To all Handling
FUJIFILM Electronic Imaging Products,

3 July 2008

<TSG Vol.7>

“Flicker” phenomena on the LCD under Fluorescent Lighting

＜Overview＞

When a digital camera is used to take pictures under fluorescent lighting, the LCD screen or the monitor screen used to view video output may appear to flicker or blink. This “flicker” phenomena can also occur during AF operation when the shutter button is pressed.

The flicker phenomena visible on the LCD screen during shooting is a result of the balance between three factors:

(1) the flicker caused by light emission frequency of the fluorescent lamp
(2) the frame rate setting of the LCD screen
(3) the electronic shutter speed

While this effect has no impact on photographed images, some customers may judge the image quality only through LCD screen, and misunderstand as the faulty. This article explains the mechanisms of flicker in detail and eliminates mistaken understanding as the faulty.

<What is “flicker”?>

Fluorescent lamps is operated by continually lighting ON and OFF at a constant frequency. This is because the power is supplied by Alternating Current (AC) source and fluorescent lamps emit light through an electrical discharge that occurs when the difference between the positive and negative voltages in the AC current is largest.

(The high and low voltages repeatedly oscillate above and below 0 volts.)

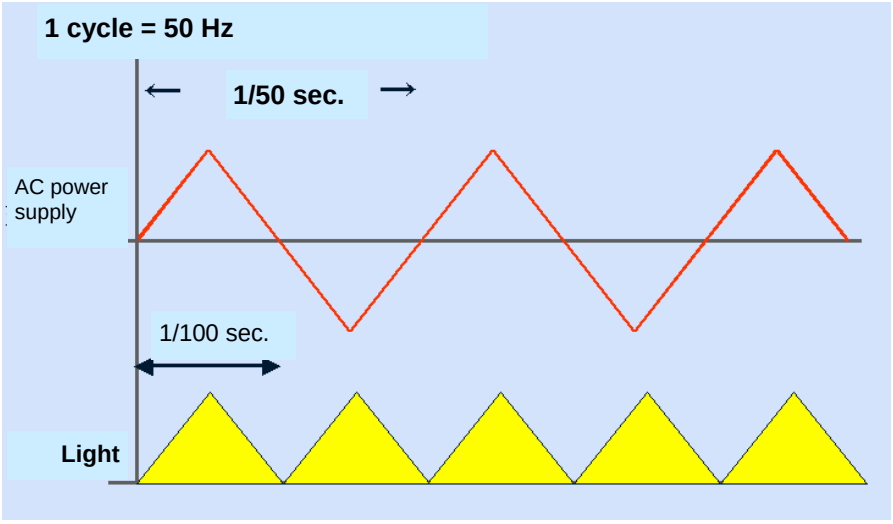
These operation results “flicker” that can be visible to the human eye and can sometimes be seen on “live” images of the monitor screens and “movie” images of the screens.

The power supply frequencies are either 50 Hz or 60 Hz (*1). In general, more people tend to notice flicker when the power supply frequency is lower (50 Hz). Also, as the fluorescent lamp nears to be exhausted (i.e. end of life stage), the afterglow period from each light emission becomes shorter. Then, the flashing of light becomes much easier to be noticed by human eye, and acknowledged as “flicker” easily.

In case of power supply with 50Hz, the voltage oscillates above and below 0 volts with 100 times per second, so that the fluorescent lamp repeatedly emits flashes of light at a rate of 100 flashes per second. (See Figure 1 below.)

(*1) 50 Hz : Major countries in Europe, Asia and Oceania.
60 Hz : Major countries in North and South America, including Korea and Taiwan.
50/60Hz : Some countries, such as Japan, use different frequencies in different regions.
(e.g. East Japan :50Hz, West Japan : 60Hz)

[Figure 1] Overview of voltage fluctuations in an AC power supply (50 Hz regions) and the flashes of light emitted by fluorescent lamps.



<- In a 50 Hz AC power supply, the voltage oscillates above and below 0 volts at intervals of 1/50 sec.

<- Centered on 0 volts in the above power supply, the fluorescent lamp emits light each time the negative or positive voltage peaks, resulting in one flash every 1/100 seconds.

<What is the "frame rate"?>

This is an index referring to the number of times which the display of LCD (or similar display) is refreshed per unit period. The frame rate is expressed in frames per second (fps). The higher this value, the smoother the live or movie images shown on the LCD appear.

e.g.: The default setting for the F100fd LCD monitor is 30 fps, and by changing the rate to 60 fps the live image on the LCD monitor is displayed more smoothly.

