

Phase and Auto Tracking — Countermeasures Against False Detection Vol.3 —

Technical Note Vol.4 took up *product effect* as a factor contributes to false detection of metal detector, and introduced Auto-Tracking function of Anritsu duw metal detector, which prevents false detection by compensating for *phase shift* caused by product effect. This issue will explain what *phase* is all about and how Auto-Tracking function works on phase.



[1] Magnetic field and metal detector

Phase is closely associated with magnetic field. Let's look at the basic principle of magnetic field first.

A metal detector's detection head consists of three coils: one transmitter coil and two receiver coils. When electrical current flows in, the transmitter coil produces magnetic lines. The space containing magnetic lines are referred to as magnetic field. A metallic object entering into the detection head disrupts the magnetic field. The changes in the magnetic field is detected by the two receiver coils arranged along the flow direction.

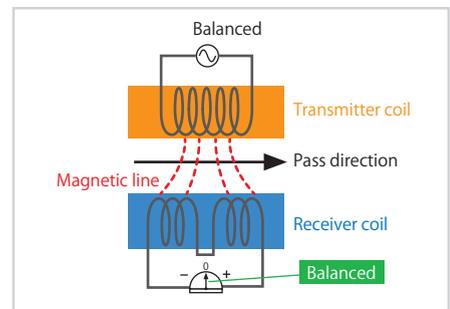


Fig.1: Magnetic field in detection head

[2] The product itself can disturb the magnetic field

A product itself, in fact, interacts with the magnetic field. When a product or a metallic contaminant affects the magnetic field, the amount of magnetic lines received by receiver coils changes. This change is represented in signal waveform. While a product is passing through the detection head, continuous signal waveforms are generated. Figure 2.1 shows a clipped waveform. When the signal is zero, product effect becomes minimal, where the signal of only metal contaminants can be detected. Anritsu metal detectors' auto setting function automatically determines the best evaluation timing. The timing is called phase and expressed as an angle.

Figure 2.2 shows compound signal waveform observed when a product includes a SUS test piece passes through the magnetic field. When the phase angle is 85 degrees, product effect becomes zero and only the effect of the test piece is observed.

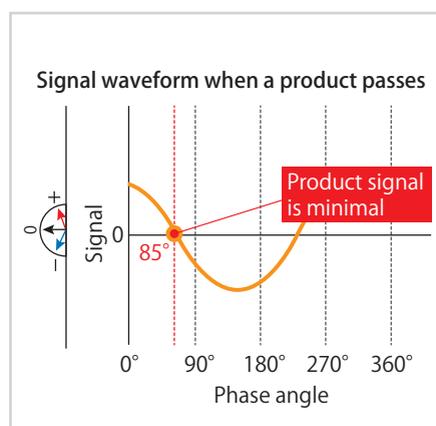


Fig. 2.1: Example of signal waveform

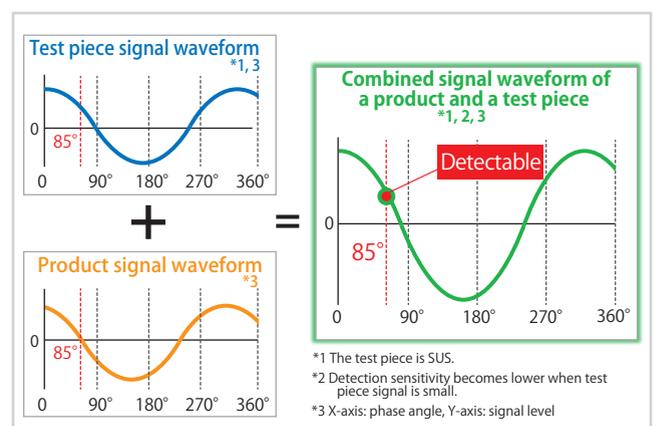


Fig.2.2: Compound signal waveform of product and test piece

[3] The phase angle of a product can shift

In food facilities, thousands of products are continuously fed into metal detectors. As production progresses, the temperature of such products as frozen foods becomes higher, and false detection becomes more likely to occur. You can observe that on the metal detector's indicator going orange or even red. This is the effect of "phase shift", a phenomenon that a phase is displaced from its predetermined position, allowing the metal detector to evaluate at an undesirable timing where product effect becomes large. Auto-Tracking function of Anritsu duw series metal detector overcomes this phenomenon. It compensates for the phase shift to maintain maximum accuracy (Fig.3.1 and 3.2).

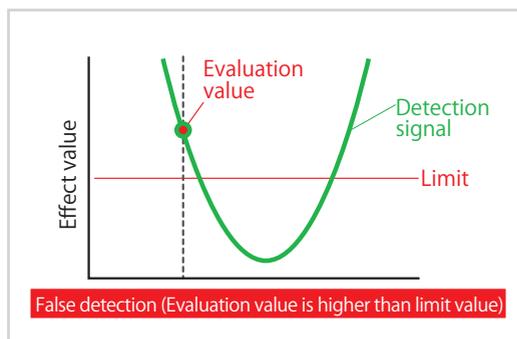


Fig.3.1: Auto-tracking OFF

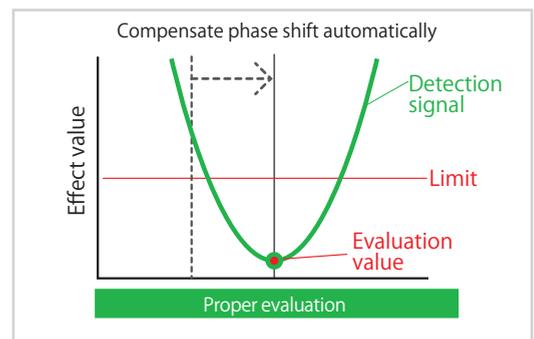


Fig. 3.2: Auto-tracking ON

[4] Measures against changes and variations of product conditions

Let's take a look at what Auto-Tracking can do when the temperature of block ham rises from 4 degree C to 16. Without Auto-Tracking, as the metal detector continuously inspects the product, the indicator went to yellow, then to red, and eventually resulted in a false detection (Fig.4.2). On the contrary, with Auto-Tracking on, the indicator stayed green and false detection did not occur (Fig.4.3). This is because phase shift has been continuously compensated. Figure 4.3 shows that the phase was compensated by 0.82.



Fig. 4.1: Phase shift



Fig. 4.2: Auto-tracking OFF

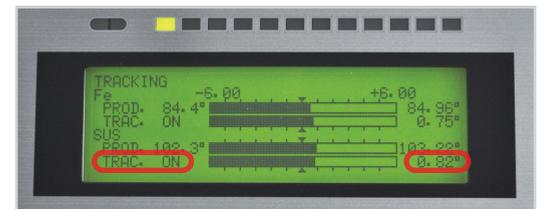


Fig. 4.3: Auto-tracking ON

[5] Closing comments

For optimal operation, start by making sure that your metal detector has been installed and cleaned properly. Next, adjust detection limit and activate Auto-Tracking function to maintain the detector's stability. If these are in place, the metal detector becomes an effective tool in ensuring your products' safety and security.