# Chapter 5

## Installation

This chapter describes the procedure and cautions for the installation of the BL-600 Series and special power supply unit.

# 5.1    Installation of the BL-600 Series

This section describes situations to check for before installing the BL-600 Series, and the installation procedure.
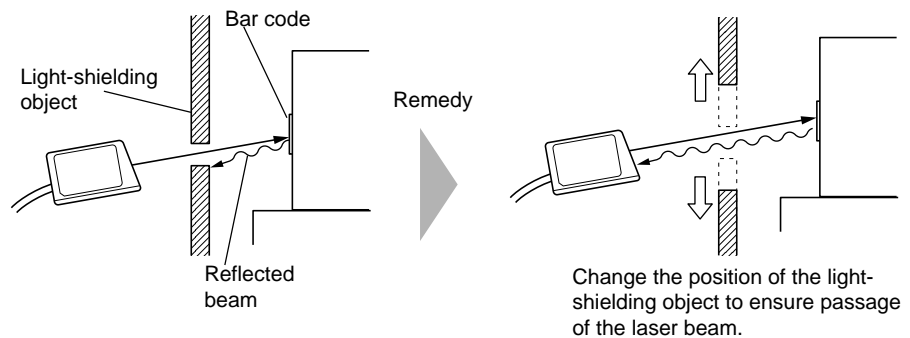
## 5.1.1    Situations to check for before installing the BL-600 Series

Check the following points before installing the BL-600 Series.

Avoid extraneous light from entering the transmitter/receiver of the BL-600 Series. Otherwise, the reading may fail or be unreliable.
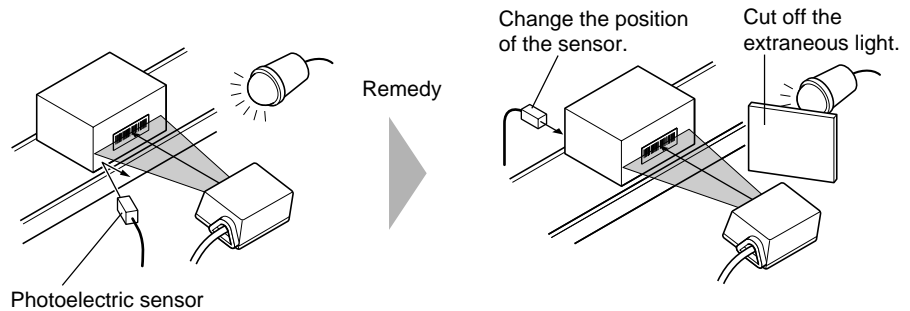


If something interrupts the emitted or reflected laser beam, the reading may be unreliable.



If the laser beam reflects the bar code at a right angle (specular reflection), the reading may fail or be unreliable.
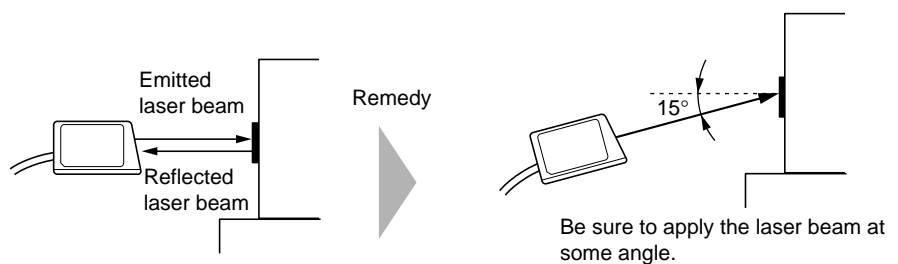


*   Since the BL-650HA/651HA emits a laser beam at an angle of 17°, tilting the unit is unnecessary.

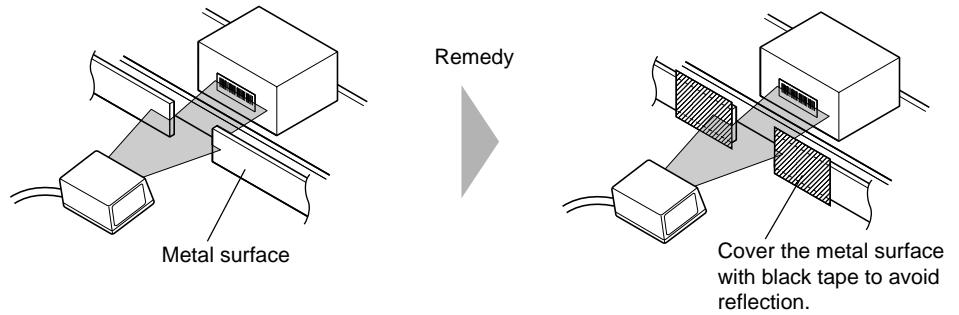If a strong reflected light enters the receiver of the BL-600 Series, the reading may fail or be unreliable.

Remedy

Metal surface

Cover the metal surface with black tape to avoid reflection.

If reflected light enters the receiver of another unit, the reading may be unreliable, because of mutual interference.

Bar code

Remedy

Place a light-shielding plate.

BL-600 Series

Keep a distance between the units.
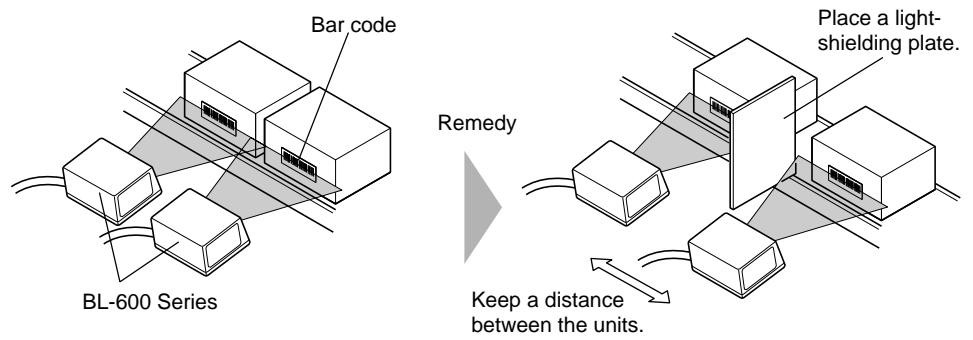
If two or more bar code labels enter the laser beam at the same time, the BL-600 cannot be set to read a specific bar code.

Keep a distance between the bar codes.

Bar code

Remedy

Decrease the scanning width.
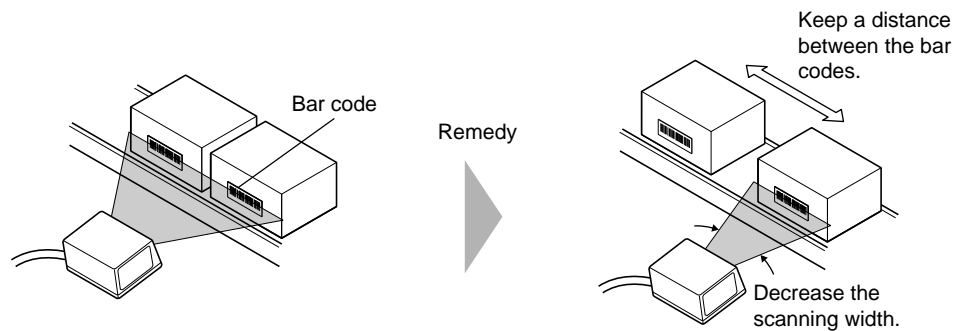
➪ *See page 67 to change the scanning width.*

*   When "Multi-label read mode 3" is specified, the BL-600 Series can simultaneously read up to 4 bar codes in the field of the laser beam.

**5**

## 5.1.2   Mounting angle and distance

The BL-600 Series must be installed so that the laser beam is applied at an angle of approximately 15° with reference to a line perpendicular to the target. This means that the BL-600/601/600HA/601HA must be tilted at an angle of 15°. Since the BL-650HA/651HA emits a laser beam at an angle of 17°, tilting the unit is unnecessary.

Refer to the read range and angle characteristics on pages 148 to 150 for the appropriate mounting angle and distance for the BL-600 Series.

Normally, the BL-600 Series provides the best reading stability when mounted at the following angle and distance.

BL-600/601/600HA/601HA                              BL-650HA/651HA



Reading distance
BL-600/601: 120 mm
BL-600HA/601HA: 90 mm

Reading distance
BL-650HA/651HA: 65 mm
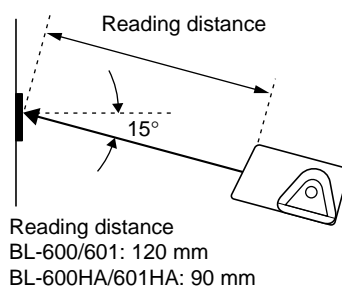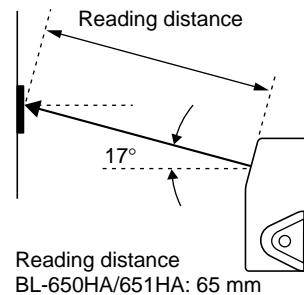
*   The supplied mounting bracket facilitates the angle setting. *( See pages 75 to 78.)*
*   The reading rate check mode *( See pages 94 to 96.)* ensures an optimal reading position.
*   The laser beam application angle for the BL-650HA/651HA is 17° ±3° with reference to a line perpendicular to the rear surface of the unit.

**Note 1:** Do not mount the BL-600 Series so that the laser beam is applied to bar codes at a right angle (±10°). Otherwise, the specular reflections may cause unstable reading or reading errors. *( See page 151.)*

BL-600/601/600HA/601HA                              BL-650HA/651HA



Incorrect                                                  Incorrect
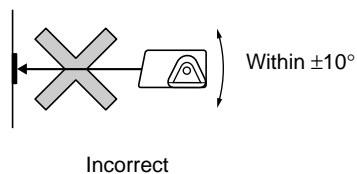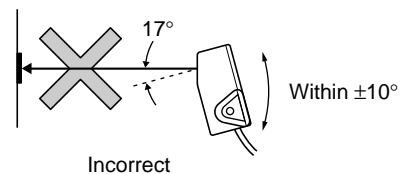
**Note 2:** The reading distance and angle may vary depending on the narrow bar width, size, and printing quality of bar codes. Be sure to test the BL-600 Series' ability to read the actual bar codes using "Reading rate check mode" on pages 94 to 96.

## 5.1.3  Mounting the BL-600/601/600HA/601HA

The following is the procedure for mounting the BL-600/601/600HA/601HA with the supplied mounting bracket. To mount the BL-600 Series without the mounting bracket, refer to "Mounting the BL-600 Series without the mounting bracket" on pages 79 and 80.

1. Check the surroundings of the mounting position.

   Check the surroundings according to "Situations to check for before installing the BL-600 Series" on pages 72 and 73.

2. Attach the BL-600 Series to the mounting bracket.

   ➯ *Refer to page 155 for the dimensions of the mounting bracket.*
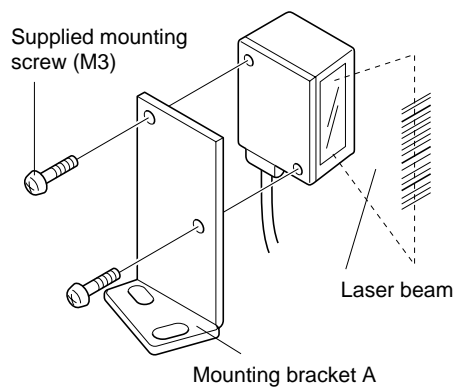
When bracket A is used                    When bracket B is used



3. Temporarily fix the mounting bracket.

   The angle of the laser beam application is 15° when the BL-600 Series is secured to the mounting bracket as shown below.

   ➯ *See "5.1.2 Mounting angle and distance" on page 74 for the mounting distance.*

When mounting bracket A is used:          When mounting bracket B is used:
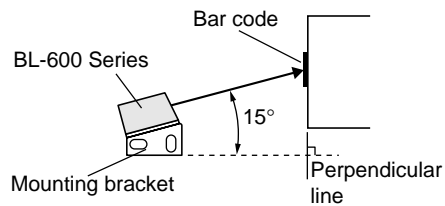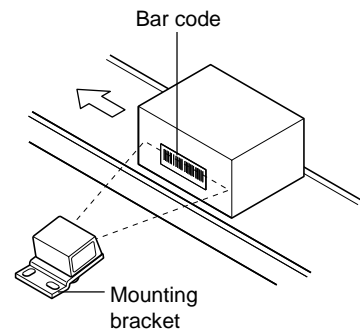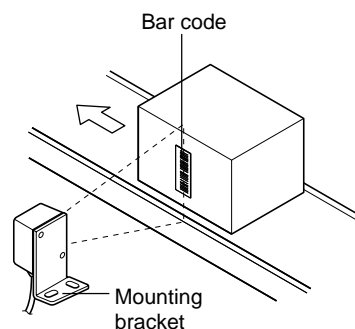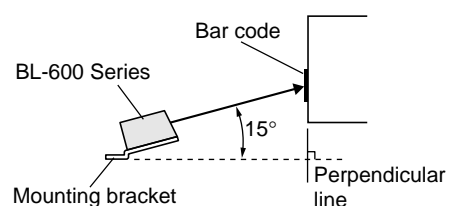
**5**

4.  Check the reliability of the bar code reading using the Test mode.

    Check the reliability of the bar code reading using "Reading rate check mode".
    ⇨ *See pages 94 to 96.*

5.  Check the surroundings and adjust the mounting distance and angle.

    If the bar code reading is unreliable, check/adjust the position again by referring to "5.1.1 Situations to check for before installing the BL-600 Series" on pages 72 and 73 and "5.1.2 Mounting angle and distance" on page 74.

6.  Fasten the mounting bracket.

    *   Mounting screws (M4) are not included.
    *   To suppress the noise conveyed through the mounting bracket, be sure to use insulating spacers.

When bracket A is used

When bracket B is used

Mounting screw (M4)

Washer

Insulating spacer

Mounting screw (M4)

Washer

Insulating spacer

**5**
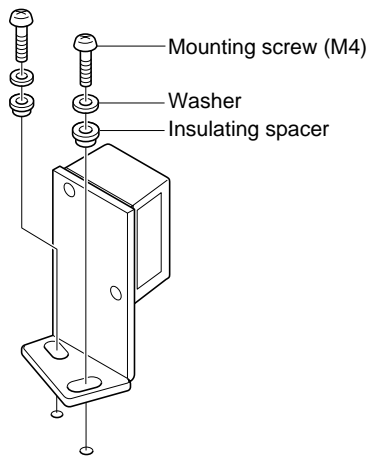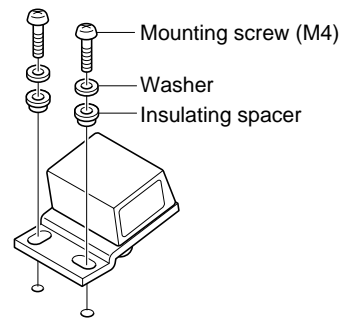
## 5.1.4  Mounting the BL-650HA/651HA

The following is the procedure for mounting the BL-650HA/651HA with the supplied mounting bracket. To mount the BL-600 Series without the mounting bracket, refer to "Mounting the BL-600 Series without the mounting bracket" on page 79.

1. Check the surroundings of the mounting position.

   Check the surroundings according to "5.1.1 Situations to check for before installing the BL-600 Series" on pages 72 and 73.
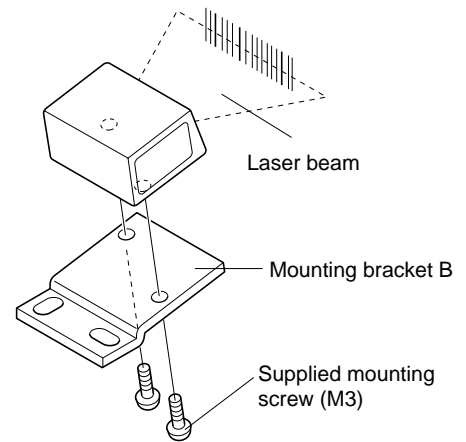
2. Attach the BL-600 Series to the mounting bracket.

   *  The mounting bracket for the BL-650HA/651HA allows two mounting orientations. Choose the appropriate orientation according to the application.
   ➪ *Refer to page 155 for the dimensions of the mounting bracket.*
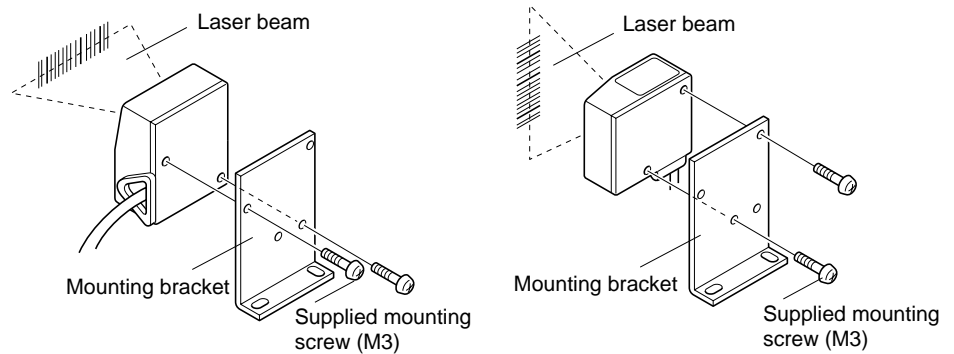


3. Temporarily fix the mounting bracket.

   Since the BL-650HA/651HA emits a laser beam at an angle of 17°, install the unit parallel to the surface of the bar code as shown below.
   ➪ *See "5.1.2 Mounting angle and distance" on page 74 for the mounting distance.*

   *  The laser beam application angle for the BL-650HA/651HA is 17° ±3° with reference to a line perpendicular to the rear surface of the unit.
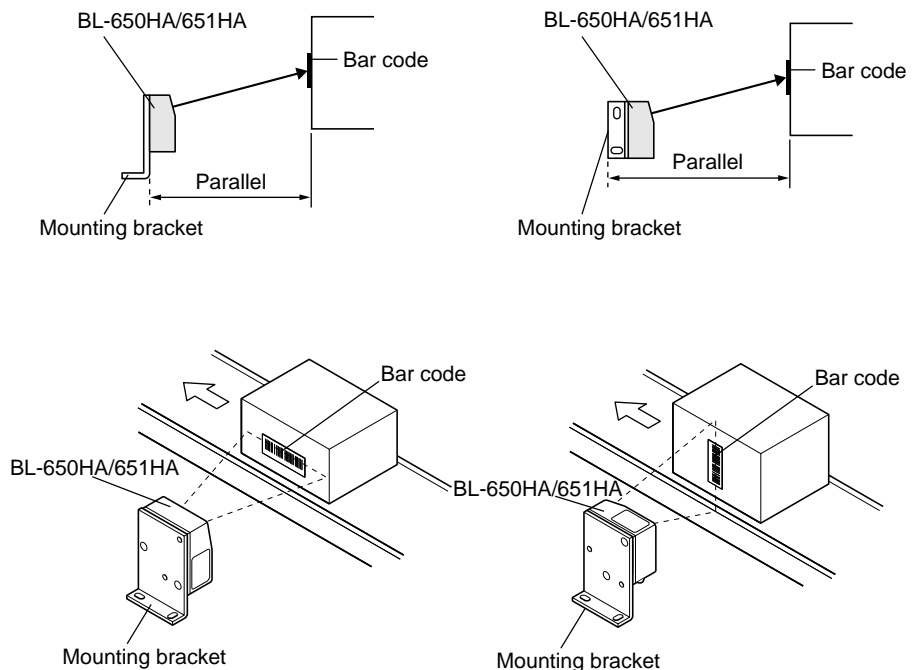
4.  Check the reliability of the bar code reading using the Test mode.

    Check the reliability of the bar code reading using "6.4.1 Reading rate check mode".

5.  Check the surroundings and adjust the mounting distance and angle.

    If the bar code reading is unreliable, check/adjust the position again by referring to "5.1.1 Situations to check for before installing the BL-600 Series" on pages 72 and 73 and "5.1.2 Mounting angle and distance" on page 74.

6.  Fasten the mounting bracket.

    *   Mounting screws (M4) are not included.
    *   To suppress the noise conveyed through the mounting bracket, be sure to use insulating spacers.



**5**
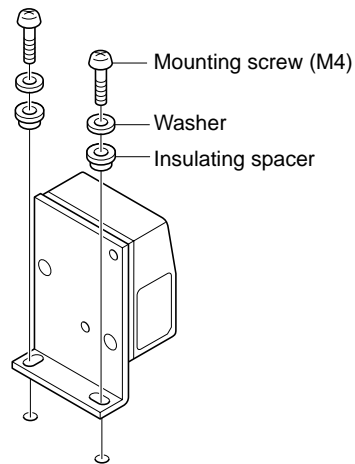
## 5.1.5   Mounting the BL-600 Series without the mounting bracket

1.  Check the surroundings of the mounting position.

    Check the surroundings according to "5.1.1 Situations to check for before installing the BL-600 Series" on pages 72 and 73.

2.  Temporarily mount the BL-600 Series in position.

    The BL-600 Series must be installed so that laser beam is applied at an angle of approximately 15° with reference to a line perpendicular to the target.
    This means that the BL-600/601/600HA/601HA must be titled at an angle of 15°.
    Since the BL-650HA/651HA emits a laser beam at an angle of 17°, tilting the unit is unnecessary.
    Mount the BL-600 Series in the following orientation according to the laser beam orientation to be used.
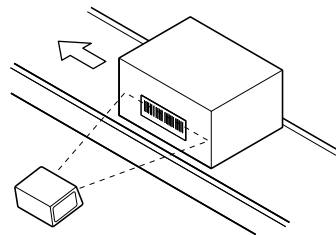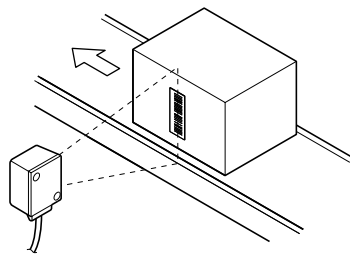
    BL-600/601/600HA/601HA                    BL-650HA/651HA
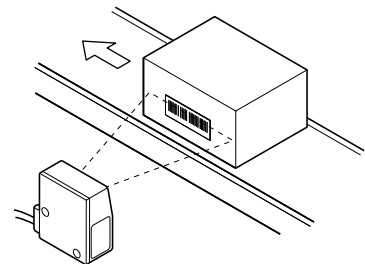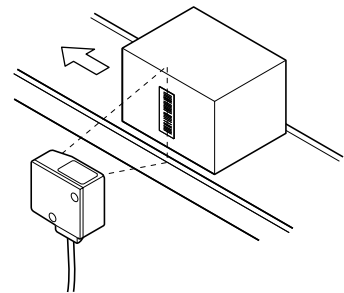
    

    ⇨ *See "5.1.2 Mounting angle and distance" on page 74 for the mounting distance.*
    *   The laser beam application angle for the BL-650HA/651HA is 17° ±3° with reference to a line perpendicular to the rear surface of the unit.

3.  Check the reliability of the bar code reading using the Test mode.

    Check the reliability of the bar code reading using "Reading rate check mode".
    ⇨ *See pages 94 to 96.*

4.  Check the surroundings and adjust the mounting distance and angle.

    If the bar code reading is unreliable, check/adjust the position again by referring to "5.1.1 Situations to check for before installing the BL-600 Series" on pages 72 and 73 and "5.1.2 Mounting angle and distance" on page 74.

5.  Fasten the BL-600 Series.

    Fasten the BL-600 Series in the mounting position with M3 screws.
    *   The M3 screws are not included. Select the M3 screws after checking the panel thickness and other factors of the mounting position. (The mounting hole for the BL-600 Series is 4 mm deep.)

    BL-600/601/600HA/601HA                     BL-650HA/651HA



    Mounting hole

    Mounting screw (M3)                       Mounting screw (M3)
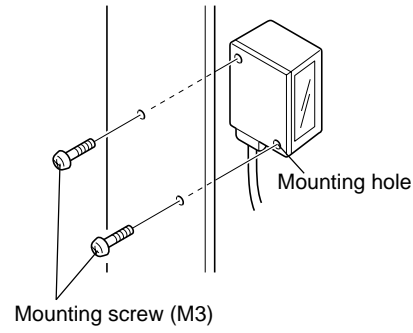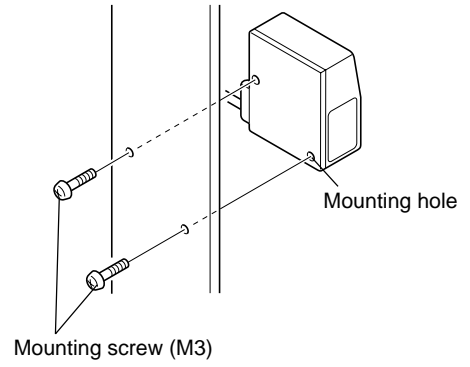
# 5.2    Installation of the Special Power Supply Unit

This section describes how to install the special power supply units BL-U1, BL-U2, and N-42.

## 5.2.1  In-panel installation

To mount the power supply unit BL-U1, BL-U2 or N-42, carefully observe the following instructions.

- Provide enough ventilation space.
- If the ambient temperature may fall below 0°C or exceed 50°C, provide a fan or air conditioner.
- Do not mount this unit in a panel where a high voltage device is installed.
- Place this unit as far away from power lines as possible.

## 5.2.2  Installing the BL-U1

There are 2 methods for installing the BL-U1.

