# RAA462113FYL

# Surveillance Camera Module

# Introduction

This document describes key features and operation method about surveillance camera module with RAA262113FYL CMOS image sensor (PDAF).

# **Target Device**

RAA462113FYL ISL9307

ISL8022

ISL85009

ISL8016

ISL80505

ISL9005A

ISL3170E

When applying the sample program covered in this document to another microcomputer, modify the program according to the specifications for the target microcomputer and conduct an extensive evaluation of the modified program.

# Contents

1.	Description	3
1.1	1 Overview	3
1.2	2 Specifications	3
1.3	3 Operation Conditions	3
1.4	4 Configuration	4
1.	5 Block Diagram	4
1.6	6 Outside View	5
2.	Operation Setup	7
2.′	1 Component List	7
2.2	2 Setup	7
2.3	3 Network setting1	1
2.4	4 UART & Telnet setting1	3
2.	5 RTSP Video Play1	4
2	2.5.1 Install VLC media player1	4
2	2.5.2 RTSP streaming output1	4
2	2.5.3 RTSP Video play on VLC 1	5
2	2.5.4 Open Media1	5
2.6	6 HDMI Video Play1	6
2.7	7 USB Video Play1	7
2.8	8 WiFi Configuration 1	9
2.9	9 Lens Zoom/focus tuning2	20
2.′	10 IR cut	20
2.′	11 AF trigger2	!1
2.1	12 Software update 2	2
2.′	13 PQ Tuning	2
2.1	14 PDAF correction	2

# 1. Description

### 1.1 Overview

The surveillance camera module includes a CMOS image sensor (CIS) board with phase-detection autofocus (PDAF), and a high-performance image signal processing (ISP) board along with autofocus zoom lens software.

This reference design enables 4K resolution, excellent color imaging and better recognition accuracy of objects, including small objects in low-light conditions. Its impressive high-speed autofocus operation can also be realized with low-priced lenses. Built around Renesas' high performance RAA462113FYL CMOS image sensor and Novatek's dual core SoC image signal processor, the surveillance camera reference design uses several other Renesas ICs that address its signal chain electrical functions. The CIS board includes the RAA462113FYL, DC/DC buck converters, LDOs, motor driver and lens. The ISP board features the SoC and associated signal chain components.

### 1.2 Specifications

Table 1.1 lists the specification of surveillance camera module.

Function	Description
Lens mount	Customized lens mount for YT50011DB, CS mount
Video output Interface	USB/ HDMI / Ether/ WiFi
Output resolution	4K
Frame rate 10fps ~ 30fps	
Video output format H.265 / H.264	
Video & image capture	RAW
White balance	Auto (2500K to 7500K)
Exposure time Auto (Max:1/30sec) / Manual(Max:1/5sec (5fps))	
Gain control	Auto (Max:72dB including ISP digital gain) / Manual (Max:72dB including ISP digital gain)
HDR (High Dynamic Range)	Manual (Off / On), 4K@30fps (Max) (Under development)
2D Noise reduction filter	Manual (Off / On)
3D Noise reduction filter	Manual (Off / On)
IR cut filter control	Manual (Off / On)
AF function	Hybrid AF(PDAF + Contrast AF),
Zoom control	Optical zoom for YT50011DB (10.9mm ~ 29mm)

#### Table 1.1 Specifications

#### 1.3 **Operation Conditions**

Table 1.2 lists operating conditions of surveillance camera module.

#### **Table 1.2 Operation Conditions**

Symbol	Item	Rated Value	Note
5.0V	5V power voltage by Type C	4.5V to 5.5V	Vss standard
	Typical consumed current	0.95A	The whole module current consumption powered by 5V
12V	12V power by AC/DC adaptor		
Topr	Operational temperature	-20°C to 70°C	
Tstg	Storage temperature	-20°C to 110°C	

Note: Power input can be selected DC 12V or DC 5V.

# 1.4 Configuration

Figure 1.1 shows an example of system configuration for surveillance camera module.



Figure 1.1 Surveillance Camera Module System Configuration

# 1.5 Block Diagram

Figure 1.2 surveillance camera module block diagram. The blue color blocks are Renesas's products.



