Stand Alone SMD – Testing and Verification

The following is a detailed report of each test on the SAS system. The tests may or may not be complete and will be clearly marked on the title page. Each test includes the purpose of the test, the measurements completed during the test, the procedure of setup and testing, the post processing of the data, and the final results of the test.

Included tests:

ADXL345	--- ---	COMPLETE
BMP085	--- ---	COMPLETE
DS1307	--- ---	COMPLETE
HIH6131	--- ---	COMPLETE
TEMT6000	--- ---	COMPLETE
LS20031	--- ---	COMPLETE
XBEE	--- ---	COMPLETE
LED	--- ---	COMPLETE
MAIN CONTROLLER	--- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- ---	COMPLETE
SECONDARY CONTROLLER	--- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- ---	COMPLETE
SD 1	--- ---	COMPLETE
SD 2	--- ---	COMPLETE

The full reports of each of the test follows.

Penn State USLI - LTRL
Component: ADXL345
Subsystem: Payload
Test Complete By: Nicholas Braskey
[3/15/2013]

COMPLETE: YES

RESULTS: PASS

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Purpose of Test

The purpose of this test is to ensure the ADXL345 Acceleration Sensor is working properly on the SAS System. Proper operation is necessary for accurate results with the system.

Test Measurements

Visual inspection of the collected data during testing will be sufficient in determining if this component is working properly.

Equipment List

1. SAS System
2. 9 volt battery
3. FTDI FT232RL USB connection
4. AVR Programmer

Test Procedure

Setup and Operating Description

A test program will be programmed onto the main microcontroller that will read values from the ADXL345 component and display them on the serial monitor. These values will be monitored while accelerations are exerted upon the system. Visual inspection of the reactions of increased acceleration will determine functionality of the component.

Test Setup Procedure

1. Load test program onto main microcontroller

Test Operating Procedure

1. Connect 9 volt battery
2. Visually inspect values displayed on serial monitor

Test Closeout Procedure

1. Disconnect 9 volt battery
2. Compare recorded values to local records to determine accuracy

Post Processing of Data

Visual inspection of the reactions of the ADXL345 component during testing will determine functionality of the component. The device should accurately recognize increased accelerations during testing.

Results of Test

After visual inspection of the received data the ADXL345 was able to detect acceleration due to gravity and detect large increases in acceleration which represent powered ascent in the vehicle. This test has passed

Penn State USLI - LTRL
Component: BMP085
Subsystem: Payload
Test Complete By: Nicholas Braskey
[3/08/2013]

COMPLETE: YES

RESULTS: PASS

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Purpose of Test

The purpose of this test is to ensure the BMP085 Barometric Pressure Sensor is working properly on the SAS System. Proper operation is necessary for accurate results with the system.

Test Measurements

Visual inspection of the collected data and comparison to current local records will be sufficient in determining if this component is working properly.

Equipment List

1. SAS System
2. 9 volt battery
3. FTDI FT232RL USB connection
4. AVR Programmer

Test Procedure

Setup and Operating Description

A test program will be programmed onto the main microcontroller that will read values from the BMP085 component and display them on the serial monitor. These values can then be compared to the local records to determine the accuracy of the unit.

Test Setup Procedure

1. Load test program onto main microcontroller

Test Operating Procedure

1. Connect 9 volt battery
2. Visually inspect values displayed on serial monitor

Test Closeout Procedure

1. Disconnect 9 volt battery
2. Compare recorded values to local records to determine accuracy

Post Processing of Data

Visual comparison of data from SAS System compared to local records can determine the accuracy of the BMP085 component. If the data recorded closely matched that of local conditions this device will be considered to be operating correctly..

Results of Test

After completing the test the BMP085 was able to accurately calculate current pressure, temperature, and altitude. The BMP085 was able to detect altitude changes as low as one or two meters. This test has passed.

