Hydraulic Universal Testing Machines

UH-X/FX Series
UH-X/FX Series
Hydraulic Universal Testing Machines

Environmentally and operator friendly state-of-the-art universal testing machine

Significantly Improved Control
Performance and Ease-of-Operation

Semi-auto-tuning function enables high-precision stress control and strain control (compliant with ISO 6892 and JIS Z2241 metallic materials tensile testing standards)  >> Page 4

Extra large color LCD touch panel screen significantly improves ease-of-operation and visibility >> Page 4

Environmentally Friendly Design Saves Energy and Hydraulic Oil

Product line includes UH-Xh/UH-FXh series, which features a hybrid hydraulic unit that reduces energy consumption by 82 % (with model UH-500kNXh) Hybrid >> Page 5

Ensures Reliability and Safety

Ultra-high-speed sampling function ensures no sudden variations in strength are missed  >> Page 6

A variety of automatic control programs included as standard  >> Page 6
Significantly Improved Control Performance and Ease-of-Operation

Semi-Auto-Tuning Function Enables High Precision Stress Control and Strain Control
(compliant with ISO 6892 and JIS Z2241 metallic materials tensile testing standards)

Control parameters are auto-tuned in real time, based on test force and strain values measured during testing. This eliminates the need for preliminary testing and makes it easy to perform highly precise stress-controlled or strain-controlled testing. The semi-auto-tuning function also allows performing ISO 6892 (precision strain-controlled testing)* and JIS Z2241 compliant metallic materials tensile testing.

* Requires Extensometer and TRAPEZIUM X.

Extra-Large Color LCD Touch-Screen Significantly Improves Ease-of-Operation and Visibility

The large 10.4-inch color touch-screen significantly improves visibility and ease-of-operation. This color graphical user interface enables performing a wide variety of functions with a simple touch of the screen. This makes it easy to operate the testing machine, even for first-time users. It also displays S–S curves in real time during testing.
Rangeless Data Measurement

Test force and strain can be measured without having to specify an amplifier range. This means data can be acquired using optimal measurement parameters, even for specimens with unknown strength. In addition, since the analog indicator and output to the data recorder have a virtual range, evaluation is possible in the same manner as before.

Key Switch
Included Standard

A key switch is provided standard to ensure security is properly controlled.

USB Memory Enables Performing Tests Without Connecting to a Computer*

By inserting a USB memory stick into the measurement controller with test parameters stored in the USB memory, tests can be performed without a computer. Furthermore, measurement data is automatically saved in the USB memory after tests, which enables analyzing the data with TRAPEZIUM X or using it to create reports.

* Requires TRAPEZIUM X.

Crosshead Elevating Switch Box (optional) Provides Finger-Tip Control

Using the crosshead elevating switch box allows positioning the crosshead without looking away from the testing space.

Environmentally Friendly Design Saves Energy and Hydraulic Oil

Hybrid Hydraulic Unit Reduces Power Consumption by 82 % (with model UH-500kNXh)

A hybrid hydraulic unit combines an AC servo motor with a hydraulic pump so that the pump only operates when necessary. This provides an energy-efficient testing machine and reduces its environmental impact.

Quieter Hydraulic Unit

The sound level of the hydraulic unit for the grips was reduced by over 10 dB, from 75 dB to 65 dB, compared to the previous model.

Requires up to 50 % Less Hydraulic Oil

For model UH-F500kNXh, the amount of hydraulic oil required has been cut in half, from 80 to 40 liters.
Ensures Reliability and Safety

Ultra-High-Speed Sampling Function Ensures No Sudden Variations in Strength Are Missed

By connecting to a computer installed with TRAPEZIUM X data processing software, data can be acquired at ultra-high sampling rates of up to 1 msec (1 kHz). This enables capturing any sudden changes in test force, such as at the break point of brittle materials, with high precision. Sampling parameters can be changed during tests, so that critical areas can be analyzed in more detail.

