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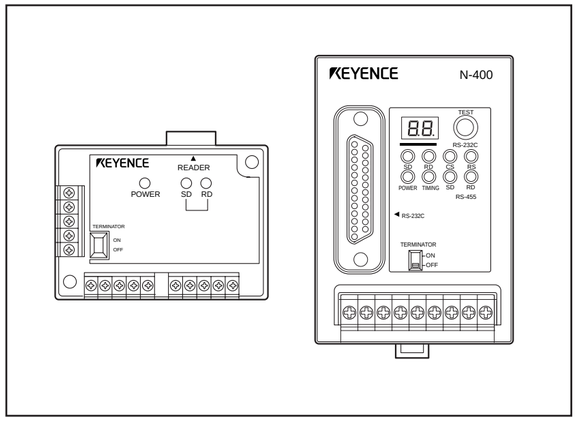
KEYENCE

96M0353

User's Manual

Multi-Drop Controller for BL Series

N-400



Specifications are subject to change without notice.

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Safety Precautions

This instruction manual describes the operation and function of the N-400. Read this manual carefully to ensure safe use and maximum performance from your N-400.

The N-400 can be connected to the BL-700, BL-180 and BL-500 series.

Symbols

The following symbols alert you to important messages. Be sure to read these messages carefully.

⚠ WARNING Failure to follow instruction may lead to injury. (electric shock, burn, etc.)

⚠ CAUTION Failure to follow instructions may lead to product damage.

Note: Provides additional information on proper operation.

General Precautions

- At startup and during operation, be sure to monitor the functions and performance of the N-400.
- We recommend that you take substantial safety measures to avoid any damage in the event a problem occurs.
- Do not open or modify the N-400 or use it in any way other than described in the specifications.
- When the N-400 is used in combination with other instruments, functions and performance may be degraded, depending on operating conditions and the surrounding environment.
- Do not use the N-400 for the purpose of protecting the human body.

Warnings and Cautions Specific to the N-400

⚠ CAUTION

- ***To operate the N-400/N-48, use a 24 VDC power supply. Using a different type of power supply may damage the unit.***
- ***This unit is a precision instrument and may be damaged if dropped. Be careful when carrying and mounting the unit.***
- To install this unit, read “Chapter 2, 2.6 Mounting Procedure” in this manual thoroughly for instructions on proper mounting conditions.
- For the RS-485 connections, use the recommended cable and follow the instructions given in this manual. (*See “Chapter 2, 2.3.3 Connecting RS-485” or “Chapter 2, 2.4.5 Connecting RS-485”.*) Connecting the RS-485 cable without following these instructions may cause a communication error.

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List of Package Contents

The N-400 includes the following equipment and accessories. Before using the unit, ensure that all of these items are included with your N-400.

■ **N-400 package contents**

- N-400 (x 1)
- User's Manual (x 1)
- N-400 setup software (x 1)

■ **N-48 package contents**

- N-48 (x 1)
- Instruction manual (x 1)

■ **BL-U1 [1] package contents**

- BL-U1 (x 1)

■ **BL-U2 package contents**

- BL-U2 (x 1)

1. BL-U1 is not available in Europe. Use BL-U2 instead.

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Chapter 1

Overview of the N-400

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1.1 Functions of the N-400

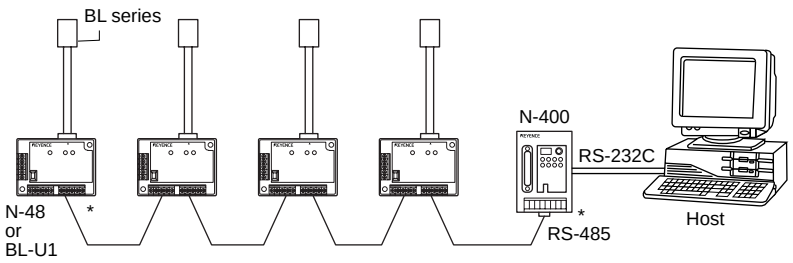
The N-400 multi-drop controller allows the following functions to be added to the BL series.

Note: The BL-U1 and N-48 can be used as an RS-232C to RS-485 converter. However, the BL-U1 is not available in Europe.

Multi-drop link function (mode)

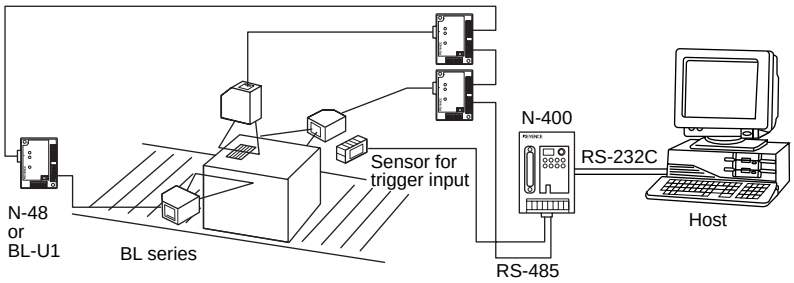
The N-400 can control up to thirty-one BL series units using a host computer, enabling the multi-drop link configuration.
The communication path is an RS-485 cable, which provides high noise-resistance and enables data transmission over a long distance (up to 1.2 km). Since a twisted pair cable (two cables) is used for the connections, the multi-drop link configuration can be realized with simple wiring.

The N-400 controls the complicated communication (RS-485 communication) between each BL series and the N-400. Since the host computer works only for communication with the N-400, it can be operated with a simple program. (The ID number assigned to the head of the transmitted data allows you to identify the BL series unit that sends the data.) Therefore, the host computer's job is reduced with this system configuration.



Multi-head scan function (mode)

If the position of bar codes is unknown in a product, or bar codes are printed in several positions, the bar codes cannot be read with a single bar code reader. In such cases, several bar code readers need to be mounted in various positions or at various angles.
When the N-400 controller is used in multi-head scan mode, a host computer can control several BL series units as if they were a single unit.



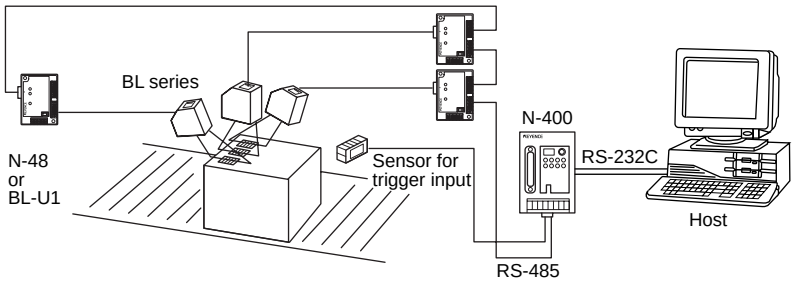
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■ Mutual-interference suppression function (in multi-head scan mode)

When several bar code readers are mounted close to each other, for example when reading multi-stage labels as shown below, the units' light sources (laser beams) interfere with each other, affecting the reading stability.

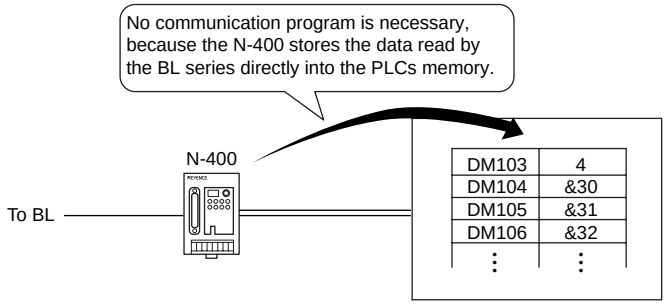
The mutual-interference suppression function allows the BL series' laser beams to turn ON sequentially, thus suppressing the mutual interference to ensure stable readings.

Since the laser beams turn ON sequentially, the duration of laser OFF time (when each unit is not reading a bar code) becomes longer as the number of connected units is increased. Therefore, the bar code readers may fail to read bar codes if the line speed is set too fast.



■ PLC link function

In the multi-drop link mode or multi-head scan mode, the PLC link function enables the BL series' data to be sent to a PLC without a communication program. Using this function, you can reduce the number of steps for a PLC program.



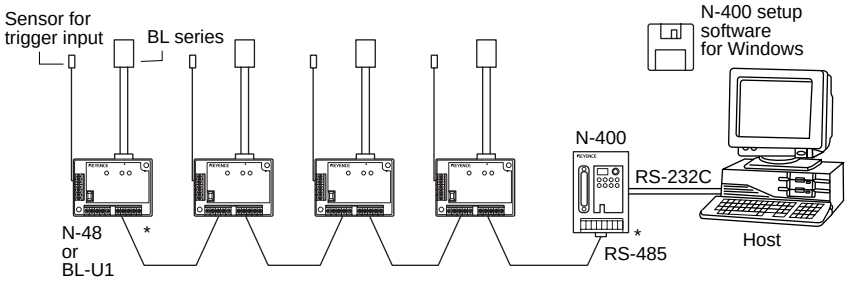
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1.2 System Configuration

The system configurations using the N-400 controller are as follows:
This section describes multi-drop link mode and multi-head scan mode individually.

Multi-drop link mode

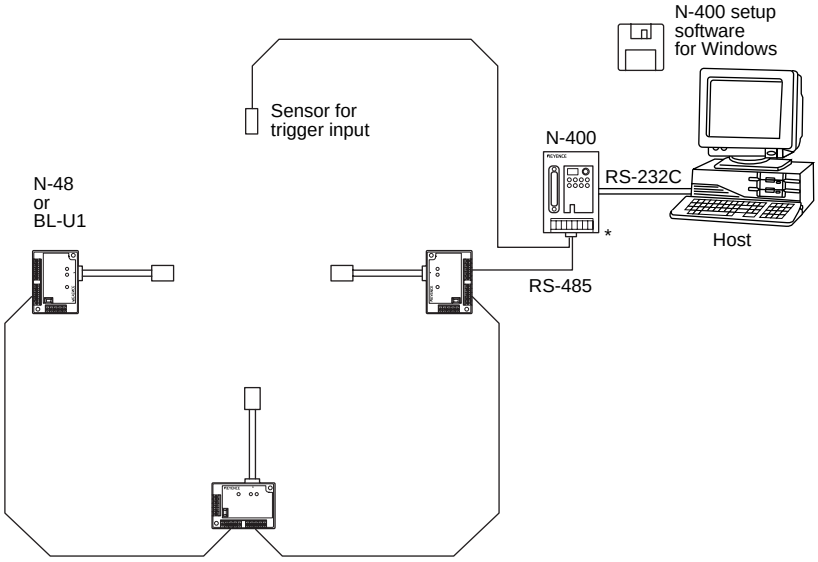
- Maximum number of connectable units: 31
- Maximum extension distance: 1.2 km



* The N-400 can be connected to the BL-700/BL-500/BL-180 series bar code readers.
* Additional 24 VDC power supply is required for the N-400 and N-48.

Multi-head scan mode (with the interference suppression function)

- Maximum number of connectable units: 31
- Maximum extension distance: 1.2 km

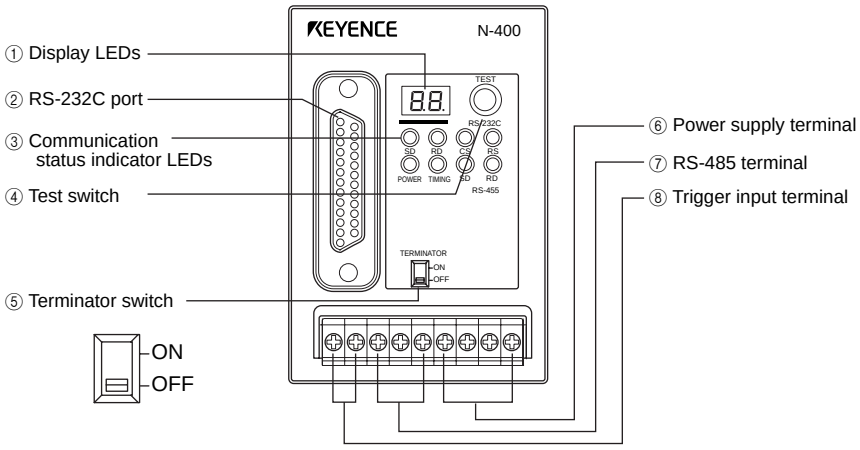


* Connect the sensor for trigger input to the N-400.
* The N-400 can be connected to the BL-700/BL-500/BL-180 series bar code readers.
* Additional 24 VDC power supply is required for the N-400 and N-48.

