Application Note

AN001023

Proximity Detection

Factory Calibration

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Content Guide

1 Introduction

In order to optimize proximity sensor performance in the final product, a factory calibration may be required to adjust for the manufacturing and material variations that could affect proximity measurement accuracy. Some examples of system components that could cause variations and affect the proximity measurement are:

- Cover glass
- Ink properties
- Ink apertures
- Air gap
- Rubber boot
- Optical alignment
- Mechanical assembly tolerances
- Sensor
- IR emitter

Etc.

This application note discusses a method that can be implemented to calibrate a proximity detection system to compensate for these potential system component variations.

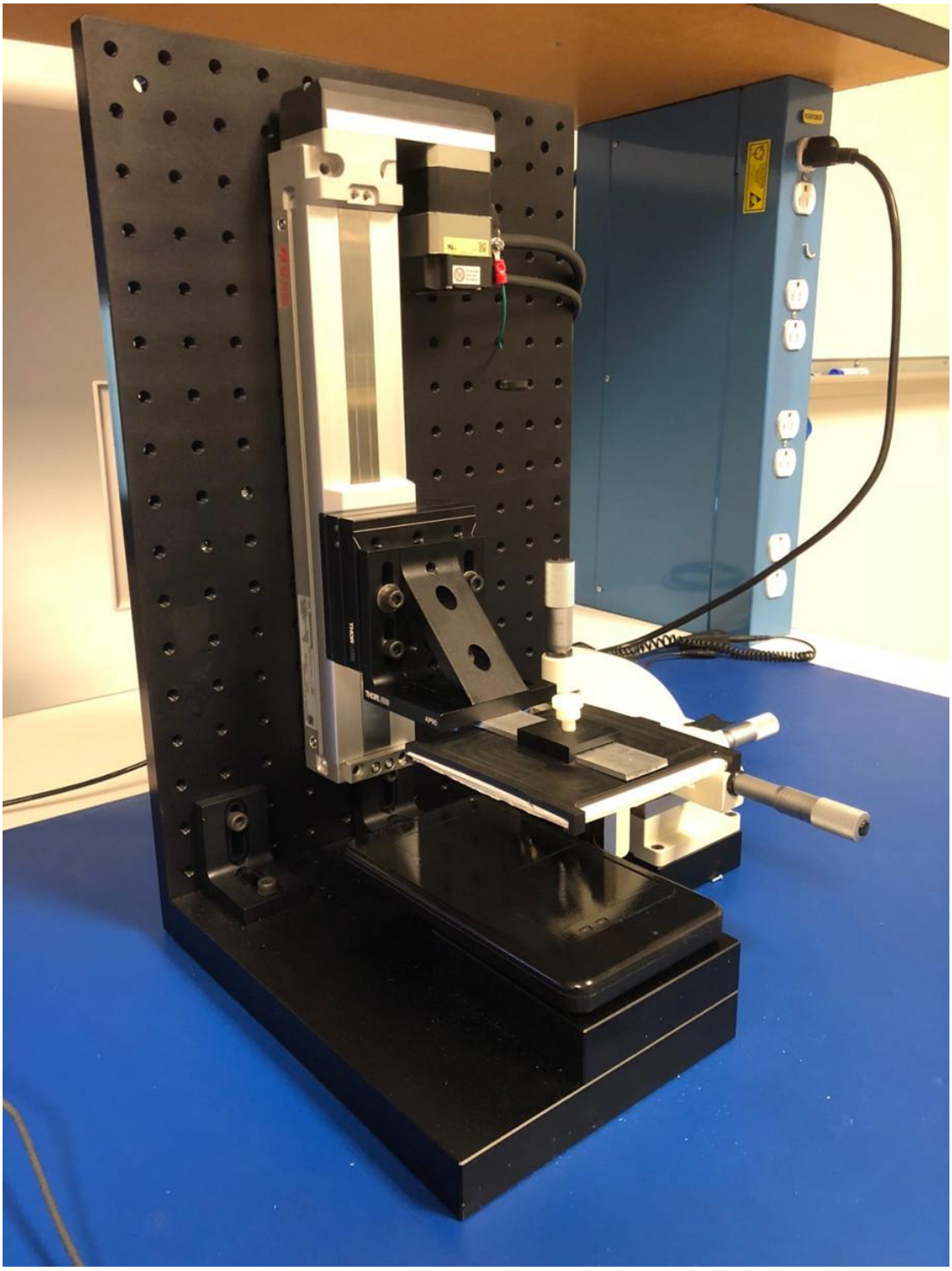
2 Pre-Calibration

Prior to factory calibration, the final product's proximity system needs to be characterized and the performance requirements determined. This includes the following:

- Choose the optimal parameter settings (IR pulse parameters, gain, etc.).
- Characterize the proximity data (PDATA) noise level.
- Characterize the proximity data over distance
- Choose the detect distance.
- Choose the release distance.
- Determine the minimum PDATA delta for Release minus no-target crosstalk (with PDATA noise factored in).
- Determine the minimum PDATA delta for Detect minus Release (with PDATA noise factored in).

Once the above has been determined, an appropriate test fixture is required. The fixture should be designed to hold the Device Under Test (DUT) and reflective target in stable and repeatable positions. The target and DUT should be parallel to each other in the fixture. The target should be high quality and durable with a consistent reflectance at the IR wavelength It should be properly sized for the Field of Illumination (FoI) of the emitter and Field of View (FoV) of the sensor. The ambient light environment should be controlled and constant and have low IR content. If the fixture is enclosed, ensure the internal surface is coated with a low-reflectance, matte black material to prevent unwanted reflections from affecting the test measurements. Figure 1 shows an example of an automated proximity test fixture. This fixture utilizes a computer controlled linear stage to precisely position the target over the device under test. The target used in this example is a 10 cm x 10 cm Kodak 18% gray card.

