C1182
Video Compression Module
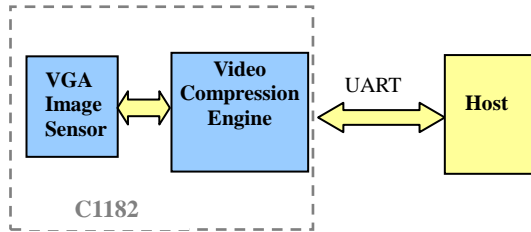# User Manual

Release Note:
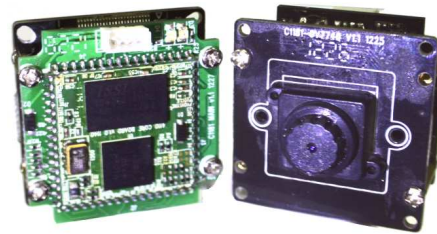1st Release : Aug 01, 2012

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General Description

This is a series of camera modules which perform video compression and output video stream through UART port. It can be attached to a wireless host and performing a remote video camera.

**System block diagram**

Features

- ✓ Small in size 32x32mm
- ✓ On board VGA color sensor
- ✓ Lens included(option)
- ✓ 3.3V Operation
- ✓ Advance H.264 CODEC provide excellent image at low bit rate
- ✓ Simple and user friendly command
- ✓ Interface to external host via RS-232.
- ✓ UART: 128Kbps max for data transfer
- ✓ Built-in down sampling, clamping and windowing circuits for VGA(640 x480), QVGA(320x240)
- ✓ Power saving mode, power on by RS232 trigger

Board Layout and Pin Description

The module consists of 2 boards, sensor and controller board. They are interconnected by using flexible flat cable. They can be bind together by using 4 screws
Sensor board: it has been designed to be mounted in standard camera house for 32x32mm PCB. Either 14mm or 20mm lens holder can be used. If use C/CS-Mount lens, just remove the lens holder and cover the holes by any means.
Controller board: it can be mounted on the back of sensor board. The 4pin 1.25mm pitch board connector is provided for UART cable. Due to the high speed operation, the controller board needs more space for heat dissipation and therefore the bigger housing will be recommended.
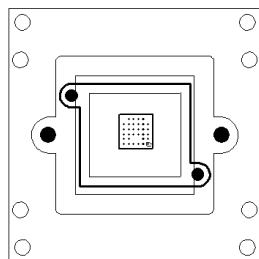
Front View
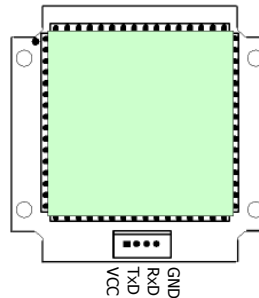
Rear View

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

Connector: 1.25 mm pitch, 4 pin single row

<u>Serial Interface</u>

1. Baud Rate

    C1182 use a settled baud rate 115200 bps. It can be configured to other baud rate at max 128Kb. Refer to the command set 0x01.

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.

Single Byte Transmission
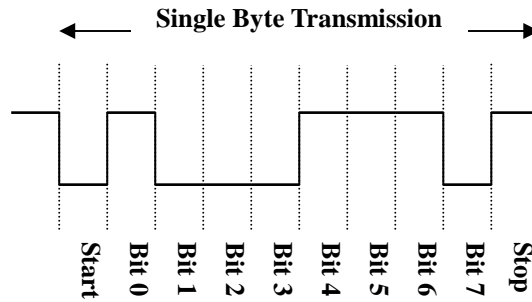
RS-232 single byte timing diagram

3. Command Timing Diagram

    A single command consists of 6 continuous single byte RS-232 transmissions. Below is an example for Capture Command (AA 05 01 FF FF FF)

