

# **C328-7221 Mono Camera Module with UART Interface**

## **User Manual**

### Release Note:

1. 16 Mar, 2009 – official released v1.0

## General Description

The C328-7221 is VGA camera module which is specially designed for serial communication and working under low light condition. It performs as a JPEG compressed still camera and can be attached to a wireless or PDA host. Users can send out a snapshot command from the host in order to capture a full resolution single-frame still picture. The picture is then compressed by the JPEG engine and transferred to the host thru serial port.

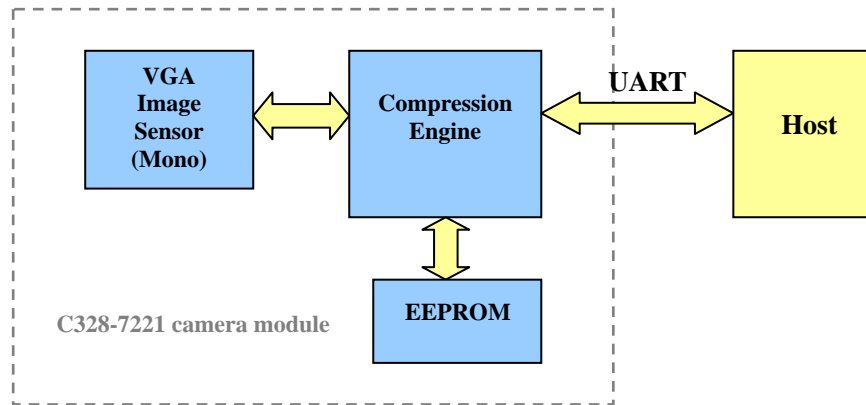


Figure 1 – System Block Diagram

## Features

- Small in size, 20x28mm
- Monochrome image sensor used
- 8-bit, 256-level grey level
- Sensitive to IR, good for night vision
- VGA resolution, down sample to QVGA
- 3.3V operation
- Low power consumption 105mA
- User friendly commands for control
- UART interface of up to 115.2Kbps
- Auto detect baud rate and make connection to the host
- Power saving mode
- Various lens options

## Board Layout

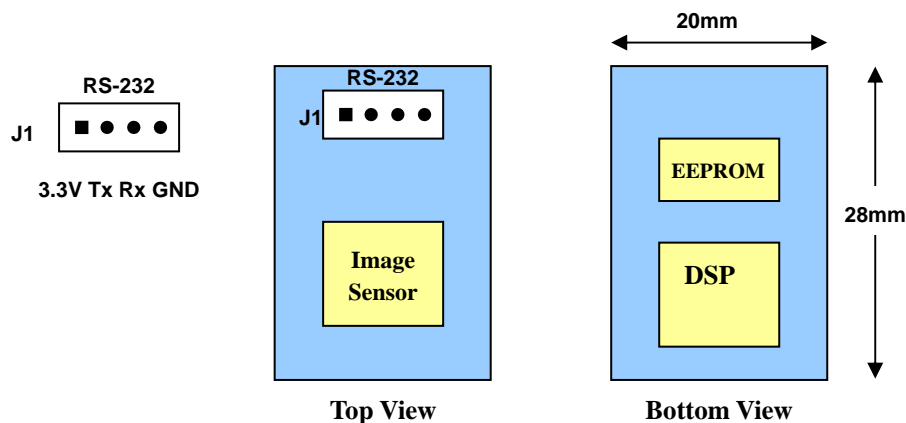


Figure 2 – C328 board layout and serial interface pin assignment

Pin	VCC	TxD	RxD	GND
Description	Power 3.3V DC	Data Transmit (3.3V)	Data Receive (3.3V)	Power Ground

## Serial Interface

### 1. Baud Rate

C328-7221 will auto detect baud rate and make connection to the host.

C328-7221 supports 8 types of baud rate: 115200bps, 57600bps, 38400bps, 28800bps, 19200bps, 14400bps, 9600bps, 7200bps.

### 2. Single Byte Timing Diagram

A single byte RS-232 transmission consists of the start bit, 8-bit contents and the stop bit. A start bit is always 0, while a stop bit is always 1. LSB is sent out first and is right after the start bit.

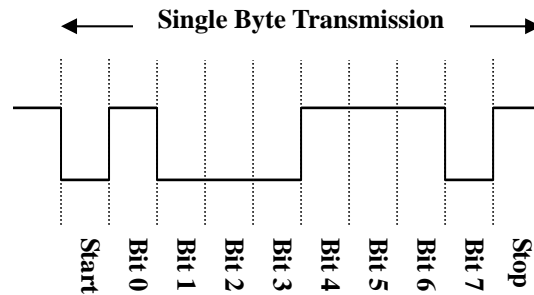


Figure 3 – RS-232 single byte timing diagram

### 3. Command Timing Diagram

A single command consists of 6 continuous single byte RS-232 transmissions. The following is an example of SYNC (AAh,0Dh,00h,00h,00h,00h) command.

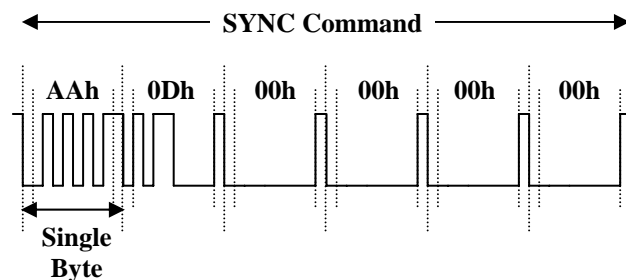


Figure 4 – RS-232 SYNC command timing diagram

## Command Summary

Command	Function
INITIAL	To configure the image size
GET PICTURE	Get Picture type
SNAPSHOT	Set snap shot image type
SET PACKAGE SIZE	Set the package size to transmit data from module to Host
SET BAUDRATE	Change the baud rate
RESET	Reset the whole system or reset the state machine
POWER OFF	To enter sleep mode
DATA	Set the data type and length for transmitting data to host
SYNC	Sync signal to connect between host and module
ACK	Command to indicate the communication success
NAK	Command to indicate the communication fail with error code

## Command Set

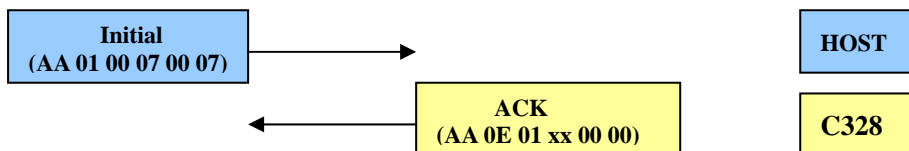
The C328-7221 module supports total 12 commands for interfacing to host as following:

Command	ID Number	Parameter1	Parameter2	Parameter3	Parameter4
Initial	AA01h	00h	07h	xx	Resolution 05h: 320x240 07h: 640x480
Get Picture	AA04h	Picture Type	00h	00h	00h
Snapshot	AA05h	Snapshot Type	Skip Frame Low Byte	Skip Frame High Byte	00h
Set Package Size	AA06h	08h	Package Size Low Byte	Package Size High Byte	00h
Set Baud Rate	AA07h	1st Divider	2nd Divider	00h	00h
Reset	AA08h	Reset Type	00h	00h	00h
Power Off	AA09h	00h	00h	00h	00h
Data	AA0Ah	Data Type	Length Byte 0	Length Byte 1	Length Byte 2
SYNC	AA0Dh	00h	00h	00h	00h
ACK	AA0Eh	Command ID	ACK counter	00h / Package ID Byte 0	00h / Package ID Byte 1
NAK	AA0Fh	00h	NAK counter	Error Number	00h

### 1. INITIAL COMMAND (AA01H)

The host issues this command to configure the preview image size and color type. After receiving this command, the module will send out an ACK command to the host if the configuration success. Otherwise, an NAK command will be sent out.