### ■ Screw mounting

1. Pull out the 4 screw slot tabs from the rear panel of the BL-U1.
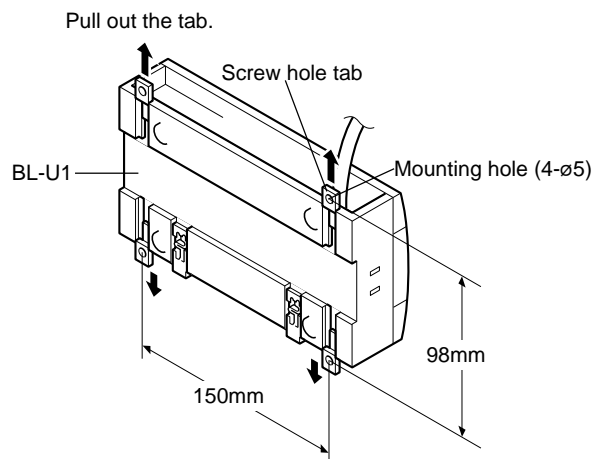


2. Secure the BL-U1 with screws.

   *      The mounting screws are not included.
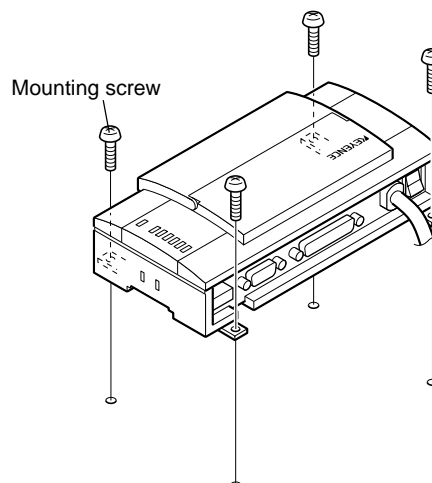
■ **DIN-rail mounting**

1. Check that the DIN-rail mounting claw is in the condition shown in the figure.

Front view

DIN-rail mounting claw
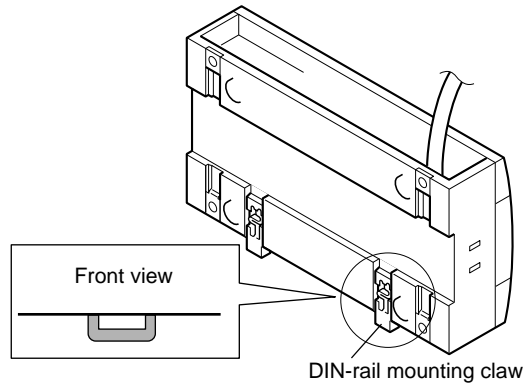
2. Attach the BL-U1 to the DIN rail as shown in the figure.

Fixed claw

DIN rail

**Mounting the BL-U1 to a DIN-rail**

1. Hook the BL-U1 to the rail.

DIN rail

Fixed claw

2. Push the bottom of the BL-U1 against the rail.
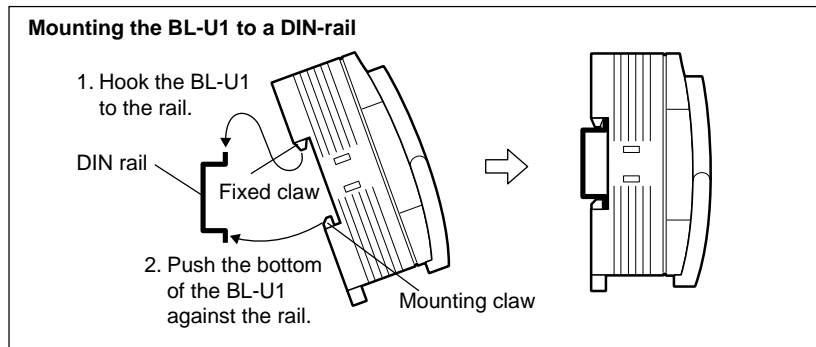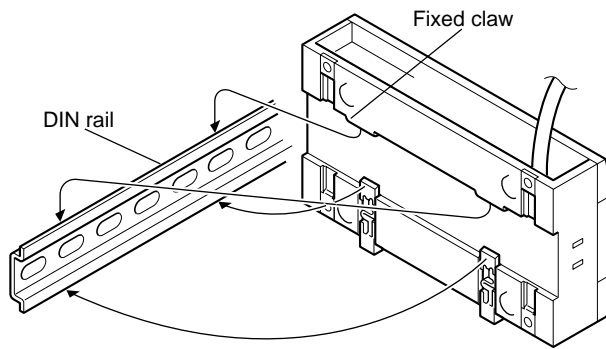
Mounting claw

■ **Removal from a DIN rail**

1. Pull the mounting claw down until it is in position B. Disengage the BL-U1 from the DIN rail.

2. After removal, push the mounting claw back to position A.

**A**         **B**

Pull the claw down using a screwdriver, etc.

Mounting claw
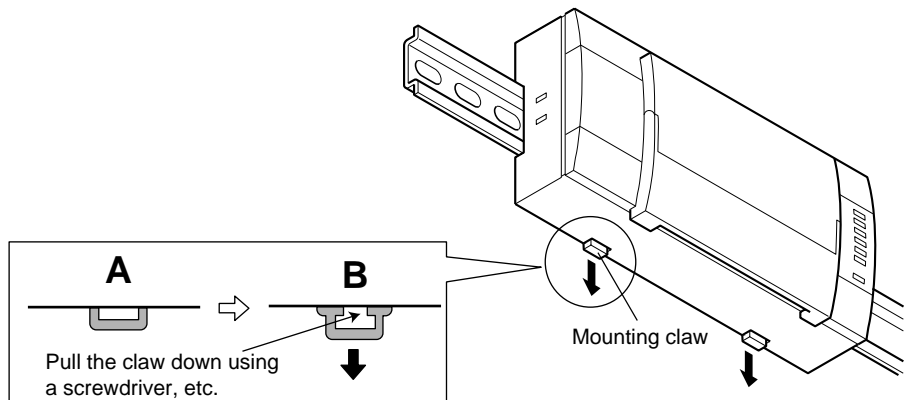
## 5.2.3   Installing the BL-U2 and N-42

Install the BL-U2 and N-42 using screws through the mounting holes.
*    The mounting screws are not included.



Mounting screw

Mounting hole (2-ø4.5mm)

63.2mm

43.2mm

BL-U2: 21 mm
N-42: 26 mm

**5**

5
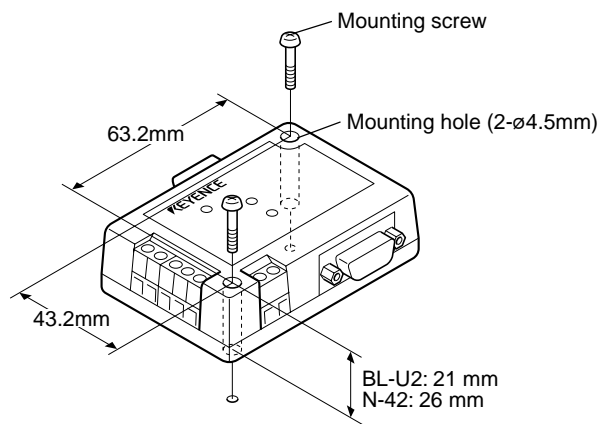
# Chapter 6

## Functions for Reading Operation

This chapter describes the reading operation and other functions, such as test mode, of the BL-600 Series.

# 6.1    Read Operation

This section describes the scanning methods of the BL-600 Series.

## 6.1.1    Scanning method

There are two methods to trigger the BL-600 Series to read bar codes: the "Level signal" method and the "One-shot signal" method. Select an appropriate method according to the application. Typically, the "Level signal" method is used.
The following examples for these two methods use the "6.2.1 Single label read mode".  ⇨ *See page 88.*

**Level signal trigger**

When the trigger input turns on, the BL-600 Series starts laser emission to read the bar codes. The laser turns off after the number of the bar code reading reaches the specified decoding match count. ⇨ *See page 43.* The BL-600 Series then sends the read data.

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**Reference 1:** The BL-600 Series can read up to 4 types of bar codes without changing settings. ⇨ *See page 49.*

**Reference 2:** Pressing the TEST switch lightly (for less than 2 seconds) serves as a trigger input (The laser turns on once.). ⇨ *See page 8.*

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■  **Timing diagram**
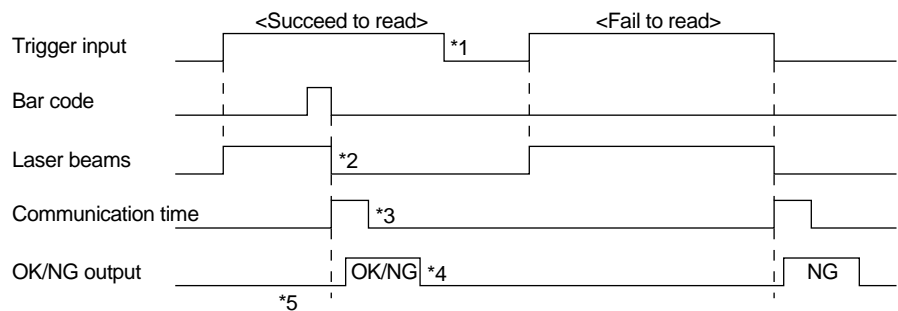


*1  Set trigger input so that it stays on long enough for the laser beam to cover the entire bar code.

*2  The BL-600 Series emits a laser after the trigger input exceeds the preset input time. ⇨ *See the following note.*

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**Note:** The BL-600 Series has a built-in AGC (auto gain control) circuit. It requires a maximum of 3 scans (6 ms) to adjust the gain. Therefore, the BL-600 Series requires a maximum of 6 ms after the laser beam turns on before it begins to read the data.

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*3  The communication time can be obtained from the following expression:

$$\frac{\text{Data bits} + (1: \text{If parity is used}) + \text{Start/stop bit}}{\text{Baud rate}} \times \begin{array}{l}\text{(Code length of data to be} \\ \text{sent} + \text{Header/number of} \\ \text{characters in delimiter)}\end{array}$$

*4  The length of time that the OK/NG output is on can be changed to any value between the range of 10 ms to 2.55 s. ⇨ *See page 53.*

*5  The OK/NG output turns on 5 ms after the bar code is read.
If the bar code cannot be read, the NG output is delayed by 5 ms plus the specified input time.

**Note:** 5 seconds after the power switch turns on or an UNLOCK command ( ⇨ *See page 116.*) is sent, the unit will not start reading a bar code by turning on the trigger input.

## One-shot signal trigger

The BL-600 Series detects when the trigger input turns on and starts reading bar codes for the preset "One shot input time". ⇨ *See page 44.* The laser turns off after the number of the bar code reading reaches the specified decoding match count. ⇨ *See page 43.* The BL-600 Series then sends the read data.
The rest of the operation is the same as that for the "Level signal" method.
Use the one-shot signal trigger when the one shot input time is extremely short or to fix the scanning time.

**Reference 1:** The BL-600 can read up to 4 types of bar codes without changing the bar code type setting. ⇨ *See page 49.*

**Reference 2:** Pressing the TEST switch lightly (for less than 2 seconds) serves as a trigger input (The laser turns on once.). ⇨ *See page 8.*

### ■ Timing diagram
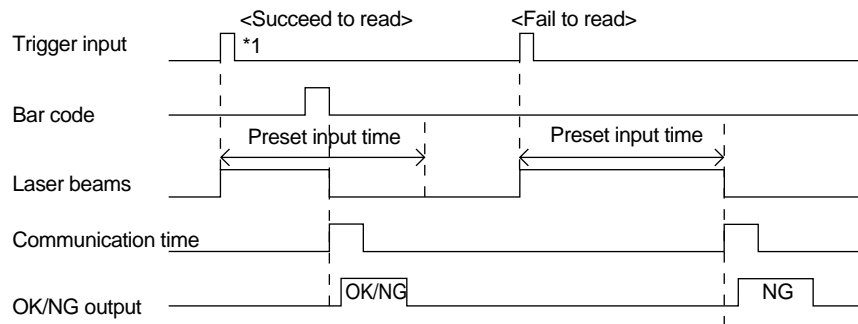


*1 After the trigger input exceeds the preset input times, the laser begins to emit.

Trigger input minimum ON time:
   5 ms (when the trigger input value is 2 ms)
   15 ms (when the trigger input value is 10 ms)

**Note:** The BL-600 has a built-in AGC (auto gain control) circuit. It requires a maximum of 3 scans (6 ms) to adjust gain. The BL-600 generates a maximum of 6 ms delay until starting to read the data after the laser beam turns ON.

**6**

# 6.2    Read Modes

The BL-600 provides 4 types of read modes.

## 6.2.1    Single label read mode

The single label read mode allows the BL-600 Series to read only one bar code during one trigger input signal.

■ **Data output timing**

The BL-600 Series offers the following two data output modes to send data and output OK/NG signals. Select an appropriate mode according to the application. Typically, "After Read" is selected.

● After Read
The BL-600 Series sends read data and outputs an OK/NG signal after a successful read.
This is the operation described in "6.1.1 Scanning methods" on page 86 and 87.

● At trigger input
The BL-600 Series sends read data and outputs an OK/NG signal at the following timings.

   • For a "Level signal" trigger :
     When the trigger input turns off

   • For a "One-shot" trigger :
     After the preset input time has passed
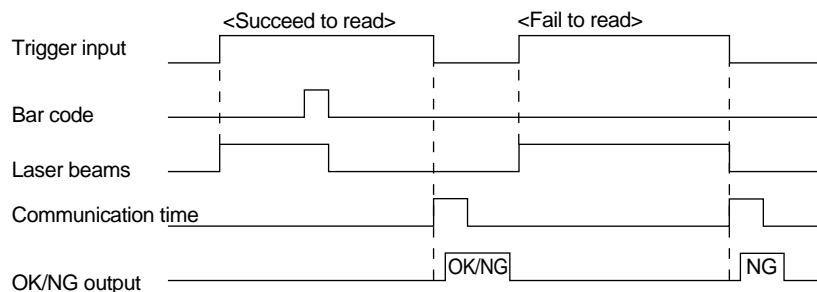


\*    The timing diagram above shows the case for a "Level signal" trigger.

## 6.2.2   Multi-label read mode 1 (Multi 1)

Multi-label read mode 1 allows the BL-600 Series to continuously read all of the several bar codes printed on one label during one trigger input signal.
The BL-600 Series outputs the read data every time one bar code is read.
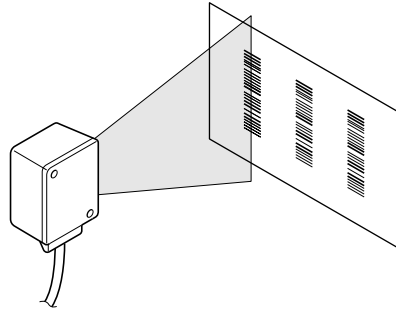


■ **Timing diagram**
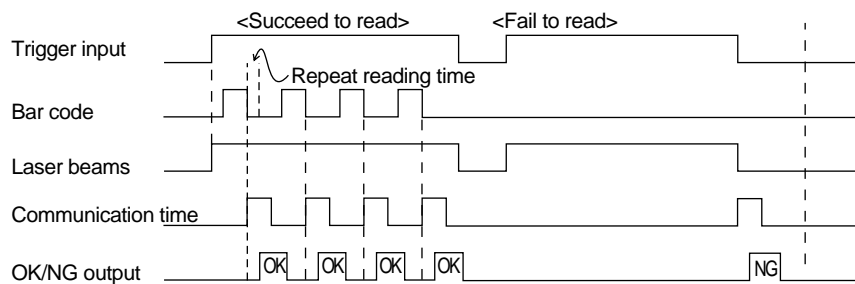


*   The BL-600 Series continuously reads bar codes in the following periods.

    *   For a "Level signal" trigger ➩ *See page 86.*:
        During the trigger input signal

    *   For a "One-shot" trigger ➩ *See page 87.*:
        During the preset input time

*   It is necessary to set the "Repeat-reading time" (➩ *See page 42.*) to prevent the BL-600 Series from reading the same bar code twice.
    Set the "Repeat-reading time" longer than the time it takes for the read bar code to go out of the field of the laser beam (100 ms to 25.5 s).

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**Note:** The same type of bar code cannot be read during the specified repeat-reading time. Different types of bar codes can be read continuously during the period.

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*   The OK output turns on every time the BL-600 Series reads a bar code. (Comparison to the preset data is not performed.)
    The NG output turns on after the trigger input turns off if the BL-600 Series fails to read any of the bar codes.

**6**

## 6.2.3  Multi-label read mode 2 (Multi 2)

Multi-label read mode 1 allows the BL-600 Series to continuously read all of the several bar codes printed on one label during one trigger input signal.

\*   The number of readable bar codes varies depending on the capacity of the transmission buffer of the BL-600 Series.

In multi-label read mode 2, all the read data is sent at one time after the trigger input turns off.
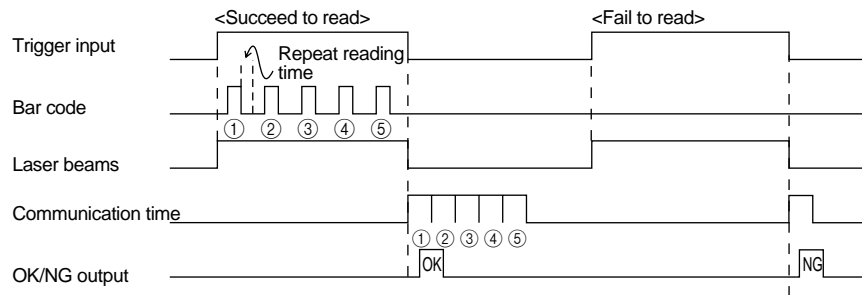
■   **Timing diagram**



\*   The BL-600 Series continuously reads bar codes in the following periods.

- For a "Level signal" trigger :
  During the trigger input signal

- For a "One-shot" trigger :
  During the preset input time has passed

\*   It is necessary to set the "Repeat-reading time" () to prevent the BL-600 Series from reading the same bar code twice.
Set the "Repeat-reading time" longer than the time it takes for the read bar code to go out of the field of the laser beam (100 ms to 25.5 s).

---

**Note:** The same type of bar code cannot be read during the specified repeat-reading time. Different types of bar codes can be read continuously during the period.

---

\*   The OK signal turns on if the BL-600 Series reads at least one bar code. (Comparison to the preset data is not performed.)
The NG signal turns on if the BL-600 Series fails to read any of the bar codes.

■   **Data format**

The read data is sent to the personal computer in the following format.

| Header | 1st data | , | 2nd data | , | 3rd data | , | 4th data | , | •••••• | Delimiter |
|--------|----------|---|----------|---|----------|---|----------|---|--------|-----------|

\*   Each data packet is separated by a comma (, : 2CH) (intermediate delimiter).

\*   The unit sends as many data packets the number of bar codes read.

\*   The number of bar codes varies depending on the capacity of the transmission buffer of the BL-600 Series.

## 6.2.4  Multi-label read mode 3 (Multi 3)

- Multi-label read mode 3 allows the BL-600 Series to continuously read one of each of the 4 bar code types, "Code 1" to "Code 4", as specified in the [[Code setup]] screen of the setup software *(⇨ See page 49.)* during one trigger input signal.

    * If three types are specified in the [[Code setup]] screen, the BL-600 Series reads three bar codes. If two types are specified, it reads two bar codes.

- Even if several bar codes (4 max.) exist in the field of the laser beam, the BL-600 Series can simultaneously read all the bar codes, provided the data of all the bar codes is different.

The BL-600 Series sends all the read data at one time in the order of "Code 1" to "Code 4" after the trigger input turns off.
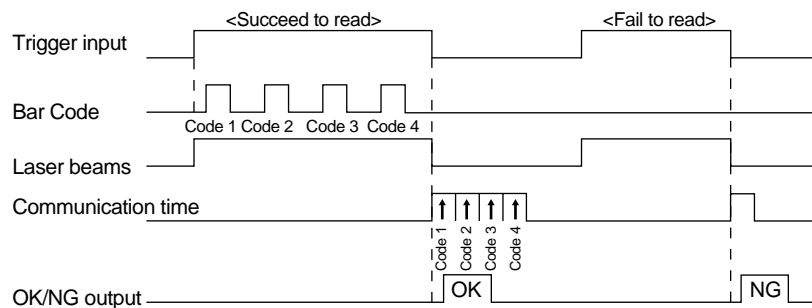
■ **Timing diagram**



* The BL-600 Series continuously reads bar codes in the following periods.

    - For a "Level signal" trigger ⇨ *See page 86.*:
      During the trigger input signal

    - For a "One-shot" trigger ⇨ *See page 87.*:
      During the preset input time

* The OK signal turns on if the BL-600 Series reads all the bar codes specified for "Code 1" to "Code 4".(Comparison to the preset data is not performed.)
  The NG output turns on if the BL-600 Series fails to read at least one bar code.

■ **Data format**

The read data is sent to the personal computer in the following format.

| Header | Data read from Code 1 | , | Data read from Code 2 | , | Data read from Code 3 | , | Data read from Code 4 | Delimiter |
|--------|------|---|------|---|------|---|------|-----------|

* Each data packet is separated by a comma (, : 2CH) (intermediate delimiter).

* If the reading fails for any one of the Codes 1 to 4, or the corresponding bar code does not exist, an "ERROR" *(⇨ See page 112 for the reading error codes.)* is sent instead of the read data.

⇨ *See page 113  for "header string" and "delimiter".*

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*Example*

Suppose that the following codes are specified:

| "Code" setting | Type of bar code | No. of digits |
|---|---|---|
| Code 1 | CODE39 | 10 digits |
| Code 2 | EAN/UPC | 13 digits |
| Code 3 | – | – |
| Code 4 | CODE39 | 8 digits |

• When the unit successfully reads all 3 types of codes:

| Header | ABCDE12345 | , | 4901234567894 | , | KEYENCE1 | Delimiter |
|---|---|---|---|---|---|---|

• When the unit fails to read Code 1 (CODE39, 10 digits)

| Header | ERROR | , | 4901234567894 | , | KEYENCE1 | Delimiter |
|---|---|---|---|---|---|---|

• When the unit fails to read Code 1 (CODE39, 10 digits) and Code 4 (CODE39, 8 digits)

| Header | ERROR | , | 4901234567894 | , | ERROR | Delimiter |
|---|---|---|---|---|---|---|

\*   When the same type of data having the same digits is specified to all Codes 1 to 4, the unit sends the data in the reading order.

*Example*

Suppose that the following codes are specified:

| "Code" setting | Type of bar code | No. of digits |
|---|---|---|
| Code 1 | CODE39 | 7 digits |
| Code 2 | CODE39 | 7 digits |
| Code 3 | CODE39 | 7 digits |
| Code 4 | CODE39 | 7 digits |

| Header | ABCD123 | , | XYZ3333 | , | 1234567 | , | KEYENCE | , | Delimiter |
|---|---|---|---|---|---|---|---|---|---|

**Note:** The unit cannot read the bar code having the same content twice while trigger input turns on once.

# 6.3    Label Orientation Mode

You can specify the orientation of the bar code labels to be read.

The label orientation mode allows the BL-600 Series to only read the bar codes in the specified orientation if the bar code labels are moving in both the forward and reverse directions.
Normally, the unit can read bar codes regardless of the orientation.

Forward orientation

Reverse orientation

■  **Timing diagram**

| | <Specified orientation> | <Non-specified orientation> |
|---|---|---|
| Trigger input | | |
| Bar code | | |
| Laser beams | | |
| Communication time | | |
| OK/NG output | OK/NG | NG |
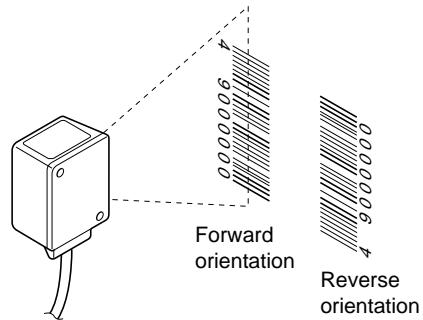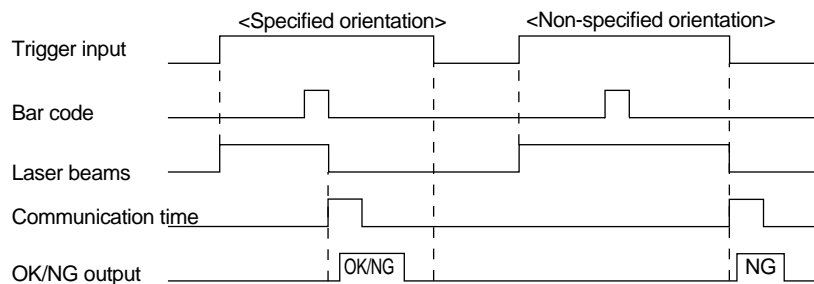
*    The timing diagram above shows the case for the "single label read mode".

•    A reading error is issued if the BL-600 Series reads a bar code label moving in an orientation that is not specified.

•    This mode can be used with the desired multi-label read mode. However, the BL-600 Series does not read bar codes moving in an orientation that is not specified.

•    You can specify the orientation individually for Codes 1 to 4, such as specifying "forward orientation" for Code 1, and "reverse orientation" for Code 2.

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# 6.4   Test Mode

Test mode can be used for the bar code reading test. The BL-600 Series offers three types of test mode.

**Note:** The BL-600 Series continues laser emission during test mode. This can shorten the service life of the laser. Only select test mode when you need to perform a reading test.

## 6.4.1   Reading rate check mode

The reading rate check mode is used to measure how many times the BL-600 Series can decode the scanned data while scanning a bar code 100 times. This mode is useful for the following cases:

● Adjusting the mounting distance and angle

Adjust the mounting distance and angle so that the highest reading rate is obtained.

● Verifying the reading reliability of the bar code to be used

A high reading rate shows that the printing quality of the bar code is high.

**Note:** The reading rate check should only be performed for a stationary bar code.

### ■ Starting method

There are four methods to start the reading rate check mode. Select one of the following for your convenience.

- Press the TEST switch of the BL-600 Series.
- Use the [[Monitor]] screen of the setup software. ⇨ *See page 62.*
- Use the bar code display interface BL-V35E. ⇨ *See the BL-V35E User's Manual.*

### ■ Operation

The following instruction uses the TEST switch to start/quit the reading rate check. All other operations are the same for the other starting methods.