Capture Command
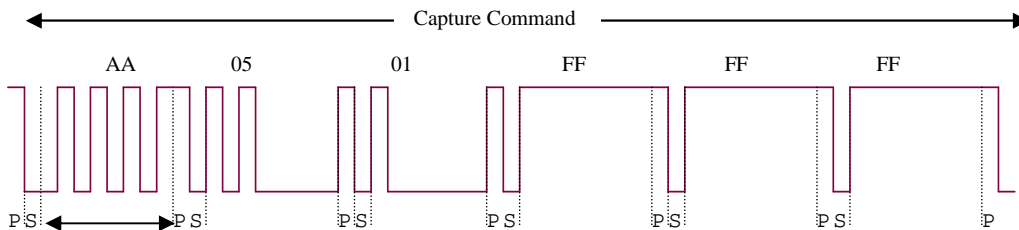
P=Stop bit
S=Start bit

<u>Command Summary</u>

1	INITIAL	To configure the image size, quality, baud rate and packet size
2	DATE	Send from Host the Date info for stamping purpose
3	TIME	Send from Host the Time info for stamping purpose
4	PREVIEW	Command to get video frame data continuously
5	CAPTURE	Command to take a frame for transmission
6	DATA LENGTH	Information about the image data length
7	GET DATA	Get the image data packet from module
8	SYNC	Sync the host to the module
9	POWER CONTROL	Turn off the module, all parameter reset
10	ACK	Command to indicate the communication success
11	NAK	Command to indicate the communication fail with error code

<u>Power control of the module</u>

The module power is controlled by UART. When power is applied to the module and UART cable is connected, the module will not operate by itself. To power on the module, issue Sync (AA08) command to turn on the module and start operation. When Power Off (AA09) command is sent, the module will cut the power and the standby current will be less than 1mA. If by accident, the host to activate the module and no other operation, the module will consume power until power disconnected.

Command Set
The C1182 module supports total 11 commands for interfacing to host as following:

Command	ID Number	Parameter1	Parameter2	Parameter3	Parameter4
Initial	AA01H	Image Size:	Image Quality	Baud Rate	Packet Size:
Date	AA02H	YY	MM	DD	01H: Stamp 00H: no stamp
Time	AA03H	hh	mm	ss	01H: Stamp 00H: no stamp
Preview	AA04H	START: 01H STOP: 00H	I-frame Interval	Packet Interval	FFH
Capture	AA05H	I-frame: 01H p-frame: 00H	FFH	FFH	FFH
Data Length	AA06H	Length Byte low	Length Byte mid	Length Byte high	FFH
Get Data	AA07H	Packet ID low byte	Packet ID high byte	FFH	FFH
Sync	AA08H	00H	00H	00H	00H
PWR Ctrl	AA09H	Auto OFF : 01H Always ON : 00H	ON:01H OFF: 00H	00H	00H
ACK	AA0Ah	Command ID	ACK counter	FFH	FFH
NAK	AA0Bh	NAK counter	Error Number	FFH	FFH

1. INITIAL COMMAND (AA01H)
   The host issues this command to configure the image size, quality, baud rate and data packet size. 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 Image Size (Parameter 1)
   To define image size. Note that the bigger the image size the longer transmission time for one picture.

QVGA(320 x 240)	01H
VGA(640 x 480)	02H

1.2 Image Quality (Parameter 2)
   To define the compression rate of image. It is divided into 2 parts, I-frame and P-frame.

   Format: IPH   where I is for I-frame and P for P-frame

   Compression rate can be set from 0H-FH. The bigger the number, the higher compression or smaller image size. Higher compression will result the poor image quality.

1.3 Baud Rate (Parameter 3)
   Default baud rate is 115.2Kb but user can set this to other baud rate after connection. After change, user needs to change host baud rate before connection.

128Kb	01H
115Kb	02H
57.6Kb	03H
38.4Kb	04H
19.2Kb	05H
14.4Kb	06H
9.6K	07H

1.4 Packet Size (Parameter 4)

C1182 can support 4 different Data Packet Size as below:

512 Bytes	01H
2048 Bytes	02H
4096 Bytes	03H
8192 Bytes	04H

The host issues this command to change the size of data packet which is used to transmit image data from the C1182 to the host. This command should be issued before sending Capture command or Get Data command to C1182.
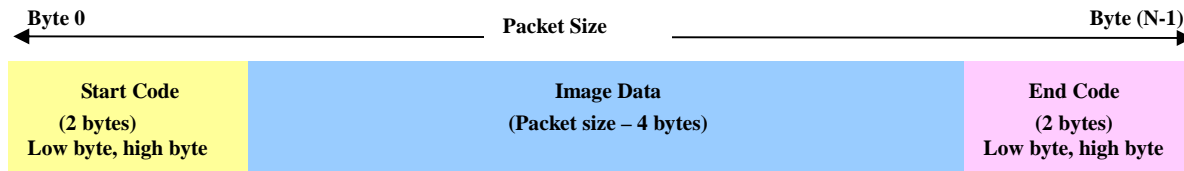
1.4.1 Data Packet Content (For Capture Command):

