ecmc motion system test report

Data file : ../../ecmc\_bifrost\_slits\_sat/tests/11359/axis1/axis1\_data.log Date : Tue Dec 15 20:30:22 CET 2020

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Sensors

Open loop step counter of stepper

The stepper motors was run in open loop during all the tests. The openloop step counter reflects the actual position of the contolsystem.

Resolver:

Conversion data (to open loop coord syst):

1. Scale factor : 1

2. Offset : 2.0011mm

External verification system, Micro-Epsilon ILD2300 sensor

Conversion data (to open loop coord syst):

1. Scale factor : -1 (measure from top)

2. Offset : 59.6583mm

Limit Switch Performance

Low Limit Engage Position

|  |  |  |  |
| --- | --- | --- | --- |
| Test | Openloop [mm] | Resolver [mm] | Diff [mm] |
| 1 | -0.2282 | -0.2196 | 0.0086 |
| 2 | -0.2387 | -0.2351 | 0.0036 |
| 3 | -0.2396 | -0.2362 | 0.0034 |
| 4 | -0.2372 | -0.2327 | 0.0045 |
| 5 | -0.2341 | -0.2285 | 0.0056 |
| 6 | -0.2341 | -0.2286 | 0.0056 |
| 7 | -0.2357 | -0.2307 | 0.0050 |
| 8 | -0.2357 | -0.2307 | 0.0050 |
| 9 | -0.2364 | -0.2318 | 0.0047 |
| 10 | -0.2387 | -0.2350 | 0.0037 |
| AVG | -0.2358 | -0.2309 | -0.0050 |
| STD | 0.0031 | 0.0045 | -0.0014 |
| Range | 0.0114 | 0.0166 |  |

Low Limit Disengage Position

|  |  |  |  |
| --- | --- | --- | --- |
| Test | Openloop [mm] | Resolver [mm] | Diff [mm] |
| 1 | 0.0098 | 0.0142 | 0.0044 |

|  |  |  |  |
| --- | --- | --- | --- |
| Test | Openloop [mm] | Resolver [mm] | Diff [mm] |
| 2 | 0.0084 | 0.0120 | 0.0037 |
| 3 | 0.0061 | 0.0086 | 0.0025 |
| 4 | 0.0054 | 0.0073 | 0.0019 |
| 5 | 0.0038 | 0.0052 | 0.0014 |
| 6 | 0.0098 | 0.0143 | 0.0044 |
| 7 | 0.0113 | 0.0167 | 0.0054 |
| 8 | 0.0106 | 0.0155 | 0.0049 |
| 9 | 0.0038 | 0.0052 | 0.0014 |
| 10 | 0.0068 | 0.0098 | 0.0030 |
| AVG | 0.0076 | 0.0109 | -0.0033 |
| STD | 0.0026 | 0.0040 | -0.0014 |
| Range | 0.0075 | 0.0115 |  |

High Limit Engage Position

|  |  |  |  |
| --- | --- | --- | --- |
| Test | Openloop [mm] | Resolver [mm] | Diff [mm] |
| 1 | 68.5137 | 68.5216 | 0.0079 |
| 2 | 68.4927 | 68.4902 | -0.0026 |
| 3 | 68.5408 | 68.5591 | 0.0183 |
| 4 | 68.4035 | 68.3879 | -0.0156 |
| 5 | 68.4455 | 68.4266 | -0.0189 |
| 6 | 68.4620 | 68.4465 | -0.0155 |
| 7 | 68.4740 | 68.4626 | -0.0113 |
| 8 | 68.4298 | 68.4103 | -0.0195 |
| 9 | 68.4410 | 68.4218 | -0.0192 |
| 10 | 68.4110 | 68.3939 | -0.0171 |
| AVG | 68.4614 | 68.4521 | 0.0093 |
| STD | 0.0421 | 0.0536 | -0.0114 |
| Range | 0.1373 | 0.1712 |  |

