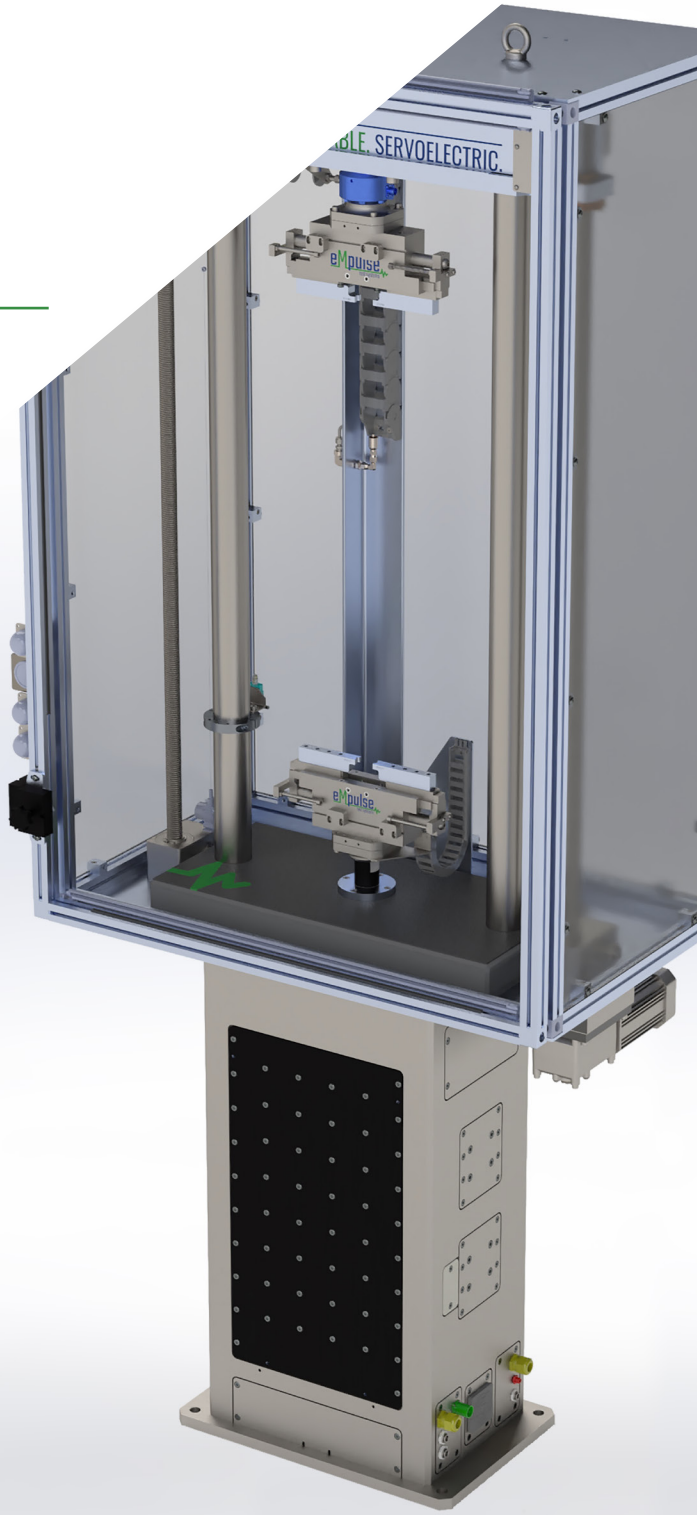
Load Frames

Global Expert in
Servoelectric Testing
Solutions



REV. 4.0 OCT2025

eMpulse
test systems

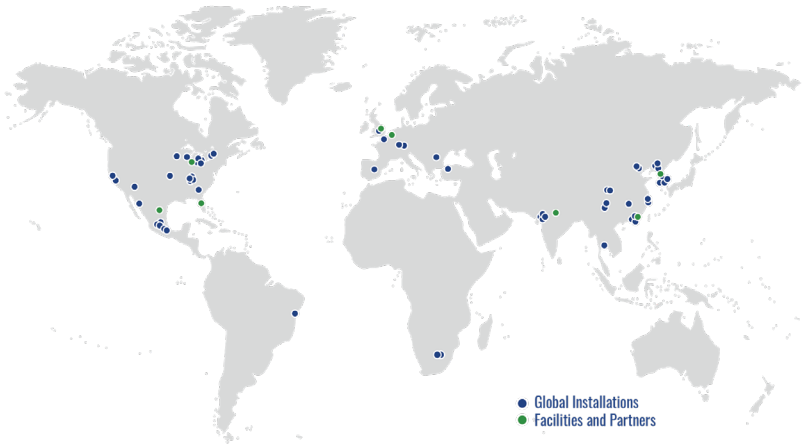
Servoelectric Load Frames

Designed to replace hydraulic systems while providing higher dynamic performance and improved efficiency, with a 46% increase in performance or previous design. These systems offer precise force and displacement control for single-axis durability, fatigue, and structural testing across a range of components and materials.

