

# Frequently asked questions

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## ON ELECTRIC DISTURBANCES

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### What are the so called 'disturbances'?

The facilities are subject to a lot of disturbances (fluctuations of voltage and current bases of time with very small values of 6000 V / 3000 A as for IEEE 587 cat B). These disturbances can be atmospheric or electrical.

### What are the ways in which the disturbances enter to equipment and facilities?

The entrance to the premises and therefore the equipment are numerous, including: current conductors, telephone lines, coaxial cables, radio frequency and data transmission wiring, alarms, etc. In general, we can say that all copper wire entering to the premises' equipment is a potential conduit of disturbances.

### What are the advantages of a protected network?

A protected network presents numerous advantages, including:

- Safeguard investment and avoid deterioration of the components.
- Debugging of operation errors.
- Prevent the loss of data and information.
- Remove the unplanned stops and service interruptions.
- Prevent breakdowns in general.

### What kind of equipment is sensitive to atmospheric disturbances?

All applied electronic components equipment. Once the disturbances entered the compound, can affect the operation of all types of communications equipment such as:

- Satellite equipment
- Radio Bases
- MW Repeaters
- Computers
- Programmable Logic Controller
- Commuted source technology rectifiers
- UPS's
- Command and Control Systems
- Alarm Systems
- Automatic Transfer Keys
- Rectifiers

- Alarm and monitoring devices
- Fix telephony
- CATV connected equipment

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## ON ENERGY FEED

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### What are the causes of disturbances in the power lines, electric power distribution systems?

The main causes are as follows:

- Direct impacts caused or induced by atmospheric discharges.
- Switching energy in the power distribution stations.
- Energy Transfer of energy generators.
- Action of compensation banks.
- Entering and leaving large loads (own and external).

These cases, present in power lines, generate transient with amplitudes of thousands of volts and small bases of time.

### What may be the first defensive barrier against disturbances coming from the network?

The one the user makes, since there are very few cases where companies install electricity protection elements in the sub-stations, I.E.: MOV (metal oxide varistors) and / or gas dischargers. This situation allows direct and residual tensions to enter the facilities and can cause irreversible damage in solid-state equipment.

Depending on the current sensitivity of the equipment installed, its value, the discontinuity of services, lost profits during the fault and repair, mean that users must plan adequate protection for them. An adequate protection is the one that is capable of attenuate the disturbances and disruption of power lines to obtain a value close to reliable security in the operation of the facilities and distant from the destruction and / or damage to equipment.

### How can we protect equipment against surge and transient line?

In various forms, but let's look at the problem first. In existing facilities about 95% of the problems in power lines are caused

by disturbances in what is called “normal mode”. These noise disturbances are transported between energy conductors, that is phase to phase and phase to neutral. The remaining 5% are called “common mode” that occurs between conductors phase and / or neutral to physic ground.

As most problems have their origin in disturbances in normal mode, a protective device in that mode will solve the problem in this area. As for disturbances in the common mode, although being less frequent, are removed effectively with proper grounding and a good protective device for that specific area.

### Is it possible to use some sort of line monitor to determine the magnitude of the problems in the power lines?

The use of monitors to define the problems is complex because:

- Many of the conventional monitors have been designed to measure voltage line and are slow to register events such as very fast transient peaks.
- Other monitors recorded only the worst of observed events that may or may not be the most damaging for equipment I.E.: A boost of 1 microsecond recorded while another more damaging is ignored.

To make efficient use of monitors its limitations must be understood, its principle of operation, frequency and speed and should interpret the data obtained. the correct calibration of the device is essential.

### Are the disturbances in line are increasing in frequency and danger?

Yes, one of the reasons is the ‘use factor’ of the electric plants reaching the limits of available capacity. This leads to an increase in apparent impedance of the source, degrading regulation and increased susceptibility to the tensions of the transitional power lines, both the sources and loads.

On the part of users, the size reduction of equipment due to the integration of circuits and components, increases the working temperature and makes them more susceptible to noise and hence originate more and greater problems.

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## ON VOICE AND DATA

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### What are the causes of disturbances in voice and data lines?

The main causes are as follows:

Direct impacts caused or induced by atmospheric discharges in:

- communications towers.
- Cable trays, ducts, shelters, etc.
- multi-pair Cables, coaxial cables, grids, telephone lines, etc.
- Outdoor lines lying between different precincts.