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1.3 Part Names

N-400

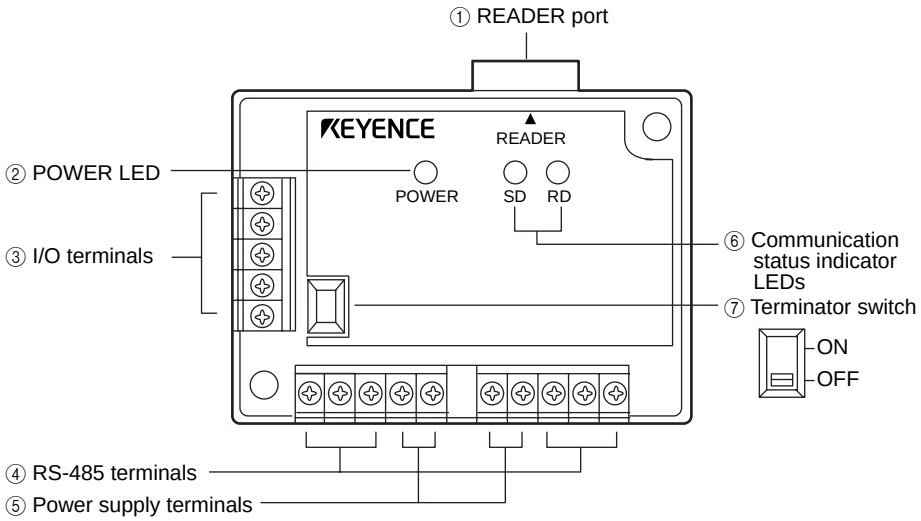


No.	Name	Function
①	Display LEDs	• Normally displays “00” (ID number of the N400). • Displays the ID number of the device being tested. *(⇨ See p. 26.)* • Displays “S1 (51)” to indicate setup mode. *(⇨ See p. 75.)* • Displays “S0 (50)” to indicate initial communication status after a setting change. *(⇨ See p. 48.)* • Displays the N-400’s error condition. *(⇨ See 131.)* • Displays the ID number of the device currently connected when sending a hotline command. *(⇨ See p. 73.)*
②	RS-232C port	• Connect a host computer or PLC to this connector.
③	Communication status indicator LEDs	• POWER: Lit when power is ON. • TIMING: Lit when the trigger input connected to the N-400 is ON. (For the RS-232C connections) Lit when the SD, RD, RS and CS signals are ON. (For the RS-485 connections) SD: Lit when the N-400 is sending data. RD: Lit when the N-400 is receiving data. * Both the SD and RD indicators are lit when the N-400 is receiving data.
④	Test switch	Starts the connection test mode.
⑤	Terminator switch	Switches the terminator’s ON/OFF status.
⑥	Power supply terminal	Connect a 24 VDC power supply.
⑦	RS-485 terminal	Used for the multi-drop link connection.
⑧	Trigger input terminal	Used for trigger input in multi-head scan mode.

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N-48

Note: BL-U1 is not available in the Europe area.

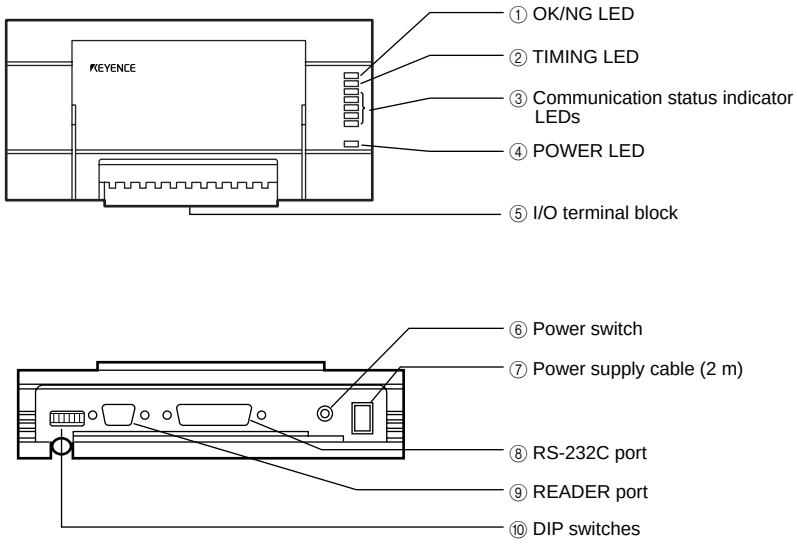


No.	Name	Function
①	READER port	Connect the BL series to this port.
②	POWER LED	Lit when power is ON.
③	I/O terminals	Includes the trigger input terminal and OK/NG output terminals.
④	RS-485 terminals	Used for multi-drop link mode.
⑤	Power supply terminals	Connect a 24 VDC power supply to these terminals.
⑥	Communication status indicator LEDs	Allows you to monitor the communication status of the READER port. SD: Lit when the BL series is sending data. RD: Lit when the BL series is receiving a command.
⑦	Terminator switch	Turns the terminator ON/OFF.

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BL-U1

Note: The BL-U1 is not available in Europe



No.	Name	Function
①	OK/NG LED	• When OK output is ON: The green LED lights. • When NG output is ON: The red LED lights.
②	TIMING LED	Lit when trigger input is ON.
③	Communication status indicator LEDs	• Allows you to monitor the communication status of the RS-232C port. • The SD, RD, RS and CS indicators are provided in this order from the top.
④	POWER LED	Lit when power is ON.
⑤	I/O terminal block	Includes the trigger input terminal, OK/NG output terminals, RS-422A terminal and RS-485 terminal.
⑥	Power switch	Turns the power ON/OFF.
⑦	Power supply cable (2 m)	Use a 100 to 240 VAC (50/60 Hz) power supply.
⑧	RS-232C port	Connect a personal computer to this port. This port is unused in multi-drop link mode.
⑨	READER port	Connect the BL series to this port.
⑩	DIP switche	Switches the communication port, and turns the terminator ON/OFF.

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2.1 Installing the N-400

■ **Equipment used**

- **N-400 multi-drop controller**

- **BL series bar code readers**
  The N-400 can be connected to the BL-700, BL-500 and BL-180 series bar code readers.

- **N-48 (or BL-U1) power supply unit for BL series (RS-485 mode)**
  Each bar code reader requires one N-48 (or BL-U1) power supply.

- **BL-U2 (or BL-U1) power supply unit for BL series (RS-232C mode)**
  To change the BL series' settings, one BL-U2 or BL-U1 power supply unit is required.
  To use the N-48 for multi-drop link, an additional BL-U2 24 VDC power supply unit is required. (The N-48 does not provide an RS-232C port.)
  (The BL-U1 can be used as an RS-232C or RS-485 power supply.)

- **RS-232C cable for the N-400**
  This cable is used to connect the N-400 and the host computer.
  Use a cable appropriate for the personal computer and the PLC's pin assignment. OP-98769 cable and OP-25057 connector are available.

- **RS-232C cable for BL series setup**
  This cable is used to connect the BL-U2 (or BL-U1) and the host computer to change the BL series' settings. Since the wiring of this cable is different from that of the RS-232C cable for the N-400, both cables must be prepared.
  For wiring the BL-U2 and BL-U1, see the "BL-U2 Instruction Manual" and "BL series User's Manual", respectively.
  OP-27937 cable is available for BL-U2. (OP-22149 cable and OP-25057 are available for BL-U1.)

- **Twisted pair cable for the RS-485**
  Prepare the recommended cable. *(☞ See pp. 19, 20 and 25.)*

- **Host computer**
  Use a personal computer with an RS-232C port.
  When large quantities of data are sent from several BL series, they may exceed the host computer's data processing capacity.
  If this occurs, reduce the number of the connected BL series units, or enhance the data processing capacity (including the programming language) of the host computer.

■ **Setup and connection**

1) Setting the BL series bar code readers

Prepare the BL series unit, the BL-U2 (or BL-U1) RS-232C power supply unit, the RS-232C cable used for setup, and a personal computer. Set up the BL series using the BL series setup software.
For connection and setup procedures, see the "BL series User's Manual".
For the pin assignment of the connection cable between the BL-U2 and the host computer, see the "BL-U2 Instruction Manual".

The setting contents vary slightly depending on the mode being used. Refer to the following pages for more information.

- Multi-drop link mode: p. 60
- Multi-head scan mode: p. 87

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2) Setting the N-400

Prepare the N-400, the RS-232C cable for the N-400, and a personal computer. Set up the N-400 using the N-400 setup software.
For the setup software operating procedure, see pp. 32 and following.

The setting contents vary slightly depending on the mode being used.

- Multi-drop link mode: p. 60
- Multi-head scan mode: p. 88
- PLC link: p. 102

3) Setting a host computer/PLC

For the RS-232C communication, set the baud rate, data length, parity and stop bit length according to the settings of the N-400.

To use a PLC link, set up the PLC according to pp. 104 and 105.

4) Connection between the BL series and N-400 (See pp. 19, 20 and 25.)

Connect the N-48 (or BL-U1) power supply unit to the BL series. Then connect the specified cable (twisted pair cable) between the power supply and the N-400. Turn ON the equipment terminator at both ends of the connection.
When using the BL-U1, set the DIP switch to “RS-485”. (See p. 22.)

5) Connection between the N-400 and host computer/PLC (See pp. 13 to 15.)

To connect the N-400 to the host computer or PLC, use the RS-232C cable whose pin assignment conforms to that of the host computer and PLC.

6) Checking the RS-485 connection between the N-400 and the BL series

The N-400 provides a connection test mode that checks whether the RS-485 connection is correct or not. Using this function, check whether the RS-485 communication can be correctly performed.
For the procedure for using this function, see p. 26.

7) Connecting a sensor for trigger input

Connect a sensor for trigger input to each N-48 or BL-U1 unit. (This sensor is not required when controlling the BL series’ reading operation using the read start/end commands.)

To use the BL series in multi-head scan mode, connect a sensor for trigger input to the N-400. (This sensor is not required when controlling the BL series’ reading operation using the read start/end commands.)
If the sensor for trigger input is directly connected to each BL series, the BL series cannot operate normally.

8) Checking operation

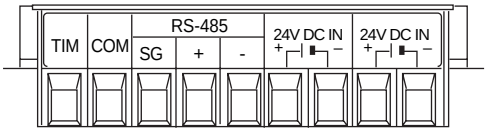
Using the terminal software included in the N-400 setup software, check whether the RS-232C communication between the N-400 and host computer can be performed correctly. (See p. 52.)

To use a PLC link, check whether data is stored in the PLC’s memory.

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2.2 Connecting N-400 and Wiring

This section describes the procedure for connecting the N-400 to external equipment.



