Technical Data **TD05301001E**

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iProx inductive proximity sensors—field saturation

Description

iProx™ inductive proximity sensors use an embedded microprocessor to deliver powerful, intelligent sensing capabilities. This means that the iProx family can solve applications where standard proximity sensors fail. One such feature unique to iProx is the ability to sense metal objects within a specific distance, or band, while ignoring targets in areas closer or farther away (see **Figure 1**).

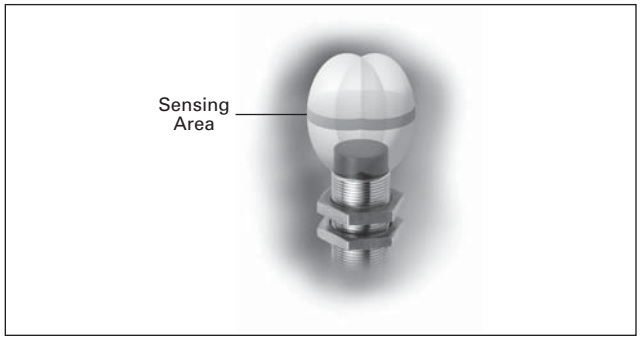

Figure 1. Band Sensing

Another capability is position sensing, where the sensor is set up to operate only when a target reaches a specific point in the X, Y, or Z coordinates, as shown in **Figure 2**.

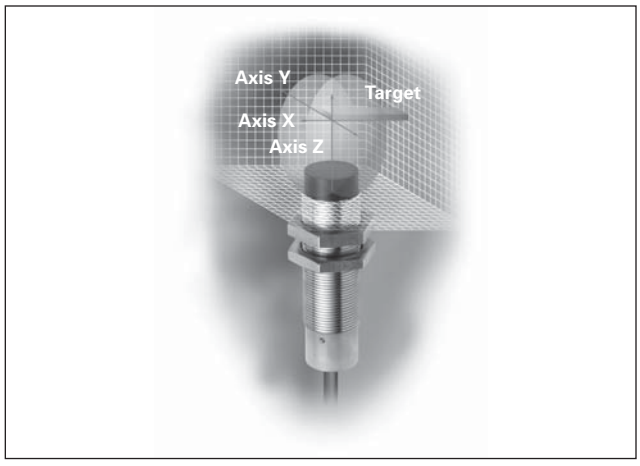

Figure 2. Position Sensing

How it works

The sensor is able to perform these feats by carefully monitoring very small changes in field saturation as the target moves within the sensing field, then comparing these changes against specific values programmed by the user. In simple terms, field saturation can be defined as the relative strength of the signal produced by the target at different positions within the inductive sensing field. A target closer to the sensor face will cause a higher level of field saturation than the same target farther away (**Figure 3**). The microprocessor monitors the field saturation level and produces an output when the current saturation level is equal to the level set when the target was in the desired operating position during programming.

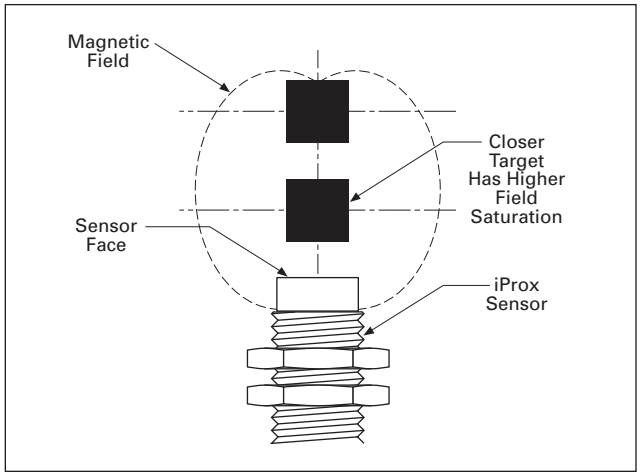

Figure 3. Target Position Affects Field Saturation Level

Note: There are situations when the field saturation is at the desired level and the sensor produces an output, even though the target is not in the desired position. By understanding the theory of how iProx works, a user can ensure high reliability in the sensing application.

