

ZC0301 and ZC0301P Image Processor and Control Chip
Driver for Linux

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- Documentation -

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1. Copyright

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2. Disclaimer

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4. Overview and features

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This driver supports the video interface of the devices mounting the ZC0301 or ZC0301P Image Processors and Control Chips.

zc0301.txt.txt

The driver relies on the Video4Linux2 and USB core modules. It has been designed to run properly on SMP systems as well.

The latest version of the ZC0301[P] driver can be found at the following URL:
<http://www.linux-projects.org/>

Some of the features of the driver are:

- full compliance with the Video4Linux2 API (see also "Notes for V4L2 application developers" paragraph);
- available mmap or read/poll methods for video streaming through isochronous data transfers;
- automatic detection of image sensor;
- video format is standard JPEG;
- dynamic driver control thanks to various module parameters (see "Module parameters" paragraph);
- up to 64 cameras can be handled at the same time; they can be connected and disconnected from the host many times without turning off the computer, if the system supports hotplugging;

5. Module dependencies

For it to work properly, the driver needs kernel support for Video4Linux and USB.

The following options of the kernel configuration file must be enabled and corresponding modules must be compiled:

```
# Multimedia devices
#
CONFIG_VIDEO_DEV=m
```

```
# USB support
#
CONFIG_USB=m
```

In addition, depending on the hardware being used, the modules below are necessary:

```
# USB Host Controller Drivers
#
CONFIG_USB_EHCI_HCD=m
CONFIG_USB_UHCI_HCD=m
CONFIG_USB_OHCI_HCD=m
```

The ZC0301 controller also provides a built-in microphone interface. It is supported by the USB Audio driver thanks to the ALSA API:

```
# Sound
#
CONFIG_SOUND=y

# Advanced Linux Sound Architecture
#
CONFIG_SND=m
```

zc0301.txt.txt

```
# USB devices
#
CONFIG_SND_USB_AUDIO=m
```

And finally:

```
# V4L USB devices
#
CONFIG_USB_ZC0301=m
```

6. Module loading

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To use the driver, it is necessary to load the "zc0301" module into memory after every other module required: "videodev", "v4l2_common", "compat_ioctl32", "usbcore" and, depending on the USB host controller you have, "ehci-hcd", "uhci-hcd" or "ohci-hcd".

Loading can be done as shown below:

```
[root@localhost home]# modprobe zc0301
```

At this point the devices should be recognized. You can invoke "dmesg" to analyze kernel messages and verify that the loading process has gone well:

```
[user@localhost home]$ dmesg
```

7. Module parameters

=====

Module parameters are listed below:

```
-----
Name:          video_nr
Type:          short array (min = 0, max = 64)
Syntax:        <-1|n[,...]>
Description:   Specify V4L2 minor mode number:
               -1 = use next available
               n = use minor number n
               You can specify up to 64 cameras this way.
               For example:
               video_nr=-1,2,-1 would assign minor number 2 to the second
               registered camera and use auto for the first one and for every
               other camera.
Default:       -1
-----
```

```
-----
Name:          force_munmap
Type:          bool array (min = 0, max = 64)
Syntax:        <0|1[,...]>
Description:   Force the application to unmap previously mapped buffer memory
               before calling any VIDIOC_S_CROP or VIDIOC_S_FMT ioctl's. Not
               all the applications support this feature. This parameter is
               specific for each detected camera.
               0 = do not force memory unmapping
               1 = force memory unmapping (save memory)
Default:       0
-----
```

Name: frame_timeout
 Type: uint array (min = 0, max = 64)
 Syntax: <n[,...]>
 Description: Timeout for a video frame in seconds. This parameter is specific for each detected camera. This parameter can be changed at runtime thanks to the /sys filesystem interface.
 Default: 2

Name: debug
 Type: ushort
 Syntax: <n>
 Description: Debugging information level, from 0 to 3:
 0 = none (use carefully)
 1 = critical errors
 2 = significant informations
 3 = more verbose messages
 Level 3 is useful for testing only, when only one device is used at the same time. It also shows some more informations about the hardware being detected. This module parameter can be changed at runtime thanks to the /sys filesystem interface.
 Default: 2

8. Supported devices

None of the names of the companies as well as their products will be mentioned here. They have never collaborated with the author, so no advertising.

From the point of view of a driver, what unambiguously identify a device are its vendor and product USB identifiers. Below is a list of known identifiers of devices mounting the ZC0301 Image Processor and Control Chips:

Vendor ID	Product ID
0x041e	0x4017
0x041e	0x401c
0x041e	0x401e
0x041e	0x401f
0x041e	0x4022
0x041e	0x4034
0x041e	0x4035
0x041e	0x4036
0x041e	0x403a
0x0458	0x7007
0x0458	0x700c
0x0458	0x700f
0x046d	0x08ae
0x055f	0xd003
0x055f	0xd004
0x0ac8	0x0301
0x0ac8	0x301b
0x0ac8	0x303b
0x10fd	0x0128
0x10fd	0x8050

0x10fd 0x804e

The list above does not imply that all those devices work with this driver: up until now only the ones that mount the following image sensors are supported; kernel messages will always tell you whether this is the case:

Model	Manufacturer
PAS202BCB	PixArt Imaging, Inc.
PB-0330	Photobit Corporation

9. Notes for V4L2 application developers

This driver follows the V4L2 API specifications. In particular, it enforces two rules:

- exactly one I/O method, either "mmap" or "read", is associated with each file descriptor. Once it is selected, the application must close and reopen the device to switch to the other I/O method;
- although it is not mandatory, previously mapped buffer memory should always be unmapped before calling any "VIDIOC_S_CROP" or "VIDIOC_S_FMT" ioctl's. The same number of buffers as before will be allocated again to match the size of the new video frames, so you have to map the buffers again before any I/O attempts on them.

10. Contact information

The author may be contacted by e-mail at <luca.risolia@studio.unibo.it>.

GPG/PGP encrypted e-mail's are accepted. The GPG key ID of the author is 'FCE635A4'; the public 1024-bit key should be available at any keyserver; the fingerprint is: '88E8 F32F 7244 68BA 3958 5D40 99DA 5D2A FCE6 35A4'.

11. Credits

- Informations about the chip internals needed to enable the I2C protocol have been taken from the documentation of the ZC030x Video4Linux1 driver written by Andrew Birkett <andy@nobugs.org>;
- The initialization values of the ZC0301 controller connected to the PAS202BCB and PB-0330 image sensors have been taken from the SPCA5XX driver maintained by Michel Xhaard <mxhaard@magic.fr>;
- Stanislav Lechev donated one camera.