Kodak Digital Science

DC120 Zoom Digital Camera

HOST INTERFACE SPECIFICATION

Version 1.61

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Digital Camera Products
Eastman Kodak Company

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Revision History

Revision Number	Date	Summary
0.01	6/12/'96	First version for DC120 Host Interface. Internal release to get feed back.
0.1	6/17/'96	Add TIFF/EP file transfer (first release)
0.2	7/10/'96	• Add White Balance Gain in Picture Information. • Add front cover status in camera status. • Change file name. • Change command code of 40 ~ 49 commands. • Add Date/time and Distance format commands.
0.3	7/31/'96	• Add very good quality in camera status and picture information. • Add Date/Time format and distance status in camera status. • Add reset command description.
0.4	8/1/'96	• Add Set Sleep Time
0.5	8/6/'96	• Change thumbnail size of internal memory
0.6	8/8/'96	• Change Camera Status
0.7	8/9/'96	• Correct some typo
0.8	9/6/'96	• Add picture white balance gain in picture info.
0.9	9/24/'96	• Remove # of taken picture from camera status. • Correct #45 and #48 command.
1.0	10/8/'96	• Add password return strings. • Add set default mode command.
1.1	10/23/'96	• Add #84, #95,#9B in removed command list.
1.2	10/29/'96	• Add pWbCalib
1.3	10/31/'96	• Add description of album number 0. • Add TIFF/EP tag description in appendix.
1.4	11/8/'96	• Remove Manual exposure U/I inactive flag from camera status. • Remove manual exposure U/I inactive by FFFFFF value from Set Manual Exposure command. • Add Send file name in Album command.

1.5	11/12/'96	• Correct packet size of Set Available Album • Removed DC60 related description • Add explanation of Album. • Add error handling of album full in Take a picture command.
1.6	11/18'96	• Add Album Characters.
1.61	11/22/'96	• Change resolution terminology

1. INTRODUCTION

This document is the design specification of interface command of the TAKA II digital camera. This document references the host interface specification of TAKA camera ver. 0.9. Because the TAKA II camera is a super set of TAKA camera, this document shows additional command to TAKA camera, and some modified portion of the interface.

2. DATA FORMAT

2.1 Camera Status Table

- ***The Byte of 1 is changed, and byte 18 and 112 ~ 115 is added.***

Byte offset	Description
0	Data type (0x01 for camera status table)
1	Camera type (0x02 for DC120)
2	Firmware version (Integer part : 0 - 255)
3	Firmware version (two decimal places : 0 to 99)
4	ROM Version (Integer part : 0 - 255) for 16 bit µ
5	ROM Version (two decimal places : 0 to 99)
6	ROM Version for 8 bit µ (Integer part)
7	ROM Version for 8 bit µ (two decimal places)
8	Battery status ((0 : OK, 1 : Weak, 2 : Empty)
9	AC adapter flag (0 : No use, 1 : In use)
10	Capture Mode Sleep duration (60 - 255 seconds)
11	Review Mode Sleep duration (60 - 255 seconds)
12	Elapsed time (MSB)
13	Elapsed time
14	Elapsed time
15	Elapsed time (LSB)
16	Zoom position
17	Reserved
18	Flash Status (0: not charged, 1: charged)
19	I.Q. : Image quality (0 : No comp, 1 : Best, 2 : Better, 3: Good)
20	Flash mode (0 : Auto, 1 : Fill-in, 2 : Off)
21	Exposure compensation value
22	LV value (measured light data)
23	Manual exposure (0 : Off, 1 : Manual)
24	Manual exposure time (MSB)
25	Manual exposure time

26	Manual exposure time
27	Manual exposure time (LSB)
28	Reserved
29	Shutter delay mode (0 : Off, 1 : On)
30	Memory card status
31	Front Cover Status (0: close 1: open)
32	Date format status
33	Time format status
34	Distance display format status (0: centi. 1: inch)
35	Reserved
36	# of pictures taken in memory (MSB)
37	# of pictures taken in memory (LSB)
38	Reserved
39	Reserved
40	Reserved
41	Reserved
42	Reserved
43	Reserved
44	Reserved
45	Reserved
46	Remaining pictures at No comp I.Q. for memory (MSB)
47	Remaining pictures at No comp I.Q. for memory (LSB)
48	Remaining pictures at Best I.Q. for memory (MSB)
49	Remaining pictures at Best I.Q. for memory (LSB)
50	Remaining pictures at Better I.Q. for memory (MSB)
51	Remaining pictures at Better I.Q. for memory (LSB)
52	Remaining pictures at good I.Q. for memory (MSB)
53	Remaining pictures at good I.Q. for memory (LSB)
54	Reserved
55	Reserved
56	# of pictures taken in card (MSB)
57	# of pictures taken in card (LSB)
58	Reserved
59	Reserved
60	Reserved
61	Reserved
62	Reserved
63	Reserved
64	Reserved
65	Reserved
66	Remaining pictures at No comp I.Q. for card (MSB)
67	Remaining pictures at No comp I.Q. for card (LSB)
68	Remaining pictures at best I.Q. for card (MSB)

69	Remaining pictures at best I.Q. for card (LSB)
70	Remaining pictures at better I.Q. for card (MSB)
71	Remaining pictures at better I.Q. for card (LSB)
72	Remaining pictures at good I.Q. for card (MSB)
73	Remaining pictures at good I.Q. for card (LSB)
74	Reserved
75	Reserved
76	Reserved
77	Volume ID of the ATA Card (11 characters)
88	Reserved
89	Reserved
90	Camera ID (32 byte ASCII characters)
122	# of Albums in memory (MSB)
123	# of Albums in memory (LSB)
124	# of Albums in card (MSB)
125	# of Albums in card (LSB)
•	Reserved
255	Reserved
256	Reserved

• Zoom position (Byte 16)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
16	N/A		AF mode		Zoom data (7 steps)			

AF mode : 00 Multi spot
01 Single spot
10 Close up

Zoom data 0 : 37 mm (35 mm equivalent)
1 : Approximately 46 mm (35 mm equivalent)
2 : Approximately 61 mm (35 mm equivalent)
3 : Approximately 77 mm (35 mm equivalent)
4 : Approximately 92 mm (35 mm equivalent)
5 : Approximately 100 mm (35 mm equivalent)
6 : 111 mm (35 mm equivalent)

Note that if the close up is selected, 6 is set to the zoom data.

• Exposure compensation value (Byte 21)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
20	Sign	Value						

Sign 0 : + (Plus value)
1 : - (Minus value)
Value : The range of the value is 0 to 15

• Manual exposure time (Byte 24 - 27)

32 bit value in 10 micro seconds increments specified by "Set manual exposure" command.

