LION PRECISION

TechNote

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Thread Detection – Centering Errors

Applicable Equipment:

ThreadSense thread detection sensors

Applications:

All thread detection applications

Summary:

This TechNote describes the nature and magnitude of error voltages generated by off-center positioning of thread-detection probes and mechanical limitations for centering errors.

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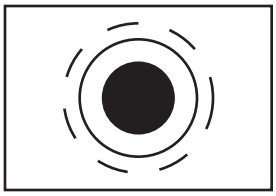
Synopsis

Limiting centering errors to 0.010" (0.25mm) provides reliable operation with all probes and hole sizes.

Larger holes allow for more centering error.

Ferrous materials allow for significantly more centering error than nonferrous materials.

Mechanical Limitations for Centering Errors



Ferrous Materials

Probe diameters are about 65% of hole diameter for ferrous materials.

Nonferrous Materials

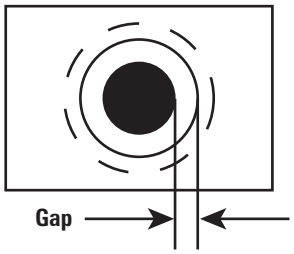
Probe diameters are about 85% of hole diameter for nonferrous materials.

Introduction

Thread sensors generate different output voltages for tapped versus untapped holes. The presence or absence of threads is determined by the this voltage difference. Voltage differences are also generated by off-center probe insertion. For reliable operation, these off-center voltage changes must be less then the tapped/untapped voltage changes.

Mechanical Considerations

Severe centering errors may cause the probe to crash into the target. Nonferrous sensor diameters are about 85% of the hole size, while ferrous sensors are about 65% of the hole size. The table below shows typical gap sizes:



Ferrous Materials		
Hole Size	**Probe**	**Gap (inch/mm)**
M6 x 1	T5BZ	0.035/0.88
M7 x 1	T5BZ	0.054/1.37
M8 x 1.25	T6BZ	0.052/1.31
M8 x 1	T6BZ	0.057/1.45
M10 x 1.5	T7BZ	0.065/1.65
M10 x 1.25	T7BZ	0.071/1.80
M12 x 1.75	T8BZ	0.087/2.21
M12 x 1.25	T8BZ	0.096/2.44
M14 x 2	T10BZ	0.088/2.24
M14 x 1.5	T10BZ	0.098/2.49
M16 x 2	T12BZ	0.092/2.33
M16 x 1.5	T12BZ	0.101/2.58

Nonferrous Materials		
Hole Size	**Probe**	**Gap (inch/mm)**
M5 x .8	T5BZ	0.018/0.46
M6 x 1	T6BZ	0.018/0.46
M7 x 1	T7BZ	0.018/0.46
M8 x 1.25	T8BZ	0.018/0.46
M8 x 1	T8BZ	0.024/0.60
M10 x 1.5	T10BZ	0.018/0.46
M10 x 1.25	T10BZ	0.024/0.61
M12 x 1.75	T12BZ	0.018/0.46
M12 x 1.25	T12BZ	0.027/0.68
M16 x 1.5	T16BZ	0.018/0.46
M16 x 2	T16BZ	0.028/0.71

Protective Mounting

Spring-loaded probe mounts can be used to protect probes from damage in case of crash. Two models are available for different probe sizes:

Model:	SN-08	SN-12	SN-18
Internal Thread (must match probe)	M8x1 (T5BZ-T8BZ)	M12x1 (T10BZ-T12BZ)	M18x1 (T16BZ)
External Thread	M16x1.5	M22x1.5	M30x1.5
Maximum Extension	0.35" (8.9mm)	0.41" (10.4mm)	0.49" (12.4mm)