<Characteristics of AF>

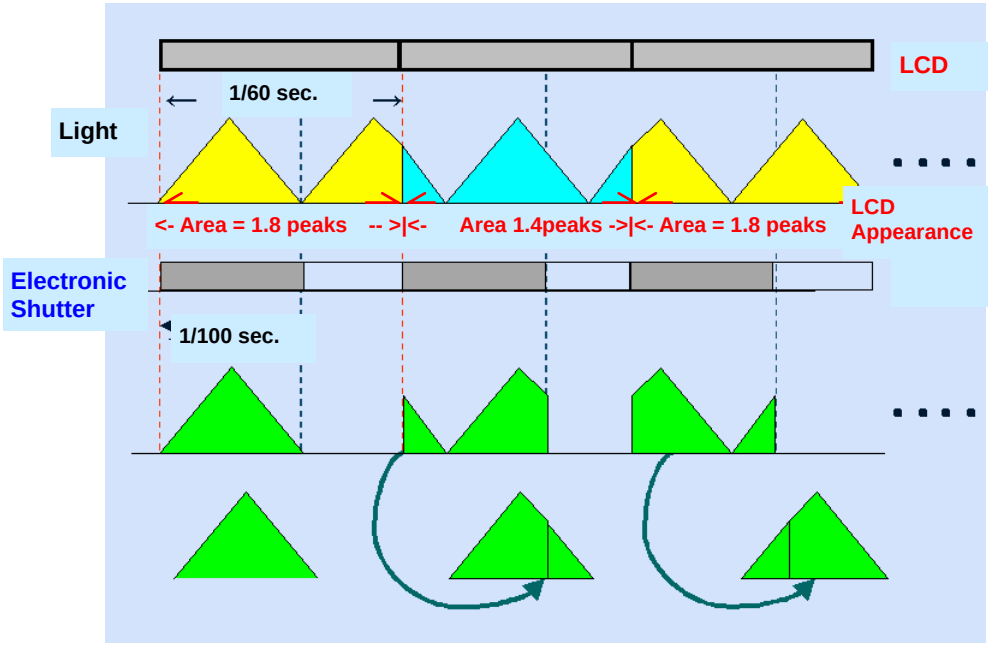
- In case of most compact digital camera, “CCD-AF (contrast –type)” is equipped. Focusing position is judged from the difference of image contrast by CCD. However, if the subject has low or no contrast, or the shooting condition is under very dark lightng, the camera cannot detect the correct focusing position due to low contrast. (See EPN vol.277: TSG Vol. 3 “AF in Low-contrast, Low-brightness scenes".)
- To acquire suitable focus position in these occasion, the camera automatically change “effective sensitivity” higher than normal condition, by changing the setting of ISO sensitivity, or changing electronic shutter speed slower (lower frame rate).

<Difference of flicker visibility >

Flicker phenomena can be noticed at some frame rate of LCD. Electronic shutter speed is also correlated. (Please check the following is just as example data.)

- The fluorescent lamp is used at power supply frequency with 50 Hz, and flashes at a rate of 100 times per second. If this flashing is divided by 1/60 second (i.e. 60 fps, set for frame rate of LCD), the each energy of those divisions is not constant. This inconsistent energy results flashing as changes in the brightness. That is noticed as flicker.
- This flicker phenomena also affect to CCD-AF performance. By using fast electronic shutter speed of 1/100 second (frequency: 60fps during AF operation), flicker is compensated and acquired light energy is equalized. Then, even after releasing the half shutter for AF, flicker phenomena can be compensated (See Figure 2 below.)

[Figure 2] Flicker: Light energy emitted by a fluorescent lamp with 50Hz is divided at 1/60 sec (60 fps)
Effectiveness of electronic shutter speed at 1/100sec



<- 1/60 sec. (60 fps) Frequency of the LCD

<- The light energy at 50Hz is divided at 60 fps.The energy area in each 1/60 sec has the pattern where the area = 1.8 peaks (yellow peak) -> area = 1.4 peaks (blue peak) -> area = 1.8 peaks (yellow peak) As a result, the amount of light appears to vary and this is perceived as flicker.

<- Using electronic shutter with 1/100 sec. results in the green peak areas, where each energy area is the same, and flicker is eliminated..

- During AF procedure, sometimes, electronic shutter speeds is set slower than 1/100 sec. for better AF performance due to other condition. If the speed is slowed to 1/60 sec., flicker can be caused by the electronic shutter under 50 Hz lighting, just as explained by upper part of Figure 2.
- Also, the electronic shutter speed can be changeable due to the camera's AE condition. So, the visible impact of flicker may vary depending on the shooting conditions and the geographical region (*2). In addition, even if the brightness of the shooting condition is the similar, electronic shutter speeds vary depending on each camera model, and the visible impact of flicker may vary also.

(*2) Differences in the power supply frequency is mentioned in above <What is flicker?> section.

<General countermeasures for eliminating flicker>

If flicker must be eliminated, shooting with non-flicker type lighting is recommended. Among fluorescent lamps with inverter-type generate higher frequencies than those with normal type, and are less likely to cause flicker.

< Q&A for FinePix F100fd >

Q1: When I take pictures under fluorescent lighting, the LCD seems to blink several times when I press the shutter button down halfway. Is this a fault with the camera? (This sort of problem doesn't arise with the F50fd.)

A1: No. it may not be a fault with the camera (F100fd)

1. This LCD blinking may be caused by flicker phenomena with the fluorescent lamps during AF operation in F100fd.
2. In normal shooting conditions, frame rate for AF operation in the F100fd is set at higher than those in F50fd, for smoother LCD display & suitable AF performance.
3. However, the level of flicker is determined by the correlation with the frequency in fluorescent lamps, shooting condition (including location) and the camera model.
4. As a result, the situation which flicker can be noticed not with F50fd but with F100fd can be happened.
5. The light emission frequency in fluorescent lamps varies depending on the type of the lamps. So, if possible, please try to take pictures under different type of lighting (such as another type of fluorescent lamps).

If you have any question about above issues, please feel free to contact us.

<Technical Contact Person>
(Mr.) Shuuji Nose : e-mail sfuuji_nose@fujifilm.co.jp
(Mr.) Mitsuo Takahashi : e-mail mitsuo_takahashi@fujifilm.co.jp

Best regards,

Hiroyuki Saito
Operation Manager
Product Planning & Technical Service Div.
Electronic Imaging Products Div,
FUJIFILM Corporation
e-mail : hiroyuki_a_saitou@fujifilm.co.jp