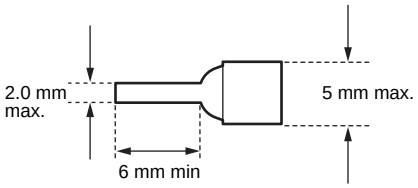
2

2.2.1 Terminals of I/O terminal block and wiring

Symbol	Description	Signal direction
TIM	Trigger input	Input
COM	Common terminal for trigger input	Input
RS-485 SG	RS-485 signal ground	——
RS-485 +	RS-485 + terminal	Input/Output
RS-485 -	RS-485 - terminal	Input/Output
24 VDC OUT	24 VDC power output + terminal	Output
	24 VDC power output - terminal	Output
24 VDC IN	24 VDC power input + terminal	Input
	24 VDC power input - terminal	Input

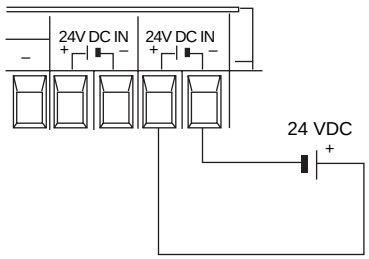
* Viewed from the left of the terminal block.

- The following I-type clips can be used for the connections.



Connecting power supply

The N-400 operates with a 24 VDC power supply.



When a 24 VDC power supply is connected to the power supply “IN” terminal, the “OUT” terminal can be used as the 24 VDC power supply output terminal. (Note: The power supply connected to the “IN” terminal must have a capacity high enough to supply power to the equipment connected to the “OUT” terminal.)
Using this function, the “OUT” terminal can be used as a 24 VDC power supply for each BL series connected in the multi-drop link configuration. (For a connection example, see p. 19.)

CAUTION

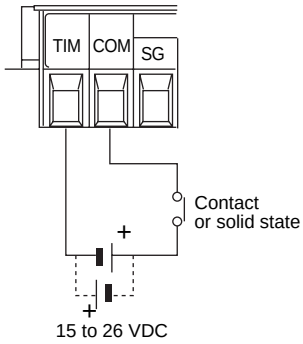
To operate the N-400, be sure to use a 24 VDC power supply. Using a power supply exceeding 24 VDC or using an AC power supply may damage the unit.

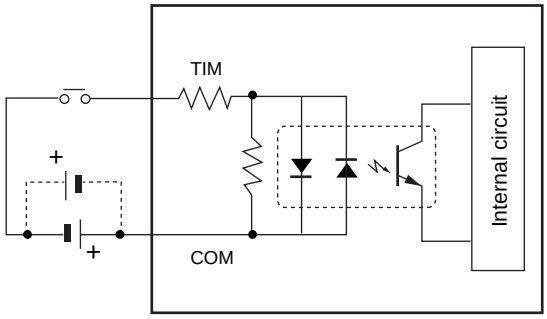
If your system must comply with UL regulations, be sure to use the power supply with NEC class 2 output.

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Connecting trigger input

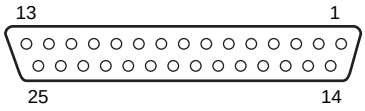
To use multi-head scan mode, connect the trigger input to the N-400 only, instead of to each BL series unit.





2.2.2 Connecting RS-232C

Pin assignment



D-sub 25-pin (male)
DCE specification (defined as terminal)
M2.6 screw

Pin No.	Symbol	Function	Signal direction
1	FG	Frame ground	—
2	SD (TXD)	Sends data.	Input
3	RD (RXD)	Receives data.	Output
4	RS (RTS)	Ready to send data.	Input
5	CS (CTS)	Request to send data.	Output
6	DR (DSR)	Connected to pin No. 20 inside.	Output
7	SG	Signal ground	—
20	ER (DTR)	Connected to pin No. 6 inside.	Input
25	+5 V	5 V power supply output (100 mA)	Output

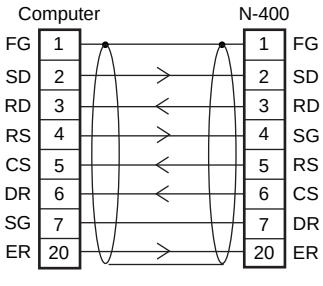
CAUTION

Pin No. 25 is used for a 5 V power supply output. Do not connect this terminal to the ground terminal or any other terminal when it is unused. Doing this may damage the N-400 or the external device connected to this terminal.

RS-232C cable connections

■ **Connecting personal computer**

• Connecting the computer with 25-pin

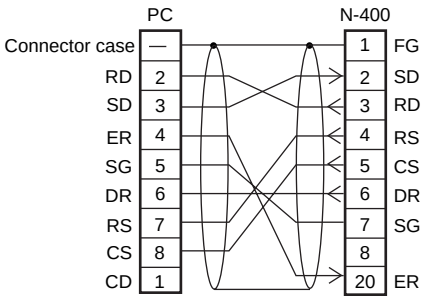


D-sub 25-pin (male)
M2.6 screw

D-sub 25-pin (male)
M2.6 screw

* The OP-98769 cable (1.5 m: manufactured by KEYENCE) can be used.

• Connecting IBM PC



D-sub 9-pin (female)
#4-40 screw

D-sub 25-pin (male)
M2.6 screw

* The OP-98769 cable (1.5 m: manufactured by KEYENCE) and the OP25057 conversion connector can be used.

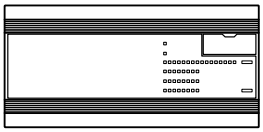
Tips A commercially-available straight cable (D-sub 25 pin - 25 pin, or D-sub 25 pin - 9 pin) can be used.

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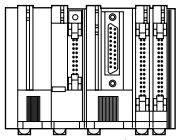
2

■ Connecting KV series/Handheld programmer port

Use the optional cable manufactured by KEYENCE.



KV-10, 16, 24
KV-40, 80



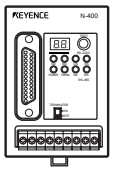
KV-300 [1.]



OP-24045 (1 m)
or
OP-24025 (5 m)



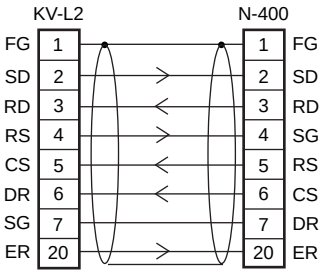
OP-96369



1. KV-300 and KV-L2 are not available in Europe.

■ Connecting KV-L2 [1.]

Port 1

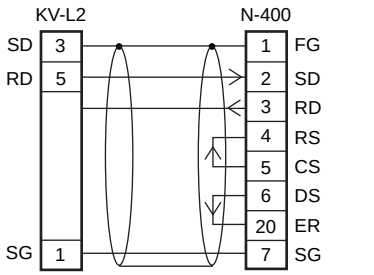


D-sub 25-pin (male)
M2.6 screw

D-sub 25-pin (male)
M2.6 screw

* The OP-98769 cable (1.5 m: manufactured by KEYENCE) or a commercially-available straight cable can be used.

Terminal block



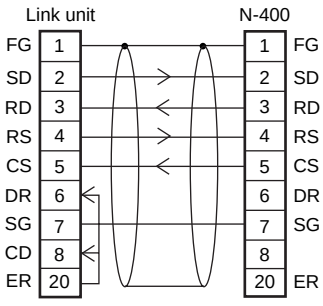
Terminal block

D-sub 25-pin (male)
M2.6 screw

1. KV-300 and KV-L2 are not available in Europe.

■ Connecting MELSEC-A series

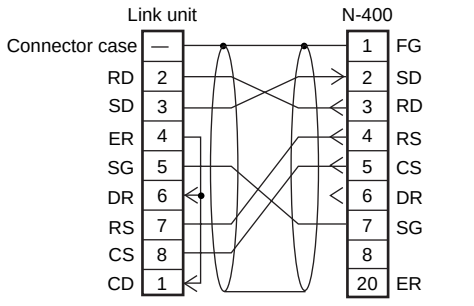
Connection with AJ71C24, AL71C24-S*, A0J2-C214S1, AJ71UC24



D-sub 25-pin (male)
M2.6 screw

D-sub 25-pin (male)
M2.6 screw

Connection with A1SJ71C24-R2/PRF, A2CCPUC24, A2CCPUC24-PRF, A1SJ71UC24-R2/PRF



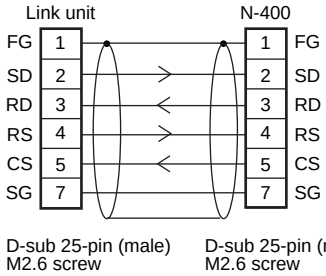
D-sub 25-pin (male)
M2.6 screw

D-sub 25-pin (male)
M2.6 screw

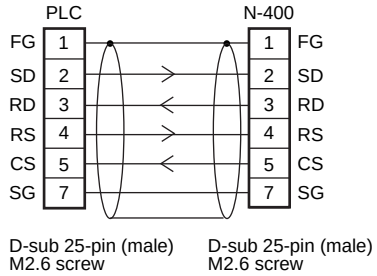
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■ SYSMAC-C series

Connection with C-200H-LK201(-V1), C-500-LK203, C-500-LK201-V1, C120-LK201-V1

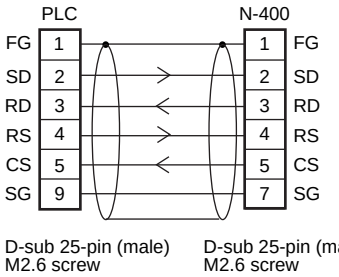


Connection with C-20H, C-28H, C-40H, C-60H, C-80H



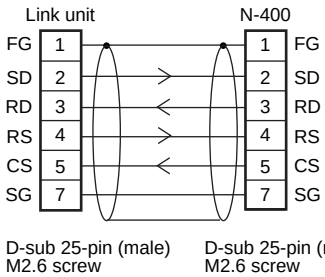
* The OP-98769 cable (1.5 m: manufactured by KEYENCE) or a commercially-available straight cable can be used.

Connection with C-200HS(CPU21/23/31/33), CQM1(CPU21/41/42/43/44), C-200HE(CPU42), C200HG(CPU43/63), C200HX(CPU44/64), C200HWCOM02/COM04/COM05/COM06

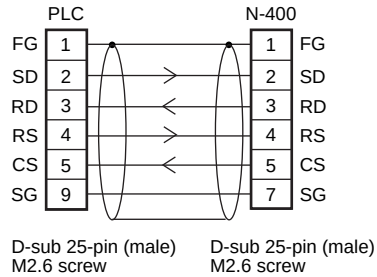


■ SYSMAC-CV series

Connection with CV500-LK201(Port 1)



Connection with CV500-LK201(Port 2), CV500, CV1000, CVM1



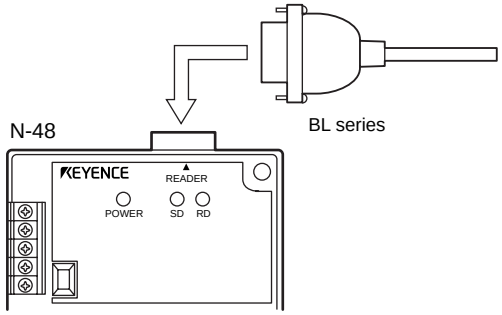
* The OP-98769 cable (1.5 m: manufactured by KEYENCE) or a commercially-available straight cable can be used.

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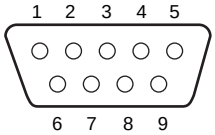
2.3 Connecting N-48 and Wiring

2.3.1 Connecting the BL series

Connect the BL series to the READER port of the N-48.