• Memory card status (Byte 30)

Bit 7 1 : ATA Card is inserted
0 : ATA Card is not inserted
Bit 6 Reserved
Bit 5 1 : Illegal card is inserted
0 : Correct card is inserted
Bit 4 1 : Card is not formatted
0 : Card is formatted
Bit 3 1 : Card is opened
0 : Card is not opened
Bit 2 Reserved

Bit 1 Reserved
Bit 0 Reserved

Bit 3 (open flag) is set when an open command is executed. In the following cases, bit 3 will be reset.

- Camera is turned off
- Close command is executed
- Card is ejected

Note that bit 3 is not reset when the camera returns from power save mode.

• Camera ID (Byte 90-121)

32-byte camera ID is defined in the EEPROM and the ID will be written in the camera status table at the camera initialization. This ID can be written with " Write Camera ID" command.

• Date format status

Date format	00:	day / month/ year	(e.g.	3/11/97 for Nov. 3 1997)
	01:	month / day / year	(e.g.	11/ 3/97 for Nov. 3 1997)
	02:	year . month . day	(e.g.	97 . 11. 3 for Nov. 3 1997)

• Time format status

Time format	00:	12h	(e.g.	8:04 PM)
	01:	24h	(e.g.	20:04)

2.2 Picture Information Table

Picture information for each image consists of 256 byte data as follows. The host software can know the information of each picture by reading this table.

Byte offset	Description
0	Data type (0x01 for picture information)
1	Picture data type (0x02 for CDI JPEG (T.B.R.))
2	Reserved
3	Reserved
4	Image quality (0 : No comp, 1 : Best,, 2 : Better 3: Good)

5	Reserved
6	Reserved
7	Reserved
8	Data size (MSB)
9	Data size
10	Data size
11	Data size (LSB)
12	Elapsed time(MSB) *1
13	Elapsed time
14	Elapsed time
15	Elapsed time (LSB)
16	Flash flag (0 : Off, 1 : On)
17	Flash mode (0 : Auto, 1 : Fill-in, 2 : Off)
18	LV value (measured light data)
19	AF step
20	AF mode (0 : Multi, 1 : Single, 2 : Close-up)
21	Zoom step
22	Image incomplete flag (0 : OK, 1 : NG)
23	Reserved
24	EV data (Exposure control data)
25	AV data (Flash-matic data)
26	Reserved
27	Timer Mode (0: Off, 1 : On)
28	Exposure time (MSB) *2
29	Exposure time
30	Exposure time
31	Exposure time (LSB)
32	Reserved
33	Aperture (F-Number) value
34	Battery level (0: OK, 1: Weak, 2: Empty)
35	Manual exposure (0: Off, 1: On)
36	Reserved
37 38 39 40 41 42 43 44	Image name *3
45	Reserved
46	Reserved
47	Reserved

48	pAWbGainR (MSB)
49	pAWbGainR
50	pAWbGainR
51	pAWbGainR (LSB)
52	pAWbGainG (MSB)
53	pAWbGainG
54	pAWbGainG
55	pAWbGainG (LSB)
56	pAWbGainB (MSB)
57	pAWbGainB
58	pAWbGainB
59	pAWbGainB (LSB)
60	pFWbGainR (MSB)
61	pFWbGainR
62	pFWbGainR
63	pFWbGainR (LSB)
64	pFWbGainG (MSB)
65	pFWbGainG
66	pFWbGainG
67	pFWbGainG (LSB)
68	pFWbGainB (MSB)
69	pFWbGainB
70	pFWbGainB
71	pFWbGainB (LSB)
72	pTWbGainR (MSB)
73	pTWbGainR
74	pTWbGainR
75	pTWbGainR (LSB)
76	pTWbGainG (MSB)
77	pTWbGainG
78	pTWbGainG
79	pTWbGainG (LSB)
80	pTWbGainB (MSB)
81	pTWbGainB
82	pTWbGainB
83	pTWbGainB (LSB)
84	pDWbGainR (MSB)
85	pDWbGainR
86	pDWbGainR
87	pDWbGainR (LSB)
88	pDWbGainG (MSB)
89	pDWbGainG
90	pDWbGainG

91	pDWbGainG (LSB)
92	pDWbGainB (MSB)
93	pDWbGainB
94	pDWbGainB
95	pDWbGainB (LSB)
96	pWbCalibR (MSB)
97	pWbCalibR
98	pWbCalibR
99	pWbCalibR (LSB)
100	pWbCalibG (MSB)
101	pWbCalibG
102	pWbCalibG
103	pWbCalibG (LSB)
104	pWbCalibB (MSB)
105	pWbCalibB
106	pWbCalibB
107	pWbCalibB (LSB)
108 • • • • • • 254 255	Reserved

*1 Elapsed time in 0.5 seconds since 00:00 on 1/1/1994
*2 32 bit value in 10 microseconds increments
*3 Image name consists of 8 ASCII characters. This name will be leading 8 characters of file name of this image.

- LV value (Byte 18)

LV value shows light value measured with Cds. The measured value is shown in 1 byte value from 0 to 54. Actual LV data is calculated as below.

LV value = 6.5 + 0.125 x n where n is content of LV value (0 to 54)

The following shows the relationship between LV data and actual LV value.

LV data (hex)	Value (LV)
0	6.5

1	6.625	
.	.	0.125 increments
.	.	
53	16.875	
54	17.0	

- AF step (Byte 19)

AF step shows the measured distance between the camera and the object. The relationship between AF step data and measured distance is shown below.

AF data (hex)	Distance (m)	
0-77	8.2	
78	6.7	
.	.	See appendix 3
.	.	
D9	0.7	
DA-FF	0.7	

- EV value (Byte 24)

  This value is used just for development. Application does not need this data. The value is 0 ~ 0x5d.

- AV value (Byte 25)

  This value is used just for development. Application does not need this data. The value is 0 ~ 0x41.

2.3. Image Data

- Image data in internal memory can be retrieved from host as TIFF/EP format by conversion in camera.
- Thumbnail image retrieved by host through serial communication is 4 bit full color thumbnail. The size of the image is 7220 bytes.

