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SOLAR ORBITER ENERGETIC PARTICLE DETECTOR

### **STEP FS Functional Test Report**

**Document ID:** SO-EPD-KIE-TR-0048

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**Date:** 8/1/2019

| Signature not needed if electronically approved by route |                    |                                      |                    |                                |                                    |  |  |  |  |
|--|--------------------|--------------------------------------|--------------------|--------------------------------|------------------------------------|--|--|--|--|
| Written  | Checked            | Approved<br>Configuration<br>Control | Approved QA        | Approved<br>Experiment Manager | Approved Principal<br>Investigator |  |  |  |  |
|  |                    |                                      |                    |                                |                                    |  |  |  |  |
|  |                    |                                      |                    |                                |                                    |  |  |  |  |
|  |                    |                                      |                    |                                |                                    |  |  |  |  |
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#### **Changes Record**

| Issue | Revision | Date       | Modified by | Section modified | Change implemented    |
|-------|----------|------------|-------------|------------------|-----------------------|
| 1     | 0        | 2018-09-12 | Panitzsch   | All              | Initial release       |
| 1     | 1        | 2019-01-08 | Terasa      | Annex            | Added Scan 2018-12-17 |



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#### 1 INTRODUCTION

### 1.1 Scope

The scope of this report is to summarize the results of the Functional Tests (FTs) conducted with STEP FS, most of them being performed during the unit level environmental tests. The functional tests have been carried out following RD-1. The referred procedure is the most up-to-date one. Multiple functional tests have been carried out following older versions of that procedure. This is not considered problematic as the main test objectives did not change significantly and usually more test objectives have been added. The way how to determine certain aspects (how to achive certain information) has improved significantly over time.

#### 2 APPLICABLE AND REFERENCE DOCUMENTS

#### 2.1 Applicable Documents

| ID.  | Title                                  | Reference          | Iss./Rev. | Date       |
|------|--|--------------------|-----------|------------|
| AD-1 | Experiment Interface Document part A   | SOL-EST-RCD-0050   | 5         | 16/03/2015 |
| AD-2 | STEP FS EMC Test Procedure             | SO-EPD-KIE-TP-0050 | 1/0       | 06/12/2016 |
| AD-3 | STEP FS Thermal Cycling Test Procedure | SO-EPD-KIE-TP-0049 | 1/1       | 06/12/2016 |
| AD-4 | STEP FS Vibration Test Procedure       | SO-EPD-KIE-TP-0048 | 1/0       | 06/12/2016 |

#### 2.2 Reference Documents

| ID.  | Title                             | Reference          | Iss./Rev. | Date       |
|------|-----------------------------------|--------------------|-----------|------------|
| RD-1 | STEP-FM-Functional-Test-Procedure | SO-EPD-KIE-TP-0051 | 1/2       | 14/08/2018 |



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### 3 Summary of the Test Results

It can be stated that the STEP FS unit has successfully passed all functional tests that have been carried out before, during, and after the environmental test campaigns. The details of the test results will be given in the particular sections below. As all of the conducted functional tests concluded successfully, this report will not discuss all the test results in detail, but give one result per test as an example (as the results differ sufficiently marginally), and provide scans of the tests documentation in the annex. It shall be pointed out that each impedance check as documented in the annex was always accompanied by a successful ad-hoc functional and performance check.

#### 3.1 Unit Impedance Check

The unit impedance check has been performed after each transportation of the unit, and after tests during whose the unit was not operational but a certain risk to damage the unit was present (i.e. the vibration tests, thermal cycling). **The unit passed this test each time this test has been conducted.** The values determined on 2017-05-19 (exemplarily chosen functional test performed in Kiel after return from vibration tests at Airbus DS in Portsmouth) are given below as an example. The unit's impedance checks have always yielded the expected results as will be shown in the annex (scans of the impedance check documentation). This holds for both externally accessible connectors, the MDM25 (connected to EPD-ICU) and the MDM15 (connected to the S/C) connector.

| MDM15 connector    |         |         |                     |             |  |  |  |  |  |  |
|--------------------|---------|---------|---------------------|-------------|--|--|--|--|--|--|
| Name               | Pin (+) | Pin (-) | Expected $[\Omega]$ | Measurement |  |  |  |  |  |  |
| Thermistor 1       | 1       | 9       | 15k to 20k *        | 17.4k       |  |  |  |  |  |  |
| Thermistor 2       | 2       | 10      | 15k to 20k *        | 17.3k       |  |  |  |  |  |  |
| Thermistor 3       | 3       | 11      | 15k to 20k *        | 17.3k       |  |  |  |  |  |  |
| Survival Heaters 1 | 7       | 14      | 119                 | 118.3       |  |  |  |  |  |  |
| Survival Heaters 2 | 8       | 15      | 119                 | 119.2       |  |  |  |  |  |  |

<sup>\*</sup> depending on the unit's temperature at approximately room temperature



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| MDM25 connector                   |                    |         |                      |                     |                        |  |  |  |  |  |
|-----------------------------------|--------------------|---------|----------------------|---------------------|------------------------|--|--|--|--|--|
| Pin (+)                           | Signal             | Pin (-) | Signal               | Expected $[\Omega]$ | Measurement $[\Omega]$ |  |  |  |  |  |
| Nominal power lines and grounding |                    |         |                      |                     |                        |  |  |  |  |  |
| Chassis                           | Instrument chassis | 15      | Chassis gnd          | < 1                 | 0.4                    |  |  |  |  |  |
| Chassis                           | Instrument chassis | 24      | Chassis gnd          | < 1                 | 0.4                    |  |  |  |  |  |
| Chassis                           | Instrument chassis | 1       | Nom. power           | >10M                | <b>√</b>               |  |  |  |  |  |
| 14                                | Nom. power return  | 1       | Nom. power           | >10M                | ✓                      |  |  |  |  |  |
| Redundant power lines             |                    |         |                      |                     |                        |  |  |  |  |  |
| Chassis                           | Instrument chassis | 13      | Red. power           | >10M                | <b>√</b>               |  |  |  |  |  |
| 25                                | Red. power return  | 13      | Red. power           | >10M                | <b>√</b>               |  |  |  |  |  |
|                                   |                    | Nomina  | I communication line | S                   |                        |  |  |  |  |  |
| 4                                 | LVDS I2S-          | 16      | LVDS I2S+            | 100                 | 102.3                  |  |  |  |  |  |
| 6                                 | CLK I2S+           | 19      | CLK I2S-             | 100                 | 102.4                  |  |  |  |  |  |
| 8                                 | LVDS S2I+          | 21      | LVDS S2I-            | 50                  | 51.4                   |  |  |  |  |  |
|                                   |                    | Redunda | nt communication lin | es                  |                        |  |  |  |  |  |
| 5                                 | LVDS I2S-          | 17      | LVDS I2S+            | 100                 | 102.4                  |  |  |  |  |  |
| 7                                 | CLK I2S+           | 20      | CLK I2S-             | 100                 | 102.5                  |  |  |  |  |  |
| 10                                | LVDS S2I-          | 22      | LVDS S2I+            | 50                  | 51.4                   |  |  |  |  |  |
| not connected and other pins      |                    |         |                      |                     |                        |  |  |  |  |  |
| 2                                 | NC                 | Chassis | Instrument chassis   | >10M                | <b>√</b>               |  |  |  |  |  |
| 3                                 | DGND               | Chassis | Instrument chassis   | < 1                 | 0.7                    |  |  |  |  |  |
| 4                                 | LVDS I2S-          | Chassis | Instrument chassis   | >10M                | <b>√</b>               |  |  |  |  |  |
| 5                                 | LVDS I2S-          | Chassis | Instrument chassis   | >10M                | <b>√</b>               |  |  |  |  |  |
| 6                                 | CLK I2S+           | Chassis | Instrument chassis   | >10M                | <b>√</b>               |  |  |  |  |  |
| 7                                 | CLK I2S+           | Chassis | Instrument chassis   | >10M                | <b>√</b>               |  |  |  |  |  |
| 8                                 | LVDS S2I+          | Chassis | Instrument chassis   | >10M                | <b>√</b>               |  |  |  |  |  |
| 9                                 | NC                 | Chassis | Instrument chassis   | >10M                | <b>√</b>               |  |  |  |  |  |
| 10                                | LVDS S2I-          | Chassis | Instrument chassis   | >10M                | ✓                      |  |  |  |  |  |
| 11                                | DGND.              | Chassis | Instrument chassis   | < 1                 | 0.7                    |  |  |  |  |  |
| 12                                | NC                 | Chassis | Instrument chassis   | >10M                | <b>√</b>               |  |  |  |  |  |
| 14                                | Nom. power return  | Chassis | Instrument chassis   | 100k                | 99.9 k                 |  |  |  |  |  |
| 16                                | LVDS I2S+          | Chassis | Instrument chassis   | >10M                | <b>√</b>               |  |  |  |  |  |
| 17                                | LVDS I2S+          | Chassis | Instrument chassis   | >10M                | <b>√</b>               |  |  |  |  |  |
| 18                                | NC                 | Chassis | Instrument chassis   | >10M                | <b>√</b>               |  |  |  |  |  |
| 19                                | CLK I2S-           | Chassis | Instrument chassis   | >10M                | <b>√</b>               |  |  |  |  |  |
| 20                                | CLK I2S-           | Chassis | Instrument chassis   | >10M                | <b>√</b>               |  |  |  |  |  |
| 21                                | LVDS S2I-          | Chassis | Instrument chassis   | >10M                | <b>√</b>               |  |  |  |  |  |
| 22                                | LVDS S2I+          | Chassis | Instrument chassis   | >10M                | <b>√</b>               |  |  |  |  |  |
| 23                                | NC                 | Chassis | Instrument chassis   | >10M                | ✓                      |  |  |  |  |  |
| 25                                | Red. power return  | Chassis | Instrument chassis   | 100k                | 99.9 k                 |  |  |  |  |  |



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#### 3.2 Power Consumption Check

The power consumption is always checked when the unit is operational. At a supply voltage of 28 V, the expected and determined current consumption is around 100 mA at room temperature. The table below indicates the units power consumption in different operational modes as denoted in the table. The values have been determine on 2018-08-15.

| Condition                                     | 28.0 V | Current | 26.0 V | Current | 29.0 V | Current |
|---|--------|---------|--------|---------|--------|---------|
| Unit unconfigured (after POWER ON and reset)  | 28.0 V | 98 mA   | 26.0 V | 106 mA  | 29.0 V | 95 mA   |
| Unit in HK mode                               | 28.0 V | 101 mA  | 26.0 V | 110 mA  | 29.0 V | 98 mA   |
| Unit in SCI mode (low activity)               | 28.0 V | 101 mA  | 26.0 V | 110 mA  | 29.0 V | 98 mA   |
| Unit in SCI mode (high activity, test-pulser) | 28.0 V | 100 mA  | 26.0 V | 108 mA  | 29.0 V | 97 mA   |

The measurements yield a units power consumption of about 2.8 W when supplied with 28 V at room temperature in all modes of operation. During the thermal tests, the current consumption for different supply voltages was recorded as summarized in the table below:

| Unit configured  | 28.0 V | Current | 26.0 V | Current | 29.0 V | Current |
|------------------|--------|---------|--------|---------|--------|---------|
| Room temperature | 28.0 V | 98 mA   | 26.0 V | 106 mA  | 29.0 V | 95 mA   |
| +40°C            | 28.0 V | 98 mA   | 26.0 V | 107 mA  | 29.0 V | 95 mA   |
| -46°C            | 28.0 V | 101 mA  | 26.0 V | 109 mA  | 29.0 V | 98 mA   |

The change in the power consumption of the STEP unit at different (extreme mission) temperatures is negliable.



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#### 3.3 Ad-Hoc (Full) Functional Test

The ad-hoc functional test is performed to check whether all sub-assemblies of the unit are working properly (for details, see RD-1). This test is usually (good practice, no requirement) conducted after powering the unit. Also, this test was (or earlier versions of it were) conducted after each transportation of the unit, and after tests with increased risk of damage to the unit. **These tests yielded positive results each time they were conducted and are thus considered successful.** The results as read during one of the full functional test after unit (DIG board) modifications in the scope of NCR-0044 (test run 2018-08-14) are given as an example below:

```
STEP SFT results
======>Register readout <======
UNIT ID 0xd3 STEP FM msg=5 reg=9 sci=9
REG STATUS 0x01 0xd3 0x100 0x0000 0x0002
REG POINTER 0x02000 0x00000 0x00000 0x000
REG CLOCK 1220 3599 0 7 7 1
REG SCRATCH 22505 0 0 6823
REG UART NOM 882 509 0x00 3 0x0100
REG UART RED 6 0 0x14 0 0x0180
REG HEATER 1317 0 0
REG L1L2 0x1e82ff1f1e82ff1f
REG DEADTIME 0 0
REG LIFETIME 0 0
TEST RUN VIA NOMIMAL TERMINAL
                                       OK
                                       OK
FPGA communication
3 REGISTER read-outs found
                                       OK
Status word 3 = 0xa200 (!= 0)
                                       OK
Status word 4 = 0 \times 0002 \ (!= 0)
                                       OK
======>STEP housekeeping <======
voltages:
+2V5REF = 2.48 V (2.5 V)
                                       OK
AVCC2V5 = 2.47 V (2.5 V)
                                       OK
AVCC3V3 = 3.29 V (3.3 V)
                                       OK
+6VAVCC = 5.92 V (6.0 V)
                                       OK
temperatures: (check for plausibility)
                          T_Ti0 =
T ANA = 22.14°C
                                   20.59°C
T_DIG = 23.73^{\circ}C
                          T_{-}Ti2 = 20.26^{\circ}C
T_LVPS = 23.84°C
                          T_Ti3 =
                                   20.06°C
detector bias: (check for plausibility)
VOLTAGE = 72.97 V
```

CURRENT = 2.92 nA



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| ========                                | ====>EEPRC       | OM <===      |                     |                  |               |               |                     |
|---|------------------|--------------|---------------------|------------------|---------------|---------------|---------------------|
| EEPROM found                            |                  |              | OK                  |                  |               |               |                     |
| EEPROM content<br>STEP FS AF1, 20       | `                |              | • /                 | 7882             |               |               |                     |
| 51LI 15 AI 1, 20                        | 10-09-29, COMI   | g version o, | , 3011 3433, CIC 02 | (1002            |               |               |                     |
| ======================================  | ====>SRAI        | M <====      |                     |                  |               |               |                     |
| SRAM found                              |                  |              | OK                  |                  |               |               |                     |
| ========                                |                  |              |                     | 2 62 62 62 62 62 | 0 60 60 60 60 | . 60 60 60 60 | 2 62 62 62 62 62    |
| STEP IX 0 THRS<br>STEP IX 0 REGS        |                  |              |                     |                  |               | 2 02 02 02 02 | 2 02 02 02 02 02    |
| STEP IX 1 THRS                          |                  |              |                     |                  |               | 2 62 62 62 62 | 2 62 62 62 62 62    |
| STEP IX 1 REGS                          |                  |              |                     |                  |               | . 02 02 02 02 | . 02 02 02 02 02    |
| STEP IX 0 TEMP                          |                  |              |                     |                  | 1011 —0       |               |                     |
| STEP IX 1 TEMP                          |                  |              |                     |                  |               |               |                     |
| IX0  rsm = 0                            | (== 0)           |              | OK                  |                  |               |               |                     |
|   | (==0)<br>(==2)   |              | OK                  |                  |               |               |                     |
| IX0  sentiter = 2<br>IX1  rsm = 0       | (==2)<br>(==0)   |              | OK                  |                  |               |               |                     |
| IX1  selfilter = 0                      | (==0)<br>(==2)   |              | OK                  |                  |               |               |                     |
| IXI Scillici — 2                        | ( 2)             |              | OK                  |                  |               |               |                     |
| ========                                | >L0 counter reg  | jisters <==  | =======             |                  |               |               |                     |
| COUNTER[0x4400                          | 000] 5967 5967   | 5965 5967    | 7 5968 5967 5972    | 5969 5967 5968   | 3 5967 5968 5 | 5967 5968 59  | 967 5968            |
| COUNTER[0x4400                          | 10] 5968 5967    | 5967 5966    | 5 5968 5968 5967    | 5967 5968 5968   | 3 5968 5967 5 | 5967 5974 59  | 969 5967            |
| COUNTER[0x4400                          |                  |              |                     |                  |               |               |                     |
| COUNTER[0x4400                          | 30] 5967 5968    | 5969 5967    | 7 5970 5967 5974    | 5966 5967 5967   | 7 5967 5968 5 | 5968 5978 59  | 968 5967            |
| COUNTER[0x4400                          | •                |              |                     |                  |               |               |                     |
| COUNTER[0x4400                          | •                |              |                     |                  |               |               |                     |
| COUNTER[0x4400                          | •                |              |                     |                  |               |               |                     |
| COUNTER[0x4400                          | 070] 1 0 0 1 1 1 | 11100        | 00001               |                  |               |               |                     |
| testpulses on chn0                      | = 5967           | (>0)         | OK                  |                  |               |               |                     |
| ======================================= | >Digital counte  | r registers  | <=======            | =                |               |               |                     |
| COUNTER[0x0400                          | •                | -            |                     |                  | 264 191360 3° | 3 33          |                     |
| COUNTER 0x0400                          | •                |              |                     |                  |               |               |                     |
| COUNTER 0x0400                          | 020 0 0 49 0 68  | 3 2 2 0 124  | 49 0 0 512 0 0 0 (  | O                |               |               |                     |
| COUNTER 0x0400                          | 30 0 1 381952    | 0 1 76390    | 04 190944 190976    | 500001011        | <u>_</u>      |               |                     |
| COUNTER[0x0400                          | •                |              |                     |                  |               |               |                     |
| triggers on chn0=                       | 190944           | (>0)         | OK                  |                  |               |               |                     |
| SFT result: All che for plausibility.   | ecks passed suc  | cessfully.(  | Check EEPROM        | content read-out | , temperature | es, and detec | tor bias parameters |
| End of STEP SFT                         |                  |              |                     |                  |               |               |                     |
| ********                                | ******           | ******       | ******              |                  |               |               |                     |
| *******                                 | ******           | ******       | ******              |                  |               |               |                     |
|   |                  |              |                     |                  |               |               |                     |



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#### STEP FFT results:

check testpulser results (focus on sigmas):

->add "plot" to the command line in order to get a plot of each channel  $<\!\!\!\!-$ 

| ix     | pix     | mu    | sigma | d_sigma | ix     | pix  | mu    | sigma | d_sigma |
|--------|---------|-------|-------|---------|--------|------|-------|-------|---------|
| 0      | 0       | 226.9 | 6.6   | 3.8     | 1      | 0    | 322.8 | 6.6   | 3.8     |
| 0      | 1       | 366.1 | 6.2   | 4.2     | 1      | 1    | 395.4 | 6.4   | 4.1     |
| 0      | 2       | 220.3 | 6.7   | 3.7     | 1      | 2    | 397.5 | 5.9   | 4.8     |
| 0      | 3       | 170.1 | 6.4   | 4.0     | 1      | 3    | 261.1 | 6.3   | 4.2     |
| 0      | 4       | 236.0 | 6.3   | 4.2     | 1      | 4    | 235.6 | 6.5   | 4.0     |
| 0      | 5       | 343.1 | 7.1   | 3.3     | 1      | 5    | 353.6 | 6.3   | 4.2     |
| 0      | 6       | 373.0 | 7.1   | 3.3     | 1      | 6    | 374.3 | 6.1   | 4.4     |
| 0      | 7       | 309.5 | 6.7   | 3.7     | 1      | 7    | 386.3 | 6.1   | 4.5     |
| 0      | 8       | 387.7 | 7.0   | 3.4     | 1      | 8    | 367.0 | 6.4   | 4.1     |
| 0      | 9       | 113.6 | 6.3   | 4.2     | 1      | 9    | 200.6 | 6.2   | 4.3     |
| 0      | 10      | 393.8 | 5.8   | 5.0     | 1      | 10   | 352.5 | 6.2   | 4.4     |
| 0      | 11      | 356.7 | 6.5   | 3.9     | 1      | 11   | 361.1 | 6.3   | 4.1     |
| 0      | 12      | 359.4 | 6.7   | 3.7     | 1      | 12   | 260.6 | 6.2   | 4.2     |
| 0      | 13      | 337.7 | 6.5   | 3.9     | 1      | 13   | 312.6 | 6.5   | 3.9     |
| 0      | 14      | 337.6 | 6.8   | 3.6     | 1      | 14   | 368.2 | 6.5   | 3.9     |
| 0      | 15      | 295.5 | 6.4   | 4.0     | 1      | 15   | 326.5 | 6.3   | 4.2     |
|        |         |       |       |         |        |      |       |       |         |
| 0      | 16      | 351.9 | 4.2   | 3.8     | 1      | 16   | 322.8 | 4.3   | 3.7     |
| 0      | 17      | 400.1 | 4.0   | 4.2     | 1      | 17   | 420.4 | 3.9   | 4.6     |
| 0      | 18      | 384.4 | 4.3   | 3.7     | 1      | 18   | 384.1 | 4.3   | 3.6     |
| 0      | 19      | 211.0 | 4.1   | 4.0     | 1      | 19   | 339.8 | 4.2   | 3.8     |
| 0      | 20      | 384.6 | 4.4   | 3.5     | 1      | 20   | 329.9 | 3.8   | 4.6     |
| 0      | 21      | 397.8 | 4.1   | 4.1     | 1      | 21   | 407.2 | 3.9   | 4.4     |
| 0      | 22      | 260.6 | 4.2   | 3.9     | 1      | 22   | 347.2 | 4.1   | 4.0     |
| 0      | 23      | 221.8 | 4.2   | 3.9     | 1      | 23   | 377.9 | 3.8   | 4.6     |
| 0      | 24      | 413.6 | 4.1   | 4.1     | 1      | 24   | 363.6 | 3.9   | 4.4     |
| 0      | 25      | 371.8 | 4.1   | 4.1     | 1      | 25   | 365.5 | 4.2   | 3.9     |
| 0      | 26      | 362.1 | 4.1   | 4.1     | 1      | 26   | 265.9 | 4.2   | 3.9     |
| 0      | 27      | 323.2 | 4.1   | 4.1     | 1      | 27   | 267.3 | 3.8   | 4.7     |
| 0      | 28      | 429.7 | 4.5   | 3.4     | 1      | 28   | 313.7 | 4.1   | 4.1     |
| 0      | 29      | 423.0 | 4.0   | 4.2     | 1      | 29   | 275.4 | 4.2   | 3.9     |
| 0      | 30      | 285.8 | 4.4   | 3.6     | 1      | 30   | 305.5 | 4.2   | 3.8     |
| 0      | 31      | 318.9 | 4.3   | 3.7     | 1      | 31   | 153.8 | 4.0   | 4.2     |
|        |         |       |       |         |        |      |       |       |         |
|        | sigmas: |       |       |         | 13.44  |      |       |       |         |
| IX0 la | _       |       | 6.6   |         | IX1 la | _    |       | 6.3   |         |
| IX0 sn | nall    |       | 4.2   |         | IX1 sn | nall |       | 4.1   |         |



Reference:

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#### 3.4 Ad-Hoc Performance Test

The ad-hoc performance test is performed to check whether all channels of both sensors are functional. In this test, the thresholds of all channels of one sensor at a time are reduced step by step. By lowering the thresholds, the sensor gets more sensitive to noise. Using that technique, acceptable threshold levels for each channel can be determined. The results vary, depending on the environmental conditions (temperature, EMI). It is also observed that the values of the determined threshold values increase if the unit's sensors were non-powered and simultaneously not purged for timescales of about a day or more. It needs to be pointed out the threshold values come down again to the expected values with time when the unit incl the sensors is powered. Depending on how long the sensors were off and unpurged it can take up to a few week to re-achive the high sensitivity. Nevertheless, under normal conditions the variations of the determined thresholds for each channel are sufficiently low when repeating this test. This test can be considered successful if no deviations larger than three from the expected threshold values per channel and sensor are detected. For STEP FS, the thresholds shwon below have been determined (2018-08-15, at room temperature) representing the expected threshold values:

#### Integral channel (IX1):

Resulting thresholds: [5, 7, 5, 5, 5, 7, 5, 6, 5, 6, 6, 5, 6, 6, 5, 5, 7, 6, 6, 7, 4, 5, 5, 6, 6, 6, 7, 5, 6, 4, 7, 6]

Mean of all thresholds: 5.69 Mean of large pixel thresholds: 6.38 Mean of small pixel thresholds: 5.00

Thresholds of large pixels: [7, 7, 6, 6, 6, 6, 7, 6, 6, 7, 6, 6, 7, 6, 7, 6]

 $Corresponds\ to\ IX\ channel:\ [1,\ 5,\ 7,\ 9,\ 10,\ 12,\ 16,\ 17,\ 18,\ 19,\ 23,\ 24,\ 26,\ 28,\ 30,\ 31]$ 

Thresholds of small pixels: [5, 5, 5, 5, 5, 5, 5, 6, 5, 5, 4, 5, 5, 6, 5, 4]

 $Corresponds\ to\ IX\ channel:\ [0,\ 2,\ 3,\ 4,\ 6,\ 8,\ 11,\ 13,\ 14,\ 15,\ 20,\ 21,\ 22,\ 25,\ 27,\ 29]$ 

#### Proton channel (IX2):

Resulting thresholds: [4, 6, 5, 5, 5, 6, 5, 6, 5, 5, 7, 5, 5, 5, 6, 6, 6, 6, 6, 7, 5, 5, 5, 6, 6, 5, 6, 5, 6, 5, 6, 5, 6, 5, 6]

Mean of all thresholds: 5.47 Mean of large pixel thresholds: 5.94 Mean of small pixel thresholds: 5.00

Thresholds of large pixels: [6, 6, 6, 5, 7, 5, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6]

Corresponds to IX channel: [1, 5, 7, 9, 10, 12, 16, 17, 18, 19, 23, 24, 26, 28, 30, 31]

Thresholds of small pixels: [4, 5, 5, 5, 5, 5, 5, 5, 6, 5, 5, 5, 5, 5, 5]

 $\hbox{Corresponds to IX channel: } [0,\,2,\,3,\,4,\,6,\,8,\,11,\,13,\,14,\,15,\,20,\,21,\,22,\,25,\,27,\,29] \\$ 

With this criterion, the ad-hoc performance tests yielded positive results each time they were conducted, which means the variations were reasonably small. Hence, we consider the performance tests that have been conducted as successful.



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#### 3.5 Continuous Functionality and Performance Check

For unit calibration purposes Ba133 spectra have been acquired during calibration campaigns in the Kiel Thermal Vacuum Chamber with the unit at mission-plausible temperatures while also adhering the expected thermal gradients throughout the unit. From the acquired data the energy resolution for each channel (equals pixel) has been determined. The table below lists the mean energy resolution over all applied temperatures. Also, the sensitivity was determined at all temperatures. The value in the table represents the worst sensitivity across the whole temperature range. It can be seen that the energy resolution (FWHM) is usually in the order of 700 eV or better. The sensitivity is better than 3 keV for all pixels and temperatures.

|          |           | Integral Channel          | (IX0)        | Magnet Channel (IX1) |                 |  |
|----------|-----------|---------------------------|--------------|----------------------|-----------------|--|
| IX chn   | SSD pixel | mean FWHM worst detection |              | mean FWHM            | worst detection |  |
|          |           | in eV of Ba133            | threshold in | in eV of Ba133       | threshold in    |  |
|          |           | 81 keV line               | keV          | 81 keV line          | keV             |  |
| Large p  | ixels     |                           |              |                      |                 |  |
| 1        | 15        | 660                       | 2.2          | 669                  | 2.1             |  |
| 5        | 10        | 698                       | 2.3          | 658                  | 2.4             |  |
| 7        | 5         | 708                       | 2.4          | 681                  | 2.4             |  |
| 9        | 14        | 667                       | 2.7          | 686                  | 2.5             |  |
| 10       | 9         | 656                       | 2.1          | 674                  | 2.4             |  |
| 12       | 4         | 672                       | 2.4          | 687                  | 2.4             |  |
| 16       | 0         | 711                       | 2.4          | 695                  | 2.3             |  |
| 17       | 3         | 649                       | 2.4          | 656                  | 2.6             |  |
| 18       | 8         | 728                       | 2.4          | 666                  | 2.3             |  |
| 19       | 13        | 691                       | 2.4          | 683                  | 2.4             |  |
| 23       | 2         | 702                       | 2.6          | 654                  | 2.4             |  |
| 24       | 7         | 676                       | 2.5          | 680                  | 2.4             |  |
| 26       | 12        | 671                       | 2.2          | 676                  | 2.0             |  |
| 28       | 1         | 669                       | 2.5          | 659                  | 2.3             |  |
| 30       | 6         | 736                       | 2.3          | 669                  | 2.2             |  |
| 31       | 11        | 671                       | 2.4          | 691                  | 2.6             |  |
| Small pi | ixels     |                           |              |                      |                 |  |
| 0        | 15        | 645                       | 1.6          | 640                  | 2.2             |  |
| 2        | 10        | 596                       | 1.9          | 608                  | 2.0             |  |
| 3        | 5         | 656                       | 1.9          | 601                  | 2.1             |  |
| 4        | 14        | 545                       | 2.0          | 606                  | 1.7             |  |
| 6        | 9         | 576                       | 1.8          | 590                  | 1.9             |  |
| 8        | 4         | 589                       | 1.9          | 638                  | 1.8             |  |
| 11       | 13        | 615                       | 1.6          | 580                  | 1.9             |  |
| 13       | 8         | 627                       | 1.9          | 610                  | 1.9             |  |
| 14       | 3         | 622                       | 1.8          | 602                  | 1.9             |  |
| 15       | 0         | 658                       | 2.0          | 620                  | 2.0             |  |
| 20       | 2         | 631                       | 1.7          | 626                  | 1.7             |  |
| 21       | 7         | 689                       | 1.8          | 621                  | 1.9             |  |
| 22       | 12        | 612                       | 2.0          | 586                  | 1.8             |  |
| 25       | 1         | 629                       | 1.9          | 604                  | 1.9             |  |
| 27       | 6         | 627                       | 1.7          | 606                  | 1.8             |  |
| 29       | 11        | 581                       | 1.7          | 611                  | 1.7             |  |



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The figure below shows calibrated Ba133 spectra only separated for the two sensors (IX1 = Integral channel, IX2 = Magnet channel) but integrated over all 32 channels of the particular sensor and integrated over multiple unit temperatures (ranging from  $+22^{\circ}\text{C}$  to  $-52^{\circ}\text{C}$  IX temperature. This is to verify the validity of the various channels' thermal calibrations. The FWHM of these two sensorand temperature-integrated spectra can be determined to be around 700 to 800 eV, respectively, determined at the 53 keV line. This value is only slightly larger than the FWHMs of the single channels determined at a single unit's temperature (around 600 eV as per table above) and proves a good thermal and overall calibration. The additional line in IX2 at roughly 37-39keV stems from the fluorescence of Nd (Neodymium), used in the permanent magnets close to IX2.

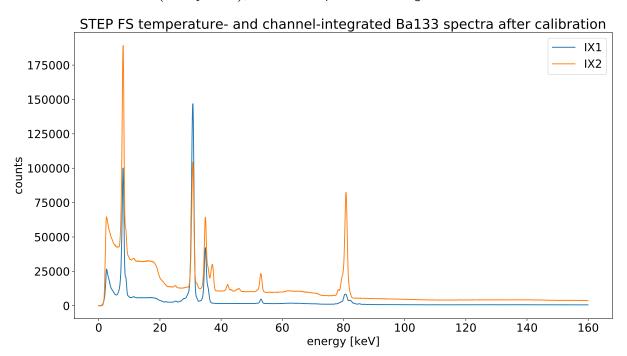


Figure 1: Calibrated Ba133 spectra integrated over all channels of both sensors (IX1 = Integral channel, IX2 = Magnet channel) at multiple temperatures to validate the unit's thermal calibration.



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### 3.6 Operational Heaters Proof of Work

To prove the autonomous functionality of the operational heaters the unit was set to operation (nominal mode) at temperatures cold enough to trigger operational heating. As expected, the operational heaters autonomously started heating up the unit via the unit's heaters located on the LVPS board. This is demonstrated on the figure below. Note that the unit is in parallel being heated via the heating provisions of the TVAC chamber it is installed in but the increased heating rate of the LVPS board can easily be identified. It can also be seen that the operational heaters were switched off at the set temperature autonomously, as well.

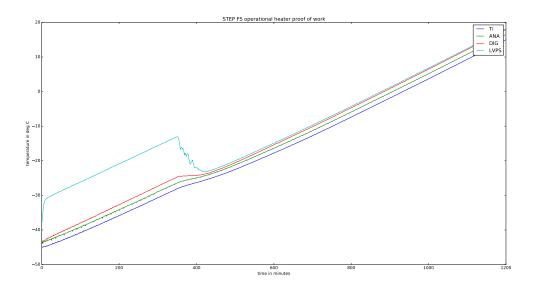


Figure 2: STEP FS operational heaters proof of work.



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### 3.7 NCR-specific Tests (for NCRs with possible impact on the unit's performance or way of operation

#### 3.7.1 NCR-0040: unconnected GND pin of the ripple counter

The root cause for this NCR did not have any impact on the unit's ad-hoc operation or performance. Thus, no NCR-specific tests were conducted. All subsequent SFTs and FFTs yielded positive results.

#### 3.7.2 NCR-0042: x-axis random vibration over-testing at Airbus DS Portsmouth

The overtesting did not introduce any observed damage to the electrical components and neither altered the unit's ad-hoc operation or performance. Thus, no NCR-specific tests were conducted. All subsequent SFTs and FFTs yielded positive results.

#### 3.7.3 NCR-0044: SRAM read errors

In the scope of NCR-0044 SRAM read errors were observed. After successful modification of the STEP FS DIG board the earlier-observed SRAM read errors have not been observed any further. This is true for extended tests on the cleanbench and a slow (and thus extensive) special TVAC cycle focusing on this issue as well. All subsequent SFTs and FFTs yielded positive results.



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### 4 ANNEX: FT document scans

The following pages are scans of the functional tests performed on the STEP FS.

### STEP FS 17.12.88 BEPROM UPPATE



### STEP FS Functional test plan and procedure

Reference:

SO-EPD-KIE-TP-0051

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### 4.3 Unit Impedance Check

This test was not performed as the unit

After transport, before the first connection to the EGSE, and after tests with higher risks to damage the unit the impedances of the unit shall be measured and compared with the expected values as given in the table (based on RD-1):

| MDM15              |         | 他们会     |                     |             |
|--------------------|---------|---------|---------------------|-------------|
| Name               | Pin (+) | Pin (-) | Expected $[\Omega]$ | Measurement |
| Thermistor 1       | 1       | 9       | 15k to 20k *        |             |
| Thermistor 2       | 2       | 10      | 15k to 20k *        |             |
| Thermistor 3       | 3       | 11      | 15k to 20k *        |             |
| Survival Heaters 1 | 7       | 14      | 119                 |             |
| Survival Heaters 2 | 8       | 15      | 119                 |             |

has stored without being moved from clean room

<sup>\*</sup> See figure below, all thermistors are supposed to show similar results depending on the unit's temperature.

| Γ= 0=    | Τ         |
|----------|-----------|
| Temp. °C | Ohms      |
|          | Ţ         |
| -60      | 1,342,000 |
| -55      | 957,000   |
| -50      | 690,000   |
| -45      | 503,700   |
| -40      | 371,300   |
| -35      | 276,200   |
| -30      | 207,500   |
| -25      | 157,200   |
| -20      | 120,100   |
| -15      | 92,600    |
| -10      | 71,940    |
| -5       | 56,310    |
| 0        | 44,420    |
| 2        | 40,490    |
| 4        | 36,930    |
| 6        | 33,740    |
| 8        | 30,840    |
| 10       | 28,230    |
| 12       | 25,860    |
| 14       | 23,720    |
| 16       | 21,780    |
| 18       | 20,010    |

| Temp. °C | Ohms   |
|----------|--------|
|          |        |
| 20       | 18,410 |
| 22       | 16,950 |
| 24       | 15,620 |
| 25       | 15,000 |
| 26       | 14,410 |
| 28       | 13,310 |
| 30       | 12,300 |
| 32       | 11,370 |
| 34       | 10,530 |
| 36       | 9,756  |
| 38       | 9,047  |
| 40       | 8,397  |
| 42       | 7,800  |
| 44       | 7,253  |
| 46       | 6,747  |
| 48       | 6,282  |
| 50       | 5,855  |
| 52       | 5,460  |
| 54       | 5,096  |
| 56       | 4,758  |
| 58       | 4,448  |
| 60       | 4,160  |

Figure 3: Thermistor resistivities for various temperatures, taken from the thermistor's datasheet



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| MDM25   |                    |           |                        |                     |             |
|---------|--------------------|-----------|------------------------|---------------------|-------------|
| Pin (+) | Signal             | Pin (-)   | Signal                 | Expected $[\Omega]$ | Measurement |
| 142     | No.                | minal pov | ver lines and groundin | ıg 🛴                |             |
| Chassis | Instrument chassis | 15        | Chassis gnd            | < 1                 |             |
| Chassis | Instrument chassis | 24        | Chassis gnd            | < 1                 | -           |
| Chassis | Instrument chassis | 1         | Nom. power             | >10M                |             |
| 14      | Nom. power return  | 1         | Nom. power             | >10M                |             |
| \$30.   |                    |           | dant power lines       |                     |             |
| Chassis | Instrument chassis | 13        | Red. power             | >10M                |             |
| 25      | Red. power return  | 13        | Red. power             | >10M                |             |
| - 下事    |                    |           | communication lines    |                     |             |
| 4       | LVDS I2S-          | 16        | LVDS I2S+              | 100                 |             |
| 6       | CLK I2S+           | 19        | CLK I2S-               | 100                 |             |
| 8       | LVDS S2I+          | 21        | LVDS S2I-              | 50                  |             |
|         |                    | Redundant | communication lines    |                     |             |
| 5       | LVDS I2S-          | 17        | LVDS I2S+              | 100                 |             |
| 7       | CLK I2S+           | 20        | CLK I2S-               | 100                 |             |
| 10      | LVDS S2I-          | 22        | LVDS S2I+              | 50                  |             |
|         |                    | not con   | nected (NC) pins       |                     |             |
| 2       | NC                 | Chassis   | Instrument chassis     | >10M                |             |
| 3       | DGND               | Chassis   | Instrument chassis     | < 1                 |             |
| 4       | LVDS I2S-          | Chassis   | Instrument chassis     | >10M                |             |
| 5       | LVDS I2S-          | Chassis   | Instrument chassis     | >10M                |             |
| 6       | CLK I2S+           | Chassis   | Instrument chassis     | >10M                |             |
| 7       | CLK I2S+           | Chassis   | Instrument chassis     | >10M                |             |
| 8       | LVDS S2I+          | Chassis   | Instrument chassis     | >10M                |             |
| 9       | NC                 | Chassis   | Instrument chassis     | >10M                |             |
| 10      | LVDS S2I-          | Chassis   | Instrument chassis     | >10M                |             |
| 11      | DGND.              | Chassis   | Instrument chassis     | < 1                 | 4           |
| 12      | NC                 | Chassis   | Instrument chassis     | >10M                |             |
| 14      | Nom. power return  | Chassis   | Instrument chassis     | 100k                |             |
| 16      | LVDS I2S+          | Chassis   | Instrument chassis     | >10M                |             |
| 17      | LVDS I2S+          | Chassis   | Instrument chassis     | >10M                |             |
| 18      | NC                 | Chassis   | Instrument chassis     | >10M                |             |
| 19      | CLK I2S-           | Chassis   | Instrument chassis     | >10M                |             |
| 20      | CLK I2S-           | Chassis   | Instrument chassis     | >10M                |             |
| 21      | LVDS S2I-          | Chassis   | Instrument chassis     | >10M                |             |
| 22      | LVDS S2I+          | Chassis   | Instrument chassis     | >10M                |             |
| 23      | NC                 | Chassis   | Instrument chassis     | >10M                |             |
| 25      | Red. power return  | Chassis   | Instrument chassis     | 100k                |             |



Reference:

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for EEMUM VPdate

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### 4.4 Abbreviated Safe-to-Mate Test and Power Consumption Check

The abbreviated safe-to-mate test shall be performed before the first connection of EGSE to the unit and after transport of the EGSE.

| MDM25    |                    |            |                  |                |               |
|----------|--------------------|------------|------------------|----------------|---------------|
| Pin (+)  | Signal             | Pin (-)    | Signal           | Expected [V]   | Measurement   |
| 1        | Nom. power         | 14         | Nom. power ret.  | 28 or 0 *      | 28.03 ~ ~     |
| 13       | Red. power         | 25         | Red. power ret.  | 28 or 0 *      | OVL           |
| * 28V ex | xpected if connect | ted to the | corresponding NO | M or RED port, | 0V otherwise. |
| any      | other pin          | 15         | Chassis gnd      | < 3            | 63 V          |
| MDM15    | MDM15              |            |                  |                |               |
| 1        | Thermistor 1       | 9          | Thermistor 1     | tbd by ADS *   |               |
| 2        | Thermistor 2       | 10         | Thermistor 2     | tbd by ADS *   |               |
| 3        | 3 Thermistor 3 1   |            | Thermistor 3     | tbd by ADS *   |               |
| 7        | Surv Heaters 1     | 14         | Surv Heaters 1   | 28             |               |
| 8        | Surv Heaters 2     | 15         | Surv Heaters 2   | 28             |               |

<sup>\*</sup> Voltage and polarity to be defined by ADS, a constant voltage lower than 28 V is expected.

After successful safe-to-mate test, the unit can be powered. The power consumption of the unit is not supposed to change significantly. When powered, the unit shall drain about 100 mA at 28 V, so about 2.8 W. The current limitation of the power supply shall be set to 500 mA. Document the power consumption as part of the standard procedure. This condition resembles the "Unit unconfigured" as per the table below. After configuration of the sensors, the total power consumption is expected to increase to 100 mA  $\pm$  5 mA. For the unconfigured unit (after power ON), or after a "reset"-command after communication has been established:

| Parameter | Expected                        | Measured |   |
|-----------|---------------------------------|----------|---|
| Voltage   | 28.0 V                          | 28.0 V   | V |
| Current   | $100\mathrm{mA}\pm5\mathrm{mA}$ | 98 mA    | V |

To define the units power consumption under the different operational modes and under different supply voltages, document the power consumption under the conditions as given below. **This part of the procedure is required to be conducted only once!** 

| Condition                   | 28.0 V | Current | 26.0 V | Current | 29.0 V | Current |
|-----------------------------|--------|---------|--------|---------|--------|---------|
| Unit unconfigured           |        |         |        |         |        |         |
| (after POWER ON)            |        |         |        |         |        |         |
| Unit in HK mode             |        |         |        |         |        |         |
|                             |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (low activity)              |        |         |        |         | 8 5    |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (high activity, testpulser) |        |         |        |         |        |         |



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### 4.5 Setting up Unit Communication

This short sequence describes how to set up the unit and to establish and check the communication with the EGSE. This sequence has to be obeyed before performing any of the following tests.

- Make sure the laptop is switched ON
- Switch ON the laboratory power supply. Make sure that the supply voltage is at 28 V, or at least within the margins given in AD-2. After power-on the STEP unit will drain about 2.8 W, i.e. the current will be roughly 100 mA.
- On the laptop follow these steps:
  - in a terminal browse to /data/etsolo1/step/svn/solo/eda/gse/
  - start a session with typing ./sologse.py and press enter
  - in the prompt you then should read amongst others:
     Connected to UNIT via /dev/ttyUSBx
     Connected to GSE via /dev/ttyUSBx
  - test the communication with the unit (each line followed by an enter):

reset()
status()

All data bokfine with

EEPROM V3.

If status() returns an SoloGSE timeout error, close the session (Ctrl + D), re-plug the USB cable, restart the session, and repeat the communication test. If status() returns a list of parameters, the connection to the unit has been established successfully. Use this session to perform the below listed tests.

\* This was successful. (Pre-update SFT)

\* The EEPROM Content has been updated

from VO to V3 in STEP FS successfully.

\* Post-update SFT was successful.

Data collected

for about 2 hours.

PA AIT Instrumat Scientist



Reference:

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### 4.3 Unit Impedance Check

After transport, before the first connection to the EGSE, and after tests with higher risks to damage the unit the impedances of the unit shall be measured and compared with the expected values as given in the table (based on RD-1):

| MDM15              |         |         |                     |             |
|--------------------|---------|---------|---------------------|-------------|
| Name               | Pin (+) | Pin (-) | Expected $[\Omega]$ | Measurement |
| Thermistor 1       | 1       | 9       | 15k to 20k *        | 15,76K      |
| Thermistor 2       | 2       | 10      | 15k to 20k *        | 15,70h      |
| Thermistor 3       | 3       | 11      | 15k to 20k *        | 15,72K      |
| Survival Heaters 1 | 7       | 14      | 119                 | 118,7       |
| Survival Heaters 2 | 8       | 15      | 119                 | 119,6       |

06

<sup>\*</sup> See figure below, all thermistors are supposed to show similar results depending on the unit's temperature.

| Temp. °C | Ohms      |
|----------|-----------|
|          |           |
| -60      | 1,342,000 |
| -55      | 957,000   |
| -50      | 690,000   |
| -45      | 503,700   |
| -40      | 371,300   |
| -35      | 276,200   |
| -30      | 207,500   |
| -25      | 157,200   |
| -20      | 120,100   |
| -15      | 92,600    |
| -10      | 71,940    |
| -5       | 56,310    |
| 0        | 44,420    |
| 2        | 40,490    |
| 4        | 36,930    |
| 6        | 33,740    |
| 8        | 30,840    |
| 10       | 28,230    |
| 12       | 25,860    |
| 14       | 23,720    |
| 16       | 21,780    |
| 18       | 20,010    |

| Temp. °C | Ohms   |
|----------|--------|
|          | 1      |
| 20       | 18,410 |
| 22       | 16,950 |
| 24       | 15,620 |
| 25       | 15,000 |
| 26       | 14,410 |
| 28       | 13,310 |
| 30       | 12,300 |
| 32       | 11,370 |
| 34       | 10,530 |
| 36       | 9,756  |
| 38       | 9,047  |
| 40       | 8,397  |
| 42       | 7,800  |
| 44       | 7,253  |
| 46       | 6,747  |
| 48       | 6,282  |
| 50       | 5,855  |
| 52       | 5,460  |
| 54       | 5,096  |
| 56       | 4,758  |
| 58       | 4,448  |
| 60       | 4,160  |

Figure 3: Thermistor resistivities for various temperatures, taken from the thermistor's datasheet



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| MDM25                             |                    |           |                     |                     |             |  |  |  |
|-----------------------------------|--------------------|-----------|---------------------|---------------------|-------------|--|--|--|
| Pin (+)                           | Signal             | Pin (-)   | Signal              | Expected $[\Omega]$ | Measurement |  |  |  |
| Nominal power lines and grounding |                    |           |                     |                     |             |  |  |  |
| Chassis                           | Instrument chassis | 15        | Chassis gnd         | < 1                 | 6.0         |  |  |  |
| Chassis                           | Instrument chassis | 24        | Chassis gnd         | < 1                 | 0,8         |  |  |  |
| Chassis                           | Instrument chassis | 1         | Nom. power          | >10M                | V           |  |  |  |
| 14                                | Nom. power return  | 1         | Nom. power          | > 10M               | V           |  |  |  |
|                                   |                    | Redun     | dant power lines    |                     |             |  |  |  |
| Chassis                           | Instrument chassis | 13        | Red. power          | >10M                | V           |  |  |  |
| 25                                | Red. power return  | 13        | Red. power          | >10M                | V           |  |  |  |
|                                   |                    | Nominal o | communication lines |                     |             |  |  |  |
| 4                                 | LVDS I2S-          | 16        | LVDS I2S+           | 100                 | (62,6       |  |  |  |
| 6                                 | CLK I2S+           | 19        | CLK I2S-            | 100                 | 102,6       |  |  |  |
| 8                                 | LVDS S2I+          | 21        | LVDS S2I-           | 50                  | 51,6        |  |  |  |
|                                   | F                  | Redundant | communication lines |                     |             |  |  |  |
| 5                                 | LVDS I2S-          | 17        | LVDS I2S+           | 100                 | 103.0       |  |  |  |
| 7                                 | CLK I2S+           | 20        | CLK I2S-            | 100                 | 102,9       |  |  |  |
| 10                                | LVDS S2I-          | 22        | LVDS S2I+           | 50                  | 57,3        |  |  |  |
|                                   |                    | not con   | nected (NC) pins    |                     |             |  |  |  |
| 2                                 | NC                 | Chassis   | Instrument chassis  | >10M                |             |  |  |  |
| 3                                 | DGND               | Chassis   | Instrument chassis  | < 1                 | 0,7         |  |  |  |
| 4                                 | LVDS I2S-          | Chassis   | Instrument chassis  | >10M                | V           |  |  |  |
| 5                                 | LVDS I2S-          | Chassis   | Instrument chassis  | >10M                |             |  |  |  |
| 6                                 | CLK I2S+           | Chassis   | Instrument chassis  | >10M                | V           |  |  |  |
| 7                                 | CLK I2S+           | Chassis   | Instrument chassis  | > 10M               | V           |  |  |  |
| 8                                 | LVDS S2I+          | Chassis   | Instrument chassis  | >10M                | V           |  |  |  |
| 9                                 | NC                 | Chassis   | Instrument chassis  | >10M                |             |  |  |  |
| 10                                | LVDS S2I-          | Chassis   | Instrument chassis  | >10M                | $\vee$      |  |  |  |
| 11                                | DGND.              | Chassis   | Instrument chassis  | < 1                 | 0,6         |  |  |  |
| 12                                | NC                 | Chassis   | Instrument chassis  | >10M                | V           |  |  |  |
| 14                                | Nom. power return  | Chassis   | Instrument chassis  | 100k                | 30,0 K      |  |  |  |
| 16                                | LVDS I2S+          | Chassis   | Instrument chassis  | >10M                | V           |  |  |  |
| 17                                | LVDS I2S+          | Chassis   | Instrument chassis  | > 10M               | V           |  |  |  |
| 18                                | NC                 | Chassis   | Instrument chassis  | > 10M               | V           |  |  |  |
| 19                                | CLK I2S-           | Chassis   | Instrument chassis  | >10M                | V           |  |  |  |
| 20                                | CLK I2S-           | Chassis   | Instrument chassis  | >10M                | J           |  |  |  |
| 21                                | LVDS S2I-          | Chassis   | Instrument chassis  | >10M                | V           |  |  |  |
| 22                                | LVDS S2I+          | Chassis   | Instrument chassis  | >10M                | V           |  |  |  |
| 23                                | NC                 | Chassis   | Instrument chassis  | > 10M               | ν           |  |  |  |
| 25                                | Red. power return  | Chassis   | Instrument chassis  | 100k                | 25,011      |  |  |  |



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### Abbreviated Safe-to-Mate Test and Power Consumption Check

The abbreviated safe-to-mate test shall be performed before the first connection of EGSE to the unit and after transport of the EGSE.

| MDM25   |                    |           |                  |                |               |
|---------|--------------------|-----------|------------------|----------------|---------------|
| Pin (+) | Signal             | Pin (-)   | Signal           | Expected [V]   | Measurement   |
| 1       | Nom. power         | 14        | Nom. power ret.  | 28 or 0 *      | V             |
| 13      | Red. power         | 25        | Red. power ret.  | 28 or 0 *      | V             |
| * 28V e | xpected if connect | ed to the | corresponding NO | M or RED port, | 0V otherwise. |
| any     | other pin          | 15        | Chassis gnd      | < 3            | V             |
| MDM15   |                    |           |                  |                |               |
| 1       | Thermistor 1       | 9         | Thermistor 1     | tbd by ADS *   |               |
| 2       | Thermistor 2       | 10        | Thermistor 2     | tbd by ADS *   |               |
| 3       | Thermistor 3       | 11        | Thermistor 3     | tbd by ADS *   |               |
| 7       | Surv Heaters 1     | 14        | Surv Heaters 1   | 28             |               |
| 8       | Surv Heaters 2     | 15        | Surv Heaters 2   | 28             |               |

<sup>\*</sup> Voltage and polarity to be defined by ADS, a constant voltage lower than 28 V is expected.

