General Purpose Digital Laser Sensor
LV Series
Instruction Manual

Safety Precautions

Warning
• This is the product for detecting the target object. Do not use it in the safety circuit such as the human body protection circuit.
• This product does not have the explosion-proof construction. Do not use it in the inflammable atmosphere such as atmosphere gas, liquid or dust.

Laser safety precautions

Warning
• Use of controls or adjustments, or the performance of procedures other than those specified herein, may result in hazardous radiation exposure.
• Do not look directly at the laser beam.
• Do not disassemble the sensor head. Laser emission from the LV Series is not automatically stopped if the sensor head is disassembled. If you disassemble the sensor head for inspection or repair, you may be exposed to the laser beam. If the LV Series malfunctions, contact KEYENCE immediately.
• Do not look directly at the laser beam. Looking directly at the laser beam may result in serious eye injury.
• Protective enclosure
It is recommended that you install a protective enclosure around the sensor head to prevent anyone from getting near the sensor head during operation.
• Protective goggle
It is recommended that you wear protective goggle when using the LV Series.
• When using the LV Series, follow these instructions.
• Stop laser emissions before cleaning the laser emission port.
• Failure to stop the laser emission may expose eyes or skin to the laser beam.
• Check the laser beam path.
To prevent exposure to the laser beam due to specular or diffuse reflection, install a screen which offers the appropriate reflectance and temperature characteristics to interrupt the reflected laser beam. Do not install the LV Series in such a way that the laser beam passes at eye height.

Specifications of the laser diode change depending on the model. Refer to the tables below.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wavelength</td>
<td>650 nm</td>
<td>785 nm</td>
</tr>
<tr>
<td>Maximum output</td>
<td>3 mW</td>
<td>2.5 mW</td>
</tr>
<tr>
<td>FDA class</td>
<td>II</td>
<td>1</td>
</tr>
<tr>
<td>IEC class</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Safety features

- **Laser ON alarm indicator**
The laser ON alarm indicator will start flashing after power is turned on. The lamp will remain ON for as long as the laser light is emitting. This alarm indicator can be seen even when wearing protective goggles.

- **Laser emission stop input (LV-21A/21AP/51M/51MP/11A)**
Laser emission can be stopped by short-circuiting between the purple and blue (GND) wires when LV-21A, LV-51M or LV-11A used. When LV-21AP or 51MP is used, short-circuit between the purple and brown (12 to 24 V DC) wires to stop laser emission.

- **Label location**
Warning labels are attached to the sensor head, as shown below.

- **Warning labels**

  - IEC CLASS 2 (LV-H32 only)
  - IEC (French) CLASS 2 (LV-H32 only)
  - DIN Klasse 2 (LV-H32 only)
  - Laser CLASS II warning labels (FDA CLASS II)
  - Aperture label
  - Protective housing label

- **Safety consideration**

  Warning
Follow the safety precautions below to ensure operator safety:

  - Operate the LV Series only according to the procedures described in this instruction manual.
  - Otherwise, injury may occur due to exposure to the laser beam.
  - Do not disassemble the sensor head. Laser emission from the LV Series is not automatically stopped if the sensor head is disassembled. If you disassemble the sensor head for inspection or repair, you may be exposed to the laser beam. If the LV Series malfunctions, contact KEYENCE immediately.
  - Do not look directly at the laser beam. Looking directly at the laser beam may result in serious eye injury.
  - Protective enclosure
It is recommended that you install a protective enclosure around the sensor head to prevent anyone from getting near the sensor head during operation.
  - Protective goggle
It is recommended that you wear protective goggle when using the LV Series.
  - When using the LV Series, follow these instructions.
  - Stop laser emissions before cleaning the laser emission port.
  - Failure to stop the laser emission may expose eyes or skin to the laser beam.
  - Check the laser beam path.
To prevent exposure to the laser beam due to specular or diffuse reflection, install a screen which offers the appropriate reflectance and temperature characteristics to interrupt the reflected laser beam. Do not install the LV Series in such a way that the laser beam passes at eye height.
When A, which is closer to the amplifier, is ON, the monitor displays the excess gain of output A. When B is ON, the monitor displays the excess gain of output B.

Sensor head

- **Bar LED monitor (sensor head)**
  When A, which is closer to the amplifier, is ON, the monitor displays the excess gain of output A. When B is ON, the monitor displays the excess gain of output B.

- **Bar Graph LED monitor (Interlocked with amplifier)**
  The indicator turns on according to the difference between the received light intensity and the setting value. The current level of detection stability can be determined from this difference.

  - Light is steadily received
  - Setting value
  - Light is steadily interrupted

  If detection becomes unstable (light cannot be "steadily received" or "steadily interrupted") due to a change in the surroundings or the target, or for any other reason, readjust the sensitivity.

- **Slit for sensor head (Option for LV-H41/H42/H47/H51/H52)**
  Use in accordance with the distance and target.