1.  Set the mounting distance and angle of the BL-600 Series. ⇨ *See page 75.*

BL-600/601/600HA/601HA
Reading distance
15°
Reading distance
BL-600/601: 120 mm
BL-600HA/601HA: 90 mm

BL-650HA/651HA
Reading distance
17°
Reading distance
BL-650HA/651HA: 65 mm

**Note :** Do not mount the BL-600 Series so that the laser beam is applied to bar codes at a right angle (±10°). Otherwise, the specular reflections may cause unstable reading or reading errors. ⇨ *See page 151.*

BL-600/601/600HA/601HA
Within ±10°

BL-650HA/651HA
17°
Within ±10°
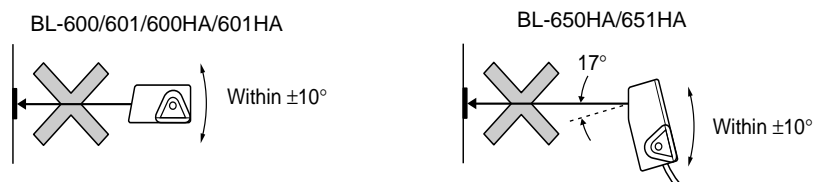
2.  Start the test mode.

    1)  Press the TEST switch for 3 seconds.
    2)  When one STABILITY LED illuminates, release the TEST switch.
        The BL-600 Series continues laser emission.

Press the TEST switch
for 3 seconds.

**KEYENCE**

LASER ON
OK/NG
TIMING

TEST
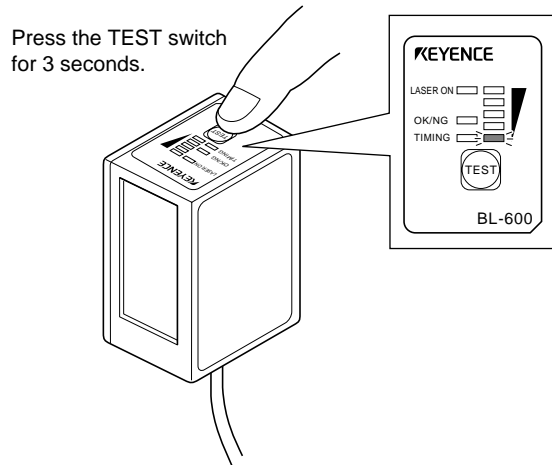
BL-600

⚠ **WARNING**    ***Do not look directly at the laser beam. This may result in serious eye injury. The laser beam is not harmful to the skin; however, do not intentionally direct the laser beam at the human body.***

3.  Read the bar code.

    The BL-600 Series displays the STABILITY LEDs as shown in the following table depending on the "Reading rate", which shows the number of times it can decode the scanned data while scanning a bar code 100 times. While checking the display, adjust the mounting distance and angle so that the reading rate reaches its highest level.

    \*   ON/NG LED turns ON but OK/NG output does not turn ON.

| Reading rate | STABILITY LED | OK/NG LED |
|---|---|---|
| 81 to 100 % | 5 LEDs ON | Green |
| 61 to 80 % | 4 LEDs ON | Green |
| 41 to 60 % | 3 LEDs ON | Green |
| 21 to 40 % | 2 LEDs ON | Green |
| 1 to 20 % | 1 LED ON | Green |
| 0 % | – | Red |

**Note1:** The higher the reading rate indicated, the more accurately and reliably the bar code is read. However, this does not mean that the reading is only possible with a reading rate of 100%. For example, if the reading rate is displayed as 20%, 20 reads were acceptable during the 100 scans. The read operation is not affected if the scanning time for the bar code is set long enough.

**Note2:** If a raster-scanning model (BL-601/601HA/651HA) is used for a bar code with a short height, some laser beams will not be applied to the bar code, resulting in a low reading rate. For example, if only 4 out of the 8 laser beams of the BL-600 Series can scan the bar code, the highest reading rate obtained will be 50%. However, this problem can also be solved if the scanning time for the bar code is set long enough.

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4. The BL-600 Series sends data.

In test mode, the BL-600 Series sends the data in the following format every 100 scans.

Partition mark

| Readout data | : | m |
|---|---|---|

m = Reading rate (1 to 100) (Zero-suppressed)
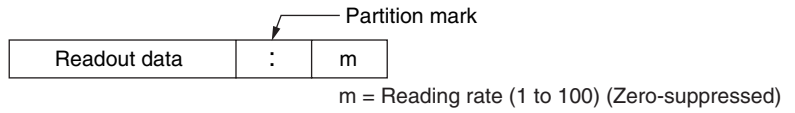
*   You can set the BL-600 Series so that it will not send data while in the test mode. ➪ *See page 54.*

*   To check the reading rate on a PC screen, connect the BL-600 Series to a PC and use the [[Monitor]] screen of the setup software. ➪ *See page 62.*



5.  Quit the test mode.

Press the TEST switch again to quit the test mode. The STABILITY LED turns off.

Press once.
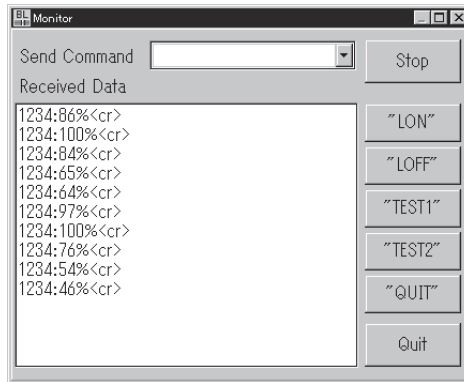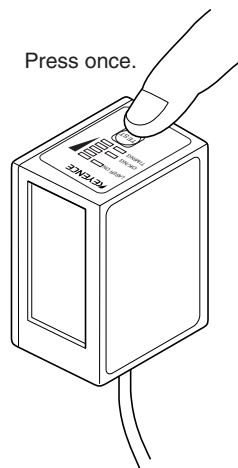


**Note 1:** If the additional information function (➪ *See pages 102 to 106.*) is used while in the test mode, the BL-600 Series adds the specified data in the same manner as in normal operation. However, only if the "Reading rate check mode" is selected, will the "Decoding count" and "Scan count" data not be added.

**Note 2:** If a PLC link is used, the read data, reading rate, and decoding count are not written while the test mode is active.

## 6.4.2  Tact check mode

The tact check mode is used to count how many scans the BL-600 Series can accurately read (decode) while reading a moving bar code.
This mode is useful for the following case:

● Testing the line speed that can be expected before actually implementing the BL-600 Series on the line

  A large decoding number shows that the BL-600 Series can reliably read the bar code (capable for the line speed).

**Note:** The tact check should be performed on a moving bar code.
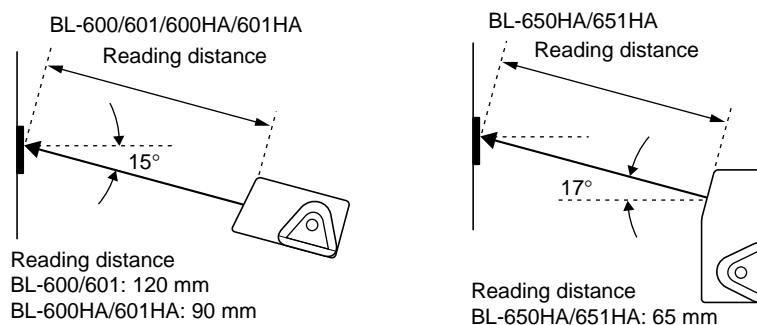
### ■ Starting method

There are four methods to start the reading rate check mode. Select one of the following for your convenience.

- Press the TEST switch of the BL-600 Series.
- Use the [[Monitor]] screen of the setup software. ⇨ *See page 62.*
- Use the bar code display interface BL-V35E. ⇨ *See the BL-V35E User's Manual.*

### ■ Operation

The following instruction uses the TEST switch to start/quit the reading rate check. All other operations are the same for the other starting methods.

1. Install the BL-600 Series.

   Install the BL-600 Series according to "Chapter 5, Installation" on page 72.

2. Start the test mode.

   1) Press the TEST switch for 5 seconds.
   2) When two STABILITY LED illuminates, release the TEST switch.
      The BL-600 Series continues laser emission.



Press the TEST switch for 5 seconds.

KEYENCE
LASER ON
OK/NG
TIMING
TEST
BL-600
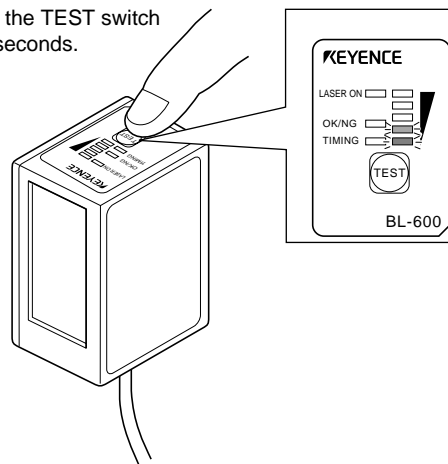
**⚠ WARNING**  *Do not look directly at the laser beam. This may result in serious eye injury. The laser beam is not harmful to the skin; however, do not intentionally direct the laser beam at the human body.*

3.  Read the bar codes moving on the line.

    Depending on the decoding count, the BL-600 Series displays the STABILITY LEDs as shown in the following table 0.2 seconds after the bar code has passed the field of the laser beam. By checking the display, you can notice the reliability that the BL-600 Series ensures during the readout (how capable it is for the line speed).

| Decoding count | STABILITY LED | OK/NG LED |
|---|---|---|
| 100 or more | 5 LEDs ON | Green (The readout count equals or exceeds the specified decoding match count.) ⇨ *See page 43.* Red (The readout count is below the specified decoding match count.) ⇨ *See page 43.* |
| 50 to 99 | 4 LEDs ON | |
| 10 to 49 | 3 LEDs ON | |
| 5 to 9 | 2 LEDs ON | |
| 1 to 4 | 1 LED ON | |

*   ON/NG LED turns ON but OK/NG output does not turn ON.

*   The BL-600 Series continues to read data while bar codes are in the field of the laser beam. Therefore, the STABILITY LEDs do not illuminate.

*   If reading bar codes with the same data continuously within 0.2 seconds, the BL-600 Series cannot differentiate between the data and continues to scan and add to the decoding count without displaying the STABILITY LEDs. If the BL-600 Series reads different bar codes within 0.2 seconds of each other, it displays the STABILITY LEDs to show the decoding count.

4.  The BL-600 Series sends data.

    The BL-600 Series sends the data to the PC in the following format every time the STABILITY LEDs illuminate.
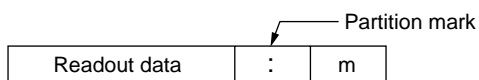
```
                                    ┌──── Partition mark
                               ┌──↙─┐
    │  Readout data  │  :  │ m │
    └───────────────┴────┴───┘
         m = Decoding count (1 to 9999) (Zero-suppressed)
```

*   A value greater than 9999 cannot be added.

*   You can set the BL-600 Series so that it will not send data while in the test mode. ⇨ *See page 54.*

---

**Note:** It should be judged that the BL-600 Series is capable for the line speed if the decoding count is always more than 5 to 10. If the decoding count is only 1 or 2, you need to perform a reading rate check (⇨ *See pages 94 to 96.*) and change the position of the bar code reader to obtain a higher reading rate.

---

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\*    To check the reading rate on a PC screen, connect the BL-600 Series to a PC and use the [[Monitor]] screen of the setup software. ⇨ *See page 62.*



5.  Quit the test mode.

    Press the TEST switch again to quit the test mode. The STABILITY LED turns off.

    Press once.
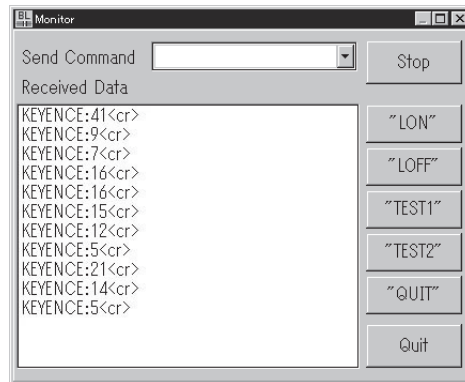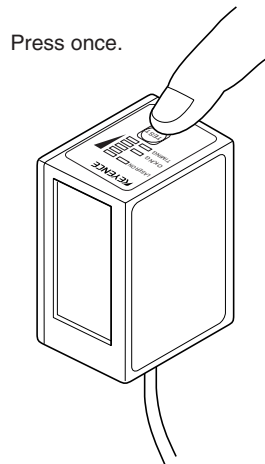


## 6.4.3  Online test mode

The online test mode allows the BL-600 Series to display the reading reliability in real time during normal reading operation.

■ **Operation**

1.  Set the online test mode.

    1) Send the "#TEST1" command to the BL-600 Series using the [[Monitor]] screen of the setup software. ⇨ *See page 62.*
    2) The setting is completed when a response to the sent command "OK" is returned from the BL-600 Series.

2.  Read bar codes with the BL-600 Series.

    After the trigger input turns off, the BL-600 Series sends the read data and displays the reading reliability with the STABILITY LEDs.

3.  Quit the online test mode.

    1) Send the "#QUIT" command to the BL-600 Series using the [[Monitor]] screen of the setup software. ⇨ See page 62.
    2) The mode is ended when a response to the sent command "OK" is returned from the BL-600 Series.

**Note:** The command setting is only effective if the BL-600 Series is turned on. The setting will be reset when the power is turned off.

**Reference:** To save the online test mode setting in the BL-600 Series, set the following using the setup software.

- [[Main]]    →   "Additional information"    →   Select "Decoding count".
                                              →   Select "Scan count".

- [[Utilities]]   →   "Stability LED"          →   Select "Use stability LED".

### ■ STABILITY LED display

The STABILITY LEDs illuminate as shown in the table, indicating how many times the BL-600 Series can correctly read (decode) the data of the moving bar codes.

| Decoding count | STABILITY LED |
|:---:|:---:|
| 100 or more | 5 LEDs ON |
| 50 to 99 | 4 LEDs ON |
| 10 to 49 | 3 LEDs ON |
| 5 to 9 | 2 LEDs ON |
| 1 to 4 | 1 LED ON |
| 0 | – |

### ■ Data format

The BL-600 Series appends the number of scans (scan count) and the number of correctly read bar codes (decoding count) while one trigger input turns on.

\*   The scan count includes the cases where a bar code does not exist in the field of the laser beam.



| Readout data | : | m | / | s |
|:---:|:---:|:---:|:---:|:---:|

Partition mark
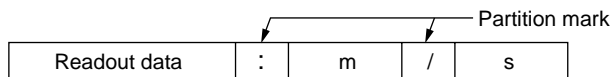
m = Decoding count (1 to 9999) (Zero-suppressed)
s = Scan count (1 to 9999) (Zero-suppressed)

# 6.5    Preset Function (Compare with:)

This section describes the preset function to prevent different bar codes from being read.

## 6.5.1    Preset function

The preset function is the function that compares the preset data (one bar code data entered beforehand) to the bar code data actually read and outputs OK/NG signals to indicate whether or not there is a match.
The preset function allows the BL-600 Series to detect different bar codes without using a PC.

### ■   OK/NG signal output timing

⇨ *See pages 86 to 88.*

### ■   Entering the preset data

Use the setup software (⇨ *See page 53.*) or a serial command (⇨ *See page 128.*) to enter the preset data.

---

**Note:** The bar code actually read can be compared to the preset data only in the single label read mode.

⇨ *See page 164 if you want to use CODE93.*
⇨ *See page 165 if you want to use CODE128.*

---

## 6.5.2    Using "?" and "!" in the preset data

Using "?" and "!" in the preset data allows a wider range of bar codes to match the preset data.

?:   One "?" character represents one character. Use "?" to regard any one-digit character as being matched.
If the preset data is entered as "4912??56", the two digits positioned in "??" can contain any characters (numeric values) for a match.

!:   One "!" character represents an unlimited number of characters. Use "!" to regard any number of characters as being matched.
If the preset data is entered as "4912!", any bar codes that begin with "4912" will be regarded as a match. If the preset data is "!4912", any bar codes that  end with "4912" will be regarded as a match.
You can only use "!" once in one preset data.

### *Setting examples*

1.  "ABC?"      ABCD (OK),      ABC3 (OK),    ABC (NG),       ABCDE (NG)

2.  "ABC!"      ABCD (OK),      ABC3 (OK),    ABC (OK),       ABCDE (OK),      AB (NB)

3.  "?????"     Any 5-digit bar code will be OK.

4.  "!CDE"      ABCDE (OK),    3CDE (OK),    CDE (OK),       ABBDE (NG),      ADE (NG)

5.  "A!E"       ABCDE (OK),    A3CE (OK),    ABCD (NG),    AE (OK)

---

**Reference:** If you do not register preset data, "!" is automatically registered. Therefore, when the unit successfully reads a bar code, "OK" is output; when the unit fails to read, "NG" is output.

---

**6**

# 6.6    Additional Information Function

This section describes the additional information function that allows the BL-600 Series to send the read data together with various additional data.

## 6.6.1    Decode match count add function

Adds the number of successful scans during one bar code reading (decode count) to the end of the readout data (up to 9999 count). However, this decode count is never less than the preset decoding match count.
This function can be used to check reading stability and code label quality.

■ **Data format**

Partition mark

| Readout data | : | d |
|---|---|---|
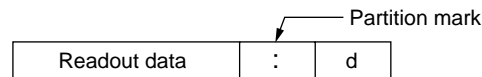
d = [Decoding match count] to 9999: Decode count

\*    The partition mark (:) can be changed as desired (1 character max.).

■ **Data output timing**

If the decoding count add function is used, the data is output at a different time than with normal operation.

•    If single label read mode is used:
The data is always output after the trigger input turns off.

•    If multi-label read mode 1 is used:
The data is output when the repeat-reading time has passed after a bar code passes across the field of the laser beam.

•    If multi-label read mode 2 or 3 is used:
The operation is the same as when the decoding count add function is not used.

## 6.6.2    Scan count add function (valid only if using the decoding count add function)

If the decoding count add function is used, you can add the number of scans while the trigger input is on, including when the reading has failed and when a bar code does not exist, to the end of the decoding count (up to 9999).

■ **Data format**

Partition mark
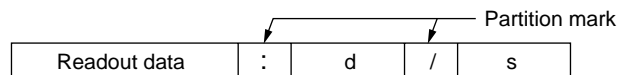
| Readout data | : | d | / | s |
|---|---|---|---|---|

s = Scan count (1 to 9999) (Zero-suppressed)

\*    The partition mark (:) can be changed as desired (1 character max.).
However, the partition mark for the scan count (/) cannot be changed.

## 6.6.3   Code type add function

Adds the bar code type before the readout data .

■ **Data format**

Partition mark

| t | : | Readout data |
|---|---|---|

| | | |
|---|---|---|
| t = 0 | : CODE39 |
| 1 | : ITF |
| 2 | : Industrial 2of5 |
| 3 | : Codabar |
| 4 | : EAN/UPC (A•E) |
| 5 | : CODE 128 |
| 6 | : COOP 2 of 5 |
| 7 | : Read error |
| 8 | : CODE93 |
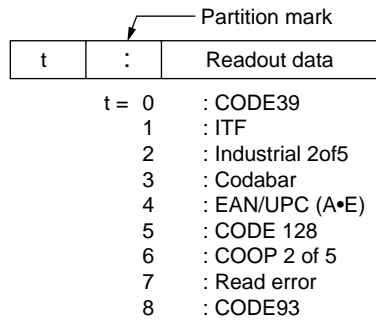
\*   The partition mark (:) can be changed as desired (1 character max.).

## 6.6.4   Label orientation add function

Adds the orientation of bar code travel before the readout data.
➱ *See pages 52 and 93*

■ **Data format**

Partition mark

| r | : | Readout data |
|---|---|---|

r =  F: Forward orientation
     R: Reverse orientation

Forward orientation

Reverse orientation
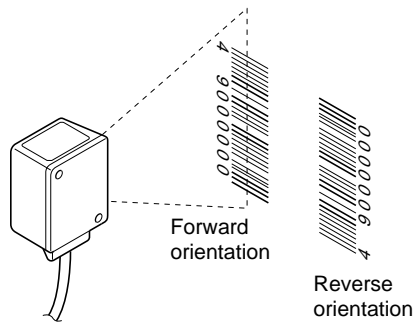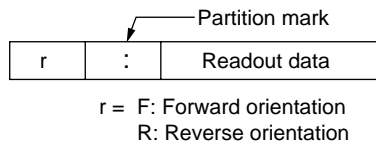
\*   If an read error occurs, this information is not added.
\*   The partition mark (:) can be changed as desired (1 character max.).

## 6.6.5  Symbology ID add function

Adds the bar code symbology identifier specified by AIM.

■ **Data format**

| SD | Readout data |
|----|--------------|
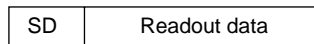
\*    No partition mark is used.

| Bar code type | Data specification | Symbology identifier (SD) |
|---------------|--------------------|---------------------------|
| CODE39 | No check digit | ]A0 |
| | Inspect check digit (sent). | ]A1 |
| | Inspect check digit (not sent). | ]A3 |
| ITF | No check digit | ]I0 |
| | Inspect check digit (sent). | ]I1 |
| | Inspect check digit (not sent). | ]I3 |
| Industrial 2of5 | —— | ]S0 |
| Codabar | —— | ]F0 |
| UPC/EAN | 13-digit EAN | ]E0 |
| | 8-digit EAN | ]E4 |
| | UPC-A 13-digit format | ]E0 |
| | UPC-A 12-digit format | None |
| | UPC-E | |
| CODE128 | No FNC1 | ]C0 |
| | FNC1 is on the 1st digit of data (EAN-128). | ]C1 |
| | FNC1 is on the 2nd digit of data. | ]C2 |
| CODE93 | —— | ]G0 |
| COOP 2of5 | —— | ]X0 |

## 6.6.6  PMI add function

Adds the data indicating the reading reliability of the bar codes (PMI: Preventive Maintenance Information).
You can recognize a low reading reliability due to a low printing quality of bar code labels or a dirty transmitter/receiver of the BL-600 Series, taking appropriate actions before serious problems can occur.

\*    The PMI add function is only available if the single label read mode is used.

■ **Data format**

Partition mark

| Readout data | : | PMI |
|--------------|---|-----|
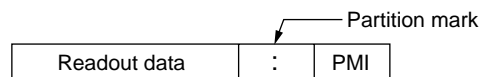
PM1 = 0 : Normal
1 : Caution
2 : Warning
9 : Reading error

\*    The partition mark (:) can be changed as desired (1 character max.).

■ **Assessment criteria for PMI**

The BL-600 Series assesses the PMI (Preventive Maintenance Information) in four levels by calculating the multiplier for the scan count between laser emission start and reading completion with reference to the specified decoding match count.

Trigger input

Laser emission

Scan count between laser emission
start and reading completion
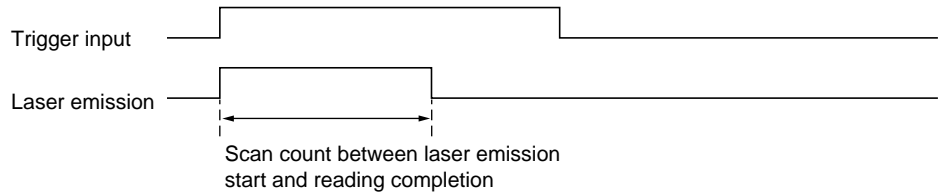
The BL-600 Series calculates the PMI using the following calculations.
The assessment uses two reference values (L1: Preset value 1, L2: Preset value 2).

\*  Be sure to set L2 larger than L1.

| PMI | Calculation | Assessment |
|-----|-------------|------------|
| 0 | Scan count/Decoding match count ≤ L1 | Normal |
| 1 | L1 <  Scan count/Decoding match count ≤ L2 | Caution |
| 2 | L2 <  Scan count/Decoding match count | Warning |
| 9 | Reading error | Reading error |

**Note:** The scan count includes scans that are not applied to a bar code. If many scan counts are not applied to a bar code, such as if using a raster-scan type reader, increase the preset values (L1 and L2).

*Example:*
When the decoding match count is 2, preset value 1 (L1) is 5, and preset value 2 (L2) is 10:

- Scan count for L1: 2 (Decoding match count) x 5 (L1) = 10
- Scan count for L2: 2 (Decoding match count) x 10 (L1) = 20

As a result, PMI is assessed as follows:

- 10 scans or less             →   PMI = 0
- From 11 scans to 20 scans  →   PMI = 1
- 21 scans or more             →   PMI = 2

■ **Setting the PMI preset values**

First, perform a reading rate check. Then, check the result and the following table to determine the preset values. A reading rate of less than 20% is not included.

| Reading rate | Preset value 1 | Preset value 2 |
|--------------|----------------|----------------|
| 20% to 39% | 6 | 12 |
| 40% to 59% | 5 | 10 |
| 60% to 79% | 4 | 8 |
| 80% to 100% | 3 | 6 |

The above values should only be used as a guide. Select the optimal value according to the operating conditions for a more severe or a more moderate criteria.

**Reference:** When the preset value 1 (L1) is set to "0", there is no assessment criteria for preset value 1, so PMI 1 will not be displayed. If the preset value 2 (L2) is set to "0", there is no assessment criteria for preset value 2, so PMI 2 will not be displayed.

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■ **Conditions for effective PMI**

To use PMI effectively, use the function under the following conditions:

- Set the BL-600 Series so that it emits the laser after the bar codes have completely entered the field of the laser beam.
  If the BL-600 Series emits the laser before the bar codes enter the field of the laser beam, it will start counting scans with no bar codes, resulting in an inaccurate PMI.

- Use the PMI add function for stationary or slowly moving bar codes. If the bar codes move at a fast speed, the scan count for each bar code decreases, resulting in an inaccurate PMI. Use the function if the decoding count in the tact check mode (⇨ *See page 94.*) is at least 20.

- The PMI add function is only effective in "Single label read mode".

■ **Useful examples of PMI applications**

● Controlling the printing quality of bar codes
  Monitor the PMI constantly. If the PMI value is degraded, the printing quality of the bar code may have a problem. Inspect the bar code.

● Preventing problems before they happen
  If using several BL-600 Series units, monitor the PMI of all the units constantly.

  - If the PMI value of a specific unit is degraded:
    The unit may have a problem, such as a dirty transmitter/receiver.

  - If the PMI value for a specific bar code is degraded:
    The bar code may have a problem, such as a low printing quality.

  As shown above, PMI allows you to identify problems. You can take appropriate action before a reading error actually occurs.

