

Issue: 1.0 Ref.: FAC2020-RR-PQA-FI-002 Page: 1/16

SERVICE DATASHEET

 \bigotimes

Vibration Test Facility

| PROJECT TITLE | - |
|---------------|--|
| PROJECT REF. | FAC2020 |
| PREPARED BY | REMRED Space Technologies Ltd. |
| SUPERVISOR | Viktória Katona, viktoria.katona@remred.hu |
| ISSUE | 1.0 |
| DATE OF ISSUE | 10/01/2020 |
| STATUS | Issued |
| ТҮРЕ | Service Datasheet, Non-Confidential |
| REFERENCE | FAC2020-RR-PQA-FI-002_01_00 |
| | |
| | |

| CUSTOMER(S) | - |
|---------------|---|
| CONTRACT REF. | - |
| CUSTOMER ID. | - |

Template file ref.: QUA2020-RR-PQA-SS-001_i0.1

@REMRED 2020



Issue: 1.0 Ref.: FAC2020-RR-PQA-FI-002 Page: 2/16

APPROVAL

 \bigotimes

| Issue | Data | | | |
|-------|------------|-----------------|---------------|---------------|
| | Date | Author(s) | Reviewed by | Approved by |
| | | | | |
| 1.0 | 10/01/2020 | Viktória Katona | Anna Baranyai | lstván Apáthy |
| | | | | |

DISTRIBUTION LIST

| Company | Name | No. of copies |
|-----------------|------|---------------|
| N/A | N/A | N/A |
| REMRED archives | | 1 |

CHANGE LOG

| Reference | Date | Issue | Revision |
|-----------------------------|------------|-------|----------|
| FAC2020-RR-PQA-FI-002_01_00 | 10/01/2020 | 1.0 | 1 |

CHANGE RECORD

| Issue: 1.0 | Revision: 1 | | |
|------------------------|-------------|------|--------------|
| Reason for change | Date | Page | Paragraph(s) |
| N/A (initial release). | | | |



@REMRED 2020



Issue: 1.0 Ref.: FAC2020-RR-PQA-FI-002 Page: 3/16

TABLE OF CONTENTS

 \bigotimes

| 1. | Purpose and Scope | 4 |
|-----------------------------------|---|---------------------------------|
| 2. | Application and Key Features | 5 |
| 2.1. | Application | 5 |
| 2.2. | Key features | 5 |
| 3. | Specification | 6 |
| 3.1 | Vibration Test System | 6 |
| 3.2 | StrobeCAM Vibration Testing and Analysis System | 7 |
| 4. | Accreditation and Audits | 8 |
| | | |
| 5. | ANNEX A – Vibration Test System | 9 |
| 5. 6. | ANNEX A – Vibration Test System ANNEX B – StrobeCAM Vibration Testing and Analysis System | 9 12 |
| 5. 6. 7. | ANNEX A – Vibration Test System ANNEX B – StrobeCAM Vibration Testing and Analysis System List of Abbreviations | 9 12 13 |
| 5. 6. 7. 8. | ANNEX A – Vibration Test System ANNEX B – StrobeCAM Vibration Testing and Analysis System List of Abbreviations List of Figures | 9 12 13 14 |
| 5. 6. 7. 8. 9. | ANNEX A – Vibration Test System ANNEX B – StrobeCAM Vibration Testing and Analysis System List of Abbreviations List of Figures List of Tables | 9 12 13 14 15 |
| 5. 6. 7. 8. 9. | ANNEX A – Vibration Test System ANNEX B – StrobeCAM Vibration Testing and Analysis System List of Abbreviations List of Figures List of Figures References | 9 12 13 14 15 16 |
| 5. 6. 7. 8. 9. 10. | ANNEX A – Vibration Test System | 9 12 13 13 16 16 |





Issue: 1.0 Ref.: FAC2020-RR-PQA-FI-002 Page: 4/16

1 **Purpose and Scope**

The present document provides detailed technical information about the Vibration Test Facility operated by REMRED Space Technologies Ltd. used for ECSS-conform space equipment testing and analysis in the following cases:

- Resonance Search;
- Sine Vibration test;
- Random Vibration test;
- Shock / SRS Shock test;
- Contactless Vibration Testing using Stroboscope System;
- Vibration Analysis using Stroboscope System.

