

Manufacturing Test

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Gold Finch DM8070– Test List

Revision History

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| --- | --- | --- | --- |
| Rev | Author | Date | Description of Changes |
| 0.1 | C. O’Neil | 06/27/2017 | Initial Draft for review |
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| --- | --- | --- | --- |
| Rev | Item | Date | Location |
|  | ERD |  |  |
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## List of Stages

|  |  |
| --- | --- |
| Stage Name | Sequence # |
| Engine Functional | 1 |
| Engine Focus | 2 |
| Engine Debris | 3 |
| DM8070 Final | 4 |

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## Test List

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| --- | --- | --- | --- | --- | --- | --- | --- |
| Tests | Test Stages | | | |  |  |  |
| Engine Functional | Engine Focus | Engine Debris | DM8070 Final |  | Legend |  |
| Liquid Lens | X | X | Y - separate | Y - go/no-go |  | IP | Implicitly Tested |
| Illumination | X | X | Y - separate | Y - go/no-go |  | N/A | Not Applicable |
| Label Configuration | Y | Y | Y | Y |  |  |  |
| USB Communication | Y | Y | N/A | Y - implictily tested  5th pin? |  |  |  |
| Sensor Data Path | Y | Y | N/A | Y |  |  |  |
| Image Acquire | Y | Y | N/A | Y |  |  |  |
| Debris | Y | X | N/A | Y |  |  |  |
| Trigger |  |  | N/A | Y |  |  |  |
| Status LED | X | X | N/A | Y |  |  |  |
| USB Slide In |  |  | N/A | Y |  |  |  |
| Beeper |  |  | N/A | Y |  |  |  |
| Vibration Motor |  |  | N/A | Y |  |  |  |
| Accelerometer |  |  |  | Y |  |  |  |
| Ethernet Communication | Y | Y | N/A | N/A |  |  |  |
| RS232 Communication | Y | Y | N/A | N/A |  |  |  |
| Digital I/O | Y | Y | N/A | N/A |  |  |  |
| Hot Pixel | Y | Y | N/A | PT |  |  |  |
| Cold Pixel | Y | X | N/A | PT |  |  |  |
| Liquid lens front connector | Y | X | N/A | Y - implictily tested |  |  |  |
| Illumination front connector | Y | X | N/A | Y - implictily tested |  |  |  |
| Aimers | Y | X | X | X |  |  |  |
| Focus | X | Y | N/A | PT |  |  |  |
| Pixel Correction | N/A | N/A | N/A | N/A |  |  |  |
| POE | N/A | N/A | N/A | N/A |  |  |  |
| \* Must consume calibrated liquid lenses/illumination modules, this is NOT a functional test/calibration |  |  |  |  |  |  |  |

## Notes on Test Process

The engine will undergo a functional test, focus test, and then will be built into a handheld reader for a final test.

The engine will not have a lens at the functional test, and will contain an accurate debris test at this stage.

Ideally, the lens modules would then be focused as their own sub-assemblies at the CM.

The lens modules are then assembled onto the engine at either the CM or the DC, and a quick debris test is performed. This is to ensure there are no debris issues once the imager and lens have been sealed.

Given the potential variations of assembled handheld products, it is easier to perform this 2nd debris test in its own stage, at the engine level, rather than forcing it into each final test.

The engine is assembled into the handheld reader, either DM8070 or MX1500, for a final test. This is done either at the CM or DC. It is likely that the assembly will be too difficult for the DC to create customizable handheld readers, but customizable fixed mount readers will definitely be built at the DC.

All illumination and liquid lens modules will be tested in a separate, offline test that has been explained in the Merlin/Wren documentation.

## Functional Test Stage

Engines may eventually be built and stocked at the DCs, so it is a requirement to ensure that can be tested at PCI at a basic level. This means there are no optics elements attached to the product, and imager specific tests can be complete.

