

TIRA

Schwingtechnik
Vibration Test Systems



TIRA Vibration Test Systems – Vibration Testing Equipment

System overview

TIRA GmbH supplies measuring and testing systems for industry and research worldwide. At the Thuringia business location, we develop and manufacture modern plant engineering including application-specific software for testing the properties of materials and recording and eliminating undesirable vibrations.

Our product- and delivery range:

- Electrodynamical vibration test systems, 9N - 300 kN
- Modal systems from 100 N - 15 kN
- Long stroke systems from 4 kN - 15 kN, max. stroke 100 mm
- Calibration shaker systems 100 N - 800 N
- Inertial shaker systems 125 N - 650 N
- Analog/digital amplifiers
- Vibration control systems for sine/random/shock/mixed mode
- Slip tables, linear/hydrostatically guided
- Head expanders/special-purpose fixtures
- Elektrodynamical 3D vibration test systems
- Servomotor powered vibration test systems

General formula for calculating the force vector of vibration systems:

$$\text{Force (N)} = \text{mass (kg)} \times \text{acceleration (m/s}^2\text{)}$$

*Mass = moving element + device under test + fixture,

where applicable: slip table + driver bar + thermobarrier

A variety of applications, all from one source.

The corporate structure of the **TIRA** Group with its product line of vibration testing technology, its own mechanical machining centre and the specialized departments of Material Testing Technology and Balancing Technology opens up the greatest possible flexibility and high manufacturing depth. More than 50 years of tradition, experience and the latest research in our sector form a solid base for first-class technology and reliable performance.

We offer tailor-made and standardized system solutions from one source. We also provide competent support to our customers, from concept and development, via construction, assembly, up to commissioning and support.

TIRA machines have proven themselves worldwide in industry, universities and institutes. Selected sales and service companies in more than 60 countries around the world represent the name and know-how of TIRA GmbH in order to advise and support users and prospective customers all over the world with regard to products.



TIRA booth at the trade show Productronica in Munich

Vibration test systems from 9 N to 400 N

Our products are subject to strict quality control in accordance with the requirements of CE and national and international standards. The same care is given to the maintenance and modernisation of our traditional TIRA test and measurement technology, which has been proven over many years. In close cooperation with our customers, we maintain the progress, efficiency and quality of TIRA products and invest in the future of this potential. Our quality management has been certified according to DIN ISO 9001 since 1995 and according to DIN EN ISO 9001:2015 since February 2018.

TIRA permanent-magnet shakers are used as portable and stationary systems for the simulation of environmental influences. Typical applications are **structural analysis** and **testing of smaller assemblies**. The robust construction of the shakers guarantees a long service life. TIRA shakers are characterized by **high lateral stiffness**. TIRA has met the requirements of the industry for **lightweight construction** of the shakers. New rare earth magnets have been added to the usual Alnico magnets. This has resulted in a **reduction in mass** from 36 kg to 12 kg, which guarantees **easy handling** of the shakers especially **in mobile use**. These shakers have proven their worth in applications such as environmental laboratories and universities as well as in industrial production lines for component testing and calibration. These complete system offers allow users to test according to national and international standards such as DIN, ISO, BS, MIL, IEC and ASTM.



Shakers 9 N - 400 N

| System | TV 50009 | TV 50018 | TV 51110 |
|---|----------------|---------------|----------------|
| Shaker | S 50009 | S 50018 | S 51110 |
| Amplifier | BAA 60 /DA 200 | BAA 60/DA 200 | BAA 120/DA 200 |
| Rated peak force (N) Sine _{pk} / Random _{RMS} | 9/- | 18/- | 100/70 |
| Frequency range (Hz) | 2 - 20000 | 2 - 20000 | 2 - 7000 |
| Max. displacement (mm) Pk - Pk | 3 | 5 | 13 |
| Max. velocity (m/s) | 1.5 | 1.5 | 1.5 |
| Max. acceleration (g) Sine/Random | 60/- | 65/- | 45/30 |
| Suspension stiffness (N/mm) | 4 | 4.4 | 8 |
| Effective moving mass ±5% (kg) | 0.015 | 0.028 | 0.23 |
| Main resonance frequency (Hz) | >13000 | >13000 | >6500 |
| Total shaker mass (without trunnion) (kg) | 2.2 (1.7) | 5.0 (3.7) | 12 |
| Coupling/Armature (ø/mm) | M4 | M4 | 60 |
| Max. power consumption at 230V (kVA) | 0.05 | 0.05 | 0.08 |

| System | TV 51120 | TV 52110 | TV 52120 | TV 51140 |
|---|-----------|----------------|-----------|----------|
| Shaker | S 51120 | S 52110 | S 52120 | S 51140 |
| Amplifier | BAA 500 | BAA 120/DA 200 | BAA 500 | BAA 1000 |
| Blower | TB 0080 | - | TB 0080 | TB 0140 |
| Rated peak force (N) Sine _{pk} / Random _{RMS} | 200/140 | 100/50 | 200/100 | 400/311 |
| Frequency range (Hz) | 2 - 7000 | 2 - 7000 | 2 - 7000 | 2 - 6500 |
| Max. displacement (mm) Pk - Pk | 13 | 15 | 15 | 20 |
| Max. velocity (m/s) | 1.5 | 1.5 | 1.5 | 1.5 |
| Max. acceleration (g) Sine/Random | 89/62 | 50/25 | 100/50 | 100/50 |
| Suspension stiffness (N/mm) | 8 | 5 | 5 | 5 |
| Effective moving mass ±5% (kg) | 0.23 | 0.25 | 0.25 | 0.4 |
| Main resonance frequency (Hz) | >6500 | >5700 | >5700 | >5500 |
| Total shaker mass (kg) | 12 | 36 | 36 | 18 |
| Armature (ø/mm) | 60 | 60 | 60 | 60 |
| Max. power consumption at 230V (kVA) Amplifier/Blower | 0.35/0.46 | 0.08/- | 0.35/0.46 | 2.7/1.4 |

General data - For detailed technical information see product data sheets (Download at <https://www.tira-gmbh.de/en/tira-gmbh/downloads/vibration-test-systems/vibration-test-systems/>)

TIRA Vibration Test Systems

Vibration test systems from 1000 N to 2700 N

- Automatic centering of the armature
- LS-shakers with up to 45 mm displacement and electronic zero-point regulation with adjustable stiffness
- Optional degauss kit to reduce stray magnetic field
- Multiple safety devices
- Coarse filter unit
- Squeak&Rattle Option (Low noise operation without blower)

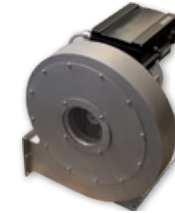
TIRA Energy Management System

The TIRA Energy Management System enables for all vibration test systems with a force of 2.7 kN to 55 kN two possible energy saving options:

- operation with temperature-controlled cooling blower
- operation with temperature-controlled cooling blower and variable field power (+optional low degaussing kit)

Advantages: Reduction of costs, noise emission and environmental influences

TIRA EMS



| System | TV 5220-120 | TV 5220/LS-120 | TV 54216-130 | TV 50350-120 | TV 50350/LS-120 |
|---|---|---|---|---|---|
| Shaker | S 5220-120 | S 5220/LS-120 | S 54216-130 | S 50350-120 | S 50350/LS-120 |
| Amplifier | BAA 1000-E | BAA 1000-ET | BAA 1000-E | A 1 01 11 010 | A 1 01 11 010 T |
| Blower | TB 0140 | TB 0140 | TB 0140 | TB 0310 | TB 0310 |
| Rated peak force (N) Sine _{pk} / Random _{RMS} / Shock _{pk} | 1000/650/1500 | 1000/650/1500 | 1600/1000/2000 | 2700/2000/5500 | 2700/2000/5300 |
| Frequency range (Hz) | 2 - 6500 | 2 - 6500 | 2 - 3500 | 2 - 4500 | 2 - 4500 |
| Max. displacement (mm) Pk - Pk | 25.4 | 45.0 | 25.4 | 25.4 | 45.0 |
| Max. velocity (m/s) Sine/Random/Shock | 1.5/1.5/2.0 | 1.5/1.5/2.0 | 1.5/1.5/2.0 | 1.5/1.5/2.5 | 1.5/1.5/2.5 |
| Max. acceleration (g) Sine/Random/Shock | 60/35/90 | 60/35/90 | 60/40/80 | 100/70/180 | 95/73/160 |
| Suspension stiffness (N/mm) | 22 | Electr. adjustable | 22 | 22 | Electr. adjustable |
| Effective moving mass ±5% (kg) | 1.75 | 1.75 | 2.6 | 2.7 | 2.9 |
| Max. payload (kg) | 20 | 20 | 20 | 25 | 25 |
| Main resonance frequency (Hz) | >4800 | >4600 | >3000 | >3800 | >3700 |
| Total shaker mass (kg) | 122 | 122 | 188 | 280 | 280 |
| Stray magnetic field (mT) without/with degauss kit | <8.5/<1.5 | <8.5/<1 | <8.5/- | <8.5/<1.4 | <8.5/<1.4 |
| Armature (ø/mm) | 120 | 120 | 130 | 120 | 120 |
| Max. power consumption at 230/400 V (kVA) incl. blower | 5.1 | 5.2 | 5.2 | 4.5 | 4.5 |
| Interlocks | Temperature, overtravel, airflow, overcurrent, compressed air | Temperature, overtravel, airflow, overcurrent | Temperature, overtravel, airflow, overcurrent, compressed air | Temperature, overtravel, airflow, overcurrent, compressed air | Temperature, overtravel, airflow, overcurrent |

General data - For detailed technical information see product data sheets (Download at <https://www.tira-gmbh.de/en/tira-gmbh/downloads/vibration-test-systems/vibration-test-systems/>)

Vibration test systems from 4 kN to 8 kN



- Clamping table ø180 mm with 21 threaded inserts or ø340 mm with 25 threaded inserts
- Long-time operation
- Minimum maintenance effort
- High cross-axial stiffness
- Supported by rugged frame with combined rubber/air isolators
- Automatic centering of the armature
- Fully automatic pneumatic load compensation for heavy test loads
- 50.8 mm (2 inch) displacement

- Standard degauss kit to reduce stray magnetic field
- Optional low degauss kit to reduce stray magnetic field to <0.8 mT
- Multiple safety devices
- Coarse filter unit
- Squeak&Rattle Option (Low noise operation without blower)
- Wheels&Rails Option (Shaker is maneuverable on rails)



Shaker S 55240/LS-340

| System | TV 55240/LS-180 | TV 55240/LS-340 | TV 56280/LS-180 | TV 56280/LS-340 |
|--|---|---|---|---|
| Shaker | S 55240/LS-180 | S 55240/LS-340 | S 56280/LS-180 | S 56280/LS-340 |
| Amplifier | A 1 01 11 010 | A 1 01 11 010 | A 1 02 11 021 | A 1 02 11 021 |
| Blower | TB 0310 | TB 0310 | TB 9 FUK | TB 9 FUK |
| Rated peak force (N) Sinepk / RandomRMS / Shockpk | 4000/3500/12000 | 4000/3600/12000 | 8000/7200/24000 | 8000/7200/24000 |
| Frequency range (Hz) | 2 - 3000 | 2 - 3000 | 2 - 3000 | 2 - 3000 |
| Max. displacement (mm) Pk - Pk | 50.8 | 50.8 | 50.8 | 50.8 |
| Max. velocity (m/s) Sine/Random/Shock | 2.0/2.0/2.4 | 2.0/2.0/2.4 | 2.0/2.0/3.5 | 2.0/2.0/3.5 |
| Max. acceleration (g) Sine/Random/Shock | 60/50/150 | 50/45/130 | 93/72/186 | 88/65/200 |
| Suspension stiffness (N/mm) | 50 | 50 | 50 | 50 |
| Effective moving mass ±5% (kg) | 6.8 | 8.3 | 8.1 | 9.6 |
| Max. payload (kg) | 250 | 250 | 250 | 250 |
| Main resonance frequency (Hz) | >3000 | >2700 | >2900 | >2500 |
| Total shaker mass (kg) | 700 | 780 | 765 | 780 |
| Stray magnetic field (mT) Std./Low degaussing | <1.5/<0.8 | <1.5/<0.8 | <1.5/<0.8 | <1.5/<0.8 |
| Armature (ø/mm) | 180 | 340 | 180 | 340 |
| Max. power consumption at 400 V (kVA) incl. blower | 6.5 | 6.5 | 17 | 17 |
| Interlocks | Temperature, overtravel, airflow, overcurrent, compressed air | Temperature, overtravel, airflow, overcurrent, compressed air | Temperature, overtravel, airflow, overcurrent, compressed air | Temperature, overtravel, airflow, overcurrent, compressed air |

General data - For detailed technical information see product data sheets (Download at <https://www.tira-gmbh.de/en/tira-gmbh/downloads/vibration-test-systems/vibration-test-systems/>)

TIRA Vibration Test Systems

Vibration test systems from 11 kN to 15 kN



See page 4

- Long-time operation
- Minimum maintenance effort
- High cross-axial stiffness
- Supported by rugged frame with vibration isolators
- Fully automatic pneumatic load compensation for heavy test loads
- Coarse filter unit
- 50.8 mm (2 inch) displacement
- Standard degauss kit to reduce stray magnetic field
- Optional low degauss kit to reduce stray magnetic field to <0.8 mT
- Wheels&Rails Option (Shaker is maneuverable on rails)
- Squeak&Rattle Option (Low noise operation without blower)