#### 1.1 Initialization example



### 2. SET BAUD RATE (AA07h)

Set the C328-7221 baud rate by issuing this command. As the module can auto-detect the baud rate of the incoming command, host can make connection with one of the following baud rate in the table. The module will keep using the detected baud rate until physically power off.

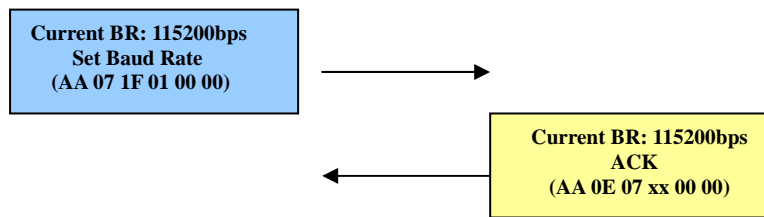
#### 2.1 Baud Rate Divider

Baud Rate = 14.7456MHz / 2 x (2nd Divider + 1) / 2 x (1st Divider + 1)

Baud Rate	1 <sup>st</sup> Divider	2 <sup>nd</sup> Divider	Baud Rate	1 <sup>st</sup> Divider	2 <sup>nd</sup> Divider
7200 bps	FFh	01h	28800 bps	3Fh	01h
9600 bps	BFh	01h	38400 bps	2Fh	01h
14400 bps	7Fh	01h	57600 bps	1Fh	01h
19200 bps	5Fh	01h	115200 bps	0Fh	01h

## 2.2 Communication Protocol

For instance: The current Baud Rate is 115200bps, the host wants to change the Baud Rate to 57,600bps.



## 3. SET PACKAGE SIZE (AA06h)

The host issues this command to change the size of data package which is used to transmit JPEG image data from the C328-7221 to the host. This command should be issued before sending Snapshot command or Get Picture command to C328-7221, even though it is default value. It is noted that the size of the last package varies for different image.

### 3.1 Package Size

The default size is 64 bytes and the maximum size is 512 bytes.

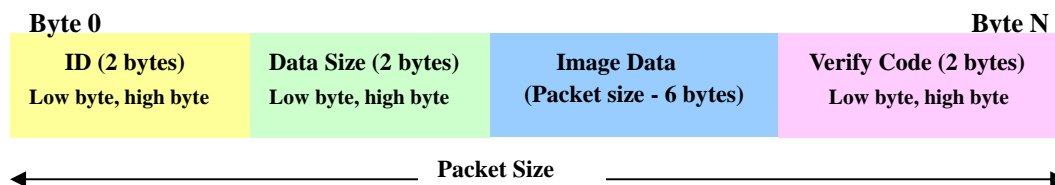


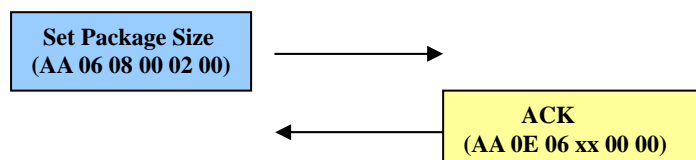
Figure 5 – Data Packet sequence diagram

ID	-> Data Packet ID, starts from 0000h to F0F0h
Data Size	-> Actual size of available image data in the packet
Image Data	-> Available image data
Verify Code	-> Error detection code, equals to the lower byte of sum of the whole data packet except the verify code field. The higher byte of this code is always zero. i.e. verify code = low byte(sum(byte[0] to byte[N-2]))

Note: As the transmission of uncompressed image is not in package mode, it is not necessary to set the package size for uncompressed image.

### 3.2 Communication Protocol

For instance: The host wants to set the package size = 512 byte



#### 4. [SNAPSHOT \(AA05h\)](#)

C328-7221 will keep a single frame of still picture data in the buffer after receiving this command.

##### 4.1 Snapshot Type

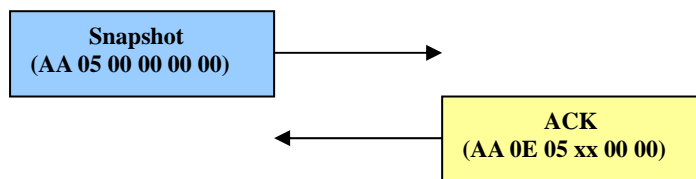
Snapshot Type	Parameter 1
JPEG Picture	00h
Uncompressed Picture (RAW)	01h

##### 4.2 Skip Frame Counter

The number of dropped frames can be defined before compression occurs. "0" keeps the current frame, "1" captures the next frame, and so forth.

##### 4.3 Communication Protocol

For instance: The host wants to snapshot a JPEG picture.



#### 5. [GET PICTURE \(AA04h\)](#)

The host gets a picture from C328-7221 by sending this command.

##### 5.1 Picture Type

Picture Type	Parameter 1
Snapshot Picture	01h
Uncompressed Preview Picture	02h
JPEG Preview Picture	05h

##### 5.2 Composite Command

The SNAPSHOT command and GET PICTURE command can be combined to get a still picture. There are 4 methods to get 4 different kinds of still pictures.

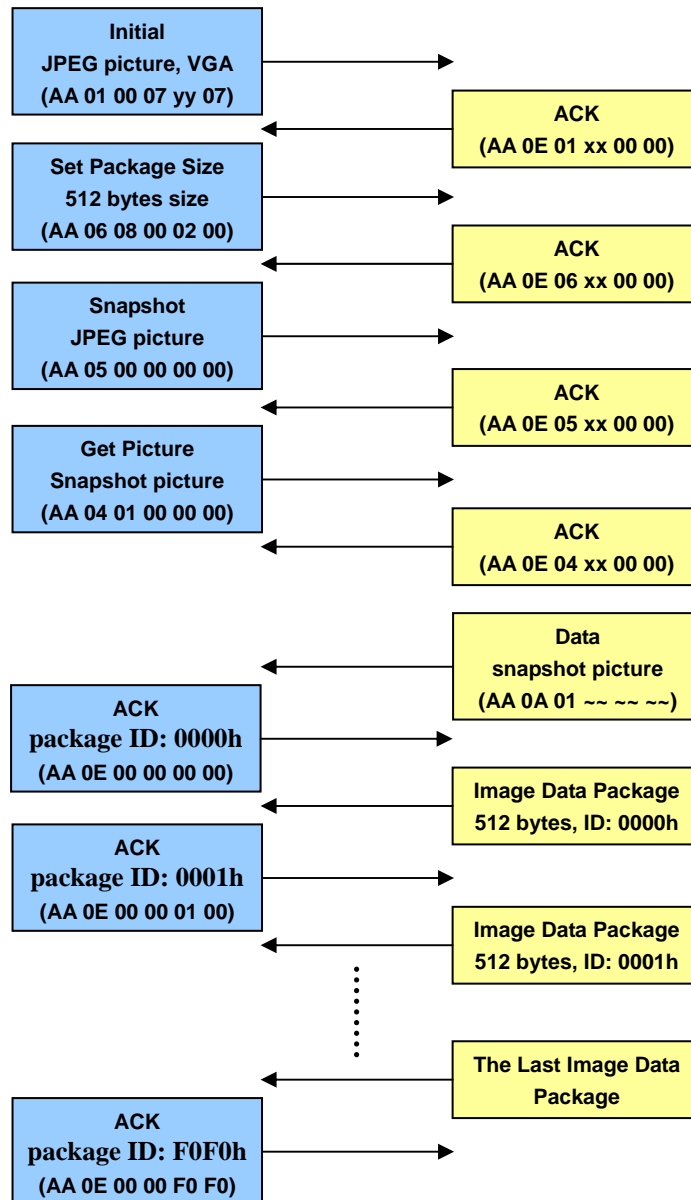
Desc Command	Method 1	Method 2	Method 3	Method 4
	JPEG Snapshot Picture	Uncompressed Snapshot Picture	JPEG Preview Picture	Uncompressed Preview Picture
Snapshot	(aa 05 00 00 00 00)	(aa 05 01 00 00 00)	No need	No need
Get Picture	(aa 04 01 00 00 00)	(aa 04 01 00 00 00)	(aa 04 05 00 00 00)	(aa 04 02 00 00 00)

### 5.3 Communication Protocol

Make sure connection is made before the following communication.

