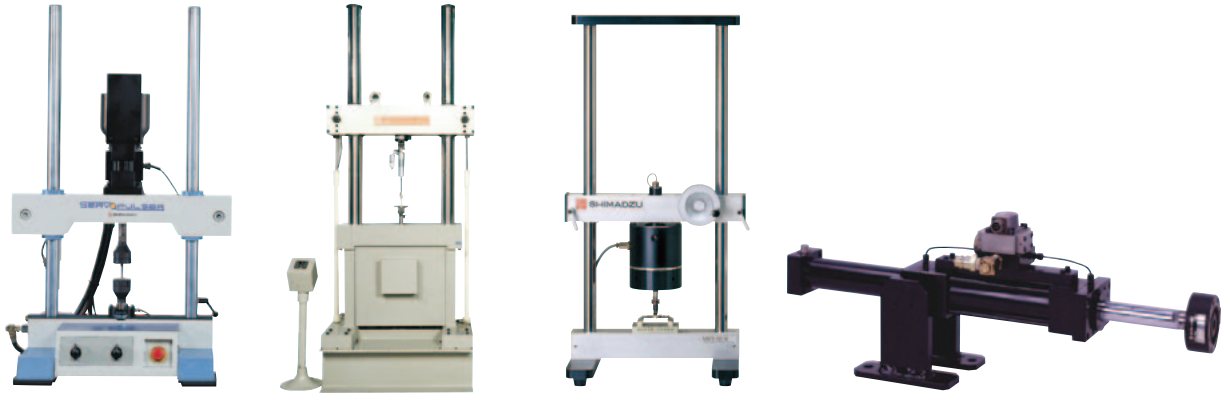
C225-E020B

SHIMADZU
Excellence in Science

Fatigue and Endurance Testing Systems

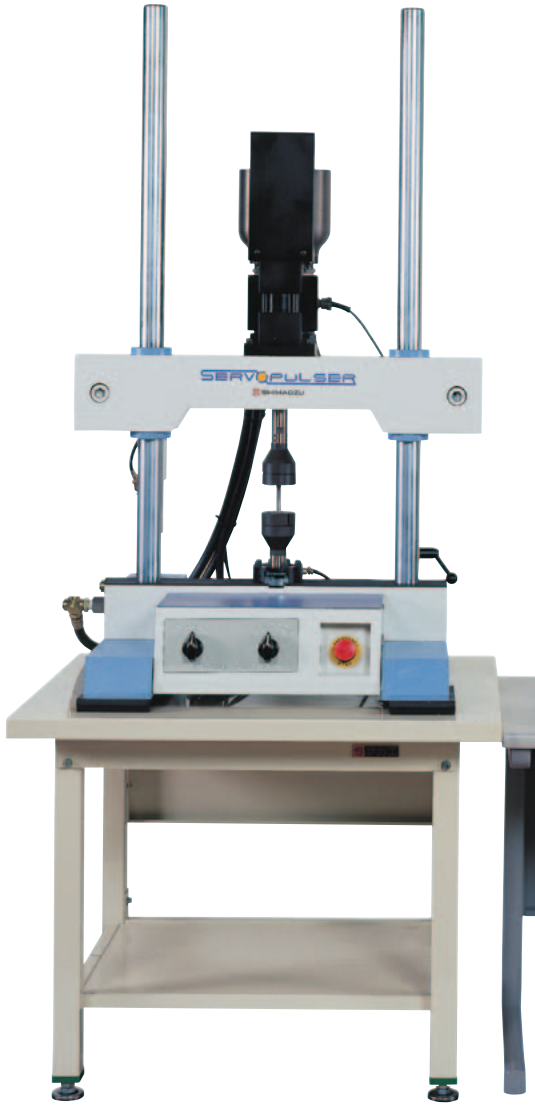
Shimadzu Servopulser



Servo-hydraulic Fatigue and Endurance Tester

Servopulser Series

The evaluation of strength, which relates to safety and durability will affect the product life. It has become increasing important in areas such as product development, quality control and failure analysis.
The Servopulser Series of high-performance, high-accuracy strength testing machines can accommodate this diverse range of requirements. The comprehensive lineup allows configuration of the optimal system for each user's requirements.



Features of the Servopulser

Compact but Powerful

Hydraulically operated to generate large test forces in a compact design.

Continuously Variable Force and Speed

The high-performance servo valve allows instant variation of test force and speed.

Rigid Construction

The highly rigid frame prevents buckling of specimens.

Full Safety Features

Alarm functions and post-alarm operations allow safe unmanned operation.

Wide-ranging Test Applications

Extensive ranges of test jigs, detectors, and environment control devices permit testing for a wide range of applications.

Servopulser Basic Configuration

The Servopulser is a hydraulically operated testing machine.
The customer chooses the **1** main frame, **2** controller, **3** **4** actuators, and **5** hydraulic power supply unit to achieve the required test forces and test rates.
An extensive range of extensometers and other detectors, test jigs, and environment control devices can be added to permit a variety of tests.

2 Controller ➡ P6/7

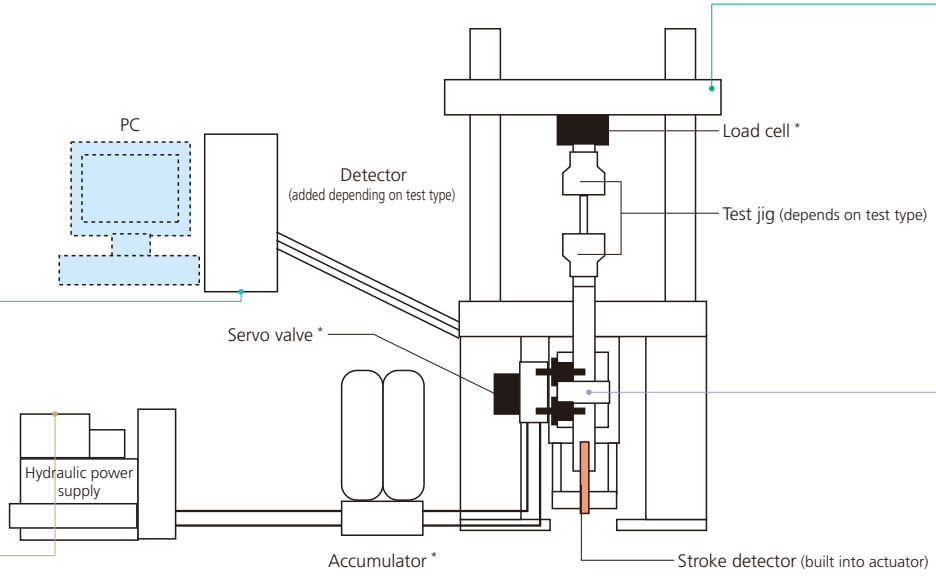
The controller feeds back the measured signals to achieve the target control.

- Controller 4830 (Type V)
  General-purpose, stand-alone type
- Controller 4890 (Type M)
  High-performance, PC type

5 Hydraulic power supply ➡ P10/11

Generates the hydraulic power.
4, 10, 20, 40, 70, 110, or 140 L/min max. discharge capacity

Standard system configuration



* Item supplied varies according to the combination of actuator and hydraulic power supply.

1 Main Unit Frame ➡ P4/5

Frame to mount the loading mechanism.

- E-type Loading Frame-test force to 200 kN Bottom actuator type
- U-type Loading Frame-test force to 200 kN Overhead actuator type
- L-type Loading Frame-test force to 20 kN Overhead actuator type

3 4 Actuator ➡ P4/5

Provides the load for the testing machine.
Max. test force : 5 kN, 10 kN, 20 kN, 50 kN, 100 kN, or 200 kN
Stroke : ±25 mm or ±50 mm

Selecting A Testing System

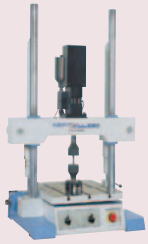
Select your ideal combination of main unit, controller, and hydraulic power supply to meet the test aims (force capacity, loading speed, etc.).
Consult your Shimadzu representative about extra large or small machines or for custom specifications. Shimadzu will apply its extensive experience in the industry to provide the optimal system for every need.

Key to Model Codes

EHF – [E] [V] [0][5][1] k [1] – [0][2][0] – [ ] A
1 2 3 4 5 6

1 Select the Main Unit Frame Type (See pages 4 and 5 for details.) → [ ]
Select the most applicable of the following three frame types.

L L-type Loading Frame

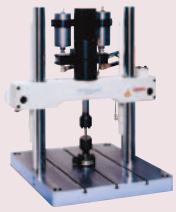


Tabletop frame with overhead actuator
This frame is suited to testing parts and formed specimens with a test force up to 20 kN.
Sample application : bearing components

E E-type Loading Frame

Standard frame with bottom actuator
This frame is suited to testing of small parts and formed specimens with a test force up to 200 kN.
Sample application : standard specimens

U U-type Loading Frame



Standard frame with overhead actuator
This frame is suited to testing structural materials and large specimens with a test force up to 200 kN.
Sample application : large parts

2 Select the Controller (See pages 6 and 7 for details.) → [ ]
Select one of the following two controller types that provides the functions required.

V Controller 4830

Compact controller with color LCD and touchpanel
Generates a comprehensive variety of loading waveforms. Handles measurement and control, and displays the waveforms.
Optional software provides waveform combinations and permits testing using actual waves.

M Controller 4890

All-purpose, high-performance controller
Generates six different loading waveforms and combinations of them. Handles measurement, control, hydraulic power supply operation, data acquisition, and data processing.
Requires a PC and dedicated GLUON software.

3 Select the Actuator Capacity (Select an actuator that matches the frame capacity.) → [ ][ ][ ] k
Select the maximum test force from the list below.

[0][0][5] : 5 kN	[0][1][0] : 10 kN	[0][2][0] : 20 kN
[0][5][0] : 50 kN (U-type)	[1][0][0] : 100 kN (U-type)	[2][0][0] : 200 kN
[0][5][1] : 50 kN (E-type)	[1][0][1] : 100 kN (E-type)	

4 Select the Stroke → [ ]
Select the stroke from the following alternatives.

[1] : ±25 mm [2] : ±50 mm

5 Select the Hydraulic Power Supply Flow Rate.
(Select according to the required test ranges (frequency and amplitude). (See pages 14 and 15 for details.) → [ ][ ][ ]
Select the appropriate model from the table of amplitude characteristics on pages 14 and 15.

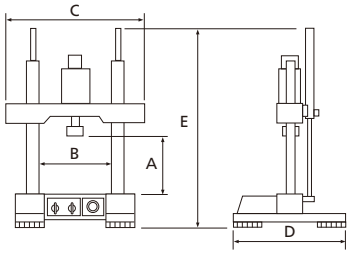
[0][1][0] : QF-10B	[0][2][0] : QF-20B	[0][4][0] : QF-40B
[0][7][0] : QF-70B	[1][1][E]*) : QF-110 (for 50 Hz)	[1][4][0] : QF-140
[A][1][0] : AF-10B	[1][1][W]*) : QF-110 (for 60 Hz)	[A][0][4] : AF-4
	[A][2][0] : AF-20B	

* Model QF-110 differs according to the power supply frequency.

6 Select the column length of loading frame → [ ] A

[0] : Standard
[1] : Standard + 400 mm

See page 18 for typical combinations.



L-type Loading Frame

Tabletop testing machine with overhead actuator. Despite its low capacity, the overhead actuator allows testing of actual parts and comparatively large specimens.

- An environment control device can be attached, despite the compact frame size.
- The optional T-grooved base plate (346-78491) permits evaluation testing of actual parts and components.

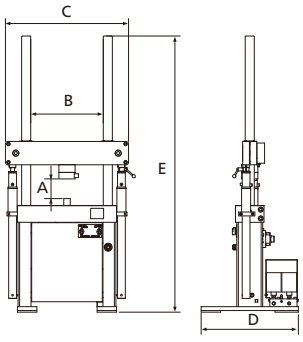
Major Specifications

Main Unit Model	Stroke *1	Max. test force Dynamic/static (kN)	Frame rigidity *2 (mm/kN)	Crosshead drive mechanism
L5 kN	±25 mm	±5/±6	0.0033	Hydraulic drive (with hydraulic clamp)
	±50 mm			
L10 kN	±25 mm	±10/±12		
	±50 mm			
L20 kN	±25 mm	±20/±26		
	±50 mm			

*Note1 Loading frame with ±100 mm maximum stroke is also available.
*Note2 At 300 mm clearance between crosshead and table.
A special table is available as an option.
The QF-10B, QF-20B, AF-4, AF-10B, and AF-20B power supplies are suitable for the L-type loading frame.

Major Dimensions

Specifications		Testing space (mm)		Main unit dimensions (mm)			Approx. weight (kg)
Capacity	Actuator stroke	A	B	C	D	E	
5 kN	±25 mm	135 ~ 835	460	800	600	Approx. 1780	300
	±50 mm						
10 kN	±25 mm						
	±50 mm						
20 kN	±25 mm						
	±50 mm						



E-type Loading Frame

This is the most standard frame type. It requires a small installation space and is suited to the testing of formed specimens and small parts.