Electrical Considerations

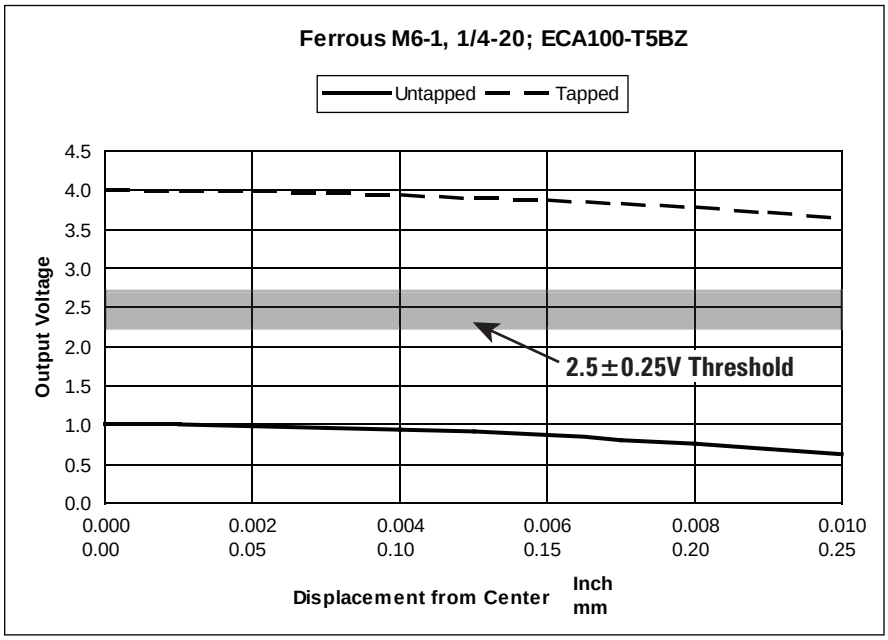
Basic Operation

Thread sensors generate different voltages for threaded vs. unthreaded holes. A threshold voltage is set halfway between these two voltages using the switch adjustment (2.5V in the example below). The system indicates an unthreaded hole when the output is below the threshold.

As the probe is moved off-center, the voltage output decreases. For reliable operation, the unthreaded voltage must remain 0.25V above the threshold voltage (see sample figure below).

Ferrous Sample Chart

This sample chart is for ferrous materials which typically generate a 4V difference for thread and unthreaded holes. Nonferrous materials typically only generate about a 0.5-1V difference.



Ferrous materials

The presence/absence voltage difference is large with ferrous materials. This allows for significant off-center voltages without affecting performance.

Off-center amounts of 0.010" (0.25mm) generate voltage changes amounting to 2%-5% of the presence/absence voltage change.

Nonferrous materials

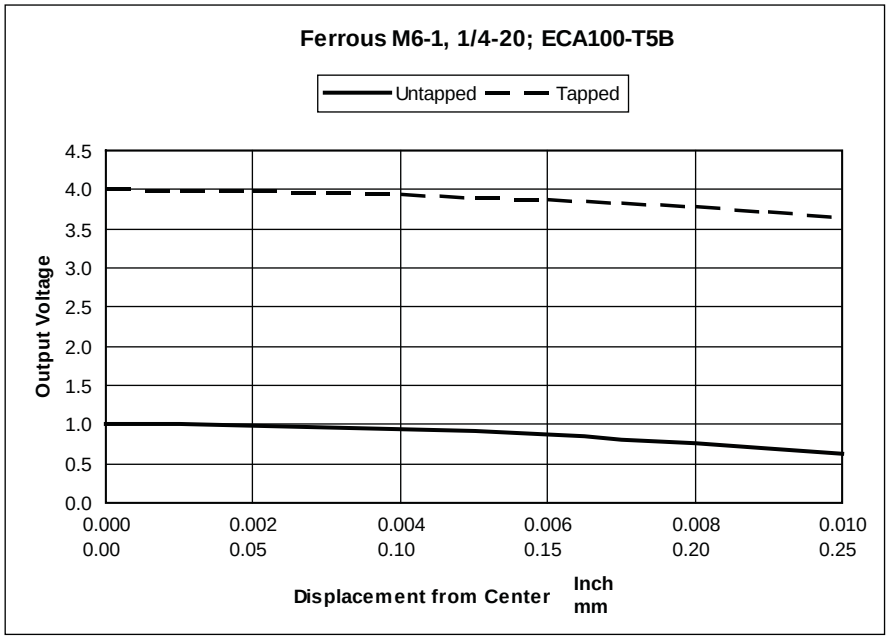
The presence/absence voltage difference is small with nonferrous materials; therefore, control of probe centering is of greater concern.

Off-center amounts of 0.010" (0.25mm) generate voltage changes about 10%-25% of the presence/absence voltage change.