Shaker S 57315/LS-340

| System | TV 51010/LS-230 | TV 51010/LS-340 | TV 57315/LS-230 | TV 57315/LS-340 |
|---|--|---|---|---|
| Shaker | S 51010/LS-230 | S 51010/LS-340 | S 57315/LS-230 | S 57315/LS-340 |
| Amplifier | A 1 01 11 021 | A 1 01 11 021 | A 3 01 11 042 | A 3 01 11 042 |
| Blower | TB 120 FUK | TB 120 FUK | TB 120 FUK | TB 120 FUK |
| Rated peak force (N) | Sine _{pk} / Random _{RMS} / Shock _{pk} | 11000/11000/33000 | 11000/11000/33000 | 15000/13000/45000 |
| Frequency range (Hz) | | 2 - 3000 | 2 - 3000 | 2 - 3000 |
| Max. displacement (mm) | Pk - Pk | 50.8 | 50.8 | 50.8 |
| Max. velocity (m/s) | Sine/Random/Shock | 2.0/2.0/3.0 | 2.0/2.0/3.0 | 2.0/2.0/3.5 |
| Max. acceleration (g) | Sine/Random/Shock | 85/65/220 | 85/70/200 | 115/80/230 |
| Suspension stiffness (N/mm) | | 75 | 75 | 75 |
| Effective moving mass ±5% (kg) | | 13 | 14 | 13 |
| Max. payload (kg) | | 250 | 250 | 250 |
| Main resonance frequency (Hz) | | >2300 | >2400 | >2300 |
| Total shaker mass (kg) | | 1100 | 1100 | 1100 |
| Stray magnetic field (mT) | Std./Low degaussing | <1.5/<0.8 | <1.5/<0.8 | <1.5/<0.8 |
| Armature (ø/mm) | | 230 | 340 | 230 |
| Max. power consumption at 400V (kVA) incl. blower | | 16 | 16 | 23.5 |
| Interlocks | | Temperature, overtravel, airflow, overcurrent, compressed air | Temperature, overtravel, airflow, overcurrent, compressed air | Temperature, overtravel, airflow, overcurrent, compressed air |

General data - For detailed technical information see product data sheets (Download at <https://www.tira-gmbh.de/en/tira-gmbh/downloads/vibration-test-systems/vibration-test-systems/>)

Vibration test system 22 kN



- Long-time operation
- Minimum maintenance effort
- High cross-axial stiffness
- Supported by rugged frame with vibration isolators
- Automatic centering of the AIT-System and the armature
- Fully automatic pneumatic load compensation for heavy test loads
- AIT-System fixable to use the full displacement also at low frequencies and heavy loads

- Coarse filter unit
- Available as RIT or AIT trunnion system*
- 76.2 mm (3 inch) displacement (Shock)
- Energy-saving mode (Field power reduction)
- Standard degauss kit to reduce stray magnetic field
- Wheels&Rails Option (Shaker is maneuverable on rails)
- Airglide option (Shaker is maneuverable on air cushions)



Shaker S 59322/AIT-340

| System | | TV 59322/*-340 | TV 59322/*-440 |
|--|--|---|---|
| Shaker | | S 59322/*-340 | S 59322/*-440 |
| Amplifier | | A 3 09 11 042 | A 3 09 11 042 |
| Blower | | TB 7/FUK/11 | TB 7/FUK/11 |
| Rated peak force (N) | Sine _{pk} / Random _{RMS} / Shock _{pk} | 22000/15500/66000 | 22000/15500/66000 |
| Frequency range (Hz) | | 5 - 3000 | 5 - 3000 |
| Max. displacement (mm) | Sine/Random/Shock Pk - Pk | 63.5/63.5/76.2 | 63.5/63.5/76.2 |
| Max. velocity (m/s) | Sine/Random/Shock | 2.0/2.0/3.5 | 2.0/2.0/3.5 |
| Max. acceleration (g) | Sine/Random/Shock | 80/55/200 | 80/55/200 |
| Suspension stiffness (N/mm) | | 150 | 150 |
| Effective moving mass (kg) | | 28.0 | 28.5 |
| Max. payload (kg) | | 300 | 300 |
| Main resonance frequency (Hz) | | >2250 | >2250 |
| Total shaker mass (kg) | *RIT / AIT | 1750/2000 | 1750/2000 |
| Stray magnetic field (mT) | | <1.5 | <1.5 |
| Armature (ø/mm) | | 340 | 440 |
| Max. power consumption at 400V (kVA) Amp./Blower | | 29/17.5 | 29/17.5 |
| Interlocks | | Temperature, overtravel, airflow, overcurrent, compressed air | Temperature, overtravel, airflow, overcurrent, compressed air |

General data - For detailed technical information see product data sheets (Download at <https://www.tira-gmbh.de/en/tira-gmbh/downloads/vibration-test-systems/vibration-test-systems/>)

The transmission of vibrations to the installation site can be reduced by means of a corresponding trunnion mount ("**RIT**" = **R**igid **I**solated **T**runnion). The frame is equipped with vibration isolators as standard.

The TIRA AIT-System ("**AIT**" = **A**ir **I**solated **T**runnion) is a vibration isolation system integrated in the frame for vertical and horizontal guidance of the shaker. At low frequencies, it ensures optimal vibration isolation and precise guidance of the shaker body in the excitation direction.

Low Base "LB" vibration shakers for vertical test operation can be equipped with vibration damping elements or with rail systems for mobility. TIRA shakers, amplifiers and vibration control systems form a complete test system that allows users to verify the quality of their products in accordance with national standards (such as DIN, ISO, BS, MIL, IEC, ASTM).

TIRA Vibration Test Systems

Vibration test systems from 27 kN to 35 kN



See page 4

- Energy-saving mode (Field power reduction)
- Optional Dual Bearing-System for enhancement of cross axial stiffness and reduction of wear
- Airglide option (Shaker is maneuverable on air cushions)
- Multiple safety devices
- Clamping table $\varnothing 340$ mm, $\varnothing 440$ mm or $\varnothing 640$ mm
- Long-time operation
- Minimum maintenance effort
- High cross-axial stiffness
- Supported by rugged frame with vibration isolators
- Automatic centering of the AIT-System and the armature
- AIT-System fixable to use the full displacement also at low frequencies and heavy loads
- Fully automatic pneumatic load compensation for heavy test loads
- Air-cooling blower with optional fan speed control
- Available as RIT, AIT or LB trunnion system*
- Displacement of up to 76.2 mm (3 inch) (option for 440 mm CT)
- Standard degauss kit to reduce stray magnetic field
- Optional low degauss kit to reduce stray magnetic field to <0.8 mT



Shaker S 59335/AIT-440

| System | | TV 59327/*-340 | TV 59327/*-440 | TV 59327/*-640 | TV 59335/*-340 | TV 59335/*-440 | TV 59335/*-640 |
|--------------------------------------|--|---|---|---|---|---|---|
| Shaker | | S 59327/*-340 | S 59327/*-440 | S 59327/*-640 | S 59335/*-340 | S 59335/*-440 | S 59335/*-640 |
| Amplifier | | A 3 08 11 042 | A 3 08 11 042 | A 3 08 11 042 | A 3 08 11 063 | A 3 08 11 063 | A 3 08 11 063 |
| Blower | | TB 7/FUK/11 | TB 7/FUK/11 | TB 7/FUK/11 | TB 7/FUK/11 | TB 7/FUK/11 | TB 7/FUK/11 |
| Rated peak force (N) | Sine _{pk} / Random _{RMS} / Shock _{pk} | 27000/27000/80000 | 27000/27000/80000 | 27000/27000/80000 | 35000/32000/105000 | 35000/32000/105000 | 35000/32000/105000 |
| Frequency range (Hz) | | 5 - 3000 | 5 - 3000 | 5 - 2000 | 5 - 3000 | 5 - 3000 | 5 - 2000 |
| Max. displacement Pk-Pk (mm) | Sine/Random/Shock | 50.8/50.8/50.8 | 50.8/50.8/50.8 | 50.8/50.8/50.8 | 50.8/50.8/50.8 | 50.8/50.8/50.8 | 50.8/50.8/50.8 |
| Max. velocity (m/s) | Sine/Random/Shock | 2.0/1.8/3.0 | 2.0/1.8/3.0 | 2.0/1.8/3.0 | 2.0/1.8/3.0 | 2.0/1.8/3.0 | 2.0/1.8/3.0 |
| Max. acceleration (g) | Sine/Random/Shock | 84/65/167 | 79/50/158 | 66/50/131 | 100/88/220 | 100/67/207 | 70/63/160 |
| Suspension stiffness (N/mm) | | 150 | 150 | 150 | 150 | 150 | 150 |
| Effective moving mass (kg) | | 29.0 | 38.0 | 40.5 | 29.0 | 38.0 | 40.5 |
| Max. payload (kg) | | 610 | 610 | 610 | 610 | 610 | 610 |
| Main resonance frequency (Hz) | | >2400 | >2400 | >1900 | >2400 | >2400 | 2000 |
| Total shaker mass (kg) | *RIT/AIT/LB | 2350/2700/2250 | 2350/2700/2250 | 2350/2700/2250 | 2350/2700/2250 | 2350/2700/2250 | 2350/2700/2250 |
| Stray magnetic field (mT) | Std./Low degaussing | <1.5/<0.8 | <1.5/<0.8 | <2/<1 | <1.5/<0.8 | <1.5/<0.8 | <2/<1 |
| Armature (\varnothing /mm) | | 340 | 440 | 640 | 340 | 440 | 640 |
| Max. power consumption at 400V (kVA) | Amplifier/Blower | 30/17.5 | 30/17.5 | 30/17.5 | 32/17.5 | 32/17.5 | 32/17.5 |
| Interlocks | | Temperature, overtravel, airflow, overcurrent, compressed air | Temperature, overtravel, airflow, overcurrent, compressed air | Temperature, overtravel, airflow, overcurrent, compressed air | Temperature, overtravel, airflow, overcurrent, compressed air | Temperature, overtravel, airflow, overcurrent, compressed air | Temperature, overtravel, airflow, overcurrent, compressed air |

General data - For detailed technical information see product data sheets (Download at <https://www.tira-gmbh.de/en/tira-gmbh/downloads/vibration-test-systems/vibration-test-systems/>)

Vibration test systems from 49.5 kN to 70 kN



- Clamping table \varnothing 340 mm, \varnothing 440 mm or \varnothing 640 mm
- Long-time operation
- Minimum maintenance effort
- High cross-axial stiffness
- Supported by rugged frame with vibration isolators
- Automatic centering of the AIT-System and the armature
- AIT-System fixable to use the full displacement also at low frequencies and heavy loads
- Fully automatic pneumatic load compensation for heavy test loads
- Air-cooling blower with optional fan speed control

- Up to 76.2 mm (3") displacement (option for 440 mm CT)
- Standard degauss kit to reduce stray magnetic field
- Optional low degauss kit to reduce stray magnetic field to <0.8 mT
- Energy-saving mode (Field power reduction)
- Optional Dual Bearing-System for enhancement of cross axial stiffness and reduction of wear
- Airglide option (Shaker is maneuverable on air cushions)
- Multiple safety devices



Shaker S 59349/AIT-440

| System | TV 59349/AIT-340 | TV 59349/AIT-440 | TV 59349/AIT-640 | TV 59355/AIT-340 | TV 59355/AIT-440 | TV 59355/AIT-640 | TV 59370/AIT-480 |
|--------------------------------------|---|---|---|---|---|---|---|
| Shaker | S 59349/AIT-340 | S 59349/AIT-440 | S 59349/AIT-640 | S 59355/AIT-340 | S 59355/AIT-440 | S 59355/AIT-640 | S 59370/AIT-480 |
| Amplifier | A 2 11 11 105 | A 2 11 11 105 | A 2 11 11 105 | A 4 11 11 126 | A 4 11 11 126 | A 4 11 11 126 | A 4 26 11 126 |
| Blower | TB 7/FUK/20 | TB 7/FUK/20 | TB 7/FUK/20 | TB 7/FUK/20 | TB 7/FUK/20 | TB 7/FUK/20 | TB 7/FUK/20 |
| Rated peak force (N) | 49500/48000/148500 | 49500/48000/148500 | 49500/48000/148500 | 55000/51000/165000 | 55000/51000/165000 | 55000/51000/165000 | 70000/65000/210000 |
| Frequency range (Hz) | 5 - 3000 | 5 - 2500 | 5 - 2000 | 5 - 3000 | 5 - 2500 | 5 - 2000 | 5 - 2500 |
| Max. displacement Pk-Pk (mm) | 50.8/50.8/50.8 | 50.8/50.8/50.8 | 50.8/50.8/50.8 | 50.8/50.8/50.8 | 50.8/50.8/50.8 | 50.8/50.8/50.8 | 63.5/63.5/76.2 |
| Max. velocity (m/s) | 2.0/2.0/3.0 | 2.0/2.0/3.0 | 2.0/2.0/3.0 | 2.0/2.0/3.0 | 2.0/2.0/3.0 | 2.0/2.0/3.0 | 2.0/2.0/3.5 |
| Max. acceleration (g) | 100/75/264 | 100/75/224 | 70/70/160 | 100/75/264 | 100/75/224 | 70/70/160 | 100/80/350 |
| Suspension stiffness (N/mm) | 200 | 200 | 200 | 200 | 200 | 200 | 250 |
| Effective moving mass (kg) | 43.0 | 48.0 | 55.0 | 43.0 | 50.0 | 55.0 | 70.0 |
| Max. payload (kg) | 910 | 910 | 910 | 910 | 910 | 910 | 910 |
| Main resonance frequency (Hz) | >2100 | 2000 | 2000 | >2100 | 2000 | 2000 | >2100 |
| Total shaker mass (kg) | 4550 | 4550 | 4550 | 4550 | 4550 | 4550 | 4020 |
| Stray magnetic field (mT) | <1.5/<0.8 | <1.5/<0.8 | <2/<1 | <1.5/<0.8 | <1.5/<0.8 | <2/<1.5 | 1.5 (Std.) |
| Armature (\varnothing /mm) | 340 | 440 | 640 | 340 | 440 | 640 | 480 |
| Max. power consumption at 400V (kVA) | 52/27 | 52/27 | 52/27 | 59/27 | 59/27 | 59/27 | 69/27 |
| Interlocks | Temperature, overtravel, airflow, overcurrent, compressed air | Temperature, overtravel, airflow, overcurrent, compressed air | Temperature, overtravel, airflow, overcurrent, compressed air | Temperature, overtravel, airflow, overcurrent, compressed air | Temperature, overtravel, airflow, overcurrent, compressed air | Temperature, overtravel, airflow, overcurrent, compressed air | Temperature, overtravel, airflow, overcurrent, compressed air |

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TIRA Vibration Test Systems

Water-cooled vibration test systems from 55 kN to 125 kN

Water-cooled **TIRA** shakers are guided hydrostatically and cooled by a closed water circuit. The external cooling unit also supplies the lubricant for the hydrostatic bearings, which enables frictionless positioning of the vibration armature. Water-cooled shakers have the advantage of generating high forces for testing heavy loads with high accelerations. Specimen masses up to 910 kg are possible. A fully automatic pneumatic load compensation system enables the nominal vibration displacement to be reached even at high specimen masses.

