High-Resolution Digimatic Measuring Unit
LITEMATIC VL-50-B/50S-B

Low and constant measuring force of 0.01N, 0.15N, or 1N
Providing low and constant measuring force for high-accuracy inspection of delicate workpieces

LITEMATIC VL-50-B/50S-B

**FEATURES**

- Patent registered (Japan), Patent pending (Japan)
- Ideal for measuring the thickness or height of a workpiece that can be easily affected by the measuring force
  - With a measuring force of only 0.01N, the Litematic is ideal for measuring easily deformed workpieces or high-accuracy components.
  - For workpieces for which 0.01N is insufficient, either the 0.15N or 1N model is recommended.
  - The spindle is motor-driven and stops when the contact point touches the workpiece. From then on, the maximum, minimum, or difference value can be measured using a constant measuring force.

High-accuracy measurement

- High resolution down to 0.01µm and a wide 50mm measurement range. The use of a low thermal-expansion material for the spindle and ceramic for the measuring table minimizes the effect of temperature variation during use. The unit is rust-free, simplifying maintenance and management.

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**Constant measuring force principle**

An unbalanced, parallel-link structure enables the Litematic to offer a low and constant measuring force.

The Litematic’s measuring force is not provided by a spring but comes from a structure resembling a balance scale. We call this a “parallel linkage.” A motorized slider carrying the linked spindle moves down its guideway while the linkage is supported on a stop, as shown in Fig. 1. When the spindle contacts the workpiece (Fig. 2) it moves the linkage up off the stop and the motor is halted. At this point the linkage is now supported by the workpiece, and thus a constant measuring force is applied.

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Separate type VL-50S-B

Because the measuring unit and the display unit are separate, they can be integrated into the user’s measurement system. An optional dedicated stand is also available.

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*The stand (No. 957460) is sold as an option.*
Measurement Applications

**Rubber and plastic**

If the workpiece is soft the risk of indentation may be reduced by replacing the standard contact point with one of larger radius, such as an optional carbide-ball type.

- Plastic
- Rubber
- Keypad

**Glass**

For this type of workpiece the smallest measuring force available is recommended.

- Blue plate glass
- Lenses
- Contact lenses

**Film and sheet**

If the workpiece flexes, making accurate measurement impossible, using a type with a larger measuring force or adding a weight to the spindle may be effective.

- Film
- Flexible substrates
- Various types of sheet

**Precision components**

The Litematic can be used as a high-precision displacement gage.

- Bearing
- Shaft

**Thin sheet metal**

Because the measuring force is small, deformation of the workpiece can be minimized.

- Chassis
- Shimming materials
- Blade springs
- Beverage can materials

**Media discs**

For this type of workpiece the smallest measuring force available is recommended.

- Media tape
- Hard disks
- Various types of disks

**Medical and pharmaceutical products**

If the workpiece is soft the risk of indentation may be reduced by replacing the standard contact point with one of larger radius, such as an optional carbide-ball type.

- Injection needles
- Pills
- Patches and ointments

**Semiconductors**

If the workpiece flexes, making accurate measurement impossible, using a type with a larger measuring force or adding a weight to the spindle may be effective.

- Chips
- Wafers
- Lead frames

**Electronic components**

For this type of workpiece the smallest measuring force available is recommended.

- Printed circuit boards
- Connectors
- Battery components
LITEMATIC VL-50-B/50S-B

FUNCTIONS

• Control panel/Display Unit

• Rear panel (switches and connectors)