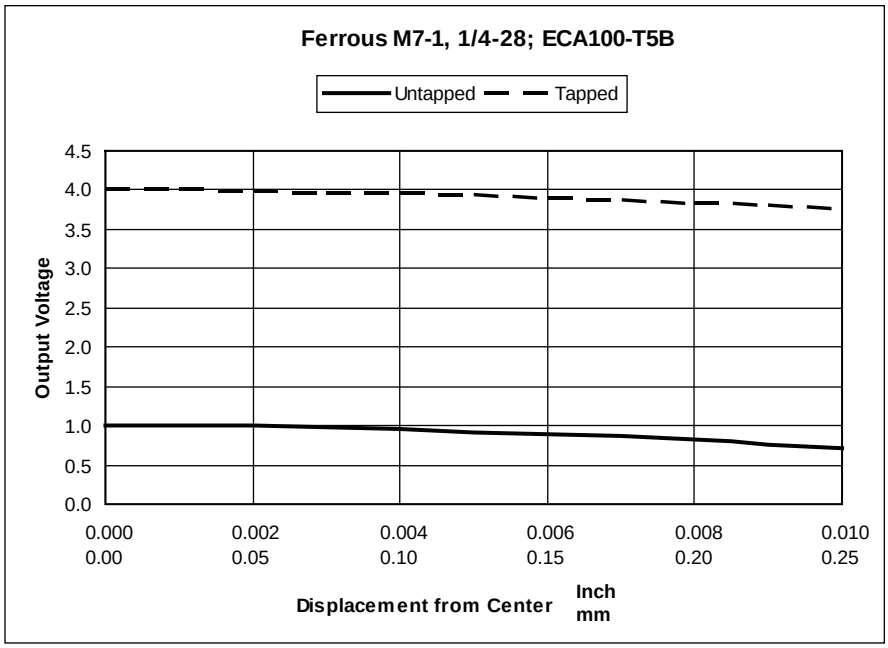
The following pages list specific voltage changes for specific probe models and hole/tap size.