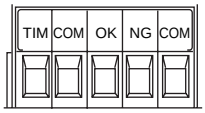
Pin assignment



D-sub 9-pin (male)
DCE specification (defined as terminal)
#4-40 screw

Pin No.	Symbol	Function	Signal direction
1	TIM	Trigger input	Output
2	RD (RXD)	Receives data.	Output
3	SD (TXD)	Sends data.	Input
4	OK	OK	Input
5	GND (SG)	Ground (Common ground for respective signal)	—
6	NG	NG	Input
7	RS (RTS)	Ready to send data.	Input
8	CS (CTS)	Request to send data.	Output
9	+5 V	5 V power supply output (600mA)	Output

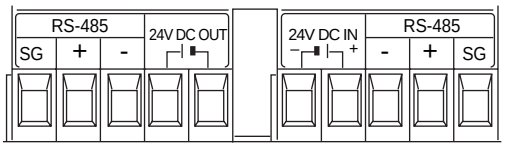
2.3.2 Terminals of I/O terminal block and connections



* Viewed from the left of the unit

Symbol	Description	Signal direction
TIM	Trigger input	Input
COM	Common terminal for trigger input	Input
OK	OK output	Output
NG	NG output	Output
COM	Common terminal for output	Output

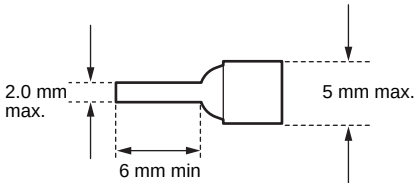
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* Viewed from the bottom of the unit

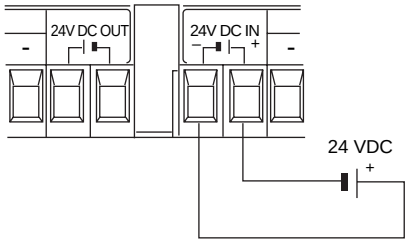
Symbol	Description	Signal direction
RS-485 SG	RS-485 signal ground	——
RS-485 +	RS-485 + terminal	Input/Output
RS-485 -	RS-485 - terminal	Input/Output
24 VDC IN (OUT)	24 VDC power supply input (output) + terminal	Input(Output)
	24 VDC power supply input (output) - terminal	Input(Output)

• The following I-type clips can be used for connections.



Connecting power supply

Connect a 24 VDC power supply to the “IN” terminal.
When a 24 VDC power supply is connected to the “IN” terminal, the “OUT” terminal can be used as a 24 VDC power supply output terminal. In this case, the “OUT” terminal can be used as a power supply for other N-48 unit connected in the multi-drop link configuration. (⇨ *For a connection example, see p. 19.*)



⚠ CAUTION

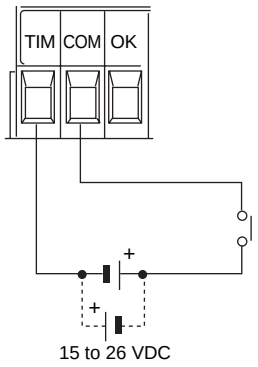
- ***Do not connect a power supply other than 24 VDC or the unit may be damaged.***
- ***Connecting a power supply to the RS-485 terminal may damage the N-48.***
- ***Do not connect different types of power supplies to the IN and OUT terminals or the unit may not start normally due to the potential difference between the power supplies.***

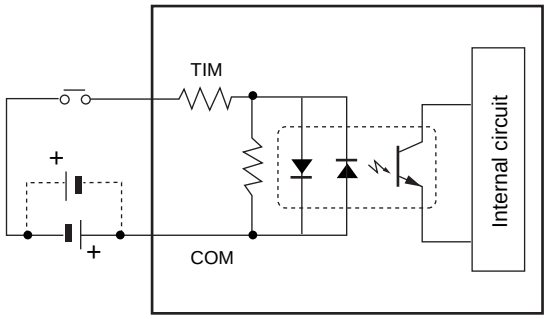
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Connecting trigger input

The trigger input allows the BL series to start reading bar codes (turn on the laser beam).

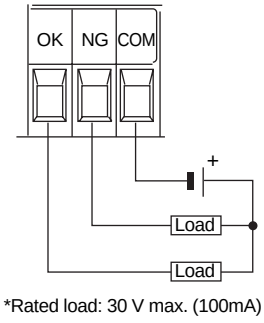
To connect the BL series in multi-head mode, send the trigger input to the N-400 instead of the N-48.

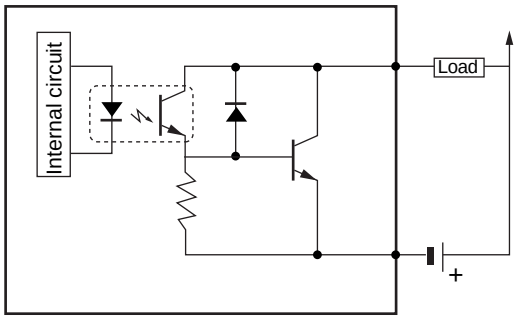




Connecting OK/NG output

The OK/NG output indicates the result of the comparison with preset data, or indicates whether reading is successful or not.

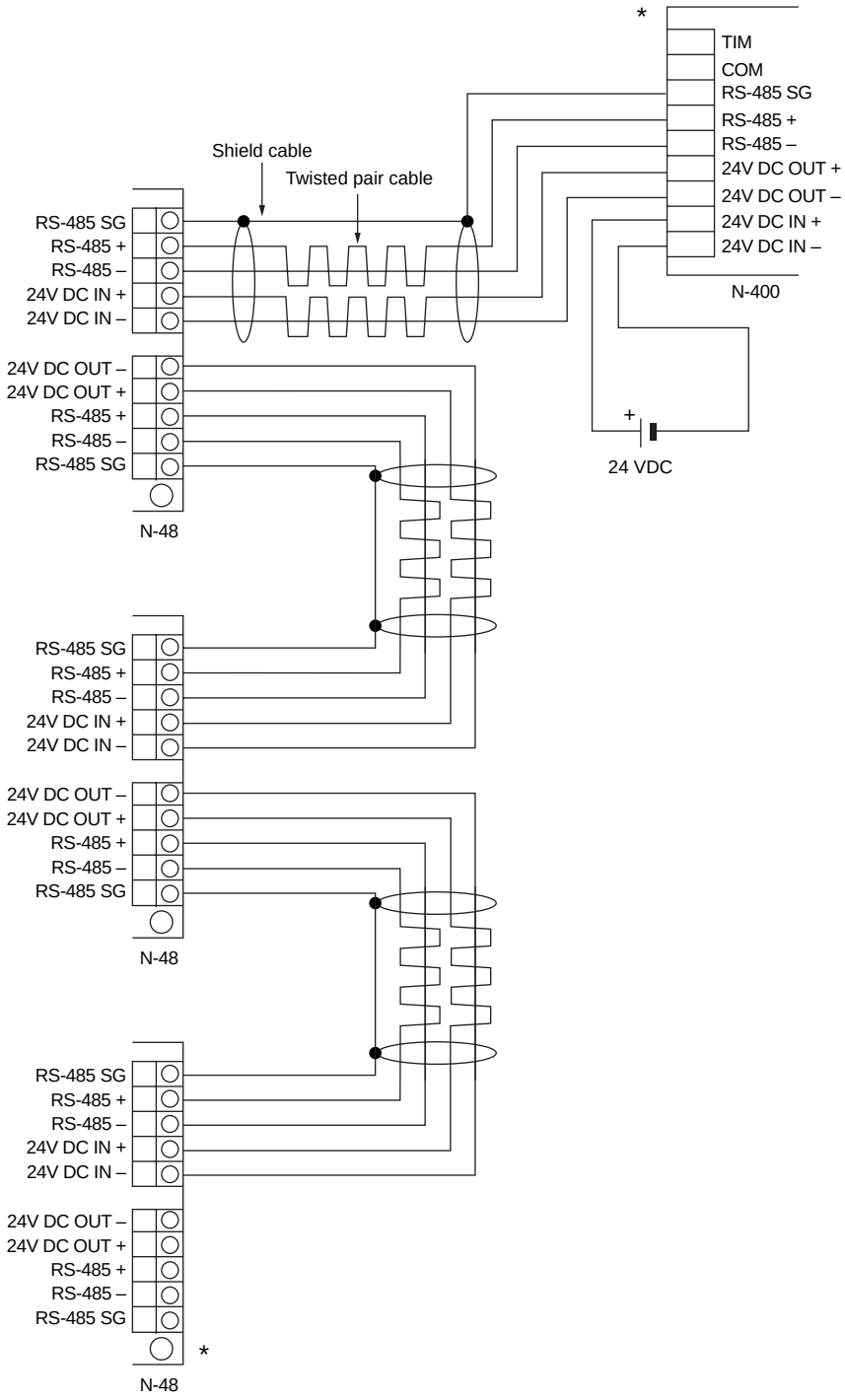




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2.3.3 Connecting RS-485

For the RS-485 connections, use the “RS-485 +” and “RS-485 -” terminals provided on the terminal block.



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- The diagram on the previous page shows the connections to supply 24 VDC power to the N-48 from the power supply connected to the N-400. In this case, the 24 VDC power supply connected to the N-400 must have a capacity of at least “140 mA (N-400 current consumption) + 260 mA (N-48 current consumption) x n (Number of N48 units connected)”.

  Example
  When five N-48 units are connected:
  140 mA + 260 mA x 5 = 1.44 A
  Use a power supply with at least 1.44 A capacity.

Note: The RS-485 cable can be extended up to 1.2 km. With the power supply cable, however, the 1.2 km extension is not guaranteed.

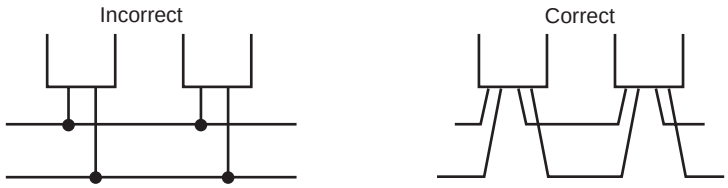
To extend the power supply cable as shown in the connection diagram on the previous page, ensure that the power voltage supplied to all the N-48 units is within the range of 24 VDC -20% to +10%.

- To connect a 24 VDC power supply to each N-48 unit, remove the 24 VDC wiring shown in the previous page. To connect the power supply, use the following cable.

Recommended RS-485 cable
• 0.75 mm^2 x 2 cores, sheilded

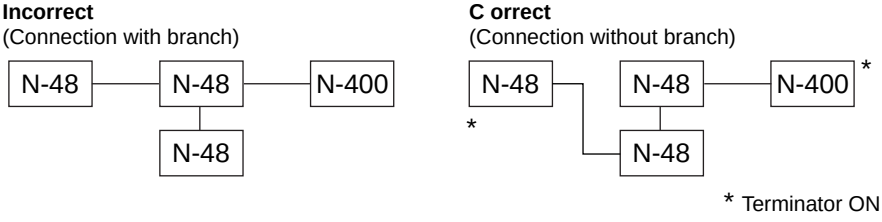
- Up to thirty-one N-48 (BL series) units can be connected in multi-drop link mode.
- The total extension length of the RS-485 cable must be within 1.2 km.
- Turn ON the equipment terminator (termination resistance: 100 Ω) at both ends of the RS-485 connection (marked with * in the figure above).
- Turn ON/OFF the N-48 terminator using the terminator switch. (☞ *See p. 7.*)
- Turn ON/OFF the N-400 terminator using the terminator switch. (☞ *See p. 6.*)

Note: Be sure not to connect the RS-485 cable using the terminal block.



Note 1: Do not place the RS-485 cable in the same conduit as a power cable.

Note 2: Do not branch the RS-485 connection as shown below.



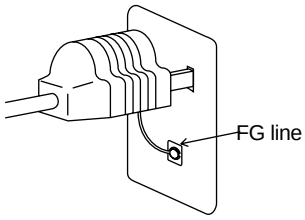
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2.4 Connecting BL-U1 and Wiring

To use the BL-U1 AC power supply, connect it as described below.