This test stage would only occur at PCI. Engines can then be sent to the DCs, or built further into assembled units at PCI. The unit is running diags at this stage.

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| --- | --- | --- | --- |
|  | Scan Label Step | | |
| Scan the label of the unit under test and store the values for later use. | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Prompt the operator to scan the product label using a handheld  barcode reader | None |
| 2 | Store the label information | None |

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|  | Connect to unit over RS232 Step | | |
| This step will initially connect to the unit under test (implicitly testing RS232 functionality) in order to determine the IP address. | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Open a serial connection to the unit under test (115.2, 8, N, 1) | Ability to run diagnostic commands over the RS232 connection |
| 2 | Send IP address request command to the unit under test and receive an expected response | Diagnostic command to query the IP address of the unit |
| 3 | Pass or fail the unit depending on the success |  |

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|  | Connect to unit over Ethernet Step | | |
| This step will connect to the unit using Ethernet on the Development Board (implicitly testing Ethernet functionality) to perform all tests. | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Open a Ethernet connection to the unit under test at the IP address determined over RS232 | Ability to run diagnostic commands over the Ethernet connection |
| 2 | Send data to the unit under test and receive an expected response | Diagnostic command respond correctly to commands |
| 3 | Pass or fail the unit depending on the results |  |

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|  | Update Firmware Step (NPI only) | | |
| This step will verify the firmware version of the unit under test and update it if necessary. This step will be removed when the product is released to full production. The expectation is that the firmware will be pre-programmed at Beta/RTM. | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Query the current application, apploader and failsafe version of the unit under test | Diagnostic commands to perform the stated functions |
| 2 | Update the firmware, apploader and failsafe as necessary | Diagnostic commands to upload stated firmware |
| 3 | Pass or fail the unit depending on the results |  |

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|  | Configuration Test | | |
| This test will write and/or verify the device’s configuration information (serial number, MAC Address, part number, hardware revisions, firmware revisions etc.) on the unit under test. | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Write or verify the serial number & part number, and revision information | Diagnostic commands to read and write serial number, mac address, part number and revision information. |
| 2 | Verify any required hardware versions | Diagnostic commands to read necessary hardware revision numbers |
| 3 | Verify firmware versions | Diagnostic commands to read the firmware versions |

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|  | Image Acquire Test | | |
| This test will verify that the unit under test will complete an image acquisition. | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Acquire and transfer an image to the test PC. | Diagnostic commands to set exposure, and acquire and transfer an image to the test PC. |
| 2 | Run histogram on acquired image to verify image is reasonable (not all black, all white, etc.). | None |
| 3 | Fail unit under test if image doesn’t acquire, or image is unreasonable. | None |

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|  | Sensor Data Path Test | | |
| This test step will verify that none of the imager data lines are open/shorted (legacy test) | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Turn on wedge (linear gradient) pattern | Diagnostic commands to enable linear gradient pattern |
| 2 | Acquire and transfer an image to the test PC. | Diagnostic commands to acquire and transfer an image to the test PC. |
| 3 | Verify 8-bit data using histogram tool | None |
| 4 | Pass or fail the unit depending on the results. | None |

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|  | Hot Pixel Test | | |
| This test step will verify that the sensor of the unit under test has no hot pixels or hot pixel clusters (light pixels on a dark background). If pixel correction is required, the test will locate and retain the location of each hot pixel and/ or hot pixel cluster. | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Isolate the unit under test from any light sources. | None |
| 2 | Acquire an image and transfer it to the test PC | Diagnostic commands to set exposure, gain, offset, and acquire and transfer an image to the test PC. |
| 3 | Run an algorithm to detect hot pixels and hot pixel clusters | None |
| 4 | Pass or fail the unit depending on the results. |  |

