Interference resistance:

Goals, causes and solutions

# Why are interference-free products so important?

**What is meant exactly by "interference-free"? Technology is generally vulnerable to interference. Measurement, automation and control technology is exposed to potential interference in the harsh industrial environment. There are many reasons for this: EMC radiation, the insertion of motor contactors along with elements such as the motors and valves themselves provide a tough test of the interference resistance of the technology. Every element of the measurement chain can be affected by interference: From the sensors that perform the measurement through the lines to the control unit. Even the signal output can be influenced by radiation, for example. This is precisely where interference-free products from ADDI-DATA come in.**

They help to protect applications and hardware from external unwanted and possibly dangerous interference. Interference-free products not only protect products and their applications, they also guarantee the protection of their environment. A simple example: mobile phone radiation. The electromagnetic field of a mobile phone can limit the functions of aeroplanes or interfere with measuring devices in hospitals. This could have serious consequences and must therefore be avoided. Interference-free products by ADDI-DATA protect from external influences AND interferences from the environment are avoided.

## Protection where needed

The use of interference-free products ensures that processes run reliably as the hardware is better protected from possible damage. If, for example, there is an overvoltage while using an ADDI-DATA communication board with optical isolation (for each port), only one port will be affected. When using a non interference-free product without optical isolation, the whole computer can be destroyed if there is an overvoltage. Interference-free products thereby prevent the complete failure of a device and the possible consequences that this would entail for the measurement chain. In addition, interference-free products from ADDI-DATA guarantee correct measurement values, which in turn significantly increase productivity. Peaks or noise created by interference are not recorded when receiving the signal. Therefore stable signals can be guaranteed. At the same time, interference-free products prevent interference with and possible damage to other devices in the immediate surroundings, as the technology used does not itself cause any interference to its surroundings.

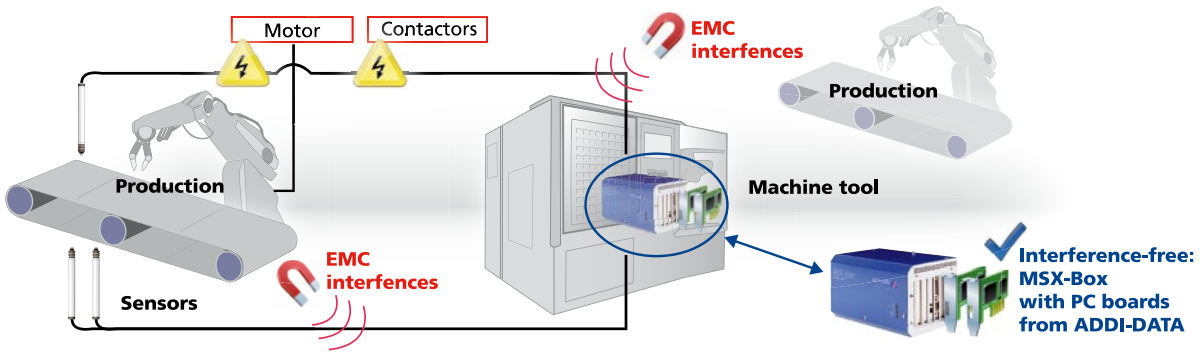
## The causes of interference

To create steel sheets, iron ore is melted in a furnace and cast as steel blocks or slabs. These slabs are rolled out into a sheet whilst still warm in several rolling steps. In order to ensure that the completed sheets have the same thickness throughout, the thickness of the sheet must be constantly measured during processing and the pressure of the rollers as well as the feed rate of the sheets must be adjusted accordingly. Separating the measuring point from the location of the corrective rollers or the control unit of the corresponding motors means relatively long distances to the relevant sensors. The MSX-Box with the ADDI-DATA boards APCI-3120 and APCI-1710 is integrated in a switch cabinet and thereby directly connected with the protective earth.

However, as in the case of a steelworks, where extremely high loads are switched due to the large masses to be moved and high currents flow, the potential for the ground connection of individual sensors or actuators can change at short notice.