Byte 0 ← Packet Size → **Byte (N-1)**

ID (2 bytes) Low byte, high byte	Data Size (2 bytes) Low byte, high byte	Image Data (Packet size – 8 bytes)	Reserved (2 bytes) 0xFFFF	Verify Code (2 bytes) Low byte, high byte

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
Reserved	-> 0xFFFF
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-3])) N = packet size

Note: The size of the last data packet varies for different image.

1.4.2 Data Packet Content (For Preview Command):

Byte 0 ← Packet Size → **Byte (N-1)**

Start Code (2 bytes) Low byte, high byte	Image Data (Packet size – 4 bytes)	End Code (2 bytes) Low byte, high byte

Start Code	-> 2-byte start code (0xAA55)
Image Data	-> Available image data
End Code	-> 2-byte end code (0x55AA)

2. DATE COMMAND (AA02H)

C1182 can accept date time stamp on the image. By default D/T stamp is off, parameter 4 = 00H User can select stamp either date or time or both. Data time info will be stamped on the right hand bottom of the image. This command is in YYMMDD format, differ from other hexadecimal. Date time info will keep update as long as the module is powered.
Command format: e.g. To input date of Dec 25, 2011, stamp on
    AA 02 11 12 25 01

(Note: this is only good for VGA resolution video.)

3. TIME COMMAND (AA03H)

Time display is in 24Hr format. Again, this command is in HHMMSS format, differ from other hexadecimal.
Command format: e.g. To input time of 12:30:00, stamp off
    AA 03 12 30 00 00

(Note: this is only good for VGA resolution video.)

4. PREVIEW COMMAND (AA04H)

Host to issue this command for capturing a sequence of I-frame or P-frame continuously. Once the host issues this command, the module will send out the data packets continuously, without any handshaking command in between. In this case, the amount of command-data overheads and also the CPU loading at the host side can be reduced. Due to the nature of this uncontrolled data transmission, it is the host's responsibility to handle the received data packet in a right timing and manner.

4.1 START/STOP (Parameter 1)
To start (01H) or stop (00H) the preview operation

4.2 I-frame Interval (Parameter 2)
To set the number of P-frames to be inserted between successive I-frames, e,g.
00H – IPPPPP …………. (first I-frame and then all P-frames)
01H – I I I I I I I …………. (all I-frames)
02H—IPIPIPIP…….
03H – IPPIPPIPP….
etc …….

4.3 Packet Interval (Parameter 3)
To set the minimum time interval between each packet transmission. It can be used to control the data rate of the video stream sending out from the module.
00H -- 0 ms. The next packet will be sent out immediately after the current packet is sent.
01H -- ~2*(1) = 2 ms
02H -- ~2*(2) = 4 ms
…..
FEH - ~ 2*(254) = 508 ms
FFH - ~ use system default

5. CAPTURE COMMAND (AA05H)

Host to issue this command for capture either I-frame or P-frame, such case, video format can be all I-frame or any combination of I-P frame, such as IPIP, IPPIPP etc. C1182 will send out an ACK command and Data Length command to the host if the operation success. Otherwise, an NAK command will be sent out.

6.   <u>DATA LENGTH COMMAND (AA06H)</u>

C1182 issues this command for telling the host the size of the image data which is ready for transmitting out to the host.
These three bytes (LOW, MID, HIGH) represent the length of the image data. User needs to calculate the number of packets by using this length data.

7.   <u>GET DATA COMMAND (AA07H)</u>

The host can issue this command to request image data packet with desired packet ID after receiving Data Length command from C1182.

After receiving this command, C1182 will send a data packet to the host. The details about the content of the data packet please refer to the previous page in the manual.

7.1   Packet ID

Data packet ID, starts from 0000h to F0F0h.

Package ID	Command
0000h	AA 06 00 00 FF FF
0001h	AA 06 01 00 FF FF
0002h	AA 06 02 00 FF FF
0003h	AA 06 03 00 FF FF
……	……
F0F0h	AA 06 F0 F0 FF FF

7.2   Packet Number
Number of packet = Image size / (Packet size – 8)

8.   <u>SYNC COMMAND (AA08H)</u>
The host needs to send this command to sync with C1182 when power up.

