



Schwingtechnik
Vibration Test Systems



TIRA Vibration Test Systems – Vibration Testing Equipment

The system at a glance

As a worldwide supplier of measuring and testing systems for industry and research, TIRA operates from a number of sites and is active in the development and production of advanced equipment (including application-specific software) for simulating environmental conditions, testing the properties of materials, and eliminating undesirable vibrations.

Product range:

- Electrodynamic vibration systems, 9N - 300 kN
- Modal thrusters
- Long stroke systems, max. stroke 100 mm
- Analog/digital amplifiers
- Vibration control systems for sine/random/shock/mixed mode
- Slip tables, linear/hydrostatic guided
- Climatic/temperature systems
- Head expanders/special-purpose units
- Calibration 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 **TIRA** group is structured for maximum flexibility and production depth, an effect reinforced by interaction between such product lines as vibration testing and environmental simulation, a company-owned mechanical manufacturing center, and divisions for material testing and balancing equipment. Records have been kept for the last 65 years and include design data, past experience and the latest findings regarding the industry as a whole, all designed to form the best technological standards and reliable performance. Customers can thus expect customized and/or standardized system solutions from one source, and advice from the development, planning and design stages through to assembly, installation, startup and after-sales services.

TIRA equipment has proven its worth in industry and at universities and research institutes worldwide. In order to provide product-specific consulting, assistance and know-how on a global scale, the company works through selected distributors and service partner in over 60 countries.



TIRA booth at the trade show Productronica in Munich

Vibration systems from 9 N to 400 N

TIRA products are subject to strict quality assurance procedures designed to meet CE requirements as well as national and international norms. This also applies to our proven testing and measuring systems where feedback from our customers helps us to retain high standards of quality and profitability now and in the future. Quality management has been certified in terms of DIN ISO 9001 since 1995, and DIN EN ISO 9001: 2008 since February 2010.

These shakers use permanent magnets and are available as portable and stationary systems for simulating ambient vibration conditions. Robust design ensures a long service life, and typical applications include **structure analysis** and testing **smaller subassemblies**. These exciters are characterized by **high lateral and axial stiffness** and come in **lightweight construction** as specified by industrial users.

New rare earth magnets have been added to the range of conventional Alnico magnets, **reducing weight** from 30 kg to 10 kg for **easy handling** particularly in **mobile applications**. Our vibration generators have proven their worth in environmental labs, universities and industrial production lines both for components and calibration. These complete systems enable testing in accordance with 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 | BAA 60 | BAA 120 |
| 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) Sine/Random | 1.5/- | 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 (kg) | 0.015 | 0.028 | 0.23 |
| Main resonance frequency (Hz) | >13000 | >13000 | >6500 |
| Weight (without trunnion) (kg) | 2.2 (1.7) | 5.0 (3.7) | 12 |
| 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 | 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) Sine/Random | 1.5/1.5 | 1.5/1.5 | 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 (kg) | 0.23 | 0.25 | 0.25 | 0.4 |
| Max. weight tested (kg) | 3.0 | 3.0 | 3.0 | 6.0 |
| Main resonance frequency (Hz) | >6500 | >5700 | >5700 | >5500 |
| Weight with trunnion (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 | 1.22/1.4 |

TIRA Vibration Test Systems – Vibration Systems

Vibration systems from 1000 N to 2700 N

- Long-time operation
- Minimum maintenance effort
- High cross-axial stiffness
- Supported by rugged frame with vibration isolators
- Automatic centering of the armature
- Pneumatic or electronic load compensation for heavy test loads
- 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)
- Wheels&Rails Option (Shaker is displaceable on rails)



Shaker S 50350-120

| System | TV 5220-120 | TV 5220/LS-120 | TV 50303-120 | TV 50303/LS-120 | TV 50350-120 | TV 50350/LS-120 |
|--|---|---|---|---|---|---|
| Shaker | S 5220-120 | S 5220/LS-120 | S 50303-120 | S 50303/LS-120 | S 50350-120 | S 50350/LS-120 |
| Amplifier | BAA 1000-E | BAA 1000-ET | A 1 01 1 003 | A 1 01 1 003 T | A 1 01 1 004 | A 1 01 1 004 T |
| Blower | TB 0140 | TB 0140 | TB 0200 | TB 0200 | TB 0310 | TB 0310 |
| Rated peak force (N) Sine _{pk} / Random _{RMS} / Shock _{pk} ¹ | 1000/650/1300 | 1000/650/1300 | 2000/1000/4000 | 2000/1000/4000 | 2700/2000/6000 | 2700/2000/6000 |
| Frequency range (Hz) | 2 - 7000 | 2 - 7000 | 2 - 4000 | 2 - 4000 | 2 - 4000 | 2 - 4000 |
| Max. displacement (mm) Pk - Pk | 25.4 | 45.0 | 25.4 | 45.0 | 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 | 1.5/1.5/2.0 | 1.5/1.5/2.5 | 1.5/1.5/2.5 |
| Max. acceleration (g) Sine/Random/Shock ¹ | 60/40/79 | 60/40/79 | 80/40/160 | 72/36/144 | 110/81/163 | 98/73/148 |
| Suspension stiffness (N/mm) | 22 | ² | 22 | ² | 22 | ² |
| Effective moving mass (kg) | 1.7 | 1.7 | 2.8 | 3.0 | 2.8 | 3.0 |
| Max. weight tested (kg) | 20 | 20 | 25 | 25 | 25 | 25 |
| Main resonance frequency (Hz) | >5000 | >5000 | >4000 | >3700 | >4000 | >3700 |
| Weight with trunnion (kg) | 122 | 122 | 280 | 280 | 280 | 280 |
| Stray magnetic field (mT) without/with degauss kit | <8.5/<1 | <8.5/<1 | <8.5/<1 | <8.5/<1 | <8.5/<1 | <8.5/<1 |
| Armature (ø/mm) | 120 | 120 | 120 | 120 | 120 | 120 |
| Max. power consumption at 230/400 V (kVA) incl. blower | 4.4 | 4.5 | 5 | 5 | 6 | 6 |
| Interlocks | Temperature, overtravel, airflow, overcurrent, compressed air | Temperature, overtravel, airflow, overcurrent | Temperature, overtravel, airflow, overcurrent, compressed air | Temperature, overtravel, airflow, overcurrent | Temperature, overtravel, airflow, overcurrent, compressed air | Temperature, overtravel, airflow, overcurrent |

¹ Theoretical maximum shock value. Depends on payload, amplifier, shock and shock width² Electronic 0 – point regulation with adjustable stiffness

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



Shaker S 56263/LS-180

| System | TV 55240/LS-180 | TV 55240/LS-340 | TV 56263/LS-180 | TV 56263/LS-340 | TV 56280/LS-180 | TV 56280/LS-340 |
|--|---|---|---|---|---|---|
| Shaker | S 55240/LS-180 | S 55240/LS-340 | S 56263/LS-180 | S 56263/LS-340 | S 56280/LS-180 | S 56280/LS-340 |
| Amplifier | A 1 01 1 011 | A 1 01 1 011 | A 1 02 1 011 | A 1 02 1 011 | A 1 02 1 016 | A 1 02 1 016 |
| Blower | TB 0310 | TB 0310 | TB 9 | TB 9 | TB 9 | TB 9 |
| Rated peak force (N) Sinepk / RandomRMS / Shockpk ¹ | 4000/3600/12000 | 4000/3600/12000 | 6300/5600/18900 | 6300/5600/18900 | 8000/7200/24000 | 8000/7200/24000 |
| Frequency range (Hz) | 2 - 3000 | 2 - 3000 | 2 - 3000 | 2 - 3000 | 2 - 3000 | 2 - 3000 |
| Max. displacement (mm) Pk - Pk | 50.8 | 50.8 | 50.8 | 50.8 | 50.8 | 50.8 |
| Max. velocity (m/s) Sine/Random/Shock | 2.0/2.0/2.0 | 2.0/2.0/2.0 | 2.0/2.0/2.5 | 2.0/2.0/2.5 | 2.0/2.0/2.5 | 2.0/2.0/2.5 |
| Max. acceleration (g) Sine/Random/Shock ¹ | 59/50/119 | 49/40/98 | 80/55/160 | 75/52/151 | 93/72/186 | 88/65/175 |
| Suspension stiffness (N/mm) | 50 | 50 | 50 | 50 | 50 | 50 |
| Effective moving mass (kg) | 7.1 | 8.3 | 8 | 8.5 | 8.5 | 9.6 |
| Max. weight tested (kg) | 100 | 100 | 150 | 150 | 150 | 150 |
| Main resonance frequency (Hz) | >3000 | >2700 | >3000 | >2500 | >2900 | >2600 |
| Weight with trunnion (kg) | 700 | 780 | 765 | 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 | <1.5/<0.8 | <1.5/<0.8 |
| Armature (ø/mm) | 180 | 340 | 180 | 340 | 180 | 340 |
| Max. power consumption at 400 V (kVA) incl. Blower | 7.7 | 7.7 | 14.6 | 14.6 | 16 | 16 |
| 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 |