- Up to 76.2 mm (3 inch) displacement
- Shaker water circuit with overpressure

- Degauss kit to reduce stray magnetic field
- Dual Bearing-System for enhancement of cross axial stiffness and reduction of wear
- Automatic permanent conductance monitoring of the cooling water
- Automatic centering of the AIT-System and the armature
- AIT-System fixable to use the full displacement also at low frequencies
- Energy saving mode (Field power reduction)



Shaker S 59389/AIT-440

| System | TV 59355/AIT-440 W | TV 59360/AIT-440 | TV 59374/AIT-440 | TV 59389/AIT-440 | TV 59410/AIT-440 | TV 59412/AIT-480 |
|---|---|---|---|---|---|---|
| Shaker | S 59355/AIT-440 W | S 59360/AIT-440 | S 59374/AIT-440 | S 59389/AIT-440 | S 59410/AIT-440 | S 59412/AIT-480 |
| Amplifier | A 5 40 11 147 | A 5 40 11 189 | A 5 40 11 210 | A 5 40 11 252 | A 5 40 11 294 | A 5 40 11 315 |
| Cooling Unit | C 59410 | C 59410 | C 59410 | C 59410 | C 59410 | C 59410 |
| Rated peak force (N) Sinepk / RandomRMS / Shockpk | 55000/55000/165000 | 60000/60000/180000 | 74000/74000/222000 | 89000/89000/267000 | 100000/89000/300000 | 125000/115000/375000 |
| Frequency range (Hz) | 5 - 2400 | 5 - 2400 | 5 - 2400 | 5 - 2400 | 5 - 2400 | 5 - 2500 |
| Max. displacement Pk-Pk (mm) Sine/Random/Shock | 63.5/63.5/76.2 | 63.5/63.5/76.2 | 63.5/63.5/76.2 | 63.5/63.5/76.2 | 63.5/63.5/76.2 | 63.5/63.5/76.2 |
| Max. velocity (m/s) Sine/Random/Shock | 2.0/2.0/4.0 | 2.0/2.0/4.0 | 2.0/2.0/4.0 | 2.0/2.0/4.0 | 2.0/2.0/4.0 | 2.0/2.0/4.0 |
| Max. acceleration (g) Sine/Random/Shock | 100/85/350 | 100/85/350 | 100/85/350 | 100/85/350 | 100/85/350 | 100/90/300 |
| Suspension stiffness (N/mm) | 175 | 175 | 175 | 175 | 175 | 250 |
| Effective moving mass (kg) | 58 | 58 | 58 | 58 | 58 | 76 |
| Max. payload (kg) | 910 | 910 | 910 | 910 | 910 | 910 |
| Main resonance frequency (Hz) | 2100 | 2100 | 2100 | 2100 | 2100 | >2100 |
| Total shaker mass (kg) | 4500 | 4500 | 4500 | 4500 | 4500 | 4500 |
| Stray magnetic field (mT) | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | <1.5 |
| Armature (ø/mm) | 440 | 440 | 440 | 440 | 440 | 480 |
| Max. power consumption at 400V (kVA) incl. cooling unit | 100 | 100 | 120 | 143 | 167 | 167 |
| Interlocks | Temperature, overtravel, overcurrent, compressed air, water flow rate, differential pressure, conductance | Temperature, overtravel, overcurrent, compressed air, water flow rate, differential pressure, conductance | Temperature, overtravel, overcurrent, compressed air, water flow rate, differential pressure, conductance | Temperature, overtravel, overcurrent, compressed air, water flow rate, differential pressure, conductance | Temperature, overtravel, overcurrent, compressed air, water flow rate, differential pressure, conductance | Temperature, overtravel, overcurrent, compressed air, water flow rate, differential pressure, conductance |

General data - For detailed technical information see product data sheets (Download at <https://www.tira-gmbh.de/en/tira-gmbh/downloads/vibration-test-systems/vibration-test-systems/>)

Water-cooled vibration test systems from 130 kN to 300 kN

- Up to 76.2 mm (3 inch) displacement
- Shaker water circuit with overpressure
- Degauss kit to reduce stray magnetic field
- Dual Bearing-System for enhancement of cross axial stiffness and reduction of wear
- Payloads of up to 2500 kg
- Automatic permanent conductance monitoring of the cooling water
- Automatic centering of the AIT-System and the armature
- AIT-System fixable to use the full displacement also at low frequencies
- Energy saving mode (Field power reduction)



Schwingereger S 59420/AIT-590

| System | TV 59413/AIT-590 | TV 59416/AIT-590 | TV 59420/AIT-590 | TV 59430/AIT-840 |
|---|---|---|---|---|
| Shaker | S 59413/AIT-590 | S 59416/AIT-590 | S 59420/AIT-590 | S 59430/AIT-840 |
| Amplifier | A 5 85 11 336 | A 5 85 11 378 | A 5 85 11 462 | A 5 00 11 483/ext. FPS |
| Cooling Unit | C 59430 | C 59430 | C 59430 | C 59430 |
| Rated peak force (N) | Sine _{pk} / Random _{RMS} / Shock _{pk} | 130000/130000/390000 | 168000/168000/504000 | 200000/168000/600000 |
| Frequency range (Hz) | | 5 - 2000 | 5 - 2000 | 5 - 2000 |
| Max. displacement Pk-Pk(mm) | Sine/Random/Shock | 63.5/63.5/76.2 | 63.5/63.5/76.2 | 63.5/63.5/76.2 |
| Max. velocity (m/s) | Sine/Random/Shock | 2.0/2.0/3.5 | 2.0/2.0/3.5 | 2.0/2.0/3.5 |
| Max. acceleration (g) | Sine/Random/Shock | 100/75/300 | 100/75/300 | 100/75/300 |
| Suspension stiffness (N/mm) | | 250 | 250 | 450 |
| Effective moving mass (kg) | | 125 | 125 | 275 |
| Max. payload (kg) | | 1300 (7 bar) | 1300 (7 bar) | 2500 |
| Main resonance frequency (Hz) | | 1700 | 1700 | 1500 |
| Total shaker mass (kg) | | 8450 | 8450 | 18500 |
| Stray magnetic field (mT) | | 1.5 | 1.5 | 2.5 |
| Armature (ø/mm) | | 590 | 590 | 840 |
| Max. power consumption at 400V (kVA) incl. cooling unit | | 249 | 249 | 370 (FPS:110) |
| Interlocks | Temperature, overtravel, overcurrent, compressed air, water flow rate, differential pressure, conductance | Temperature, overtravel, overcurrent, compressed air, water flow rate, differential pressure, conductance | Temperature, overtravel, overcurrent, compressed air, water flow rate, differential pressure, conductance | Temperature, overtravel, overcurrent, compressed air, water flow rate, differential pressure, conductance |

General data - For detailed technical information see product data sheets (Download at <https://www.tira-gmbh.de/en/tira-gmbh/downloads/vibration-test-systems/vibration-test-systems/>)

TIRA Vibration Test Systems – Calibration systems

Calibration shakers from 100 N to 800 N

Measurements for determining vibration transmission and vibration analysis are increasingly being carried out in all areas of industry, aviation, the automotive industry and power plants.

In order to be able to carry out such tests, a large number of measuring sensors are necessary. The sensors must be checked and calibrated for accuracy at defined time intervals. Since most transducers have a high measuring range and wide frequency ranges, special shakers are required to calibrate the transducers.

TIRA has taken up this challenge and developed a shaker that meets these requirements. This newly developed shaker consists of a **ceramic vibration system** and a special guide system. This newly developed vibration system is characterized by its very high, usable frequency range up to 25 kHz and is ideally suited for professional calibration with the appropriate measuring equipment. Note: The calibration shakers are not designed for continuous operation at maximum power.

The "AC" calibration shaker additionally has a special air bearing which offers the advantage of friction and wear-free operation and also dampens interference vibrations.



Calibration Shaker S 51140-C

| System | | TV 51110-C | TV 51110-AC | TV 51120-C | TV 51140-C | TV 5220-C |
|--------------------------------------|--|----------------|--------------------|------------|------------|-------------|
| Shaker | | S 51110-C | S 51110-AC | S 51120-C | S 51140-C | S 5220-C |
| Amplifier | | BAA 120/DA 200 | BAA 500-T | BAA 500 | BAA 1000 | BAA 1000-ET |
| Blower | | - | - | TB 0080 | TB 0140 | TB 0140 |
| Rated peak force (N) | Sine _{pk} / Random _{RMS} | 100/50 | 100/50 | 200/100 | 400/200 | 800/400 |
| Frequency range (Hz) | | 10 - 25000 | 1 - 20000 | 10 - 25000 | 10 - 20000 | 1 - 20000 |
| Max. displacement (mm) | Pk - Pk | 4 | 25.4 | 4 | 4 | 25.4 |
| Max. velocity (m/s) | | 1.2 | 1.2 | 1.2 | 1.2 | 1.5 |
| Max. acceleration (g) | Sine/Random | 25/12 | 17/8 | 51/25 | 68/34 | 60/30 |
| Effective moving mass ±5% (kg) | | 0.40 | 0.53 | 0.40 | 0.50 | 1.35 |
| Main resonance frequency (Hz) | | >25000 | >19000 | >25000 | >19000 | >13000 |
| Total shaker mass (kg) | | 33 | 18 | 42 | 21 | 110 |
| Armature (ø/mm) | | 54 | 50 | 54 | 54 | 130 |
| Compressed air (bar) | | | 3 (app. 2.5 l/min) | | | |
| Max. power consumption at 230V (kVA) | Amplifier/Blower | 0.08/- | 0.35/- | 0.35/0.46 | 2.7/1.4 | 2.7/2.5 |

General data - For detailed technical information see product data sheets (Download at <https://www.tira-gmbh.de/en/tira-gmbh/downloads/vibration-test-systems/vibration-test-systems/>)

Modal systems from 100 N to 2.7 kN

TIRA provides a series of modal exciters from 100 N to 2.7 kN specifically for the requirements of **modal and structural analysis**.

Up to 400 N, the modal exciters are excited by permanent magnets, whereby the exciters, which are manufactured especially with rare-earth magnets, convince by their **lightweight construction** in mobile use. The construction of the modal exciters is characterized by **high lateral stiffness**. Modal exciters from 1000 N upwards provide a vibration displacement of up to 45 mm. This is made possible by a TMC control. The **electronic zero point control TMC** enables an exact coupling of the modal exciter to the test object. The axial stiffness is also electronically adjustable.

All modal exciters are equipped with a trunnion as standard. A variety of coupling options are offered.

The modal exciter systems TV 51120-MNC and TV 51130-MSC are a special development of TIRA to **increase mobility**. The 200 N shaker does not require any additional cooling unit and the 350 N shaker has an integrated air cooling system, which eliminates the need for an additional external cooling unit.



Modal shaker S 51120-M



Modal shaker S 51130-MSC

| System | TV 51110-M | TV 51120-M | TV 51120-MNC | TV 51130-MSC |
|---|----------------|------------|--------------|--------------------|
| Shaker | S 51110-M | S 51120-M | S 51120-MNC | S 51130-MSC |
| Amplifier | BAA 120/DA 200 | BAA 500 | BAA 500 | BAA 500-MSC |
| Blower | – | TB 0080 | – | internal |
| Rated peak force (N) Sine _{pk} / Random _{RMS} | 100/70 | 200/140 | 200/100 | 350/200 |
| Frequency range (Hz) | DC - 5000 | DC - 5000 | DC - 3000 | DC - 4000 |
| Max. displacement (mm) Pk - Pk | 13 | 13 | 9 | 10 |
| Max. velocity (m/s) | 1.5 | 1.5 | 1.3 | 1.3 |
| Suspension stiffness (N/mm) | 8 | 8 | 70 | 70 |
| Effective moving mass ±5% (kg) | 0.23 | 0.23 | 0.5 | 0.55 |
| Main resonance frequency (Hz) (free-swinging) | >2680 | >2680 | >4000 | >2700 |
| Total shaker mass (kg) | 12 | 12 | 18 | 27 |
| Coupling (Thread ø) | M6 | M6 | M8 | M8 |
| Max. power consumption at 230V (kVA) Amplifier/Blower | 0.08/- | 0.35/0.46 | 0.35/- | 0.9 (incl. blower) |

| System | TV 51140-M | TV 5220-M | TV 50350-M |
|--|------------|--------------------|--------------------|
| Shaker | S 51140-M | S 5220-M | S 50350-M |
| Amplifier | BAA 1000 | BAA 1000-ET | A 1 01 11 010 T |
| Blower | TB 0140 | TB 0140 | TB 0310 |
| Rated peak force (N) Sine _{pk} / Random _{RMS} | 400/311 | 1000/650 | 2700/2000 |
| Frequency range (Hz) | DC - 5000 | 1 - 5000 | 1 - 3000 |
| Max. displacement (mm) Pk - Pk | 20 | 45 | 45 |
| Max. velocity (m/s) | 1.5 | 1.5 | 1.5 |
| Suspension stiffness (N/mm) | 5 | Electr. adjustable | Electr. adjustable |
| Effective moving mass ±5% (kg) | 0.4 | 1.45 | 2.3 |
| Main resonance frequency (Hz) (free-swinging) | >2450 | >4000 | >3000 |
| Total shaker mass (kg) | 18 | 122 | 280 |
| Coupling (Thread ø) | M6 | M8 | M8 |
| Max. power consumption at 230/400V (kVA) Amplifier/Blower (+FPS) | 2.7/1.4 | 2.7/2.5 | 4.5 (total) |

General data - For detailed technical information see product data sheets (Download at <https://www.tira-gmbh.de/en/tira-gmbh/downloads/vibration-test-systems/vibration-test-systems/>)

TIRA Vibration Test Systems – Modal systems

Modal systems from 100 N to 15 kN

TIRA offers a new range of special modal exciters for **mobile use**. The MOSP models feature a **large vibration displacement** of up to 25.4 mm. The low mass by using rare-earth magnets, the through hole in the center of the armature for **using piano-wire stingers** besides push/pull stingers and for accomplishing a variable adjustment of the distance to the test structure, are additional features of this series.

