Acceptance Test Data Sheets

For

Skyryse Flight OS LEMA TPX 325

|  |  |
| --- | --- |
| LEMA Assembly Part Number | Serial Number |
|  | SERNO |

6.1. **Visual Examination of the Product**

Case of units coming from field without a rig bar, do we need to include a manual rig to get it close

|  |  |
| --- | --- |
| UUT conforms to the requirements of paragraph 6.1 | \_\_\_\_\_\_\_\_\_\_\_\_ |

6.2 **Weight**

|  |  |
| --- | --- |
| UUT weight should not exceed 10 lbs | actual weight \_\_\_\_\_ lbs |

**6.3 Bonding**

Bonding resistance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Expected** | **Tolerance** | **Simplex** | **Duplex** |
|  | (mOhms) | (mOhms) | (mOhms) | (mOhms) |
| Motor End Cap |  |  |  |  |
| Solenoid housing |  |  |  |  |
| Encoder cover |  |  |  |  |

6.4 Resistance and Inductance Test (motor and solenoid)

**Resistances:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Expected** | **Tolerance** | **Connector J1** | **Connector J2** | **Connector J3** |
| Pins | Resistance (Ohms) | Resistance (Ohms) | Resistance (Ohms) | Resistance (Ohms) | Resistance (Ohms) |
| E to F |  |  |  |  |  |
| F to G |  |  |  |  |  |
| G to E |  |  |  |  |  |
| A to L |  |  |  |  |  |
| G,F,E,A,L tied together to chassis grounds. Apply 500VDC |  |  |  |  |  |

**Inductances:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Expected** | **Tolerance** | **Connector J1** | **Connector J2** | **Connector J3** |
|  |  |  | Inductance(mH) | Inductance(mH) | Inductance(mH) |
| E to F |  |  |  |  |  |
| F to |  |  |  |  |  |
| G to E |  |  |  |  |  |
| A to L |  |  |  |  |  |

6.5 **Power ON UUT Checks**

Confirm all sensors are reporting nominal values and no faults reported

Delete? Does this matter before power

|  |  |  |
| --- | --- | --- |
| Sensor | Value | Pass/Fail |
| Motor 1 | VALUE | RESULTS |
| Motor 2 | VALUE | RESULTS |
| Motor 3 | VALUE | RESULTS |
| M1 | VALUE | RESULTS |
| M2 | VALUE | RESULTS |
| M3 | VALUE | RESULTS |
| Faults 1 | VALUE | RESULTS |
| Faults 2 | VALUE | RESULTS |
| Faults 3 | VALUE | RESULTS |

6.7 **Functional Check Out**

6.7.1 **MCE1, MCE 2, MCE3 Power Up**

|  |  |  |  |
| --- | --- | --- | --- |
| Description | Ballnut position | Pass/Fail | |
| MCE 1 reports values for Ballnut position and motor current | POSITION | Ballnut Position | Current |
| RESULTS | VALUE |
| (Simulated) FCC/reports values for M1(QPS) | POSITION | RESULTS | VALUE |
| MCE 2 reports values for Ballnut position and motor current | POSITION | RESULTS | VALUE |
| (Simulated) FCC/reports values for M2(QPS) | POSITION | RESULTS | VALUE |
| MCE 3 reports values for Ballnut position and motor current | POSITION | RESULTS | VALUE |
| (Simulated) FCC/reports values for M3(QPS) | POSITION | RESULTS | VALUE |

6.7.2 **N1 and N2 Extend Mechanical Stops and MCE Rigging**

**CALIBRATION ADDITON TO MCE (NEW)**

**Step 6.7.2.1** **Extend using M1/N1**

|  |  |  |
| --- | --- | --- |
| Description | Value | Pass/Fail |
| N1 extend stop engaged (M1 current saturated) | <CODE> | <RESULTS> |
| MCE 1 Motor Current 4.5 +/- 0.15 Amps | <AMPS> Amps | <RESULTS> |
| Linear Encoder Value | <INCHES> | <RESULTS> |
| N1 is Rigged | RESULTS> | RESULTS> |