The seaPLUS series Load Frames are comprised of five standard models with peak dynamic forces of 13kN, 27N, 40kN, 54kN, and 108kN. oupled with our integrated Static Load Support the full dynamic force range is available in addition to a static load offset, further increasing the total force capacity of the test stands.

The SEA actuator modular structure allows the upper columns, crosshead, and adjustment mechanisms to be configured for specific testing requirements without altering actuator performance. Our Load Frames utilize digital control with real-time feedback for force, velocity, and displacement; enabling stable closed-loop operation, high repeatability, and long-duration testing with reduced maintenance and energy consumption compared to hydraulic systems.

- **Durability**
- **Research and Development**
- **Accelerated Life**
- **End-of-Line Production**



seaPLUS Load Frames Software and Hardware

Feature three dedicated software configurations, each optimized for user interface and test setups for specific applications:

- **BL1 General Purpose**
  - optional **M10 Fatigue Test**
  - optional **M3 MIMIC** Iterative Transfer Function Compensation
- **M18A Damper Testing**
  - optional **M33 Automation Interface**
- **M83 Elastomer Testing**
  - optional **M33 Automation Interface**

Anumber of hardware options are available to provide additional functionality, including:

- Pneumatic Static Air Assist
- Integrated Safety Cage or Light Curtain
- Automated Crosshead Lifts and Locks
- Pneumatic Sideload
- Acoustic or Environmental Specimen Chambers
- Automation Interface for use in Production

Advantages of seaPLUS Load Frames

Pedestal Styles

Pedestal style servo electric linear motors form the base of the standard two column load frames.

Thermal Management for Extended Testing

Increased efficiency in converting electrical to mechanical energy, results in significantly lower heat generation. This improved efficiency reduces the size of the active cooling infrastructure, minimizes thermal loading on components, and contributes to lower overall operational costs.

High-Frequency Capability

Motor coherence up to 400 Hz enables test profiles that demand high dynamic response, exceeding the capabilities of servo-hydraulic actuators.

Solid Welded Construction

Precision CNC machined and ground surfaces to 0.0001” tolerances to ensure perfect alignment for system longevity. Nickel plating surfaces resist long-term corrosion better than zinc, powder-coating or paint.

Force Range and Modular Design

Modular motor configurations deliver peak dynamic forces from 1 kN to 108 kN, independent of static load.

Advantages of seaPLUS Load Frames

Nanometer-Level Accuracy
Integrated displacement feedback systems offer <10 nm resolution, supporting high-precision test requirements.

Side Load Capacity
Outboard bearings significantly improve sideload tolerance, outperforming comparable servohydraulic systems in lateral stability and reliability.

Pneumatic Support
Patented Integrated high volume Air-bag pneumatic support system for no maintenance and long-term durability.

Internal Motor Cooling
Internal motor cooling allows higher continuous force capacity to run extended or durability test profiles.

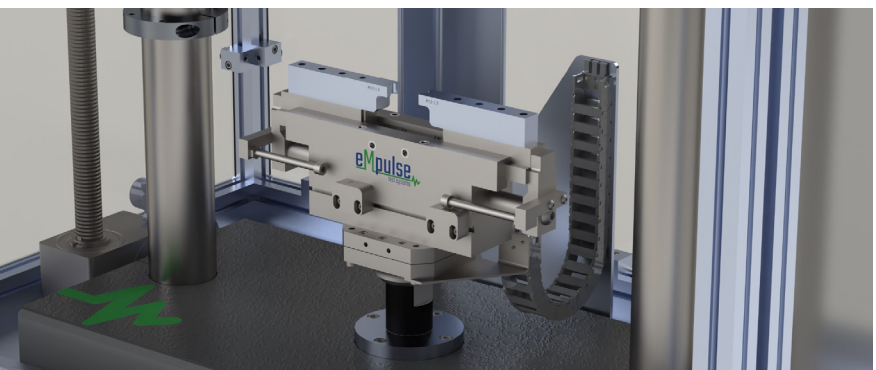
High Fidelity
High fidelity 32-bit closed-loop control ensures smooth, accurate motion across all test speeds, without switching valve types or control strategies.