  - **Attaching the slit**
    Attach the slit to the transmitter
  - **Removing the slit**
    Remove the slit by lifting up the pin on the slit with a screwdriver.

**Part Names**

**Amplifier**

- **Bar LED Monitor**

  - Light is steadily received
  - Light is irregularly received
  - Light is irregularly interrupted
  - Light is steadily interrupted

**LV-H51/H52**

- Transmitter
  - Receiver

**LV-H35/H62/H67**

- Transmitter, Receiver

**LV-H300**

- Transmitter side (T)
  - Receiver side (R)

**LV-H64/H65**

- Transmitter, Receiver

**LV-H100**

- Transmitter
  - Receiver (side R)

**LV-H37/H47**

- Transmitter
  - Receiver

**LV-H64/H65**

- Transmitter
  - Receiver (side R)

**LV-H300**

- Transmitter side (T)
  - Receiver side (R)

**LV-H37/H47**

- Transmitter
  - Receiver

**LV-H100**

- Transmitter
  - Receiver (side R)

**LV-H35/H62/H67**

- Transmitter, Receiver

**LV-H300**

- Transmitter side (T)
  - Receiver side (R)

**LV-H37/H47**

- Transmitter
  - Receiver

**LV-H100**

- Transmitter
  - Receiver (side R)
**Accessories**

### Amplifier

- **Amplifier**
  - Mounting bracket (LV-21A/21AP/51M/51MP/11A only)
  - End unit (LV-22A/22AP/52/52P only)

### Sensor head

- **LV-H32**
  - Plastic driver
  - Mounting bracket

- **LV-H35**
  - Mounting bracket

- **LV-H37**
  - Magnifying glass
  - Mounting bracket

- **LV-H41/H42**
  - Slit (black, gray)
  - Mounting bracket

- **LV-H47**
  - Slit (black, gray)
  - Mounting bracket

### LV-H51/H52

- **Stir**
  - Mounting bracket

### LV-H62

- **Reflector**
  - Mounting bracket

### LV-H64/H65

- **Reflector**
  - Mounting bracket

### LV-H67

- **Reflector**
  - Mounting bracket

### LV-H100

- **Transmitter side (T)**
  - Receiver side (R)
  - Gray cable
  - Black cable

### LV-H300

- **Transmitter side (T)**
  - Receiver side (R)
  - Gray cable
  - Black cable

### Input/Output Circuit Diagram

#### LV-11A/21A/51M

- Blue
- Purple or Pink
- Brown 12 to 24 V DC
- 0 V DC
- Black

#### LV-22A/52

- Black
- Green
- Red
- White
- Laser radiation interruption input
- Control output A
- Control output B
- 12 to 24 V DC
- 5 to 40 V DC

#### LV-21AP/51MP

- Black
- Green
- Red
- White
- Laser radiation interruption input
- Control output A
- Control output B
- 12 to 24 V DC
- 0 V DC

#### LV-22AP/52P

- Black
- Green
- Red
- White
- Laser radiation interruption input
- Control output A
- Control output B
- 12 to 24 V DC

#### Laser radiation interruption

- (Main unit only)
- External tuning input circuit diagram

#### Analog output circuit diagram for monitor (LV-51M/51MP)

#### LV-21A/11A/51M

- Blue
- Purple
- Orange
- 0 V

* LV-51M (monitor output) only is orange.

#### LV-21AP/51MP

* LV-51MP (monitor output) only is orange.
### Mounting Amplifiers

#### Mounting and detaching amplifiers to and from the DIN rail mounting bracket

Hook the claw on the rear of the amplifier onto the mounting bracket of the DIN rail, then hook the front claw on the bracket while pressing the amplifier forward. To detach the amplifier, unhook the front claw by simultaneously lifting and pushing the amplifier forward.

#### Mounting additional amplifiers

The number of expansion units that can be mounted to the side of main unit (LV-11A/21A/51M) is as shown below.

<table>
<thead>
<tr>
<th>Number</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 7</td>
<td>LV-22A, LV-52, AP-V42</td>
</tr>
<tr>
<td>Up to 14</td>
<td>FS-T3/M2/V12/V22/PS-T3/ES-M2</td>
</tr>
</tbody>
</table>

1. Remove the protective cover on the side of the amplifier.
2. Mount expansion units one by one to the DIN rail.
3. Slide one expansion unit toward the main unit or other unit. Align the front claws of the units and push them together until you hear a click.
4. Secure the units together by pushing the end units (included with the expansion unit) from both sides.

* The sticker on the right is included with the expansion unit. Attach this sticker near the amplifier.

#### Detaching amplifiers

1. Take off the end unit.
2. Slide the expansion units. Remove them one by one from the DIN rail.

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### Mounting the Senser Head

#### Mounting the reflection type

1. Insert the connector into the amplifier and lock it with the lever. Pass the cable underneath the lever and close the dust cover.