After successful safe-to-mate test, the unit can be powered. The power consumption of the unit is not supposed to change significantly. When powered, the unit shall drain about 100 mA at 28 V, so about 2.8 W. The current limitation of the power supply shall be set to 500 mA. Document the power consumption as part of the standard procedure. This condition resembles the "Unit unconfigured" as per the table below. After configuration of the sensors, the total power consumption is expected to increase to 100 mA  $\pm$  5 mA. For the unconfigured unit (after power ON), or after a "reset"-command after communication has been established:

| Parameter | Expected                        | Measured |
|-----------|---------------------------------|----------|
| Voltage   | 28.0 V                          | 27.8 V   |
| Current   | $100\mathrm{mA}\pm5\mathrm{mA}$ | 38 m A   |

To define the units power consumption under the different operational modes and under different supply voltages, document the power consumption under the conditions as given below. This part of the procedure is required to be conducted only once!

| Condition                   | 28.0 V | Current | 26.0 V | Current | 29.0 V | Current |
|-----------------------------|--------|---------|--------|---------|--------|---------|
| Unit unconfigured           |        |         |        |         |        |         |
| (after POWER ON)            |        |         |        |         |        |         |
| Unit in HK mode             |        |         |        |         |        |         |
|                             |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (low activity)              |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (high activity, testpulser) |        |         |        |         |        |         |

PFTs successful on RED & NOM drawel Ole



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#### 4.5 Setting up Unit Communication

This short sequence describes how to set up the unit and to establish and check the communication with the EGSE. This sequence has to be obeyed before performing any of the following tests.

- Make sure the laptop is switched ON
- Switch ON the laboratory power supply. Make sure that the supply voltage is at 28 V, or at least within the margins given in AD-2. After power-on the STEP unit will drain about 2.8 W, i.e. the current will be roughly 100 mA.
- On the laptop follow these steps:
  - in a terminal browse to /data/etsolo1/step/svn/solo/eda/gse/
  - start a session with typing ./sologse.py and press enter
  - in the prompt you then should read amongst others:
     Connected to UNIT via /dev/ttyUSBx
     Connected to GSE via /dev/ttyUSBx
  - test the communication with the unit (each line followed by an enter):

reset()
status()

If status() returns an SoloGSE timeout error, close the session (Ctrl + D), re-plug the USB cable, restart the session, and repeat the communication test. If status() returns a list of parameters, the connection to the unit has been established successfully. Use this session to perform the below listed tests.



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2018-02-19 ADS Skraney DC Magnt

### 4.3 Unit Impedance Check

After transport, before the first connection to the EGSE, and after tests with higher risks to damage the unit the impedances of the unit shall be measured and compared with the expected values as given in the table (based on RD-1):

| MDM15              |         |         |              |             |
|--------------------|---------|---------|--------------|-------------|
| Name               | Pin (+) | Pin (-) | Expected [Ω] | Measurement |
| Thermistor 1       | 1       | 9       | 15k to 20k * | 17.02       |
| Thermistor 2       | 2       | 10      | 15k to 20k * | 16,39       |
| Thermistor 3       | 3       | 11      | 15k to 20k * | 16,92       |
| Survival Heaters 1 | 7       | 14      | 119          | 120.6       |
| Survival Heaters 2 | 8       | 15      | 119          | -/22.0      |

120.1 repeat

<sup>\*</sup> See figure below, all thermistors are supposed to show similar results depending on the unit's temperature.

| Temp. °C | Ohms      | 7 | Temp. °C | Ohms   |
|----------|-----------|---|----------|--------|
| 10111111 | 9111115   | J | Temp. 0  | Omns   |
| -60      | 1,342,000 |   | 20       | 18,410 |
| -55      | 957,000   |   | 22       | 16,950 |
| -50      | 690,000   |   | 24       | 15,620 |
| -45      | 503,700   | ] | 25       | 15,000 |
| -40      | 371,300   |   | 26       | 14,410 |
| -35      | 276,200   |   | 28       | 13,310 |
| -30      | 207,500   |   | 30       | 12,300 |
| -25      | 157,200   |   | 32       | 11,370 |
| -20      | 120,100   |   | 34       | 10,530 |
| -15      | 92,600    |   | 36       | 9,756  |
| -10      | 71,940    |   | 38       | 9,047  |
| -5       | 56,310    |   | 40       | 8,397  |
| 0        | 44,420    |   | 42       | 7,800  |
| 2        | 40,490    |   | 44       | 7,253  |
| 4        | 36,930    |   | 46       | 6,747  |
| 6        | 33,740    |   | 48       | 6,282  |
| 8        | 30,840    |   | 50       | 5,855  |
| 10       | 28,230    |   | 52       | 5,460  |
| 12       | 25,860    |   | 54       | 5,096  |
| 14       | 23,720    |   | 56       | 4,758  |
| 16       | 21,780    |   | 58       | 4,448  |
| 18       | 20,010    |   | 60       | 4,160  |

Figure 3: Thermistor resistivities for various temperatures, taken from the thermistor's datasheet



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| MDM25   |                       |           |                       |                     |                     |  |  |  |  |
|---------|-----------------------|-----------|-----------------------|---------------------|---------------------|--|--|--|--|
| Pin (+) | Signal                | Pin (-)   | Signal                | Expected $[\Omega]$ | Measurement         |  |  |  |  |
|         | No                    | minal pow | er lines and groundin | g                   |                     |  |  |  |  |
| Chassis | Instrument chassis    | 15        | Chassis gnd           | < 1                 | 0.6                 |  |  |  |  |
| Chassis | Instrument chassis    | 24        | Chassis gnd           | < 1                 | 0,6                 |  |  |  |  |
| Chassis | Instrument chassis    | 1         | Nom. power            | >10M                | only                |  |  |  |  |
| 14      | Nom. power return     | 1         | Nom. power            | >10M                | o, b open open open |  |  |  |  |
|         | Redundant power lines |           |                       |                     |                     |  |  |  |  |
| Chassis | Instrument chassis    | 13        | Red. power            | >10M                | upe                 |  |  |  |  |
| 25      | Red. power return     | 13        | Red. power            | >10M                | ope                 |  |  |  |  |
|         |                       | Nominal o | communication lines   |                     |                     |  |  |  |  |
| 4       | LVDS I2S-             | 16        | LVDS I2S+             | 100                 | 102.5               |  |  |  |  |
| 6       | CLK I2S+              | 19        | CLK I2S-              | 100                 | 102.5               |  |  |  |  |
| 8       | LVDS S2I+             | 21        | LVDS S2I-             | 50                  | 51.6                |  |  |  |  |
|         | F                     | Redundant | communication lines   |                     |                     |  |  |  |  |
| 5       | LVDS I2S-             | 17        | LVDS I2S+             | 100                 | 102,5               |  |  |  |  |
| 7       | CLK I2S+              | 20        | CLK I2S-              | 100                 | 102.6               |  |  |  |  |
| 10      | LVDS S2I-             | 22        | LVDS S2I+             | 50                  | 51.5                |  |  |  |  |
|         |                       | not con   | nected (NC) pins      |                     |                     |  |  |  |  |
| 2       | NC                    | Chassis   | Instrument chassis    | >10M                | open                |  |  |  |  |
| 3       | DGND                  | Chassis   | Instrument chassis    | < 1                 | 0,5                 |  |  |  |  |
| 4       | LVDS I2S-             | Chassis   | Instrument chassis    | >10M                | 10 pc               |  |  |  |  |
| 5       | LVDS I2S-             | Chassis   | Instrument chassis    | >10M                | ope                 |  |  |  |  |
| 6       | CLK I2S+              | Chassis   | Instrument chassis    | > 10M               | wer                 |  |  |  |  |
| 7       | CLK I2S+              | Chassis   | Instrument chassis    | > 10M               | ye-                 |  |  |  |  |
| 8       | LVDS S2I+             | Chassis   | Instrument chassis    | > 10M               | up                  |  |  |  |  |
| 9       | NC                    | Chassis   | Instrument chassis    | >10M                | 57                  |  |  |  |  |
| 10      | LVDS S2I-             | Chassis   | Instrument chassis    | >10M                | 5/2                 |  |  |  |  |
| 11      | DGND.                 | Chassis   | Instrument chassis    | < 1                 | 0.5                 |  |  |  |  |
| 12      | , NC                  | Chassis   | Instrument chassis    | >10M                | age                 |  |  |  |  |
| 14      | Nom. power return     | Chassis   | Instrument chassis    | 100k                | 99.96               |  |  |  |  |
| 16      | LVDS I2S+             | Chassis   | Instrument chassis    | >10M                | age.                |  |  |  |  |
| 17      | LVDS I2S+             | Chassis   | Instrument chassis    | >10M                | -p                  |  |  |  |  |
| 18      | NC                    | Chassis   | Instrument chassis    | >10M                | ap                  |  |  |  |  |
| 19      | CLK I2S-              | Chassis   | Instrument chassis    | > 10M               | upe                 |  |  |  |  |
| 20      | CLK I2S-              | Chassis   | Instrument chassis    | >10M                | nee                 |  |  |  |  |
| 21      | LVDS S2I-             | Chassis   | Instrument chassis    | >10M                | ege                 |  |  |  |  |
| 22      | LVDS S2I+             | Chassis   | Instrument chassis    | >10M                | and a               |  |  |  |  |
| 23      | NC                    | Chassis   | Instrument chassis    | >10M                | or-                 |  |  |  |  |
| 25      | Red. power return     | Chassis   | Instrument chassis    | 100k                | 99,9 K              |  |  |  |  |



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### 4.4 Abbreviated Safe-to-Mate Test and Power Consumption Check

The abbreviated safe-to-mate test shall be performed before the first connection of EGSE to the unit and after transport of the EGSE.

|          |   |         | 24.70           |              | NOW/RED      |  |  |
|----------|---|---------|-----------------|--------------|--------------|--|--|
| MDM25    |   |         |                 |              |              |  |  |
| Pin (+)  | Signal  | Pin (-) | Signal          | Expected [V] | Measurement  |  |  |
| 1        | Nom. power  | 14      | Nom. power ret. | 28 or 0 *    | 27.93/0      |  |  |
| 13       | Red. power  | 25      | Red. power ret. | 28 or 0 *    | 0/27.92      |  |  |
| * 28V ex | * 28V expected if connected to the corresponding NOM or RED port, 0V otherwise. |         |                 |              |              |  |  |
|          | any other pin   |         | Chassis gnd     | < 3          | <2,6V /<2.6V |  |  |
| MDM15    |   |         |                 |              |              |  |  |
| 1        | Thermistor 1  | 9       | Thermistor 1    | tbd by ADS * |              |  |  |
| 2        | Thermistor 2  | 10      | Thermistor 2    | tbd by ADS * |              |  |  |
| 3        | Thermistor 3  | 11      | Thermistor 3    | tbd by ADS * |              |  |  |
| 7        | Surv Heaters 1  | 14      | Surv Heaters 1  | 28           | 27.87        |  |  |
| 8        | Surv Heaters 2  | 15      | Surv Heaters 2  | 28           | - wc-        |  |  |

<sup>\*</sup> Voltage and polarity to be defined by ADS, a constant voltage lower than 28 V is expected.

After successful safe-to-mate test, the unit can be powered. The power consumption of the unit is not supposed to change significantly. When powered, the unit shall drain about  $100\,\text{mA}$  at  $28\,\text{V}$ , so about  $2.8\,\text{W}$ . The current limitation of the power supply shall be set to  $500\,\text{mA}$ . Document the power consumption as part of the standard procedure. This condition resembles the "Unit unconfigured" as per the table below. After configuration of the sensors, the total power consumption is expected to increase to  $100\,\text{mA} \pm 5\,\text{mA}$ . For the unconfigured unit (after power ON), or after a "reset"-command after communication has been established:

| Parameter | Expected                        | Measured |
|-----------|---------------------------------|----------|
| Voltage   | 28.0 V                          |          |
| Current   | $100\mathrm{mA}\pm5\mathrm{mA}$ |          |

To define the units power consumption under the different operational modes and under different supply voltages, document the power consumption under the conditions as given below. This part of the procedure is required to be conducted only once!

| Condition                   | 28.0 V | Current | 26.0 V | Current | 29.0 V | Current |
|-----------------------------|--------|---------|--------|---------|--------|---------|
| Unit unconfigured           |        |         |        |         |        |         |
| (after POWER ON)            |        |         |        |         |        |         |
| Unit in HK mode             |        |         |        |         |        |         |
|                             |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (low activity)              |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (high activity, testpulser) |        |         |        |         |        |         |



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### 4.5 Setting up Unit Communication

This short sequence describes how to set up the unit and to establish and check the communication with the EGSE. This sequence has to be obeyed before performing any of the following tests.

- Make sure the laptop is switched ON
- Switch ON the laboratory power supply. Make sure that the supply voltage is at 28 V, or at least within the margins given in AD-2. After power-on the STEP unit will drain about 2.8 W, i.e. the current will be roughly 100 mA.
- On the laptop follow these steps:
  - in a terminal browse to /data/etsolo1/step/svn/solo/eda/gse/
  - start a session with typing ./sologse.py and press enter
  - in the prompt you then should read amongst others:
     Connected to UNIT via /dev/ttyUSBx
     Connected to GSE via /dev/ttyUSBx
  - test the communication with the unit (each line followed by an enter):

reset()
status()

If status() returns an SoloGSE timeout error, close the session (Ctrl + D), re-plug the USB cable, restart the session, and repeat the communication test. If status() returns a list of parameters, the connection to the unit has been established successfully. Use this session to perform the below listed tests.



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#### 4.3 Unit Impedance Check

After transport, before the first connection to the EGSE, and after tests with higher risks to damage the unit the impedances of the unit shall be measured and compared with the expected values as given in the table (based on RD-1):

| MDM15              |         |         |                     |             |
|--------------------|---------|---------|---------------------|-------------|
| Name               | Pin (+) | Pin (-) | Expected $[\Omega]$ | Measurement |
| Thermistor 1       | 1       | 9       | 15k to 20k *        |             |
| Thermistor 2       | 2       | 10      | 15k to 20k *        |             |
| Thermistor 3       | 3       | 11      | 15k to 20k *        |             |
| Survival Heaters 1 | 7       | 14      | 119                 |             |
| Survival Heaters 2 | 8       | 15      | 119                 |             |

<sup>\*</sup> See figure below, all thermistors are supposed to show similar results depending on the unit's temperature.

| Temp. °C | Ohms      | Temp. °C | Ohms   |
|----------|-----------|----------|--------|
|          |           |          |        |
| -60      | 1,342,000 | 20       | 18,410 |
| -55      | 957,000   | 22       | 16,950 |
| -50      | 690,000   | 24       | 15,620 |
| -45      | 503,700   | 25       | 15,000 |
| -40      | 371,300   | 26       | 14,410 |
| -35      | 276,200   | 28       | 13,310 |
| -30      | 207,500   | 30       | 12,300 |
| -25      | 157,200   | 32       | 11,370 |
| -20      | 120,100   | 34       | 10,530 |
| -15      | 92,600    | 36       | 9,756  |
| -10      | 71,940    | 38       | 9,047  |
| -5       | 56,310    | 40       | 8,397  |
| 0        | 44,420    | 42       | 7,800  |
| 2        | 40,490    | 44       | 7,253  |
| 4        | 36,930    | 46       | 6,747  |
| 6        | 33,740    | 48       | 6,282  |
| 8        | 30,840    | 50       | 5,855  |
| 10       | 28,230    | 52       | 5,460  |
| 12       | 25,860    | 54       | 5,096  |
| 14       | 23,720    | 56       | 4,758  |
| 16       | 21,780    | 58       | 4,448  |
| 18       | 20,010    | 60       | 4,160  |

Figure 3: Thermistor resistivities for various temperatures, taken from the thermistor's datasheet



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| MDM25   |                    |            |                        |              |             |
|---------|--------------------|------------|------------------------|--------------|-------------|
| Pin (+) | Signal             | Pin (-)    | Signal                 | Expected [Ω] | Measurement |
|         | No                 | ominal pov | ver lines and groundir | ng           |             |
| Chassis | Instrument chassis | 15         | Chassis gnd            | < 1          |             |
| Chassis | Instrument chassis | 24         | Chassis gnd            | < 1          |             |
| Chassis | Instrument chassis | 1          | Nom. power             | >10M         |             |
| 14      | Nom. power return  | 1          | Nom. power             | > 10M        |             |
|         |                    | Redun      | dant power lines       |              |             |
| Chassis | Instrument chassis | 13         | Red. power             | >10M         |             |
| 25      | Red. power return  | 13         | Red. power             | >10M         |             |
|         |                    | Nominal o  | communication lines    |              |             |
| 4       | LVDS I2S-          | 16         | LVDS I2S+              | 100          |             |
| 6       | CLK I2S+           | 19         | CLK I2S-               | 100          |             |
| 8       | LVDS S2I+          | 21         | LVDS S2I-              | 50           |             |
|         | F                  | Redundant  | communication lines    |              |             |
| 5       | LVDS I2S-          | 17         | LVDS I2S+              | 100          |             |
| 7       | CLK I2S+           | 20         | CLK I2S-               | 100          |             |
| 10      | LVDS S2I-          | 22         | LVDS S2I+              | 50           |             |
|         |                    | not cor    | nected (NC) pins       |              |             |
| 2       | NC                 | Chassis    | Instrument chassis     | > 10M        |             |
| 3       | DGND               | Chassis    | Instrument chassis     | < 1          |             |
| 4       | LVDS I2S-          | Chassis    | Instrument chassis     | > 10M        |             |
| 5       | LVDS I2S-          | Chassis    | Instrument chassis     | > 10M        |             |
| 6       | CLK I2S+           | Chassis    | Instrument chassis     | > 10M        |             |
| 7       | CLK I2S+           | Chassis    | Instrument chassis     | > 10M        |             |
| 8       | LVDS S2I+          | Chassis    | Instrument chassis     | > 10M        |             |
| 9       | NC                 | Chassis    | Instrument chassis     | > 10M        |             |
| 10      | LVDS S2I-          | Chassis    | Instrument chassis     | > 10M        |             |
| 11      | DGND.              | Chassis    | Instrument chassis     | < 1          |             |
| 12      | NC                 | Chassis    | Instrument chassis     | > 10M        |             |
| 14      | Nom. power return  | Chassis    | Instrument chassis     | 100k         |             |
| 16      | LVDS I2S+          | Chassis    | Instrument chassis     | > 10M        |             |
| 17      | LVDS I2S+          | Chassis    | Instrument chassis     | >10M         |             |
| 18      | NC                 | Chassis    | Instrument chassis     | > 10M        |             |
| 19      | CLK I2S-           | Chassis    | Instrument chassis     | > 10M        |             |
| 20      | CLK I2S-           | Chassis    | Instrument chassis     | > 10M        |             |
| 21      | LVDS S2I-          | Chassis    | Instrument chassis     | > 10M        |             |
| 22      | LVDS S2I+          | Chassis    | Instrument chassis     | > 10M        |             |
| 23      | NC                 | Chassis    | Instrument chassis     | > 10M        |             |
| 25      | Red. power return  | Chassis    | Instrument chassis     | 100k         |             |



Reference:

SO-EPD-KIE-TP-0051

EM Harnes

oh

STEP PS

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WORKMANSHIP EMC TEST ANDRUS DS EVT PORTSMOWTH TVACL

#### 4.4 Abbreviated Safe-to-Mate Test and Power Consumption Check

The abbreviated safe-to-mate test shall be performed before the first connection of EGSE to the unit and after transport of the EGSE.

| MDM25    |                    |           |                  |                |               |
|----------|--------------------|-----------|------------------|----------------|---------------|
| Pin (+)  | Signal             | Pin (-)   | Signal           | Expected [V]   | Measurement   |
| 1        | Nom. power         | 14        | Nom. power ret.  | 28 or 0 *      | 27.91         |
| 13       | Red. power         | 25        | Red. power ret.  | 28 or 0 *      | O             |
| * 28V ex | spected if connect | ed to the | corresponding NO | M or RED port, | 0V otherwise. |
| any      | any other pin      |           | Chassis gnd      | < 3            | <2.6          |
| MDM15    |                    |           |                  |                |               |
| 1        | Thermistor 1       | 9         | Thermistor 1     | tbd by ADS *   |               |
| 2        | Thermistor 2       | 10        | Thermistor 2     | tbd by ADS *   | u.            |
| 3        | Thermistor 3       | 11        | Thermistor 3     | tbd by ADS *   |               |
| 7        | Surv Heaters 1     | 14        | Surv Heaters 1   | 28             |               |
| 8        | Surv Heaters 2     | 15        | Surv Heaters 2   | 28             |               |

<sup>\*</sup> Voltage and polarity to be defined by ADS, a constant voltage lower than 28 V is expected.

After successful safe-to-mate test, the unit can be powered. The power consumption of the unit is not supposed to change significantly. When powered, the unit shall drain about  $100\,\text{mA}$  at  $28\,\text{V}$ , so about  $2.8\,\text{W}$ . The current limitation of the power supply shall be set to  $500\,\text{mA}$ . Document the power consumption as part of the standard procedure. This condition resembles the "Unit unconfigured" as per the table below. After configuration of the sensors, the total power consumption is expected to increase to  $100\,\text{mA} \pm 5\,\text{mA}$ . For the unconfigured unit (after power ON), or after a "reset"-command after communication has been established:

| Parameter | Expected                        | Measured |
|-----------|---------------------------------|----------|
| Voltage   | 28.0 V                          |          |
| Current   | $100\mathrm{mA}\pm5\mathrm{mA}$ |          |

To define the units power consumption under the different operational modes and under different supply voltages, document the power consumption under the conditions as given below. This part of the procedure is required to be conducted only once!

| Condition                   | 28.0 V | Current | 26.0 V | Current | 29.0 V | Current |
|-----------------------------|--------|---------|--------|---------|--------|---------|
| Unit unconfigured           |        |         |        |         |        |         |
| (after POWER ON)            |        |         |        |         |        |         |
| Unit in HK mode             |        |         |        |         |        |         |
|                             |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (low activity)              |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (high activity, testpulser) |        |         |        |         |        |         |



Reference:

SO-EPD-KIE-TP-0051

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#### 4.5 Setting up Unit Communication

This short sequence describes how to set up the unit and to establish and check the communication with the EGSE. This sequence has to be obeyed before performing any of the following tests.

- Make sure the laptop is switched ON
- Switch ON the laboratory power supply. Make sure that the supply voltage is at 28 V, or at least within the margins given in AD-2. After power-on the STEP unit will drain about 2.8 W, i.e. the current will be roughly 100 mA.
- On the laptop follow these steps:
  - in a terminal browse to /data/etsolo1/step/svn/solo/eda/gse/
  - start a session with typing ./sologse.py and press enter
  - in the prompt you then should read amongst others:
     Connected to UNIT via /dev/ttyUSBx
     Connected to GSE via /dev/ttyUSBx
  - test the communication with the unit (each line followed by an enter):

reset()
status()

If status() returns an SoloGSE timeout error, close the session (Ctrl + D), re-plug the USB cable, restart the session, and repeat the communication test. If status() returns a list of parameters, the connection to the unit has been established successfully. Use this session to perform the below listed tests.



Reference:

119,4

SO-EPD-KIE-TP-0051

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penalty Z-axis vibrato Dost

### **Unit Impedance Check**

2018-09-17

After transport, before the first connection to the EGSE, and after tests with higher risks to damage the unit the impedances of the unit shall be measured and compared with the expected values as given in the table (based on RD-1): Replace Saver

MDM15 Name Pin (+) Pin (-) Expected  $[\Omega]$ Measurement Thermistor 1 9 15k to 20k \* 17.75k Thermistor 2 2 10 15k to 20k \* 17,61 k Thermistor 3 3 11 15k to 20k \* 17.646 Survival Heaters 1 7 14 119 1185 Survival Heaters 2 8 15 119

or

<sup>\*</sup> See figure below, all thermistors are supposed to show similar results depending on the unit's temperature.

| T 00     | O.L.      | 7 | T 00     |        |
|----------|-----------|---|----------|--------|
| Temp. °C | Ohms      |   | Temp. °C | Ohms   |
|          |           | 1 |          |        |
| -60      | 1,342,000 |   | 20       | 18,410 |
| -55      | 957,000   |   | 22       | 16,950 |
| -50      | 690,000   |   | 24       | 15,620 |
| -45      | 503,700   |   | 25       | 15,000 |
| -40      | 371,300   |   | 26       | 14,410 |
| -35      | 276,200   |   | 28       | 13,310 |
| -30      | 207,500   |   | 30       | 12,300 |
| -25      | 157,200   |   | 32       | 11,370 |
| -20      | 120,100   |   | 34       | 10,530 |
| -15      | 92,600    |   | 36       | 9,756  |
| -10      | 71,940    |   | 38       | 9,047  |
| -5       | 56,310    |   | 40       | 8,397  |
| 0        | 44,420    |   | 42       | 7,800  |
| 2        | 40,490    |   | 44       | 7,253  |
| 4        | 36,930    |   | 46       | 6,747  |
| 6        | 33,740    |   | 48       | 6,282  |
| 8        | 30,840    |   | 50       | 5,855  |
| 10       | 28,230    |   | 52       | 5,460  |
| 12       | 25,860    |   | 54       | 5,096  |
| 14       | 23,720    |   | 56       | 4,758  |
| 16       | 21,780    |   | 58       | 4,448  |
| 18       | 20,010    |   | 60       | 4,160  |

Figure 3: Thermistor resistivities for various temperatures, taken from the thermistor's datasheet



Reference:

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| MDM25                             |                    |           |                     |                     |             |  |  |
|-----------------------------------|--------------------|-----------|---------------------|---------------------|-------------|--|--|
| Pin (+)                           | Signal             | Pin (-)   | Signal              | Expected $[\Omega]$ | Measurement |  |  |
| Nominal power lines and grounding |                    |           |                     |                     |             |  |  |
| Chassis                           | Instrument chassis | 15        | Chassis gnd         | < 1                 | 0.6         |  |  |
| Chassis                           | Instrument chassis | 24        | Chassis gnd         | < 1                 | 0.5         |  |  |
| Chassis                           | Instrument chassis | 1         | Nom. power          | > 10M               | 6pm         |  |  |
| 14                                | Nom. power return  | 1         | Nom. power          | > 10M               | ope         |  |  |
| Redundant power lines             |                    |           |                     |                     |             |  |  |
| Chassis                           | Instrument chassis | 13        | Red. power          | > 10M               | ope         |  |  |
| 25                                | Red. power return  | 13        | Red. power          | >10M                | open        |  |  |
|                                   |                    | Nominal c | communication lines |                     |             |  |  |
| 4                                 | LVDS I2S-          | 16        | LVDS I2S+           | 100                 | 102.6       |  |  |
| 6                                 | CLK I2S+           | 19        | CLK I2S-            | 100                 | 8,501       |  |  |
| 8                                 | LVDS S2I+          | 21        | LVDS S2I-           | 50                  | 51.1        |  |  |
|                                   |                    | Redundant | communication lines |                     |             |  |  |
| 5                                 | LVDS I2S-          | 17        | LVDS I2S+           | 100                 | 102.6       |  |  |
| 7                                 | CLK I2S+           | 20        | CLK I2S-            | 100                 | 102.7       |  |  |
| 10                                | LVDS S2I-          | 22        | LVDS S2I+           | 50                  | 51,5        |  |  |
|                                   |                    | not con   | nected (NC) pins    |                     |             |  |  |
| 2                                 | NC                 | Chassis   | Instrument chassis  | >10M                | oper        |  |  |
| 3                                 | DGND               | Chassis   | Instrument chassis  | < 1                 | 0,8         |  |  |
| 4                                 | LVDS I2S-          | Chassis   | Instrument chassis  | >10M                | oper        |  |  |
| 5                                 | LVDS I2S-          | Chassis   | Instrument chassis  | >10M                | cpi         |  |  |
| 6                                 | CLK I2S+           | Chassis   | Instrument chassis  | >10M                | ope         |  |  |
| 7                                 | CLK I2S+           | Chassis   | Instrument chassis  | >10M                | open        |  |  |
| 8                                 | LVDS S2I+          | Chassis   | Instrument chassis  | >10M                | an          |  |  |
| 9                                 | NC                 | Chassis   | Instrument chassis  | >10M                | oh          |  |  |
| 10                                | LVDS S2I-          | Chassis   | Instrument chassis  | > 10M               | open        |  |  |
| 11                                | DGND.              | Chassis   | Instrument chassis  | < 1                 | 0,7         |  |  |
| 12                                | NC                 | Chassis   | Instrument chassis  | > 10M               | oge         |  |  |
| 14                                | Nom. power return  | Chassis   | Instrument chassis  | 100k                | 99,9 k      |  |  |
| 16                                | LVDS I2S+          | Chassis   | Instrument chassis  | >10M                | open        |  |  |
| 17                                | LVDS I2S+          | Chassis   | Instrument chassis  | >10M                | over        |  |  |
| 18                                | NC                 | Chassis   | Instrument chassis  | >10M                | ope         |  |  |
| 19                                | CLK I2S-           | Chassis   | Instrument chassis  | >10M                | op          |  |  |
| 20                                | CLK I2S-           | Chassis   | Instrument chassis  | > 10M               | ope         |  |  |
| 21                                | LVDS S2I-          | Chassis   | Instrument chassis  | > 10M               | cpn         |  |  |
| 22                                | LVDS S2I+          | Chassis   | Instrument chassis  | >10M                | con         |  |  |
| 23                                | NC                 | Chassis   | Instrument chassis  | >10M                | apr         |  |  |
| 25                                | Red. power return  | Chassis   | Instrument chassis  | 100k                | 99.91       |  |  |



Reference:

SO-EPD-KIE-TP-0051

0,09-0.10 A

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### 4.4 Abbreviated Safe-to-Mate Test and Power Consumption Check

The abbreviated safe-to-mate test shall be performed before the first connection of EGSE to the unit and after transport of the EGSE.

| MDM25    |                    |           |                  |                |               |
|----------|--------------------|-----------|------------------|----------------|---------------|
| Pin (+)  | Signal             | Pin (-)   | Signal           | Expected [V]   | Measurement   |
| 1        | Nom. power         | 14        | Nom. power ret.  | 28 or 0 *      |               |
| 13       | Red. power         | 25        | Red. power ret.  | 28 or 0 *      |               |
| * 28V ex | xpected if connect | ed to the | corresponding NO | M or RED port, | 0V otherwise. |
| any      | other pin          | 15        | Chassis gnd      | < 3            |               |
| MDM15    |                    |           |                  |                |               |
| 1        | Thermistor 1       | 9         | Thermistor 1     | tbd by ADS *   |               |
| 2        | Thermistor 2       | 10        | Thermistor 2     | tbd by ADS *   |               |
| 3        | Thermistor 3       | 11        | Thermistor 3     | tbd by ADS *   |               |
| 7        | Surv Heaters 1     | 14        | Surv Heaters 1   | 28             |               |
| 8        | Surv Heaters 2     | 15        | Surv Heaters 2   | 28             |               |

<sup>\*</sup> Voltage and polarity to be defined by ADS, a constant voltage lower than 28 V is expected.

After successful safe-to-mate test, the unit can be powered. The power consumption of the unit is not supposed to change significantly. When powered, the unit shall drain about  $100\,\text{mA}$  at  $28\,\text{V}$ , so about  $2.8\,\text{W}$ . The current limitation of the power supply shall be set to  $500\,\text{mA}$ . Document the power consumption as part of the standard procedure. This condition resembles the "Unit unconfigured" as per the table below. After configuration of the sensors, the total power consumption is expected to increase to  $100\,\text{mA} \pm 5\,\text{mA}$ . For the unconfigured unit (after power ON), or after a "reset"-command after communication has been established:

| Parameter | Expected                        | Measured REP | NOM   |
|-----------|---------------------------------|--------------|-------|
| Voltage   | 28.0 V                          | \$ 27.9 V    | 27.9V |
| Current   | $100\mathrm{mA}\pm5\mathrm{mA}$ | 0.10 A       | 0.70A |

To define the units power consumption under the different operational modes and under different supply voltages, document the power consumption under the conditions as given below. This part of the procedure is required to be conducted only once!

| Condition                   | 28.0 V | Current | 26.0 V | Current | 29.0 V | Current |
|-----------------------------|--------|---------|--------|---------|--------|---------|
| Unit unconfigured           |        |         |        |         |        |         |
| (after POWER ON)            |        |         |        |         |        |         |
| Unit in HK mode             |        |         |        |         |        |         |
|                             |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (low activity)              |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (high activity, testpulser) |        |         |        |         |        |         |

SET. FITS ON RED & NOM SUCCESSIFIC (DCCFFOR)



Reference:

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#### 4.5 Setting up Unit Communication

This short sequence describes how to set up the unit and to establish and check the communication with the EGSE. This sequence has to be obeyed before performing any of the following tests.

- Make sure the laptop is switched ON
- Switch ON the laboratory power supply. Make sure that the supply voltage is at 28 V, or at least within the margins given in AD-2. After power-on the STEP unit will drain about 2.8 W, i.e. the current will be roughly 100 mA.
- On the laptop follow these steps:
  - in a terminal browse to /data/etsolo1/step/svn/solo/eda/gse/
  - start a session with typing ./sologse.py and press enter
  - in the prompt you then should read amongst others:
     Connected to UNIT via /dev/ttyUSBx
     Connected to GSE via /dev/ttyUSBx
  - test the communication with the unit (each line followed by an enter):

reset()
status()

If status() returns an SoloGSE timeout error, close the session (Ctrl + D), re-plug the USB cable, restart the session, and repeat the communication test. If status() returns a list of parameters, the connection to the unit has been established successfully. Use this session to perform the below listed tests.



Reference:

17.03.2018

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Dost-housportation d

#### 4.3 Unit Impedance Check

After transport, before the first connection to the EGSE, and after tests with higher risks to damage the unit the impedances of the unit shall be measured and compared with the expected values as given in the table (based on RD-1):

| MDM15              |         |         |                     |             |
|--------------------|---------|---------|---------------------|-------------|
| Name               | Pin (+) | Pin (-) | Expected $[\Omega]$ | Measurement |
| Thermistor 1       | 1       | 9       | 15k to 20k *        | 16.38 kc.   |
| Thermistor 2       | 2       | 10      | 15k to 20k *        | 16:27 k     |
| Thermistor 3       | 3       | 11      | 15k to 20k *        | 16.30k      |
| Survival Heaters 1 | 7       | 14      | 119                 | 118.6       |
| Survival Heaters 2 | 8       | 15      | 119                 | 119.5       |

oh

Remove Connector Saver

clean text

<sup>\*</sup> See figure below, all thermistors are supposed to show similar results depending on the unit's temperature.

21C outside the

| Temp. °C | Ohms |
|----------|------|
|----------|------|

| -60 | 1,342,000 |
|-----|-----------|
| -55 | 957,000   |
| -50 | 690,000   |
| -45 | 503,700   |
| -40 | 371,300   |
| -35 | 276,200   |
| -30 | 207,500   |
| -25 | 157,200   |
| -20 | 120,100   |
| -15 | 92,600    |
| -10 | 71,940    |
| -5  | 56,310    |
| 0   | 44,420    |
| 2   | 40,490    |
| 4   | 36,930    |
| 6   | 33,740    |
| 8   | 30,840    |
| 10  | 28,230    |
| 12  | 25,860    |
| 14  | 23,720    |
| 16  | 21.780    |

18

| Temp. °C | Ohms |
|----------|------|
|          |      |

| 20 | 18,410 |
|----|--------|
| 22 | 16,950 |
| 24 | 15,620 |
| 25 | 15,000 |
| 26 | 14,410 |
| 28 | 13,310 |
| 30 | 12,300 |
| 32 | 11,370 |
| 34 | 10,530 |
| 36 | 9,756  |
| 38 | 9,047  |
| 40 | 8,397  |
| 42 | 7,800  |
| 44 | 7,253  |
| 46 | 6,747  |
| 48 | 6,282  |
| 50 | 5,855  |
| 52 | 5,460  |
| 54 | 5,096  |
| 56 | 4,758  |
| 58 | 4,448  |
| 60 | 4,160  |

Figure 3: Thermistor resistivities for various temperatures, taken from the thermistor's datasheet

20,010



Reference:

SO-EPD-KIE-TP-0051

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| MDM25   |                    |            |                       |                     |             |
|---------|--------------------|------------|-----------------------|---------------------|-------------|
| Pin (+) | Signal             | Pin (-)    | Signal                | Expected $[\Omega]$ | Measurement |
|         | No                 | minal pow  | er lines and groundin | g                   |             |
| Chassis | Instrument chassis | 15         | Chassis gnd           | < 1                 | 0.7         |
| Chassis | Instrument chassis | 24         | Chassis gnd           | < 1                 | 0,7         |
| Chassis | Instrument chassis | 1          | Nom. power            | > 10M               | oper        |
| 14      | Nom. power return  | 1          | Nom. power            | > 10M               | one         |
|         |                    | Redun      | dant power lines      |                     |             |
| Chassis | Instrument chassis | 13         | Red. power            | >10M                | open        |
| 25      | Red. power return  | 13         | Red. power            | > 10M               | gren        |
|         |                    | Nominal of | communication lines   |                     | 0           |
| 4       | LVDS I2S-          | 16         | LVDS I2S+             | 100                 | 102.8       |
| 6       | CLK I2S+           | 19         | CLK I2S-              | 100                 | 102.8       |
| 8       | LVDS S2I+          | 21         | LVDS S2I-             | 50                  | 51.7        |
|         | F                  | Redundant  | communication lines   |                     |             |
| 5       | LVDS I2S-          | 17         | LVDS I2S+             | 100                 | 102.9       |
| 7       | CLK I2S+           | 20         | CLK I2S-              | 100                 | 103.0       |
| 10      | LVDS S2I-          | 22         | LVDS S2I+             | 50                  | 52,0        |
|         |                    | not con    | nected (NC) pins      |                     |             |
| 2       | NC                 | Chassis    | Instrument chassis    | > 10M               | of          |
| 3       | DGND               | Chassis    | Instrument chassis    | < 1                 | 0.8         |
| 4       | LVDS I2S-          | Chassis    | Instrument chassis    | >10M                | ope         |
| 5       | LVDS I2S-          | Chassis    | Instrument chassis    | >10M                | ope         |
| 6       | CLK I2S+           | Chassis    | Instrument chassis    | >10M                | open        |
| 7       | CLK I2S+           | Chassis    | Instrument chassis    | >10M                | one         |
| 8       | LVDS S2I+          | Chassis    | Instrument chassis    | >10M                | ope         |
| 9       | NC                 | Chassis    | Instrument chassis    | >10M                | com         |
| 10      | LVDS S2I-          | Chassis    | Instrument chassis    | >10M                | cym         |
| 11      | DGND.              | Chassis    | Instrument chassis    | < 1                 | 0.7         |
| 12      | NC                 | Chassis    | Instrument chassis    | >10M                | ope         |
| 14      | Nom. power return  | Chassis    | Instrument chassis    | 100k                | 99,9 K      |
| 16      | LVDS I2S+          | Chassis    | Instrument chassis    | >10M                | appe        |
| 17      | LVDS I2S+          | Chassis    | Instrument chassis    | >10M                | com         |
| 18      | NC                 | Chassis    | Instrument chassis    | >10M                | ope         |
| 19      | CLK I2S-           | Chassis    | Instrument chassis    | >10M                | 57          |
| 20      | CLK I2S-           | Chassis    | Instrument chassis    | >10M                | of          |
| 21      | LVDS S2I-          | Chassis    | Instrument chassis    | >10M                | ope         |
| 22      | LVDS S2I+          | Chassis    | Instrument chassis    | >10M                | open        |
| 23      | NC                 | Chassis    | Instrument chassis    | > 10M               | ine         |
| 25      | Red. power return  | Chassis    | Instrument chassis    | 100k                | 9929        |



Reference:

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#### 4.4 Abbreviated Safe-to-Mate Test and Power Consumption Check

The abbreviated safe-to-mate test shall be performed before the first connection of EGSE to the unit and after transport of the EGSE.

| MDM25    |                    |            |                  |                |             | /      |
|----------|--------------------|------------|------------------|----------------|-------------|--------|
| Pin (+)  | Signal             | Pin (-)    | Signal           | Expected [V]   | Measurement | Nom /  |
| 1        | Nom. power         | 14         | Nom. power ret.  | 28 or 0 *      | 27.95/0     | //     |
| 13       | Red. power         | 25         | Red. power ret.  | 28 or 0 *      | 0/27.94     | of or  |
| * 28V ex | xpected if connect | ted to the | corresponding NO | M or RED port, |             | /      |
| any      | other pin          | 15         | Chassis gnd      | < 3            | 42.8/62     | 802/00 |
| MDM15    |                    |            |                  |                |             |        |
| 1        | Thermistor 1       | 9          | Thermistor 1     | tbd by ADS *   |             |        |
| 2        | Thermistor 2       | 10         | Thermistor 2     | tbd by ADS *   |             |        |
| 3        | Thermistor 3       | 11         | Thermistor 3     | tbd by ADS *   |             |        |
| 7        | Surv Heaters 1     | 14         | Surv Heaters 1   | 28             |             |        |
| 8        | Surv Heaters 2     | 15         | Surv Heaters 2   | 28             |             |        |

<sup>\*</sup> Voltage and polarity to be defined by ADS, a constant voltage lower than 28 V is expected.

After successful safe-to-mate test, the unit can be powered. The power consumption of the unit is not supposed to change significantly. When powered, the unit shall drain about  $100\,\text{mA}$  at  $28\,\text{V}$ , so about  $2.8\,\text{W}$ . The current limitation of the power supply shall be set to  $500\,\text{mA}$ . Document the power consumption as part of the standard procedure. This condition resembles the "Unit unconfigured" as per the table below. After configuration of the sensors, the total power consumption is expected to increase to  $100\,\text{mA} \pm 5\,\text{mA}$ . For the unconfigured unit (after power ON), or after a "reset"-command after communication has been established:

| Parameter | Expected                        | Measured |
|-----------|---------------------------------|----------|
| Voltage   | 28.0 V                          | 27.9 V   |
| Current   | $100\mathrm{mA}\pm5\mathrm{mA}$ | 0.10A    |

at Multimite

To define the units power consumption under the different operational modes and under different supply voltages, document the power consumption under the conditions as given below. This part of the procedure is required to be conducted only once!

| Condition                   | 28.0 V | Current | 26.0 V | Current | 29.0 V | Current |
|-----------------------------|--------|---------|--------|---------|--------|---------|
| Unit unconfigured           |        |         |        |         |        |         |
| (after POWER ON)            |        |         |        |         |        |         |
| Unit in HK mode             |        |         |        |         |        |         |
|                             |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (low activity)              |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (high activity, testpulser) |        |         |        |         |        |         |

FFIS on RED I NOM SUCCESSING (SCEPROM)



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#### 4.5 Setting up Unit Communication

This short sequence describes how to set up the unit and to establish and check the communication with the EGSE. This sequence has to be obeyed before performing any of the following tests.

- Make sure the laptop is switched ON
- Switch ON the laboratory power supply. Make sure that the supply voltage is at 28 V, or at least within the margins given in AD-2. After power-on the STEP unit will drain about 2.8 W, i.e. the current will be roughly 100 mA.
- On the laptop follow these steps:
  - in a terminal browse to /data/etsolo1/step/svn/solo/eda/gse/
  - start a session with typing ./sologse.py and press enter
  - in the prompt you then should read amongst others:
     Connected to UNIT via /dev/ttyUSBx
     Connected to GSE via /dev/ttyUSBx
  - test the communication with the unit (each line followed by an enter):

reset()
status()

If status() returns an SoloGSE timeout error, close the session (Ctrl + D), re-plug the USB cable, restart the session, and repeat the communication test. If status() returns a list of parameters, the connection to the unit has been established successfully. Use this session to perform the below listed tests.



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#### 4.3 **Unit Impedance Check**

After transport, before the first connection to the EGSE, and after tests with higher risks to damage the unit the impedances of the unit shall be measured and compared with the expected values as given in the table (based on RD-1):

| MDM15              |         |         |                     |             |
|--------------------|---------|---------|---------------------|-------------|
| Name               | Pin (+) | Pin (-) | Expected $[\Omega]$ | Measurement |
| Thermistor 1       | 1       | 9       | 15k to 20k *        | 19.46       |
| Thermistor 2       | 2       | 10      | 15k to 20k *        | 1934        |
| Thermistor 3       | 3       | 11      | 15k to 20k *        | 1934        |
| Survival Heaters 1 | 7       | 14      | 119                 | 116,5       |
| Survival Heaters 2 | 8       | 15      | 119                 | 1195        |

<sup>\*</sup> See figure below, all thermistors are supposed to show similar results depending on the unit's temperature.

|          |           | 7 |          |        |
|----------|-----------|---|----------|--------|
| Temp. °C | Ohms      | _ | Temp. °C | Ohms   |
|          |           |   |          |        |
| -60      | 1,342,000 |   | 20       | 18,410 |
| -55      | 957,000   |   | 22       | 16,950 |
| -50      | 690,000   |   | 24       | 15,620 |
| -45      | 503,700   |   | 25       | 15,000 |
| -40      | 371,300   |   | 26       | 14,410 |
| -35      | 276,200   |   | 28       | 13,310 |
| -30      | 207,500   |   | 30       | 12,300 |
| -25      | 157,200   |   | 32       | 11,370 |
| -20      | 120,100   |   | 34       | 10,530 |
| -15      | 92,600    |   | 36       | 9,756  |
| -10      | 71,940    |   | 38       | 9,047  |
| -5       | 56,310    |   | 40       | 8,397  |
| 0        | 44,420    |   | 42       | 7,800  |
| 2        | 40,490    |   | 44       | 7,253  |
| 4        | 36,930    |   | 46       | 6,747  |
| 6        | 33,740    |   | 48       | 6,282  |
| 8        | 30,840    |   | 50       | 5,855  |
| 10       | 28,230    |   | 52       | 5,460  |
| 12       | 25,860    |   | 54       | 5,096  |
| 14       | 23,720    |   | 56       | 4,758  |
| 16       | 21,780    |   | 58       | 4,448  |
| 18       | 20,010    |   | 60       | 4,160  |

Figure 3: Thermistor resistivities for various temperatures, taken from the thermistor's datasheet



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| MDM25                             |                    |           |                     |              |             |  |  |  |
|-----------------------------------|--------------------|-----------|---------------------|--------------|-------------|--|--|--|
| Pin (+)                           | Signal             | Pin (-)   | Signal              | Expected [Ω] | Measurement |  |  |  |
| Nominal power lines and grounding |                    |           |                     |              |             |  |  |  |
| Chassis                           | Instrument chassis | 15        | Chassis gnd         | < 1          | 0.8         |  |  |  |
| Chassis                           | Instrument chassis | 24        | Chassis gnd         | < 1          | 0,3         |  |  |  |
| Chassis                           | Instrument chassis | 1         | Nom. power          | > 10M        | OL          |  |  |  |
| 14                                | Nom. power return  | 1         | Nom. power          | > 10M        | 0/          |  |  |  |
|                                   |                    | Redun     | dant power lines    |              |             |  |  |  |
| Chassis                           | Instrument chassis | 13        | Red. power          | > 10M        | OL          |  |  |  |
| 25                                | Red. power return  | 13        | Red. power          | > 10M        | 06          |  |  |  |
|                                   |                    | Nominal o | communication lines |              |             |  |  |  |
| 4                                 | LVDS I2S-          | 16        | LVDS I2S+           | 100          | 103,0       |  |  |  |
| 6                                 | CLK I2S+           | 19        | CLK I2S-            | 100          | 1031        |  |  |  |
| 8                                 | LVDS S2I+          | 21        | LVDS S2I-           | 50           | 52,1        |  |  |  |
|                                   | F                  | Redundant | communication lines |              |             |  |  |  |
| 5                                 | LVDS I2S-          | 17        | LVDS I2S+           | 100          | 1037        |  |  |  |
| 7                                 | CLK I2S+           | 20        | CLK I2S-            | 100          | 1031        |  |  |  |
| 10                                | LVDS S2I-          | 22        | LVDS S2I+           | 50           | 52,1        |  |  |  |
|                                   |                    | not con   | nected (NC) pins    |              |             |  |  |  |
| 2                                 | NC                 | Chassis   | Instrument chassis  | >10M         | 06          |  |  |  |
| 3                                 | DGND               | Chassis   | Instrument chassis  | < 1          | 0,7         |  |  |  |
| 4                                 | LVDS I2S-          | Chassis   | Instrument chassis  | >10M         | ol          |  |  |  |
| 5                                 | LVDS I2S-          | Chassis   | Instrument chassis  | >10M         | OL          |  |  |  |
| 6                                 | CLK I2S+           | Chassis   | Instrument chassis  | >10M         | OL          |  |  |  |
| 7                                 | CLK I2S+           | Chassis   | Instrument chassis  | >10M         | OL          |  |  |  |
| 8                                 | LVDS S2I+          | Chassis   | Instrument chassis  | > 10M        | 06          |  |  |  |
| 9                                 | NC                 | Chassis   | Instrument chassis  | > 10M        | Œ           |  |  |  |
| 10                                | LVDS S2I-          | Chassis   | Instrument chassis  | > 10M        | OL          |  |  |  |
| 11                                | DGND.              | Chassis   | Instrument chassis  | < 1          | 5,0         |  |  |  |
| 12                                | NC                 | Chassis   | Instrument chassis  | >10M         | UC.         |  |  |  |
| 14                                | Nom. power return  | Chassis   | Instrument chassis  | 100k         | 99.9 K      |  |  |  |
| 16                                | LVDS I2S+          | Chassis   | Instrument chassis  | > 10M        | 02          |  |  |  |
| 17                                | LVDS I2S+          | Chassis   | Instrument chassis  | > 10M        | OL          |  |  |  |
| 18                                | NC                 | Chassis   | Instrument chassis  | > 10M        | OL          |  |  |  |
| 19                                | CLK I2S-           | Chassis   | Instrument chassis  | > 10M        | Ô7          |  |  |  |
| 20                                | CLK I2S-           | Chassis   | Instrument chassis  | > 10M        | OL          |  |  |  |
| 21                                | LVDS S2I-          | Chassis   | Instrument chassis  | >10M         | OL          |  |  |  |
| 22                                | LVDS S2I+          | Chassis   | Instrument chassis  | >10M         | OL          |  |  |  |
| 23                                | NC                 | Chassis   | Instrument chassis  | > 10M        | OL          |  |  |  |
| 25                                | Red. power return  | Chassis   | Instrument chassis  | 100k         | 9994        |  |  |  |



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#### 4.4 Abbreviated Safe-to-Mate Test and Power Consumption Check

The abbreviated safe-to-mate test shall be performed before the first connection of EGSE to the unit and after transport of the EGSE.

| MDM25         |                    |            |                  |                |               |
|---------------|--------------------|------------|------------------|----------------|---------------|
| Pin (+)       | Signal             | Pin (-)    | Signal           | Expected [V]   | Measurement   |
| 1             | Nom. power         | 14         | Nom. power ret.  | 28 or 0 *      | .0            |
| 13            | Red. power         | 25         | Red. power ret.  | 28 or 0 *      | 28,0V         |
| * 28V ex      | xpected if connect | ted to the | corresponding NO | M or RED port, | 0V otherwise. |
| any other pin |                    | 15         | Chassis gnd      | < 3            | V             |
| MDM15         |                    |            |                  |                |               |
| 1             | Thermistor 1       | 9          | Thermistor 1     | tbd by ADS *   |               |
| 2             | Thermistor 2       | 10         | Thermistor 2     | tbd by ADS *   |               |
| 3             | Thermistor 3       | 11         | Thermistor 3     | tbd by ADS *   |               |
| 7             | Surv Heaters 1     | 14         | Surv Heaters 1   | 28             | 2             |
| 8             | Surv Heaters 2     | 15         | Surv Heaters 2   | 28             |               |

<sup>\*</sup> Voltage and polarity to be defined by ADS, a constant voltage lower than 28 V is expected.