Application-Specific Software
Integrated with eMpulse controls that feature application-specific software, seaPLUS Road Simulators are ideal for field data reproduction, sine sweep, or Power Spectral Density (PSD) profile replication.

Efficient, Clean Operation
Direct-drive electric motion is up to 80% more efficient than hydraulics, with no fluid handling, reduced maintenance, and a cleaner test environment.

Integrated Safety Features
These features are built into the control architecture to ensure operator safety and specimen integrity during every test cycle. Every system includes comprehensive safety monitoring:

- Safe Limited Speed (SLS)
- Safe Limited Acceleration (SLA)
- Absolute encoder fault detection
- Safe Torque Off (STO)
- Internal motor/drive temperature monitoring
- Customizable specimen-specific protection limits

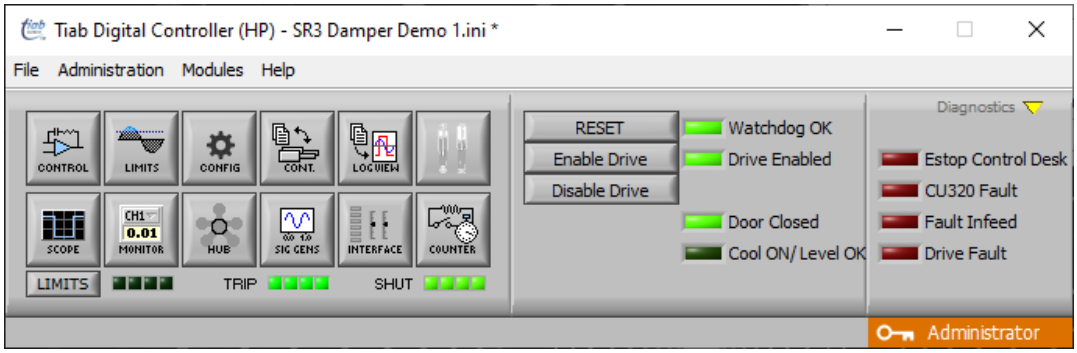


seaPLUS Load Frame Testing

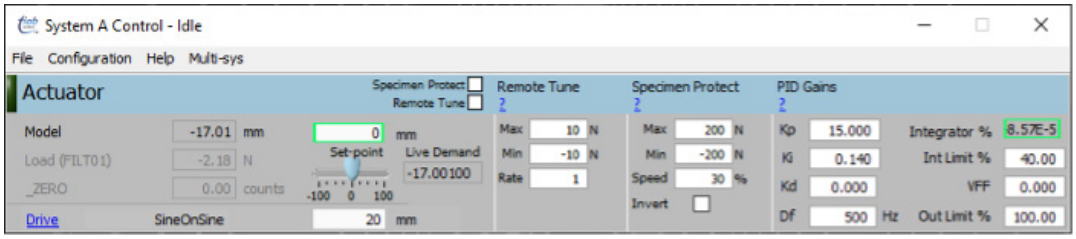
BL1 General Purpose

For general purpose applications, most test steps required to run a test can be done manually through a suite of modules in BL1 General Purpose Test Software. These include:

- Waveform amplitude and mean control
- Periodic Waveforms include Sine, Triangle, Square, and more, with cycle counters
- Replay from time history files
- Limit monitoring with custom response
- Force limited position control for loading /unloading test specimens
- Amplitude Control from a second transducer (also called Remote Tune)
- 4 Channel Oscilloscope with active cursors
- Reduced Force mode when safety circuits are triggered
- Customizable Digital Monitors for viewing any internal variable
- Built in Data Logger with Viewer
- Compatible with advanced MIMIC system transfer function compensation with Iterative Control



When used in conjunction with M10 Fatigue Test Software, BL1 Generic Purpose software can provide a convenient method to Install, Tune, Configure, Setup Upper and Lower Peak Limits, Run, Monitor, and Collect Data on many endurance or Durability test configurations.