Penn State USLI - LTRL
Component: DS1307
Subsystem: Payload
Test Complete By:
[3/13/2013]

COMPLETE: YES

RESULTS: PASS

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Purpose of Test

The purpose of this test is to ensure the DS1307 Real Time Clock is working properly on the SAS System. Proper operation is necessary for accurate results with the system.

Test Measurements

Visual inspection of the responding data and comparison to current local records will be sufficient in determining if this component is working properly.

Equipment List

1. SAS System
2. 9 volt battery
3. FTDI FT232RL USB connection
4. AVR Programmer

Test Procedure

Setup and Operating Description

A test program will be programmed onto the main microcontroller that will allow the user to program the current date and time to the DS1307 component followed by displaying them on the serial monitor. These values can then be compared to the local records over time to determine the accuracy of the unit.

Test Setup Procedure

1. Load test program onto main microcontroller

Test Operating Procedure

1. Connect 9 volt battery
2. Connect FTDI FT232RL USB connection
3. Program the current date and time to the DS1307
4. Visually inspect the responding date and time over a time period of 20 minutes. Checking every 5 minutes

Test Closeout Procedure

1. Disconnect 9 volt battery

Post Processing of Data

Visual comparison of the date and time during the test period will be sufficient in evaluating the accuracy of the DS1307 component. Accurate readings at all points during the test period will determine whether the test is considered as passed.

Results of Test

After visual inspection the DS1307 was able to accurately be programmed within two seconds of desired time. The clock the consistently kept accurate time throughout further testing.

Penn State USLI - LTRL
Component: HIH6131
Subsystem: Payload
Test Complete By: Nicholas Braskey
[3/08/2013]

COMPLETE: YES

RESULTS: PASS

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Purpose of Test

The purpose of this test is to ensure the HIH6131 Humidity sensor is working properly on the SAS System. Proper operation is necessary for accurate results with the system.

Test Measurements

Visual inspection of the collected data and comparison to current local records will be sufficient in determining if this component is working properly.

Equipment List

1. SAS System
2. 9 volt battery
3. FTDI FT232RL USB connection
4. AVR Programmer

Test Procedure

Setup and Operating Description

A test program will be programmed onto the main microcontroller that will read values from the HIH6131 component and display them on the serial monitor. These values can then be compared to the local records to determine the accuracy of the unit.

Test Setup Procedure

1. Load test program onto main microcontroller

Test Operating Procedure

1. Connect 9 volt battery
2. Visually inspect values displayed on serial monitor

Test Closeout Procedure

1. Disconnect 9 volt battery
2. Compare recorded values to local records to determine accuracy

Post Processing of Data

Visual comparison of data from SAS System compared to local records can determine the accuracy of the HIH6131 component. If the data recorded closely matched that of local conditions this device will be considered to be operating correctly.

Results of Test

The HIH6131 component was able to measure relative humidity and temperature to within 10% accuracy. Adjustments will be made to calibration functions to attempt to decrease that error. This test has shown that the HIH6131 component is working and recording values. This test is passed.

Penn State USLI - LTRL
Component: TEMT6000
Subsystem: Payload
Test Complete By: Nicholas Braskey
[DATE]

COMPLETE: YES

RESULTS: PASS

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Purpose of Test

The purpose of this test is to verify that the analog light sensor TEMT6000 is detecting light levels on the SAS System

Test Measurements

A test program that reads the sensor's value and displays the recorded value through the serial monitor will be used for visual verification. The sensor will be exposed to high and low levels of light and the values recorded will be verified.

Equipment List

1. SAS System
2. 9 volt battery
3. AVR Programmer
4. FTDI FT232RL USB connection

Test Procedure

Setup and Operating Description

Once the test program is loaded to the main microcontroller the light sensor will be exposed to several different light levels. Visual verification of the change in the recorded value will be sufficient to verify that the light sensor is detecting light variation correctly.