¹ Theoretical maximum shock value. Depends on payload, amplifier, shock and shock width

TIRA Vibration Test Systems – Vibration Systems

Vibration systems from 11 kN to 15 kN

- 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
- Wheels&Rails Option (Shaker is displaceable on rails)



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 3 023 | A 1 01 3 023 | A 3 01 3 034 | A 3 01 3 034 |
| Blower | TB 120 | TB 120 | TB 120 | TB 120 |
| Rated peak force (N) Sine _{pk} / Random _{RMS} / Shock _{pk} ¹ | 11000/11000/33000 | 11000/11000/33000 | 15000/13000/45000 | 15000/13000/45000 |
| 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 | 2.0/2.0/2.5 | 2.0/2.0/2.5 | 2.0/2.0/2.5 | 2.0/2.0/2.5 |
| Max. acceleration (g) Sine/Random/Shock ¹ | 85/65/200 | 82/75/167 | 115/80/230 | 110/80/200 |
| Suspension stiffness (N/mm) | 75 | 75 | 75 | 75 |
| Effective moving mass (kg) | 13 | 14 | 13 | 14 |
| Max. weight tested (kg) | 150 | 150 | 250 | 250 |
| Main resonance frequency (Hz) | >2300 | >2400 | >2300 | >2400 |
| Weight with trunnion (kg) | 1100 | 1100 | 1100 | 1100 |
| 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) | 230 | 340 | 230 | 340 |
| Max. power consumption at 400V (kVA) incl. Blower | 22 | 22 | 27 | 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 |

¹ Theoretical maximum shock value. Depends on payload, amplifier, shock and shock width

Vibration system 20 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, AIT or LB trunnion system
- 50.8 mm (2 inch) displacement
- Power save function (Field power reduction)
- Wheels&Rails Option (Shaker is displaceable on rails)



Shaker S 59320/RIT-340

| System | TV 59320/*-340 | TV 59320/*-440 | TV 59320/*-640 |
|--|---|---|---|
| Shaker | S 59320/*-340 | S 59320/*-440 | S 59320/*-640 |
| Amplifier | A 3 07 3 034 | A 3 07 3 034 | A 3 07 3 034 |
| Blower | TB 8 | TB 8 | TB 8 |
| Rated peak force (N) Sine _{pk} / Random _{RMS} / Shock _{pk} ¹ | 20000/18000/60000 | 20000/18000/60000 | 20000/18000/60000 |
| Frequency range(Hz) | 5 - 3000 | 5 - 3000 | 5 - 2000 |
| Max. displacement (mm) Pk - Pk | 50.8 | 50.8 | 50.8 |
| Max. velocity (m/s) Sine/Random/Shock | 2.0/1.8/2.5 | 2.0/1.8/2.5 | 2.0/1.8/2.5 |
| Max. acceleration(g) Sine/Random/Shock ¹ | 82/65/163 | 73/58/146 | 50/46/101 |
| Suspension stiffness (N/mm) | 150 | 150 | 150 |
| Effective moving mass (kg) | 25.0 | 28.0 | 35.0 |
| Max. weight tested (kg) | 410 | 410 | 410 |
| Main resonance frequency (Hz) | >2400 | >2400 | >1900 |
| Weight with trunnion (kg) RIT / AIT / LB | 1650/1850/1550 | 1850/2100/1750 | 2000/2250/1900 |
| Stray magnetic field (mT) Std./Low degaussing | <1.5/<0.8 | <1.5/<0.8 | <2.5/<1 |
| Armature (ø/mm) | 340 | 440 | 640 |
| Max. power consumption at 400V (kVA) incl. Blower | 30 | 30 | 30 |
| Interlocks | Temperature, overtravel, airflow, overcurrent, compressed air | Temperature, overtravel, airflow, overcurrent, compressed air | Temperature, overtravel, airflow, overcurrent, compressed air |

* RIT, AIT or LB

¹ Theoretical maximum shock value. Depends on payload, amplifier, shock and shock width

Vibration transfer to the floor can be reduced with a swivel-frame („RIT“=Rigid Isolated Trunnion) which has vibration isolators as a standard feature.

TIRA's AIT system („AIT“=Air Isolated Trunnion) - built into the frame - provides integrated compressed air vibration isolation for vertical and horizontal body operation. The AIT system ensures optimal vibration isolation at low frequencies and precisely guides the generator body in the direction of excitation.

Low Base “LB” generators for vertical test operation are available with vibration dampers or rail systems for better mobility.

TIRA vibration generators, amplifiers and vibration control systems form a complete test system to document product quality in conformity with international standards (such as DIN, ISO, BS, MIL, IEC, ASTM).

TIRA Vibration Test Systems – Vibration Systems

Vibration systems from 27 kN to 35 kN

- Power save function (Field power reduction)
- Optional Dual Bearing-System for enhancement of cross axial stiffness and reduction of wear
- Airslide option (Shaker is displaceable on air cushions)
- Multiple safety devices
- Clamping table ø340 mm, ø440 mm or ø640 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)
- Degauss kit to reduce stray magnetic field



Shaker S 59327/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 3 045 | A 3 08 3 045 | A 3 08 3 057 | A 3 08 3 057 | A 3 08 3 057 | A 3 08 3 057 |
| Blower | TB 7/FU/11 | TB 7/FU/11 | TB 7/FU/11 | TB 7/FU/11 | TB 7/FU/11 | TB 7/FU/11 |
| Rated peak force (N) Sine _{pk} / Random _{RMS} / Shock _{pk} ¹ | 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 ² | 50.8/50.8/50.8 | 50.8/50.8/50.8 | 50.8/50.8/50.8 ² | 50.8/50.8/50.8 |
| Max. velocity (m/s) Sine/Random/Shock | 2.0/1.8/2.5 | 2.0/1.8/2.5 | 2.0/1.8/2.5 | 2.0/1.8/2.5 | 2.0/1.8/2.5 | 2.0/1.8/2.5 |
| Max. acceleration (g) Sine/Random/Shock ¹ | 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 | 200 |
| Effective moving mass (kg) | 29.0 | 38.0 | 40.5 | 29.0 | 38.0 | 40.5 |
| Max. weight tested (kg) | 610 | 610 | 610 | 610 | 610 | 610 |
| Main resonance frequency (Hz) | >2400 | >2400 | >1900 | >2400 | >2400 | 2000 |
| Weight with trunnion (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 (ø/mm) | 340 | 440 | 640 | 340 | 440 | 640 |
| Max. power consumption at 400 V (kVA) Amplifier/Blower | 25/17.5 | 25/17.5 | 28/17.5 | 35/17.5 | 38/17.5 | 38/17.5 |
| 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 |

¹ Theoretical maximum shock value. Depends on payload, amplifier, shock and shock width

* RIT, AIT or LB

² Optionally displacement of 76.2 mm (3 inch), impact by moving to static mass and frequency is possible

Vibration systems from 49.5 kN to 55 kN

- Clamping table ø340 mm, ø440 mm or ø640 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
- Degauss kit to reduce stray magnetic field
- Power save function (Field power reduction)
- Optional Dual Bearing-System for enhancement of cross axial stiffness and reduction of wear
- Airglide option (Shaker is displaceable 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 |
|--|---|---|---|---|---|---|
| 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 |
| Amplifier | A 2 11 3 090 | A 2 11 3 090 | A 2 11 3 090 | A 4 11 3 113 | A 4 11 3 113 | A 4 11 3 113 |
| Blower | TB 7/FU/20 | TB 7/FU/20 | TB 7/FU/20 | TB 7/FU/20 | TB 7/FU/20 | TB 7/FU/20 |
| Rated peak force (N) Sinepk / RandomRMS / Shockpk ¹ | 49500/48000/148500 | 49500/48000/148500 | 49500/48000/148500 | 55000/51000/165000 | 55000/51000/165000 | 55000/51000/165000 |
| Frequency range (Hz) | 5-3000 | 5-2500 | 5 - 2000 | 5-3000 | 5 - 2500 | 5 - 2000 |
| Max. displacement Pk-Pk (mm) Sine/Random/Shock | 50.8/50.8/50.8 | 50.8/50.8/50.8 ² | 50.8/50.8/50.8 | 50.8/50.8/50.8 | 50.8/50.8/50.8 ² | 50.8/50.8/50.8 |
| Max. velocity (m/s) Sine/Random/Shock | 2.0/2.0/2.5 | 2.0/2.0/2.5 | 2.0/2.0/2.5 | 2.0/2.0/2.5 | 2.0/2.0/2.5 | 2.0/2.0/2.5 |
| Max. acceleration (g) Sine/Random/Shock ¹ | 100/95/264 | 100/90/224 | 70/70/160 | 100/100/264 | 100/100/224 | 70/70/160 |
| Suspension stiffness (N/mm) | 200 | 200 | 200 | 200 | 200 | 200 |
| Effective moving mass (kg) | 43.0 | 45.5 | 55.0 | 43.0 | 45.5 | 55.0 |
| Max. weight tested (kg) | 910 | 910 | 910 | 910 | 910 | 910 |
| Main resonance frequency (Hz) | >2100 | 2000 | 2000 | >2100 | 2000 | 2000 |
| Weight with trunnion (kg) | 4550 | 4550 | 4550 | 4550 | 4550 | 4550 |
| 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/<1.5 |
| Armature (ø/mm) | 340 | 440 | 640 | 340 | 440 | 640 |
| Max. power consumption at 400V (kVA) Amplifier/Blower | 56/27 | 56/27 | 56/27 | 62/27 | 62/27 | 62/27 |
| 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 |