<table>
<thead>
<tr>
<th>Key function</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Up</td>
<td>Moves the spindle up only while the key is pressed.</td>
</tr>
<tr>
<td>2) Down</td>
<td>Moves the spindle down only while the key is pressed.</td>
</tr>
<tr>
<td>3) Rapid Up</td>
<td>Moves the spindle up quickly only while the key is pressed.</td>
</tr>
<tr>
<td>4) Rapid Down</td>
<td>Moves the spindle down quickly only while the key is pressed.</td>
</tr>
<tr>
<td>5) ZERO</td>
<td>Sets the origin at any position of the spindle. Also, it zero-sets all display values for difference measurements. The key can be used to clear an error.</td>
</tr>
<tr>
<td>6) PRESET</td>
<td>Allows the currently displayed value to be set from the keyboard, irrespective of spindle position. Often used in conjunction with gauge blocks.</td>
</tr>
<tr>
<td>7) MODE</td>
<td>Selects and sets one of various measurement modes such as MAX/MIN measurement.</td>
</tr>
<tr>
<td>8) LIMIT</td>
<td>Enters tolerance limits for tolerance judgment.</td>
</tr>
<tr>
<td>9) TEACH</td>
<td>Sets up the position memory.</td>
</tr>
<tr>
<td>10) PM1 to PM3</td>
<td>Moves the spindle to a previously stored position with a single keystroke.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Indicator (LED)</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) GO/NG</td>
<td>Displays the result of a GO/NG judgment.</td>
</tr>
<tr>
<td>2) Sign</td>
<td>Lights to display a minus value.</td>
</tr>
<tr>
<td>3) MAX</td>
<td>Lights in the maximum value mode. Both light when the measurement is the difference type (MAX - MIN).</td>
</tr>
<tr>
<td>4) MIN</td>
<td>Lights in the minimum value mode.</td>
</tr>
<tr>
<td>5) WORK</td>
<td>Lights while a workpiece is being measured.</td>
</tr>
<tr>
<td>6) T.H.</td>
<td>Lights when a measurement value is held after measurement has been completed.</td>
</tr>
<tr>
<td>7) C.T.</td>
<td>Lights when the user compensation is set to ON.</td>
</tr>
<tr>
<td>8) UNIT</td>
<td>Lights while the display units are inch. (Lights in the external HOLD mode.)</td>
</tr>
</tbody>
</table>

1) Measurement data output connector (OUT) | Outputs measurement data to a Digimatic mini-processor, etc. |
2) RS-LINK connector (IN/OUT) | Connects multiple devices and can output measurement data from one RS-232 port. |
3) RS-232C connector | For communication with a PC, etc. |
4) External control connector | Used to connect this instrument to an external device for remote control. |
5) GND terminal | — |
6) Foot switch | Foot switch (optional) for controlling measurement operation is connected here. |
7) DC IN | Input connector to receive power from the AC mains adapter. |
8) Power switch | — |
9) AC adapter cord clamp | Prevents AC adapter cord from pulling out. |
10) CONTROL connector: for VL-50S-B only | Gage head connector. |
11) INPUT connector: for VL-50S-B only | Gage head connector. |
### SPECIFICATIONS

**VL-50-B/50S-B**

<table>
<thead>
<tr>
<th>Order No.</th>
<th>318-221A</th>
<th>318-222A</th>
<th>318-223A</th>
<th>318-226A</th>
<th>318-227A</th>
<th>318-228A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring Range*1</td>
<td>0-50mm (0 - 2&quot;)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resolution (selectable)</td>
<td>0.01/0.1/0.0µm (0.000005’/0.000005’/0.000005’)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display unit</td>
<td>Character height 14mm (.6”) digits (excluding “minus” sign)</td>
<td>4/4 Photoelectric reflection linear encoder</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scale type</td>
<td>Stroke</td>
<td>51.5mm (2”) With standard contact point</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accuracy at 20ºC*1</td>
<td>(0.5+L/100)µm L = Measured length (mm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accuracy guarantee temperature*2</td>
<td>20 ± 1ºC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeatability*1</td>
<td>σ = 0.05 µm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measuring force*1</td>
<td>0.01N (approx. 1gf)</td>
<td>0.15N (approx. 15.3gf)</td>
<td>1N (approx. 102gf)</td>
<td>0.01N (approx. 1gf)</td>
<td>0.15N (approx. 15.3gf)</td>
<td>1N (approx. 102gf)</td>
</tr>
<tr>
<td>Spindle feed speed</td>
<td>Approx. 2mm/s (.08”/s) or 4mm/s (.16”/s) (selectable by parameter)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quick feed</td>
<td>Approx. 8mm/s (.3”/s)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard contact point</td>
<td>ø3mm carbide ball</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worktable</td>
<td>ø100 (Ceramic, grooved, replaceable)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input</td>
<td>Data can be input with the foot switch</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output</td>
<td>SPC output, RS-232C output (switching by parameter)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td>85V to 264VAC (connected to AC adapter)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td>Maximum 12W (12V, 1A)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main unit mass</td>
<td>19kg (35.2lbs)</td>
<td>6kg (11lbs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard accessories</td>
<td>• AC adapter: No.357651 • Power cord • Grounding wire: No.934626 • Allen wrench (for replacing the interchangeable contact point)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Optional accessories</td>
<td>Foot switch: 937179T</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dedicated stand: 957460</td>
<td></td>
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<tr>
<td></td>
<td>Output connector (with cover): 024DB440 (for external control)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>RS-LINK/Digimatic connecting cable (1m): 936937</td>
<td>RS-LINK/Digimatic connecting cable (2m): 965014</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Recommended interchangeable contact points: the following dial indicator interchangeable contact points are mountable.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Part No.: 101118 Measuring force*: Approx 0.02N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Part No.: 120059 Measuring force*: Approx 0.03N</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Part No.: 120060 Measuring force*: Approx 0.06N</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Part No.: 120066 Measuring force*: Approx 0.01N</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>02AZE375 Measuring force*: Approx 0.01N to 0.96N</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