9.   <u>PWR CTRL COMMAND (AA09)</u>

C1182 has no sleep mode but auto off mode to save power. By default it is auto off mode, user can turn this mode on or off by setting the parameter of this command.

9.1 Turn on/off the auto off mode
The module has built in timer to turn off itself if system idle more than 30sec. To turn off this feature, issue this command and set parameter 1 to 00H, such case, the module will be ON forever until power removed or receiving force power off command.
Command format: e.g. Turn off the auto off feature
                              AA 09 00 01 00 00
9.2 Power off the module
User can turn off the module immediately after operation completed to save power by sending parameter 2 of 00H. It doesn't care what the power mode is.
Command format: e.g. Turn off the module any time
                              AA 09 xx 00 00 00

10.   <u>ACK COMMAND (AA0AH)</u>
This command indicates the success of last operation. After receiving any valid command, ACK command must be sent out except when getting image data.

10.1 Command ID
The command with that ID is acknowledged by this command.

10.2 ACK Counter
ACK counter, indicates the amount of ACK

11.   NAK COMMAND (AA0BH)

This command indicates corrupted transmission or unsupported features.

11.1 NAK Counter (Parameter 1)
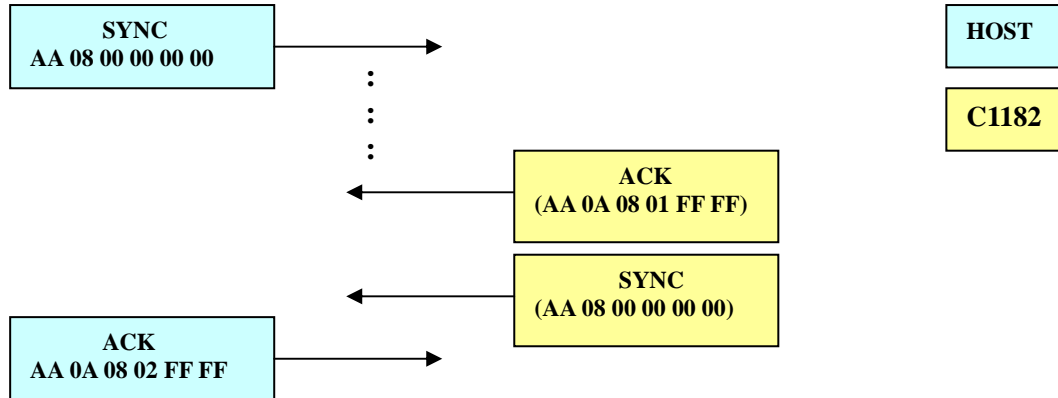
NAK counter, indicates the amount of NAK

11.2 Error Number (Parameter 2)

Number	Description
01H	Parameter 1 error
02H	Parameter 2 error
03H	Parameter 3 error
04H	Parameter 4 error
05H	Command ID error
06H	Picture not ready
07H	Packet ID error

V1.0

<u>Command Protocol</u>

SYNC Command

Before the host to talk to module, host needs to send SYNC command until receiving ACK command from the module. If connection is good, usually, ACK command will be received within 10times of SYNC command
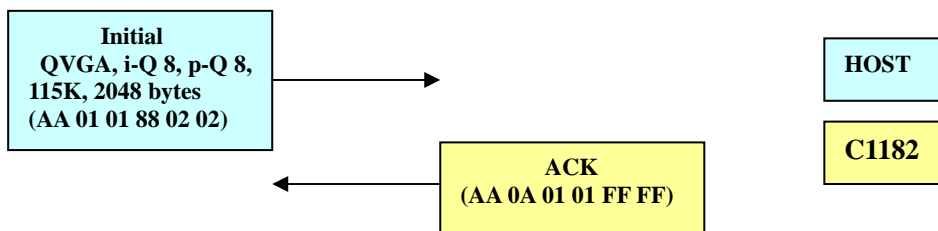
SYNC **AA 08 00 00 00 00**	

HOST

C1182

ACK
(AA 0A 08 01 FF FF)

SYNC
(AA 08 00 00 00 00)