Figure 1.2 Surveillance Camera Module Block Diagram

# 1.6 Outside View

Figure 1.3 shows the top view of ISP board.



Figure 1.3 Top view of ISP Board



Figure 1.4 Top View of CIS Board

Figure 1.5 shows the bottom view of CIS board.



Figure 1.5 Bottom View of CIS Board

# 2. Operation Setup

# 2.1 Component List















Note: If select other adapter, ensure the output current > 1.5A.

### 2.2 Setup

Figure 2.1 shows the connection LAN cable and USB type-C cable (only for power). Then, power on for the surveillance camera module. Red LED on the back of CIS board will be lighted. DC 12V can power for the surveillance camera module also. Figure 2.2 show the connect of DC 12V with ISP board.



Figure 2.1 LAN and USB Type C Cable Connection



Figure 2.2 DC 12V Power

The following are installation steps if reinstalling the camera module.

a) Install Lens on CIS board



Figure 2.3 Install Lens on CIS Board

b) Connect ISP board and CIS board by HSI cable & SPI Cable. HIS cable is yellow. SPI cable is white.



Figure 2.4 Assembly HSI and SPI Cable

c) Mount ISP board, CIS board & Mounting board together as below.



Figure 2.5 Mount ISP, CIS and Mounting Board

- d) Connect DC 12V power to ISP board DC 12V socket. Or connect TYPE-C connector to type-c connector.
- e) Connect to PC by ethernet RJ45 connector with LAN cable.



Figure 2.6 Connect LAN Cable

f) Connect Debug UART connector to PC.



Figure 2.7 UART Debug Interface



Figure 2.8 UART Debug Board Connection

# 2.3 Network setting

Configure the TCP/IPv4 setting of the PC for video display.

Input IP address and Subnet mask as follows

Settings		Network Connections
命 Home	Ethernet	← → · ↑ ♥ · Control Panel > Network and Internet > Network
		Internet 协议版本 4 (TCP/IPv4) Properties X
Find a setting $ ho$	Ethernet	General
Network & Internet	記 い Not connected	You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Status	not connected	Obtain an IP address automatically
		Use the following IP address:
n Wi-Fi		IP address: 192 . 168 . 88 . 31
문 Ethernet		Subnet mask:         255 . 255 . 0           Default gateway:
ଳ Dial-up		Obtain DNS server address automatically  Use the following DNS server addresses:
∞ VPN		Preferred DNS server: Alternate DNS server:
$r_{\mathcal{U}}^{n}$ Airplane mode		Validate settings upon exit Advanced
(ျာ) Mobile hotspot		OK Cancel
🕒 Data usage		2 items 1 item selected
Proxy		

EX) "IP address" (192.168.88.31), "Subnet mask" (255.255.255.0)

#### Information: Setting TCP/IPv4

- 1) Select Windows button.
- 2) Select Setting button.



3) Select "Network and Internet".

	Window	s Settings	
	Find a setting	P	
System Display, notifications, power	Devices Bluetooth, printers, mouse	Network & Internet Wi-Fi, arplane mode, VPN	3) Personalization Background. lock screen, colors
	0	e.	

- 4) Select "Ethernet".
- 5) Select "Network and Sharing center".

Home	Ethernet
Find a setting	∠ Ethernet
etwork & Internet	Ethernet Not connected
Þ Status	
(Wift) <b>4</b> )	Related settings
/	Change adapter options
P Ethernet	Change advanced sharing options
• Dial-up	Network and Sharing Center
° VPN	HomeGroup
Airplane mode	Windows Firewall
Mobile hotspot	Have a question?
9 Data usage	Get help

6) Select "Change adapter settings".

Change adapter settings	View you	r active networks		
Change advanced sharing settings		n.renesas.com ain network		cess type: No Internet access nnections: Wi-Fi (REL-WSG)
	Change	our networking settings		
	*	Set up a new connection or ne Set up a broadband, dial-up, o		set up a router or access point.
		Troubleshoot problems		
		Diagnose and repair network p	problems, or get troub	leshooting information.