#### 5.3.1 JPEG Snapshot Picture

(For instance: 640×480 resolution)



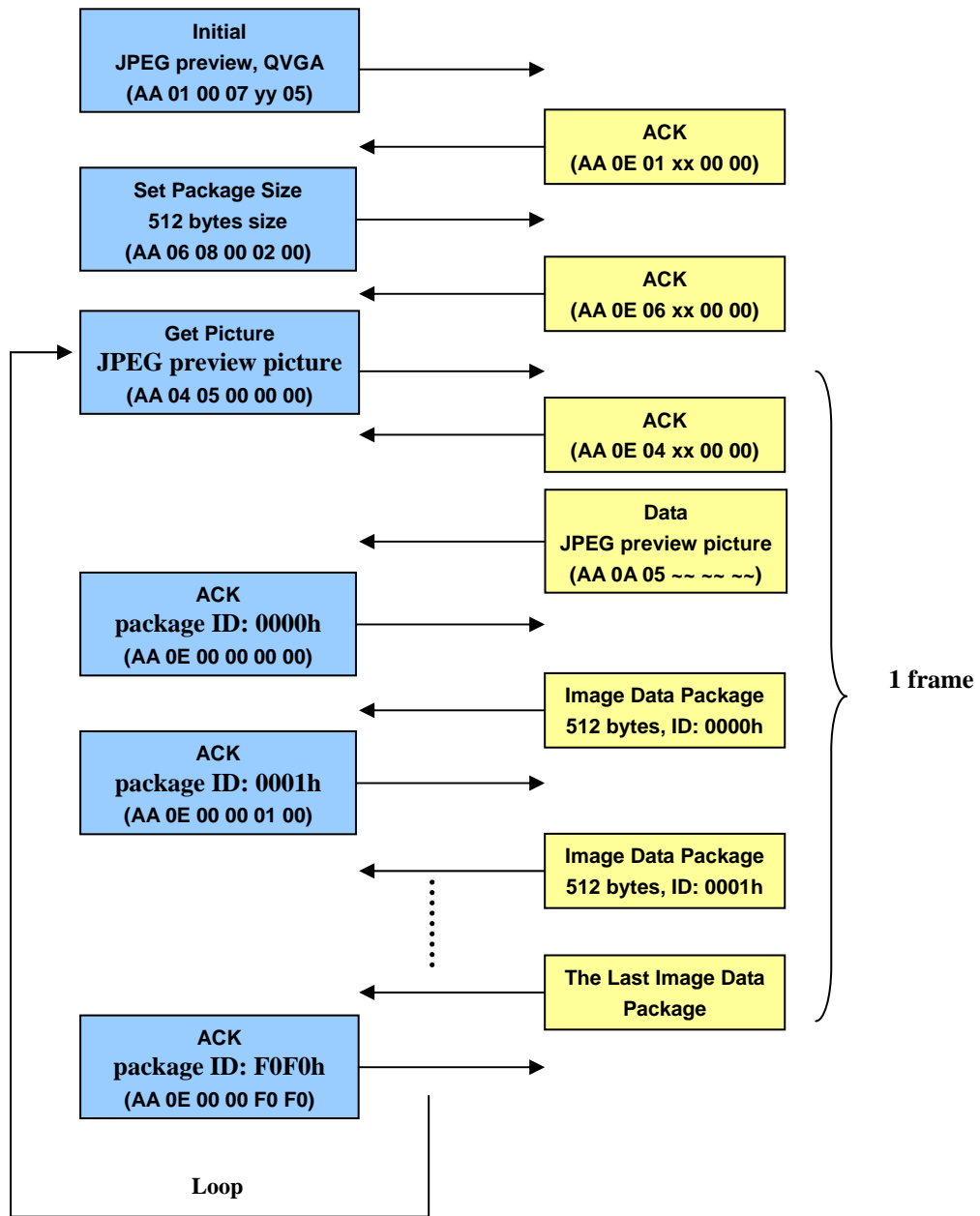
Note:

xx, yy: Don't care

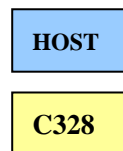
~~: Image size returned by C328

### 5.3.2 JPEG Preview Picture

(For instance: 320x240 resolution)



Note:  
 xx,yy: Don't care  
 ~: Image size returned by C328





## 6. [DATA \(AA0Ah\)](#)

C328-7221 issues this command for telling the host the type and the size of the image data which is ready for transmitting out to the host.

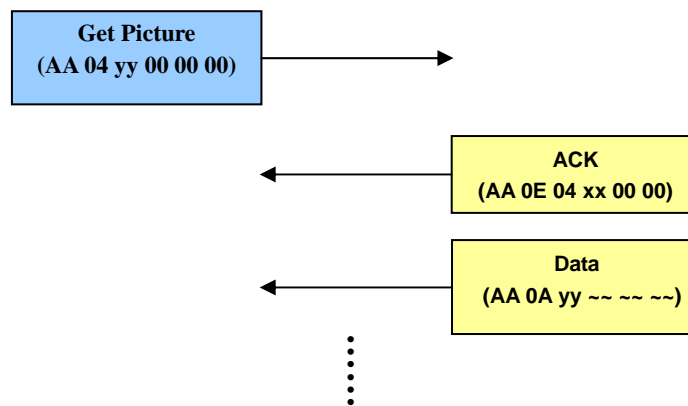
### 6.1 Data Type

Data Type	Parameter 1
Snapshot Picture	01h
Uncompressed Preview Picture	02h
JPEG Preview Picture	05h

### 6.2 Length

These three bytes represent the length of data of the Snapshot Picture, Preview Picture or JPEG Preview Picture.

### 6.3 Communication Protocol



**Note:**  
 xx: Don't care  
 yy: Get picture type  
 ~: Image size returned by C328

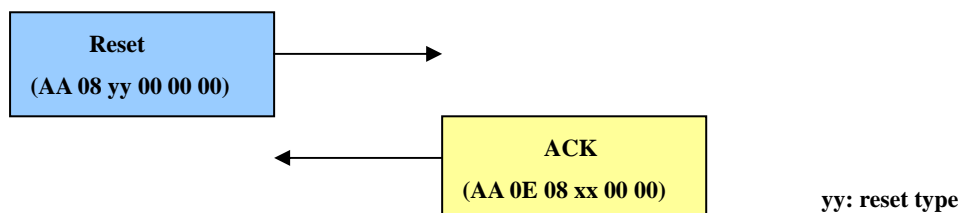
## 7. [RESET \(AA08h\)](#)

The host reset C328-7221 by issuing this command. C328-7221 will return an ACK command to host at first then perform the reset operation.

### 7.1 Reset Type

“00h” resets the whole system. C328-7221 will reboot and reset all registers and state machines. “01h” resets state machines only.