The definitions and glossary of terms from ECSS-S-ST-00-01C [AD 1] apply to this document.



Figure 1 – Vibration Test Facility

@REMRED 2020

The copyright in this document is vested in REMRED Ltd. This document may only be reproduced in whole or in part, or stored in a retrieval system, or transmitted in any form, or by means of electronic, mechanical, photocopying or otherwise, either with the prior permission of REMRED Ltd.

 \sim



Issue: 1.0 Ref.: FAC2020-RR-PQA-FI-002 Page: 5/16

2 Application and Key Features

2.1 APPLICATION

- Vibration ECSS-conform tests including
 - Resonance Search
 - Sine Vibration test
 - Random Vibration test
 - Shock / SRS Shock test
- Vibration testing and analysis using StrobeCAM System including
 - Contactless Vibration Testing

2.2 KEY FEATURES

- \checkmark The following test systems are available
 - IMV i250/SA5M 40kN vibration test system
 - LIMESS StrobeCAM v4 vibration testing and analysis system
- StrobeCAM contactless vibration testing and analysis
 - Vibration testing and analysis without accelerometers
 - Visualisation, recording and documentation of object motion
 - Measurement of resonance curve (frequency response)
 - Measurement of displacement, velocity and acceleration
 - Contactless component testing
- Configurable test systems according to the user's need
 - Controlled via graphical user interface
 - Programmed test operation and remote access
 - Data collection and analysis via dedicated software (K2 Software, LimTrack)
- ✓ High level of safety assurance
 - The Facility is located at a closed, guarded site with limited number of access
 - Every area is video controlled
 - Any access to the Facility area is logged
- ✓ Facility environmental parameters are logged (temperature, humidity)
- ECSS-conform space testing engineering support is available upon request
- Mechanical workshop is available upon request

@REMRED 2020



Issue: 1.0 Ref.: FAC2020-RR-PQA-FI-002 Page: 6/16

3 Specification

3.1 VIBRATION TEST SYSTEM

Table 1 – Vibration Test System general specification

| Parameters | Values |
|---|---|
| Applicable ECSS tests as per ECSS-E-ST-10-03C [AD 2], ECSS-E-HB-32-25A [AD 3], ECSS-E-HB-32-26A [AD 4] | Resonance Search Sine Vibration Random Vibration (ASD or PSD) Shock / SRS Shock |
| Test system name or ID | EK Vibration Test System (S/N: 51000452) |
| Test system type | IMV i250/SA5M (EM2502) with K2 controller |
| Frequency range | 52500 Hz |
| Armature resonance | 1900 Hz |
| Maximum peak force | Sine: 40 kN Random: 40 kN _{rms} Shock: 80 kN |
| Maximum acceleration | Sine: 1140 m/s² Random: 80 m/s² Shock: 2284 m/s² |
| Maximum velocity | Sine: 2.2 m/s Shock: 2.2 m/s peak |
| Maximum displacement | Sine: 51 mm _{p-p} Max travel: 68 mm _{p-p} |
| Number of test axis | 1* |
| Armature diameter | 440 mm |
| Armature mass | 35 kg |
| Peak load | 600 kg |
| Allowable eccentric moment | 1550 Nm |
| Cooling system type | Air cooling |
| Crane support capacity | 3 t |
| Built-in protections | Phase-sequence, high temperature, cooling dropout, surge current |
| triaxial accelerometers | 1 pc PCB Piezotronics TLD356A02 (±200g, 10mV/g±10%) 1 pc PCB Piezotronics TLD356A15 (±50g, 100mV/g±10%) |
| monoaxial accelerometers | 2 pcs PCB Piezotronics TLD352C03 (±200g, 10mV/g±10%) 2 pcs PCB Piezotronics TLD352C33 (±50g, 100mV/g±10%) |
| Mechanical interfaces | 25 pcs M10x40 fixing points on the armature Witworth BSF 3/16"x32 or M6x0.75 on the accelerometers For more details see ANNEX A – Vibration Test System |

* Dedicated adapters are needed for 3-axial testing.