7) Select "Ethernet".

NOTE: Confirm the Ethernet status. If "Network cable unplugged", re-connect LAN cable.

-> - 🛧 💆 > Control Panel > Network a	dana ha di fanalari	-	✓ δ Search Network Connections	General	
	ne internet + Network Connections +	- 7)	V O SEARCH NEEVEN COMPACIENT	Connection	
enize *			► • <b>□</b>	IPv4 Connectivity:	No network acc
Blattoath Network Connection Net connected Blattoath Device (Personal Area	Not connected	Bernd nidentified network		IPv6 Connectivity:	No network acc
Bluetooth Device (Personal Area X	Intel®) Dual Band Wireless-AC 82.	tel(R) Ethernet Connection (219		Media State:	Enab
				Duration:	00:05
				Speed:	1.0 G
				Details	
				Detais	
				Activity	
				Activity	
				Sent	_ Receiv
					00
				Packets:	85
				8) Packets:	85
				Packets:	

8) Select "Properties" button of "Ethernet Status".

9) Select "Internet Protocol version 4 (TCP/IPv4)" of "Ethernet Properties".

NOTE: Don't uncheck the box.

10) Select "Properties" button.

11) Select "Use the following IP address" of "Internet Protocol version 4 (TCP/IPv4) Properties". Set "IP address".

letworking Sharing		$\leftarrow \rightarrow \land \uparrow \Psi > Control P$	anel → Network and Internet	> Netv
Connect using:		Internet 协议版本 4 (TCP/IPv4) Pro	perties	×
Intel(R) Ethemet Connection 1219-LM		General		
This connection uses the following items:	igure	You can get IP settings assigned au this capability. Otherwise, you need for the appropriate IP settings.		
File and Printer Sharing for Microsoft Networks     Gos Packet Scheduler	^	Obtain an IP address automati	cally	
Internet Protocol Version 4 (TCP/IPv4)		IP address:	192 . 168 . 88 . 31	
Adapter Multiplexor Protocol	100	Subnet mask:	255 . 255 . 255 . 0	1
<ul> <li>Microsoft LLDP Protocol Driver</li> <li>Internet Protocol Version 6 (TCP/IPv6)</li> </ul>	~	Default gateway:		
<	<u> </u>	Obtain DNS server address au	tomatically	
Install Uninstall Prope	erties	• Use the following DNS server a	ddresses:	_
Description		Preferred DNS server:		
		Alternate DNS server:		
Transmission Control Protocol/Internet Protocol. The de wide area network protocol that provides communication	00			

# 2.4 UART & Telnet setting

Please install the software that can control UART in advance.

e.g.) Tera Term for Windows (version:4.105)

USB/UART conversion cable is required to connect the PC.

#### Operating "Tera Term".

Selecting the "seri	al" and USB port then	ı clicking "OK".	
Tera Term: New conn	ection		×
○ ТСР/ІР	Hos <u>t</u> : <mark>192.166.</mark> ✓ Hist <u>o</u> ry Service: ○ Te <u>I</u> net ◎ <u>S</u> SH ○ Other		
● S <u>e</u> rial	Po <u>r</u> t: COM27: U OK Cance	JSB Serial Port (COM27) v	

Selecting "serial port..." of menu.

Setting "speed" to "115200" then clicking "New setting".

User can see following log when turning on the power (USB-C) of this camera module.

💻 сом	27 - Tera Term VT		- 0	×	
File Edit	Setup Control Window	Help			
	Terminal		Tera Term: Serial port setu	ıp	×
	Window				
	Font		<u>P</u> ort:	COM27 ~	ОК
	Keyboard		<u>B</u> aud rate:	115200 ~	
	Serial port		<u>D</u> ata:	8 bit 🗸	Cancel
	Proxy SSH		– P <u>a</u> rity:	none ~	
	SSH Authentication		-		<u>H</u> elp
	SSH Forwarding		<u>S</u> top:	1 bit ~	<u></u>
	SSH KeyGenerator		<u>F</u> low control:	none v	
	TCP/IP		The second delay		
	General		Transmit dela		
	Additional settings		0 mse	с/ <u>c</u> har 0 п	nsec/ <u>l</u> ine
	Save setup				
	Restore setup				
	Setup directory				
	Load key map				
				$\sim$	

Configure UART & Telnet parameters in tool (Such as SecureCRT, Tera Term etc.):

UART serial setting: baud rate 115200bps, 8 data bit, 1 stop bit, none parity.