TIRA offers a series of modal exciters from 4 kN to 15 kN especially for modal excitation of **large structures** or structures with **high mass**. The construction of these modal exciters is characterized by **high lateral stiffness**. Modal exciters from 4 kN upwards provide a vibration displacement of up to 100 mm (pk-pk), which is achieved by means of a TMC control.

The **electronic zero point control TMC** enables an exact coupling of the modal exciter to the test object. The axial stiffness can be easily adjusted.



Modal shaker S 51110-MOSP

Modal shaker S 55240-M/LSS

| System | TV 51110-MOSP | TV 51120-MOSP | TV 51140-MOSP |
|---|----------------|---------------|---------------|
| Shaker | S 51110-MOSP | S 51120-MOSP | S 51140-MOSP |
| Amplifier | BAA 120/DA 200 | BAA 500 | BAA 1000 |
| Blower | – | TB 0080 | TB 0140 |
| Rated peak force (N) Sine _{pk} / Random _{RMS} | 100/70 | 200/140 | 400/280 |
| Frequency range (Hz) | DC - 5000 | DC - 5000 | DC - 5000 |
| Max. displacement (mm) Pk - Pk | 25.4 | 25.4 | 25.4 |
| Max. velocity (m/s) | 1.5 | 1.5 | 1.5 |
| Suspension stiffness (N/mm) | 4 | 4 | 4 |
| Effective moving mass ±5% (kg) | 0.23 | 0.23 | 0.4 |
| Main resonance frequency (Hz) (free-swinging) | >6000 | >6000 | 4000 |
| Total shaker mass (kg) | 21 | 21 | 21 |
| Coupling (Thread ø) | M6 | M6 | M6 |
| Max. power consumpt. at 230V (kVA) Amplifier/Blower | 0.08/- | 0.35/0.46 | 2.7/1.4 |

| System | TV 55240-M/LSS | TV 56280-M/LSS | TV 57315-M/LSS |
|---|-----------------|-----------------|-----------------|
| Shaker | S 55240-M/LSS | S 56280-M/LSS | S 57315-M/LSS |
| Amplifier | A 1 01 11 021 T | A 1 02 11 021 T | A 3 01 11 063 T |
| Blower | TB 0310 | TB 9 FUK | TB 120 FUK |
| Rated peak force (N) Sine _{pk} / Random _{RMS} | 4000/3400 | 8000/6000 | 15000/11000 |
| Frequency range (Hz) | 1 - 2000 | 1 - 2000 | 1 - 2000 |
| Max. displacement (mm) Pk - Pk | 100 | 100 | 100 |
| Max. velocity (m/s) | 2.0 | 2.0 | 2.0 |
| Effective moving mass ±5% (kg) | 11.0 | 12.0 | 18.0 |
| Main resonance frequency (Hz) (free-swinging) | >2500 | >2500 | >2500 |
| Total shaker mass (kg) | 800 | 850 | 1200 |
| Coupling (Thread ø) | M10 | M10 | M10 |
| Max. power consumption at 400V (kVA) incl. blower | 14 | 17 | 29 |

General data - For detailed technical information see product data sheets (Download at <https://www.tira-gmbh.de/en/tira-gmbh/downloads/vibration-test-systems/vibration-test-systems/>)

Inertial systems from 125 N to 650 N

TIRA manufactures a range of inertial exciters (IN) from 125 N to 650 N. The inertial exciters (IN) are screwed directly to the structure and can be coupled at any angle in 360 degrees to the structure.

These inertial exciters (IN) are characterized by **high lateral stiffness**. The permanent magnet driven inertial exciters are equipped with a special spring system which provides an optimal guidance. This allows the exciter to work on the structure with its full body mass with no problems.

A maintenance-free fan guarantees the cooling of the vibration exciter. The cooling air is suctioned through a coarse filter system. TIRA's inertial exciters (IN) are used in industry, aerospace, civil engineering and the shipbuilding industry, as they are a favourable and effective method for transferring dynamic forces into large structures.



Inertial shaker S 51140-IN

| System | TV 51112-IN | TV 51125-IN |
|---|----------------|-------------|
| Shaker | S 51112-IN | S 51125-IN |
| Amplifier | BAA 120/DA 200 | BAA 500 |
| Blower | – | TB 0080 |
| Rated peak force (N) Sine _{pk} / Random _{RMS} | 125/70 | 250/150 |
| Frequency range (Hz) | 2 - 2000 | 2 - 2000 |
| Max. displacement (mm) Pk - Pk | 9 | 9 |
| Max. velocity (m/s) | 1.5 | 1.5 |
| Max. acceleration (g) Sine/Random | 0.98/0.54 | 2/1.2 |
| Suspension stiffness (N/mm) | 20 | 20 |
| Effective moving mass ±5% (kg) | 0.35 | 0.35 |
| Total shaker mass (kg) | 13 | 13 |
| Coupling (Thread ø) | M12 | M12 |
| Max. power consumption at 230V (kVA) Amplifier/Blower | 0.1/- | 0.4/0.46 |

| System | TV 51140-IN | TV 51165-IN |
|---|-------------|-------------|
| Shaker | S 51140-IN | S 51165-IN |
| Amplifier | BAA 1000 | BAA 1000 |
| Blower | TB 0140 | TB 0140 |
| Rated peak force (N) Sine _{pk} / Random _{RMS} | 400/311 | 650/420 |
| Frequency range (Hz) | 2 - 2000 | 2 - 2000 |
| Max. displacement (mm) Pk - Pk | 9 | 9 |
| Max. velocity (m/s) | 1.5 | 1.5 |
| Max. acceleration (g) Sine/Random | 2.8/2 | 2.6/1.7 |
| Suspension stiffness (N/mm) | 56 | 98 |
| Effective moving mass ±5% (kg) | 0.63 | 0.97 |
| Total shaker mass (kg) | 16 | 26 |
| Coupling (Thread ø) | M12 | M12 |
| Max. power consumption at 230V (kVA) Amplifier/Blower | 2.7/1.4 | 2.7/1.4 |

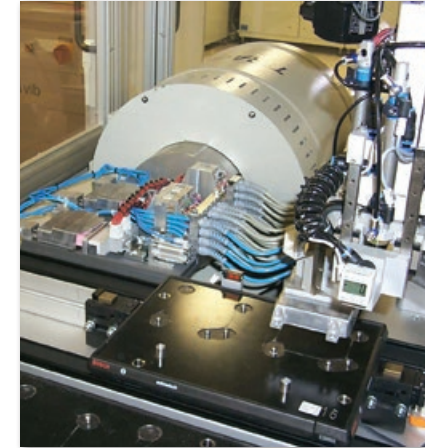
General data - For detailed technical information see product data sheets (Download at <https://www.tira-gmbh.de/en/tira-gmbh/downloads/vibration-test-systems/vibration-test-systems/>)

TIRA Vibration Test Systems – Long stroke systems

Long stroke shaker with 100 mm displacement (pk-pk)

As a result of growing safety requirements, the industry is increasingly developing sensors and components that have to be tested under extreme stress conditions. The test parameters reach higher and higher accelerations combined with long shock duration - these tests are no longer possible with conventional standard systems with a vibration displacement of 50.8 mm.

TIRA has responded to the requirements of the industry for testing systems that can simulate extreme shocks by developing a series of long stroke exciters with 100 mm vibration displacement (pk-pk). In addition to their use in the laboratory for testing development tasks, these shakers have also proved their worth in the integration into complete production lines.



| System | | TV 55240/LSS-250 | TV 56280/LSS-250 | TV 57315/LSS-300 |
|--|--|------------------|------------------|-------------------|
| Shaker | | S 55240/LSS-250 | S 56280/LSS-250 | S 57315/LSS-300 |
| Amplifier | | A 1 01 11 021 T | A 1 02 11 021 T | A 3 01 11 063 T |
| Blower | | TB 0310 | TB 9 FUK | TB 120 FUK |
| Rated peak force (N) | Sine _{pk} / Random _{RMS} / Shock _{pk} | 4000/3400/10000 | 8000/6000/20000 | 15000/11000/37500 |
| Frequency range (Hz) | | 1 - 2000 | 1 - 2000 | 1 - 2000 |
| Max. displacement (mm) | Pk - Pk | 100 | 100 | 100 |
| Max. velocity (m/s) | Sine/Random/Shock | 2.0/2.0/4.5 | 2.0/2.0/4.5 | 2.0/2.0/4.5 |
| Max. acceleration (g) | Sine/Random/Shock | 37/30/74 | 60/45/136 | 60/50/210 |
| Max. payload (kg) | | 50 | 50 | 80 |
| Effective moving mass ±5% (kg) | | 12.0 | 13.0 | 17.0 |
| Main resonance frequency (Hz) | | >2000 | >2000 | >1700 |
| Total shaker mass (kg) | | 800 | 850 | 1200 |
| Stray magnetic field (mT) | | n/a | n/a | <6 |
| Armature (ø/mm) | | 250 | 250 | 300 |
| Max. power consumption at 400V (kVA) incl. blower | | 14 | 17 | 29 |

General data - For detailed technical information see product data sheets (Download at <https://www.tira-gmbh.de/en/tira-gmbh/downloads/vibration-test-systems/vibration-test-systems/>)

TIRA Slip Tables

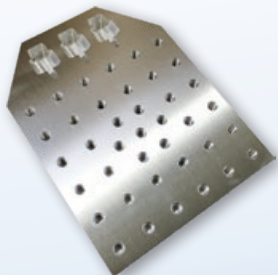
OUR CONCEPT

The clear and functional design of TIRA slip tables enables **user-friendly handling and trouble-free testing**. Swiveling the shaker does not limit the possibility of conventional vibration tests on the vibration armature. Rigid welded structures as a basis increase the reaction mass of our systems. Undesirable vibrations on the surrounding area are damped. Linear guides guarantee the lateral stiffness of the slip plate and minimize lateral vibrations in asymmetrical test arrangements.

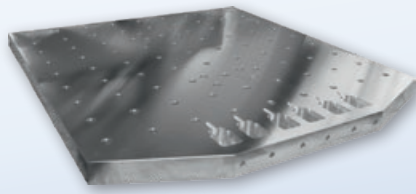
TIRA's Monobase slip tables are available in different versions:

- Index XS: for vibration systems: TV 5220, TV 54216
- Index S: for vibration systems: TV 50350
- Index SM: for vibration systems: TV 55240
- Index M: for vibration systems: TV 56280
- Index L: for vibration systems: TV 51010, TV 57315
- Index XL: for vibration systems: TV 59322, TV 59327, TV 59335
- Index XXL: for vibration systems: TV 59349 - TV 59412
- Index XXXL: for vibration systems: TV 59413, TV 59416, TV 59420
- Index LX: for vibration systems: TV 59430

In vibration technology, testing tasks arise from applications in research, development and quality assurance. As the masses and dimensions of the test specimens increase, the testing tasks can no longer be performed on the armatures of electrodynamic shakers.

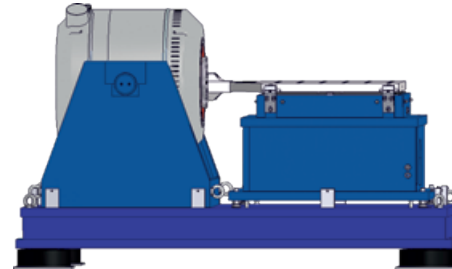


Slip plate 12"



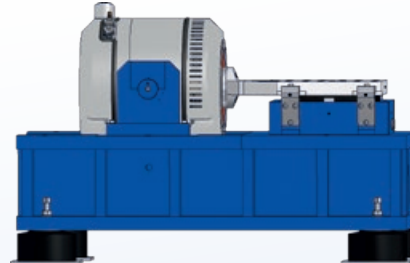
Slip plate 48"

SLIP TABLE MINIBASE



TIRA MINIBASE slip table: shaker in the original frame and slip table module mounted together on a base plate.
Available on request.

SLIP TABLE MONOBASE



TIRA MONOBASE slip table: shaker and slip plate are integrated in a common frame.

Tailor-made manufacturing is our success. We offer customer-specific solutions which can be adapted to all special requirements. TIRA slip tables can be optionally adapted to all existing vibration and climate test systems. By the use of high-quality materials and reliable components, our products ensure long-term use at low operating costs.

TIRA Vibration Test Systems – Slip Tables

TIRA Slip Tables

TESTING UNDER STRESS

Modern systems and installations have to prove themselves in all areas under their operating conditions such as temperature changes, vibrations and high humidity. From the conceptual design stage to the final inspection of electrical, electronic or mechanical products, **combined vibration-climate testing systems** simulate environmental influences on the test object. Weak points can be detected early and optimized cost-effectively. Expensive downtimes and damage are avoided by the correct design of functionally relevant components. These multi-test systems are important elements of quality assurance in the production process.