A Variety of Automatic Control Programs Included Standard

A tensile testing control program for metallic materials (JIS Z2241 and ISO 6892) is included standard.

Standard programs include testing at a constant speed, as well as testing where the controlled parameter is increased at a constant rate, and then held at a certain value. The controlled parameters include stroke, test force, strain, and others.

Not only cycle test control, but also high-temperature tensile test control, stroke speed 3-step switching control, and even concrete test control are included standard.
Equipped with Easy-to-Operate Front-Opening Hydraulic Grips

- The center hole hydraulic cylinder actuated front-opening hydraulic grips allow efficient specimen recovery and scale removal and provide superior safety. Testing long materials is easy as well.
- The grip face open/close switch is designed for safety. Grips are actuated only while the switch is depressed.

Easy to Replace Grip Faces
Grip faces are lightweight and can be exchanged easily by simply inserting them from the front.

Compression Plates
Installed/Removed Easily in a Single Step
No wrenches or other tools are necessary.

Includes Grip Face Overhang Indicator Cover
An indicator cover is installed at the maximum grip face overhang position, occurring when the grip faces are closed. This allows mounting specimens with confidence.

Multi-Level Crosshead Positioning Structure
(all models)
The upper crosshead position can be changed easily depending on the specimen length. Therefore, tests can be performed at a height appropriate for the operator.

Easy-to-Understand Specimen Grip Positioning Indicator Included
The grip face positioning markings allow gripping specimens easily and accurately.

Non-Rotating Threaded Columns Improve Safety
(not included on large-capacity models from 2000 to 4000 kN)
This allows mounting specimens with confidence.

Grip Holder Includes Safety Stopper
A safety stopper prevents the left and right grip faces from contacting each other in the event of an operating error, which prevents damaging the grip faces.

Safety Cover Can be Included for Protection from Flying Specimen Debris
(optional for all models)
A protective safety cover can be included on the loading unit for protection from flying specimen debris. In addition, an interlocked switch can be included on the door, upon request.
Measurement Controller (Operation Unit)

Easy-to-See Display for Both Digital and Analog Measurements

The analog indicator is large, with a 450 mm diameter. The digital display is located within the same field of view to ensure even small changes in test force are not overlooked, such as at the yield point.
step 01
Main screen
From this initial screen, various settings can be specified or information displayed.

step 02
Set test parameters
This screen allows the easy entering of all necessary test parameters via a single screen. Enter the loading speed, specimen information, test mode, and other settings.

step 03
Set the break detection mode
Next, specify the method used for detecting the break point. In addition to the break sensitivity and break level functions available previously, a new break peak level function was added to make the system even easier to use.

step 04
Start the test
This completes the setup. Now press the start button. To prevent starting accidentally, a two-step interactive start process is used.
The Touch-Screen Enables Intuitive Operation

- **Large Character Display**
  The large-sized test force/stroke data display can be easily read. The display can be switched to the stress value display mode or displacement value display mode with a touch of a button.

- **S–S Curve Display**
  During a test, an S–S curve is displayed in real time.

- **Testing Machine Operating Status/Test Parameters Display**
  Since the testing machine’s operating status and test parameters can be checked at a glance, an erroneous setting or operation can be prevented.

- **Test Parameters Menu Screen**
  The testing machine’s functions can be visibly operated with the icon buttons. This can prevent erroneous operation, and improve test efficiency.

- **File Operation Screen**
  The test parameters changeover operation can be simplified by storing test parameters in a file of each test type.
<table>
<thead>
<tr>
<th>Cycle Test Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed Meter Function</td>
</tr>
<tr>
<td>Cycle Count Function</td>
</tr>
<tr>
<td>Auto/Full-Auto Test Force Range Switching Function</td>
</tr>
<tr>
<td>Test Force Auto-Calibration Function</td>
</tr>
<tr>
<td>Break Detecting Function</td>
</tr>
<tr>
<td>Auto-Return Function</td>
</tr>
<tr>
<td>Bilingual Function</td>
</tr>
<tr>
<td>PEAK/BREAK Value Display Function</td>
</tr>
</tbody>
</table>

In contrast to the specified speed setting, the actual current speed is displayed on the screen.

