**B3VCU software resource specification**

# Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Date | Reason For Changes | Version |
| Chen Yong | May 14, 2022 | Initial draft | 1.0.1 |
| Chen Yong | Aug 3, 2022 | Modify by VCU\_IDS\_V0.2.xlsx requirement | 1.0.2 |
| Chen Yong | Aug 17, 2022 | Modify by VDU Software V0.5\_16082022.pptx | 1.0.3 |
| Chen Yong | Aug 14, 2023 | Append Version Control list | 1.0.4 |

Table of Contents

[1 Scope 4](#__RefHeading___Toc1969_2362462405)

[1.1 Identification 4](#__RefHeading__67_353707614)

[1.2 System overview 4](#__RefHeading__4330_211762208)

[1.3 Document overview 4](#__RefHeading__4332_211762208)

[2 Referenced documents 4](#__RefHeading__91_750141981)

[3 Requirements 4](#__RefHeading___Toc1971_2362462405)

[3.1 Required states and modes 4](#__RefHeading___Toc1973_2362462405)

[3.1.1 verbose information mode 4](#__RefHeading___Toc9161_1605989181)

[3.1.2 Normal working mode 5](#__RefHeading___Toc9163_1605989181)

[3.2 CSCI capability requirements 5](#__RefHeading___Toc1975_2362462405)

[3.3 CSCI external interface requirements 5](#__RefHeading___Toc1977_2362462405)

[3.3.1 CAM UART 5](#__RefHeading___Toc1317_2756806970)

[3.3.2 VDU UART 5](#__RefHeading___Toc1319_2756806970)

[3.3.3 SPARE UART 6](#__RefHeading___Toc1321_2756806970)

[3.3.4 Ethernet 6](#__RefHeading___Toc1323_2756806970)

[3.3.5 KeyPad 6](#__RefHeading___Toc1325_2756806970)

[3.3.6 Digital GPIO Output 7](#__RefHeading___Toc1327_2756806970)

[3.3.7 SDI Video Input 7](#__RefHeading___Toc1329_2756806970)

[3.3.8 *SDI Video Output* 7](#__RefHeading___Toc1331_2756806970)

[3.3.9 LED 8](#__RefHeading___Toc1333_2756806970)

[3.4 CSCI internal interface requirements 8](#__RefHeading___Toc1979_2362462405)

[3.4.1 I2C 8](#__RefHeading___Toc1335_2756806970)

[3.4.2 frmbuf\_rd 8](#__RefHeading___Toc1337_2756806970)

[3.4.6 iio sensor 9](#__RefHeading___Toc1339_2756806970)

[3.4.7 pdma 9](#__RefHeading___Toc2399_3499696116)

[3.4.8 Reserv memory 9](#__RefHeading___Toc2401_3499696116)

[3.4.9 Watchdog 9](#__RefHeading___Toc2403_3499696116)

[3.5 CSCI internal data requirements 9](#__RefHeading___Toc1990_2362462405)

[3.5.1 Log data 9](#__RefHeading___Toc9165_1605989181)

[3.5.2 Configuration file data 10](#__RefHeading___Toc2405_3499696116)

[3.5.3 global parameters 10](#__RefHeading___Toc2330_112839629)

[4 Requirements traceability 11](#__RefHeading___Toc1992_2362462405)

[5 Note 11](#__RefHeading___Toc1994_2362462405)

[6 Appendixes 11](#__RefHeading___Toc1996_2362462405)

# Scope

## Identification

## System overview

## Document overview

Chapter 1: Scope

Chapter 2: Referenced documents

Chapter 3: Requirements

Chapter 4: Requirements traceability

Chapter 5: Notes

chapter 6: Appendixes.

# Referenced documents

# Requirements

## Required states and modes

### verbose information mode

Run application with option ‘-v’, then it will enter into the print verbose information mode. It will print out the verbose information of the VCU and exit.

The verbose information includes: the device info, the configuration data, the error recording data and the working information data.

* The device info:(refer 3.5.2)

Main Version:x.x.x (the whole system version)

App Version:x.x.x (the firmware version)

OSD Variant:xxxx(the VDU OSD variant)

SN:B3VCU-xxx (the VCU serial Number)

date:xx-xx-xxxx (manufacturing date)

* The Configuration [data: (refer](data:(refer) 3.5.1)

Configuration: tick=xxxxx (the total power on time. unit(s))

* the error recording <data:(refer> 3.5.1)

Recording:

timestamp=xxxxx info=0xhhhhhhhh desc=xxxxxxxxxxx

....