ACK
AA 0A 08 02 FF FF
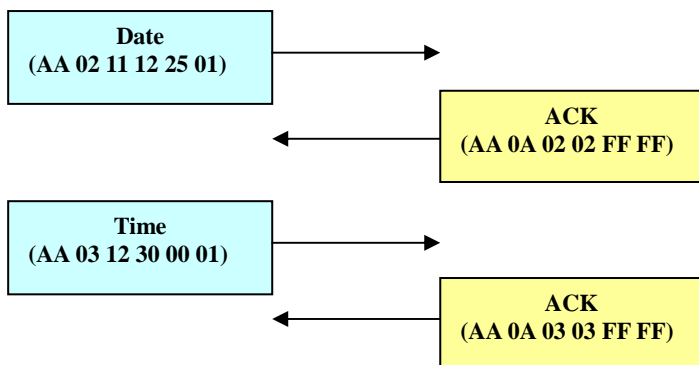
Synchronize complete.

Example 1 – capture a QVGA image

Below is an example of getting a QVGA image, at baud rate 115Kb, packet size of 2KB with date/time stamping on the picture, power off the module after completion.
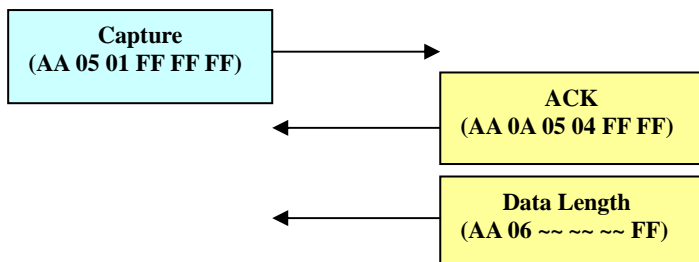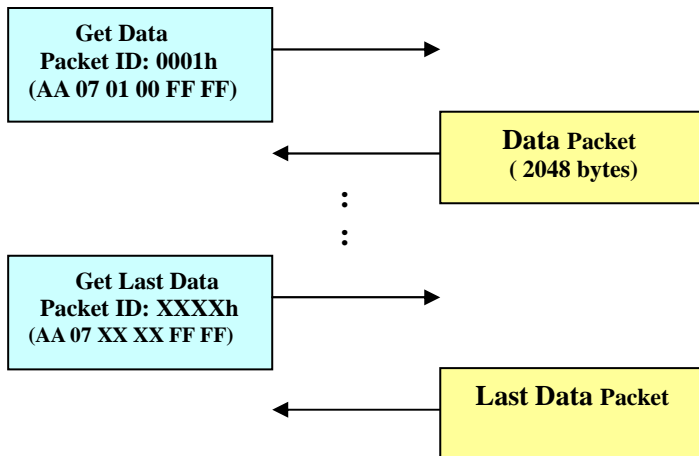
1. Initial Command

Initial
QVGA, i-Q 8, p-Q 8,
115K, 2048 bytes
(AA 01 01 88 02 02)

HOST

C1182

ACK
(AA 0A 01 01 FF FF)

2. Date/time Command

Date
(AA 02 11 12 25 01)

ACK
(AA 0A 02 02 FF FF)

Time
(AA 03 12 30 00 01)

ACK
(AA 0A 03 03 FF FF)

3. Capture I frame

Capture
(AA 05 01 FF FF FF)

ACK
(AA 0A 05 04 FF FF)

Data Length
(AA 06 ~~ ~~ ~~ FF)