- The highly rigid frame prevents buckling of specimens and saves losses in hydraulic energy due to frame deformation.
- The crosshead hydraulic drive mechanism simplifies crosshead vertical movement and clamping.
- Various test jigs and environment control devices can be attached. Major test applications:
- evaluation of metal and plastic specimens, fracture toughness testing, testing of standard specimens and small parts.

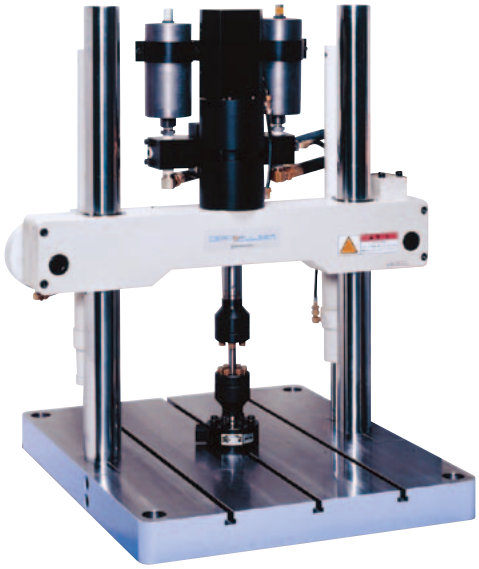
Major Specifications

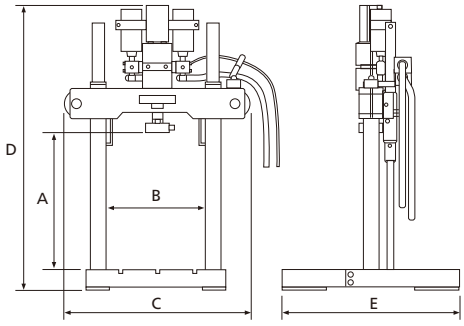
Main Unit Model	Stroke	Max. test force Dynamic/static (kN)	Frame rigidity *1 (mm/kN)	Crosshead drive mechanism *2
E051 kN	±25 mm	±50/±60	0.0012	Hydraulic drive (with hydraulic clamp)
	±50 mm			
E101 kN	±25 mm	±100/±120	0.0012	
	±50 mm			
E200 kN	±25 mm	±200/±240	0.00065	
	±50 mm			

*Note1 At 500 mm clearance between crosshead and table.
*Note2 Fixed crosshead type also available (without drive mechanism or hydraulic clamp).

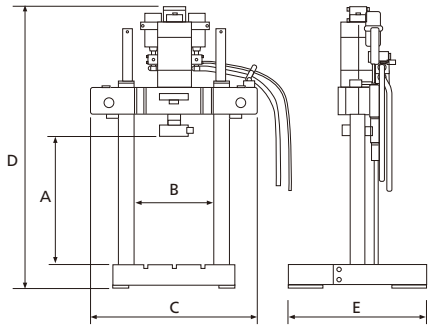
Major Dimensions

Specifications			Testing space (mm)		Main unit dimensions (mm)			Approx. weight(kg)
Capacity	Actuator stroke	Column length (mm)	A	B	C	D	E	
50 kN	±25 mm	Standard	162 ~ 962	560	980	750	Approx. 2155	790
		Standard + 400	362 ~ 1362				Approx. 2555	820
	±50 mm	Standard	137 ~ 937				Approx. 2155	790
		Standard + 400	337 ~ 1337				Approx. 2555	820
100 kN	±25 mm	Standard	138 ~ 938		980	750	Approx. 2155	790
		Standard + 400	338 ~ 1338				Approx. 2555	820
	±50 mm	Standard	113 ~ 913				Approx. 2155	790
		Standard + 400	313 ~ 1313				Approx. 2555	820
200 kN	±25 mm	Standard	200 ~ 1000		1170	850	Approx. 2405	1460
		Standard + 400	400 ~ 1400				Approx. 2805	1530
	±50 mm	Standard	175 ~ 975				Approx. 2405	1460
		Standard + 400	375 ~ 1375				Approx. 2805	1530





U50kN/U100 kN Frame



U200 kN Frame

U-type Loading Frame

The large testing table below and crosshead-mounted actuator above create a large testing space for testing construction materials and large specimens.

- The large testing space accommodates large specimens and allows the attachment of various test jigs and environment control devices.
- The highly rigid frame prevents buckling of specimens and saves losses in hydraulic energy due to frame deformation.
- Various test jigs can be attached.
- Major test applications: testing of automobile parts and frames

Major Specifications

Main Unit Model	Stroke	Max. test force Dynamic/static (kN)	Frame rigidity *1 (mm/kN)	Crosshead drive mechanism *2 *3
U50 kN	±25 mm	±50/±60	0.0025	Hydraulic drive (with hydraulic clamp)
	±50 mm			
U100 kN	±25 mm	±100/±120	0.0019	
	±50 mm			
U200 kN	±25 mm	±200/±240	0.0009	
	±50 mm			

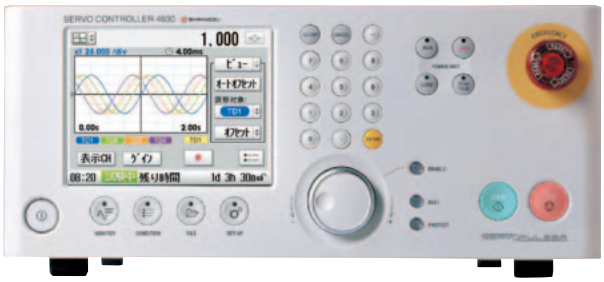
*Note1 At 500 mm clearance between crosshead and table.
*Note2 Separate crosshead drive and clamp operation stand.
*Note3 version with no vertical jack is available as an option.

Major Dimensions

Specifications			Testing space (mm)		Main unit dimensions (mm)			Approx.
Capacity	Test stroke	Column length (mm)	A	B	C	D	E	weight(kg) *4
50 kN	±25 mm	Standard	179 ~ 789	560	1046	1610	1000	970
							1500	1330
							2000	1630
		Standard + 400	379 ~ 1189			2010	1000	1000
							1500	1360
							2000	1660
	±50 mm	Standard	154 ~ 764			1710	1000	970
							1500	1330
							2000	1630
		Standard + 400	354 ~ 1164			2110	1000	1000
							1500	1360
							2000	1660
100 kN	±25 mm	Standard	175 ~ 740	560	1046	1655	1000	1070
							1500	1460
							2000	1900
		Standard + 400	375 ~ 1140			2055	1000	1100
							1500	1500
							2000	1940
	±50 mm	Standard	150 ~ 715			1755	1000	1070
							1500	1460
							2000	1900
		Standard + 400	350 ~ 1115			2155	1000	1100
							1500	1500
							2000	1940
200 kN	±25 mm	Standard	199 ~ 954	560	1200	2255	1000	1960
							1500	2570
							2000	3240
		Standard + 400	399 ~ 1354			2655	1000	2030
							1500	2640
							2000	3310
	±50 mm	Standard	174 ~ 929			2305	1000	1960
							1500	2570
							2000	3240
		Standard + 400	374 ~ 1329			2705	1000	2030
							1500	2640
							2000	3310

*Note4 Unit weight includes hydraulic drive and clamp mechanisms.

Servopulser Series Servo-hydraulic Testing Machines



Controller 4830

Easy-to-use and multi-functional!
The next generation of controller...

Extremely simple operation using a color LCD and touchpanel

- **Waveform generation with excellent reproducibility**
  Fully digital control with control parameter autotuning and waveform distortion correction functions achieves faithful load waveform reproducibility.
- **Push test function for testing actual objects**
  Achieves stable peak-value control using the test force, even for specimens with "play" (areas where no test force is applied).
- **World-class basic performance**
  The 24-bit high-resolution AD converter and detector-output linearization function achieve Class 0.5 test force accuracy (0.5% indicated value) with a standard system.
- **Waveform display functions**
  Test waveform display functions installed as standard permit the realtime display of time graphs, X-Y graphs, and peak graphs.

Major Specifications

Part No.		347-39536-40
Loading waveform	Standard types	Sine, triangular, rectangular, haversine, havertriangular, haver-rectangular, trapezoidal, 1/2 haversine, ramp, step, sweep, random, external input, combination*1 and file waveforms (any wave)*1
	Frequency	0.00001 to 1000Hz
Measurement amplifiers	Type	Test force, stroke amplifiers (2 additional optional amplifiers can be added)
	Range	24-bit, rangeless
Control	Type	Fully digital closed-loop control (two-degree-of-freedom PID)
	Correction	Automatic amplitude/mean-value correction (AGC), autotuning, shockless control switching, touch-load function, waveform distortion correction*1, push test function
	Synchronous control	Up to 4 units
Signal I/O	Analog	4 CH (±10 V) output; 1 CH (±10 V) input
	Digital	8CH output; 8CH input
Safety features	Types	4-point limiter, power unit alarm, counter, external alarm
	Stop modes	Power unit stop, waveform stop, waveform zero, waveform mean-value stop, unload, position hold
Required power supply		Single-phase,100 to 230 VAC*2, 50/60 Hz, 300 VA

*1 Using software. *2 Standard power cable supplied is for 100 VAC only.

Option

Windows Software for 4830

Software Configuration

● Program function testing ● Durability testing ● Static properties testing
● Combined testing

Other Optional Software

● Static test software ● Resonance tracking test software
● Multi-Axis Sine Wave test software ● Multi-Axis Actual Wave test software

Standard Contents

● Media CD-ROM ● Instruction manual ● USB cable

PC Operation Environment

OS	WindowsXP® 32 bit (Japanese/English), Windows7 32 bit (Japanese/English)
CPU	1 GHz min.
Memory capacity	1 GB min.
HDD capacity	8 GB min.
Screen resolution and displayed colors	1024 × 768 pixels, 65535 colors min.

*PC and table are not included in the standard configuration.

Controller 4890

High-performance controller packed with state-of-the-art technologies

The 4890 is a highly functional controller that offers test operations, data acquisition, and data processing.It incorporates state-of-the-art technologies to achieve highly accurate control and measurements.The Windows-based GLUON software packages offer comprehensive customization wizards and online help functions, which can be selected according to the application. (See pages 8 to 9.)

- **2-degree-of-freedom PID Control**
  The 4890 is the first controller to offer 2-degree-of-freedom PID control for testing machines.Conventional control methods suffered from excessive response to external factors when response with respect to the target waveform was improved. The controller 4890 enhances both the response to the target waveform and minimizes the effects due to external forces.

- **Highly Accurate Measurement**
  The world's first 20-bit high resolution* achieves "rangeless" performance. Non-linear sensor outputs are linearized for high-accuracy measurement. High resolution is achieved across the entire measuring range without discontinuity due to range switching.
  (*As of August 2004)

- **Automatic Sensor Recognition and Calibration**
  The detector rating, units, and calibration information (zero, span) are read automatically to eliminate complicated settings of ratings and units calibration operations.Ensures safe operation when multiple load cells or extensometers are used.

- **Remote Subcontroller**
  The subcontroller box supplied as standard allows the actuator to be operated near the testing machine. The Digital Load Limiter ensures safe removal of the specimen.

- **Digital Load Limiter**
  Digitally monitors the test forces to restrict overloads. The degree of overload can be adjusted to several percent of full-scale. This device uses digital technology to prevent overloading reliably.

Major Specifications

Part No.		346-99845-11
Loading waveform	Type	Sine, triangular, rectangular, haversine, ramp, file, hold, and combinations of these waveforms
	Frequency	0.00001 to 500 Hz
	Other	Frequency sweep function Generate any waveform from digital data
Measurement amplifier	Type	Test force, stroke amplifiers (6 additional optional amplifiers can be added)
	Range	Rangeless (due to 20-bit A/D converter)
Control	Type	Fully digital closed-loop control (2-degree-of-freedom PID control)
	Correction	Automatic amplitude/mean-value correction (AGC), integral correction (I-ACT), differential correction (D-ACT), autotuning, realtime gain adjustment
	Other	Function to prevent overloading during specimen clamping/unclamping (subcontroller) Functions for inputting external loading waveforms and external feedback signals Virtual transducer (VTD) function
Monitor outputs	Type	TD1 to TD8, VTD1 to VTD6, loading waveform
	Voltage	±10V/set value (set from software)
Safety features	Item	(1) Emergency stop, (2) Oil temperature rise, (3) Oil loss, (4) Power failure, (5) External input, (6) Excessive amplitude (measured values and control deviation), (7) Low amplitude (measured values)
	Action	(1), (2), (3), (4): Hydraulic power turned off and testing stops (5), (6), (7): Select hydraulic power off, reset signal to zero, reset signal to mean value, piston position hold, or reset load to zero
Required power supply		100 V, 1 kVA, single phase

- At least one GLUON software package is required to use the Controller 4890.
- The standard package includes an uninterruptible power supply, test-force amplifier, stroke amplifier, CAL cables (one each for test force and stroke), and sub-controller box.