* Additional measuring force that is applied when non-standard contact points or VL weights are used.
*1 Using the standard contact point.
*2 Temperature variation must be gradual. The instrument must not be exposed directly to hot or cold drafts.
• Optional weights for the Litematic (No. 02AZE375)

One of the notable characteristics of the Litematic is its small measuring force (0.01N or 0.15N models). However, depending on the characteristics of the workpiece, it may not be possible to transmit a sufficient measuring force and the contact point may appear suspended. To solve such a problem, optional weights are available that attach to the spindle to achieve the appropriate measuring force without damaging the workpiece.

*Cannot be used with VL-50AH, VL-50-100-B, or VL-50S-100-B

### Measuring forces generated by weight combinations for 0.01/0.15N models

<table>
<thead>
<tr>
<th>Measuring force (N)</th>
<th>Extension rod</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.01</td>
<td>0.15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.06</td>
<td>0.21</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.16</td>
<td>0.31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.26</td>
<td>0.41</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.36</td>
<td>0.51</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.46</td>
<td>0.61</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.56</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.65</td>
<td>0.81</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.76</td>
<td>0.91</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.86</td>
<td>—</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.96</td>
<td>—</td>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### External appearance of optional weights

- Weight A: (approximately 0.75gf)
- Weight B: (approximately 1.5gf)
- Weight C: (approximately 5gf)
• Connector terminal Function

1) Applicable plug No. 02ADB440

No. 02ADB440 (with cover) Optional accessory

(3) Input/output circuit

1. Output circuit: When the signal goes to "Low," the transistor turns on.

Open collector output

Counter

External equipment

Reference diagram

Maximum output voltage: 24V
Maximum output current: 20mA
Maximum saturation voltage: 0.7V

2. Input circuit: When the signal goes to "Low," the input is enabled.

Counter

External equipment

Use open-collector output or relay output, etc

Maximum input current: 1mA

MIV:

TD62583 or the equivalent

Pin No. Signal name Input/Output Description (purpose)

1 COM — Common terminal to input and output circuits (internally connected to GND)

2 COM — A related judgment terminal only outputs "L" at error occurrence

3 L1 OUT Tolerance judgment output terminal

A related judgment terminal only outputs "L" at error occurrence

L1, L5 = Outputs "L"

L2, L3, L4 = Outputs "H"

4 L2 OUT

5 L3 OUT

6 L4 OUT

7 L5 OUT

8 NOM OUT

Outputs "L" in the count mode.

21 ULIMIT OUT Outputs "L" at the top dead point of the spindle.

22 WORK OUT Outputs "L" upon detection of a workpiece.

25 SET1 IN Specifies peak selection/motor speed in combination with SET.

26 SET2 IN

28 MODE IN

Peak selection: In combination with SET

Motor control: Specifies a spindle ascent speed along with SET.

