Test Plan

Digital Beam Attenuator

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Document Change History

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V1.0	11.09.2011	Katherine Lake	Initial document generated
V1.1	12.13.2011	Katherine Lake	Testing details added

1. Introduction

This test approach document describes the appropriate strategies and processes used to plan, organize, and execute testing of the digital beam attenuator project actuated wedges.

1.1 Quality Objective

1.1.1 Primary Objective

The primary objective of testing this system is to ensure it meets the full requirements, including the quality requirements, provided by the client. The system shall satisfy the use case scenarios and maintain the quality of the project. At the end of the design project, the client should find that the project has met or exceeded all of their expectations as detailed in the requirements.

1.2.1 Secondary Objective

The secondary objective of testing the digital beam attenuator actuation system is to identify and expose all issues and associated risks, communicate discovered issues to the design team, and ensure that all issues are addressed prior to the completion of the design project. All areas of the system must be examined and all issues found must be documented and dealt with appropriately.

2. Test Methodology

2.1 Purpose

The purpose of the Test Plan is to achieve the following:

- Define strategies to test all the functional and quality requirements.
- Identify required resources and related information.

2.2 Test Strategies

2.2.1 Velocity Test

The purpose of this test is to determine the average linear velocity the motor is capable of pushing the wedge at.

The test shall be conducted as follows:

- The motor shall be connected to the wedge it will actuate.
- Determine the number of steps required to travel a pre-specified distance.
    - Distances shall be n = 20, 30, 40, 50, 70 mm.
    - Distances lower than 20 mm shall not be tested due to potential inaccuracies caused by the use of stopwatches.
- Run a program that causes the motor to move the pre-specified distance.
- Determine the amount of time required to transverse the distance using two stopwatches.
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The values obtained from test shall be recorded in a Microsoft Excel spreadsheet.

The speed shall be calculated by:

- Determine the average velocity required for the wedge to travel the given distance by dividing the distance by the time required.
  - This will be performed for each trial at each distance.
- Take the average of all the calculated velocities for each trial to find an estimated velocity for each distance.

2.2.2 Acceleration Test

The purpose of this test is to determine the average acceleration of the wedge.

The test shall be conducted as follows:

- The average velocity values calculated in 2.2.1 Velocity Test will be plotted. The value on the X axis shall be the average time, taken as an average of all the times recorded, that corresponds to that particular velocity value.
- A linear trendline shall be added using Microsoft Excel.
- The slope of the linear trendline will be taken as the average linear acceleration.

2.2.3 Position Test

The purpose of this test is to determine the accuracy and precision of the motor.

The test shall be conducted as follows:

- Connect the motor to the wedge via the adapter.
- Send the motor a command that causes it to move to its absolute zero point.
- Run a program that causes the motor 500,000 μsteps using the Move Absolute command.
- Measure the distance the wedge travelled by measuring the distance between the body of the motor and the back of the adapter. This will remove any inaccuracies caused by the motor moving the test and misplacing the wedge from its initial position.
- Divide the number of steps by the distance travelled to determine the number of μsteps travelled per millimeter.
- Use n = 9 trials total and run the motor 500,000 μsteps each trial, moving the motor to absolute zero position each time.
- Average the number of μsteps per millimeter over each of the nine trials.
  - Find the standard deviation to determine the precision of the motor.
  - Find the percent error, comparing the actual μsteps travelled to the number of μsteps travelled per millimeter given in the M Drive 23 Plus Linear Actuator datasheet. The given number is based on the leadscrew pitch, which should be determined before

comparison to the estimated value. The percent error is a measure of the accuracy of the motor.

All values shall be recorded in a Microsoft Excel spreadsheet.