## 6.6.7 Order of the additional information

If you select to include all the additional information functions, they appear in the following order:

| Symbology identifier | Code type | : | Label orientation | : | Readout data | : | Decoding count | : | Scan count |
|---|---|---|---|---|---|---|---|---|---|

\* You can change the partition mark as desired (one character), except the delimiter of the scan count.

\* No partition mark is used for the symbology identifier.

- If the PMI add function is used, the decoding and scan counts cannot be added.

| Symbology identifier | Code type | : | Label orientation | : | Readout data | : | PMI |
|---|---|---|---|---|---|---|---|

# 6.7    Max. Code Length (Designated Digit ) Output Function

The max. code length output function allows the BL-600 Series to output only the designated digit(s) to the PC.

For example, you can extract "345" for the output from the bar code data "49123456".

Individually set the function for Codes 1 to 4 by the following procedure.
⇨ See page 52.

1.  Set "Direction".

    Set the direction, "Forward" or "Reverse", from which you would like to start counting.

    Direction

    Forward    Reverse

    4  9  1  2  3  4  5  6
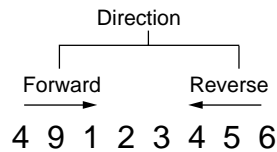
2.  Set "Starting".

    Specify from which digit you would like to begin selection (designation start digit) in the direction specified in step 1.

    Starting

    5th digit by counting forward

    4  9  1  2  **3**  4  5  6
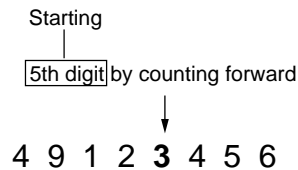
3.  Set "Effective".

    Specify how many digits you would like to select for output (designation effective digits) starting from the designation start digit specified in step 2.

    Effective

    3 digits starting from 5th digit by counting forward

    4  9  1  2  **3  4  5**  6

---
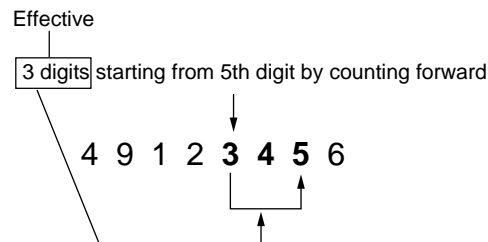
**Note 1:** The data is output in the forward direction regardless of the selected direction.

**Note 2:** When the bar code group includes those having different digits, take special care on the designated direction when setting the digits to be output.

*Example*

Designating and outputting "34" from bar codes "158423421" and "58423421"

1  5  8  4  2  **3  4**  2  1        5  8  4  2  **3  4**  2  1
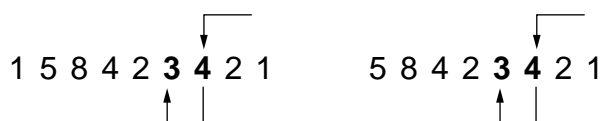
Designate 2 digits starting from 3rd digit by counting reversely.

**Note 3:** When comparing to the preset data, all the digits of the bar code are used.

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# Chapter 7

## Serial Communication

This chapter describes the serial communication control.

# 7.1    Serial Communication

Serial communication allows you to send the bar code read data from the BL-600 Series to a personal computer, or change the BL-600 Series settings from a personal computer without using the setup software.

**Communication types**

The BL-600 provides the following two communication types:

• Data communication
  Sends read bar code data from the BL-600 to the PC.

• Command communication
  Changes the BL-600's settings by sending a command from the PC to the BL-600.

\*    All communication is performed using ASCII codes on page Appendix 26.

**Communication setup**

Configure the setup for BL-600 and the PC before attempting serial communication.

• Setup of BL-600
  Set the following parameters for the BL-600 using the setup software.
  • Baud rate, Data bits, Parity, Stop bits ⇨ *See page 45.*
  • Communication protocol ⇨ *See pages 45 and 46.*
  • Header/Delimiter ⇨ *See page 46.*
  • Read error code ⇨ *See page 43.*

• PC setup
  Based on the BL-600's settings, set the communication parameters on the PC using the "Ports" setting in the Windows Control Panel/System/Device Manager.

**Tips**

• The following communication parameters are the default settings for the BL-600:
  • Baud rate: 9600 bps
  • Data bits: 7 bits
  • Parity: Even
  • Stop bit: 1 bit

  Set the PC according to the above settings before attempting communication.

• The BL-600 is set, temporarily, to the default settings for 5 seconds after the power switch is turned on.
  When the current settings of BL-600 is not certain, send the command "SSET" *(⇨ See page 116.)* and a [CR] to the BL-600 from your PC with 5 seconds after power-up. This causes the BL-600 to remain at its default settings and you can communicate with the BL-600 at the default settings. For information on checking the BL-600's current settings, see "Sift to setting mode" on page 116.
  For information on changing the above communication parameters see "Details on parameter setting commands" on page 118.
• When the BL-600 TEST switch is pressed for 8 seconds, the 1st, 3rd and 5th STABILITY LEDs from the top flash, indicating that the communication parameters are set as above. (Press the TEST switch again to reset the settings.)

**Note:** All commands should be entered in all uppercase characters. The BL cannot accept lowercase characters.

# 7.2    Details on Data Communication

This section describes the communication protocols and data format for data communication.

### Communication protocols

The BL-600 supports the following four handshaking protocols (types of data communication).

#### ■ No Handshaking

The BL-600 Series sends read data to the PC without any handshaking protocol.
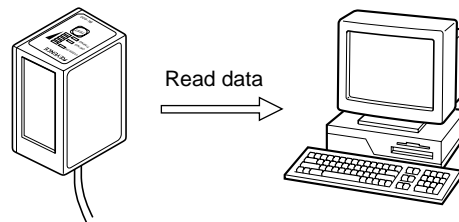
Read data

#### ■ PASS/RTRY Handshaking

1. The BL-600 Series sends read data to the PC.

2. The BL-600 Series waits for a response from the PC (PASS: Transmission succeeded, RTRY: Request to re-send).

3. If "PASS" is sent from the PC to the BL-600 Series, the data transmission is complete. The BL-600 is ready for the next data transmission.
   * The BL-600 Series does not respond to the "PASS" command.

4. If the BL-600 Series receives "RTRY" from the PC while waiting for "PASS", the BL-600 Series resends the same data and again waits for "PASS".
   * Once the BL-600 Series receives a "PASS", it will send nothing, even if "RTRY" is received from the PC.

5. The BL-600 can continue to read bar codes while waiting for "PASS." The data is stored in the BL-600's transmission buffer.

Read data

Response

(PASS, RTRY)

**Note:** If the amount of stored data exceeds the capacity of the transmission buffer, the BL-600 Series sends "[Header] OVER [Delimiter]" to the PC, and clears all the data stored in the transmission buffer. In this case, the BL-600 Series will stop operation. Operation is resumed when the BL-600 Series receives a "PASS" in response to "[Header] OVER [Delimiter]."

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● PASS and RTRY can be received in either communication format

PASS <CR>(RTRY<CR>) or <STX> PASS <ETX>(<STX>RTRY<ETX>).
  *   An <ESC> can also be added to the beginning and an <LF> added to the
      end of the format.

---

**Note 1**: The BL-600 Series can receive all commands while waiting for a "PASS."
In this case, the BL-600 Series will send back without waiting for a response to the
command (e.g. OK).

**Note 2:** When the BL-600 Series receives the "SSET" command *(⇨ See page 116.)*
while waiting for a "PASS", it clears all the data stored in the transmission buffer,
and enters the setting mode.

---

### ■ ACK/NAK Handshaking

The ACK/NAK handshaking uses <ACK> (06H) and <NAK> (15H) instead of
"PASS" and "RTRY", which are used in the PASS/RTRY handshaking. Operation is
the same as that for the PASS/RTRY handshaking, except for the transmission
characters.

### ■ RTS/CTS Handshaking

●  When the PC's "RTS" (BL-600 series' CTS) signal turns off, the BL-600 Series
   suspends data transmission. When the PC's "RTS" signal turns on, the BL-600
   Series sends the suspended data.

●  The BL-600 Series can still read bar codes even if the PC's "RTS" signal is off.
   In this case, the data is stored in the BL-600 series' transmission buffer.
   *⇨ See page 112 for its capacity.*

---

**Note 1:** If the amount of stored data exceeds the capacity of the transmission
buffer, the BL-600 sends back [Header]OVER[Delimiter] to the PC, and clears all
data stored in the transmission buffer. The BL-600 stops operation while clearing
data. It recovers when the RTS of the computer turns ON.

**Note 2:** The RTS/CTS handshaking cannot be used for RS-422A communication.
**Note 3:** The RTS/CTS protocol can be used together with other handshaking
protocols.
**Note 4:**  When the PC's RTS signal is off, the BL-600 does not sends back a
response (e.g. OK [CR]) to the PC.

---

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## Capacity of transmission buffer

The BL-600' s transmission buffer can store 400 bytes (400 characters).
The number of characters stored in the transmission buffer for each data packet is
the number of characters in the data (including additional data such as the number
of decoding match count) plus an additional five characters indicating the data's
attributes.
When multi label reading mode 2 or 3 is used, these five attribute characters are
added to each data packet.

| *Example 1* | *Example 2* |
|---|---|
| When the number of bar code digits is 10 (with no additional data) | When the number of bar code digits is 20 (with no additional data) |
| 400 ÷ (10 + 5) = 26 | 400 ÷ (20 + 5) = 16 |
| ↑            ↑<br>Capacity of    Attributes of<br>the transmis-  the data<br>sion buffer | ↑            ↑<br>Capacity of    Attributes of<br>the transmis-  the data<br>sion buffer |
| The transmission buffer can store 26 pieces of data. | The transmission buffer can store 16 pieces of data. |

**Read data format**

Set the data format of the Header and Delimiter, respectively.

| Header | Read data | Delimiter |
|--------|-----------|-----------|

With the setup software, the following formats can be selected. Other than the following formats, you can freely set up to 5 characters.

Header: **<ESC>** (1BH), **<STX>** (02H), None

Delimiter: **<CR>** (0DH), **<CR>** (0DH) **<LF>** (0AH), **<ETX>** (03H)

**Read error code**

If the BL-600 Series fails to read a bar code, it sends back a read error code.
The initial setting of the read error code is as follows:

| Header | ERROR | Delimiter |
|--------|-------|-----------|

The read error code can be changed as desired (within 8 characters).
The BL-600 can be set to send no error code.

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# 7.3    Command Communication

The BL-600 includes commands to directly operate the BL-600 (direct control commands) and the commands used to change or confirm the BL600's settings (parameter setting commands).

## 7.3.1    Setup of direct control commands

**Communication procedure**

1.  Send a direct control command from the PC to the BL-600.

2.  After receiving a command, the BL-600 Series sends back an OK response and executes the required operation.

    *   The BL-600 Series does not send back a response for the read operation and test mode control commands.
    *   When an incorrect command is sent to the BL-600, the BL-600 sends back no response.
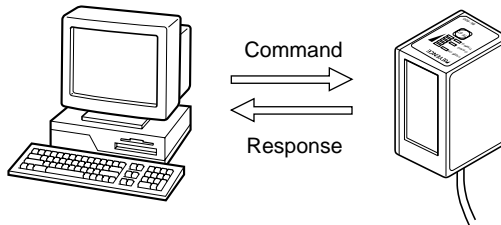
**Communication format**

When the command format is **[Command][CR]**, the response format is **[Response][CR]**. When the command format is **[STX][Command][ETX]**, the response format is **[STX][Response][ETX]**.

| Command | Response |
|---|---|
| Command CR | Response CR |
| STX Command ETX | STX Response ETX |

*   **<LF>** can be added after the command being sent. In this case, however, **<LF>** is not added to the response data.

**Note 1:** When **<ESC>** is inserted before the command being sent, characters in the BL-600's command receiving buffer are cleared.

**Note 2:** If the BL-600's command receiving buffer contains erroneous characters due to data transmission error during communication, add **<ESC>** to the command being sent.

**Note 3:** For command communication, set the time duration between transmission of each character (byte) to up to 30 seconds. If this duration exceeds 30 seconds, the BL-600 cancels the received characters.

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## Explanation of direct control commands

The following describe direct control commands in details.

| Read operation control |
|---|
| This command specifies the data read timing. |

● **Trigger on**

Command: LON
Response: None

● **Trigger off**

Command: LOFF
Response: None

• Even when the read operation is controlled with these commands, the BL-600 performs the same operation as with the trigger input. ➮ *See pages 86 to 93.* "Trigger input: on" corresponds to LON, and "trigger input: off" corresponds to LOFF.

• The BL-600 Series starts reading bar codes on receipt of LON and stops reading on receipt of LOFF.
If the bar codes are properly read and the read data is sent back, you do not need to send LOFF.

• The command characters can be freely changed (within 8 characters).

| Test mode control |
|---|
| Starts or quits the test mode. |

● **Reading rate check**

Command: TEST1
Response: None

● **Tact check**

Command: TEST2
Response: None

● **Resetting test**

Command: QUIT
Response: None

• After using the test mode, be sure to reset it.

| OK/NG output control |
|---|
| Directly turns on/off the OK/NG output. This enables you to easily check wiring. |

● **Turning the OK output on**

Command: OKON
Response: OK

● **Turning the NG output on**

Command: NGON
Response: OK

● **Turning the OK/NG outputs off**

Command: ALLOFF
Response: OK

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| **Online test mode** |
|---|
| Sets to online test mode. ⇨ *See pages 99 and 100.* |

● **Online test ON**

Command: #TEST1
Response: OK

● **Online test OFF**

Command: #QUIT
Response: OK

| **Clearing transmission buffer** |
|---|
| Clears data stored in the transmission buffer. |

Command: BCLR
Response: OK

| **Shift to setting mode** |
|---|
| Enters the setting mode. ⇨ *See page 118.* |

Command: SSET
Response: OK

| **Laser off/Resetting Laser off** |
|---|
| Turns off the laser emission when the laser beam may cause injury to an operator. ⇨ *See page 4.* |

● **Laser off**

Command: LOCK
Response: OK

● **Resetting Laser off**

Command: UNLOCK
Response: OK

• When the Laser off command is executed, bar code read operation (laser emission) is disabled until the Laser off command is reset by using UNLOCK command.

• The Laser off command is retained even after the power is turned off.

| **Reset** |
|---|
| Resets the BL-600 software. |

Command: RESET
Response: OK

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| **Readout history check** |
| Outputs the readout OK and NG counts during trigger input ON. |

> Command:  NUM
> Response:  aaaaa/bbbbb/ccccc
>                    aaaaa = 00000 to 65535: Readout OK count
>                    bbbbb = 00000 to 65535: Readout NG count
>                    ccccc = 00000 to 65535: Trigger input ON count

• These counts are reset to zero by turning the power OFF or sending the RESET command.

| **Motor control** |
| Stops motor rotation. |

● **Motor stop**

> Command: MOTOROFF
> Response: OK

● **Resetting the motor stop**

> Command: MOTORON
> Response: OK

• Reading is disabled for 5 seconds after the motor stop is reset.

| **Changing the scanning width** |
| Changes the scanning width |

● **Starting angle of scanning**

> Command: SDEGa
> (Specify the starting angle of scanning [angle "a"] using angle "c" as a reference.) [a = 0 to 400 (Unit: $0.1°$) * Initial value = 0]
> Response: OK

● **Scanning angle**

> Command: WDEGb
> (Specify the scanning angle starting from angle "a.") [b = 400 to 600 (Unit: $0.1°$) * Initial value = 600]
> Response: OK
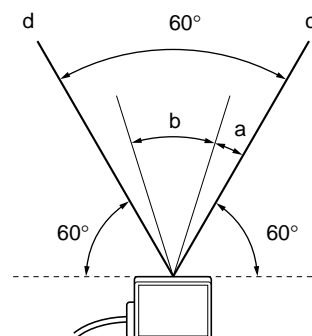


**Note 1:** The scanning width cannot be specified to exceed the angle range between "c" and "d" ($60°$).

**Note 2:** The angle specified in the steps above should be used as a guide. If a precise setting is required, adjust the position of each bar code reader separately after installation.

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## 7.3.2  Details on parameter setting commands

The following describes how to change the BL-600's settings through command communication.

You can use the setup software to change the BL-600's settings instead of these commands.

### Communication details

1. Send the direct control command SSET to the BL-600.
   The BL-600 will shift to setting mode.
   After successfully executing the command, the BL-600 sends back an OK.

2. The BL-600 Series shifts to the setting mode.
   If the command is successfully executed: The BL-600 Series sends back an "OK."

3. Send the command for an item to be changed (setting change command).
   If the command is successfully executed: The BL-600 Series sends back an "OK."
   If an error occurs:  The BL-600 Series sends back an "ERR** (**: Error code)."

4. To confirm the current settings, send a setting confirmation command.
   If the command is successfully executed: The BL-600 Series sends back the setting data.
   If an error occurs:  The BL-600 Series sends back an "ERR** (**: Error code)."

5. To save the settings in the EEP-ROM, send "SAVE" to the BL-600 Series.
   Once the settings have been saved in the EEP-ROM, the BL-600 Series will start with the new settings the next time it is turned on.
   If the command is successfully executed: The BL-600 Series sends back an "OK."
   If an error occurs:  The BL-600 Series sends back an "ERR** (**: Error code)."

6. To quit the setting mode and perform normal bar code reading, send "SEND" to the BL-600 Series.
   If the command is successfully executed: The BL-600 Series sends back an "OK."
   If an incorrect command is sent:  The BL-600 Series sends back an "ERR** (**: Error code)."

### Communication format

When the command format is **[Command][CR]**, the response format is **[Response][CR]**. When the command format is **[STX][Command][ETX]**, the response format is **[STX][Response][ETX]**.

| Command | Response |
|---|---|
| Command CR | Response CR |
| STX Command ETX | STX Response ETX |

\*  **<LF>** can be added at the end of the command being sent. In this case, however, **<LF>** is not added to the response data.

**Note 1:** When **<ESC>** is added before the command being sent, characters in the BL-600's command receiving buffer are cleared.
**Note 2:** If the BL-600's command receiving buffer contains erroneous characters due to a data transmission error during communication, add **<ESC>** to the command being sent.
**Note 3:** For command communication, set the time duration between transmission of each character (byte) to up to 30 seconds. If this duration exceeds 30 seconds, the BL-600 cancels the received characters.

**Response error code**

When an incorrect command is sent to set parameters, the BL-600 sends back data indicating the cause of the error (error code). For the commands corresponding to the error codes, see the error code column given in the table on the following pages.

| Error code | Cause of error |
|---|---|
| 00 | Undefined command. |
| 01 | Command format is incorrect. |
| 02 | Nothing corresponds to the number in the command. |
| 03 | "m" value (codes 1 to 4) is other than 0 to 3. |
| 04 | "Bar code type setting command" was not sent first. ⇨ *See page 120*. Sending "No. of readable digits setting command" is invalid for UPC/EAN code. |
| 05 | The number in the command is too long. |
| 06 | "hhh..." data is too short. |
| 07 | "n" value is not 0 or 1. |
| 08 | "n" value is exceeding the setting range. |
| 09 | "nnn" or "nn" value is exceeding the setting range. |
| 10 | "hhh..." is not specified in HEX (hexadecimal) code. |
| 11 | "hhh...=FF" cannot be set. |
| 12 | "hhh..." or "aaa..." contains more than the specified number of characters. |
| 13 | Characters of "aaa..." are invalid. |
| 14 | Data in the EEPROM may be damaged. Perform initial setup. |
| 15 | Error in the area storing initial settings. Settings are automatically initialized. |
| 17 | \ is not followed by !, ? or \ in preset data. ⇨ *See pages 164 and 165*. |
| 18 | Two !s exist in preset data. ⇨ *See page 101*. |
| 99 | The BL-600 may malfunction. Contact KEYENCE. |

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## Description of parameter setting commands

### ■ Saving/initializing settings/quitting setting mode

| Function | Command being sent | Response | Description | Error code |
|---|---|---|---|---|
| Saves settings in the EEP-ROM. | SAVE | OK | ⇨ *See page 118.* | – |
| Initializes settings. | DFLT | OK | Returns to the default-settings, and saves the settings in the EEP-ROM. | 00, 05, 14, 15 |
| Quits the setting mode. | SEND | OK | ⇨ *See page 118.* | – |

### ■ Setting bar code type and number of readable digits for codes 1 to 4

The following describes the parameter setting commands for Codes 1 to 4.
Be sure to send "Bar code type setting command" first before setting other parameters.

* When "Bar code type setting command" is newly sent, all other parameters for the specified code will return to the default settings.
  In this case, set all other parameters again.

Setting change commands and setting confirmation commands are described on the following pages.

| Function | Command being sent | | Response | Description | Error code |
|---|---|---|---|---|---|
| Setting bar code type for codes 1 to 4. (Bar code type setting command) | Change | CODEm=n | OK | m=0 to 3:Codes 1 to 4<br>n=0: CODE 39<br>　1: ITF<br>　2: Industrial 2 of 5<br>　3: Codabar<br>　4: UPC/EAN<br>　5: CODE128<br>　6: COOP2of5<br>　7: None<br>　8: CODE93 | 00, 01, 03, 05, 08, 14 |
| | Confirm | CODEm | mn | | |
| Setting Max. No. of readable digits | Change | MAXm=nn | OK | m=0 to 3: Codes 1 to 4<br>nn=01 to 32<br>* For CODE39, Codabar: 03 to 32<br>* For ITF: 02 to 32<br>* For CODE128: 01 to 64 | 00, 01, 03, 04, 05, 09, 14 |
| | Confirm | MAXm | mnn | | |
| Setting Min. No. of readable digits | Change | MINm=nn | OK | **Note:** With EAN code, this command causes error. | |
| | Confirm | MINm | mnn | | |
| CODE39 Sending start/stop character. | Change | WCm00n | OK | m=0 to 3: Codes 1 to 4<br>n=0: Disable<br>　1: Enable | 00, 02, 03, 04, 05, 07, 14 |
| | Confirm | RCm00 | 00n | | |
| CODE39 Inspection of check digit (Modulus 43) | Change | WCm01n | OK | m=0 to 3: Codes 1 to 4<br>n=0: Disable<br>　1: Enable | |
| | Confirm | RCm01 | 01n | | |

| Function | Command being sent | | Response | Description | Error code |
|---|---|---|---|---|---|
| CODE39 Sending check digit. | Change | WCm02n | OK | m=0 to 3: Codes 1 to 4 | 00, 02, 03, 04, 05, 07, 14 |
| | Confirm | RCm02 | 02n | n=0: Disable | |
| | | | | 1: Enable | |
| ITF Inspection of check digit (Modulus 10/ Wait 3) | Change | WCm10n | OK | m=0 to 3: Codes 1 to 4 | |
| | Confirm | WCm10 | 10n | n=0: Disable | |
| | | | | 1: Enable | |
| ITF Sending check digit. | Change | WCm11n | OK | m=0 to 3: Codes 1 to 4 | |
| | Confirm | RCm11 | 11n | n=0: Disable | |
| | | | | 1: Enable | |
| Codabar Sending start/stop character. | Change | WCm30n | OK | m=0 to 3: Codes 1 to 4 | |
| | Confirm | RCm30 | 30n | n=0: Disable | |
| | | | | 1: Enable | |
| Codabar Start/Stop character type | Change | WCm31n | OK | m=0 to 3: Codes 1 to 4 | |
| | Confirm | RCm31 | 31n | n=0: Lower case | |
| | | | | 1: Upper case | |
| Codabar Inspection of check digit | Change | WCm32n | OK | m=0 to 3: Codes 1 to 4 | |
| | Confirm | RCm32 | 32n | n=0: Disable | |
| | | | | 1: Enable | |
| Codabar Sending check digit | Change | WCm33n | OK | m=0 to 3: Codes 1 to 4 | |
| | Confirm | RCm33 | 33n | n=0: Disable | |
| | | | | 1: Enable | |
| Codabar Setting check digit type | Change | WCm34n | OK | m=0 to 3: Codes 1 to 4 | 00, 02 03, 04, 05, 08, 14 |
| | Confirm | RCm34 | 34n | n=0: Modulus16 | |
| | | | | 1: Modulus 11 | |
| | | | | 2: Modulus 10/Wait 2 | |
| | | | | 3: Modulus 10/Wait 3 | |
| | | | | 4: 7 Check DR | |
| | | | | 5: Modulus 11-A | |
| | | | | 6: Modulus 10/ Wait 2-A | |
| EAN/UPC (A•E) Reading UPC-E | Change | WCm40n | OK | m=0 to 3: Codes 1 to 4 | 00, 02, 03, 04, 05, 07, 14 |
| | Confirm | RCm40 | 40n | n=0: Disable | |
| | | | | 1: Enable | |
| EAN/UPC (A•E) Reading EAN 8 digits | Change | WCm41n | OK | m=0 to 3: Codes 1 to 4 | |
| | Confirm | RCm41 | 41n | n=0: Disable | |
| | | | | 1: Enable | |