During a cycle test, the number of repeated loads applied to the specimen is displayed. Also, this function can stop the test, or break the specimen in the preset cycle number.

When a recorder is connected, the force range is automatically changed immediately before the force output signal exceeds the full-scale value.

The electrical test force calibration can be performed with a touch of a button, without the necessity of troublesome adjuster knob operations.

This function detects a specimen break to automatically stop the testing machine and return it to the origin.

This function automatically returns the ram of the testing machine to the origin with a touch of a button. When the auto-return function is used together with the break detecting function, the testing machine automatically returns to the origin after detection of a specimen break.

Japanese or English can be selected on the LCD touch-panel screen. The display language can be switched with a touch of a button.

The test force, stress, and stroke values at the maximum force point and break point are displayed during a test. When a displacement meter is connected, the displacement value at each point can also be displayed.
Supported by a Thoroughly Refined Operation System

Enables Intuitive Operation

1. Search files and select parameters quickly by simply touching the screen to perform consecutive tests efficiently.

- By registering frequently used parameters in a Quick Parameter List, tests can be started in one step.

- As more test results and parameter files accumulate over time, file can be searched by keywords or date. In addition, reports and setting lists can be previewed to recall files easily.

Files found by searching

Search parameters

Preview
2. Visual wizard provides guidance for setting parameters with confidence

- Complicated parameter settings can be specified while viewing the overall process flow using the Test Parameter Wizard.
- Guidance for operating procedures is linked to the software help function and displayed on each screen.
- Easy-to-understand illustrations are used for test control, specimens, and data processing parameter screens. Specifying settings is now much easier.

Data Processing Settings Screen
(Metal is selected as the material on the screen, but rubber and plastic are also available.)

1. Typical data processing parameters have been prepared in advance. Parameters can be specified easily by simply touching a button on the corresponding illustration.

2. The illustration changes automatically depending on the test mode and specimen material selected.

3. Screen for setting specimen quantity and dimensions

3. An illustration is displayed for each specimen shape. This makes it clear at a glance what dimensions need to be entered.

4. Dimensions can be entered manually or automatically from an Excel list or using electronic calipers.

5. In addition to dimensions, information can be entered for each specimen.
Quickly Obtain the Data Needed

1. The Quick Setting Panel enables quickly entering speed, dimensions, report information, and other settings directly into the Main screen.

2. More advanced navigation, with a teaching function

- Only the functions needed for the given testing situation are displayed as Navigation buttons. This means that the system can be efficiently operated with confidence for consecutive testing by simply touching visually large buttons. Furthermore, a teaching function is provided, which learns from user operations in each situation to add new buttons to the navigation bar for frequently used functions. This means that the more the system is used, the better it fits the user’s operating style and the more quickly operations can be accomplished.

3. Retest, Add test, and File merge functions

- Retest:
  Portions of batch test results can be retested and replaced with new results.
- Add tests:
  The total number of tests can be increased by adding batch numbers (or lot numbers).
- File merging:
  Test result files can be selected and merged. It also enables statistical processing.

More Attractive Reports
Increase Persuasiveness

Create expressive reports with freely configurable layouts and a wide selection of web-compatible output functions

- Report Designer enables freely changing layouts
  Reports can be created that contain test results, graphs, photographs, logos, or other graphical content.
  The layout and size of items in reports can be freely changed.
  Fonts, colors, borders, and other features can be specified in detail for each item.
- Reports can be output in Adobe Acrobat®, Microsoft Word®, Excel®, or HTML file formats
  Reports created using Report Designer can be output in various file formats.
  This allows freely customizing reports using software preferred by the user.
- WebPlus Function (optional)
  By installing the WebPlus function (optional) on the server, networked computers without TRAPEZIUM X installed can be used to reanalyze data or print reports via Internet Explorer.
TRAPEZIUM X offers five software modules – single, cycle, control, concrete, and recorder. These can be purchased in combinations as needed for customer testing requirements. If more than one is purchased, one-touch switching between modules avoids having to launch each program separately.