**Step 6.7.2.2** **Extend using M2/N2**

|  |  |  |
| --- | --- | --- |
| Description | Value | Pass/Fail |
| N2 extend stop engaged (M2 current saturated) | <CODE> | <RESULTS> |
| MCE2 Motor Current 4.5 +/- 0.15 Amps | <AMPS> Amps | <RESULTS> |
| Linear Encoder Value | <INCHES> | <RESULTS> |
| N2 (Motor 2) is Rigged | RESULTS> | RESULTS> |
| N2 (Motor 3) is Rigged | RESULTS> | RESULTS> |

6.7.3 **N1 and N2 Stroke Check**

|  |  |  |  |
| --- | --- | --- | --- |
| Pin to pin Length is 16.732 +/- TBD (ins) | Pin to Pin Length | | Pass/Fail |
|  | |  |
| Description | Actual Value N1 | Actual Value N2 | Pass/Fail |
| N1 and N2 at NULL | <VALUE> | <VALUE> | <RESULTS> |
| N2 at -0.575 ins from Null using M2 | <VALUE> | <VALUE> | <RESULTS> |
| N1 at +1.725 ins from Null using M1 | <VALUE> | <VALUE> | <RESULTS> |
| N1 at -0.575 ins from Null using M1 | <VALUE> | <VALUE> | <RESULTS> |
| N2 at +1.725 ins from NULL using M2 | <VALUE> | <VALUE> | <RESULTS> |
| N2 at +1.725 ins from Null using M3 | <VALUE> | <VALUE> | <RESULTS> |
| N2 at -0.575 ins from Null using M3 | <VALUE> | <VALUE> | <RESULTS> |
| N1 and N2 at NULL (using M3 Motor) | <VALUE> | <VALUE> | <RESULTS> |

Change table to display full retraction and extension

**MOTOR 1**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Description | Expected | Tolerance | Actual | Pass/fail |
| Constant Velocity | <EXPECT> |  | <VELOCITY> |  |
| Delta between Motor Position and M position is less than +/- TDB | M1Delta\_IN\_LinearEncoder\_EXT  Different for each motor  Motor1 linencoder  motorQPS1 (m1) | M1Delta\_IN\_tolerance (M1, M2, M3) seperate |  |  |
| MOTOR CURRANT SMOOTH (UC) |  |  |  |  |
| Standard Deviation Current | <STDEV> |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Description | Expected Difference from Test rig encoder | Tolerance | Difference from Test rig encoder | Pass/Fail |
| One of these tables for each moor  Motor1 position + Motor 2 position = test rig encoder | MTR1\_MTR2=LIN\_EXP | MTR1\_MTR2=LIN\_TOL | <INCHES>  M!MTR1\_MTR2=LIN | <RESULTS> |
| Motor1 position + Motor 3 position = test rig encoder |  |  | <INCHES> | <RESULTS> |
| M1 position + M2 position = test rig encoder | QPS1\_QPS2=LIN\_EXP |  | <INCHES>  M1QPS1\_QPS2=LIN | <RESULTS> |
| M1 position + M3 position = test rig encoder |  |  | <INCHES> | <RESULTS> |
| Difference between Motor 2 position and Motor 3 position is < TBD ins |  |  | <INCHES>  M1DIFF MTR2 MTR3 | <RESULTS> |
| Difference between M2 position and M3 position is < TBD ins | QPS2 QPS3-EXP |  | <INCHES>  M1DIFF MTR1 QPS1 | <RESULTS> |
| Difference between Motor 1 position and M1 position is < 0.10 ins | DIFF MTR1 QPS1\_EXP |  | <INCHES> | <RESULTS> |
| Difference between Motor 2 position and M2 position is < TBD ins | DIFF MTR2 QPS2\_EXP |  | <INCHES> | <RESULTS> |
| Difference between Motor 3 position and M3 position is < TBD ins | DIFF MTR3 QPS3\_EXP |  | <INCHES> | <RESULTS> |