### 7.2 Communication Protocol



## 8 POWER OFF (AA09h)

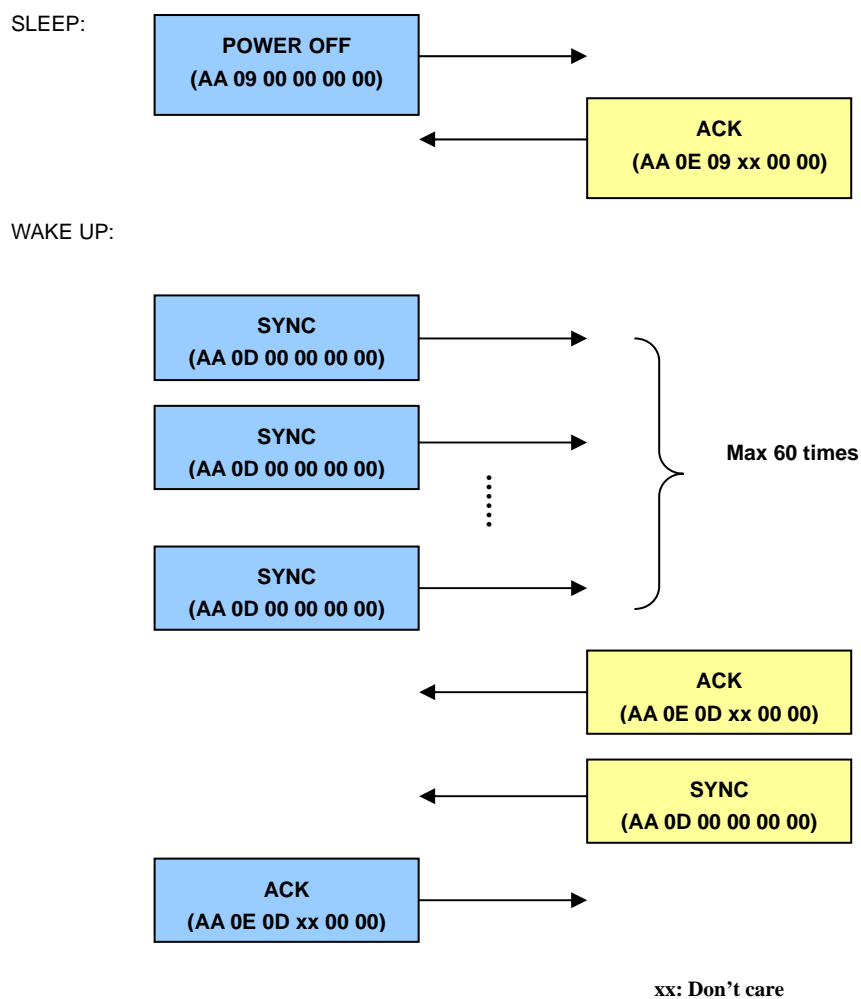
The function of this command is to save power.  
After receiving this command from host, C328-7221 will return an ACK command to host at first then go into sleep mode.

### 8.1 Wake up

SYNC command (AA0Dh) must be sent to wake up C328-7221 for certain period until receiving ACK command from C328-7221.

The previous command (setting) that has been sent to C328-7221 by host would be reserved when C328-7221 went into sleep mode. These commands include: Initial, Set Package Size, Set Baud Rate.

### 8.3 Communication Protocol

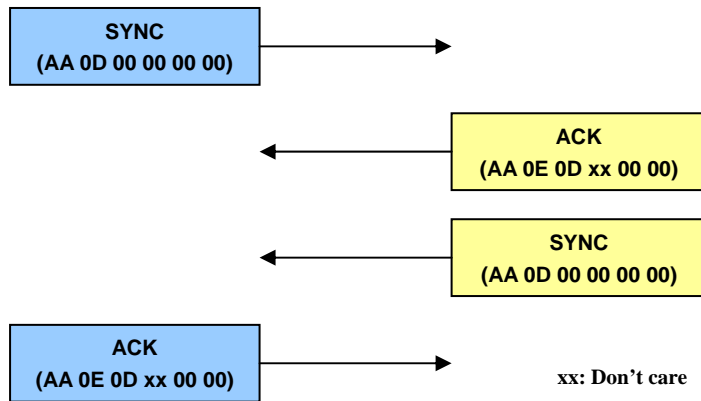


## 9 SYNC (AA0Dh)

Either the host or the C328-7221 can issue this command to make connection. An ACK command must be sent out after receiving this command.

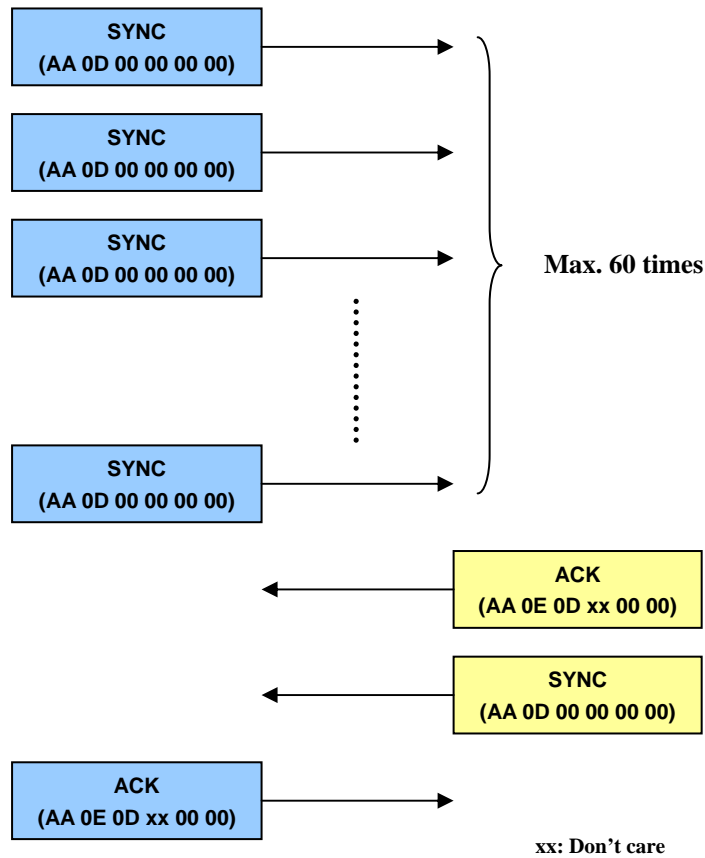
### 9.1 Communication protocol

#### 9.1.1 SYNC Command



#### 9.1.2 Make Connection with C328-7221

Send the SYNC command until receiving ACK command from C328-7221 (usually an ACK command is received after sending 25 times of SYNC command). This must be done after power up.



## 10. [ACK \(AA0Eh\)](#)

This command indicates the success of last operation. After receiving any valid command, ACK command must be sent out except when getting preview data. The host can issue this command to request image data package with desired package ID after receiving Data command from C328-7221.

### 10.1 Command ID

The command with that ID is acknowledged by this command.

### 10.2 ACK Counter

Debug only.

### 10.3 Package ID

For acknowledging Data command, these two bytes represent the requested package ID. While for acknowledging other commands, these two bytes are set to 00h.

The host should send this command with package ID F0F0h after receiving a package to end the package transfer. Note that the field "command ID" should be 00h when request image data package.

Package ID	Command
0000h	AA 0E 00 00 00 00
0001h	AA 0E 00 00 01 00
0002h	AA 0E 00 00 02 00
0003h	AA 0E 00 00 03 00
.....	.....
0102h	AA 0E 00 00 02 01
.....	.....
F0F0h	AA 0E 00 00 F0 F0

### 10.4 Package Number

Number of package = Image size / (Package size – 6)

For example: Image size = 0x4380; (From DATA command)

Package size = 0x200; (From SET PACKAGE SIZE command)

Number of package = 0x4380/(0x200-6) = 0x23.

## 11. [NAK \(AA0Fh\)](#)

This command indicates corrupted transmission or unsupported features.