#### Mounting the transmission type

1. Insert the two connectors into the amplifier unit and lock them with the lever. Insert the transmitter side connector (with gray cable) into the light gray lever side, and insert the receiver side connector (with black cable) into the dark gray lever side. Route the cable underneath the lever and close the dust cover.

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### Important

- When connecting several amplifiers, always use a DIN rail and end unit.
- Take care to turn the power off before connecting/disconnecting amplifiers.
- Do not remove the protective cover from the expansion connector of the outermost unit.
- Do not detach multiple units from the DIN rail while they are still connected to each other.
- If several units are connected, check that the ambient temperature is appropriate. *Specifications* (page 8).

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### To shorten the sensor head cable

1. Process the end of the cable as shown below.
2. Tilt the top in the direction of the arrow on the left side of the top, then open the connector.
3. Insert the cable with the shield wire bent at 90°, then bend the shield wire in the direction of the arrow along the groove. Match the color of the connector to the color of the shield wire.
4. Close the connector, and lock it by pushing down the top.
5. Using nippers or a similar tool, trim the wires sticking out from the connectors.

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**Note:**

- Main unit
- Expansion units
- End unit (incl. with expansion units)
- Up to 14 expansion units can be added.

**Important:**

- When connecting several amplifiers, always use a DIN rail and end unit.
- Take care to turn the power off before connecting/disconnecting amplifiers.
- Do not remove the protective cover from the expansion connector of the outermost unit.
- Do not detach multiple units from the DIN rail while they are still connected to each other.
- If several units are connected, check that the ambient temperature is appropriate. *Specifications* (page 8).
Sensitivity Adjustment

**Two-point tuning**

1. With no target in place, press the $S$ button lightly.
2. Put a target in place and press the $S$ button again lightly.

**Maximum sensitivity setting**

For the reflection type sensor, adjust the sensitivity without using target. For the transmission type sensor, adjust the sensitivity by using target.

**Transmission type**

1. According to the directions on the left, press the $S$ button for 3 seconds or more.
2. Confirm that the calibration indicator (orange LED) and setting monitor (green LED) are flashing.
3. Release the $S$ button.

**Automatic tuning**

1. Pass a target through the optical axis while pressing the $S$ button.
2. Confirm that the calibration indicator (orange LED) and setting monitor (green LED) are flashing.
3. Release the $S$ button.

**Positioning tuning**

1. With no target in place, press the $S$ button lightly (orange LED lights up).
2. Place a target in the position where it should stop.
3. Press the $S$ button for 3 seconds or more until the calibration indicator (orange LED) and setting monitor (green LED) are flashing.

Reference:

Differentiation Mode Detection (UP/DOWN edge)

- **UP edge detection:** Output is turned ON when light intensity increases by more than the setting value within a fixed time interval.
- **DOWN edge detection:** Output is turned ON when light intensity decreases by more than the setting value within a fixed time interval.

To achieve stable detection in differentiation mode, changes in received light intensity resulting from the presence or absence of the target must be greater than the changes in received light intensity resulting from dust or vibration.

**Fine Adjustment of Setting Values**

The values displayed on the calibration LED monitor can be changed by pressing $+$ (to increase sensitivity) or $-$ (to decrease sensitivity). This allows you to fine-tune your setting values.

**Selecting Display Modes**

The display changes each time the $M$ MODE button is pressed. The received light intensity/excess gain hold display appears only after peak/bottom hold is selected in the hold mode.

**Output state**

<table>
<thead>
<tr>
<th>D.ON</th>
<th>N.C. output</th>
<th>N.C. output</th>
</tr>
</thead>
<tbody>
<tr>
<td>L.ON</td>
<td>N.O. output</td>
<td>N.O. output</td>
</tr>
</tbody>
</table>

Note

If you press the $S$ button accidentally while performing a fine adjustment of your setting values, a sensitivity calibration will start automatically and prevent you from continuing your fine adjustment until the calibration is completed. If this happens, press the $S$ button again to cancel the setting and start your fine adjustment again. The value may not change by 1 digit during fine-tuning adjustments. This is not a malfunction.

**Setting value display**

Displays setting value.

**Received light intensity display**

Displays received light intensity.

**Excess gain display**

Shows the received light intensity as a percentage of the setting value (setting value = 100%). This display cannot be shown when the standard light intensity display is selected.

Note

The displayed value for excess gain is 0 when the excess gain is less than 1%.
If you press the **M** button for three seconds or more when either **1-1** or **1-2** is displayed, you can display the values of various settings. Each setting can be adjusted separately for channel A and channel B.

### Reference:
When the **M** button is pressed for 3 seconds or more during mode setting, the display returns to the received light intensity display.