For telnet setting, host is "192.168.88.30". Port is "23".

When UART or Telnet connected ready, you can setup ISP streaming output.

# 2.5 RTSP Video Play by Ethernet

### 2.5.1 Install VLC media player

Download VLC from https://www.videolan.org/. Install VLC media player software.



Figure 2.9 VLC Media Player Setup

# 2.5.2 RTSP streaming output

Turn on your ISP platform, after system initialization finished, system will auto run RTSP. Enter "q" to exit, then change the parameters. If your system is in command line, you can type below command to run RTSP: *hd\_video\_record\_with\_rtsp 0 0 1 1 0 0 8* 

Parameters notes:

root@NVTEVM:~\$ hd\_video\_record\_with\_rtsp 0 0 1 1 0 0 8

Usage: <sensor\_path> <shdr\_mode> <af\_mode> <pd\_func> <hdmi\_type> <enc\_type> <enc\_bitrate>

Help:
-------

<sensor_path></sensor_path>	: 0(path 1) (only 0 could be effective in this platform)
<shdr_mode></shdr_mode>	: 0(disable), 1(path 1 enable)

<af\_mode> : 0(single), 1(continuous)

<pd\_func> : 0(disable), 1(enable)

<hdmi\_type> : 0(1920x1080I@60Hz), 1(3840x2160@30Hz), 2(1920x1080P@30Hz)

<enc\_type> : 0(H265), 1(H264)

*<enc\_bitrate>* : *Mbps (must be 1, 2, 3, 4, 5, 6, 7, 8)* 

In UART debug window, enter "q" then input "enter". The current setting will be displayed to confirm the setting.

# 2.5.3 RTSP Video play on VLC

Open VLC media player and open network streaming as figure 2.10.



Figure 2.10 Open Network Streaming

#### 2.5.4 Open Media

In Open Media dialog, select "Network" tab and input "rtsp://192.168.88.30/live/ch00\_0" at URL space.

A Open Media –			×	
🕞 File 🕟 Disc 🚏 Metwork 💷 Capture Device				
Network Protocol				
Please enter a network URL:				
rtsp://192.168.88.30/live/ch00_0			~	
http://www.example.com/stream.avi rtp://@:1234				
mms://mms.examples.com/stream.asx				
rtsp://server.example.org:8080/test.sdp http://www.yourtube.com/watch?v=gg64x				
Show more options				
<u>P</u> lay	-	Car	icel	

Figure 2.11 URL setting

Click "Play" button, video will show in PC.

Figure 2.12 shows video output in VLC media player.



Figure 2.12 Video Output in VLC Media Player

# 2.6 HDMI Video Play

1) Connect ISP board with a display via HDMI cable, as Figure 2.13:



Figure 2.13 HDMI Connection

2) Video output on the monitor with HDMI interface.

Note: Default setting of HDMI display is 4K UHD monitor. Please change HDMI display type according to section "2.5.2 RTSP streaming output"

### 2.7 USB Video Play

#### 1) Download potplayer on internet: <u>https://potplayer.en.softonic.com/</u>,

https://potplayer.org/ or another Web site. And install it on your PC.

2) Connect your ISP board (Type-C socket) with your PC USB port, as below Figure 2.14:



Figure 2.14 USB Connection

3) On your ISP system type below command to run liveview

hd\_video\_record\_with\_substream

when substream work rightly, system will output as below:

enc\_type=1

##video\_out\_param w:3840,h:2160 520c0420 0

The output log may be inserted by other log information like Figure 2.15.