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Limits to the technology

The main point to remember is that the sensor doesn't know the precise location of the target, but it is able to calculate the target position based on the field saturation readings that it is monitoring. In most cases, this will produce highly accurate results, but there are limits to the technology.

If we look at the inductive sensing field in two dimensions as shown in **Figure 4**, you can see that a target that is farther from the sensor face, but closer to the center line of the sensor, may yield the same field saturation level as the same target closer to the sensor face, but farther away from the center. This is simply due to the fact that the magnetic field emanating from the coil in the face of the sensor is stronger nearer to the coil, and gets weaker in all directions as you move farther from the coil. In fact, for any given target, there are several points in this field that would yield the same field saturation level.

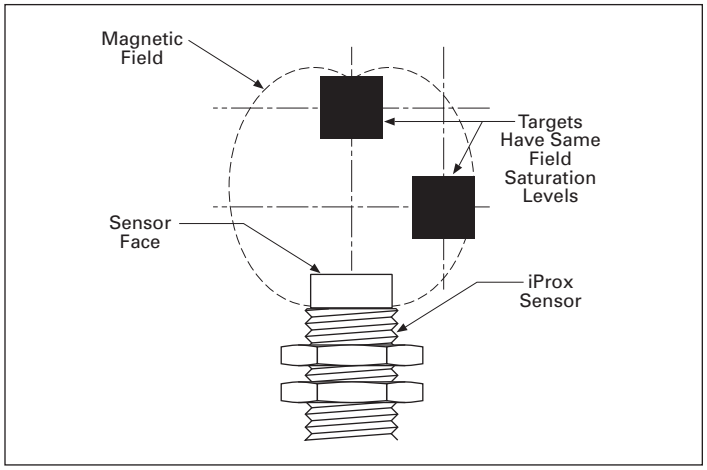

Figure 4. Same Field Saturation Levels at Different Positions

Planning for high sensing reliability

If the target is moving to and from the sensor in one axis, both band and position sensing will be successful. If the target is moving in two axes, identical saturation points are possible and must be avoided. If the target is free to move in three axes, the application will likely not be reliable. Certainly, the more predictable the path of the movement, the more reliable the application.

Listed below are a few basic application guidelines. By following these whenever possible, you can increase the reliability of your sensing application (see **Figure 5**):

1. Whenever possible, limit the target movement in the application to a simple path in a single dimension so that field saturation is a series of different values.
2. Orient the sensor such that the movement is coming toward the sensor from the front rather than the side.
3. Position the sensing point as close as possible to the sensor face. This will maximize repeatability due to the increased strength of the inductive field near the face.

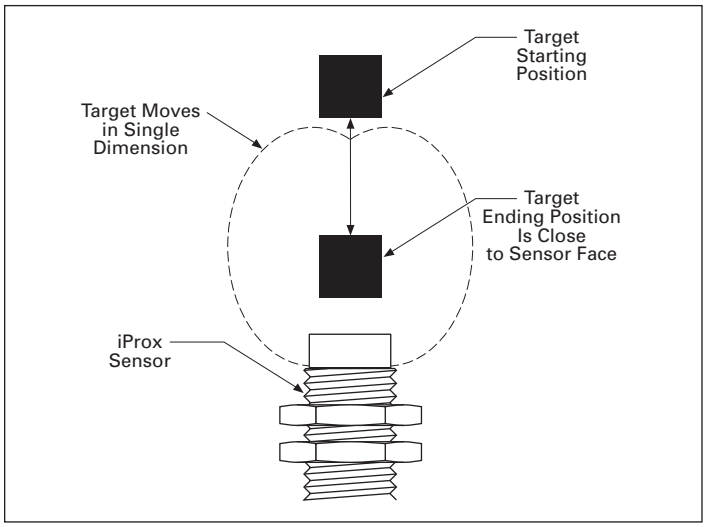

Figure 5. Ideal Target Movement

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