Figure 1
Automated Proximity Test Fixture



3 Factory Calibration

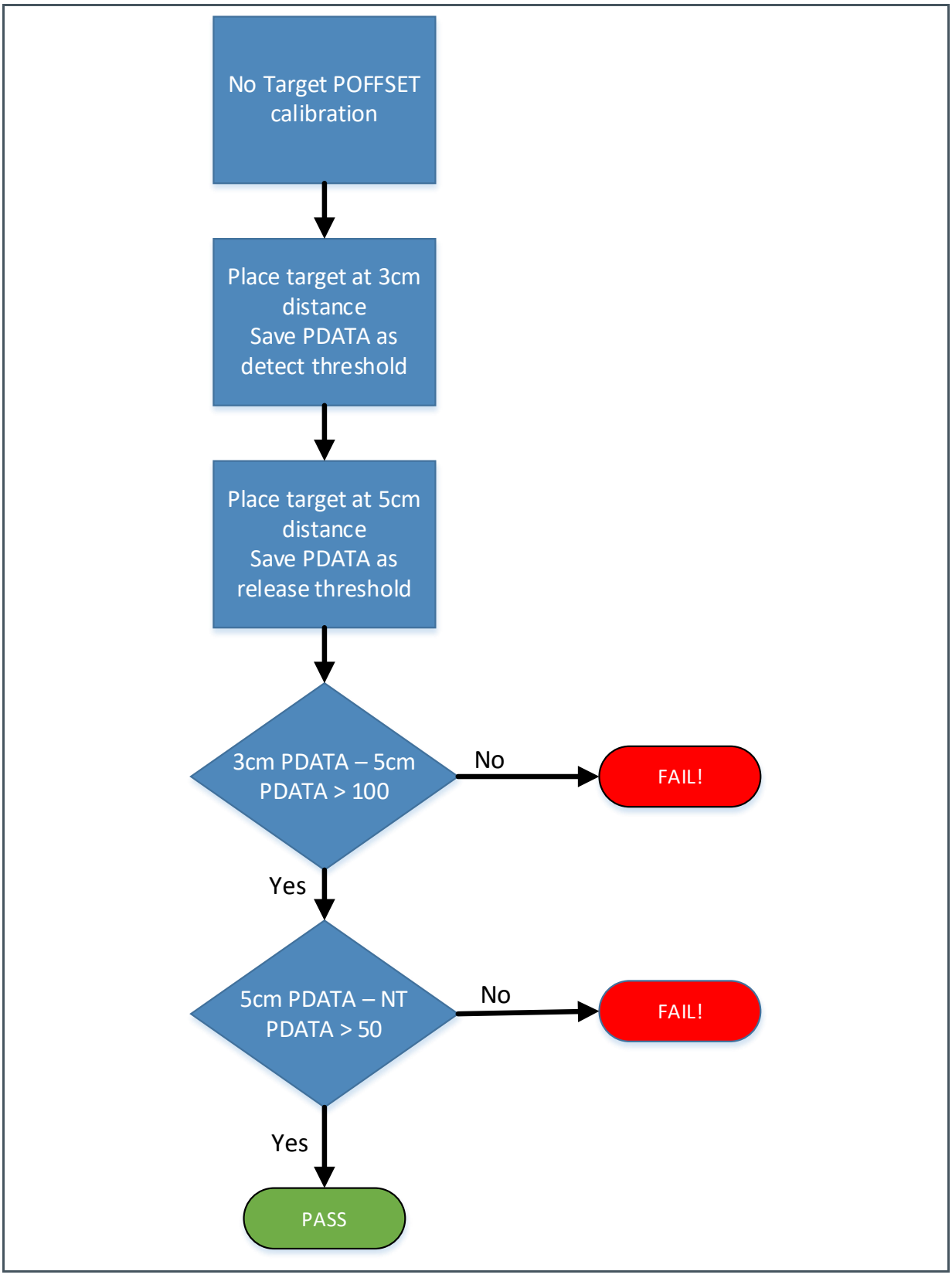
With the DUT in the test fixture, perform the following steps:

1. With no target above the device, execute a POFFSET calibration and record the no-target PDATA value.
2. Move the target to the detect distance, measure the PDATA value and store it as the detect threshold.
3. Move the target to the release distance, measure the PDATA value and store it as the release threshold.
4. Verify the detect-release delta is within customer-defined limits.
5. Verify the release threshold achieves the customer-defined margin above the no target PDATA value.

Figure 2 shows a flow chart of the factory calibration process. The parameters chosen are arbitrary examples.

- Detect distance = 3 cm
- Release distance = 5 cm
- PDATA noise = ± 5 counts
- 5cm/No Target (NT) PDATA delta = 50 counts
- 3cm/5cm PDATA delta =100 counts

Figure 2
Factory Calibration Process



4 Summary

Many factors can affect the performance and accuracy of the proximity function. Performing a factory calibration on the final assembled product can greatly improve the quality of the product and enhance the end user experience.

5 Revision Information

Changes from previous version to current revision v1-00	Page
Initial version	

- Page and figure numbers for the previous version may differ from page and figure numbers in the current revision.
- Correction of typographical errors is not explicitly mentioned.

6 Legal Information

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