2.4.1 Connecting power supply

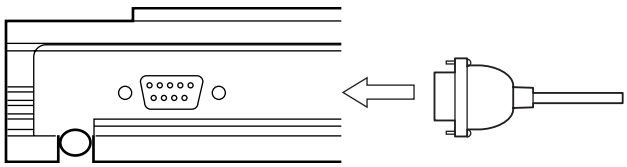
Plug the BL-U1 power cable into an outlet.



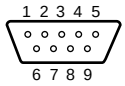
CAUTION *Use a power supply of 100 to 240 VAC ±10% (50/60 Hz).*

2.4.2 Connecting BL series

Connect the BL series to the READER port of the BL-U1.



BL-U1 READER port pin assignment



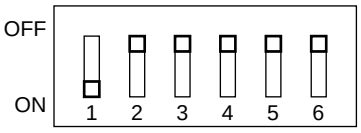
D-sub 9-pin (male)
DCE specification (defined as terminal)
#4-40 screw (female)

Pin No.	Symbol	Function	Signal direction
1	TIM	Trigger input	Output
2	RD (RXD)	Receives RS-232C data.	Output
3	SD (TXD)	Sends RS-232C data.	Input
4	OK	OK	Input
5	GND (SG)	Ground (Common ground for respective signal)	—
6	NG	NG	Input
7	RS (RTS)	Ready to send RS-232C data.	Input
8	CS (CTS)	Request to send RS-232Cdata. (Control method can be selected with the DIP switches. See p. 22.)	Output
9	+5 V	+5 V power supply (1.5 A)	Output

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2.4.3 Setting BL-U1 DIP switches

Switch the interface setting to “RS-485 multi-drop” using the BL-U1 DIP switches.
Switch the RS-485 terminator according to p. 25.

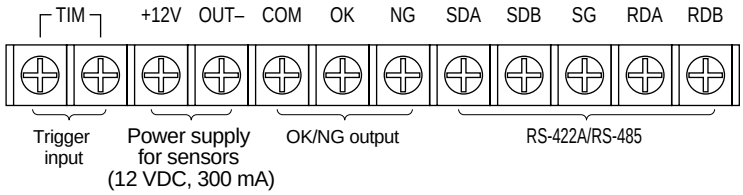


* The figure on the left shows the default settings.

	DIP Switch No.	1	2	3	4	5	6
Interface selection	RS-232C	ON	OFF	OFF			
	RS-422A	OFF	ON	OFF			
	RS-485 multidrop	OFF	OFF	ON			
RS-422A terminator	OFF				OFF		
(Termination resistance: 100 Ω)	ON				ON		
RS-485 terminator	OFF					OFF	
(Termination resistance: 100 Ω)	ON					ON	
Selection of READER port CS control method	ON or OFF according to the RS-232C port CS signal status.						OFF
	Normally ON						ON

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2.4.4 Terminals of I/O terminal block and wiring



Symbol	Description	Signal direction
TIM	Trigger input	Input
		Input
+12 V OUT	+ terminal of power supply for sensor (12 VDC, 300 mA)	Output
	– terminal of power supply for sensor (0 V)	Output
COM	Common terminal for OK/NG output	—
OK	OK output	Output
NG	NG output	Output
SDA	+ terminal for RS-422A data transmission/ RS-485 + terminal	Output, Input/Output
SDB	– terminal for RS-422A data transmission/ RS-485 - terminal	Output, Input/Output
SG	Signal ground	—
RDA	+ terminal for RS-422A data reception	Input
RDB	– terminal for RS-422A data reception	Input

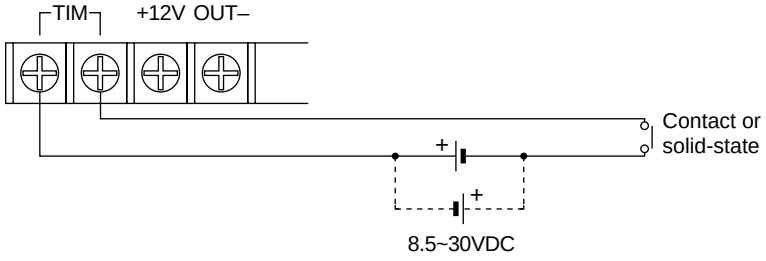
* Viewed from the left of the terminal block

• M3.0 screws are used for the terminal block.
• Use the following crimp terminals for connections.



Connecting trigger input

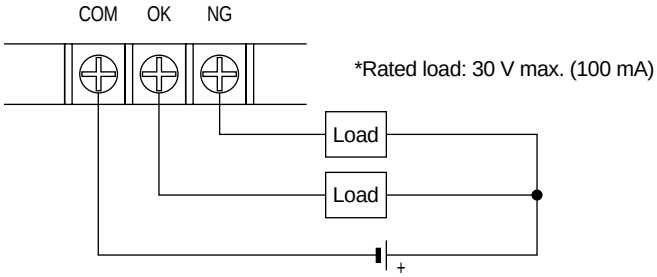
The trigger input allows the BL series to start reading bar codes (turn on the laser beam).
The trigger input is turned ON when 8.5 to 30 VDC input is activated between the trigger input terminals.
The BL-U1 power supply for the sensor can be used as the input power supply.



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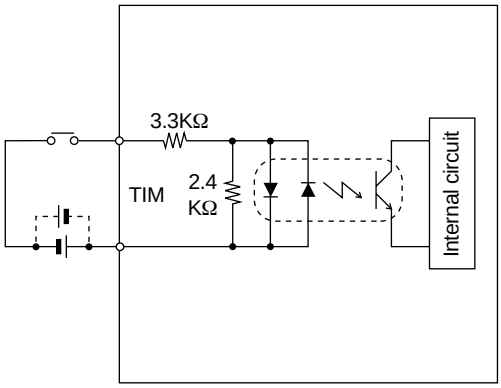
Connecting OK/NG output

The OK/NG output is used to differentiate between acceptable and unacceptable results based on the comparison with the preset data, and to indicate whether or not the BL series successfully read bar codes.
The OK/NG output is an open-collector output.

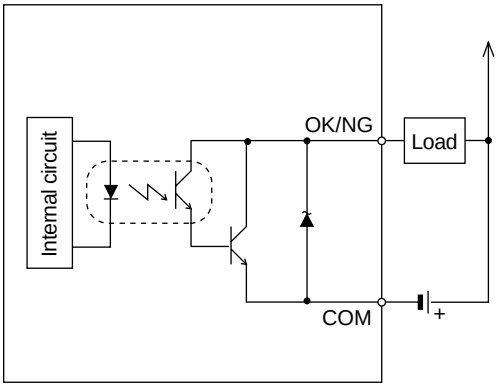


I/O circuit diagram

Input circuit diagram



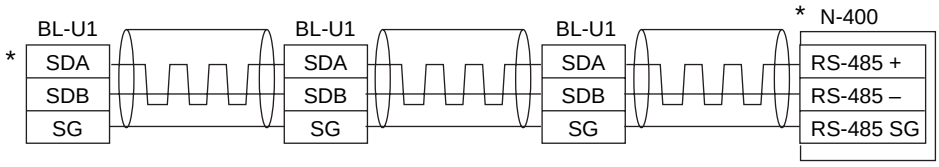
Output circuit diagram



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2.4.5 Connecting RS-485

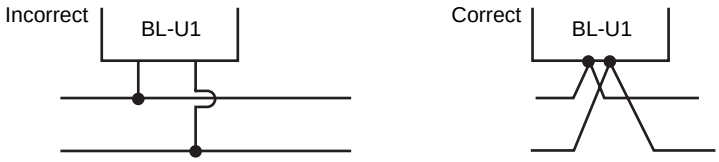
For the RS-485 connections, use the “SDA” and “SDB” terminals provided on the terminal block.



Recommended RS-485 cable
• 0.75 mm^2 x 2 cores, shielded

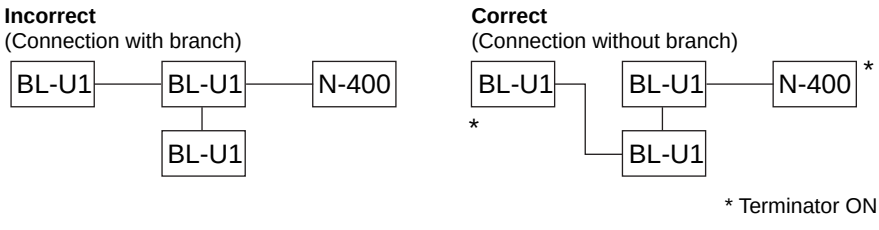
- Up to thirty-one BL-U1 (BL series) units can be connected in multi-drop link mode.
- The total extension length of the RS-485 cable must be within 1.2 km.
- Turn ON the equipment terminator (termination resistance: 100 Ω) at both ends of the RS-485 connection (marked with * in the above diagram).
- Turn ON/OFF the BL-U1 terminator using the terminator switch. (See p. 22.)
- Turn ON/OFF the N-400 terminator using the terminator switch. (See p. 6.)

Note: Be sure not to connect the RS-485 cable using the terminal block.



Note 1: Do not place the RS-485 cable in the same conduit as a power cable.

Note 2: Do not branch the RS-485 connection as shown below.



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2.5 Using Connection Test Mode

This section describes the procedure for performing a connection test after the N-400 and the BL series (N-48 or BL-U1) are connected with the RS-485 cable.

Note: To use the connection test mode, ensure that the settings of the connected BL series and those of the N-400 are switched to “multidrop link” mode.

1) When you press and hold the N-400 test switch for approximately 2 seconds after the power to all devices is turned ON, the connection test mode is activated. The N-400 displays the ID number of the device being tested. If the devices are properly connected, the ID number is automatically incremented.

2) If any device is not connected or is improperly connected, the ID number corresponding to the device flashes.
To go to the next step during the connection test, press the test switch once.

Example 1

When ten BL series (ID Nos. 1 to 10) are connected:
The displayed ID number automatically changes from “1” to “10”, and then “11” will flash if the connection test result is “OK”.

Example 2

When fourteen BL series (ID Nos. 3 to 16) are connected:
When “1” flashes, press the test switch once. When “2” flashes, press the test switch again. The displayed number changes from “3” to “16”, and then “17” will flash if the connection test result is “OK”.

3) If an ID number of any BL series flashes, the BL series unit is not properly connected. After checking the following points, perform the connection test again.

- Check that the RS-485 communication parameters (baud rate, data length, parity and stop bit length) of the N-400 match to those of the BL series.
- Check that the BL series is set to “multi-drop link” mode.
- Check that all cables are properly connected. Ensure that the connections are not branched and that no cables are connected using the terminal block. (⇨ *See pp. 19, 20 and 25.*)
- Check that the equipment terminators at both ends of the connection are ON and the terminators of other equipment are OFF.
- Check that the BL series’ ID numbers are properly assigned. Make sure that the same ID number is not assigned to different devices.

4) Pressing and holding the test switch for approximately 2 seconds again resets the connection test mode.

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2.6 Mounting Procedure

2.6.1 Operating environment precautions

CAUTION

This unit is a precision instrument and you must take care in choosing the operating environment.

■ Ambient environments

Do not install the unit in place as shown below

- The unit is exposed to direct sunlight, or the ambient temperature may fall below 0°C (32°F) or exceed 50°C (122°F);
- The relative humidity may exceed the range of 35 to 85%, or condensation may occur due to rapid temperature changes;
- Corrosive gas or inflammable gas is present, or a high level of dust, salt, iron particles or soot is present;
- The unit is subject to vibration or impact;
- Water, oil or chemicals may splash the unit;
- A strong magnetic field or electric field is generated.
- Do not place the cables in the same conduit as a power cable.

■ In-panel installation

To mount the N-400 in a panel, carefully observe the following instructions.

- Provide enough ventilation space.
- If the ambient temperature may fall below 0°C (32°F) or exceed 50°C (122°F), 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.