These potential differences, which meet at a common point – in this case the MSX-Box – are known as ground loops. Ground loops can have different effects: from interference with the measuring signal in the form of peaks or noise, to destruction of the hardware itself, e.g. through overvoltage.

However, this example only illustrates one possible consequence which entails the use of non interference-free products. The cables of the device itself can also cause later interference. The topic of interference resistance begins with measurement and automation technology before




**The measurement and control chain is exposed to numerous interfering influences. Measuring errors or even failures may result from the lack of effective protection.**

the actual signal acquisition. Interference such as EMC radiation, switching contactors etc can have an effect directly on the cables between the signal source – the sensor – and the downstream connection equipment, e.g. clamping plates.

Often, the interference originates from the laying of the cable: for example, a switching contactor directly next to the cable can cause interference. This interference is then visible in the signal and is also measured.

An additional potential interference factor is electromagnetic compatibility or EMC. During operation of electronic devices, there is also always a conversion of electromagnetic field energy into other energy forms, e.g. heat or mechanical energy. However, this is not strictly limited to the device, but can also radiate into the surrounding electronics. The functions of other electronic equipment are affected by this EMC radiation and the equipment can potentially be severely damaged.

The use of electronics in harsh environments poses additional risks: Dirt that circulates in the surroundings can contaminate the sensors. Blocked sensory devices, for example, invalidate the final measurement value. Severe temperature fluctuations also affect the smooth operation of the devices. If the surrounding temperature is outside the tolerance range for the electronics, these no longer function without errors. Vibrations, which are difficult to avoid in harsh environments, can cause noises in the signal acquisition. In addition, these vibrations can damage the solder connections.

## The importance of protection

The use of non interference-free products can have serious effects. The effects vary and depend on the type of interference in question. When manufacturing metal sheets in a steelworks, for example, enormous loads are switched and there are high currents which can lead to a short-term change in the potential for the ground connection of individual sensors. These potential differences are known as ground loops. With non interference-free electronics, these ground loops can severely affect the measurement signal in the form of peaks or noise; a valid measurement signal is therefore no longer feasible. Very large potential differences result in large overvoltage. In extreme cases, these can even destroy the hardware or cause a complete failure of the control unit of the device. The cause in this case is a lack of optical isolation between the individual modules.

By using interference-free products, signal interference can be prevented when taking measurements. In the worst case, if very large potential differences occur, only the channel affected by the interference or the respective module will fail thanks to the optical isolation of up to 1,000 V. The failure of all control components is impossible.

In addition, all electronic devices which are not protected against high-frequency interference such as EMC radiation are helpless in the face of interference pulses. This interference can lead to measurements with errors, signal noise, or malfunctions in the device itself. In addition, external devices in the close surroundings can be negatively affected or even damaged by EMC radiation from a non interference-free product. Similar interference is caused by missing filters or by vibrations in the environment, which causes a noise when acquiring the signal. Vibrations are difficult to avoid in harsh environments. A lack of protection against damaging vibrations can lead to malfunctions or even the complete failure of the device in the worst-case scenario.

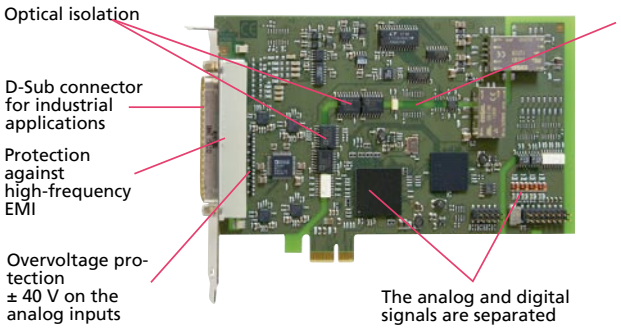
Not using interference-free products may cost less, but only at the risk of a host of negative consequences: from imprecise measurements to the complete failure of the control unit or the device itself.

## Dedicated accessories

What is the most important task which must be performed by peripheral hardware? It should run without interference and reliably transfer data. Just as reliably as the associated PC board or the Ethernet measurement system. For this, ADDI-DATA offers a varied range of optimum accessories matched precisely to the PC boards and Ethernet systems, to meet the requirements of harsh industrial environments.