2.3.1. Data in Internal Memory

The image data in the camera memory consists of a picture information which is only for camera internal usage, a 7220 bytes compressed thumbnail image and a compressed image. The thumbnail image is 80 * 60 pixels 4 bit full color. Each pixel

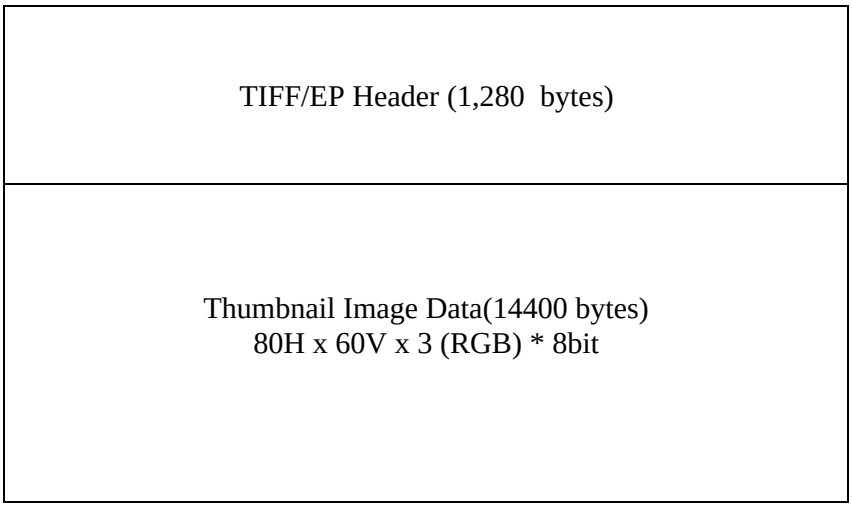
has 4 bit full color. The image size of a compressed image is as below When the image data is sent to the host or stored in the ATA card, it will be converted to TIFF/EP format shown in the following section. Because the thumbnail image in internal memory is compressed for saving memory space, the image quality is a little bit worse than that stored in ATA card.

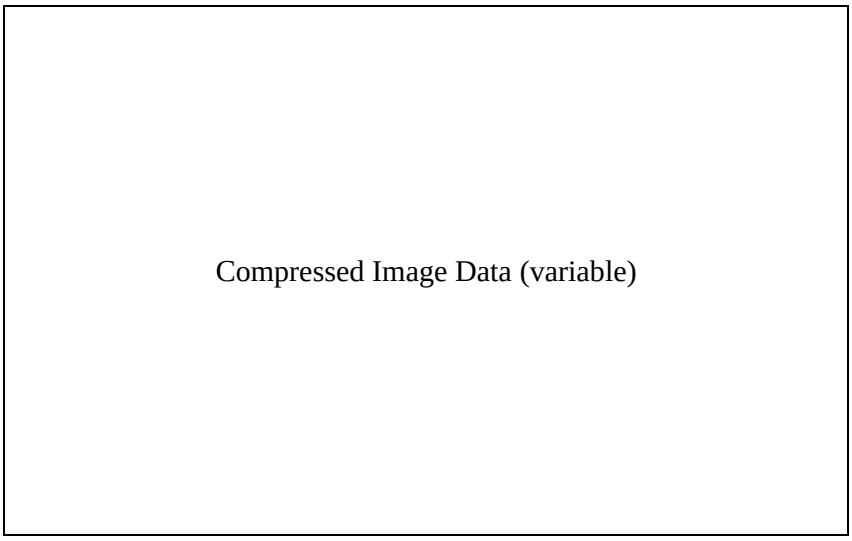
- Good image 77592 bytes
- Better image 129320 bytes
- Best image 232776 bytes
- No comp image 835104 bytes (No compression)

2.3.2. Data in ATA Card

The image data stored in card is in TIFF/EP format. The 1,280 byte TIFF/EP header that format is defined in the TIFF/EP specification contains pointers to compressed image data or thumbnail image data, a color matrix table, a compression table, etc. Then the compressed image data and uncompressed thumbnail image data follow.

Image data format





2.3.3. TIFF/EP Header

The data in TIFF/EP header is described in appendix.

2.3.4. Compressed Image Data

Data format and required image processing is described in IPM document.

3. File Organization

This chapter describes file organization for the internal memory and the ATA card and naming rules for the image files.
All images in the internal memory and the ATA card are stored as DOS files

3.1. File Name

All the files in the internal memory and the ATA card are stored as DOS files using the following naming convention.

TAKA II:
Pnnnnnn .KDC
nnnnnn : Image number that starts with 000001

The nnnnnn is serial number which shows the number of images taken by the camera. The number increase by 1 at every taking picture.

For the card, if the serial number for the taken image is smaller than the biggest number in the card, the file name will be (the biggest number in the card + 1). In this case, the serial number memorized in the camera is also changed to be (the biggest number in the card + 1).
The maximum file number is 999999. If P999999.KDC file already exists, the next image file name will be P000001.KDC if it does not exist. If it already exists and the total image file is less than the maximum, the file name will be the smallest available number.

The maximum number of image files in card is limited to 1000 regardless of size of the card.

If an image is erased through the user interface on the camera or through host communication, the file names of other files are not affected.

3.2. Directory Organization

All the image files are stored under the following directory structure. If these do not exist, the camera will create them automatically when the card is inserted. For internal memory, all images are stored under the root directory.

Card: \DCxxIMG\ xx: 120

Internal memory:\

If a user specifies the Album name for the image to be stored in, images are stored under the directory of the album. The album directory is created under the camera root directory (\DCxxIMG\ for card, \ for internal memory). If no album is specified, the images are stored under the camera root directory.

Because the album name is 15 characters and the maximum directory name is limited to 11 characters, a munged string is assigned for the directory name. The file which shows the relation between the directory name and the album name is stored in the camera root directory as a hidden file. If the user erases the file on the card using an operating system out of camera environment, all the album names are recognized as the same name as the directories.

3.2. Image Copy

When an image in the internal memory is copied to the card, the file name for this image is changed and a new file name is assigned. The assigned file number is the bigger one of serial image number or (the biggest file number already exists + 1) in the card. The time stamp information is kept same as original. If the original image is in a album, the image is copied in the album of same name in card if it exists, if it does not exist the album is created.

3.3. Change Album of a image

When the album of a image in the internal memory or card is changed, the image file are moved to the specified directory. The file name is not changed.

3.4. Change the Name of Album

When the name of a album in the internal memory or card is changed, the specified directory is renamed.

3.5. Erase the Album

When all the image file is erased in a album, the album is deleted. The related directory is removed.

3.6. Image Access

Host can has 3 ways to access image data in camera or memory card. The first way is the sequential picture number access, the second way is the Album base picture number access, and the other way is file name access via mounter.

3.6.1. Sequential Picture Number Access

Host retrieves the image data, thumbnail data and TIFF/EP information by specifying the picture number.

The picture number is sequentially assigned to images according to the exposed order in camera. The oldest image has always the picture number #1. If an images is erased via user interface on camera or host communication, the picture number is reassigned to the images which had bigger number than the erased image automatically in the camera. For example, camera has 4 images.(#1, #2, #3 and #4) If #3 image is erased, the new picture number for the #4 image is assigned as #3, consequently the image numbers will be #1, #2 and #3.