T Series Probes for Cut/Tapped Threads in Ferrous Materials

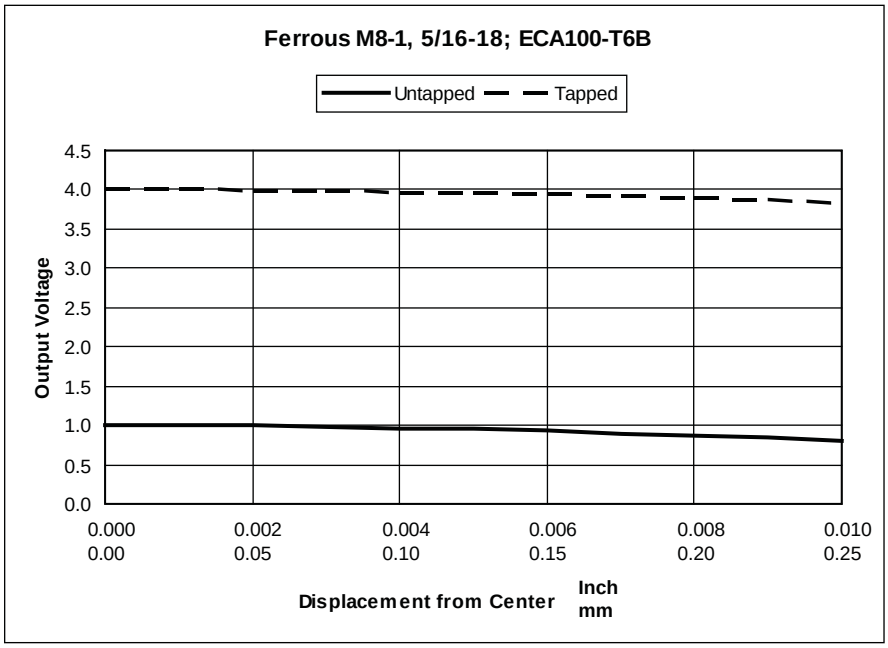
T5BZ: M6-1, 1/4-20, Ferrous



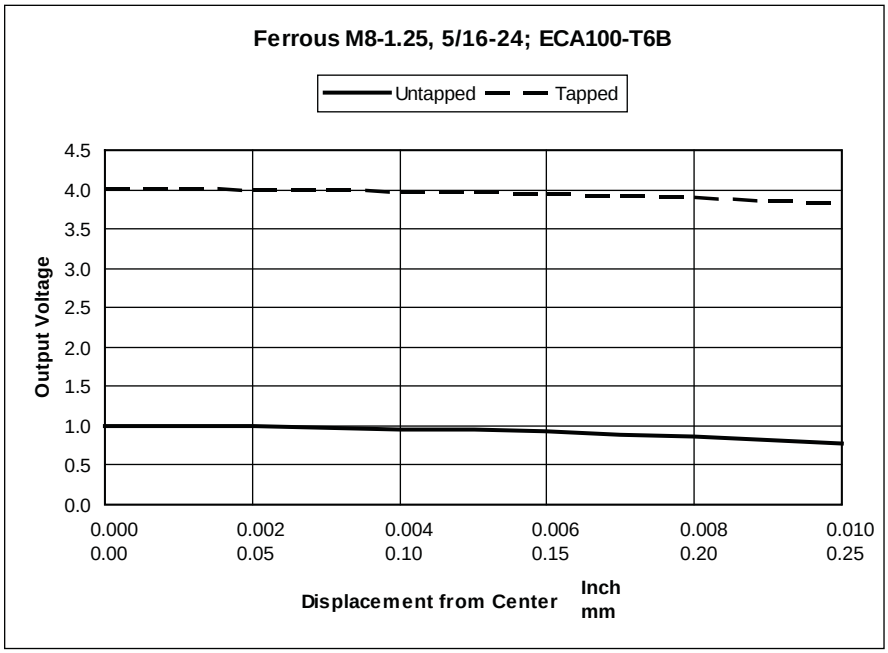
T5BZ: M7-1, 1/4-28, Ferrous



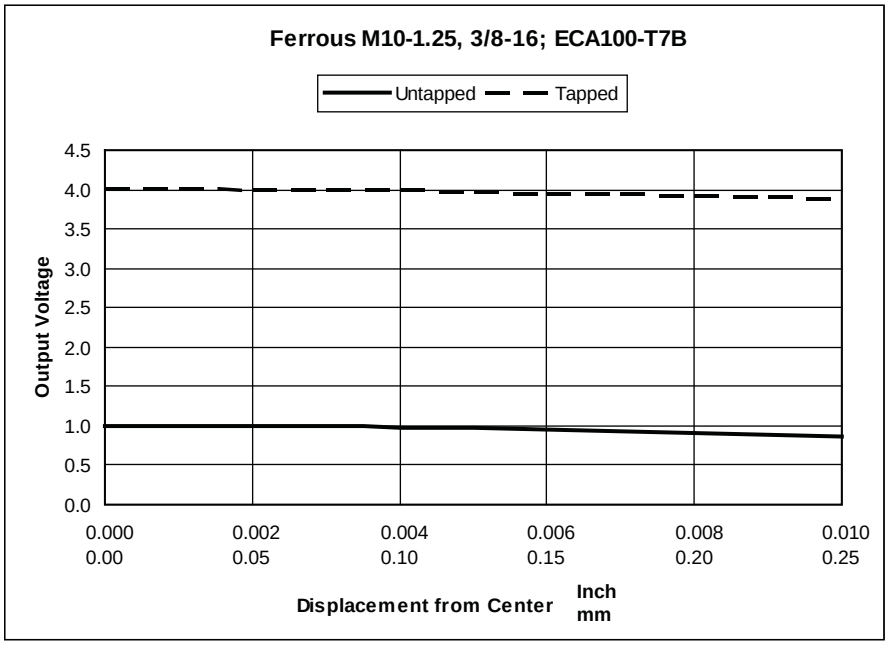
T6BZ: M8-1, 5/16-18, Ferrous