¹ Theoretical maximum shock value. Depends on payload, amplifier, shock and shock width

² Optionally displacement of 76.2 mm (3 inch) , impact by moving to static mass and frequency is possible

TIRA Vibration Test Systems – Vibration Systems

Water-cooled vibration systems from 60 kN to 300 kN

TIRA water-cooled shakers are hydrostatically guided and cooled by a closed-loop water cooling system. The external cooling unit also provides the guidance lubricant for the hydrostatic bearings which enable a frictionless guidance of the armature. Water-cooled vibration test systems have the advantage of generating very high forces to test heavy payloads at high acceleration. Payloads of up to 2500 kg are possible.

A built-in fully automatic, pneumatic operated load compensation system allows the realization of the nominal vibration displacement, even with heavy test loads.

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

- 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
- Power save function (Field power reduction)



Shaker S 59389/AIT-440

| System | TV 59360/AIT-440 | TV 59374/AIT-440 | TV 59389/AIT-440 | TV 59410/AIT-440 | TV 59416/AIT-590 | TV 59420/AIT-590 | TV 59430/AIT-840 |
|---|---|---|---|---|---|---|---|
| Shaker | S 59360/AIT-440 | S 59374/AIT-440 | S 59389/AIT-440 | S 59410/AIT-440 | S 59416/AIT-590 | S 59420/AIT-590 | S 59430/AIT-840 |
| Amplifier | A 5 40 3 158 | A 5 40 3 180 | A 5 40 3 203 | A 5 40 3 225 | A 5 85 3 293 | A 5 85 3 338 | A 5 00 3 360/ext. FPS |
| Cooling Unit | C 59410 | C 59410 | C 59410 | C 59410 | C 59430 | C 59430 | C 59430 |
| Rated peak force (N) Sine _{pk} / Random _{RMS} / Shock _{pk} ¹ | 60000/60000/180000 | 74000/74000/222000 | 89000/89000/267000 | 100000/89000/300000 | 168000/168000/504000 | 200000/168000/600000 | 300000/270000/900000 |
| Frequency range (Hz) | 5 - 2400 | 5 - 2400 | 5 - 2400 | 5 - 2400 | 5 - 2000 | 5 - 2000 | 5 - 1800 |
| Max. displacement Pk-Pk(mm) Sine/Random/Shock | 50.8/50.8/50.8 ² | 50.8/50.8/50.8 ² | 50.8/50.8/50.8 ² | 50.8/50.8/50.8 ² | 50.8/50.8/50.8 | 50.8/50.8/50.8 | 50.8/50.8/50.8 ² |
| Max. velocity (m/s) Sine/Random/Shock | 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 | 2.0/2.0/3.0 |
| Max. acceleration (g) Sine/Random/Shock ¹ | 100/90/250 | 100/90/250 | 100/90/250 | 100/90/250 | 100/100/250 | 100/100/250 | 70/70/250 |
| Suspension stiffness (N/mm) | 175 | 175 | 175 | 175 | 250 | 250 | 450 |
| Effective moving mass (kg) | 58 | 58 | 58 | 58 | 125 | 125 | 275 |
| Max. weight tested (kg) | 910 | 910 | 910 | 910 | 1300 (7 bar) | 1300 (7 bar) | 2500 |
| Main resonance frequency (Hz) | 2100 | 2100 | 2100 | 2100 | 1700 | 1700 | 1500 |
| Weight (kg) | 4500 | 4500 | 4500 | 4500 | 8450 | 8450 | 18500 |
| Stray magnetic field (mT) | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 |
| Armature (ø/mm) | 440 | 440 | 440 | 440 | 590 | 590 | 840 |
| Max. power consumption at 400V (kVA) incl. Blower | 100 | 120 | 143 | 167 | 249 | 290 | 360 (FPS:140) |
| 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 | Temperature, overtravel, overcurrent, compressed air, water flow rate, differential pressure, conductance |

¹ Theoretical maximum shock value. Depends on payload, amplifier, shock and shock width

² Optionally displacement of 76.2 mm (3 inch), impact by moving to static mass and frequency is possible

Calibration shakers from 100 N to 400 N

In all fields of industry, in aviation, the automotive industry and in power stations, vibration analyses and measurements for determining the vibration transmission are increasingly carried out. A large variety of measuring sensors is necessary to realize such investigations. These measuring sensors have to be checked for their accuracy and calibrated in defined time intervals. As most of the measuring sensors have a large measuring range and large frequency ranges, special shakers for calibrating these sensors are required.

TIRA has risen to this challenge and designed a unique shaker which meets these requirements. This newly developed shaker is equipped with a special guide system and a vibration system made of ceramic material. It is characterized by a very high utilizable frequency range up to 20 kHz and with the appropriate measuring equipment it is optimally suitable for professional calibration applications. The “AC” calibration shaker has additionally a special air bearing with the advantage of being frictionless, wear-free and damping spurious oscillations.



Calibration Shaker S 51140-C

| System | | TV 51110-C | TV 51110-AC | TV 51120-C | TV 51140-C |
|--------------------------------------|--|------------|-------------------|------------|------------|
| Shaker | | S 51110-C | S 51110-AC | S 51120-C | S 51140-C |
| Amplifier | | BAA 120 | BAA 500-T | BAA 500 | BAA 1000 |
| Blower | | - | - | TB 0080 | TB 0140 |
| Rated peak force (N) | Sine _{pk} / Random _{RMS} | 100/50 | 100/50 | 200/100 | 400/200 |
| Frequency range (Hz) | | 40 - 20000 | DC - 20000 | 40-20000 | 40 - 20000 |
| Max. displacement (mm) | Pk - Pk | 4 | 25.4 | 4 | 4 |
| Max. velocity (m/s) | Sine/Random | 1.2/1.2 | 1.2/1.2 | 1.2/1.2 | 1.2/1.2 |
| Max. acceleration (g) | Sine/Random | 25/12 | 17/8 | 51/25 | 68/34 |
| Effective moving mass (kg) | | 0.40 | 0.53 | 0.40 | 0.60 |
| Main resonance frequency (Hz) | | >25000 | >19000 | >25000 | >19000 |
| Weight with trunnion (kg) | | 33 | 18 | 42 | 21 |
| Armature (ø/mm) | | 54 | 50 | 54 | 54 |
| Compressed air (bar) | | | 3 (ca. 2.5 l/min) | | |
| Max. power consumption at 230V (kVA) | Amplifier/Blower | 0.08 | 0.35 | 0.35/0.46 | 1.22/1.4 |

TIRA Vibration Test Systems – Modal systems

Modal systems from 100 N to 2.7 kN

These exciters are specifically designed for **modal and structure analysis**. Modal shakers up to 400 N are excited by permanent magnets, with **lightweight** rare earth magnets provided for mobile use. These shakers are characterized by **high cross-axial stiffness**. From 1000 N onwards, modal systems permit a max. displacement of 50.8 mm due to **TMC control**. TMC is an **electronic armature position control system** for precisely coupling the modal shaker to the specimen. The armature datum adjustment allows the operator to offset the nominal position of the armature in relation to the body. The axial stiffness can also be adjusted electronically.

A standard feature on all modal shakers is a swivel-frame. This allows a great variety of coupling options.

The Modal system TV 51130-MSC is a special development of TIRA to increase the mobility. The 350 N vibration exciter has an integrated air cooling to make an external cooling unit unnecessary.