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|  | Cold Pixel Test | | |
| This test step will verify that the sensor of the unit under test has no cold pixels or cold pixel clusters (dark pixels on a light background). If pixel correction is required, the test will locate and retain the location of each cold pixel and/ or cold pixel cluster. | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Supply diffuse light to the unit under test | None |
| 2 | Acquire an image and transfer it to the test PC | Diagnostic commands to set exposure, gain, offset, and acquire and transfer an image to the test PC. |
| 3 | Run an algorithm to detect Cold pixels and Cold pixel clusters | None |
| 4 | Pass or fail the unit depending on the results. | None |

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|  | Digital I/O Test | | |
| This test step will verify all I/O pins on the 50-pin external connector are functioning correctly. | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Activate/deactivate each interface pin | Diagnostic commands to enable or disable the outputs pins  Diagnostic commands to configure the configurable I/O pins Diagnostic commands to read the input pins |
| 2 | Verify expected response or state | None |
| 3 | Pass or fail the unit depending on the results. | None |

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|  | USB Communication Test | | |
| This test step will verify that the USB lines of the unit under test are operational. | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Open a USB serial connection to the unit under test. | Serial USB driver |
| 2 | Issue diagnostic commands to the unit under test over USB | Ability to run diagnostic commands over the USB connection |
| 3 | Pass or fail the unit depending on the results. | None |

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|  | Liquid Lens Connector Test | | |
| This test step will verify all pins on the internal illumination connector are functioning correctly using a custom test board – see the schematic for more information about this board and the test. | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Activate or communicate over each interface pin which are connected to the custom test board (note: same as liquid lens test board) | Diagnostic commands to turn on/off discrete pins  Diagnostic commands to communicate via raw I2C commands |
| 2 | Pass or fail the unit depending on the results. | None |

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| --- | --- | --- | --- |
|  | Illumination Connector Test | | |
| This test step will verify all pins on the liquid lens connector are functioning correctly using a custom test board – see the schematic for more information about the board and the test. | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Activate or communicate over each interface pin which are connected to the custom test board (note: same as liquid lens test board) | Diagnostic commands to turn on/off discrete pins  Diagnostic commands to communicate via raw I2C commands |
| 2 | Pass or fail the unit depending on the results. | None |

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|  | Aimer Test | | |
| This test step will verify the aimer LEDs are functioning correctly using a custom inspection board. | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Activate Aimer LEDs | Diagnostic commands to control the aimers |
| 2 | Verify expected response or state with inspection board | None |
| 3 | Pass or fail the unit depending on the results. | None |
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|  | Debris Test | | |
| This test step will verify that the optical path of unit under test is clean and free of debris. The test fixture will have the appropriate hardware necessary to detect debris. | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Acquire and transfer an image to the test PC. | Diagnostic commands to set exposure, and acquire and transfer an image to the test PC. |
| 2 | Run CVL vision job on the acquired image to detect debris blobs | None |
| 3 | Pass or fail the unit depending on the results. | None |

## Focus Test Stage

The lens needs to be focused to a specific distance. This stage handles the process of rotating the lens, until an optimal sharpness of the image is recorded.

Ideally this stage is performed at PCI only, and the focused lens modules can then be brought to the DCs for easy assembly. The unit is running diags at this stage.

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| --- | --- | --- | --- |
|  | Scan Label Step | | |
| Scan the label of the unit under test and store the values for later use. | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Prompt the operator to scan the product label using a handheld  barcode reader | None |
| 2 | Store the label information | None |

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| --- | --- | --- | --- |
|  | Connect to unit over RS232 Step | | |
| This step will initially connect to the unit under test (implicitly testing RS232 functionality) in order to determine the IP address. | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Open a serial connection to the unit under test (115.2, 8, N, 1) | Ability to run diagnostic commands over the RS232 connection |
| 2 | Send IP address request command to the unit under test and receive an expected response | Diagnostic command to query the IP address of the unit |
| 3 | Pass or fail the unit depending on the success |  |

