BASIC KNOWLEDGE OF LED DRIVER

1. What is PF value ?

PF value is the power factor: it is an indicator of the utilization rate of electrical equipment to the power system of the grid. For the equipment with the same power, the input current of the equipment with higher PF value is smaller, and the capacity of the power system required is also smaller. All the countries have clear PE value requirements for civil, commercial and industrial electrical equipment.

2. What are the disadvantages if low PE value?

Too low PE value will bring many adverse effects: First, too low PE value will lead to large input current, and it is necessary to increase the diameter of the input line to ensure the safety of the line; second, too low PE value will increase the loss of the power grid, pull down the power grid voltage, resulting in abnormal electrical equipment. At the same time, equipment with low PE value often has large harmonics, which are easy to interfere with power grid electrical equipment and affect the normal operation of equipment.

3. What is Total Harmonic Distortion (THD)?

Harmonics refers to the amount of electricity contained in the current which frequency is an integer multiple of the fundamental wave. Total harmonic distortion refers to extra harmonic components based on the more output signal than the input signal when the signal is inputting,each harmonic superimposed on the input signal will produce distorted waveform, THD is usually expressed in percentage, indicating the current harmonic content in the percentage of the fundamental wave content.

4. What's disadvantages with too high total harmonic distortion (THD)?

When a large number of electrical equipment with high THD is used, the total harmonic current generated by it will seriously pollute the entire power supply system and other power users, and also distort the voltage waveform of the grid.

Excessive harmonic current will cause the following hazards:

(1) The power transformer produces local magnetization and the increasing loss, and the transformer and power operation safety are endangered in serious cases;

(2) When the harmonic current passes through the power capacitor of the power compensation equipment, it is easy to cause the power capacitor damage because of over current or over voltage;

(3) Harmonic current can cause strong interference to relay protection, instrumentation, automatic control, electronic communication, satellite navigation and computer systems on the line, resulting in mistake operation,noise and other abnormal phenomena;

(4) In the 3-phase four-wire power supply system, the harmonic current will make the phase current of the grid unable to cancel each other in the middle line to result in superposition of the current in the middle line and cause over current damages, if three-phase potential is offset, it will seriously lead to the burning of the lamp and even it is easy to cause fire.

5. What is the surge?

As the name suggests, it is an instantaneous peak beyond the stable value, which includes surge voltage and surge current. The surge, also called a surge, as the name suggests, is one transient over voltage that exceeds

the normal operating voltage. Essentially, a surge is a violent pulse that occurs in just a few millionths of a second. Possibly causes of surges include heavy equipment, short circuits, power switches, or large engines. Products containing surge suppression devices can effectively absorb the burst of huge energy to protect the connected equipment from damage.

Surge profile:

Surge current refers to peak current or overload current that is much higher than the stable current when power supply is switched on or when the circuit is abnormal. In electronic design, the surge mainly refers to power supply or other parts of the circuit suffers itself or external spike interference which has just turned on .

It is likely to make the circuit burned out at the moment of the surge. For example, PN junction capacitor is breakdown, or resistance is burned etc. And surge protection is to use nonlinear components to protect high the circuit of high frequency (surge) sensitive design. The simple and commonly used part is parallel capacitor and series inductance.

Causes:

1) External reasons (lightning cause)

The surge caused by lightning is the most harmful, and the dangerous over voltage may be generated within 1.5 ~ 2KM of the lightning strike as the center during lightning discharge. The (external) surge point caused by lightning strike is single-phase pulse type and the energy is huge. The voltage of the external power can be rapidly increased from a few hundred volts to 20000V in a few microseconds, which can be transmitted for a considerable distance. According to ANSI/IEEE C62.41-1991, the instantaneous power supply can reach 10000A. According to statistics, the power surge outside the system mainly comes from lightning and other system shocks,

accounting for about 20%.

(1) Induced lightning surge over voltage: the electromagnetic field with high speed changes produced through lightning, lightning radiation of the electric field acting on the conductor, induction of high over voltage, such over voltages have a very steep front and rapid decay.

(2) Direct lightning surge over voltage: direct lightning falls on the power grid, due to the huge instantaneous energy and super destructive power, there is no equipment to protect from direct lightning falls.

(3) lightning surge over voltage: conducted by distant overhead lines, because the equipment connected to the power network has different suppression of over voltage, so the conducted over voltage energy weakens with the extension of the line.

(4) Oscillation surge over voltage: the power line is equivalent to an induction, and there is a distributed capacitor between the earth and nearby metal objects, forming a parallel harmonic circuit, in the TT and TN power supply system, when there is a single-phase grounding fault happened, due to the resonance of the high frequency components, high over voltage is generated on the line, which mainly damages the secondary instrument.

A direct lightning strike is the most serious event, especially if it hits an overhead power line near a customer's entry point. In these events, the overhead transmission line voltage will rise to several hundred thousand volts, usually causing insulation flash over. The lightning current is transmitted over a company or more distance on the power line, and the peak current near the lightning strike point can reach 100kA or more. The current of the low voltage line at the user's outlet can reach 5kA to 10kA per phase. In areas with frequent lightning activity, power facilities may suffer from direct lightning events several times a year to produce severe lightning currents. For the use of underground power cable power supply or in areas where lightning activity is not frequent, the above events are rare. The probability of indirect lightning strikes and internal surges is high, and most of the electrical equipment damage is related to it. Therefore, the focus of power surge prevention is to absorb and suppress this part of the surge energy.

2) Internal reasons (large equipment work, short circuit, power switch, equipment failure, too much load on the

same line)

Inside power system, due to the operation of the circuit breaker, the input and removal of the load or system failure and other internal state changes in the system make the system parameters change, which result in electromagnetic energy conversion transmission or transition process of the internal power, it will cause over voltage in the system. The power surge in the system mainly comes from the impact of the internal power load of the system, accounting for about 80%. The reasons of the internal over voltage caused by the power system can be roughly divided into:

(1) Input and removal of large power loads

(2) Input and removal of inductive load

(3) the input and removal of capacitors based on power factor compensates

(4) Short circuit fault

(5) Too much load on the same line

6. Classification of surges

According to GB/T17626.5-2008 《Electromagnetic Compatibility Test and measurement technology Surge (shock) immunity test》which is equivalent to international standards.

Surge immunity test grades are divided into:

Grade	Open-circuit test voltage
1	0.5KV
2	1KV
3	2KV
4	4KV
X	pending

Note: "X" can be any grade above or below or between other grades, below or between other grades, which can be in the product standard specification.

7. Ripple current

Ripple current is defined as AC component superimposed on output DC current. LED power supply converts input AC to DC(direct current) to drive LED, and AC component is inevitably superimposed during the conversion process due to the characteristics of the circuit and device. It has been proved that the ripple current has an impact on light output and light efficiency of LED, the presence of ripple current will reduce light output and light efficiency of LED. The larger the ripple current amplitude, the more obvious the decline in light efficiency and output, but the value of the ripple amplitude is controlled, LED can still maintain a high light efficiency.