### 11.1 NAK Counter

Debug only.

### 11.2 Error Code

Description	Parameter 3	Description	Parameter 3
Picture Type Error	01h	Parameter Error	0Bh
Picture Up Scale	02h	Send Register Timeout	0Ch
Picture Scale Error	03h	Command ID Error	0Dh
Unexpected Reply	04h	Picture Not Ready	0Fh
Send Picture Timeout	05h	Transfer Package Number Error	10h
Unexpected Command	06h	Set Transfer Package Size Wrong	11h
SRAM JPEG Type Error	07h	Command Header Error	F0h
SRAM JPEG Size Error	08h	Command Length Error	F1h
Picture Format Error	09h	Send Picture Error	F5h
Picture Size Error	0Ah	Send Command Error	FFh



00 52 37 DD 3F 4A 5A 47 FB 87 E9 40 1E 7C 4F FC 4D 0F FB DF D2 BA 34 FB A2 B9 BE BA A1 E7 F8 BF A5 74 8B F7 45  
00 3A 93 34 1A 4C D0 02 E6 93 34 94 50 03 B3 46 78 A4 14 A6 80 39 BB C3 8B D6 FA 8A DC 5F BA 2B 06 FD B1 7C DF  
85 6E C6 73 1A FD 28 01 D4 51 49 40 05 14 51 40 08 6A 8E A8 33 66 7F 0F E6 2A ED 53 D4 B9 B2 7F C3 F9 8A 00 CA  
B3 3F 2B 0C FE B5 67 35 56 C8 FD F1 9F 4A B5 9A 00 42 69 33 47 E3 4D 26 80 10 9F 7A AB 77 CC 26 AC D4 37 03 30  
9A 00 86 D0 E6 E1 39 EF 5D 32 9E 05 73 36 47 37 29 CD 74 AA 78 A0 09 01 A3 34 80 D2 E6 80 21 BD 38 B5 73 ED 56  
F4 61 FE 82 A7 D4 FF 00 5A A1 A8 36 2C DF F0 FE 75 A1 A3 7F C8 39 0F D7 F9 D0 06 85 25 75 00

**Package05:**

05 00 FA 01 14 50 01 45 25 14 01 95 AE 1F F4 75 FA FF 00 85 69 78 70 7F C4 B0 1F 7F EA 6B 2F 5D 38 89 3E BF E1 5A  
DE 1D FF 00 90 5A FD 4F F3 34 01 AD 45 14 50 01 45 14 50 01 48 FF 00 70 FD 29 69 AF F7 0F D2 80 3C FB FE 62 87  
FD EF E9 5D 2A 7D D1 5C D0 6F F8 9A 11 FE D7 F4 AE 95 4F CA 28 00 34 DA 71 34 DC E6 80 0A 29 28 CD 00 3C 1A 4C  
D2 66 8C D0 07 33 A9 1C 5F 37 E1 5B B0 9C C2 A7 DA B0 35 56 C5 F3 0F A5 6E DB 9C C0 9F 4A 00 96 8A 4C D2 66 80  
1D 9A 4A 4C D2 66 80 16 AA EA 1F F1 E5 27 E1 FC EA CE 6A B5 F1 FF 00 43 97 E9 40 18 96 47 E6 6E 7D 2A ED 67 D8  
B7 EF 1B E9 57 F3 40 08 69 B9 A7 13 4C ED 40 09 F8 D3 25 E6 23 4F CF 1D 69 92 30 F2 CD 00 54 B0 39 BB 8F EB 5D  
30 35 CB 58 37 FA 5C 7C F7 AE 98 1A 00 94 1E 29 73 51 86 C7 7A 50 E3 D6 80 2B 6A 67 FD 0D BF 0F E6 2B 53 46 FF  
00 90 6C 5F E7 BD 63 EA 6E 0D 9B 60 F7 1F CC 56 9E 91 3C 6B A6 C4 0B 60 E0 FF 00 3A 00 D4 CD 15 0F DA 42 1F C6  
29 BF 6C 80 75 71 40 13 D1 55 8D FD B8 FE 31 48 75 1B 70 3E F8 A0 0A 1A E9 FD DA 7D 7F C2 B6 7C 3D FF 00 20 A4  
FA 9F E6 6B 9E D6 6E E2 9D 50 46 D9 20 FF 00 85 69 E8 DA B5 AD B6 9E 91 CA E0 30 FF 00 1A 00 E8 E8 AC B3 AF D8  
8F F9 6A 3F 5A 69 F1 15 80 FF 00 96 9F CE 80 35 A8 AC 7F F8 49 6C 3F BF FC FF 00 C2 9A 7C 4D 60 3F 88 FE BF E1  
40 1B 54 D9 3F D5 B7 D2 B1 7F E1 28 B1 F5 3F AF F8 53 24 F1 4D 91 42 06 72 47 BF F8 50 07 31 BB FE 26 87 9F E2  
FE 95 D3 29 F9 45 72 3F 69 1F 6B F3 BB 67 38 CD 6B 8D 72 00 A3 AD 00 6B 93 4D AC 83 AF C0 3B 1A 6F FC 24 10 FA  
1A 00 D9 A2 B1 7F E1 20 84 FF 00 09 A5 FE DF 8B FB A6 80 36 B3 49 9A C5 FE DF 8B FB C5 00

**Package06:**

06 00 FA 01 A7 F3 A3 FE 12 08 BF B8 7F 3A 00 A1 AC 1F F4 F6 FC 3F 90 AD CB 63 FE 8D 1F D2 B9 AB DB 9F B5 5C 19  
07 00 D5 F8 35 95 8E 15 43 1F 20 7A D0 06 DE 68 AC 7F ED C4 3F F2 CC FE 74 0D 75 3A 98 CF E7 40 1B 19 CD 25 64  
FF 00 6E C7 FF 00 3C CF E7 4B FD B9 1F F7 0F E7 40 1A B9 AA F7 A7 FD 0E 5F A5 51 FE DC 8B FB 87 F3 A8 AE 35 88  
A5 81 D0 29 C9 18 EB 40 14 6C 5B F7 A4 66 B4 73 59 16 F3 08 E4 DC 7F 9D 5C 17 8A 7B 7E B4 01 6B 34 D2 6A B1 BD  
41 4D FB 6C 74 01 67 3C D4 6E 46 D3 51 7D B2 3F 5A 6B 5D CF 49 00 7A 50 07 01 FD 99 A9 9E AA 7F EF A1 FE 34 E1 A3  
AA DF C2 DF 98 FF 00 1A AD A0 B7 FC 4E 2D F3 EA 7F 91 AF 49 00 7A 50 07 01 FD 99 A9 9E AA 7F EF A1 FE 34 E1 A3  
EA 4D FC 27 F3 FF 00 EB D7 7C 00 A5 18 A0 0F 39 BB D3 2E ED 21 F3 66 52 10 7B FF 00 F5 E9 6D B4 FB B9 E0 57 8F  
3B 0F 4E 7F FA F5 D5 F8 A7 FE 40 CE 7D C7 F3 15 5B 43 39 D2 A2 FC 7F 9D 00 62 0D 1E F4 F5 FE 7F FD 7A 70 D1 6E  
CE 3F C7 FF 00 AF 5D 55 2D 00 72 C3 43 B9 F5 FF 00 3F 9D 38 68 77 3E BF E7 F3 AE 9B BD 2D 00 72 17 96 12 D9 2A  
B3 9C 83 FE 7D 6A 28 A0 79 57 70 3C 7F 9F 7A DA F1 17 FA 88 FE BF E1 59 F6 47 30 8E 68 02 0F B2 49 EB FE 7F 3A  
0D 9C 87 F8 BF CF E7 57 E9 33 40 19 FF 00 62 7F EF 7F 9F CE 8F B1 B7 F7 BF CF E7 57 89 A6 93 40 14 BE C6 D9 FB  
DF E7 F3 A0 D9 9C 1F 9B FC FE 75 72 93 1C 75 A0 0C A8 A3 F3 66 58 F3 C9 35 B8 BE 1D 25 41 F3 0F 3F E7 D6 B2 6D  
78 BE 4E 7B FA D7 70 87 E4 5F A5 00 73 9F F0 8D FF 00 D3 43 FE 7F 1A 4F F8 46 47 FC F4 3F 97 FF 00 5E BA 4C D2  
50 07 3A 3C 34 BF F3 D0 FF 00 9F C6 97 FE 11 A1 8F F5 87 FC FE 35 D0 E6 8A 00 E7 47 86 3D 00