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| --- | --- | --- | --- |
|  | Connect to unit over USB Step | | |
| This step will connect to the unit using USB to perform all tests. | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Open a USB connection to the unit under | Ability to run diagnostic commands over the USB connection |
| 2 | Send data to the unit under test and receive an expected response | Diagnostic command respond correctly to commands |
| 3 | Pass or fail the unit depending on the results |  |

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| --- | --- | --- | --- |
|  | Update Firmware Step (NPI only) | | |
| This step will verify the firmware version of the unit under test and update it if necessary. This step will be removed when the product is released to full production. The expectation is that the firmware will be pre-programmed at Beta/RTM. | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Query the current application, apploader and failsafe version of the unit under test | Diagnostic commands to perform the stated functions |
| 2 | Update the firmware, apploader and failsafe as necessary | Diagnostic commands to upload stated firmware |
| 3 | Pass or fail the unit depending on the results |  |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Configuration Test | | |
| This test will verify the device’s configuration information (serial number, MAC Address, part number, hardware revisions, firmware revisions etc.) on the unit under test. | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Verify the serial number & part number, and revision information | Diagnostic commands to read serial number, mac address, part number and revision information. |
| 2 | Verify any required hardware versions | Diagnostic commands to read necessary hardware revision numbers |
| 3 | Verify firmware versions | Diagnostic commands to read the firmware versions |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Image Acquire Test | | |
| This test will verify that the unit under test will complete an image acquisition. | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Acquire and transfer an image to the test PC. | Diagnostic commands to set exposure, and acquire and transfer an image to the test PC. |
| 2 | Run histogram on acquired image to verify image is reasonable (not all black, all white, etc.). | None |
| 3 | Fail unit under test if image doesn’t acquire, or image is unreasonable. | None |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Sensor Data Path Test | | |
| This test step will verify that none of the imager data lines are open/shorted (legacy test) | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Turn on wedge (linear gradient) pattern | Diagnostic commands to enable linear gradient pattern |
| 2 | Acquire and transfer an image to the test PC. | Diagnostic commands to acquire and transfer an image to the test PC. |
| 3 | Verify 8-bit data using histogram tool | None |
| 4 | Pass or fail the unit depending on the results. | None |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Focus Test | | |
| This test step will focus the unit under test to a specified focus distance | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Move the target to specified distance | Diagnostic commands to enable linear gradient pattern |
| 2 | Move the lens to a known position | None |
| 3 | Perform standard focus algorithm | Diagnostic command to acquire an averaged image (acquire and average ‘n’ images)  Diagnostic commands to set exposure and acquire and transfer the averaged image to the test PC. |
| 4 | Pass or fail the unit depending on the results. | None |

## Debris Test Stage

The engine has undergone a detailed debris check on the raw imager, but new debris could have been introduced before the lens was locked down. As a result, a post-focus debris test is required, and the most robust method of handling this is to pull out the debris test and create its own fixture. The engine would be tested as soon as the lens is locked down onto the engine.

Because the size of the handheld and fixed mount readers will vary tremendously, putting a debris test at the final stage would be very inconsistent between products. By creating a separate fixture and test, the spacing of the imager to debris hardware can be tightly controlled and optimized.

This stage would be performed at both PCI for high runner, fully assembled units and at the DCs for low volume, custom options. The unit is running diags at this stage.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Debris Test | | |
| This test step will verify that the optical path of unit under test is clean and free of debris. The test fixture will have the appropriate hardware necessary to detect debris. | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Acquire and transfer an image to the test PC. | Diagnostic commands to set exposure, and acquire and transfer an image to the test PC. |
| 2 | Run CVL vision job on the acquired image to detect debris blobs | None |
| 3 | Pass or fail the unit depending on the results. | None |

## Gold Finch DM8070 Final Test Stage

After the engine has been calibrated and assembled into the handheld reader, a final test must be performed to ensure any peripheral features are functional. These tests are designed to be go/no go, in order to create a quick, effective, multi-up test fixture.

