quad / Dual) and i.MX6 Controller (Solo / Dual Lite)

On the phyFLEX-i.MX6 the CSI0/IPU#1 camera path (thru a serializer) go out as LVDS signal. Together with power signal and the I²C-Bus on the phyBOARD-SUBRA-i.MX6 - SBC go it on the two phyCAM-S+ Camera interfaces (see figure 2).
Here you can connect one of the different phyCAM-S(+) camera modules. See the phyCAM-P/-S manual L-748 for more information.
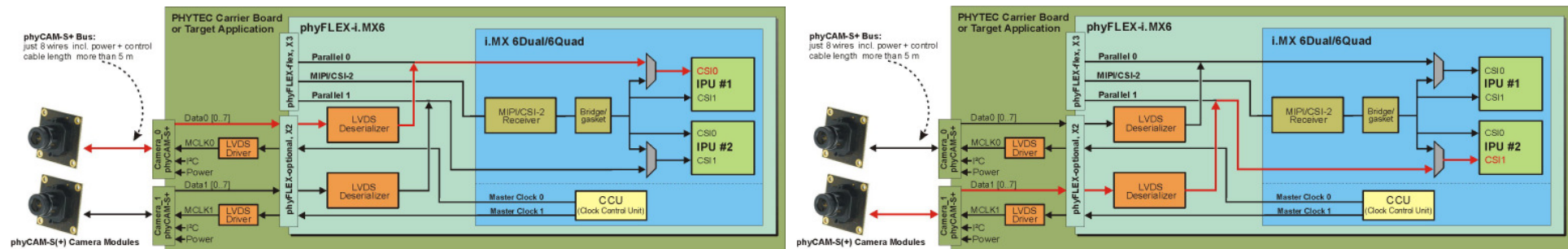

figure 2: Block Diagram of phyCAM-S(+) Camera Interfaces of phyFLEX-i.MX6 (Quad / Dual) and the go out on the phyBOARD-SUBRA-i.MX6 - SBC

The BSP shipped with the Kit includes already the software drivers for the supported phyCAM camera modules. The drivers are compatible with v4l2. Also GStreamer scripts are included for the evaluation of the camera modules. If you need more then one camera interface or/and phyCAM-P support, please use the phyFLEX-i.MX6 Modul.

Note:
The phyBOARD-SUBRA features up to two interfaces for phyCAM-S(+) camera modules.
Please find more information about the camera support in the path: …\Documentation\...

The kit version KPB-00601-001 is shipped with an i.MX6 controller board which has no camera support installed.
The kit version KPB-00601-002 is shipped with an i.MX6 controller board which has camera support installed.

The Linux BSP PD14.0.0 for these kits does support the camera VM-009-LVDS. For support the other PHYTEC phyCAM-S(+) cameras you need an patch.
ftp://ftp.phytec.de/pub/Products/phyBOARD-Subra-i.MX6/Linux/PD14.0.0/PATCH_for_all_phyCAM_MODULES/

The table below lists the options:

Hardware Configuration			Software Support	
phyBOARD Kit	**phyCAM-S+ at CSI_0**	**phyCAM-S+ at CSI_1**	**phyCAM-S+ at CSI_0**	**phyCAM-S+ at CSI_1**
KPB-00601-001	NM	NM	no	no
KPB-00601-002	yes	yes	yes (VM-009-LVDS) (for all other PHYTEC cameras the BSP PD14.0.0 need a patch)	yes (VM-009-LVDS) (for all other PHYTEC cameras the BSP PD14.0.0 need a patch)

NM = no mount

2   Camera Connectors on the SUBRA - Carrier Boards

The development kits for the phyBOARD-SUBRA-i.MX6 may contain either:
*   one carrier board (SUBRA)
*   one phyFLEX-i.MX6 modul SOM

The carrier board connects to the phyFLEX-connector, with the phyFLEX-i.MX6 modul.