Internal memory and the card have independent picture number, therefore #1 image can exist in internal memory and card simultaneously.

The maximum picture number in memory is 60, and that of card is 1000.

3.6.2. Album Base Picture Number Access

Host retrieves the image data, thumbnail data and TIFF/EP information by specifying the Album number and the Album base picture number.

Albums stored in card or memory are numbered. The Album number of a certain Album (Album names and their number) can be retrieved from camera. The number for card and memory is independent, therefore the same Album number can exist in card and memory simultaneously.

The Album base picture number is sequentially assigned to images according to the exposed order in every Album. The oldest image in a Album has the number #1 in every Album. In the different Album, the Album base picture number is independent, therefore the same Album base picture number exists in different Album simultaneously.

If an images is erased via user interface on camera or host communication, the number is reassigned for the images which had bigger number than the erased image automatically in the camera. For example, a Album has 4 images.(#1, #2, #3 and #4) If #3 image is erased, the new number for the #4 image is assigned as #3, consequently the Album base picture numbers will be #1, #2 and #3.
Same as images, if an Album is erased (via user interface, host or automatically for no image in the Album), the Album number is reassigned for the Albums which had bigger number than the erased Album automatically.

The maximum number of Albums in memory is 8, and that of card is 60.
The maximum number of pictures in a Album is not limited.

3.6.3. File Name Base Access via Camera Mounter

The contains of the internal image memory or memory card can be seen as DOS files at the host computer with camera mounter software. This access is limited read access only. Any erasing, moving, copying or writing operation is not supported.

If a user defines the camera as d: the camera file system can be accessed as follows.

- internal memory d:\memory\AlbumName\FileName

d:\memory \FileName
(if Album (see following section) is not specified)

- card d:\pccard\DCxxIMG\AlbumName\FileName
  d:\pccard\DCxxIMG\ FileName
  (if Album is not specified)

xx: DC120 120

Because the directory name is munged, host cannot know the actual Album name from the directory name. To know that, ALBUM.CTL in camera root directory should be retrieved.

3.6.4. Image Format

The image in the internal memory and in the ATA card can be accessed as TIFF/EP format in both way access. The image in the internal memory can also be accessed in picture information format.

3.7. Album

Album name can be downloaded from host computer with Set Available Album command. The available Album are stored in EEPROM in the camera. Operator can choose the active Album in which the next image is by Set active Album command. Images are stored in the specified active Album. Albums are created when a image is stored. Album is deleted when all images in the Album are erased. Therefore the Album which has no image should not exist.
Flash memory can have at most 8 albums which does not include no album, and card can have 60. Album names which is stored in memory or card can be retrieved by Send Stored Album command.

4. COMMANDS

4.1. Change from DC50 commands

The following commands are eliminated from DC50 command sets.

Code	Description
62	Send attribute data of card (not supported by DC50)
63	Write word data to attribute data of card (not supported by DC50)
84	Send compression table
85	Take and send preview image
87	Store preview image in memory
88	Store preview image in card
89	Erase preview image
90	Set program mode (not supported by DC50)
94	Wait (not supported by DC50)
95	Initialize memory card (not supported by DC50)
9B	Write file information (not supported by DC50)
9C	Write file (not supported by DC50)
9D	Delete file (not supported by DC50)
8C	Execute program (not supported by DC50)

The following commands are changed.

Code	Description
51	Send picture in memory
55	Send picture information in memory
56	Send thumbnail picture in memory
61	Send picture in card
65	Send TIFF/EP information in card
66	Send thumbnail picture in card
71	Set Image Quality
76	Copy Image from memory to card
77	Take a Picture to Flash Memory
7A	Erase images in flash memory
7B	Erase images in memory card
81	Set Manual Exposure
82	Set Sleep Time
8A	Reset Camera

The following commands are added.

Code	Description
52	Send TIFF/EP information in memory
54	Send TIFF/EP file in memory
64	Send TIFF/EP file in card
42	Set available Album
43	Send available Album
44	Send stored Album
45	Send number of pictures in Album
46	Erase Album
47	Change Album name
48	Move image to another Album
49	Set Active Album
4A	Send file name in Album
33	Set Date/Time Format
34	Set Distance Format
35	Set Default Setting

4.2. Changed commands

Following are description of changed and added commands.

4.2.1. Send Picture in Memory

Offset	Host command
0	51
1	Access mode
2	Picture No. (Upper)
3	Picture No. (Lower)
4	Album No.
5	00
6	00
7	1A

This command sends a compressed picture data in the flash memory to the host with 1,025-byte packets..

Access mode 0: Sequential picture number access

1: Album base picture number access

Picture No. The number of a picture to be sent to the host in the flash memory. In the Sequential picture number access mode the number is sequential picture number, and in the Album base picture number access, this number specifies the Album base picture number.

Album No. The Album number indicates the Album in which the image specified by the picture number. This field is ignored when Access mode is 0. 0 specifies no album (root directory).

If specified picture number or Album number exceeds the maximum number in the flash memory, the camera will return a command execution error (e2h).

4.2.2. Send TIFF/EP Information in Memory

Offset	Host command
0	52
1	Access mode
2	Picture No. (Upper)
3	Picture No. (Lower)
4	Album No.
5	00
6	00
7	1A

This command sends the TIFF/EP information of a specified picture in the flash memory to the host in 257 packed data format..

Access mode 0: Sequential picture number access
1: Album base picture number access

Picture No. The number of a picture to be sent to the host in the flash memory. In the Sequential picture number access mode the number is sequential picture number, and in the Album base picture number access, this number specifies the Album base picture number.

Album No. The Album number indicates the Album in which the image specified by the picture number. This field is ignored when Access mode is 0. 0 specifies no album (root directory).

If specified picture number or Album number exceeds the maximum number in the flash memory, the camera will return a command execution error (e2h).

4.2.3. Send TIFF/EP File in Memory

Offset	Host command
0	54
1	Access mode
2	Picture No. (Upper)
3	Picture No. (Lower)
4	Album No.
5	00
6	00
7	1A

This command sends the TIFF/EP file (Information, Thumbnail and Picture) of a specified picture in the flash memory to the host in 1025 packed data format..

Access mode 0: Sequential picture number access
1: Album base picture number access

Picture No. The number of a picture to be sent to the host in the flash memory. In the Sequential picture number access mode the number is sequential picture number, and in the Album base picture number access, this number specifies the Album base picture number.

Album No. The Album number indicates the Album in which the image specified by the picture number. This field is ignored when Access mode is 0. 0 specifies no album (root directory).