Table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | expected | tolerance | peak | Peak P/F |
| Motor 1 | Peak\_VelocityN1\_EXP | Peak\_VelocityN\_Tolerance | Peak\_VelocityN1\_EXT |  |
| Motor 2 |  |  |  |  |
| Motor 3 |  |  |  |  |

**6.7.4 Brake Release Test**

**Step d –** LEMA reaches commanded position

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Description | Expected | Tolerance | Position | Pass/Fail |
| MCE1 /Motor 1 +/- TDB inches |  |  | <RESULTS> | <RESULTS> |
| MCE2 /Motor 2 |  |  | <RESULTS> | <RESULTS> |

**6.7.5 Performance Test – unloaded operation (one channel operation)**

**6.7.5.1.1 MCE 1 - Step Response Test**

**The result for motor one is shown below:**

**Step d Extension**

|  |  |  |
| --- | --- | --- |
| Description | Actual Speed / Time | Pass/Fail |
| No Load speed is 2.7 to 3.3 in/sec | SPEED | RESULTS |
| Time to achieve 80% of the specified stroke (+ 0.575 ins) is 170+9/-9 ms seconds | TIME | RESULTS |

**Step e Retraction**

|  |  |  |
| --- | --- | --- |
| Description | Actual Speed / Time | Pass/Fail |
| No Load speed is 2.7 to 3.3 in/sec | SPEED | RESULTS |
| Time to achieve 80% of the specified stroke (- 0.575 ins) is 170+9/-9 ms seconds | TIME | RESULTS |

**6.7.5.1.2 MCE 1 - Frequency Response**

**Step d**

**Frequency Response**

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency** | **Phase** | **Max phase** | **Pass/Fail** |
| 0.1 Hz |  |  |  |
| 0.5 Hz |  |  |  |
| 1 Hz |  |  |  |
| 2 Hz |  |  |  |
| 3 Hz |  |  |  |
| 4 Hz |  |  |  |
| 5 Hz |  |  |  |

6.7.5.2.1 **MCE 2 - Step Response Test**

**Step d Extension**

|  |  |  |
| --- | --- | --- |
| Description | Actual Speed / Time | Pass/Fail |
| No Load speed is 2.7 to 3.3 in/sec | SPEED | RESULTS |
| Time to achieve 80% of the specified stroke (+ 0.575 ins) is 170+9/-9 ms seconds | TIME | RESULTS |

**Step e Retraction**

|  |  |  |
| --- | --- | --- |
| Description | Actual Speed / Time | Pass/Fail |
| No Load speed is 2.7 to 3.3 in/sec | SPEED | RESULTS |
| Time to achieve 80% of the specified stroke (- 0.575 ins) is 170+9/-9 ms seconds | TIME | RESULTS |

6.7.5.2.2 **MCE 2 - Frequency Response Test**

**Step d**

**Frequency Response**

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency** | **Phase** | **Max phase** | **Pass/Fail** |
| 0.1 Hz |  |  |  |
| 0.5 Hz |  |  |  |
| 1 Hz |  |  |  |
| 2 Hz |  |  |  |
| 3 Hz |  |  |  |
| 4 Hz |  |  |  |
| 5 Hz |  |  |  |

6.7.5.3.1 **MCE 3 – Step Response Test**

**Step d Extension**

|  |  |  |
| --- | --- | --- |
| Description | Actual Speed / Time | Pass/Fail |
| No Load speed is 2.7 to 3.3 in/sec | SPEED | RESULTS |
| Time to achieve 80% of the specified stroke (+ 0.575 ins) is 170+9/-9 ms seconds | TIME | RESULTS |