*See the separate controller catalog for details.

The GLUON software packages run on a PC to control the Controller 4890. Nine GLUON software packages are available for different test aims.

PC Environment

OS	:	Windows XP / 7 (English) 32bit
CPU	:	800 MHz min. (1 GHz min. recommended)
Memory capacity	:	1 GB min.
Hard disk capacity	:	8 GB min.
Screen resolution	:	1024 × 768, 65535 colors
Network	:	100Base-T compatible

The "gluon" is the elementary particle that imparts the strong force in physics. Gluons trap quarks inside protons and neutrons and hold together the atomic nucleus. The name "GLUON" was chosen to suggest a powerful force.

* See the separate GLUON catalog for details.

Software			Part No.
1	GLUON	M.P. (multipurpose) test package	346-99918
2	GLUON	Fatigue test package	346-99919
3	GLUON	Static test package	346-99920
4	GLUON	Crack growth test package	346-99921
5	GLUON	KIC / COD test package	346-99922
6	GLUON	JIC test package	346-99923
7	GLUON	Dynamic characteristics test package	346-99314
8	GLUON	Thermal fatigue test package	346-99313
9	GLUON	Pseudo-dynamic test package	346-99315

GLUON software set			Part No.
A	GLUON	Fatigue / M.P. test package set (1 + 2)	346-99305
B	GLUON	Fatigue / static test package set (2 + 3)	346-99306
C	GLUON	Fracture mechanics test package set (4 + 5 + 6) (Crack growth, KIC/COD, JIC)	346-99307
D	GLUON	M.P. / fracture mechanics test package set (1 + C)	346-99308
E	GLUON	M.P. / fatigue / static / fracture mechanics test package set (1 to 6)	346-99309

GLUON Features

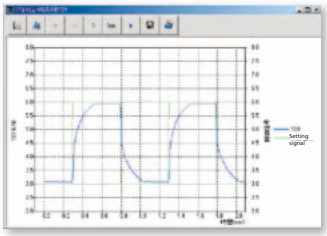
Mail Notification Function

The mail notification function can reduce the daily monitoring workload. It sends mail notifications at fixed intervals or when the status changes during testing. It allows immediate action on specimen failure or when an alarm occurs.

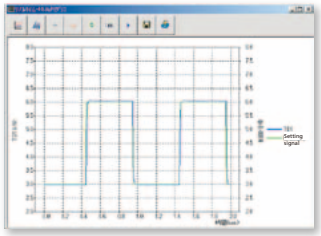
Mobile phone display

Autotuning

Autotuning automatically determines the optimal parameters for control.Simply mount the specimen in a status similar to the actual test status and set the preload. This function assures safe operation when a new material is tested or when the detector changes.



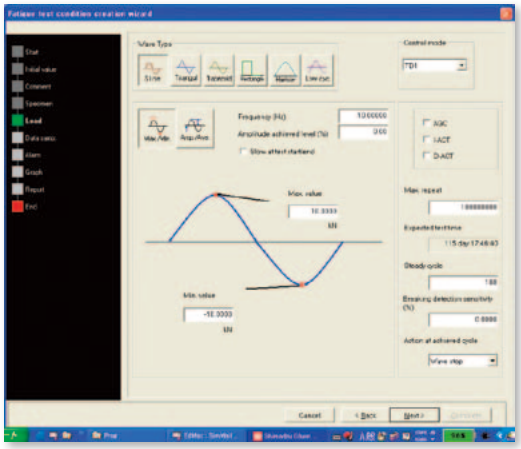
▲Waveform before tuning



▲Waveform after tuning

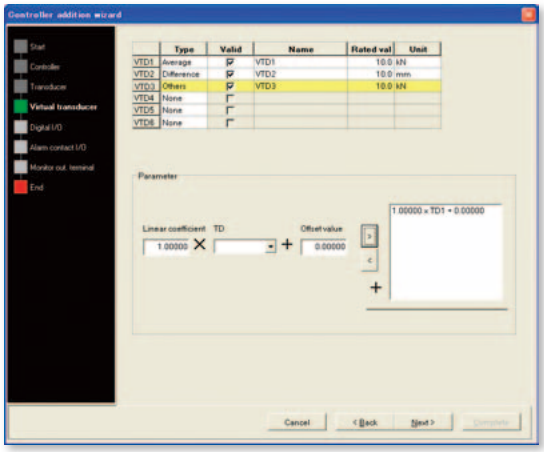
Wizards

GLUON offers a variety of Windows-compatible wizards. Even first-time users can intuitively make all settings.



Virtual Transducer Function

The measured signal with added primary signal processing can be registered as a new virtual transducer. This function allows easy direct control of stress and strain or control using the mean value from multiple extensometers.



1 GLUON M.P. (Multipurpose) Test Package

* Please consult your Shimadzu representative about the multi-controllers system.

Combined-load control and multi-axis control. Easy generation of complex simulation loads.

By permitting the synchronized operation of up to 16 controllers*, this package can handle almost any type of testing.
Control and measurement commands can be flexibly combined to permit complex measurement and control, including programmed loading using combinations of different waveforms and multi-axis control. Measured data can be handled by commercial spreadsheet software for simple analysis by the user.

2 GLUON Fatigue Test Package

Handles all fatigue testing from low to high cycles. Easily plots S-N curves and calculates hysteresis energy.

This package can create the S-N curves of stress amplitude (S) versus number of cycles to failure (N) for high-cycle fatigue testing. Additionally, it can calculate the hysteresis energy and plastic strain from the stress-strain relationship for low-cycle fatigue testing.

3 GLUON Static Test Package

For fundamental strength evaluation. Handles tensile, compression, and bending static testing.

Determines the static characteristics of a material from the relationship between test force (or stress/bending stress) and displacement (or strain) when a constant loading rate is applied to the specimen. It calculates the characteristic values: maximum test force, displacement at failure, Young's modulus, 0.2% yield stress, and absorbed energy.

4 GLUON Crack Growth Test Package

Compliant with:
ASTM E647-00 *1
ISO 12108-02 *1

Evaluates the crack growth properties of notched specimens. Ideal to pre-crack specimens for KIC and JIC tests.

Calculation functions provide smooth control of ΔK. Can evaluate the relationship between the crack growth rate (da/dN) and change in stress intensity factor (DK). Various loading modes (constant test force, K value smooth increase/decrease, K value step increase/decrease) allow pre-cracking of specimens in compliance with all fracture toughness standards.

5 GLUON KIC/COD Test Package

Compliant with:
ASTM E399-90 *2
ISO 12737-96

For fracture toughness evaluation. Calculates the CTOD value for the failure mode and evaluates the validity of the KIC value.

Evaluates the fracture resistance, namely the fracture toughness, when a load is applied to notched specimens so that the K value increases at a constant rate. Can determine the plane-strain fracture toughness KIC (valid in the applicable range of linear fracture mechanics) and crack opening displacement (COD) (valid for materials generating high yield).

6 GLUON JIC Test Package

Compliant with:
ASTM E1820-99 *3
JIS Z 2284-98

For elastic-plastic fracture toughness (JIC) evaluation. Easy JIC testing with complex procedures.

Testing is conducted with test force control or opening displacement control at a constant loading rate, and the specimen is then unloaded to calculate the crack length. The data obtained is used to plot graphs of increment in crack length (Δa) against crack growth resistance (J value), and to calculate the JIC value and its effectiveness.

7 GLUON Dynamic Characteristics Test Package

Compliant with:
JIS K6385-01 *4
JIS K6394-98 *5

For fundamental evaluation of rubber. Simplifies evaluation of anti-vibration characteristics.

Static Characteristics Testing Applies a constant loading rate to plot test force – displacement (deflection) curves and to calculate the static spring constant.

Dynamic Characteristics Testing Applies a constant frequency or stepped frequency to calculate dynamic characteristics based on the number of repeated cycles and the frequency.

8 GLUON Thermal Fatigue Test Package

For compound loads of heat and strain. Permits strain constraint testing under constant strain.

A temperature pattern synchronized with the load is applied to provide mechanical strain control and constant constraint control after correction for thermal expansion. Additionally, it can calculate the hysteresis energy and plastic strain from the acquired data.

9 GLUON Pseudo-dynamic Test Package

Conducts earthquake-response testing on construction materials.

Provides accurate control of earthquake-response displacements under seismic vibrations.

Elastic-plastic response displacement for each input seismic-wave step is taken as the target values and is controlled to reach each layer simultaneously.The Newmark b method is used for the response calculations, but user's individual response calculations can be handled in an external PC. Vertical jacks can be used in addition to the horizontal jacks (in up to four layers).

*1 The correspondence specimens are CT and 3-bend. Only the compliance method is supported for crack-size monitoring. The force constant, K linear smooth, and K step are selectable for K control. The K control by exponent is noncompliant.
*2 The correspondence specimens are CT and 3-bend.
*3 The correspondence specimen is only CT. The calculation of KIC, Jc, Ju, CTOD, and δIC are not supported. The method for rapid loading KIC test and rapid load J-integral fracture toughness test are noncompliant.
*4 The static characteristic test and dynamic characteristic test by nonresonant method are supported.
*5 The forced oscillation nonresonant method is supported. The free oscillation method and temperature characteristic test are not supported.

QF Series Hydraulic Power Supply Unit (Water-cooled)

This hydraulic power supply unit was specially designed for use with materials strength testing machines using electrohydraulic-servo systems. It comprises a hydraulic pump, oil reservoir, filter, cooler, pressure regulator valve, and other components.

- The hydraulic power supply uses a low-noise, low-pulse gear pump.
- The 3-micron filter element eliminates wear in the servo valve and other equipment.
- The vertical pump and motor reduce installation space (QF-10B to 70B, AF-4, AF10B to 20B).

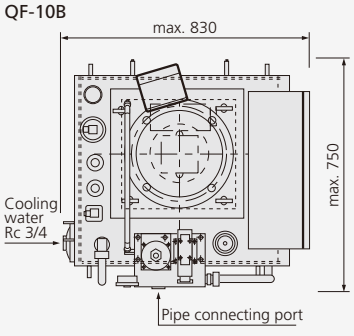
Specifications

model		QF-10B	QF-20B	QF-40B	QF-70B	QF-110*	QF-140
Part No.		346-75200	346-75201	346-75245	346-75246	346-75401-01(50 Hz) 346-26575-02(60 Hz)	346-75402
Applicable testing machine	E-type	○	○	○	○	○	○
	U-type	○	○	○	○	○	○
	L-type	○	○				
Approx. pumping rate	50 Hz (L/min.)	9	19	42	68	108	134
	60 Hz (L/min.)	11	24	51	81	104	162
Normal oil pressure (MPa)		21					
Hydraulic fluid		MOBILE DTE25					
Pump	Model	Constant-rate gear pump					
	Qty	1					2
Motor capacity (kW)		5.5	11	22	37	45	37 × 2
Oil filter		3 μm					
Tank capacity (L)		90	90	190	300	500	590
Noise (at 21MPa) (dBA)		65	71	76	76	83	85
Required power supply **	100 V, single-phase	1.5 kVA					
	200/220 V, 3-phase	8 kVA	16 kVA	32 kVA	47 kVA	57 kVA	93 kVA
Required cooling water capacity (L/min.) at 32°C		20	20	65	80	110	150/180(50/60 Hz)
Cooling tower capacity (cooling tons)		2	3	5	10	20	20
Approx. unit dimensions	width (mm)	830	920	1100	1200	1730	1950
	depth (mm)	750	750	860	1000	1290	1500
	height (mm)	1235	1235	1400	1515	1370	1550
Unit weight (including fluid) (kg)		530	530	720	920	1500	2200

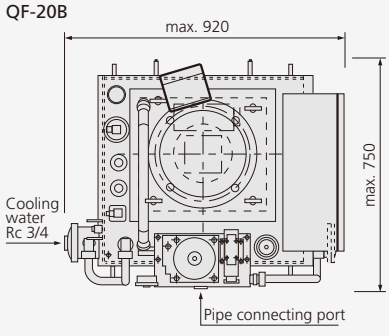
* Model QF-110 differs according to the (50 Hz/60 Hz) power supply frequency.
** Please contact us to modify the power supply voltage. (option)

Dimensional Drawings of the QF Series (Water-cooled)

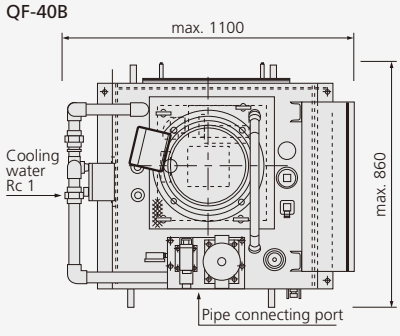
QF-10B



QF-20B



QF-40B



AF-4

AF Series Hydraulic Power Supply Unit (Air-cooled)

- The hydraulic power supply uses a low-noise, low-pulse gear pump.
- No cooling water is required.

