AC DC converter Performance test guide

Note: the input of our AC-DC product nominal voltage is 110VAC and 230VAC

1. Output voltage accuracy:
Nominal input voltage. Under the condition of full-load output, Nominal output voltage is Vnom;
Measure output voltage under nominal input voltage is Vout;
**Output voltage accuracy = (Vout - Vnom) / Vnom * 100%**.

2. Line Regulation:
Nominal input rated loaded, measured output voltage is Voutn;
Input voltage high-limit rated loaded, measured output voltage is Vouth;
Input voltage low-limit rated loaded, measured output voltage is Voutl;
Vmdev take Vouth, Voutn in the maximum deviation from the Voutl;
**Line Regulation = (Voutn - Vmdev) / Voutn * 100%**

3. Line load regulation:
Nominal input 10% loaded, measured output voltage is Vb1;
Nominal input 100% loaded, measured output voltage is Vb2;
Nominal input 100% loaded, output voltage nominal value is Vb 0;
Vb take Vb1, Vb2 in the maximum deviation from the Vb 0;
**Line load regulation = (Vb - Vb0) / Vb0 * 100%**

4. AC-DC converter efficiency:
The voltage and current value measured by avometer can not use as input power while use the wattmeter to read input power Pin; calculate the output power by real output loaded value Iout and output voltage value Vout.
Under Nominal input voltage Pin;
Full loaded condition Iout;
Measured output voltage is Vout;
**Converter efficiency: Iout * Vout / Pin * 100%**

Note: input is AC, the exist of inductance and capacitance in product caused phase-difference of input voltage and current, and input current wave aberrant.

5. Ripple & Noise
Ripple and noise is the periodic and random AC components superimposed on DC output, it affects the output accuracy. In general, we use mVp-p for ripple & noise.

1st, set oscillograph broadband as 20MHz to avoid high-frequency noise;
2nd, use parallel testing,
1) $C_1 = 1 \mu F \text{ (ceramic capacitor)}$.

2) $C_2$: Capacitance is $10 \mu F \text{ (electrolytic capacitor)}$, withstand voltage higher than the output voltage more than twice.

3) Distance between two parallel lines of copper foil tape is 2.5mm, sum of voltage drop of two parallel copper foil tape should be less than 2% of output voltage.

Another testing method double strand test as showed fig.7. Use the 30cm long and #20AWG form the twisted pair connect with switching power supply tested $V_0$ and 0V.

Because the ground wire clamp of the oscilloscope can absorb all kinds of high frequency noise interference measurement results, in order to shield the interference can be measured by the side method, as shown in figure 8. The ripple and noise of the actual test can be different due to the difference of the circuit and the external components. Figure 9 is the ripple noise waveform of the actual test.
5.1 Ripple & Noise Testing of LS01/LS03-R2/LS05

This series of products are economical small size with no filtering e-cap of input and output. There is unique requirements when testing and use this series of products. Input and output should be connected in accordance with technical parameters of the product, see fig. 10 for typical circuit:

![fig. 10](image)

**Ripple & noise test chart**

![fig. 11](image)

Note: output ripple & noise needs π filter.
6. Isolation and Insulation Properties

![Connection diagram](image12)

**fig. 12**

Voltage-endurance testing method:

Connection diagram see fig. 12, according to test standard of voltage-endurance, slowly increase the withstand voltage from 0 till the maximum, and last for one minute.

Insulation strength: short input and output pins respectively, add isolation voltage (peak of DC or AC according to given isolation voltage of the product) between input and output. Test for 1 minute.

Insulation resistance: short input and output pins respectively, add 500VDC between input and output. Test the insulation resistance between input and output.

7. FAQ

7.1 Earthing - input and output:

Input earthing: AC-DC module supply input has 3 pins, live line-L, null line-N, FG, FG is connected with equipment case or earth wire of grid.

Output earthing: in practical use, customer will connect output-FG and FG directly, as shown below left view, which might cause output error or damage of product by surge and group pulses. So it is not recommended.

It can be connected by Y-capacitor (Generally 1000pF/400V), see fig.13.
7.2 Surge Current:
Surge current are peak current of product instant starting (regularly called product inrush current) and the current created by huge surge voltage during running.

7.3 Drain Current:
There are two concepts for drain current, one is the leakage current between input and FG during the product running; another one is the drain current between isolation zone during withstanding voltage test.

7.4 AC/DC Input:
AC-DC input generally use full bridge rectifier to satisfy the power supply mode of AC and DC voltage.

7.5 The Relationship of FG and Class I, Class II Equipments:
EN60950 well defined the concept of class I, class II equipment. Class I equipment uses basic insulation and a kind of connecting device. Once the basic insulation failed, the conductive parts with dangerous voltage would connect with protective earth conductor in building distributors. Class I equipment has FG pin. Class II equipment means protection against electric shock. Not only rely on basic insulation, it uses additional protection (such as double insulation or reinforced insulation). Such equipments neither rely on protective grounding nor installation protection. Class II equipment doesn't have FG pin.

7.6 Input Transient:
The voltage transient of input power cord is destructive to product. If the input transient greater than product high limit, it has to add protective circuit to input. Protective circuit see fig.1.

7.7 Output No-load Use:
For multi-output products, there is over-spec situation with no-load use, which may be 20% or more. In practical use, it is recommended that the minimum load is 10% of full load.
7.8 Maximum Operating Temperature:
Under high temperature condition, product internal components temperature is much higher than environment. In order to ensure its normal work, the maximum working temperature should be 70°. When the temperature reaches 55°, it requires derating. Detailed information pls refer to corresponding product technical manual.