**Step e Retraction**

|  |  |  |
| --- | --- | --- |
| Description | Actual Speed / Time | Pass/Fail |
| No Load speed is 2.7 to 3.3 in/sec | SPEED | RESULTS |
| Time to achieve 80% of the specified stroke (+ 0.575 ins) is 170+9/-9 ms seconds | TIME | RESULTS |

6.7.5.3.2 **MCE 3 Frequency Response Test**

**Step d**

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency** | **Phase** | **Max phase** | **Pass/Fail** |
| 0.1 Hz |  |  |  |
| 0.5 Hz |  |  |  |
| 1 Hz |  |  |  |
| 2 Hz |  |  |  |
| 3 Hz |  |  |  |
| 4 Hz |  |  |  |
| 5 Hz |  |  |  |

6.7.6 **Performance Test – Loaded Operation**

6.7.6.1 **Step and Frequency Response Test - Loaded**

6.7.6.1.1 **MCE1 – Step Response Test**

Step response Test

**Step j – 225 lbf tension**

|  |  |  |
| --- | --- | --- |
| Description | Actual Value | Pass/Fail |
| speed between 2.07 and 2.53 in/sec | SPEED | RESULTS |
| Time to achieve 80% of the specified stroke (+ 0.575 ins) is 170 +9/-9 ms | TIME | RESULTS |

**Step k – 225 lbf tension**

|  |  |  |
| --- | --- | --- |
| Description | Actual Value | Pass/Fail |
| speed between 2.07 and 2.53 in/sec | SPEED | RESULTS |
| Time to achieve 80% of the specified stroke (- 0.575 ins) is 170 +9/-9 ms | TIME | RESULTS |

**Step n – 225 lbf compression**

|  |  |  |
| --- | --- | --- |
| Description | Actual Value | Pass/Fail |
| speed between 2.07 and 2.53 in/sec | SPEED | RESULTS |
| Time to achieve 80% of the specified stroke (+ 0.575 ins) is 170 +9/-9 ms | TIME | RESULTS |

**Step o – 225 lbf compression**

|  |  |  |
| --- | --- | --- |
| Description | Actual Value | Pass/Fail |
| speed between 2.07 and 2.53 in/sec | SPEED | RESULTS |
| Time to achieve 80% of the specified stroke (- 0.575 ins) is 170 +9/-9 ms | TIME | RESULTS |

6.7.6.1.2 **MCE 1 – Frequency Response Test**

**Step d – 225 lbf Tension**

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency** | **Phase** | **Max phase** | **Pass/Fail** |
| 0.1 Hz |  |  |  |
| 0.5 Hz |  |  |  |
| 1 Hz |  |  |  |
| 2 Hz |  |  |  |
| 3 Hz |  |  |  |
| 4 Hz |  |  |  |
| 5 Hz |  |  |  |

**Step h – 225 lbf Compression**

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency** | **Phase** | **Max phase** | **Pass/Fail** |
| 0.1 Hz |  |  |  |
| 0.5 Hz |  |  |  |
| 1 Hz |  |  |  |
| 2 Hz |  |  |  |
| 3 Hz |  |  |  |
| 4 Hz |  |  |  |
| 5 Hz |  |  |  |

6.7.6.1.3 **MCE 2 – Step Response Test**

**Step j – 225 lbf tension**

|  |  |  |
| --- | --- | --- |
| Description | Actual Value | Pass/Fail |
| speed between 2.07 and 2.53 in/sec | SPEED | RESULTS |
| Time to achieve 80% of the specified stroke (+ 0.575 ins) is 170 +9/-9 ms | SPEED | RESULTS |

**Step k – 225 lbf tension**

|  |  |  |
| --- | --- | --- |
| Description | Actual Value | Pass/Fail |
| speed between 2.07 and 2.53 in/sec | SPEED | RESULTS |
| Time to achieve 80% of the specified stroke (- 0.575 ins) is 170 +9/-9 ms | SPEED | RESULTS |