DRIVER BARS

TIRA driver bars provide the **link between shaker and slip plate**. They are FEM designed and made of magnesium. Depending on size, they are single pieces or welded together. Their geometric design enables perfect force transmission while minimizing the moving mass. Driver bars are available for vibration generators with different armature diameters from 120 mm to 840 mm.

| Driver bars | | |
|--------------------|------------------------|------------|
| Slip table version | Armature diameter (mm) | ~Mass (kg) |
| XS | 120 | 1.0 |
| S | 120 | 1.5 |
| SM | 180 | 3.0 |
| | 340 | 6.5 |
| M | 180 | 3.0 |
| | 340 | 6.5 |
| L | 230 | 3.5 |
| | 340 | 6.0 |
| XL | 340 | 8.0 |
| | 440 | 9.0 |
| | 640 | 10.0 |
| XXL | 340 | 15.0 |
| | 440 | 16.0 |
| | 640 | 20.0 |
| XXXL | 590 | 49.0 |
| LX | 840 | 96.0 |

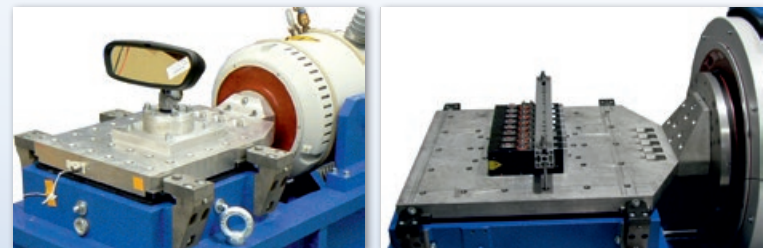
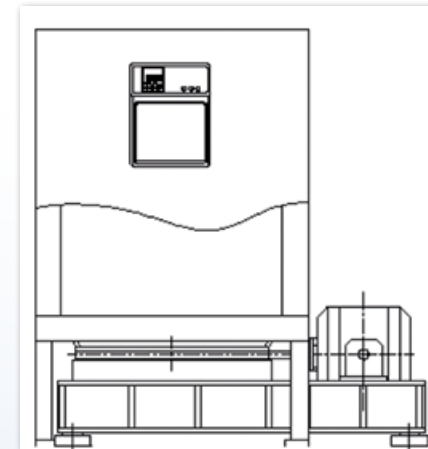


VIBRATION ISOLATION, SAFE INSTALLATION

Air spring elements allow the use of the slip tables without expensive foundations. Due to the low natural frequency of the isolators (3 - 5 Hz) a wide test spectrum can be applied.

TEST OBJECT FIXING

Test objects must be excited in their final position for practice-oriented simulation. TIRA supplies individual clamping devices for each application.



Oil-film slip tables

Increasing requirements in vibration testing demand additional slip table systems, which also allow testing of large and heavy specimens in horizontal mounting positions. The monobase design ensures fast and precise alignment and coupling of the shaker to the slip table. The slip tables are available as standard with slip table plates up to 2000 mm x 2000 mm. Different and larger tables are manufactured according to customer requirements. The oil film slip tables consist of a precision ground and lapped natural granite base plate on which a magnesium plate slides onto an oil film. 4 Linear guides ensure the lateral guidance of the slip plate and minimize lateral vibrations. The possibility of horizontal and vertical excitation al-



Shaker S 51010/LS-340
with slip table TGT MO 20 L

lows tests in mounting position. Vibration isolators are mounted on the bottom of the frame as a standard feature to prevent vibration effects on the building.

- 100 mm displacement possible
- Integrated oil pan
- Non-contact displacement monitoring (only with AIT-systems)

| | Moving plate working area (mm) | Slip plate mass (±5%) (kg) | Slip plate thickness (mm) | Max. specimen mass (kg) | Dimension ~ L*W*H (mm) | Max. pitch moment (Nm) | Max. roll moment (Nm) | Max. yaw moment (Nm) |
|---------------|--------------------------------|----------------------------|---------------------------|-------------------------|------------------------|------------------------|-----------------------|----------------------|
| TGT MO 12 XS | 305*305 | 8.5 | 40 | 100 | 950*600*550 | 550 | 550 | 250 |
| TGT MO 12 S | | | | | 1150*750*750 | | | |
| TGT MO 12 SM | | | | | 1500*1050*900 | | | |
| TGT MO 12 M | | | | | 1500*1050*900 | | | |
| TGT MO 18 XS | 458*458 | 18 | 40 | 300 | 1250*650*550 | 1600 | 1600 | 250 |
| TGT MO 18 S | | | | | 1350*950*750 | | | |
| TGT MO 18 SM | | | | | 1600*1050*900 | | | |
| TGT MO 18 M | | | | | 1700*1100*900 | | | |
| TGT MO 18 L | | | | | 1600*1200*950 | | | |
| TGT MO 20 XS | 508*508 | 22 | 40 | 400 | 1350*700*550 | 2400 | 2400 | 250 |
| TGT MO 20 S | | | | | 1350*850*750 | | | |
| TGT MO 20 SM | | | | | 1650*1100*900 | | | |
| TGT MO 20 M | | | | | 1650*1100*900 | | | |
| TGT MO 20 L | | | | | 1700*1200*950 | | | |
| TGT MO 20 XL | | | | | 2050*1350*1200 | | | |
| TGT MO 24 S | 610*610 | 31 | 40 | 550 | 1500*950*750 | 3880 | 3880 | 250 |
| TGT MO 24 SM | | | | | 1800*1100*900 | | | |
| TGT MO 24 M | | | | | 1800*1100*900 | | | |
| TGT MO 24 L | | | | | 1800*1250*950 | | | |
| TGT MO 24 XL | | | | | 2150*1600*1250 | | | |
| TGT MO 30 M | 762*762 | 47 | 40 | 1000 | 1950*1100*900 | 7600 | 7600 | 250 |
| TGT MO 30 L | | | | | 1950*1100*950 | | | |
| TGT MO 30 XL | | | | | 2500*1400*1250 | | | |
| TGT MO 36 L | 915*915 | 80.5 | 50 | 1750 | 2050*1250*1000 | 12670 | 12670 | 250 |
| TGT MO 36 XL | | | | | 2300*1600*1250 | | | |
| TGT MO 36 XXL | | | | | 2700*2000*1600 | | | |
| TGT MO 39 L | 991*991 | 100 | 50 | 2200 | 2150*1750*1000 | 16700 | 16700 | 250 |
| TGT MO 39 XL | | | | | 2450*1650*1250 | | | |
| TGT MO 39 XXL | | | | | 2800*2000*1600 | | | |
| TGT MO 48 L | 1200*1200 | 142 | 50 | 2400 | 2200*1800*1000 | 19500 | 19500 | 250 |
| TGT MO 48 XL | | | | | 2700*1600*1250 | | | |
| TGT MO 48 XXL | | | | | 3000*1950*1500 | | | |
| TGT MO 60 L | 1500*1500 | 243 | 50 | 3500 | 2850*1800*1000 | 25600 | 25600 | 250 |
| TGT MO 60 XL | | | | | 3050*1800*1200 | | | |
| TGT MO 60 XXL | | | | | 3150*1700*1400 | | | |
| TGT MO 70 L | 1800*1800 | 302 | 50 | 4000 | 3150*2100*1000 | 30000 | 30000 | 250 |
| TGT MO 70 XL | | | | | 3250*2100*1200 | | | |
| TGT MO 70 XXL | | | | | 3450*2000*1400 | | | |
| TGT MO 78 XL | | | | | 3550*2300*1400 | | | |
| TGT MO 78 XXL | 2000*2000 | 390 | 50 | 4500 | 3650*2300*1400 | 34000 | 34000 | 250 |

Effective frequency range 0 - 2000 Hz / please inquire for larger slip plates/other sizes

Subject to change without notice. Errors and omissions excepted.

TIRA Vibration Test Systems – Slip Tables

Hydrostatically guided slip tables

Oil-film slip tables with hydrostatic guidance from TIRA give you a compact system for a variety of vibration tests, including those of large and heavy specimens which generate high yaw, roll and pitch moments due to their high centers of gravity above the slip plate. These tables use high-pressure bearings with a separate hydraulic supply unit.

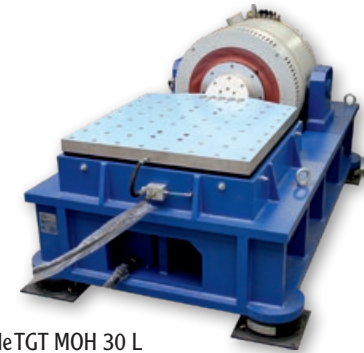
The monobase design enables rapid conversion from horizontal to vertical testing and the accurate alignment of vibration generators relative to slip tables. Magnesium slip plates are available in different sizes, up to a working area of max. 2000 x 2000 mm. Other (and larger) sizes can be produced on request.

Oil-film slip tables consist of a precision ground and lapped natural granite block with a magnesium plate sliding on an oil film.

Hydrostatic slide bearings make it possible to restrain the high yaw, roll and pitch moments as they appear with heavy test items or very large loads which may have a high

centre of gravity. Hydrostatically guided slip tables are used to test specimens in a horizontal direction. Vibration isolators are provided on the underside of the frame as a standard feature to prevent vibration transfer to the building.

- Enclosed oil aggregate with return flow pump
- Integrated oil pan
- Non-contact displacement monitoring (only with AIT-systems)
- 100 mm displacement possible



Shaker S 57315/LS-340 with slip table TGT MOH 30 L

| | Moving plate working area (mm) | Bearings | Slip plate mass ($\pm 5\%$) (kg) | Slip plate thickness (mm) | Max. specimen mass (kg) | Dimension L*W*H (mm) | Max. pitch moment (Nm) | Max. roll moment (Nm) | Max. yaw moment (Nm) |
|----------------|--------------------------------|----------|------------------------------------|---------------------------|-------------------------|----------------------|------------------------|-----------------------|----------------------|
| TGT MOH 24 SM | 610*610 | 2 | 48 | 50 | 550 | 1800*1100*900 | 26500 | 25000 | 22300 |
| TGT MOH 24 M | | | | | | 1800*1100*900 | | | |
| TGT MOH 24 L | | | | | | 1800*1250*950 | | | |
| TGT MOH 24 XL | | | | | | 2150*1600*1250 | | | |
| TGT MOH 30 M | 762*762 | 2 | 72 | 50 | 1000 | 1950*1100*900 | 32200 | 34000 | 24700 |
| TGT MOH 30 L | | | | | | 1950*1100*950 | | | |
| TGT MOH 30 XL | | | | | | 2250*1650*1250 | | | |
| TGT MOH 36 L | 915*915 | 2 | 96 | 50 | 1750 | 2050*1250*1000 | 47900 | 45700 | 34700 |
| TGT MOH 36 XL | | | | | | 2300*1600*1250 | | | |
| TGT MOH 36 XXL | | | | | | 2700*2000*1600 | | | |
| TGT MOH 39 L | 991*991 | 2 | 105 | 50 | 2200 | 2150*1750*1000 | 66500 | 59800 | 44700 |
| TGT MOH 39 XL | | | | | | 2450*1650*1250 | | | |
| TGT MOH 39 XXL | | | | | | 2800*2000*1600 | | | |
| TGT MOH 48 L | 1200*1200 | 3 | 170 | 50 | 6000 | 2200*1800*1000 | 91400 | 82200 | 56000 |
| TGT MOH 48 XL | | | | | | 2700*1600*1250 | | | |
| TGT MOH 48 XXL | | | | | | 3000*1700*1500 | | | |
| TGT MOH 60 L | 1500*1500 | 3 | 252 | 50 | 8000 | 2850*1800*1000 | 167000 | 143000 | 99600 |
| TGT MOH 60 XL | | | | | | 3050*1800*1200 | | | |
| TGT MOH 60 XXL | | | | | | 3150*1700*1400 | | | |
| TGT MOH 70 L | 1800*1800 | 5 | 330 | 50 | 10000 | 3150*2100*1000 | 260000 | 215000 | 125000 |
| TGT MOH 70 XL | | | | | | 3250*2100*1200 | | | |
| TGT MOH 70 XXL | | | | | | 3450*2000*1400 | | | |
| TGT MOH 78 XL | | | | | | 3550*2300*1400 | | | |
| TGT MOH 78 XXL | 2000*2000 | 5 | 430 | 50 | 12000 | 3650*2300*1400 | 320000 | 272000 | 182000 |

Effective frequency range 0 - 2000 Hz / please inquire for larger slip plates/other sizes