@REMRED 2020





Issue: 1.0 Ref.: FAC2020-RR-PQA-FI-002 Page: 7/16

3.2 STROBECAM VIBRATION TESTING AND ANALYSIS SYSTEM

| Parameters | Values |
|---|---|
| Applicable ECSS tests as per ECSS-E-ST-10-03C [AD 2], ECSS-E-HB-32-25A [AD 3], ECSS-E-HB-32-26A [AD 4] | Contactless Vibration Testing and Analysis (Mode shape tests, PCB level tests, Resonance curve tests) |
| Test system name or ID | EK StrobeCam Vibration Testing and Analysis System (S/N: 503400933) |
| Test system type | LIMESS StrobeCAM v4 |
| Input frequency range | 1Hz4kHz |
| Camera information | 0.329MP |
| Field of view | from millimeter to meter |
| Visualisation in 3D | Slow-motion visualisation of fast events |
| Contactless measurements in 2D | of 2D coordinaten and 2D displacements in mm at unlimited number of points (subpixel accurate tracking) |
| Calculated quantities in 2D | Velocities, accelerations* |
| Analysis software(s) | StrobeCAM, LIMTrack |

Table 2 – StrobeCAM Vibration Testing and Analysis System general specification

* Using scale calibration.

@REMRED 2020



Tile: Vibration Test Facility Datasheet Company: REMRED Space Technologies Ltd. Department: Facilities | RR-FAC | Contact: W: remred.hu | T: +36-1-392-2222

Issue: 1.0 Ref.: FAC2020-RR-PQA-FI-002 Page: 8/16

4 Accreditation and Audits

| Code | Title | Туре | Validity | Remarks |
|----------------------------|--|-------------------------|----------|--------------------------------|
| ISO 9001:2015 | Quality management systems | Accrediation planned | N/A | Accreditation is in progress |
| ISO 17025:2018 | General requirements for the competence of testing and calibration laboratories | Accrediation planned | N/A | Accreditation is in progress |
| ECSS-Q-ST-20-07C [AD 5] | Quality and safety assurance for space test centres | Audit by ESA | N/A | Audit was performed in 2018 |

Table 4 – Accreditation and Audits

@REMRED 2020



Issue: 1.0 Ref.: FAC2020-RR-PQA-FI-002 Page: 9/16

5 ANNEX A – Vibration Test System

You find here the Vibration Test System related mechanical interface information for designing the mount of the test item and related accelerometers.



Figure 2 – The picture of the Vibration Test System

 \bigotimes



Figure 3 – The shaker adapter, the fixing points are placed with distance given on the picture above (M10/40 screws can be used for fixing)

@REMRED 2020

The copyright in this document is vested in REMRED Ltd. This document may only be reproduced in whole or in part, or stored in a retrieval system, or transmitted in any form, or by means of electronic, mechanical, photocopying or otherwise, either with the prior permission of REMRED Ltd.

X



Tile: Vibration Test Facility Datasheet Company: REMRED Space Technologies Ltd. Department: Facilities | RR-FAC | Contact: W: remred.hu | T: +36-1-392-2222

Issue: 1.0 Ref.: FAC2020-RR-PQA-FI-002 Page: 10/16



Figure 4 – Mechanical drawings of triaxial accelerometers and related interfaces (Witworth BSF 3/16"x32 or M6x0.75 course shall be provided on the tested item for fixture if needed)

@REMRED 2020



 \bigotimes

Tile: Vibration Test Facility Datasheet Company: REMRED Space Technologies Ltd. Department: Facilities | RR-FAC | Contact: W: remred.hu | T: +36-1-392-2222

Issue: 1.0 Ref.: FAC2020-RR-PQA-FI-002 Page: 11/16



Figure 5 – Mechanical drawings of monoaxial accelerometers and related interfaces (Witworth BSF 3/16"x32 or M6x0.75 course shall be provided on the tested item for fixture if needed)

@REMRED 2020



Issue: 1.0 Ref.: FAC2020-RR-PQA-FI-002 Page: 12/16

6 ANNEX B – StrobeCAM Vibration Testing and Analysis System

You find here the StrobeCAM Vibration Testing and Analysis System related additional information.



