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Product inspection

Thermo Scientific Intellitrack XR (IXR) Signal Processing Software – Enhanced metal detector performance for conductive products

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Industrial metal detectors have been widely used in manufacturing facilities to identify unwanted metal contaminants in packaged, unpackaged, and bulk goods. Specifically in the food industry, certain products containing high salt and moisture content present a challenge to metal detectors due to high product effect. This high product effect can cause false rejects leading to a reduction in manufacturing efficiency and profitability. The innovative Thermo Scientific™ Intellitrack XR (IXR) signal processing software is designed to enhance metal detector performance for challenging applications with high product effect. Some typical applications that benefit from IXR software include:

• Dairy products with high salt content, such as cheese and butter

• Marinated meat and seafood

• Cleaning products such as wet wipes and wet floor mopping cloths

• Pickled vegetables and fruits

Introduction
Modern industrial metal detector technology utilizes multi-coil designs. Transmitter coils located in the center of the housing emit high frequency radio signal ranges from 50 kHz to 1000 kHz, and the receiver coils reside on both sides of this transmitter coil. The signals between transmitter and receiver coil on either side are equal in strength, this is defined as a balanced system. When products or contaminants pass through the metal detector, the magnetic and/or conductive nature disturbs the signal on one side of the metal detector, causing the system to be out of balance. Depending on the signal strength, the metal detector will determine whether this is a product with metal contaminants, or simply the product itself.
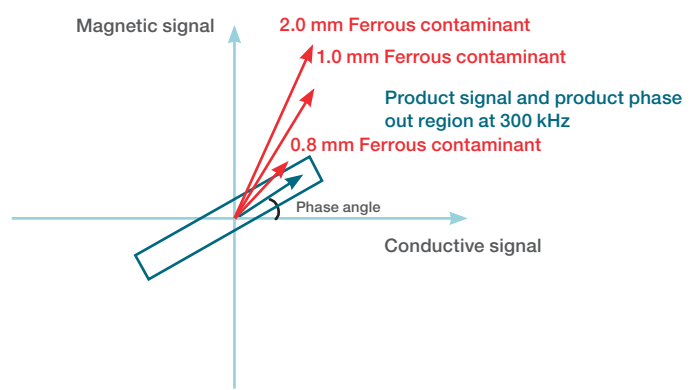
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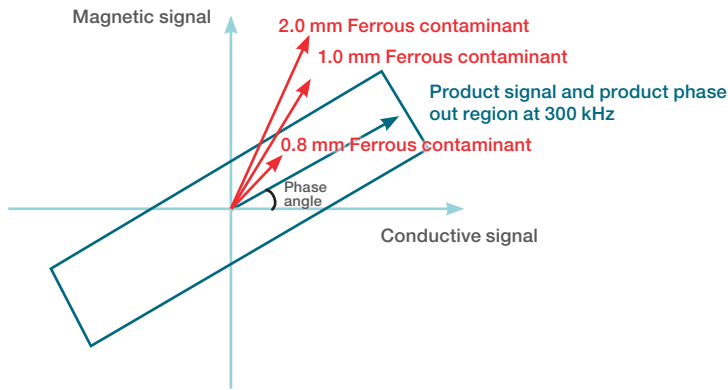
Figure 1. Phasing out a product to identify various sizes of ferrous contaminants.

Figure 2. Using IXR to identify various sizes of ferrous contaminants.

Product effect is often discussed for metal detector applications. It refers to the signal generated by the products when passing through the metal detector. Dry products such as flour or crackers possess minimum to no product effect. However, products contain high salt, mineral, or moisture content such as meat, pickles, or wet wipes generate a significant product signal, which could be considered a contaminant by the metal detector and falsely rejected from the manufacturing line.

The ratio of the conductive and magnetic properties of a product is known as phase angle. Traditional metal detectors ignore a region around the phase angle of the product and consider the signals within this range to be the product signal. This process is known as "phasing out a product," or "phasing" for short. However, if the product effect is significant, smaller contaminants may not be detected, creating the risk of a contaminant escape and a potential consumer safety issue. An example of phasing out a product is shown in Figure 1.

IXR technology

IXR technology was introduced to overcome the detection challenge associated with the traditional phase out technology, especially for wet and conductive products. The IXR function learns the sinusoidal conductive and magnetic product waveform and applies an additional sinusoidal wave with opposite phase to cancel out the product waveform. As a result, the product effect

is significantly minimized, resulting in the metal detector's ability to easily detect contaminants that are smaller in size. An example of IXR is shown in Figure 2.

For dry products such as flour, cereal, crackers, etc., the product effect is already minimal, therefore, the effect of IXR technology is less significant. For conductive products that contain high salt, mineral, and moisture content, using IXR technology can improve detection sensitivity 10–40%, depending on the product composition. Table 1 below includes sensitivity test comparison on various products using phasing and IXR technology.

Table 1. Contaminant Test results comparison using Phasing and IXR* (Fe = Ferrous, NFe = Non-Ferrous, SST = Stainless Steel)

Product	Fe Phasing	Fe IXR	NFe Phasing	NFe IXR	SST Phasing	SST IXR
Sliced cheese	1.5	1.1	1.7	1.4	2.25	2.0
Cereal	0.8	0.9	0.8	0.8	1.3	1.3
Wet floor mopping cloths	1.7	1.0	2.0	1.6	3.0	2.75

* Detection sensitivity and IXR improvement may vary depending on the product composition.

Important note on using IXR technology

Since IXR uses mathematical subtraction to minimize product signal, variation from package to package on the production line can result in over or under manipulated product signal, causing false rejects or missed detection. Therefore, product presentation and consistency are key to the successful use of IXR. The following aspects of the products must be consistent to optimize the application:

1. Product orientation and position on the belt going into the metal detector, guiderail is recommended

2. Photo eye trigger timing

3. Product temperature

4. Conveyor belt speed

Conclusion

In today's competitive global economy, consumer safety and brand protection are more important than ever. Intellitrack XR helps address the challenging detection issues associated with products that have a high product effect. IXR technology minimizes false rejects and maximizes metal detection capabilities, providing both manufacturers and consumers with the highest level of food safety.

Learn more at **thermofisher.com/metaldetector**