### What may be the first defensive barrier against disturbances?

The one the user makes, since very few equipment that have its own protection system.

### Do the protection elements interfere with the quality of data transmission?

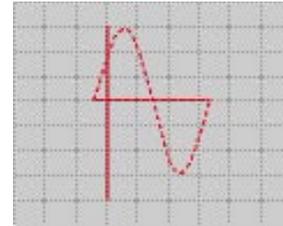
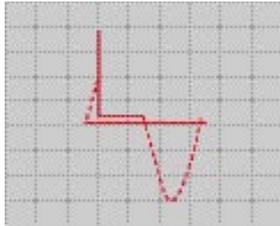
We must bear in mind the technical specifications of the protectors, so that the values of capacitance, resistance and suppression are correct for each application and do not degrade signal quality.

Note 1: in all cases adequate grounding is necessary to ensure maximum efficiency of protective devices.

Note 2: The American IEEE standard is the guiding design, maintenance and operation of electronic equipment, in terms of their integration into the power lines.

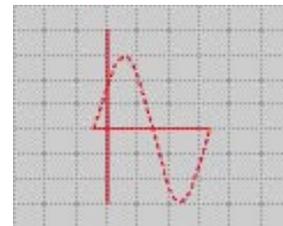
### What technologies exist for protection against disturbances in energy networks, voice and data?

1-GAS-DISCHARGE TUBES: Designed for a massive absorption of energy when they are activated by 20v voltage peak between line and Ground. The shooting occurs in microseconds, but the recovery time in a typical line of 60 Hz is 8.33 ms. Once the arc is produced, the impedance of the tube between phase and neutral, is virtually zero for the remainder of the Chamber of negative AC. Therefore an unlimited amount of Current will flow. Moreover, the response that these elements possess is in the order of milliseconds, not fast enough for disturbances that can easily reach several thousand volts per microsecond.



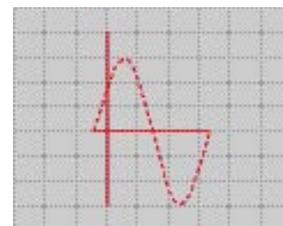
2. SOLID-STATE AVALANCHE ELEMENTS: These bi-polar elements can be extremely fast (in the order of nanosecs. being 1000 times higher than the gas-discharge tubes), can absorb moderate amounts of energy (some Joules) fall within the blockade strain under 1.5 times the nominal value, but do not have the energy storage capacity. In addition, this does not have an adequate negative pulses filtering capacity, for example: In a line of 120 VAC, inverse peaks can reach 340 VAC, before protection acts. At the same time, repetitive transient events can lead the element to recurrent failure because the potential at stake are high, and low absorptive capacity.

4. EMI / RFI FILTERS: They are adequate to solve disturbances emanating from high-frequency pulses in the range of electro mechanical signals. Moreover, its decay is specified and tested for lines with loads of 50 ohm and sine signals. This situation is far away from reality for an element of suppression of transients, and, in many cases the peaks are amplified rather than attenuated.

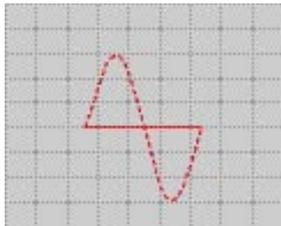


3. MOV- VARIABLE VOLTAGE RESISTORS- VARISTORS: These bi-polar elements, which are fast and able to react in some nano-seconds, have a high capacity to absorb energy, in the order of hundreds of joules. However, the relation between voltages is higher than that of the avalanche elements. Accordingly, the MOV whose securities are designed for 200V can let noises from 400 to 500V. Moreover, these elements do not react to negative pulses and thus allow a peak at the crossing point (where the AC voltage passing through the coordinates axis 0 and 180 ) has a peak of about 400 v. Another disadvantage of the MOV is its deterioration as it is "bombarded" with frequent peaks of tension.

5. INSULATED AND SHIELDED TRANSFORMERS: It is well known that these elements efficiently suppress noise in common mode. Some insulating transformers necessarily need to be complemented with noise protectors in normal mode, thus increasing its cost.