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| Function | Command being sent | | Response | Description | Error code |
|---|---|---|---|---|---|
| EAN/UPC (A•E) Reading JAN 13 digits | Change | WCm42n | OK | m=0 to 3: Codes 1 to 4 | 00, 02, 03, 04, 05, 07, 14 |
| | Confirm | RCm42 | 42n | n=0: Disable<br>    1: Enable | |
| EAN/UPC (A•E) No. of UPC-A output digits | Change | WCm43n | OK | m=0 to 3: Codes 1 to 4 | |
| | Confirm | RCm43 | 43n | n=0:Output in 13 digits<br>    1:Output in 12 digits | |
| EAN/UPC (A•E) Adding "0" to UPC-E system code | Change | WCm44n | OK | m=0 to 3: Codes 1 to 4 | |
| | Confirm | RCm44 | 44n | n=0: Disable<br>    1: Enable | |
| CODE128 EAN-128 support ⇨ *See p. 32.* | Change | WCm51n | OK | m=0 to 3: Codes 1 to 4 | |
| | Confirm | RCm51 | 51n | n=0: Disable<br>    1: Enable | |
| Setting max. code length output function | Change | WCm83n | OK | m=0 to 3: Codes 1 to 4 | |
| | Confirm | RCm83 | 83n | n=0: Disable<br>    1: Enable | |
| Setting direction for max. code length output | Change | WCm84n | OK | m=0 to 3: Codes 1 to 4 | |
| | Confirm | RCm84 | 84n | n=0: Forward<br>    1: Reverse | |
| Setting effective digits for max. code length output | Change | WCm85nn | OK | m=0 to 3: Codes 1 to 4 | 00, 02, 03, 04, 05, 09, 14 |
| | Confirm | RCm85 | 85nn | nn=01 to 32<br>  : Effective digits | |
| Setting starting digit for max. code length output | Change | WCm86nn | OK | m=0 to 3: Codes 1 to 4 | |
| | Confirm | RCm86 | 86nn | nn=01 to 32<br>  : Starting digit | |
| Setting label orientation speci-fied reading | Change | WCm81n | OK | m=0 to 3: Codes 1 to 4 | 00, 02, 03, 04, 05, 07, 14 |
| | Confirm | RCm81 | 81n | n=0: Disable<br>    1: Enable | |
| Setting orientation for orientation-specified reading | Change | WCm82n | OK | m=0 to 3: Codes 1 to 4 | |
| | Confirm | RCm82 | 82n | n=0: Forward<br>    1: Reverse | |

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■ **Setting Reading Mode/Data Addition Functions**

| Function | Command being sent | | Response | Description | Error code |
|---|---|---|---|---|---|
| Setting reading mode | Change | WP12n | OK | n=0: Single label<br>    1: Multi label 1<br>    2: Multi label 2<br>    3: Multi label 3 | 00, 02, 05, 07, 14 |
| | Confirm | RP12 | 12n | | |
| Setting data send timing | Change | WP13n | OK | N=0: Sends data after reading<br>    1: Sends after timing input turns off | 00, 02, 05, 07, 14 |
| | Confirm | RP13 | 13n | | |
| Setting repeat-read time in multi label reading mode 1 or 2 | Change | WP41nnn | OK | nnn=001 to 225 (by 100 ms step) | 00, 02, 05, 09, 14 |
| | Confirm | RP41 | 41nnn | | |
| Setting decoding match count | Change | WP43nnn | OK | nnn=001 to 225 | |
| | Confirm | RP43 | 43nnn | | |
| Setting decoding match count in additional information | Change | WP10n | OK | n=0: No addition<br>    1: Add | 00, 02, 05, 07, 14 |
| | Confirm | RP10 | 10n | | |
| Setting scans in additional information | Change | WP11n | OK | n=0: No addition<br>    1: Add<br><br>**Note:** Effective only when No. of decodings are added. | |
| | Confirm | RP11 | 11n | | |
| Setting label orientation in additional information | Change | WP14n | OK | n=0: No addition<br>    1: Add | |
| | Confirm | RP14 | 14n | | |
| Setting code type in additional information | Change | WP17n | OK | n=0: No addition<br>    1: Add | |
| | Confirm | RP17 | 17n | | |
| Adding a symbol identifier | Change | WP80n | OK | n=0: No addition<br>    1: Add | |
| | Confirm | RP80 | 80n | | |
| Adding PMI (Preventive mainte-nance information) | Change | WP86n | OK | n=0: No addition<br>    1: Add | |
| | Confirm | RP86 | 86n | | |
| PMI Preset value 1 (L1) | Change | WP48nnn | OK | nnn= 000 to 100 | 00, 02, 05, 07, 14 |
| | Confirm | RP48 | 48nnn | | |
| PMI Preset value 2 (L2) | Change | WP49nnn | OK | nnn= 000 to 100 | |
| | Confirm | RP49 | 49nnn | | |
| Setting reading error code | Change | WP55hhh... | OK | hhh ... = Reading error code (within 8 characters)<br>* Specify the characters in HEX (hexadeci-mal) code.<br>* If the reading error code is not specified, hhh... = FF. | 00, 02, 05, 06, 10, 12, 14 |
| | Confirm | RP55 | 55hhh... | | |

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**Tips**

To set the reading error code, send the following command:

*Example 1*
Set the reading error code to "BR".

B R

WP554252
* B = 42h, R = 52h

*Example 2*
Set no reading error code.
WP55FF

■ **Setting trigger input (Starting test mode)**

| Function | Command being sent | | Response | Description | Error code |
|---|---|---|---|---|---|
| Setting signal type | Change | WP05n | OK | n=0: Level | 00, 02, 05, 07, 14 |
| | Confirm | RP05 | 05n | 1: One-shot | |
| Setting one-shot input time | Change | WP42nnn | OK | nnn=001 to 225 | 00, 02, 05, 09, 14 |
| | Confirm | RP42 | 42nnn | (by 100 ms step) | |
| Setting time constant of trigger input | Change | WP04n | OK | n=0: 2 ms | 00, 02, 05, 07, 14 |
| | Confirm | RP04 | 04n | 1: 10 ms | |
| Setting state of trigger input | Change | WP03n | OK | n=0: Normal-open | |
| | Confirm | RP03 | 03n | 1: Normal-close | |
| Trigger the input status at power-on | Change | WP02n | OK | n=0: OFF | |
| | Confirm | RP02 | 02n | 1: ON | |
| Starting test mode when trigger input turns on. (To specify the test mode, use the command below.) | Change | WP06n | OK | n=0: Disable | |
| | Confirm | RP06 | 06n | 1: Enable | |
| Specifying the test mode to be started when trigger input turns on. | Change | TRGTn | OK | n=1: Reading rate check mode | 00, 02, 05, 08, 14 |
| | Confirm | TRGT | TRGTn | 2: Tact check mode | |
| Starting test mode when power is turned on. | Change | TESTn | OK | n=0: Reset | |
| | Confirm | TEST | TESTn | 1: Reading rate check mode | |
| | | | | 2: Tact check mode | |
| Setting characters of trigger on command | Change | WP56hhh... | OK | hhh...=Trigger on command (Up to 8 characters) | 00, 02, 05, 11, 14 |
| | Confirm | RP56 | 56hhh... | * Specify characters in HEX (hexadecimal) code. | |
| Setting characters of trigger off command | Change | WP57hhh... | OK | hhh...=Trigger off command (Up to 8 characters) | |
| | Confirm | RP57 | 57hhh... | * Specify characters in HEX (hexadecimal) code. | |

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**Tips**    To set characters of the trigger On/Off command, send the following command.

*Example 1*

Change the trigger on command to S.

```
          S
          ⌐
     WP5653
     * S=53h
```

■ **Setting communication parameters 1**

| Function | Command being sent | | Response | Description | Error code |
|---|---|---|---|---|---|
| Setting baud rate | Change | WP35n | OK | n=5: 38400 bps | 00, 02, |
| | Confirm | RP35 | 035n | 6: 31250 bps | 05, 08, |
| | | | | 7: 19200 bps | 14 |
| | | | | 0: 9600 bps | |
| | | | | 1: 4800 bps | |
| | | | | 2: 2400 bps | |
| | | | | 3: 1200 bps | |
| | | | | 4: 600 bps | |
| Setting data bit length | Change | WP30n | OK | n=0: 7 bits | 00, 02, |
| | Confirm | RP30 | 30n | 1: 8 bits | 05, 07, |
| Setting parity check * To set the parity type, use the command below. | Change | WP31n | OK | n=0: Disable | 14 |
| | Confirm | RP31 | 31n | 1: Enable | |
| Setting parity type | Change | WP32n | OK | n=0: Even | |
| | Confirm | RP32 | 32n | 1: Odd | |
| Setting Stop bit | Change | WP33n | OK | n=0:1 bit | |
| | Confirm | RP33 | 33n | 1: 2 bits | |
| Setting RTS/CTS handshaking | Change | WP22n | OK | n=0: Disable | |
| | Confirm | RP22 | 22n | 1: Enable | |
| Setting RS-485 multi drop link | Change | WP34n | OK | n=0: Disable | |
| | Confirm | RP34 | 34n | 1: Enable | |
| Setting ID No. for RS-485 multi drop link. | Change | WP44nn | OK | nn=01 to 31 | 00, 02 |
| | Confirm | RP44 | 44nn | | 05, 09, 14 |

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■ **Setting communication parameters 2 (When the PLC link is not used)**

| Function | Command | | Response | Description | Error code |
|---|---|---|---|---|---|
| Handshaking protocol 1 | Change | WP07n | OK | n = 0: No handshaking<br>n = 1: Use protocol<br><br>*To set details of the protocol, use handshaking protocol 2. | 00, 02, 05, 07, 14 |
| | Confirm | RP07 | 07n | | |
| Handshaking protocol 2 | Change | WP08n | OK | n = 0: PASS/RTRY protocol<br><br>n = 1: ACK/NAK protocol | |
| | Confirm | RP08 | 08n | | |
| Adding checksum | Change | WP39n | OK | n = 0: Do not add<br>n = 1: Add | |
| | Confirm | RP39 | 39n | | |
| Header | Change | WP51hhh... | OK | hhh... = Header  (up to five characters)<br>* To set a header, use HEX (hexadecimal) codes.<br>* hhh... = FF: Header is not set. | 00, 02, 05, 06, 10, 12, 14 |
| | Confirm | RP51 | 51hhh... | | |
| Delimiter | Change | WP52hhh... | OK | hhh... = Delimiter (up to five characters)<br>* To set a delimiter, use HEX (hexadecimal) codes.<br>* hhh... = FF: Delimiter is not set. | |
| | Confirm | RP52 | 52hhh... | | |
| Transmission delay time | Change | WP98nnn | OK | nnn = 000 to 255<br>(by 10 ms step) | 00, 02, 05, 09, 14 |
| | Confirm | RP98 | 98nnn | | |

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**Tips**

To set the header and delimiter, send the following command:

*Example*

Set the communication data format to <SOH> 01 bar code data A <CR>.

```
      SOH  0  1                        A  CR
      ┌┐  ┌┐ ┌┐                       ┌┐ ┌┐
    WP51013031              WP52410D
```
\* SOH =01h, 0=30h, 1=31h, A=41h, CR =0Dh

■ **Setting communication parameters 2 (only when PLC link is used)**

| Function | Command | | Response | Description | Error code |
|---|---|---|---|---|---|
| PLC link model | Change | WP36n | OK | n = 0: PLC link disabled<br>n = 1: SYSNAC-C<br>n = 2: MELSEC-A<br>n = 3: KV<br>n = 4: MELSEC-A (File register is used.) | 00, 02, 05, 07, 14 |
| | Confirm | RP36 | 36n | | |
| Trigger input through PLC link | Change | WP37n | OK | n = 0: Disable<br>n = 1: Enable | |
| | Confirm | RP37 | 37n | | |
| DM head address | Change | WP45nn | OK | nn = 00 to 99<br>(0000 to 9900) | 00, 02, 05, 09, 14 |
| | Confirm | RP45 | 45nn | | |
| PLC / station number | Change | WP47nn | OK | nn = 00 to 31 | |
| | Confirm | RP47 | 47nn | | |
| File register block number | Change | WP46nnn | OK | nnn = 000 to 255 | |
| | Confirm | RP46 | 46nnn | | |

■ **Setting communication strings**

| Function | Command | | Response | Description | Error code |
|---|---|---|---|---|---|
| Setting partition mark when additional information is used. | Change | WP50hh | OK | hh = Partition mark (1 character)<br>* Specify the mark in HEX (hexadecimal) code. | 00, 02, 05, 06, 10, 12, 14 |
| | Confirm | RP50 | 50hh | | |
| Setting intermediate delimiter when multi label reading mode 2 or 3 is used. | Change | WP54hhh... | OK | hhh = Intermediate delimiter (Up to 5 characters)<br>* Specify the mark in HEX (hexadecimal) code.<br>* To set no intermediate delimiter, hhh = FF. | |
| | Confirm | RP54 | 54hhh... | | |

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■ **Utility Setting (Stability LED, OK/NG output duration, Preset data for compare)**

| Function | Command being sent | | Response | Description | Error code |
|---|---|---|---|---|---|
| Indication of Stability LED | Change | WP09n | OK | n=0: Disable | 00, 02, 05, 07, 14 |
| | Confirm | RP09 | 09n | 1: Enable | |
| Setting OK/NG output duration | Change | WP40nnn | OK | nnn= 001 to 255 | 00, 02, 05, 09, 14 |
| | Confirm | RP40 | 40nnn | (by 10 ms step) | |
| Registration of preset data for compare | Change | WP68aaa... | OK | aaa...= Preset data (Up to 32 characters) | 00, 02, 05, 12, 13, 14, 17, 18 |
| | Confirm | RP68 | 68aaa... | * For CODE128, see P.136 to 137. * To delete the preset data, send WP68. | |
| Scaling factor for the quiet zone | Change | WP0Mn | OK | n = 0: 4x    1: 5x    2: 6x    3: 7x    4: 8x    5: 9x    6: 10x    7: 11x | 00, 02, 05, 07, 14 |
| | Confirm | RP0M | 0Mn | | |
| Reading a reversed bar code | Change | WP0Rn | OK | n= 0: OFF    1: On | |
| | Confirm | RP0R | 0Rn | | |
| Outputting the test mode result | Change | WP85n | OK | n = 0: Disable output    1: Enable output | |
| | Confirm | RP85 | n | | |
| Changing the decoding match count | Change | WP93nnn | OK | nnn= 000 to 255 | |
| | Confirm | RP93 | 93nnn | | |

**Tips**

To register the preset data, send the following command.

*Example*

Register "ABC123" as preset data.

    WP68ABC123

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# Chapter 8

## PLC Link

This chapter describes the PLC link control.

# 8.1    PLC Link

This section describes the applicable PLCs and devices for the PLC link.

Since the BL-600 directly controls the PLC's memory, no program is required for data communication, resulting in a reduced number of programming steps.

As compared with the serial communication using a computer, the PLC link involves the following limitations:

• The BL-600 settings cannot be changed because the PLC link cannot send a command to the BL-600. However, the PLC link provides a reading control address to start/end reading.

• The PLC link cannot start the test mode.

## 8.1.1    List of PLCs used for PLC link

| | | |
|---|---|---|
| **KEYENCE KV Series** | Built-in CPU port | KV-10/16/24/40/80, KV-300 NEW KV-10/16/24/40 |
| | Serial interface module | KV-L2 |
| **Mitsubishi MELSEC-A Series** | Built-in CPU port | A2CCPUC24, A2CCPUC24-PRF |
| | Calculator link unit | AJ71(U)C24(-Sx), AJ71Q24(-R2/R4), A0J2-C214-S1 A1SJ71(U)C24-R2/PRF/R4 |
| **OMRON SYSMAC-C Series** | Built-in CPU port | C20H/28H/40H C200HS-CPU21/23/31/33 C200HE-CPU/32/42 C200HG-CPU33/43/53/63 C200HX-CPU34/44/54/64 C200HX-CPU65-Z/85-Z |
| | High-order link unit | C200H-LK201(-V1), C500-LK203 C500-LK201-V1, C120-LK201-V1 C200H-LK202(-V1), C120-LK202-V1 |
| | Communication board | C200HW-COM02/COM03/COM04/ COM05/COM06 |
| **OMRON SYSMAC-CQM1 Series** | Built-in CPU port | CQM1-CPU21/41/42/43/44 |
| **OMRON SYSMAC-CV Series** | Built-in CPU port | CV500/1000, CV-M1 |
| | High-order link unit | CV500-LK201 |

**Note:** KV-300 and KV-L2 are not available in Europe.

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## 8.1.2  Devices used for PLC link

The BL-600 supports the following PLC devices.
To use MELSEC-A Series, select the data register or file register.

| PLC | Device name | Memory area |
|-----|-------------|-------------|
| KV-10/16 | Data memory | DM0000 to DM0999 |
| KV-24/40/80 NEW KV-10/16/24/40 | Data memory | DM0000 to DM1999 |
| KV-300 | Data memory | DM0000 to DM8999 |
| MELSEC-A | Data register | D0000 to D8191 |
| | File register | R0000 to R8191 (according to the setting) |
| SYSMAC-C | Data memory | DM0000 to DM6143 |

\*   The available memory areas of the MELSEC-A or SYSMAC-C may be smaller than the following data.
For details, see the instruction manual for the PLC being used.

\*   The MELSEC-A Series provides an extension file register.

\*   When a block number is specified during the BL-600 setup, the specified extension file register is used.
When "0" is specified for the block number, the extension file register of the block number specified in the PLC program is used.
If no block number is specified (during the BL-600 setup and PLC programming), the file register incorporated in the CPU is used.

**Note:** KV-300 is not available in Europe.

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# 8.2    Setting the BL-600 and PLC

This section describes setting the BL-600 Series and the PLC.

## 8.2.1    Setting the BL-600 Series

Use the BL-600 setup software to set the following. For the differences in setting due to the link unit or PLC type, see the next subsection "Setting the PLC".

1. In [[Comm settings-1]], set the following data.

   • Match the baud rate, data length, parity and stop bit length of the BL-600 to those of the PLC.

   • Disable the RTS/CTS protocol.

   • Disable the multi-drop link.

2. In [[Comm settings-2]], set the following data.

   • Type of the PLC
     When using the KV-L2* in "Display interface mode", set "SYSMAC-C" in the BL-600 settings.

   • PLC trigger input area

   • DM head address

   • PLC unit No./station No.

   • Set whether or not the final register is used.

## 8.2.2    Setting the PLC

Set the PLC or link unit as follows:

■ **Setting MELSEC-A Series**

1. Set the RS-232C communication parameters (baud rate, data length, parity and stop bit length) according to the BL-600's settings.

2. Set the station number according to the BL-600's setting.

3. Set the mode to "Protocol Type 4 ".
   * Only for the AJ71QC24, set the mode to "Special protocol", "ASCII", and "Type4".

4. Set the main channel to either "RS-232C" or "RS-422A".

5. Set "Checksum" to "Enable".

6. Set "Write during running" to "Enable".

7. Set "Selecting computer link/multi-drop" to "Computer link" (for the AJ71UC24 only).

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■ **Setting SYSMAC-C Series**

1. Set the RS-232C communication parameters (baud rate, data length, parity and stop bit length) according to the BL-600's settings.

2. Set the unit number according to the BL-600's setting.

3. Set the command level to "Level 1, 2, 3".

4. Set "1:1/1:N" to "1:N".

5. Set "I/O port" to either "RS-232C" or "RS-422A".

6. Set "Trigger input" to "Internal".

7. Set "Supply 5 V" to "Disable".

8. Set "CTS" to "0 V (Normally ON)."

* The "I/O port", "Trigger input", "Supply 5 V" and "CTS" parameters may not be provided depending on the type of link unit.

* If using the C200HE/HG/HX or a communication board, follow steps 1 and 2 above, and set the mode to "Upper link", and "CTS control" to "None". Use the initial settings for the other parameters.

■ **Setting KV Series/handheld programmer port**

1. The KV series' RS-232C port must always be set to the following values:

    • Baud rate : 9600 bps
    • Data length: 8 bits
    • Parity: Even
    • Stop bit length: 1 bit

2. Set the RS-232C communication parameters of the BL-600 according to the above settings. Set the BL-600's communication mode to "KV".

* No other parameters need to be set.

■ **Settings for KV-L2/KV mode***

1. Set the KV-L2's communication mode to "KV mode".
   Set the BL-600's communication mode to "KV".

2. The KV mode must be always set to the following values:

    • Baud rate : 9600 bps
    • Data length: 8 bits
    • Parity: Even
    • Stop bit length: 1 bit

    Set the RS-232C communication parameters of the BL-600 according to the above settings.

3. Set the station number to "00".

4. To use the KV-L2 port 2, set the port 2 selector switch to "RS-232C" or "RS-422A".

* No other parameters need to be set.

**Note:** KV-L2 is not available in Europe.

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■ **Settings for KV-L2/Display Interface mode***

1. Set the KV-L2's communication mode to "Display Interface" mode. To use link mode, select "SYSMAC-C" for the BL-600's setting.

2. Set the baud rate, data length, parity and stop bit length according to the RS-232C communication parameters of the BL-600.

3. Set the station number to "00".

4. To use the KV-L2 port 2, set the port 2 selector switch to "RS-232C" or "RS-422A".

*    No other parameters need to be set.

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# 8.3    Device Assignment

The data areas used to control the BL-600 are provided in the PLC's internal memory (D areas or DM areas).
When a device head address is specified on the "PLC SETUP" screen in the BL-600 setup software, the device numbers are automatically assigned based on the specified head address.

## 8.3.1    Data memory head address

[Specified head address] +00 indicates the area where the bar code data is stored.
[Specified head address] +01 to +03 are reserved areas and cannot be assigned for the bar code data.
[Specified head address] +04 to +06 are the areas used by the PLC to send a reading trigger to the BL-600.

\*    The method for using the areas varies depending on the BL-600 scan method, "Level signal trigger" or "One-shot signal trigger".

\*    If the BL-600 Series is set to disable the "PLC Trigger Area", data is not assigned to the data memory head address area. You can use this area for other purposes.

| Address | Description | Reference page |
|---------|-------------|----------------|
| +00 | Data memory head address for Code 1 | 137 |
| +01 | Reserved area for Code 2 | 137 |
| +02 | Reserved area for Code 3 | 137 |
| +03 | Reserved area for Code 4 | 137 |
| +04 | Reading trigger area | |
| +05 | Reading trigger response area<br>\* Only when "Level signal trigger" is selected. | 137 to 139 |
| +06 | One-shot trigger time setup area<br>\* Only when "One-shot signal trigger" is selected. | |

**Note 1:** When using the BL-600 in multi-label read mode 3, addresses +00 to +03 are used as the data memory head addresses for Codes 1 to 4, respectively. Data is not stored in the areas for which the code type is not set.

**Note 2:** If using the BL-600 Series in multi-label read mode 1 or 2, the read data is written one at a time to the area specified with address +00 in the order of the reading.

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## 8.3.2  Data memory areas

Bar code data read by the BL-600 is stored in the areas starting from "+00". (Based on the specified data memory head address).

"A" indicates the data memory head address

| Address | Description | Reference page |
|---|---|---|
| A+00 | Data memory flag area | 139 to 140 |
| A+01 | Label orientation | 140 |
| A+02 | Decoding count/PMI | |
| A+03 | Scan count | |
| A+04 | Bar code type | |
| A+05 | Number of digits of bar code data | 141 |
| A+06 | 1st digit of bar code data | |
| A+07 | 2nd digit of bar code data | |
| A+08 | 3rd digit of bar code data | |
| : | : | |
| A+69 | 64th digit of bar code data | |

**Note:** The data memory areas accept up to 64 digits. However, the BL-600 Series can only read a maximum of 32 digits. It can only read 64 digits if the bar code type is CODE128 and the start character is CODE-C.

*Example*

When the bar code types are set in Codes 1 to 3 in multi-label read mode 3 (Code 4 is not set)
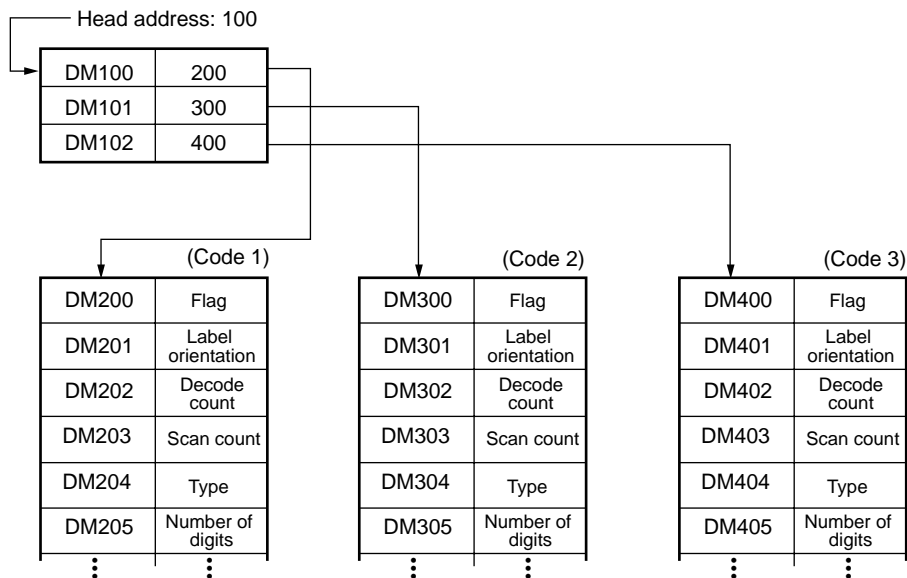
## 8.3.3   Detailed description of device assignment

| +00 to +03 |
| --- |
| Data memory head address |

Specify the head address of the areas where the read data is stored.
\* Specify the head address as binary data.

---

**Note:** When using the BL-600 in multi-label read mode 3, +00 to +03 are used as the data memory head address for Codes 1 to 4, respectively. However, data is not stored in the area for which the code type is not set.

---

| +04 to +06 |
| --- |
| Reading trigger area |

These areas are used to send the trigger input signal to the BL-600 to start reading bar code data.

\* If the BL-600 Series is set to disable the "PLC Trigger Area", data is not assigned to the data memory head address area. You can use this area for other purposes.

---

**Note:** When connecting a photoelectric sensor for trigger input in the BL-600 Series, do not use these areas.

---

The method for using the areas varies depending on the BL-600 scan method, "Level signal trigger" or "One-shot signal trigger". Each case is described below.

■ **When "Level signal trigger" is set**

• "Reading trigger area" at the +04 address is used to trigger the BL-600 to start reading the data (turn on the laser beams).

• "Trigger input response area" at the +05 address is used to check whether the data at +04 was sent correctly to the BL-600. When the BL-600 recognizes the +04 address (which means that the process has been completed), it returns a "1" to the +05 address.

| Address | Description | Data |
| --- | --- | --- |
| +04 | Reading trigger area | 1 ... Trigger ON<br>0 ... Trigger OFF |
| +05 | Trigger input response area | 1 ... Process completed<br>0 ... Process not completed |
| +06 | Reserved | Reserved |

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**Operating procedure**

1.  Set the +05 address to "0".

2.  To trigger the BL-600 to start reading (to turn the trigger ON), set the +04 address to "1".

3.  When the BL-600 recognizes the change in the +04 address, it returns a "1" to the +05 address. The BL-600 then starts reading the data.
    If a "1" is not returned, the BL-600 has not recognized the +04 address yet. Do not immediately reset the +04 address to "0".
    After confirming that a "1" has been returned to the +05 address, reset the address to "0".