Modal shaker S 51120-M



Modal shaker S 51130-MSC

| System | TV 51110-M | TV 51120-M | TV 51130-MSC | TV 51140-M |
|---|------------|------------|----------------------|------------|
| Shaker | S 51110-M | S 51120-M | S 51130-MSC | S 51140-M |
| Amplifier | BAA 120 | BAA 500 | BAA 500-MSC | BAA 1000 |
| Blower | – | TB 0080 | internal | TB 0140 |
| Rated peak force (N) Sine _{pk} / Random _{RMS} | 100/70 | 200/140 | 350/200 | 400/311 |
| Frequency range (Hz) | 5 - 5000 | 5 - 5000 | 5 - 500 | 5 - 5000 |
| Max. displacement (mm) Pk - Pk | 13 | 13 | 9 | 20 |
| Max. velocity (m/s) Sine/Random | 1.5/1.5 | 1.5/1.5 | 1.3/1.3 | 1.5/1.5 |
| Suspension stiffness (N/mm) | 8 | 8 | 70 | 5 |
| Effective moving mass (kg) | 0.23 | 0.23 | 0.5 | 0.4 |
| Main resonance frequency (Hz) (free-swinging) | >6000 | >6000 | >4000 | >2300 |
| Weight with trunnion (kg) | 12 | 12 | 27 | 18 |
| Coupling (Thread ø/mm) | M6 | M6 | M8 | M6 |
| Max. power consumption at 230V (kVA) Amplifier/Blower | 0.08/- | 0.35/0.46 | 0.35 (inkl. Gebläse) | 1.22/1.4 |

| System | TV 5220-M | TV 50303-M | TV 50350-M |
|---|-------------|------------------|------------------|
| Shaker | S 5220-M | S 50303-M | S 50350-M |
| Amplifier | BAA 1000-ET | A 1 01 1 003 T | A 1 01 1 004 T |
| Blower | TB 0140 | TB 0200 | TB 0310 |
| Rated peak force (N) Sine _{pk} / Random _{RMS} | 1000/650 | 2000/1000 | 2700/2000 |
| Frequency range (Hz) | 5 - 5000 | 5 - 3000 | 5 - 3000 |
| Max. displacement (mm) Pk - Pk | 50.8 | 50.8 | 50.8 |
| Max. velocity (m/s) Sine/Random | 1.5/1.5 | 1.5/1.5 | 1.5/1.5 |
| Suspension stiffness (N/mm) | 1 | 1 | 1 |
| Effective moving mass (kg) | 1.3 | 2.2 | 2.3 |
| Main resonance frequency (Hz) | >3000 | >3000 | >3000 |
| Weight with trunnion (kg) | 122 | 280 | 280 |
| Coupling (Thread ø/mm) | M8 | M8 | M8 |
| Max. power consumption at 230/400V (kVA) Amplifier/Blower | 2.1/2.4 | 5 (incl. Blower) | 6 (incl. Blower) |

¹ Electronic 0 – point regulation with adjustable stiffness

Modal systems from 4 kN to 15 kN

Specially to meet the requirements for **modal and structure analysis**, TIRA offers a range of modal systems from 4 kN up to 15 kN. These shakers are characterized by **high cross axial stiffness** and permit a max. displacement of up to 100 mm (pk-pk) due to **TMC control**.

TMC is an electronic armature position control system for precisely coupling the modal shaker to the specimen. The armature datum level adjustment allows the operator to offset the nominal position of the armature in relation to the body. The axial stiffness can also be adjusted electronically.

A standard feature on all modal shakers is a swivel-frame. This allows a great variety of coupling options.



Modal shaker S 55240-M/LSS

| System | TV 55240-M/LSS | TV 56263-M/LSS | TV 56280-M/LSS | TV 51010-M/LSS | TV 57315-M/LSS |
|---|----------------|----------------|----------------|----------------|----------------|
| Shaker | S 55240-M/LSS | S 56263-M/LSS | S 56280-M/LSS | S 51010-M/LSS | S 57315-M/LSS |
| Amplifier | A 1 01 3 023 T | A 1 02 3 023 T | A 1 02 3 023 T | A 3 01 3 045 T | A 3 01 3 045 T |
| Blower | TB 0310 | TB 9 | TB 9 | TB 120 | TB 120 |
| Rated peak force (N) Sine _{pk} / Random _{RMS} | 4000/3400 | 6300/4300 | 8000/6000 | 11000/9000 | 15000/11000 |
| Frequency range (Hz) | 5 - 2000 | 5 - 2000 | 5 - 2000 | 5 - 2000 | 5 - 2000 |
| Max. displacement (mm) ¹ Pk - Pk | 100 | 100 | 100 | 100 | 100 |
| Max. velocity (m/s) Sine/Random | 2.0/2.0 | 2.0/2.0 | 2.0/2.0 | 2.0/2.0 | 2.0/2.0 |
| Effective moving mass (kg) | 11.0 | 12.0 | 12.0 | 14.0 | 18.0 |
| Main resonance frequency (Hz) | >2500 | >2500 | >2500 | >2500 | >2500 |
| Weight with trunnion (kg) | 800 | 850 | 850 | 1200 | 1200 |
| Coupling (Thread ø/mm) | M10 | M10 | M10 | M10 | M10 |
| Max. power consumption at 400V (kVA) incl. Blower | 7.7 | 14.6 | 16 | 28.2 | 38 |

¹ only with foundation mounting

TIRA Vibration Test Systems – Inertial systems

Inertial systems from 125 N to 650 N

TIRA produces inertial systems (IN) in the range from 125 N to 650 N, which can be bolted directly to the structure and aligned at any angle within 360°.

The generators have an **excellent lateral and axial stiffness**. Excitation is made by permanent magnets, and a special spring system provides optimal guidance so that the full body mass can impact on the structure.

The generator is cooled by a maintenance-free fan, with cooling air entering through a filter assembly. As inertial generators from **TIRA** can efficiently apply dynamic forces to large structures, they have found their applications in manufacturing, aerospace, buildings, civil engineering and shipbuilding.



Inertial shaker S 51140-IN

| System | TV 51112-IN | TV 51125-IN |
|---|-------------|-------------|
| Shaker | S 51112-IN | S 51125-IN |
| Amplifier | BAA 120 | BAA 500 |
| Blower | – | TB 0080 |
| Rated peak force (N) Sine _{pk} / Random _{RMS} | 125/70 | 250/150 |
| Frequency range (Hz) | DC - 2000 | DC - 2000 |
| Max. displacement (mm) Pk - Pk | 9 | 9 |
| Max. velocity (m/s) Sine/Random | 1.5/1.5 | 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 (kg) | 0.35 | 0.35 |
| Weight (kg) | 13 | 13 |
| Coupling (Thread ø/mm) | 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) | DC - 2000 | DC - 2000 |
| Max. displacement (mm) Pk - Pk | 9 | 9 |
| Max. velocity (m/s) Sine/Random | 1.5/1.5 | 1.5/1.5 |
| Max. acceleration (g) Sine/Random | 2.8/2 | 2.8/1.8 |
| Suspension stiffness (N/mm) | 56 | 98 |
| Effective moving mass (kg) | 0.63 | 0.97 |
| Weight (kg) | 16 | 26 |
| Coupling (Thread ø/mm) | M12 | M12 |
| Max. power consumption at 230V (kVA) Amplifier/Blower | 1.22/1.4 | 1.27/1.4 |

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

Due to the ever increasing safety requirements the industry develops a wide range of sensor technology and components that have to be tested under extreme stress conditions. The test parameters are developing to match higher accelerations in combination with large impact ranges. These tests cannot be realized with conventional standard systems offering a displacement of 50.8 mm (2").