Test Setup Procedure

1. Program main microcontroller

Test Operating Procedure

1. Connect 9 volt battery
2. Connect FTDI FT232RL USB connection
3. Visually inspect values on serial monitor
4. Adjust light levels and verify changes in detected values

Test Closeout Procedure

1. Remove 9 volt battery

Post Processing of Data

Visual inspection of changes in detected values corresponding to changes in light levels will be sufficient to verify that the light sensor is detecting changes in light levels.

Results of Test

The light sensor detected light levels and all changes accurately. TEMT6000 has PASSED

Penn State USLI - LTRL
Component: LS20031
Subsystem: Payload
Test Complete By: Nicholas Braskey
[3/07/2013]

COMPLETE: YES

RESULTS: PASS

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Purpose of Test

The purpose of this test is to ensure the LS20031 GPS Unit is working properly on the SAS System. Proper operation is necessary for accurate results with the system.

Test Measurements

Visual inspection of the responding data and analysis of location on mapping software will determine the accuracy of the unit.

Equipment List

1. SAS System
2. 9 volt battery
3. FTDI FT232RL USB connection
4. LS20031 GPS Unit
5. AVR Programmer

Test Procedure

Setup and Operating Description

A test program will be programmed onto the main microcontroller that will display the GPS NMEA statements through the serial monitor. These statements can then be imported to mapping software and the accuracy of the unit can be analyzed.

Test Setup Procedure

1. Load test program onto main microcontroller
2. Connect LS20031 Unit to SAS System

Test Operating Procedure

1. Connect 9 volt battery
2. Connect FTDI FT232RL USB connection
3. Allow LS20031 GPS Unit to acquire a connection to satellites.
4. Allow sufficient amount of NMEA statements to be collected on serial monitor

Test Closeout Procedure

1. Disconnect FTDI FT232RL USB connection
2. Disconnect 9 volt battery
3. Disconnect LS20031 GPS Unit

Post Processing of Data

The collected statements will be imported to mapping software to analyze the measured location of the device. Visual inspection of the accuracy of the GPS unit will be sufficient to determine if this unit is working properly

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Results of Test

The LS20031 GPS unit was able to record NMEA statements that mapped the SAS Systems location to approximately ten feet of its actual location. The GPS Unit appeared to be working very accurately. This component test has passed.

Penn State USLI - LTRL
Component: XBEE
Subsystem: Payload
Test Complete By: Nicholas Braskey
[3/07/2013]

COMPLETE: YES

RESULTS: PASS

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Purpose of Test

The purpose of this test is to verify that the wireless communication protocol is working correctly. The wireless communication will allow for all data to be reported back to the team's ground station during the vehicle's flight.

Test Measurements

This test will use visual verification to determine its results. The main microcontroller will be set to continuously send a string "Test: " along with a integer that increments with each send. There will be a paired XBEE device connected to a serial monitor on a computer receiving the string and integer. The serial monitor should display matching values.

Equipment List

1. SAS System
2. 9 volt battery
3. XBEE transmitting device
4. XBEE receiving device
5. FTDI FT232RL USB connection

Test Procedure

Setup and Operating Description

A test program that sends the string "Test: " and an incrementing integer will be loaded onto the main microcontroller. The sending XBEE unit will then be attached to that device. The receiving XBEE device, connected to the computer's serial monitor, should then receive matching values. Upon visual inspection we can determine if the wireless communication protocol is working properly.

Test Setup Procedure

1. Load test program onto main microcontroller
2. Attach sending XBEE device to SAS System
3. Attach receiving XBEE device to FTDI FT232RL USB connection

Test Operating Procedure

1. Connect 9 volt battery
2. Visually inspect incoming values on serial monitor

Test Closeout Procedure

1. Disconnect 9 volt battery
2. Disconnect both XBEE devices

Post Processing of Data

Visual inspection of incoming values will verify that wireless communication is working properly. Serial monitor should read a string "Test: " followed by an incrementing integer.

Results of Test

The serial monitor on the computer was successfully able to receive the string “Test: “ followed by an incrementing integer sent from the wireless communication system on board the SAS System. This test has passed.