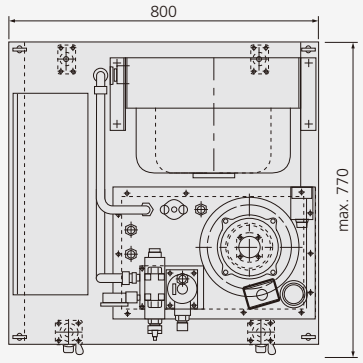
▲ Installed in Special AF-4 Base

Specifications

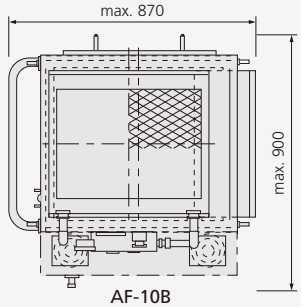
Model		AF-4	AF-10B	AF-20B
Part No.		339-88838	346-75202	346-75203
Applicable testing machine	E-type		○	○
	U-type		○	○
	L-type	○	○	○
Approx. pumping rate	50 Hz (L/min.)	3.7	9	19
	60 Hz (L/min.)	4.5	11	24
Normal oil pressure (MPa)		21		
Hydraulic fluid		MOBILE DTE25		
Pump	Model	Constant-rate gear pump		
	Qty	1		
Motor capacity (kW)		2.2	5.5	11
Cooling fan (kW)		0.1	0.1	0.2
Oil filter		3 µm		
Tank capacity (L)		24	90	90
Noise* (dBA)		56	64	71
Required power supply **	100 V, single-phase	1.5 kVA		
	200 V, 3-phase	3.5 kVA	8 kVA	17 kVA
Approx. unit dimensions	width (mm)	800	870	870
	depth (mm)	770	900	900
	height (mm)	700	1700	1700
Unit weight (including fluid) (kg)		185	630	630

* Noise value for AF-4 applies to unit installed in special AF-4 base.
** Please contact us to modify the power supply voltage. (option)
*** Please keep the room temperature at 25°C or less.

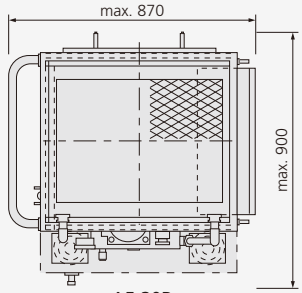
Dimensional Drawings of the AF Series (Air-cooled)



AF-4

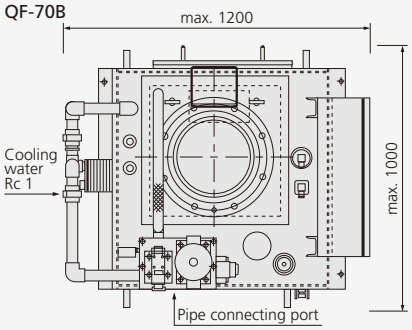


AF-10B

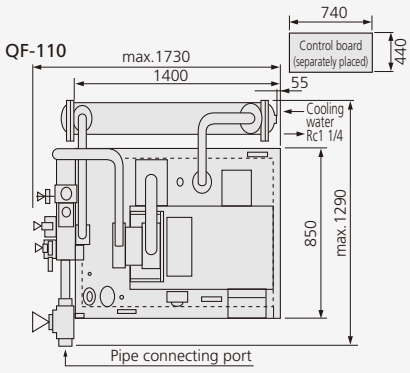


AF-20B

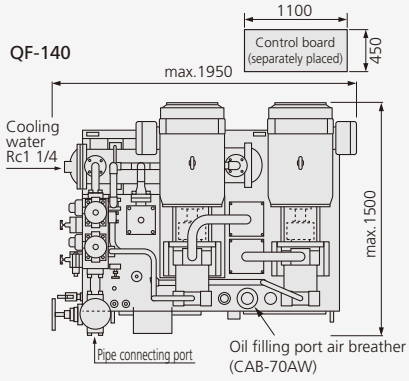
QF-70B



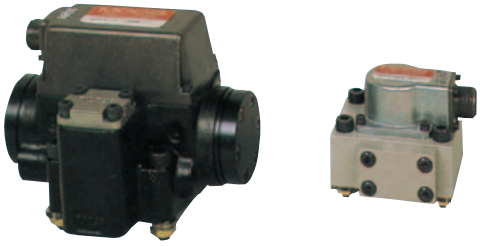
QF-110



QF-140



Servo Valves



Servo Valves

Servo Valves

The servo valve lies at the heart of the servo-hydraulic testing system. It allows small electric signals to control the flow rate of high-pressure hydraulic fluid over a wide range of speeds.

- The servo valves incorporate special Shimadzu features for electrohydraulic-servo testing machines.
- Excellent response
- Long service life and able to withstand long-term fatigue testing
- Good resolution and threshold for precise control

Specifications

Model	Part No.	Rated flow rate (L/min) *1	Supply pressure range (MPa)	Applicable hydraulic power supply	Comments
761-4015	339-89458-01	3.8	1.4 to 21		For low-cycle testing
761-4016	339-89458-02	9.5		AF-4	
761-4018	339-89458-04	38		QF-10B, AF-10B	
761-4019	339-89458-05	57		QF-20B, AF-20B	
				QF-40B	2 valves used
72-023	340-01917-03	228		QF-70B, QF-110	
				QF-140	2 valves used

*1 Flow rate when pressure drops through 7 MPa

Detectors

Flat load cell

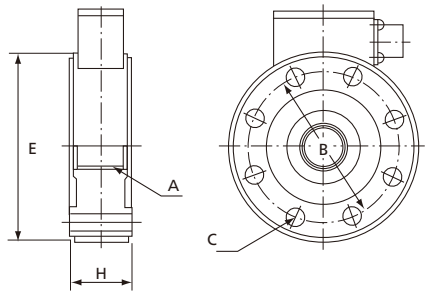
Load Cell

The flat load cells used with the Servopulser series are strain gauge-type shear load cells developed by Shimadzu for fatigue testing machines. They are ideal for fatigue testing due to their endurance under tensile, compression, and bending loads. They feature low deformation under load and a high natural frequency.

All types permit stable testing up to 10^9 cycles.

Flat Load Cells for E- and U-type Main Units

Model	Part No.	Applicable main unit	Dynamic rated capacity (kN)	Static rated capacity (kN)	External dimensions (mm)					Weight (kg)
					A	B	C	D	E	
SFL-50 kN	346-77948-10	E51 kN U50 kN	50	75	M24 × 1.5	Ø95	8-Ø13	Ø125	50	4
SFL-100 kN	346-77948-11	E101 kN U100 kN	100	150	M36 × 2	Ø135	8-Ø17	Ø175	60	10
SFL-200 kN	346-77948-13	E200 kN U200 kN	200	300	M50 × 2	Ø185	8-Ø22	Ø235	70	20



Flat Load Cells for L-type Main Units

Model	Part No.	Applicable main unit	Dynamic rated capacity (kN)	Static rated capacity (kN)	External dimensions (mm)				
					A	B	C	E	H
SCL-5 kNB	346-77948-03	L5 kN	5	7.5	M18 × 1.5	Ø85	8-Ø9	Ø100	40
SCL-10 kNB	346-77948-06	L10 kN	10	15					
SCL-20 kNB	346-77948-08	L20 kN	20	30					

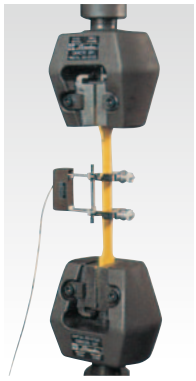
Stroke Detector

A differential-transformer type stroke detector is installed as standard at the tip of the actuator. It controls the piston displacement during testing and controls the actuator when mounting or removing the specimen (subcontroller control).

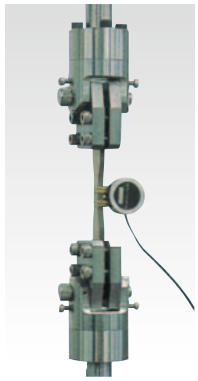
▸ Comprehensive Range of Optional Accessories

The Servopulser units can be configured to meet specific test requirements. A variety of test jigs, detectors, and environment control devices are available for many test applications. A range of these optional accessories is described below. See the separate optional accessories catalog for details.

Tensile Test Jigs

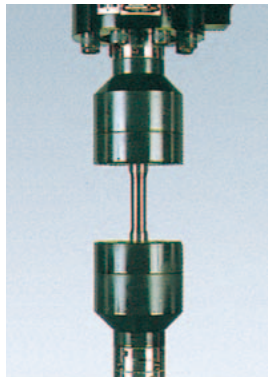


Static tensile test jigs
with extensometer



Pin-type grips for flat specimens
with Dynastrain

Tensile and Compression Fatigue Test Jigs



Split-flange type grips
for round specimens

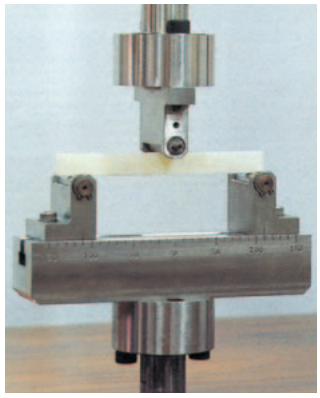
Manual non-shift grips
for flat specimens

Front-opening hydraulic grips

Compression Test Jig

Compression plates

Bending Test Jigs



3-point bending jig for fatigue testing (pulsating)

Uniform bending jig for fatigue testing (reversed)

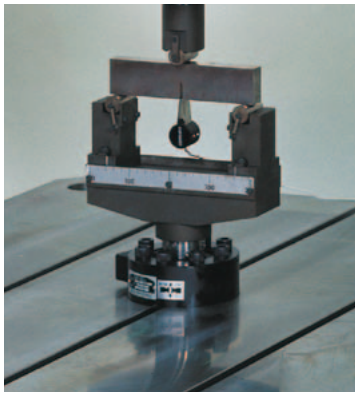
Bolt Test Jigs

Tensile test jig
for fatigue testing of bolts

Thread-loosening test jig

Fracture Toughness Test Jigs

Grips for CT specimens
with clip gauge



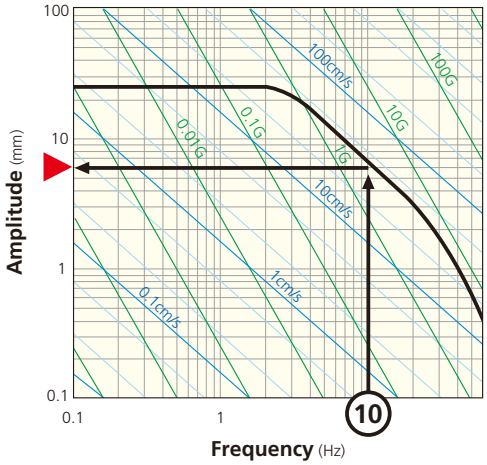
COD test jig

Extensometers

Clip gauge

Dynastrain
(measures displacement
between gauge marks)

How to Read Amplitude Characteristics



To conduct fatigue testing at 10 Hz…

The characteristics of the amplitude curves graphically represent the system testing range. For the Servopulser, these characteristics are determined from the capacities of the actuator and hydraulic power supply and the rated flow rate and frequency characteristics of the servo valve. To select the optimal system, confirm that the amplitude characteristics comply with the test conditions. Testing is also possible at a frequency of 0.1 Hz, or below, which does not appear in the diagrams.

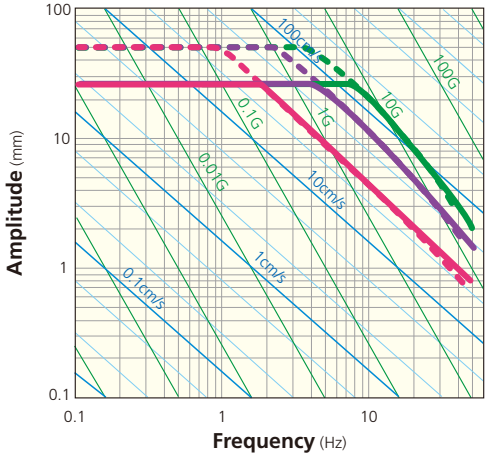
- The diagrams show the relationship between the single amplitude and frequency for a sinewave drive at rated load.
- The testing range is indicated by the region to the bottom-left of each characteristics curve for the capacity and stroke of the selected actuator and the capacity of the hydraulic power supply.
  The diagrams below show amplitude characteristic curves for a 60Hz power supply. The amplitude characteristics for a 50 Hz supply are approximately 5/6 of those shown.
- These characteristics do not incorporate the frame and load cell characteristics. Subtract these characteristics to determine the actual amplitude characteristic values.
- These amplitude characteristics were calculated using typical servo-valve characteristics. Differences of approximately 10% may occur along the frequency axis.
- The frequency may be limited by the characteristics of the jig and specimen.