This test stage would be at PCI for high runner assemblies, and at the DCs to allow for custom optics to be installed for specific customers. Because there is limited handheld support in diags, the units will be upgraded to a version of Dataman that supports both the DM8070 and the MX1500 final test stages.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Scan Label Step | | |
| Scan the label of the unit under test and store the values for later use. | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Prompt the operator to scan the product label using a handheld  barcode reader | None |
| 2 | Store the label information | None |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Connect to unit over Serial and Ethernet Step | | |
| This step will connect to the unit using USB to perform all tests. | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Connect over RS232 | Ability to run diagnostic commands over the USB connection |
| 2 | Send data to the unit under test and receive an expected response | Diagnostic command respond correctly to commands |
|  | As |  |
| 3 | Pass or fail the unit depending on the results |  |

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| --- | --- | --- | --- |
|  | Update Firmware Step (NPI only) | | |
| This step will verify the firmware version of the unit under test and update it if necessary. This step will be removed when the product is released to full production. The expectation is that the firmware will be pre-programmed at Beta/RTM. | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Query the current application, apploader and failsafe version of the unit under test | Diagnostic commands to perform the stated functions |
| 2 | Update the firmware, apploader and failsafe as necessary | Diagnostic commands to upload stated firmware |
| 3 | Pass or fail the unit depending on the results |  |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Label Configuration Test | | |
| This test will write and/or verify the device’s configuration information (serial number, MAC Address, part number, hardware revisions, firmware revisions etc.) on the unit under test. | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Write or verify the serial number & part number, and revision information | Diagnostic commands to read and write serial number, mac address, part number and revision information. |
| 2 | Write EEPROM information to the IO board | Diagnostic commands to read and write the IO board EEPROM. |
| 3 | Verify any required hardware versions | Diagnostic commands to read necessary hardware revision numbers |
| 4 | Verify firmware versions | Diagnostic commands to read the firmware versions |

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|  | Image Acquire Test | | |
| This test will verify that the unit under test will complete an image acquisition. | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Acquire and transfer an image to the test PC. | Diagnostic commands to set exposure, and acquire and transfer an image to the test PC. |
| 2 | Run histogram on acquired image to verify image is reasonable (not all black, all white, etc.). | None |
| 3 | Fail unit under test if image doesn’t acquire, or image is unreasonable. | None |

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| --- | --- | --- | --- |
|  | Sensor Data Path Test | | |
| This test step will verify that none of the imager data lines are open/shorted (legacy test) | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Turn on wedge (linear gradient) pattern | Diagnostic commands to enable linear gradient pattern |
| 2 | Acquire and transfer an image to the test PC. | Diagnostic commands to acquire and transfer an image to the test PC. |
| 3 | Verify 8-bit data using histogram tool | None |
| 4 | Pass or fail the unit depending on the results. | None |

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|  | Status LED Test | | |
| This test step will verify the functionality of the status LED, ring LEDs (if present), etc. | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Activate/deactivate each status LED pin | Diagnostic commands to turn on and off status LEDs. |
| 2 | Activate/deactivate any or LEDs | Diagnostic commands to turn on and off miscellaneous LEDs. |
| 3 | Pass or fail the unit depending on the results. | None |

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|  | Internal Illumination Test | | |
| This test step will verify the Internal illumination functionality. This is a go/no-go test, since all illumination modules will be tested and programmed elsewhere. | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Acquire an image with internal illumination turned on, UUT looking at a flat target. | Diagnostic commands to turn on and off internal illumination.  Diagnostic commands to adjust exposure and acquire and transfer an image to the test PC. |
| 2 | Verify expected response or state | None |
| 3 | Pass or fail the unit depending on the results. | None |