4.  After reading the bar code data, the BL-600 writes new data in A+05 to A+69.

5.  To turn the trigger OFF, reset the +04 address to "0".

6.  When the BL-600 recognizes the change in the +04 address, it returns a "1" to the +05 address. The trigger then turns OFF.
    If a "1" is not returned, the BL-600 has not recognized the +04 address yet. Do not immediately set the +04 address to "1".
    After confirming that the +05 address has been set to "1", reset the address to "0".

7.  If a reading error occurs, a reading error code is written in A+05 to A+69.

---

**Note:** When quickly turning the trigger ON/OFF at the +04 address, the BL-600 may overlook the change in the +04 address and fail to turn the trigger ON/OFF. If this occurs, change the program so that the +05 address can confirm that the BL-600 recognized the +04 address.

If your system does not have the problem described above, monitoring by the +05 address is not required.

---

■ **One-shot signal trigger**

*   The +04 address "Reading trigger area" triggers the BL-600 to start reading (turn ON the laser).

*   The +06 address "One-shot signal trigger time setup area" sets the scan time in one-shot signal mode. ⇨ *See page 86.*
    When "0" is set for this address, the value set by the BL-600 setup software is used as the scan time.

| Address | Description | Data |
|---------|-------------|------|
| +04 | Reading trigger area and response area | 1: Trigger ON<br>0: Trigger OFF |
| +05 | Reserved | Reserved |
| +06 | One-shot signal trigger time setup area | 0: Use the value set by the BL-600 setup software.<br>1 to 255 (binary) : 100 ms to 25.5 s |

\* When the BL-600 recognizes "1", "0" is set to the +04 address.

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**Operating procedure**

1. To trigger the BL-600 to start reading, set the +04 address to "1".

2. When the BL-600 recognizes the +04 address, it returns a "0" to the +04 address. The BL-600 then starts reading the data.

3. The BL-600 continues reading for the "one-shot signal trigger time" set at the +06 address.

4. When the BL-600 has read all the bar codes, it writes the new data in A+05 to A+69.

5. If a reading error occurs, the BL-600 writes a reading error code in A+05 to A+69.

| **A+00   (A is the head address in which the data specified in +00 to +03 is stored.)** |
|---|
| Memory data flag areas |

The memory data flag areas are used to flag that the bar code data has been stored.
The following two methods are available depending on the application.

■ **Real-time processing**

• A number of "0" or "1" is written to the memory data flag area.

• While the BL-600 is reading and writing the bar code data in the PLC's memory, the flag area is set to "1".

• When new data is stored in addresses A+05 to A+69, address A+00 becomes "0". In other words, new data is the data when address A+00 changes from a "1" to a "0".

• If the bar code reading interval of the BL-600 Series is shorter than that of the communication in the PLC link, data that has not been written into the specified area is stored in the transmission buffer of the BL-600 Series.
If the amount of stored data exceeds the capacity of the buffer, the entire contents of the buffer is cleared and an "OVER" is stored in the memory data area (A+05 to A+09).
If an overflowed buffer error occurs, the BL-600 Series halts operation. It will resume operation once the "OVER" has been stored.

*Example 1*

Normally, the A+00 address is set to "0".
While the BL-600 is writing data, the flag area is "1". When the flag area becomes "0", the data stored in the A+05 to A+69 addresses can be processed.

*Example 2*

Normally, the A+00 address is set to "1".
When data writing is completed, the flag area becomes "0". The data stored in the A+05 to A+69 addresses can be processed.
Set the A+00 address to "1" immediately after data processing is completed. This enables the BL-600 to use the point at which the A+00 address becomes "0" as the trigger for writing new data.

**Note:** When the BL-600 continuously reads bar codes, the real time processing mode may replace stored data with new data before the new data is processed in the PLC. To prevent this, use the sequential processing mode as shown in the next page.

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■ **Sequential processing**

• A number of "2" or "3" is written to the memory data flag area.

• When the A+00 address is "2", new data can be stored.

• When data writing is completed, the flag area becomes "3", and new data has been stored in the A+05 to A+69 addresses.

• After data processing is completed, set the flag area to "2". Writing new data is impossible until the flag area is set to "2".

• Data that has not been written into the specified area is stored in the transmission buffer of the BL-600 Series. If the amount of stored data exceeds the capacity of the buffer, the entire contents of the buffer is cleared and an "OVER" is stored in the memory data area (A+05 to A+09).
When an overflowed buffer error occurs, the BL-600 Series halts operation. It will resume operation once the "OVER" has been stored.

---

**Note:** If the PLC link communication is not established or the memory data flag area stores data other than a "0" or a "2" at the occurrence of an overflowed buffer error, the BL-600 Series stops all operation because the "OVER" cannot be stored. (Laser emission is disabled even if the trigger input turns on.)
In this case, check the settings and wiring of the BL-600 Series and the PLC, and the PLC program.

---

| A+01 to A+04 |
| --- |
| Additional data area |

The label orientation, decode count and other additional data are stored in these areas.

| Address | Description | Data |
| --- | --- | --- |
| A+01 | Label orientation | 0: Reading error<br>1: Formal orientation<br>2: Reverse orientation |
| A+02 | Decode count | 0 to 9999 (binary) |
| A+03 | Scan count | 0 to 9999 (binary) |
| A+04 | Bar code type | 0: CODE 39<br>1: ITF<br>2: Industrial 2of5<br>3: Codabar<br>4: EAN/UPC<br>5: CODE128<br>6: COOP 2of5<br>7: Reading error<br>8: CODE 93 |

If PMI is added, only A+02 and A+03 store the following data.

| Address | Description | Data |
| --- | --- | --- |
| A+02 | PMI (Preventive Maintenance Information) | 0: Normal<br>1: Caution<br>2: Warning<br>9: Reading error |
| A+03 | Reserved | Reserved |

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| A+05 to A+69 |
|---|
| Data memory area |

• The number of digits of the data is stored in the +05 address.

• The read bar code data is stored in the A+06 to A+69 addresses using the ASCII codes (hexadecimal numbers in two digits) by the digit.
  ⇨ *See the ASCII code table on page 169.*

• If a read error occurs, the "ERROR" code is stored in the corresponding area. (The reading error code can be easily changed in the BL-600 settings.)
  ⇨ *See page 43.*

• If a buffer overflow error occurs with the BL-600, the "OVER" code is stored in the corresponding area.

• If an error occurs in the main unit, the "MOTOR" code is stored in the corresponding area.

| Address | Description | Data |
|---|---|---|
| A+05 | Number of digits of bar code data (1 to 64) | 1 to 64 (binary) ... Number of digits |
| A+06 | 1st digit of read data | A single ASCII code |
| A+07 | 2nd digit of read data | A single ASCII code |
| : | : | : |
| A+69 | 64th digit of read data | A single ASCII code |

**Note 1:** When test mode is enabled, the BL-600 does not write data.

**Note 2:** These data areas accept up to 64 digits. However, the BL-600 can read only 32 digits. When the bar code type is CODE128 and the start character is CODE-C, up to 64 digits can be read.

*Example*

When the BL-600 reads the bar code "KE12"

| A+05 | 4 | ← Number of digits |
|---|---|---|
| A+06 | $004B | |
| A+07 | $0045 | Stored in ASCII codes (hexadecimal) |
| A+08 | $0031 | |
| A+09 | $0032 | |

*Example*

When the BL-600 generates a reading error (ERROR)

| A+05 | 5 | ← Number of digits |
|---|---|---|
| A+06 | $0045 | |
| A+07 | $0052 | |
| A+08 | $0052 | Stored in ASCII codes (hexadecimal) |
| A+09 | $004F | |
| A+10 | $0052 | |

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# 8.4   PLC Link Error

This section describes the remedy if a communication error occurs during the PLC link.

If an error occurs, the BL-600 Series stops communication. The top LED in the STABILITY indicator flashes.

1. Check the following points and eliminate the cause.

    1) Check if the RS-232C communication parameters (baud rate, data length, parity and stop bit length) for the PLC are matched with the N-400's settings.

    2) Check if the PLC link is set to "Use" in the communication parameters 2 setup.

    3) Check if the PLC's settings are correct. ⇨ *See pages 132 to 134.*

    4) Check if the cable connections are correct, or if any cable is disconnected. Referring to chapter 2 of this manual, check the connections using a multimeter.

    5) Check if the device setting range does not exceed the available data memory areas of the PLC.
    If the data memory areas used for the BL-600 do not exist in the PLC, communication is impossible.

    6) Check if the link unit operates normally.

\*   For the settings of the link unit, see the instruction manual for the link unit being used.

2. Press the TEST switch of the BL-600 Series.

    Communication recovers.

If the problem cannot be solved in the procedure above, contact your nearest KEYENCE office or distributor (listed at the end of this manual).

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# 8.5   Communication Time

This section describes the communication time required for data transmission between the BL-600 Series and the PLC.

■ **Time required data transmission**

The time required for data transmission from the BL-600 to the PLC is as follows: This communication time may change depending on the PLC's scan time and the model of the PLC.

\* When the RS-232C communication baud rate is 9600 bps:

| Number of data digits | MELSEC-A | SYSMAC-C | KV (KV mode) |
|---|---|---|---|
| 10 | Approx. 220 ms | Approx. 330 ms | Approx. 440 ms |
| 20 | Approx. 270 ms | Approx. 380 ms | Approx. 680 ms |
| 32 | Approx. 320 ms | Approx. 460  ms | Approx. 920 ms |

■ **Communication time to start reading using reading trigger area**

To control the BL-600 Series' reading operation using the reading trigger area, enter the trigger ON command on the PLC, and obtain the time duration until the command is received by the BL-600.

\* When the RS-232C communication baud rate is 9600 bps:

| MELSEC-A | SYSMAC-C | KV (KV mode) |
|---|---|---|
| Approx. 60 ms | Approx. 80 ms | Approx. 30 ms |

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# Appendices

The appendix includes specifications, reading characteristics, dimensions, trouble-shooting, and index.

# Appendix A   BL-600 Series Specifications

## Appendix A.1    Specifications

### ■ General specifications

| Model | | BL-600 | BL-601 | BL-600HA | BL-601HA | BL-650HA | BL-651HA |
|---|---|---|---|---|---|---|---|
| Type | | Standard type | | High-resolution | | High-resolution, side-scanning type | |
| Scanning direction | | Front | | | | Side | |
| Light source | | Visible red semiconductor laser (Wavelength: 650 nm) | | | | | |
| | Muximum output | 1.5 mW | | | | | |
| | Pulse width | 99 μs | | | | 82 μs | |
| Class | FDA | Class II | | | | | |
| | IEC 825-1 11.1993 | Class 2 | | | | | |
| | DIN EN 60825-1 07.1994 | Klasse 2 | | | | | |
| Scan method | | Single | Raster | Single | Raster | Single | Raster |
| Reading distance | | 75 to 330 mm (When narrow width is 1.0 mm) | | 55 to 190 mm (When narrow width is 0.5 mm) | | 45 to 175 mm (When narrow width is 0.5 mm) | |
| Reading bar width [1] | | 0.19 to 1.0 mm * 0.25 to 1.0 mm for CODE93 and CODE128 | | 0.125 to 1.0 mm * 0.15 to 1.0 mm for CODE93 and CODE128 | | | |
| Maximum reading label width [2] | | 250 mm (When reading distance is 280 mm) | | 156 mm (When reading distance is 174 mm) | | 170 mm (When reading distance is 155 mm) | |
| PCS | | 0.6 or more (white reflection rate 75% or more) | | | | | |
| Scan count | | 500 scans/second | | | | | |
| Supported codes | | CODE39, ITF, Industrial2of5, COOP2of5, Coda bar, CODE128, EAN-128, CODE93, EAN / UPC(A•E) | | | | | |
| Reading digit | | 32 digits max. [3] | | | | | |
| Enclosure rating | | IP-65 | | | | | |
| Ambient light | | Sunlight: 10000 lx Incandescent lamp: 6000 lx | | | | | |
| Ambient temperature | | 0 to 45°C (32 to 113°F), No freezing | | | | | |
| Relative humidity | | 35 to 85%, No condensation | | | | | |
| Operating atmosphere | | No dust or corrosive gas present | | | | | |
| Vibration | | 10 to 55 Hz, amplitude 1.5 mm, 2 hours each in X, Y and Z directions. | | | | | |
| Power supply voltage | | 5 V DC ±5% | | | | | |
| Power consumption | | 330 mA max. | | | | | |
| Weight | | Approx. 115 g | | | | Approx. 130 g | |

1. Reading bar width indicates the range of readable narrow bar width when the bar code type is CODE39.
2. Maximum reading label width includes the bar code margin (quiet zone).
3. When start/stop character of CODE128 is CODE-C, up to 64 digits are allowed.

**Note:** The internal BL settings are written to the built-in EEPROM (erasable up to 100,000 times).

■ **Interface specifications**

| Trigger input | | Non-voltage input (relay contact, solid state) * TTL input is also available. |
|---|---|---|
| OK/NG output | Output type | NPN open collector |
| | Rating load | 24 V DC, 30 mA |
| | Leakage current at OFF | 0.1 mA max. |
| | Residual voltage at ON | 0.5 V max. |
| Serial interface | Applied standard | In accordance with RS-232C |
| | Synchronization | Start-stop synchronization |
| | Transmission code | ASCII code |
| | Baud rate | 600, 1200, 2400, 4800, 9600, 19200, 31250, 38400 bit/s |
| | Data length | 7/8 bits |
| | Parity check | None/even/odd |
| | Stop bit length | 1/2 bits |

■ **Raster width specification**

In raster scan mode, the BL-600 scans multiple positions of the bar code by swinging the laser beams up and down. Thus, the bar code can be read even if it has a stain or missing part.
For the up-down width of raster scan (raster width), see the table below.

| Model | Reading distance | Raster width |
|---|---|---|
| BL-601 | 120 mm | 7.1 ±1.8 mm |
| BL-601H | 90 mm | 5.5 ±1.4 mm |
| BL-651H | 65 mm | 5.5 ±1.4 mm |

# Appendix A.2    Reading range characteristics (Typical)

■ **BL-600/601**

Unit: mm

|   | Bar code type | Narrow bar width | Reading distance |
|---|---|---|---|
| A | CODE39 | 0.19 | 90 to 160 |
| B | CODE39 | 0.25 | 75 to 200 |
| C | CODE39 | 0.5 | 75 to 290 |
| D | CODE39 | 1.0 | 75 to 330 |
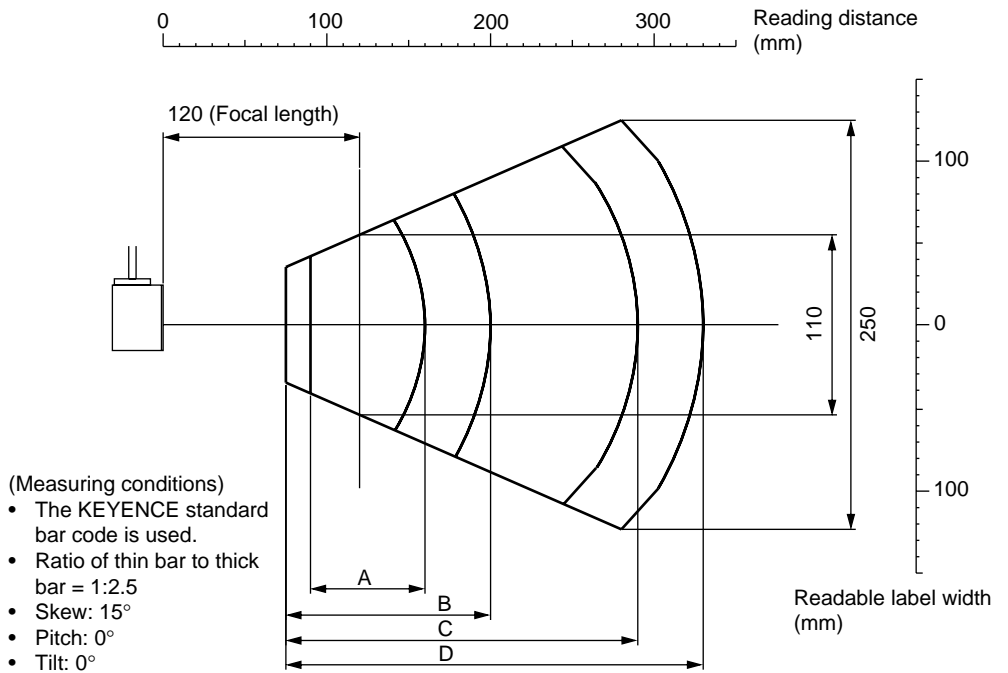
(Measuring conditions)
- The KEYENCE standard bar code is used.
- Ratio of thin bar to thick bar = 1:2.5
- Skew: 15°
- Pitch: 0°
- Tilt: 0°

\* For the reading distance measuring reference, see page 74.

**Note 1:** The readable label width means a bar code length including the right and left margins (quiet zones) of a bar code.
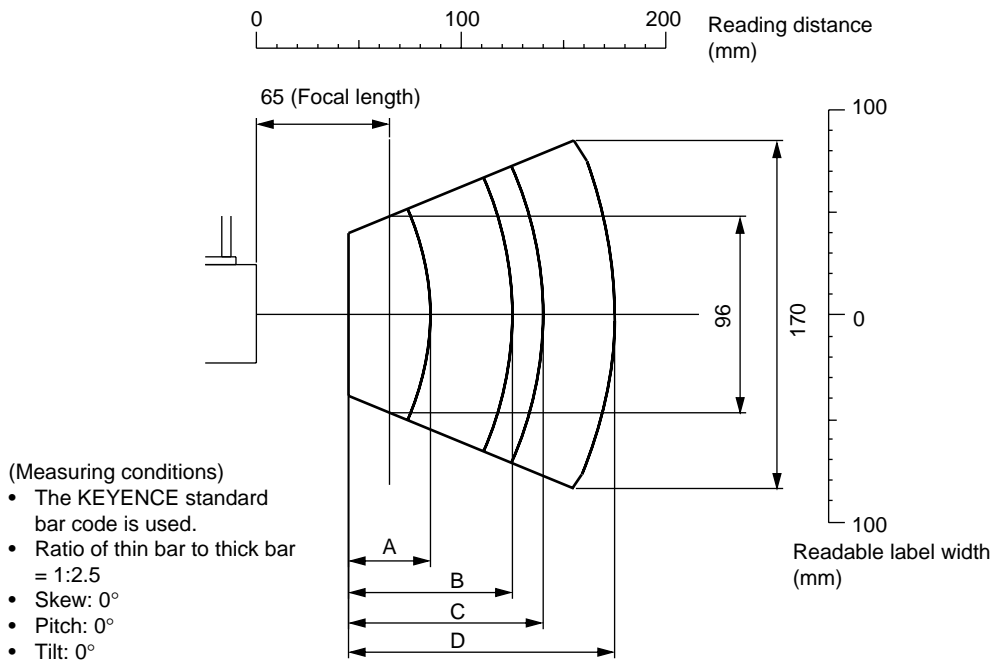
**Note: 2** Even if a bar code is within the above reading range, it may not be read depending on the bar code quality. Set the optimum reading position based on enough reading tests.

**Note 3:** It is recommended that the focal length (120 mm) is set as the mounting distance. In this case, the maximum readable label width is 110 mm.

### ■ BL-600HA/601HA

Unit: mm

|   | Bar code type | Narrow bar width | Reading distance |
|---|---|---|---|
| A | CODE39 | 0.125 | 70 to 105 |
| B | CODE39 | 0.19 | 60 to 140 |
| C | CODE39 | 0.25 | 55 to 150 |
| D | CODE39 | 0.5 | 55 to 190 |
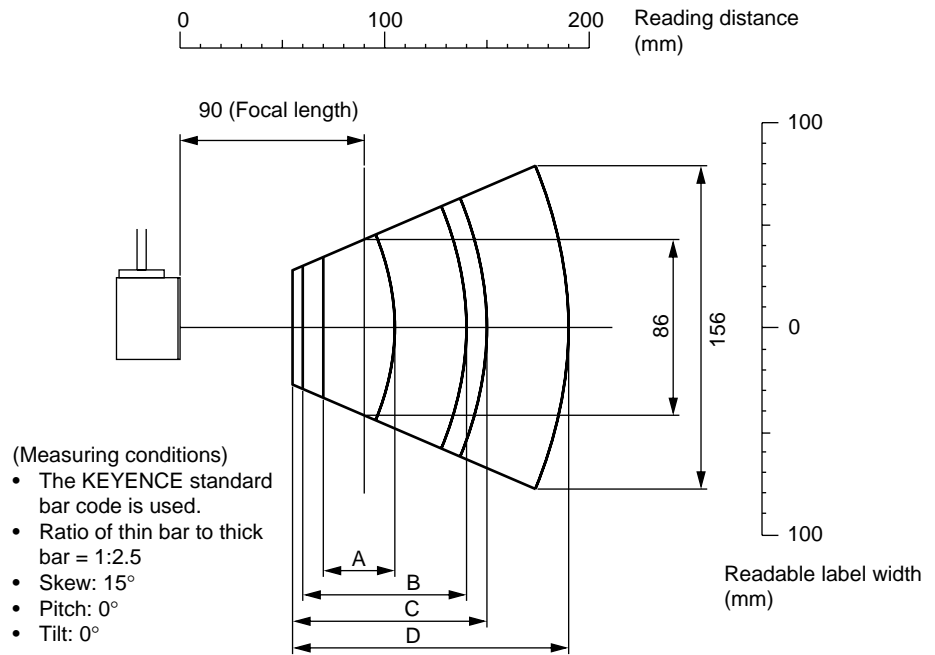
0  100  200  Reading distance (mm)

90 (Focal length)

100

86  156  0

100

Readable label width (mm)

(Measuring conditions)
• The KEYENCE standard bar code is used.
• Ratio of thin bar to thick bar = 1:2.5
• Skew: 15°
• Pitch: 0°
• Tilt: 0°

A
B
C
D

* For the reading distance measuring reference, see page 74.

**Note 1:** The readable label width means a bar code length including the right and left margins (quiet zones) of a bar code.

**Note: 2** Even if a bar code is within the above reading range, it may not be read depending on the bar code quality. Set the optimum reading position based on enough reading tests.

**Note 3:** It is recommended that the focal length (90 mm) is set as the mounting distance. In this case, the maximum readable label width is 86 mm.

**Appendices**

### ■ BL-650HA/651HA

Unit: mm

|   | Bar code type | Narrow bar width | Reading distance |
|---|---|---|---|
| A | CODE39 | 0.125 | 45 to 85 |
| B | CODE39 | 0.19 | 45 to 125 |
| C | CODE39 | 0.25 | 45 to 140 |
| D | CODE39 | 0.5 | 45 to 175 |



(Measuring conditions)
- The KEYENCE standard bar code is used.
- Ratio of thin bar to thick bar = 1:2.5
- Skew: 0°
- Pitch: 0°
- Tilt: 0°

\*   For the reading distance measuring reference, see page 74.

**Note 1:** The readable label width means a bar code length including the right and left margins (quiet zones) of a bar code.

**Note: 2** Even if a bar code is within the above reading range, it may not be read depending on the bar code quality. Set the optimum reading position based on enough reading tests.

**Note 3:** It is recommended that the focal length (65 mm) is set as the mounting distance. In this case, the maximum readable label width is 96 mm.

# Appendix A.3    Angular characteristics (Typical)

| Model | Narrow bar width | Skew | Pitch | Tilt |
|---|---|---|---|---|
| BL-600/601 | 0.19 mm | -60° to -10°, -10° to +60° | ±40° | ±50° |
|  | 0.5 mm | -60° to -10°, -10° to +60° | ±50° | ±50° |
| BL-600HA/601HA | 0.125 mm | -60° to -10°, -10° to +60° | ±30° | ±50° |
|  | 0.25 mm | -60° to -10°, -10° to +60° | ±50° | ±50° |
| BL-650HA/651HA | 0.125 mm | -80° to -30°, -10° to +40° | ±40° | ±50° |
|  | 0.25 mm | -80° to -30°, -10° to +40° | ±50° | ±50° |

Measuring conditions
• Bar code: KEYENCE standard bar code
• Reading distance: 120 mm (BL-600/601)
              90 mm (BL-600HA/601HA)
              65 mm (BL-650HA/651HA)

**Note:** The skew angle of -10° to +10°(-30° to -10° in BL-650HA/651HA) is the specular reflection range. In this range, bar codes cannot be read, or reading error may occur. Be sure not to mount the BL-600 Series at the above skew angles.