L-type

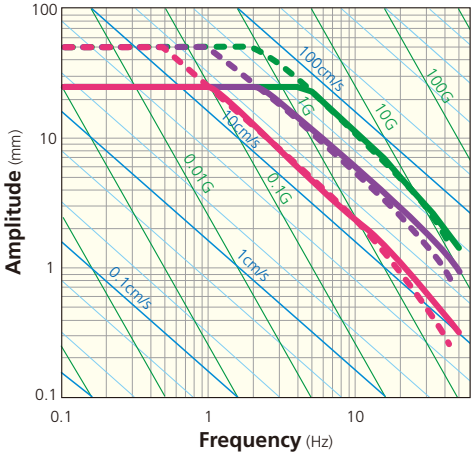
AF-4
QF-10B
QF-20B

25 mm stroke
50 mm stroke

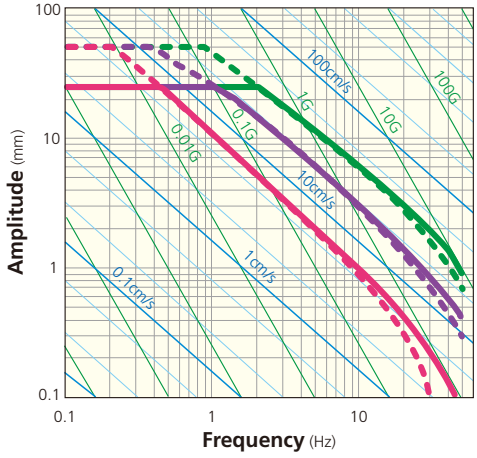
60 Hz amplitude characteristics at 5 kN



60 Hz amplitude characteristics at 10 kN



60 Hz amplitude characteristics at 20 kN

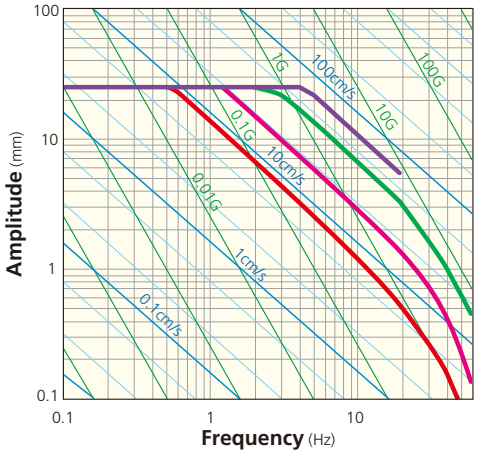


E-type, U-type

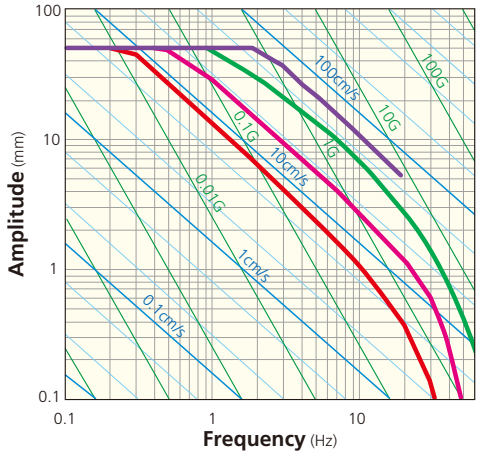
QF-10B
QF-20B
QF-40B
QF-70B*
QF-110 *
QF-140 *

*The servo-valve characteristics prevent operation in the high-frequency region with the standard configuration of QF-70B, or above. However, the servo valve can be replaced to permit operation in the high-frequency region. Consult your Shimadzu representative for details.

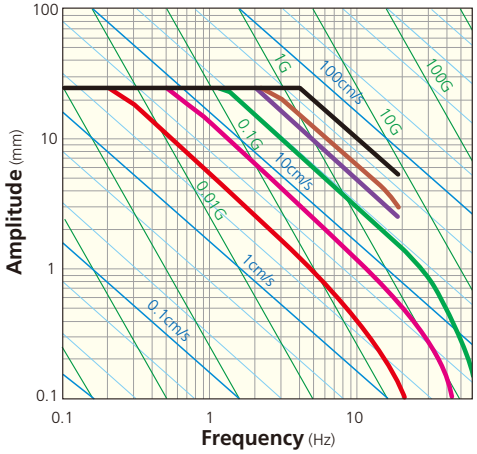
60 Hz amplitude characteristics at 50 kN, ± 25 mm



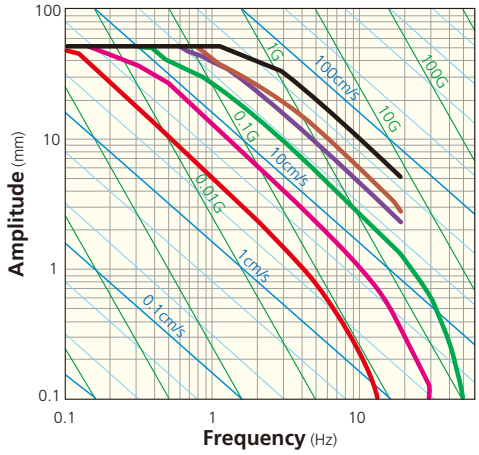
60 Hz amplitude characteristics at 50 kN, ±50 mm



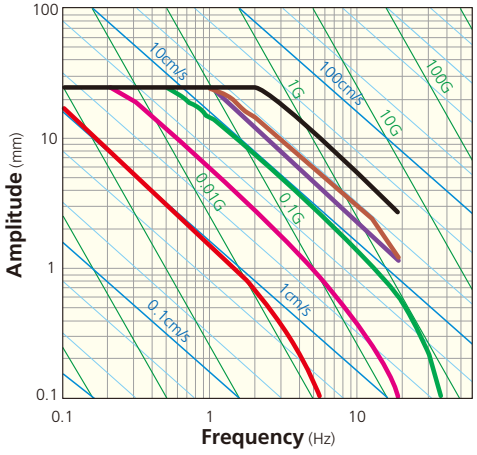
60 Hz amplitude characteristics at 100 kN, ±25 mm



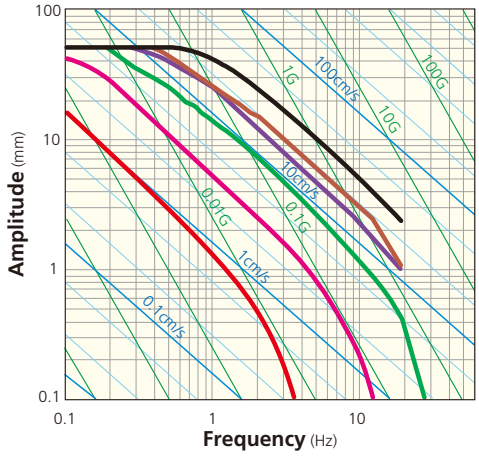
60 Hz amplitude characteristics at 100 kN, ±50 mm



60 Hz amplitude characteristics at 200 kN, ±25 mm



60 Hz amplitude characteristics at 200 kN, ±50 mm



Installation

- No foundation work is required if a 150 mm-thick concrete floor is available.
- However, foundation work is required for the QF-70B hydraulic power supply (or larger) or in locations where vibrations cannot be tolerated.

1 Location
Install in a location that satisfies the following conditions

- small ambient temperature fluctuations (+10 to +35˚C recommended);
- low humidity (10 to 75% recommended);
- not subject to air flows from air conditioning equipment;
- no direct sunlight;
- low dust levels;
- no contamination by corrosive gases; and
- no vibrations (0.1 G max. recommended).
- Keep the room temperature at 25°C or less.

2 Power Supply Requirements

- 100 – 220 V ±10%, 50/60 Hz, single-phase
  500VA (using Controller 4830) 1 kVA (using Controller 4890)
- 200 – 400 V ±10%, 50/60 Hz, 3-phase
  The required power supply capacity depends on the hydraulic power supply capacity.
- Use a clean grounding wire (D-type grounding recommended)
- Avoid power supplies with extreme voltage fluctuations.
  If unavoidable, use a voltage stabilizer and noise-cut transformer.
- The customer is responsible for electrical wiring installation up to the terminals on the power control board of the hydraulic power supply unit.
  Provide separate power supplies for accessories that require separate power supplies.
  *Check the power supply voltage and inform Shimadzu when ordering a system.

3 Cooling Water

- The customer is responsible for cooling water pipe connections to the cooling water connector on the hydraulic power supply unit.
- Provide separate cooling water supplies for accessories that require separate cooling water.
- Use tap water up to 32˚C as the cooling water.

Required Power Supplies and Cooling Water Flow Rates

Hydraulic power supply	Required power supply (kVA)	Cooling water flow rate (L/min.)
QF-10B	8	20
QF-20B	16	20
QF-40B	32	65
QF-70B	47	80
QF-110B	57	110
QF-140B	93	150
AF-4	3.5	——
AF-10B	8	——
AF-20B	17	——

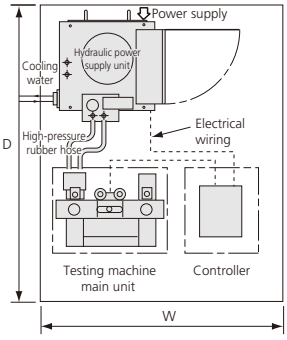
Standard Configurations

*The diagrams show the area occupied by the equipment. The shape and installation orientation of the hydraulic power supply may differ according to the unit capacity.
*If necessary consult your Shimadzu representative for more detailed layout drawings.
*PC and table are not included in the standard configuration.

L-type

*To allow operation and maintenance, reserve an additional 500 mm-wide space around the area shown in the diagram.

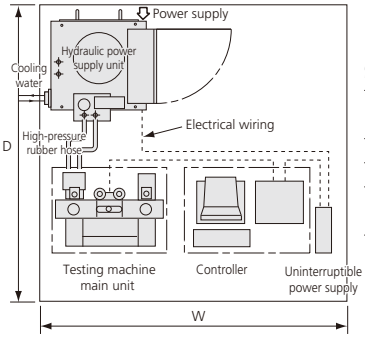
Model LV



Space required for Model LV (mm)

Main unit	Hydraulic power supply	Space required (W × D)
L5 kN	QF-10B	2000 × 2200
L10 kN	QF-20B	2000 × 2400
L20 kN	AF-10B	2000 × 2400
	AF-20B	2000 × 2400

Model LM

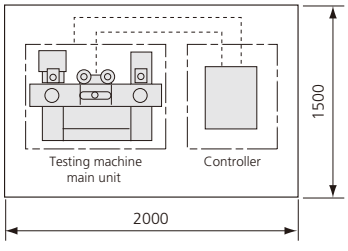


Space required for Model LM (mm)

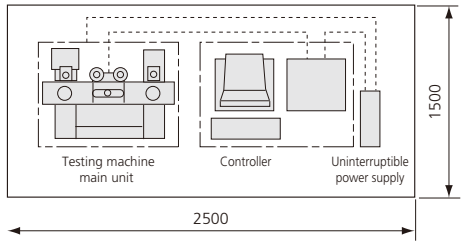
Main unit	Hydraulic power supply	Space required (W × D)
L5 kN	QF-10B	2500 × 2200
L10 kN	QF-20B	2500 × 2400
L20 kN	AF-10B	2500 × 2400
	AF-20B	2500 × 2400

Using AF-4 hydraulic power supply

Model LV



Model LM

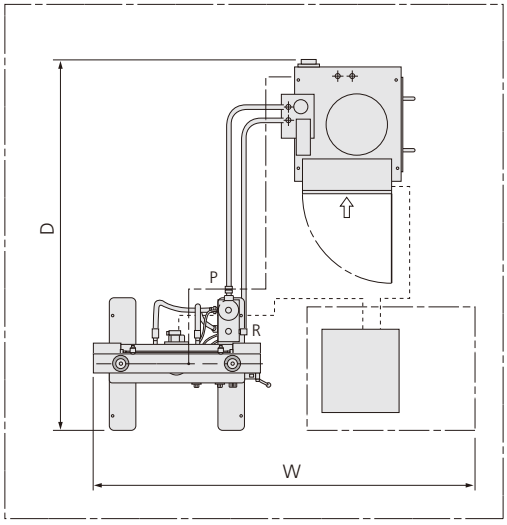


• **Use these diagrams as a reference if a special layout arrangement is required to suit the location.**

E-type (common for Model EV and EM)

E-type Layout

*To allow operation and maintenance, reserve an additional 500 mm-wide space around the area shown in the diagram.