TIRA has met the requirements of the industry to manufacture test installations that can imitate extreme shock simulations. It developed a series of long-stroke shakers with a displacement of 100 mm (peak-peak). Apart from their application in laboratories for testing development problems the integration of these shakers in complete production lines has been a proven advantage.



| System | TV 55240/LSS-250 | TV 56263/LSS-250 | TV 56280/LSS-250 | TV 51010/LSS-300 | TV 57315/LSS-300 |
|--|------------------|------------------|------------------|------------------|-------------------|
| Shaker | S 55240/LSS-250 | S 56263/LSS-250 | S 56280/LSS-250 | S 51010/LSS-300 | S 57315/LSS-300 |
| Amplifier | A 1 01 3 023 T | A 1 02 3 023 T | A 1 02 3 023 T | A 3 01 3 045 T | A 3 01 3 045 T |
| Blower | TB 0310 | TB 9 | TB 9 | TB 120 | TB 120 |
| Rated peak force (N) Sine _{pk} / Random _{RMS} / Shock _{pk} ¹ | 4000/3400/10000 | 6300/4300/15750 | 8000/6000/20000 | 11000/9000/27500 | 15000/11000/37500 |
| Frequency range (Hz) | 5 - 2000 | 5 - 2000 | 5 - 2000 | 5 - 2000 | 5 - 2000 |
| Max. displacement (mm) Pk - Pk ² | 100 | 100 | 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 | 2.0/2.0/4.5 | 2.0/2.0/4.5 |
| Max. acceleration (g) Sine/Random/Shock ¹ | 37/30/74 | 54/34/107 | 68/48/136 | 80/80/160 | 96/96/191 |
| Max. weight tested(kg) | 50 | 50 | 50 | 80 | 80 |
| Effective moving mass (kg) | 12.0 | 13.0 | 13.0 | 17.0 | 17.0 |
| Main resonance frequency (Hz) | >2000 | >2000 | >2000 | >2000 | >2000 |
| Weight with trunnion (kg) | 800 | 850 | 850 | 1200 | 1200 |
| Armature (ø/mm) | 250 | 250 | 250 | 300 | 300 |
| Max. power consumption at 400V (kVA) incl. Blower | 7.7 | 14.6 | 16 | 28.2 | 38 |

¹ Theoretical maximum shock value. Depends on payload, amplifier, shock and shock width

² only with foundation mounting

TIRA Vibration Test Systems – Slip Tables

TIRA Slip Tables

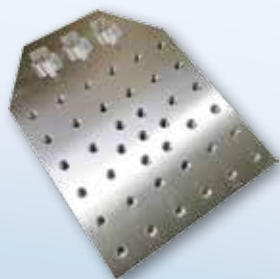
OUR CONCEPT

TIRA slip tables are clearly designed and functional, which makes them easy to handle for smooth testing. Turning the shaker will not limit conventional testing on the vibrating fixture. Stiffened and welded structures at the base increase the reaction mass, while any undesirable transfer of vibration is damped. The linear guide system guarantees high stiffness of the slip plate and minimize cross vibration if the test setup is not symmetrical.

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

| | | |
|-------------|------------------------|---|
| Index XS: | for vibration systems: | TV 5220 |
| Index S: | for vibration systems: | TV 50303, TV 50350 |
| Index M: | for vibration systems: | TV 55240, TV 56263, TV 56280 |
| Index L: | for vibration systems: | TV 51010, TV 57315 |
| Index XL: | for vibration systems: | TV 59320, TV 59327, TV 59335 |
| Index XXL: | for vibration systems: | TV 59349, TV 59355, TV 59360 - TV 59410 |
| Index XXXL: | for vibration systems: | TV 59416, TV 59420 |
| Index LX: | for vibration systems: | TV 59430 |

Vibration technology enables testing in research, development and quality assurance. As test objects become heavier and larger, electrodynamic generators can no longer be used.

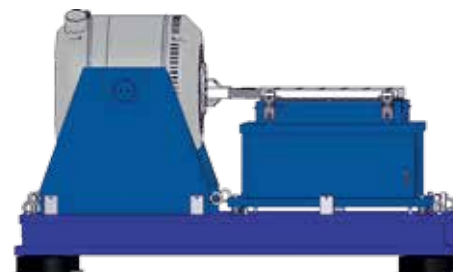


Slip plate 12"



Slip plate 48"

SLIP TABLE MINIBASE



TIRA MINIBASE slip table: shaker in the original frame and sliding 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.

- customized solutions - our key to success
- solutions from TIRA can meet any requirements you specify, with slip tables adjusted to all existing vibration/climatic chamber systems. Our products use high-grade materials and reliable components for long-time use at low operating costs.

TIRA Vibration Test Systems – Slip Tables

TIRA Slip Tables

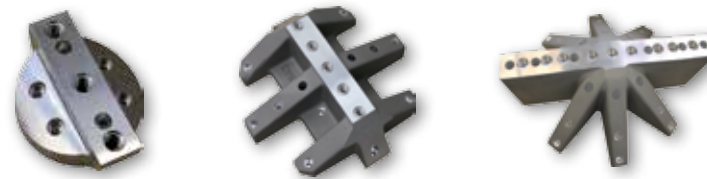
TESTING UNDER STRESS

Today's equipment has to work in all kinds of environments including changes of temperature, vibration, and high humidity. From the design stage right through to final inspection, combined vibration/climatic test systems can simulate the effect of environmental conditions on electric, electronic and mechanical components. Weak points can thus be detected at an early point and eliminated at low cost. Properly designed key parts will prevent expensive downtimes and/or damage. Such multi-test systems are indispensable for **quality assurance, research and development**.

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. Our test systems guarantee your product functions.

| Driver bars | | |
|--------------------|------------------------|--------------|
| Slip table version | Armature diameter (mm) | ~Weight (kg) |
| XS | 120 | 1.0 |
| S | 120 | 1.0 |
| M | 180 | 5.5 |
| | 340 | 7.0 |
| L | 230 | 8.0 |
| | 340 | 8.0 |
| XL | 340 | 8.0 |
| | 440 | 9.0 |
| | 640 | 10.0 |
| XXL | 340 | 15.0 |
| | 440 | 18.0 |
| | 640 | 20.0 |
| XXXL | 590 | 53.0 |
| LX | 840 | 98.0 |

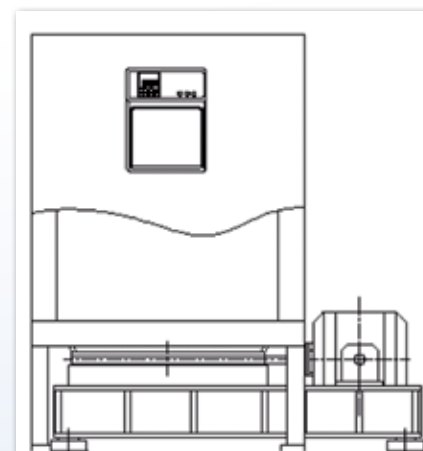


VIBRATION ISOLATION, SAFE INSTALLATION

Pneumatic isolation elements make it possible to install slip tables without expensive foundations. Due to the low natural frequency of isolators (3 - 5 Hz), a wide test spectrum is applicable.

TEST OBJECT FIXING

To simulate practical conditions, devices under test have to be excited in their working position. TIRA has specific magnesium fixtures for all applications.



TIRA Vibration Test Systems – Slip Tables

Oil-film slip tables

With growing requirements on vibration test systems, there is a need for **slip table systems** which can hold large and heavy specimens in a mounting position for testing in horizontal direction.

With **monobase** designs, you can quickly align and precisely couple vibration generators to slip tables. These are available with standard working areas of max. 2000 x 2000 mm, other sizes can be produced on request.

Oil-film slip tables consist of a precision grinded and lapped natural granite block with a magnesium plate that slides on an oil film. **Four linear guides** guarantee the lateral

guidance of the slip plate and **minimize transverse motion. Horizontal and vertical excitation** is possible so that specimens may be tested in their working position.

Vibration isolators are provided on the underside of the frame as a standard feature to prevent vibration transfer to the building.

- Integrated oil pan
- 100 mm displacement possible
- Non-contact displacement monitoring



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

| | Moving plate working area (mm) | Slip plate weight (kg) | Slip plate thickness (mm) | Max. testing object weight (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 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 M | | | | | 1700*1100*900 | | | |
| TGT MO 18 L | | | | | 1600*1200*950 | | | |
| TGT MO 20 XS | 508*508 | 23.5 | 40 | 400 | 1350*700*550 | 2400 | 2400 | 250 |
| TGT MO 20 S | | | | | 1350*1050*750 | | | |
| 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 | 30 | 40 | 550 | 1500*950*750 | 3880 | 3880 | 250 |
| 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 | | | | | 2250*1650*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 | | | | | 2200*1800*1000 | | | |
| TGT MO 48 XL | 1200*1200 | 145 | 50 | 2400 | 2700*1600*1250 | 19500 | 19500 | 250 |
| TGT MO 48 XXL | | | | | 3000*1950*1500 | | | |
| TGT MO 60 L | | | | | 2850*1800*1000 | | | |
| TGT MO 60 XL | 1500*1500 | 243 | 50 | 3500 | 3050*1800*1200 | 25600 | 25600 | 250 |
| TGT MO 60 XXL | | | | | 3150*1700*1400 | | | |
| TGT MO 70 L | | | | | 3150*2100*1000 | | | |
| TGT MO 70 XL | 1800*1800 | 302 | 50 | 4000 | 3250*2100*1200 | 30000 | 30000 | 250 |
| 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 grinded and lapped natural granite block with a magnesium plate sliding on an oil film.