#### Mode Setting

<table>
<thead>
<tr>
<th>1. Initial display</th>
<th>Press <strong>M</strong> once lightly.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>2. Selecting power mode</th>
<th>Select a power mode to use for <strong>A</strong> or <strong>B</strong>.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Press <strong>M</strong> once lightly.</td>
<td><strong>FINE</strong> : Set to this mode for detecting high-speed targets.</td>
</tr>
<tr>
<td></td>
<td><strong>TURBO</strong> : Set to this mode for regular detection work.</td>
</tr>
<tr>
<td></td>
<td><strong>SUPER</strong> : Set to this mode when there is insufficient light.</td>
</tr>
</tbody>
</table>

Be sure to adjust the sensitivity again after switching POWER mode.

<table>
<thead>
<tr>
<th>3. Selecting detection method</th>
<th>Select a detection mode to use for <strong>A</strong> or <strong>B</strong>.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Press <strong>M</strong> once lightly.</td>
<td><strong>STANDARD 1</strong> : Use this mode to increase hysteresis.</td>
</tr>
<tr>
<td></td>
<td><strong>STANDARD 2</strong> : Detects the UP edge of received light change.</td>
</tr>
<tr>
<td></td>
<td><strong>DIFFERENTIATION</strong> : Detect the DOWN edge of received light change.</td>
</tr>
<tr>
<td></td>
<td><strong>NORM</strong> : This mode is skipped during the regular detection work.</td>
</tr>
<tr>
<td></td>
<td><strong>ABSOLUTE</strong> : Set this mode for detecting targets with a wide range of light intensity.</td>
</tr>
</tbody>
</table>

Selecting no timer

<table>
<thead>
<tr>
<th>4. Selecting display shift</th>
<th>By pressing <strong>M</strong> once lightly, the received light intensity display will shift to a value of 0. Also, fine adjustments of display shift can be done using <strong>A</strong> or <strong>B</strong>.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Press <strong>M</strong> once lightly.</td>
<td><strong>STANDARD</strong> : Displays the data in accordance with the received light intensity.</td>
</tr>
<tr>
<td></td>
<td><strong>DIGITAL</strong> : Displays the data in accordance with the interrupted light intensity.</td>
</tr>
<tr>
<td></td>
<td><strong>NON-DISPLAY</strong> : Displays the interrupted light intensity.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5. Selecting hold mode</th>
<th>Select a hold mode to use for <strong>A</strong> or <strong>B</strong>.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Press <strong>M</strong> once lightly.</td>
<td><strong>NO HOLD</strong> : Display is not held.</td>
</tr>
<tr>
<td></td>
<td><strong>PEAK HOLD</strong> : Peak value is held on the display.</td>
</tr>
<tr>
<td></td>
<td><strong>BOTTOM HOLD</strong> : Minimum value is held on the display.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6. Selecting timer mode</th>
<th>Select a timer mode to use for <strong>A</strong> or <strong>B</strong>.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Press <strong>M</strong> once lightly.</td>
<td><strong>NO TIMER</strong> : Set to this mode for regular detection work.</td>
</tr>
<tr>
<td></td>
<td><strong>OFF DELAY</strong> : Use for output OFF delay.</td>
</tr>
<tr>
<td></td>
<td><strong>ON DELAY</strong> : Use for output ON delay.</td>
</tr>
<tr>
<td></td>
<td><strong>ONE SHOT</strong> : Use for one-shot output.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>7. Timer setting</th>
<th>Set the timer for <strong>A</strong> or <strong>B</strong>.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Press <strong>M</strong> once lightly.</td>
<td><strong>MIN. 1 ms to max. 9999 ms</strong></td>
</tr>
</tbody>
</table>

*"LV-51M505/51MP53P only"

1-1. Setting the standard light intensity

<table>
<thead>
<tr>
<th>Press <strong>M</strong> once lightly.</th>
<th><strong>A</strong> displays the received light intensity.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>B</strong> displays the interrupted light intensity.</td>
<td></td>
</tr>
</tbody>
</table>

1-2. Registering the standard light intensity

<table>
<thead>
<tr>
<th>Press <strong>M</strong> once lightly.</th>
<th><strong>A</strong> displays the received light intensity.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>B</strong> displays the interrupted light intensity.</td>
<td></td>
</tr>
</tbody>
</table>

1-3. Changing the number of display digits

The last digit of digital display can be set to non-display. Select a value to be displayed in the digital display (green) by using **A** or **B**.

Ex. When **A-5** is selected in 1-1

**Note**

When the standard light intensity is set, the detection mode is fixed to "Standard Detection 1".
Initializing Settings (Initial Reset)

All settings can be reset to their original values (factory defaults).
This can be done only when the operation button is not locked.