30 UP IN

31 DN IN

Motor control: Same function as that of foot switch.

Motor control: Specifies a spindle ascent speed along with SET.

When changing the spindle speed, stops the spindle once and allows 50ms more before change.

When changing the spindle speed, stops the spindle once and allows 50ms more before change.

32 FSIN IN Motor control: Same function as that of foot switch.

34 HOLD IN The display value is held during input.

At error occurrence the error is cleared at the leading edge of this signal.

35 P.SET IN Executes presetting.

Peak clear: The peak value is cleared upon input of the signal during the HOLD signal input in the Peak mode.

N.C. — Unconnected terminals (8, 9, 11-20, 23, 24, 27, 29, 33 and 36 pin terminals)

(4) Timing Chart

1. Power On characteristics

2. External presetting

3. Tolerance judgment result output timing

4. Mode/Up/DN timing

5. HOLD, Error clear

6. RS-232C command input and response output

RS-232C data output time

The maximum output time when the all-data-output command (GA00CRLF) is used can be calculated using the following formula:

Maximum output time [ms] = counter connection count X 20 + connected channel X 17 (8.5) + 6 (3)

* At a transfer speed of 9,600 bps; figures inside ( ) indicate values [in ms] when the speed is 19,200 bps.

(Calculation example) 1 VL unit = MAX43 (31.5) ms (Note: The processing time by the personal computer is not included.)
**RS-232C Communication Function**

### 1. List of commands

<table>
<thead>
<tr>
<th>Command format</th>
<th>Response output</th>
<th>Operation content</th>
</tr>
</thead>
<tbody>
<tr>
<td>GA *** CRFL</td>
<td>G *** CRFL</td>
<td>A display value is output via RS-232C.</td>
</tr>
<tr>
<td>CH *** CRFL</td>
<td>CH *** CRFL</td>
<td>The display is switched to the current value.</td>
</tr>
<tr>
<td>CX *** CRFL</td>
<td>CH *** CRFL</td>
<td>The display is switched to the maximum value.</td>
</tr>
<tr>
<td>CM *** CRFL</td>
<td>CH *** CRFL</td>
<td>The display is switched to the minimum value.</td>
</tr>
<tr>
<td>CR *** CRFL</td>
<td>CH *** CRFL</td>
<td>The display is switched to the TIR value.</td>
</tr>
<tr>
<td>CL *** CRFL</td>
<td>CH *** CRFL</td>
<td>The peak value is cleared.</td>
</tr>
<tr>
<td>CP *** CRFL</td>
<td>CH *** CRFL</td>
<td>A display value is output via RS-232C.</td>
</tr>
</tbody>
</table>

### 2. Pin assignment

- Acceptor specification: D-Sub 9-pin (male), inch thread spec.
- Applicable plug specification: D-Sub 9-pin (female), inch thread spec.
- Commercial cable examples:
  - For DOS/V: KRS-403XF1K (1.5m), Sanwa Supply Corp.
  - For PC-98 series: KRS-423XF1K (1.5m), Sanwa Supply Corp.

### 3. Communication protocol (EIA RS-232C compatible)

- Home position: DTE (terminal) and cross cable are to be used.
- Communication method: Half-duplex, non-procedural.
- Baud rate: 4800, 9600, 19200bps.
- Bit configuration: Start bit: 1, Data bits: (7 or 8) ASCII, uppercase, Parity bit: None, even or odd, Stop bits: 2.
- Communication condition setup: Set with parameters. See "3.3 List of Parameters".

### Digimatic output function

- The number of significant digits in the Digimatic output is 6.

### Data transmission to the PC

#### Input Tool IT-012U

No. 264-012-10

Converts the Digimatic output from Litematic into keyboard signals and transfers to the PC.

Connecting cable (No.536937)

#### Printer

Digimatic mini processor DP-1VR

No. 264-504-5A

Prints the Digimatic output from Litematic.

Connecting cable (No.536937)

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**Notes:**

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