NOISE FILTERS

Fax Back Document #1300

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Model Number	Rated Current										Feature	Terminal	Characteristics Application	Safety Standards						
	1	2	3	4	5	6	1	1	2	3				UL	CSA	VDE	TUV	SEMKO	SEV	EI
SUP-B☐R-E		●		●		●					Plastic case	CP-wire solder-plated	Direct installation to PCB	E78644						
SUP-C☐G-E			●			●														
SUP-E☐H-EP	●	●	●								Metal case	Vinyl insulated cable	1,000V Pulse absorption		LR60681	10529 -4730 -1003				
SUP-E☐H-EP					●		●	●	●			Screw terminals				10529 -4730 -1001	R85074	8415187		
SUP-G☐H-EPR					●		●	●	●			Faston	2,000V Pulse absorption Bleeder resistor			10529 -4730 -1001		8707213		
SUP-G☐H-EPR-2					●		●	●	●			Solder terminals								
SUP-G☐H-EPR-4					●		●	●	●			Screw terminals								
SUP-E☐H **	●	●	●								Metal case	Vinyl insulated cable	Low leakage	E78644 **		10529 -4730 -1003				
SUP-E☐H					●		●	●				Screw terminals				10529 -4730 -1001		8415187		
SUP-E☐H-0 **	●	●	●		●		●	●	●			Faston								
SUP-E☐H-2 **	●	●	●		●		●	●	●			Solder					R85074			
SUP-J☐G-E(1) **			●			●	●	●			Inlet socket	Faston Solder terminals	Compact type			10529 -4730 -1002		8946082 9014077	Nr.91.1 12062	139047
SUP-J☐G-E(1)-2			●			●	●	●												
SUP-F☐H-ER-2			●			●	●											8815052		
SUP-J☐H-ER-4					●		●	●	●	●	Metal case	Screw terminals	High Current			10529 -4730 -1001				
SUP-K☐H-ERB-4P							●	●	●	●	Surge		Surge Absorber and Filter	E78644						
SUP-L☐H-ERB-2					●		●	●	●		277VAC									
SUP-P☐H **					●		●	●	●	●	Metal case	Faston Solder Screw	TVSS		LR60681		R9250051			
3SUP-H☐H *					●		●	●	●	●	3-Phase	Screw terminals	3-Phase				R9251182 T9250187			
3SUP-C☐H *					●		●		●	●				Pending	Pending					
3SUP-D☐H *					●		●		●	●							J9650389			
4SUP-T☐H *										●				Pending	Pending					

* 35 Amp, 50 Amp, 75 Amp, 100 Amp, & 170 Amp Versions Also Available
** UL544 Medical & Dental Equipment Rating Available

• INTRODUCTION

Recent years have witnessed tremendous advances in electronics. In the field of personal computers, word processors and other computer related equipment, legal restrictions regarding safety and noise generation have grown more strict with each passing year. In most cases, electronic devices exported must now conform to the noise regulations of the target country in order for them to be given market approval.

The following is an introductory description of the ways in which noise is generated and the various noise regulations currently enforced throughout the world.

• NOISE GENERATION AND TRANSMISSION

The noise generated by electronic devices consists of two kinds. Radiated noise is transmitted directly into the air from an electronic device, taking the form of an electric wave that interferes with other electronic devices. In contrast Conductive noise interferes with other components and devices by being transmitted along power lines and the wiring of electronic circuits. These two kinds of noise can be briefly explained in the context of an electronic device by means of the following diagram (Figure 1).

A) Electronic device

1. Conductive noise from electric power line.
2. Conductive noise along the signal lines connecting electronic devices.
3. Radiated noise transmitted from an electronic device which interferes with another device.
4. Radiated noise picked up and generated by the power line which acts as an antenna.
5. Radiated noise picked up and generated by the signal lines which act as an antenna.
6. Noise produced from a source within the electronic device.
7. Noise entering from the ground line.

As shown in Figure 2, conductive noise can also be divided into two types, normal mode noise involving symmetrical noise components oscillating between lines (L1-L2) and common mode noise involving asymmetrical noise components transmitted between a line and ground (L1-E, L2-E).