-------Over----------

* the working information <data:(refer> 3.4.6)

Power Current: raw=xxx.xxx scale=x.xxx current=x.xxxx

PS temp:raw=xxx.xxx scale=x.xxx offset=xxx.xxx temp=xx.xxx

### Normal working mode

Defaut system booting up, the application will run in this normal working mode. The system script file is in /*etc*/init.d/loaduserapp.sh.

It has a configuration file. The default configuration file is /*etc*/b3vcu.conf. It can be assign a special configuration file by option(-f filename). The configuration file data format refer to 3.5.2

## CSCI capability requirements

### Booting up

The maxium system booting up time is less than 30 seconds.

### Watchdog enable

Enable watchdog and the application refresh the watchdog timer. The watchdog can restart the system if the application cannot refresh the watchdog.

### Video Error monitor

Keep monitoring the video input. Disable the SDI output if any error in the video input is found.

## CSCI external interface requirements

### CAM UART

***Format****: RS422*

***Device name****: /dev/ttySC0*

***working mode****:Duplex*

***data****: 115200n8*

***flow control****: no*

*The “NUC” command output to camera.*

*Protocol refer to document (TSP-545-AJ-0014-C\_23Oct19.pdf) provided by STK*

### VDU UART

***Format****: RS422*

***Device name****: /dev/ttySC1*

***working mode****:Duplex*

***data****: 115200n8*

***flow control****: no*

*Receiving “Key” information from VDU and reponse it.*

*Protocol refer to document (Serial Protocol) provided by Teamone*

### SPARE UART

***Format****: RS232*

***Device name****: /dev/ttyPS1, /dev/ttySC2, /dev/ttySC3*

***working mode****:Duplex*

***data****: 115200n8*

***flow control****: no*

### Ethernet

1**0/100/1000 BASE-T**

* **Port 1(eth2):** VCU control port static IP 192.168.1.254 port 51000
* **Port 2(eth0):** VCU RTP video stream port. Static IP 192.168.6.254
* **Port 3(eth1):** VCU RTP video stream port. Static IP 192.168.7.254

**RTP Video Stream:**

To Host IP: Port 2: 192.168.6.255 Port 3: 192.168.7.255

To Host port 5001: Video Input 0

To Host port 5002: Video Input 1

To Host port 5003: Video Input 2

To Host port 5004: Video Input 3

To Host port 5005: Video Input 4

To Host port 5006: Video Input 5

To Host port 5007: Video Input 6

To Host port 5008: Video Input 7

To Host port 5009: Video Input 8

To Host port 5010: Video Input 9

Format: UDP /RTP

clock rate: 90000

encoding name:H264

payload:96

Control:

Protocol Refer to document(VCU\_IDS\_V0.3.xlsx)

### KeyPad

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Key No | Gpio port | Key name | Linux code |  |
| KEY\_DIN\_1 | <axi\_gpio\_0 0> | key1 | KEY\_1(2) | Trailer ? |
| KEY\_DIN\_2 | <axi\_gpio\_0 1> | key2 | KEY\_2(3) | Reverse Gear |
| KEY\_DIN\_3 | <axi\_gpio\_0 2> | key3 | KEY\_3(4) | Forward Gear |
| KEY\_DIN\_4 | <axi\_gpio\_0 3> | key4 | KEY\_4(5) | TBD |
| KEY\_DIN\_5 | <axi\_gpio\_0 4> | key5 | KEY\_5(6) | TBD |
| KEY\_DIN\_6 | <axi\_gpio\_0 5> | key6 | KEY\_6(7) | TBD |
| KEY\_DIN\_7 | <axi\_gpio\_0 6> | key7 | KEY\_7(8) | TBD |
| KEY\_DIN\_8 | <axi\_gpio\_0 7> | key8 | KEY\_8(9) | TBD |

### Digital GPIO Output

|  |  |  |  |
| --- | --- | --- | --- |
| DO No | Linux GPIO No | Terminal | Description |
| DO1 | 492 | IR | On/OFF IR |
| DO2 | 493 | IR | On/OFF IR |
| DO3 | 494 | TBD |  |
| DO4 | 495 | TBD |  |
| DO5 | 496 | TBD |  |