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|  | Liquid Lens Verification Test | | |
| This test step will verify the liquid lens connectivity. This is a go/no-go test, since all liquid lens modules will be tested and programmed elsewhere. | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Read the temperature sensor contents of the liquid lens | Diagnostic commands to read the liquid lens temperature sensor |
| 2 | Change liquid lens register value, unit responds indicating it correctly received the command | Diagnostic commands to change the liquid lens value |
| 3 | Pass or fail the unit depending on the results. | None |

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| --- | --- | --- | --- |
|  | Trigger Test | | |
| This test step will verify the functionality of the trigger | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Activate/De-activate trigger | None |
| 2 | Query the state of the trigger | Diagnostic commands to independently read the state of the trigger |
| 3 | Pass or fail the unit depending on the results. | None |

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|  | Slide – In Test | | |
| This test step will verify the unit can be powered and communicated to using the Ethernet and Serial slide ins. An Aachen designed PCB assembly can connect the UUT to two slide ins at the same time, and simply use software to toggle between each one. The Ethernet and serial are tested implicitly during setup, only USB and Bluetooth need to be tested. | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Check if USB communication is working properly | Diagnostic command to communicate to USB slide in |
| 2 | Check if Bluetooth Wifi is working properly | Diagnostic command to communicate to Bluetooth Wifi pin |
| 3 | Pass or fail the unit depending on the response from the UUT | None |
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|  | Beeper Test | | |
| This test step will verify the functionality of the beeper | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Activate the beeper at a specified frequency | Diagnostic commands to turn on and off the beeper at a specified frequency |
| 2 | Read the frequency and amplitude of the response | None |
| 3 | Pass or fail the unit depending on the results. | None |

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| --- | --- | --- | --- |
|  | Vibration Motor Test | | |
| This test step will verify the functionality of the beeper | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Activate the vibration motor | Diagnostic commands to turn on and off the vibration motor |
| 2 | Read the frequency and amplitude of the response | None |
| 3 | Pass or fail the unit depending on the results. | None |

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|  | Accelerometer Test | | |
| This test will verify that the accelerometer is capable of providing data to the UUT | | |
| **Strategy** | | **Diagnostic Requirements** |
| 1 | Query the accelerometer’s position | Diagnostic command to query the accelerometer |
| 2 | Pass or fail the unit if any position is recorded | None |

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| Diagnostic Firmware Requirements (Consolidated) |
| Diagnostic commands to allow for acquiring and transferring an image from the unit under test to the PC |
| Diagnostic commands to allow for programming of the exposure, gain, offset, and any other required image acquisition settings |
| Diagnostic commands to read the unit under test part number, serial number and revision information from the unit under test storage. |
| Diagnostic commands to write the unit under test’s serial number, part number and revision information to the unit under test’s storage. |
| Diagnostic commands to read all firmware versions |
| Diagnostic commands to write new firmware versions |
| Diagnostic commands to send and receive an arbitrary data packet over the Ethernet port |
| Diagnostic commands to send and receive an arbitrary data packet over the serial port |
| Diagnostic commands to read and write bad pixel information to the sensor board |
| Diagnostic commands to control each status LED individually |
| Diagnostic commands to read that the button is currently pressed |
| Diagnostic commands to read that the button is currently not pressed |
| Diagnostic commands to turn on discrete pins on the front illumination connector |
| Diagnostic commands to turn on discrete pins on the front liquid lens connector |
| Diagnostic commands to communicate via I2C |
| Diagnostic commands to turn on and off outputs pins |
| Diagnostic commands to configure the configurable I/O pins |
| Diagnostic commands to read input pins |
| Diagnostic commands to activate wedge pattern |
| Diagnostic commands to turn on and off Aimer LEDs |
| Diagnostic command to write register values to LL module |
| Diagnostic command to get temperature from temp sensor on LL module |
| Diagnostic command to query the accelerometer |
| Diagnostic command to check communication with Ethernet slide in |
| Diagnostic command to check communication with Serial slide in |