High Limit Disengage Position

|  |  |  |  |
| --- | --- | --- | --- |
| Test | Openloop [mm] | Resolver [mm] | Diff [mm] |
| 1 | 67.1898 | 67.1698 | -0.0199 |
| 2 | 67.1916 | 67.1715 | -0.0200 |

|  |  |  |  |
| --- | --- | --- | --- |
| Test | Openloop [mm] | Resolver [mm] | Diff [mm] |
| 3 | 67.1899 | 67.1696 | -0.0203 |
| 4 | 67.1843 | 67.1636 | -0.0207 |
| 5 | 67.1825 | 67.1622 | -0.0203 |
| 6 | 67.1834 | 67.1628 | -0.0205 |
| 7 | 67.1804 | 67.1599 | -0.0205 |
| 8 | 67.1865 | 67.1661 | -0.0204 |
| 9 | 67.1804 | 67.1600 | -0.0204 |
| 10 | 67.1813 | 67.1609 | -0.0204 |
| AVG | 67.1850 | 67.1646 | 0.0204 |
| STD | 0.0040 | 0.0041 | -0.0001 |
| Range | 0.0112 | 0.0116 |  |

Repeatability

Target Position 15 Positive and Negative Direction

|  |  |  |  |
| --- | --- | --- | --- |
| Test | Resolver Pos [mm] | Resolver Neg  [mm] | Diff [mm] |
| 1 | 15.0002 | 14.9979 | 0.0023 |
| 2 | 15.0002 | 14.9979 | 0.0023 |
| 3 | 15.0002 | 14.9979 | 0.0023 |
| 4 | 15.0002 | 14.9979 | 0.0023 |
| 5 | 15.0003 | 14.9979 | 0.0023 |
| 6 | 15.0003 | 14.9979 | 0.0024 |
| 7 | 15.0002 | 14.9979 | 0.0023 |
| 8 | 15.0002 | 14.9979 | 0.0023 |
| 9 | 15.0003 | 14.9979 | 0.0024 |
| 10 | 15.0003 | 14.9979 | 0.0024 |
| AVG | 15.0002 | 14.9979 | 0.0023 |
| STD | 0.0000 | 0.0000 | 0.0000 |
| Range | 0.0001 | 0.0001 | 0.0001 |

Repeatability (Resolver): 0.0001

|  |  |  |  |
| --- | --- | --- | --- |
| Test | ILD2300 Pos [mm] | ILD2300 Neg  [mm] | Diff [mm] |
| 1 | 14.9478 | 14.9468 | 0.0010 |

|  |  |  |  |
| --- | --- | --- | --- |
| Test | ILD2300 Pos [mm] | ILD2300 Neg  [mm] | Diff [mm] |
| 2 | 14.9486 | 14.9470 | 0.0016 |
| 3 | 14.9490 | 14.9476 | 0.0014 |
| 4 | 14.9486 | 14.9474 | 0.0012 |
| 5 | 14.9486 | 14.9472 | 0.0014 |
| 6 | 14.9484 | 14.9470 | 0.0014 |
| 7 | 14.9484 | 14.9462 | 0.0022 |
| 8 | 14.9484 | 14.9468 | 0.0016 |
| 9 | 14.9484 | 14.9470 | 0.0014 |
| 10 | 14.9478 | 14.9464 | 0.0014 |
| AVG | 14.9484 | 14.9469 | 0.0015 |
| STD | 0.0004 | 0.0004 | -0.0001 |
| Range | 0.0012 | 0.0014 | 0.0012 |

Repeatability (ILD2300): 0.0014

Target Position 35 Positive and Negative Direction

|  |  |  |  |
| --- | --- | --- | --- |
| Test | Resolver Pos [mm] | Resolver Neg  [mm] | Diff [mm] |
| 1 | 35.0008 | 34.9981 | 0.0027 |
| 2 | 35.0008 | 34.9982 | 0.0027 |
| 3 | 35.0008 | 34.9982 | 0.0026 |
| 4 | 35.0008 | 34.9982 | 0.0025 |
| 5 | 35.0008 | 34.9982 | 0.0026 |
| 6 | 35.0008 | 34.9982 | 0.0026 |
| 7 | 35.0009 | 34.9983 | 0.0026 |
| 8 | 35.0009 | 34.9982 | 0.0026 |
| 9 | 35.0008 | 34.9982 | 0.0026 |
| 10 | 35.0008 | 34.9982 | 0.0026 |
| AVG | 35.0008 | 34.9982 | 0.0026 |
| STD | 0.0000 | 0.0000 | -0.0000 |
| Range | 0.0001 | 0.0001 | 0.0001 |