**Package07:**

07 00 FA 01 97 FE 7A 1F F3 F8 D2 FF 00 C2 34 BF F3 D0 FF 00 9F C6 BA 1C D1 DA 80 38 1D 42 DB EC 77 4D 16 EC 81  
DF FC 9A B9 0E 92 25 85 5F CC C6 47 A7 FF 00 5E A3 D7 8E 75 26 FA 0F E4 2B 5A CC FF 00 A2 47 F4 A0 0A 1F D8 AB  
FF 00 3D 4F E5 FF 00 D7 A3 FB 15 7F E7 AF E9 FF 00 D7 AD 6C FB D2 50 06 57 F6 30 FF 00 9E BF A7 FF 00 5E 8F EC  
61 FF 00 3D 3F 4F FE BD 6A D0 28 03 2B FB 18 63 FD 6F E9 FF 00 D7 A8 A7 D2 44 50 B4 9E 66 76 8C F4 FF 00 EB D6  
E7 5A AF 79 FF 00 1E 92 7D 28 03 0B 4E B3 FB 6D C7 97 BB 1C 67 FC F3 5A E3 C3 D8 FF 00 96 9F A7 FF 00 5E AA F8  
7C 7F A6 B1 F6 AE A3 BD 00 73 FF 00 F0 8E FF 00 D3 4F D3 FF 00 AF 4D 3E 1C 3F F3 D7 F4 FF 00 EB D7 47 48 68 03  
9B FF 00 84 74 FF 00 CF 5F D3 FF 00 AF 4D 3E 1D 60 33 E6 FE 9F FD 7A E9 08 A6 37 DD 3F 4A 00 E3 F4 56 C6 9D 01  
CF 73 FC 8D 7A 70 AF 2C D3 5F 65 FC 2D 9E 8C 3B D7 6F E9 FF 00 D7 A8 A7 D2 44 50 B4 9E 66 76 8C F4 FF 00 EB D6  
BF CC 55 1D 05 B3 A5 C7 F8 FF 00 33 5A 5E 21 5D FA 2D C0 F4 00 FE A2 B2 FC 3E 7F E2 5A A3 D0 9F E6 68 03 57 34  
A2 9A 3A D3 A8 01 29 D4 82 94 50 06 37 88 79 B5 4F AF F8 56 65 89 FD CD 6B 6B E3 36 63 EB FD 45 64 D8 9F DD 1E  
68 02 CF 4A 4C F1 4E A6 93 40 0D 26 9B 9F 7A 75 34 D0 01 41 3C 51 F8 D0 D8 03 AD 00 67 DA FF 00 C7 EA 73 DE BB  
78 FF 00 D5 AD 70 D6 E7 17 A9 F5 AE E6 3F F5 6B F4 A0 05 22 90 1C 53 A9 31 40 09 40 A0 51 40 05 25 2D 14 01 C4 6B  
BF F2 12 73 F4 FE 42 B5 ED 7F E3 D6 3F A5 64 EB 7F F2 12 7F C3 F9 0A D7 B6 E2 DD 3E 94 01 29 34 99 A5 A4 3C 28  
00 1C D2 D3 57 A5 3C 50 01 D7 15 05 EF FC 79 C9 F4 A9 C7 35 5E FC ED B2 90 FD 3F 98 F2 00

**Package08:**

08 00 FA 01 A0 0A 9A 00 FF 00 4A 73 EC 2B A4 AE 77 C3 DC CF 29 F6 1F D6 BA 3A 00 4A 4C D3 A9 A6 80 12 99 27 11  
B7 D2 A4 A8 6E 0E DB 77 3E D4 01 C3 42 DB 26 43 9E FE B5 EA F1 1D D1 A9 F5 15 E4 EA 79 1F E3 5E A7 62 FB EC  
E2 6F 51 40 16 68 A2 94 50 05 0D 5D 3C CD 2E 75 F5 5F EA 2B 03 C3 8D 9B 16 1E 8D 5D 35 E2 EF B4 90 7B 57 29 E1  
96 CA 4E BE E0 F5 FA D0 06 F0 A5 C5 2E 29 71 40 08 29 47 4A 5C 52 E2 80 32 75 E1 FE 80 4F B8 FE 62 B1 AC 4F EE  
CD 6E EB 63 3A 73 9F A7 F3 15 85 63 F7 5A 80 2D 53 4D 49 4C 63 40 0C 38 A6 13 8A 73 53 09 A0 05 CE 69 A5 B8 A4  
CD 21 3E 94 01 9F 0B FF 00 A6 AF D7 D6 BB B8 8F EE D7 E9 5E 7F 1B 7F A6 AE 4F F1 57 7D 0F FA C5 FA 50 04 94 52  
50 28 01 69 28 EB 45 00 14 51 49 40 1C 56 B4 73 A9 3F 3E 9F C8 56 CC 1F EA 53 E9 58 9A CB 7F C4 CA 4E 7D 3F 90  
AD B8 7F D5 2F D2 80 1F 45 14 50 01 C0 14 A3 AD 25 19 A0 05 AA 9A 91 C5 93 F3 E9 FC C5 5A CD 50 D5 9F 16 67 DC  
8F E6 28 00 F0 DF 32 4E 7F DD FE B5 D1 0A E7 FC 32 3E 49 DB D4 8F EB 5B F9 A0 05 A4 34 66 9A 4D 00 06 AB 5F B6  
DB 29 4F A0 AB 19 AA 5A AB 6D D3 A5 FC 3F 98 A0 0E 35 4F 3D 7F 5A E9 2C 3C 49 71 6B 6A 91 18 B7 2A 8C 67 22 B9  
B1 FE 79 AE CB C3 8B 1C DA 70 56 50 4A 9F EA 68 02 48 BC 5B 1B 0F 9E 32 3F 1A B7 17 89 EC 9B AB 63 F3 FF 00 0A  
91 F4 BB 59 3E F4 43 F3 35 55 BC 3B 66 DD 14 8F A1 3F E3 40 17 FF 00 B6 AC 66 8C 81 28 E4 7B D7 3B A0 C8 90 DC  
CE 8C D8 04 8C 1F CE AE BF 86 A3 1F 72 52 3F CF D6 B2 7E C0 E2 F1 AD D5 BE 61 DF FC 9A 00 EA C4 B1 9E 8C 29  
E0 83 D0 D7 2E 74 DB B8 FE EE 7F 3F FE BD 37 CA BF 8F FB DF 98 A0 0E AC 52 D7 27 F6 9B F8 FA 1D 00