• OPERATING PRINCIPLES OF NOISE FILTERS

A key counter measure taken against noise is the use of noise filters. The operating principles of these devices are described in the following:

Viewed from the perspective of the circuit network, the noise filter is a kind of low range or low pass filter. It is designed to pass only frequencies lower than the cut off frequency of the filter, while attenuating or blocking all ranges higher than the cut off frequency.

As shown in Figure 3, the filter operates according to a principle whereby inductance connected directly in series with the line has virtually no affect on the noise current at low frequencies, but at high frequencies it demonstrates a high interruptive effect with respect to the noise current.

Also, a capacitor connected in parallel with the line is used as a side path to return high frequency back to the power line. The result is that normal mode noise passes through the capacitor and is shunted back to the other line. In the case of common mode noise, the result is that the noise passes through the midpoint of the two capacitors to ground.

The use of special materials such as amorphous alloys and toroidal cores gives the Okaya noise filters excellent insertion loss characteristics and high voltage pulse attenuation capability.

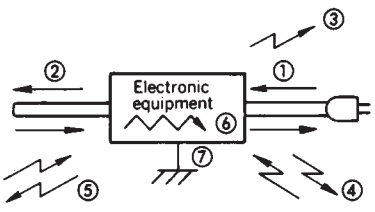


Fig. 1

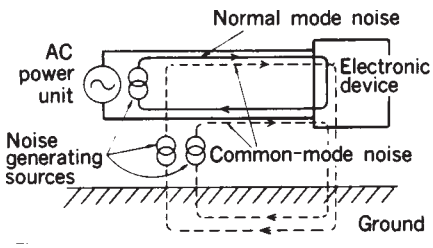


Fig. 2

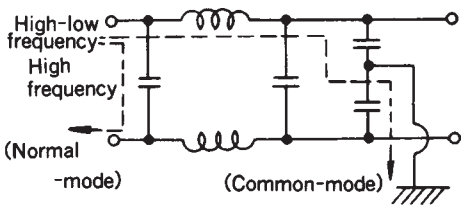


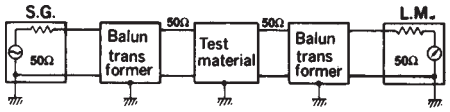
Fig. 3

• EVALUATION METHODS OF NOISE FILTER CHARACTERISTICS

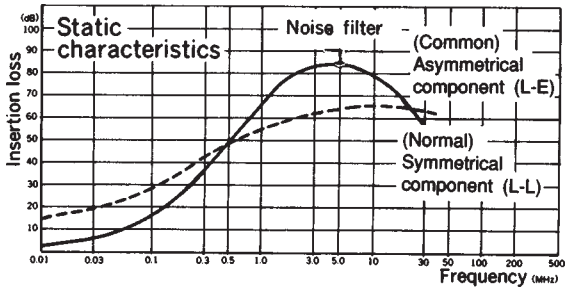
1. Static Characteristics

With a measuring impedance of 50 ohms, the amount of attenuation (insertion loss) is determined by using a level meter to measure the voltage before and after insertion of a noise filter into the test circuit. Using this method, both normal mode and common mode attenuation can be measured.

Measuring Circuit

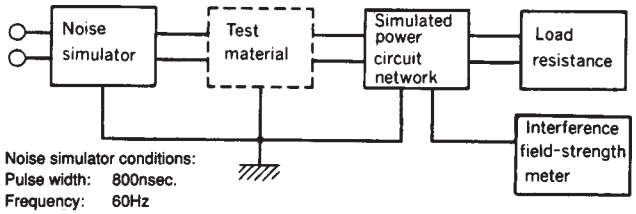


Attenuation = 20 $\log_{10}(V_2/V_1)$ [dB]
V_1···Level when test material is inserted
V_2···Level when test material is not inserted
Test material: Noise filter.



2. Dynamic Characteristics

In order to achieve measurement results as near as possible to actual application conditions, the following method is used: With a noise simulator as the noise generating source, a rated current is allowed to flow through the test device and a simulated power circuit network. The amount or normal mode and common mode attenuation is measured.