Repeatability (Resolver): 0.0001

|  |  |  |  |
| --- | --- | --- | --- |
| Test | ILD2300 Pos [mm] | ILD2300 Neg  [mm] | Diff [mm] |
| 1 | 35.0029 | 35.0020 | 0.0008 |

|  |  |  |  |
| --- | --- | --- | --- |
| Test | ILD2300 Pos [mm] | ILD2300 Neg  [mm] | Diff [mm] |
| 2 | 35.0031 | 35.0004 | 0.0027 |
| 3 | 35.0008 | 34.9992 | 0.0016 |
| 4 | 35.0000 | 34.9988 | 0.0012 |
| 5 | 35.0018 | 34.9990 | 0.0029 |
| 6 | 35.0008 | 34.9986 | 0.0022 |
| 7 | 35.0024 | 34.9988 | 0.0037 |
| 8 | 35.0014 | 35.0022 | -0.0008 |
| 9 | 35.0016 | 34.9986 | 0.0031 |
| 10 | 35.0020 | 34.9990 | 0.0031 |
| AVG | 35.0017 | 34.9997 | 0.0020 |
| STD | 0.0009 | 0.0013 | -0.0004 |
| Range | 0.0031 | 0.0037 | 0.0045 |

Repeatability (ILD2300): 0.0037

Target Position 55 Positive and Negative Direction

|  |  |  |  |
| --- | --- | --- | --- |
| Test | Resolver Pos [mm] | Resolver Neg  [mm] | Diff [mm] |
| 1 | 55.0013 | 54.9987 | 0.0026 |
| 2 | 55.0013 | 54.9987 | 0.0026 |
| 3 | 55.0014 | 54.9987 | 0.0027 |
| 4 | 55.0014 | 54.9986 | 0.0028 |
| 5 | 55.0014 | 54.9987 | 0.0027 |
| 6 | 55.0013 | 54.9987 | 0.0026 |
| 7 | 55.0014 | 54.9987 | 0.0027 |
| 8 | 55.0014 | 54.9987 | 0.0027 |
| 9 | 55.0014 | 54.9986 | 0.0028 |
| 10 | 55.0014 | 54.9987 | 0.0027 |
| AVG | 55.0014 | 54.9987 | 0.0027 |
| STD | 0.0001 | 0.0000 | 0.0000 |
| Range | 0.0002 | 0.0001 | 0.0002 |

Repeatability (Resolver): 0.0002

|  |  |  |  |
| --- | --- | --- | --- |
| Test | ILD2300 Pos [mm] | ILD2300 Neg  [mm] | Diff [mm] |
| 1 | 54.9722 | 54.9720 | 0.0002 |

|  |  |  |  |
| --- | --- | --- | --- |
| Test | ILD2300 Pos [mm] | ILD2300 Neg  [mm] | Diff [mm] |
| 2 | 54.9734 | 54.9720 | 0.0014 |
| 3 | 54.9736 | 54.9716 | 0.0020 |
| 4 | 54.9738 | 54.9730 | 0.0008 |
| 5 | 54.9734 | 54.9724 | 0.0010 |
| 6 | 54.9734 | 54.9722 | 0.0012 |
| 7 | 54.9734 | 54.9730 | 0.0004 |
| 8 | 54.9726 | 54.9732 | -0.0006 |
| 9 | 54.9736 | 54.9702 | 0.0035 |
| 10 | 54.9734 | 54.9689 | 0.0045 |
| AVG | 54.9733 | 54.9719 | 0.0014 |
| STD | 0.0005 | 0.0013 | -0.0008 |
| Range | 0.0016 | 0.0043 | 0.0051 |

Repeatability (ILD2300): 0.0043

Resolver Value Distribution

Measured at 8 positions offset by 45deg resolver shaft angle. The distrubution values are based on 75 values at each location.