### SDI Video Input

**Device name**: /*dev/media6 (/dev/video0)*

*/dev/media7 (/dev/video1)*

*/dev/media8 (/dev/video2)*

*/dev/media9 (/dev/video3)*

*/dev/media0 (/dev/video4)*

*/dev/media1 (/dev/video5)*

*/dev/media2 (/dev/video6)*

*/dev/media3 (/dev/video7)*

*/dev/media4 (/dev/video8)*

*/dev/media5 (/dev/video9)*

***SDI0-SDI3 support format****: 1080P60 or lower resolution.*

***SDI4-SDI9 support format****: 1080P30*

### *SDI Video Output*

*SDI0 output: frmbuf\_rd --> mix -> uhdsdi\_tx (‘mix’ can mix video and osd)*

*SDI1 – SDI7 output: frmbuf\_rd->udhsdi\_tx. (without osd funciton)*

*There is a device “sdi\_anc\_tx” in all output. It can embed timestamp into the SDI signal.*

*all devices refer to internal interface:*

*frmbuf\_rd: refer to 3.4.2*

*mix: refer to 3.4.3*

*uhdsdi\_tx: refer to 3.4.4*

*sdi\_anc\_tx: refer to 3.4.5*

### LED

|  |  |  |
| --- | --- | --- |
| LED | Linux GPIO No | Description |
| Green | 458 | Normal Status |
| Red | 459 | BIT error |

## CSCI internal interface requirements

### I2C

**device name**: /*dev*/i2c-0

**slave chip**: mb85rc256vfp **slave address**: 0x50

**description**: log data storage

### frmbuf\_rd

**Address**: sdi0(0xb02d0000) sdi1(0xb02f0000) sdi2(0xb0310000) sdi3(0xb0330000) sdi4(0xb03a0000) sdi5(0xb03c0000) sdi6(0xb03e0000) sdi7(0xb0400000)

**Support Format**: Y\_UV10, Y\_UV8

refer to document (pg278-v-frmbuf.pd) provided by Xilinx

* + 1. *mix*

**Address:** 0xb02e0000

**Primary video format**: YUV4:2:2 10bits

**Overlay layer1 format**: BGRA8

**Maximum resolution**: 1920x1080

refer to doucument (pg243-v-mix.pdf) provided by Xilinx

* + 1. *uhdsdi\_tx*

**Address**: sdi0(0xa0040000) sdi1(0xa0060000) sdi2(0xa0080000) sdi3(0xa00a0000) sdi4(0xa0100000) sdi5(0xa0120000) sdi6(0xa0140000) sdi7(0xa0160000)

**Mode**: 3G SDI 10bits

**format**: NV16\_10LE32

refer to document (pg289-v-smpte-uhdsdi-tx-ss.pdf) provided by Xilinx

* + 1. *sdi\_anc\_tx*

**Address**: sdi0(0xa01c0000) sdi1(0xa01d0000) sdi2(0xa01e0000) sdi3(0xa01f0000) sdi4(0xa0200000) sdi5(0xa0210000) sdi6(0xa0220000) sdi7(0xa0230000)

**data format**: 64bits unsigned interger. Microseconds of the epoch time.

### iio sensor

CPU:/sys/bus/iio/devices/iio\:device0

Power Current Sensor:/sys/bus/iio/devices/iio\:device1

### pdma

It is a user interface to transfer a DAM address of the user space to the physical address.

**Device**: /*dev*/pdma0

**ioctl cmd**: 0

**ioctl parameters**: struct{guint64 param\_in; guint64 param\_out}

param\_in: the dma user-space address.

param\_out: the dma physical address

### Reserv memory

**Osd reserve memory physcial address**:0x70000000

**osd reserve memory size**: 0xff00000

**osd image format**: ARGB32

### Watchdog

**Device**: /*dev/watchdog0, /dev/watchdog1*

*watchdog0 is controlled by OS.*

*Watchdog1 can be controoled by the user.*

## CSCI internal data requirements

### Log data

Log data is stored in the Log FRAM chip. It includes two configuration data structrue and the error recording data array. The error recording data array can fill the space of the log chip except the configuration data area.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| conf[2]  (logdata\_conf\_data\_t) | header  (guint32) | 0x5555aaaa | Configuration data header ID |
| timestamp  (guint32) |  | Linux epoch time(unit:s) |
| totaltick  (guint32) |  | Totoal power on time(unit:s) |
| rev[2]  (guint16) |  | Reserve data space |
| chk  (guint16) |  | CRC16 checksum(modbus) |
| rec[]  (logdata\_rec\_data\_t) | header  (guint32) | 0x66669999 | Recording data header ID |
| timestamp  (guint32) |  | Linux epoch time(unit:s) |
| infocode  (guint32) |  | 0x80000001: memory error  0x80000002:temperature error  0x80000003:power error  0x80010001:log chip error  0x80010002:sensor error  0x80010003:key error  0x80010004:sdi device error  0x80010005:sdi out device error  0x80010006:osd device error  0x80010007:serial device error |
| desc[34]  (guint8) |  | Error info description |
| chk  (guin16) |  | CRC16 checksum(modbus) |