**Skew**
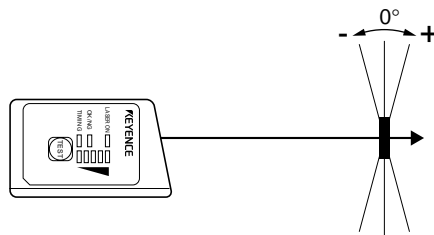
BL-600/601/600HA/601HA                    BL-650HA/651HA
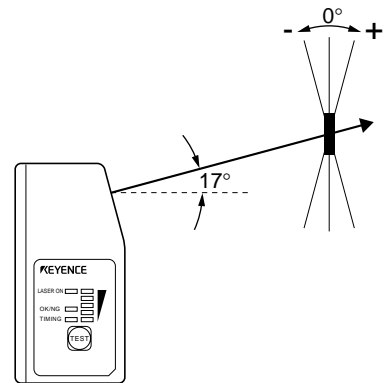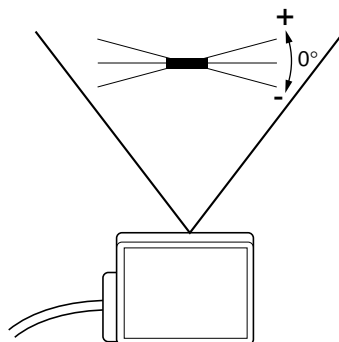


**Pitch**                                         **Tilt**
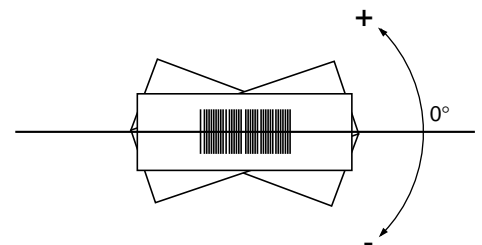
# Appendix B   BL-U1 Specifications

| Model | | BL-U1 |
|---|---|---|
| **Power supply for bar code reader** | | 5 V DC±5% (1.5 A) |
| **Power supply for sensor** | | 12 V DC ±10% (300 mA) |
| **Trigger input** | **Input rating** | 8.5 to 30 V DC, 10 mA max. |
| | **Max. OFF current** | 0.5 mA |
| **OK/NG output** | **Output type** | NPN open-collector |
| | **Rated load** | 30 V DC, 100 mA |
| | **Leakage current (at OFF)** | 0.1 mA max. |
| | **Residual voltage (at ON)** | 1 V max. |
| **Interface** | | RS-232C, RS-422A, RS-485 multidrop (Up to 31 units can be connected. Max. cable extension: 1.2 km) |
| **Ambient temperature** | | 0 to 50°C (32 to 122°F), No freezing |
| **Relative humidity** | | 35 to 85%, No condensation |
| **Ambient atmosphere** | | No dust, no corrosive gas |
| **Vibration** | | 10 to 55 Hz, 1.5 mm double amplitude in X, Y and Z directions, 2 hours respectively |
| **Noise immunity** | | 1000 V p-p, 1 µs (Power line) |
| **Power supply voltage** | | 100 to 240 V AC (50/60 Hz) |
| **Current consumption** | | 40 VA (100 V AC), 50 VA (240 V AC) |
| **Weight** | | Approx. 615 g (including cable) |

# Appendix C   BL-U2, N-42 Specifications

| Model | | BL-U2 | N-42 |
|---|---|---|---|
| **Power supply for bar code reader** | | 5 V DC ±5% (630 mA) | |
| **Trigger input** | **Input rating** | 15 to 26V DC, 10 mA max. | |
| | **Maximum OFF current** | 1.0 mA | |
| **OK/NG output** | **Output type** | NPN open-collector | |
| | **Rated load** | 30 V DC, 100 mA | |
| | **Leakage current (at OFF)** | 0.1 mA max. | |
| | **Residual voltage (at ON)** | 1 V max. | |
| **Interface** | | Conforms to EIA RS-232C. | RS-422A (Maximum extension distance: 1.2 km) |
| **Ambient temperature** | | 0 to 50°C (32 to 122°F), No freezing | |
| **Relative humidity** | | 35 to 85%, No condensation | |
| **Ambient atmosphere** | | No dust, no corrosive gas | |
| **Vibration** | | 10 to 55 Hz, 1.5 mm double amplitude in X, Y, and Z directions, 2 hours respectively | |
| **Power supply voltage** | | 24 V DC $^{+10\%}_{-20\%}$ | |
| **Current consumption** | | 250 mA max. | 260 mA max. |
| **Weight** | | Approx. 80 g | Approx. 100 g |

# Appendix D   Dimensions

■ **BL-600/601/600HA/601HA**



30

29.3

Laser beam

13.3

31

2-ø3 Depth 4

3.5    22.5    21    Center of scanning

33

40

24.3

3.5

15 min.

3.8

12.2    9.5    ø4.5

Cable lenght: 1.8 m
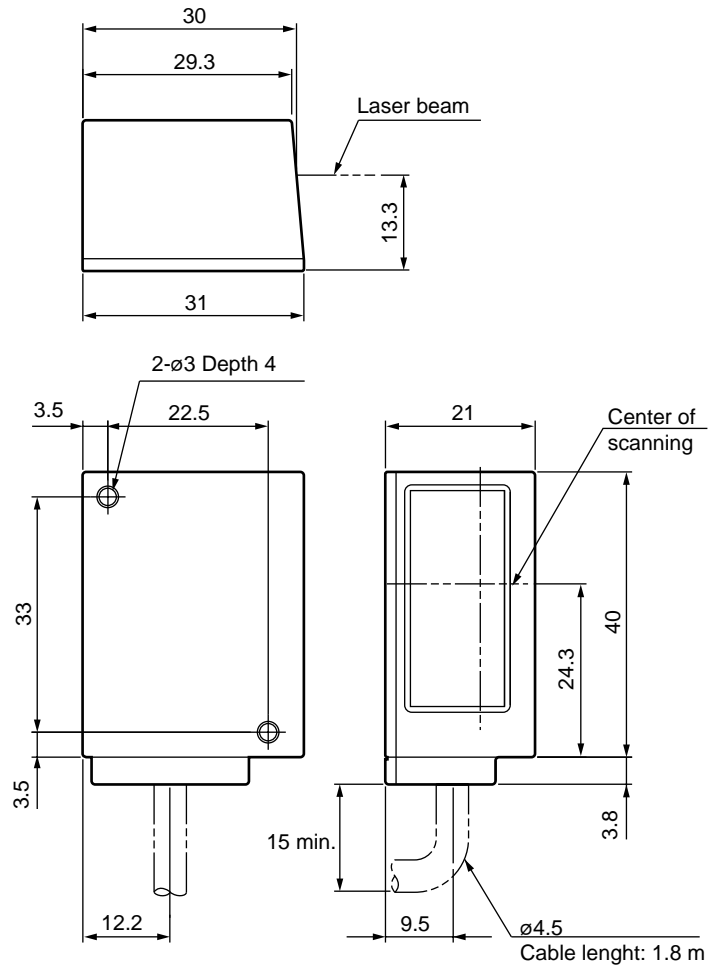
■ **BL-650HA/651HA**

\*   The laser beam application angle is 17°±3° with reference to a line perpendicular to the rear surface of the unit.
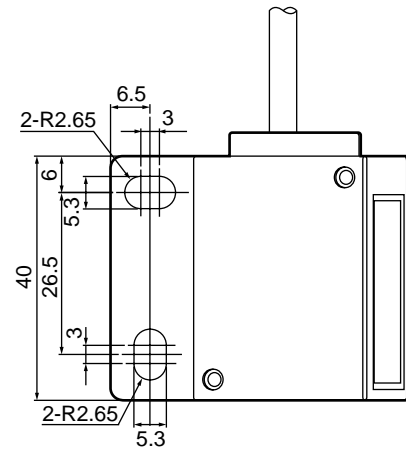


17°

Laser beam

18.9    17.6

40.7

22    3.5    21    Center of scanning

38.1

48

24.3

2-ø3 Depth 4    3.5    3.8

48    12.3    9.5    ø4.5

Cable length: 1.8 m
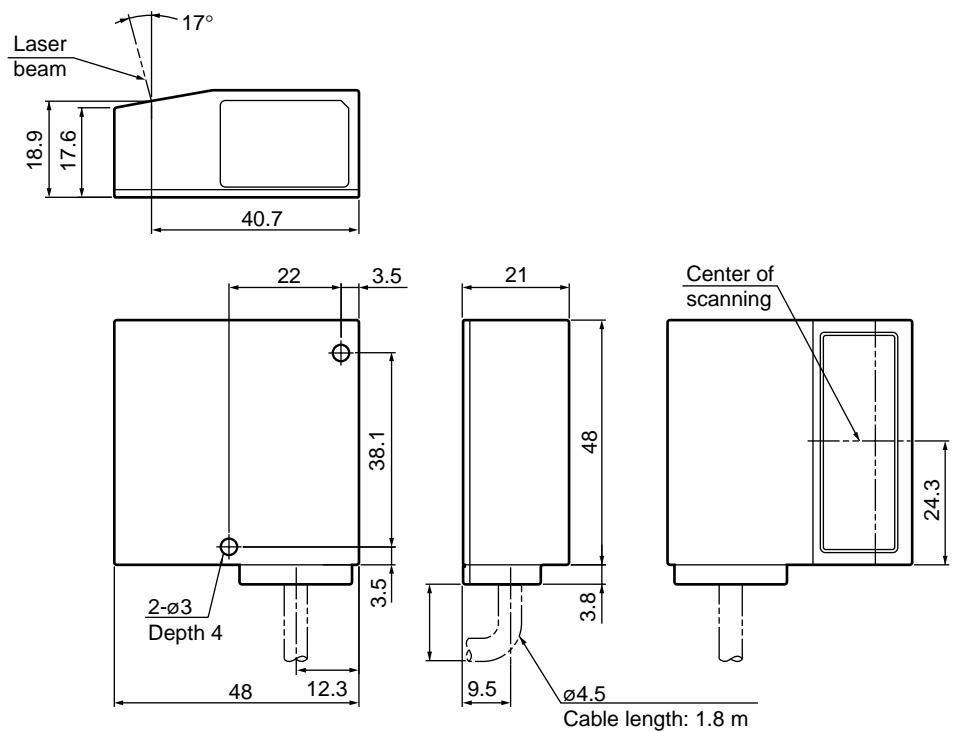
■ **BL-600/601/600HA/601HA (Mounting bracket)**

\* Use M4 screws to mount the BL-600 unit.

• When bracket A is used
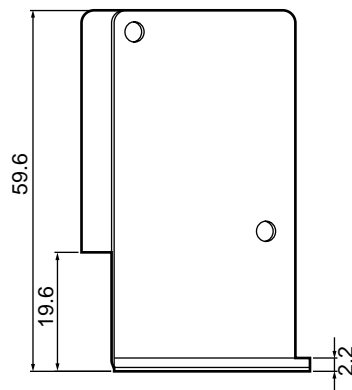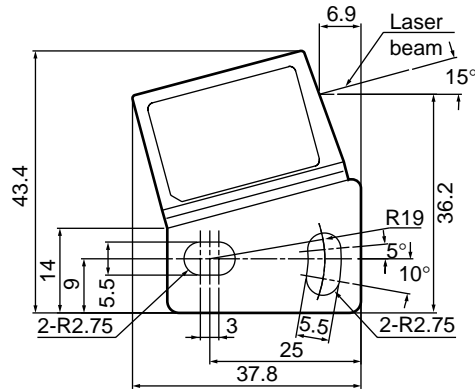
• When bracket B is used
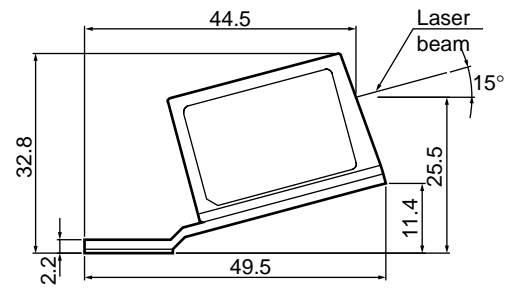
■ **Mounting bracket for the BL-600/601/600HA/601HA**

• When bracket A is used

**Appendices**
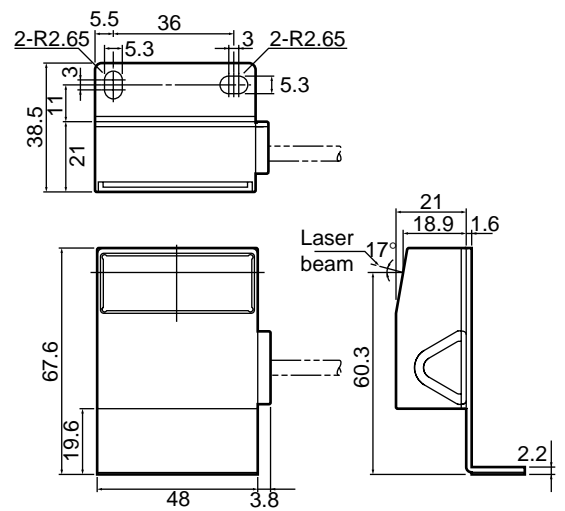
*155*
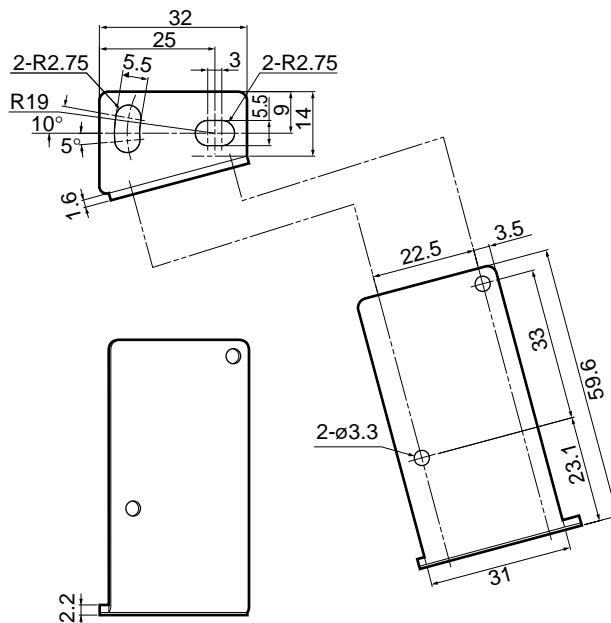
• When bracket B is used
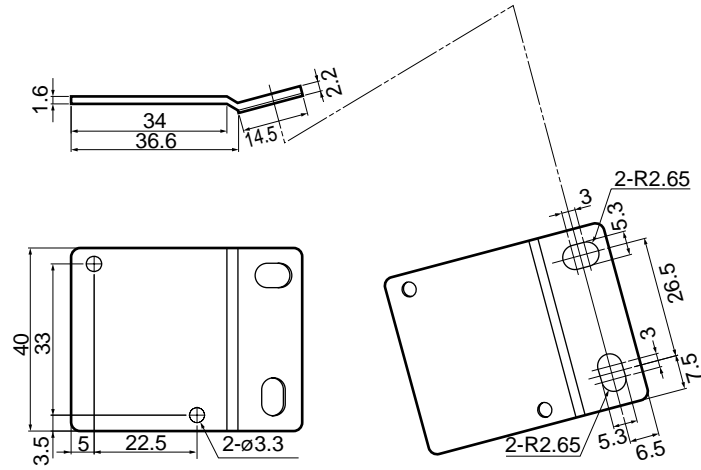


■ **BL-/650HA/651HA (Mounting bracket)**
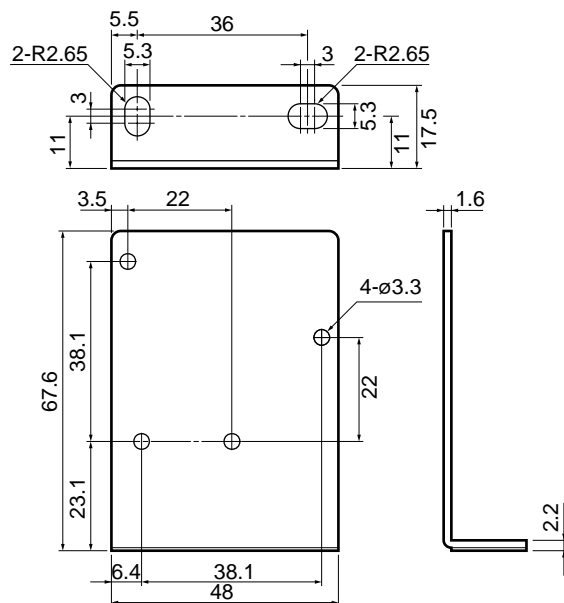
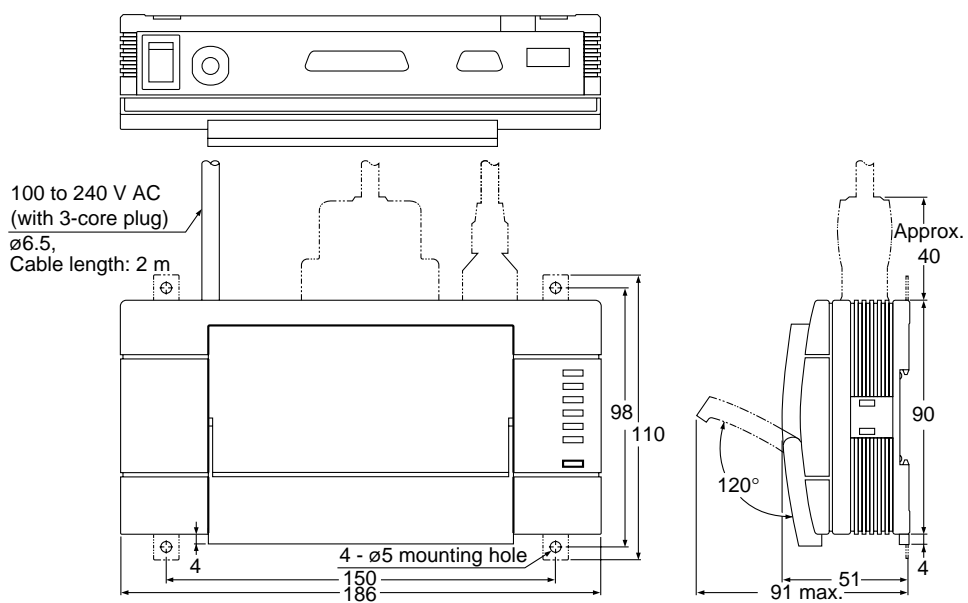\*   Use M4 screws to mount the BL-600 unit.

• Vertical scanning
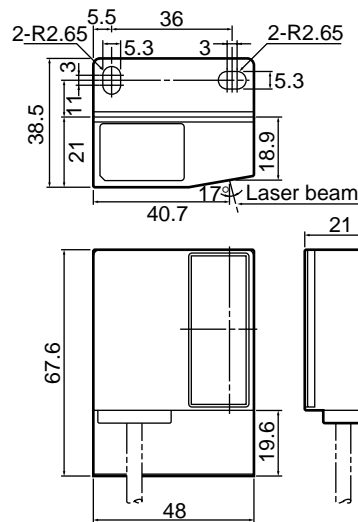


• Horizontal scanning

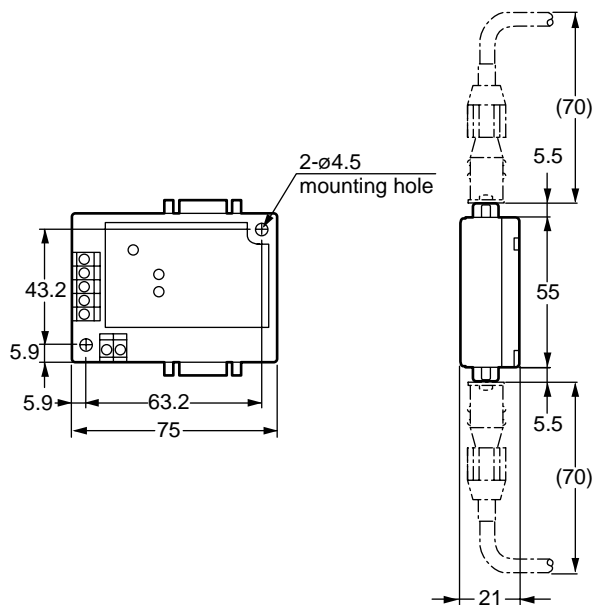

■ **Mounting bracket for the BL-650HA/651HA**

■ **BL-U1\***



100 to 240 V AC
(with 3-core plug)
ø6.5,
Cable length: 2 m

Approx. 40

98

110

90

120°

4 - ø5 mounting hole

4

150

186

51

4

91 max.

**Note:** BL-U1 is not available in Europe.

■ **BL-U2**



2-ø4.5
mounting hole

(70)

5.5

43.2

55

5.9

5.9

63.2

5.5

75

(70)

21

■ **N-42**
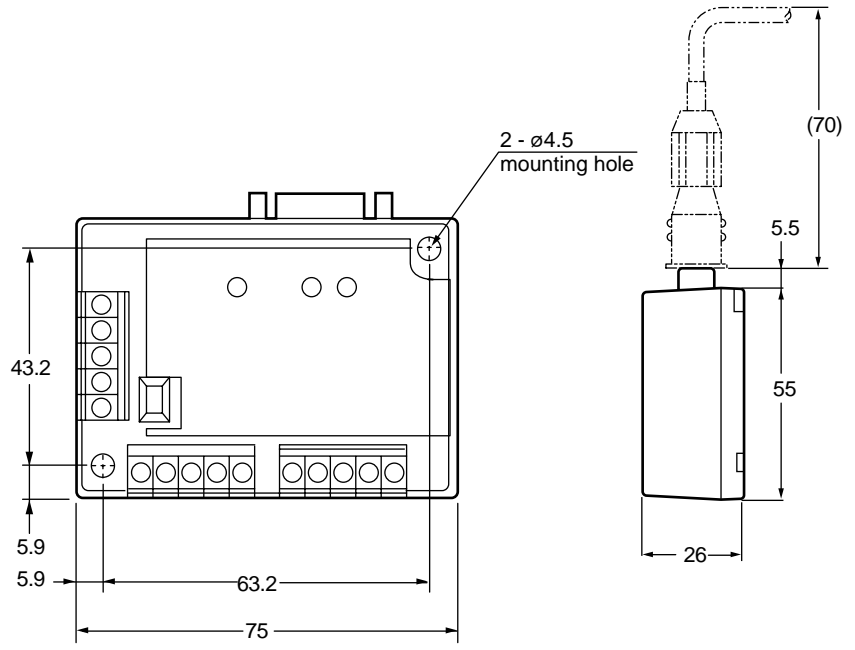
# Appendix E   Sample Program for the PLC Link

The sample program stores the read data in D105 (DM105) and subsequent DMs.
You can change the program to suit your application.
Before using the sample program, check that your system meets the following requirements.
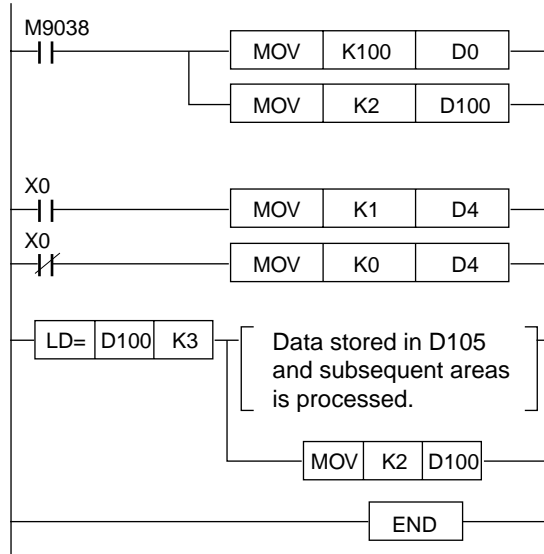
## ■ BL-600 settings

- The scan method is "level signal trigger".
- Use the "PLC trigger area".
- The DM head address is "0000".

## ■ Processing of data memory flag ... Sequential processing

\*   This sample program uses the level signal trigger. However, it does not use the +05 trigger input response area to check if the BL-600 successfully recognized the +04 reading trigger area.
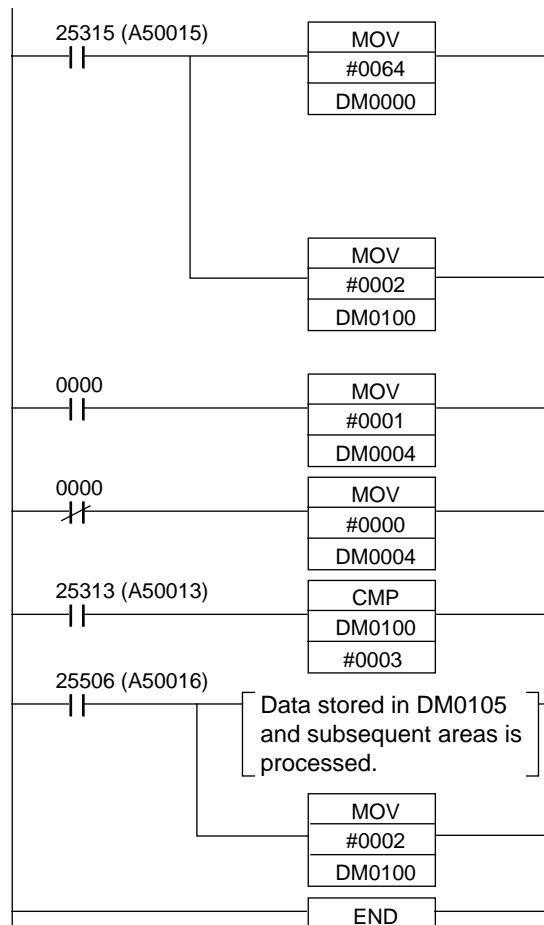
### ■ **Program for the MELSEC-A Series**

```
M9038
──┤├──────────────────┌─────┬──────┬──────┐
                       │ MOV │ K100 │  D0  │
                       └─────┴──────┴──────┘
                       ┌─────┬──────┬──────┐
                       │ MOV │  K2  │ D100 │
                       └─────┴──────┴──────┘

X0
──┤├──────────────────┌─────┬──────┬──────┐
                       │ MOV │  K1  │  D4  │
                       └─────┴──────┴──────┘
X0
──┤╱├─────────────────┌─────┬──────┬──────┐
                       │ MOV │  K0  │  D4  │
                       └─────┴──────┴──────┘

──┌────┬──────┬────┐──┌ Data stored in D105
  │ LD=│ D100 │ K3 │  │ and subsequent areas
  └────┴──────┴────┘  └ is processed.

                       ┌─────┬────┬──────┐
                       │ MOV │ K2 │ D100 │
                       └─────┴────┴──────┘
                       ┌──────────┐
                       │   END    │
                       └──────────┘
```
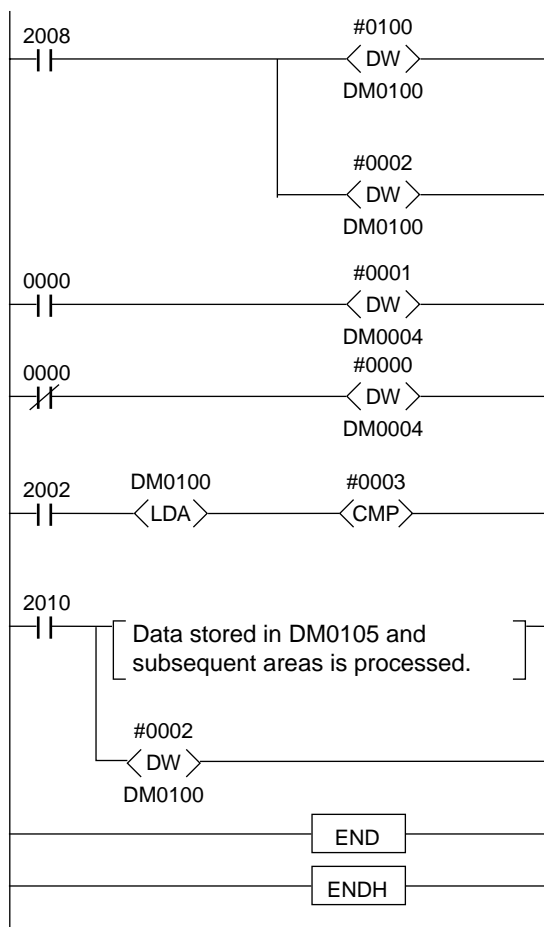
Specify the head address of the data memory area.
Enter "2" in the data memory flag. (Use sequential processing to process the flag.)