Space required for E-type Layout (mm)

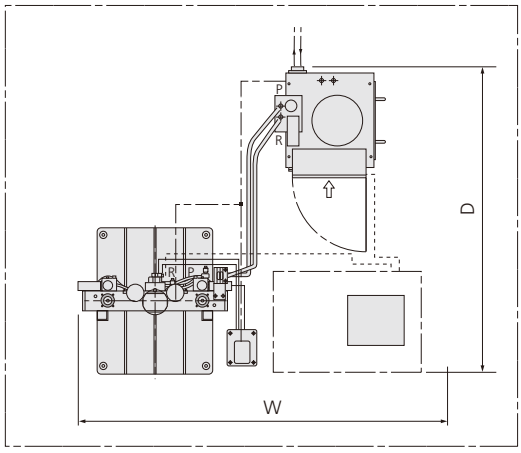
Main unit	Hydraulic power supply	Space required (W × D)
E51 kN E101 kN	QF-10B	2300 × 2100
	QF-20B	2300 × 2200
	QF-40B	2300 × 2600
	QF-70B	2300 × 2800
	AF-10B	2300 × 2200
	AF-20B	2300 × 2200

Main unit	Hydraulic power supply	Space required (W × D)
E200 kN	QF-10B	2500 × 2100
	QF-20B	2500 × 2200
	QF-40B	2500 × 2600
	QF-70B	2500 × 2800
	AF-10B	2500 × 2200
	AF-20B	2500 × 2200

U-type (common for Model UV and UM)

U-type Layout

*To allow operation and maintenance, reserve an additional 500 mm-wide space around the area shown in the diagram.



Space required for U-type Layout (mm)

Main unit	Hydraulic power supply	Space required (W × D)
U50 kN	QF-10B	2500 × 2100
	QF-20B	2500 × 2200
	QF-40B	2500 × 2600
	QF-70B	2500 × 2800
	AF-10B	2500 × 2200
	AF-20B	2500 × 2200
U100 kN	QF-10B	2500 × 2100
	QF-20B	2500 × 2200
	QF-40B	2500 × 2600
	QF-70B	2500 × 2800
	AF-10B	2500 × 2200
	AF-20B	2500 × 2200

Main unit	Hydraulic power supply	Space required (W × D)
U200 kN	QF-10B	2600 × 2100
	QF-20B	2600 × 2200
	QF-40B	2600 × 2600
	QF-70B	2600 × 2800
	AF-10B	2600 × 2200
	AF-20B	2600 × 2200

Standard Configurations

Some typical configurations are listed below. These are the most fundamental configurations that are well tried and tested.

L-type Series

Model	Part No.	Main frame	Actuator	Controller	Hydraulic power supply	Load cell	Servo valve	Accumulator
EHF-LV005k1-A04	348-20610-01	L5kN	5 kN, ±25 mm	4830	AF-4	SCL-5kN	761-4016	0.3 L × 0.3 L
EHF-LV005k1-010	348-20611-01				QF-10B		761-4017	
EHF-LV005k1-020	348-20612-01				QF-20B		761-4018	
EHF-LM005k1-A04	346-72801			4890	AF-4		761-4016	
EHF-LM005k1-010	346-72173-01				QF-10B		761-4017	
EHF-LM005k1-020	346-72173-11				QF-20B		761-4018	
EHF-LV010k1-A04	348-20630-01	L10kN	10 kN, ±25 mm	4830	AF-4	SCL-10kN	761-4016	
EHF-LV010k1-010	348-20631-01				QF-10B		761-4017	
EHF-LV010k1-020	348-20632-01				QF-20B		761-4018	
EHF-LM010k1-A04	346-72802			4890	AF-4		761-4016	
EHF-LM010k1-010	346-72174-01				QF-10B		761-4017	
EHF-LM010k1-020	348-72174-11				QF-20B		761-4018	
EHF-LV020k1-A04	348-20650-01	L20kN	20 kN, ±25 mm	4830	AF-4	SCL-20kN	761-4016	
EHF-LV020k1-010	348-20651-01				QF-10B		761-4017	
EHF-LV020k1-020	348-20652-01				QF-20B		761-4018	
EHF-LM020k1-A04	346-72803			4890	AF-4		761-4016	
EHF-LM020k1-010	346-72175-01				QF-10B		761-4017	
EHF-LM020k1-020	346-72175-11				QF-20B		761-4018	

E-type Series

Model	Part No.	Main frame	Actuator	Controller	Hydraulic power supply	Load cell	Servo valve	Accumulator
EHF-EV051k1-010-0A	348-21060-01	E50kN	50 kN, ±25 mm	4830	QF-10B	SFL-50kN	761-4018	1 L × 1 L
EHF-EV051k1-020-0A	348-21060-02				QF-20B		761-4019	
EHF-EM051k1-010-0A	348-21062-01			4890	QF-10B		761-4018	
EHF-EM051k1-020-0A	348-21062-02				QF-20B		761-4019	
EHF-EV101k1-020-0A	348-21061-01	E100kN	100 kN, ±25 mm	4830	QF-20B	SFL-100kN	761-4019	
EHF-EV101k1-040-0A	348-21061-02				QF-40B		761-4019(2 pcs)	
EHF-EM101k1-020-0A	348-21063-01			4890	QF-20B		761-4019	
EHF-EM101k1-040-0A	348-21063-02				QF-40B		761-4019(2 pcs)	
EHF-EV200k1-040-0A	348-20453-01	E200kN	200 kN, ±25 mm	4830	QF-40B	SFL-200kN	761-4019(2 pcs)	3 L × 1 L
EHF-EV200k1-070-0A	348-20454-01				QF-70B		72-023	
EHF-EM200k1-040-0A	348-20053-01			4890	QF-40B		761-4019(2 pcs)	
EHF-EM200k1-070-0A	348-20054-01				QF-70B		72-023	

U-type Series

Model	Part No.	Main frame	Actuator	Controller	Hydraulic power supply	Load cell	Servo valve	Accumulator
EHF-UV050k1-010-0A	348-20511-01	E50kN	50 kN, ±25 mm	4830	QF-10B	SFL-50kN	761-4018	1 L × 1 L
EHF-UV050k1-020-0A	348-20512-01				QF-20B		761-4019	
EHF-UM050k1-010-0A	348-20212-01			4890	QF-10B		761-4018	
EHF-UM050k1-020-0A	348-20212-11				QF-20B		761-4019	
EHF-UV100k1-020-0A	348-20532-01	E100kN	100 kN, ±25 mm	4830	QF-20B	SFL-100kN	761-4019	
EHF-UV100k1-040-0A	348-20533-01				QF-40B		761-4019(2 pcs)	
EHF-UM100k1-020-0A	348-20232-01			4890	QF-20B		761-4019	
EHF-UM100k1-040-0A	348-20233-01				QF-40B		761-4019(2 pcs)	
EHF-UV200k1-040-0A	348-20553-01	E200kN	200 kN, ±25 mm	4830	QF-40B	SFL-200kN	761-4019(2 pcs)	3 L × 1 L
EHF-UV200k1-070-0A	348-20554-01				QF-70B		72-023	
EHF-UM200k1-040-0A	348-20253-01			4890	QF-40B		761-4019(2 pcs)	
EHF-UM200k1-070-0A	348-20254-01				QF-70B		72-023	

*Other combinations are also possible. *±50 mm stroke is available as an option. *±400 mm column extension is available as an option. *+500/+1000 mm table expansion is available as an option.
*CE marked models are available as options (EV/LV/UV Series)

Overall Performance

Series		L-type series			E-, U-type series		
Max. test force	**Dynamic/Static**	±5 kN/±6 kN	±10 kN/±12 kN	±20 kN/±24 kN	±50 kN/±60 kN	±100 kN/±120 kN	±200 kN/±240 kN
Max. stroke		±25 mm, ±50 mm					
Frequency/amplitude		See amplitude characteristics on page 14.					
Controlled items		Test force, piston stroke (standard) Controller 4830: 2 additional channels can be added Controller 4890: 6 additional channels can be added					
Test force	**Static indication accuracy**	Controller 4830 : within ±0.5% indicated value or within ±0.02% dynamic max. test force, whichever is larger *1 Controller 4890 : within ±1% indicated value (high-accuracy model: ±0.5%) or within ±0.02% dynamic max. test force, whichever is larger *2					
Stroke	**Static indication accuracy**	Controller 4830 : within ±1% indicated value or within ±0.1% max. stroke, whichever is larger Controller 4890 : within ±1% indicated value or within ±0.1% max. stroke, whichever is larger					

*Request calibration by an accredited calibration authority if class certification is required for testing machines conforming to ISO/JIS standards.
*1 If the capacity exceeds 200 kN, this becomes "within ±1% indicated value or within ±0.02% dynamic max. test force, whichever is larger."
*2 A high-accuracy Controller 4890 is available as an option. Designate High-accuracy Model (346-78543).

Servopulser Retrofit

Controller

Retrofit your controller to the latest model to resurrect your servo-hydraulic testing machine.

You have an old servo-hydraulic testing machine?
Your servo-hydraulic testing machine doesn't perform to expectations?

Talk to Shimadzu. → **You get aleading-edge system**

Controller 4890 (P7)

Highly functioned model using fully digital technology

- Fully digital control (2-degree-of-freedom PID control, realtime gain adjustment, autotuning, AGC) allows anyone to conduct highly accurate testing.
- Digital Load Limiter restricts overloads.
- Mail notification function and remote monitoring.
- Automatic sensor recognition, rangeless performance, and sensor linearization
- The nine GLUON software packages can be selected according to the target application. (P8 ~ 9)

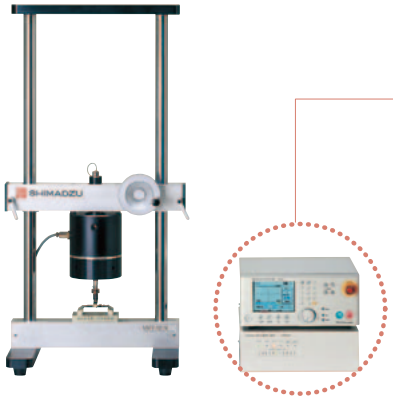


*Photo shows a typical system configuration.

Controller 4830 (P6)

A compact, high-performance, general-purpose controller offering extremely simple operation

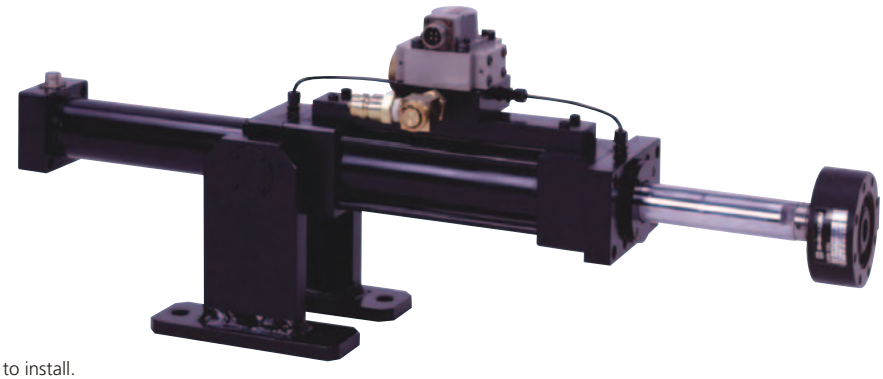
- Fully digital control with autotuning, waveform distortion correction, and AGC achieves faithful load waveform reproducibility.
- Test force control for specimens with clearance. (push test function)
- ±0.5% indicated force value accuracy
- Extremely simple operation using a color LCD and touchpanel
- Comprehensive waveform generation functions and realtime graphic
- functions
  Optional Windows software available

Contact your Shimadzu representative for details.

Compact Hydraulic Actuator

Shimadzu JF Series Force Simulator

Applies repeated loads to products such as automobile components, furniture, and structural parts to evaluate their durability. Force Simulator is a lightweight, compact, easy-to-use hydraulic actuator for these applications.



Lightweight, Compact, Easy-to-use

20 kN force and 100 mm stroke from a 25 kg actuator.
Lightweight and compact actuator is portable and easy to install.
Hydraulic hoses are easy to connect using one-touch couplings.
The AF Series portable air-cooled hydraulic power supply unit requires no cooling water. The casters make it easy to move.

Free Mounting

The optional brackets allow the actuator to be mounted in a variety of ways.

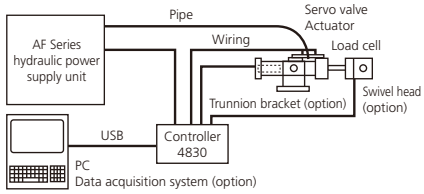
Actuator Size and Weight

Model \ Stroke		±50 mm	±100 mm	±150 mm
JF5 kN	weight *1	17 kg	20 kg	26 kg
	overall length *2	565 mm	815 mm	1065 mm
JF10 kN JF20 kN	weight *1	21 kg	25 kg	28 kg
	overall length *2	570 mm	820 mm	1070 mm
JF30 kN	weight *1	74 kg	84 kg	94 kg
	overall length *2	715 mm	965 mm	1215 mm

Top row : Weight *1
Bottom row : Overall length *2

*1 The weight includes the load cell and servo valve.
*2 The overall length is the dimension at the central position, with the load cell attached.