If specified picture number or Album number exceeds the maximum number in the flash memory, the camera will return a command execution error (e2h).

4.2.4. Send Picture Information in Memory

Offset	Host command
0	55
1	Access mode
2	Picture No. (Upper)
3	Picture No. (Lower)
4	Album No.
5	00
6	00
7	1A

This command sends the picture information of a specified picture in the flash memory to the host.

Access mode 0: Sequential picture number access
1: Album base picture number access

Picture No. The number of a picture to be sent to the host in the flash memory. In the Sequential picture number access mode the number is sequential picture number, and in the Album base picture number access, this number specifies the Album base picture number.

Album No. The Album number indicates the Album in which the image specified by the picture number. This field is ignored when Access mode is 0. 0 specifies no album (root directory).

If specified picture number or Album number exceeds the maximum number in the flash memory, the camera will return a command execution error (e2h).

4.2.5. Send Thumbnail Picture in Memory

Offset	Host command
0	56
1	Access mode
2	Picture No. (Upper)
3	Picture No. (Lower)
4	Album No.
5	00
6	00
7	1A

This command sends a thumbnail picture in the flash memory to the host. The size of the image is 7220 bytes

Access mode 0: Sequential picture number access
1: Album base picture number access

Picture No. The number of a picture to be sent to the host in the flash memory. In the Sequential picture number access mode the number is sequential picture number, and in the Album base picture number access, this number specifies the Album base picture number.

Album No. The Album number indicates the Album in which the image specified by the picture number. This field is ignored when Access mode is 0. 0 specifies no album (root directory).

If specified picture number or Album number exceeds the maximum number in the flash memory, the camera will return a command execution error (e2h).

4.2.6. Send Picture in Card

Offset	Host command
0	61
1	Access mode
2	Picture No. (Upper)
3	Picture No. (Lower)
4	Album No.
5	00
6	00
7	1A

This command sends a compressed picture data in a memory card to the host.

Access mode 0: Sequential picture number access
1: Album base picture number access

Picture No. The number of a picture to be sent to the host in the flash memory. In the Sequential picture number access mode the number is sequential picture number, and in the Album base picture number access, this number specifies the Album base picture number.

Album No. The Album number indicates the Album in which the image specified by the picture number. This field is ignored when Access mode is 0. 0 specifies no album (root directory).

In the following cases, the camera will return a command execution error (e2h) to the host.

- Memory card is not inserted in the camera.
- Specified picture number or Album number exceeds the maximum number in a memory card.

4.2.7. Send TIFF/EP File in Card

Offset	Host command
0	65
1	Access mode

2	Picture No. (Upper)
3	Picture No. (Lower)
4	Album No.
5	00
6	00
7	1A

This command sends the TIFF/EP file (TIFF/EP information, thumbnail and picture) of a specified picture in a memory card to the host in 1025 packed data format..

Access mode 0: Sequential picture number access
1: Album base picture number access
Picture No. The number of a picture to be sent to the host in the flash memory. In the Sequential picture number access mode the number is sequential picture number, and in the Album base picture number access, this number specifies the Album base picture number.
Album No. The Album number indicates the Album in which the image specified by the picture number. This field is ignored when Access mode is 0. 0 specifies no album (root directory).

In the following cases, the camera will return a command execution error (e2h) to the host.

- Memory card is not inserted in the camera.
- Specified number exceeds the maximum e number in a memory card.

4.2.8. Send TIFF/EP Information in Card

Offset	Host command
0	65
1	Access mode
2	Picture No. (Upper)
3	Picture No. (Lower)
4	Album No.
5	00
6	00
7	1A

This command sends the TIFF/EP information of a specified picture in a memory card to the host in 257 packed data format.

Access mode 0: Sequential picture number access
1: Album base picture number access
Picture No. The number of a picture to be sent to the host in the flash memory. In the Sequential picture number access mode the number is sequential picture number, and in the Album base picture number access, this number specifies the Album base picture number.
Album No. The Album number indicates the Album in which the image specified by the picture number. This field is ignored when Access mode is 0. 0 specifies no album (root directory).

In the following cases, the camera will return a command execution error (e2h) to the host.

- Memory card is not inserted in the camera.
- Specified number exceeds the maximum e number in a memory card.
- Specified number of image is not in a memory card.

4.2.9. Send Thumbnail Picture in Card

Offset	Host command
0	66
1	Access mode
2	Picture No. (Upper)
3	Picture No. (Lower)
4	Album No.
5	00
6	00
7	1A

This command indicates the camera to send a thumbnail picture in a memory card to the host. The thumbnail image is compressed before sending to the host. The size of the image is 7220 bytes

Access mode 0: Sequential picture number access
1: Album base picture number access
Picture No. The number of a picture to be sent to the host in the flash memory. In the Sequential picture number access mode the number is sequential picture number, and in the Album base picture number access, this number specifies the Album base picture number.

Album No. The Album number indicates the Album in which the image specified by the picture number. This field is ignored when Access mode is 0. 0 specifies no album (root directory).

In the following cases, the camera will return a command execution error (e2h) to the host.

- Memory card is not inserted in the camera.
- Specified picture number or Album number exceeds the maximum number in a memory card.

4.1.10. Set Image Quality

Offset	Host command
0	71
1	00
2	Image Quality
3	00
4	00
5	00
6	00
7	1A

This command sets the current image quality for pictures.

Image quality 00 : No comp image
01 : Best image
02 : Better image
03 : Good image

If an illegal value is set in the image quality field, the camera will return a command execution error (e2h) to the host.

4.2.11. Copy Memory To Card

Offset	Host command
0	76
1	Access mode
2	Picture No. (Upper)
3	Picture No. (Lower)
4	Album No.
5	00
6	00

7	1A

This command copies a specified image in the flash memory to a memory card.

Access mode 0: Sequential picture number access
1: Album base picture number access
Picture No. The number of a picture to be copied in the flash memory. In the Sequential picture number access mode the number is sequential picture number, and in the Album base picture number access, this number specifies the Album base picture number.
Album No. The Album number indicates the Album in which the image specified by the picture number. This field is ignored when Access mode is 0. 0 specifies no album (root directory).

In the following cases, the camera will return a command execution error (e2h) to the host.

- Memory card is not inserted in the camera.
- Memory card becomes full.
- Specified picture number or Album number exceeds the maximum number.
- Picture number 0 is specified.

4.1.12. Take a Picture to Flash Memory

Offset	Host command
0	77
1	00
2	00
3	00
4	00
5	00
6	00
7	1A

This command specifies to take a picture to save that image in the flash memory.
If the flash memory has no spaces to save the image, the camera will return a command execution error (e2h).
If the flash memory has already has 8 Albums and active Album is not included in the 8, the camera will return a command execution error (e2h).