After successful safe-to-mate test, the unit can be powered. The power consumption of the unit is not supposed to change significantly. When powered, the unit shall drain about  $100\,\text{mA}$  at  $28\,\text{V}$ , so about  $2.8\,\text{W}$ . The current limitation of the power supply shall be set to  $500\,\text{mA}$ . Document the power consumption as part of the standard procedure. This condition resembles the "Unit unconfigured" as per the table below. After configuration of the sensors, the total power consumption is expected to increase to  $100\,\text{mA} \pm 5\,\text{mA}$ . For the unconfigured unit (after power ON), or after a "reset"-command after communication has been established:

| Parameter | Expected                        | Measured |
|-----------|---------------------------------|----------|
| Voltage   | 28.0 V                          | 28,0     |
| Current   | $100\mathrm{mA}\pm5\mathrm{mA}$ | 98n A    |

To define the units power consumption under the different operational modes and under different supply voltages, document the power consumption under the conditions as given below. This part of the procedure is required to be conducted only once!

| Condition                   | 28.0 V | Current | 26.0 V | Current | 29.0 V | Current |
|-----------------------------|--------|---------|--------|---------|--------|---------|
| Unit unconfigured           |        |         |        |         |        |         |
| (after POWER ON)            |        |         |        |         |        |         |
| Unit in HK mode             |        |         |        |         |        |         |
|                             |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (low activity)              |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (high activity, testpulser) |        |         |        |         |        |         |



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#### 4.5 Setting up Unit Communication

This short sequence describes how to set up the unit and to establish and check the communication with the EGSE. This sequence has to be obeyed before performing any of the following tests.

- Make sure the laptop is switched ON
- Switch ON the laboratory power supply. Make sure that the supply voltage is at 28 V, or at least within the margins given in AD-2. After power-on the STEP unit will drain about 2.8 W, i.e. the current will be roughly 100 mA.
- On the laptop follow these steps:
  - in a terminal browse to /data/etsolo1/step/svn/solo/eda/gse/
  - start a session with typing ./sologse.py and press enter
  - in the prompt you then should read amongst others:
     Connected to UNIT via /dev/ttyUSBx
     Connected to GSE via /dev/ttyUSBx
  - test the communication with the unit (each line followed by an enter):

reset()
status()

If status() returns an SoloGSE timeout error, close the session (Ctrl + D), re-plug the USB cable, restart the session, and repeat the communication test. If status() returns a list of parameters, the connection to the unit has been established successfully. Use this session to perform the below listed tests.



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#### 4.6 Performing an Ad-Hoc Functional and Performance Test

The ad-hoc functional and performance test is used to check the ad-hoc functionality and performance of the unit and its sub-assemblies. This test checks the communication with and the functionality of the different sub-assemblies (FPGA, SRAM, EEPROM, IdeF-X, ADCs). The results of the various operations are internally checked for correctness. In the case of the ADCs, the user has to judge whether the determined temperatures are plausible. It shall be noted that the IdeF-X (IX) temperatures always tend to be a few degrees higher than the other temperatures if the system is in a thermally stable condition. Also data is acquired to evaluate the performance of the unit. To perform the above mentioned test, the following procedure needs to be obeyed:

In the prompt of the session type (each line followed by an enter):

```
reset()
import solo.step.fft as fft
f = fft.fft(msg)
+ Start("filename")
+ f.test()
+ Stop()
```

To see and evaluate the test results, run the following commands in a second terminal (each line followed by an enter):

#### step\_parser -fft ; filename.dat — less

The results of this test are summarized in the output. An **OK** means that the subsystem test was successfully passed. In some cases it is required to check whether the output (temperatures, currents, voltages, or received strings) are plausible. If so, these subsystem tests can be interpreted as passed. Also, check the sigmas of the FFT results. The large pixels are supposed to show a sigma lower than or about 7. The sigmas of the small pixels are expected between 4 and 5. As the result (determined sigma) mainly depends on how long the unit was unpowered while being unpurged, the assessment of the result is laid to the instrument responsible solely and no hard success limits are defined. The values have been observed to increase up to 13 or so (after long rework activities). To repeat the test, the command marked with a preceding "+" needs to be repeated.



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#### 4.7 Performing an Ad-Hoc Performance Test

The ad-hoc performance test is used to check the ad-hoc performance of the unit. This test checks the noise levels of the ldeF-X channels. As the noise levels depend on several environmental parameters (temperatures, stray light, and EMI) this test is for information only and the results do not serve as PASS/FAIL criteria. Nevertheless, this check may serve as an indicator for a potential degradation of the unit's performance. To perform the ad-hoc performance test, the following procedure needs to be obeyed:

In the prompt of the session type (each line followed by an enter):

```
reset()
config_STEP()
optimize_thresholds(ix=1, freq=1., filename="folder and filename.txt")
config_STEP()
optimize_thresholds(ix=2, freq=1., filename="folder and filename.txt")
```

The results of this test are printed to the screen and saved in the defined file (use a logging file on asterix for each unit).



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#### 4.8 Configuring the Unit to Operational Modes

The unit can be set to different operational modes following the steps declared below. The **config**-parameter defines the unit (valid options are: **FM**, **FS**, **PQM**, or **PF**) and choses the thresholds to apply accordingly. The **index**-parameter defines the operational mode the unit will be set into. The valid options with explanations are given at the bottom of this page. The resulting data stream on the one hand, and the supply voltage and current as measured by the EGSE on the other hand are sent via the EGSE to the notebook and stored in user-defined files. To set the unit to the desired operational mode, follow the sequence as given below.

In the prompt of the session type (each line followed by an enter):

- + reset()
- + StartIndex("folder and filename.dat", index = "calib", config = "FS")

It will take up to two minutes until the unit is fully configured. When configured, the prompt in the shell will get available, again. To stop the test, enter **Stop()** followed by **reset()**, and **flush()**. To optionally parse the data, open a second shell, navigate to the same folder and execute the following command:

#### step\_parser -f -A filename.defs < filename.dat

To stop the parser, press Ctrl + C.

Excerpt of valid options for the index parameter are:

| index   | short description   | applicablility for functional tests   |
|---------|---|---|
| hk      | Housekeeping mode: Provides housekeeping data in Flight configuration but no detector signals will be acquired or processed.  | Not relevant for functional tests, can be used to check the configuration of the unit.  |
| nominal | Nominal mode: Provides housekeeping and science data in Flight configuration. Only the large pixels of the detectors are active.  | Not relevant for functional tests, can be used to check the configuration of the unit.  |
| small   | Same mode as <b>nominal</b> , but with small pixels active  | Not relevant for functional tests, can be used to check the configuration of the unit.  |
| calib   | Calibration mode: All pixels are active and provide streaming data (full information, no l3 processing) and housekeeping data. Not Flight representative  | Not relevant for foreseen functional tests, can be used to calibrate the units or check for susceptibility.   |
| pcalib  | Calibration mode with test pulsers: Same mode as <b>calib</b> , but with testpulser signals cycling through all channels of both detectors at four different energies. Let it run for more than 30 minutes. | Very thorough test of the detectors performace, thus shall be executed at key points (after assembly, before possible delivery, in between some of the environmental tests) |



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| 4.9 | As | Run | <b>Functional</b> | Test | Report |
|-----|----|-----|-------------------|------|--------|
|-----|----|-----|-------------------|------|--------|

| 21. 00 201) | Date and Time | 21.08 2018 |
|-------------|---------------|------------|
|-------------|---------------|------------|

#### 4.9.1 Functional Test Readiness

| Location             | Cleanoon Chu Wiel                     |
|----------------------|---------------------------------------|
| Personnel            | Coum'                                 |
| Instrument ID        | SPEP FS                               |
| Firmware revision    |                                       |
| Reason for FT        | test sejor TVAC test in scope of NC44 |
| Test to be performed |                                       |

#### 4.9.2 FT Constraints (if applicable)

| Safe-to-mate           | 9te   |
|------------------------|-------|
| Impedance check        | gle - |
| Set up communication   | oh    |
| Additional constraints |       |



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#### 4.9.3 FT Details

| Step #     | Activity                     | Result           |  |  |
|------------|------------------------------|------------------|--|--|
| 1          | Data file name if applicable |                  |  |  |
| 2          | Test started / stopped       |                  |  |  |
| 3          | Test result                  | all tests passed |  |  |
| 4          | Comments                     |                  |  |  |
| Signatures |                              |                  |  |  |



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#### 4.3 Unit Impedance Check

After transport, before the first connection to the EGSE, and after tests with higher risks to damage the unit the impedances of the unit shall be measured and compared with the expected values as given in the table (based on RD-1):

| MDM15              |         |         |                     |             |
|--------------------|---------|---------|---------------------|-------------|
| Name               | Pin (+) | Pin (-) | Expected $[\Omega]$ | Measurement |
| Thermistor 1       | 1       | 9       | 15k to 20k *        | 16,7k       |
| Thermistor 2       | 2       | 10      | 15k to 20k *        | 16.64       |
| Thermistor 3       | 3       | 11      | 15k to 20k *        | 16.7K       |
| Survival Heaters 1 | 7       | 14      | 119                 | 1185        |
| Survival Heaters 2 | 8       | 15      | 119                 | 1105        |

<sup>\*</sup> See figure below, all thermistors are supposed to show similar results depending on the unit's temperature.

| Temp. °C | Ohms      |
|----------|-----------|
|          |           |
| -60      | 1,342,000 |
| -55      | 957,000   |
| -50      | 690,000   |
| -45      | 503,700   |
| -40      | 371,300   |
| -35      | 276,200   |
| -30      | 207,500   |
| -25      | 157,200   |
| -20      | 120,100   |
| -15      | 92,600    |
| -10      | 71,940    |
| -5       | 56,310    |
| 0        | 44,420    |
| 2        | 40,490    |
| 4        | 36,930    |
| 6        | 33,740    |
| 8        | 30,840    |
| 10       | 28,230    |
| 12       | 25,860    |
| 14       | 23,720    |
| 16       | 21,780    |
| 18       | 20,010    |

| Temp. °C | Ohms   |
|----------|--------|
| P        |        |
| 20       | 18,410 |
| 22       | 16,950 |
| 24       | 15,620 |
| 25       | 15,000 |
| 26       | 14,410 |
| 28       | 13,310 |
| 30       | 12,300 |
| 32       | 11,370 |
| 34       | 10,530 |
| 36       | 9,756  |
| 38       | 9,047  |
| 40       | 8,397  |
| 42       | 7,800  |
| 44       | 7,253  |
| 46       | 6,747  |
| 48       | 6,282  |
| 50       | 5,855  |
| 52       | 5,460  |
| 54       | 5,096  |
| 56       | 4,758  |
| 58       | 4,448  |
| 60       | 4,160  |

Figure 3: Thermistor resistivities for various temperatures, taken from the thermistor's datasheet



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| MDM25   |                                   |            |                     |                     |             |  |  |  |  |
|---------|-----------------------------------|------------|---------------------|---------------------|-------------|--|--|--|--|
| Pin (+) | Signal                            | Pin (-)    | Signal              | Expected $[\Omega]$ | Measurement |  |  |  |  |
|         | Nominal power lines and grounding |            |                     |                     |             |  |  |  |  |
| Chassis | Instrument chassis                | 15         | Chassis gnd         | < 1                 |             |  |  |  |  |
| Chassis | Instrument chassis                | 24         | Chassis gnd         | < 1                 |             |  |  |  |  |
| Chassis | Instrument chassis                | 1          | Nom. power          | >10M                |             |  |  |  |  |
| 14      | Nom. power return                 | 1          | Nom. power          | >10M                | 1           |  |  |  |  |
|         |                                   | Redun      | dant power lines    |                     |             |  |  |  |  |
| Chassis | Instrument chassis                | 13         | Red. power          | >10M                |             |  |  |  |  |
| 25      | Red. power return                 | 13         | Red. power          | >10M /              | ,           |  |  |  |  |
|         |                                   | Nominal of | communication lines |                     |             |  |  |  |  |
| 4       | LVDS I2S-                         | 16         | LVDS I2S+           | 100 /               | 1           |  |  |  |  |
| 6       | CLK I2S+                          | 19         | CLK I2S-            | 100′                | 2           |  |  |  |  |
| 8       | LVDS S2I+                         | 21         | LVDS S2I-           | 50 /                |             |  |  |  |  |
|         |                                   | Redundant  | communication lines |                     |             |  |  |  |  |
| 5       | LVDS I2S-                         | 17         | LVDS I2S+           | / 100 <sup>/</sup>  |             |  |  |  |  |
| 7       | CLK I2S+                          | 20         | CLK I2S-            | 100                 |             |  |  |  |  |
| 10      | LVDS S2I-                         | 22         | LVDS S2I+           | <i>∯</i> √50        |             |  |  |  |  |
|         |                                   | not con    | nected (NC) pins    |                     |             |  |  |  |  |
| 2       | NC                                | Chassis    | Instrument chassis  | >10M                |             |  |  |  |  |
| 3       | DGND                              | Chassis    | Instrument chassis  | < 1                 |             |  |  |  |  |
| 4       | LVDS I2S-                         | Chassis    | Instrument chassis  | >10M                |             |  |  |  |  |
| 5       | LVDS I2S-                         | Chassis    | Instrument chassis  | >10M                |             |  |  |  |  |
| 6       | CLK I2S+                          | Chassis    | Instrument chassis  | >10M                |             |  |  |  |  |
| 7       | CLK I2S+                          | Chassis    | Instrument chassis  | >10M                |             |  |  |  |  |
| 8       | LVDS S2I+                         | Chassis    | Instrument chassis  | >10M                |             |  |  |  |  |
| 9       | NC                                | Chassis    | Instrument chassis  | >10M                |             |  |  |  |  |
| 10      | LVDS S2I-                         | Chassis    | Instrument chassis  | >10M                |             |  |  |  |  |
| 11      | DGND.                             | Chassis    | Instrument chassis  | < 1                 |             |  |  |  |  |
| 12      | NC                                | Chassis    | Instrument chassis  | >10M                |             |  |  |  |  |
| 14      | Nom. power return                 | Chassis    | Instrument chassis  | 100k                |             |  |  |  |  |
| 16      | LVDS I2S+                         | Chassis    | Instrument chassis  | >10M                |             |  |  |  |  |
| 17      | LVDS I2S+                         | Chassis    | /Instrument chassis | >10M                |             |  |  |  |  |
| 18      | NC                                | Chassis/   | Instrument chassis  | >10M                |             |  |  |  |  |
| 19      | CLK I2S-                          | Chassis    | Instrument chassis  | >10M                |             |  |  |  |  |
| 20      | CLK I2S-                          | Chassis    | Instrument chassis  | >10M                |             |  |  |  |  |
| 21      | LVDS S2I-                         | Chassis /  | Instrument chassis  | >10M                |             |  |  |  |  |
| 22      | LVDS S2I+                         | Chassis    | Instrument chassis  | >10M                |             |  |  |  |  |
| 23      | NC                                | Chassis    | Instrument chassis  | >10M                |             |  |  |  |  |
| 25      | Red. power return                 | Chassis    | Instrument chassis  | 100k                |             |  |  |  |  |



Reference:

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#### 4.4 Abbreviated Safe-to-Mate Test and Power Consumption Check

The abbreviated safe-to-mate test shall be performed before the first connection of EGSE to the unit and after transport of the EGSE.

| MOMOR          |                    |           |                   |                | I the same of the |
|----------------|--------------------|-----------|-------------------|----------------|---|
| MDM25          |                    |           |                   |                |   |
| Pin (+)        | Signal             | Pin (-)   | Signal            | Expected [V]   | Measurement   |
| 1              | Nom. power         | 14        | Nom. power rét.   | 28 or 0 *      |   |
| 13             | Red. power         | 25        | Red. power ret.   | 28 or 0 *      |   |
| * 28V ex       | xpected if connect | ed to the | corresponding NOI | M or RED port, | 0V otherwise.   |
| any            | other pin          | 15        | Chassis gnd       | < 3            |   |
| MDM15          |                    |           |                   |                |   |
| 1              | Thermistor 1       | 9 /       | Thermistor 1      | tbd by ADS *   |   |
| 2 Thermistor 2 |                    | 10        | Thermistor 2      | tbd by ADS *   |   |
| 3              | Thermistor 3       | /11       | Thermistor 3      | tbd by ADS *   |   |
| 7              | Surv Heaters 1     | 14        | Surv Heaters 1    | 28             |   |
| 8              | Surv Heaters 2     | 15        | Surv Heaters 2    | 28             |   |

<sup>\*</sup> Voltage and polarity to be defined by ADS, a constant voltage lower than 28 V is expected.

After successful safe-to-mate test, the unit can be powered. The power consumption of the unit is not supposed to change significantly. When powered, the unit shall drain about  $100\,\text{mA}$  at  $28\,\text{V}$ , so about  $2.8\,\text{W}$ . The current limitation of the power supply shall be set to  $500\,\text{mA}$ . Document the power consumption as part of the standard procedure. This condition resembles the "Unit unconfigured" as per the table below. After configuration of the sensors, the total power consumption is expected to increase to  $100\,\text{mA} \pm 5\,\text{mA}$ . For the unconfigured unit (after power ON), or after a "reset"-command after communication has been established:

| Parameter | Expected                        | Measured |
|-----------|---------------------------------|----------|
| Voltage   | 28.0 V                          | 15,00    |
| Current   | $100\mathrm{mA}\pm5\mathrm{mA}$ | 28 mx    |

To define the units power consumption under the different operational modes and under different supply voltages, document the power consumption under the conditions as given below. This part of the procedure is required to be conducted only once!

| Condition                   | 28.0 V | Current | 26.0 V | Current | 29.0 V | Current |
|-----------------------------|--------|---------|--------|---------|--------|---------|
| Unit unconfigured           |        |         |        |         |        |         |
| (after POWER ON)            |        |         |        |         |        |         |
| Unit in HK mode             |        |         |        |         |        |         |
|                             |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (low activity)              |        |         | 16     |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (high activity, testpulser) |        |         |        |         |        |         |

Communication & HTT passed

Lan'



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| 4.9 | As | Run | <b>Functional</b> | <b>Test</b> | Report |
|-----|----|-----|-------------------|-------------|--------|
|-----|----|-----|-------------------|-------------|--------|

| Date and Time | 23.03.16 |
|---------------|----------|
|---------------|----------|

#### 4.9.1 Functional Test Readiness

| Location             | hed clean room TVAC      |
|----------------------|--------------------------|
| Personnel            | Robert, Laur             |
| Instrument ID        | SPEP F3                  |
| Firmware revision    |                          |
| Reason for FT        | end of TVAC test MCR0044 |
| Test to be performed | V                        |

#### 4.9.2 FT Constraints (if applicable)

| Safe-to-mate           |  |
|------------------------|--|
| Impedance check        |  |
| Set up communication   |  |
| Additional constraints |  |



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#### 4.9.3 FT Details

| Step #   | Activity                     | Result |
|----------|------------------------------|--------|
| 1        | Data file name if applicable |        |
| 2        | Test started / stopped       |        |
| 3        | Test result                  |        |
| 4        | Comments                     |        |
| Signatur | es                           |        |

15.03.2018 TVAC SRAM times fest pre- test



## STEP FS Functional test plan and procedure

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#### 4.3 Unit Impedance Check

After transport, before the first connection to the EGSE, and after tests with higher risks to damage the unit the impedances of the unit shall be measured and compared with the expected values as given in the table (based on RD-1):

| MDM15              |         |         |                     |             |
|--------------------|---------|---------|---------------------|-------------|
| Name               | Pin (+) | Pin (-) | Expected $[\Omega]$ | Measurement |
| Thermistor 1       | 1       | 9       | 15k to 20k *        | 17.3K       |
| Thermistor 2       | 2       | 10      | 15k to 20k *        | 17.14       |
| Thermistor 3       | 3       | 11      | 15k to 20k *        | 1+,24       |
| Survival Heaters 1 | 7       | 14      | 119                 | 1185        |
| Survival Heaters 2 | 8       | 15      | 119                 | 115,5       |

<sup>\*</sup> See figure below, all thermistors are supposed to show similar results depending on the unit's temperature.

| 7 00     |           | 1 | - 00     | Т -:   |
|----------|-----------|---|----------|--------|
| Temp. °C | Ohms      | _ | Temp. °C | Ohms   |
|          |           | 1 |          |        |
| -60      | 1,342,000 |   | 20       | 18,410 |
| -55      | 957,000   |   | 22       | 16,950 |
| -50      | 690,000   |   | 24       | 15,620 |
| -45      | 503,700   |   | 25       | 15,000 |
| -40      | 371,300   |   | 26       | 14,410 |
| -35      | 276,200   |   | 28       | 13,310 |
| -30      | 207,500   |   | 30       | 12,300 |
| -25      | 157,200   |   | 32       | 11,370 |
| -20      | 120,100   |   | 34       | 10,530 |
| -15      | 92,600    |   | 36       | 9,756  |
| -10      | 71,940    |   | 38       | 9,047  |
| -5       | 56,310    |   | 40       | 8,397  |
| 0        | 44,420    |   | 42       | 7,800  |
| 2        | 40,490    |   | 44       | 7,253  |
| 4        | 36,930    |   | 46       | 6,747  |
| 6        | 33,740    |   | 48       | 6,282  |
| 8        | 30,840    |   | 50       | 5,855  |
| 10       | 28,230    |   | 52       | 5,460  |
| 12       | 25,860    |   | 54       | 5,096  |
| 14       | 23,720    |   | 56       | 4,758  |
| 16       | 21,780    |   | 58       | 4,448  |
| 18       | 20,010    |   | 60       | 4,160  |

Figure 3: Thermistor resistivities for various temperatures, taken from the thermistor's datasheet



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| MDM25                             |                    |            |                     |                     |             |  |  |  |
|-----------------------------------|--------------------|------------|---------------------|---------------------|-------------|--|--|--|
| Pin (+)                           | Signal             | Pin (-)    | Signal              | Expected $[\Omega]$ | Measurement |  |  |  |
| Nominal power lines and grounding |                    |            |                     |                     |             |  |  |  |
| Chassis                           | Instrument chassis | 15         | Chassis gnd         | < 1                 |             |  |  |  |
| Chassis                           | Instrument chassis | 24         | Chassis gnd         | < 1                 |             |  |  |  |
| Chassis                           | Instrument chassis | 1          | Nom. power          | >10M                |             |  |  |  |
| 14                                | Nom. power return  | 1          | Nom. power          | >10M                |             |  |  |  |
|                                   |                    | Redun      | dant power lines    |                     |             |  |  |  |
| Chassis                           | Instrument chassis | 13         | Red. power          | >10M                | 1           |  |  |  |
| 25                                | Red. power return  | 13         | Red. power          | >10M                |             |  |  |  |
|                                   |                    | Nominal of | communication lines |                     |             |  |  |  |
| 4                                 | LVDS I2S-          | 16         | LVDS I2S+           | 100                 |             |  |  |  |
| 6                                 | CLK I2S+           | 19         | CLK I2S-            | 100                 |             |  |  |  |
| 8                                 | LVDS S2I+          | 21         | LVDS S2I-           | 50                  |             |  |  |  |
|                                   |                    | Redundant  | communication lines |                     |             |  |  |  |
| 5                                 | LVDS I2S-          | 17         | LVDS I2S+           | 100                 |             |  |  |  |
| 7                                 | CLK I2S+           | 20         | CLK I2S-            | 100                 |             |  |  |  |
| 10                                | LVDS S2I-          | 22         | LVDS S2I+           | 50                  |             |  |  |  |
|                                   |                    | not con    | nected (NC) pins    | 4                   |             |  |  |  |
| 2                                 | NC                 | Chassis    | Instrument chassis  | >10M                |             |  |  |  |
| 3                                 | DGND               | Chassis    | Instrument chassis  | < 1                 |             |  |  |  |
| 4                                 | LVDS I2S-          | Chassis    | Instrument chassis  | >10M                |             |  |  |  |
| 5                                 | LVDS I2S-          | Chassis    | Instrument chassis  | > 10M               |             |  |  |  |
| 6                                 | CLK I2S+           | Chassis    | Instrument chassis  | >10M                |             |  |  |  |
| 7                                 | CLK I2S+           | Chassis    | Instrument chassis  | >10M                |             |  |  |  |
| 8                                 | LVDS S2I+          | Chassis    | Instrument chassis  | > 10M               |             |  |  |  |
| 9                                 | NC                 | Chassis    | Instrument chassis  | >10M                |             |  |  |  |
| 10                                | LVDS S2I-          | Chassis    | Instrument chassis  | >10M                |             |  |  |  |
| 11                                | DGND.              | Chassis    | Instrument chassis  | < 1                 |             |  |  |  |
| 12                                | NC                 | Chassis    | Instrument chassis  | >10M                |             |  |  |  |
| 14                                | Nom. power return  | Chassis    | Instrument chassis  | 100k                |             |  |  |  |
| 16                                | LVDS I2S+          | Chassis    | Instrument chassis  | > 10M               |             |  |  |  |
| 17                                | LVDS I2S+          | Chassis    | Instrument chassis  | >10M                |             |  |  |  |
| 18                                | NC                 | Chassis    | Instrument chassis  | >10M                |             |  |  |  |
| 19                                | CLK I2S-           | Chassis    | Instrument chassis  | >10M                |             |  |  |  |
| 20                                | CLK I2S-           | Chassis    | Instrument chassis  | >10M                |             |  |  |  |
| 21                                | LVDS S2I-          | Chassis    | Instrument chassis  | >10M                |             |  |  |  |
| 22                                | LVDS S2I+          | Chassis    | Instrument chassis  | > 10M               |             |  |  |  |
| 23                                | NC                 | Chassis    | Instrument chassis  | > 10M               |             |  |  |  |
| 25                                | Red. power return  | Chassis    | Instrument chassis  | 100k                |             |  |  |  |



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#### 4.4 Abbreviated Safe-to-Mate Test and Power Consumption Check

The abbreviated safe-to-mate test shall be performed before the first connection of EGSE to the unit and after transport of the EGSE.

| MDM25    |                    |                  |                 |               |             |
|----------|--------------------|------------------|-----------------|---------------|-------------|
| Pin (+)  | Pin (+) Signal     |                  | Signal          | Expected [V]  | Measurement |
| 1        | Nom. power         | 14               | Nom. power ret. | 28 or 0 *     | 5 V         |
| 13       | Red. power         | 25               | Red. power ret. | 28 or 0 *     | OV          |
| * 28V ex | xpected if connect | corresponding NO | M or RED port,  | 0V otherwise. |             |
| any      | other pin          | 15               | Chassis gnd     | < 3           | Pass        |
| MDM15    |                    |                  |                 |               |             |
| 1        | Thermistor 1       | 9                | Thermistor 1    | tbd by ADS *  |             |
| 2        | Thermistor 2       | 10               | Thermistor 2    | tbd by ADS *  |             |
| 3        | 3 Thermistor 3     |                  | Thermistor 3    | tbd by ADS *  |             |
| 7        | Surv Heaters 1     | 14               | Surv Heaters 1  | 28            |             |
| 8        | Surv Heaters 2     | 15               | Surv Heaters 2  | 28            |             |

<sup>\*</sup> Voltage and polarity to be defined by ADS, a constant voltage lower than 28 V is expected.

After successful safe-to-mate test, the unit can be powered. The power consumption of the unit is not supposed to change significantly. When powered, the unit shall drain about  $100\,\text{mA}$  at  $28\,\text{V}$ , so about  $2.8\,\text{W}$ . The current limitation of the power supply shall be set to  $500\,\text{mA}$ . Document the power consumption as part of the standard procedure. This condition resembles the "Unit unconfigured" as per the table below. After configuration of the sensors, the total power consumption is expected to increase to  $100\,\text{mA} \pm 5\,\text{mA}$ . For the unconfigured unit (after power ON), or after a "reset"-command after communication has been established:

| Parameter | Expected                        | Measured . |
|-----------|---------------------------------|------------|
| Voltage   | 28.0 V                          | 28,0       |
| Current   | $100\mathrm{mA}\pm5\mathrm{mA}$ | Stunk      |

To define the units power consumption under the different operational modes and under different supply voltages, document the power consumption under the conditions as given below. **This part of the procedure is required to be conducted only once!** 

| Condition                   | 28.0 V | Current | 26.0 V         | Current              | 29.0 V   | Current        |
|-----------------------------|--------|---------|----------------|----------------------|--|----------------|
| Unit unconfigured           |        |         |                |                      |  | a for the form |
| (after POWER ON)            |        |         |                |                      | And the state of t |                |
| Unit in HK mode             |        |         |                | - 2                  | -  |                |
|                             |        |         | т.             | A Particular Control |  |                |
| Unit in SCI mode            |        |         |                | /                    |  |                |
| (low activity)              |        |         | 200            |                      |  |                |
| Unit in SCI mode            |        |         | And the second |                      |  |                |
| (high activity, testpulser) |        |         | 1              | ,                    |  |                |

Communication OK

Pal

) 1



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| 4.9 | 9 , | As | Run | <b>Functional</b> | <b>Test</b> | Repor |
|-----|-----|----|-----|-------------------|-------------|-------|
|     |     |    |     |                   |             |       |

| Date and Time | 15.03.2018 |
|---------------|------------|
|---------------|------------|

#### 4.9.1 Functional Test Readiness

| Location             | Wiel chauron, TVAC                                    |     |
|----------------------|---|-----|
| Personnel            | Robert E. Walter B., Lawi P.                          |     |
| Instrument ID        | STEP FS   |     |
| Firmware revision    |   |     |
| Reason for FT        | test before TUAC test, to be repeated affection       | dj  |
| Test to be performed | MOMIS impedace, horness safe-to-morbe, communication, | SFT |

#### 4.9.2 FT Constraints (if applicable)

| Safe-to-mate           |  |
|------------------------|--|
| Impedance check        |  |
| Set up communication   |  |
| Additional constraints |  |



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#### 4.9.3 FT Details

| Step #   | Activity                     | Result |
|----------|------------------------------|--------|
| 1        | Data file name if applicable |        |
| 2        | Test started / stopped       |        |
| 3        | Test result                  |        |
| 4        | Comments                     |        |
| Signatur | es                           |        |



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#### 4.3 Unit Impedance Check

After transport, before the first connection to the EGSE, and after tests with higher risks to damage the unit the impedances of the unit shall be measured and compared with the expected values as given in the table (based on RD-1):

| MDM15              |         |         |                     |             |
|--------------------|---------|---------|---------------------|-------------|
| Name               | Pin (+) | Pin (-) | Expected $[\Omega]$ | Measurement |
| Thermistor 1       | 1       | 9       | 15k to 20k *        | 19.06 KD    |
| Thermistor 2       | 2       | 10      | 15k to 20k *        | 17.91 11 0  |
| Thermistor 3       | 3       | 11      | 15k to 20k *        | 17.94 11 1  |
| Survival Heaters 1 | 7       | 14      | 119                 | 1789 1      |
| Survival Heaters 2 | 8       | 15      | 119                 | 119.5 2     |

 $<sup>^{</sup>st}$  See figure below, all thermistors are supposed to show similar results depending on the unit's temperature.

| Temp. °C | Ohms      |  |  |
|----------|-----------|--|--|
|          |           |  |  |
| -60      | 1,342,000 |  |  |
| -55      | 957,000   |  |  |
| -50      | 690,000   |  |  |
| -45      | 503,700   |  |  |
| -40      | 371,300   |  |  |
| -35      | 276,200   |  |  |
| -30      | 207,500   |  |  |
| -25      | 157,200   |  |  |
| -20      | 120,100   |  |  |
| -15      | 92,600    |  |  |
| -10      | 71,940    |  |  |
| -5       | 56,310    |  |  |
| 0        | 44,420    |  |  |
| 2        | 40,490    |  |  |
| 4        | 36,930    |  |  |
| 6        | 33,740    |  |  |
| 8        | 30,840    |  |  |
| 10       | 28,230    |  |  |
| 12       | 25,860    |  |  |
| 14       | 23,720    |  |  |
| 16       | 21,780    |  |  |
| 18       | 20,010    |  |  |

| Temp. °C | Ohms   |
|----------|--------|
|          |        |
| 20       | 18,410 |
| 22       | 16,950 |
| 24       | 15,620 |
| 25       | 15,000 |
| 26       | 14,410 |
| 28       | 13,310 |
| 30       | 12,300 |
| 32       | 11,370 |
| 34       | 10,530 |
| 36       | 9,756  |
| 38       | 9,047  |
| 40       | 8,397  |
| 42       | 7,800  |
| 44       | 7,253  |
| 46       | 6,747  |
| 48       | 6,282  |
| 50       | 5,855  |
| 52       | 5,460  |
| 54       | 5,096  |
| 56       | 4,758  |
| 58       | 4,448  |
| 60       | 4,160  |

Figure 3: Thermistor resistivities for various temperatures, taken from the thermistor's datasheet



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| MDM25                             |   |           |                     |                     |             |  |  |  |
|-----------------------------------|---|-----------|---------------------|---------------------|-------------|--|--|--|
| Pin (+)                           | Signal  | Pin (-)   | Signal              | Expected $[\Omega]$ | Measurement |  |  |  |
| Nominal power lines and grounding |   |           |                     |                     |             |  |  |  |
| Chassis                           | Instrument chassis  | 15        | Chassis gnd         | < 1                 |             |  |  |  |
| Chassis                           | Instrument chassis  | 24        | Chassis gnd         | < 1                 |             |  |  |  |
| Chassis                           | Instrument chassis  | 1         | Nom. power          | >10M                |             |  |  |  |
| 14                                | Nom. power return   | 1         | Nom. power          | >10M                |             |  |  |  |
|                                   |   |           | dant power lines    |                     |             |  |  |  |
| Chassis                           | Instrument chassis  | 13        | Red. power          | >10M                |             |  |  |  |
| 25                                | Red. power return   | 13        | Red. power          | >10M                |             |  |  |  |
|                                   |   |           | communication lines |                     |             |  |  |  |
| 4                                 | LVDS I2S-   | 16        | LVDS I2S+           | 100                 |             |  |  |  |
| 6                                 | CLK I2S+  | 19        | CLK I2S-            | 100                 |             |  |  |  |
| 8                                 | LVDS S2I+   | 21        | LVDS S2I-           | 50                  |             |  |  |  |
|                                   | Fig. 1. September | Redundant | communication lines |                     |             |  |  |  |
| 5                                 | LVDS 12S-   | 17        | LVDS I2S+           | 100                 |             |  |  |  |
| 7                                 | CLK I2S+  | 20        | CLK I2S-            | 100                 |             |  |  |  |
| 10                                | LVDS S2I-   | 22        | LVDS S2I+           | 50                  |             |  |  |  |
|                                   |   | not con   | nected (NC) pins    |                     |             |  |  |  |
| 2                                 | NC  | Chassis   | Instrument chassis  | > 10M               |             |  |  |  |
| 3                                 | DGND  | Chassis   | Instrument chassis  | < 1                 |             |  |  |  |
| 4                                 | LVDS I2S-   | Chassis   | Instrument chassis  | >10M                |             |  |  |  |
| 5                                 | LVDS I2S-   | Chassis   | Instrument chassis  | > 10M               |             |  |  |  |
| 6                                 | CLK I2S+  | Chassis   | Instrument chassis  | >10M                |             |  |  |  |
| 7                                 | CLK I2S+  | Chassis   | Instrument chassis  | >10M                |             |  |  |  |
| 8                                 | LVDS S2I+   | Chassis   | Instrument chassis  | >10M                |             |  |  |  |
| 9                                 | NC  | Chassis   | Instrument chassis  | >10M                |             |  |  |  |
| 10                                | LVDS S2I-   | Chassis   | Instrument chassis  | >10M                |             |  |  |  |
| 11                                | DGND.   | Chassis   | Instrument chassis  | < 1                 |             |  |  |  |
| 12                                | NC  | Chassis   | Instrument chassis  | >10M                |             |  |  |  |
| 14                                | Nom. power return   | Chassis   | Instrument chassis  | 100k                |             |  |  |  |
| 16                                | LVDS I2S+   | Chassis   | Instrument chassis  | >10M                |             |  |  |  |
| 17                                | LVDS I2S+   | Chassis   | Instrument chassis  | >10M                |             |  |  |  |
| 18                                | NC  | Chassis   | Instrument chassis  | > 10M               |             |  |  |  |
| 19                                | CLK I2S-  | Chassis   | Instrument chassis  | >10M                |             |  |  |  |
| 20                                | CLK I2S-  | Chassis   | Instrument chassis  | >10M                |             |  |  |  |
| 21                                | LVDS S2I-   | Chassis   | Instrument chassis  | > 10M               |             |  |  |  |
| 22                                | LVDS S2I+   | Chassis   | Instrument chassis  | >10M                |             |  |  |  |
| 23                                | NC  | Chassis   | Instrument chassis  | >10M                |             |  |  |  |
| 25                                | Red. power return   | Chassis   | Instrument chassis  | 100k                |             |  |  |  |

Test shipped. Lind was apended for 2 neeks just before test.



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#### 4.4 Abbreviated Safe-to-Mate Test and Power Consumption Check

The abbreviated safe-to-mate test shall be performed before the first connection of EGSE to the unit and after transport of the EGSE.

| MDM25   | <b>一类型。在这个</b>     |           |                  |                |               |
|---------|--------------------|-----------|------------------|----------------|---------------|
| Pin (+) | Signal             | Pin (-)   | Signal           | Expected [V]   | Measurement   |
| 1       | Nom. power         | 14        | Nom. power ret.  | 28 or 0 *      | 28.0V         |
| 13      | Red. power         | 25        | Red. power ret.  | 28 or 0 *      | 0 1/          |
| * 28V e | xpected if connect | ed to the | corresponding NO | M or RED port, | 0V otherwise. |
| any     | any other pin      |           | Chassis gnd      | < 3            |               |
| MDM15   |                    |           |                  |                |               |
| 1       | Thermistor 1       | 9         | Thermistor 1     | tbd by ADS *   |               |
| 2       | Thermistor 2       | 10        | Thermistor 2     | tbd by ADS *   |               |
| 3       | Thermistor 3       | 11        | Thermistor 3     | tbd by ADS *   |               |
| 7       | Surv Heaters 1     | 14        | Surv Heaters 1   | 28             |               |
| 8       | Surv Heaters 2     | 15        | Surv Heaters 2   | 28             |               |

<sup>\*</sup> Voltage and polarity to be defined by ADS, a constant voltage lower than 28 V is expected.

After successful safe-to-mate test, the unit can be powered. The power consumption of the unit is not supposed to change significantly. When powered, the unit shall drain about  $100\,\text{mA}$  at  $28\,\text{V}$ , so about  $2.8\,\text{W}$ . The current limitation of the power supply shall be set to  $500\,\text{mA}$ . Document the power consumption as part of the standard procedure. This condition resembles the "Unit unconfigured" as per the table below. After configuration of the sensors, the total power consumption is expected to increase to  $100\,\text{mA} \pm 5\,\text{mA}$ . For the unconfigured unit (after power ON), or after a "reset"-command after communication has been established:

| Parameter | Expected                        | Measured |
|-----------|---------------------------------|----------|
| Voltage   | 28.0 V                          | 28V      |
| Current   | $100\mathrm{mA}\pm5\mathrm{mA}$ | 97 in A  |

To define the units power consumption under the different operational modes and under different supply voltages, document the power consumption under the conditions as given below. This part of the procedure is required to be conducted only once!

| Condition                   | 28.0 V | Current | 26.0 V | Current | 29.0 V | Current |
|-----------------------------|--------|---------|--------|---------|--------|---------|
| Unit unconfigured           |        |         |        |         |        |         |
| (after POWER ON)            |        | 19      |        |         |        |         |
| Unit in HK mode             |        |         |        |         |        |         |
|                             |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (low activity)              |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (high activity, testpulser) |        |         |        |         |        |         |

Communication terred successfully





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| 4.9 | As | Run | <b>Functional</b> | <b>Test</b> | Report |
|-----|----|-----|-------------------|-------------|--------|
|-----|----|-----|-------------------|-------------|--------|

| Date and Time 06 02 20(8 /150 |
|-------------------------------|
|-------------------------------|

#### 4.9.1 Functional Test Readiness

| Location             | Wiel TVAC                      |  |  |  |  |
|----------------------|--------------------------------|--|--|--|--|
| Personnel            | Walter B., Robert E., Louis P. |  |  |  |  |
| Instrument ID        | STEP 73                        |  |  |  |  |
| Firmware revision    |                                |  |  |  |  |
| Reason for FT        | installation in TVAC           |  |  |  |  |
| Test to be performed | safe-to-unte, com-micatra      |  |  |  |  |

#### 4.9.2 FT Constraints (if applicable)

| Safe-to-mate           |  |
|------------------------|--|
|                        |  |
| Impedance check        |  |
|                        |  |
| Set up communication   |  |
|                        |  |
| Additional constraints |  |



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#### 4.9.3 FT Details

| Step #   | Activity                     | Result      |
|----------|------------------------------|-------------|
| 1        | Data file name if applicable |             |
| 2        | Test started / stopped       |             |
| 3        | Test result                  | success ful |
| 4        | Comments                     |             |
| Signatur | es Pal                       | ,           |

### Also STEP FS TCT



### STEP FS Functional test plan and procedure

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#### 4.9 As Run Functional Test Report

| Date and Time | 12.11.17 |
|---------------|----------|
|               |          |

#### 4.9.1 Functional Test Readiness

| Location             | hiel clean room                  |
|----------------------|----------------------------------|
| Personnel            | Makesh, Lauri                    |
| Instrument ID        | SPEP FS                          |
| Firmware revision    |                                  |
| Reason for FT        | frhal TCT test                   |
| Test to be performed | un pedance test, Sft, threshold) |

#### 4.9.2 FT Constraints (if applicable)

| Safe-to-mate           |  |
|------------------------|--|
| Impedance check        |  |
| Set up communication   |  |
| Additional constraints |  |



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#### 4.3 Unit Impedance Check

After transport, before the first connection to the EGSE, and after tests with higher risks to damage the unit the impedances of the unit shall be measured and compared with the expected values as given in the table (based on RD-1):

| MDM15              |         |         |                     |             |
|--------------------|---------|---------|---------------------|-------------|
| Name               | Pin (+) | Pin (-) | Expected $[\Omega]$ | Measurement |
| Thermistor 1       | 1       | 9       | 15k to 20k *        | 1304        |
| Thermistor 2       | 2       | 10      | 15k to 20k *        | 18.84       |
| Thermistor 3       | 3       | 11      | 15k to 20k *        | 18.94       |
| Survival Heaters 1 | 7       | 14      | 119                 | 118.5       |
| Survival Heaters 2 | 8       | 15      | 119                 | 119.4       |

<sup>\*</sup> See figure below, all thermistors are supposed to show similar results depending on the unit's temperature.

| Temp. °C | Ohms      |  |  |
|----------|-----------|--|--|
|          |           |  |  |
| -60      | 1,342,000 |  |  |
| -55      | 957,000   |  |  |
| -50      | 690,000   |  |  |
| -45      | 503,700   |  |  |
| -40      | 371,300   |  |  |
| -35      | 276,200   |  |  |
| -30      | 207,500   |  |  |
| -25      | 157,200   |  |  |
| -20      | 120,100   |  |  |
| -15      | 92,600    |  |  |
| -10      | 71,940    |  |  |
| -5       | 56,310    |  |  |
| 0        | 44,420    |  |  |
| 2        | 40,490    |  |  |
| 4        | 36,930    |  |  |
| 6        | 33,740    |  |  |
| 8        | 30,840    |  |  |
| 10       | 28,230    |  |  |
| 12       | 25,860    |  |  |
| 14       | 23,720    |  |  |
| 16       | 21,780    |  |  |
| 18       | 20,010    |  |  |

| Temp. °C | Ohms   |
|----------|--------|
|          |        |
| 20       | 18,410 |
| 22       | 16,950 |
| 24       | 15,620 |
| 25       | 15,000 |
| 26       | 14,410 |
| 28       | 13,310 |
| 30       | 12,300 |
| 32       | 11,370 |
| 34       | 10,530 |
| 36       | 9,756  |
| 38       | 9,047  |
| 40       | 8,397  |
| 42       | 7,800  |
| 44       | 7,253  |
| 46       | 6,747  |
| 48       | 6,282  |
| 50       | 5,855  |
| 52       | 5,460  |
| 54       | 5,096  |
| 56       | 4,758  |
| 58       | 4,448  |
| 60       | 4,160  |

19,6°C

 $\sqrt{\phantom{a}}$ 

Figure 3: Thermistor resistivities for various temperatures, taken from the thermistor's datasheet



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| MDM25   |                       |           |                     |             |               |  |  |  |
|---|-----------------------|-----------|---------------------|-------------|---------------|--|--|--|
| Pin (+)   | Signal                | Pin (-)   | Signal              | Measurement |               |  |  |  |
| Pin (+)       Signal       Expected [Ω]       Measurement         Nominal power lines and grounding |                       |           |                     |             |               |  |  |  |
| Chassis   | Instrument chassis    | 15        | 15 Chassis gnd <1   |             | 0.7           |  |  |  |
| Chassis   | Instrument chassis    | 24        | Chassis gnd         | < 1         | 0.7           |  |  |  |
| Chassis   | Instrument chassis    | 1         | Nom. power          | >10M        | oL.           |  |  |  |
| 14  | Nom. power return     | 1         | Nom. power          | >10M        | OL            |  |  |  |
|   | Redundant power lines |           |                     |             |               |  |  |  |
| Chassis   | Instrument chassis    | 13        | Red. power          | >10M        | 01            |  |  |  |
| 25  | Red. power return     | 13        | Red. power          | >10M        | 01            |  |  |  |
|   |                       |           | communication lines | <b>建筑的</b>  | THE THE PARTY |  |  |  |
| 4   | LVDS I2S-             | 16        | LVDS I2S+           | 100         | 103           |  |  |  |
| 6   | CLK I2S+              | 19        | CLK I2S-            | 100         | 103           |  |  |  |
| 8   | LVDS S2I+             | 21        | LVDS S2I-           | 50          | 52.3          |  |  |  |
|   |                       | Redundant | communication lines |             |               |  |  |  |
| 5   | LVDS I2S-             | 17        | LVDS I2S+           | 100         | 102.8         |  |  |  |
| 7   | CLK I2S+              | 20        | CLK I2S-            | 100         |               |  |  |  |
| 10  | LVDS S2I-             | 22        | LVDS S2I+           | 50          | 102.9<br>51-8 |  |  |  |
|   |                       |           | nnected (NC) pins   |             |               |  |  |  |
| 2   | NC                    | Chassis   | Instrument chassis  | >10M        | OL            |  |  |  |
| 3   | DGND                  | Chassis   | Instrument chassis  | < 1         | 0.6           |  |  |  |
| 4   | LVDS I2S-             | Chassis   | Instrument chassis  | >10M        | oL            |  |  |  |
| 5   | LVDS I2S-             | Chassis   | Instrument chassis  | >10M        | 96.           |  |  |  |
| 6   | CLK I2S+              | Chassis   | Instrument chassis  | >10M        | 01-           |  |  |  |
| 7   | CLK I2S+              | Chassis   | Instrument chassis  | >10M        | oL            |  |  |  |
| 8   | LVDS S2I+             | Chassis   | Instrument chassis  | >10M        | 01            |  |  |  |
| 9   | NC                    | Chassis   | Instrument chassis  | >10M        | 01.           |  |  |  |
| 10  | LVDS S2I-             | Chassis   | Instrument chassis  | >10M        | 01            |  |  |  |
| 11  | DGND.                 | Chassis   | Instrument chassis  | < 1         | 0:5           |  |  |  |
| 12  | NC                    | Chassis   | Instrument chassis  | >10M        | 01            |  |  |  |
| 14  | Nom. power return     | Chassis   | Instrument chassis  | 100k        | 99.9K         |  |  |  |
| 16  | LVDS I2S+             | Chassis   | Instrument chassis  | >10M        | 01            |  |  |  |
| 17  | LVDS I2S+             | Chassis   | Instrument chassis  | >10M        | 01            |  |  |  |
| 18  | NC                    | Chassis   | Instrument chassis  | >10M        | 06            |  |  |  |
| 19  | CLK I2S-              | Chassis   | Instrument chassis  | >10M        | 06            |  |  |  |
| 20  | CLK I2S-              | Chassis   | Instrument chassis  | >10M        | 06            |  |  |  |
| 21  | LVDS S2I-             | Chassis   | Instrument chassis  | >10M        | OL            |  |  |  |
| 22  | LVDS S2I+             | Chassis   | Instrument chassis  | >10M        | OL            |  |  |  |
| 23  | NC                    | Chassis   | Instrument chassis  | >10M        | OL            |  |  |  |
| 25  | Red. power return     | Chassis   | Instrument chassis  | 100k        | 99.9K         |  |  |  |



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#### 4.4 Abbreviated Safe-to-Mate Test and Power Consumption Check

The abbreviated safe-to-mate test shall be performed before the first connection of EGSE to the unit and after transport of the EGSE.

| MDM25   |                |         |                 | 1000         |             |
|---|----------------|---------|-----------------|--------------|-------------|
| Pin (+)   | Signal         | Pin (-) | Signal          | Expected [V] | Measurement |
| 1   | Nom. power     | 14      | Nom. power ret. | 28 or 0 *    | 28V & 98m   |
| 13  | Red. power     | 25      | Red. power ret. | 28 or 0 *    |             |
| * 28V expected if connected to the corresponding NOM or RED port, 0V otherwise. |                |         |                 |              |             |
| any   | other pin      | 15      | Chassis gnd     | < 3          |             |
| MDM15   |                |         |                 |              |             |
| 1   | Thermistor 1   | 9       | Thermistor 1    | tbd by ADS * |             |
| 2   | Thermistor 2   | 10      | Thermistor 2    | tbd by ADS * |             |
| 3   | Thermistor 3   | 11      | Thermistor 3    | tbd by ADS * |             |
| 7   | Surv Heaters 1 | 14      | Surv Heaters 1  | 28           |             |
| 8   | Surv Heaters 2 | 15      | Surv Heaters 2  | 28           |             |

<sup>\*</sup> Voltage and polarity to be defined by ADS, a constant voltage lower than 28 V is expected.