System Configuration Example



Standard System Configuration and Major Specifications

Model		EHF-JF5kNV-XX-A10	EHF-JF10kNV-XX-A10	EHF-JF20kNV-XX-A10	EHF-JF30kNV-XX-A10
Part No.		348-20708-xx	348-20718-xx	348-20728-xx	348-20738-xx
Actuator *	Dynamic test force	±5 kN	±10 kN	±20 kN	±30 kN
	Static test force	approx. ±7 kN	approx. ±13 kN	approx. ±27 kN	approx. ±39 kN
	Effective stroke (±mm)	Select 50, 100, or 150			
Servo valve	Rated pressure	21 MPa			
	Flow rate	19 L/min. (when pressure drops through 7 MPa)			
Load cell	Model	SCL-5 kN	SCL-10 kN	SCL-20 kN	SFL-30 kN
Controller	Model	4830			
Hydraulic power supply unit	Model	AF-10B			
	Rated pressure	21 MPa			
	Pumping rate	9 L/min/50 Hz, 11 L/min/60 Hz			
	Other	Motor : 5.5 kW, 4pole (drip-proof) / Constant-rate gear pump Tank capacity : 90 L / ACC1 L installed / Cooling method : air cooled / With casters			
Pipes	High-pressure rubber hose	5 m, 1/2 inch with coupling at each end, including spiral-wire guard			3/4 inch
Utilities	Power supply	200/220 V ±10%, 8 kVA, 3-phase and 100 V ±10%, 300 VA, single-phase			

* Other combinations of hydraulic power supply, controller, etc. are possible. Consult your Shimadzu representative for details.

* Example Model name EHF–JF [20kN] V– [100] – [A10] P/N [346–20728] [–50]

Force Simulator

AF-10B hydraulic power supply unit model : A10

Actuator stroke

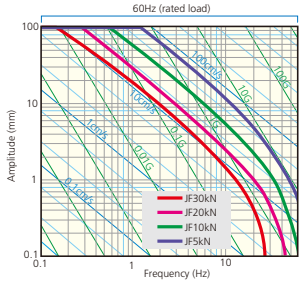
Controller 4830 : V

Actuator dynamic capacity		
Dynamic capacity	Part No.	Model code
±5 kN	348-20708	5 kN
±10 kN	348-20718	10 kN
±20 kN	348-20728	20 kN
±30 kN	348-20738	30 kN

Dash No.	Stroke (±mm)
–00	100
–02	50
–03	150

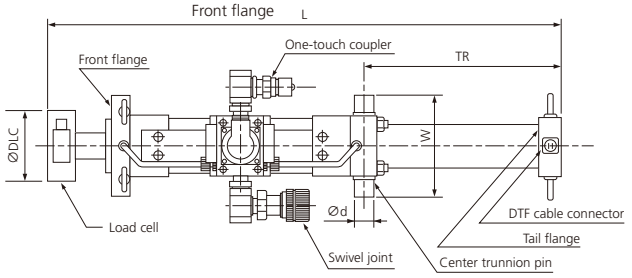
Amplitude Characteristics

- The diagram shows the relationship between the single amplitude and frequency for a sinewave drive at rated load.
- These characteristics do not incorporate the frame and load cell characteristics. Subtract these characteristics to determine the actual amplitude characteristic values.
- These amplitude characteristics were calculated using typical servo-valve characteristics. Differences of approximately 10% may occur along the frequency axis.
- The amplitude characteristics for a 50Hz supply are approximately 5/6 of those shown. Consult your Shimadzu representative for details.



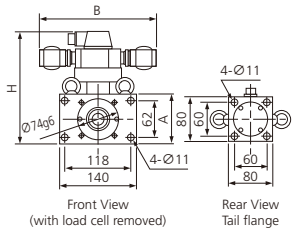
Servo valve	Model	761-4017
	Qty	1
	Rated flow rate	19 × 1 L/min
Hydraulic power supply	Model	AF-10B
	Power supply frequency	60 Hz
	Accumulator	1 L

External Dimensional Drawings

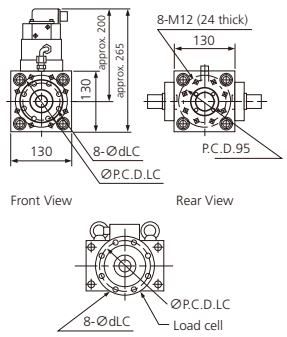


* Front flange on 5kN, 10kN, and 20kN models only.

• 5 kN to 20 kN



• 30 kN



	W	Ød	L			TR			ØDLC	ØP.C.D.LC	ØdLC	B	H	A
Stroke	—	—	50	100	150	50	100	150	—	—	—	—	—	—
JF5 kN	140	Ø25	565	815	1065	169	269	369	Ø100	Ø85	Ø9	210	196	80
JF10 kN/20 kN	140	Ø25	570	820	1070	176	276	376	Ø100	Ø85	Ø9	210	200	84
JF30 kN	245	Ø30	744	994	1244	278	378	478	Ø125	Ø110	Ø13	—	—	—

Optional Bracket

Combinations of a front bracket, trunnion bracket, swivel base/head can be used at three positions : front flange, center trunnion, and tail flange.

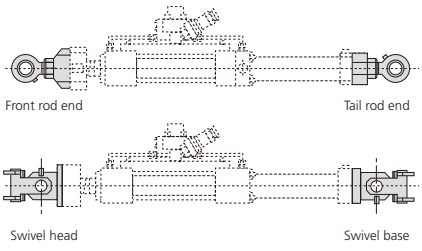
JF30KN Optional Brackets

Name	Model	Part No.	Comments
Swivel base/head	JS-50	344-14757	Used with base head *1
Front bracket	JF-50	346-77042	
Trunnion bracket	JT-50	346-76901	

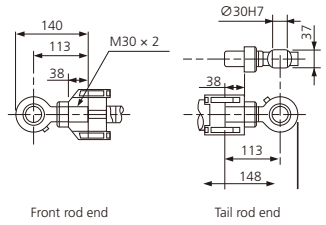
*1 Purchase two units for combination with base head.

JF5KN to JF20KN Optional Brackets

Name		Model	Part No.
Rod end (to 15 kN dynamic load)	Set	JRS-20	346-76807-00
	Front	JRF-20	346-76807-01
	Tail	JRT-20	346-76807-02
Swivel	Set	JSS-20	346-74116-00
	Head	JSF-20	346-74116-01
	Base	JST-20	346-74116-02
Front bracket		JF-20	346-74114
Trunnion bracket		JT-20	346-74115
Angle set bracket	(Stroke. 50 mm, 100 mm)	JA-20	346-74117
	(Stroke. 150 mm)	JA-20A	346-74117-01

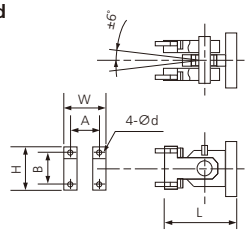


• Rod Ends

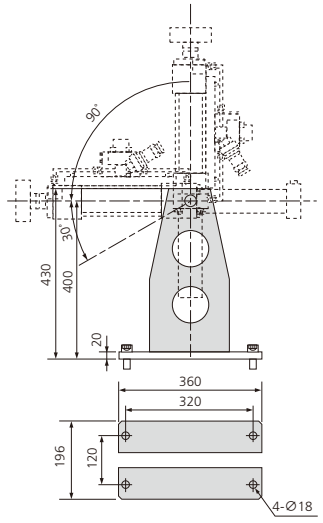


• Swivel Base/Head

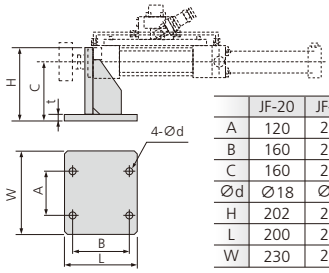
	JS-20	JS-50
A	60	200
B	60	200
Ød	Ø11	Ø22
H	80	140
L	135	200
W	78	140



• Angle Set Brackets (JA-20)

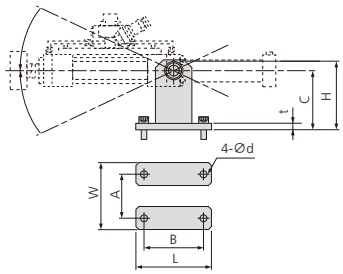


• Front Brackets



	JF-20	JF-50
A	120	200
B	160	200
C	160	200
Ød	Ø18	Ø22
H	202	265
L	200	255
W	230	270

• Trunnion Brackets



	JT-20	JT-50
A	120	200
B	160	200
C	160	200
Ød	Ø18	Ø22
H	190	240
L	200	250
W	184	280

System Customization

Consult your Shimadzu representative for customized systems with modifications to all or part of the system.

<Precautions on changing the hydraulic power supply unit>

- A separate accumulator stand and hydraulic pipes are required to use a QF Series hydraulic power supply unit. (Specify the distances between the hydraulic power supply unit and accumulator stand and between the accumulator and actuator.)
- Select servo valve 761-4018 when changing to a QF-20 or AF-20 hydraulic power supply unit. (For JF10KN to JF30KN.)
- Select servo valve 761-4019 when changing to a QF-40 hydraulic power supply unit. (For JF20KN to JF30KN.)

<Branch divider>

Consult your Shimadzu representative, quoting the information below, to use a system incorporating a branch divider after the hydraulic power supply unit to drive multiple actuators.

- Hydraulic power supply unit capacity
- Is each actuator individually driven to the maximum capacity of the hydraulic power supply unit or is the hydraulic power divided equally between them? (Select servo valve or select piping.)
- Distances between the hydraulic power supply unit and accumulator stand and between the accumulator and actuator. (Select piping.)
- On an alarm, does the entire system stop, or do individual actuators stop?
  (To stop individual actuators, a solenoid valve must be installed for each actuator to cut off the hydraulic pressure to that actuator while the hydraulic power supply unit continues operating.)

<Changing the length of hydraulic pipes or electrical wires> Consult your Shimadzu representative.
<Changing the controller> The controller can be changed to Controller 4890.
<Hydraulic Power Supply Unit and Controller Specifications > See pages 6, 7, 10, and 11 for details.
<Frame for Reactive Force > Shimadzu designs and manufactures various frames to use with the JF Series. Consult your Shimadzu representative for details.

Customized system example: bed durability evaluation system

Electromagnetic Force Micro Material Testing Machine

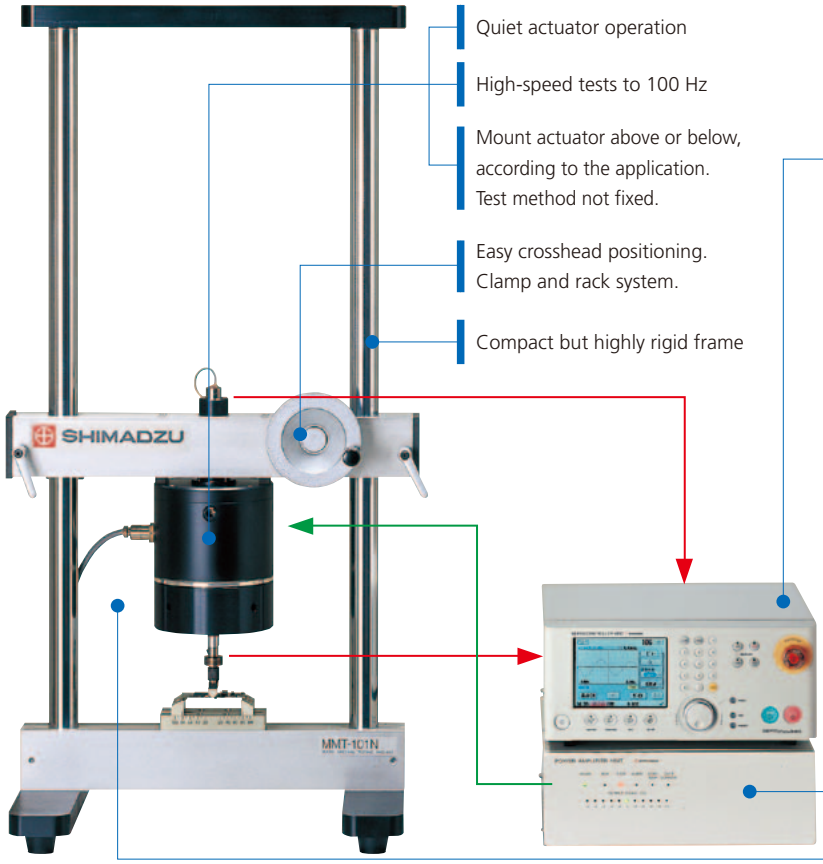
Microservo **MMT** Series

In recent years, we have seen the demand for the strength testing of minute materials and parts across a range of fields, such as materials like composite and superconductors. Practical micro machines including micro actuators and micro sensors can be used on electronics and communications industries (which are achieving greater compactness and higher functionality), which can be used in lead-free soldered joint technologies developed due to increasing concerns about environmental problems and biotechnologies.
The Microservo MMT Series employs an electromagnetic actuator with extremely high frequency response characteristics as the loading mechanism. The combination with closed-loop control achieves rapid and accurate control of minutes test forces and microdeflections.