**Package09:**

09 00 FA 01 96 FC 85 28 D5 2F 50 F2 DF A0 A0 0D DD 55 77 69 F2 0F 6F EA 2B 9C B0 3C B0 A9 65 D5 AE 25 88 A3 90  
41 FA 55 28 66 68 5B 2B 40 1A 84 D3 7B D5 2F B7 BF F7 47 E7 4D 3A 83 0E AB FA D0 05 C6 A6 55 33 A8 FA A7 EB 4D  
FE D1 1F DC FD 68 02 D9 26 90 F4 AA BF DA 2B FD DF D6 9A 75 04 23 A1 FC E8 02 B2 9C 5E 8E 7B D7 7D 07 FA A5  
AF 3D F3 07 9F BF B6 7D 6B AB 87 C4 16 6B 12 82 D8 23 EB 40 1B 54 0A C9 FF 00 84 86 CB FB FF 00 CE 8F F8 48 2C  
BF BF FC E8 03 5A 8A CB FE DF B3 FE FF 00 F3 A4 FE DF B3 FE FF 00 E8 68 03 53 B5 15 95 FD BF 67 FD EF E7 4D  
3E 20 B3 FE F7 F3 A0 0E 77 56 39 D4 E5 E7 B8 FE 42 B7 A3 E2 35 FA 57 39 79 3A DC 5E 3C AB D0 91 FD 2B 48 6B 11  
00 06 D3 F9 D0 06 98 A5 EF 59 67 5A 8F FE 79 9F CE 9A 75 A5 ED 11 FF 00 BE A8 03 57 14 56 49 D6 89 1C 45 FF 00  
8F 54 67 5A 7E D1 8F FB EA 80 36 8F 22 B2 F5 A6 C5 B2 2E 7A 9F 0A AA C7 59 98 8E 14 0F C6 AA DD 5E C9 74 14 3F  
41 D2 80 37 BC B8 B3 66 F5 35 B4 4D 71 56 BA A4 F6 B0 88 A3 20 0C D3 DB 59 BD 61 FE B3 1F 80 A0 0E C7 3C 75  
A6 17 1E B5 C7 1D 46 F5 BF E5 A1 FC 85 30 DC 5D 3F 57 3F A5 00 76 46 68 C7 56 15 99 AC 5D 46 6C CA 2B 02 58 FF  
00 51 5C F8 59 98 F2 C7 F3 FF 00 EB D0 D1 B2 E3 71 EB FE 7D 68 02 15 1E F5 D5 78 55 F8 96 3C FA 1F E7 5C E4 68

4D 6E F8 79 FC BB DD B9 FB D4 01 D6 81 4E 02 80 29 45 00 21 15 CF 5C 29 8B 5B 0D D8 FF 00 85 74 26 B0 B5 71 B2  
EE 27 F5 FF 00 EB 50 06 8E 73 47 06 9A A7 2A 0D 3A 80 10 AA 9E D4 D3 12 1F E1 14 FE D4 50 05 69 ED 22 68 9B E4  
1D 2B 98 B6 55 69 B6 B7 23 EB 5D 73 8C A1 AE 4D 3E 4B E2 33 DE 80 2C 9B 48 8F 6F D6 A3 36 51 **8C 00**

**Package0A:**

0A 00 FA 01 1E C7 F3 35 6F F1 A6 D0 05 16 D3 E2 3D CF E7 FF 00 D7 A8 9B 4E 43 FC 47 FC FE 35 A2 4D 30 D0 06 71  
D3 47 69 3F 4F FE BD 34 E9 BE 92 7E 9F FD 7A D1 E9 49 F8 D0 06 13 AE C9 4A 67 A5 6A A6 84 5D 03 09 FA FF 00 B3  
FF 00 D7 AC EB 9E 2E 9B 9E E2 BA B8 0E 60 4F A5 00 63 7F 60 B7 69 FF 00 F1 DF FE BD 28 D0 5F FE 7B FF 00 E3 BF  
FD 7A DC A2 80 31 06 84 FF 00 F3 DF FF 00 1D FF 00 EB D1 FD 86 FF 00 F3 DF FF 00 1D FF 00 EB D6 DD 2D 00 62  
8D 09 BF E7 B7 FE 3B FF 00 D7 A4 FE C3 23 9F 3F F4 FF 00 EB D6 D5 04 FC B4 01 C8 F9 05 AE 44 20 F2 4E 33 FE 4D  
75 51 78 42 32 80 99 8F E5 FF 00 D7 AE 7A D4 6F D5 53 9F E2 AF 49 4E 10 50 07 36 3C 1F 6E 3A CA 7F 5F F1 A9 07 84  
AD 3B B3 1F C4 FF 00 8D 74 74 94 01 80 BE 14 B1 1D 72 7F 13 FE 35 22 F8 5F 4F 5F F9 66 4F E2 7F C6 B6 E9 28 03  
29 7C 3F 60 9D 21 1F 99 FF 00 1A E6 BC 55 6B 05 A4 B0 24 2A 17 20 E7 07 E9 5D CD 70 BE 2D 93 76 A2 A9 9F BA 3F  
A0 A0 0C A8 23 53 10 27 F9 FF 00 F5 EA 5D AA 28 8C 11 18 14 EC E7 BD 00 20 C7 6A 32 01 A5 1C 77 FD 69 3B D0 02  
83 EF 51 4E 7E 70 33 52 AF 5E B5 5E 56 CC A7 9A 00 99 54 0A B9 A7 C9 E5 DE 46 D9 EF 54 C3 8F 5F D6 A5 8D B0 C0  
E6 80 3B E5 39 00 D2 E6 AB D9 CC B2 DB 23 06 07 8A 9E 80 16 B2 75 A4 CC 68 DE 87 FC 2B 54 D5 1D 51 37 D9 B7 B5  
00 36 07 DD 0A 9A 93 35 52 C1 F7 5B 2F B5 5A A0 07 66 92 8C D1 40 0B DA B9 3B 9F DD EA 6E 3D FF 00 A5 75 79 AE  
5F 55 1E 5E A0 4F AE 3F A5 00 5A A4 A0 1C A8 A3 3C 50 03 4F 34 C3 F5 A7 1A 6E 68 01 BD 0F 5A 37 71 46 73 4D DD  
9A 00 C7 BB FF 00 8F A6 E7 F5 AE A6 DB FE 3D D3 E9 5C BD EF FC 7C 9E 6B A7 B4 39 B5 8C **F0 00**