Enter "X0" for the reading trigger input.

When D100 becomes "3", the specified processing is performed. After processing is completed, enter "2" in D100.

### ■ **Program for the SYSMAC-C**

```
25315 (A50015)
──┤├──────────────────┌──────────┐
                       │   MOV    │
                       │  #0064   │
                       │  DM0000  │
                       └──────────┘

                       ┌──────────┐
                       │   MOV    │
                       │  #0002   │
                       │  DM0100  │
                       └──────────┘

0000
──┤├──────────────────┌──────────┐
                       │   MOV    │
                       │  #0001   │
                       │  DM0004  │
                       └──────────┘
0000
──┤╱├─────────────────┌──────────┐
                       │   MOV    │
                       │  #0000   │
                       │  DM0004  │
                       └──────────┘

25313 (A50013)
──┤├──────────────────┌──────────┐
                       │   CMP    │
                       │  DM0100  │
                       │  #0003   │
                       └──────────┘
25506 (A50016)
──┤├──────────────────┌ Data stored in DM0105
                       │ and subsequent areas is
                       └ processed.
                       ┌──────────┐
                       │   MOV    │
                       │  #0002   │
                       │  DM0100  │
                       └──────────┘
                       ┌──────────┐
                       │   END    │
                       └──────────┘
```

Specify the head address of the data memory area (DM100). The BL-600 processes data as binary data. Specify each DM number in binary format.

Enter "2" in the data memory flag. (Use sequential processing to process the flag.)

Enter "0000" for the reading trigger input.

When DM0100 becomes "3", the specified processing is performed. After processing is completed, enter "2" in DM0100.

\* The descriptions in parentheses are the cases for the CV Series.

## ■ **Program for the KV Series**

```
2008                            #0100
─┤├─                           ⟨ DW ⟩
                                DM0100


                                #0002
                               ⟨ DW ⟩
                                DM0100

0000                            #0001
─┤├─                           ⟨ DW ⟩
                                DM0004
0000                            #0000
─┤/├─                          ⟨ DW ⟩
                                DM0004

2002       DM0100               #0003
─┤├─     ⟨ LDA ⟩              ⟨CMP⟩


2010
─┤├─    ┌ Data stored in DM0105 and      ┐
        └ subsequent areas is processed. ┘

         #0002
        ⟨ DW ⟩
         DM0100

                              ┌─────┐
                              │ END │
                              └─────┘
                              ┌─────┐
                              │ ENDH│
                              └─────┘
```

Specify the head address of the data memory area.

Enter "2" in the data memory flag. (Use sequential processing to process the flag.)

Enter "0000" for the reading trigger input.

When DM0100 becomes "3", the specified processing is performed.
After processing is completed, enter "2" in DM0100.

# Appendix F   Troubleshooting

If a problem occurs during operation of the BL-600 Series, please check the following troubleshooting list first. If you cannot fix the problem, contact your nearest KEYENCE office or distributor (listed at the end of this manual).

## Appendix F.1   Bar codes cannot be read

● **Check whether or not the laser is emitted.**

• If using the power supply unit BL-U1, BL-U2, N-42 or N-48, check the wiring of the power supply unit, the power switch (BL-U1 only), and the wiring of the trigger input terminal. ⇨ *See pages 16 to 32.*

• Check whether or not the laser off command (⇨ *See page 116.*) has been sent to the BL-600 Series. If so, send the resetting laser off command (UNLOCK) to enable laser emission.
If a laser off command has been executed, the bottom LED in the STABILITY indicator flashes.

• If a optional power supply unit is not used, confirm that the supplied power voltage and capacity (5 V DC±5%, 330 mA min.) is correct. Also, check the wiring of the power supply unit and the trigger input terminal.
⇨ *See pages 33 to 35.*

**Note:** Connecting the power supply in reverse may damage the product. If the BL-600 Series does not operate, contact your nearest KEYENCE office or distributor (listed at the end of this manual).

● **Check the bar code settings (type, No. of digits, etc.). Check the following parameters using the setup software.**
• Bar code type, No. of digits.
• Setting of the check digit inspection (enabled or disabled)
• Setting of the label orientation-specified reading

**Note:** When using CODE39 or Codabar, include the start/stop characters and check digit in the number of digits.
⇨ *For CODE93, See page 164.*
⇨ *For CODE128, See page 165.*

● **Check the mounting distance and angle of the BL-600 Series.**
⇨ *See page 74.*

● **Check the bar code quiet zones (margins).**
A bar code requires the right and left margins to be at least 10 times wider than the narrow bar width.
If the bar code margins are too narrow, it may not be read. ⇨ *See page 74.*

● **Check the bar code label length.**
The bar code label length is the lateral length of a bar code including the right and left margins (quiet zones).
The readable bar code label length is limited depending on the reading distance.
See "Appendix A.2 Reading range characteristics (Typical)" on page 148 to 150.

● **Check the printing quality of the bar code.**
A bar code with blurred sections, defects or stains may not be read correctly.
Bar codes printed with dot matrix or ink jet printers are prone to such problems.

● **Check whether the transmitter (light source) and the receiver (optical pickup) are clean.**

If moisture, oil or dust adheres to the transmitter or the receiver, wipe the units using a soft cloth and a mild plastic cleaner.

● **Check the environmental conditions.**
⇨ *See pages ii and 72 to 80 for details.*

## Appendix F.2   Reading rate check mode is not 100%

Check the previous item "Bar codes cannot be read".

**Note 1:** The reading rate indicates the number of acceptable readings during 100 scans of a bar code. If a bar code has spots or voids, the reading rate is reduced.

**Note 2:** Even If the reading rate is 20%, two readings are acceptable during 10 scans. Therefore, if the decoding match count number is set to "2", the bar code can be read. The read operation is not affected if the scan time for the bar code is set long enough.

## Appendix F.3   The setting data cannot be sent/received using the setup software

**Is the BL-600 set to "setting data send/receive waiting status"?**

Press the TEST switch for 8 seconds to enter setting data send/receive waiting status. (The 1st, 3rd and 5th STABILITY LEDs from the top flash.) The BL-600 setup software [[Com port]] must be set as below:

- Baud rate: 9600 bit/s
- Data length: 7 bits
- Parity: Even
- Stop bits: 1 bit

● **Does the RS-232C pin assignment of the BL-600 (BL-U1 or BL-U2) match that of the PC? Are the cables firmly attached?**

● **Is power supplied to the BL-600, BL-U1 or BL-U2?**

● **Is RS-232C used for the interface of the BL-U1 DIP switches?** ⇨ *See page 9.*

## Appendix F.4   Cannot communicate successfully when using the PLC link

⇨ *For details,* see *page 130.*

**Appendices**

*163*

# Appendix G   CODE93 Specifications

### ■ Setting of No. of Digits

• The start/stop character and check digit are not included in the number of digits.

### ■ Data Transmission

• The start/stop characters and check digit cannot be sent.
• Control codes are sent.

---

**Note:** Do not use CODE93 with control codes when using a multi-drop link. Communication errors may occur.

---

### ■ Registration of Preset Data

• When ! or ? is registered as preset data, it functions as the Preset "!" "?" Function, as described on page 45.
Since CODE93 can represent all ASCII codes as bar code data, ! or ? can also be represented as bar code data.
To register ! or ? as preset data, send \! or \? to differentiate them from the preset "!" "?" function.
To register \ as preset data, send \\.

*Example*

To register 123 \!?ABC as preset data, send the following command.

WP68123 \\\!\?ABC<CR>

• Control codes (data in 00h to 2Fh of the ASCII code table, such as <CR> and <STX>), the start/stop characters, and the check digit cannot be registered as preset data. (Data comparison is also impossible.)

# Appendix H   CODE128 Specifications

■ **Setting No. of Digits**

• The start/stop character and check digit are not included in the number of digits.

• FNC1 to 4 (Function codes), SHIFT, and CODE-A to -C should not be added to the number of digits.

• The number of digits setting range varies depending on the start character (CODE-A to -C).

  CODE-A, B: 1 to 32
  CODE-C: 1 to 64

  One digit of CODE-A or CODE-B represents two digits of CODE-C.

■ **Data Transmission**

• The start/stop character and check digit cannot be sent.

• FNC1 to 4 (Function codes), SHIFT, and CODE-A to -C cannot be sent.

• Control codes are sent.

---

**Note:** Do not use CODE128 with control codes when you build a multidrop link. Communication errors may occur.

---

■ **Registration of Preset Data**

• The number of characters that can be registered as preset data is up to 32 digits for CODE-A or CODE-B, and up to 64 digits for CODE-C, as described above.

• When ! or ? is registered as preset data, it functions as the Preset "!" "?" Function, as described on page 18.
  Since CODE128 can represent all ASCII codes as bar code data, ! or ? can also be represented as bar code data.
  To register ! or ? as preset data, send \! or \? to differentiate it from the Preset "!" "?" function.

  To register \ as preset data, send \\.

  *Example*
  To register 123 \!?ABC as preset data, send the following command.
  ⇨ *See page 101.*

      WP68123 \\\!\?ABC <CR>

• Control codes (data in 00h to 2Fh of the ASCII code table, such as <CR> and <STX>), start/stop character, check digit, FNC1 to 4 (function codes), SHIFT or CODE-A to-C cannot be registered as preset data. (Data comparison is also impossible.)

**Appendices**

## ■ **EAN-128 reading specifications**

| Start code | FNC1 | Data 1 Fixed length | Data 2 Variable length | FNC1 | Data 3 Variable length | Check digit | Stop code |
|---|---|---|---|---|---|---|---|

EAN-128 Start pattern — Separator
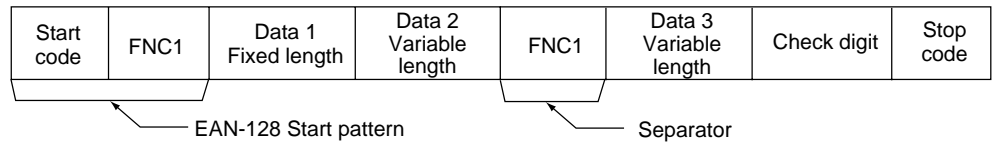
The BL-600 Series operates as follows if "EAN-128 support" is selected using the setup software. ⇨ *See page 52.*

• The header of the EAN-128 data is always the combination of a "Start code A to C" and "FNC1" (Start pattern). A reading error occurs when another item is used.

• "FNC1" (separator) is used at the end of each set of data that has a variable length to separate the data. "FNC1" is replaced with character [GS] ("1Dh" of ASCII code) for output.

# Appendix I    Checksum Calculation Method

You can add a checksum to transmitted data. (The checksum cannot be added to a command or a response to a command.)

Adding a checksum enables incorrect data translation to be detected in the RS-232C communication. If the checksum does not match when the PASS/RTRY or ACK/NAK protocol is used, modify the program so that the "Request to resend" (RTRY or <NAK>) command is sent to the BL-600. To set the checksum, use the "PROTOCOL SETUP" screen of the BL-600 setup software.

*    The checksum cannot be added when the PLC link is used.

#### ■ Checksum calculation range and the position to add checksum
The checksum calculation is performed with all characters except for the header and delimiter. The checksum is added immediately before the delimiter.

CC = Checksum (2 ASCII code characters)

• Data format

| Heade | Read Data | CC | Delimiter |
|-------|-----------|-----|-----------|
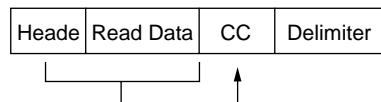
• When using the  data addition function

| Header | Code Type | : | Label Orientation | : | Read Data | : | Decode Count | / | Scan Count | CC | Delimiter |
|--------|-----------|---|-------------------|---|-----------|---|--------------|---|------------|-----|-----------|

• Test mode

| Header | Read Data | : | Reading Rate or Decode Count | CC | Delimiter |
|--------|-----------|---|------------------------------|-----|-----------|
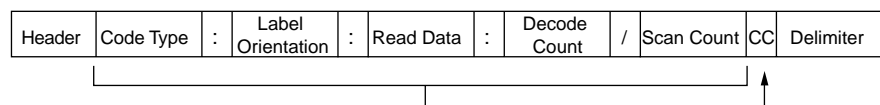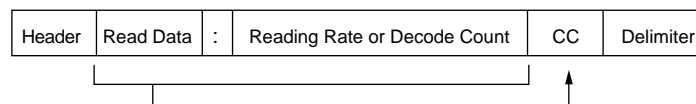
### ■ **Checksum calculation method**

Calculate the checksum (CC) using the read data of "ABC123" as an example. Convert each character into the ASCII code as shown below, and express the result as 8-bit binary numbers.
Calculate the "Exclusive-OR" of the binary numbers of each bit.

| Header | ABC123 | CC | Delimiter |

```
        ASCII code    Bit
A → 41h → 0100  0001
B → 42h → 0100  0010
C → 43h → 0100  0011
1 → 31h → 0011  0001
2 → 32h → 0011  0010
3 → 33h → 0011  0011        ⊕
        ─────────────────────────────
              ⇩      ⇩
            0111   0000 ⇨    70h
```

\* Based on the "Exclusive OR" logic, when an odd number of "1"s are present, the calculation result is "1", and when an even number of "1"s are present, the calculation result is "0".

Convert the calculated hexadecimal number into an ASCII code in two digits. The result obtained is the checksum.
Therefore, the checksum for the above example is "CC =70 (37h 30h).

*Example*

| Header | ERROR | CC | Delimiter |        CC=58

| Header | KEYENCE | : | 100 % | CC | Delimiter |        CC=74

---

**Reference 1:** Exclusive OR calculation formula

Calculate the numbers of each bit, referring to the following formula:

$0 \oplus 0 = 0$
$0 \oplus 1 = 1$
$1 \oplus 0 = 1$
$1 \oplus 1 = 0$
\* $\oplus$ : Operator of Exclusive OR

**Reference 2:** Conversion from hexadecimal number into binary number
To convert ASCII codes into binary numbers, refer to the following table.

| Hexadecimal number | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| Binary number | 0000 | 0001 | 0010 | 0011 | 0100 | 0101 | 0110 | 0111 |

| Hexadecimal number | 8 | 9 | A | B | C | D | E | F |
|---|---|---|---|---|---|---|---|---|
| Binary number | 1000 | 1001 | 1010 | 1011 | 1100 | 1101 | 1110 | 1111 |

# Appendix J   ASCII Code Table

| Hexadecimal | | High-order 4 bits | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | Binary | 0000 | 0001 | 0010 | 0011 | 0100 | 0101 | 0110 | 0111 |
| 0 | 0000 | NUL | DLE | (SP) | 0 | @ | P | | p |
| 1 | 0001 | SOH | DC1 | ! | 1 | A | Q | a | q |
| 2 | 0010 | STX | DC2 | " | 2 | B | R | b | r |
| 3 | 0011 | ETX | DC3 | # | 3 | C | S | c | s |
| 4 | 0100 | EOT | DC4 | $ | 4 | D | T | d | t |
| 5 | 0101 | ENQ | NAK | % | 5 | E | U | e | u |
| 6 | 0110 | ACK | SYN | & | 6 | F | V | f | v |
| 7 | 0111 | BEL | ETB | ' | 7 | G | W | g | w |
| 8 | 1000 | BS | CAN | ( | 8 | H | X | h | x |
| 9 | 1001 | HT | EM | ) | 9 | I | Y | i | y |
| A | 1010 | LF | SUB | ∗ | : | J | Z | j | z |
| B | 1011 | HM | ESC | + | ; | K | [ | k | { |
| C | 1100 | CL | FS | , | < | L | \ | l | \| |
| D | 1101 | CR | GS | – | = | M | ] | m | } |
| E | 1110 | SO | RS | . | > | N | ^ | n | ~ |
| F | 1111 | SI | US | / | ? | O | _ | o | del |

Low-order 4 bits

# Appendix K   Setup Parameter List

Fill in the specified data for each parameter.
Copy the list for daily operation.

■ **Bar code setup**

| Setup parameter | | Code 1 | Code 2 | Code 3 | Code 4 |
|---|---|---|---|---|---|
| **Code type** | | ( ) | ( ) | ( ) | ( ) |
| **Maximum number of digits** | | ( ) | ( ) | ( ) | ( ) |
| **Minimum number of digits** | | ( ) | ( ) | ( ) | ( ) |
| **Send start/stop character (CODE39, Coda bar)** | | ☐ Don't send<br>☐ Send | ☐ Don't send<br>☐ Send | ☐ Don't send<br>☐ Send | ☐ Don't send<br>☐ Send |
| **Start/stop character type (Coda bar)** | | ☐ Lowercase<br>☐ Uppercase | ☐ Lowercase<br>☐ Uppercase | ☐ Lowercase<br>☐ Uppercase | ☐ Lowercase<br>☐ Uppercase |
| **Test check digit (CODE39, Coda bar, ITF)** | | ☐ Don't test<br>☐ Test | ☐ Don't test<br>☐ Test | ☐ Don't test<br>☐ Test | ☐ Don't test<br>☐ Test |
| **Check digit type (Coda bar)** | | ( ) | ( ) | ( ) | ( ) |
| **Send check digit (CODE39, Coda bar, ITF)** | | ☐ Don't send<br>☐ Send | ☐ Don't send<br>☐ Send | ☐ Don't send<br>☐ Send | ☐ Don't send<br>☐ Send |
| **Read EAN (More than one can be selected.)** | | ☐ EAN 13-digit<br>☐ EAN 8-digit<br>☐ UPC-E | ☐ EAN 13-digit<br>☐ EAN 8-digit<br>☐ UPC-E | ☐ EAN 13-digit<br>☐ EAN 8-digit<br>☐ UPC-E | ☐ EAN 13-digit<br>☐ EAN 8-digit<br>☐ UPC-E |
| | **Number of output digits of UPC-A** | ☐ 13 digits<br>☐ 12 digits | ☐ 13 digits<br>☐ 12 digits | ☐ 13 digits<br>☐ 12 digits | ☐ 13 digits<br>☐ 12 digits |
| | **Add "0" to UPC-E system code** | ☐ Don't add<br>☐ Add | ☐ Don't add<br>☐ Add | ☐ Don't add<br>☐ Add | ☐ Don't add<br>☐ Add |
| **CODE 128** | **EAN-128 support** | ☐ Don't check<br>☐ Check | ☐ Don't check<br>☐ Check | ☐ Don't check<br>☐ Check | ☐ Don't check<br>☐ Check |
| **Set specified-digit output function** | | ☐ Don't set<br>☐ Set | ☐ Don't set<br>☐ Set | ☐ Don't set<br>☐ Set | ☐ Don't set<br>☐ Set |
| | **Specified direction** | ☐ Forward<br>☐ Backward | ☐ Forward<br>☐ Backward | ☐ Forward<br>☐ Backward | ☐ Forward<br>☐ Backward |
| | **Number of effective digits** | ( ) | ( ) | ( ) | ( ) |
| | **Start digit** | ( ) | ( ) | ( ) | ( ) |
| **Set label reading in the specified direction** | | ☐ Don't set<br>☐ Set | ☐ Don't set<br>☐ Set | ☐ Don't set<br>☐ Set | ☐ Don't set<br>☐ Set |
| | **Specified direction** | ☐ Forward<br>☐ Reverse | ☐ Forward<br>☐ Reverse | ☐ Forward<br>☐ Reverse | ☐ Forward<br>☐ Reverse |

### ■ Main setup

| Read mode | □ Single | Data send trigger | □ After reading | □ After trigger OFF |
|---|---|---|---|---|
| | □ Multi 1<br>□ Multi 2 | Double reading prevention time | ( ) | |
| | □ Multi 3 | | | |
| **Decode match count** | ( ) | | | |
| **Data addition function (more than one can be selected)** | □ Decode count □ Scan count<br>(available only when decode count is added)<br>□ Label orientation □ Code type<br><br>□ Adding a symbol identifier | | | |
| | □ Preventive maintenance information (PMI) | PMI Preset value 1 (L1) | ( ) | |
| | | PMI Preset value 2 (L2) | ( ) | |
| **Reading error code** | ( ) | | | |

### ■ Trigger Input Setup

| Trigger input | Selection method | □ Level signal trigger | □ One-shot signal trigger |
|---|---|---|---|
| | **One-shot signal trigger time** | ( ) | |
| | **Input time** | □ 2 ms | □ 10 ms |
| | **Input polarity** | □ N.O. | □ N.C. |
| | **Trigger input operation at power-on** | □ Disable | □ Enable |
| | **Trigger the input status at power-on** | □ Don't start<br>□ Start | □ Reading rate □ Tact measurement measurement |
| | **Start test mode at power ON** | □ Don't start<br>□ Start | □ Reading rate □ Tact measurement measurement |
| Command | **Trigger ON command** | ( ) | |
| | **Trigger OFF command** | ( ) | |

### ■ Comm Settings-1

| **Baud rate** | ( ) | | | | |
|---|---|---|---|---|---|
| **Data length** | □ 7 bits<br>□ 8 bits | □ Stop bits | □ 1 bit<br>□ 2 bits | □ Parity | □ None<br>□ Even<br>□ Odd |
| **RTS/CTS protocol** | □ Don't use □ Use | | | | |
| **Multi-drop link** | □ Don't use | | | | |
| | □ Use | □ ID No. | ( ) | | |

■ **Communication parameters 2**

| PLC link | □ Don't use | Protocol | □ Non-procedure □ PASS/RTRY □ ACK/NAK |
| | | Header | □ None □ STX □ ESC □ Specify ( ) |
| | | Delimiter | □ None □ CR+LF □ ETX □ Specify ( ) |
| | | Checksum | □ Don't add □ Add |
| | | Transmission delay time | ( ) |
| | □ Use | PLC type | □ SYSMAC-C □ MELSEC-A □ KV |
| | | PLC trigger area | □ Don't use □ Use |
| | | DM head address | ( ) 00 |
| | | PLC station/Unit No. | ( ) |
| | | File register | □ Don't use □ Use |
| | | File register block No. | ( ) |

■ **Communication character**

| Delimiter character | ( ) |
| --- | --- |
| Semi-delimiter | ( ) |

■ **Utilities**

| Display STABILITY LEDs | □ Don't display □ Display |
| --- | --- |
| OK/NG output ON time | ( ) |
| Preset data | ( ) |
| Scaling factor for the quiet zone | ( ) |
| Reading a reversed bar code | □ Don't display □ Display |
| Outputting the test mode result | □ Don't display □ Display |
| Changing the decoding match count | ( ) |

# Appendix L   Default Setting List

## ■ Bar code setup

| Parameter | Code 1 | Code 2 | Code 3 | Code 4 |
|---|---|---|---|---|
| **Code type** | CODE39 | Coda bar | UPC/EAN | CODE128 |
| **Maximum number of digits** | 32 | 32 | – | 32 |
| **Minimum number of digits** | 03 | 03 | – | 01 |
| **Send start/stop character** | Don't send | Send | – | – |
| **Start/stop character type** | – | Lowercase | – | – |
| **Test check digit** | Don't test | Don't test | – | – |
| **Read JAN (More than one can be selected.)** | – | – | All EAN 13-digit, EAN 8-digit and UPC-E are readable. | – |
|     **Number of output digits of UPC-A** | – | – | 13 digits | – |
|     **Add "0" to UPC-E system code** | – | – | Don't add | Don't add |
| **Set specified-digit output function** | Don't set | Don't set | Don't set | Don't set |
| **Set label reading in the specified direction** | Don't set | Don't set | Don't set | Don't set |

## ■ Main setup

| | |
|---|---|
| **Read mode** | Single |
| **Data send trigger** | After reading |
| **Decode match count** | 2 |
| **Data addition function** | None |
| **Reading error code** | ERROR |

## ■ Trigger input setup

| | |
|---|---|
| **Selection method** | Level signal trigger |
| **Input time** | 2 ms |
| **Input polarity** | Normal Open |
| **Trigger input operation at power-on** | Disable |
| **Start test mode at trigger input ON** | Don't start |
| **Start test mode at power ON** | Don't start |
| **Trigger ON command** | LON |
| **Trigger OFF command** | LOFF |

**Appendices**

■ **Comm Settings-1**

| Baud rate | 9600 bit/s |
|---|---|
| Data length | 7 bits |
| Parity | Even |
| Stop bits | 1 bit |
| RTS/CTS protocol | Don't use |
| Multi-drop link | Don't use |

■ **Comm Settings-2**

| PLC link | Don't use |
|---|---|
| Protocol | Non-procedure |
| Header | None |
| Delimiter | CR |
| Checksum | Don't add |
| Transmission delay time | 0 ms |

■ **Communication character**

| Delimiter character | : [3A] |
|---|---|
| Semi-delimiter | , [2C] |

■ **Utilities**

| OK/NG output ON time | 500 ms |
|---|---|
| STABILITY LEDs | Don't display |
| Preset data | Don't set |
| Scaling factor for the quiet zone | x7 |
| Reading a reversed bar code | Don't read |
| Outputting the test mode result | Display |
| Changing the decoding match count | 0 |

# Index

# Index

The index lists the terms used in this manual in alphabetical order.

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