### Single Software
This software is used to perform typical single-direction tests. It enables performing tensile, compression, and bending testing.

### Cycle Software
This software enables performing endurance testing and other tests that involve repeated application of test forces.

### Control Software
This software enables freely creating a user-specified testing machine movement routine. It allows configuring complicated combinations of tensile, compression, and holding steps.

### Concrete Software
The software is used for testing concrete (compression, bending, and cleavage testing). It enables performing tests compliant with JIS A1108, JIS A1106, and JIS A1113 standards.

### Recorder Software
Tests are controlled using a UH-X measuring controller and this software is used to acquire data, display graphs, and process data. This software is used in cases such as when using the load control knobs on the measuring controller to manually perform tests.
UH-X/UH-FX Series — Layout/Installation

The following figures show the standard layout of Shimadzu Universal Testing Machines. To change the layout according to the conditions of the installation place or a change in system configuration, examine the layout referring to these figures.

To install the universal testing machine, concrete foundation work is required. When purchasing this product, design and construct the foundation suitable for the conditions of the installation place (withstand strength of the ground, occupied space, etc.), referring to the foundation reference drawing supplied by Shimadzu Corporation.

Occupied space recommended for the standard layout

* For the dimensions of the testing machine loading unit and measurement controller of each type, see pp. 18 and 19.

<table>
<thead>
<tr>
<th>Testing Machine</th>
<th>Capacity</th>
<th>Recommended Occupied Space (W × D × H mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UH-X</td>
<td>200 kN</td>
<td>2800 × 2350 × 2500</td>
</tr>
<tr>
<td></td>
<td>300 kN</td>
<td>2800 × 2350 × 2500</td>
</tr>
<tr>
<td></td>
<td>500 kN/600 kN</td>
<td>3000 × 2350 × 3000</td>
</tr>
<tr>
<td></td>
<td>1000 kN</td>
<td>3300 × 2400 × 3500</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Testing Machine</th>
<th>Capacity</th>
<th>Recommended Occupied Space (W × D × H mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UH-X</td>
<td>2000 kN</td>
<td>4600 × 3500 × 4000</td>
</tr>
<tr>
<td></td>
<td>3000 kN</td>
<td>5300 × 3900 × 5000</td>
</tr>
<tr>
<td></td>
<td>4000 kN</td>
<td>5800 × 4300 × 6000</td>
</tr>
</tbody>
</table>
1. Installation environment

Avoid installing the UH-X/FX series in the following harsh environments:
- In a place where a large temperature fluctuation is expected (Recommended temperature: +5 °C to +40 °C)
- In a place where high humidity is expected (Make sure no condensation occurs in the installation place.)
- In a dusty place
- In a place where the equipment is exposed to vibration (Recommended vibration amplitude: 5 µm or less)
- In a place contaminated by corrosive gas
- In a place where the equipment is directly exposed to vapor
- In a place where the equipment is directly exposed to sunlight

2. Requirements for power supply

- Conduct electric wiring work to the position shown in the foundation reference drawing.
- Avoid using a power supply with large voltage fluctuations. (Recommended voltage fluctuation level: Within ±10 %)
  If voltage fluctuations cannot be avoided, use a constant-voltage power supply.

3. Cooling water

To mount the optional hydraulic oil cooler, conduct water supply/drain piping work to the position shown in the foundation reference drawing supplied by Shimadzu Corporation.