The serial phyCAM-S+ camera input is available directly on the carrier board PBA-B-05 on the HIROSE(CAM) connectors. See figure 3 for the location of the connectors on the carrier board.
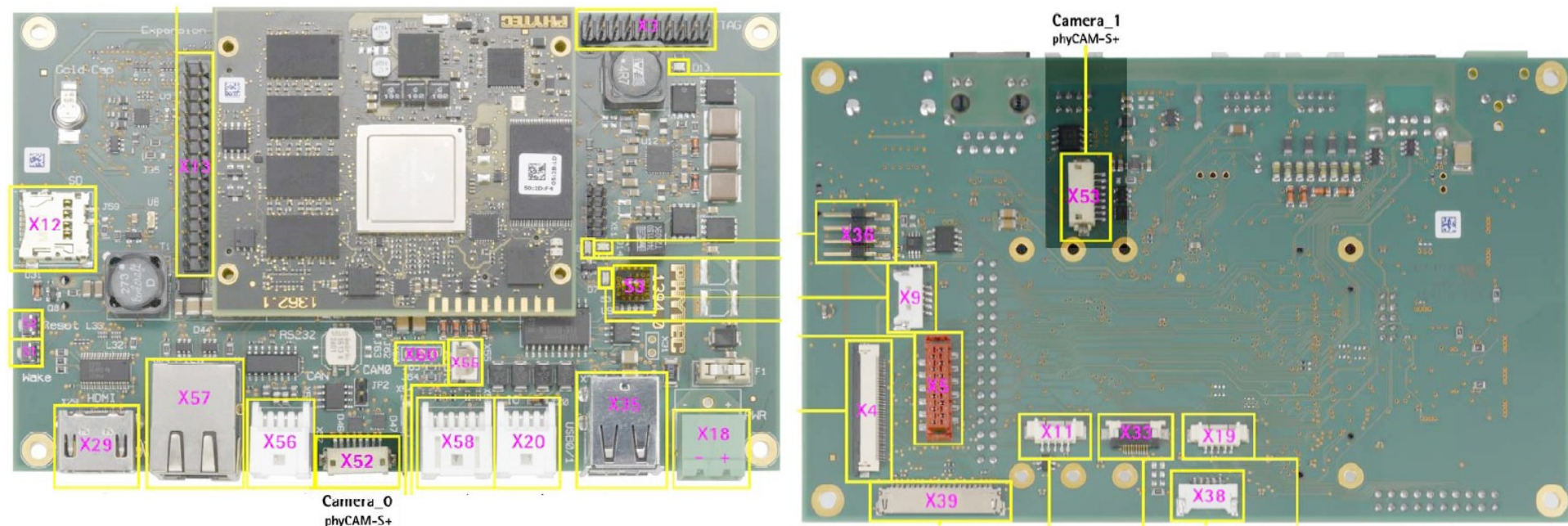

figure 3: Camera Interfaces on phyBOARD-SUBRA for the phyFLEX-i.MX6 SOM

3   Set bootarg parameters in the *config*-file for cameras (Linux PD14.0.0 and higher)

The bootarg parameters are used to adapt the software environment to the hardware configuration and camera module(s) connected to the board.

The configuration in the config file must match with the camera models that are connected to the camera interfaces.
Note that model, interface type and I²C-addresses must be set correctly. Otherwise the camera(s) are not working.
Please check, if the correct camera model is set in the config file. If not, please follow the steps below to set the appropriate configuration.

Changing the setting of the bootarg parameters

To change the config-file (bootargs-cam), use the Barebox environment:
- 'cd env/bin' <enter>
- 'edit bootargs-cam' <enter>

The following settings in config-file are necessary:
- CSI0/1=<csi[X]_cam_type>,<csi[X]_cam_address>
- only for VM-010: bootargs="$bootargs mt9v022.sensor_type=<color or mono>"
- only for VM-011: bootargs="$bootargs mt9p031.mono=Y"
- only for VM-012: bootargs="$bootargs vita1300.sensor_type=<color or mono>"

The parameters for the phyCAM – modules are shown in the table below (see next page).

After changing the settings with the editor:
- close the editor (CTRL D)
- type 'saveenv' <enter> to save
- restart PHYTEC module
- **Note: press "m" during the barebox count -> select "2 <ENTER>" for start image with camera support**

After login, change into the directory: \gstreamer_examples\..
cd gstreamer_examples <ENTER>.

Now you can start working with the GStreamer demo-scripts.
Detailed information about the GStreamer examples can be found in the phyCAM-Manual L-748.

Hardware Configuration		Bootarg Parameters		Bootarg settings for default I²C-address (default jumper on camera and boards)
phyCAM camera model (part number)	connected to	csi[X]_cam_type	csi[X]_cam_address	
VM-006-BW-LVDS (-M12 / -H)	X52 on base board	VM-006	0x5D	CSI0=VM-006,0x5D
	X53 on base board	VM-006	0x5D	CSI1=VM-006,0x5D
VM-008 (-M12/ -H)	X52 on base board	VM-008	0x44, 0x45	CSI0=VM-008,0x45
	X53 on base board	VM-008	0x44, 0x45	CSI1=VM-008,0x45
VM-009-LVDS (-M12 / -H)	X52 on base board	VM-009	0x48, 0x5D	CSI0=VM-009,0x48
	X53 on base board	VM-009	0x48, 0x5D	CSI1=VM-009,0x48
VM-010-BW-LVDS (-M12 / -H)	X52 on base board	VM-010	0x48, 0x4C, 0x58, 0x5C	CSI0=VM-010,0x48 bootargs="$bootargs mt9v022.sensor_type=mono"
	X53 on base board	VM-010	0x48, 0x4C, 0x58, 0x5C	CSI1=VM-010,0x48 bootargs="$bootargs mt9v022.sensor_type=mono"
VM-010-COL-LVDS (-M12 / -H)	X52 on base board	VM-010	0x48, 0x4C, 0x58, 0x5C	CSI0=VM-010,0x48 bootargs="$bootargs mt9v022.sensor_type= color"
	X53 on base board	VM-010	0x48, 0x4C, 0x58, 0x5C	CSI1=VM-010,0x48 bootargs="$bootargs mt9v022.sensor_type= color"
VM-011-BW-LVDS (-M12 / -H)	X52 on base board	VM-011	0x48, 0x5D	CSI0=VM-011,0x48 bootargs="$bootargs mt9p031.mono=Y"
	X53 on base board	VM-011	0x48, 0x5D	CSI1=VM-011,0x48 bootargs="$bootargs mt9p031.mono=Y"
VM-011-COL-LVDS (-M12 / -H)	X52 on base board	VM-011	0x48, 0x5D	CSI0=VM-011,0x48 #bootargs="$bootargs mt9p031.mono=Y"
	X53 on base board	VM-011	0x48, 0x5D	CSI1=VM-011,0x48 #bootargs="$bootargs mt9p031.mono=Y"
VM-012-BW-LVDS (-M12 / -H)	X52 on base board	VM-012	0x48, 0x4C, 0x58, 0x5C	CSI0=VM-012,0x48 bootargs="$bootargs vita1300.sensor_type=mono"
	X53 on base board	VM-012	0x48, 0x4C, 0x58, 0x5C	CSI1=VM-012,0x48 bootargs="$bootargs vita1300.sensor_type=mono"