🔟 COM27 - Tera Term VT
File Edit Setup Control Window Help
<pre>rootBWVTEVM: \$ hd_video_record_with_substream HUAL: Version: vhd_common_init 0.2000.0 [ 71.636153] hd_common_init: already init? [ 71.640742] hd_reset - begin [ 71.640742] hd_reset - end [ 71.690558] sen_pwr_ctrl_raa462113:enter flag 0 [ 71.695938] sen_pwr_ctrl_raa462113:mclk=0 [ 71.701503] sen_pwr_ctrl_raa462113:gpio_request fail [ 71.766789] sen_pwr_ctrl_raa462113:sgPI0= 5 [ 71.766789] sen_pwr_ctrl_raa462113:sgPI0= 4 [ 71.895708] hdmitx_ddc_read_byte2:hdmitx_ddc_read_byte2 fail: i2c_transfer not [ 71.805708] hdmitx_ddc_read_byte2:hdmitx_ddc_read_byte2 fail: i2c_transfer not [ 71.81488] hdmitx_ddc_read_byte2:hdmitx_ddc_read_byte2 fail: i2c_transfer not [ 71.821269] hdmitx_ddc_read_byte2:hdmitx_ddc_read_byte2 fail: i2c_transfer not [ 71.8348886] hdmitx_ddc_read_byte2:hdmitx_ddc_read_byte2 fail: i2c_transfer not [ 71.844762] hdmitx_ddc_read_byte:hdmitx_ddc_read_byte2 fail: i2c_transfer not [ 71.861615] hdmitx_ddc_read_byte:hdmitx_ddc_read_byte2 fail: i2c_transfer not [ 71.861815] hdmitx_ddc_read_byte:hdmitx_ddc_read_byte fail: i2c_transfer not [ 71.861815] hdmitx_ddc_read_byte:</pre>

Figure 2.15 USB output log

if you want to stop, enter "q" to exit.

If you want exit substream, press "ctrl + c".

4) Open potplayer, enter "Open" menu -> "Device settings" as below Figure 2.16:



Figure 2.16 HDMI Connection

In "Webcam" page, select "UVC Camera" in Device list, in format list, select "H.264", for example:

"H.264 1920x1080 30" , then click "Open device"

	Device Settings
	Screen Capture Webcam Analog TV Digital TV DVD/Blu-ray
	Video capture device
	Device: UVC Camera v
	Type:         捕获         v         Format:         H264 1920×1080 30         v
	Audio: Use audio capture de v Rescan Devices
	Audio capture device
	Device: WASAPI - Default Device v
	Input: v
	☑ Preview audio
	Advanced Settings
	Enable timeshift
-	
l L	QK Cancel Open device

Figure 2.17 Webcam setting

5) Video output in "Potplayer" as Figure 2.18.



Figure 2.18 USB Video Player

# 2.8 WiFi Configuration

Connect WiFi antenna in ANT501 port like Figure 2.19.



Figure 2.19 Open Network Streaming

Search WiFi signal "680ap-5G" like Figure 2.20. Connect with "680ap-5G", no password. After connection Wifi successfully, output "*rtsp://192.168.1.3/live/ch00\_0*" in VLC media player. You can output video in smart phone with VLC App shown in Figure 2.21.





18:07	ыl 4G 🗭	20:57	.nl 46 🐲
Network		Open Net	work Str
Cloud Services 0 logged in services	>	http://myserve	
Open Network St Play streams directly w		Open Netw Enter any HTTP, RTSP, RT address to open t	MP, MMS, FTP or UDP/RTP
▲ Downloads Download files directly	y to your device	Private Playba	ck
Sharing via WiFi No active WiFi connec	tion	Scan for Subti	
File Servers	Connect	rtsp://192.168.88.30/live ch00_0 rtsp://192.168.1.3/live/ch	
Video Audio Playlists	Network Settings		lists Network Settings

Figure 2.21 VLC Smart Phone App Setting

Please reduce Wifi communication speed by UART or telnet if the video output is not stable. Normally, 2Mbps is stable.