4.2.13. Erase Images in Flash Memory

Offset	Host command
0	7A
1	Access mode
2	Picture No. (Upper)
3	Picture No. (Lower)
4	Album No.
5	00
6	00
7	1A

This command specifies to erase image/images in the flash memory.

Access mode 0: Sequential picture number access
1: Album base picture number access

Picture No. The number of a picture to be erased in the flash memory. In the Sequential picture number access mode the number is sequential picture number. If 0 is specified all images are erased.
In the Album base picture number access mode, this number specifies the Album base picture number. If 0 is specified all images in the Album is erased.

Album No. The Album number indicates the Album in which the image specified by the picture number. This field is ignored when Access mode is 0. 0 specifies no album (root directory).

If specified images do not exist in the flash memory, the camera will return a command execution error (e2h) to the host.

4.2.14. Erase Images in Memory Card

Offset	Host command
0	7B
1	Access mode
2	Picture No. (Upper)
3	Picture No. (Lower)
4	Album No.
5	00
6	00
7	1A

This command specifies to erase image/images in card.

Access mode 0: Sequential picture number access
1: Album base picture number access
Picture No. The number of a picture to be erased in the memory card. In the Sequential picture number access mode the number is sequential picture number. If 0 is specified all images are erased.
In the Album base picture number access mode, this number specifies the Album base picture number. If 0 is specified all images in the Album is erased.
Album No. The Album number indicates the Album in which the image specified by the picture number. This field is ignored when Access mode is 0. 0 specifies no album (root directory).

If specified images do not exist in the flash memory, or memory card is not inserted, the camera will return a command execution error (e2h) to the host.

4.1.15. Take a Picture to Card

Offset	Host command
0	7C
1	00
2	00
3	00
4	00
5	00
6	00
7	1A

This command specifies to take a picture to save that image in a memory card. In the following cases, the camera will return a command execution error (e2h).

- Memory card is already full.
- Memory card is not inserted in the camera.
- Memory card already has 60 Albums and active Album is not included in the 60 Albums.

4.2.16. Set Available Album

Offset	Host command
0	42
1	00
2	00

3	00
4	00
5	00
6	00
7	1A

This command is to set available 8 Albums (except for No album (root directory)) in camera. This command sets names of 8 available Albums for pictures to be taken. This command transfers a 257 byte packet data. (without packet control byte heading, with check sum at the end) The data format is as follows. All Album names are 15 characters (include last \0) and unused character space is filled with \0.
The charactors which can be used in Album name are as follows.
‘0’, ‘1’, ‘2’, ‘3’, ‘4’, ‘5’, ‘6’, ‘7’, ‘8’, ‘9’, ‘A’, ‘B’, ‘C’, ‘D’, ‘E’, ‘F’, ‘G’, ‘H’, ‘I’, ‘J’, ‘K’, ‘L’, ‘M’, ‘N’, ‘O’, ‘P’, ‘Q’, ‘R’, ‘S’, ‘T’, ‘U’, ‘V’, ‘W’, ‘X’, ‘Y’, ‘Z’, ‘?’, ‘ ’ (space), ‘/’, ‘:’, ‘=’, ‘>’, ‘.’, ‘_’.

														#
A	L	B	U	M	N	A	M	E	1	\0	\0	\0	\0	\0
A	L	B	U	M	N	A	M	E	2	\0	\0	\0	\0	\0
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
\0	\0	\0	\0	\0	\0	\0	\0	\0	\0	\0	\0	\0	\0	\0
*														

Control Byte
* Check Sum

If illegal characters is received, camera returns a command execution error (e2h).

4.2.17. Send Available Album

Offset	Host command
0	43
1	00
2	00
3	00
4	00
5	00
6	00
7	1A

This command is to retrieve available 8 Albums (except for No album (root directory)). This command retrieves current available Album names for taking picture. When this command is

received, camera transfers 258 byte packet data to host. The data format is as follows. All Album names are 15 characters (include last \0) and unused character space is filled with \0.

A	L	B	U	M	N	A	M	E	1	\0	\0	\0	\0	\0
A	L	B	U	M	N	A	M	E	2	\0	\0	\0	\0	\0
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
\0	\0	\0	\0	\0	\0	\0	\0	\0	\0	\0	\0	\0	\0	\0
*														

* check sum

4.2.18. Send Stored Album

Offset	Host command
0	44
1	00: memory 01: card
2	00
3	00
4	00
5	00
6	00
7	1A

This command is to retrieve stored Albums (except for No album (root directory)) in card or memory. This command is to retrieve Album names (not directory names) which exist in memory or card. When this command is received, camera transfers 257 byte packet data to host. All Album names are 15 characters (include last \0) and unused character space is filled with \0**.** The order of the Album name is the same as album number. Number of packets to be sent depends on the number of Albums in card or memory. The number of Albums is indicated in Camera Status Information.

A	L	B	U	M	N	A	M	E	1	\0	\0	\0	\0	\0
A	L	B	U	M	N	A	M	E	2	\0	\0	\0	\0	\0
•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
\0	\0	\0	\0	\0	\0	\0	\0	\0	\0	\0	\0	\0	\0	\0
*														

* check sum

4.2.19. Send Number of Pictures in Album

Offset	Host command
0	45
1	00: memory 01: card
2	00
3	00
4	Album Number
5	00
6	00
7	1A

This command is to know how many images are in the specified Album. Album number 0 specifies no album (root directory).
When this command is received by Camera, one 17 size packet data is sent from camera to host. The packet data is as follows.

Byte offset	Description
0	Number of pictures (MSB)
1	Number of pictures
2	Number of pictures
3	Number of pictures (LSB)
4	Reserved
5	Reserved
•	•
15	Reserved
16	Check Sum

4.2.20. Erase Album

Offset	Host command
0	46
1	00: memory 01: card
2	00
3	00
4	Album Number
5	00
6	00
7	1A

This command is to erase the Album in memory or card. When this command is received, camera erases all the image in the Album and delete the directory for the Album. When album number 0 is specified, all images in root directory are erased.

If the specified Album does not exist, camera returns command execution error (e2h).

4.2.21. Change Album Name

Offset	Host command
0	47
1	00: memory 01: card
2	00
3	00
4	Album Number
5	00
6	00
7	1A

This command is to change the Album name in memory or card. When this command is received, camera rename the Album. 17 bytes packet data is sent followed by this command.

A	L	B	U	M	N	A	M	E	\0	\0	\0	\0	\0	\0	\0	#

= check sum

If the specified Album does not exist or 0 is specified, camera returns command execution error (e2h).

