### SPARK DIGITAL BOARD TEST PROCEDURE

\*This is a Manufacturer’s Document related to a product that has been approved by a notifying body for use in an explosive environment.  This document shall be reviewed by Engineering and the ISP Manager before it is released or revised.  Any changes to this document could result in modifications to approved design that could result in an unsafe condition.

**1.0 PURPOSE AND SCOPE**

This document describes the test procedure for verifying that the Spark digital board is functioning within specified parameters. All employees who have responsibility for testing this component are required to follow the instructions detailed in this procedure.

**2.0 AFFECTED DEPARTMENTS**

Manufacturing

**3.0 REFERENCE DOCUMENTS**

* Current revision schematics and assembly drawings for the digital board (A705.11, A705.21 or A706.11).
* Current SPARK & BLAZE user manual.

**4.0 RESPONSIBILITIES & AUTHORITY**

The technician has the following responsibilities and authority:

* Verify compliance of the product under test to specifications.
* Troubleshoot and correct product as required.
* Communicate concerns to the Supervisor of Quality Assurance.
* Request management review of product concerns.
* Follow established ESD standards.

**5.0 DEFINITIONS**

The term “digital board” will be used in this document to refer to board assemblies A705.11, A705.21 or A706.11.

**6.0 SAFETY PRECAUTIONS**

Safety glasses are required when soldering, lead clipping, or testing power supplies.

**7.0 EQUIPMENT AND MATERIALS**

## DC Power Supply.

## Spark Programming Cable (AVRISP mkII) or equivalent.

* IR Communications interface module (DVX008 IR Dongle) or equivalent.
* IRTest.exe Windows Software (In the Engineering Firmware folder for the Spark family).
* Current BLAZE Windows Software.
* Oscilloscope with DC Voltmeter and Frequency Counter or equivalent instruments.
* Computer (PC that is compatible with Windows ME, 2000, XP or later).
* Current revision digital board.

**8.0 INSTRUCTIONS**

**8.1 Inspection**

1. Inspect the board for missing parts, solder shorts, or unsoldered parts.
2. If this will be an ATEX unit, check the intrinsically safe critical parts listed on the loading diagram. These need to be checked to verify they are the correct parts and the final checklist for this unit marked to signify you have checked these.
3. If this will be an ATEX unit, write down the batch code number that should be on a sticker on the board. This number needs to be entered on the final checklist.

**8.2 Measure the Current Draw of the Digital Board**

1. Setup the DC power supply with the voltage = 3V and the current limit = 1.0A (Do this if the power supply used has current limiting capability).
2. Connect the power supply leads to the battery-input terminals of the digital board. Tin the terminals as necessary.
3. The board should be drawing less than 10mA (1mV through a .1Ω resistor), but because the board is not programmed it powers up in random states. If it is drawing slightly more than 10mA, continue with the procedure and after step 8.3 recheck the current draw and make sure it is less than 10mA.
4. Disconnect the power.
	1. **Load Firmware**
		1. **Using AVRISP mkII (ATmega128 chip)**
5. To load firmware the AVRISP mkII programmer is connected to the PC using the supplied USB cable. Connect AVRISP mkII to the Spark Digital board using the constructed programmer cable.
6. If not already installed, run the AVRCommandlineTools.exe in the SparkProgrammer folder on the shared network drive to install the programming software and drivers.
7. Using the SparkProgrammer.exe tool (must be ran as Administrator) found in the same directory, select proper Spark model. Only the most common models are listed. If another model version is needed click the IC icon to open it.
8. NOTE: new boards with a blank ATmega128 chip require additional fuse bits to be programmed. Check the **New Chip** checkbox to program the fuse bits during the programming.
9. Click Go. The progress bar should turn green when done. The two numbers next to the bar indicate the number tested and the number successful.
10. Instruments with the ATmega103 chip cannot be programmed with this tool and must use the other programmer.

**8.3.2 Using Kanda AVRISP-U (ATmega103 chip)**

1. Connect the programming cable to the Spark Digital board’s 20 pin connector, P1. Make sure pin 1 of the cable’s male connector matches pin 1 of the digital board 20 pin female connector.
2. Set the power supply from 3.3V to 4.5V. Older ATmega103 chip may require higher voltage to properly program, adjust the power supply accordingly. Connect the power supply to the DC barrel connector of the programming cable.
3. Using AVRISP-U program supplied with the programmer:
* If not already selected, select AVRISP-U from the Hardware drop down menu.
* If not already selected, select ATmega103 from the Device drop down menu.
* Open the firmware file with **File > Load > Flash... (Ctrl+O)**
* Verify the Flash memory display is updated.
* Click on the **Fuses & Lock Bits** tab.
* Select **Mode 3 - No Further Reads or Writes** from the Lock bits drop down menu.
* If not already set, open the **Device -> Auto Program Options…** and ensure only the following check boxes are checked:
	+ Reload Files
	+ Erase Device
	+ Program Flash Memory
	+ Flash Verification
	+ Program Lockbits
	+ Run
* Program the chip with **Device > Auto Program (F5)**

Note: Some custom firmware versions have different part numbers. Refer to the custom firmware in the directory for these part numbers.

If programming fails, or errors are reported, fix the problem before proceeding.

**Version 2.XX is located in the Engineering Firmware Directory\Spark\**

|  |  |
| --- | --- |
| **Model** | **Firmware** |
| 703 | 703-ATEX | 703.a90 |
| 703+ | 703+-ATEX | 703P.a90 |
| 704 | 704-ATEX | 704.a90 |
|  |  |  |
| 705 | 705-ATEX | 705.a90 |
| 705+, 705M+ | 705+-ATEX | 705P.a90 |
|  |  |  |
| 706 | 706-ATEX | 706.a90 |
| 706RC | 706RC-ATEX | 706RC.a90 |

NOTE: 2.XX is the currently released firmware version.