Figure 6 – The camera of LIMESS StrobeCAM Vibration Testing and Analysis System

@REMRED 2020



Tile: Vibration Test Facility Datasheet Company: REMRED Space Technologies Ltd. Department: Facilities | RR-FAC | Contact: W: remred.hu | T: +36-1-392-2222

Issue: 1.0 Ref.: FAC2020-RR-PQA-FI-002 Page: 13/16

 \sum

7 List of Abbreviations

| AD | Applicable Documents |
|------|--|
| ASD | Amplitude Spectral Density |
| ECSS | European Cooperation for Space Standardization |
| PSD | Power Spectral Density |
| RD | Reference Documents |
| SRS | Shok Response Spectra |
| тс | Telecommand |
| тм | Telemetry |

@REMRED 2020



Tile: Vibration Test Facility Datasheet Company: REMRED Space Technologies Ltd. Department: Facilities | RR-FAC | Contact: W: remred.hu | T: +36-1-392-2222

Issue: 1.0 Ref.: FAC2020-RR-PQA-FI-002 Page: 14/16

8 List of Figures

| Figure 1 – | Vibration Test Facility | 4 |
|------------|---|-----|
| Figure 2 – | The picture of the Vibration Test System | 9 |
| Figure 3 – | The shaker adapter, the fixing points are placed with distance given on the picture above (M10/40 screws can be used for fixing) | 9 |
| Figure 4 – | Mechanical drawings of triaxial accelerometers and related interfaces (Witworth BSF 3/16"x32 or M6x0.75 course shall be provided on the tested item for fixture if needed) | 10 |
| Figure 5 – | Mechanical drawings of monoaxial accelerometers and related interfaces (Witworth BSF 3/16"x32 or M6x0.75 course shall be provided on the tested item for fixture if needed) | .11 |
| Figure 6 – | The camera of LIMESS StrobeCAM Vibration Testing and Analysis System | 12 |





Tile: Vibration Test Facility Datasheet Company: REMRED Space Technologies Ltd. Department: Facilities | RR-FAC | Contact: W: remred.hu | T: +36-1-392-2222

Issue: 1.0 Ref.: FAC2020-RR-PQA-FI-002 Page: 15/16

 \sum

9 List of Tables

| Table 1 – Vibration Test System general specification | 6 |
|---|----|
| Table 2 – StrobeCAM Vibration Testing and Analysis System general specification | 7 |
| Table 3 – Accreditation and Audits | 8 |
| Table 4 – Applicable and Normative Documents | 16 |
| Table 5 – Reference Documents | 16 |

@REMRED 2020



Issue: 1.0 Ref.: FAC2020-RR-PQA-FI-002 Page: 16/16

10 References

10.1 APPLICABLE AND NORMATIVE DOCUMENTSS

| AD | Title | Reference | Version |
|--------|---|------------------|--------------|
| [AD 1] | ECSS system - Glossary of terms | ECSS-S-ST-00-01C | 1 Oct 2012 |
| [AD 2] | Space engineering - Testing | ECSS-E-ST-10-03C | 1 June 2012 |
| [AD 3] | Space engineering - Mechanical shock design and verification handbook | ECSS-E-HB-32-25A | 14 July 2015 |
| [AD 4] | Space engineering - Spacecraft mechanical loads analysis handbook | ECSS-E-HB-32-26A | 19 Feb 2013 |
| [AD 5] | Space product assurance - Quality and safety assurance for space test centres | ECSS-Q-ST-20-07C | 1 Oct 2014 |

Table 4 – Applicable and Normative Documents

10.2 REFERENCE DOCUMENTS

| Table | 5 – | Reference | Documents |
|-------|-----|-----------|-----------|
| Table | - | Reference | Documento |

| RD | Title | Reference | Version |
|--------|-------|-----------|---------|
| [RD 1] | - | - | - |

@REMRED 2020