

●CCFL leak current at the LCD Module

How to reduce the leak current

It is impossible to eliminate the leak current perfectly. There is an effect that a stray capacitance decreases the lighting start voltage. Therefore, it is recommended to decrease the leak current to the possible level in consideration of matching with Inverter.

Leak current $I_s = 2\pi f C_s V_L$

(1) By lowering the driving frequency f

If the driving frequency f is made too low, electric discharge becomes unstable and the luminance is decreased. In consideration of the luminance efficiency of the lamp, 50-60 kHz is currently prevalent. As the lamp diameter is smaller, it is necessary to raise the frequency for stable lighting.

(2) By reducing the stray capacitance Cs

$C_s = \epsilon S/d$

Widen the distance "d" between the high voltage wiring / lamp and the conductor portion (reflector, chassis etc.).

For example, a non-conductive reflector should be reviewed.

It is to be noted, however, that the metallic reflector has an effect of lowering the lighting start voltage.

(3) By reducing the Lamp Voltage VL (Reducing the lamp impedance)

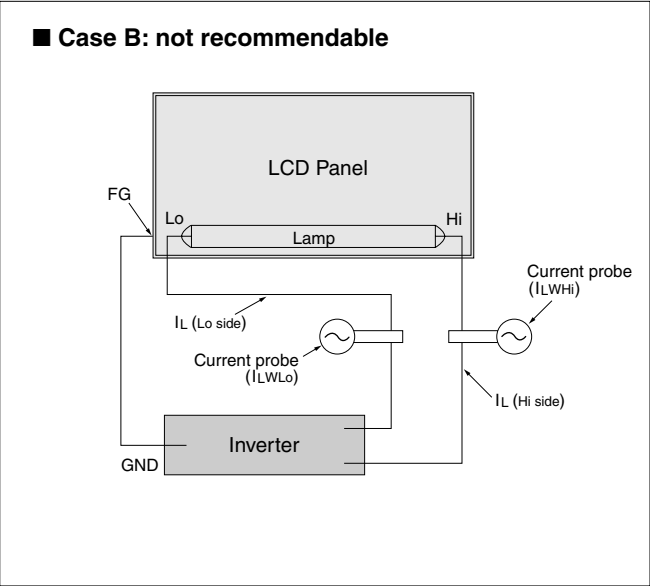
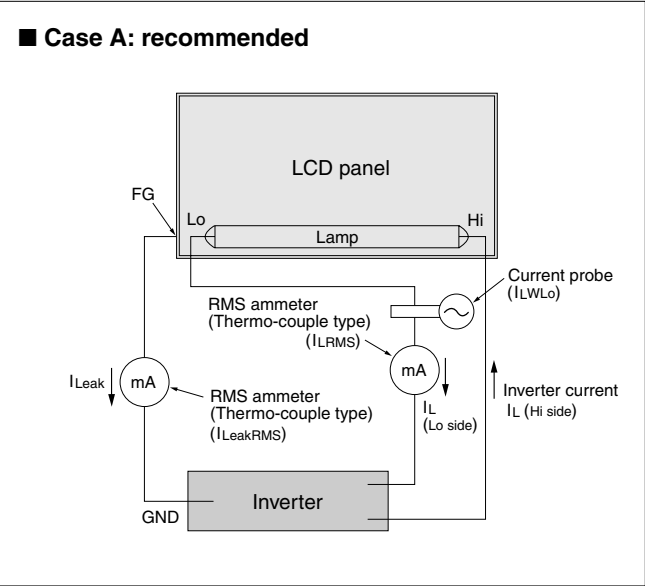
The lamp voltage depends on the CCFL characteristics.

As the CCFL is thinner and longer, the lamp voltage becomes higher. As the gas pressure is higher, the impedance tends to be higher.

[Appendix] How to measure leak current

As a measuring method of the lamp current, please see “Case A” which is recommendable and “Case B” (not recommendable) as follows.

The measurement point of current is shown.



● Case A

Measure the lamp current and leak current with the RMS ammeter (Thermo-couple type). This is because the ammeter value is more accurate than the calculated value of the oscilloscope. The oscilloscope is used for checking the lamp current waveform (Crest & Imbalance Factor).

● Case B

This is a measuring method in which the difference between high side (IL) and low side (IL) is deemed as leak current {IL(Hi) – IL(LO)}. However, the accurate leak current cannot be obtained, because the current value (Hi side IL) is the value of the synthesized current (IL+I leak).

(Not scalar, but the sum of vector should be used.)

● For your reference, let us explain the synthesis of the vector of Fig. 27.

The sum of vector of lamp current and the leak current is equivalent to the current of the inverter.

The phase of inverter current advances against lamp current about 34.3° due to the influence of the C component of the panel.

As a result, inverter current, lamp current and leak current will be 7.3 mA, 6mA and 4.1mA respectively.

This is expressed by the following equation:

Inverter Current 7.3 mA

Lamp Current 6 mA

Leak Current 4.1 mA

$$\begin{aligned} \text{Inverter current [IL (Hi side)]} &= \sqrt{(I_{\text{Leak}})^2 + (I_{\text{L (Lo side)}})^2} \\ &= \sqrt{(4.1\text{mA})^2 + (6\text{mA})^2} \\ &= 7.3\text{mA} \end{aligned}$$

● Incidentally, refer to Fig. 28 for the difference between the voltage phase and the current phase.

The phase difference is 0 for component R (resistance), delays 90° for L component (coil) and advances 90° for component C (capacitor).

Fig. 27

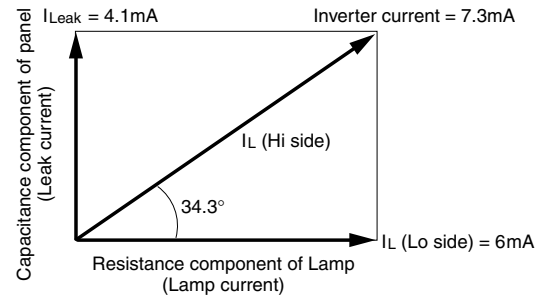


Fig. 28