1. In the state of the received light intensity display, press \( \mathcal{S} \) five times, while pressing \( \mathcal{M} \). \( \begin{array}{c} \text{PH} \quad \text{BH} \quad \% \end{array} \)

2. When \( \mathcal{S} \) is displayed on the digital LED monitor, press \( \mathcal{S} \) once.
   (When \( \mathcal{S} \) is pressed here instead of \( \mathcal{S} \) the monitor returns to the received light intensity display without being reset)

3. \( \begin{array}{c} \text{PH} \quad \text{BH} \quad \% \end{array} \) is displayed on the setting monitor for three seconds and then \( \begin{array}{c} \text{PH} \quad \text{BH} \quad \% \end{array} \) is displayed. Initialization is now complete. The received light intensity display will appear on the monitor again.

Initial settings

<table>
<thead>
<tr>
<th>Setting</th>
<th>Output A / Output B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard light intensity*1</td>
<td>OFF</td>
</tr>
<tr>
<td>Power mode*2</td>
<td>TURBO</td>
</tr>
<tr>
<td>Detection methods</td>
<td>Standard output 1</td>
</tr>
<tr>
<td>Display shift</td>
<td>Shift value: 0</td>
</tr>
<tr>
<td>Hold mode</td>
<td>No hold display</td>
</tr>
<tr>
<td>Timer mode</td>
<td>No timer</td>
</tr>
<tr>
<td>Timer</td>
<td>10 ms</td>
</tr>
<tr>
<td>Output setting</td>
<td>D. ON: 46, L. ON: 30 (82 for LV-H62)</td>
</tr>
</tbody>
</table>

*1: LV-51M/52/51MP/52P only
*2: For LV-51M/52/51MP/52P, FINE only

Selecting Channels

The LV Series can perform two different types of sensitivity settings.

1. Press \( \mathcal{S} \) or \( \mathcal{S} \) quickly while holding down \( \mathcal{M} \).
2. Channel indicator for set up mode starts flashing.
3. Release \( \mathcal{M} \)

Note: While tuning sensitivity or setting modes such as power mode, it is not possible to select channels.

Selecting Output Mode

Three types of output modes can be selected.

<table>
<thead>
<tr>
<th>Switch</th>
<th>Output A</th>
<th>Output B</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>L. ON</td>
<td>(Output ON when light is interrupted)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. ON</td>
<td>(Output ON when light is interrupted)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D. ON</td>
<td>(Output ON when light is interrupted)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Key Lock

The operation button can be locked to prevent anyone accidentally touching the operation button and changing settings.

■ Turning on Key Lock
Press \( \mathcal{S} \) or \( \mathcal{S} \) for three seconds or more while pressing \( \mathcal{M} \). \( \mathcal{S} \) will start flashing on the display.

■ Releasing Key Lock
Press \( \mathcal{S} \) or \( \mathcal{S} \) for three seconds or more while pressing \( \mathcal{M} \). \( \mathcal{S} \) will start flashing on the display.

When Key Lock is on, all settings except selecting display, selecting output and display settings remain disabled until Key Lock is released.

Adjusting Sensitivity via External Signals (External Tuning)

This is the function of the LV-11A/21A/21AP. You cannot use this function with LV-51M/51MP.

1. Lock the operation button

Important: The operation button must be locked to perform external tuning.

2. Connect the pink cable to a switch or PLC.

3. Making a short circuit between the pink cable and blue cable has the same effect as pressing \( \mathcal{S} \).

Note: Minimum input time is 20 ms.

Error Messages

If any of the following errors appear on the LED display, check the amplifier or sensor unit according to the countermeasures listed below.

<table>
<thead>
<tr>
<th>Error Message</th>
<th>Problem description</th>
<th>Countermeasures</th>
</tr>
</thead>
<tbody>
<tr>
<td>brt</td>
<td>The sensor head is not connected, sensor is inserted in a wrong connector, or the sensor head cable has an open circuit.</td>
<td>Check for an open circuit in the head cable, and that the sensor is connected to the correct connector.</td>
</tr>
<tr>
<td>outld</td>
<td>Excessive current in output cable.</td>
<td>Check the load and adjust to within rated values.</td>
</tr>
<tr>
<td>Err</td>
<td>Data error</td>
<td>Perform the initial reset.</td>
</tr>
</tbody>
</table>

Note: If an error message other than the above is displayed, contact KEYENCE.
**Caution on usage of QL (LV-20A only)**

- When you want to monitor the received light intensity in a PLC using the KEYENCE QL-R01, note that the indication will be limited in the range of 0 to 4095, and that the threshold value that can be written in LV using the QL-R01 is up to 4095 (common to all of FINE, TURBO and SUPER TURBO).
- Monitoring of the received light intensity and writing of the threshold value using QL-R01 are possible in the LV-20A only.
- Up to eight expansion units can be mounted on the QL-R01 provided all the expansion units are the LV-20A. Refer to "Mounting additional amplifier" (page 4) and the instruction manual for the QL-R01.
- LV requires two QL channels because a single LV unit has two output channels.
- Restrictions due to compliance with EMC Directive: When linking four LVs or more to the QL-R01, install a ferrite core to the root of the QL-R01 cable.