Penn State USLI - LTRL
Component: LED
Subsystem: Payload
Test Complete By: Nicholas Braskey
[3/06/2013]

COMPLETE: YES

RESULTS: PASS

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Purpose of Test

To test the RGB LED component is fully functional

Test Measurements

The RGB LED component needs to be fully functional for easy identification of the systems current stage. All three color modes of the component must be fully functional and easy to see and identify for accurate use.

Equipment List

1. SAS System
2. 9 volt battery
3. AVR programmer

Test Procedure

Setup and Operating Description

The SAS System's Main Controller will be loaded with a program that flashes each color of the RGB LED component with a delay in between each color. Visual inspection will determine whether the component is functioning correctly.

Test Setup Procedure

1. Load prepared program to SAS System
2. Obtain charged 9 volt battery

Test Operating Procedure

1. Connect 9 Volt battery to SAS System
2. Visually inspect all three colors of RGB LED component

Test Closeout Procedure

1. Remove 9 volt battery from SAS System

Post Processing of Data

Visual inspection is sufficient enough to determine whether this component is working properly

Results of Test

After completing the steps outlined in this test report the RGB LED functioned properly. All three color modes of the LED illuminate correctly and brightly enough to be seen from the vehicles body. This component test has PASSED.

Penn State USLI - LTRL
Component: Main Controller
Subsystem: Payload
Test Complete By: Nicholas Braskey
[3/05/2013]

COMPLETE: YES

RESULTS: PASS

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Purpose of Test

The purpose of this test is to determine if the main microcontroller system is working properly. This test is required as the main microcontroller is the center of the SAS System. It and its peripherals must be working properly for the system to function.

Test Measurements

The main microcontroller will be tested along with its serial communication capabilities. If the microcontroller can correctly load several test functions and send and receive serial communications correctly then the test will be considered passed. This can be determined using visual inspection

Equipment List

1. SAS System
2. 9 volt battery
3. AVR Programmer
4. FTDI FT232RL USB connection

Test Procedure

Setup and Operating Description

The main microcontroller will be programmed with several test programs to determine if it can successfully be reprogrammed and if serial communication functions properly. Visual inspection is sufficient enough to determine if the test was successful.

Test Setup Procedure

1. No initial setup required

Test Operating Procedure

1. Remove FTDI FT232RL USB connection (if connected)
2. Remove 9 volt battery (if connected)
3. Connect AVR Programmer
4. Upload program
5. Remove AVR Programmer
6. Connect 9 volt battery
7. Connect FTDI FT232RL USB connection
8. Open serial monitor
9. Visually inspect the communication between microcontroller and serial monitor
10. Repeat steps 1 – 9 for each test program

Test Closeout Procedure

1. Remove FTDI FT232RL USB connection
2. Remove 9 volt battery

Post Processing of Data

Visual inspection of serial communication during each program test is sufficient enough to determine the results of this test. If serial communication is successful with each programming then the main controller is operating correctly.

Results of Test

The main controller was able to successfully communication through the serial connection with each program. This test has PASSED

Penn State USLI - LTRL
Component: Secondary Controller
Subsystem: Payload
Test Complete By: Nicholas Braskey
[DATE]

COMPLETE: YES

RESULTS: PASS

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Purpose of Test

The purpose of this test is to determine if the secondary microcontroller system is working properly. This test is required as the secondary microcontroller is responsible for image collecting on the SAS System. It and its peripherals must be working properly for this system to function.

Test Measurements

The secondary microcontroller will be tested along with its serial communication capabilities. If the microcontroller can correctly load several test functions and send and receive serial communications correctly then the test will be considered passed. This can be determined using visual inspection

Equipment List

1. SAS System
2. 9 volt battery
3. AVR Programmer
4. FTDI FT232RL USB connection

Test Procedure

Setup and Operating Description

The secondary microcontroller will be programmed with several test programs to determine if it can successfully be reprogrammed and if serial communication functions properly. Visual inspection is sufficient enough to determine if the test was successful.