**Package0B:**

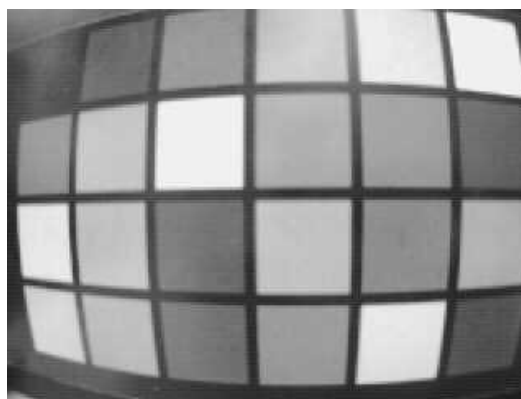
0B 00 FA 01 FB 50 04 F9 ED 47 6A 28 A0 02 8A 33 45 00 2D 35 CE 10 FD 29 D5 1C A7 11 B1 F6 A0 0E 7B 4B F9 F5 78  
B9 EA C7 F9 57 A4 8E 00 AF 39 D0 C6 ED 62 1F A9 FE 55 E8 A3 A5 00 2D 1D 28 CD 26 68 01 73 9A 29 33 49 9A 00 2B  
CF 3C 41 27 9B AC CB CF 4C 0F D0 57 A0 B3 61 49 AF 36 BD 7F 3B 54 91 B3 D5 BF A5 00 4A 0F 03 9A 69 E4 D2 E7 DF  
F5 A4 27 8E B4 00 64 51 9E 69 A4 E7 BD 19 E7 AF EB 40 0F 0D 81 9C D5 32 D9 62 73 FA D5 87 6D B1 93 9A A6 1B 9E  
B4 01 69 8E D3 CF F3 A9 A0 6D D5 98 92 B7 F7 AA E4 33 EF AF F3 A0 0D 28 EE 25 88 8D 8F 8A BF 0E B5 71 1F 0C 43  
0F C2 B2 16 65 61 D6 9E 1B 8E B4 01 D1 C3 AE C6 DC 3A E3 F1 AB 0F 7D 6F 71 03 2A C8 32 45 72 A0 D2 86 E3 AD 00  
6D 69 92 65 5D 73 D0 D6 86 6B 97 49 5A 33 95 6C 1A B2 9A 84 EB FC 59 A0 0E 84 1A 5C D6 1A EB 2C BF 79 33 F8 D4  
E9 AD 40 46 18 6D A0 0D 4C D7 3B AF 2E DB 88 DB D4 7F 85 6B 26 A7 6A FD 25 15 99 AE 49 1C B1 C6 E8 E0 E0 F6  
FC 28 01 B1 36 E8 94 D3 F3 EF 55 ED 1B 75 BA F3 53 66 80 10 E2 9A 4D 38 D3 4D 00 34 D3 69 D4 DA 00 C9 BE E2 E3  
AF EB 5D 1D 81 FF 00 42 8F BF 15 CF 6A 1C 4E 2B 7B 4E 39 B1 8F E9 FD 68 02 E0 A2 9B 9A 50 68 01 68 CD 25 14 00  
B9 E2 A2 B8 6C 5B B9 F6 A9 33 55 EF 9B 16 92 1F 6A 00 CC F0 DA EE D5 D0 FA 03 FC AB D0 01 E2 B8 5F 0A 8C EA 24  
FA 0F E8 6B B8 06 80 1D 9A 33 4D CD 26 68 01 D9 A4 CD 21 34 99 A0 08 EE A4 D9 6C ED E8 2B CD E3 3B EE 4B 13  
EF 5D D6 B7 70 21 D3 25 39 E7 03 F9 8A E1 2D DD 41 25 9A 80 2D 13 EF 4D A6 35 C4 63 F8 AA 33 76 A3 A7 F3 A0 09  
BF CF 5A 07 5E B5 54 DD FA 0F D6 98 6E 5C F7 FD 68 02 7B 86 C2 01 9E B5 54 1F 7A 46 90 B1 E4 **3D 00**

**Package0C:**

0C 00 D8 01 D2 03 EF FA D0 03 95 48 EB 53 A7 4A E9 E3 D3 63 0B 86 5E 2A BC FA 2A 1E 62 3B 4F A7 F9 34 01 88 3A  
53 D2 46 43 C1 A9 A6 B3 9A 03 F3 AF 1E B9 FF 00 EB D4 14 01 3A DC 0F E2 1F AD 48 92 C6 DC 6E C5 54 1F 5F D6 90  
FD 68 02 FF 00 5E 87 34 D2 6A A0 62 BC 86 C7 E3 4B E7 B8 3F 7B 34 01 33 1F 7A 89 8F BD 1F 69 04 7C CB FA D1 BE  
26 FF 00 96 85 7F 0C D0 04 79 F7 FD 68 60 42 82 4F 1F 5A 70 50 C4 05 60 7F 1A 1A 17 53 C8 FD 68 01 82 46 5F BA DF  
AD 38 5D 4A 3A 48 69 84 11 D6 9A 7E B4 01 30 BF 9C 7F 1F F2 A7 0D 46 5E E4 55 53 4D CD 00 5D 1A 9B F7 50 7F 1A  
3F B4 CF 74 07 F1 AA 26 9B 9F 7A 00 9A E2 E3 CF 70 D8 C7 E3 57 ED 35 64 82 DD 63 28 49 1D F3 59 39 A0 1F 7A 00  
DF FE DC 8B 1F EACF E7 40 D7 21 FF 00 9E 67 F3 AC 10 7F CE 69 33 CF 5A 00 E8 3F B7 22 FE E1 FC E9 3F B7 62 FF  
00 9E 67 F3 AC 0C FB FE B4 67 DE 80 37 8E BB 1F FC F2 3F F7 D5 57 BA D6 16 78 1A 31 1E 33 DF 75 64 67 9E B4 99  
FF 00 39 A0 0D 4D 1F 55 1A 64 CF 21 8F 7E EC 7F 16 3F CF 5A D8 3E 31 63 D2 DB FF 00 1F FF 00 EB 57 27 9F F3 9A  
5C FB FE B4 01 D3 9F 17 CC 7E EC 20 7F C0 87 F8 54 4D E2 BB B3 D0 28 FC AB 9D DD EF FA D1 9F 7A 00 DA 7F 12  
5F BF FC B4 03 F0 15 5D F5 AB E7 EB 3F E8 2B 37 77 BD 19 F7 A0 0B 13 5E 4D 38 C4 92 16 15 5B 77 BF EB 4B B5 8F  
6F D6 82 A4 0C 9E 3F 1F FE BD 00 37 3E F4 67 DF F5 A5 1B 7B B5 1B 90 77 CD 00 26 7D FF 00 5A 07 D6 8F 35 71 C0  
FD 69 A6 43 EB 8A 00 7E D2 07 FF 00 5F FF 00 AF 46 40 EA 6A 32 EC 7A 9A 41 F5 FD 68 03 FF D9 00 **35 00**

You need to get rid of the packet ID, data size in the head and verify code in the end. And you should combine the available image data together one by one.

At last, you should create a file with suffix “.JPG” and put the available image data into it. The image showed here was made from the above data.



Q: What is the power range of the camera module?

A: The range is +3.0V - +3.6V.

Q: I want to establish the connection between a PC and the camera module. Is there any configuration should be done?

A: To connection with a PC, a RS-232 transceiver set-up should be used as a communication interface.

Q: I have sent an SYNC command to camera, but it has no response. How can I synchronize with the module?

A: Users should send the SYNC commands one by one continuously until receiving the ACK and SYNC commands from the module. Normally, 25-60 SYNC commands are required. After that, users should reply with an ACK command.

Q: What is the baud rate to synchronize with the camera? Will the baud rate change after SYNC?

A: C328-7221 supports 7200, 9600, 14400, 19200, 28800, 38400, 57600 and 115200bps. Users can synchronize with the camera at one of the baud rate above. Once synchronizing with camera successfully, the baud rate will not be changed until users change it with the "Set Baud rate" command.

Q: When will the baud rate be changed after receiving the "Set Baud rate" command?

A: The baud rate will be changed after the module reply with the ACK command. Users must use the new baud rate after this.

Q: After sending "Getpicture" command to the camera, what will the users receive?

A: After sending "Getpicture" command to the module, users will receive an "ACK", a "Data" command, "AA 0A 01 XX YY ZZ" telling you the image size, and then the first package of image data. .

Q: How to use the image size returned? Also, how many packages must be received to get the captured image?

A: Users can use the image size to calculate the number of packages will be received according to the package size set. The equation is shown in the following:  
Number of package = Image size / (Package size – 6)

Q: According to the flow diagram, the ACK command for the first package is AA 0E 00 00 00 00 and that for the second one AA 0E 00 00 01 00. Is the third one AA 0E 00 00 02 00 or AA 0E 00 00 01 01?

A: For the third package, it should be AA 0E 00 00 02 00. Those for the other package are shown in the following:  
AA 0E 00 00 L'L H'H.  
L'L is the low byte of package ID  
H'H is the high byte of package ID  
i.e. ID = H'H L'L in hex

Q: After synchronization, I got the first picture with too low or too high luminance. What's wrong with it?

A: After synchronization, the camera needs a little time for AEC and AGC to be stable. Users should wait for 1-2 seconds before capturing the first picture.