4.2.22. Move Image To Another Album

Offset	Host command
0	48
1	00: memory 01: card
2	Picture No. (Upper)
3	Picture No. (Lower)
4	Album Number (Source)
5	Album Number (Destination)
6	00
7	1A

This command is to change location of the specified image. When this command is received the camera moves the specified image from source Album to the destination Album. Album number 0 specifies no album (root directory).
The picture number is album base picture number.

Note: Move from memory to card or card to memory is not supported.

If the specified Album does not exist, camera returns command execution error (e2h).

4.2.23. Set Active Album

Offset	Host command
0	49
1	00
2	Active Album Number
3	00
4	00
5	00
6	00
7	1A

This command is to set the active album which specifies the Album for the next taken picture. Album number 0 specifies no album (root directory).

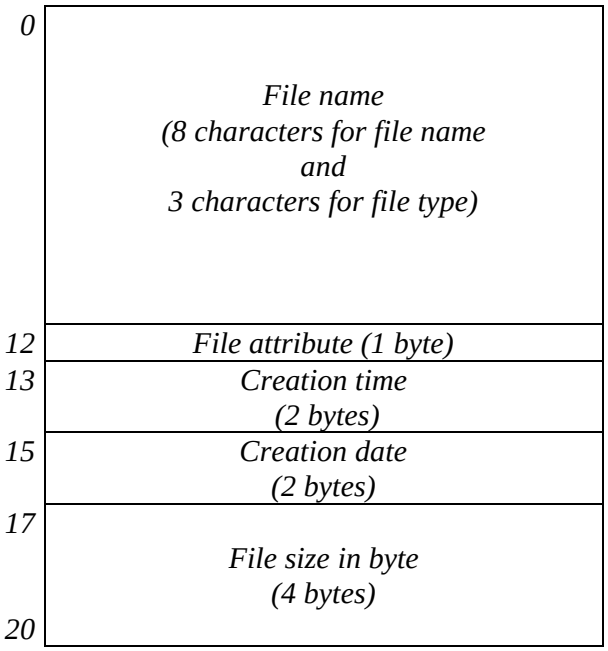
If the Album number exceeds 8 or number of available albums, camera returns command execution error (e2h).

4.2.24. Send File Name in Album

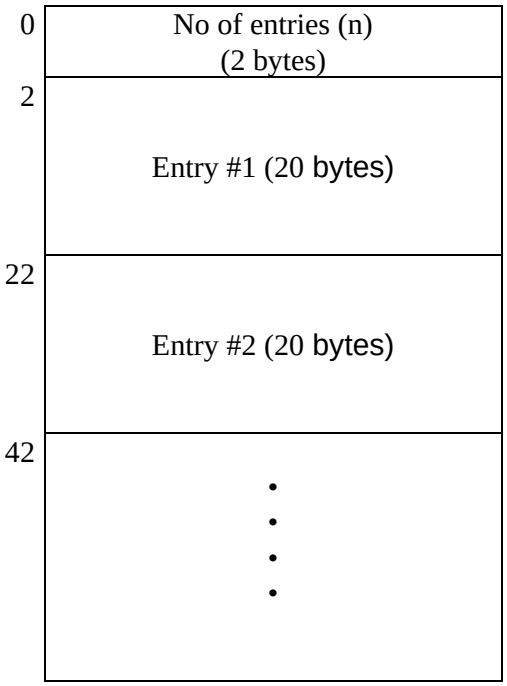
Offset	Host command
0	4A
1	00: memory 01: card
2	00
3	00
4	Album Number
5	00
6	00
7	1A

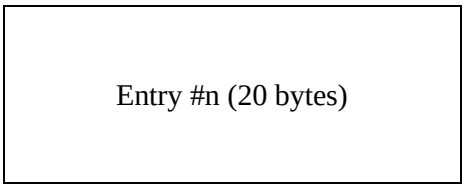
This command is to know file names in the specified Album. When this command is received the camera sends file name in the form of following 257 byte packed data. Album number 0 specifies no album (root directory).
The order of the file names in packed data should be the same as Album base picture number.

The camera will send file information for all entries of specified Album (directory) of as follows. Each entry has the following information. (Same information which is sent by Read File Command)



The following data will be sent with 257-byte packets from the camera.





Note: The order of the file names in packed data should be the same as Album base picture number.

If the specified Album does not exist, camera returns command execution error (e2h).

4.2.25. Set Date/Time Format

Offset	Host command
0	33
1	00
2	Date format
3	Time format
4	00
5	00
6	00
7	1A

This command is to change format of date and time.

Date format	00:	day / month/ year	(e.g.	3/11/97 for Nov. 3 1997)
	01:	month / day / year	(e.g.	11/ 3/97 for Nov. 3 1997)
	02:	year . month . day	(e.g.	97 . 11. 3 for Nov. 3 1997)
Time format	00:	12h	(e.g.	8:04 PM)
	01:	24h	(e.g.	20:04)

4.2.26. Set Distance Format

Offset	Host command
0	34
1	00
2	0: centimeter 1: inch
3	00
4	00
5	00

6	00
7	1A

This command is to change display format of distance in macro mode.

4.2.27. Set Default Mode

Offset	Host command
0	35
1	00
2	Mode
3	Parameter
4	00
5	00
6	00
7	1A

This command is to change default mode of the camera.

Mode: 0 Strobe mode

Parameter: 0: Auto
1: Fill
2: Off

4.2.28. Reset Camera

Offset	Host command
0	8A
1	00
2	00
3	00
4	00
5	00
6	00
7	1A

This command specifies the camera to reset the following settings.

- Sleep time 60 seconds
- Focus mode Auto with 3 spots
- Exposure mode Auto with no offset

- Flash Default setting
- Timer Off
- Exposure time for manual mode 3,300 (default value)
- Zoom value 0 (37 mm)
- Active Album 0 (no Album)

4.2.29. Set Sleep Time

Offset	Host command
0	82
1	00: Capture mode sleep time 01: Review mode sleep time
2	Sleep time
3	00
4	00
5	00
6	00
7	1A

This command sets the time-out value for sleep.

Time out value 60 - 255 (in second)

If an illegal value is set in the program number field, the camera will return a command execution error (e2h) to the host.

4.2.30. Set Manual Exposure

Offset	Host command
0	81
1	00
2	Exposure time 0 (MSB)
3	Exposure time 1
4	Exposure time 2
5	Exposure time 3 (LSB)
6	00
7	1A

This command sets an exposure control value to the camera. The camera will capture images with specified exposure time if manual exposure mode is specified by the "Set Exposure Mode" command. The aperture value depends on the exposure time automatically for DC120 camera

The camera will take pictures with the lightest aperture value if longer exposure time than about 1/100 sec is specified.