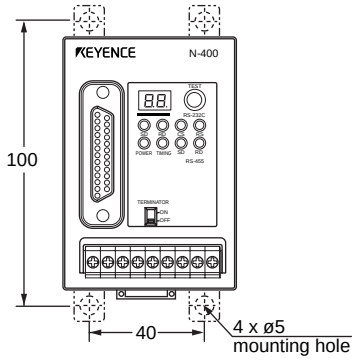
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2.6.2 Mounting N-400

To mount the N-400, you can use one of the following two methods:

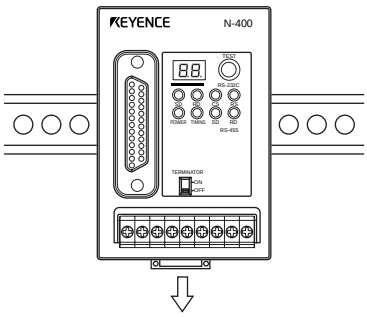
Direct mounting

Pull the brackets provided at four positions on the rear of the N-400, and fix them with screws.



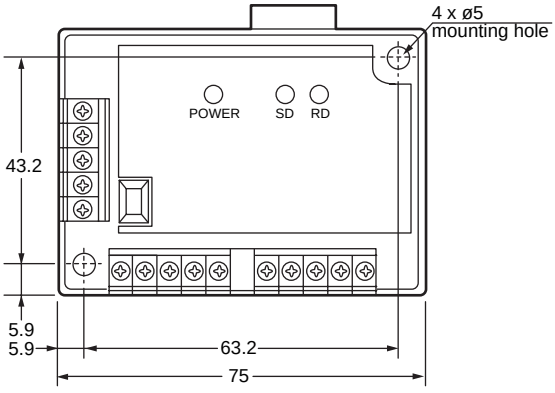
DIN-rail mounting

To mount the N-400 on a DIN-rail, press the unit against the DIN rail until it clicks. To remove the unit, pull the hook in the direction indicated by arrow.



2.6.3 Mounting N-48

To mount the N-48, use the mounting hole.



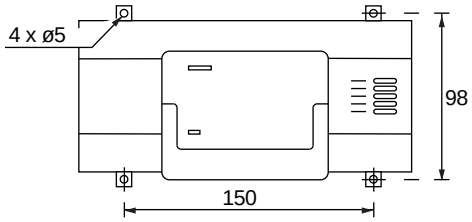
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2.6.4 Mounting BL-U1

To mount the BL-U1, you can use one of the following two methods:

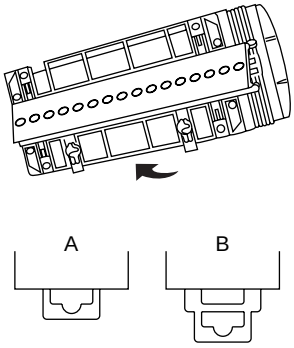
Positions of direct mounting

Pull the brackets provided at four positions on the rear of the BL-U1, and fix them with screws.



DIN-rail mounting

1. Hook the BL-U1 in the groove of the DIN rail from the top, and press the bottom of the BL-U1 against the DIN rail until it clicks.
2. Make sure that the DIN-rail mounting hook is set in condition “A”. If it is not, push it inward.
3. To remove the BL-U1 from the DIN rail, pull the hook so that it is set in condition “B”.
4. To mount the unit on the DIN rail again, restore the hook to condition “A”.



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Chapter 3

N-400 Setup Procedure

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3.1 Installing Setup Software

The N-400 includes the setup software for the Windows version only.
The operating environments and the procedure for installing this setup software are described below.

■ Hardware requirments

- IBM PC/AT 100% compatible
  CPU: 80386 or higher
  Memory: 4 MB or more
  Floppy disk drive: 3.5 inch floppy disk drive (1.44 Mb compatible)
  Serial port: A minimum of one RS-232C port is required.

■ OS requirements

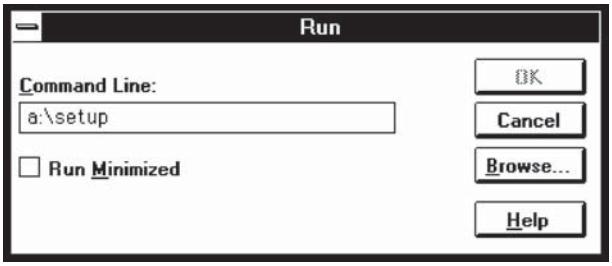
• MS-Windows 3.1 or MS-Windows 95

Installation procedure

1. Insert the N-400 setup software system disk into the floppy drive.

2. Perform the following procedure.

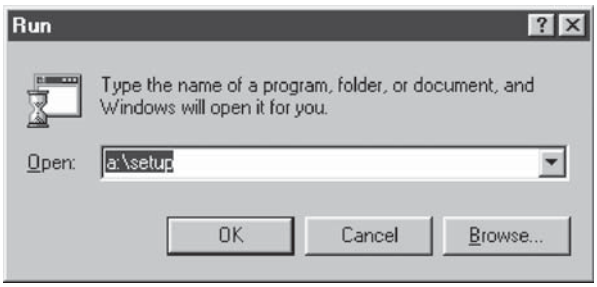
- Windows 3.1:
  Execute “Run” in the icon menu of the program manager.



- Windows 95:
  Select “Run” from the "Start" menu.

3. Run the “SETUP” file from the floppy disk drive.
   (This step is common to both the Windows 3.1 and Windows 95.)

   Type in as follows:
   A: \SETUP



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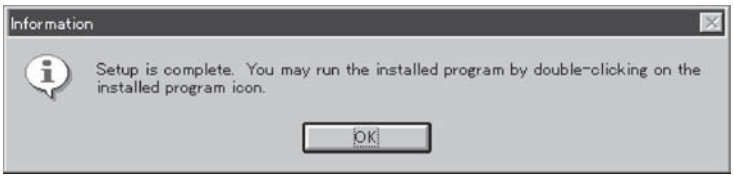
4. The N-400 setup software installer starts. Follow the instructions in the install window. (Typically, the installation procedure can be completed simply by pressing [Next (N)] twice.)

5. The setup software is normally installed in the following directory:

   C: \KEYENCE\N400

   If this directory is correct, click on [Next (N)]. If you wish to change the directory, click on [Browse (R)..], and select the desired directory.

6. When installation starts, the file copy process is displayed as a graph. When the installation is completed, the following message appears.



7. For Windows 3.1, double-click on the [N400] icon in the [KEYENCE] group to start the setup software.
   For Windows 95, start the program from the "Start" menu.

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3.2 Setup Software Operating Procedure

3.2.1 Operating procedure

To set up the N-400 using the setup software, follow the procedure below.

1. Connect the N-400 to the host computer using the RS-232C cable.
   ➪ *For the recommended cable, see 2.2.2 Connecting RS-232C.*

2. Start the N-400 setup software.

3. Select a setup item, and set it to the desired condition.

4. Before sending the updated settings to the N-400, click on [COM PORT] to match the communication parameters of the personal computer with the current settings of the N-400.

   The default settings of the N-400 are as follows:
   • Baud rate: 9600 bit/s
   • Data length: 7 bit
   • Parity: Even
   • Stop bit length: 1 bit

   Immediately after you purchase the N-400, set [COM PORT] to the above settings.
   If you do not know the current settings of the N-400, press the N-400 test switch for approximately 5 seconds. When the N-400 displays “S0(50)”, the N-400 is automatically set to the above settings. The N-400 can communicate with the host computer if the “COM PORT” settings are same as the above.

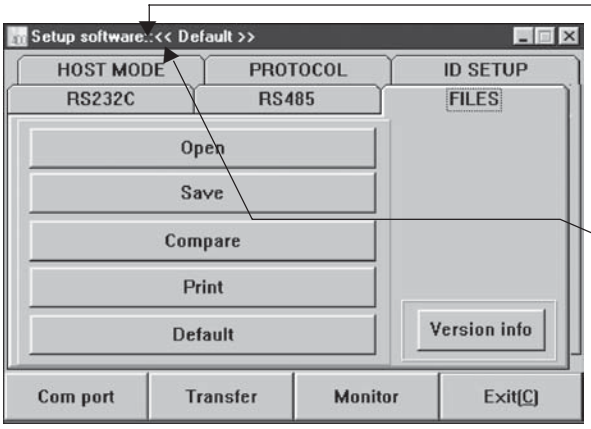
5. Click on [Transfer] to send the updated settings to the N-400.
   (The current settings of the N-400 can also be read.)

6. Select [FILES] to save or print the settings, as required.

7. After the setup procedure is completed, click on [Exit] to close the setup software.

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3.2.2 Description on each setup screen



Displays the name of the setup file currently being edited. If the file has been read from the setup file, the file name is specified as “File: ...”. If the file has been read from the N-400, the file name is marked with “N-400”. If the file name is the initial setting, “default” is displayed.

If the file name has been changed from the initial setting (the condition immediately after it is read from the file), “changed” is displayed.

HOST MODE:
- Sets auto-polling mode (multi-drop link) and multi-head scan mode
- Sets the interference suppression function in multi-head mode
- Sets read mode, measuring method and trigger input in multi-head mode
- Sets a read error code and trigger ON/OFF commands in multi-head mode

PROTOCOL:
- Sets the handshaking protocol
- Sets the header and delimiter
- Sets the PLC link

ID SETUP:
- Registers the ID number of the connected BL Bar Code Reader

RS-232C:
- Sets the baud rate, data length, stop bit length and parity for the RS-232C communication
- Setting the RTS/CTS protocol

RS-485:
- Sets the baud rate, data length, stop bit length and parity for the RS-485 communication

FILES:
- Saves, reads or prints settings

COM PORT:
- Sets the communication parameters (baud rate, etc.) of the host computer according to the settings of the N-400 before communication starts between the N-400 and host computer.

TRANSFER:
- Sends updated settings to the N-400, or reads the current settings of the N-400.

MONITOR:
- Checks if the N-400 can operate normally.

EXIT:
- Quits the N-400 setup software.

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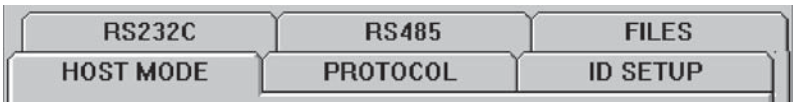
3.2.3 Outline of operation

This section describes the basic operations of the N-400 setup software.
To enter settings, place the mouse pointer on the item to be changed, and click the left mouse button.



Clicking on [• • •]

Used to select the item to be changed.



Clicking on ○

Used to select any of several options.
The selected item is marked with ⊙.



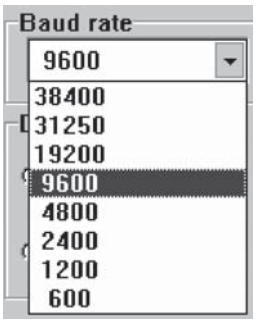
Clicking on □

Used to select whether to enable or disable this function.
To enable this function, the □ mark is checked with "√". (For the Windows Ver. 3.1, it is checked with "x".)



Clicking on ↧

Used to select any of several options.



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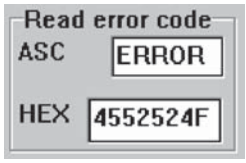
Entering a value

After clicking in the frame, enter a value using the keyboard.
If the entered value exceeds the setting range, an error message is displayed.
(☞ *See p. 55.*)



Entering characters

When you click in the frame labeled “ASC”, you can enter characters using the keyboard.
When you click in the frame labeled “HEX”, you can enter characters using hexadecimal numbers (00 to 7F). This function is used to enter control characters (00 to 21h ASCII codes, such as [CR] and [STX]).