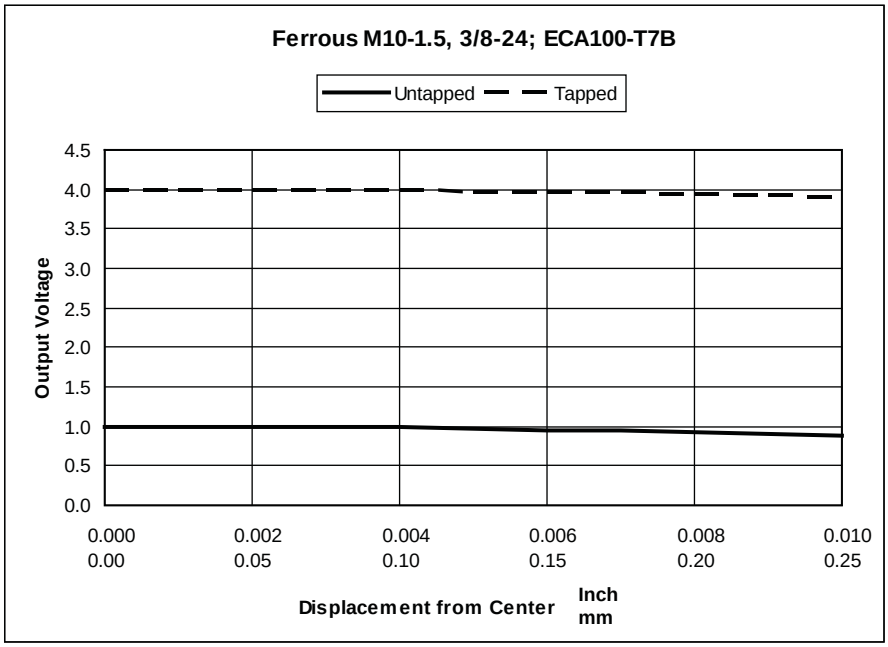
T6BZ: M8-1.25, 5/16-24, Ferrous



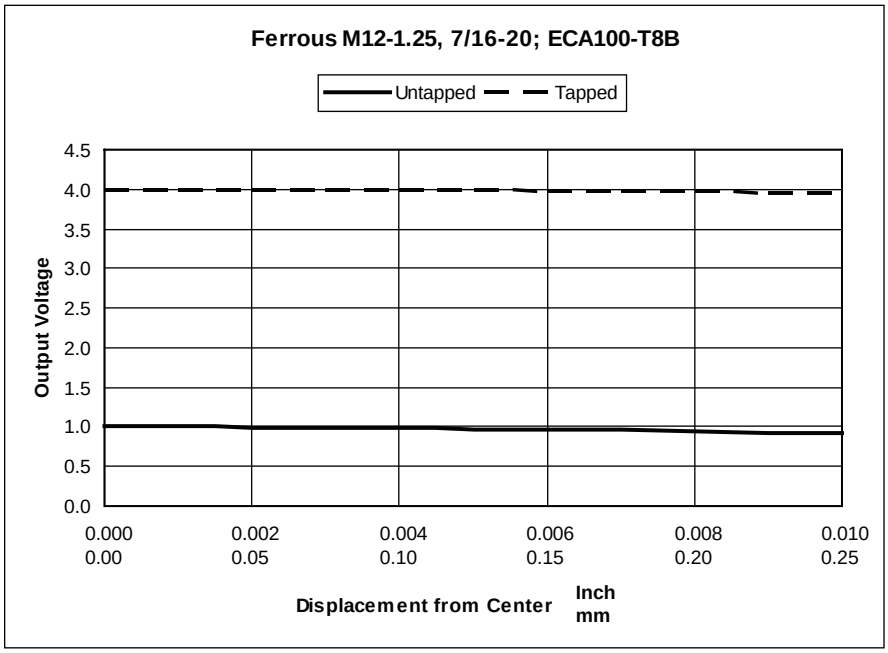
T7BZ: M10-1.25, 3/8-16, Ferrous



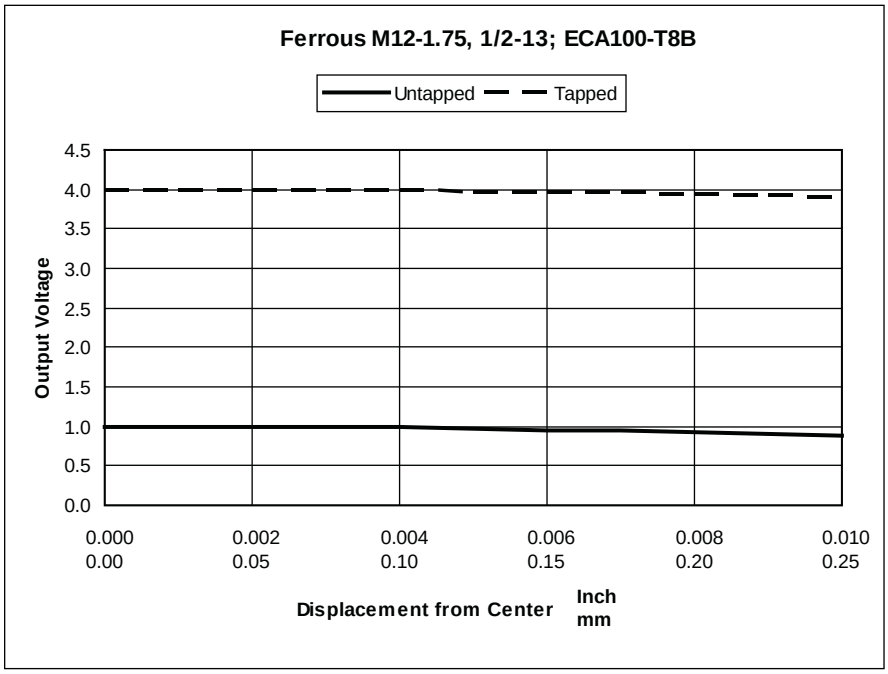
T7BZ: M10-1.5, 3/8-24, Ferrous



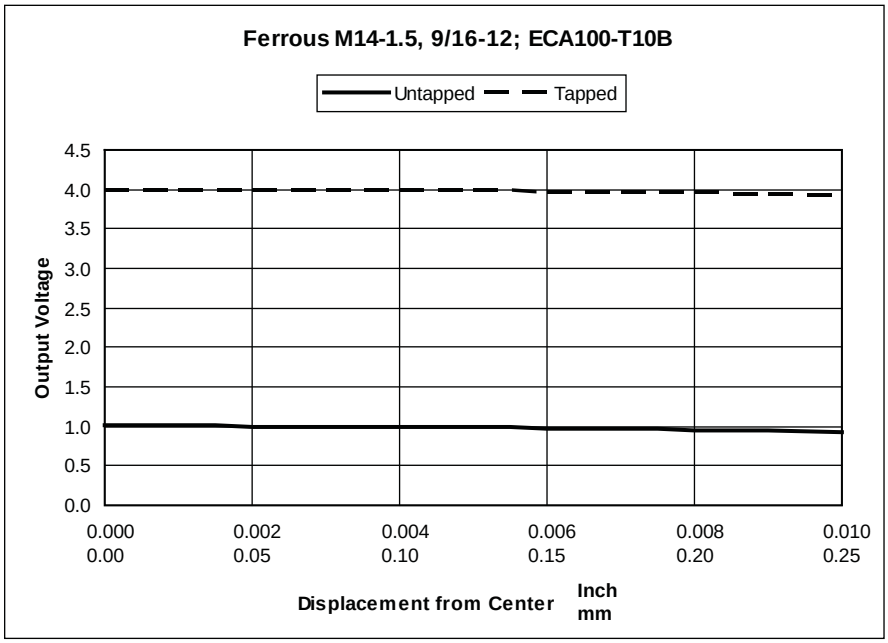
