

## How to select EMC filters?

To comply with current valid regulations, a frequency range of 150 KHz to 1000 MHz has to be taken into consideration in order to ensure electromagnetic compatibility.

EMC filters must have good RF characteristics and are usually required to be effective over a broad frequency range.

Information required to select the EMC filter:

- 1 - Voltage and current
- 2 - Frequency (50/60 Hz)
- 3 - Phases / Lines (1 or 3; 2,3 or 4)
- 4 - Attenuation (insertion loss - dB)
  - a) Common mode (asymmetrical)
  - b) Differential mode (symmetrical)
  - c) Unsymmetrical
- 5 - Leakage current (mA)
- 6 - Environment (temperature, humidity, etc.)

## What is decibel?

The decibel (dB) is a logarithmic unit of measure of a ratio of power or other quantities. It is a quantity without dimension (unit of measure) outside of the international measurement systems. It is used in the fields of acoustics, physics, electronics, and widely in the field of engineering.

We can equally express X in a sub multiple of decibel (dB):

$$\text{dB} = 10 \log_{10}(P1/P0)$$

If  $P1=100$  and  $P0=1$ , then  $\log_{10}(P1/P0)$  equals 2 and XdB equals 20dB

If  $P1=2$  and  $P0=1$ , then  $\log_{10}(P1/P0)$  equals 0.3 and XdB equals 3dB

## Which are the typical filter applications?

All equipment which integrates an electronic power circuit installed in an electrical network or is in proximity with other electronic equipments, such as:

- Motor drives
- Elevators
- Pumping station
- Traction systems

- HVAC
- Wind farms
- Photovoltaics
- UPS
- Power supplies

Susceptible equipment to be protected:

- Automated lighting circuits
- Security cameras
- Audio and video systems
- Radio transmission equipment
- Computers
- TV closed circuit
- Telemetry and telephony systems
- Proximity sensors
- Photoelectric sensors

## Can we guarantee success in controlling RFI?

Filter alone won't do. To have success we must:

- Identify sources and susceptibilities. Take a look at equipment and cables (physical separation and location). Enclosure shielding if required.
- Grounding (shielded cable and ground circuit)
- Design and choose the right RFI filters

## Where we can find filters?

### **Drive systems and electronic motor controls:**

Consistent use of filters on electronic motor controls can reduce industrial electricity consumption by around 30% within a short space of time.

### **Electronic devices and power supplies:**

It's a well known phenomenon: you switch on the printer and the PC screen starts to flicker. Two electrical devices can be prevented from interfering with each other by using EMC/EMI filters. The same applies to network related interference. As process automation and complexity increase, the risk of a malfunction caused by electromagnetic interference also increases, The use of EMC/EMI filters to ensure flawless functioning is steadily growing.

### **HVAC:**

Today's buildings like offices, hotels, warehouses, and hospitals use a multitude of pumps and fans to control the heat, cool the air, and pump fresh water. Advanced control features and high reliability of electronic systems are necessary for energy efficient buildings. Variable speed drives with high efficiency motors provide a potential energy saving of 40%. HVAC products must fulfill minimum requirements in order to comply with the regulations. All electronic equipment must work together on the same power supply without any disturbance from line voltage interferences, therefore certain product standards must be considered with regard to the electromagnetic compatibility (EMC).

### **Machine tools and robotics:**

EMC/EMI filters are widely used on machine tools like milling, textile, packaging, printing presses and in robots for the automotive industry. These machines are usually electronically controlled and have to meet the most exacting standards even though they are subjected to extreme stress and strain. The sensitive electronics must be protected from network faults which can interfere with the process quality and the reliable functioning of the machinery. Reduction of high frequency interferences for an uninterrupted production system EMC/EMI filters reduce, to the prescribed limits, the high frequency interference originated from electronic drive units and guarantee uninterrupted production systems uptime.

### **Medical devices:**

In our modern world an increasing number of innovative medical devices are being developed and manufactured with the goal of ensuring or improving the well-being and health of people. Product safety already takes up a significant importance in development to ensure patients and operators safety later on. There are strong EMI/RFI standards in this environment. In medical technology, a variety of medical devices (diagnostic and measuring equipment, X-ray machines and computer tomographs) are used in various environments for different purposes. Devices for use in hospitals, in doctors' practices or in home treatment for diagnosis, therapy or monitoring must not have a negative influence upon each other. Disturbances or accidents that lead to damages of the devices or can endanger the health and the life of patients must be prevented under all circumstances. They reduce electromagnetic interferences and guarantee minimal leakage current that ensures a safe and reliable operation of electrical medical devices.

### **Photovoltaics:**

Renewable energy sources deliver environmentally friendly sustainable power. This power is initially not always generated as AC current at 50 or 60Hz. DC current, as generated for example by photovoltaic panels, must be transformed by a process called power conversion before it can be fed into the grid, using inverters. The currently used high speed semiconductor switch mode techniques, to achieve highest efficiency levels, unfortunately create a broad spectrum of interference, ranging from low frequency harmonics to conducted and radiated electromagnetic interference (EMI) emissions in the Megahertz range. Such interferences must be eliminated for three reasons: first, systems must meet power quality standards and adhere to local utility codes. Second, electric and electronic equipment in the vicinity or connected to the same branch of the

grid must not be affected in their function and reliability. Third, contractors need to be able to guarantee the quality and durability of this kind of systems.

### **Public transport:**

The use of modern combination propulsion equipment (diesel/electric engines) becomes a large challenge on locomotives, railway carriages and ships day after day. They must ensure efficient use of power and the fault-free flow of energy upstream of the variable drive systems as well as between the variable drive systems and the motor by using EMI/EMC filters.

### **Railway technology:**

We are able to offer high quality custom EMC/EMI filters for rail traction application. These include higher power DC and AC filters for propulsion converters as well as filters for auxiliary systems like lighting, galley, doors, control and communication equipment. EMC/EMI filters help to ensure the reliable and fault-free operation of many electrical and electronic devices within the train by suppressing interference and by increasing conducted immunity. These passive filters change variable speed motor drives virtually into linear consumers, drawing almost a sinusoidal current from the grid.

### **Renewable energy:**

Electrical energy from regenerative sources cannot be fed directly into the supply networks. Power networks need alternating current and a stable network frequency that is in line with the requirements of the relevant national networks. Solar plants and fuel cells generate direct current and wind turbines produce alternating current but with strong frequency fluctuations due to variable wind speed. In order to be able to feed electrical current from renewable energies into power networks, alternating current with a constant network frequency must be generated using high performance electronic devices such as frequency converters or inverters. Manufacturers of frequency converters use fast switching power semiconductors which generate interference pulses and can impair the function of other electrical and electronic devices and even breach voltage quality standards.

### **Telecoms:**

Special EMC/EMI filters and components developed to tailor to the needs of the global telecommunications industry. They are used worldwide in power supply and in back-up power equipment in mobile network base stations as well as in switchboards of fixed networks. EMC/EMI filters for use in the telecommunications infrastructure have special properties for suppressing interference in the high frequency range.

### **General technical information**

[General information \[884 Ko\]](#)

## **Mounting instuctions**

[Mounting instructions \[367 Ko\]](#)