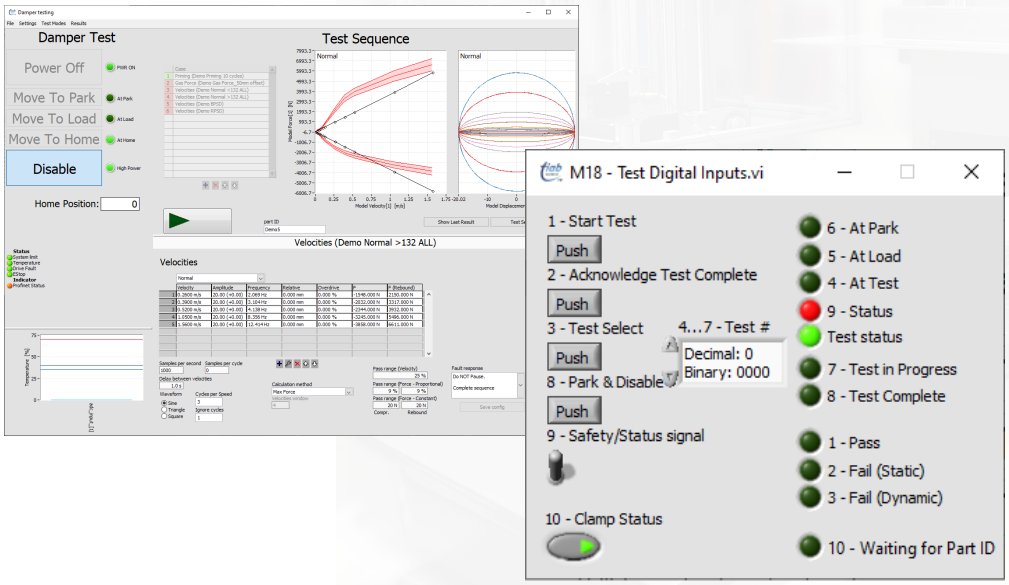


M18A Damper Testing

The M18A Damper Testing Software suite provides an intuitive interface to setup and run common tasks associated with testing Dampers, including:

- Precycles based on number of cycles or temperature
- Gas Force Test
- Friction Force Test
- Combined Gas and Friction Force Test
- Multi-Speed (PVP) Test Cases with variable offset test position
- Group results based on customer-defined parameters, such as test position, temperature, etc.
- Customizable Data Collection available for post analysis and comparison using M38 TDAP TIAB Data Analysis Package
- Select Sine or Triangle waveforms
- Pass/Fail criteria based on Absolute Values or % plus offset values
- Accelerometer-based Test Cases
- Multiple Force Evaluation methods
- Variable number of cycles, with ability to ignore and average multiple cycles
- Batch Testing, with Part Identification entered manually or via Scanner, along with Statistics

The M18A Damper Test Software can be combined with M33 Automation Interface to integrate the seaPLUS Load Frame into your existing Production Automation system. Additionally, eMpulse can provide a complete PLC integrated solution with pneumatic grippers and lighted touch button controls for manual load/unload and test operation.