T8BZ: M12-1.25, 7/16-20, Ferrous



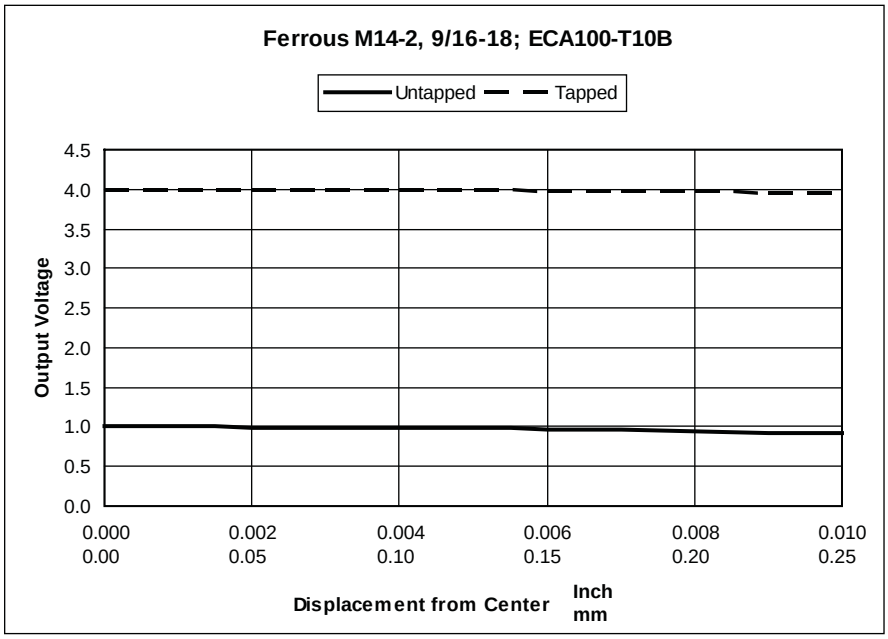
T8BZ: M12-1.75, 1/2-13, Ferrous



T10BZ: M14-1.5, 9/16-12, Ferrous

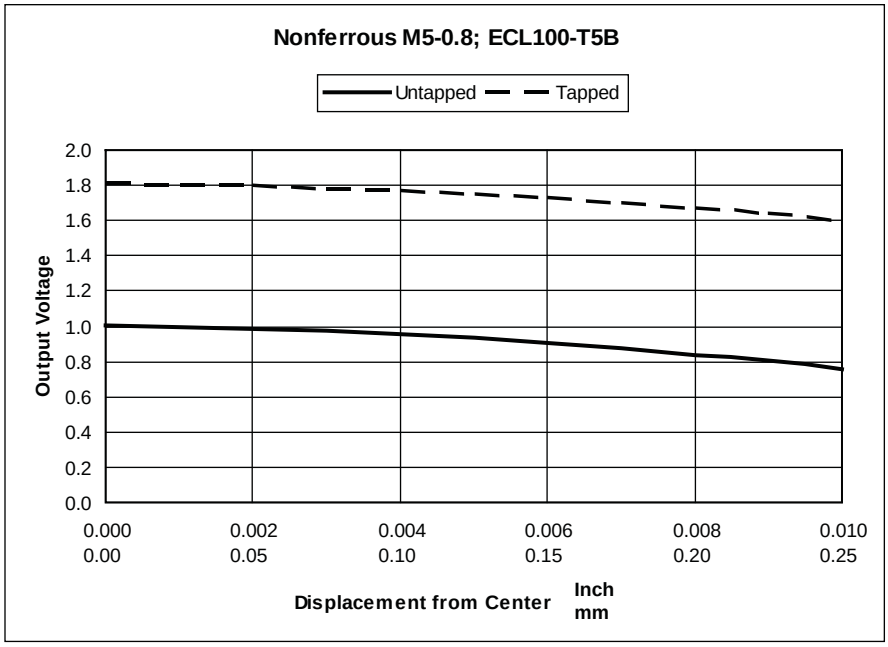


T10BZ: M14-2, 9/16-18, Ferrous

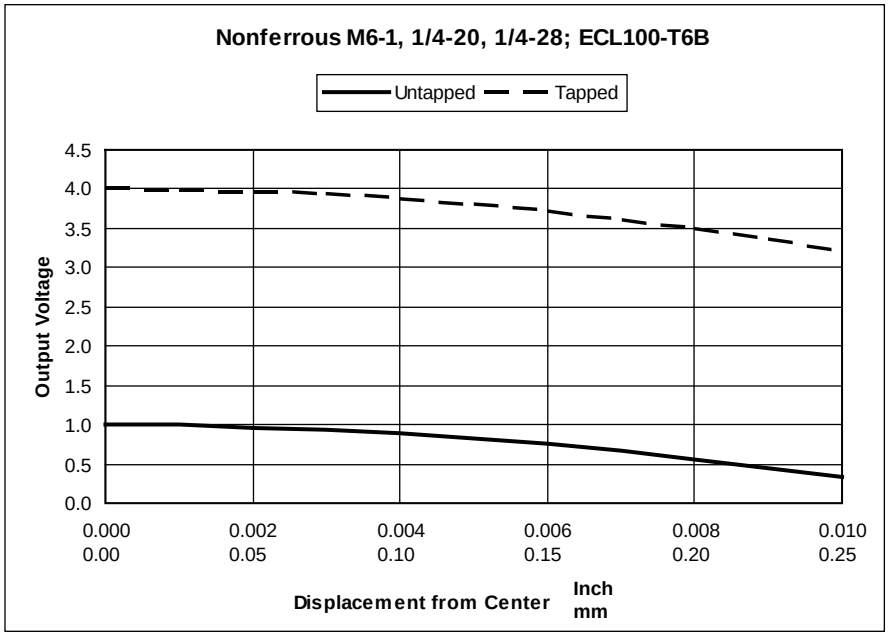