Exposure time 32 bit values in 10 microsecond increments. The shortest allowable setting is 570 (~1/175 sec.). The longest allowable is 1,600,000 (16 sec.).

Factory default values are 3300 (~1/30 sec.) for exposure time.

If an illegal value is set in the exposure time field (includes all F in the field), the camera will return a command execution error (e2h) to the host.
When serial cable is disconnected, the specified exposure is discarded**.**

5. Firmware Download

This function is reserved for factory and Kodak service use.

6. State Transition

See User Interaction Specification Document.

7. Appendix (TIFF/EP tag support status table)

Tag Name	Dec.	Hex	DC120	Compression	
				None	JPEG
NewSubFileType	254	FE	Supported	M	M
ImageWidth	256	100	Supported	M	M
ImageLength	257	101	Supported	M	M
BitsPerSample	258	102	Supported	M	M
Compression	259	103	Supported	M	M
PhotometricInterpretation	262	106	Supported	M	M
ImageDescription	270	10E	Supported	M	M
Make	271	10F	Supported	M	M
Model	272	110	Supported	M	M
StripOffsets	273	111	Supported	M1	M1
Orientation	274	112	Supported	O	O

SamplesPerPixel	**277**	**115**	**Supported**	**M**	**M**
RowsPerStrip	**278**	**116**	**Supported**	**M1**	**M1**
StripByteCounts	**279**	**117**	**Supported**	**M1**	**M1**
XResolution	**282**	**11A**	**Supported**	**M**	**M**
YResolution	**283**	**11B**	**Supported**	**M**	**M**
PlanarConfiguration	**284**	**11C**	**Supported**	**M**	**M**
ResolutionUnit	**296**	**128**	**Supported**	**M**	**M**
Software	**305**	**131**	**Supported**	**M**	**M**
DateTime	**306**	**132**	**Supported**	**M**	**M**
Artist	**315**	**13B**		**O**	**O**
TileWidth	**322**	**142**		**M2**	**M2**
TileLength	**323**	**143**		**M2**	**M2**
TileOffsets	**324**	**144**		**M2**	**M2**
TileByteCounts	**325**	**145**		**M2**	**M2**
SubIFDs	***330***	***14A***	**Supported**	***R***	***R***
JPEGTables	**347**	**15B**		**O**	**O**
YCbCrCoefficients	**529**	**211**		**M3**	**M3**
YCbCrSubSampling	**530**	**212**		**M3**	**M3**
YCbCrPositioning	**531**	**213**		**M3**	**M3**
ReferenceBlackWhite	**532**	**214**		**M3**	**M3**
CFARepeatPatternDim	***33421***	***828D***	**Supported**	***O***	***O***
CFAPattern	***33422***	***828E***	**Supported**	***O***	***O***
BatteryLevel	***33423***	***828F***	**Supported**	***O***	***O***
Copyright	**33432**	**8298**	**Supported**	**M**	**M**
ExposureTime	***33434***	***829A***	**Supported**	***O***	***O***
FNumber	***33437***	***829D***	**Supported**	***O***	***O***
IPTC/NAA	***33723***	***83BB***		***O***	***O***
InterColorProfile	***34675***	***8773***		***R***	***R***
ExposureProgram	***34850***	***8822***	**Supported**	***O***	***O***
Encryption	***34851***	***8823***		***O***	***O***
SpectralSensitivity	***34852***	***8824***		***O***	***O***
GPSInfo	***34853***	***8825***		***O***	***O***
DigitalSignature	***34854***	***8826***		***O***	***O***
ISOSpeedRatings	***34855***	***8827***		***O***	***O***
OECF	***34856***	***8828***		***O***	***O***
Interlace	***34857***	***8829***		***O***	***O***
TimeZoneOffset	***34858***	***882A***		***O***	***O***
SelfTimerMode	***34859***	***882B***	**Supported**	***O***	***O***
DateTimeOriginal	***36867***	***9003***	**Supported**	***M***	***M***
CompressedBitsPerPixel	***37122***	***9102***	**Supported**	***N***	***O***
ShutterSpeedValue	***37377***	***9201***		***O***	***O***
ApertureValue	***37378***	***9202***		***O***	***O***
BrightnessValue	***37379***	***9203***		***O***	***O***

ExposureBiasValue	*37380*	*9204*		*O*	*O*
MaxApertureValue	*37381*	*9205*		*O*	*O*
SubjectDistance	*37382*	*9206*	**Supported**	*O*	*O*
MeteringMode	*37383*	*9207*		*O*	*O*
LightSource	*37384*	*9208*		*O*	*O*
Flash	*37385*	*9209*	**Supported**	*O*	*O*
FocalLength	*37386*	*920A*	**Supported**	*O*	*O*
FlashEnergy	*37387*	*920B*		*O*	*O*
SpatialFrequencyResponse	*37388*	*920C*		*O*	*O*
Noise	*37389*	*920D*		*O*	*O*
FocalPlaneXResolution	*37390*	*920E*		*R*	*R*
FocalPlaneYResolution	*37391*	*920F*		*R*	*R*
FocalPlaneResolutionUnit	*37392*	*9210*		*R*	*R*
ImageNumber	*37393*	*9211*	**Supported**	*O*	*O*
SecurityClassification	*37394*	*9212*		*O*	*O*
ImageHistory	*37395*	*9213*		*O*	*O*
SubjectLocation	*37396*	*9214*		*O*	*O*
ExposureIndex	*37397*	*9215*		*O*	*O*
TIFF/EPStandardID	*37398*	*9216*	**Supported**	*M*	*M*
SensingMethod	*37399*	*9217*	**Supported**	*R*	*R*

1. **Either all M1 tags must be present for strips, or all M2 tags must be present for tiles, but not both.**
2. **All M3 tags must be present for YCC images**

CompressionTable	*33425*	*8291*		*O*	*O*
ColorMatrixCoeefficients	*37400*	*9218*	**Supported**	*O*	*O*

KodakVersion	*0*	*0*	**Supported**	*O*	*O*
LightValue	*1*	*1*	**Supported**	*O*	*O*
AutoFocusMode	*2*	*2*	**Supported**	*O*	*O*
ExposureValue	*3*	*3*	**Supported**	*O*	*O*
ApatureValue	*4*	*4*	**Supported**	*O*	*O*
ProgramMode	*5*	*5*	**Supported**	*O*	*O*
AWBCoefficients	*6*	*6*	**Supported**	*O*	*O*
AWBCalibCoefficients	*7*	*7*	**Supported**	*O*	*O*