**Step n – 225 lbf compression**

|  |  |  |
| --- | --- | --- |
| Description | Actual Value | Pass/Fail |
| speed between 2.07 and 2.53 in/sec | SPEED | RESULTS |
| Time to achieve 80% of the specified stroke (+ 0.575 ins) is 170 +9/-9 ms | TIME | RESULTS |

**Step o – 225 lbf compression**

|  |  |  |
| --- | --- | --- |
| Description | Actual Value | Pass/Fail |
| speed between 2.07 and 2.53 in/sec | SPEED | RESULTS |
| Time to achieve 80% of the specified stroke (- 0.575 ins) is 170 +9/-9 ms | TIME | RESULTS |

6.7.6.1.4 **MCE 2 – Frequency response Test**

**Step d – 225 lbf Tension**

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency** | **Phase** | **Max phase** | **Pass/Fail** |
| 0.1 Hz |  |  |  |
| 0.5 Hz |  |  |  |
| 1 Hz |  |  |  |
| 2 Hz |  |  |  |
| 3 Hz |  |  |  |
| 4 Hz |  |  |  |
| 5 Hz |  |  |  |

**Step h – 225 lbf Compression**

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency** | **Phase** | **Max phase** | **Pass/Fail** |
| 0.1 Hz |  |  |  |
| 0.5 Hz |  |  |  |
| 1 Hz |  |  |  |
| 2 Hz |  |  |  |
| 3 Hz |  |  |  |
| 4 Hz |  |  |  |
| 5 Hz |  |  |  |

6.7.6.1.5 **MCE 3 – Step Response Test**

**Step j – 225 lbf tension**

|  |  |  |
| --- | --- | --- |
| Description | Actual Value | Pass/Fail |
| speed between 2.07 and 2.53 in/sec | SPEED | RESULTS |
| Time to achieve 80% of the specified stroke (+ 0.575 ins) is 170 +9/-9 ms | SPEED | RESULTS |

**Step k – 225 lbf tension**

|  |  |  |
| --- | --- | --- |
| Description | Actual Value | Pass/Fail |
| speed between 2.07 and 2.53 in/sec | SPEED | RESULTS |
| Time to achieve 80% of the specified stroke (- 0.575 ins) is 170 +9/-9 ms | SPEED | RESULTS |

**Step n – 225 lbf compression**

|  |  |  |
| --- | --- | --- |
| Description | Actual Value | Pass/Fail |
| speed between 2.07 and 2.53 in/sec | SPEED | RESULTS |
| Time to achieve 80% of the specified stroke (+ 0.575 ins) is 170 +9/-9 ms | TIME | RESULTS |

**Step o – 225 lbf compression**

|  |  |  |
| --- | --- | --- |
| Description | Actual Value | Pass/Fail |
| speed between 2.07 and 2.53 in/sec | SPEED | RESULTS |
| Time to achieve 80% of the specified stroke (- 0.575 ins) is 170 +9/-9 ms | TIME | RESULTS |

6.7.6.1.6 **MCE 3 – Frequency Response Test**

**Step d – 225 lbf Tension**

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency** | **Phase** | **Max phase** | **Pass/Fail** |
| 0.1 Hz |  |  |  |
| 0.5 Hz |  |  |  |
| 1 Hz |  |  |  |
| 2 Hz |  |  |  |
| 3 Hz |  |  |  |
| 4 Hz |  |  |  |
| 5 Hz |  |  |  |

**Step h – 225 lbf Compression**

|  |  |  |  |
| --- | --- | --- | --- |
| **Frequency** | **Phase** | **Max phase** | **Pass/Fail** |
| 0.1 Hz |  |  |  |
| 0.5 Hz |  |  |  |
| 1 Hz |  |  |  |
| 2 Hz |  |  |  |
| 3 Hz |  |  |  |
| 4 Hz |  |  |  |
| 5 Hz |  |  |  |