<table>
<thead>
<tr>
<th>Testing Machine</th>
<th>Recommended Occupied Space (W × D × H mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series Name</td>
<td>Capacity</td>
</tr>
<tr>
<td>UH-FX</td>
<td>300 kN</td>
</tr>
<tr>
<td></td>
<td>500 kN</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Testing Machine</th>
<th>Recommended Occupied Space (W × D × H mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Series Name</td>
<td>Capacity</td>
</tr>
<tr>
<td>UH-FX</td>
<td>1000 kN</td>
</tr>
<tr>
<td></td>
<td>2000 kN</td>
</tr>
<tr>
<td></td>
<td>3000 kN</td>
</tr>
<tr>
<td></td>
<td>4000 kN</td>
</tr>
</tbody>
</table>
## UH-X/UH-FX Series — Loading Unit Standard Specifications

### Standard Series

<table>
<thead>
<tr>
<th>Model</th>
<th>Servo valve Type</th>
<th>Hybrid Type</th>
<th>UH-200kNX</th>
<th>UH-300kNX</th>
<th>UH-500kNX</th>
<th>UH-500kNXh</th>
<th>UH-F300kNXh</th>
<th>UH-F500kNXh</th>
</tr>
</thead>
</table>

### Capacity

<table>
<thead>
<tr>
<th>Force range</th>
<th>Max. capacity</th>
<th>Force range</th>
<th>Max. capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rangeless</td>
<td>200 kN</td>
<td>Rangeless</td>
<td>300 kN</td>
</tr>
<tr>
<td>Rangeless</td>
<td>500 kN</td>
<td>Rangeless</td>
<td>500 kN</td>
</tr>
</tbody>
</table>

| Analog indicator (option) | 200/100/40/20/10/4 kN | 300/150/60/30/15/6 kN | 500/250/100/50/25/10 kN |

### Specifications

1. **Tensile test**
   - Max. grip span (mm): 800, 800, 800, 900
   - Grip face for rod specimens (mm): *8 to 40, 1 type With liner* *8 to 40, 1 type With liner* *8 to 25 *a25 to 40 (option) *a12 to 50, 1 type With liner* *a12 to 30 *a30 to 50 (option)
   - Grip face for flat plate specimens (option)**: *0 to 35, 1 type (50 in width)* *0 to 35, 1 type (50 in width)* *0 to 20 *20 to 40 (50 in width) *0 to 45, 1 type (60 in width) *0 to 30 *30 to 50 (60 in width)

2. **Compression test**
   - Max. compression plate span (mm): 720, 720, 720, 800
   - Compression plate size (mm): ø100, ø100, ø100, ø120

3. **Transverse/bending test (option)**
   - Max. support span (mm): 500, 500, 500, 600
   - Support diameter x width (mm): 30 x 130, 30 x 130, 30 x 130, 50 x 160
   - Punch tip radius (mm): 15, 15, 15, 25
   - Punch width (mm): 130, 130, 130, 160

4. **Loading speed (50/60 Hz)**
   - (mm/min)/*1: 80/100 max. 100 max. 80/100 max. 100 max. 65/80 max. 65/80 max. 100 max.
   - Drive motor: Servo valve 1.5 kW 1.5 kW 1.5 kW 1.5 kW 2.0 kW 2.0 kW
   - Drive motor: Hybrid 2.0 kW 2.0 kW 2.0 kW 2.0 kW 2.0 kW 2.0 kW

5. **Ram stroke**
   - (mm): 200, 200, 200, 250

6. **Crosshead elevation speed (50/60 Hz)**
   - (Approx.) (mm/min): 315/380 315/380 380/450 375/450 210/250
   - Drive motor: 400 W 400 W 750 W 750 W

7. **Column span**
   - (mm): 500, 500, 500, 650

8. **Effective table dimensions (W x D)**
   - (mm): 500 x 500, 500 x 500, 500 x 500, 650 x 650

9. **Power supply capacity (Approx.)**
   - (3-phase, 200 V, 50 Hz/200 to 220 V, 60 Hz): Servo valve 4 kVA 4 kVA 5.5 kVA 4.5 kVA 5.5 kVA
   - Hybrid 6.5 kVA 6.5 kVA 8.5 kVA 7 kVA 8 kVA