After successful safe-to-mate test, the unit can be powered. The power consumption of the unit is not supposed to change significantly. When powered, the unit shall drain about 100 mA at 28 V, so about 2.8 W. The current limitation of the power supply shall be set to 500 mA. Document the power consumption as part of the standard procedure. This condition resembles the "Unit unconfigured" as per the table below. After configuration of the sensors, the total power consumption is expected to increase to 100 mA  $\pm$  5 mA. For the unconfigured unit (after power ON), or after a "reset"-command after communication has been established:

| Parameter | Expected                        | Measured |
|-----------|---------------------------------|----------|
| Voltage   | 28.0 V                          | 28V      |
| Current   | $100\mathrm{mA}\pm5\mathrm{mA}$ | 98mA     |

To define the units power consumption under the different operational modes and under different supply voltages, document the power consumption under the conditions as given below. This part of the procedure is required to be conducted only once!

| Condition                   | 28.0 V | Current | 26.0 V | Current | 29.0 V | Current |
|-----------------------------|--------|---------|--------|---------|--------|---------|
| Unit unconfigured           |        |         |        |         |        |         |
| (after POWER ON)            |        |         |        |         |        |         |
| Unit in HK mode             |        |         |        |         |        |         |
|                             |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (low activity)              |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (high activity, testpulser) |        |         |        |         |        |         |

Alominal Channel SFT-Lucarful'
Redundant — 10

1X0 6.3 5.0 1X1 5.9 4.8

Pal



Reference:

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#### 4.9 As Run Functional Test Report

| Date and Time 26.03.2017 1500 |  |
|-------------------------------|--|
|-------------------------------|--|

#### 4.9.1 Functional Test Readiness

| Location             | Che her clear |
|----------------------|---------------|
| Personnel            | Lauri         |
| Instrument ID        | STEP PS       |
| Firmware revision    |               |
| Reason for FT        |               |
| Test to be performed |               |

#### 4.9.2 FT Constraints (if applicable)

| Safe-to-mate           | $\checkmark$ |
|------------------------|--------------|
| Impedance check        | V            |
| Set up communication   | V            |
| Additional constraints |              |



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#### 4.3 Unit Impedance Check

After transport, before the first connection to the EGSE, and after tests with higher risks to damage the unit the impedances of the unit shall be measured and compared with the expected values as given in the table (based on RD-1):

| MDM15              |         |         |              |             |
|--------------------|---------|---------|--------------|-------------|
| Name               | Pin (+) | Pin (-) | Expected [Ω] | Measurement |
| Thermistor 1       | 1       | 9       | 15k to 20k * | 19.00k      |
| Thermistor 2       | 2       | 10      | 15k to 20k * | 15,85k      |
| Thermistor 3       | 3       | 11      | 15k to 20k * | 19.884      |
| Survival Heaters 1 | 7       | 14      | 119          | 118.5       |
| Survival Heaters 2 | 8       | 15      | 119          | 1195        |



 $<sup>^{</sup>st}$  See figure below, all thermistors are supposed to show similar results depending on the unit's temperature.

| Temp. °C | Ohms      |
|----------|-----------|
|          |           |
| -60      | 1,342,000 |
| -55      | 957,000   |
| -50      | 690,000   |
| -45      | 503,700   |
| -40      | 371,300   |
| -35      | 276,200   |
| -30      | 207,500   |
| -25      | 157,200   |
| -20      | 120,100   |
| -15      | 92,600    |
| -10      | 71,940    |
| -5       | 56,310    |
| 0        | 44,420    |
| 2        | 40,490    |
| 4        | 36,930    |
| 6        | 33,740    |
| 8        | 30,840    |
| 10       | 28,230    |
| 12       | 25,860    |
| 14       | 23,720    |
| 16       | 21,780    |
| 18       | 20,010    |

| Temp. °C | Ohms   |
|----------|--------|
|          |        |
| 20       | 18,410 |
| 22       | 16,950 |
| 24       | 15,620 |
| 25       | 15,000 |
| 26       | 14,410 |
| 28       | 13,310 |
| 30       | 12,300 |
| 32       | 11,370 |
| 34       | 10,530 |
| 36       | 9,756  |
| 38       | 9,047  |
| 40       | 8,397  |
| 42       | 7,800  |
| 44       | 7,253  |
| 46       | 6,747  |
| 48       | 6,282  |
| 50       | 5,855  |
| 52       | 5,460  |
| 54       | 5,096  |
| 56       | 4,758  |
| 58       | 4,448  |
| 60       | 4,160  |

Figure 3: Thermistor resistivities for various temperatures, taken from the thermistor's datasheet



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| MDM25   |                                   |           |                     |                     |              |  |
|---------|-----------------------------------|-----------|---------------------|---------------------|--------------|--|
| Pin (+) | Signal                            | Pin (-)   | Signal              | Expected $[\Omega]$ | Measurement  |  |
|         | Nominal power lines and grounding |           |                     |                     |              |  |
| Chassis | Instrument chassis                | 15        | Chassis gnd         | < 1                 | OB           |  |
| Chassis | Instrument chassis                | 24        | Chassis gnd         | < 1                 | 0.6          |  |
| Chassis | Instrument chassis                | 1         | Nom. power          | >10M                | V            |  |
| 14      | Nom. power return                 | 1         | Nom. power          | >10M                | <b>V</b>     |  |
|         |                                   | Redun     | dant power lines    |                     |              |  |
| Chassis | Instrument chassis                | 13        | Red. power          | >10M                | V            |  |
| 25      | Red. power return                 | 13        | Red. power          | >10M                |              |  |
|         |                                   | Nominal o | communication lines |                     |              |  |
| 4       | LVDS I2S-                         | 16        | LVDS I2S+           | 100                 | 102.7        |  |
| 6       | CLK I2S+                          | 19        | CLK I2S-            | 100                 | 102,7        |  |
| 8       | LVDS S2I+                         | 21        | LVDS S2I-           | 50                  | 51.6         |  |
|         | F                                 | Redundant | communication lines |                     |              |  |
| 5       | LVDS I2S-                         | 17        | LVDS I2S+           | 100                 | (02.7        |  |
| 7       | CLK I2S+                          | 20        | CLK I2S-            | 100                 | 107.8        |  |
| 10      | LVDS S2I-                         | 22        | LVDS S2I+           | 50                  | 51.6         |  |
|         |                                   | not con   | nected (NC) pins    |                     |              |  |
| 2       | NC                                | Chassis   | Instrument chassis  | >10M                | <i>S</i>     |  |
| 3       | DGND                              | Chassis   | Instrument chassis  | < 1                 | 0,6          |  |
| 4       | LVDS I2S-                         | Chassis   | Instrument chassis  | >10M                | V            |  |
| 5       | LVDS I2S-                         | Chassis   | Instrument chassis  | >10M                | V            |  |
| 6       | CLK I2S+                          | Chassis   | Instrument chassis  | >10M                | V            |  |
| 7       | CLK I2S+                          | Chassis   | Instrument chassis  | >10M                | V            |  |
| 8       | LVDS S2I+                         | Chassis   | Instrument chassis  | >10M                | V            |  |
| 9       | NC                                | Chassis   | Instrument chassis  | >10M                | V            |  |
| 10      | LVDS S2I-                         | Chassis   | Instrument chassis  | >10M                | V            |  |
| 11      | DGND.                             | Chassis   | Instrument chassis  | < 1                 | 0,6          |  |
| 12      | NC                                | Chassis   | Instrument chassis  | >10M                | V            |  |
| 14      | Nom. power return                 | Chassis   | Instrument chassis  | 100k                | 99.94        |  |
| 16      | LVDS I2S+                         | Chassis   | Instrument chassis  | >10M                | V'           |  |
| 17      | LVDS I2S+                         | Chassis   | Instrument chassis  | >10M                | $\checkmark$ |  |
| 18      | NC                                | Chassis   | Instrument chassis  | >10M                | 1            |  |
| 19      | CLK I2S-                          | Chassis   | Instrument chassis  | >10M                | V            |  |
| 20      | CLK I2S-                          | Chassis   | Instrument chassis  | >10M                | V            |  |
| 21      | LVDS S2I-                         | Chassis   | Instrument chassis  | >10M                | 1            |  |
| 22      | LVDS S2I+                         | Chassis   | Instrument chassis  | >10M                | V            |  |
| 23      | NC                                | Chassis   | Instrument chassis  | >10M                | √            |  |
| 25      | Red. power return                 | Chassis   | Instrument chassis  | 100k                | 39,9 W       |  |





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26,04 V

of tested now a

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#### 4.4 Abbreviated Safe-to-Mate Test and Power Consumption Check

The abbreviated safe-to-mate test shall be performed before the first connection of EGSE to the unit and after transport of the EGSE.

| MDM25   |                    |            |                  |                |               |
|---------|--------------------|------------|------------------|----------------|---------------|
| Pin (+) | Signal             | Pin (-)    | Signal           | Expected [V]   | Measurement   |
| 1       | Nom. power         | 14         | Nom. power ret.  | 28 or 0 *      | V             |
| 13      | Red. power         | 25         | Red. power ret.  | 28 or 0 *      | V             |
| * 28V e | xpected if connect | ted to the | corresponding NO | M or RED port, | 0V otherwise. |
| any     | other pin          | 15         | Chassis gnd      | < 3            | V             |
| MDM15   |                    |            |                  |                |               |
| 1       | Thermistor 1       | 9          | Thermistor 1     | tbd by ADS *   |               |
| 2       | Thermistor 2       | 10         | Thermistor 2     | tbd by ADS *   |               |
| 3       | Thermistor 3       | 11         | Thermistor 3     | tbd by ADS *   |               |
| 7       | Surv Heaters 1     | 14         | Surv Heaters 1   | 28             |               |
| 8       | Surv Heaters 2     | 15         | Surv Heaters 2   | 28             | 1             |

<sup>\*</sup> Voltage and polarity to be defined by ADS, a constant voltage lower than 28 V is expected.

After successful safe-to-mate test, the unit can be powered. The power consumption of the unit is not supposed to change significantly. When powered, the unit shall drain about  $100 \, \text{mA}$  at  $28 \, \text{V}$ , so about  $2.8 \, \text{W}$ . The current limitation of the power supply shall be set to  $500 \, \text{mA}$ . Document the power consumption as part of the standard procedure. This condition resembles the "Unit unconfigured" as per the table below. After configuration of the sensors, the total power consumption is expected to increase to  $100 \, \text{mA} \pm 5 \, \text{mA}$ . For the unconfigured unit (after power ON), or after a "reset"-command after communication has been established:

| Parameter | Expected                        | Measured |
|-----------|---------------------------------|----------|
| Voltage   | 28.0 V                          | 7800     |
| Current   | $100\mathrm{mA}\pm5\mathrm{mA}$ | 100 mg   |

To define the units power consumption under the different operational modes and under different supply voltages, document the power consumption under the conditions as given below. This part of the procedure is required to be conducted only once!

| Condition                   | 28.0 V | Current | 26.0 V | Current | 29.0 V | Current |
|-----------------------------|--------|---------|--------|---------|--------|---------|
| Unit unconfigured           |        |         |        |         |        |         |
| (after POWER ON)            |        |         |        |         |        |         |
| Unit in HK mode             |        |         |        |         |        |         |
|                             |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (low activity)              |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (high activity, testpulser) |        |         |        |         |        |         |

| SFT succe   | essful on NOM & RED                      |      |
|-------------|--|------|
| thres holds | after direct purge:                      |      |
|             | <l>: 6,49 1×2: <l> = 6,12</l></l>        | . /  |
|             | <5>: 5,00 <5>: 5,12                      | Vlan |
| Pulser      | <5>: 5,00 <5>: 5,12 widths nominal (3,6) |      |

# Post-transportation de pre-vidration tests at history De Partomon M



### STEP FS Functional test plan and procedure

Reference:

SO-EPD-KIE-TP-0051

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4.9 As Run Functional Test Report

Date and Time 17.05.17 1100 (EST

#### 4.9.1 Functional Test Readiness

| Location             | Ailons DS vibraha fect |
|----------------------|------------------------|
| Personnel            | lauri, dule            |
| Instrument ID        | STEP 75                |
| Firmware revision    |                        |
| Reason for FT        |                        |
| Test to be performed | F                      |

#### 4.9.2 FT Constraints (if applicable)

| Safe-to-mate           | æl v         |
|------------------------|--------------|
| Impedance check        | W V          |
| Set up communication   | $\checkmark$ |
| Additional constraints |              |

Humidely indicator & 50-60%. school indicator Ok



Reference:

SO-EPD-KIE-TP-0051

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#### 4.3 Unit Impedance Check

J. Mills Flake 110 Multimbu + 20 offst

After transport, before the first connection to the EGSE, and after tests with higher risks to damage the unit the impedances of the unit shall be measured and compared with the expected values as given in the table (based on RD-1):

| MDM15              |         |         |                     |             |
|--------------------|---------|---------|---------------------|-------------|
| Name               | Pin (+) | Pin (-) | Expected $[\Omega]$ | Measurement |
| Thermistor 1       | 1       | 9       | 15k to 20k *        | 17.962      |
| Thermistor 2       | 2       | 10      | 15k to 20k *        | 17.862      |
| Thermistor 3       | 3       | 11      | 15k to 20k *        | (7.8kl      |
| Survival Heaters 1 | 7       | 14      | 119                 | 118.80      |
| Survival Heaters 2 | 8       | 15      | 119                 | 119.8.2     |

Mu2

<sup>\*</sup> See figure below, all thermistors are supposed to show similar results depending on the unit's temperature.

| Temp. °C | Ohms      |
|----------|-----------|
|          |           |
| -60      | 1,342,000 |
| -55      | 957,000   |
| -50      | 690,000   |
| -45      | 503,700   |
| -40      | 371,300   |
| -35      | 276,200   |
| -30      | 207,500   |
| -25      | 157,200   |
| -20      | 120,100   |
| -15      | 92,600    |
| -10      | 71,940    |
| -5       | 56,310    |
| 0        | 44,420    |
| 2        | 40,490    |
| 4        | 36,930    |
| 6        | 33,740    |
| 8        | 30,840    |
| 10       | 28,230    |
| 12       | 25,860    |
| 14       | 23,720    |
| 16       | 21,780    |
| 18       | 20,010    |

| Temp. °C | Ohms   |
|----------|--------|
|          |        |
| 20       | 18,410 |
| 22       | 16,950 |
| 24       | 15,620 |
| 25       | 15,000 |
| 26       | 14,410 |
| 28       | 13,310 |
| 30       | 12,300 |
| 32       | 11,370 |
| 34       | 10,530 |
| 36       | 9,756  |
| 38       | 9,047  |
| 40       | 8,397  |
| 42       | 7,800  |
| 44       | 7,253  |
| 46       | 6,747  |
| 48       | 6,282  |
| 50       | 5,855  |
| 52       | 5,460  |
| 54       | 5,096  |
| 56       | 4,758  |
| 58       | 4,448  |
| 60       | 4,160  |

Figure 3: Thermistor resistivities for various temperatures, taken from the thermistor's datasheet



Reference:

SO-EPD-KIE-TP-0051

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Note Offict

| MDM25                             |                    |           |                     |              |             |       |
|-----------------------------------|--------------------|-----------|---------------------|--------------|-------------|-------|
| Pin (+)                           | Signal             | Pin (-)   | Signal              | Expected [Ω] | Measurement |       |
| Nominal power lines and grounding |                    |           |                     |              |             |       |
| Chassis                           | Instrument chassis | 15        | Chassis gnd         | < 1          | 1.4.20.8    | Il my |
| Chassis                           | Instrument chassis | 24        | Chassis gnd         | < 1          | 20,80       | news  |
| Chassis                           | Instrument chassis | 1         | Nom. power          | >10M         | -           |       |
| 14                                | Nom. power return  | 1         | Nom. power          | >10M         | 2           |       |
|                                   |                    | Redur     | idant power lines   |              |             |       |
| Chassis                           | Instrument chassis | 13        | Red. power          | >10M         | V           |       |
| 25                                | Red. power return  | 13        | Red. power          | >10M         | V           |       |
|                                   |                    | Nominal o | communication lines |              |             |       |
| 4                                 | LVDS I2S-          | 16        | LVDS I2S+           | 100          | 103.7 1     |       |
| 6                                 | CLK I2S+           | 19        | CLK I2S-            | 100          | 25.50i      |       |
| 8                                 | LVDS S2I+          | 21        | LVDS S2I-           | 50           | 53.32       |       |
|                                   |                    | Redundant | communication lines |              |             |       |
| 5                                 | LVDS I2S-          | 17        | LVDS I2S+           | 100          | 103,9 1     |       |
| 7                                 | CLK I2S+           | 20        | CLK I2S-            | 100          | 104.4 2     |       |
| 10                                | LVDS S2I-          | 22        | LVDS S2I+           | 50           | 53,10       |       |
|                                   |                    | not cor   | nected (NC) pins    |              |             |       |
| 2                                 | NC                 | Chassis   | Instrument chassis  | >10M         | /           |       |
| 3                                 | DGND               | Chassis   | Instrument chassis  | < 1          | 1.82        |       |
| 4                                 | LVDS I2S-          | Chassis   | Instrument chassis  | >10M         | V           |       |
| 5                                 | LVDS I2S-          | Chassis   | Instrument chassis  | >10M         | 1           |       |
| 6                                 | CLK I2S+           | Chassis   | Instrument chassis  | >10M         | /           |       |
| 7                                 | CLK I2S+           | Chassis   | Instrument chassis  | >10M         | /           |       |
| 8                                 | LVDS S2I+          | Chassis   | Instrument chassis  | >10M         |             |       |
| 9                                 | NC                 | Chassis   | Instrument chassis  | >10M         | 7           |       |
| 10                                | LVDS S2I-          | Chassis   | Instrument chassis  | >10M         | V           |       |
| 11                                | DGND.              | Chassis   | Instrument chassis  | < 1          | 1.952       |       |
| 12                                | NC                 | Chassis   | Instrument chassis  | >10M         | ~           |       |
| 14                                | Nom. power return  | Chassis   | Instrument chassis  | 100k         | 1006-52     |       |
| 16                                | LVDS I2S+          | Chassis   | Instrument chassis  | >10M         | V           |       |
| 17                                | LVDS I2S+          | Chassis   | Instrument chassis  | >10M         | ~           |       |
| 18                                | NC                 | Chassis   | Instrument chassis  | >10M         | V           |       |
| 19                                | CLK I2S-           | Chassis   | Instrument chassis  | >10M         | ~           |       |
| 20                                | CLK I2S-           | Chassis   | Instrument chassis  | >10M         | V           |       |
| 21                                | LVDS S2I-          | Chassis   | Instrument chassis  | >10M         | ~           |       |
| 22                                | LVDS S2I+          | Chassis   | Instrument chassis  | >10M         | V           |       |
| 23                                | NC                 | Chassis   | Instrument chassis  | >10M         | 1           |       |
| 25                                | Red. power return  | Chassis   | Instrument chassis  | 100k         | 100 le s2   |       |

nur



Reference:

SO-EPD-KIE-TP-0051

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#### 4.4 Abbreviated Safe-to-Mate Test and Power Consumption Check

The abbreviated safe-to-mate test shall be performed before the first connection of EGSE to the unit and after transport of the EGSE.

|         |                    |            |                  |                | <b>V</b>      |     |
|---------|--------------------|------------|------------------|----------------|---------------|-----|
| MDM25   |                    |            |                  |                |               |     |
| Pin (+) | Signal             | Pin (-)    | Signal           | Expected [V]   | Measurement   |     |
| 1       | Nom. power         | 14         | Nom. power ret.  | 28 or 0 *      | 29.0          | 0   |
| 13      | Red. power         | 25         | Red. power ret.  | 28 or 0 *      | 0             | 28. |
| * 28V e | xpected if connect | ted to the | corresponding NO | M or RED port, | 0V otherwise. |     |
| any     | other pin          | 15         | Chassis gnd      | < 3            | V             | /   |
| MDM15   |                    |            |                  |                |               | m   |
| 1       | Thermistor 1       | 9          | Thermistor 1     | tbd by ADS *   |               |     |
| 2       | Thermistor 2       | 10         | Thermistor 2     | tbd by ADS *   |               |     |
| 3       | Thermistor 3       | 11         | Thermistor 3     | tbd by ADS *   |               |     |
| 7       | Surv Heaters 1     | 14         | Surv Heaters 1   | 28             |               |     |
| 8       | Surv Heaters 2     | 15         | Surv Heaters 2   | 28             |               | 1   |

<sup>\*</sup> Voltage and polarity to be defined by ADS, a constant voltage lower than 28 V is expected.

After successful safe-to-mate test, the unit can be powered. The power consumption of the unit is not supposed to change significantly. When powered, the unit shall drain about 100 mA at 28 V, so about 2.8 W. The current limitation of the power supply shall be set to 500 mA. Document the power consumption as part of the standard procedure. This condition resembles the "Unit unconfigured" as per the table below. After configuration of the sensors, the total power consumption is expected to increase to  $100 \text{ mA} \pm 5 \text{ mA}$ . For the unconfigured unit (after power ON), or after a "reset"-command after communication has been established:

|           |                                 | 100      | 1600  |
|-----------|---------------------------------|----------|-------|
| Parameter | Expected                        | Measured |       |
| Voltage   | 28.0 V                          | 28.0     | 1     |
| Current   | $100\mathrm{mA}\pm5\mathrm{mA}$ | 0,03     | 0.09A |

To define the units power consumption under the different operational modes and under different supply voltages, document the power consumption under the conditions as given below. This part of the procedure is required to be conducted only once!

| Condition                   | 28.0 V | Current | 26.0 V | Current | 29.0 V | Current |
|-----------------------------|--------|---------|--------|---------|--------|---------|
| Unit unconfigured           |        |         |        |         |        |         |
| (after POWER ON)            |        |         |        |         |        |         |
| Unit in HK mode             |        |         |        |         |        |         |
|                             |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (low activity)              |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (high activity, testpulser) |        |         |        |         |        |         |

| SFT | results: | RED! | all | passed |
|-----|----------|------|-----|--------|
|     |          | HOM: | all | passed |

large pixel thresholds: 1x0: 6,75 A1: 6,31



Reference:

SO-EPD-KIE-TP-0051

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After X-RANDOM

#### 4.9 As Run Functional Test Report

| Date and Time | 17.05.17 | 1730 | CEST |
|---------------|----------|------|------|
|---------------|----------|------|------|

#### 4.9.1 Functional Test Readiness

| Location             | as | before |
|----------------------|----|--------|
| Personnel            |    |        |
| Instrument ID        |    |        |
| Firmware revision    |    |        |
| Reason for FT        |    |        |
| Test to be performed |    |        |

#### 4.9.2 FT Constraints (if applicable)

| Safe-to-mate           | A            |
|------------------------|--------------|
| Impedance check        | $\checkmark$ |
| Set up communication   | $\checkmark$ |
| Additional constraints |              |





Reference:

SO-EPD-KIE-TP-0051

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#### 4.3 Unit Impedance Check

After transport, before the first connection to the EGSE, and after tests with higher risks to damage the unit the impedances of the unit shall be measured and compared with the expected values as given in the table (based on RD-1):

| MDM15              |         |         |                     |             |
|--------------------|---------|---------|---------------------|-------------|
| Name               | Pin (+) | Pin (-) | Expected $[\Omega]$ | Measurement |
| Thermistor 1       | 1       | 9       | 15k to 20k *        | 17.3h Q     |
| Thermistor 2       | 2       | 10      | 15k to 20k *        | 17.262      |
| Thermistor 3       | 3       | 11      | 15k to 20k *        | 17.2ks      |
| Survival Heaters 1 | 7       | 14      | 119                 | 119,50      |
| Survival Heaters 2 | 8       | 15      | 119                 | 120.30      |

mor

 $<sup>^{</sup>st}$  See figure below, all thermistors are supposed to show similar results depending on the unit's temperature.

| Temp. °C | Ohms      |
|----------|-----------|
|          |           |
| -60      | 1,342,000 |
| -55      | 957,000   |
| -50      | 690,000   |
| -45      | 503,700   |
| -40      | 371,300   |
| -35      | 276,200   |
| -30      | 207,500   |
| -25      | 157,200   |
| -20      | 120,100   |
| -15      | 92,600    |
| -10      | 71,940    |
| -5       | 56,310    |
| 0        | 44,420    |
| 2        | 40,490    |
| 4        | 36,930    |
| 6        | 33,740    |
| 8        | 30,840    |
| 10       | 28,230    |
| 12       | 25,860    |
| 14       | 23,720    |
| 16       | 21,780    |
| 18       | 20,010    |

| Temp. °C | Ohms   |
|----------|--------|
|          |        |
| 20       | 18,410 |
| 22       | 16,950 |
| 24       | 15,620 |
| 25       | 15,000 |
| 26       | 14,410 |
| 28       | 13,310 |
| 30       | 12,300 |
| 32       | 11,370 |
| 34       | 10,530 |
| 36       | 9,756  |
| 38       | 9,047  |
| 40       | 8,397  |
| 42       | 7,800  |
| 44       | 7,253  |
| 46       | 6,747  |
| 48       | 6,282  |
| 50       | 5,855  |
| 52       | 5,460  |
| 54       | 5,096  |
| 56       | 4,758  |
| 58       | 4,448  |
| 60       | 4,160  |

Figure 3: Thermistor resistivities for various temperatures, taken from the thermistor's datasheet



Reference:

SO-EPD-KIE-TP-0051

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| Pin (+)SignalExpectedNominal power lines and groundingChassisInstrument chassis15Chassis gnd< 1 | 0.80     |
|---|----------|
|   | 0.8.2    |
| ChassisInstrument chassis24Chassis gnd<1ChassisInstrument chassis1Nom. power>10M                | 0.8.2    |
| Chassis Instrument chassis 1 Nom. power > 10M   | 0.8.2    |
| 0008/000000000000000000000000000000000  | V        |
|   | /        |
| 14 Nom. power return 1 Nom. power > 10M   |          |
| Redundant power lines   |          |
| Chassis Instrument chassis 13 Red. power > 10M  |          |
| 25 Red. power return 13 Red. power > 10M  | V        |
| Nominal communication lines   |          |
| 4 LVDS I2S- 16 LVDS I2S+ 100  | 103,52   |
| 6 CLK I2S+ 19 CLK I2S- 100  | 103,652  |
| 8 LVDS S2I+ 21 LVDS S2I- 50   | 52,40    |
| Redundant communication lines   |          |
| 5 LVDS I2S- 17 LVDS I2S+ 100  | 103,352  |
| 7 CLK I2S+ 20 CLK I2S- 100  | 103,30   |
| 10 LVDS S2I- 22 LVDS S2I+ 50  | 5220     |
| not connected (NC) pins   |          |
| 2 NC Chassis Instrument chassis > 10M   |          |
| 3 DGND Chassis Instrument chassis <1  | 0.92     |
| 4 LVDS I2S- Chassis Instrument chassis > 10M  |          |
| 5 LVDS I2S- Chassis Instrument chassis > 10M  | V        |
| 6 CLK I2S+ Chassis Instrument chassis > 10M   | V        |
| 7 CLK I2S+ Chassis Instrument chassis > 10M   | · /      |
| 8 LVDS S2I+ Chassis Instrument chassis > 10M  | V        |
| 9 NC Chassis Instrument chassis > 10M   |          |
| 10 LVDS S2I- Chassis Instrument chassis > 10M   | <b>/</b> |
| 11 DGND. Chassis Instrument chassis <1  | 0.42     |
| 12 NC Chassis Instrument chassis > 10M  |          |
| 14 Nom. power return   Chassis   Instrument chassis   100k                                      | 100 KQ   |
| 16 LVDS I2S+ Chassis Instrument chassis > 10M   | . ~      |
| 17 LVDS I2S+ Chassis Instrument chassis > 10M   | i v      |
| 18 NC Chassis Instrument chassis > 10M  | -        |
| 19 CLK I2S- Chassis Instrument chassis > 10M  | V        |
| 20 CLK I2S- Chassis Instrument chassis > 10M  |          |
| 21 LVDS S2I- Chassis Instrument chassis > 10M   | ·        |
| 22 LVDS S2I+ Chassis Instrument chassis > 10M   | V        |
| 23 NC Chassis Instrument chassis > 10M  |          |
| 25 Red. power return Chassis Instrument chassis 100k  | 100.012  |

2017-05-17 post X-cris Randu



Reference:

SO-EPD-KIE-TP-0051

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#### Abbreviated Safe-to-Mate Test and Power Consumption Check

The abbreviated safe-to-mate test shall be performed before the first connection of EGSE to the unit and after transport of the EGSE.

| MDM25    |                    |           |                  |                |               |
|----------|--------------------|-----------|------------------|----------------|---------------|
| Pin (+)  | Signal             | Pin (-)   | Signal           | Expected, [V]  | Measurement   |
| 1        | Nom. power         | 14        | Nom. power ret.  | 28 or 0 *      |               |
| 13       | Red. power         | 25        | Red. power ret.  | 28 or 0 *      |               |
| * 28V ex | spected if connect | ed to the | corresponding NO | M or RED port, | 0V otherwise. |
| any      | other pin          | 15        | Chassis gnd      | < 3            |               |
| MDM15    |                    |           |                  |                |               |
| 1        | Thermistor 1       | 9         | Thermistor 1     | tbd by ADS *   |               |
| 2        | Thermistor 2       | 10        | Thermistor 2     | tbd by ADS *   |               |
| 3        | Thermistor 3       | 11        | Thermistor 3     | tbd by ADS *   |               |
| 7        | Surv Heaters 1     | /14       | Surv Heaters 1   | 28             |               |
| 8        | Surv Heaters 2     | 15        | Surv Heaters 2   | 28             |               |

<sup>\*</sup> Voltage and polarity to be defined by ADS, a constant voltage lower than 28 V is expected.

After successful safe-to-mate test, the unit can be powered. The power consumption of the unit is not supposed to change significantly. When powered, the unit shall drain about 100 mA at 28 V, so about 2.8 W. The current limitation of the power supply shall be set to 500 mA. Document the power consumption as part of the standard procedure. This condition resembles the "Unit unconfigured" as per the table below. After configuration of the sensors, the total power consumption is expected to increase to 100 mA  $\pm$  5 mA. For the unconfigured unit (after power ON), or after a "reset"-command after communication has been established:

|           |                                 | Non 1    | Red    |
|-----------|---------------------------------|----------|--------|
| Parameter | Expected                        | Measured |        |
| Voltage   | 28.0 V                          | 28,0     | 28,0   |
| Current   | $100\mathrm{mA}\pm5\mathrm{mA}$ | 6,104    | 0,10 A |

To define the units power consumption under the different operational modes and under different supply voltages, document the power consumption under the conditions as given below. This part of the procedure is required to be conducted only once!

| Condition                   | 28.0 V | Current | 26.0 V | Current | 29.0 V | Current |
|-----------------------------|--------|---------|--------|---------|--------|---------|
| Unit unconfigured           |        |         |        |         |        |         |
| (after POWER ON)            |        |         |        |         |        |         |
| Unit in HK mode             |        |         |        |         |        |         |
|                             |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (low activity)              |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (high activity, testpulser) |        |         |        |         |        |         |

SFT: Noh: all tests passed

RED: - "

thresholds: (mean, large) 1x0: 6,69

1x1: 6,38

thresholds saved in Step/data/thresholds-75.txt



Reference:

SO-EPD-KIE-TP-0051

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#### 4.9 As Run Functional Test Report

| Date and Time | 18.08.17 | 1140 |  |
|---------------|----------|------|--|
|---------------|----------|------|--|

#### 4.9.1 Functional Test Readiness

| Location             | Dission DS Partsmark into tent |
|----------------------|--------------------------------|
| Personnel            | Lani, dute                     |
| Instrument ID        | STEP FS                        |
| Firmware revision    |                                |
| Reason for FT        |                                |
| Test to be performed | all unt tests                  |

#### 4.9.2 FT Constraints (if applicable)

| Safe-to-mate           |              |
|------------------------|--------------|
| Impedance check        | $\checkmark$ |
| Set up communication   |              |
| Additional constraints |              |



Reference:

SO-EPD-KIE-TP-0051

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#### 4.3 Unit Impedance Check

After transport, before the first connection to the EGSE, and after tests with higher risks to damage the unit the impedances of the unit shall be measured and compared with the expected values as given in the table (based on RD-1):

| MDM15              |         |         |                     |             |
|--------------------|---------|---------|---------------------|-------------|
| Name               | Pin (+) | Pin (-) | Expected $[\Omega]$ | Measurement |
| Thermistor 1       | 1       | 9       | 15k to 20k *        | 17.3 ks     |
| Thermistor 2       | 2       | 10      | 15k to 20k *        | 17.1 kg     |
| Thermistor 3       | 3       | 11      | 15k to 20k *        | 17,21252    |
| Survival Heaters 1 | 7       | 14      | 119                 | 119.30      |
| Survival Heaters 2 | 8       | 15      | 119                 | 120,252     |

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<sup>\*</sup> See figure below, all thermistors are supposed to show similar results depending on the unit's temperature.

| Temp. °C | Ohms      |
|----------|-----------|
|          |           |
| -60      | 1,342,000 |
| -55      | 957,000   |
| -50      | 690,000   |
| -45      | 503,700   |
| -40      | 371,300   |
| -35      | 276,200   |
| -30      | 207,500   |
| -25      | 157,200   |
| -20      | 120,100   |
| -15      | 92,600    |
| -10      | 71,940    |
| -5       | 56,310    |
| 0        | 44,420    |
| 2        | 40,490    |
| 4        | 36,930    |
| 6        | 33,740    |
| 8        | 30,840    |
| 10       | 28,230    |
| 12       | 25,860    |
| 14       | 23,720    |
| 16       | 21,780    |
| 18       | 20,010    |

| Temp. °C | Ohms   |  |  |  |
|----------|--------|--|--|--|
|          |        |  |  |  |
| 20       | 18,410 |  |  |  |
| 22       | 16,950 |  |  |  |
| 24       | 15,620 |  |  |  |
| 25       | 15,000 |  |  |  |
| 26       | 14,410 |  |  |  |
| 28       | 13,310 |  |  |  |
| 30       | 12,300 |  |  |  |
| 32       | 11,370 |  |  |  |
| 34       | 10,530 |  |  |  |
| 36       | 9,756  |  |  |  |
| 38       | 9,047  |  |  |  |
| 40       | 8,397  |  |  |  |
| 42       | 7,800  |  |  |  |
| 44       | 7,253  |  |  |  |
| 46       | 6,747  |  |  |  |
| 48       | 6,282  |  |  |  |
| 50       | 5,855  |  |  |  |
| 52       | 5,460  |  |  |  |
| 54       | 5,096  |  |  |  |
| 56       | 4,758  |  |  |  |
| 58       | 4,448  |  |  |  |
| 60       | 4,160  |  |  |  |

Figure 3: Thermistor resistivities for various temperatures, taken from the thermistor's datasheet



Reference:

SO-EPD-KIE-TP-0051

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| MDM25   |                    |           |                         |                     |                  |
|---------|--------------------|-----------|-------------------------|---------------------|------------------|
| Pin (+) | Signal             | Pin (-)   | Signal                  | Expected $[\Omega]$ | Measurement      |
|         | No                 |           | ver lines and grounding | ig                  |                  |
| Chassis | Instrument chassis | 15        | Chassis gnd             | < 1                 | 0.90             |
| Chassis | Instrument chassis | 24        | Chassis gnd             | < 1                 | 0,70             |
| Chassis | Instrument chassis | 1         | Nom. power              | >10M                | V                |
| 14      | Nom. power return  | 1         | Nom. power              | >10M                |                  |
|         |                    | Redun     | dant power lines        |                     |                  |
| Chassis | Instrument chassis | 13        | Red. power              | >10M                |                  |
| 25      | Red. power return  | 13        | Red. power              | >10M                | V                |
|         |                    | Nominal o | communication lines     |                     | Constant of      |
| 4       | LVDS I2S-          | 16        | LVDS I2S+               | 100                 | 102,50           |
| 6       | CLK I2S+           | 19        | CLK I2S-                | 100                 | 162.6.2          |
| 8       | LVDS S2I+          | 21        | LVDS S2I-               | 50                  | 16Z.6.2<br>51.8Ω |
|         | F                  | Redundant | communication lines     | <b>建筑</b> 发表。建      |                  |
| 5       | LVDS I2S-          | 17        | LVDS I2S+               | 100                 | 102.80           |
| 7       | CLK I2S+           | 20        | CLK I2S-                | 100                 | 102,80           |
| 10      | LVDS S2I-          | 22        | LVDS S2I+               | 50                  | 5460             |
|         |                    | not con   | nected (NC) pins        |                     |                  |
| 2       | NC                 | Chassis   | Instrument chassis      | >10M                |                  |
| 3       | DGND               | Chassis   | Instrument chassis      | < 1                 | 0.82             |
| 4       | LVDS I2S-          | Chassis   | Instrument chassis      | >10M                | V                |
| 5       | LVDS I2S-          | Chassis   | Instrument chassis      | >10M                | V                |
| 6       | CLK I2S+           | Chassis   | Instrument chassis      | >10M                | V                |
| 7       | CLK I2S+           | Chassis   | Instrument chassis      | >10M                | V                |
| 8       | LVDS S2I+          | Chassis   | Instrument chassis      | >10M                |                  |
| 9       | NC                 | Chassis   | Instrument chassis      | >10M                | V                |
| 10      | LVDS S2I-          | Chassis   | Instrument chassis      | >10M                |                  |
| 11      | DGND.              | Chassis   | Instrument chassis      | < 1                 | 0.50             |
| 12      | NC                 | Chassis   | Instrument chassis      | >10M                |                  |
| 14      | Nom. power return  | Chassis   | Instrument chassis      | 100k                | 100.060          |
| 16      | LVDS I2S+          | Chassis   | Instrument chassis      | >10M                | 1                |
| 17      | LVDS I2S+          | Chassis   | Instrument chassis      | >10M                |                  |
| 18      | NC                 | Chassis   | Instrument chassis      | >10M                | V                |
| 19      | CLK I2S-           | Chassis   | Instrument chassis      | >10M                | V,               |
| 20      | CLK I2S-           | Chassis   | Instrument chassis      | >10M                | V,               |
| 21      | LVDS S2I-          | Chassis   | Instrument chassis      | > 10M               | 1                |
| 22      | LVDS S2I+          | Chassis   | Instrument chassis      | >10M                | V.               |
| 23      | NC                 | Chassis   | Instrument chassis      | >10M                |                  |
| 25      | Red. power return  | Chassis   | Instrument chassis      | 100k                | 100.0 ED         |

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### Abbreviated Safe-to-Mate Test and Power Consumption Check

The abbreviated safe-to-mate test shall be performed before the first connection of EGSE to the unit and after transport of the EGSE.

| MDM25    |                    |           |                  |                |               |
|----------|--------------------|-----------|------------------|----------------|---------------|
| Pin (+)  | Signal             | Pin (-)   | Signal           | Expected [V]   | Measurement   |
| 1        | Nom. power         | 14        | Nom. power ret.  | 28 or 0 *      |               |
| 13       | Red. power         | 25        | Red. power ret.  | 28 or 0 *      |               |
| * 28V ex | xpected if connect | ed to the | corresponding NO | M or RED port, | 0V otherwise. |
| any      | other pin          | 15        | Chassis gnd      | < 3            |               |
| MDM15    |                    |           |                  |                |               |
| 1        | Thermistor 1       | 9         | Thermistor 1     | tbd by ADS *   |               |
| 2        | Thermistor 2       | 10        | Thermistor 2     | tbd by ADS *   |               |
| 3        | Thermistor 3       | 11        | Thermistor 3     | tbd by ADS *   |               |
| 7        | Surv Heaters 1     | 14        | Surv Heaters 1   | 28             |               |
| 8        | Surv Heaters 2     | 15        | Surv Heaters 2   | 28             |               |

<sup>\*</sup> Voltage and polarity to be defined by ADS, a constant voltage lower than 28 V is expected.

After successful safe-to-mate test, the unit can be powered. The power consumption of the unit is not supposed to change significantly. When powered, the unit shall drain about 100 mA at 28 V, so about 2.8 W. The current limitation of the power supply shall be set to 500 mA. Document the power consumption as part of the standard procedure. This condition resembles the "Unit unconfigured" as per the table below. After configuration of the sensors, the total power consumption is expected to increase to 100 mA  $\pm$  5 mA. For the unconfigured unit (after power ON), or after a "reset"-command after communication has been established:

|           |                                 | MM       | KED   |
|-----------|---------------------------------|----------|---|
| Parameter | Expected                        | Measured | Territoria de la constante de |
| Voltage   | 28.0 V                          | 28.0V    | 28,0V   |
| Current   | $100\mathrm{mA}\pm5\mathrm{mA}$ | (O) Junk | 1 100 mA  |

To define the units power consumption under the different operational modes and under different supply voltages, document the power consumption under the conditions as given below. This part of the procedure is required to be conducted only once!

| Condition                   | 28.0 V | Current | 26.0 V | Current | 29.0 V | Current |
|-----------------------------|--------|---------|--------|---------|--------|---------|
| Unit unconfigured           |        |         |        |         |        |         |
| (after POWER ON)            |        |         |        |         |        |         |
| Unit in HK mode             |        |         |        |         |        |         |
|                             |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (low activity)              |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (high activity, testpulser) |        |         |        |         |        |         |

|      |     |   | 0.0 | 1 4   | 0 00 00 |
|------|-----|---|-----|-------|---------|
| STT: | Non | 7 | all | tests | passed  |
|      | RED | • | _   | ( _   |         |

Sterted testpulso at 1200 stopped at 1300

men (are pitel thresholds: 1x0: 6,81 1x1: 6,38

Post-transportation test after ord. tests in him



# STEP FS Functional test plan and procedure

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#### 4.9 As Run Functional Test Report

| Date and Time | 13.05.17 | 1400 |  |
|---------------|----------|------|--|
|---------------|----------|------|--|

#### 4.9.1 Functional Test Readiness

| Location             | hiel cleara |
|----------------------|-------------|
| Personnel            | Lan.        |
| Instrument ID        | SPEP P3     |
| Firmware revision    |             |
| Reason for FT        |             |
| Test to be performed |             |

#### 4.9.2 FT Constraints (if applicable)

| Safe-to-mate           |              |
|------------------------|--------------|
| Impedance check        | $\checkmark$ |
| Set up communication   |              |
| Additional constraints |              |



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#### 4.3 Unit Impedance Check

After transport, before the first connection to the EGSE, and after tests with higher risks to damage the unit the impedances of the unit shall be measured and compared with the expected values as given in the table (based on RD-1):

| MDM15              |         | A SALE  | The state of the s |             |
|--------------------|---------|---------|--|-------------|
| Name               | Pin (+) | Pin (-) | Expected $[\Omega]$  | Measurement |
| Thermistor 1       | 1       | 9       | 15k to 20k *   | 17.4 KR     |
| Thermistor 2       | 2       | 10      | 15k to 20k *   | 17.3652     |
| Thermistor 3       | 3       | 11      | 15k to 20k *   | M3KR        |
| Survival Heaters 1 | 7       | 14      | 119  | 118,30      |
| Survival Heaters 2 | 8       | 15      | 119  | 113,20      |

<sup>\*</sup> See figure below, all thermistors are supposed to show similar results depending on the unit's temperature.

| Temp. °C | Ohms      |
|----------|-----------|
| remp. C  | Omis      |
|          |           |
| -60      | 1,342,000 |
| -55      | 957,000   |
| -50      | 690,000   |
| -45      | 503,700   |
| -40      | 371,300   |
| -35      | 276,200   |
| -30      | 207,500   |
| -25      | 157,200   |
| -20      | 120,100   |
| -15      | 92,600    |
| -10      | 71,940    |
| -5       | 56,310    |
| 0        | 44,420    |
| 2        | 40,490    |
| 4        | 36,930    |
| 6        | 33,740    |
| 8        | 30,840    |
| 10       | 28,230    |
| 12       | 25,860    |
| 14       | 23,720    |
| 16       | 21,780    |
| 18       | 20,010    |

| Temp. °C | Ohms   |
|----------|--------|
|          |        |
| 20       | 18,410 |
| 22       | 16,950 |
| 24       | 15,620 |
| 25       | 15,000 |
| 26       | 14,410 |
| 28       | 13,310 |
| 30       | 12,300 |
| 32       | 11,370 |
| 34       | 10,530 |
| 36       | 9,756  |
| 38       | 9,047  |
| 40       | 8,397  |
| 42       | 7,800  |
| 44       | 7,253  |
| 46       | 6,747  |
| 48       | 6,282  |
| 50       | 5,855  |
| 52       | 5,460  |
| 54       | 5,096  |
| 56       | 4,758  |
| 58       | 4,448  |
| 60       | 4,160  |

Figure 3: Thermistor resistivities for various temperatures, taken from the thermistor's datasheet