**6.7.7 Holding Load Test**

6.7.7.1 Brake OFF, LEMA Output Locked

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| MCE | Expected Output force, lbf | Actual Output force, lbf | Output force, Pass/Fail | Position feedback signals (all sensors) Pass/Fail |
| MCE 1, 6.7.8.1.1 step i – extend 0.2 in |  | FORCE | RESULTS | RESULTS |
| MCE 1, 6.7.8.1.1 step k - retract 0.2 in |  | FORCE | RESULTS | RESULTS |
| MCE 2, m step i – extend 0.2 in |  | FORCE | RESULTS | RESULTS |
| MCE 2, m step k - retract 0.2 in |  | FORCE | RESULTS | RESULTS |
| MCE 3 m step i – extend 0.2 in |  | FORCE | RESULTS | RESULTS |
| MCE 3 m step k - retract 0.2 in |  | FORCE | RESULTS | RESULTS |

**6.7.7.2 Brake ON, LEMA Output Free**

|  |  |  |
| --- | --- | --- |
| MCE | 12.6 +/- TBD Amps for 3-5 sec | Position feedback signals (all sensors) |
| MCE 1, 6.7.8.2.1 step I – extend 0.2 in | RESULTS | RESULTS |
| MCE 1, 6.7.8.2.1 step k - retract 0.2 in | RESULTS | RESULTS |
| MCE 2, 6.7.8.2.2 6.7.8.2.3 step i – extend 0.2 in | RESULTS | RESULTS |
| MCE 2, m step k - retract 0.2 in | RESULTS | RESULTS |
| MCE 3 m step i– extend 0.2 in | RESULTS | RESULTS |
| MCE 3 m step k - retract 0.2 in | RESULTS | RESULTS |

**6.7.7.3 Brake Release test**

**Step d –** LEMA reaches commanded position

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Expected | Tolerance | Actual Position | Pass/Fail |
| MCE1 /Motor 1 |  |  |  | RESULTS |
| MCE2 /Motor 2 |  |  |  | RESULTS |

6.7.8 **Backlash**

6.7.8.1 **Simplex Brake 1 – ON; Duplex brake 2 – OFF**

|  |  |  |
| --- | --- | --- |
| Load (lbf) | Backlash (ins) | Pass/Fail |
| Step e +/- 100 lbf (motor 2 and motor 3 ZERO position) | INCHES | RESULTS |
| Step h, Total backlash | INCHES | RESULTS |
| Step f 322 lbf tension followed by 322 lbf compression | INCHES | RESULTS |
| All channels feedback signals (Motor 1, Motor 2, Motor 3, M1, M2 and M3 remain within allowable limits | INCHES | RESULTS |

6.7.8.2 **Simplex Brake 1 – OFF; Duplex Brake 2 – ON**

|  |  |  |
| --- | --- | --- |
| Load (lbf) | Backlash (ins) | Pass/Fail |
| Step e +/- 100 lbf (motor 1 holding ZERO position) | INCHES | RESULTS |
| Step h, Total backlash | INCHES | RESULTS |
| Step f, 322 lbf tension followed by 322 lbf compression | INCHES | RESULTS |
| All channels feedback signals (Motor 1, Motor 2, Motor 3, M1, M2 and M3 remain within allowable limits | INCHES | RESULTS |

6.7.8.3 **Both Brakes OFF**

|  |  |  |
| --- | --- | --- |
| Load (lbf) | Backlash (ins) | Pass/Fail |
| Step e +/- 100 lbf (both motors holding ZERO position) | INCHES | RESULTS |
| Step h, Total backlash | INCHES | RESULTS |
| Step f 322 lbf tension followed by 322 lbf compression | INCHES | RESULTS |
| All channels feedback signals (Motor 1, Motor 2, Motor 3, M1, M2 and M3 remain within allowable limits | INCHES | RESULTS |