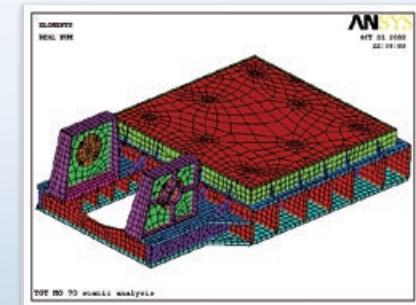
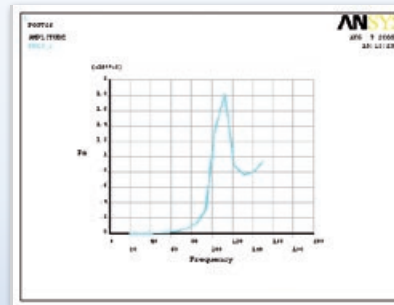
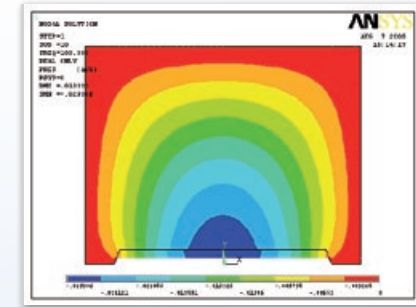
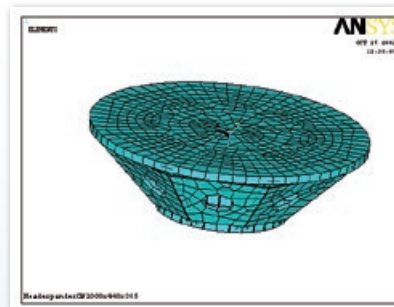
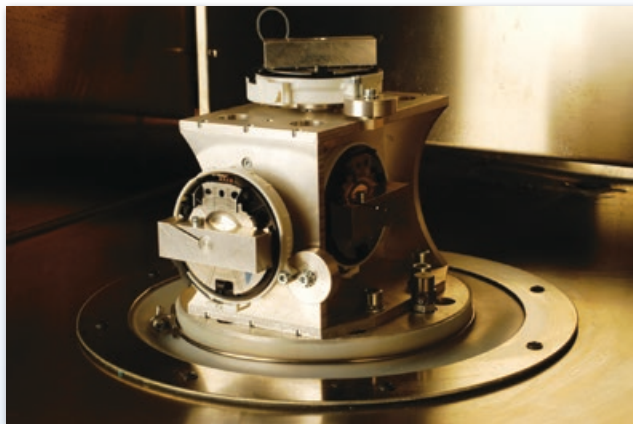
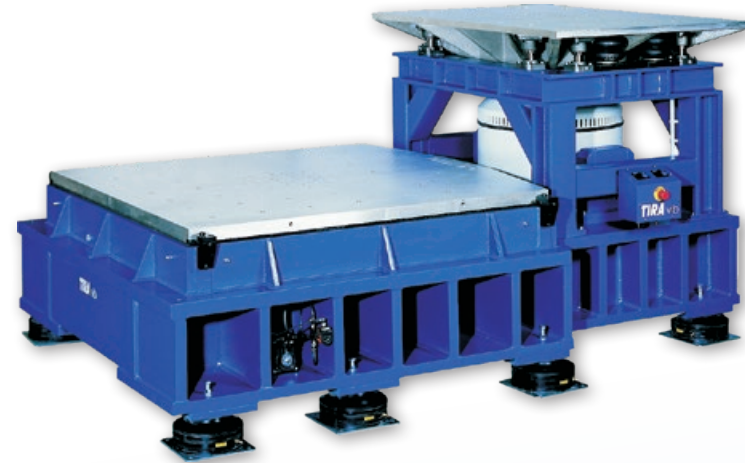
Load-bearing platforms (guided head expanders)

FEM-designed head expanders

TIRA offers a wide range of head expanders, L and T-type fixtures, cubes and special support systems. The latest software for FEM calculation and analysis is used so that customers get specifically designed fixture assemblies with optimized and predicted dynamic performance to produce the best result.

Fixtures are often main items of application conditions in industrial testing where specimens are tested to high standards of precision. This means that the fixture has to be optimized for both the specimen and the test parameters. Many customers, however, can't do these sophisticated calculations to produce a suitable fixture. TIRA has met this challenge and will develop, calculate and manufacture any type of special-purpose fixtures for your application, with the emphasis on minimizing its mass and optimize its dynamic performance.

Monobase systems with a horizontal slip table and vertically guided load-bearing platform make it possible to test extremely large and heavy loads in direction of x, y and z axis. Specially-designed slip tables and load-bearing platforms are available with a working area of max. 2000 mm x 2000 mm (78 x 78"). Slip plate and load-bearing platform are accurately aligned in a common base frame. Conversion from horizontal to vertical operation is easy and takes a minimum of time.



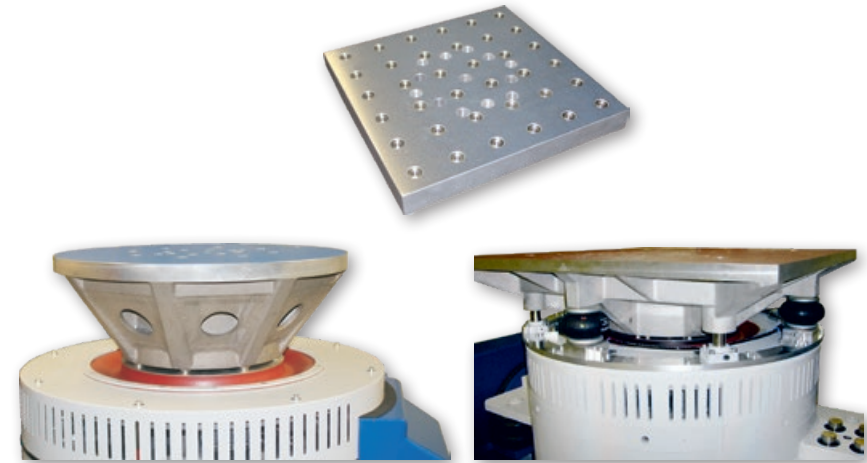
TIRA Vibration Test Systems

Head Expanders

TIRA head expanders are manufactured from magnesium and provide an expansion of the armature table. The unique design of the head expanders and 3 channel control strategies allow tests up to a frequency of 2000 Hz (depends on resonance frequency). Head expanders especially provided with 'vibrodamp' can be subjected to test frequencies above 1000 Hz. This damping process reduces amplification of upper frequency resonances.

If a test object needs eccentric clamping or generates high transverse moments, Tira also offers guided head expanders.

Apart from the range of standard head expanders **TIRA** also offers customized fixtures for round, square or rectangular working areas.



| CIRCULAR VERSION | | | | |
|------------------|-------------|-----------------|-------------|-----------|
| Size (ø/mm) | Type | Armature (ø/mm) | Height (mm) | Mass (kg) |
| 250 | THR 25-120 | 120 | 80 | 3.7 |
| | THR 25-180 | 180 | 80 | 4.3 |
| 300 | THR 30-180 | 180 | 80 | 5.6 |
| | THR 30-230 | 230 | 80 | 6.7 |
| 400 | THR 40-180 | 180 | 120 | 10.8 |
| | THR 40-230 | 230 | 120 | 12.0 |
| 500 | THR 50-180 | 180 | 150 | 20.5 |
| | THR 50-230 | 230 | 150 | 22.0 |
| | THR 50-340 | 340 | 150 | 24.4 |
| 600 | THR 60-180 | 180 | 210 | 29.0 |
| | THR 60-230 | 230 | 190 | 31.0 |
| | THR 60-340 | 340 | 181 | 35.5 |
| 800 | THR 80-340 | 340 | 210 | 51.0 |
| | THR 80-440 | 440 | 200 | 62.0 |
| | THR 80-640 | 640 | 130 | 47.0 |
| 1000 | THR 100-440 | 440 | 340 | 122.0 |
| | THR 100-590 | 590 | 305 | 125.0 |
| | THR 100-640 | 640 | 185 | 91.0 |
| 1200 | THR 120-440 | 440 | 335 | 172.0 |
| | THR 120-590 | 590 | 350 | 184.0 |
| | THR 120-840 | 840 | 280 | 169.0 |
| 1500 | THR 150-590 | 590 | 286 | 282.0 |
| | THR 150-840 | 840 | 275 | 280.0 |

Vibrodamp version on request

| SQUARE VERSION | | | | |
|----------------|-------------|-----------------|-------------|-----------|
| Size (mm) | Type | Armature (ø/mm) | Height (mm) | Mass (kg) |
| 300 x 300 | THS 30-120 | 120 | 100 | 7.3 |
| | THS 30-180 | 180 | 105 | 8.2 |
| 400 x 400 | THS 40-180 | 180 | 100 | 14.0 |
| | THS 40-230 | 230 | 100 | 14.5 |
| 500 x 500 | THS 50-180 | 180 | 125 | 22.5 |
| | THS 50-230 | 230 | 150 | 27.5 |
| | THS 50-340 | 340 | 180 | 34.0 |
| 600 x 600 | THS 60-180 | 180 | 180 | 36.0 |
| | THS 60-230 | 230 | 180 | 39.5 |
| | THS 60-340 | 340 | 180 | 47.5 |
| | THS 60-440 | 440 | 180 | 49.0 |
| 800 x 800 | THS 80-340 | 340 | 250 | 89.0 |
| | THS 80-440 | 440 | 250 | 90.0 |
| | THS 80-640 | 640 | 120 | 66.0 |
| 1000 x 1000 | THS 100-440 | 440 | 230 | 129.0 |
| | THS 100-590 | 590 | 285 | 155.0 |
| | THS 100-640 | 640 | 175 | 135.0 |
| 1200 x 1200 | THS 120-440 | 440 | 295 | 195.0 |
| | THS 120-590 | 590 | 340 | 255.0 |
| | THS 120-840 | 840 | 345 | 258.0 |
| 1500 x 1500 | THS 150-440 | 440 | 380 | 286.0 |
| | THS 150-590 | 590 | 340 | 345.0 |
| | THS 150-840 | 840 | 380 | 385.0 |

Vibrodamp version on request

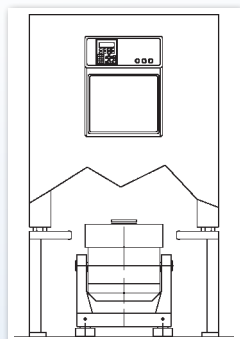
TIRA Shakers and Vibration Test Chambers

Quality, reliability and safety of products require utmost care from the concept to the end-user. To meet this pretentious requirement, one nowadays investigates the interactions between objects and their direct or indirect environment by means of environmental testing systems. Based upon such experience, products are developed with reference to specific applications as well as high quality and reliability. Utilizing combined temperature and vibration testing techniques our customers can detect material and workmanship defects at an early stage to minimize warranty costs.

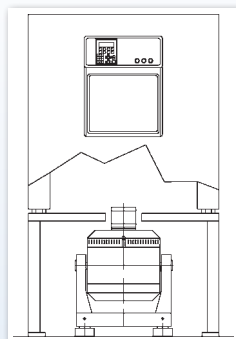
In practical use, the products are exposed to various environmental influences at the same time such as e.g. temperature, humidity, vibrations and transport loads.

TIRA offers individual fixtures, consisting of steel rings, fitting membranes and clamping ring, for the combination of our vibration exciters with climatic chambers of different manufacturers and allows a smooth process of the testing programs in vertical, horizontal and triaxial direction.

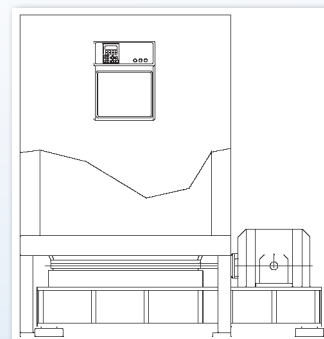
For the operation of our vibration exciters (27 to 55 kN) with low pressure chambers TIRA's product range includes a special low pressure unit for armature diameters of 340 mm.



Integration of vibration generator into climatic chamber



Head extender



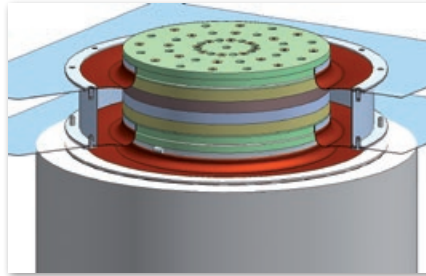
Integration of slip table into climatic chamber

TIRA Vibration Test Systems – Temperature/Climatic Test Systems

Chamber leadthroughs

TIRA chamber leadthroughs

TIRA has developed a new leadthrough for the operation of shakers with climatic chambers. This leadthrough allows in comparison to the previous systems with headextender and massive thermobarrier plate a significant better isolation at high temperature differences. This way an operation of sensitive climate with higher dew points is better possible.



Therefore more constant temperature conditions for the test material are present. The condensation of humidity out of the testing air is reduced considerably. At cooling operation of the chamber the shaker inside is better protected against condensation. The new model offers in addition to the significantly enhanced isolation attributes also a mass advantage of about 30%.

Thermobarriers (TBR, Circular version)

| Diameter mm | Height mm | Mass kg |
|-------------|-----------|---------|
| 60 | 20 | 0.1 |
| 80 | 20 | 0.2 |
| 120 | 20 | 0.5 |
| 180 | 20 | 1.0 |
| 230 | 20 | 1.6 |
| 250 | 20 | 2.0 |
| 300 | 20 | 3.0 |
| 340 | 20 | 3.5 |
| 400 | 20 | 5.0 |
| 440 | 20 | 5.8 |
| 500 | 20 | 8.0 |
| 590 | 20 | 10.5 |
| 600 | 20 | 11.5 |
| 640 | 20 | 12.3 |
| 840 | 30 | 31.5 |

Other sizes on request

Climatic chamber leadthroughs (THX)

| Armature diameter mm | Height (Standard) mm | for chamber floor thickness (Standard) mm | Mass* kg |
|----------------------|----------------------|---|----------|
| 120 | 100-200 (160) | 40-140 (100) | 2.5 |
| 180 | 100-200 (160) | 40-140 (100) | 5.6 |
| 230 | 100-200 (160) | 40-140 (100) | 7.8 |
| 340 | 100-200 (160) | 40-140 (100) | 17.5 |
| 440 | 100-200 (160) | 40-140 (100) | 25.0 |
| 590 | 100-200 (160) | 40-140 (100) | 52.0 |
| 640 | 100-200 (160) | 40-140 (100) | 59.0 |
| 840 | 100-200 (160) | 40-140 (100) | 107.0 |

Temperature range -40 °C to 160 °C

* Mass at standard height of 160 mm

Thermobarriers (TBS, Square version)

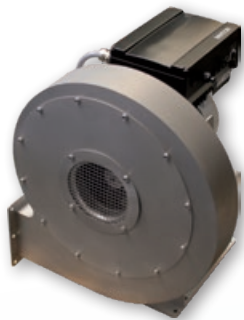
| Size mm | Height mm | Mass kg |
|-------------|-----------|---------|
| 300 x 300 | 20 | 3.6 |
| 400 x 400 | 20 | 6.4 |
| 500 x 500 | 20 | 10.0 |
| 600 x 600 | 20 | 14.4 |
| 800 x 800 | 20 | 25.6 |
| 900 x 900 | 20 | 32.4 |
| 1000 x 1000 | 20 | 40.0 |
| 1200 x 1200 | 20 | 57.6 |
| 1500 x 1500 | 20 | 90.0 |
| 1800 x 1800 | 20 | 129.6 |
| 2000 x 2000 | 20 | 160.0 |

Blowers/Noise reduction

Blowers are used for cooling the shakers. TIRA mainly offers side channel blowers that provide an above-average cooling performance in comparison with axial blowers. In addition to this, silencers for damping the blow-off noise are offered.