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| Pin (+)   Signal   Pin (-)   Signal   Expected [Ω]   Measurement   Nominal power lines and grounding  | MDM25                             |                      |           |                     |              |              |  |  |  |
|---|-----------------------------------|----------------------|-----------|---------------------|--------------|--------------|--|--|--|
| Chassis   Instrument chassis   15   | Pin (+)                           | Signal               | Pin (-)   | Signal              | Expected [Ω] | Measurement  |  |  |  |
| Chassis         Instrument chassis         15         Chassis gnd         < 1         0, 4           Chassis         Instrument chassis         24         Chassis gnd         < 1  | Nominal power lines and grounding |                      |           |                     |              |              |  |  |  |
| Chassis   Instrument chassis   1  | Chassis                           | Instrument chassis   | 15        | Chassis gnd         |              | 2.4          |  |  |  |
| Chassis   Instrument chassis   1  | Chassis                           | Instrument chassis   | 24        | Chassis gnd         | < 1          | 0,4          |  |  |  |
| Redundant power lines   | Chassis                           | Instrument chassis   | 1         | Nom. power          | >10M         | 9            |  |  |  |
| Chassis   | 14                                | Nom. power return    | 1         | Nom. power          | >10M         | V            |  |  |  |
| Section   Sect    |                                   |                      | Redur     | ndant power lines   |              |              |  |  |  |
| Nominal communication lines   | Chassis                           | Instrument chassis   | 13        | Red. power          | >10M         | V            |  |  |  |
| 4 LVDS I2S- 16 LVDS I2S+ 100  | 25                                | Red. power return    | 13        | Red. power          | >10M         | V            |  |  |  |
| 6 CLK   |                                   |                      | Nominal   | communication lines |              | 1000 8000    |  |  |  |
| 8 LVDS S2I+ 21 LVDS S2I- 50 Si (  |                                   |                      | 16        | LVDS I2S+           | 100          | 102,3        |  |  |  |
| Redundant communication lines  5 LVDS I2S- 17 LVDS I2S+ 100 (02 s)  7 CLK I2S+ 20 CLK I2S- 100 (02 s)  10 LVDS S2I- 22 LVDS S2I+ 50 5 s s s s s s s s s s s s s s s s s   | 6                                 | CLK I2S+             | 19        | CLK I2S-            | 100          | 162,4        |  |  |  |
| 5   | 8                                 | LVDS S2I+            | 21        | LVDS S2I-           | 50           | 51,4         |  |  |  |
| 7 CLK I2S+ 20 CLK I2S- 100 (02 s) 10 LVDS S2I- 22 LVDS S2I+ 50 57 s  not connected (NC) pins  2 NC Chassis Instrument chassis > 10M   |                                   |                      | Redundant |                     |              |              |  |  |  |
| 10 LVDS S2I- 22 LVDS S2I+ 50 \$\overline{5}\int_{\coloredge}{\sqrt{5}\int}}\infty}}}}}}}}}}}}}} \) \lambda \lambd |                                   |                      | 17        | LVDS I2S+           | 100          | 102.4        |  |  |  |
| 10  | 7                                 | CLK I2S+             | 20        | CLK I2S-            | 100          | (OZ, 5       |  |  |  |
| NC Chassis Instrument chassis > 10M   | 10                                | LVDS S2I-            | 22        | LVDS S2I+           | 50           |              |  |  |  |
| 3 DGND Chassis Instrument chassis <1 0, ↑ 4 LVDS I2S- Chassis Instrument chassis >10M √ 5 LVDS I2S- Chassis Instrument chassis >10M √ 6 CLK I2S+ Chassis Instrument chassis >10M √ 7 CLK I2S+ Chassis Instrument chassis >10M √ 8 LVDS S2I+ Chassis Instrument chassis >10M √ 9 NC Chassis Instrument chassis >10M √ 10 LVDS S2I- Chassis Instrument chassis >10M √ 11 DGND. Chassis Instrument chassis >10M √ 12 NC Chassis Instrument chassis >10M √ 14 Nom. power return Chassis Instrument chassis >10M √ 16 LVDS I2S+ Chassis Instrument chassis >10M √ 17 LVDS I2S+ Chassis Instrument chassis >10M √ 18 NC Chassis Instrument chassis >10M √ 19 CLK I2S- Chassis Instrument chassis >10M √ 20 CLK I2S- Chassis Instrument chassis >10M √ 21 LVDS S2I+ Chassis Instrument chassis >10M √ 22 LVDS S2I+ Chassis Instrument chassis >10M √ 23 NC Chassis Instrument chassis >10M √ 24 LVDS S2I+ Chassis Instrument chassis >10M √ 25 LVDS S2I+ Chassis Instrument chassis >10M √ 26 Chassis Instrument chassis >10M √ 27 LVDS S2I+ Chassis Instrument chassis >10M √ 28 LVDS S2I+ Chassis Instrument chassis >10M √ 29 CLK I2S- Chassis Instrument chassis >10M √ 20 CLK I2S- Chassis Instrument chassis >10M √ 21 LVDS S2I- Chassis Instrument chassis >10M √ 22 LVDS S2I- Chassis Instrument chassis >10M √  |                                   |                      | not cor   | nected (NC) pins    |              |              |  |  |  |
| 4 LVDS I2S- Chassis Instrument chassis > 10M  |                                   |                      | Chassis   | Instrument chassis  | >10M         | V            |  |  |  |
| 4 LVDS I2S- Chassis Instrument chassis > 10M  | 3                                 | 2010) 872(00) 883(0) | Chassis   | Instrument chassis  | < 1          | 0,7          |  |  |  |
| 6 CLK I2S+ Chassis Instrument chassis > 10M 7 CLK I2S+ Chassis Instrument chassis > 10M 8 LVDS S2I+ Chassis Instrument chassis > 10M 9 NC Chassis Instrument chassis > 10M 10 LVDS S2I- Chassis Instrument chassis > 10M 11 DGND. Chassis Instrument chassis > 10M 12 NC Chassis Instrument chassis > 10M 14 Nom. power return Chassis Instrument chassis 100k 16 LVDS I2S+ Chassis Instrument chassis > 10M 17 LVDS I2S+ Chassis Instrument chassis > 10M 18 NC Chassis Instrument chassis > 10M 19 CLK I2S- Chassis Instrument chassis > 10M 20 CLK I2S- Chassis Instrument chassis > 10M 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I+ Chassis Instrument chassis > 10M 23 NC Chassis Instrument chassis > 10M 24 V 25 LVDS S2I+ Chassis Instrument chassis > 10M 26 Chassis Instrument chassis > 10M 27 Chassis Instrument chassis > 10M 28 V  | 4                                 |                      |           | Instrument chassis  | >10M         | V            |  |  |  |
| 7 CLK I2S+ Chassis Instrument chassis > 10M 8 LVDS S2I+ Chassis Instrument chassis > 10M 9 NC Chassis Instrument chassis > 10M 10 LVDS S2I- Chassis Instrument chassis > 10M 11 DGND. Chassis Instrument chassis < 1 12 NC Chassis Instrument chassis > 10M 14 Nom. power return Chassis Instrument chassis 100k 16 LVDS I2S+ Chassis Instrument chassis > 10M 17 LVDS I2S+ Chassis Instrument chassis > 10M 18 NC Chassis Instrument chassis > 10M 19 CLK I2S- Chassis Instrument chassis > 10M 20 CLK I2S- Chassis Instrument chassis > 10M 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I+ Chassis Instrument chassis > 10M 23 NC Chassis Instrument chassis > 10M 24 Chassis Instrument chassis > 10M 25 Chassis Instrument chassis > 10M 26 Chassis Instrument chassis > 10M 27 Chassis Instrument chassis > 10M 28 Chassis Instrument chassis > 10M 29 CLK I2S- Chassis Instrument chassis > 10M 20 CLK I2S- Chassis Instrument chassis > 10M 21 CLX I2S- Chassis Instrument chassis > 10M 22 CLX I2S- Chassis Instrument chassis > 10M 23 NC  | 5                                 | LVDS I2S-            | Chassis   | Instrument chassis  | >10M         | V            |  |  |  |
| 8 LVDS S2I+ Chassis Instrument chassis > 10M 9 NC Chassis Instrument chassis > 10M 10 LVDS S2I- Chassis Instrument chassis > 10M 11 DGND. Chassis Instrument chassis > 10M 12 NC Chassis Instrument chassis > 10M 14 Nom. power return Chassis Instrument chassis 100k 16 LVDS I2S+ Chassis Instrument chassis > 10M 17 LVDS I2S+ Chassis Instrument chassis > 10M 18 NC Chassis Instrument chassis > 10M 19 CLK I2S- Chassis Instrument chassis > 10M 20 CLK I2S- Chassis Instrument chassis > 10M 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I+ Chassis Instrument chassis > 10M 23 NC Chassis Instrument chassis > 10M 24 LVDS S2I+ Chassis Instrument chassis > 10M 25 V   | 6                                 |                      |           | Instrument chassis  | >10M         | <b>√</b>     |  |  |  |
| 9 NC Chassis Instrument chassis > 10M  10 LVDS S2I- Chassis Instrument chassis > 10M  11 DGND. Chassis Instrument chassis < 1  12 NC Chassis Instrument chassis > 10M  14 Nom. power return Chassis Instrument chassis 100k  16 LVDS I2S+ Chassis Instrument chassis > 10M  17 LVDS I2S+ Chassis Instrument chassis > 10M  18 NC Chassis Instrument chassis > 10M  19 CLK I2S- Chassis Instrument chassis > 10M  20 CLK I2S- Chassis Instrument chassis > 10M  21 LVDS S2I- Chassis Instrument chassis > 10M  22 LVDS S2I+ Chassis Instrument chassis > 10M  23 NC Chassis Instrument chassis > 10M  24 LVDS S2I- Chassis Instrument chassis > 10M  25 NC Chassis Instrument chassis > 10M  26 Chassis Instrument chassis > 10M  27 LVDS S2I- Chassis Instrument chassis > 10M  28 NC Chassis Instrument chassis > 10M  29 NC Chassis Instrument chassis > 10M  |                                   |                      | Chassis   | Instrument chassis  | >10M         | V            |  |  |  |
| 10 LVDS S2I- Chassis Instrument chassis > 10M  11 DGND. Chassis Instrument chassis < 1  12 NC Chassis Instrument chassis > 10M  14 Nom. power return Chassis Instrument chassis 100k  16 LVDS I2S+ Chassis Instrument chassis > 10M  17 LVDS I2S+ Chassis Instrument chassis > 10M  18 NC Chassis Instrument chassis > 10M  19 CLK I2S- Chassis Instrument chassis > 10M  20 CLK I2S- Chassis Instrument chassis > 10M  21 LVDS S2I- Chassis Instrument chassis > 10M  22 LVDS S2I+ Chassis Instrument chassis > 10M  23 NC Chassis Instrument chassis > 10M  24 LVDS S2I- Chassis Instrument chassis > 10M  25 LVDS S2I- Chassis Instrument chassis > 10M  26 Chassis Instrument chassis > 10M  27 LVDS S2I- Chassis Instrument chassis > 10M  28 LVDS S2I- Chassis Instrument chassis > 10M  29 LVDS S2I- Chassis Instrument chassis > 10M  20 Chassis Instrument chassis > 10M  21 LVDS S2I- Chassis Instrument chassis > 10M  22 LVDS S2I- Chassis Instrument chassis > 10M   |                                   | LVDS S2I+            | Chassis   | Instrument chassis  | >10M         | V            |  |  |  |
| 11 DGND. Chassis Instrument chassis <1 0, 4  12 NC Chassis Instrument chassis >10M  14 Nom. power return Chassis Instrument chassis 100k  16 LVDS I2S+ Chassis Instrument chassis >10M  17 LVDS I2S+ Chassis Instrument chassis >10M  18 NC Chassis Instrument chassis >10M  19 CLK I2S- Chassis Instrument chassis >10M  20 CLK I2S- Chassis Instrument chassis >10M  21 LVDS S2I- Chassis Instrument chassis >10M  22 LVDS S2I+ Chassis Instrument chassis >10M  23 NC Chassis Instrument chassis >10M  24 LVDS S2I+ Chassis Instrument chassis >10M  25 NC Chassis Instrument chassis >10M   |                                   |                      | Chassis   | Instrument chassis  | >10M         | $\vee$       |  |  |  |
| 12 NC Chassis Instrument chassis > 10M  14 Nom. power return Chassis Instrument chassis 100k  16 LVDS I2S+ Chassis Instrument chassis > 10M  17 LVDS I2S+ Chassis Instrument chassis > 10M  18 NC Chassis Instrument chassis > 10M  19 CLK I2S- Chassis Instrument chassis > 10M  20 CLK I2S- Chassis Instrument chassis > 10M  21 LVDS S2I- Chassis Instrument chassis > 10M  22 LVDS S2I+ Chassis Instrument chassis > 10M  23 NC Chassis Instrument chassis > 10M  26 Chassis Instrument chassis > 10M  27 Chassis Instrument chassis > 10M  28 Chassis Instrument chassis > 10M  29 Chassis Instrument chassis > 10M  20 Chassis Instrument chassis > 10M  21 LVDS S2I- Chassis Instrument chassis > 10M  22 LVDS S2I- Chassis Instrument chassis > 10M   | 10                                | LVDS S2I-            | Chassis   | Instrument chassis  | >10M         |              |  |  |  |
| 14 Nom. power return Chassis Instrument chassis 100k 99 9 1   |                                   |                      | Chassis   | Instrument chassis  | < 1          | 0,7          |  |  |  |
| 16 LVDS I2S+ Chassis Instrument chassis > 10M V  17 LVDS I2S+ Chassis Instrument chassis > 10M V  18 NC Chassis Instrument chassis > 10M V  19 CLK I2S- Chassis Instrument chassis > 10M V  20 CLK I2S- Chassis Instrument chassis > 10M V  21 LVDS S2I- Chassis Instrument chassis > 10M V  22 LVDS S2I+ Chassis Instrument chassis > 10M V  23 NC Chassis Instrument chassis > 10M V  | 12                                | NC                   | Chassis   | Instrument chassis  | >10M         | V            |  |  |  |
| 17 LVDS I2S+ Chassis Instrument chassis > 10M  18 NC Chassis Instrument chassis > 10M  19 CLK I2S- Chassis Instrument chassis > 10M  20 CLK I2S- Chassis Instrument chassis > 10M  21 LVDS S2I- Chassis Instrument chassis > 10M  22 LVDS S2I+ Chassis Instrument chassis > 10M  23 NC Chassis Instrument chassis > 10M   | , 10.10° UI                       |                      | Chassis   | Instrument chassis  | 100k         | 999k         |  |  |  |
| 18 NC Chassis Instrument chassis > 10M V 19 CLK I2S- Chassis Instrument chassis > 10M V 20 CLK I2S- Chassis Instrument chassis > 10M V 21 LVDS S2I- Chassis Instrument chassis > 10M V 22 LVDS S2I+ Chassis Instrument chassis > 10M V 23 NC Chassis Instrument chassis > 10M V   | 16                                |                      | Chassis   | Instrument chassis  | >10M         | v'           |  |  |  |
| 19 CLK I2S- Chassis Instrument chassis > 10M 20 CLK I2S- Chassis Instrument chassis > 10M 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I+ Chassis Instrument chassis > 10M 23 NC Chassis Instrument chassis > 10M  | 17                                | LVDS I2S+            | Chassis   | Instrument chassis  | >10M         | $\checkmark$ |  |  |  |
| 20 CLK I2S- Chassis Instrument chassis > 10M 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I+ Chassis Instrument chassis > 10M 23 NC Chassis Instrument chassis > 10M V   |                                   |                      | Chassis   | Instrument chassis  | >10M         | V            |  |  |  |
| 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I+ Chassis Instrument chassis > 10M 23 NC Chassis Instrument chassis > 10M 30 V   | 19                                |                      |           | Instrument chassis  | >10M         |              |  |  |  |
| 22 LVDS S2I+ Chassis Instrument chassis > 10M   23 NC Chassis Instrument chassis > 10M   3   4  |                                   |                      | Chassis   | Instrument chassis  | >10M         | · ·          |  |  |  |
| 23 NC Chassis Instrument chassis > 10M 🔻 🗸  |                                   |                      | Chassis   | Instrument chassis  | >10M         |              |  |  |  |
| The second secon  | 22                                |                      | Chassis   | Instrument chassis  | >10M         | V            |  |  |  |
| 25 Red. power return Chassis Instrument chassis 100k  | 23                                | NC                   | Chassis   | Instrument chassis  | >10M         | 3 V          |  |  |  |
|   | 25                                | Red. power return    | Chassis   | Instrument chassis  | 100k         | 99,9 K       |  |  |  |



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MAM

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#### 4.4 Abbreviated Safe-to-Mate Test and Power Consumption Check

The abbreviated safe-to-mate test shall be performed before the first connection of EGSE to the unit and after transport of the EGSE.

| MDM25    |                    |           |                  |                |               |
|----------|--------------------|-----------|------------------|----------------|---------------|
| Pin (+)  | Signal             | Pin (-)   | Signal           | Expected [V]   | Measurement   |
| 1        | Nom. power         | 14        | Nom. power ret.  | 28 or 0 *      |               |
| 13       | Red. power         | 25        | Red. power ret.  | 28 or 0 *      |               |
| * 28V ex | spected if connect | ed to the | corresponding NO | M or RED port, | 0V otherwise. |
| any      | any other pin      |           | Chassis gnd      | < 3            |               |
| MDM15    |                    |           |                  |                |               |
| 1        | Thermistor 1       | 9         | Thermistor 1     | tbd by ADS *   |               |
| 2        | Thermistor 2       | 10        | Thermistor 2     | tbd by ADS *   |               |
| 3        | Thermistor 3       | 11        | Thermistor 3     | tbd by ADS *   |               |
| 7        | Surv Heaters 1     | 14        | Surv Heaters 1   | 28             |               |
| 8        | Surv Heaters 2     | 15        | Surv Heaters 2   | 28             |               |

<sup>\*</sup> Voltage and polarity to be defined by ADS, a constant voltage lower than 28 V is expected.

After successful safe-to-mate test, the unit can be powered. The power consumption of the unit is not supposed to change significantly. When powered, the unit shall drain about  $100\,\text{mA}$  at  $28\,\text{V}$ , so about  $2.8\,\text{W}$ . The current limitation of the power supply shall be set to  $500\,\text{mA}$ . Document the power consumption as part of the standard procedure. This condition resembles the "Unit unconfigured" as per the table below. After configuration of the sensors, the total power consumption is expected to increase to  $100\,\text{mA} \pm 5\,\text{mA}$ . For the unconfigured unit (after power ON), or after a "reset"-command after communication has been established:

|           |                                 | 150      |       |
|-----------|---------------------------------|----------|-------|
| Parameter | Expected                        | Measured |       |
| Voltage   | 28.0 V                          | 28.0V    | 28,0  |
| Current   | $100\mathrm{mA}\pm5\mathrm{mA}$ | 梅wA      | Win A |

To define the units power consumption under the different operational modes and under different supply voltages, document the power consumption under the conditions as given below. This part of the procedure is required to be conducted only once!

| Condition                   | 28.0 V | Current | 26.0 V | Current | 29.0 V | Current |
|-----------------------------|--------|---------|--------|---------|--------|---------|
| Unit unconfigured           |        |         |        |         |        |         |
| (after POWER ON)            |        |         |        |         |        |         |
| Unit in HK mode             |        |         |        |         |        |         |
|                             |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (low activity)              |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (high activity, testpulser) |        |         |        |         |        |         |

SFT: RED: all took possed

<1X0L>: 6,81 <1X1L>: 6,49 1st functional test after NCR-0040 Migesta LVPS reword



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#### 4.3 Unit Impedance Check

After transport, before the first connection to the EGSE, and after tests with higher risks to damage the unit the impedances of the unit shall be measured and compared with the expected values as given in the table (based on RD-1):

| MDM15              |         |         |                     |             |
|--------------------|---------|---------|---------------------|-------------|
| Name               | Pin (+) | Pin (-) | Expected $[\Omega]$ | Measurement |
| Thermistor 1       | 1       | 9       | 15k to 20k *        | 17,68KR     |
| Thermistor 2       | 2       | 10      | 15k to 20k *        | 17,53 hr    |
| Thermistor 3       | 3       | 11      | 15k to 20k *        | 17566S      |
| Survival Heaters 1 | 7       | 14      | 119                 | 118,352     |
| Survival Heaters 2 | 8       | 15      | 119                 | 11932       |



\* See figure below, all thermistors are supposed to show similar results depending on the unit's temperature.

| Temp. °C | Ohms      |
|----------|-----------|
|          |           |
| -60      | 1,342,000 |
| -55      | 957,000   |
| -50      | 690,000   |
| -45      | 503,700   |
| -40      | 371,300   |
| -35      | 276,200   |
| -30      | 207,500   |
| -25      | 157,200   |
| -20      | 120,100   |
| -15      | 92,600    |
| -10      | 71,940    |
| -5       | 56,310    |
| 0        | 44,420    |
| 2        | 40,490    |
| 4        | 36,930    |
| 6        | 33,740    |
| 8        | 30,840    |
| 10       | 28,230    |
| 12       | 25,860    |
| 14       | 23,720    |
| 16       | 21,780    |
| 18       | 20,010    |

| Temp. °C | Ohms   |
|----------|--------|
|          |        |
| 20       | 18,410 |
| 22       | 16,950 |
| 24       | 15,620 |
| 25       | 15,000 |
| 26       | 14,410 |
| 28       | 13,310 |
| 30       | 12,300 |
| 32       | 11,370 |
| 34       | 10,530 |
| 36       | 9,756  |
| 38       | 9,047  |
| 40       | 8,397  |
| 42       | 7,800  |
| 44       | 7,253  |
| 46       | 6,747  |
| 48       | 6,282  |
| 50       | 5,855  |
| 52       | 5,460  |
| 54       | 5,096  |
| 56       | 4,758  |
| 58       | 4,448  |
| 60       | 4,160  |

Figure 3: Thermistor resistivities for various temperatures, taken from the thermistor's datasheet

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26-04-2017 Laws P Hahen Y

After ne-assembly of LVPS bound

C A U *ieap*Christian-Albrechts-Universität zu Kiel

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| MDM25   |                    |           |                        |              |               |
|---------|--------------------|-----------|------------------------|--------------|---------------|
| Pin (+) | Signal             | Pin (-)   | Signal                 | Expected [Ω] | Measurement   |
|         |                    |           | wer lines and groundir |              | Wedsdreffielt |
| Chassis | Instrument chassis | 15        | Chassis gnd            | < 1          | 0.6           |
| Chassis | Instrument chassis | 24        | Chassis gnd            | <1           | 0.6           |
| Chassis | Instrument chassis | 1         | Nom. power             | >10M         | BL            |
| 14      | Nom. power return  | 1         | Nom. power             | >10M         | 06            |
|         |                    | Redur     | ndant power lines      | SECOND .     |               |
| Chassis | Instrument chassis | 13        | Red. power             | >10M         | OL            |
| 25      | Red. power return  | 13        | Red. power             | >10M         | oL            |
|         |                    | Nominal   | communication lines    |              |               |
| 4       | LVDS I2S-          | 16        | LVDS I2S+              | 100          | 102.5         |
| 6       | CLK I2S+           | 19        | CLK I2S-               | 100          | 1025          |
| 8       | LVDS S2I+          | 21        | LVDS S2I-              | 50           | 515           |
|         |                    | Redundant | communication lines    |              |               |
| 5       | LVDS I2S-          | 17        | LVDS I2S+              | 100          | 1024          |
| 7       | CLK I2S+           | 20        | CLK I2S-               | 100          | 102-4         |
| 10      | LVDS S2I-          | 22        | LVDS S2I+              | 50           | 51.4          |
|         |                    |           | nnected (NC) pins      |              |               |
| 2       | NC                 | Chassis   | Instrument chassis     | >10M         | OL            |
| 3       | DGND               | Chassis   | Instrument chassis     | < 1          | 0:5           |
| 4       | LVDS I2S-          | Chassis   | Instrument chassis     | >10M         | 01.           |
| 5       | LVDS I2S-          | Chassis   | Instrument chassis     | >10M         | 01-           |
| 6       | CLK I2S+           | Chassis   | Instrument chassis     | >10M         | 01            |
| 7       | CLK I2S+           | Chassis   | Instrument chassis     | >10M         | 01.           |
| 8       | LVDS S2I+          | Chassis   | Instrument chassis     | >10M         | 01_           |
| 9       | NC                 | Chassis   | Instrument chassis     | >10M         | 0/            |
| 10      | LVDS S2I-          | Chassis   | Instrument chassis     | >10M         | 0(            |
| 11      | DGND.              | Chassis   | Instrument chassis     | < 1          | 0.4           |
| 12      | NC                 | Chassis   | Instrument chassis     | >10M         | C.C           |
| 14      | Nom. power return  | Chassis   | Instrument chassis     | 100k         | 99.95         |
| 16      | LVDS I2S+          | Chassis   | Instrument chassis     | >10M         | 06            |
| 17      | LVDS I2S+          | Chassis   | Instrument chassis     | >10M         | 01            |
| 18      | NC                 | Chassis   | Instrument chassis     | >10M         | OL            |
| 19      | CLK I2S-           | Chassis   | Instrument chassis     | >10M         | 01.           |
| 20      | CLK I2S-           | Chassis   | Instrument chassis     | >10M         | oL            |
| 21      | LVDS S2I-          | Chassis   | Instrument chassis     | >10M         | oL            |
| 22      | LVDS S2I+          | Chassis   | Instrument chassis     | >10M         | ol.           |
| 23      | NC                 | Chassis   | Instrument chassis     | >10M         | 0/            |
| 25      | Red. power return  | Chassis   | Instrument chassis     | 100k         | 99.9 E        |

 $\sqrt{}$ 



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#### 4.4 Abbreviated Safe-to-Mate Test and Power Consumption Check

The abbreviated safe-to-mate test shall be performed before the first connection of EGSE to the unit and after transport of the EGSE.

| MDM25    |                              |           |                  |                |               |
|----------|------------------------------|-----------|------------------|----------------|---------------|
| Pin (+)  | Signal                       | Pin (-)   | Signal           | Expected [V]   | Measurement   |
| 1        | Nom. power                   | 14        | Nom. power ret.  | 28 or 0 *      |               |
| 13       | Red. power                   | 25        | Red. power ret.  | 28 or 0 *      |               |
| * 28V ex | xpected if connect           | ed to the | corresponding NO | M or RED port, | 0V otherwise. |
| any      | any other pin 15 Chassis gnd |           | < 3              |                |               |
| MDM15    |                              |           |                  |                |               |
| 1        | Thermistor 1                 | 9         | Thermistor 1     | tbd by ADS *   | 17.68 K.R     |
| 2        | Thermistor 2                 | 10        | Thermistor 2     | tbd by ADS *   | 12 BCN        |
| 3        | Thermistor 3                 | 11        | Thermistor 3     | tbd by ADS *   | 17:56KR       |
| 7        | Surv Heaters 1               | 14        | Surv Heaters 1   | 28             | 1183n         |
| 8        | Surv Heaters 2               | 15        | Surv Heaters 2   | 28             | W9.32         |

<sup>\*</sup> Voltage and polarity to be defined by ADS, a constant voltage lower than 28V is expected.

After successful safe-to-mate test, the unit can be powered. The power consumption of the unit is not supposed to change significantly. When powered, the unit shall drain about  $110\,\text{mA}$  at  $28\,\text{V}$ , so about  $3.1\,\text{W}$ . The current limitation of the power supply shall be set to  $500\,\text{mA}$ . Document the power consumption as part of the standard procedure. This condition resembles the "Unit unconfigured" as per the table below. After configuration of the sensors, the total power consumption is expected to increase to  $110\,\text{mA} \pm 5\,\text{mA}$ . For the unconfigured unit (after power ON), or after a "reset"-command after communication has been established:

| Parameter | Expected                        | Measured |
|-----------|---------------------------------|----------|
| Voltage   | 28.0 V                          | 280      |
| Current   | $107\mathrm{mA}\pm5\mathrm{mA}$ | 97m A    |

To define the units power consumption under the different operational modes and under different supply voltages, document the power consumption under the conditions as given below. **This part of the procedure is required to be conducted only once!** 

| Condition                   | 28.0 V   | Current  | 26.0 V   | Current  | 29.0 V   | Current |
|-----------------------------|--|--|--|--|--|---------|
| Unit unconfigured           |  |  |  |  |  |         |
| (after POWER ON)            |  |  |  |  | and the same of th |         |
| Unit in HK mode             | -  |  |  |  |  |         |
|                             |  |  | and a prime of the contract of |  |  |         |
| Unit in SCI mode            |  |  | and the second   |  |  |         |
| (low activity)              |  | and the same of th | - management   |  |  |         |
| Unit in SCI mode            | The same of the sa |  | 77   | -  |  |         |
| (high activity, testpulser) | 4  |  | ,  | The same of the sa |  |         |



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| 40  | Λc | Run  | <b>Functional</b> | Toct | Poport |
|-----|----|------|-------------------|------|--------|
| 4.9 | HS | Rull | runctional        | rest | Report |

| Date and Time | 26-04-2017 | 4 | 12:20 |  |
|---------------|------------|---|-------|--|
|---------------|------------|---|-------|--|

#### 4.9.1 Functional Test Readiness

| Location             | IEAP Kiel, Cleanswoom         |
|----------------------|-------------------------------|
| Personnel            | Lauri J. Maher                |
| Instrument ID        | STEP FS                       |
| Firmware revision    |                               |
| Reason for FT        | After instally the LVPS bound |
| Test to be performed | v                             |

#### 4.9.2 FT Constraints (if applicable)

| Safe-to-mate           |  |
|------------------------|--|
| Impedance check        |  |
| Set up communication   |  |
| Additional constraints |  |

| SFT-         |                        |       |                    |
|--------------|------------------------|-------|--------------------|
| Thur hold.   | Tesult are documented. | inthe | Choran Kodd_Payta- |
| theresholds. | Ps. txt. (on asterix]. |       |                    |

STEP FS incoming juspechaning test 13.01.17

Louisi



#### STEP FS Functional test plan and procedure

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#### **Unit Impedance Check**

After transport, before the first connection to the EGSE, and after tests with higher risks to damage the unit the impedances of the unit shall be measured and compared with the expected values as given in the table (based on RD-1):

| MDM15              |         |         |                     |             |
|--------------------|---------|---------|---------------------|-------------|
| Name               | Pin (+) | Pin (-) | Expected $[\Omega]$ | Measurement |
| Thermistor 1       | 1       | 9       | 15k to 20k *        | NJF.FN      |
| Thermistor 2       | 2       | 10      | 15k to 20k *        | 13.514      |
| Thermistor 3       | 3       | 11      | 15k to 20k *        | 17.55K      |
| Survival Heaters 1 | 7       | 14      | 119                 | 118,7       |
| Survival Heaters 2 | 8       | 15      | 119                 | 113,7       |

<sup>\*</sup> See figure below, all thermistors are supposed to show similar results depending on the unit's temperature.

|          |           | 1 |          |        |
|----------|-----------|---|----------|--------|
| Temp. °C | Ohms      |   | Temp. °C | Ohms   |
|          |           |   |          |        |
| -60      | 1,342,000 |   | 20       | 18,410 |
| -55      | 957,000   |   | 22       | 16,950 |
| -50      | 690,000   |   | 24       | 15,620 |
| -45      | 503,700   |   | 25       | 15,000 |
| -40      | 371,300   |   | 26       | 14,410 |
| -35      | 276,200   |   | 28       | 13,310 |
| -30      | 207,500   |   | 30       | 12,300 |
| -25      | 157,200   |   | 32       | 11,370 |
| -20      | 120,100   |   | 34       | 10,530 |
| -15 `    | 92,600    |   | 36       | 9,756  |
| -10      | 71,940    |   | 38       | 9,047  |
| -5       | 56,310    |   | 40       | 8,397  |
| 0        | 44,420    |   | 42       | 7,800  |
| 2        | 40,490    |   | 44       | 7,253  |
| 4        | 36,930    |   | 46       | 6,747  |
| 6        | 33,740    |   | 48       | 6,282  |
| 8        | 30,840    |   | 50       | 5,855  |
| 10       | 28,230    |   | 52       | 5,460  |
| 12       | 25,860    |   | 54       | 5,096  |
| 14       | 23,720    |   | 56       | 4,758  |
| 16       | 21,780    |   | 58       | 4,448  |
| 18       | 20,010    |   | 60       | 4,160  |

Figure 3: Thermistor resistivities for various temperatures, taken from the thermistor's datasheet



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| MDM25   |                    | 100        |                         |   |               |
|---------|--------------------|------------|-------------------------|---|---------------|
| Pin (+) | Signal             | Pin (-)    | Signal                  | Expected [Ω]                                      | Measurement   |
|         | No                 | ominal pov | ver lines and grounding | ng  |               |
| Chassis | Instrument chassis | 15         | Chassis gnd             | < 1   | 6)            |
| Chassis | Instrument chassis | 24         | Chassis gnd             | < 1   | 1,0           |
| Chassis | Instrument chassis | 1          | Nom. power              | >10M  | SZ            |
| 14      | Nom. power return  | 1          | Nom. power              | >10M  | 02            |
|         |                    | Redun      | dant power lines        |   |               |
| Chassis | Instrument chassis | 13         | Red. power              | >10M  | ٥٢            |
| 25      | Red. power return  | 13         | Red. power              | >10M  | OL            |
|         |                    |            | communication lines     | <b>建</b> 有 11 12 12 12 12 12 12 12 12 12 12 12 12 |               |
| 4       | LVDS I2S-          | 16         | LVDS I2S+               | 100   | 102 3         |
| 6       | CLK I2S+           | 19         | CLK I2S-                | 100   | 167.8         |
| 8       | LVDS S2I+          | 21         | LVDS S2I-               | 50  | 51,8          |
|         |                    | Redundant  | communication lines     |   |               |
| 5       | LVDS I2S-          | 17         | LVDS I2S+               | 100   | 102,8         |
| 7       | CLK I2S+           | 20         | CLK I2S-                | 100   | (07,5         |
| 10      | LVDS S2I-          | 22         | LVDS S2I+               | 50  | (07,5<br>67,3 |
|         |                    | not cor    | nected (NC) pins        | <b>PERSON</b>                                     |               |
| 2       | NC                 | Chassis    | Instrument chassis      | >10M  | OC            |
| 3       | DGND               | Chassis    | Instrument chassis      | < 1   | 1,8           |
| 4       | LVDS I2S-          | Chassis    | Instrument chassis      | >10M  | OK.           |
| 5       | LVDS I2S-          | Chassis    | Instrument chassis      | >10M  | ÕL.           |
| 6       | CLK I2S+           | Chassis    | Instrument chassis      | >10M  | 0i            |
| 7       | CLK I2S+           | Chassis    | Instrument chassis      | >10M  | OL.           |
| 8       | LVDS S2I+          | Chassis    | Instrument chassis      | >10M  | 0i_           |
| 9       | NC                 | Chassis    | Instrument chassis      | >10M  | OC            |
| 10      | LVDS S2I-          | Chassis    | Instrument chassis      | >10M  | ci            |
| 11      | DGND.              | Chassis    | Instrument chassis      | < 1   | 1,1           |
| 12      | NC                 | Chassis    | Instrument chassis      | >10M  | OL            |
| 14      | Nom. power return  | Chassis    | Instrument chassis      | 100k  | 99.8          |
| 16      | LVDS I2S+          | Chassis    | Instrument chassis      | >10M  | Q             |
| 17      | LVDS I2S+          | Chassis    | Instrument chassis      | > 10M   | 01            |
| 18      | NC                 | Chassis    | Instrument chassis      | > 10M   | OC            |
| 19      | CLK I2S-           | Chassis    | Instrument chassis      | >10M  | OL            |
| 20      | CLK I2S-           | Chassis    | Instrument chassis      | >10M  | $\alpha$      |
| 21      | LVDS S2I-          | Chassis    | Instrument chassis      | > 10M   | QC            |
| 22      | LVDS S2I+          | Chassis    | Instrument chassis      | > 10M   | OC            |
| 23      | NC                 | Chassis    | Instrument chassis      | > 10M   | OL            |
| 25      | Red. power return  | Chassis    | Instrument chassis      | 100k  | 39.8          |



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#### Abbreviated Safe-to-Mate Test and Power Consumption Check

The abbreviated safe-to-mate test shall be performed before the first connection of EGSE to the unit and after transport of the EGSE.

| MDM25    |                    |            |                  |                |               |
|----------|--------------------|------------|------------------|----------------|---------------|
| Pin (+)  | Signal             | Pin (-)    | Signal           | Expected [V]   | Measurement   |
| 1        | Nom. power         | 14         | Nom. power ret.  | 28 or 0 *      |               |
| 13       | Red. power         | 25         | Red. power ret.  | 28 or 0 *      |               |
| * 28V ex | xpected if connect | ted to the | corresponding NO | M or RED port, | 0V otherwise. |
| any      | other pin          | 15         | Chassis gnd      | < 3            |               |
| MDM15    |                    |            |                  |                |               |
| 1        | Thermistor 1       | 9          | Thermistor 1     | tbd by ADS *   | ×             |
| 2        | Thermistor 2       | 10         | Thermistor 2     | tbd by ADS *   |               |
| 3        | Thermistor 3       | 11         | Thermistor 3     | tbd by ADS *   |               |
| 7        | Surv Heaters 1     | 14         | Surv Heaters 1   | 28             |               |
| 8        | Surv Heaters 2     | 15         | Surv Heaters 2   | 28             |               |

<sup>\*</sup> Voltage and polarity to be defined by ADS, a constant voltage lower than 28 V is expected.

After successful safe-to-mate test, the unit can be powered. The power consumption of the unit is not supposed to change significantly. When powered, the unit shall drain about 110 mA at 28 V, so about 3.1 W. The current limitation of the power supply shall be set to 500 mA. Document the power consumption as part of the standard procedure. This condition resembles the "Unit unconfigured" as per the table below. After configuration of the sensors, the total power consumption is expected to increase to 110 mA  $\pm$  5 mA. For the unconfigured unit (after power ON), or after a "reset"-command after communication has been established:

| Parameter | Expected                        | Measured |  |
|-----------|---------------------------------|----------|--|
| Voltage   | 28.0 V                          | 28.3     |  |
| Current   | $107\mathrm{mA}\pm5\mathrm{mA}$ | 100      |  |

To define the units power consumption under the different operational modes and under different supply voltages, document the power consumption under the conditions as given below. This part of the procedure is required to be conducted only once!

| Condition                   | 28.0 V | Current | 26.0 V | Current | 29.0 V | Current |
|-----------------------------|--------|---------|--------|---------|--------|---------|
| Unit unconfigured           |        |         |        |         |        |         |
| (after POWER ON)            |        |         |        |         |        |         |
| Unit in HK mode             |        |         |        |         |        |         |
|                             |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (low activity)              |        |         |        |         |        |         |
| Unit in SCI mode            | ,      |         |        |         |        |         |
| (high activity, testpulser) |        |         |        |         |        |         |

NOM: SFT OK RED: SFT OK

Successful,



Additional constraints

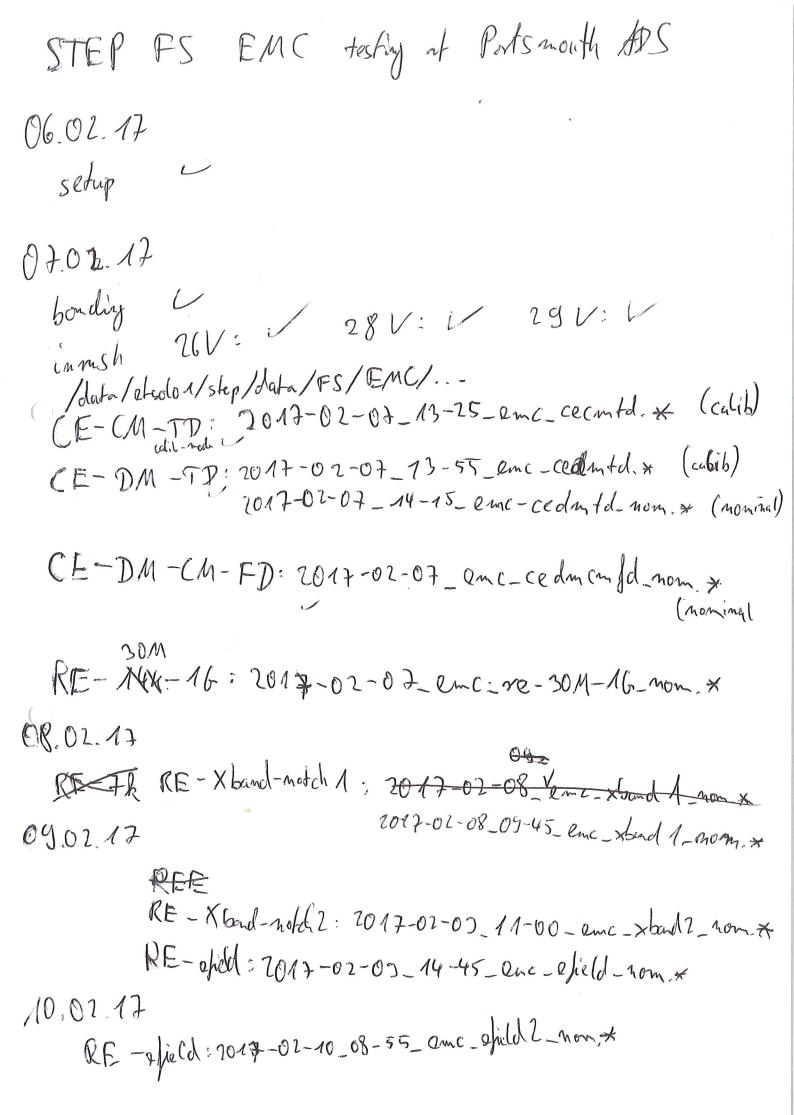
# STEP FS Functional test plan and procedure

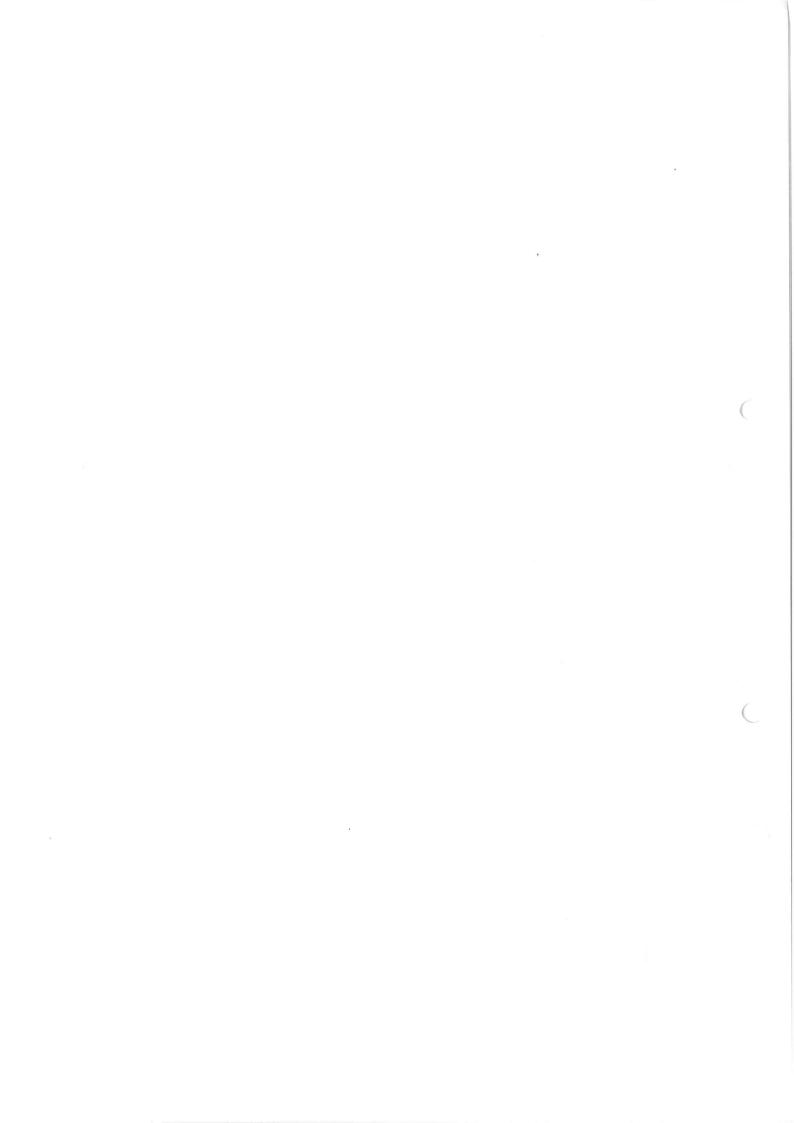
Reference:

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| 4.9 As Run Functiona    | al Test Report | a   |     |
|-------------------------|----------------|-----|-----|
| Date and Time           |                |     |     |
| 4.9.1 Functional Test R | Readiness      |     |     |
| Location                |                |     |     |
| Personnel               |                |     |     |
| Instrument ID           |                |     |     |
| Firmware revision       |                |     |     |
| Reason for FT           |                |     |     |
| Test to be performed    |                |     | 8 ° |
| 4.9.2 FT Constraints (i | f applicable)  |     |     |
| Safe-to-mate            |                | 190 |     |
| Impedance check         |                |     |     |
| Set up communication    |                |     |     |







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#### 4.3 Unit Impedance Check

After transport, before the first connection to the EGSE, and after tests with higher risks to damage the unit the impedances of the unit shall be measured and compared with the expected values as given in the table (based on RD-1):

| MDM15              |         |         |                     |             |
|--------------------|---------|---------|---------------------|-------------|
| Name               | Pin (+) | Pin (-) | Expected $[\Omega]$ | Measurement |
| Thermistor 1       | 1       | 9       | 15k to 20k *        | 19.6K       |
| Thermistor 2       | 2       | 10      | 15k to 20k *        | 19.41       |
| Thermistor 3       | 3       | 11      | 15k to 20k *        | 19.4 K      |
| Survival Heaters 1 | 7       | 14      | 119                 | 118.4       |
| Survival Heaters 2 | 8       | 15      | 119                 | 119.5       |

<sup>\*</sup> See figure below, all thermistors are supposed to show similar results depending on the unit's temperature.

| Temp. °C | Ohms      |
|----------|-----------|
|          |           |
| -60      | 1,342,000 |
| -55      | 957,000   |
| -50      | 690,000   |
| -45      | 503,700   |
| -40      | 371,300   |
| -35      | 276,200   |
| -30      | 207,500   |
| -25      | 157,200   |
| -20      | 120,100   |
| -15      | 92,600    |
| -10      | 71,940    |
| -5       | 56,310    |
| 0        | 44,420    |
| 2        | 40,490    |
| 4        | 36,930    |
| 6        | 33,740    |
| 8        | 30,840    |
| 10       | 28,230    |
| 12       | 25,860    |
| 14       | 23,720    |
| 16       | 21,780    |
| 18       | 20,010    |

| Temp. °C | Ohms   |
|----------|--------|
|          |        |
| 20       | 18,410 |
| 22       | 16,950 |
| 24       | 15,620 |
| 25       | 15,000 |
| 26       | 14,410 |
| 28       | 13,310 |
| 30       | 12,300 |
| 32       | 11,370 |
| 34       | 10,530 |
| 36       | 9,756  |
| 38       | 9,047  |
| 40       | 8,397  |
| 42       | 7,800  |
| 44       | 7,253  |
| 46       | 6,747  |
| 48       | 6,282  |
| 50       | 5,855  |
| 52       | 5,460  |
| 54       | 5,096  |
| 56       | 4,758  |
| 58       | 4,448  |
| 60       | 4,160  |

Figure 3: Thermistor resistivities for various temperatures, taken from the thermistor's datasheet



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| MDM25           |                    |           |                        |                |             |
|-----------------|--------------------|-----------|------------------------|----------------|-------------|
| Pin (+)         | Signal             | Pin (-)   | Signal                 | Expected [Ω]   | Measurement |
|                 | N                  |           | wer lines and groundir |                |             |
| Chassis         | Instrument chassis | 15        | Chassis gnd            | <1             | 0.5         |
| Chassis         | Instrument chassis | 24        | Chassis gnd            | <1             | 0.5         |
| Chassis         | Instrument chassis | 1         | Nom. power             | >10M           | OL          |
| 14              | Nom. power return  | 1         | Nom. power             | >10M           | OL          |
|                 |                    | Redur     | ndant power lines      |                |             |
| Chassis         | Instrument chassis | 13        | Red. power             | >10M           | OL          |
| 25 <sup>,</sup> | Red. power return  | 13        | Red. power             | >10M           | OL          |
|                 | <b>建整星型等等</b>      | Nominal   | communication lines    | <b>建设,不断</b> 对 |             |
| 4               | LVDS I2S-          | 16        | LVDS I2S+              | 100            | 102.5       |
| 6               | CLK I2S+           | 19        | CLK I2S-               | 100            | 102.5       |
| 8               | LVDS S2I+          | 21        | LVDS S2I-              | 50             | 51.6        |
|                 |                    | Redundant | communication lines    |                |             |
| 5               | LVDS I2S-          | 17        | LVDS I2S+              | 100            | 102.5       |
| 7               | CLK I2S+           | 20        | CLK I2S-               | 100            | 102.5       |
| 10              | LVDS S2I-          | 22        | LVDS S2I+              | 50             | 51.6        |
|                 |                    | not cor   | nnected (NC) pins      |                |             |
| 2               | NC                 | Chassis   | Instrument chassis     | >10M           | OL          |
| 3               | DGND               | Chassis   | Instrument chassis     | < 1            | 0.5         |
| 4               | LVDS I2S-          | Chassis   | Instrument chassis     | >10M           | OC          |
| 5               | LVDS I2S-          | Chassis   | Instrument chassis     | >10M           | OL          |
| 6               | CLK I2S+           | Chassis   | Instrument chassis     | >10M           | OL          |
| 7               | CLK I2S+           | Chassis   | Instrument chassis     | >10M           | OL          |
| 8               | LVDS S2I+          | Chassis   | Instrument chassis     | >10M           | OL          |
| 9               | NC                 | Chassis   | Instrument chassis     | >10M           | 02          |
| 10              | LVDS S2I-          | Chassis   | Instrument chassis     | >10M           | 01          |
| 11              | DGND.              | Chassis   | Instrument chassis     | < 1            | 0.5         |
| 12              | NC                 | Chassis   | Instrument chassis     | >10M           | OL          |
| 14              | Nom. power return  | Chassis   | Instrument chassis     | 100k           | 99.94       |
| 16              | LVDS I2S+          | Chassis   | Instrument chassis     | >10M           | OL          |
| 17              | LVDS I2S+          | Chassis   | Instrument chassis     | >10M           | ol          |
| 18              | NC                 | Chassis   | Instrument chassis     | >10M           | oL          |
| 19              | CLK I2S-           | Chassis   | Instrument chassis     | >10M           | 01          |
| 20              | CLK I2S-           | Chassis   | Instrument chassis     | >10M           | OL          |
| 21              | LVDS S2I-          | Chassis   | Instrument chassis     | >10M           | OL          |
| 22              | LVDS S2I+          | Chassis   | Instrument chassis     | >10M           | OL          |
| 23              | NC                 | Chassis   | Instrument chassis     | >10M           | 0(          |
| 25              | Red. power return  | Chassis   | Instrument chassis     | 100k           |             |
| 25              | Red. power return  | Chassis   | Instrument chassis     | 100k           | 95.94       |



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#### 4.4 Abbreviated Safe-to-Mate Test and Power Consumption Check

The abbreviated safe-to-mate test shall be performed before the first connection of EGSE to the unit and after transport of the EGSE.

| MDM25    |                    |           |                  |                |               |
|----------|--------------------|-----------|------------------|----------------|---------------|
| Pin (+)  | Signal             | Pin (-)   | Signal           | Expected [V]   | Measurement   |
| 1        | Nom. power         | 14        | Nom. power ret.  | 28 or 0 *      | 27.43         |
| 13       | Red. power         | 25        | Red. power ret.  | 28 or 0 *      | 0             |
| * 28V ex | spected if connect | ed to the | corresponding NO | M or RED port, | 0V otherwise. |
| any      | other pin          | 15        | Chassis gnd      | < 3            | < 3           |
| MDM15    |                    |           |                  |                |               |
| 1        | Thermistor 1       | 9         | Thermistor 1     | tbd by ADS *   |               |
| 2        | Thermistor 2       | 10        | Thermistor 2     | tbd by ADS *   |               |
| 3        | Thermistor 3       | 11        | Thermistor 3     | tbd by ADS *   |               |
| 7        | Surv Heaters 1     | 14        | Surv Heaters 1   | /28            |               |
| -8       | Surv Heaters 2     | 15        | Surv Heaters 2   | 28             |               |

<sup>\*</sup> Voltage and polarity to be defined by ADS, a constant voltage lower than 28 V is expected.