Hydrostatic slide bearings make it possible to apply 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
- 100 mm displacement possible



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

| | Moving plate working area (mm) | Bearings | Slip plate weight (kg) | Slip plate thickness (mm) | Max. testing object weight (kg) | Dimension L*W*H (mm) | Max. pitch moment (Nm) | Max. roll moment (Nm) | Max. yaw moment (Nm) |
|----------------|-----------------------------------|----------|---------------------------|------------------------------|------------------------------------|-------------------------|---------------------------|--------------------------|-------------------------|
| TGT MOH 24 M | 610*610 | 2 | 48 | 50 | 550 | 1800*1100*900 | 26500 | 25000 | 22300 |
| 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 | 105.2 | 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*1950*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 | 2000*2000 | 5 | 430 | 50 | 12000 | 3550*2300*1400 | 320000 | 272000 | 182000 |
| TGT MOH 78 XXL | | | | | | 3650*2300*1400 | | | |

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

TIRA Vibration Test Systems – Headexpanders and Fixtures

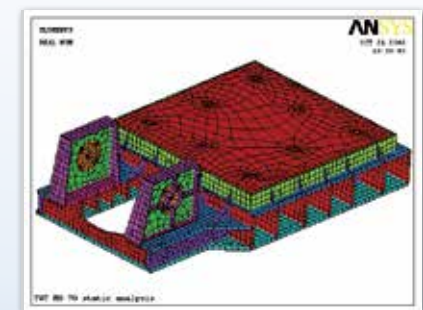
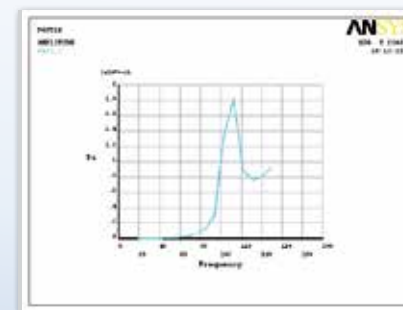
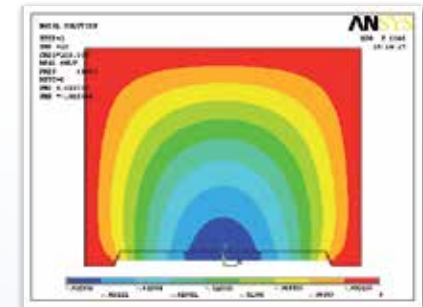
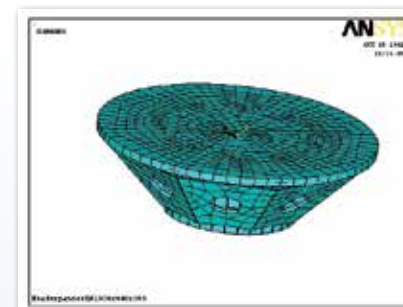
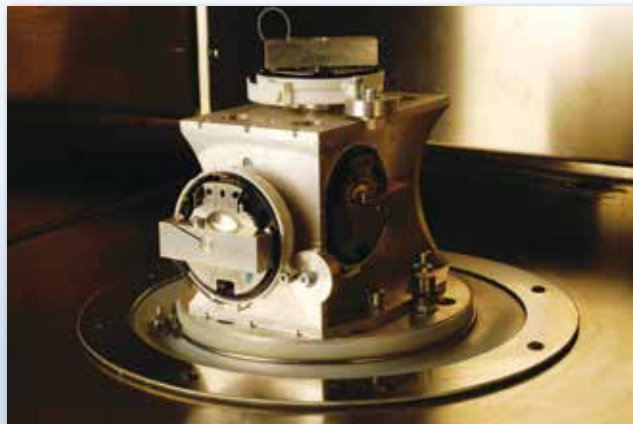
Load-bearing platform (guided head expander)

FEM-designed head expander

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 weight 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. of 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 – Headexpanders and Fixtures

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 special control strategies allow tests up to 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 needs excentric clamping of the testobject or higher 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) | Weight (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 | 415.0 |
| | THR 150-840 | 840 | 275 | 385.0 |

Vibrodamp version on request

| SQUARE VERSION | | | | |
|----------------|-------------|-----------------|-------------|-------------|
| Size (ø/mm) | Type | Armature (ø/mm) | Height (mm) | Weight (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 Vibration Test Systems

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 by TIRA 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.



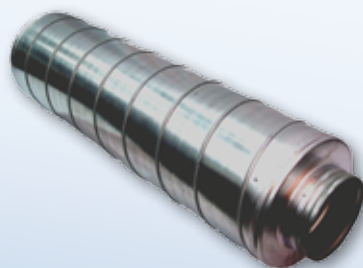
Blower TB 9



Air-Water-Heat exchanger WWT



Acoustic Enclosure TB 7/FU-AE



Silencer TB 7/FU-SI

| Blower (free blowing) | | Engine | | | | Dimensions | Air hose | | Weight | Sound-pressure |
|-----------------------|------------------|----------------|-------|-----------|--------------|-------------|-------------|----------|--------|----------------|
| Designation | Volume flow m³/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 0200 | 210 | 2.2 | 3 | 230/400 | 50 | 334/337/346 | 60 | 5 | 25 | 64 |
| TB 0310 | 315 | 4.0 | 3 | 400 | 50 | 382/384/432 | 60 | 5 | 42 | 69 |
| TB 9 | 870 | 7.0 | 3 | 400 | 50 | 560/605/695 | 100 | 5 | 104 | 86 |
| TB120 | 1140 | 11.5 | 3 | 400 | 50 | 600/636/701 | 100 | 5 | 131 | 87 |
| TB 8 | 3300 | 5.5 | 3 | 400 | 50 | 841/916/592 | 150 | 5 | 127 | 93 |
| TB 7/FU/11 | 1920 | 11 | 3 | 400 | 50 | 625/700/537 | 150 | 5 | 157 | 102 |
| TB 7/FU/20 | 5820 | 20 | 3 | 400 | 50 | 625/700/575 | 175 | 5 | 157 | 105 |

| Blower | Acoustic Enclosure | | | | Silencer | | | |
|-----------------|--------------------|----------------------|-----------|------------------------|-------------|-------------------|-----------|------------------------|
| Designation | Designation | Dimension (LxWxH) mm | Weight kg | Noise Reduction* dB(A) | Designation | Dimension(LxD) mm | Weight kg | Noise Reduction* dB(A) |
| TB 0080 | TB 0080-AE | 795x699x841 | 45 | 15-23 | TB 0080-SI | 310x65 | 0.2 | 5 |
| TB 0140 | TB 0140-AE | 795x699x841 | 45 | 15-23 | TB 0140-SI | 308x82 | 0.2 | 8 |
| TB 0200 | TB 0200-AE | 795x836x841 | 55 | 15-23 | TB 0200-SI | 308x82 | 0.58 | 6 |
| TB 0310 | TB 0310-AE | 795x836x841 | 55 | 15-23 | TB 0310-SI | 308x82 | 0.58 | 6 |
| TB 9 | TB 9-AE | 1094x1000x1086 | 134 | 5-23 | TB 9-SI | 1012x150 | 1.2 | 3-6 |
| TB120 | TB 120-AE | 1094x1000x1086 | 134 | 5-23 | TB 120-SI | 1100x160 | 1.2 | 3-6 |
| TB 8 | TB 8-AE | 1094x1179x1271 | 134 | 5-23 | TB 8-SI | 1200x340 | 3.3 | 6-10 |
| TB 7/FU | TB 7/FU-AE | 1130x1630x1630 | 103 | 5-23 | TB 7/FU-SI | 1120x280 | 9.2 | 9-15 |
| variable | WWT | 1200x1500x2080 | 800 | 30 | | | | |

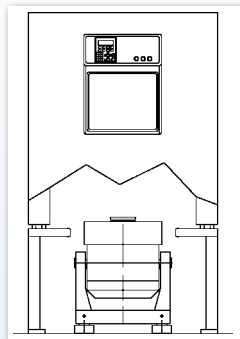
*Depending on frequency

TIRAvibro - Vibration Test Chambers

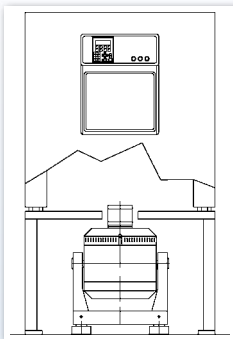
Quality, reliability and safety of products require utmost care from the concept to the end-user. To meet this pretentious requirement, one nowadays investigates the interactions between objects and their direct or indirect environment by means of environment testing systems. Based upon such experience, products are developed with reference to specific applications as well as high quality and long lifetime achieved. Such flaws as materialand production faults can be detected early and costly breakdowns avoided.

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.