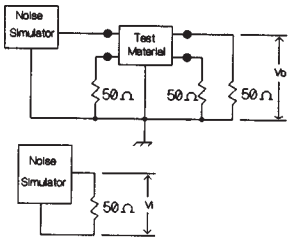
Noise simulator conditions:
Pulse width: 800nsec.
Frequency: 60Hz
Polarity: (+)
Test Material: Noise filter

3. Pulse Attentuation Characteristics

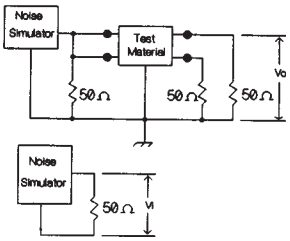
The following method is used to measure the noise margin for the external noise in an electronic device: a noise simulator is connected and the input/output voltages are measured. The formula noted below is then used to calculate the amount of attenuation in the form of the pulse absorption effect produced. In general, the noise condition used to test malfunctions is a high voltage pulse of 50nsec. to 1µsec at 1kV to 2kV in amplitude.

Attenuation = 20$\log_{10}$ (V_0/V_1) [dB]

Normal Mode

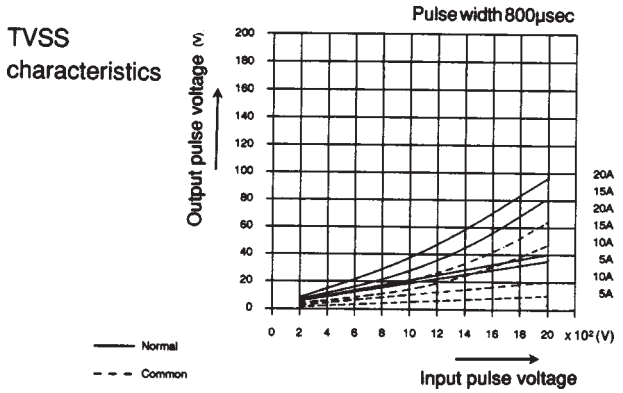


Common Mode



Attenuation = 20$\log_{10}$ (V_0/V_1) [dB]

SUP-G□H-EPR-4

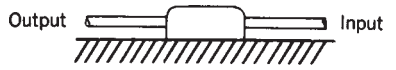


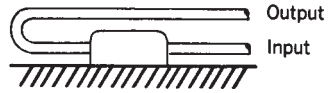
• APPLICATION PRECAUTIONS

The following points should be kept in mind with regard to the installation of noise filters.

1. When mounting on the noise producing side, they should be mounted as close as possible to the source of the noise with noise electrical or mechanical contact between the input and output side of the filter.
(Example) When the input/output lines are bundled together or arranged parallel with each other, high frequency noise components induced on the input side, results in the production of noise current on the output side.

Separation of input/output lines (good example)





Bundling or parallel arrangement of input/output lines (poor example)

2. When the device is directly installed on the equipment exposed to interference, it is important to mount the noise filter as close as possible to the machines power unit or input wiring. If a power line is allowed to enter the case of the equipment without passing through the noise filter, noise current can be radiated throughout the inside of the equipment enclosure, affecting the internal electronics.

3. Precautions should be taken to insure that the ground line for the noise filter has a lower impedance than that of the noise current. If this is not done, the noise prevention effect will be lost. Also, ground lines should be as short as possible. The use of long ground lines will result in substantial reduction of the noise prevention effects (particularly in the high frequency ranges above several MHz.).

4. Whenever possible, the outer case of the noise filter should be mounted directly to the outer case of the electronic equipment. When this is not possible, a short grounding line should be used to link the outer case of the filter and the equipment.

• INTERNATIONAL ELECTROMAGNETIC INTERFERENCE (EMI) REGULATIONS

In recent years the diffusion of personal computers, facsimiles and other data processing equipment has made safety measures and noise prevention measures for such devices a pressing concern. When selling electronic equipment domestically or exporting, the EMI (Electromagnetic Interference) standards for the target country must be satisfied or the product will not be approved for marketing in those countries. The following is a summary of the EMI regulations.