T Series Probes for Cut/Tapped Threads in Nonferrous Materials

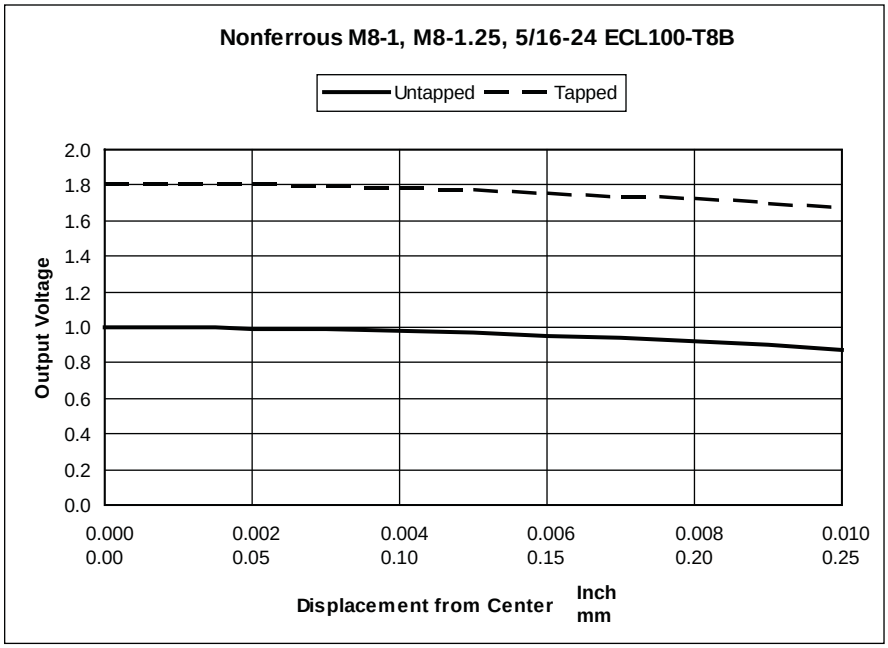
T5BZ:0.8, Nonferrous



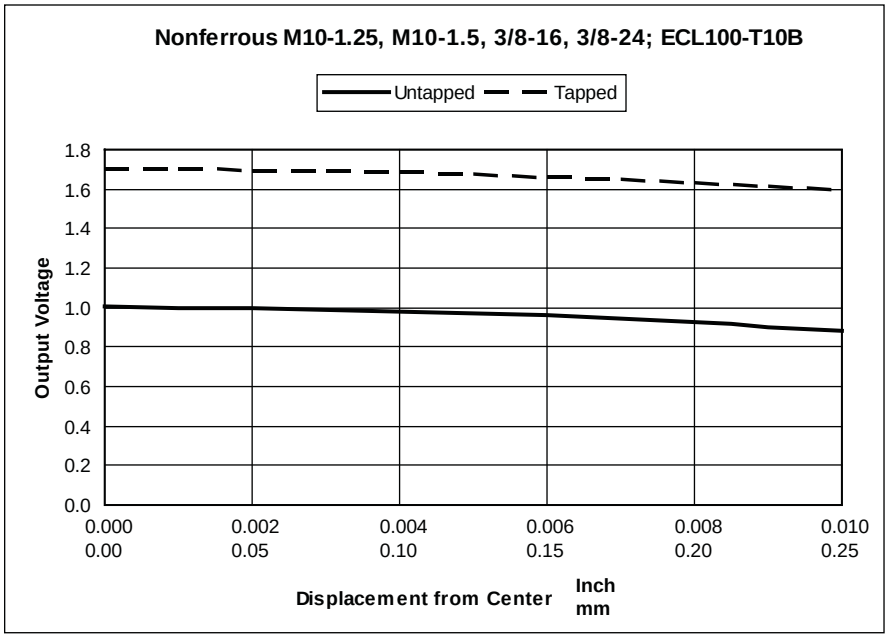
T6BZ: M6-1, 1/4-20, 1/4-28, Nonferrous



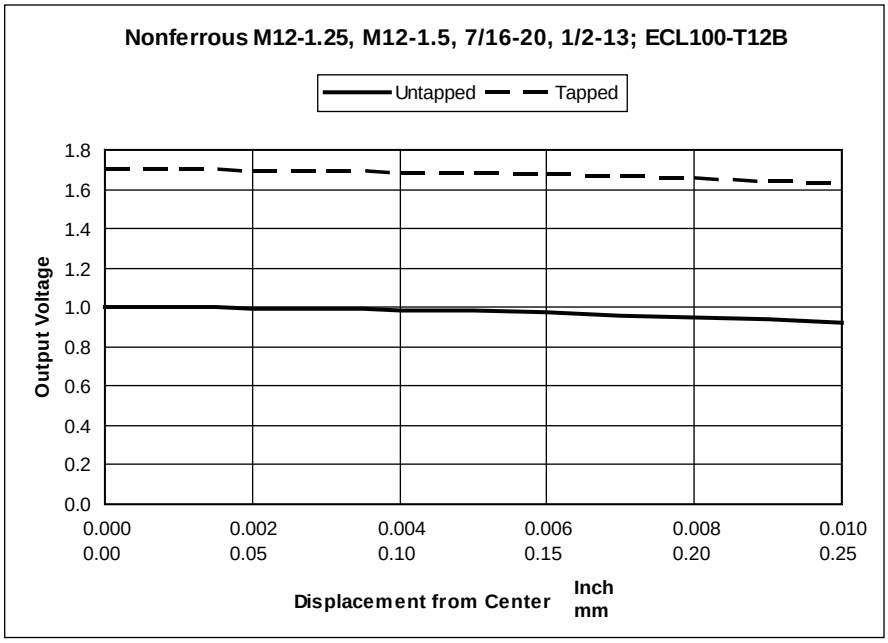
T8BZ: M8-1, M8-1.25, 5/16-24, Nonferrous



T10BZ: M10-1.25, M10-1.5, 3/8-16, 3/8-24, Nonferrous



T12BZ: M12-1.25, M12-1.5, 7/16-20, 1/2-13, Nonferrous



T16BZ: M16-1.5, M16-2, Nonferrous

No data available; will be proportionally similar to the T12BZ charts.