**Specifications**

### Amplifier

<table>
<thead>
<tr>
<th>Model</th>
<th>NPN output</th>
<th>PNP output</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LV-21A</td>
<td>LV-21AP</td>
</tr>
<tr>
<td></td>
<td>LV-22A</td>
<td>LV-22AP</td>
</tr>
<tr>
<td></td>
<td>LV-20A</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>LV-11A</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>LV-51M</td>
<td>LV-52P</td>
</tr>
</tbody>
</table>

- **Supported sensor head**
  - LV-H32/H35/H37/H42/H47/H52/H64/H65/H67
  - LV-H41/H51
  - LV-H100/H300
- **FDA class**
  - class II
  - class I
  - class II
- **IEC class(JIS)**
  - class 2
  - class 1
  - class 2
- **Main unit/expansion unit**
  - Main unit
  - Expansion unit (1 line)
  - Expansion unit (0 line)
  - Main unit
  - Main unit
  - Expansion unit (1 line)

- **Response time**
  - FINE: 80 µs
  - TURBO: 500 µs
  - SUPER: 4 ms
  - FINE: 500 µs
  - TURBO: 2 ms
  - SUPER: 8 ms

- **Operation mode**
  - LIGHT-ON/DARK-ON (switch selectable)

- **Indicators**
  - Output display x 2, Digital LED monitor (light intensity monitor, setting monitor), Bar LED monitor, Laser ON alarm indicator

- **Detection modes**
  - STANDARD 1, STANDARD 2, UP edge, DOWN edge, separate settings for ch A/B (Except the mode in which the standard light intensity setting is in progress)

- **Timer function**
  - OFF DELAY/ON DELAY/ONE SHOT, separate settings for ch A/B, timer 1 to 9999 ms variable

- **Laser emission stop input**
  - Non-voltage input, stop during laser radiation, input time: at least 20 ms (Main unit only)

- **External tuning input**
  - Non-voltage input, input time: at least 20 ms (LV-51M/51MP do not support this item)

- **Control output**(3)
  - NPN output
  - PNP output

- **Analog output for monitor**
  - 1 to 4 V voltage output, 1 to 4 V across load resistance of at least 20 kΩ

- **Protection circuit**
  - Reverse-polarity protection, overcurrent protection, surge absorber

- **Protection**
  - Power voltage: DC 12 to 24V ±10% max., Ripple (P-P) 10% max.(3)
  - Power consumption (current consumption): 1.5 W (12 V:125 mA, 24 V:62.5 mA)

- **Environmental resistance**
  - Ambient temperature: -10 to +55 °C (14 to 131 °F), No freezing(4)
  - Relative humidity: 35 to 85%, No condensation
  - Vibration resistance: 10 to 55 Hz, 1.5 mm double-amplitude in X, Y, and Z direction: 2 hours per axis

### Important

- When you want to monitor the received light intensity in a PLC using the KEYENCE QL-R01, note that the indication will be limited in the range of 0 to 4095, and that the threshold value that can be written in LV using the QL-R01 is up to 4095 (common to all of FINE, TURBO and SUPER TURBO).
- Monitoring of the received light intensity and writing of the threshold value using QL-R01 are possible in the LV-20A only.
- Up to eight expansion units can be mounted on the QL-R01 provided all the expansion units are the LV-20A. Refer to "Mounting additional amplifier" (page 4) and the instruction manual for the QL-R01.
- LV requires two QL channels because a single LV unit has two output channels.
- Restrictions due to compliance with EMC Directive: When linking four LVs or more to the QL-R01, install a ferrite core to the root of the QL-R01 cable.

### Mutual Interference Suppression

The LV Series is equipped with a mutual interference suppression function. Please note, however, that this mutual interference suppression function will not work when two main units are used together.

- **When additional sensor head units are installed, mutual interference suppression allows the units to be positioned close together. The number of units with which mutual interference suppression will work depends on the selected power mode.**

<table>
<thead>
<tr>
<th>Power mode</th>
<th>FINE</th>
<th>TURBO</th>
<th>SUPER</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of units free</td>
<td>Not possible</td>
<td>2 *</td>
<td>4 *</td>
</tr>
</tbody>
</table>

  * Total (main unit plus expansion units)

### Interruption of Laser Radiation

A short circuit between the laser blue and red conductors will cause laser radiation to be interrupted (min. input time: 20 ms).

- **This function is available only with the main unit.**
  - Even when expansion units (LV-23A/23AP/52/52AP) are connected, laser radiation stops only from the main unit.