### Configuration file data

Default Configuration file: /*etc/b3vdu.conf*

*file data format based on “libconfig”*

|  |  |  |  |
| --- | --- | --- | --- |
| **Item** | **Type** | **Value** | **descritpion** |
| device.version | String | “x.x.x” | Whole system version |
| device.SN | String | “B3VCU-xxx” | Device Serial Number |
| device.date | String | “xx-xx-xxxx” | Manufacturing Date |
| VARIANT | String | “xxxxxx” | VDU OSD variant |
| BITMASK | HEX(32 bits) | 0xhhhhhhhh | Error bit mask for light  0:disable  1: enable |
| DISABEL\_WATCHDOG | Boolean | true: disable watchdog  false: enable watchdog | Firmware watchdog enable/disable |
| DISABLE\_SEI | Boolean | true: disable SEI package  false: enable SEI package | SEI package of RTP/UDP streamer data |
| MaxRtpStream | Integer | 1 – 8 | The maximum rtp streams can be enable. |

### global parameters

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| PGParam (glb\_priv\_data\_t) | Sysbits (guint32) | Bit0: memory  bit1: logdata  bit2: snsor  bit3: current  bit4: temperature  bit5: keypad  bit6: video out0  bit7: video out1  bit8: video out2  bit9: video out3  bit10: video out4  bit11: video out5  bit12: video out6  bit13: video out7  bit14: vdieo in0  bit15: video in1  bit16: video in2  bit17: video in3  bit18: video in4  bit19: video in5  bit20: video in6  bit21: video in7  bit22: video in8  bit23: video in9  bit24: osd  bit25: serial  bit26: vdu | System BIT information:  0: pass  1: fail |
|  |  |  |  |
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# Requirements traceability

# Note

# Appendixes

## Version Log

|  |  |  |
| --- | --- | --- |
| **Vesrion** | **Date** | **content** |
| 1.0.1 | 29 Jun 2022 | inital version |
| 1.0.2 | 14 Jul 2022 | NUC camera command and show 'NUC' information  based on STK document "VDU View Switching 13072022.pptx" |
| 1.1.1 | 20 Jul 2022 | net communication protocol  based on STK document "VCU\_IDS\_V0.2.xlsx" |
| 1.1.2 | 27 Jul 2022 | enable 8 stream out among all 10 SDI input. |
| 1.1.3 | 11 Aug 2022 | Modify OSD base on STK document "VDU View Switching 25072022.pptx" |
| 1.1.4 | 17 Aug 2022 | Modify OSD base on STK document "VDU Software V0.5\_16082022.pptx" |
| 1.1.5 | 21 Sep 2022 | IR on/off status shown by VDU not VCU.  based on STK document "VDU Software V0.6\_20092022.pptx" |
| 1.1.6 | 4 Oct 2022 | Add all bytes as checksum based on "tcp protocol" of "VCU\_IDS\_V0.3.xlsx" |
| 1.1.7 | 1 Nov 2022 | request VDU system information and send to Host  based on STK document "VCU\_IDS\_V0.4.xlsx" |
| 1.1.8 | 15 Nov 2022 | red led flashing based on "VDU Software V0.7\_31102022.pptx" |
| 1.1.9 | 15 Dec 2022 | Red Led will not flashing. Only detect 3 HD-SDI input in BIT. |
| 1.1.10 | 3 Jan 2023 | Downgrade Video Ethernet stream 30fps to 15fps base on STK document. |
| 1.1.11 | 7 Feb 2023 | print application information with syslog. Change NUC protocol base on STK document  "VDU Software V0.8\_06022023.pptx". |
| 1.1.12 | 17 Feb 2023 | change camera RS422 baudrate from 115200 to 38400 base on STK document  "VDU Software V0.9\_16022023.pptx" |
| 1.1.13 | 27 Apr 2023 | change Fault light mode based on "VDU Software V0.10\_27042023.pptx"  change network protocol based on "VCU\_IDS\_V0.6.xlsx" |
| 1.1.14 | 8 Jun 2023 | Remove downgrade fps module. Downgrade streams number to 4 and upgrade to low-latency mode.  baed on STK document "VDU Software V0.12\_08072023.pptx" |