After successful safe-to-mate test, the unit can be powered. The power consumption of the unit is not supposed to change significantly. When powered, the unit shall drain about  $110\,\text{mA}$  at  $28\,\text{V}$ , so about  $3.1\,\text{W}$ . The current limitation of the power supply shall be set to  $500\,\text{mA}$ . Document the power consumption as part of the standard procedure. This condition resembles the "Unit unconfigured" as per the table below. After configuration of the sensors, the total power consumption is expected to increase to  $110\,\text{mA} \pm 5\,\text{mA}$ . For the unconfigured unit (after power ON), or after a "reset"-command after communication has been established:

| Parameter | Expected                        | Measured |
|-----------|---------------------------------|----------|
| Voltage   | 28.0 V                          |          |
| Current   | $107\mathrm{mA}\pm5\mathrm{mA}$ |          |

To define the units power consumption under the different operational modes and under different supply voltages, document the power consumption under the conditions as given below. This part of the procedure is required to be conducted only once!

| Condition                   | 28.0 V | Current | 26.0 V | Current | 29.0 V | Current |
|-----------------------------|--------|---------|--------|---------|--------|---------|
| Unit unconfigured           |        |         |        |         |        |         |
| (after POWER ON)            |        |         |        |         |        |         |
| Unit in HK mode             |        |         |        |         |        |         |
|                             | 1      |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (low activity)              |        |         |        |         | 97     |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (high activity, testpulser) |        |         |        |         |        |         |



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| 4.9 | As | Run | <b>Functional</b> | <b>Test</b> | Report |
|-----|----|-----|-------------------|-------------|--------|
|-----|----|-----|-------------------|-------------|--------|

| Date and Time | 06.01.17 | 10 40 GA | 7 |
|---------------|----------|----------|---|
|---------------|----------|----------|---|

#### 4.9.1 Functional Test Readiness

| Location             | Portsmouth, UK; ADS ENC foc. test chamber        |
|----------------------|--|
| Personnel            | Al, Mike, Christoph                              |
| Instrument ID        | STRP PS  |
| Soldware revision    | 5374   |
| Reason for FT        | post-transput FT                                 |
| Test to be performed | imp. check MDM 15+25, sefe-to-mate, pover can op |

#### 4.9.2 FT Constraints (if applicable)

| Safe-to-mate           |  |
|------------------------|--|
| Impedance check        |  |
| Set up communication   |  |
| Additional constraints |  |

Communication setup: V

SFT: V

ad-hoc perf. test: IXO: C 1821: V

Calibration mode: V

In: 2017-02-06\_11-35\_enc\_postdans.\*\*



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#### 4.3 Unit Impedance Check

After transport, before the first connection to the EGSE, and after tests with higher risks to damage the unit the impedances of the unit shall be measured and compared with the expected values as given in the table (based on RD-1):

| MDM15              |         |         |                     |             |
|--------------------|---------|---------|---------------------|-------------|
| Name               | Pin (+) | Pin (-) | Expected $[\Omega]$ | Measurement |
| Thermistor 1       | 1       | 9       | 15k to 20k *        |             |
| Thermistor 2       | 2       | 10      | 15k to 20k *        |             |
| Thermistor 3       | 3       | 11      | 15k to 20k *        |             |
| Survival Heaters 1 | 7       | 14      | 118                 |             |
| Survival Heaters 2 | 8       | 15      | 118                 |             |

 $<sup>^{</sup>st}$  See figure below, all thermistors are supposed to show similar results depending on the unit's temperature.

| Temp. °C | Ohms      |
|----------|-----------|
|          |           |
| -60      | 1,342,000 |
| -55      | 957,000   |
| -50      | 690,000   |
| -45      | 503,700   |
| -40      | 371,300   |
| -35      | 276,200   |
| -30      | 207,500   |
| -25      | 157,200   |
| -20      | 120,100   |
| -15      | 92,600    |
| -10      | 71,940    |
| -5       | 56,310    |
| 0        | 44,420    |
| 2        | 40,490    |
| 4        | 36,930    |
| 6        | 33,740    |
| 8        | 30,840    |
| 10       | 28,230    |
| 12       | 25,860    |
| 14       | 23,720    |
| 16       | 21,780    |
| 18       | 20,010    |

| Temp. °C | Ohms   |
|----------|--------|
|          |        |
| 20       | 18,410 |
| 22       | 16,950 |
| 24       | 15,620 |
| 25       | 15,000 |
| 26       | 14,410 |
| 28       | 13,310 |
| 30       | 12,300 |
| 32       | 11,370 |
| 34       | 10,530 |
| 36       | 9,756  |
| 38       | 9,047  |
| 40       | 8,397  |
| 42       | 7,800  |
| 44       | 7,253  |
| 46       | 6,747  |
| 48       | 6,282  |
| 50       | 5,855  |
| 52       | 5,460  |
| 54       | 5,096  |
| 56       | 4,758  |
| 58       | 4,448  |
| 60       | 4,160  |

Figure 3: Thermistor resistivities for various temperatures, taken from the thermistor's datasheet





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| Pin (+)   Signal   | MDM25                                      |  |  |                     |              |             |  |  |  |
|--|--|--|--|---------------------|--------------|-------------|--|--|--|
| Chassis         Instrument chassis         24         Chassis gnd         < 1           Chassis         Instrument chassis         24         Chassis gnd         < 1  | Pin (+)                                    | Signal   | Pin (-)  | Signal              | Expected [Ω] | Measurement |  |  |  |
| Chassis         Instrument chassis         24         Chassis gnd         < 1           Chassis         Instrument chassis         1         Nom. power         > 10M           14         Nom. power return         1         Nom. power         > 10M           Redundant power lines           Chassis           Instrument chassis         13         Red. power         > 10M           Nominal communication lines           4         LVDS 12S-         16         LVDS 12S+         100           6         CLK 12S+         19         CLK 12S-         100           Redundant communication lines           LVDS 12S-         100           CLK 12S+         10         CLK 12S+         100         10         100         100         100         100         100         100         100         100         100         100         100         100 </td <td colspan="9">Nominal power lines and grounding</td>   | Nominal power lines and grounding          |  |  |                     |              |             |  |  |  |
| Chassis  | Chassis                                    | Instrument chassis   | 15   | Chassis gnd         | < 1          |             |  |  |  |
| Nom. power return   1  | \$400 BR0000000000000000000000000000000000 | Instrument chassis   | 24   | Chassis gnd         | <1           |             |  |  |  |
| Redurdant power lines  | Chassis                                    | Instrument chassis   | 1  | Nom. power          | >10M         |             |  |  |  |
| Chassis  | 14   | Nom. power return  | 1  | Nom. power          | >10M         |             |  |  |  |
| Nominal communication lines  |  |  | Redur  | ndant power lines   |              |             |  |  |  |
| Nominal communication lines  |  | Instrument chassis   | 13   | Red. power          | >10M         |             |  |  |  |
| A  | 25   | Red. power return  | 13   | Red. power          | >10M         |             |  |  |  |
| 6         CLK I2S+         19         CLK I2S-         100           8         LVDS S2I+         21         LVDS S2I-         50           Redundant communication lines           5         LVDS I2S-         17         LVDS I2S+         100           7         CLK I2S+         20         CLK I2S-         100           10         LVDS S2I-         22         LVDS S2I+         50           not connected (NC) pins           2         NC         Chassis         Instrument chassis         > 10M           3         DGND         Chassis         Instrument chassis         > 10M           3         DGND         Chassis         Instrument chassis         > 10M           4         LVDS I2S-         Chassis         Instrument chassis         > 10M           5         LVDS I2S-         Chassis         Instrument chassis         > 10M           6         CLK I2S+         Chassis         Instrument chassis         > 10M           9         NC         Chassis         Instrument chassis         > 10M           10         LVDS S2I-         Chassis         Instrument chassis         > 10M           11   |  |  | Nominal  | communication lines | OLIVER A     |             |  |  |  |
| Redundant communication lines  |  |  | 16   | LVDS I2S+           | 100          |             |  |  |  |
| Redundant communication lines  5 LVDS I2S- 17 LVDS I2S+ 100  7 CLK I2S+ 20 CLK I2S- 100  10 LVDS S2I- 22 LVDS S2I+ 50  not connected (NC) pins  2 NC Chassis Instrument chassis > 10M  3 DGND Chassis Instrument chassis > 10M  5 LVDS I2S- Chassis Instrument chassis > 10M  6 CLK I2S+ Chassis Instrument chassis > 10M  7 CLK I2S+ Chassis Instrument chassis > 10M  8 LVDS S2I+ Chassis Instrument chassis > 10M  9 NC Chassis Instrument chassis > 10M  10 LVDS S2I- Chassis Instrument chassis > 10M  11 DGND. Chassis Instrument chassis > 10M  12 NC Chassis Instrument chassis > 10M  14 Nom. power return Chassis Instrument chassis > 10M  16 LVDS I2S+ Chassis Instrument chassis > 10M  17 LVDS I2S+ Chassis Instrument chassis > 10M  18 NC Chassis Instrument chassis > 10M  19 CLK I2S- Chassis Instrument chassis > 10M  19 CLK I2S- Chassis Instrument chassis > 10M  10 LVDS I2S+ Chassis Instrument chassis > 10M  11 Nom. power return Chassis Instrument chassis > 10M  12 NC Chassis Instrument chassis > 10M  13 NC Chassis Instrument chassis > 10M  14 Nom. power return Chassis Instrument chassis > 10M  15 LVDS I2S+ Chassis Instrument chassis > 10M  16 LVDS I2S+ Chassis Instrument chassis > 10M  17 LVDS I2S+ Chassis Instrument chassis > 10M  18 NC Chassis Instrument chassis > 10M  19 CLK I2S- Chassis Instrument chassis > 10M  20 CLK I2S- Chassis Instrument chassis > 10M  21 LVDS S2I+ Chassis Instrument chassis > 10M  22 LVDS S2I+ Chassis Instrument chassis > 10M |  | CLK I2S+   | 19   | CLK I2S-            | 100          |             |  |  |  |
| 5         LVDS I2S-         17         LVDS I2S-         100           7         CLK I2S+         20         CLK I2S-         100           10         LVDS S2I-         22         LVDS S2I+         50           not connected (NC) pins           not connected (NC) pins           NC         Chassis         Instrument chassis         > 10M           3         DGND         Chassis         Instrument chassis         > 10M           4         LVDS I2S-         Chassis         Instrument chassis         > 10M           5         LVDS I2S-         Chassis         Instrument chassis         > 10M           6         CLK I2S+         Chassis         Instrument chassis         > 10M           7         CLK I2S+         Chassis         Instrument chassis         > 10M           8         LVDS S2I+         Chassis         Instrument chassis         > 10M           9         NC         Chassis         Instrument chassis         > 10M           10         LVDS S2I-         Chassis         Instrument chassis         > 10M           11         DGND.         Chassis         Instrument chassis         > 10M           14   | 8  | LVDS S2I+  | 21   | LVDS S2I-           | 50           |             |  |  |  |
| 7         CLK I2S+         20         CLK I2S-         100           10         LVDS S2I-         22         LVDS S2I+         50           not connected (NC) pins           2         NC         Chassis         Instrument chassis         > 10M           3         DGND         Chassis         Instrument chassis         > 10M           4         LVDS I2S-         Chassis         Instrument chassis         > 10M           5         LVDS I2S-         Chassis         Instrument chassis         > 10M           6         CLK I2S+         Chassis         Instrument chassis         > 10M           7         CLK I2S+         Chassis         Instrument chassis         > 10M           8         LVDS S2I+         Chassis         Instrument chassis         > 10M           9         NC         Chassis         Instrument chassis         > 10M           10         LVDS S2I-         Chassis         Instrument chassis         > 10M           11         DGND.         Chassis         Instrument chassis         > 10M           14         Nom. power return         Chassis         Instrument chassis         > 10M           16         LVDS I2S+         Chassis  |  |  | Redundant  | communication lines | To the last  |             |  |  |  |
| 10 LVDS S2I- 22 LVDS S2I+ 50  not connected (NC) pins  2 NC Chassis Instrument chassis > 10M  3 DGND Chassis Instrument chassis > 10M  4 LVDS I2S- Chassis Instrument chassis > 10M  5 LVDS I2S- Chassis Instrument chassis > 10M  6 CLK I2S+ Chassis Instrument chassis > 10M  7 CLK I2S+ Chassis Instrument chassis > 10M  8 LVDS S2I+ Chassis Instrument chassis > 10M  9 NC Chassis Instrument chassis > 10M  10 LVDS S2I- Chassis Instrument chassis > 10M  11 DGND. Chassis Instrument chassis > 10M  12 NC Chassis Instrument chassis > 10M  14 Nom. power return Chassis Instrument chassis > 10M  16 LVDS I2S+ Chassis Instrument chassis > 10M  17 LVDS I2S+ Chassis Instrument chassis > 10M  18 NC Chassis Instrument chassis > 10M  19 CLK I2S- Chassis Instrument chassis > 10M  20 CLK I2S- Chassis Instrument chassis > 10M  21 LVDS S2I+ Chassis Instrument chassis > 10M  22 LVDS S2I+ Chassis Instrument chassis > 10M  23 NC Chassis Instrument chassis > 10M  24 LVDS S2I+ Chassis Instrument chassis > 10M  25 LVDS S2I+ Chassis Instrument chassis > 10M  26 CLK I2S- Chassis Instrument chassis > 10M  27 LVDS S2I- Chassis Instrument chassis > 10M  28 LVDS S2I+ Chassis Instrument chassis > 10M  29 LVDS S2I- Chassis Instrument chassis > 10M  20 CLK I2S- Chassis Instrument chassis > 10M  20 CLK I2S- Chassis Instrument chassis > 10M  21 LVDS S2I- Chassis Instrument chassis > 10M  |  | CONTRACTOR AND APPROXIMENT OF THE PARTY OF T | 17   |                     | 100          |             |  |  |  |
| not connected (NC) pins  2   |  |  | 20   | CLK I2S-            | 100          |             |  |  |  |
| 2NCChassisInstrument chassis> 10M3DGNDChassisInstrument chassis< 1   | 10   | LVDS S2I-  | 22   | LVDS S2I+           | 50           |             |  |  |  |
| 3 DGND Chassis Instrument chassis <1 4 LVDS I2S- Chassis Instrument chassis >10M 5 LVDS I2S- Chassis Instrument chassis >10M 6 CLK I2S+ Chassis Instrument chassis >10M 7 CLK I2S+ Chassis Instrument chassis >10M 8 LVDS S2I+ Chassis Instrument chassis >10M 9 NC Chassis Instrument chassis >10M 10 LVDS S2I- Chassis Instrument chassis >10M 11 DGND. Chassis Instrument chassis >10M 12 NC Chassis Instrument chassis >10M 14 Nom. power return Chassis Instrument chassis >10M 16 LVDS I2S+ Chassis Instrument chassis >10M 17 LVDS I2S+ Chassis Instrument chassis >10M 18 NC Chassis Instrument chassis >10M 19 CLK I2S- Chassis Instrument chassis >10M 20 CLK I2S- Chassis Instrument chassis >10M 21 LVDS S2I- Chassis Instrument chassis >10M 22 LVDS S2I+ Chassis Instrument chassis >10M 23 NC Chassis Instrument chassis >10M 24 LVDS S2I+ Chassis Instrument chassis >10M 25 LVDS S2I+ Chassis Instrument chassis >10M 26 CLK I2S- Chassis Instrument chassis >10M 27 LVDS S2I- Chassis Instrument chassis >10M 28 LVDS S2I- Chassis Instrument chassis >10M 29 LVDS S2I- Chassis Instrument chassis >10M 20 CLK I2S- Chassis Instrument chassis >10M 21 LVDS S2I- Chassis Instrument chassis >10M 22 LVDS S2I- Chassis Instrument chassis >10M 23 NC Chassis Instrument chassis >10M  |  | 用作。在是1900年1900年1900年1  | not cor  | nnected (NC) pins   |              |             |  |  |  |
| 4 LVDS I2S- Chassis Instrument chassis > 10M 5 LVDS I2S- Chassis Instrument chassis > 10M 6 CLK I2S+ Chassis Instrument chassis > 10M 7 CLK I2S+ Chassis Instrument chassis > 10M 8 LVDS S2I+ Chassis Instrument chassis > 10M 9 NC Chassis Instrument chassis > 10M 10 LVDS S2I- Chassis Instrument chassis > 10M 11 DGND. Chassis Instrument chassis > 10M 12 NC Chassis Instrument chassis > 10M 14 Nom. power return Chassis Instrument chassis > 10M 16 LVDS I2S+ Chassis Instrument chassis > 10M 17 LVDS I2S+ Chassis Instrument chassis > 10M 18 NC Chassis Instrument chassis > 10M 19 CLK I2S- Chassis Instrument chassis > 10M 20 CLK I2S- Chassis Instrument chassis > 10M 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I+ Chassis Instrument chassis > 10M 23 NC Chassis Instrument chassis > 10M 25 DIM 26 Chassis Instrument chassis > 10M 27 LVDS S2I- Chassis Instrument chassis > 10M 28 NC Chassis Instrument chassis > 10M 29 CLK I2S- Chassis Instrument chassis > 10M 20 CLK I2S- Chassis Instrument chassis > 10M 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I+ Chassis Instrument chassis > 10M 23 NC Chassis Instrument chassis > 10M   |  |  | Chassis  | Instrument chassis  | >10M         |             |  |  |  |
| 5 LVDS I2S- Chassis Instrument chassis > 10M 6 CLK I2S+ Chassis Instrument chassis > 10M 7 CLK I2S+ Chassis Instrument chassis > 10M 8 LVDS S2I+ Chassis Instrument chassis > 10M 9 NC Chassis Instrument chassis > 10M 10 LVDS S2I- Chassis Instrument chassis > 10M 11 DGND. Chassis Instrument chassis > 10M 12 NC Chassis Instrument chassis > 10M 14 Nom. power return Chassis Instrument chassis 100k 16 LVDS I2S+ Chassis Instrument chassis > 10M 17 LVDS I2S+ Chassis Instrument chassis > 10M 18 NC Chassis Instrument chassis > 10M 19 CLK I2S- Chassis Instrument chassis > 10M 20 CLK I2S- Chassis Instrument chassis > 10M 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I+ Chassis Instrument chassis > 10M 23 NC Chassis Instrument chassis > 10M 23 NC Chassis Instrument chassis > 10M 25 LVDS S2I- Chassis Instrument chassis > 10M 27 Chassis Instrument chassis > 10M 28 NC Chassis Instrument chassis > 10M 29 CLK I2S- Chassis Instrument chassis > 10M 20 CLK I2S- Chassis Instrument chassis > 10M 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I- Chassis Instrument chassis > 10M  |  |  | Chassis  | Instrument chassis  | < 1          |             |  |  |  |
| 6 CLK I2S+ Chassis Instrument chassis > 10M 7 CLK I2S+ Chassis Instrument chassis > 10M 8 LVDS S2I+ Chassis Instrument chassis > 10M 9 NC Chassis Instrument chassis > 10M 10 LVDS S2I- Chassis Instrument chassis > 10M 11 DGND. Chassis Instrument chassis > 10M 12 NC Chassis Instrument chassis > 10M 14 Nom. power return Chassis Instrument chassis > 10M 16 LVDS I2S+ Chassis Instrument chassis > 10M 17 LVDS I2S+ Chassis Instrument chassis > 10M 18 NC Chassis Instrument chassis > 10M 19 CLK I2S- Chassis Instrument chassis > 10M 20 CLK I2S- Chassis Instrument chassis > 10M 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I+ Chassis Instrument chassis > 10M 23 NC Chassis Instrument chassis > 10M 25 Instrument chassis > 10M 27 Chassis Instrument chassis > 10M 28 Instrument chassis > 10M 29 CLK I2S- Chassis Instrument chassis > 10M 20 CLK I2S- Chassis Instrument chassis > 10M 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I+ Chassis Instrument chassis > 10M 23 NC Chassis Instrument chassis > 10M   |  |  |  | Instrument chassis  | >10M         |             |  |  |  |
| 7 CLK I2S+ Chassis Instrument chassis > 10M 8 LVDS S2I+ Chassis Instrument chassis > 10M 9 NC Chassis Instrument chassis > 10M 10 LVDS S2I- Chassis Instrument chassis > 10M 11 DGND. Chassis Instrument chassis > 10M 12 NC Chassis Instrument chassis > 10M 14 Nom. power return Chassis Instrument chassis 100k 16 LVDS I2S+ Chassis Instrument chassis > 10M 17 LVDS I2S+ Chassis Instrument chassis > 10M 18 NC Chassis Instrument chassis > 10M 19 CLK I2S- Chassis Instrument chassis > 10M 20 CLK I2S- Chassis Instrument chassis > 10M 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I+ Chassis Instrument chassis > 10M 23 NC Chassis Instrument chassis > 10M 25 Instrument chassis > 10M 26 Chassis Instrument chassis > 10M 27 Chassis Instrument chassis > 10M 28 Instrument chassis > 10M 29 CLK I2S- Chassis Instrument chassis > 10M 20 CLK I2S- Chassis Instrument chassis > 10M 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I- Chassis Instrument chassis > 10M   |  |  | Chassis  | Instrument chassis  | >10M         |             |  |  |  |
| 8 LVDS S2I+ Chassis Instrument chassis > 10M 9 NC Chassis Instrument chassis > 10M 10 LVDS S2I- Chassis Instrument chassis > 10M 11 DGND. Chassis Instrument chassis > 10M 12 NC Chassis Instrument chassis > 10M 14 Nom. power return Chassis Instrument chassis 100k 16 LVDS I2S+ Chassis Instrument chassis > 10M 17 LVDS I2S+ Chassis Instrument chassis > 10M 18 NC Chassis Instrument chassis > 10M 19 CLK I2S- Chassis Instrument chassis > 10M 20 CLK I2S- Chassis Instrument chassis > 10M 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I+ Chassis Instrument chassis > 10M 23 NC Chassis Instrument chassis > 10M 25 Chassis Instrument chassis > 10M 26 Chassis Instrument chassis > 10M 27 Chassis Instrument chassis > 10M 28 Chassis Instrument chassis > 10M 29 Chassis Instrument chassis > 10M 20 Chassis Instrument chassis > 10M   |  |  | The state of the s | Instrument chassis  | >10M         |             |  |  |  |
| 9 NC Chassis Instrument chassis > 10M 10 LVDS S2I- Chassis Instrument chassis > 10M 11 DGND. Chassis Instrument chassis > 10M 12 NC Chassis Instrument chassis > 10M 14 Nom. power return Chassis Instrument chassis 100k 16 LVDS I2S+ Chassis Instrument chassis > 10M 17 LVDS I2S+ Chassis Instrument chassis > 10M 18 NC Chassis Instrument chassis > 10M 19 CLK I2S- Chassis Instrument chassis > 10M 20 CLK I2S- Chassis Instrument chassis > 10M 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I+ Chassis Instrument chassis > 10M 23 NC Chassis Instrument chassis > 10M  |  |  |  | Instrument chassis  | >10M         |             |  |  |  |
| 10 LVDS S2I- Chassis Instrument chassis > 10M  11 DGND. Chassis Instrument chassis < 1  12 NC Chassis Instrument chassis > 10M  14 Nom. power return Chassis Instrument chassis 100k  16 LVDS I2S+ Chassis Instrument chassis > 10M  17 LVDS I2S+ Chassis Instrument chassis > 10M  18 NC Chassis Instrument chassis > 10M  19 CLK I2S- Chassis Instrument chassis > 10M  20 CLK I2S- Chassis Instrument chassis > 10M  21 LVDS S2I- Chassis Instrument chassis > 10M  22 LVDS S2I+ Chassis Instrument chassis > 10M  23 NC Chassis Instrument chassis > 10M   |  |  | Chassis  | Instrument chassis  | >10M         |             |  |  |  |
| 11 DGND. Chassis Instrument chassis < 1 12 NC Chassis Instrument chassis > 10M 14 Nom. power return Chassis Instrument chassis 100k 16 LVDS I2S+ Chassis Instrument chassis > 10M 17 LVDS I2S+ Chassis Instrument chassis > 10M 18 NC Chassis Instrument chassis > 10M 19 CLK I2S- Chassis Instrument chassis > 10M 20 CLK I2S- Chassis Instrument chassis > 10M 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I+ Chassis Instrument chassis > 10M 23 NC Chassis Instrument chassis > 10M  |  |  | Chassis  | Instrument chassis  | >10M         |             |  |  |  |
| 12 NC Chassis Instrument chassis > 10M  14 Nom. power return Chassis Instrument chassis 100k  16 LVDS I2S+ Chassis Instrument chassis > 10M  17 LVDS I2S+ Chassis Instrument chassis > 10M  18 NC Chassis Instrument chassis > 10M  19 CLK I2S- Chassis Instrument chassis > 10M  20 CLK I2S- Chassis Instrument chassis > 10M  21 LVDS S2I- Chassis Instrument chassis > 10M  22 LVDS S2I+ Chassis Instrument chassis > 10M  23 NC Chassis Instrument chassis > 10M   | 10   | LVDS S2I-  | Chassis  | Instrument chassis  | >10M         |             |  |  |  |
| 14 Nom. power return Chassis Instrument chassis 100k 16 LVDS I2S+ Chassis Instrument chassis > 10M 17 LVDS I2S+ Chassis Instrument chassis > 10M 18 NC Chassis Instrument chassis > 10M 19 CLK I2S- Chassis Instrument chassis > 10M 20 CLK I2S- Chassis Instrument chassis > 10M 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I+ Chassis Instrument chassis > 10M 23 NC Chassis Instrument chassis > 10M   |  | AND AND SALES OF   |  | Instrument chassis  | < 1          |             |  |  |  |
| 16LVDS I2S+ChassisInstrument chassis> 10M17LVDS I2S+ChassisInstrument chassis> 10M18NCChassisInstrument chassis> 10M19CLK I2S-ChassisInstrument chassis> 10M20CLK I2S-ChassisInstrument chassis> 10M21LVDS S2I-ChassisInstrument chassis> 10M22LVDS S2I+ChassisInstrument chassis> 10M23NCChassisInstrument chassis> 10M   | 12   | 0.00.00  | Chassis  | Instrument chassis  | >10M         |             |  |  |  |
| 17 LVDS I2S+ Chassis Instrument chassis > 10M  18 NC Chassis Instrument chassis > 10M  19 CLK I2S- Chassis Instrument chassis > 10M  20 CLK I2S- Chassis Instrument chassis > 10M  21 LVDS S2I- Chassis Instrument chassis > 10M  22 LVDS S2I+ Chassis Instrument chassis > 10M  23 NC Chassis Instrument chassis > 10M  | 14   | Nom. power return  | Chassis  | Instrument chassis  | 100k         |             |  |  |  |
| 18NCChassisInstrument chassis> 10M19CLK I2S-ChassisInstrument chassis> 10M20CLK I2S-ChassisInstrument chassis> 10M21LVDS S2I-ChassisInstrument chassis> 10M22LVDS S2I+ChassisInstrument chassis> 10M23NCChassisInstrument chassis> 10M   | 16   | LVDS I2S+  | Chassis  | Instrument chassis  | >10M         |             |  |  |  |
| 19 CLK I2S- Chassis Instrument chassis > 10M 20 CLK I2S- Chassis Instrument chassis > 10M 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I+ Chassis Instrument chassis > 10M 23 NC Chassis Instrument chassis > 10M   | 17   | LVDS I2S+  | Chassis  | Instrument chassis  | >10M         |             |  |  |  |
| 20 CLK I2S- Chassis Instrument chassis > 10M 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I+ Chassis Instrument chassis > 10M 23 NC Chassis Instrument chassis > 10M  | 18   | NC   | Chassis  | Instrument chassis  | >10M         |             |  |  |  |
| 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I+ Chassis Instrument chassis > 10M 23 NC Chassis Instrument chassis > 10M   | 19   | CLK I2S-   | Chassis  | Instrument chassis  |              |             |  |  |  |
| 21LVDS S2I-ChassisInstrument chassis> 10M22LVDS S2I+ChassisInstrument chassis> 10M23NCChassisInstrument chassis> 10M   | 20   | CLK I2S-   | Chassis  | Instrument chassis  | >10M         |             |  |  |  |
| 22 LVDS S2I+ Chassis Instrument chassis > 10M 23 NC Chassis Instrument chassis > 10M   |  |  | Chassis  | Instrument chassis  |              |             |  |  |  |
| 23 NC Chassis Instrument chassis > 10M   | 22   | LVDS S2I+  | Chassis  | Instrument chassis  |              |             |  |  |  |
|  | 23   | NC   | Chassis  | Instrument chassis  |              |             |  |  |  |
|  | 25   | Red. power return  | Chassis  | Instrument chassis  |              |             |  |  |  |



Reference:

SO-EPD-KIE-TP-0043

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### 4.4 Abbreviated Safe-to-Mate Test and Power Consumption Check

The abbreviated safe-to-mate test shall be performed before the first connection of EGSE to the unit and after transport of the EGSE.

| MDM25   |   |         |                 |              |             |  |  |
|---------|---|---------|-----------------|--------------|-------------|--|--|
| Pin (+) | Signal  | Pin (-) | Signal          | Expected [V] | Measurement |  |  |
| 1       | Nom. power  | 14      | Nom. power ret. | 28 or 0 *    | 28          |  |  |
| 13      | Red. power  | 25      | Red. power ret. | 28 or 0 *    | 0           |  |  |
|         | * 28V expected if connected to the corresponding NOM or RED port, 0V otherwise. |         |                 |              |             |  |  |
| any     | other pin   | 15      | Chassis gnd     | < 3          |             |  |  |
| MDM15   |   |         | THE RESIDENCE   | ile live in  |             |  |  |
| 1       | Thermistor 1  | 9       | Thermistor 1    | tbd by ADS * |             |  |  |
| 2       | Thermistor 2  | 10      | Thermistor 2    | tbd by ADS * |             |  |  |
| 3       | Thermistor 3  | 11      | Thermistor 3    | tbd by ADS * |             |  |  |
| 7       | Surv Heaters 1  | 14      | Surv Heaters 1  | 28           |             |  |  |
| 8       | Surv Heaters 2  | 15      | Surv Heaters 2  | 28           |             |  |  |

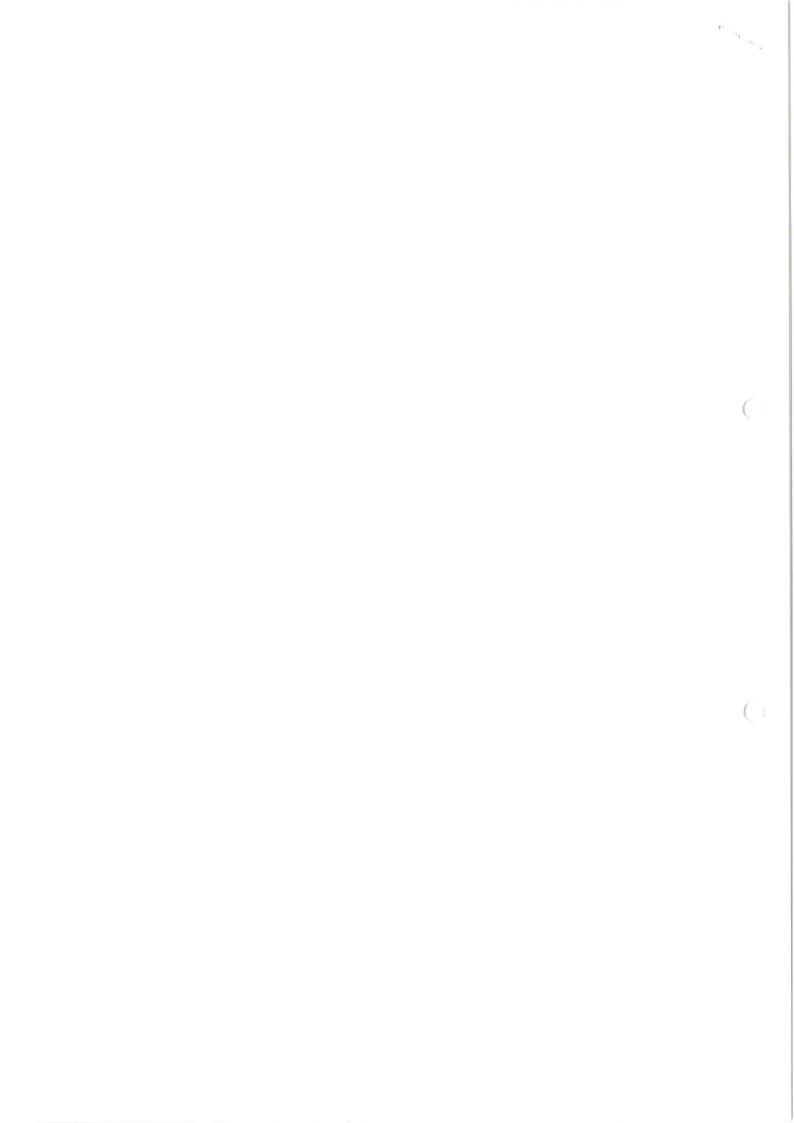
<sup>\*</sup> Voltage and polarity to be defined by ADS, a constant voltage lower than 28 V is expected.

After successful safe-to-mate test, the unit can be powered. The power consumption of the unit is not supposed to change significantly. When powered, the unit shall drain about  $110\,\text{mA}$  at  $28\,\text{V}$ , so about  $3.1\,\text{W}$ . The current limitation of the power supply shall be set to  $500\,\text{mA}$ . Document the power consumption as part of the standard procedure. This condition resembles the "Unit unconfigured" as per the table below. After configuration of the sensors, the total power consumption is expected to increase to  $110\,\text{mA} \pm 5\,\text{mA}$ . For the unconfigured unit (after power ON), or after a "reset"-command after communication has been established:

| Parameter | Expected                        | Measured      |          |
|-----------|---------------------------------|---------------|----------|
| Voltage   | 28.0 V                          | 281           |          |
| Current   | $107\mathrm{mA}\pm5\mathrm{mA}$ | 110mA / 107 a | No reset |

To define the units power consumption under the different operational modes and under different supply voltages, document the power consumption under the conditions as given below. This part of the procedure is required to be conducted only once!

| Condition                   | 28.0 V | Current | 26.0 V | Current | 29.0 V | Current |
|-----------------------------|--------|---------|--------|---------|--------|---------|
| Unit unconfigured           |        |         |        |         |        |         |
| (after POWER ON)            |        |         |        |         |        |         |
| Unit in HK mode             |        |         |        |         |        |         |
|                             |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (low activity)              |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (high activity, testpulser) |        |         |        |         |        |         |





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| 4.9 As Run Functional Test Repo | ort |
|---------------------------------|-----|
|---------------------------------|-----|

| Date and Time | 14.17.16 | 1200 |  |
|---------------|----------|------|--|
|---------------|----------|------|--|

### 4.9.1 Functional Test Readiness

| Location             | Viel clear row       |
|----------------------|----------------------|
| Personnel            | Mahesh, Robot, Lauri |
| Instrument ID        | STEP FS              |
| Firmware revision    |                      |
| Reason for FT        |                      |
| Test to be performed | SFT, Sale to make    |

| Safe-to-mate           |  |
|------------------------|--|
| Impedance check        |  |
| Set up communication   |  |
| Additional constraints |  |





Reference:

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### 4.9.3 FT Details

| Step #   | Activity                     | Result |
|----------|------------------------------|--------|
| 1        | Data file name if applicable |        |
| 2        | Test started / stopped       |        |
| 3        | Test result                  |        |
| 4        | Comments                     |        |
| Signatur | es Pame                      | u      |



Reference:

SO-EPD-KIE-TP-0051

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#### 4.3 Unit Impedance Check

After transport, before the first connection to the EGSE, and after tests with higher risks to damage the unit the impedances of the unit shall be measured and compared with the expected values as given in the table (based on RD-1):

| MDM15              |         |         |                     |             |
|--------------------|---------|---------|---------------------|-------------|
| Name               | Pin (+) | Pin (-) | Expected $[\Omega]$ | Measurement |
| Thermistor 1       | 1       | 9       | 15k to 20k *        | 17:70/20    |
| Thermistor 2       | 2       | 10      | 15k to 20k *        | 17:55 Es    |
| Thermistor 3       | 3       | 11      | 15k to 20k *        | 17,5862     |
| Survival Heaters 1 | 7       | 14      | 119                 | 119.2 2     |
| Survival Heaters 2 | 8       | 15      | 119                 | 120.7 2     |

0950

mrs

<sup>\*</sup> See figure below, all thermistors are supposed to show similar results depending on the unit's temperature.

| Temp. °C | Ohms      |   | Temp. °C | Ohms   |
|----------|-----------|---|----------|--------|
|          |           |   |          |        |
| -60      | 1,342,000 |   | 20       | 18,410 |
| -55      | 957,000   |   | 22       | 16,950 |
| -50      | 690,000   |   | 24       | 15,620 |
| -45      | 503,700   |   | 25       | 15,000 |
| -40      | 371,300   |   | 26       | 14,410 |
| -35      | 276,200   |   | 28       | 13,310 |
| -30      | 207,500   |   | 30       | 12,300 |
| -25      | 157,200   |   | 32       | 11,370 |
| -20      | 120,100   |   | 34       | 10,530 |
| -15      | 92,600    |   | 36       | 9,756  |
| -10      | 71,940    |   | 38       | 9,047  |
| -5       | 56,310    |   | 40       | 8,397  |
| 0        | 44,420    |   | 42       | 7,800  |
| 2        | 40,490    |   | 44       | 7,253  |
| 4        | 36,930    |   | 46       | 6,747  |
| 6        | 33,740    |   | 48       | 6,282  |
| 8        | 30,840    |   | 50       | 5,855  |
| 10       | 28,230    |   | 52       | 5,460  |
| 12       | 25,860    |   | 54       | 5,096  |
| 14       | 23,720    |   | 56       | 4,758  |
| 16       | 21,780    |   | 58       | 4,448  |
| 18       | 20.010    | ] | 60       | 4.160  |

Figure 3: Thermistor resistivities for various temperatures, taken from the thermistor's datasheet



Reference:

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| MDM25   | · · · · · · · · · · · · · · · · · · · |           |                         |              |                      |
|---------|---------------------------------------|-----------|-------------------------|--------------|----------------------|
| Pin (+) | Signal                                | Pin (-)   | Signal                  | Expected [Ω] | Measurement          |
|         | N                                     |           | wer lines and grounding | ng           |                      |
| Chassis | Instrument chassis                    | 15        | Chassis gnd             | < 1          | 1.55                 |
| Chassis | Instrument chassis                    | 24        | Chassis gnd             | < 1          | 102 2                |
| Chassis | Instrument chassis                    | 1         | Nom. power              | >10M         |                      |
| 14      | Nom. power return                     | 1         | Nom. power              | >10M         | Ope                  |
|         |                                       | Redur     | ndant power lines       |              |                      |
| Chassis | Instrument chassis                    | 13        | Red. power              | >10M         | Open                 |
| 25      | Red. power return                     | 13        | Red. power              | >10M         | Open                 |
|         |                                       | Nominal   | communication lines     | 3 A. F.      |                      |
| 4       | LVDS I2S-                             | 16        | LVDS I2S+               | 100          | 104.12               |
| 6       | CLK I2S+                              | 19        | CLK I2S-                | 100          | 104.252              |
| 8       | LVDS S2I+                             | 21        | LVDS S2I-               | 50           | 53.35                |
|         | The second second                     | Redundant | communication lines     |              |                      |
| 5       | LVDS I2S-                             | 17        | LVDS I2S+               | 100          | 104.12               |
| 7       | CLK I2S+                              | 20        | CLK I2S-                | 100          | (04.20               |
| 10      | LVDS S2I-                             | 22        | LVDS S2I+               | 50           | 53.12                |
|         | TO LINE ALL THE VALUE                 | not cor   | nnected (NC) pins       | 华老领域自然       |                      |
| 2       | NC                                    | Chassis   | Instrument chassis      | >10M         | Doe.                 |
| 3       | DGND                                  | Chassis   | Instrument chassis      | < 1          | 0,9R                 |
| 4       | LVDS I2S-                             | Chassis   | Instrument chassis      | >10M         | 0.01                 |
| 5       | LVDS I2S-                             | Chassis   | Instrument chassis      | >10M         | Open                 |
| 6       | CLK I2S+                              | Chassis   | Instrument chassis      | >10M         | open<br>open<br>open |
| 7       | CLK I2S+                              | Chassis   | Instrument chassis      | >10M         | Ope                  |
| 8       | LVDS S2I+                             | Chassis   | Instrument chassis      | >10M         | Der                  |
| 9       | NC                                    | Chassis   | Instrument chassis      | >10M         | ope<br>ope           |
| 10      | LVDS S2I-                             | Chassis   | Instrument chassis      | >10M         | Or                   |
| 11      | DGND.                                 | Chassis   | Instrument chassis      | < 1          | 0.80                 |
| 12      | NC                                    | Chassis   | Instrument chassis      | >10M         | on                   |
| 14      | Nom. power return                     | Chassis   | Instrument chassis      | 100k         | 99,9 k.s.            |
| 16      | LVDS I2S+                             | Chassis   | Instrument chassis      | >10M         |                      |
| 17      | LVDS I2S+                             | Chassis   | Instrument chassis      | >10M         | Open                 |
| 18      | NC                                    | Chassis   | Instrument chassis      | > 10M        | Ole                  |
| 19      | CLK I2S-                              | Chassis   | Instrument chassis      | >10M         | 6                    |
| 20      | CLK I2S-                              | Chassis   | Instrument chassis      | >10M         |                      |
| 21      | LVDS S2I-                             | Chassis   | Instrument chassis      | >10M         | de                   |
| 22      | LVDS S2I+                             | Chassis   | Instrument chassis      | > 10M        | or                   |
| 23      | NC                                    | Chassis   | Instrument chassis      | > 10M        | Up~                  |
| 25      | Red. power return                     | Chassis   | Instrument chassis      | 100k         | 22245                |

1.0.2



Reference:

SO-EPD-KIE-TP-0051

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#### 4.4 Abbreviated Safe-to-Mate Test and Power Consumption Check

The abbreviated safe-to-mate test shall be performed before the first connection of EGSE to the unit and after transport of the EGSE.

| MDM25    |                     |            |                  |                |               |
|----------|---------------------|------------|------------------|----------------|---------------|
| Pin (+)  | Signal              | Pin (-)    | Signal           | Expected [V]   | Measurement   |
| 1        | Nom. power          | 14         | Nom. power ret.  | 28 or 0 *      |               |
| 13       | Red. power          | 25         | Red. power ret.  | 28 or 0 *      |               |
| * 28V ex | expected if connect | ted to the | corresponding NO | M or RED port, | 0V otherwise. |
| any      | other pin           | 15         | Chassis gnd      | < 3            |               |
| MDM15    |                     |            |                  |                |               |
| 1        | Thermistor 1        | 9          | Thermistor 1     | tbd by ADS *   |               |
| 2        | Thermistor 2        | 10         | Thermistor 2     | tbd by ADS *   |               |
| 3        | Thermistor 3        | 11         | Thermistor 3     | tbd by ADS *   |               |
| 7        | Surv Heaters 1      | 14         | Surv Heaters 1   | 28             |               |
| 8        | Surv Heaters 2      | 15         | Surv Heaters 2   | 28             |               |

<sup>\*</sup> Voltage and polarity to be defined by ADS, a constant voltage lower than 28 V is expected.

After successful safe-to-mate test, the unit can be powered. The power consumption of the unit is not supposed to change significantly. When powered, the unit shall drain about  $110\,\text{mA}$  at  $28\,\text{V}$ , so about  $3.1\,\text{W}$ . The current limitation of the power supply shall be set to  $500\,\text{mA}$ . Document the power consumption as part of the standard procedure. This condition resembles the "Unit unconfigured" as per the table below. After configuration of the sensors, the total power consumption is expected to increase to  $110\,\text{mA} \pm 5\,\text{mA}$ . For the unconfigured unit (after power ON), or after a "reset"-command after communication has been established:

| POWER ON 10:09 |                                 |          |  |  |  |  |
|----------------|---------------------------------|----------|--|--|--|--|
| Parameter      | Expected                        | Measured |  |  |  |  |
| Voltage        | 28.0 V                          | 27.9 V   |  |  |  |  |
| Current        | $107\mathrm{mA}\pm5\mathrm{mA}$ | 0.10 A   |  |  |  |  |

Mrs

To define the units power consumption under the different operational modes and under different supply voltages, document the power consumption under the conditions as given below. This part of the procedure is required to be conducted only once!

| Condition                     | 28.0 V | Current | 26.0 V | Current | 29.0 V   | Current |
|-------------------------------|--------|---------|--------|---------|----------|---------|
| Unit unconfigured             |        |         | /      | 1       |          |         |
| (after POWER ON)              |        |         |        |         |          |         |
| Unit in HK mode               |        |         |        |         |          |         |
|                               |        |         |        |         | $\times$ |         |
| Unit in SCI mode              |        |         |        | _       |          |         |
| (low activity)                |        |         |        |         | ľ        |         |
| Unit in SCI mode              |        |         |        |         |          |         |
| (high activity, testpulser) / |        |         |        |         |          |         |

SFT Red oh, Nom oh Threshold text: Idetiral very good Idetiral gravel 10:18

mor



Reference:

SO-EPD-KIE-TP-0051

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### 4.9 As Run Functional Test Report

Date and Time 2017-01-25 09:40

#### 4.9.1 Functional Test Readiness

| Location             | ADS Portsmouth EVT1                            |
|----------------------|--|
| Personnel            | 1. Pouritash, 1. Seinte, M. Liha. A. Blavarbak |
| Instrument ID        | STEP FS  |
| Firmware revision    |  |
| Reason for FT        | Pre wibration test                             |
| Test to be performed |  |

#### 4.9.2 FT Constraints (if applicable)

| Safe-to-mate           | NA, Performed 2017-01-23 in STEPPOM Shick LA |
|------------------------|--|
| Impedance check        |  |
| Set up communication   |  |
| Additional constraints |  |

After transport

Shock in Size to the

Homedia 40-58%

No Jamese bags or container

2017-01-26 Vibrakian Test After Y-axis



## **STEP FS Functional test** plan and procedure

Reference:

SO-EPD-KIE-TP-0051

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### 4.3 Unit Impedance Check

After transport, before the first connection to the EGSE, and after tests with higher risks to damage the unit the impedances of the unit shall be measured and compared with the expected values as given in the table (based on RD-1):

| MDM15              |         |         |                     |             |
|--------------------|---------|---------|---------------------|-------------|
| Name               | Pin (+) | Pin (-) | Expected $[\Omega]$ | Measurement |
| Thermistor 1       | 1       | 9       | 15k to 20k *        |             |
| Thermistor 2       | 2       | 10      | 15k to 20k *        |             |
| Thermistor 3       | 3       | 11      | 15k to 20k *        |             |
| Survival Heaters 1 | 7       | 14      | 119                 |             |
| Survival Heaters 2 | 8       | 15      | 119                 |             |

<sup>\*</sup> See figure below, all thermistors are supposed to show similar results depending on the unit's temperature.

| Temp. °C | Ohms      |
|----------|-----------|
|          | 4040000   |
| -60      | 1,342,000 |
| -55      | 957,000   |
| -50      | 690,000   |
| -45      | 503,700   |
| -40      | 371,300   |
| -35      | 276,200   |
| -30      | 207,500   |
| -25      | 157,200   |
| -20      | 120,100   |
| -15      | 92,600    |
| -10      | 71,940    |
| -5       | 56,310    |
| 0        | 44,420    |
| 2        | 40,490    |
| 4        | 36,930    |
| 6        | 33,740    |
| 8        | 30,840    |
| 10       | 28,230    |
| 12       | 25,860    |
| 14       | 23,720    |
| 16       | 21,780    |
| 18       | 20,010    |

| Temp. °C | Ohms   |
|----------|--------|
|          |        |
| 20       | 18,410 |
| 22       | 16,950 |
| 24       | 15,620 |
| 25       | 15,000 |
| 26       | 14,410 |
| 28       | 13,310 |
| 30       | 12,300 |
| 32       | 11,370 |
| 34       | 10,530 |
| 36       | 9,756  |
| 38       | 9,047  |
| 40       | 8,397  |
| 42       | 7,800  |
| 44       | 7,253  |
| 46       | 6,747  |
| 48       | 6,282  |
| 50       | 5,855  |
| 52       | 5,460  |
| 54       | 5,096  |
| 56       | 4,758  |
| 58       | 4,448  |
| 60       | 4,160  |

Figure 3: Thermistor resistivities for various temperatures, taken from the thermistor's datasheet



Reference:

SO-EPD-KIE-TP-0051

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| Pin (+)   Signal   Pin (-)   Signal   Expected   Ω   Measurement   | MDM25         |  |                             |                        |      |  |  |  |  |
|--|---------------|--|-----------------------------|------------------------|------|--|--|--|--|
| Chassis         Instrument chassis         15         Chassis gnd         <1         I. ≥ SL           Chassis         Instrument chassis         24         Chassis gnd         <1  | Pin (+)       |  |                             |                        |      | Measurement                                      |  |  |  |
| Chassis   Instrument chassis   24  |               |  |                             |                        |      |  |  |  |  |
| Chassis   Instrument chassis   24  | Chassis       | Instrument chassis   | 15                          | Chassis gnd            | < 1  | 1,252  |  |  |  |
| Chassis  |               | To the transfer of the transfe | 24                          | Chassis gnd            | < 1  |  |  |  |  |
| Chassis  |               | Instrument chassis   |                             | Nom. power             | >10M | Open   |  |  |  |
| Chassis  | 14            | Nom. power return  |                             |                        | >10M | Open   |  |  |  |
| Section   Sect   |               |  | Redur                       | ndant power lines      |      |  |  |  |  |
| A  |               |  | 13                          | Red. power             | >10M | Open   |  |  |  |
| A  | 25            | Red. power return  | 500 500                     |                        | >10M | Open   |  |  |  |
| 6 CLK  |               |  | Nominal                     | communication lines    |      | 3.2 50 X 2 2 2 2 3 3 4 3 3 3 3 3 3 3 3 3 3 3 3 3 |  |  |  |
| CLK   25+   19   | 4             |  | 16                          | LVDS I2S+              | 100  | (83,80   |  |  |  |
| Redundant communication lines  | 6             |  | 19                          | CLK I2S-               | 100  | 103.92   |  |  |  |
| Redundant communication lines  5 LVDS I2S- 17 LVDS I2S+ 100 103.8 =  7 CLK I2S+ 20 CLK I2S- 100 104.0 =  10 LVDS S2I- 22 LVDS S2I+ 50 52.8 =  Not connected (NC) pins  2 NC Chassis Instrument chassis > 10M 0 per  4 LVDS I2S- Chassis Instrument chassis > 10M 0 per  5 LVDS I2S- Chassis Instrument chassis > 10M 0 per  6 CLK I2S+ Chassis Instrument chassis > 10M 0 per  7 CLK I2S+ Chassis Instrument chassis > 10M 0 per  8 LVDS S2I- Chassis Instrument chassis > 10M 0 per  9 NC Chassis Instrument chassis > 10M 0 per  10 LVDS S2I- Chassis Instrument chassis > 10M 0 per  11 DGND. Chassis Instrument chassis > 10M 0 per  12 NC Chassis Instrument chassis > 10M 0 per  14 Nom. power return Chassis Instrument chassis > 10M 0 per  15 LVDS I2S+ Chassis Instrument chassis > 10M 0 per  16 LVDS I2S+ Chassis Instrument chassis > 10M 0 per  17 LVDS I2S+ Chassis Instrument chassis > 10M 0 per  18 NC Chassis Instrument chassis > 10M 0 per  19 CLK I2S- Chassis Instrument chassis > 10M 0 per  20 CLK I2S- Chassis Instrument chassis > 10M 0 per  21 LVDS S2I- Chassis Instrument chassis > 10M 0 per  22 LVDS S2I- Chassis Instrument chassis > 10M 0 per  23 NC Chassis Instrument chassis > 10M 0 per  24 LVDS S2I- Chassis Instrument chassis > 10M 0 per  25 LVDS S2I- Chassis Instrument chassis > 10M 0 per  26 LVDS S2I- Chassis Instrument chassis > 10M 0 per  27 LVDS S2I- Chassis Instrument chassis > 10M 0 per  28 LVDS S2I- Chassis Instrument chassis > 10M 0 per  19 CLK I2S- Chassis Instrument chassis > 10M 0 per  29 CLK I2S- Chassis Instrument chassis > 10M 0 per  20 CLK I2S- Chassis Instrument chassis > 10M 0 per  21 LVDS S2I- Chassis Instrument chassis > 10M 0 per  | 8             |  |                             | Company of the Company |      | 52.9 52  |  |  |  |
| 7  | <b>是第</b> 4。第 |  | Redundant                   | communication lines    |      |  |  |  |  |
| 7         CLK I2S+         20         CLK I2S-         100         L 041, 0 a.           10         LVDS S2I-         22         LVDS S2I+         50         52.8 a.           not connected (NC) pins           2         NC         Chassis         Instrument chassis         > 10M         Open           3         DGND         Chassis         Instrument chassis         > 10M         Open           4         LVDS I2S-         Chassis         Instrument chassis         > 10M         Open           5         LVDS I2S-         Chassis         Instrument chassis         > 10M         Open           6         CLK I2S+         Chassis         Instrument chassis         > 10M         Open           7         CLK I2S+         Chassis         Instrument chassis         > 10M         Open           8         LVDS S2I+         Chassis         Instrument chassis         > 10M         Open           9         NC         Chassis         Instrument chassis         > 10M         Open           10         LVDS S2I-         Chassis         Instrument chassis         > 10M         Open           12         NC         Chassis         Instrument chassis         > 10M   |               |  | 17                          | LVDS I2S+              | 100  | 103.8 0  |  |  |  |
| 10   |               |  | 20                          | CLK I2S-               | 100  |  |  |  |  |
| 2 NC Chassis Instrument chassis > 10M Open 3 DGND Chassis Instrument chassis < 1 4 LVDS I2S- Chassis Instrument chassis > 10M Open 5 LVDS I2S- Chassis Instrument chassis > 10M Open 6 CLK I2S+ Chassis Instrument chassis > 10M Open 7 CLK I2S+ Chassis Instrument chassis > 10M Open 8 LVDS S2I+ Chassis Instrument chassis > 10M Open 9 NC Chassis Instrument chassis > 10M Open 10 LVDS S2I- Chassis Instrument chassis > 10M Open 11 DGND. Chassis Instrument chassis > 10M Open 12 NC Chassis Instrument chassis > 10M Open 14 Nom. power return Chassis Instrument chassis > 10M Open 16 LVDS I2S+ Chassis Instrument chassis > 10M Open 17 LVDS I2S+ Chassis Instrument chassis > 10M Open 18 NC Chassis Instrument chassis > 10M Open 19 CLK I2S- Chassis Instrument chassis > 10M Open 20 CLK I2S- Chassis Instrument chassis > 10M Open 21 LVDS S2I+ Chassis Instrument chassis > 10M Open 22 LVDS S2I+ Chassis Instrument chassis > 10M Open 23 NC Chassis Instrument chassis > 10M Open 24 LVDS S2I- Chassis Instrument chassis > 10M Open 25 LVDS S2I- Chassis Instrument chassis > 10M Open 26 CLK I2S- Chassis Instrument chassis > 10M Open 27 LVDS S2I- Chassis Instrument chassis > 10M Open 28 LVDS S2I- Chassis Instrument chassis > 10M Open 29 CLK I2S- Chassis Instrument chassis > 10M Open 20 CLK I2S- Chassis Instrument chassis > 10M Open 20 CLK I2S- Chassis Instrument chassis > 10M Open 20 CLK I2S- Chassis Instrument chassis > 10M Open 20 CLK I2S- Chassis Instrument chassis > 10M Open 20 CLK I2S- Chassis Instrument chassis > 10M Open 20 CLK I2S- Chassis Instrument chassis > 10M Open 21 LVDS S2I- Chassis Instrument chassis > 10M Open  | 10            | LVDS S2I-  | 22                          | LVDS S2I+              | 50   |  |  |  |  |
| 3  |               | Harris No. of Child  | not cor                     | nected (NC) pins       |      |  |  |  |  |
| A  |               |  | Chassis                     | Instrument chassis     | >10M | Open   |  |  |  |
| 4 LVDS I2S- Chassis Instrument chassis > 10M   | 3             |  | Chassis                     | Instrument chassis     | < 1  |  |  |  |  |
| Solution   Chassis   Instrument chassis   Solution      |               |  | Chassis                     | Instrument chassis     | >10M |  |  |  |  |
| 7 CLK I2S+ Chassis Instrument chassis > 10M 8 LVDS S2I+ Chassis Instrument chassis > 10M 9 NC Chassis Instrument chassis > 10M 10 LVDS S2I- Chassis Instrument chassis > 10M 11 DGND. Chassis Instrument chassis < 1 12 NC Chassis Instrument chassis > 10M 14 Nom. power return Chassis Instrument chassis   100k 15 LVDS I2S+ Chassis Instrument chassis   100k 16 LVDS I2S+ Chassis Instrument chassis > 10M 17 LVDS I2S+ Chassis Instrument chassis > 10M 18 NC Chassis Instrument chassis > 10M 19 CLK I2S- Chassis Instrument chassis > 10M 20 CLK I2S- Chassis Instrument chassis > 10M 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I+ Chassis Instrument chassis > 10M 23 NC Chassis Instrument chassis > 10M 24 Opt 25 Chassis Instrument chassis > 10M 26 Opt 27 Chassis Instrument chassis > 10M 28 Opt 29 CLK I2S- Chassis Instrument chassis > 10M 29 Opt 20 CLK I2S- Chassis Instrument chassis > 10M 20 CLK I2S- Chassis Instrument chassis > 10M 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I- Chassis Instrument chassis > 10M 29 Opt 20 CLK I2S- Chassis Instrument chassis > 10M 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I- Chassis Instrument chassis > 10M  |               | LVDS I2S-  | Chassis                     | Instrument chassis     | >10M | N ages   |  |  |  |
| 7 CLK I2S+ Chassis Instrument chassis > 10M 8 LVDS S2I+ Chassis Instrument chassis > 10M 9 NC Chassis Instrument chassis > 10M 10 LVDS S2I- Chassis Instrument chassis > 10M 11 DGND. Chassis Instrument chassis < 1 12 NC Chassis Instrument chassis > 10M 14 Nom. power return Chassis Instrument chassis   100k 15 LVDS I2S+ Chassis Instrument chassis   100k 16 LVDS I2S+ Chassis Instrument chassis   10M 17 LVDS I2S+ Chassis Instrument chassis   10M 18 NC Chassis Instrument chassis   10M 19 CLK I2S- Chassis Instrument chassis   10M 20 CLK I2S- Chassis Instrument chassis   10M 21 LVDS S2I- Chassis Instrument chassis   10M 22 LVDS S2I+ Chassis Instrument chassis   10M 23 NC Chassis Instrument chassis   10M 24 Chassis Instrument chassis   10M 25 Chassis Instrument chassis   10M 26 Chassis Instrument chassis   10M 27 Chassis Instrument chassis   10M 28 Chassis Instrument chassis   10M 29 Chassis Instrument chassis   10M 20 CLK I2S- Chassis Instrument chassis   10M 20 CLK I2S- Chassis Instrument chassis   10M 20 CLK I2S- Chassis Instrument chassis   10M 21 LVDS S2I- Chassis Instrument chassis   10M 22 LVDS S2I- Chassis Instrument chassis   10M 29 CCLK I2S- Chassis Instrument chassis   10M 20 CCLK I2S- Chassis Instrument chassis   10M 20 CCLK I2S- Chassis Instrument chassis   10M 20 CCLK I2S- Chassis Instrument chassis   10M 21 CCLK I2S- Chassis Instrument chassis   10M 22 CCLK I2S- Chassis Instrument chassis   10M 20 CCLK I2S- Chassis Instrument chassis   10M   |               | CLK I2S+   | Chassis                     | Instrument chassis     | >10M | Ugu  |  |  |  |
| 8 LVDS S2I+ Chassis Instrument chassis > 10M 9 NC Chassis Instrument chassis > 10M 10 LVDS S2I- Chassis Instrument chassis > 10M 11 DGND. Chassis Instrument chassis < 1 12 NC Chassis Instrument chassis > 10M 14 Nom. power return Chassis Instrument chassis 100k 16 LVDS I2S+ Chassis Instrument chassis > 10M 17 LVDS I2S+ Chassis Instrument chassis > 10M 18 NC Chassis Instrument chassis > 10M 19 CLK I2S- Chassis Instrument chassis > 10M 20 CLK I2S- Chassis Instrument chassis > 10M 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I+ Chassis Instrument chassis > 10M 23 NC Chassis Instrument chassis > 10M 24 Chassis Instrument chassis > 10M 25 Chassis Instrument chassis > 10M 26 Chassis Instrument chassis > 10M 27 Chassis Instrument chassis > 10M 28 Chassis Instrument chassis > 10M 29 Chassis Instrument chassis > 10M 20 CLK I2S- Chassis Instrument chassis > 10M 20 CLK I2S- Chassis Instrument chassis > 10M 20 CLK I2S- Chassis Instrument chassis > 10M 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I- Chassis Instrument chassis > 10M 29 Chassis Instrument chassis > 10M 20 Chassis Instrument chassis > 10M  | 7             | CLK I2S+   | Chassis                     | Instrument chassis     | >10M |  |  |  |  |
| 10 LVDS S2I- Chassis Instrument chassis > 10M Office 1 DGND. | 8             | A THE RESERVE OF THE PARTY OF T | Chassis                     | Instrument chassis     | >10M |  |  |  |  |
| 11 DGND. Chassis Instrument chassis <1 2.1 2  12 NC Chassis Instrument chassis >10M  14 Nom. power return Chassis Instrument chassis 100k  16 LVDS I2S+ Chassis Instrument chassis >10M  17 LVDS I2S+ Chassis Instrument chassis >10M  18 NC Chassis Instrument chassis >10M  19 CLK I2S- Chassis Instrument chassis >10M  20 CLK I2S- Chassis Instrument chassis >10M  21 LVDS S2I- Chassis Instrument chassis >10M  22 LVDS S2I+ Chassis Instrument chassis >10M  23 NC Chassis Instrument chassis >10M   |               |  | Chassis                     | Instrument chassis     | >10M | Open   |  |  |  |
| 12 NC Chassis Instrument chassis > 10M  14 Nom. power return Chassis Instrument chassis 100k  16 LVDS I2S+ Chassis Instrument chassis > 10M  17 LVDS I2S+ Chassis Instrument chassis > 10M  18 NC Chassis Instrument chassis > 10M  19 CLK I2S- Chassis Instrument chassis > 10M  20 CLK I2S- Chassis Instrument chassis > 10M  21 LVDS S2I- Chassis Instrument chassis > 10M  22 LVDS S2I+ Chassis Instrument chassis > 10M  23 NC Chassis Instrument chassis > 10M  24 Chassis Instrument chassis > 10M  25 Chassis Instrument chassis > 10M  26 Chassis Instrument chassis > 10M  27 Chassis Instrument chassis > 10M  28 Chassis Instrument chassis > 10M  29 Chassis Instrument chassis > 10M  20 Chassis Instrument chassis > 10M  21 Chassis Instrument chassis > 10M  22 Chassis Instrument chassis > 10M  23 NC Chassis Instrument chassis > 10M  |               |  | Chassis                     | Instrument chassis     | >10M | Oren   |  |  |  |
| 12 NC Chassis Instrument chassis > 10M Ope 14 Nom. power return Chassis Instrument chassis 100k 99.9 k so 16 LVDS I2S+ Chassis Instrument chassis > 10M Ope 17 LVDS I2S+ Chassis Instrument chassis > 10M Ope 18 NC Chassis Instrument chassis > 10M Ope 19 CLK I2S- Chassis Instrument chassis > 10M Ope 19 CLK I2S- Chassis Instrument chassis > 10M Ope 19 CLK I2S- Chassis Instrument chassis > 10M Ope 10 CLK I2S- Chassis I1S- Chassis I1S- Chassis I1S- Chassis I1S- Chassis I1S- Chassis I1S- Chassis IIS- Chassis IIIS- Chassis IIIS- Chassis IIIS- Chassis IIIS- Chassis IIIS- Chassis IIIS- Chassis IIIIS- Chassis IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII  | 0.000         |  | Chassis                     | Instrument chassis     | < 1  | 2.12   |  |  |  |
| 16 LVDS I2S+ Chassis Instrument chassis > 10M Operation   17 LVDS I2S+ Chassis Instrument chassis > 10M Operation   18 NC Chassis Instrument chassis > 10M Operation   19 CLK I2S- Chassis Instrument chassis > 10M Operation   20 CLK I2S- Chassis Instrument chassis > 10M Operation   21 LVDS S2I- Chassis Instrument chassis > 10M Operation   22 LVDS S2I+ Chassis Instrument chassis > 10M Operation   23 NC Chassis Instrument chassis > 10M Operation   10 Operation   11 Operation   12 Operation   12 Operation   13 Operation   14 Operation   15 Operation   16 Operation   17 Operation   18 Operation   18 Operation   19 Operation   19 Operation   10 Operation   11 Operation   12 Operation   12 Operation   13 Operation   14 Operation   15 Operation   16 Operation   17 Operation   18 Operation   18 Operation   19 Operation   19 Operation   19 Operation   10 Operation   11 Operation   12 Operation   13 Operation   14 Operation   15 Operation   16 Operation   16 Operation   17 Operation   18 Operation   18 Operation   19 Operation   19 Operation   19 Operation   19 Operation   10 Opera |               |  | Polyacolaria de Historia de | Instrument chassis     | >10M |  |  |  |  |
| 16 LVDS I2S+ Chassis Instrument chassis > 10M Operation  17 LVDS I2S+ Chassis Instrument chassis > 10M Operation  18 NC Chassis Instrument chassis > 10M Operation  19 CLK I2S- Chassis Instrument chassis > 10M Operation  20 CLK I2S- Chassis Instrument chassis > 10M Operation  21 LVDS S2I- Chassis Instrument chassis > 10M Operation  22 LVDS S2I+ Chassis Instrument chassis > 10M Operation  23 NC Chassis Instrument chassis > 10M Operation  10 Operation  10 Operation  11 Operation  12 Operation  12 Operation  13 Operation  14 Operation  15 Operation  16 Operation  17 Operation  18 Operation  19 Operation  19 Operation  20 CLK I2S- Chassis Instrument chassis > 10M Operation  21 Chassis Instrument chassis > 10M Operation  22 Operation  23 NC Chassis Instrument chassis > 10M Operation  24 Operation  25 Operation  17 Operation  18 Operation  18 Operation  19 Operation  19 Operation  10 Operation  10 Operation  20 Operation  21 Operation  22 Operation  23 Operation  24 Operation  25 Operation  26 Operation  26 Operation  27 Operation  28 Operation  29 Operation  20 Operation  20 Operation  20 Operation  20 Operation  21 Operation  22 Operation  23 Operation  24 Operation  25 Operation  26 Operation  26 Operation  27 Operation  28 Operation  29 Operation  20 Operation  21 Operation  22 Operation  23 Operation  24 Operation  25 Operation  26 Operation  26 Operation  27 Operation  27 Operation  28 Operation  28 Operation  29 Operation  20 Operation  21 Operation  22 Operation  23 Operation  24 Operation  25 Operation  26 Operation  26 Operation  27 Operation  28 Operation  28 Operation  29 Operation  20 Operation  20 Operation  20 Operation  20 Operation  20 Operation  21 Operation  22 Operation  23 Operation  24 Operation  25 Operation  26 Operation  26 Operation  27 Operation  27 Operation  28 Operation  28 Operation  29 Operation  20 Operation  20 Operatio | 14            | · · · · · · · · · · · · · · · · · · ·  |                             | Instrument chassis     | 100k |  |  |  |  |
| 19 CLK I2S- Chassis Instrument chassis > 10M 20 CLK I2S- Chassis Instrument chassis > 10M 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I+ Chassis Instrument chassis > 10M 23 NC Chassis Instrument chassis > 10M 24 Chassis Instrument chassis > 10M 25 Chassis Instrument chassis > 10M   |               |  | Chassis                     | Instrument chassis     | >10M |  |  |  |  |
| 19 CLK I2S- Chassis Instrument chassis > 10M 20 CLK I2S- Chassis Instrument chassis > 10M 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I+ Chassis Instrument chassis > 10M 23 NC Chassis Instrument chassis > 10M 24 Chassis Instrument chassis > 10M 25 Chassis Instrument chassis > 10M   | 17            | 7 1 1 70 10 10 10 10 10 10 10 10 10 10 10 10 10  | Chassis                     | Instrument chassis     | >10M | Oye  |  |  |  |
| 20 CLK I2S- Chassis Instrument chassis > 10M O/C 20 CLK I2S- Chassis Instrument chassis > 10M O/C 21 LVDS S2I- Chassis Instrument chassis > 10M O/C 22 LVDS S2I+ Chassis Instrument chassis > 10M O/C 23 NC Chassis Instrument chassis > 10M O/C 24 Chassis Instrument chassis > 10M O/C 25 Chassis Instrument chassis > 10M O/C 26 Chassis Instrument chassis > 10M   |               |  |                             | Instrument chassis     | >10M | ()ne   |  |  |  |
| 20 CLK I2S- Chassis Instrument chassis > 10M 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I+ Chassis Instrument chassis > 10M 23 NC Chassis Instrument chassis > 10M 24 Chassis Instrument chassis > 10M 25 Chassis Instrument chassis > 10M  | 19            | CLK I2S-   | Chassis                     | Instrument chassis     | >10M |  |  |  |  |
| 22 LVDS S2I+ Chassis Instrument chassis > 10M Cpu 23 NC Chassis Instrument chassis > 10M   |               |  | Chassis                     | Instrument chassis     | >10M | Open   |  |  |  |
| 23 NC Chassis Instrument chassis > 10M   |               |  | Chassis                     | Instrument chassis     | >10M | de   |  |  |  |
| 5/2  | 22            |  | Chassis                     | Instrument chassis     | >10M | Gen  |  |  |  |
| 25 Red. power return Chassis Instrument chassis 100k 99.9 Gap  | 23            | NC   | Chassis                     | Instrument chassis     | >10M | Of   |  |  |  |
|  | 25            | Red. power return  | Chassis                     | Instrument chassis     | 100k | 99.960D  |  |  |  |



Reference:

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#### 4.4 Abbreviated Safe-to-Mate Test and Power Consumption Check

The abbreviated safe-to-mate test shall be performed before the first connection of EGSE to the unit and after transport of the EGSE.

| MDM25    |                    |           |                  |                |               |
|----------|--------------------|-----------|------------------|----------------|---------------|
| Pin (+)  | Signal             | Pin (-)   | Signal           | Expected [V]   | Measurement   |
| 1        | Nom. power         | 14        | Nom. power ret.  | 28 or 0 *      |               |
| 13       | Red. power         | 25        | Red. power ret.  | 28 or 0 *      |               |
| * 28V ex | xpected if connect | ed to the | corresponding NO | M or RED port, | 0V otherwise. |
| any      | other pin          | 15        | Chassis gnd      | < 3            |               |
| MDM15    |                    |           |                  |                |               |
| 1        | Thermistor 1       | 9         | Thermistor 1     | tbd by ADS *   |               |
| 2        | Thermistor 2       | 10        | Thermistor 2     | tbd by ADS *   |               |
| 3        | Thermistor 3       | 11        | Thermistor 3     | tbd by ADS *   |               |
| 7        | Surv Heaters 1     | 14        | Surv Heaters 1   | 28             |               |
| 8        | Surv Heaters 2     | 15        | Surv Heaters 2   | 28             |               |

<sup>\*</sup> Voltage and polarity to be defined by ADS, a constant voltage lower than 28 V is expected.

After successful safe-to-mate test, the unit can be powered. The power consumption of the unit is not supposed to change significantly. When powered, the unit shall drain about 110 mA at 28 V, so about 3.1 W. The current limitation of the power supply shall be set to 500 mA. Document the power consumption as part of the standard procedure. This condition resembles the "Unit unconfigured" as per the table below. After configuration of the sensors, the total power consumption is expected to increase to 110 mA  $\pm$  5 mA. For the unconfigured unit (after power ON), or after a "reset"-command after communication has been established:

POWERON

| Parameter | Expected                        | Measured     |  |  |
|-----------|---------------------------------|--------------|--|--|
| Voltage   | 28.0 V                          | 27,94        |  |  |
| Current   | $107\mathrm{mA}\pm5\mathrm{mA}$ | 0.10A /0.10A |  |  |

1221 / 6225 RED

To define the units power consumption under the different operational modes and under different supply voltages, document the power consumption under the conditions as given below. This part of the procedure is required to be conducted only once!

| Condition                                    | 28.0 V | Current | 26.0 V | Current | 29.0 V | Current |
|--|--------|---------|--------|---------|--------|---------|
| Unit unconfigured (after POWER ON)           |        |         |        |         |        |         |
| Unit in HK mode                              |        |         |        |         |        |         |
| Unit in SCI mode (low activity)              |        |         |        |         |        |         |
| Unit in SCI mode (high activity, testpulser) |        |         |        |         |        |         |

NOM Communicate of a courter Nom side of

SFT & Nom of a pages

RED SFT process

THRESHOLD: Same lines in I seffer 152 as yes feeding (fretest)

Pulser Calibration 5 fout 12:30 in d 13:38 good

pur FT passed



Reference:

SO-EPD-KIE-TP-0051

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## 4.9 As Run Functional Test Report

Date and Time 2017-01-26 12

### 4.9.1 Functional Test Readiness

| Location             | ADS Portsmouth EVT     |
|----------------------|------------------------|
| Personnel            | L.P., L.S., A.R., M.R. |
| Instrument ID        | FS /                   |
| Firmware revision    |                        |
| Reason for FT        | F, Test followy Y-axis |
| Test to be performed |                        |

| Safe-to-mate           | MDM27 connecto Saver Mated / de Mated |
|------------------------|---------------------------------------|
| Impedance check        |                                       |
| Set up communication   |                                       |
| Additional constraints | ∆o.                                   |

2017-01-26 aborted RANDOM in X-cxis



## STEP FS Functional test plan and procedure

Reference:

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#### 4.3 Unit Impedance Check

After transport, before the first connection to the EGSE, and after tests with higher risks to damage the unit the impedances of the unit shall be measured and compared with the expected values as given in the table (based on RD-1):

| MDM15              |         |         |                     |             |
|--------------------|---------|---------|---------------------|-------------|
| Name               | Pin (+) | Pin (-) | Expected $[\Omega]$ | Measurement |
| Thermistor 1       | 1       | 9       | 15k to 20k *        |             |
| Thermistor 2       | 2       | 10      | 15k to 20k *        |             |
| Thermistor 3       | 3       | 11      | 15k to 20k *        |             |
| Survival Heaters 1 | 7       | 14      | 119                 |             |
| Survival Heaters 2 | 8       | 15      | 119                 |             |

<sup>\*</sup> See figure below, all thermistors are supposed to show similar results depending on the unit's temperature.

| 0        |           |
|----------|-----------|
| Temp. °C | Ohms      |
|          |           |
| -60      | 1,342,000 |
| -55      | 957,000   |
| -50      | 690,000   |
| -45      | 503,700   |
| -40      | 371,300   |
| -35      | 276,200   |
| -30      | 207,500   |
| -25      | 157,200   |
| -20      | 120,100   |
| -15      | 92,600    |
| -10      | 71,940    |
| -5       | 56,310    |
| 0        | 44,420    |
| 2        | 40,490    |
| 4        | 36,930    |
| 6        | 33,740    |
| 8        | 30,840    |
| 10       | 28,230    |
| 12       | 25,860    |
| 14       | 23,720    |
| 16       | 21,780    |
| 18       | 20,010    |

| Temp. °C | Ohms   |
|----------|--------|
|          |        |
| 20       | 18,410 |
| 22       | 16,950 |
| 24       | 15,620 |
| 25       | 15,000 |
| 26       | 14,410 |
| 28       | 13,310 |
| 30       | 12,300 |
| 32       | 11,370 |
| 34       | 10,530 |
| 36       | 9,756  |
| 38       | 9,047  |
| 40       | 8,397  |
| 42       | 7,800  |
| 44       | 7,253  |
| 46       | 6,747  |
| 48       | 6,282  |
| 50       | 5,855  |
| 52       | 5,460  |
| 54       | 5,096  |
| 56       | 4,758  |
| 58       | 4,448  |
| 60       | 4,160  |

Figure 3: Thermistor resistivities for various temperatures, taken from the thermistor's datasheet



Reference:

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| MDM25   |                                   |           |                     |              |                               |
|---------|-----------------------------------|-----------|---------------------|--------------|-------------------------------|
| Pin (+) | Signal                            | Pin (-)   | Signal              | Expected [Ω] | Measurement                   |
|         | Nominal power lines and grounding |           |                     |              |                               |
| Chassis | Instrument chassis                | 15        | Chassis gnd         | < 1          | 1,2-12                        |
| Chassis | Instrument chassis                | 24        | Chassis gnd         | < 1          | 1.1.02                        |
| Chassis | Instrument chassis                | 1         | Nom. power          | >10M         |                               |
| 14      | Nom. power return                 | 1         | Nom. power          | >10M         | Ope                           |
|         |                                   | Redur     | ndant power lines   |              |                               |
| Chassis | Instrument chassis                | 13        | Red. power          | >10M         | or                            |
| 25      | Red. power return                 | 13        | Red. power          | >10M         | ope                           |
|         |                                   | Nominal   | communication lines |              |                               |
| 4       | LVDS I2S-                         | 16        | LVDS I2S+           | 100          | 103.40                        |
| 6       | CLK I2S+                          | 19        | CLK I2S-            | 100          | 103-302                       |
| 8       | LVDS S2I+                         | 21        | LVDS S2I-           | 50           | 52,4 a                        |
|         |                                   | Redundant | communication lines |              |                               |
| 5       | LVDS I2S-                         | 17        | LVDS I2S+           | 100          | 103.302                       |
| 7       | CLK I2S+                          | 20        | CLK I2S-            | 100          |                               |
| 10      | LVDS S2I-                         | 22        | LVDS S2I+           | 50           | 103.32<br>52.20               |
|         |                                   | not cor   | nected (NC) pins    |              |                               |
| 2       | NC                                | Chassis   | Instrument chassis  | >10M         | Ope                           |
| 3       | DGND                              | Chassis   | Instrument chassis  | < 1          | 1.952                         |
| 4       | LVDS I2S-                         | Chassis   | Instrument chassis  | >10M         | Open                          |
| 5       | LVDS I2S-                         | Chassis   | Instrument chassis  | >10M         | 128-                          |
| 6       | CLK I2S+                          | Chassis   | Instrument chassis  | >10M         | 1.9.a<br>Open<br>Open<br>Open |
| 7       | CLK I2S+                          | Chassis   | Instrument chassis  | >10M         | ch-                           |
| 8       | LVDS S2I+                         | Chassis   | Instrument chassis  | >10M         | 2+~                           |
| 9       | NC                                | Chassis   | Instrument chassis  | >10M         | (2-4-4                        |
| 10      | LVDS S2I-                         | Chassis   | Instrument chassis  | >10M         | du.                           |
| 11      | DGND.                             | Chassis   | Instrument chassis  | < 1          | \$ O.D.A                      |
| 12      | NC                                | Chassis   | Instrument chassis  | >10M         | on                            |
| 14      | Nom. power return                 | Chassis   | Instrument chassis  | 100k         | ,99.9 ks                      |
| 16      | LVDS I2S+                         | Chassis   | Instrument chassis  | >10M         | Ope                           |
| 17      | LVDS I2S+                         | Chassis   | Instrument chassis  | >10M         | Ope                           |
| 18      | NC                                | Chassis   | Instrument chassis  | >10M         | Or                            |
| 19      | CLK I2S-                          | Chassis   | Instrument chassis  | >10M         | Opn                           |
| 20      | CLK I2S-                          | Chassis   | Instrument chassis  | >10M         | Oju                           |
| 21      | LVDS S2I-                         | Chassis   | Instrument chassis  | >10M         | 100-                          |
| 22      | LVDS S2I+                         | Chassis   | Instrument chassis  | >10M         | On                            |
| 23      | NC                                | Chassis   | Instrument chassis  | >10M         | 1212                          |
| 25      | Red. power return                 | Chassis   | Instrument chassis  | 100k         | 79.960                        |
|         |                                   |           |                     |              |                               |



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### Abbreviated Safe-to-Mate Test and Power Consumption Check

The abbreviated safe-to-mate test shall be performed before the first connection of EGSE to the unit and after transport of the EGSE.

| MDM25    |                    |           |                  |                |               |
|----------|--------------------|-----------|------------------|----------------|---------------|
| Pin (+)  | Signal             | Pin (-)   | Signal           | Expected [V]   | Measurement   |
| 1        | Nom. power         | 14        | Nom. power ret.  | 28 or 0 *      |               |
| 13       | Red. power         | 25        | Red. power ret.  | 28 or 0 *      |               |
| * 28V ex | spected if connect | ed to the | corresponding NO | M or RED port, | 0V otherwise. |
| any      | other pin          | 15        | Chassis gnd      | < 3            |               |
| MDM15    |                    |           |                  |                |               |
| 1        | Thermistor 1       | 9         | Thermistor 1     | tbd by ADS *   |               |
| 2        | Thermistor 2       | 10        | Thermistor 2     | tbd by ADS *   |               |
| 3        | Thermistor 3       | 11        | Thermistor 3     | tbd by ADS *   |               |
| 7        | Surv Heaters 1     | 14        | Surv Heaters 1   | 28             |               |
| 8        | Surv Heaters 2     | 15        | Surv Heaters 2   | 28             |               |

<sup>\*</sup> Voltage and polarity to be defined by ADS, a constant voltage lower than 28 V is expected.

After successful safe-to-mate test, the unit can be powered. The power consumption of the unit is not supposed to change significantly. When powered, the unit shall drain about 110 mA at 28 V, so about 3.1 W. The current limitation of the power supply shall be set to 500 mA. Document the power consumption as part of the standard procedure. This condition resembles the "Unit unconfigured" as per the table below. After configuration of the sensors, the total power consumption is expected to increase to 110 mA  $\pm$  5 mA. For the unconfigured unit (after power ON), or after a "reset"-command after communication has been established:

Current hinit Expected Measured Parameter 28.0 V Voltage 2218 V 0,10 A (Red) /0,10 A (Non) 1558 of Mul  $107\,\mathrm{mA}\pm5\,\mathrm{mA}$ Current

To define the units power consumption under the different operational modes and under different supply voltages, document the power consumption under the conditions as given below. This part of the procedure is required to be conducted only once!

| Condition                   | 28.0 V | Current | 26.0 V | Current | 29.0 V | Current |
|-----------------------------|--------|---------|--------|---------|--------|---------|
| Unit unconfigured           |        |         |        |         |        |         |
| (after POWER ON)            |        |         |        |         |        |         |
| Unit in HK mode             |        |         |        |         |        |         |
|                             |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (low activity)              |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (high activity, testpulser) |        |         |        |         |        |         |

|   | 01   | 0   | ` .    | 0 | CI  | - | .1  |
|---|------|-----|--------|---|-----|---|-----|
| 0 | Ked: | Cmi | nemita | 1 | 2/- | T | OIL |

6 Non; Counch, SFTole, Throhald unchanged, oh 6 Pulses that the
6 Heresholds ohe



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## 4.9 As Run Functional Test Report

| 6 1600 |
|--------|
| (      |

### 4.9.1 Functional Test Readiness

| Location             | ADS PORTSMOUTH EVT                         |
|----------------------|--|
| Personnel            |  |
| Instrument ID        | FS   |
| Firmware revision    |  |
| Reason for FT        | Abnormal high level starty parson, ABORTED |
| Test to be performed |  |

| Safe-to-mate           |  |
|------------------------|--|
| Impedance check        |  |
| Set up communication   |  |
| Additional constraints |  |



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### 4.3 Unit Impedance Check

After transport, before the first connection to the EGSE, and after tests with higher risks to damage the unit the impedances of the unit shall be measured and compared with the expected values as given in the table (based on RD-1):

| MDM15              |         |         |                     |             |
|--------------------|---------|---------|---------------------|-------------|
| Name               | Pin (+) | Pin (-) | Expected $[\Omega]$ | Measurement |
| Thermistor 1       | 1       | 9       | 15k to 20k *        |             |
| Thermistor 2       | 2       | 10      | 15k to 20k *        |             |
| Thermistor 3       | 3       | 11      | 15k to 20k *        |             |
| Survival Heaters 1 | 7       | 14      | 119                 |             |
| Survival Heaters 2 | 8       | 15      | 119                 |             |

<sup>\*</sup> See figure below, all thermistors are supposed to show similar results depending on the unit's temperature.

| Temp. °C | Ohms      |
|----------|-----------|
|          |           |
| -60      | 1,342,000 |
| -55      | 957,000   |
| -50      | 690,000   |
| -45      | 503,700   |
| -40      | 371,300   |
| -35      | 276,200   |
| -30      | 207,500   |
| -25      | 157,200   |
| -20      | 120,100   |
| -15      | 92,600    |
| -10      | 71,940    |
| -5       | 56,310    |
| 0        | 44,420    |
| 2        | 40,490    |
| 4        | 36,930    |
| 6        | 33,740    |
| 8        | 30,840    |
| 10       | 28,230    |
| 12       | 25,860    |
| 14       | 23,720    |
| 16       | 21,780    |
| 18       | 20,010    |

| Temp. °C | Ohms   |
|----------|--------|
|          |        |
| 20       | 18,410 |
| 22       | 16,950 |
| 24       | 15,620 |
| 25       | 15,000 |
| 26       | 14,410 |
| 28       | 13,310 |
| 30       | 12,300 |
| 32       | 11,370 |
| 34       | 10,530 |
| 36       | 9,756  |
| 38       | 9,047  |
| 40       | 8,397  |
| 42       | 7,800  |
| 44       | 7,253  |
| 46       | 6,747  |
| 48       | 6,282  |
| 50       | 5,855  |
| 52       | 5,460  |
| 54       | 5,096  |
| 56       | 4,758  |
| 58       | 4,448  |
| 60       | 4,160  |

Figure 3: Thermistor resistivities for various temperatures, taken from the thermistor's datasheet



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| Pin (+)   Signal   Pin (-)   Signal   Expected [Ω]   Measurement   | MDM25   |                    |           | CONTRACTOR OF THE   |  |             |
|--|---------|--------------------|-----------|---------------------|--|-------------|
| Chassis   Instrument chassis   15  | Pin (+) | Signal             | Pin (-)   | Signal              | Expected [Ω]   | Measurement |
| Chassis         Instrument chassis         15         Chassis gnd         < 1         1,5 g           Chassis         Instrument chassis         24         Chassis gnd         < 1  |         |                    |           |                     |  |             |
| Chassis         Instrument chassis         24         Chassis gnd         < 1         1.5 Ω           14         Nom. power return         1         Nom. power         > 10M         O p en           14         Nom. power return         1         Nom. power         > 10M         O p en           Redundant power lines           Chassis         Instrument chassis         13         Red. power         > 10M         O p en           25         Red. power return         13         Red. power         > 10M         O p en           Nominal communication lines           4         LVDS 12S-         16         LVDS 12S-         100         103.8 Ω           6         CLK 12S+         19         CLK 12S-         100         103.8 Ω           8         LVDS 22I+         21         LVDS 52I-         50         53.0 Ω           7         CLK 12S+         20         CLK 12S-         100         103.9 Ω           10         LVDS 52I-         22         LVDS 52I+         50         52.2 Ω           10         LVDS 52I-         Chassis         Instrument chassis         > 10M         Op en           2         NC         Chassis         In  | Chassis |                    |           |                     | THE PARTY OF THE P | 1,5.0       |
| Chassis         Instrument chassis         1         Nom. power         > 10M         Open           14         Nom. power return         1         Nom. power         > 10M         Open           Redundant power lines           Chassis         Instrument chassis         13         Red. power         > 10M         Open           25         Red. power return         13         Red. power         > 10M         Open           Nominal communication lines           4         LVDS I2S-         16         LVDS I2S-         100         103.8 cn           6         CLK I2S+         19         CLK I2S-         100         103.8 cn           8         LVDS S2I+         21         LVDS S2I-         50         53.0 sn           Redundant communication lines           5         LVDS I2S-         17         LVDS I2S+         100         103.8 cn           Redundant communication lines           5         LVDS I2S-         17         LVDS I2S+         100         103.8 cn           Redundant communication lines           LVDS I2S-         17         LVDS I2S+         100         103.9 cn           Redundan   | Chassis | Instrument chassis | 24        | 15.                 | < 1  |             |
| Chassis   Instrument chassis   13  | Chassis | Instrument chassis | 1         | Nom. power          | >10M   |             |
| Chassis   Instrument chassis   13  | 14      | Nom. power return  | 1         | Nom. power          | >10M   | 00.         |
| Section   Sect   |         |                    | Redur     | idant power lines   |  |             |
| A  | Chassis | Instrument chassis | 13        | Red. power          | >10M   | Open        |
| A  | 25      | Red. power return  | 13        | Red. power          | >10M   | Ocer        |
| 6 CLK  |         |                    | Nominal o | communication lines |  |             |
| CLK  | 4       | LVDS I2S-          | 16        | LVDS I2S+           | 100  | 104,00      |
| Redundant communication lines  | 6       | CLK I2S+           | 19        | CLK I2S-            | 100  | 103.80      |
| Section   Sect   | 8       | LVDS S2I+          | 21        | LVDS S2I-           | 50   |             |
| 7         CLK I2S+         20         CLK I2S-         100         Ava.o.a           10         LVDS S2I-         22         LVDS S2I+         50         52.9 a           not connected (NC) pins           2         NC         Chassis         Instrument chassis         > 10M         Ope.           3         DGND         Chassis         Instrument chassis         > 10M         Ope.           4         LVDS I2S-         Chassis         Instrument chassis         > 10M         Ope.           5         LVDS I2S-         Chassis         Instrument chassis         > 10M         Ope.           6         CLK I2S+         Chassis         Instrument chassis         > 10M         Ope.           7         CLK I2S+         Chassis         Instrument chassis         > 10M         Ope.           8         LVDS S2I+         Chassis         Instrument chassis         > 10M         Ope.           9         NC         Chassis         Instrument chassis         > 10M         Ope.           10         LVDS S2I-         Chassis         Instrument chassis         > 10M         Ope.           12         NC         Chassis         Instrument chassis         > 10M  |         |                    | Redundant | communication lines | CALLET STATE   |             |
| The control of the co |         | LVDS I2S-          | 17        | LVDS I2S+           | 100  | 103,90      |
| 10   | 7       | CLK I2S+           | 20        | CLK I2S-            | 100  | 104.00      |
| not connected (NC) pins  2 NC Chassis Instrument chassis > 10M Open  3 DGND Chassis Instrument chassis < 1 2, 4 ac  4 LVDS I2S- Chassis Instrument chassis > 10M Open  5 LVDS I2S- Chassis Instrument chassis > 10M Open  6 CLK I2S+ Chassis Instrument chassis > 10M Open  7 CLK I2S+ Chassis Instrument chassis > 10M Open  8 LVDS S2I+ Chassis Instrument chassis > 10M Open  9 NC Chassis Instrument chassis > 10M Open  10 LVDS S2I- Chassis Instrument chassis > 10M Open  11 DGND. Chassis Instrument chassis > 10M Open  12 NC Chassis Instrument chassis > 10M Open  14 Nom. power return Chassis Instrument chassis > 10M Open  16 LVDS I2S+ Chassis Instrument chassis > 10M Open  17 LVDS I2S+ Chassis Instrument chassis > 10M Open  18 NC Chassis Instrument chassis > 10M Open  19 CLK I2S- Chassis Instrument chassis > 10M Open  20 CLK I2S- Chassis Instrument chassis > 10M Open  21 LVDS S2I+ Chassis Instrument chassis > 10M Open  22 LVDS S2I+ Chassis Instrument chassis > 10M Open  23 NC Chassis Instrument chassis > 10M Open  19 CLK I2S- Chassis Instrument chassis > 10M Open  21 LVDS S2I- Chassis Instrument chassis > 10M Open  22 LVDS S2I+ Chassis Instrument chassis > 10M Open  23 NC Chassis Instrument chassis > 10M Open  24 LVDS S2I+ Chassis Instrument chassis > 10M Open  25 LVDS S2I+ Chassis Instrument chassis > 10M Open  26 CLK I2S- Chassis Instrument chassis > 10M Open  27 LVDS S2I+ Chassis Instrument chassis > 10M Open  28 LVDS S2I+ Chassis Instrument chassis > 10M Open  29 CLK I2S- Chassis Instrument chassis > 10M Open  20 CLK I2S- Chassis Instrument chassis > 10M Open  20 CLK I2S- Chassis Instrument chassis > 10M Open  21 LVDS S2I+ Chassis Instrument chassis > 10M Open  22 LVDS S2I+ Chassis Instrument chassis > 10M Open  23 NC Chassis Instrument chassis > 10M Open  24 LVDS S2I+ Chassis Instrument chassis > 10M Open  25 LVDS S2I+ Chassis Instrument chassis > 10M Open  26 LVDS S2I- Chassis Instrument chassis > 10M Open  27 LVDS S2I- Chassis Instrument chassis > 10M Open  28 LVDS S2I- Chassis Instrument chassis > 10M Open  29 LVDS | 10      | LVDS S2I-          | 22        | LVDS S2I+           | 50   |             |
| DGND   Chassis   Instrument chassis   C1   2.4 Graph   |         |                    | not cor   | nected (NC) pins    | <b>建筑为战场</b>   |             |
| CLK   ISS   Chassis   Instrument chassis   S   10M   Open  |         | DF 5000000         | Chassis   | Instrument chassis  | >10M   | Oper        |
| CLK   ISS   Chassis   Instrument chassis   S   10M   Open  | 3       |                    |           | Instrument chassis  |  | 2,10        |
| CLK   ISS   Chassis   Instrument chassis   S   10M   Open  |         | LVDS I2S-          | Chassis   | Instrument chassis  | >10M   | Oper        |
| 6CLK I2S+ChassisInstrument chassis> 10MOpen7CLK I2S+ChassisInstrument chassis> 10MOpen8LVDS S2I+ChassisInstrument chassis> 10MOpen9NCChassisInstrument chassis> 10MOpen10LVDS S2I-ChassisInstrument chassis> 10MOpen11DGND.ChassisInstrument chassis> 10MOpen12NCChassisInstrument chassis> 10MOpen14Nom. power returnChassisInstrument chassis> 10MOpen16LVDS I2S+ChassisInstrument chassis> 10MOpen17LVDS I2S+ChassisInstrument chassis> 10MOpen18NCChassisInstrument chassis> 10MOpen19CLK I2S-ChassisInstrument chassis> 10MOpen20CLK I2S-ChassisInstrument chassis> 10MOpen21LVDS S2I-ChassisInstrument chassis> 10MOpen22LVDS S2I+ChassisInstrument chassis> 10MOpen23NCChassisInstrument chassis> 10MOpen   | 5       | LVDS I2S-          | Chassis   | Instrument chassis  | >10M   | 0,50        |
| Solution    | 6       | CLK I2S+           | Chassis   | Instrument chassis  | >10M   | 0 pm        |
| Solution    | 7       | CLK I2S+           | Chassis   | Instrument chassis  | >10M   | Ope         |
| 10 LVDS S2I- Chassis Instrument chassis > 10M  11 DGND. Chassis Instrument chassis < 1  12 NC Chassis Instrument chassis > 10M  14 Nom. power return Chassis Instrument chassis 100k  16 LVDS I2S+ Chassis Instrument chassis > 10M  17 LVDS I2S+ Chassis Instrument chassis > 10M  18 NC Chassis Instrument chassis > 10M  19 CLK I2S- Chassis Instrument chassis > 10M  20 CLK I2S- Chassis Instrument chassis > 10M  21 LVDS S2I- Chassis Instrument chassis > 10M  22 LVDS S2I- Chassis Instrument chassis > 10M  23 NC Chassis Instrument chassis > 10M  24 LVDS S2I- Chassis Instrument chassis > 10M  25 LVDS S2I- Chassis Instrument chassis > 10M  26 Chassis Instrument chassis > 10M  27 Chassis Instrument chassis > 10M  28 LVDS S2I- Chassis Instrument chassis > 10M  29 DECEMBRITED OF THE PROPERTY OF THE PRO |         | LVDS S2I+          | Chassis   | Instrument chassis  | >10M   | O per       |
| 10 LVDS S2I- Chassis Instrument chassis > 10M  11 DGND. Chassis Instrument chassis < 1  12 NC Chassis Instrument chassis > 10M  14 Nom. power return Chassis Instrument chassis 100k  16 LVDS I2S+ Chassis Instrument chassis > 10M  17 LVDS I2S+ Chassis Instrument chassis > 10M  18 NC Chassis Instrument chassis > 10M  19 CLK I2S- Chassis Instrument chassis > 10M  20 CLK I2S- Chassis Instrument chassis > 10M  21 LVDS S2I- Chassis Instrument chassis > 10M  22 LVDS S2I- Chassis Instrument chassis > 10M  23 NC Chassis Instrument chassis > 10M  24 LVDS S2I- Chassis Instrument chassis > 10M  25 LVDS S2I- Chassis Instrument chassis > 10M  26 Chassis Instrument chassis > 10M  27 Chassis Instrument chassis > 10M  28 LVDS S2I- Chassis Instrument chassis > 10M  29 DECEMBRITED OF THE PROPERTY OF THE PRO | 9       | - A C 1997         |           | Instrument chassis  | >10M   | Ore         |
| NC Chassis Instrument chassis > 10M Ope 14 Nom. power return Chassis Instrument chassis 100k 99.9 kg 16 LVDS I2S+ Chassis Instrument chassis > 10M Ope 17 LVDS I2S+ Chassis Instrument chassis > 10M Ope 18 NC Chassis Instrument chassis > 10M Ope 19 CLK I2S- Chassis I1S- Chassis I1S- Chassis I1S- Chassis I1S- Chassis IIS- Chassis IIIS- Chassis IIIIS- Chassis IIIIS- Chassis IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII   | 10      | LVDS S2I-          | Chassis   | Instrument chassis  | >10M   | (2.1-       |
| 12 NC Chassis Instrument chassis > 10M Operated Nom. power return Chassis Instrument chassis 100k 99.9 kg. 16 LVDS I2S+ Chassis Instrument chassis > 10M Operated NC Chassis Instrument chassis > 10M Ope | 11      | DGND.              | Chassis   | Instrument chassis  | < 1  | 2,00        |
| Nom. power return Chassis Instrument chassis 100k 99.9 k.s.  16 LVDS I2S+ Chassis Instrument chassis >10M 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  | 12      | NC                 | Chassis   | Instrument chassis  | >10M   | Ope         |
| 16 LVDS I2S+ Chassis Instrument chassis > 10M  17 LVDS I2S+ Chassis Instrument chassis > 10M  18 NC Chassis Instrument chassis > 10M  19 CLK I2S- Chassis Instrument chassis > 10M  20 CLK I2S- Chassis Instrument chassis > 10M  21 LVDS S2I- Chassis Instrument chassis > 10M  22 LVDS S2I+ Chassis Instrument chassis > 10M  23 NC Chassis Instrument chassis > 10M  26  27  28  29  20  20  20  20  20  21  21  22  23  24  25  26  27  28  29  20  20  20  20  20  20  20  20  20   |         |                    | Chassis   | Instrument chassis  | 100k   |             |
| 17 LVDS 12S+ Chassis Instrument chassis > 10M OF 18 NC Chassis Instrument chassis > 10M OF 19 CLK 12S- Chassis Chassis Chastin  19 CLK 12S- Chassis Chastin  19 CLK 12S- Chast |         |                    |           | Instrument chassis  | >10M   |             |
| 19 CLK I2S- Chassis Instrument chassis > 10M Operation   20 CLK I2S- Chassis Instrument chassis > 10M Operation   21 LVDS S2I- Chassis Instrument chassis > 10M Operation   22 LVDS S2I+ Chassis Instrument chassis > 10M Operation   23 NC Chassis Instrument chassis > 10M Operation   26 NC Chassis Instrument chassis > 10M Operation   27 NC Chassis Instrument chassis > 10M Operation   28 NC Chassis Instrument chassis > 10M Operation   29 NC Chassis Instrument chassis > 10M Operation   20 NC Chassis Instrument chassis > 10M Operation   20 NC Chassis Instrument chassis > 10M Operation   21 NC Chassis Instrument chassis > 10M Operation   22 NC Chassis Instrument chassis > 10M Operation   23 NC Chassis Instrument chassis > 10M Operation   24 NC Chassis Instrument chassis > 10M Operation   25 NC Chassis Instrument chassis > 10M Operation   26 NC Chassis Instrument chassis > 10M Operation   27 NC Chassis Instrument chassis > 10M Operation   28 NC Chassis Instrument chassis > 10M Operation   29 NC Chassis Instrument chassis > 10M Operation   20 NC Chassis Chassi | 10.000  |                    | Chassis   | Instrument chassis  | >10M   | op          |
| 19 CLK I2S- Chassis Instrument chassis > 10M Operation   20 CLK I2S- Chassis Instrument chassis > 10M Operation   21 LVDS S2I- Chassis Instrument chassis > 10M Operation   22 LVDS S2I+ Chassis Instrument chassis > 10M Operation   23 NC Chassis Instrument chassis > 10M Operation   26 NC Chassis Instrument chassis > 10M Operation   27 NC Chassis Instrument chassis > 10M Operation   28 NC Chassis Instrument chassis > 10M Operation   29 NC Chassis Instrument chassis > 10M Operation   20 NC Chassis Instrument chassis > 10M Operation   20 NC Chassis Instrument chassis > 10M Operation   21 NC Chassis Instrument chassis > 10M Operation   22 NC Chassis Instrument chassis > 10M Operation   23 NC Chassis Instrument chassis > 10M Operation   24 NC Chassis Instrument chassis > 10M Operation   25 NC Chassis Instrument chassis > 10M Operation   26 NC Chassis Instrument chassis > 10M Operation   27 NC Chassis Instrument chassis > 10M Operation   28 NC Chassis Instrument chassis > 10M Operation   29 NC Chassis Instrument chassis > 10M Operation   20 NC Chassis Chassi | 18      | NC                 | Chassis   | Instrument chassis  | >10M   | 0~          |
| 21 LVDS S2I- Chassis Instrument chassis > 10M  | 19      | CLK I2S-           | Chassis   | Instrument chassis  | >10M   | Open        |
| 22 LVDS S2I+ Chassis Instrument chassis > 10M OCC S1 NC Chassis   10M OCC S1 NC Chassis  | 20      |                    | Chassis   | Instrument chassis  | >10M   | O'pe        |
| 23 NC Chassis Instrument chassis > 10M   | 21      | LVDS S2I-          | Chassis   | Instrument chassis  | >10M   | 0-          |
|  | 22      | LVDS S2I+          | Chassis   | Instrument chassis  | >10M   | 00          |
| 25 Red. power return Chassis Instrument chassis 100k 99.3k.a.  | 23      | NC                 | Chassis   | Instrument chassis  | >10M   | Open        |
|  | 25      | Red. power return  | Chassis   | Instrument chassis  | 100k   | 99.3 ka     |



Reference:

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#### 4.4 Abbreviated Safe-to-Mate Test and Power Consumption Check

The abbreviated safe-to-mate test shall be performed before the first connection of EGSE to the unit and after transport of the EGSE.

| MDM25    |                    |           |                  |                |               |
|----------|--------------------|-----------|------------------|----------------|---------------|
| Pin (+)  | Signal             | Pin (-)   | Signal           | Expected [V]   | Measurement   |
| 1        | Nom. power         | 14        | Nom. power ret.  | 28 or 0 *      |               |
| 13       | Red. power         | 25        | Red. power ret.  | 28 or 0 *      |               |
| * 28V ex | spected if connect | ed to the | corresponding NO | M or RED port, | 0V otherwise. |
| any      | other pin          | 15        | Chassis gnd      | < 3            |               |
| MDM15    |                    |           |                  |                |               |
| 1        | Thermistor 1       | 9         | Thermistor 1     | tbd by ADS *   |               |
| 2        | Thermistor 2       | 10        | Thermistor 2     | tbd by ADS *   |               |
| 3        | Thermistor 3       | 11        | Thermistor 3     | tbd by ADS *   |               |
| 7        | Surv Heaters 1     | 14        | Surv Heaters 1   | 28             |               |
| 8        | Surv Heaters 2     | 15        | Surv Heaters 2   | 28             |               |

<sup>\*</sup> Voltage and polarity to be defined by ADS, a constant voltage lower than 28 V is expected.