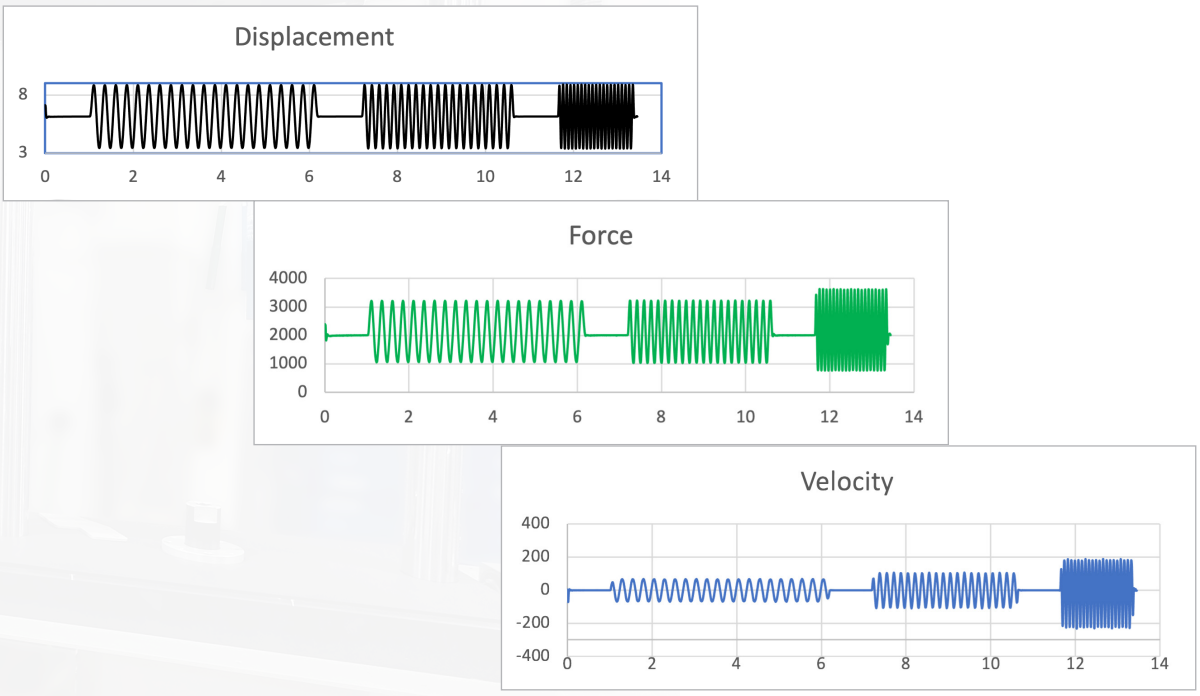


M83 Elastomer Testing

M83 Elastomer Testing Software operates in a similar fashion to M18A Damper Testing software, with a specific focus on calculating the material properties of elastomeric materials. These calculations include:

K* Dynamic Spring Rate
C* Dynamic Damping coefficient
Θ Phase Angle
K′ Elastic Stiffness
K″ Viscous or loss Stiffness
tan(Θ) tan Delta
DE_t Damping Energy Extension
DE_c Damping Energy Compression
H_t Hysteresis Extension
H_c Hysteresis Compression
Additional parameters can be added on request

Elastomer Test Stands are available with frequency response exceeding 200 Hz.



seaPLUS Load Frame Specifications

SPECIFICATIONS	UNITS	sea+ 13	sea+ 20	sea+ 27	sea+ 40	sea+ 54	sea+ 108
Peak Dynamic Force Motor Peak Force (not including Air Support	N (lbF)	13468 (3028)	20176 4536	26910 (6050)	40326 (9066)	53820 (12100)	107640 (242000)
Continuous Dynamic Force** Moto Continuous Force (not including Air Support)	N (lbF)	5018 (1128)	7527 1692	10530 (2367)	21060 (4735)	21060 (4735)	42120 (9469)
Maximum Static Air Support Air support maximum force @100 psi (6.9 bar)	N (lbF)	8900 (2000)	8900 2000	17800 (4000)	17800 (4000)	17800 (4000)	35600 (8000)
Continuous Force Motor Continuous Force + Maximum Air support	N (lbF)	13918 (3129)	16427 3693	28330 (6369)	38860 (8737)	38660 (8737)	77720 (143240)
Combined Peak Force Motor Peak Force + Maximum Air Support	N (lbF)	22368 (5029)	29076 6537	44710 (10052)	58126 (13068)	71620 (16102)	143240 (32203)
Peak Velocity at Continuous Dynamic Force	m/sec in/sec	4.6 181	4.6 181	4.2 165	4.2 165	4.2 165	4.2 165
Peak Velocity at Peak Dynamic Force	m/sec in/sec	2.0 79	2.0 79	1.9 75	1.9 75	1.9 75	1.9 75
Frequency Response -3dB Velocity Roll-Off	Hz	149	149	149	149	149	149
Temperature Monitoring	Specimen	Monitored Non-contacting IR					
	Motor	Embedded PTC thermocouple with redundant safety KTY sensor					
Digital Encoder Accuracy	nm	10.0					
Noise Level – Typical	dbA	<55					
Waveforms Supported	Type	Sine, Triangle, Square, Frequency Sweep & Custom					
Facility Requirements	V	380-480Vac, 3φ, 50-60 Hz					
	A	Current Rating based on motor sizing and system performance requirements.					
Air Supply, Rated	psi (bar)	100 (6.9), higher Static Load Support possible at higher supply pressures.					
	CFM	<5					
Recommend Liquid Cooling Flow, approximately 20deg delta C	Lpm gpm	5 1.3	5 1.3	5.5 1.5	6.5 1.7	6.5 1.7	13 3.4
Max Heat Removal @100% duty cycle, full durability rating	kW Btu/hr ton	3.9 13208 1.1	3.9 13208 1.1	7.3 2505 2.1	13.5 45928 3.8	13.5 45928 3.8	26.9 91856 7.7

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