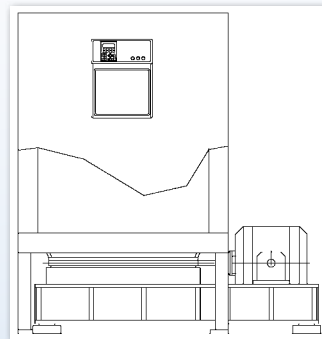
- compatible with many various types of shakers for vertical, horizontal and tri-axial vibrations
- test room automatic lifting system, operated by removable touch-screen control panel
- manual or automatic horizontal movement optional (for the use of vertical- and horizontal movement or use of more shakers with the same chamber)
- different removable floors for vertical and horizontal vibrations for adaption the chamber to any existing standard shaker
- available volumes in temperature- and climatic versions are: test space volume 600, 1200 and 2200 l



Integration of vibration generator into climatic chamber



Head extender



Integration of slip table into climatic chamber

- 3 choices of temperature change rates for the types - 70/+180°C: 5, 10 or 15 K/min
- humidity range for climatic chambers: 10% to 98%
- control system, based on PLC, easy to use by a color touchscreen control panel (Keykratos Plus)
- Software WinKratos® allows the PC control of the chamber (optional) via Ethernet

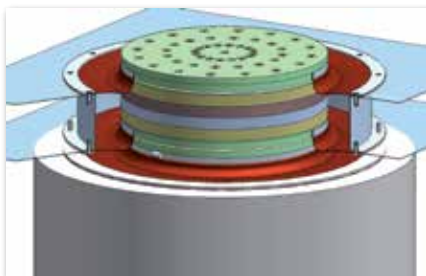


Chamber leadthrough

TIRA chamber leadthrough

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 weight advantage of about 30%.

Thermobarriers (Circular version)

| Diameter mm | Height mm | Weight 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

| Armature diameter mm | Height (Standard) mm | for chamber floor thickness (Standard) mm | Weight* 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

* Weight at standard height of 160 mm

Thermobarriers (Square version)

| Size mm | Height mm | Weight 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 |

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 |
| Volume flow at max. supply temperature (m ³ /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 (bar) | < 140 ppm (< 8 °dH) | < 140 ppm (< 8 °dH) |
| Water hardness - carbonate | < 90 ppm (< 5 °dH) | < 90 ppm (< 5 °dH) |
| Hose connection - Nominal width - supply (mm) | 32 | 40 |
| Hose connection - Nominal width - return (mm) | 32 | 40 |
| Weight (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.



TIRA Vibration Test Systems

Analog Power Amplifiers

TIRA offers a new series of analog 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 backgrounlight 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 | BAA 500 | BAA 1000 | BAA 1000-E | BAA 1000-ET |
|--------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| Output power RMS (VA) | 60 | 120 | 500 | 1200 | 1200 | 1200 |
| Frequency range (Hz) | 2 - 20000 | DC- 20000 | DC- 20000 | 2 - 20000 | 2 - 20000 | DC- 20000 |
| Voltage-/Current mode | yes/no | yes/yes | yes/yes | yes/yes | yes/yes | yes/no |
| Voltage RMS , max. (V) | 16 | 22 | 45 | 72 | 72 | 72 |
| Current RMS , max. (A) | 3.8 | 5.5 | 11.2 | 18 | 18 | 18 |
| Optimal load resistance (Ohm) | 4 | 4 | 4 | 4 | 4 | 4 |
| Signal input voltage RMS (V) | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 |
| Distortion (%) | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| Signal to noise ratio (dB) | > 90 | > 90 | > 90 | > 90 | > 90 | > 90 |
| Field supply | no | no | no | no | yes (external) | yes (external+TMC) |
| Field voltage, max. (V) | – | – | – | – | 70 | 70 |
| Field current, max. (A) | – | – | – | – | 3.2 | 3.2 |
| Weight (kg) | 12 | 16 | 25 | 45 | 72 | 76 |
| Size (WxHxD) (mm) | 483 x 90 x 450 | 483 x 90 x 450 | 483 x 90 x 450 | 483 x 190 x 600 | 483 x 320x 600 | 483 x 400 x 600 |
| Interlocks | Overload, Temperature, Clipping | Overload, Temperature, Clipping | Overload, Temperature, Clipping | Overload, Temperature, Clipping | Overload, Temperature, Clipping | Overload, Temperature, Clipping |

Digital Power Amplifiers

TIRA power amplifiers are built with cascadable modules, designed according to the latest technological developments. Highly-advanced MOSFET power transistors combined with a complete module management guarantee a high output power at highest safety. On the **LCD-touch screen display** the module status with current indication, the percental modulation of the modules 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 82 kHz allows test frequencies of up to **4000 Hz** without any decrease in power possible. The cascading of the modules allows an **amplifier design up to 405 kVA** at low floor space requirement. 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 1 003 | A 1 01 1 004 | A 1 01 1 011 | A 1 02 1 011 | A 1 02 1 016 | A 1 01 3 023 |
|---|--|--|--|--|--|--|
| Output power, max. RMS (kVA) | 2.7 | 4.2 | 11 | 11 | 16 | 22.5 |
| Frequency range (Hz) | DC - 4000 | DC - 4000 | DC - 4000 | DC - 4000 | DC - 4000 | DC - 4000 |
| Voltage, max. RMS (V) | 105 | 105 | 105 | 105 | 105 | 150 |
| Current, max. RMS, max. (A) | 25 | 40 | 100 | 100 | 150 | 150 |
| Optimal load resistance (Ohm) | 4.2 | 2.6 | 1 | 1 | 1 | 1 |
| Signal input voltage (switchable) RMS (V) | 2.5/5/10 | 2.5/5/10 | 2.5/5/10 | 2.5/5/10 | 2.5/5/10 | 2.5/5/10 |
| Distortion (%) | < 0.5 | < 0.5 | < 0.5 | < 0.5 | < 0.7 | < 0.7 |
| Signal to noise ratio (dB) | > 90 | > 90 | > 90 | > 90 | > 90 | > 90 |
| Field supply | internal | internal | internal | internal | internal | internal |
| Field voltage, max. * (V) | 100 | 100/180 | 180 | 280 | 280 | 140 |
| Field current, max. * (A) | 6 | 6 | 6 | 6 | 6 | 8 |
| Weight (kg) | 234 | 225 | 250 | 290 | 330 | 330 |
| Size (W x H x D) (mm) | 600 x 1800 x 800 | 600 x 1800 x 800 | 600 x 1800 x 800 | 600 x 1800 x 800 | 600 x 1800 x 800 | 600 x 1800 x 800 |
| Interlocks | Overload, Temperature, Clipping and more | Overload, Temperature, Clipping and more | Overload, Temperature, Clipping and more | Overload, Temperature, Clipping and more | Overload, Temperature, Clipping and more | Overload, Temperature, Clipping and more |

* variable according to customer specification

Digital Power Amplifiers



| Amplifier | A 3 01 3 034 | A 3 07 3 034 | A 3 08 3 045 |
|---|--|--|--|
| Output power, max. R_{MS} (kVA) | 34 | 34 | 45 |
| Frequency range (Hz) | DC - 4000 | DC - 4000 | DC - 4000 |
| Voltage R_{MS} , max. (V) | 150 | 150 | 150 |
| Current R_{MS} , max. (A) | 225 | 225 | 300 |
| Optimal load resistance (Ohm) | 1 | 1 | 1 |
| Signal input voltage R_{MS} switchable) (V) | 2.5/5/10 | 2.5/5/10 | 2.5/5/10 |
| Distortion (%) | < 0.7 | < 0.7 | < 0.7 |
| Signal to noise ratio (dB) | > 90 | > 90 | > 90 |
| Field supply | internal | internal | internal |
| Field voltage, max. * (V) | 140 | 85 | 105 |
| Field current, max. * (A) | 8 | 85 | 75 |
| Weight (kg) | 515 | 615 | 620 |
| Size (W x H x D) (mm) | 600 x 2200 x 800 | 600 x 2200 x 800 | 600 x 2200 x 800 |
| Interlocks | Overload, Temperature, Clipping and more | Overload, Temperature, Clipping and more | Overload, Temperature, Clipping and more |

| Amplifier | A 3 08 3 057 | A 2 11 3 090 | A 4 11 3 113 |
|---|--|--|--|
| Output power, max. R_{MS} (kVA) | 57 | 90 | 113 |
| Frequency range (Hz) | DC - 4000 | DC - 4000 | DC - 4000 |
| Voltage R_{MS} , max. (V) | 150 | 150 | 150 |
| Current R_{MS} , max. (A) | 375 | 600 | 750 |
| Optimal load resistance (Ohm) | 1 | 1 | 1 |
| Signal input voltage R_{MS} switchable) (V) | 2.5/5/10 | 2.5/5/10 | 2.5/5/10 |
| Distortion (%) | < 0.7 | < 0.7 | < 0.7 |
| Signal to noise ratio (dB) | > 90 | > 90 | > 90 |
| Field supply | internal | internal | internal |
| Field voltage, max. * (V) | 105 | 112 | 112 |
| Field current, max. * (A) | 75 | 100 | 100 |
| Weight (kg) | 640 | 860 | 910 |
| Size (W x H x D) (mm) | 600 x 2200 x 800 | 1200 x 1800 x 800 | 1200 x 2200 x 800 |
| Interlocks | Overload, Temperature, Clipping and more | Overload, Temperature, Clipping and more | Overload, Temperature, Clipping and more |

* variable according to customer specification

Power modules BPS 1016-PG / BPS 1514-PG for grounded systems

The BPS 1016-PG/1514-PG is a switched high power amplifier, which can be connected to an external BPS 15-1 M (M/R) master module. A special feature allows this amplifier to be connected to single ended shaker systems.

