

# Thermo Scientific Intellitrack XR Technology Backgrounder

## Key Words

signal processing, metal detector, phasing, IXR, Intellitrack XR, product effect



## A New Level of Metal Detection Performance

Thermo Scientific™ Intellitrack XR<sup>1</sup> (IXR) is a new, breakthrough signal processing approach that addresses the unique challenges of detecting smaller diameter metals in products that have a lot of product effect. Designed to provide the highest level of protection for manufacturers and consumers, IXR is currently available as a standard feature in all Thermo Scientific™ APEX metal detectors.

This paper will explain why Thermo Scientific™ Intellitrack XR can significantly improve metal detection performance in the most difficult applications as compared to the methodology employed in most systems designed and sold today. Further, it will also explain why the product compensation technique described as phasing is inherently limited in its capability to accurately detect metal objects in certain types of products.



## Overview

In the past 50+ years, metal detection technology has been constantly evolving. Opportunities for new applications, tougher standards to protect consumers against the inclusion of metal or other extraneous materials in food, and other health and safety requirements have combined to create an environment where companies around the world depend on metal detectors to detect smaller and smaller diameter metals—without creating unwanted false rejects. In addition, heightened consumer awareness about food and product safety from several high profile cases in recent years has ensured that the cost of failure will be expensive and well publicized.

Intellitrack XR was designed to solve many of the problems that companies face when they have to comply with more stringent safety requirements and traditional techniques that just don't work.

## Metal Detectors – How They Work

All metal detectors use high frequency radio signals (50 – 700 KHz) to detect the presence of metal in food or other products. Here's how the technology works:

Most metal detectors have three coils (or antennas) which consist of one transmitter and two receivers. The transmitter is placed exactly between the two receivers. The transmitter sends identical signals to each receiver. When one receiver signal is subtracted from the other, the result is zero – or a balanced condition.

Metal objects that pass through the detector cause X (magnetic) and R (resistive) effects which affect the receiver signals in different ways. A digital signal processing system analyzes these signals and differentiates between these two effects. As long as the receivers are in balance, no metal is present. If the signals are unbalanced, this typically indicates the presence of metal, but not in every case!

Products that are inert or dry work best with metal detectors as they do not have X and R effects. Wet or salty products have X and R effects and can appear to be similar to metal. This is known as the “product effect.” It can cause false positives in many metal detection systems.

To compensate for this “product effect,” traditional metal detectors learn the product's peak X and R signals. The ratio of the two effects is known as the phase angle.

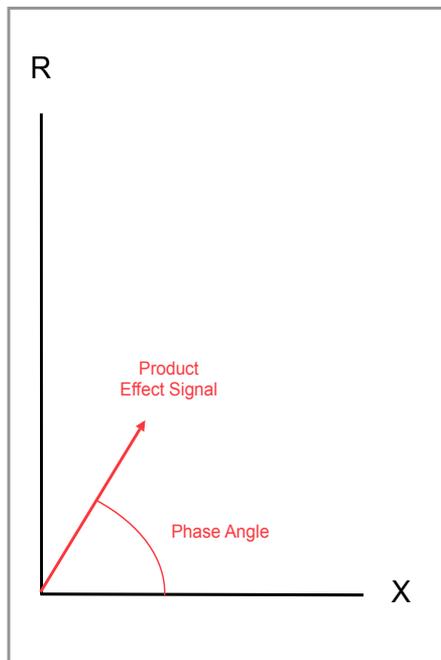


Figure 1: Product effect and phase angle in a metal detector

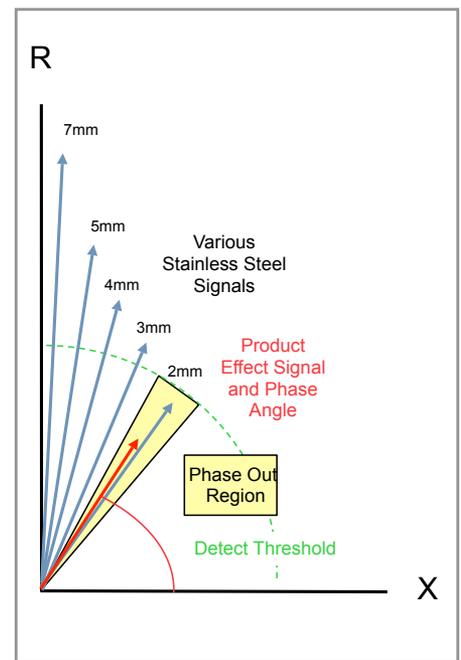
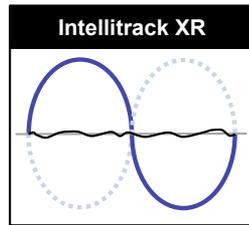