---

**Supported senser head**

- LV-H32/H35/H37/H42/H47/H52/H64/H65/H67
- LV-H41/H51
- LV-H100/H300

**FDA class**

- class II
- class I
- class II

**IEC class(JIS)**

- class 2
- class 1
- class 2

**Main unit/expansion unit**

- Main unit
- Expansion unit (1 line)
- Expansion unit (0 line)
- Main unit
- Main unit
- Expansion unit (1 line)

**Response time**

- FINE: 80 µs
- TURBO: 500 µs
- SUPER: 4 ms
- FINE: 500 µs
- TURBO: 2 ms
- SUPER: 8 ms

**Operation mode**

- LIGHT-ON/DARK-ON (switch selectable)

**Indicators**

- Output display x 2, Digital LED monitor (light intensity monitor, setting monitor), Bar LED monitor, Laser ON alarm indicator

**Detection modes**

- STANDARD 1, STANDARD 2, UP edge, DOWN edge, separate settings for ch A/B (Except the mode in which the standard light intensity setting is in progress)

**Timer function**

- OFF DELAY/ON DELAY/ONE SHOT, separate settings for ch A/B, timer 1 to 9999 ms variable

**Laser emission stop input**

- Non-voltage input, stop during laser radiation, input time: at least 20 ms (Main unit only)

**External tuning input**

- Non-voltage input, input time: at least 20 ms (LV-51M/51MP do not support this item)

**Control output**(3)

- NPN output
- PNP output

**Analog output for monitor**

- 1 to 4 V voltage output, 1 to 4 V across load resistance of at least 20 kΩ

**Protection circuit**

- Reverse-polarity protection, overcurrent protection, surge absorber

**Protection**

- Power voltage: DC 12 to 24V ±10% max., Ripple (P-P) 10% max.(3)
- Power consumption (current consumption): 1.5 W (12 V:125 mA, 24 V:62.5 mA)

**Environmental resistance**

- Ambient temperature: -10 to +55 °C (14 to 131 °F), No freezing(4)
- Relative humidity: 35 to 85%, No condensation
- Vibration resistance: 10 to 55 Hz, 1.5 mm double-amplitude in X, Y, and Z direction: 2 hours per axis

**Materials**

- Main body & cover: Polycarbonate

**Ratings**

- Weight (incl. 2-m cable): Approx. 120 g Approx. 75 g Approx. 35 g Approx. 120 g Approx. 120 g Approx. 75 g

---

(1) For use with FS-R0 as main unit. If you wish to use the QL-R01 as the main unit, contact KEYENCE.
(2) No control output cable for LV-20A.
(3) The power for LV-20A/22A/22AP/52/52AP is supplied from the main unit.
(4) With additional units connected, the allowable ambient temperature range varies as follows.
  - 2 to 5 units connected: -10 to +50°C (14 to 122°F)
  - 6 to 7 units connected: -10 to +45°C (14 to 113°F)

Note also that the expansion unit cannot be used as it is.
### Specifications

#### Sensor head specifications 1

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Light source</td>
<td>Visible red semiconductor laser, Wavelength: 650 nm, 3 mW max.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Supported amplifier unit</td>
<td></td>
<td>LV-21A / 22A / 20A / 21AP / 22AP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FDA class</td>
<td></td>
<td>class II</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>IEC class(JIS)</td>
<td></td>
<td>class 2</td>
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</tbody>
</table>

#### Detection distance

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>LV-H32</td>
<td>30 to 250 mm</td>
<td>150 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LV-H35</td>
<td>30 to 250 mm</td>
<td>150 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LV-H37</td>
<td>30 to 250 mm</td>
<td>150 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LV-H42</td>
<td>30 to 250 mm</td>
<td>150 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LV-H47</td>
<td>30 to 250 mm</td>
<td>150 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LV-H52</td>
<td>30 to 250 mm</td>
<td>150 mm</td>
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</tr>
</tbody>
</table>