Screw terminal panels, relay output boards or connecting cables – the same high standards of reliability and EM compatibility apply as for the PC boards or Ethernet measurement systems themselves. The D-Sub connector, for example is robust and interference-free and provides optimum protection against electromagnetic fields. On a cable with a D-Sub connector, the cable shielding is connected all round to the metal cap of the plug-in connector. This assures earthing at both ends, essential to shield against electromagnetic fields.

In order to keep the interference influences on the signals to a minimum, ADDI-DATA uses for its connection technology and the connected cables transorb diodes along with shielded and dual strand cables which are adapted specifically for the pin assignment of boards.




## Interference-free PC boards

Interference-free PC boards from ADDI-DATA have filters for inputs and outputs and guarantee protection against short-circuits, overtemperature and overvoltage.

With analog signals, a differential signal transfer is generally recommended. As opposed to single-ended acquisition, the difference between two signal lines of a sensor is established here. If there is interference to one signal, both signal lines are simultaneously affected. The interference is therefore easily cleared using the differential calculation.

Optical isolation up to 1,000 V also guarantees the interference-free operation of ADDI-DATA products. Using opto-couplers, AC/DC converters and plug-in connectors prevents rapid transients, overvoltage and ground loops. The layout has a creeping distance of 3.2 mm in accordance with the IEC 61010-1 standard.

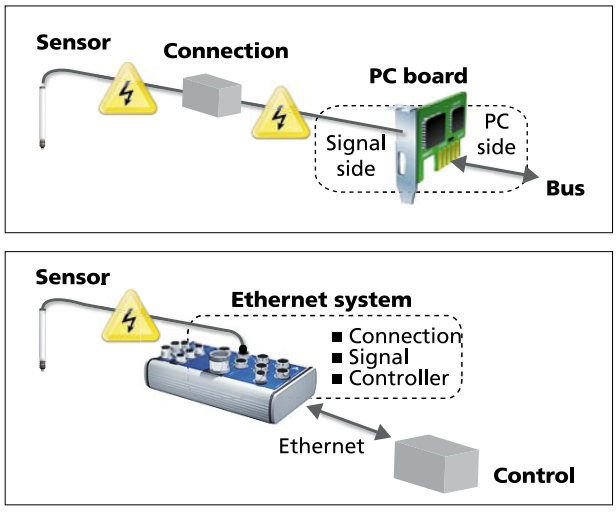
For protection against high-frequency interference, ADDI-DATA uses low-pass filters. These filter interference pulses from the signal and can be individually adapted to customer requirements. However, it is also ensured that the ADDI-DATA products themselves do not emit high levels of EMC radiation into their surroundings. The function of external devices in the immediate surroundings could be heavily affected by this. This could have particularly serious consequences for medical technology.

In order to avoid such consequences for the surroundings, all ADDI-DATA products are tested for CE conformity, i.e. the conformity with EU directives, in accredited laboratories.

## Protection through closeness

In order to better protect against interference, it is a good idea to move closer to the measuring point. This is possible with the MSX-E series intelligent Ethernet systems and the real-time open source PAC system from ADDI-DATA, MSX-Box. With these products, you avoid having to use cables which make the device susceptible to interference, and the same protection measures can be guaranteed as for the boards. In order to provide additional interference resistance, the MSX-E systems have a robust metal housing which protects against EMC radiation, vibrations and temperature. The MSX-E systems have been developed especially for an extended temperature range.

The MSX-Box functions as far as possible without rotating parts, enabling it to be moved closer to the application itself. This distributed use opens up completely new possibilities: The closer the signals measured are to the sensor, the smaller the possible effect of an interference influence on the result.




**The Ethernet systems have the same protection measures as the PC boards. The integrated connection provides additional interference resistance.**

ADDI-DATA GmbH
Airpark Business Center
Airport Boulevard B210
77836 Rheinmuenster
Germany

Phone: +49 7229 1847-0
Fax: +49 7229 1847-222
info@addi-data.com
www.addi-data.biz

www.addi-data.biz