After successful safe-to-mate test, the unit can be powered. The power consumption of the unit is not supposed to change significantly. When powered, the unit shall drain about  $110\,\text{mA}$  at  $28\,\text{V}$ , so about  $3.1\,\text{W}$ . The current limitation of the power supply shall be set to  $500\,\text{mA}$ . Document the power consumption as part of the standard procedure. This condition resembles the "Unit unconfigured" as per the table below. After configuration of the sensors, the total power consumption is expected to increase to  $110\,\text{mA} \pm 5\,\text{mA}$ . For the unconfigured unit (after power ON), or after a "reset"-command after communication has been established:

current conit still set at 350 mA

| Parameter | Expected                        | Measured   |           |
|-----------|---------------------------------|------------|-----------|
| Voltage   | 28.0 V                          | 27.9 V     |           |
| Current   | $107\mathrm{mA}\pm5\mathrm{mA}$ | 0.10 A Nom | 0.10 ARED |

1821

To define the units power consumption under the different operational modes and under different supply voltages, document the power consumption under the conditions as given below. This part of the procedure is required to be conducted only once!

| Condition                   | 28.0 V | Current | 26.0 V | Current | 29.0 V | Current |
|-----------------------------|--------|---------|--------|---------|--------|---------|
| Unit unconfigured           |        |         |        |         |        |         |
| (after POWER ON)            |        |         |        |         |        |         |
| Unit in HK mode             |        |         |        |         |        |         |
|                             |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (low activity)              |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (high activity, testpulser) |        |         |        |         |        |         |

NOM: SFT passed, Thresholds the Kirlgrod, IdeFix2 good, passed.
NOMINAL mode

1



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### 4.9 As Run Functional Test Report

| Date and Time 2017-01-26 | 1810 |  |
|--------------------------|------|--|
|--------------------------|------|--|

#### 4.9.1 Functional Test Readiness

| Location             |                              |
|----------------------|------------------------------|
| Personnel            |                              |
| Instrument ID        |                              |
| Firmware revision    | D. A                         |
| Reason for FT        | Repeated LLSS Follown RANDOW |
| Test to be performed |                              |

| Safe-to-mate           |  |
|------------------------|--|
| Impedance check        |  |
| Set up communication   |  |
| Additional constraints |  |



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#### 4.3 Unit Impedance Check

After transport, before the first connection to the EGSE, and after tests with higher risks to damage the unit the impedances of the unit shall be measured and compared with the expected values as given in the table (based on RD-1):

| MDM15              |         |         |                     |             |
|--------------------|---------|---------|---------------------|-------------|
| Name               | Pin (+) | Pin (-) | Expected $[\Omega]$ | Measurement |
| Thermistor 1       | 1       | 9       | 15k to 20k *        | 16.2ks      |
| Thermistor 2       | 2       | 10      | 15k to 20k *        | 16,0765     |
| Thermistor 3       | 3       | 11      | 15k to 20k *        | 16.10 lcs   |
| Survival Heaters 1 | 7       | 14      | 119                 | 120,50      |
| Survival Heaters 2 | 8       | 15      | 119                 | 121.52      |

<sup>\*</sup> See figure below, all thermistors are supposed to show similar results depending on the unit's temperature.

| Temp. °C | Ohms      |
|----------|-----------|
|          |           |
| -60      | 1,342,000 |
| -55      | 957,000   |
| -50      | 690,000   |
| -45      | 503,700   |
| -40      | 371,300   |
| -35      | 276,200   |
| -30      | 207,500   |
| -25      | 157,200   |
| -20      | 120,100   |
| -15      | 92,600    |
| -10      | 71,940    |
| -5       | 56,310    |
| 0        | 44,420    |
| 2        | 40,490    |
| 4        | 36,930    |
| 6        | 33,740    |
| 8        | 30,840    |
| 10       | 28,230    |
| 12       | 25,860    |
| 14       | 23,720    |
| 16       | 21,780    |
| 18       | 20,010    |

| Temp. °C | Ohms   |
|----------|--------|
|          |        |
| 20       | 18,410 |
| 22       | 16,950 |
| 24       | 15,620 |
| 25       | 15,000 |
| 26       | 14,410 |
| 28       | 13,310 |
| 30       | 12,300 |
| 32       | 11,370 |
| 34       | 10,530 |
| 36       | 9,756  |
| 38       | 9,047  |
| 40       | 8,397  |
| 42       | 7,800  |
| 44       | 7,253  |
| 46       | 6,747  |
| 48       | 6,282  |
| 50       | 5,855  |
| 52       | 5,460  |
| 54       | 5,096  |
| 56       | 4,758  |
| 58       | 4,448  |
| 60       | 4,160  |

Figure 3: Thermistor resistivities for various temperatures, taken from the thermistor's datasheet



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| Pin (+)   Signal   Pin (-)   Signal   Expected [Ω]   Measurement   | MDM25   |                    | 1000      |                     |                  |                   |
|--|---------|--------------------|-----------|---------------------|------------------|-------------------|
| Nominal power lines and grounding  | Pin (+) | Signal             | Pin (-)   | Signal              | Expected [Q]     | Measurement       |
| Chassis         Instrument chassis         15         Chassis gnd         <1         7,4 €           Chassis         Instrument chassis         24         Chassis gnd         <1  |         |                    |           |                     | ng [25]          | Widdsur erriterit |
| Chassis         Instrument chassis         24         Chassis gnd         < 1         1, e.g.           Chassis         Instrument chassis         1         Nom. power         > 10M         opr           14         Nom. power return         1         Nom. power         > 10M         opr           Redundant power lines           Chassis         Instrument chassis         13         Red. power         > 10M         opr           Nominal communication lines           4         LVDS I2S-         16         LVDS I2S-         100         to 3. f a.g.           6         CLK I2S+         19         CLK I2S-         100         to 3. f a.g.           8         LVDS S2I+         21         LVDS S2I-         50         52. f a.g.           8         LVDS I2S-         17         LVDS I2S+         100         to 3. f a.g.           9         NC         CLK I2S+         20         CLK I2S-         100         to 3. f a.g.           10         LVDS S2I-         22         LVDS S2I+         50         52. f a.g.           10         LVDS I2S-         Chassis         Instrument chassis         > 10M         p.g.           3         DGND   | Chassis |                    |           |                     |                  | 1.40              |
| Chassis   Instrument chassis   1   | Chassis | Instrument chassis | 24        |                     |                  |                   |
| Nom. power return   1  | Chassis | Instrument chassis | 1         |                     |                  | 103               |
| Chassis  | 14      | Nom. power return  | 1         |                     |                  | 0,00              |
| Chassis   Instrument chassis   13  |         | HA IN THE RES      | Redui     |                     |                  | og-               |
| Red. power return   13   | Chassis | Instrument chassis |           |                     | >10M             | me.               |
| A  | 25      | Red. power return  | 13        | Red. power          |                  | Ole               |
| 4 LVDS 12S- 16 LVDS 12S+ 100 103, 4 π 6 CLK 12S+ 19 CLK 12S- 100 103, 4 π 8 LVDS 52I+ 21 LVDS 52I- 50 52 · 7 α  Redundant communication lines  5 LVDS 12S- 17 LVDS 12S+ 100 103. 7 π 7 CLK 12S+ 20 CLK 12S- 100 103. 7 π 10 LVDS 52I- 22 LVDS 52I+ 50 52. 7 π  10 LVDS 52I- 22 LVDS 52I+ 50 52. 7 π  10 LVDS 12S- 12 LVDS 52I+ 50 52. 7 π  11 LVDS 12S- Chassis Instrument chassis > 10M 2 μπ 15 LVDS 12S- Chassis Instrument chassis > 10M 2 μπ 16 CLK 12S+ Chassis Instrument chassis > 10M 2 μπ 17 CLK 12S+ Chassis Instrument chassis > 10M 2 μπ 18 LVDS 52I- Chassis Instrument chassis > 10M 2 μπ 10 LVDS 52I- Chassis Instrument chassis > 10M 2 μπ 11 DGND. Chassis Instrument chassis > 10M 2 μπ 11 DGND. Chassis Instrument chassis > 10M 2 μπ 11 DGND. Chassis Instrument chassis > 10M 2 μπ 11 DGND. Chassis Instrument chassis > 10M 2 μπ 11 DGND. Chassis Instrument chassis > 10M 2 μπ 11 DGND. Chassis Instrument chassis > 10M 2 μπ 11 DGND. Chassis Instrument chassis > 10M 2 μπ 11 DGND. Chassis Instrument chassis > 10M 2 μπ 11 DGND. Chassis Instrument chassis > 10M 2 μπ 11 DGND. Chassis Instrument chassis > 10M 2 μπ 11 DGND. Chassis Instrument chassis > 10M 2 μπ 11 DGND. Chassis Instrument chassis > 10M 2 μπ 11 DGND. Chassis Instrument chassis > 10M 2 μπ 11 DGND. Chassis Instrument chassis > 10M 2 μπ 11 DGND. Chassis Instrument chassis > 10M 2 μπ 11 DGND. Chassis Instrument chassis > 10M 2 μπ 11 DGND. Chassis Instrument chassis > 10M 2 μπ 11 DGND. Chassis Instrument chassis > 10M 2 μπ 11 DGND. Chassis Instrument chassis > 10M 2 μπ 11 LVDS 12S+ Chassis Instrument chassis > 10M 2 μπ 12 NC Chassis Instrument chassis > 10M 2 μπ 13 LVDS 12S+ Chassis Instrument chassis > 10M 2 μπ 14 Nom. power return Chassis Instrument chassis > 10M 2 μπ 15 LVDS 12S+ Chassis Instrument chassis > 10M 2 μπ 16 LVDS 12S+ Chassis Instrument chassis > 10M 2 μπ 17 LVDS 12S+ Chassis Instrument chassis > 10M 2 μπ 18 NC Chassis Instrument chassis > 10M 2 μπ 19 CLK 12S- Chassis Instrument chassis > 10M 2 μπ 10 CLK 12S- Chassis Instrument chassis > 10M 2 μπ 10 CLK 12S- Cha  |         |                    | Nominal   |                     |                  |                   |
| Second Color   Seco   | 4       | LVDS I2S-          |           |                     | 100              | 103.40            |
| Redundant communication lines  | 6       | CLK I2S+           | 19        | CLK I2S-            | 100              |                   |
| Redundant communication lines  5 LVDS I2S- 17 LVDS I2S+ 100 /03.7 a. 7 CLK I2S+ 20 CLK I2S- 100 /03.7 a. 10 LVDS S2I- 22 LVDS S2I+ 50 52.7 a.  10 LVDS S2I- 22 LVDS S2I+ 50 52.7 a.  10 LVDS S2I- 22 LVDS S2I+ 50 52.7 a.  11 DGND Chassis Instrument chassis > 10M 0pm  12 NC Chassis Instrument chassis > 10M 0pm  13 DGND Chassis Instrument chassis > 10M 0pm  14 LVDS I2S- Chassis Instrument chassis > 10M 0pm  15 LVDS I2S- Chassis Instrument chassis > 10M 0pm  16 CLK I2S+ Chassis Instrument chassis > 10M 0pm  17 CLK I2S+ Chassis Instrument chassis > 10M 0pm  18 LVDS S2I+ Chassis Instrument chassis > 10M 0pm  10 LVDS S2I- Chassis Instrument chassis > 10M 0pm  11 DGND. Chassis Instrument chassis > 10M 0pm  12 NC Chassis Instrument chassis > 10M 0pm  14 Nom. power return Chassis Instrument chassis > 10M 0pm  16 LVDS I2S+ Chassis Instrument chassis > 10M 0pm  17 LVDS I2S+ Chassis Instrument chassis > 10M 0pm  18 NC Chassis Instrument chassis > 10M 0pm  19 CLK I2S- Chassis Instrument chassis > 10M 0pm  19 CLK I2S- Chassis Instrument chassis > 10M 0pm  20 CLK I2S- Chassis Instrument chassis > 10M 0pm  21 LVDS S2I- Chassis Instrument chassis > 10M 0pm  22 LVDS S2I- Chassis Instrument chassis > 10M 0pm  23 NC Chassis Instrument chassis > 10M 0pm  24 DAME OF Chassis Instrument chassis > 10M 0pm  25 DAME OF Chassis Instrument chassis > 10M 0pm  26 DAME OF Chassis Instrument chassis > 10M 0pm  27 DAME OF Chassis Instrument chassis > 10M 0pm  28 DAME OF Chassis Instrument chassis > 10M 0pm  29 DAME OF Chassis Instrument chassis > 10M 0pm  20 CLK I2S- Chassis Instrument chassis > 10M 0pm  20 CLK I2S- Chassis Instrument chassis > 10M 0pm  20 DAME OF Chassis Instrument chassis > 10M 0pm  21 LVDS S2I- Chassis Instrument chassis > 10M 0pm  22 LVDS S2I- Chassis Instrument chassis > 10M 0pm   | 8       | LVDS S2I+          | 21        | LVDS S2I-           | Translation Cape |                   |
| 7 CLK I2S+ 20 CLK I2S- 100 10 70 3.7 20 10 LVDS S2I- 22 LVDS S2I+ 50 52.7 10  not connected (NC) pins  2 NC Chassis Instrument chassis > 10M 0pm  3 DGND Chassis Instrument chassis > 10M 0pm  4 LVDS I2S- Chassis Instrument chassis > 10M 0pm  5 LVDS I2S- Chassis Instrument chassis > 10M 0pm  6 CLK I2S+ Chassis Instrument chassis > 10M 0pm  7 CLK I2S+ Chassis Instrument chassis > 10M 0pm  8 LVDS S2I+ Chassis Instrument chassis > 10M 0pm  9 NC Chassis Instrument chassis > 10M 0pm  10 LVDS S2I- Chassis Instrument chassis > 10M 0pm  11 DGND. Chassis Instrument chassis > 10M 0pm  12 NC Chassis Instrument chassis > 10M 0pm  14 Nom. power return Chassis Instrument chassis > 10M 0pm  16 LVDS I2S+ Chassis Instrument chassis > 10M 0pm  17 LVDS I2S+ Chassis Instrument chassis > 10M 0pm  18 NC Chassis Instrument chassis > 10M 0pm  19 CLK I2S- Chassis Instrument chassis > 10M 0pm  19 CLK I2S- Chassis Instrument chassis > 10M 0pm  20 CLK I2S- Chassis Instrument chassis > 10M 0pm  21 LVDS S2I- Chassis Instrument chassis > 10M 0pm  22 LVDS S2I- Chassis Instrument chassis > 10M 0pm  23 NC Chassis Instrument chassis > 10M 0pm  24 Chassis Instrument chassis > 10M 0pm  25 LVDS S2I- Chassis Instrument chassis > 10M 0pm  26 CLK I2S- Chassis Instrument chassis > 10M 0pm  27 CLK I2S- Chassis Instrument chassis > 10M 0pm  28 CLK I2S- Chassis Instrument chassis > 10M 0pm  29 CLK I2S- Chassis Instrument chassis > 10M 0pm  20 CLK I2S- Chassis Instrument chassis > 10M 0pm  20 CLK I2S- Chassis Instrument chassis > 10M 0pm  20 CLK I2S- Chassis Instrument chassis > 10M 0pm  20 CLK I2S- Chassis Instrument chassis > 10M 0pm  20 CLK I2S- Chassis Instrument chassis > 10M 0pm  |         | <b>经验</b>          | Redundant | communication lines |                  |                   |
| CLK  | 5       | LVDS I2S-          | 17        | LVDS I2S+           | 100              | 103 7 0-          |
| Description      | 7       | CLK I2S+           | 20        | CLK I2S-            | 100              | 103.70            |
| NC Chassis Instrument chassis > 10M Open    Description   Description   Description  | 10      | LVDS S2I-          | 22        | LVDS S2I+           |                  | 100               |
| NC   Chassis   Instrument chassis   > 10M   Open   |         |                    | not cor   | nnected (NC) pins   |                  |                   |
| DGND   Chassis   Instrument chassis   1,4 ca   |         | NC                 |           |                     | >10M             | Bren              |
| LVDS I2S-   Chassis   Instrument chassis   > 10M   Quality   | 3       | DGND               | Chassis   | Instrument chassis  |                  |                   |
| CLK I2S+ Chassis Instrument chassis > 10M Openant CLX I2S- Chassis Instrument Chassis > 10M Openant Chassis   10M  | 4       |                    | Chassis   | Instrument chassis  | >10M             |                   |
| CLK I2S+ Chassis Instrument chassis > 10M Opcomb SI  | 5       | LVDS I2S-          | Chassis   | Instrument chassis  | >10M             | one               |
| 9 NC Chassis Instrument chassis > 10M 10 LVDS S2I- Chassis Instrument chassis > 10M 11 DGND. Chassis Instrument chassis > 10M 12 NC Chassis Instrument chassis > 10M 14 Nom. power return Chassis Instrument chassis > 10M 15 LVDS I2S+ Chassis Instrument chassis > 10M 16 LVDS I2S+ Chassis Instrument chassis > 10M 17 LVDS I2S+ Chassis Instrument chassis > 10M 18 NC Chassis Instrument chassis > 10M 19 CLK I2S- Chassis Instrument chassis > 10M 20 CLK I2S- Chassis Instrument chassis > 10M 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I+ Chassis Instrument chassis > 10M 23 NC Chassis Instrument chassis > 10M 24 Chassis Instrument chassis > 10M 25 Pod Payer return Chassis Instrument chassis > 10M 26 Chassis Instrument chassis > 10M 27 Chassis Instrument chassis > 10M 28 Chassis Instrument chassis > 10M 29 Chassis Instrument chassis > 10M 20 Chassis Instrument chassis > 10M 21 Chassis Instrument chassis > 10M 22 Chassis Instrument chassis > 10M 23 NC 24 Chassis Instrument chassis > 10M 25 Chassis Instrument chassis > 10M 26 Chassis Instrument chassis > 10M 27 Chassis Instrument chassis > 10M 28 Chassis Instrument chassis > 10M 29 Chassis Instrument chassis > 10M 20 Chassis Instrument chassis > 10M 20 Chassis Instrument chassis > 10M 21 Chassis Instrument chassis > 10M 22 Chassis Instrument chassis > 10M 23 Chassis Instrument chassis > 10M 24 Chassis Instrument chassis > 10M  | 6       | CLK I2S+           | Chassis   | Instrument chassis  | >10M             | Dr.               |
| 9 NC Chassis Instrument chassis > 10M 10 LVDS S2I- Chassis Instrument chassis > 10M 11 DGND. Chassis Instrument chassis > 10M 12 NC Chassis Instrument chassis > 10M 14 Nom. power return Chassis Instrument chassis > 10M 15 LVDS I2S+ Chassis Instrument chassis > 10M 16 LVDS I2S+ Chassis Instrument chassis > 10M 17 LVDS I2S+ Chassis Instrument chassis > 10M 18 NC Chassis Instrument chassis > 10M 19 CLK I2S- Chassis Instrument chassis > 10M 20 CLK I2S- Chassis Instrument chassis > 10M 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I+ Chassis Instrument chassis > 10M 23 NC Chassis Instrument chassis > 10M 24 Chassis Instrument chassis > 10M 25 Pod Payer return Chassis Instrument chassis > 10M 26 Chassis Instrument chassis > 10M 27 Chassis Instrument chassis > 10M 28 Chassis Instrument chassis > 10M 29 Chassis Instrument chassis > 10M 20 Chassis Instrument chassis > 10M 21 Chassis Instrument chassis > 10M 22 Chassis Instrument chassis > 10M 23 NC 24 Chassis Instrument chassis > 10M 25 Chassis Instrument chassis > 10M 26 Chassis Instrument chassis > 10M 27 Chassis Instrument chassis > 10M 28 Chassis Instrument chassis > 10M 29 Chassis Instrument chassis > 10M 20 Chassis Instrument chassis > 10M 20 Chassis Instrument chassis > 10M 21 Chassis Instrument chassis > 10M 22 Chassis Instrument chassis > 10M 23 Chassis Instrument chassis > 10M 24 Chassis Instrument chassis > 10M  |         | CLK I2S+           | Chassis   | Instrument chassis  | >10M             | Ope               |
| 10 LVDS S2I- Chassis Instrument chassis > 10M  11 DGND. Chassis Instrument chassis < 1  12 NC Chassis Instrument chassis > 10M  14 Nom. power return Chassis Instrument chassis 100k  16 LVDS I2S+ Chassis Instrument chassis > 10M  17 LVDS I2S+ Chassis Instrument chassis > 10M  18 NC Chassis Instrument chassis > 10M  19 CLK I2S- Chassis Instrument chassis > 10M  20 CLK I2S- Chassis Instrument chassis > 10M  21 LVDS S2I- Chassis Instrument chassis > 10M  22 LVDS S2I+ Chassis Instrument chassis > 10M  23 NC Chassis Instrument chassis > 10M  24 Chassis Instrument chassis > 10M  25 Pod Payror return Chassis Instrument chassis > 10M  26 Chassis Instrument chassis > 10M  27 Chassis Instrument chassis > 10M  28 Chassis Instrument chassis > 10M  29 Chassis Instrument chassis > 10M  20 Chassis Instrument chassis > 10M  21 Chassis Instrument chassis > 10M  22 Chassis Instrument chassis > 10M  23 NC  24 Chassis Instrument chassis > 10M  25 Chassis Instrument chassis > 10M  26 Chassis Instrument chassis > 10M  27 Chassis Instrument chassis > 10M  28 Chassis Instrument chassis > 10M  29 Chassis Instrument chassis > 10M  20 Chassis Instrument chassis > 10M  21 Chassis Instrument chassis > 10M  22 Chassis Instrument chassis > 10M  23 Chassis Instrument chassis > 10M   |         | LVDS S2I+          | Chassis   | Instrument chassis  | >10M             | Oran              |
| 11 DGND. Chassis Instrument chassis <1 1.3 st  12 NC Chassis Instrument chassis >10M Open  14 Nom. power return Chassis Instrument chassis 100k 99 9 ca  16 LVDS I2S+ Chassis Instrument chassis >10M Open  17 LVDS I2S+ Chassis Instrument chassis >10M Open  18 NC Chassis Instrument chassis >10M Open  19 CLK I2S- Chassis Instrument chassis >10M Open  20 CLK I2S- Chassis Instrument chassis >10M Open  21 LVDS S2I- Chassis Instrument chassis >10M Open  22 LVDS S2I+ Chassis Instrument chassis >10M Open  23 NC Chassis Instrument chassis >10M Open  25 Pod power return Chassis Instrument chassis >10M Open  26 Pod power return Chassis Instrument chassis >10M Open  27 Pod power return Chassis Instrument chassis >10M Open  28 Pod power return Chassis Instrument chassis >10M Open  29 Pod power return Chassis Instrument chassis >10M Open  20 Pod power return Chassis Instrument chassis >10M Open  21 Pod power return Chassis Instrument chassis >10M Open  22 Pod power return Chassis Instrument chassis >10M Open  23 Pod power return Chassis Instrument chassis >10M Open  24 Pod power return Chassis Instrument chassis >10M Open  25 Pod power return Chassis Instrument chassis >10M Open  26 Pod power return Chassis Instrument chassis >10M Open  27 Pod power return Chassis Instrument chassis >10M Open  28 Pod power return Chassis Instrument chassis >10M Open  29 Pod power return Chassis Instrument chassis >10M Open  20 Pod power return Chassis Instrument chassis >10M Open  20 Pod power return Chassis Instrument chassis >10M Open  21 Pod power return Chassis Instrument chassis >10M Open  22 Pod power return Chassis Instrument chassis >10M Open  25 Pod power return Chassis Instrument chassis >10M Open  26 Pod power return Chassis Instrument chassis >10M Open  27 Pod power return Chassis Instrument chassis >10M Open  28 Pod power return Chassis Instrument chassis >10M Open  29 Pod power return Chassis Instrument chassis >10M Open  20 Pod power return Chassis Instrument chassis >10M Open  20 Pod power return Chassis Instrument chassis >10M | 9       |                    | Chassis   | Instrument chassis  | >10M             | Guer              |
| 11 DGND. Chassis Instrument chassis <1 1.3 a  12 NC Chassis Instrument chassis >10M  14 Nom. power return Chassis Instrument chassis 100k  16 LVDS I2S+ Chassis Instrument chassis >10M  17 LVDS I2S+ Chassis Instrument chassis >10M  18 NC Chassis Instrument chassis >10M  19 CLK I2S- Chassis Instrument chassis >10M  20 CLK I2S- Chassis Instrument chassis >10M  21 LVDS S2I- Chassis Instrument chassis >10M  22 LVDS S2I+ Chassis Instrument chassis >10M  23 NC Chassis Instrument chassis >10M  24 Chassis Instrument chassis >10M  25 Pod Power return Chassis Instrument chassis >10M  26 Chassis Instrument chassis >10M  27 Chassis Instrument chassis >10M  28 Ded Power return Chassis Instrument chassis >10M  29 Chassis Instrument chassis >10M  20 Chassis Instrument chassis >10M  21 Chassis Instrument chassis >10M  22 Chassis Instrument chassis >10M  23 Ded Power return Chassis Instrument chassis >10M  24 Chassis Instrument chassis >10M  25 Chassis Instrument chassis >10M  26 Chassis Instrument chassis >10M  27 Chassis Instrument chassis >10M  28 Chassis Instrument chassis >10M  29 Chassis Instrument chassis >10M  20 Chassis Instrument chassis >10M  20 Chassis Instrument chassis >10M  21 Chassis Instrument chassis >10M   |         |                    | Chassis   | Instrument chassis  | >10M             | Du                |
| 12 NC Chassis Instrument chassis > 10M  14 Nom. power return Chassis Instrument chassis 100k  16 LVDS I2S+ Chassis Instrument chassis > 10M  17 LVDS I2S+ Chassis Instrument chassis > 10M  18 NC Chassis Instrument chassis > 10M  19 CLK I2S- Chassis Instrument chassis > 10M  20 CLK I2S- Chassis Instrument chassis > 10M  21 LVDS S2I- Chassis Instrument chassis > 10M  22 LVDS S2I+ Chassis Instrument chassis > 10M  23 NC Chassis Instrument chassis > 10M  24 Chassis Instrument chassis > 10M  25 Pod power return Chassis Instrument chassis > 10M  26 Pod power return Chassis Instrument chassis > 10M  |         |                    | Chassis   | Instrument chassis  | < 1              | 1.35              |
| Nom. power return Chassis Instrument chassis 100k 16 LVDS I2S+ Chassis Instrument chassis > 10M 17 LVDS I2S+ Chassis Instrument chassis > 10M 18 NC Chassis Instrument chassis > 10M 19 CLK I2S- Chassis  |         | 2020 10            | Chassis   | Instrument chassis  | >10M             |                   |
| 16 LVDS I2S+ Chassis Instrument chassis > 10M  17 LVDS I2S+ Chassis Instrument chassis > 10M  18 NC Chassis Instrument chassis > 10M  19 CLK I2S- Chassis Instrument chassis > 10M  20 CLK I2S- Chassis Instrument chassis > 10M  21 LVDS S2I- Chassis Instrument chassis > 10M  22 LVDS S2I+ Chassis Instrument chassis > 10M  23 NC Chassis Instrument chassis > 10M  24 Chassis Instrument chassis > 10M  25 Pod payer return Chassis Instrument chassis > 10M  |         | Nom. power return  | Chassis   | Instrument chassis  | 100k             |                   |
| 17 LVDS I2S+ Chassis Instrument chassis > 10M Ome 18 NC Chassis Instrument chassis > 10M Ome 19 CLK I2S- Chassis Instrument chassis > 10M Ome 20 CLK I2S- Chassis Instrument chassis > 10M Ome 21 LVDS S2I- Chassis Instrument chassis > 10M Ome 22 LVDS S2I+ Chassis Instrument chassis > 10M Ome 23 NC Chassis Instrument chassis > 10M Ome 24 Chassis Instrument chassis > 10M Ome 25 Pod Power return Chassis Instrument chassis > 10M Ome 18 Chassis Inst |         | LVDS I2S+          | Chassis   | Instrument chassis  | >10M             |                   |
| 19 CLK I2S- Chassis Instrument chassis > 10M Cyc  20 CLK I2S- Chassis Instrument chassis > 10M Cyc  21 LVDS S2I- Chassis Instrument chassis > 10M Cyc  22 LVDS S2I+ Chassis Instrument chassis > 10M Cyc  23 NC Chassis Instrument chassis > 10M Cyc  26 Pod power return Chassis Instrument chassis > 10M Cyc  27 Pod power return Chassis Instrument chassis > 10M Cyc  28 Pod power return Chassis Instrument chassis > 10M Cyc  29 Pod power return Chassis Instrument chassis > 10M Cyc  20 Pod power return Chassis Instrument chassis > 10M Cyc  21 Pod power return Chassis Instrument chassis > 10M Cyc  22 Pod power return Chassis Instrument chassis > 10M Cyc  23 Pod power return Chassis Instrument chassis > 10M Cyc  25 Pod power return Chassis Instrument chassis > 10M Cyc  26 Pod power return Chassis Instrument chassis > 10M Cyc  27 Pod power return Chassis Instrument chassis > 10M Cyc  28 Pod power return Chassis Instrument chassis > 10M Cyc  29 Pod power return Chassis Instrument chassis > 10M Cyc  20 Pod power return Chassis Instrument chassis > 10M Cyc  20 Pod power return Chassis Instrument chassis > 10M Cyc  20 Pod power return Chassis Instrument chassis > 10M Cyc  20 Pod power return Chassis Instrument chassis > 10M Cyc  20 Pod power return Chassis Instrument chassis > 10M Cyc  20 Pod power return Chassis Instrument chassis > 10M Cyc  20 Pod power return Chassis Instrument chassis > 10M Cyc  20 Pod power return Chassis Instrument chassis > 10M Cyc  20 Pod power return Chassis Instrument chassis > 10M Cyc  20 Pod power return Chassis Instrument chassis > 10M Cyc  21 Pod power return Chassis Instrument chassis > 10M Cyc  22 Pod power return Chassis Instrument chassis > 10M Cyc  23 Pod power return Chassis Instrument chassis > 10M Cyc  24 Pod power return Chassis Instrument chassis > 10M Cyc  25 Pod power return Chassis Instrument chassis > 10M Cyc  26 Pod power return Chassis Instrument chassis > 10M Cyc  27 Pod power return Chassis Instrument chassis > 10M Cyc  28 Pod power return Chassis Instrument chassis > 10M Cyc  29 |         |                    | Chassis   | Instrument chassis  | >10M             | One               |
| 20 CLK I2S- Chassis Instrument chassis > 10M Operation   21 LVDS S2I- Chassis Instrument chassis > 10M Cuparation   22 LVDS S2I+ Chassis Instrument chassis > 10M Operation   23 NC Chassis Instrument chassis > 10M Operation   25 Ped power return Chassis Instrument chassis > 10M Operation   26 Ped power return Chassis Instrument chassis > 10M Operation   26 Ped power return Chassis Instrument chassis > 10M Operation   27 Ped power return Chassis Instrument chassis > 10M Operation   28 Ped power return Chassis Instrument chassis > 10M Operation   29 Ped power return Chassis Instrument chassis > 10M Operation   20 Ped power return Chassis Instrument chassis > 10M Operation   20 Ped power return Chassis Instrument chassis > 10M Operation   21 Ped power return Chassis Instrument chassis > 10M Operation   22 Ped power return Chassis Instrument chassis > 10M Operation   23 Ped power return Chassis Instrument chassis > 10M Operation   24 Ped power return Chassis Instrument chassis > 10M Operation   25 Ped power return Chassis Instrument chassis > 10M Operation   26 Ped power return Chassis Instrument chassis > 10M Operation   27 Ped power return Chassis Instrument chassis > 10M Operation   28 Ped power return Chassis Instrument chassis > 10M Operation   29 Ped power return Chassis Instrument chassis > 10M Operation   29 Ped power return Chassis Instrument chassis > 10M Operation   20 Ped power return Chassis Instrument chassis > 10M Operation   20 Ped power return Chassis Instrument chassis > 10M Operation   20 Ped power return Chassis Instrument chassis > 10M Operation   20 Ped power return Chassis Instrument chassis > 10M Operation   20 Ped power return Chassis Instrument chassis > 10M Operation   20 Ped power return Chassis Instrument chassis > 10M Operation   20 Ped power return Chassis Instrument chassis > 10M Operation   20 Ped power return Chassis Instrument chassis > 10M Operation   20 Ped power return Chassis Instrument chassis > 10M Operation   20 Ped power return chassis   20 Ped power return chassis   20 Ped | 18      | NC                 | Chassis   | Instrument chassis  | >10M             | Ch                |
| 20 CLK I2S- Chassis Instrument chassis > 10M 21 LVDS S2I- Chassis Instrument chassis > 10M 22 LVDS S2I+ Chassis Instrument chassis > 10M 23 NC Chassis Instrument chassis > 10M 25 Pod power return Chassis Instrument chassis > 10M   |         | CLK I2S-           | Chassis   | Instrument chassis  | > 10M            | Epr               |
| 21 LVDS S2I- Chassis Instrument chassis > 10M  22 LVDS S2I+ Chassis Instrument chassis > 10M  23 NC Chassis Instrument chassis > 10M  25 Pod power return Chassis Instrument chassis > 10M   |         |                    | Chassis   | Instrument chassis  |                  | Open              |
| 22 LVDS S2I+ Chassis Instrument chassis > 10M 23 NC Chassis Instrument chassis > 10M 25 Ped power return Chassis Instrument chassis > 10M  |         | LVDS S2I-          | Chassis   | Instrument chassis  |                  | Cur               |
| 25 Pod power return Chassis Instrument I is 1991   |         |                    | Chassis   | Instrument chassis  |                  | apl               |
| 25 Pod power return Chaptie Instrument I : 1001 000  |         | NC                 | Chassis   | Instrument chassis  | >10M             | on                |
|  | 25      | Red. power return  | Chassis   | Instrument chassis  | 100k             | 99.9Es            |



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#### 4.4 Abbreviated Safe-to-Mate Test and Power Consumption Check

The abbreviated safe-to-mate test shall be performed before the first connection of EGSE to the unit and after transport of the EGSE.

| MDM25    | <b>经验证的证据</b>      |           |                  |                |               |
|----------|--------------------|-----------|------------------|----------------|---------------|
| Pin (+)  | Signal             | Pin (-)   | Signal           | Expected [V]   | Measurement   |
| 1        | Nom. power         | 14        | Nom. power ret.  | 28 or 0 *      |               |
| 13       | Red. power         | 25        | Red. power ret.  | 28 or 0 *      |               |
| * 28V ex | spected if connect | ed to the | corresponding NO | M or RED port, | 0V otherwise. |
| any      | other pin          | 15        | Chassis gnd      | < 3            |               |
| MDM15    |                    |           |                  |                |               |
| 1        | Thermistor 1       | 9         | Thermistor 1     | tbd by ADS *   |               |
| 2        | Thermistor 2       | 10        | Thermistor 2     | tbd by ADS *   |               |
| 3        | Thermistor 3       | 11        | Thermistor 3     | tbd by ADS *   |               |
| 7        | Surv Heaters 1     | 14        | Surv Heaters 1   | 28             |               |
| 8        | Surv Heaters 2     | 15        | Surv Heaters 2   | 28             |               |

<sup>\*</sup> Voltage and polarity to be defined by ADS, a constant voltage lower than 28 V is expected.

After successful safe-to-mate test, the unit can be powered. The power consumption of the unit is not supposed to change significantly. When powered, the unit shall drain about  $110\,\text{mA}$  at  $28\,\text{V}$ , so about  $3.1\,\text{W}$ . The current limitation of the power supply shall be set to  $500\,\text{mA}$ . Document the power consumption as part of the standard procedure. This condition resembles the "Unit unconfigured" as per the table below. After configuration of the sensors, the total power consumption is expected to increase to  $110\,\text{mA} \pm 5\,\text{mA}$ . For the unconfigured unit (after power ON), or after a "reset"-command after communication has been established:

Donreron call 30

| Parameter | Expected                        | Measured                |
|-----------|---------------------------------|-------------------------|
| Voltage   | 28.0 V                          | 27.9V                   |
| Current   | $107\mathrm{mA}\pm5\mathrm{mA}$ | 0.10A (Nom) 0.10 A (Red |

To define the units power consumption under the different operational modes and under different supply voltages, document the power consumption under the conditions as given below. This part of the procedure is required to be conducted only once!

| Condition                   | 28.0 V | Current | 26.0 V | Current | 29.0 V | Current |
|-----------------------------|--------|---------|--------|---------|--------|---------|
| Unit unconfigured           |        |         |        |         |        |         |
| (after POWER ON)            |        |         |        |         |        |         |
| Unit in HK mode             |        |         |        |         |        |         |
|                             |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (low activity)              |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (high activity, testpulser) |        |         |        |         |        |         |

NOM: SFT ole RED: SFT ole Fin-sholds: Idefind veny good, Idefin 2 very good leave in Nominal male 1638 -



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### 4.9 As Run Functional Test Report

| Date and Time | 2017-01-27 | 1620 |
|---------------|------------|------|
| Date and Time | 2017-01-27 | 1620 |

### 4.9.1 Functional Test Readiness

| Location             | ADS Partsmoath EVT      |
|----------------------|-------------------------|
| Personnel            |                         |
| Instrument ID        |                         |
| Firmware revision    | ·                       |
| Reason for FT        | Final before trans port |
| Test to be performed |                         |

| Safe-to-mate           |                           |
|------------------------|---------------------------|
| Impedance check        |                           |
| Set up communication   |                           |
| Additional constraints | Moted Saver MDM25 & MDMas |

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Impedance check ofthe He Vibration test (return from Pollsmouth)



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#### 4.3 **Unit Impedance Check**

After transport, before the first connection to the EGSE, and after tests with higher risks to damage the unit the impedances of the unit shall be measured and compared with the expected values as given in the table (based on RD-1):

| MDM15              |         |         |                     |             |
|--------------------|---------|---------|---------------------|-------------|
| Name               | Pin (+) | Pin (-) | Expected $[\Omega]$ | Measurement |
| Thermistor 1       | 1       | 9       | 15k to 20k *        | 22. 86.K    |
| Thermistor 2       | 2       | 10      | 15k to 20k *        | 21.85K      |
| Thermistor 3       | 3       | 11      | 15k to 20k *        | 20.18K      |
| Survival Heaters 1 | 7       | 14      | 119                 | 119.9       |
| Survival Heaters 2 | 8       | 15      | 119                 | 120.9       |

<sup>\*</sup> See figure below, all thermistors are supposed to show similar results depending on the unit's temperature.

| Temp. °C | Ohms      | 1   | Temp. °C | Ohms   |
|----------|-----------|-----|----------|--------|
|          |           | J   | 70       |        |
| -60      | 1,342,000 |     | 20       | 18,410 |
| -55      | 957,000   |     | 22       | 16,950 |
| -50      | 690,000   |     | 24       | 15,620 |
| -45      | 503,700   |     | 25       | 15,000 |
| -40      | 371,300   | ] [ | 26       | 14,410 |
| -35      | 276,200   |     | 28       | 13,310 |
| -30      | 207,500   |     | 30       | 12,300 |
| -25      | 157,200   |     | 32       | 11,370 |
| -20      | 120,100   |     | 34       | 10,530 |
| -15      | 92,600    |     | 36       | 9,756  |
| -10      | 71,940    |     | 38       | 9,047  |
| -5       | 56,310    |     | 40       | 8,397  |
| 0        | 44,420    |     | 42       | 7,800  |
| 2        | 40,490    |     | 44       | 7,253  |
| 4        | 36,930    |     | 46       | 6,747  |
| 6        | 33,740    |     | 48       | 6,282  |
| 8        | 30,840    |     | 50       | 5,855  |
| 10       | 28,230    |     | 52       | 5,460  |
| 12       | 25,860    |     | 54       | 5,096  |
| 14       | 23,720    |     | 56       | 4,758  |
| 16       | 21,780    |     | 58       | 4,448  |
| 18       | 20,010    |     | 60       | 4,160  |

Figure 3: Thermistor resistivities for various temperatures, taken from the thermistor's datasheet



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| MDM25                             |  |           |                     |              |             |  |  |  |
|-----------------------------------|--|-----------|---------------------|--------------|-------------|--|--|--|
| Pin (+)                           | Signal   | Pin (-)   | Signal              | Expected [Ω] | Measurement |  |  |  |
| Nominal power lines and grounding |  |           |                     |              |             |  |  |  |
| Chassis                           | Instrument chassis                                 | 15        | Chassis gnd         | < 1          | 0.5         |  |  |  |
| Chassis                           | Instrument chassis                                 | 24        | Chassis gnd         | < 1          | 0.5         |  |  |  |
| Chassis                           | Instrument chassis                                 | 1         | Nom. power          | >10M         | OL          |  |  |  |
| 14                                | Nom. power return                                  | 1         | Nom. power          | >10M         | 01          |  |  |  |
|                                   | THE REAL PROPERTY.                                 | Redur     | ndant power lines   |              |             |  |  |  |
| Chassis                           | Instrument chassis                                 | 13        | Red. power          | >10M         | OL          |  |  |  |
| 25                                | Red. power return                                  | 13        | Red. power          | >10M         | 01          |  |  |  |
|                                   |  | Nominal   | communication lines |              |             |  |  |  |
| 4                                 | LVDS I2S-  | 16        | LVDS I2S+           | 100          | 102.4       |  |  |  |
| 6                                 | CLK I2S+   | 19        | CLK I2S-            | 100          | 102.5       |  |  |  |
| 8                                 | LVDS S2I+  | 21        | LVDS S2I-           | 50           | 51.4        |  |  |  |
|                                   | Ben Branch Fran Fran Fran Fran Fran Fran Fran Fran | Redundant | communication lines |              |             |  |  |  |
| 5                                 | LVDS I2S-  | 17        | LVDS I2S+           | 100          | 102.4       |  |  |  |
| 7                                 | CLK I2S+   | 20        | CLK I2S-            | 100          | 102.5       |  |  |  |
| 10                                | LVDS S2I-  | 22        | LVDS S2I+           | 50           | 51.4        |  |  |  |
|                                   |  | not cor   | nnected (NC) pins   |              | 7 - 1       |  |  |  |
| 2                                 | NC   | Chassis   | Instrument chassis  | > 10M        | 06          |  |  |  |
| 3                                 | DGND   | Chassis   | Instrument chassis  | < 1          | 01/2        |  |  |  |
| 4                                 | LVDS I2S-  | Chassis   | Instrument chassis  | >10M         | 017         |  |  |  |
| 5                                 | LVDS I2S-  | Chassis   | Instrument chassis  | >10M         | 01.         |  |  |  |
| 6                                 | CLK I2S+   | Chassis   | Instrument chassis  | >10M         | 01-         |  |  |  |
| 7                                 | CLK I2S+   | Chassis   | Instrument chassis  | > 10M        | 01          |  |  |  |
| 8                                 | LVDS S2I+  | Chassis   | Instrument chassis  | >10M         | 06          |  |  |  |
| 9                                 | NC   | Chassis   | Instrument chassis  | >10M         | 06          |  |  |  |
| 10                                | LVDS S2I-  | Chassis   | Instrument chassis  | >10M         | 61          |  |  |  |
| 11                                | DGND.  | Chassis   | Instrument chassis  | < 1          | 01/2        |  |  |  |
| 12                                | NC   | Chassis   | Instrument chassis  | >10M         | 01          |  |  |  |
| 14                                | Nom. power return                                  | Chassis   | Instrument chassis  | 100k         | 99.9K       |  |  |  |
| 16                                | LVDS I2S+  | Chassis   | Instrument chassis  | >10M         | 01.         |  |  |  |
| 17                                | LVDS I2S+  | Chassis   | Instrument chassis  | >10M         | 0/.         |  |  |  |
| 18                                | NC   | Chassis   | Instrument chassis  | >10M         | OL          |  |  |  |
| 19                                | CLK I2S-   | Chassis   | Instrument chassis  | >10M         | 0(          |  |  |  |
| 20                                | CLK I2S-   | Chassis   | Instrument chassis  | >10M         | 01          |  |  |  |
| 21                                | LVDS S2I-  | Chassis   | Instrument chassis  | >10M         | 01.         |  |  |  |
| 22                                | LVDS S2I+  | Chassis   | Instrument chassis  | > 10M        | 06          |  |  |  |
| 23                                | NC   | Chassis   | Instrument chassis  | >10M         | 06          |  |  |  |
| 25                                | Red. power return                                  | Chassis   | Instrument chassis  | 100k         | 99.912      |  |  |  |
|                                   |  |           |                     |              | 11          |  |  |  |



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### 4.4 Abbreviated Safe-to-Mate Test and Power Consumption Check

The abbreviated safe-to-mate test shall be performed before the first connection of EGSE to the unit and after transport of the EGSE.

| MDM25   |                    |            |                  |                |                            |
|---------|--------------------|------------|------------------|----------------|----------------------------|
| Pin (+) | Signal             | Pin (-)    | Signal           | Expected [V]   | Measurement                |
| 1       | Nom. power         | 14         | Nom. power ret.  | 28 or 0 *      |                            |
| 13      | Red. power         | 25         | Red. power ret.  | 28 or 0 *      |                            |
| * 28V e | xpected if connect | ted to the | corresponding NO | M or RED port, | 0V otherwise.              |
| any     | other pin          | 15         | Chassis gnd      | < 3            |                            |
| MDM15   |                    |            |                  |                | A Transfer of the State of |
| 1       | Thermistor 1       | 9          | Thermistor 1     | tbd by ADS *   |                            |
| 2       | Thermistor 2       | 10         | Thermistor 2     | tbd by ADS *   |                            |
| 3       | Thermistor 3       | 11         | Thermistor 3     | tbd by ADS *   |                            |
| 7       | Surv Heaters 1     | 14         | Surv Heaters 1   | 28             |                            |
| 8       | Surv Heaters 2     | 15         | Surv Heaters 2   | 28             |                            |

<sup>\*</sup> Voltage and polarity to be defined by ADS, a constant voltage lower than 28 V is expected.

After successful safe-to-mate test, the unit can be powered. The power consumption of the unit is not supposed to change significantly. When powered, the unit shall drain about 110 mA at 28 V, so about 3.1 W. The current limitation of the power supply shall be set to 500 mA. Document the power consumption as part of the standard procedure. This condition resembles the "Unit unconfigured" as per the table below. After configuration of the sensors, the total power consumption is expected to increase to 110 mA  $\pm$  5 mA. For the unconfigured unit (after power ON), or after a "reset"-command after communication has been established:

| Expected                          | Measured |
|-----------------------------------|----------|
| 28.0 V                            | 28V      |
| $107 \text{ mA} \pm 5 \text{ mA}$ | 95 mA    |
|                                   | 28.0 V   |

To define the units power consumption under the different operational modes and under different supply voltages, document the power consumption under the conditions as given below. This part of the procedure is required to be conducted only once!

| Condition                   | 28.0 V | Current | 26.0 V | Current | 29.0 V | Current |
|-----------------------------|--------|---------|--------|---------|--------|---------|
| Unit unconfigured           |        |         |        |         |        |         |
| (after POWER ON)            |        |         |        |         |        |         |
| Unit in HK mode             |        |         |        |         |        |         |
|                             |        |         |        |         |        |         |
| Unit in SCI mode            |        |         |        |         |        |         |
| (low activity)              |        |         |        |         |        |         |
| Unit in SCI mode            | - 1    |         |        |         |        |         |
| (high activity, testpulser) |        |         |        |         |        |         |

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| 4.9 As Run Functional Te | st Report |
|--------------------------|-----------|
|--------------------------|-----------|

| Date and Time | 31.01.2017 / 11:55 |
|---------------|--------------------|
|---------------|--------------------|

#### 4.9.1 Functional Test Readiness

| Location             | Clean swom, CAU |
|----------------------|-----------------|
| Personnel            | Lawo / Makest   |
| Instrument ID        | STEP FS.        |
| Firmware revision    |                 |
| Reason for FT        |                 |
| Test to be performed |                 |

| Safe-to-mate           |  |
|------------------------|--|
| Impedance check        |  |
| Set up communication   |  |
| Additional constraints |  |