Features of the Micro-servo MMT Series

Compact testing system	Light and compact for easy installation.
Requires no utilities, except AC 100 V	No water or air supply equipment is needed.
Quiet enough to install anywhere	Quieter than hydraulic machines.
Easy to operate	Simple and easy to use.

Basic Construction of the Microservo MMT Series



- Quiet actuator operation
- High-speed tests to 100 Hz
- Mount actuator above or below, according to the application. Test method not fixed.
- Easy crosshead positioning. Clamp and rack system.
- Compact but highly rigid frame
- Controller is tried and tested with servo-hydraulic systems. Handles both static and dynamic testing. Select the waveform required for the test.
- Great operability, as power amplifier operations are controlled at the Controller.
- Shockless circuits when ACT power turned ON/OFF
- Alarm circuits as standard for safe operation
- Highly efficient cooling
- Requires only AC 100 V. No other equipment needed.
- Large test space. Easy installation of environment control devices or microscopes.

* See the separate MMT catalog for details.

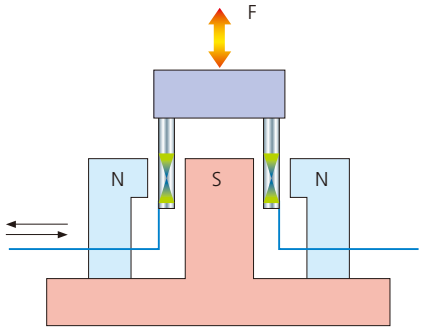
Principle of Micro Test Force Control

As shown in the diagram below, the component that generates the test forces comprises a permanent magnet and force coil. The permanent magnet is fixed and the moveable coil moves vertically. When a current flows in the coil, an electromagnetic force F is generated in proportion to the current, according to the following expression:

$$F = 2\pi nBI$$

Where,
r is the coil radius;
n is the number of coil windings;
B is the magnet flux density; and
I is the coil current.

To achieve accurate micro test force control, the coil current I is controlled by a closed-loop control method when electromagnetic forces are generated.



Major Specifications

In combination with Controller 4830

Main Unit Model	MMT-500NV-10	MMT-250NV-10	MMT-101NV-10	MMT-101NV-2	MMT-11NV-2
Part No.	348-20803-00	348-20802-00	348-20801-00	348-20801-01	348-20800-01
Test force	Max. ±500 N	Max. ±250 N	Max. ±100 N		Max. ±10 N
Piston stroke	Max. ±10 mm			Max. ±2 mm	
Frequency	Max. 100 Hz				Max. 60 Hz
Controlled items	Test force, piston stroke (can be expanded by adding options)				
Load cell (standard accessory*)	±500 N	±250 N	±100 N		±10 N
Jigs and test devices	Not included in standard configuration (standard specification). (Select options or consult Shimadzu.)				
Indication accuracy	Test force : within ±0.5% indicated value or within ±0.02% dynamic max. test force, whichever is larger*1 Stroke : within ±1% indicated value or within ±0.1% max. stroke, whichever is larger				
Installation space (W × D × H)	1000 × 500 × 1200mm (approx.)				
Total weight	approx. 150 kg	approx. 120 kg	approx. 100 kg		approx. 80 kg
Power supply	1Ø 100 V 1 kVA				1Ø 100 V 500 VA

* Various capacity load cells are available as options.
*1 For MMT-11NV-2, this becomes "within ±1% indicated value or within ±0.02% dynamic max. test force, whichever is larger."
* CE marked models are available as options (NV Series)

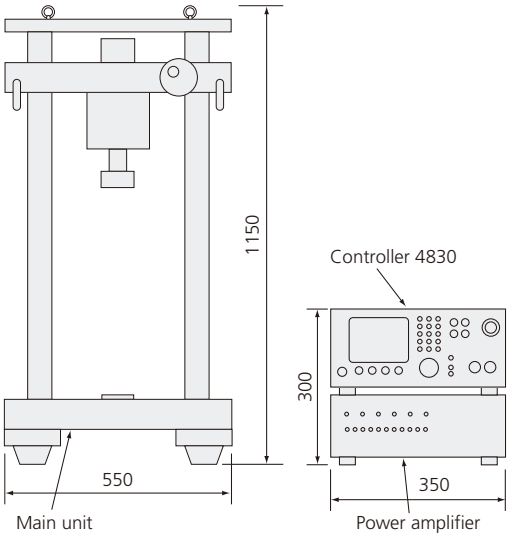
In combination with Controller 4890

Main Unit Model	MMT-500NM-10	MMT-250NM-10	MMT-101NM-10	MMT-101NM-2	MMT-11NM-2
Part No.	346-72813-11	346-72155-11	346-71624-04	346-71624-05	346-71624-06

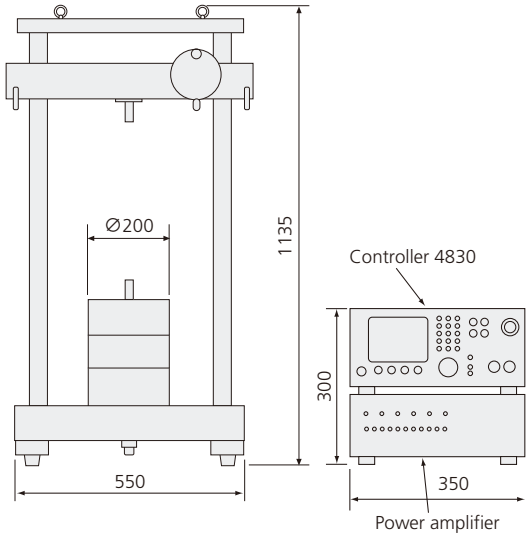
* See Servopulser pages 18 to 21 for details about the controllers and software.

External Dimensional Drawings

• 250 N to 10 N



• 500 N

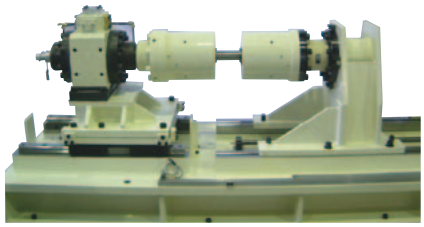


Unit : mm

Testing Systems

Guarantees High Data Reliability

The T Series torsional fatigue testing machines test the torsional strength characteristics of engines, turbines, and motors, and of shafts, couplings, clutches that transmit rotational torque used in automobiles, aircraft, carriages, electric motors, and machines.



T Series Torsional Fatigue Testing Machines

Fatigue testing for pipe materials

- With axial slide guide (mechanism to alleviate axial loads)
- Hydraulic chuck simplifies specimen clamping

System Configuration Example

- Loading Frame (T5KNM)
- Torque actuator (TQ-5KNM)
- Controller 4830
- QF-40B hydraulic power supply unit
- Hydraulic grips

The controller can be changed to Controller 4890.
The optional thermostatic chamber permits controlled-temperature environmental testing.

* Contact your Shimadzu representative for details.

300Hz High-cycle Fatigue and Endurance Testing Machine

For service life evaluation and 10^8-order fatigue testing on parts and materials

- Test frequency up to 300 Hz
- Servo-hydraulic actuator achieves 300 Hz, ±20 kN loading.

System Configuration Example

- Highly rigid frame
- ±20 kN, ±10 mm actuator
- QF-40B hydraulic power supply unit
- Controller 4830
- Windows software for 4830

Major Specifications

- Test frequency : 0.001 to 300 Hz (max.)
- Test force capacity : ±20 kN
- Piston stroke : ±10 mm

* Contact your Shimadzu representative for details.

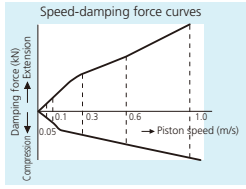
Shock Absorber Testing Machine

Damping characteristic evaluations on automobile and motorcycle shock absorbers

- Measures the damping force with respect to the shock-absorber piston speed.
- Plots graphs, including speed-damping force curves and displacement-damping force Lissajous curves.

System Configuration Example

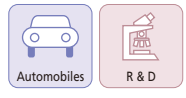
- E-type frame
- Controller 4830
- Hydraulic power supply unit
- Dedicated software



* Contact your Shimadzu representative for details.

Axial Force (Tensile/Compression) and Torsion Testing Machine

Evaluates materials and parts under conditions similar to actual use.



- Loading approximates actual use
- Simultaneously applies axial and torsional loads to specimen.

System Configuration Example

- Special frame
- Actuator combinations
- 50kN axial and 0.5 kN.m torsional
- 100kN axial and 1 kN.m torsional
- Hydraulic power supply unit
- Controller 4830 (two units)
- Windows software for 4830

* Contact your Shimadzu representative for details.

Dynamic Characteristics Testing Machine for Rubber Vibration Isolators

For R&D into rubber vibration isolators

Automobiles | Plastics, Rubber

- Can calculate the static characteristics and high-cycle dynamic characteristics (to 300 Hz) of viscoelastic materials.
- Simple measurement of spring constants, damping coefficients, and loss factors.
- Thermostatic chamber permits testing in controlled temperature environments.

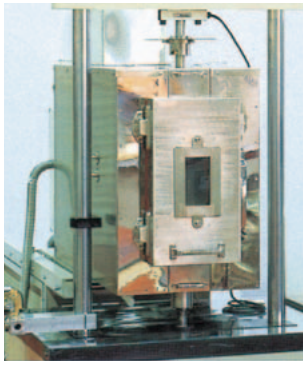
System Configuration Example

- Special frame
- 100 kN actuator
- QF-40 hydraulic power supply unit
- Controller 4830
- Windows software for 4830

Others

- Max. test force : ±100 kN
- Max. displacement : ±10 mm
- Frequency : 5 to 300 Hz
- Amplitude characteristics : 50 Hz ±2 mm, 100 Hz ±0.9 mm, 200 Hz ±0.36 mm, 300 Hz ±0.18 mm

* Contact your Shimadzu representative for details.



Thermostatic Environment Control Device

For fatigue and durability testing of materials and small parts in a temperature-controlled environment

Automobiles | Steel, Metals, Machines | Plastics, Rubber | Electrical, Communications | R & D

- Forced circulation of hot or cold air from heater or chiller
- Extremely safe during long-periods of continuous operation

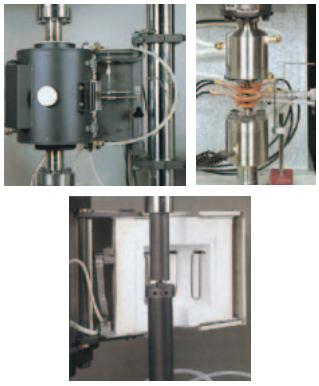
Applicable Systems

- E-type, U-type, L-type Servopulser
- Micro-servo MMT Series

Temperature Range

- -65˚C to 250˚C
- -35˚C to 250˚C
- (Room temperature +10˚C) to 300˚C

* Contact your Shimadzu representative for details.



Resistance-heated High-temperature Testing Machine

High-temperature low- and high-cycle testing of all materials

Steel, Metals, Machines

- A cooling jacket around the furnace minimizes the thermal effects on the extensometer.
- Highly accurate temperature control from Shimadzu's unique PID circuit simultaneous control method.

Applicable Systems

- E-type Servopulser

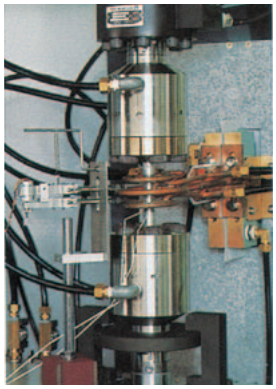
Major Specifications

- 300˚C to 1000˚C

Temperature Range

- Temperature distribution : ±3˚C (300˚C to 800˚C), ±5˚C (800˚C to 1000˚C)

* Contact your Shimadzu representative for details.



High-frequency Induction-heated Thermal Fatigue Testing Machine

For thermal fatigue testing and high-temperature, low-cycle testing on all materials

Automobiles | Steel, Metals, Machines

- High-frequency heating device achieves rapid heating and the servo-operated coolant gas injection device achieves rapid cooling.
- Permits highly accurate temperature cycle testing.

Applicable Systems

- E-type Servopulser

Temperature Range

- Temperature range : 100˚C to 1200˚C
- Max. heating rate : Room temperature to 1000˚C within 70s

* Contact your Shimadzu representative for details.

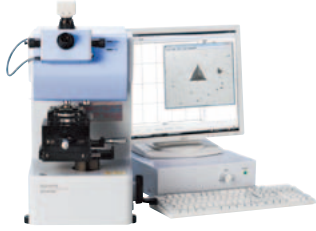
Other Testing and Evaluation Machines

UH-FX
Universal Testing Machine

AG-X plus Series
Precision Universal Tester

MST-I
Micro-Autograph
Micro Strength Tester

MCT-W Series
Micro Compression Testers



DUH-211/211S
Dynamic Ultra Micro Hardness Tester

HMV-G
Micro Hardness Tester

CFT-500D
Flow Tester
(Capillary Rheometer)

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