This product is designed with the latest technology and manufacturing methods. Modern POWER MOSFET- transistors, in MDmesh II technology, combined with state-of-the-art multi-chip technology for the module management allows very high output power, combined with a maximum of performance and safety. It may be paralleled for increased current output; therefore a customized system can be realized very easily.

| BPS 1016-PG | | BPS 1514-PG | |
|-----------------------------------|---|-----------------------------------|---|
| DC Power input | 80V to 170V | DC Power input | 80V to 270V |
| Output current R_{MS} Sine | 150 A | Output current R_{MS} Sine | 150 A |
| Output voltage R_{MS} Sine | 105V / Load dependent | Output voltage R_{MS} Sine | 150V / Load dependent |
| Output power Sinus | 16 kVA | Output power Sinus | 22,5 kVA |
| Optimum impedance for Sine | 0,7 Ohm | Optimum impedance for Sine | 1,0 Ohm |
| Max. output voltage p-p Sinus | $\pm 149V$ | Max. output voltage p-p Sinus | $\pm 212V$ |
| Max. output current p-p Sinus | $\pm 212 A$ | Max. output current p-p Sinus | $\pm 212 A$ |
| Optimum impedance for nom Noise | 0,35 Ohm | Optimum impedance for nom Noise | 0,54 Ohm |
| Max. output voltage p-p nom Noise | $\pm 158V$ | Max. output voltage p-p nom Noise | $\pm 242V$ |
| Max. output current p-p nom Noise | $\pm 450 A$ | Max. output current p-p nom Noise | $\pm 450 A$ |
| Frequency range full power - 1dB | DC to 3 kHz | Frequency range full power - 1dB | DC to 3 kHz |
| Dimensions W x H x D | 482 x 132 x 630 mm | Dimensions W x H x D | 482 x 176 x 610 mm |
| Weight | 43 kg | Weight | 43 kg |
| Protection circuits | Overtemperature control, Overcurrent RMS control, Overcurrent p-p protection + / -, DC input power control, Internal short circuit protection | Protection circuits | Overtemperature control, Overcurrent RMS control, Overcurrent p-p protection + / -, DC input power control, Internal short circuit protection |

Digital Power Amplifiers

Features:

- High Signal to Noise Ratio of >90 dB
- Integrated field power supply
- Integrated mains switch and line filter
- Lo-Field/Hi-Field button (Energy-saving mode)
- ESD monitoring (Protection of the system against damage)
- Noise button
- Input voltage analyser
- Voltage-clipping limiter to avoid clipping
- 3 σ peak current



| Amplifier | A 5 40 3 158 | A 5 40 3 180 | A 5 40 3 203 | A 5 40 3 225 | A 5 85 3 293 | A 5 85 3 338 | A 5 00 3 360 |
|---|--|--|--|--|--|--|--|
| Output power RMS (kVA) | 158 | 180 | 203 | 225 | 293 | 338 | 360 |
| Frequency range (Hz) | DC - 4000 | DC - 4000 | DC - 4000 | DC - 4000 | DC - 4000 | DC - 4000 | DC - 4000 |
| Voltage RMS, max. (V) | 150 | 150 | 150 | 150 | 150 | 150 | 150 |
| Current RMS, max. (A) | 1050 | 1200 | 1350 | 1500 | 1950 | 2250 | 2400 |
| Optimal load resistance (Ohm) | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Signal input voltage RMS (switchable) (V) | 2.5/5/10 | 2.5/5/10 | 2.5/5/10 | 2.5/5/10 | 2.5/5/10 | 2.5/5/10 | 2.5/5/10 |
| Distortion (%) | < 0.7 | < 0.7 | < 0.7 | < 0.7 | < 0.7 | < 0.7 | < 0.7 |
| Signal to noise ratio (dB) | > 90 | > 90 | > 90 | > 90 | > 90 | > 90 | > 90 |
| Field supply | internal | internal | internal | internal | internal | internal | internal |
| Field voltage, max. * (V) | 155 | 155 | 155 | 155 | 240 | 240 | 360 |
| Field current, max. * (A) | 260 | 260 | 260 | 260 | 355 | 355 | 300 |
| Weight (kg) | 2200 | 2250 | 2300 | 2400 | 2900 | 3100 | 2200 |
| Weight (External field supply) (kg) | - | - | - | - | - | - | 960 |
| Size (WxHxD) (mm) | 2840 x 2320 x 1050 | 2840 x 2320 x 1050 | 2840 x 2320 x 1050 | 2840 x 2320 x 1050 | 2840 x 2320 x 1050 | 2840 x 2320 x 1050 | 2840 x 2320 x 1050 |
| Size (WxHxD) (External field supply) (mm) | - | - | - | - | - | - | 1200 x 1800 x 800 |
| Interlocks | Overload, Temperature, Clipping and more | Overload, Temperature, Clipping and more | Overload, Temperature, Clipping and more | Overload, Temperature, Clipping and more | Overload, Temperature, Clipping and more | Overload, Temperature, Clipping and more | Overload, Temperature, Clipping and more |

* variable according to customer specification

TIRA Vibration Test Systems

Control Units

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 the PCI-Express slot of a PC.

Features:

- up to 800 m distance
- full gain control by mouse or numerical value
- shows all errors of shaker, amplifier and cooling unit
- monitoring of voltage/current level over time
- support for all operating systems from Windows 2000 to Windows 7
- additional monitoring options on request



Phase Control Unit & Supervisor

The phase control unit is used for combining multiple shakers and coordinating the thrust in magnitude and phase. The supervisor is used to control all relevant signals.

Features (Phase control):

- Multi shaker control of up to 6 shakers
- Push-Pull and Push-Push configuration switch
- Accurate control of LF and HF phase
- Master gain and bypass configuration switch
- LED front panel for magnitude and phase
- Electronic master gain overload protection

Features (Supervisor):

- High speed signal handling
- Accurate control of error messages



Vibration Control System 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 different 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 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 overlayed with a multiple sine signal, up to a load simulation in time interval. Of course all tests are accomplished according to the respective standards ISO, DIN, MIL 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 electro-dynamic shakers due to their excellent linearity at wide dynamic range and large frequency range. TIRA offers a wide variety for all types of application.



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 Environmental Simulation

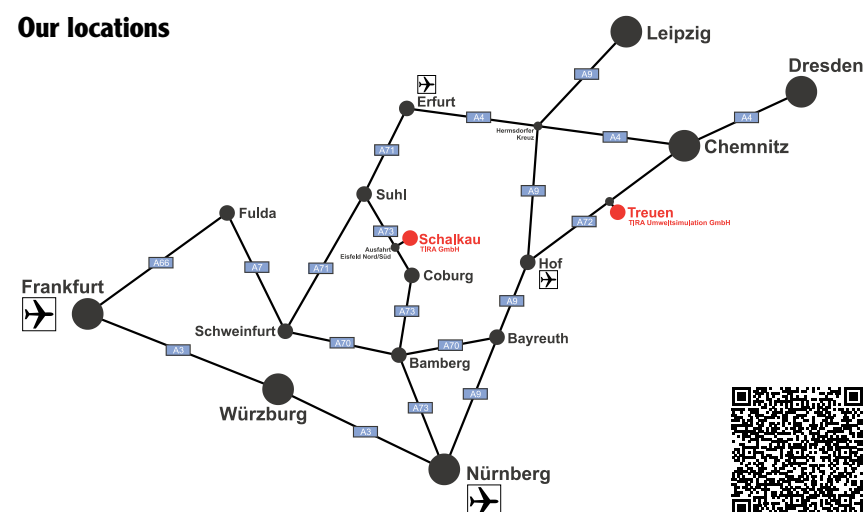
- Test chambers to simulate environmental conditions (climatic and temperature test chambers, stress screening systems, pressure, radiation)
- Vibration test chambers (vertical and horizontal vibration systems)

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



Our locations



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