Test Setup Procedure

1. No initial setup required

Test Operating Procedure

1. Remove FTDI FT232RL USB connection (if connected)
2. Remove 9 volt battery (if connected)
3. Connect AVR Programmer
4. Upload program
5. Remove AVR Programmer
6. Connect 9 volt battery
7. Connect FTDI FT232RL USB connection
8. Open serial monitor
9. Visually inspect the communication between microcontroller and serial monitor
10. Repeat steps 1 – 9 for each test program

Test Closeout Procedure

1. Remove FTDI FT232RL USB connection
2. Remove 9 volt battery

Post Processing of Data

Visual inspection of serial communication during each program test is sufficient enough to determine the results of this test. If serial communication is successful with each programming then the secondary controller is operating correctly.

Results of Test

The secondary controller was able to successfully communication through the serial connection with each program. This test has PASSED

Penn State USLI - LTRL
Component: SD 1
Subsystem: Payload
Test Complete By: Nicholas Braskey
[3/06/2013]

COMPLETE: YES

RESULTS: PASS

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Purpose of Test

The purpose of this test is to determine if the SD card connection to the Main Controller is properly working

Test Measurements

This test is necessary to determine if the main controller can accurately record data to the SD card for later analysis.

Equipment List

1. SAS System
2. 9 volt battery
3. Micro SD card
4. AVR programmer

Test Procedure

Setup and Operating Description

A program will be uploaded to the main microcontroller that opens a file on the SD card, writes a string "Testing" to the card, then closes the card. We will then remove the card and check the file on a computer. If the file on the SD card contains a matching string then the test has been successful.

Test Setup Procedure

1. Clear data from SD card
2. Create a file titled "log.txt" on SD card
3. Program main microcontroller with test program

Test Operating Procedure

1. Insert SD card into slot 1 on SAS System
2. Connect 9 volt battery to SAS System

Test Closeout Procedure

1. Allow sufficient time for data to be written to SD card
2. Remove 9 volt battery from SAS System
3. Remove SD card from SAS System
4. Insert SD card into computer and analyze file

Post Processing of Data

Visual inspection of the file on a computer is sufficient enough to determine if the SD card system is working properly. If a matching string is saved in the file the test was successful.

Results of Test

The test was completed multiple times in which the string was copied to the SD card each time. The test has PASSED

Penn State USLI - LTRL
Component: SD 2
Subsystem: Payload
Test Complete By: Nicholas Braskey
[3/06/2013]

COMPLETE: YES

RESULTS: PASS

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Purpose of Test

The purpose of this test is to determine if the SD card connection to the Secondary Controller is properly working

Test Measurements

This test is necessary to determine if the secondary controller can accurately record images to the SD card for later analysis.

Equipment List

1. SAS System
2. 9 volt battery
3. Micro SD card
4. AVR programmer

Test Procedure

Setup and Operating Description

A program will be uploaded to the secondary microcontroller that opens a file on the SD card, writes a string "Testing" to the card, then closes the card. We will then remove the card and check the file on a computer. If the file on the SD card contains a matching string then the test has been successful.

Test Setup Procedure

1. Clear data from SD card
2. Create a file titled "log.txt" on SD card
3. Program secondary microcontroller with test program

Test Operating Procedure

1. Insert SD card into slot 2 on SAS System
2. Connect 9 volt battery to SAS System

Test Closeout Procedure

1. Allow sufficient time for data to be written to SD card
2. Remove 9 volt battery from SAS System
3. Remove SD card from SAS System
4. Insert SD card into computer and analyze file

Post Processing of Data

Visual inspection of the file on a computer is sufficient enough to determine if the SD card system is working properly. If a matching string is saved in the file the test was successful.

Results of Test

The test was completed multiple times in which the string was copied to the SD card each time. The test has PASSED