10. **Recommended breaker capacity (3-phase, 200 V, 50 Hz/220 V, 60 Hz)**
    - Servo valve 30 A 30 A 30 A 30 A 40 A
    - Hybrid 40 A 40 A 50 A 40 A 50 A

11. **Testing machine size (W x D x H)**
    - Loading unit (mm): 780 x 500 x 2000 780 x 500 x 2000 870 x 520 x 2300 960 x 650 x 2400 1060 x 700 x 2800
    - Measurement controller (mm): 740 x 800 x 1800 740 x 800 x 1800 740 x 800 x 1800 740 x 800 x 1800

12. **Testing machine weight**
    - Loading unit (kg): 900 900 1500 1700 2600
    - Measurement controller (kg): 110 110 110 110 110

### Universal Testing Machines Extension Series

When the extension series of universal testing machines are used together with accessories, a wider range of tests can be performed.

For details, refer to the catalogs for accessories and application testing systems.

### Testing Machine Loading Unit with Extended Columns

#### Applicable Testing Machine | Extension Model S | Extension Model M | Extension Model L

<table>
<thead>
<tr>
<th>Series Name</th>
<th>Capacity (kN)</th>
<th>Standard Grip Span (mm)</th>
<th>Extension Length (mm)</th>
<th>Allowable Tensile Force</th>
<th>Extension Length (mm)</th>
<th>Allowable Tensile Force</th>
<th>Extension Length (mm)</th>
<th>Allowable Tensile Force</th>
</tr>
</thead>
<tbody>
<tr>
<td>UH-X</td>
<td>200 300 500 600</td>
<td>800 900 *900</td>
<td>*300</td>
<td>Full force</td>
<td>500 600 200 200</td>
<td>*400</td>
<td>Full force</td>
<td>600 800 200 200</td>
</tr>
<tr>
<td>UH-FX</td>
<td>1000 1100 1200 1300</td>
<td>600 700 *700</td>
<td>*200</td>
<td>Full force</td>
<td>500 600 200 200</td>
<td>*400</td>
<td>Full force</td>
<td>600 800 200 200</td>
</tr>
<tr>
<td>UH-FX</td>
<td>2000 2100 2200 2300</td>
<td>800 900 *900</td>
<td>*300</td>
<td>Full force</td>
<td>500 600 200 200</td>
<td>*400</td>
<td>Full force</td>
<td>600 800 200 200</td>
</tr>
</tbody>
</table>

**NOTE:**
1. In the above table, the * mark indicates the extension length required to mount the thermostatic chamber or furnace.
2. The allowable tensile force is limited at the extended part of the column. The compression force will not be limited.

---

18
**Hydraulic Oil Cooler**

To perform hold control or an equivalent test continuously for 30 minutes or longer, the hydraulic oil cooler may be required.

<table>
<thead>
<tr>
<th>Series Name</th>
<th>Capacity (kN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UH-X</td>
<td>200 300</td>
</tr>
<tr>
<td>UH-FX</td>
<td>500</td>
</tr>
<tr>
<td>UH-1000</td>
<td>600 (UH-X)</td>
</tr>
<tr>
<td>UH-1000NX</td>
<td>1000</td>
</tr>
<tr>
<td>UH-1000/NX</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** Conduct water supply/drain piping work to the position shown in the foundation reference drawing supplied by Shimadzu Corporation.

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**Large-Capacity Series**

<table>
<thead>
<tr>
<th>Capacity (kN)</th>
<th>UH-X/FX Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>UH-2000/NX</td>
</tr>
<tr>
<td>3000</td>
<td>UH-3000/NX</td>
</tr>
<tr>
<td>4000</td>
<td>UH-4000/NX</td>
</tr>
<tr>
<td>2000</td>
<td>UH-F2000/NX</td>
</tr>
<tr>
<td>3000</td>
<td>UH-F3000/NX</td>
</tr>
<tr>
<td>4000</td>
<td>UH-F4000/NX</td>
</tr>
<tr>
<td>6000</td>
<td>UH-6000/NX</td>
</tr>
<tr>
<td>8000</td>
<td>UH-8000/NX</td>
</tr>
</tbody>
</table>