4. Get Data

| Get Data
Packet ID: 0001h
(AA 07 01 00 FF FF) | → |

| ← | Data Packet
(2048 bytes) |

⋮

| Get Last Data
Packet ID: XXXXh
(AA 07 XX XX FF FF) | → |

| ← | Last Data Packet |

5. Capture P-frame

| Capture
(AA 05 00 FF FF FF) | → |

| ← | ACK
(AA 0A 05 xx FF FF) |

| ← | Data Length
(AA 06 ~~ ~~ ~~ FF) |

| Get Data
Packet ID: 0001h
(AA 07 01 00 FF FF) | → |

| ← | Data Packet
(2048 bytes) |

⋮

| Get Last Data
Packet ID: XXXXh
(AA 07 XX XX FF FF) | → |

| ← | Last Data Packet |

6   Repeat 4 or 5 to get more I-frame or P-frame

7   Power off the module

| PWR CRT
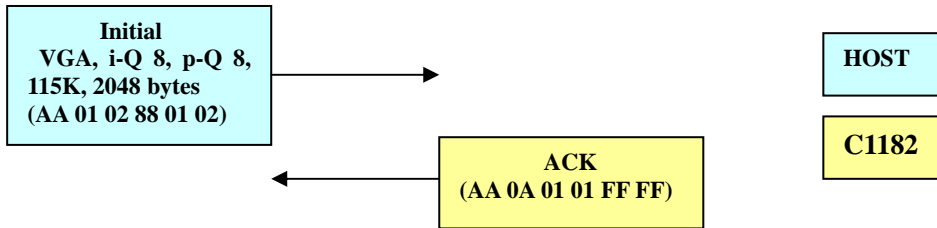(AA 09 xx 00 00 01) | → |

| ← | ACK
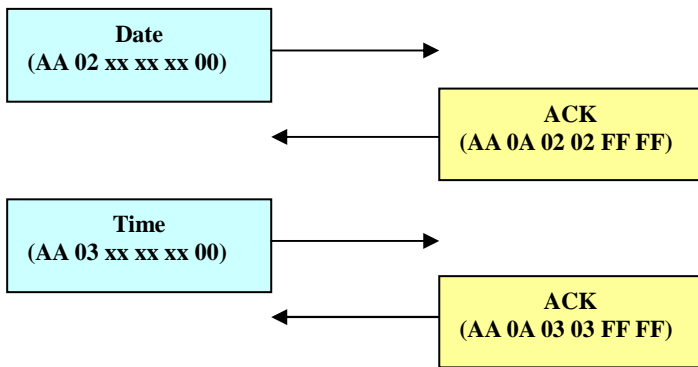(AA 0A 08 xx FF FF) |

| | Turn off module |
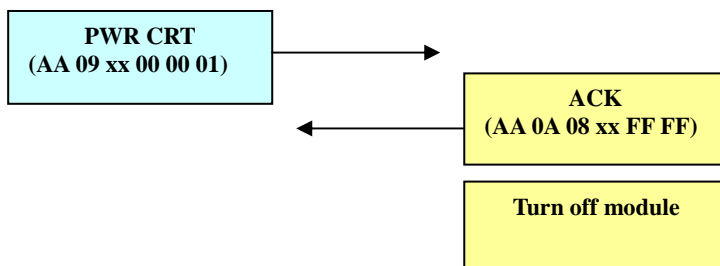
Example 2 – Preview VGA image

Below is another example to preview a VGA image, at baud rate 115Kb, packet size of 2KB, insert 30 P-frame between two I-frames, without date/time stamping on the picture, and stop the preview after some time.
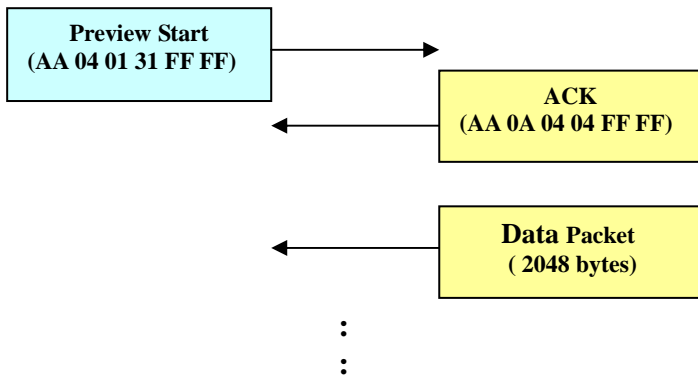
1. Initial Command

Initial VGA, i-Q 8, p-Q 8, 115K, 2048 bytes (AA 01 02 88 01 02)		HOST
	ACK (AA 0A 01 01 FF FF)	C1182

2. Date/time Command

Date (AA 02 xx xx xx 00)	
	ACK (AA 0A 02 02 FF FF)
Time (AA 03 xx xx xx 00)	
	ACK (AA 0A 03 03 FF FF)

3. Start Preview

Preview Start (AA 04 01 31 FF FF)	
	ACK (AA 0A 04 04 FF FF)
	Data Packet (2048 bytes)

⋮

4. Stop Preview

Preview Stop (AA 04 00 xx FF FF)	
	ACK (AA 0A 04 05 FF FF)