VM-012-COL-LVDS (-M12 / -H)	X52 on base board	VM-012	0x48, 0x4C, 0x58, 0x5C	CSI0=VM-012,0x48 bootargs="$bootargs vita1300.sensor_type= color"
	X53 on base board	VM-012	0x48, 0x4C, 0x58, 0x5C	CSI1=VM-012,0x48 bootargs="$bootargs vita1300.sensor_type= color"

Notes:
- I²C addresses of the camera are set by hardware configuration (jumper setting on the camera and / or on the baseboard. Please refer to the phyCAM-manual L-748 and the hardware manual of the kit.

4   GStreamer function for improved Tearing reduction

Tearing is a visual artifact in video display where the display image shows information from two or more frames in a single screen draw.
It appears as a horizontal border or line. The image part beyond the line seems to be shifted horizontally when the image content or the camera is moved.
The tearing line(s) usually move(s) vertically across the image.
The artifact occurs when the camera framerate differs from the display frame or the camera readout cycle is not in sync with the display's refresh.
Definition and background information about the tearing effect can be found in http://en.wikipedia.org/wiki/Screen_tearing.

The Freescale i.MX-6 processor contains an anti-tearing mechanism in the IPU unit, which can reduce the tearing effect.
However, since - depending on camera settings and camera model - the frame rate might be very different from the display's refresh rate, tearing effects might still be visible even if the anti-tearing mechanism is active. For applications that are intended to display live camera images on the display, additional measures should be considered to obtain a perfect image quality. This measures can include frame rate control (trimming the camera frame rate to the display's refresh rate), multi-buffering of the camera image etc.

We recommend to activate the anti-tearing mechanism of the i.MX-6 when live camera images are shown on the display.
For evaluation purposes with the development kits, Phytec added GStreamer examples, that use a different fbsink – function, that activates the anti-tearing mechanism.

Please use the following GStreamer-examples with Freescale "mfw_isink" for evaluation of the i.MX-6 camera:

Camera Module	Standard GStreamer Script	GStreamer Script with Freescale mfw_isink
	No tearing reduction	Framebuffer tearing reduction
VM-006	/more_mt9m001_scripts/mt9m001_bw_fbdef_640x480-sensor-roi	/more_mt9m001_scripts/mt9m001_fs_bw_fbdef_640x480
VM-009	/more_mt9m131_scripts/skip/skip2_fbdev_640x512	/more_mt9m131_scripts/skip/skip2_fs_fbdev_640x512

VM-010-BW	/more_mt9v024_scripts/mt9v024_bw-fbdev_752x480	/more_mt9v024_scripts/mt9v024_bw-fs_fbdev_752x480
VM-010-COL	/more_mt9v024_scripts/mt9v024_col-fbdev_752x480	/more_mt9v024_scripts/mt9v024_col-fs_fbdev_752x480
VM-011-BW	/more_mt9p031_scripts/mt9p031_bw_different_res_to_fbdev	/more_mt9p031_scripts/mt9p031_bw_fs_different_res_to_fbdev
VM-011-COL	/more_mt9p031_scripts/mt9p006_col_different_res_to_fbdev	/more_mt9p031_scripts/mt9p006_col_fs_different_res_to_fbdev
VM-012-BW	/more_vita1300_scripts/vita1300_bw_different_res_to_fbdev	/more_vita1300_scripts/vita1300_bw_fs_different_res_to_fbdev
VM-012-COL	/more_vita1300_scripts/vita1300_col_different_res_to_fbdev	/more_vita1300_scripts/vita1300_col_fs_different_res_to_fbdev

Note: After use freescale, gstreamer-sink plug-in "mfw_isink " the standard-gstreamer-sink plug-in "fbdevsink" do not working. Please restart the modul.