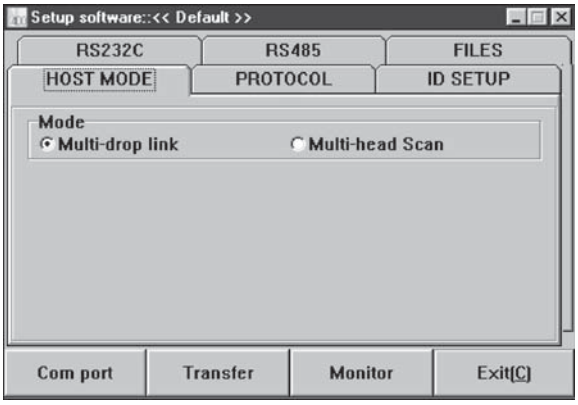
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3.3 Details of Operating Procedure

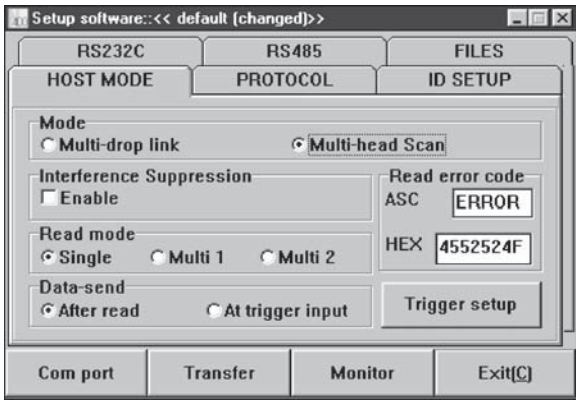
3.3.1 Setting procedure

HOST MODE

In the HOST MODE, select “Multi-drop link” or “Multi-head scan”.



1. If you select “Multi-head scan” mode, the following setup items appear. The following steps are effective for “Multi-head scan” mode only.



2. To use the “Interference Suppression” function, the following setup items appear.



“TIMER” indicates the reading time of each BL series in the interference suppression mode. Enter a value using the keyboard.

3. “Data-send” is displayed only when “Read mode” is set to “Single”.

4. Enter a read error code using the keyboard. The read error code can be changed to any eight character string. Set this code so that it conforms to the read error code of the connected BL series.

   Normally, you should use the default setting (ERROR) without changing it (as well as the BL series’ read error code).

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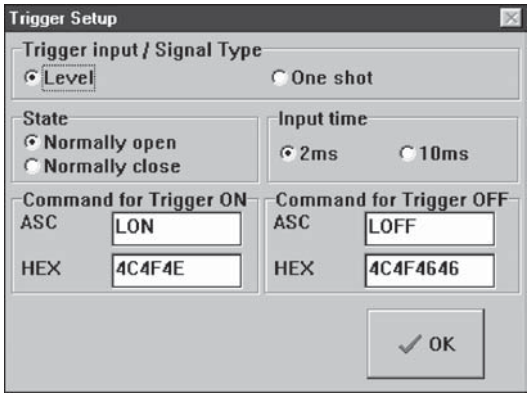
5. When you click on [Trigger setup], you can set the trigger input in multi-head mode.

Tips

- *MULTI-DROP LINK (Multi-drop link mode): p. 58*
- *MULTI-HEAD SCAN (Multi-head scan mode): p. 86*
- *Interference Suppression: p. 95*
- *Read mode: pp. 89 to 90*
- *Data-send: p. 92*
- *Read error code: p. 93*

TRIGGER SETUP (only when Multi-head scan is selected)

The Trigger Setup screen is used to set the trigger input for Multi-head scan mode.



1. Set “Trigger Input/Signal Type” to “Level” or “One-shot”.
   If you select “One-shot”, the one shot input time is displayed.



2. Enter the “Command for Trigger ON” and “Command for Trigger OFF” using the keyboard. These commands can be changed to any eight character string. Set these commands so that they conform to the trigger ON/OFF commands of the connected BL series.
   Normally, you should use the default settings (LON and LOFF) without changing them (as well as the BL series’ trigger ON/OFF commands).

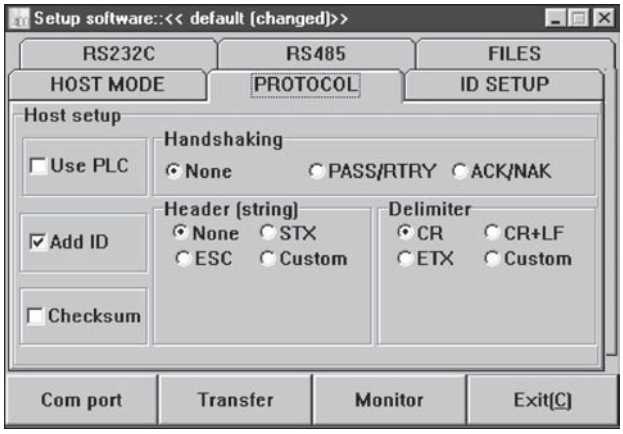
Tips

- *Trigger Input/Signal Type: p. 91*
- *Command for Trigger ON, Command for Trigger OFF: p. 72*

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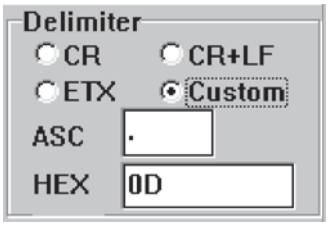
PROTOCOL (when "Use PLC" is disabled)

The PROTOCOL screen is used to set “Handshaking protocol” and various items to enable the "Use PLC".



1. When “Use PLC” is disabled, set the “Handshaking protocol” as shown above.

2. Select “Header” and “Delimiter” from the displayed items. You can change the read data format by setting these items. If you select “Custom”, the following screen appears. These items can be set to any five character string using the keyboard.



Note: When customizing the header and delimiter, you modify them based on the previously selection. When selecting "custom," if you currently use "CR", "0D" appears in hex and "." in ASCII (It is not a period but stands for "CR"). If "none" was used previously, nothing appears.

3. Normally, the ID number of the BL series that executed reading is not added to the read data in multi-head scan mode. However, you can set “Add ID” so that the ID number is added to the read data.

4. “Checksum” can be added to read data to check incompatible data translation between the N-400 and the host computer. Normally, this function is not necessary.

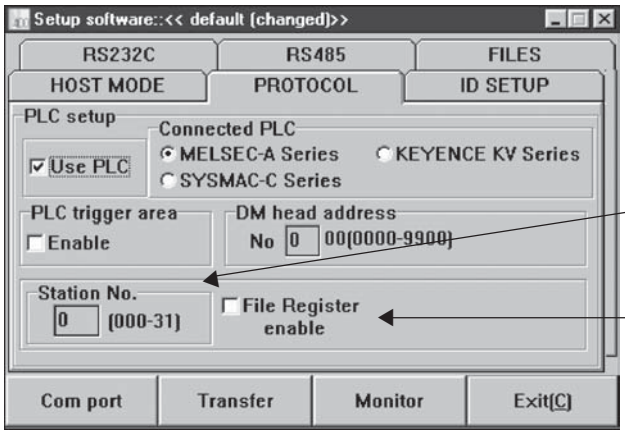
Tips

- *Handshaking protocol: pp. 65 and 66*
- *Header, Delimiter: p. 61*
- *Checksum: pp.133 and 134*

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PROTOCOL (when "Use PLC" is enabled)

To enable the "Use PLC", set each item as follows:



1. Set “Connected PLC”, “DM head address” and “Station No.”.
   To set “DM head address”, enter a value (0000 to 9900) using the keyboard.

2. To send a trigger signal to the BL series when the PLC link is enabled, set “PLC trigger area”.

3. To use “File Register”, set “File Register” to “Enable”. When “File Register” is enabled, the following screen appears. The “File Register” can be used with the Mitsubishi MELSEC-A series only.



   Enter the block number (000 to 255) of the file register using the keyboard.

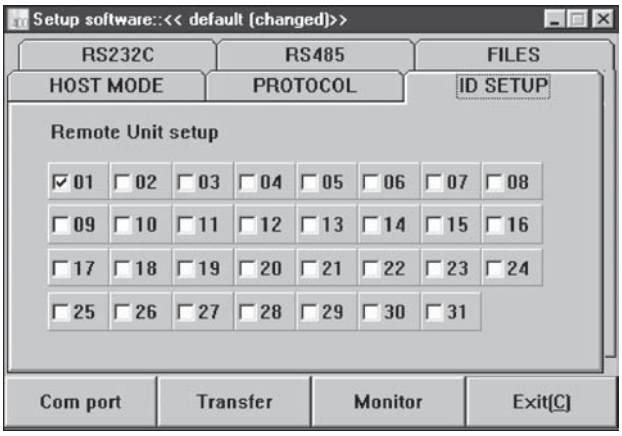
Tips

- *PLC link: p. 100*
- *PLC trigger area: p. 106*
- *DM head address: p. 106*
- *File register: p. 101*

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ID SETUP

The ID SETUP screen is used to register the ID numbers of the connected BL series. When you register the ID numbers in multidrop link mode, polling automatically starts when the N-400 starts up. To perform manual polling, skip the ID SETUP.

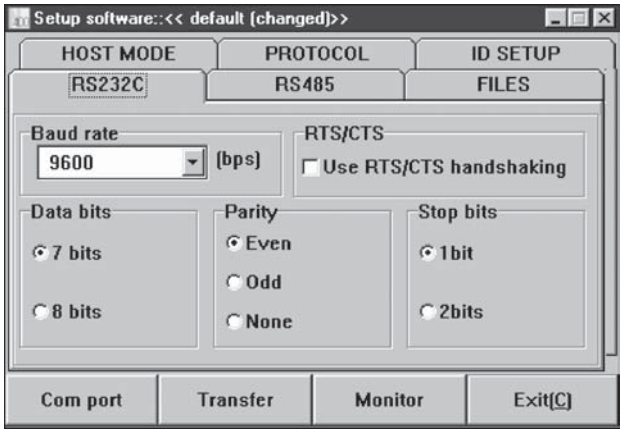


Tips

- *Auto polling: p. 61*
- *Manual polling: p. 62*

RS-232C

The RS-232C screen is used to set the RS-232C communication parameters for the N-400. Set these parameters so that they conform to those of the host computer or PLC.



1. Setting “RTS/CTS” is disabled when “Use PLC” is selected.

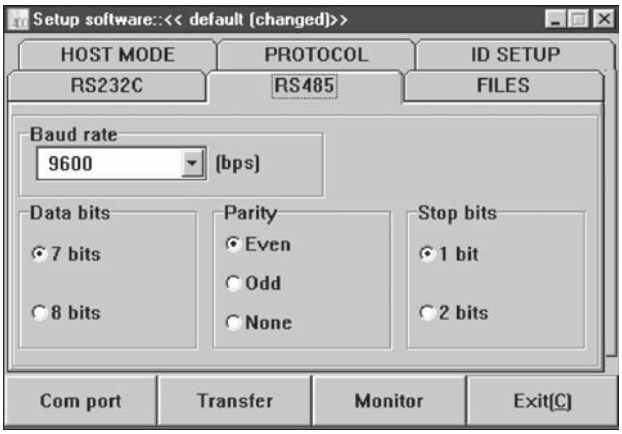
Tips

- *RTS/CTS: p. 66*

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RS-485

The RS-485 screen is used to set the RS-485 communication parameters for the N-400. Set these parameters so that they conform to those of the connected BL series.