**8.4 Setup the Digital Board for Communication with IRTest.exe**

1. Setup the DC power supply with the voltage = 3.0V and the current limit = 1.0A. (Do this if the power supply used has current limiting capability). Connect the power supply leads to the battery-input terminals of the digital board.
2. Short pins 1 and 2 of the digital board 20 pin female connector in one of two ways:
* Connect the digital board to an analog board. Use the analog board that this digital board will be paired with permanently.
* Use a jumper wire.

This jumper wire or analog board will enable IR communications.

1. Place the digital board in front of the IR interface module.

**8.5 Test the Digital Board Flash Data Memory**

Note: Steps 8.5 through 8.6 can be performed automatically with the SparkIRDigiTest.exe tool in the SparkProgrammer folder of the shared network drive.

Note: The following commands are case sensitive.

Open IRTest.exe. Refer to the SPARK/BLAZE user manual to configure com port settings for the IR communications interface module.

Verify that the data flash ICs are functioning properly by using the following commands in IR Test.

Send **R07** to test the data flash. The response should be as shown in the following table.

|  |  |
| --- | --- |
| **Model** | **R07 Response** |
| 704, 704-ATEX | 0, 0 |
|  |  |
| 703, 703-ATEX | 4194304, 0 |
| 703+, 703+-ATEX |
| 705, 705-ATEX |
| 705+, 705+-ATEX |
| 706, 706-ATEX |
| 706RC,706RC-ATEX |

If the response to the R07 command doesn’t match the number shown in the table above, then memory is already being stored in the chips, or one or both flash ICs are not functioning properly (i.e. bad solder joint, bad IC, defective PC board, etc.).

If a number other than “0” is shown on the right, and the two numbers add to 4194304, there is data stored in memory. Repair any problems.

**8.6 Program Digital Board Serial Number**

1. Store the next available serial number in the digital board with following commands. The commands are sent via the IRTest.exe program.
	1. Send **R03** and verify that the current production firmware version has been loaded in the instrument.
	2. Send **u82xxxxx** – xxxxx is the serial number. The new serial number will be shown in the result window. Note: for ATEX units leave off the first two digits (the year code) see below.
	3. Press the **Refresh** button on the IRTest program and verify that the serial number has changed to the desired number in the “Available IR Devices” window.
	4. Send **u42** to store the serial number in the micro-controller’s EEPROM. If successful, a zero will show in the result window and the correct serial number will be showing.

Specified Serial Number Ranges are found in the following table.

|  |  |
| --- | --- |
| **Product** | **Serial Numbers** |
| 703 version 1.XX | 10000 – 10299 |
|  |  |
| 706 version 1.XX | 00000 – 00299 |
|  |  |
| Version 2.XX Products |
| 703703-ATEX | 10300 – 1199912000 – 13999 |
| 703+703+-ATEX | 20000 – 2399924000 – 29999 |
| 704704-ATEX | 14000 – 1599916000 – 16999 |
|  |  |
| 705705-ATEX | 30000 – 3199932000 – 33999 |
| 705+705+-ATEX | 40000– 41999, 44000– 4999942000 – 43999 |
| 705M+ | 50000-50999 |
|  |  |
| 706706-ATEX | 00300 – 0399904000 – 09999 |
| 706RC706RC-ATEX | 17000 – 1899919000 – 19999 |

**8.7 Verify the Real Time Clock Operation (Not necessary for 704)**

1. Use the Windows Blaze software to set the time and date on the digital board. Connect to Blaze and set the instrument time to match the computer time (Synchronize to computer time).
2. Verify that the “Instrument time” is set and within a second of the “Computer time”.
If the instrument time does not set, or loses synchronization after a few seconds, fix the problem before proceeding.
3. Disconnect from Blaze.
	1. **Check IR Current Draw (Only required for 705 / 705+ (-ATEX))**
4. With an analog board connected in Blaze, calibrate the unit and measure the current draw while calibrating. If the average current draw while calibrating is measured with an Agilent 34410A, or equivalent, is greater than the limits in the table below, replace the Infrared Transceiver.

|  |  |  |
| --- | --- | --- |
| **Model** | **Power Supply** | **Maximum Allowed Average Current** |
| **Voltage** | **Current Limit** |
| 705 | 1.50V | 500mA | 61mA |
|  705+ |
|  |  |  |  |
| 705-ATEX | 1.50V | 500mA | 62mA |
| 705+-ATEX |

**9.0 INSPECTION**

No further inspection of the digital board is required at this time.

**10.0 RECORDS**

The serial number that was loaded into the digital board will be recorded when a serial record is created for this instrument.

ATEX batch code number is entered on the final checklist.

**11.0 DISTRIBUTION**

This instruction is available electronically in the online Document Control area.

**12.0 ATTACHMENTS**

Not applicable to this procedure.

**13.0 REVISION HISTORY**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DCO #** | **REV** | **DATE** | **INITIALS** | **CHANGES MADE** |
| 1856 | A | 10/09/18 | JGG | Initial release of intrinsic safe procedure. This is an updated version of D0001.8131. Added Inspection steps to note the batch codes of ATEX boards that are required on the final checklist. Changed a step that had the Technician change a resistor if the IR current was too high. Added intrinsic safe note. Added –IS to the end of the document number. |
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