Figure 2: Phasing out a product to find various sizes of stainless steel

To prevent false positive readings, the metal detector will ignore any reading that falls within a region around the product's phase angle. This is called “phasing out” the product. (Figure 1)

In most cases, phasing is a very reliable method—especially when the product effect is small and the metal is large. However, if the metal type or size generates a signal that falls into the phase out region, the system will ignore the metal. (Figure 2)

To minimize this effect, metal detectors often change the frequency of the radio signals. Remember, this method does not completely eliminate the possibility of phasing out an actual contaminant. While changing the frequency does change the X and R peak signals and the phase out region, in many cases it only moves the problem to a different size or type of metal.



## Phasing In a New Solution: IntellitrackXR

Intellitrack XR is an innovative signal processing solution that overcomes the unique challenges of ignoring a product, yet detecting small metal foreign objects. It is designed to completely replace phasing in many applications and provides the highest level of protection for manufacturers and consumers alike.

The theory behind IXR is simple. Unlike traditional metal detectors, IXR doesn't create a region that ignores all product and potential metal signals. Instead, it learns the actual sinusoidal X and R signals the product creates as it passes through the metal detector. Once the signals are stored in memory, Intellitrack XR cancels them out by subtracting a signal that is equal to but the exact opposite of the product's X and R signal. Since IXR knows the product signal and removes it— any signal left over is quickly identified as suspect. This all – new dual channel (X and R) cancellation algorithm can eliminate the risk of a foreign metal object going undetected in many cases where phasing will mask out the metal signals. (Figure 3)

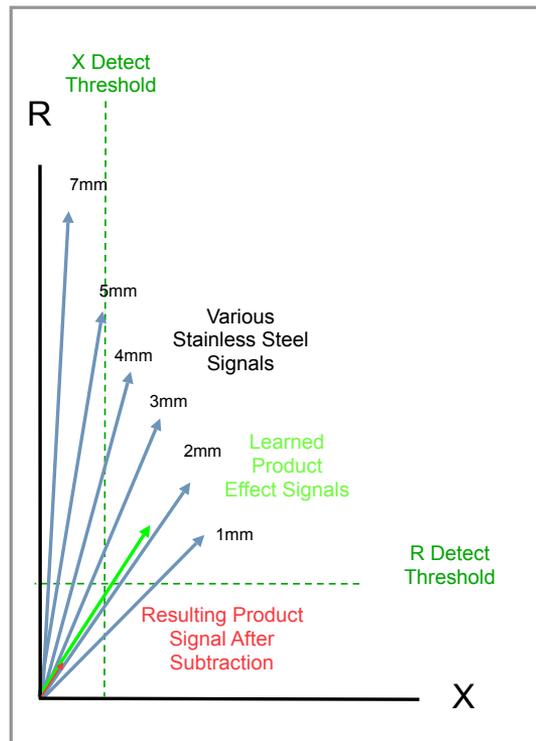


Figure 3: IXR subtracts the product signals and then detects on either channel

Because most products change over time, IXR also tracks and adjusts product signals on the fly to assure high performance and to eliminate false rejects. The result is that up to 50% smaller diameter metal can be detected in many previously difficult metal detection applications. There are no more annoying and costly false negatives.

Although the technique used in IXR is seemingly more complex than phasing, all the user has to do to apply it in an APEX metal detector is to enable it. If your equipment has a photoeye and constant speed conveyor, just run Autolearn. After several seconds of passing packages through the metal detector the system memorizes the signals, sets detect thresholds and then the production line is up and running.

## Conclusion

In today's competitive global economy, innovative metal detector technology like Intellitrack XR is helping leaders in food processing partner with product inspection solution providers to attain the highest level of metal contaminant protection possible for consumers around the world.

US patent number 8207731

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