1. FCC Regulations for Computers and Related Electronic Equipment. In October 1979, the FCC (USA) included within its part 15 regulations a new sub-part J for the control of computer equipment. The values established by the FCC computer regulations divide equipment into Classes A and B.

Class A: Computer equipment meant for commercial use, namely such things as office computers and business machines.

Class B: Computer equipment meant for consumer home use, including such things as personal computers and television games.

2. VDE (Germany) Regulations: Standard VDE-0565 along with Standard IEC-939 are the Standards for Power Line Filters. VDE-0871 specifies conducted emissions limits for computing devices.

Class A: Special operating license required.
Class B: For general approval, no operation license required.

3. IEC (International Electrotechnical Commission) Worldwide standards body: IEC 1000/EN61000 became the EMI standard in the European Community (CE) in 1995, and as a result has become the defacto Worldwide standard.

IEC1000-4-2: ESD (Electrostatic Discharge) has very fast times with high voltage (15KV) and low energy (<10Amp).

IEC1000-4-4: EFT (Electrical Fast Transient) are a burst of very fast noise pulses (5 nanosecond) several kV in amplitude.

IEC1000-4-5: SURGE is high energy (kV/kA) short duration (µsecond) pulses which can be caused by lightning, switching power loads or large inductive loads.

4. Other standards bodies in the USA include ANSI, IEEE, SAE, EIA, ASTM, FDA, and NFPA.

OKAYA DOES SPECIAL FILTER DESIGN

ASK ABOUT A NOISE SUPPRESSION FILTER TO MEET YOUR EXACT NEEDS

ASK ABOUT THE OKAYA AC POWER LINE NOISE FILTER DESIGN KIT

- **TRANSIENT VOLTAGE SURGE SUPPRESSION**

Transient Voltage Surge Suppression (TVSS) has become an important part of Power Line Protection. In the past, accessories which furnished some TVSS protection were available as add-on or after market protection devices. Many of these accessories were very marginal protection against TVSS. With the changes to International Safety Agency Regulations, better TVSS protection and TVSS protection incorporated directly into equipment is becoming a major consideration in new equipment design.

Okaya's dedication to the continual improvement of product has given rise to a new feature in many of the AC Noise Suppression Filters featured in this catalog. This new feature is Transient Voltage Surge Suppression (TVSS). Okaya has incorporated TVSS capability into many of it's Filters Series. This Suppression takes several different forms and capabilities.

The SUP-EH and SUP-EH-EP Series feature toroid coils with high performance magnetic media. This feature combined with high voltage pulse capacitors gives these two series a 20dB attenuation of 1000V, 800nsec. pulses.

The SUP-GH Series incorporate into the inductance a toroid coil which is manufactured from amorphous alloys. This special core material combined with high voltage pulse capacitors gives this series a 20dB attenuation of 2000v, 800nsec. pulses.

The SUP-KH Series incorporates a plug-in TVSS device. This TVSS device RAV-PWZ comes in either 135VAC (RAV-401 -PWZ) or 270VAC (RAV-781-PWZ) versions. This TVSS device features a line monitor indicator to assure proper protection and the ability to suppress 12KV (1.2 x 50µsec) and 1000A (8/20µsec) pulses. These features combine to give reliable TVSS protection to an already high performance EMI/RFI Filter Series.

The RAV-PH Series Feature a high mu Core material which when combined with high voltage pulse capacitors, allows this series to attenuate both common and normal transient voltage surges of 2000volt, 800 µsec. EMI/RFI attenuation curves begin at 10KHz. Some models are UL544(2601) recognized.

The ability to supply complete power line protection, from EMI/RFI noise attenuation to Transient Voltage Surge Suppression is what continues to make Okaya a leader in new innovation design to meet industry needs.

Our staff of technical personnel is always ready to work with the customer to furnish the exact product needs.

Okaya's ability to incorporate multiple features in our AC Power Line Filters is just one example of our commitment.