**NOTE:** The large-capacity series is produced at customers’ request. For details, contact your Shimadzu representative.
### UH-X / UH-FX Series — Measurement Controller Standard Specifications

<table>
<thead>
<tr>
<th>1. Loading method</th>
<th>UH-X / UH-FX</th>
<th>UH-Xh / UH-FXh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method</td>
<td>Computer-controlled electro-hydraulic servo system</td>
<td>Computer-controlled electro-hydraulic hybrid system</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Force measurement</th>
<th>Method</th>
<th>UH-X / UH-FX</th>
<th>UH-Xh / UH-FXh</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Precision standard type</td>
<td>Within ±1.0 % of indicated value (when the force is 1/1 to 1/250 of rated value) (Conforming to JIS B7721 Class 1, ISO 7500/1 Class 1, and ASTM E4)*1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High-precision type (option)</td>
<td>Within ±0.5 % of indicated value (when the force is 1/1 to 1/250 of rated value) (Conforming to JIS B7721 Class 0.5, ISO 7500/1 Class 0.5, and ASTM E4)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Force display</th>
<th>Operation unit</th>
<th>Digital display</th>
<th>Min. display resolution: 1/200,000 (300 kN/3000 kN: 1/240,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog force indicator*2</td>
<td>Analog display</td>
<td>Scale plate diameter: 450 mm; Min. scale: 1/1000 (300 kN/3000 kN: 1/600)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Digital display</td>
<td>Min. display resolution: 1/200,000 (300 kN/3000 kN: 1/240,000)</td>
<td></td>
</tr>
</tbody>
</table>

| 4. Stroke measurement display | Measurement with optical encoder; digital display (resolution: 0.01 mm) |

<table>
<thead>
<tr>
<th>5. Automatic load control</th>
<th>Method</th>
<th>Fully closed-loop automatic load control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test control functions</td>
<td>Single test control, Cycle test control (triangular wave, trapezoidal wave), Stress test control, Strain test control, Stroke speed 3-step switching control, Concrete test control (compression, bending, cleavage tests)</td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>Ram stroke control</td>
<td>Speed range: 0.1 mm/min to max. loading speed*3 Control range: Ram return point to max. ram stroke</td>
</tr>
<tr>
<td></td>
<td>Test force control</td>
<td>Speed range: 0.2 % to 500 % full-scale/min Control range: 0.4 % to 100 % of full-scale force</td>
</tr>
<tr>
<td></td>
<td>Strain control</td>
<td>Speed range: 0.1 % to 80 %/min Control range: 5 % to 100 % of full-scale elongation</td>
</tr>
</tbody>
</table>

| 6. Input/output interface | External analog input: 2 CH; External analog output: 2 CH External digital input: 2 CH (optional); Internal amplifiers possible: 2 ports Analog recorder (optional) output, USB function (for computer) / Host (for USB memory) interface, and Dataletty (optional) output |

| 7. Standard function | Auto-test force-strain control (with auto-tuning), Test force auto-zero, Test force auto-calibration, Break detecting (break sensitivity, break level, break peak level, and high sensitivity), Auto-return, Arbitrary stroke speed setting, Stroke speed preset, Cycle count, Stress value display, Displacement meter value display, PEAK/BREAK value display, Test condition files (100 files), Japanese/English display, 5–5 curve display, Specimen protection, Current speed display, and Manual load control |

| 8. Safety devices | Overload automatic stop (When the test force value exceeds 102 % of the full-scale value, the loading pump automatically stops.) Software limit detection (automatically stops test upon reaching limit setting value) Control automatic stop (When an excessive control deviation is reached, the test automatically stops.) |

*1 Calibration is required after installation to provide conformance.
*2 Models without an analog test force indicator are also available.
*3 For the maximum loading speed, refer to the testing machine specifications.