|  |  |  |  |
| --- | --- | --- | --- |
| Test | Setpoint [mm] | Resolver AVG[mm] | Resolver STD[mm] |
| 1 | 36.12422 | 36.1259000 | 0.0000105 |
| 2 | 36.24922 | 36.2502000 | 0.0000126 |
| 3 | 36.37422 | 36.3758000 | 0.0000149 |
| 4 | 36.49922 | 36.4997000 | 0.0000094 |
| 5 | 36.62422 | 36.6259000 | 0.0000138 |
| 6 | 36.74922 | 36.7500000 | 0.0000171 |
| 7 | 36.87422 | 36.8759000 | 0.0000123 |
| 8 | 36.99922 | 36.9996000 | 0.0000107 |

Accuracy based on Resolver and ILD2300 Sensor Positive Direction

Measured at 12 positions offset by 5mm over the entire actuator stro<e.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test | Setpoint [mm] | Resolver [mm] | Diff [mm] | ILD2300 [mm] | Diff [mm] |
| 1 | 5.0000 | 5.0000 | -0.0000 | Out of range | NaN |
| 2 | 10.0000 | 10.0000 | 0.0000 | 9.8013 | -0.1987 |
| 3 | 15.0000 | 15.0003 | 0.0003 | 14.7922 | -0.2078 |
| 4 | 20.0000 | 20.0004 | 0.0004 | 19.7706 | -0.2294 |
| 5 | 25.0000 | 25.0006 | 0.0006 | 24.7672 | -0.2328 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test | Setpoint [mm] | Resolver [mm] | Diff [mm] | ILD2300 [mm] | Diff [mm] |
| 6 | 30.0000 | 30.0006 | 0.0006 | 29.8170 | -0.1830 |
| 7 | 35.0000 | 35.0006 | 0.0006 | 34.8350 | -0.1650 |
| 8 | 40.0000 | 40.0010 | 0.0010 | 39.8007 | -0.1993 |
| 9 | 45.0000 | 45.0012 | 0.0012 | 44.8165 | -0.1835 |
| 10 | 50.0000 | 50.0013 | 0.0013 | 49.8390 | -0.1610 |
| 11 | 55.0000 | 55.0014 | 0.0014 | 54.8192 | -0.1808 |
| 12 | 60.0000 | 60.0016 | 0.0016 | 59.8348 | -0.1652 |
| Accuracy | - | - | 0.0016 | - | 0.2328 |

Accuracy (Resolver): 0.0016   
Accuracy (ILD2300): 0.2328

Accuracy based on Resolver and ILD2300 Sensor Negative Direction

Measured at 12 positions offset by 5mm over the entire actuator stro<e.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test | Setpoint [mm] | Resolver [mm] | Diff [mm] | ILD2300 [mm] | Diff [mm] |
| 1 | 5.0000 | 4.9976 | -0.0024 | Out of range | NaN |
| 2 | 10.0000 | 9.9977 | -0.0023 | 9.8013 | -0.1987 |
| 3 | 15.0000 | 14.9979 | -0.0021 | 14.7918 | -0.2082 |
| 4 | 20.0000 | 19.9980 | -0.0020 | 19.7704 | -0.2296 |
| 5 | 25.0000 | 24.9981 | -0.0019 | 24.7665 | -0.2335 |
| 6 | 30.0000 | 29.9983 | -0.0017 | 29.8155 | -0.1845 |
| 7 | 35.0000 | 34.9982 | -0.0018 | 34.8315 | -0.1685 |
| 8 | 40.0000 | 39.9983 | -0.0017 | 39.7997 | -0.2003 |
| 9 | 45.0000 | 44.9984 | -0.0016 | 44.8106 | -0.1894 |
| 10 | 50.0000 | 49.9985 | -0.0015 | 49.8410 | -0.1590 |
| 11 | 55.0000 | 54.9987 | -0.0013 | 54.8184 | -0.1816 |
| 12 | 60.0000 | 59.9988 | -0.0012 | 59.8337 | -0.1663 |
| Accuracy | - | - | 0.0024 | - | 0.2335 |

Accuracy (Resolver): 0.0024   
Accuracy (ILD2300): 0.2335