An aerated sound-absorbing chamber is offered for installing the cooling blower in closed rooms. The low-maintenance blower can also be installed outdoors.

The newly developed Air-Water-Heat exchanger WWT is used for cooling down the exhaust air of the vibration test system to room temperature. This allows the operation inside rooms without problems. The heat exchanger is additionally designed as a noise protection casing and therefore offers highly efficient silencing performance.



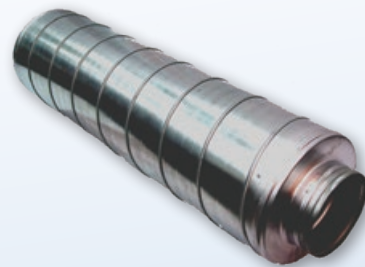
Blower TB 9 FUK



Air-Water-Heat exchanger WWT



Acoustic Enclosure TB 7/FUK-AE



Silencer TB 7/FUK-SI

| Blower (free blowing) | | Engine | | | | Dimensions | Air hose | | Mass | Sound-pressure |
|-----------------------|-------------------------------|----------------|-------|-----------|--------------|-------------|-------------|----------|------|----------------|
| Designation | Volume flow m ³ /h | Performance kW | Phase | Voltage V | Frequency Hz | W/H/D mm | Diameter mm | Length m | kg | dB(A) |
| TB 0080 | 80 | 0.37 | 1 | 115/230 | 50/60 | 246/247/256 | 40 | 3 | 10 | 53 |
| TB 0140 | 140 | 1.1 | 1 | 115/230 | 50/60 | 286/302/292 | 50 | 3 | 16 | 63 |
| TB 0310 | 315 | 4.0 | 3 | 400 | 50/60 | 382/384/432 | 60 | 5 | 42 | 69 |
| TB 9 FUK | 1080 | 4.0 | 3 | 400 | 50/60 | 505/598/464 | 140 | 5 | 60 | 99 |
| TB 120 FUK | 1500 | 5.5 | 3 | 400 | 50/60 | 487/637/487 | 140 | 5 | 61 | 102 |
| TB 7/FUK/11 | 1920 | 11 | 3 | 400 | 50/60 | 625/775/602 | 150 | 5 | 113 | 102 |
| TB 7/FUK/20 | 5820 | 20 | 3 | 400 | 50/60 | 625/773/602 | 175 | 5 | 131 | 105 |

| Blower | Acoustic Enclosure | | | | Silencer | | | |
|-------------------|--------------------|----------------------|---------|------------------------|-------------|-------------------|---------|------------------------|
| Designation | Designation | Dimension (LxWxH) mm | Mass kg | Noise Reduction* dB(A) | Designation | Dimension(LxD) mm | Mass kg | Noise Reduction* dB(A) |
| TB 0080 | TB 0080-AE | 860 x 650 x 760 | 45 | 15-23 | TB 0080-SI | 310 x 65 | 0.2 | 5 |
| TB 0140 | TB 0140-AE | 860 x 650 x 760 | 45 | 15-23 | TB 0140-SI | 308 x 82 | 0.2 | 8 |
| TB 0310 | TB 0310-AE | 860 x 650 x 760 | 55 | 15-23 | TB 0310-SI | 308 x 82 | 0.58 | 6 |
| TB 9 FUK | TB 9-AE | 1470 x 1250 x 1393 | 103 | 5-23 | TB 9-SI | 1012 x 150 | 1.2 | 3-6 |
| TB 120 FUK | TB 120-AE | 1470 x 1250 x 1393 | 103 | 5-23 | TB 120-SI | 1100 x 160 | 1.2 | 3-6 |
| TB 7/FUK | TB 7/FUK-AE | 1470 x 1250 x 1393 | 103 | 5-23 | TB 7/FUK-SI | 1120 x 280 | 9.2 | 9-15 |
| variable | WWT | 1200 x 1500 x 2080 | 800 | 30 | | | | |

*Depending on frequency

TIRA Vibration Test Systems

Water Cooling Units

The cooling units include the complete primary circuit of shaker cooling system for the TIRA water-cooled shakers and the hydraulics of the shaker's hydrostatic bearings.

The units are designed as compact mobile devices. Primary circuit is based on deionised water. The extraction of the heat is carried out by a customer-provided secondary-process water circuit. Pressure gauges and flow indicators are available at many positions.

The devices include their own control circuit based on PLC. The front and side walls are designed with swing doors to ensure a good accessibility to all built-in components. The connections to the shaker are accomplished by hoses with self-sealing couplings that are free from leakage.

| Cooling Unit | C 59410 | C 59430 |
|---|--------------------------|--------------------------|
| Process water: | | |
| Supply temperature (°C) | 5-15 | 5-15 |
| Volumeflow at max. supply temperature (m³/h) | 10 | 24 |
| Supply pressure – static (bar) | ≤ 8 | ≤ 10 |
| Return - Dynamic differential pressure (bar) | ≥ 3 | ≥ 3 |
| Dissipated heat flow (kW) | 110 | 220 |
| ph-value | 7 ±1 | 7 ±1 |
| Dirt particle size (µm) | < 25 | < 25 |
| Water hardness - overall | < 1.4 mmol/l (< 140 ppm) | < 1.4 mmol/l (< 140 ppm) |
| Water hardness - carbonate | < 0.9 mmol/l (< 90 ppm) | < 0.9 mmol/l (< 90 ppm) |
| Hose connection - Nominal width - supply (mm) | 32 | 40 |
| Hose connection - Nominal width - return (mm) | 32 | 40 |
| Total mass (kg) | 550 | 620 |
| Dimensions W x H x D (mm) | 600 x 2140 x 970 | 800 x 2140 x 1000 |

The water cooling units have the following benefits compared to other known systems:

- The primary circuit is designed as closed system, which guarantees no evaporation loss of the water and no pollution of the circuit.
- The closed system operates at a higher pressure level. This way the usual interferences of the measuring signal by cavitation are eliminated.
- The flow rate of the splitted lines of the primary circuit to moving coil, field coil and short-circuit rings is monitored.
- The primary circuit features besides the conductance monitoring an integrated demineralization cartridge, which keeps the conductance low within the bypass flow for a long operation period.
- The primary circuit offers a fine filter with pollution monitoring.
- The units control the process water flow. This way the water consumption can be reduced at low process water temperatures and during part load operation.

If needed, an additional fine filter unit for heavier polluted process water is optionally available.



Power Amplifiers up to 1200 VA

TIRA offers a new series of amplifiers with a **rated sinusoidal power** output up to **1200 VA**. The modules control all permanent magnetic shakers as well as shakers in connection with an internal field excitation up to 1000 N.

These amplifiers, equipped with highly-advanced MOSFET transistors, can be run in the **current or the voltage mode**, as desired. The amplifiers are user-friendly because of their backgroundlit multifunctional display.

A safety management system monitors functions such as temperature, overcurrent and overtravel.

A **high signal-to-noise ratio** and a **low distortion factor** are outstanding features. **Selectable ranges of operating voltage** and current range limiting are preconditions for the fact that **TIRA** amplifiers can be readily adapted to other shakers from other manufacturers.

Optionally, the amplifiers are designed for connecting the electronic zero-adjustment unit “Tira Middle Control“ (TMC), which makes even with small longstroke-shakers a load compensation for achieving the nominal displacement possible.

A remote control in hardware or software is available on request (BAA 500 and BAA 1000).



Analog power amplifier BAA 1000-ET with Field Power Supply (FPS) and electronic zero-adjustment (TMC)

| Amplifier | BAA 60 | BAA 120 | DA 200 | BAA 500 | BAA 1000 | BAA 1000-E | BAA 1000-ET |
|------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| Output power RMS (VA) | 60 | 120 | 200 | 500 | 1200 | 1200 | 1200 |
| Frequency range (Hz) | 2 - 20000 | DC - 20000 | 1.5 - 22000 | DC - 20000 | DC - 20000 | DC - 20000 | 2 - 20000 |
| Voltage-/Current mode | yes/no | yes/yes | yes/no | yes/yes | yes/yes | yes/yes | yes/no |
| Voltage RMS, max. (V) | 16 | 22 | 30 | 45 | 72 | 72 | 72 |
| Current RMS, max. (A) | 3.8 | 5.5 | 10 | 11.2 | 18 | 18 | 18 |
| Signal input voltage RMS (V) | < 5 | < 5 | 7 | < 5 | < 5 | < 5 | < 5 |
| Distortion (%) | < 0.1 | < 0.05 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| Signal to noise ratio (dB) | > 90 | > 95 | > 90 | > 90 | > 90 | > 90 | > 90 |
| Field supply | no | no | no | no | no | yes (external) | yes (external+TMC) |
| Field voltage (V) | – | – | – | – | – | 70 | 70 |
| Field current (A) | – | – | – | – | – | 3.2 | 3.2 |
| Total mass (kg) | 12 | 16 | 3.5 | 25 | 35 | 57 | 61 |
| Size (WxHxD) (mm) | 483 x 90 x 450 | 483 x 90 x 450 | 390 x 80 x 260 | 483 x 90 x 450 | 483 x 146 x 585 | 483 x 293 x 585 | 483 x 370 x 585 |
| Interlocks | Overload, Temperature, Clipping | Overload, Temperature, Clipping | Overload, Temperature, Clipping | Overload, Temperature, Clipping | Overload, Temperature, Clipping | Overload, Temperature, Clipping | Overload, Temperature, Clipping |

TIRA Vibration Test Systems

Power Amplifiers 11 to 15 kVA

The Gradient Amplifier from **TIRA** is a single axis pulse width modulated amplifier. The Amplifier's exceptionally low output noise, extremely high bandwidth and excellent stability make it ideally suited for demanding power amplifier tasks found in laboratory and medical applications. Utilizing advanced hybrid digital and analog control architecture, the **TIRA** Power Amplifiers provide a host of powerful features.

On the **LCD-touch screen display** the module status with current indication and the error diagnostics are shown. A safety monitoring unit protects the amplifier from short circuit and from a possible destruction of the modules.

Error indication and system parameters in plain text increase the availability thanks to a faster diagnostics. The high clock frequency of up to 102 kHz allows test frequencies of up to **4000 Hz** without any decrease in output power. The cascading of the modules allows an **amplifier design up to 240 kVA** at low floor space requirements. The output voltage of the modules can be modified so that **TIRA** amplifiers can be adapted to almost all shakers existing on the market.



| Amplifier | A 1 01 11 010 | A 1 01 11 021 | A 1 02 11 021 |
|-----------------------------------|--|--|--|
| Sine output power, max. RMS (kVA) | 11 | 15 | 15 |
| Frequency range (Hz) | DC - 5000 | DC - 5000 | DC - 5000 |
| Voltage, max. RMS (V) | ±105 | ±212 | ±212 |
| Current, max. RMS, max. (A) | 100 | 100 | 100 |
| Signal input voltage RMS (V) | 10 | 10 | 10 |
| Distortion (%) | < 0.2 | < 0.2 | < 0.2 |
| Signal to noise ratio (dB) | > 80 | > 80 | > 80 |
| Field supply | internal | internal | internal |
| Field voltage* (V) | 180 | 140 | 280 |
| Field current* (A) | 6 | 8 | 6 |
| Total mass (kg) | 260 | 330 | 330 |
| Size (W x H x D) (mm) | 600 x 1740 x 800 | 600 x 1740 x 800 | 600 x 1740 x 800 |
| Interlocks | Overcurrent, Temperature, Displacement, Air supply, Phase monitoring | Overcurrent, Temperature, Displacement, Air supply, Phase monitoring | Overcurrent, Temperature, Displacement, Air supply, Phase monitoring |

* variable according to customer specification

Power Amplifiers 22.5 to 150 kVA

| Amplifier | A 3 01 11 042 | A 3 09 11 042 | A 3 08 11 042 | A 3 08 11 063 | A 2 11 11 105 | A 4 11 11 126 |
|------------------------------|--|--|--|--|--|--|
| Sine output power RMS (kVA) | 22.5 | 22.5 | 25 | 37.5 | 60 | 75 |
| Frequency range (Hz) | DC - 5000 | DC - 5000 | DC - 5000 | DC - 5000 | DC - 5000 | DC - 5000 |
| Voltage RMS, max. (V) | ±212 | ±212 | ±212 | ±212 | ±212 | ±212 |
| Current RMS, max. (A) | 200 | 200 | 200 | 300 | 500 | 600 |
| Signal input voltage RMS (V) | 10 | 10 | 10 | 10 | 10 | 10 |
| Distortion (%) | < 0.2 | < 0.2 | < 0.2 | < 0.2 | < 0.2 | < 0.2 |
| Signal to noise ratio (dB) | > 80 | > 80 | > 80 | > 80 | > 80 | > 80 |
| Field supply | internal | internal | internal | internal | internal | internal |
| Field voltage* (V) | 140 | 140 | 105 | 105 | 112 | 112 |
| Field current* (A) | 8 | 62 | 75 | 75 | 100 | 100 |
| Total mass (kg) | 450 | 450 | 450 | 640 | 860 | 910 |
| Size (WxHxD) (mm) | 600 x 2200 x 800 | 600 x 2200 x 800 | 600 x 2200 x 800 | 600 x 2200 x 800 | 1200 x 1740 x 800 | 1200 x 2200 x 800 |
| Interlocks | Overcurrent, Temperature, Displacement, Air supply, etc. | Overcurrent, Temperature, Displacement, Air supply, etc. | Overcurrent, Temperature, Displacement, Air supply, etc. | Overcurrent, Temperature, Displacement, Air supply, etc. | Overcurrent, Temperature, Displacement, Air supply, etc. | Overcurrent, Temperature, Displacement, Air supply, etc. |

| Amplifier | A 5 40 11 147 | A 5 40 11 189 | A 5 40 11 210 | A 5 40 11 252 | A 5 40 11 294 |
|------------------------------|---|---|---|---|---|
| Sine output power RMS (kVA) | 90 | 105 | 120 | 135 | 150 |
| Frequency range (Hz) | DC - 5000 | DC - 5000 | DC - 5000 | DC - 5000 | DC - 5000 |
| Voltage RMS, max. (V) | ±212 | ±212 | ±212 | ±212 | ±212 |
| Current RMS, max. (A) | 700 | 900 | 1000 | 1200 | 1400 |
| Signal input voltage RMS (V) | 10 | 10 | 10 | 10 | 10 |
| Distortion (%) | < 0.2 | < 0.2 | < 0.2 | < 0.2 | < 0.2 |
| Signal to noise ratio (dB) | > 80 | > 80 | > 80 | > 80 | > 80 |
| Field supply | internal | internal | internal | internal | internal |
| Field voltage* (V) | 155 | 155 | 155 | 155 | 155 |
| Field current* (A) | 260 | 260 | 260 | 260 | 260 |
| Total mass (kg) | 2100 | 2200 | 2300 | 2400 | 2450 |
| Size (WxHxD) (mm) | 2840x2200x1050 | 2840x2200x1050 | 2840 x 2200 x 1050 | 2840 x 2200 x 1050 | 2840 x 2200 x 1050 |
| Interlocks | Overcurrent, Temperature, Displacement, Conductance, etc. | Overcurrent, Temperature, Displacement, Conductance, etc. | Overcurrent, Temperature, Displacement, Conductance, etc. | Overcurrent, Temperature, Displacement, Conductance, etc. | Overcurrent, Temperature, Displacement, Conductance, etc. |