#### Beam spot shape

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>LV-H32</td>
<td>approx. ø2 mm</td>
<td>approx. ø50 mm (distance 70 mm)</td>
<td>Detection distance 150 mm</td>
<td>Area width: approx. 77 mm</td>
<td>(Slit black: approx. 18 mm)</td>
<td>(Slit gray: approx. 7 mm)</td>
</tr>
<tr>
<td>LV-H35</td>
<td>approx. ø2 mm</td>
<td>approx. ø50 mm (distance 70 mm)</td>
<td>Detection distance 150 mm</td>
<td>Area width: approx. 77 mm</td>
<td>(Slit black: approx. 18 mm)</td>
<td>(Slit gray: approx. 7 mm)</td>
</tr>
<tr>
<td>LV-H37</td>
<td>approx. ø2 mm</td>
<td>approx. ø50 mm (distance 70 mm)</td>
<td>Detection distance 150 mm</td>
<td>Area width: approx. 77 mm</td>
<td>(Slit black: approx. 18 mm)</td>
<td>(Slit gray: approx. 7 mm)</td>
</tr>
<tr>
<td>LV-H42</td>
<td>approx. ø2 mm</td>
<td>approx. ø50 mm (distance 70 mm)</td>
<td>Detection distance 150 mm</td>
<td>Area width: approx. 77 mm</td>
<td>(Slit black: approx. 18 mm)</td>
<td>(Slit gray: approx. 7 mm)</td>
</tr>
<tr>
<td>LV-H47</td>
<td>approx. ø2 mm</td>
<td>approx. ø50 mm (distance 70 mm)</td>
<td>Detection distance 150 mm</td>
<td>Area width: approx. 77 mm</td>
<td>(Slit black: approx. 18 mm)</td>
<td>(Slit gray: approx. 7 mm)</td>
</tr>
<tr>
<td>LV-H52</td>
<td>approx. ø2 mm</td>
<td>approx. ø50 mm (distance 70 mm)</td>
<td>Detection distance 150 mm</td>
<td>Area width: approx. 77 mm</td>
<td>(Slit black: approx. 18 mm)</td>
<td>(Slit gray: approx. 7 mm)</td>
</tr>
</tbody>
</table>

#### Environmental resistance

<table>
<thead>
<tr>
<th></th>
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<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient illumination</td>
<td>Incandescent light: 10,000 lux max.</td>
<td>Sunlight: 20,000 lux max.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>-10 to +55°C (14 to 131°F), No freezing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relative humidity</td>
<td>35 to 85%, No condensation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibration resistance</td>
<td>10 to 55 Hz, 1.5 mm double amplitude in X, Y and Z directions: 2 hours per direction</td>
<td></td>
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#### Materials

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Case</td>
<td>Glass-reinforced resin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lens (cover)</td>
<td>Acrylic, Polyalylate</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Transmitter: Glass</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Receiver: Polyalylate</td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Accessories</td>
<td></td>
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</tbody>
</table>

#### Weight (incl. 2-m cable)

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<tr>
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</thead>
<tbody>
<tr>
<td>approx. 45 g</td>
<td></td>
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<td></td>
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<tr>
<td>approx. 55 g</td>
<td></td>
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</tbody>
</table>
Hints on Correct Use

- To extend the amplifier cable length, use a cable that has a cross-sectional area of at least 0.3 mm². Limit the length of cable extensions to 100 m. (For further information on connecting several units contact KEYENCE)
- Placing the amplifier cable together in the same conduit with power lines or high voltage lines may cause detection errors due to interference or sensor damage. For this reason, always isolate the amplifier cable from these lines.
- If using a commercial switching regulator, make sure to ground both the frame ground terminal and ground terminal.
- Do not use the LV Series outdoors, or in any location where extraneous light can directly enter the light receiving surface.
- At the maximum sensitivity setting, detection distance may vary somewhat due to slight differences in the characteristics of individual units.
- Improper wiring may cause the amplifier to become hot or alter sensitivity. (Input/Output Circuit Diagram: page 7)
- Do not use connectors for sensor head-to-amplifier connections more than 100 times.
- Displayed values may vary due to surrounding conditions (e.g. temperature changes, dust)

Cautions on using the LV-H62/H67

- Use FINE mode when there are any white or mirror-surfaced objects near the sensor head.
- When the output is unstable in standard 1 mode (Std), change the detection mode to standard 2 (Std2).

Reflector

- The values on the received light intensity display may vary depending on the surface condition of the reflector.

Cautions on Usage the LV-H100/H300

- Use the exclusive bracket (optional LV-B101, LV-B102, LV-B301, LV-B302) to mount the sensor. Adjust the light axis of the transmitter and receiver in both the vertical and horizontal directions without any target in the detection area. Then, mount the sensor while maximizing the value displayed on the amplifier. (Adjust the light axis so that the transmitter beam is at the center of the receiver block)
- When mounting the sensor, mount the transmitter and receiver so that their sides on which the indicator is mounted face the same direction.

Warranties

WARRANTIES (MUST ACCOMPANY THE PRODUCTS): KEYENCE, at its sole option, will refund, repair or replace at no charge any defective Products within 1 year from the date of shipment. Unless stated otherwise herein, the Products should not be used internally in humans, for human transportation, as safety devices or fail-safe systems. EXCEPT FOR THE FOREGOING, ALL EXPRESS, IMPLIED AND STATUTORY WARRANTIES, INCLUDING WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NON-INFRINGEMENT OF PROPRIETARY RIGHTS, ARE EXPRESSLY DISCLAIMED. KEYENCE SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, CONSEQUENTIAL OR OTHER DAMAGES, EVEN IF DAMAGES RESULT FROM THE USE OF THE PRODUCTS IN ACCORDANCE WITH ANY SUGGESTIONS OR INFORMATION PROVIDED BY KEYENCE. In some jurisdictions, some of the foregoing warranty disclaimers or damage limitations may not apply.