6. SERIES FILTERS: These are nonlinear type, actively monitoring the sine wave (Active Filter series), specifically designed to provide effective suppression to these disturbances, for both in common and in normal mode within the power lines. The threshold of operating for these devices is (+)(-) 2 volts above or below the ideal sine wave of Cadiz. Once the disturbance is detected anywhere in the sine wave, the system eliminates the spurious instantly, in less than 2 nanoseconds. There is no kind of internal deterioration and its MTBF (measured time between failures) is higher than the 100.00 hours, that is about 12 years.



#### What is the difference between a current diverter and a series filter?

A Current diverter does just “part of the job” in terms of limiting within a reduced range of disturbance energy entering the facilities, allowing dangerous tension values up to 300 V and low energy disturbances, which deteriorates the components of applied electronics, causing failures in equipment, and this makes it difficult to diagnose.

For this reason, companies should install primary protectors (CCA Series) and secondary protectors (ECM Series).

An Active Filter, provides a full range of protection against disturbances of high and low energy, eliminating high-frequency noise and values of voltage (+) (-) 2V on the sine wave.

#### Why should we adopt series filters technology?

Because of the need to study and implement a specific solution to the problem, within the electrical environment of the site, for a real elimination of parasite impulses and transient voltages.

“ECM” Series Filters are the only system of its kind, able to monitor and respond, providing protection for the electronic

equipment based on microprocessors, for both the immediate and medium term damage caused by parasites impulses and transients that appear in their power lines.

This series filter provides the necessary protection against disturbances of high tension, ensuring a constant level of attenuation leading them to safe levels. In this way, the device protects broadly the electronic equipment from the damage that can be lead from inductive loads, SCR contacts or other generators of hazardous electrical disturbances. It works by removing the residual tension of the dischargers or great power primary deviators.

Deviators or primary protectors are mostly compund by metal oxide varistors, allowing direct passage to their equipment, (residual tension after an atmospheric discharge) transients with values of 300 volts or more, which can cause significant damage. “ECM” series Filters are built with elements that constantly monitor the sine wave and respond instantly to the presence of disturbances. They are classified as a class “A” according to the IEEE C6241.

These series protectors are preset in (+)(-) 2 volts, so in the presence of a value above or below this level on the sine wave, it makes it ideal again, by automatically eliminating the root of disturbances. This device becomes the only that operates with full efficiency even when the disturbance becomes apparent in the zero crossing of the sine wave that is where the positive hemi-cycle becomes negative.

Another unique feature of the “ECM” series line protectors is to be able to act in a bi-directional way.

When sensitive equipment based on microprocessors, is exposed to these apparently harmless bombing of parasite pulses and transients, all electronic components will gradually lose its performance and will surely reach the point of collapse.

Limiting the peaks is not sufficient guarantee of protection for electronic microcircuits and also avoids the random flaws of doubtful identification that degrade the components of electronics. The nonlinear design of the series filters ensure maximum attenuation reducing transients to a minimum of 40 dB between 50 kHz to 50 MHz.

This instant response comfortably exceeds the physical capacity of passive filters in parallel, allowing the entry of transients with values of 300 volts or more to semiconductors, causing predictable damage.

Besides, this protectors act with the advantageous feature of “filling” the loss caused by the negative spurious in the hemicycle, with a response of 50 milliseconds, max.

### Why should you apply Energy Control's protection technology in voice and data networks?

Protective devices at present, excluding energy, can be divided into primary and secondary protection in the first stage gaseous dischargers are used in combination with semiconductor, replaceable modules (three stages of protection). As for secondary protection, a stage of semiconductors like Solid State elements (Avalanche foldback technology) and solid state resettable fuses (PolySwitch resettable fuses PTC).

Each application has protection the various connectors, formats and specifications in line with the provision to use.

We can enumerate some of the applications used in our market:

#### Telecom / Cable TV:

- Data / Signals Line Protection
- Category 5 LAN Protection
- Protection of phone lines
- Coaxial Protection
- Instrumentation Protection

#### Fire / Security Index:

- Zone, Loop and Data Protection
- Protection of phone lines
- Coaxial Protection

For each application environmental conditions must be analyzed in addition to responding to the technical characteristics of equipment to protect such as:

- Capacitance.
- Response time.
- Max Peaks.
- Modes of protection.
- Operating temperature.