* variable according to customer specification

TIRA Vibration Test Systems

Power Amplifiers 165 to 240 kVA / TIRA Remote Control

Features:

- Integrated field power supply
- Integrated mains switch and line filter
- Lo-Field/Hi-Field (Energy-saving mode)
- ESD monitoring (Protection of the system against damage)
- 4σ peak current



| Amplifier | A 5 85 11 336 | A 5 85 11 378 | A 5 85 11 462 | A 5 00 11 483 |
|---|---|---|---|---|
| Sine output power RMS (kVA) | 165 | 195 | 225 | 240 |
| Frequency range (Hz) | DC - 5000 | DC - 5000 | DC - 5000 | DC - 5000 |
| Voltage RMS , max. (V) | ± 212 | ± 212 | ± 212 | ± 212 |
| Current RMS , max. (A) | 1600 | 1800 | 2200 | 2300 |
| Signal input voltage RMS (V) | 10 | 10 | 10 | 10 |
| Distortion (%) | < 0.2 | < 0.2 | < 0.2 | < 0.2 |
| Signal to noise ratio (dB) | > 80 | > 80 | > 80 | > 80 |
| Field supply | internal | internal | internal | external |
| Field voltage* (V) | 240 | 240 | 240 | 360 |
| Field current* (A) | 355 | 355 | 355 | 300 |
| Total mass (kg) | 2800 | 2900 | 3100 | 2600 |
| Mass (External field supply) (kg) | - | - | - | 1135 |
| Size (WxHxD) (mm) | 2840 x 2200 x 1050 | 2840 x 2200 x 1050 | 2840 x 2200 x 1050 | 2840 x 2200 x 1050 |
| Size (WxHxD) (External field supply) (mm) | - | - | - | 1200 x 1740 x 800 |
| Interlocks | Overcurrent, Temperature, Displacement, Conductance, Phase monitoring, Compressed air, etc. | Overcurrent, Temperature, Displacement, Conductance, Phase monitoring, Compressed air, etc. | Overcurrent, Temperature, Displacement, Conductance, Phase monitoring, Compressed air, etc. | Overcurrent, Temperature, Displacement, Conductance, Phase monitoring, Compressed air, etc. |

* variable according to customer specification

TIRA Remote Control

The TIRA Remote Control is a Hardware/Software combination for remotely controlling a vibration test system. The hardware interface is easily plugged into a free USB-port of a PC.

Features:

- up to 800 m operating distance
- full gain control by mouse or numerical value
- shows errors of shaker, amplifier and cooling unit
- monitoring of voltage/current level over time
- support for all operating systems from Windows 2000 to Windows 10
- additional monitoring- and setting options on request, e.g. temperature monitoring, blower settings, power monitoring, field settings

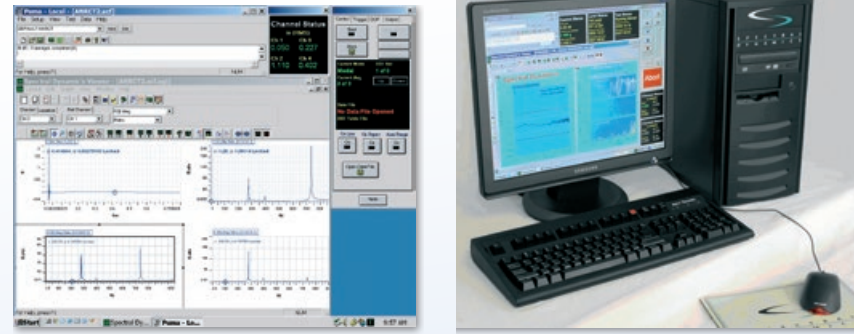
Vibration Control Systems and Vibration Accelerometers

Variable control hardware and vibration control software

The computer-aided vibration control system meets all requirements for an advanced shaker control. It combines a highly-developed and powerful DSP hardware with a personal computer that is simple to operate. The system covers the entire test range with the modes of operation random, sine, shock and mixed-mode and offers a simple operation with an graphic user environment. Within the control system the PC carries out the test preparation, the indication of the test data and the very flexible report generation.

TIRA offers vibration control systems of various manufacturers with 4 to 32 simultaneous input channels, extensive signal analysing programs incl. Sine-, Transient-, and Modal analysis, acoustic analysis, signal generator. The vibration control systems offer a wide range of options for integration with conditioning cabinets and other test equipment. They allow monitoring and complete control of the test over network and even over internet.

The respective vibration control software finds in the hardware platforms an ideal completion for comprehensive vibration tests. The controller achieves excellent measuring accuracy and an impressive realtime performance by using state of the art technology. The hardware platforms support the extensive functionality of the software, which includes simple sine or random tests over complex tests with random signal excitation, that is overlaid with a multiple sine signal, up to a load simulation in time intervals. Of course all tests are accomplished according to the respective standards ISO, DIN, MIL, ASTM and IEC.



Piezo-electric vibration accelerometers

Part of a complete vibration test system is besides the shaker and control system also a vibration accelerometer. These accelerometers are mostly of piezo-ceramic type. They are used as standard accelerometers for electrodynamic shakers due to their excellent linearity at wide dynamic range and large frequency range. TIRA offers a wide variety for all types of application.



TIRA Vibration Test Systems in Cooperation with *KOKUSAI*

Kokusai / TIRA 3D-Shaker-System

REPRODUCING THE REAL ENVIRONMENT

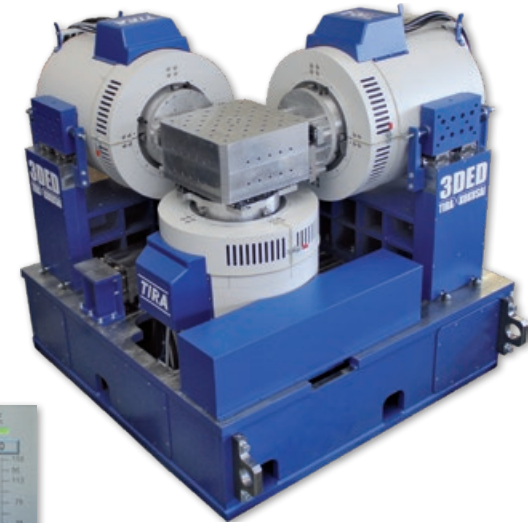
Due to the requirements of the automotive industry for a 3-axis simultaneous testing machine, which can cover a wide frequency range up to 2000 Hz, Kokusai developed a 3-axis testing machine with the aim of meeting the specifications according to MIL standard suitable for the automotive and aviation industries.

As a manufacturer of vibration testing systems, TIRA GmbH produces and supplies the necessary components such as shakers, amplifiers and cooling units in a joint project and also implements the necessary control hardware and software.

Features:

- Energy-saving mode (Field power reduction)
- Multiple safety devices
- Long-time operation
- High cross-axial stiffness
- Air-cooling blower with optional fan speed control

3DED
TIRA X KOKUSAI



| Model | | EDS-27M0-3 | EDS-35M0-3 | EDS-49M0-3 | EDS-55M0-3 | EDS-70M0-3 |
|------------------------------------|-------|------------|------------|------------|------------|------------|
| Maximum force (N) | Sine | 27000 | 35000 | 49500 | 55000 | 70000 |
| Frequency range (Hz) | | 5 - 2000 | 5 - 2000 | 5 - 2000 | 5 - 2000 | 5 - 2000 |
| Maximum acceleration (g) | Sine | 12 | 16 | 21 | 24 | 27 |
| Maximum displacement (mm) | pk-pk | 50 | 50 | 50 | 50 | 50 |
| Dimensions of vibration table (mm) | | 500 x 500 | 500 x 500 | 500 x 500 | 500 x 500 | 500 x 500 |

A wide range of models and configurations are available, contact us today for your personal quote.

3-Axis Simultaneous Vibration Tester

Our servomotor-driven vibration testing systems cover a wide range of table sizes and excitation forces. These are extremely versatile and can be adapted to almost any application in the low to medium frequency range up to 500Hz, depending on size.

Due to the similar frequency range, customers often have to weigh servo motor systems against hydraulic solutions. A direct comparison illustrates many advantages of servo motor technology.

- More precision through position-based control
- Less maintenance
- No idling or warm-up time
- Lower energy consumption
- Clean and silent operation

Suitable for testing electrical equipment and automotive components



| Technical Data | Values |
|------------------------------------|-------------------------------|
| Maximum force (N) | 10000 |
| Frequency range (Hz) | DC - 200 |
| Maximum acceleration (g) | 2 |
| Dimensions of vibration table (mm) | 500 x 500 |
| Maximum payload (kg) | 500 |
| Types of excitation | Sine, Random, Frequency sweep |

On customer request:

Dimensions of vibration table: up to 6m. (500-1000-1500-2000-2000-2500 mm)

Acceleration: Can be optimized by engine power

Displacement: up to 300 mm p-p

TIRA Vibration Test Systems in Cooperation with *Kokusai*

3-Axis/4-poster Automobile Loaded Vibration Tester

Our servomotor-driven vibration testing systems cover a wide range of table sizes and excitation forces. These are extremely versatile and can be adapted to almost any application in the low to medium frequency range up to 500Hz, depending on size.

Due to the similar frequency range, customers often have to weigh servo motor systems against hydraulic solutions. A direct comparison illustrates many advantages of servo motor technology.

- More precision through position-based control
- Less maintenance
- No idling or warm-up time
- Lower energy consumption
- Clean and silent operation



| Technical Data | Values |
|---------------------------|---|
| Maximum frequency (Hz) | 100 (vertical and horizontal) |
| Maximum acceleration (g) | 10 to 25 |
| Maximum displacement (mm) | ±50 |
| Excitation direction | Vertical excitation (Z) Horizontal excitation (X,Y) |
| Maximum payload (kg) | 1000 (single wheel) |
| Types of excitation | Sine, Random, Shock, Road simulation |
| Options | Wheelbase moving device (ST: 1000 mm/Standard) Tread width moving device (ST: 400 mm/Standard) |

On customer request:
We offer single/2D/3D-system for 4-poster-applications

Large Size of 3-Axis Simultaneous Vibration Tester

Our servomotor-driven vibration testing systems cover a wide range of table sizes and excitation forces. These are extremely versatile and can be adapted to almost any application in the low to medium frequency range up to 500Hz, depending on size.

Due to the similar frequency range, customers often have to weigh servo motor systems against hydraulic solutions. A direct comparison illustrates many advantages of servo motor technology.

- More precision through position-based control
- Less maintenance
- No idling or warm-up time
- Lower energy consumption
- Clean and silent operation

Suitable for testing railway equipment and -parts

| Technical Data | Values |
|------------------------------------|---|
| Maximum force (N) | 90000 (X/Y-Axis) 120000 (Z-Axis) |
| Excitation frequency (Hz) | 200 |
| Maximum acceleration (g) | 1,5 |
| Dimensions of vibration table (mm) | 3000 x 2500 (2 units) Total: 6000 x 2500 |
| Maximum payload (kg) | 4000 |
| Types of excitation | Sine, Random, Earthquake simulation |

This system is suitable for the railway industry. Versions for the automotive industry are also available on request.



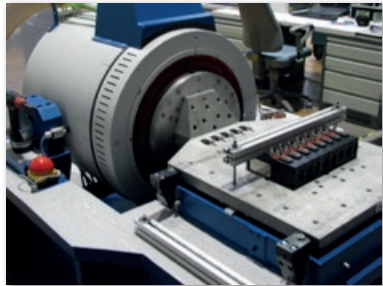
Customer applications:



Modal examinations



Chassis tests in the automotive industry
First publication in ATZworldwide 1-2013, pp. 18 - 21



Horizontal tests of electronic equipment



Integration in production lines

Additional range of products by TIRA GmbH:

Extract of the production- and delivery program of our other product groups:

TIRA Balancing Technology

- Hard-bearing and soft-bearing balancing machines
- Machines for small-, medium-, and large-batch production with unbalance compensating units

TIRA Material Testing

- Tensile-/compression-/bending machines with spindle drive
- Universal testing machines

TIRA Mechanical Engineering

- Components and sub-assemblies for plant construction, technology, machine- and machine-tool building, jig-and-fixture and mold construction
- Welded structures and components for tank construction and machinery



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Our location