<4Mbps>: hd\_video\_record\_with\_rtsp 0 0 1 1 0 0 4

<2*Mbps*>: hd\_video\_record\_with\_rtsp 0 0 1 1 0 0 2

Note: Please kill the current thread "hd\_video\_record\_with\_rtsp 0 0 1 1 0 0 8" firstly if controlling camera module in telnet. For example, kill -9 PID.

# 2.9 Lens Zoom/focus tuning

Operating "Command Prompt".

Telenet : 192.168.88.30(Ethernet), 192.168.1.3(WiFi)

Login : root

Use "vendor\_isp\_sample" to tune zoom/focus parameters.

#### Note: Please open another telnet window if you want to change play mode.

Firstly, run RTSP sample code and use VLC to play it, and then in UART mode or in Telnet mode, type

"vendor\_isp\_sample", then you can see a set of debug menu appears. We list some major items here for example:

- 1) 21. Get motor focus
- 2) 21. Get motor focus
- 3) 22. Get motor zoom
- 4) 60. Set motor focus search range
- To optimize the focus effect, you can use it to fine tune AF search range. Please follow below steps:
- (1) Type 60, and firstly select table index (0~10)
- (2) Secondly set zoom pos node (0 ~ 770), In general the mapping relation between table index & zoom pos node is as below: Table index zoom pos node
  - 0
  - 1 77

0

- 2 154
- 3 231
- 4 308
- 5 385
- 6 462
- 7 539
- 8 616 9 693
- 10 770
- (3) Thirdly set focus min => min focus value for current zoom node
- (4) Finally set focus max => max focus value for current zoom node
- (5) After setting focus min/max for all nodes, you can test auto-zoom functions is work or not on every zoom node (you can see below item 6). If you find auto zoom can't work correctly on one zoom node, just repeat this step till you get proper value. At the end, send these data to us to make new FW bin for you, and also you can directly modify the configure file at board: /etc/motor/mtr\_an41908.cfg.
- 5) 64. Set motor focus => let the lens focus on the value you set.
- 6) 65. Set motor zoom =>let the lens go to zoom node you set.
- 7) 0. Quit

#### 2.10 IR cut

IR cut command is "66". Select IR cut open or close as shown in Figure 2.22.

75 Cat and and		
75. Set va crop_roi 76. Set va win_ratio		_
77. Set va whi_ratio 77. Set va indep_crop_roi		
83. Set sensor expt		
84. Set sensor gain		
85. Set d gain		
86. Set c gain		
87. Set total gain		
88. Set 1v		
89. Set ct		
100. Print information of motion detection		
101. Disable motion detection		
102. Set sensitivity of motion detection		
103. Print temperature		
0. Quit		
>> 66		
Set open/close (0 or 1)>>		

Figure 2.22 IR cut command

# 2.11 AF trigger

AF trigger can be operated in following process. Input command "64" to set focus pos that let the lens defocus.



Figure 2.23 Set focus position command

Input "0" to quit "vendor\_isp\_sample" process. Execute "echo w re\_trigger 0 1 > /proc/hdal/vendor/af/cmd" to trigger auto focus process.



Figure 2.24 AF trigger command

### 2.12 Software update

Update ISP board's firmware as following steps.

- 1) Take out TF card from ISP board
- 2) Copy firmware file (FW96685A.bin) to TF card by PC
- 3) Tack TF card back into ISP board

4) Power on ISP system or reboot system, it will auto run updating process. After updating finished, system will reboot automatically.

# 2.13 PQ Tuning

For picture quality (PQ) tuning, please use ISP tool from Novatek. Please contact with Renesas or distributor sales window person firstly.

### 2.14 PDAF correction

For PDAF correction. Please contact with Renesas or distributor sales window person firstly.

# **Revision History**

Bay Data		Description			
Rev.	Rev. Date	Page	Summary		
0.10	Oct. 22, 2020		First edition issued		
0.20	Nov. 14,2020	3	Update specification		
		5	Update the photo of ISP board		
		7 to 16	Update operation set up		
0.50	Dec. 4,2020	All	Update operation about WiFi, USB and HDMI		
0.60	Feb. 19,2021	14	Update "2.5.2 RTSP streaming output"		