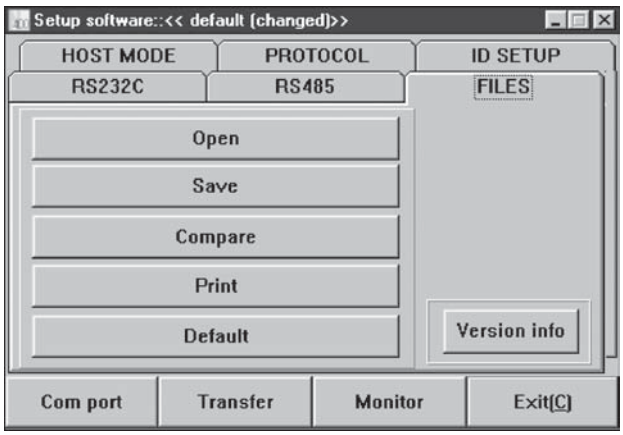


Note: We recommend that you set the baud rate to “38400 bits/s” to increase the processing speed, since the RS-485 communication between the N-400 and the BL series transfers a large volume of data.

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3.3.2 Reading/Saving/Printing File

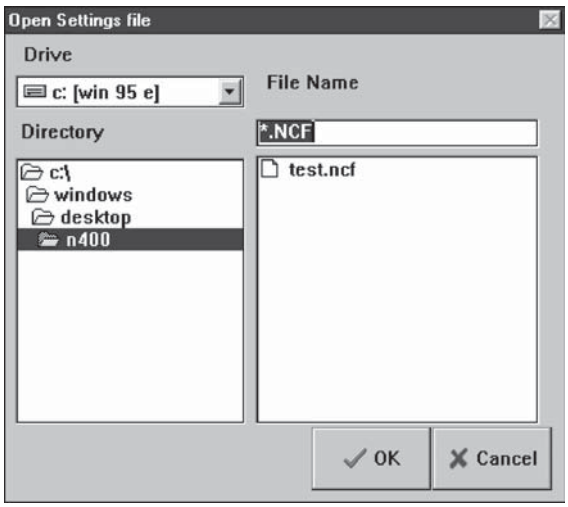
The FILES screen is used to save updated settings in a file, to read a saved setting file, and to print the contents of a setting file.



- Open: Reads a saved setting file.
- Save: Saves updated settings in a file.
- Compare: Compares the settings currently edited with a file previously saved.
- Print: Prints contents of a setting file.
- Default (Initialize settings): Restores updated settings to the default settings.
- Version info: Displays the version information of this software.

Reading a previously saved setting file

1. To read a previously saved setting file, click on [Open]. The following screen will appear.

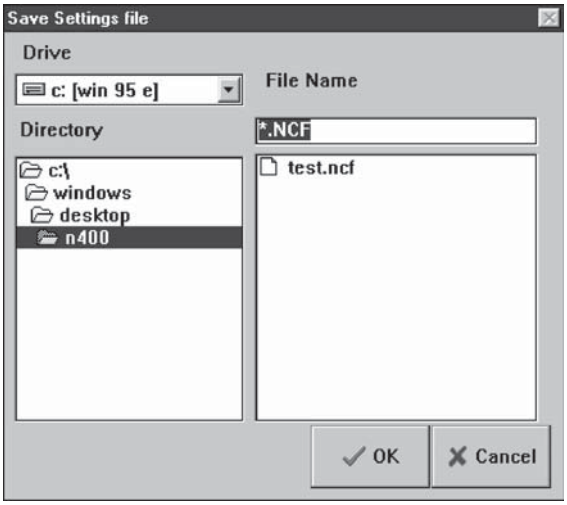


2. When you click on [OK] after selecting a file, the selected file can be opened.

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Saving updated settings in a file

1. To save updated settings in a file, click on [Save]. The following screen will appear.



2. Click on the file name entry field, and enter a file name using the keyboard. Specify a file name within eight characters. Be sure to add the extension “NCF”. After entering the file name, click on [OK] to save the file.

Note: This software cannot accept a long file name in Windows 95.

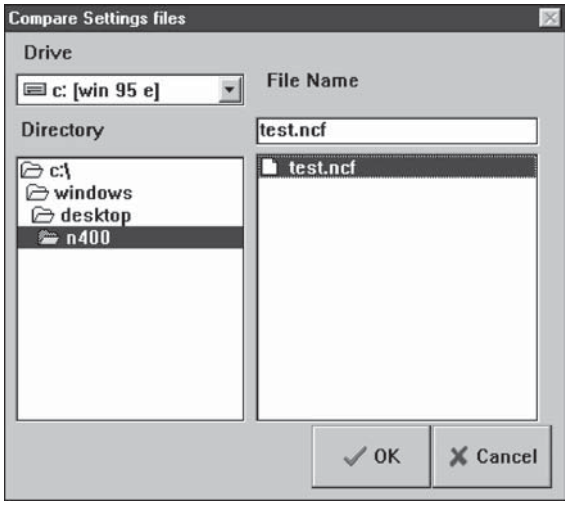
Tips

When the saved setting file is sent to the N-400, the name of the file is simultaneously sent to the N-400. When you read the settings of the N-400 using this software, the file name is also read. It is convenient for maintenance since you can find the file that stores the settings.
To enter a file name, use alphanumerics (letters and numbers) only. Otherwise, the file name cannot be sent to the N-400, because it can only recognize alphanumerics. To send a file name, be sure to enter the file name using alphanumerics and then save it. (If the file name is not saved, it cannot be sent to the N-400.)

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Comparing the settings currently edited with a saved file

1. To compare the settings currently edited with the setting file previously saved, click on [Compare].



2. Select a file to be compared, and click on [OK]. Then, the system compares the selected file with the settings currently edited, and displays the result.

Matched



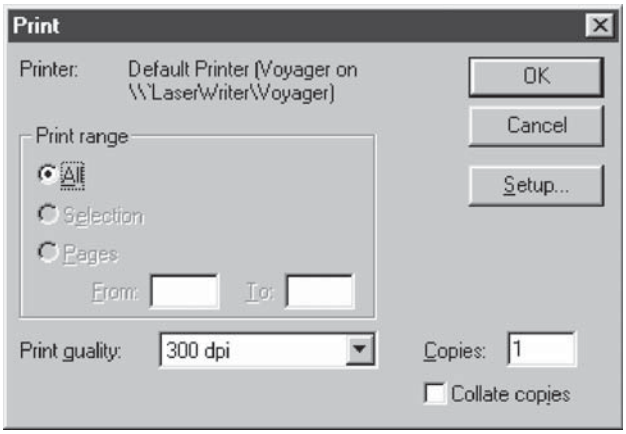
Not matched



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Printing contents of a setting file

1. To print settings, click on [Print]. The following screen will appear.



2. Adjust “Printer Setup” as required, and click on [OK]. Printing will then start.

Restoring the settings currently edited to the default (initial) settings

1. To restore the settings currently being edited to the default settings, click on [Default (Initialize settings)].

2. If you try to initialize the settings currently being edited without saving them, the following message appears. If you wish to execute initialization, click on [OK].



Note: The initialization procedure described in this section is used to initialize the settings being edited with the setup software. The settings on the N-400 cannot be initialized.

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3.4 Sending/Receiving Settings

Sending updated settings to the N-400

To send updated settings to the N-400, perform the following procedure.

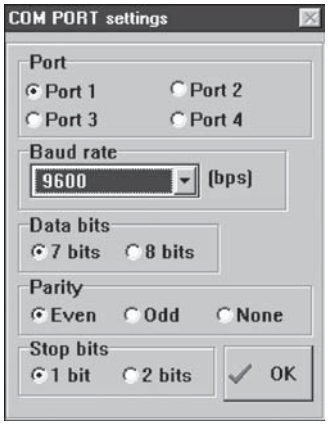
1. Press and hold the N-400 test switch for five seconds. When the N-400 displays "S0 (50)", the communication parameters are temporarily set as follows:

   - Baud rate: 9600 bits/s
   - Step bit length: 1 bit
   - Data length: 7 bits
   - PLC link: Disabled
   - Parity: Even

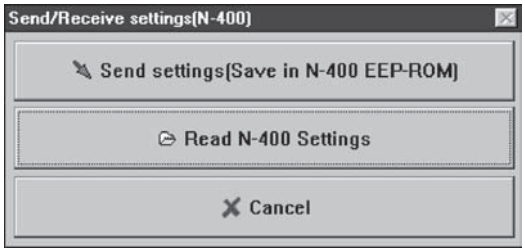
Tips

If you know the current communication parameter settings of the N-400, this step is not necessary. You can send data to the N-400 by setting the communication parameters of the host computer using [COM PORT] so that they conform to the current settings of the N-400. However, if PLC link is enabled, you cannot send data to the N-400 without performing this step because the handshaking protocol is set for PLC link only.

2. Click on [COM PORT] to set the communication parameters of the host computer according to the values listed in the step 1. (above procedure). Select an RS-232C port, and click on [OK].

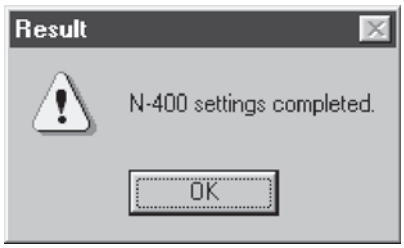


3. Click on [Send setting (Save in N-400 EEP-ROM]. The updated settings are then sent to the N-400.

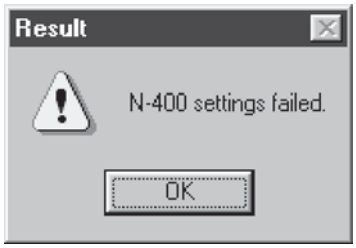


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4. If the settings were successfully sent to the N-400, the following message appears.



If the host computer failed to send the data to the N-400, the following message appears.



If this message is displayed, check the following points:

- Check that [COM PORT] is set to the values listed in step 1. when the N-400 displays “S0 (50)”.
- Check that the power to the N-400 is ON.
- Check that the RS-232C cable pin assignment of the N-400 is the same as that of the host computer.

5. After the settings are sent, press the N-400 test switch once to reset the “S0 (50)” condition. (If the N-400 does not display “S0 (50)”, you do not need to press the test switch.)
When the N-400 displays “00”, the sending procedure is completed. (The communication parameters of the N-400 are set to the updated settings.)

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Reading the current settings of the N-400

To read the current settings of the N-400, perform the following procedure. (This procedure is almost the same as the procedure for sending settings.)

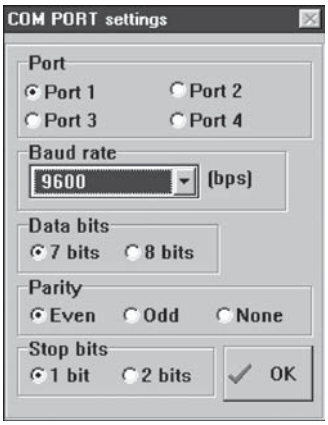
1. Press and hold the N-400 test switch for five seconds. When the N-400 displays "S0 (50)", the communication parameters are temporarily set as follows:

   - Baud rate: 9600 bits/s
   - Data length: 7 bits
   - Parity: Even
   - Step bit length: 1 bit
   - PLC link: Disabled

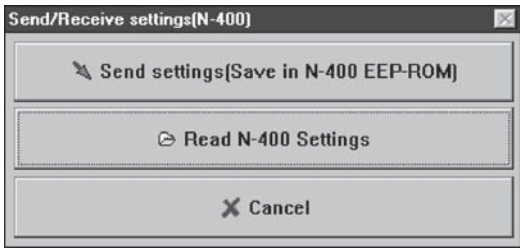
Tips

If you know the current communication parameter settings of the N-400, step 1. is not necessary. You can send data to the N-400 by setting the communication parameters of the host computer using [COM PORT] so that they conform to the current settings of the N-400. However, if PLC link is enabled, you cannot send data to the N-400 without performing step 1., because the handshaking protocol is set for PLC link only.

2. Click on [COM PORT] to set the communication parameters of the host computer according to the values listed in step 1. Select an RS-232C port and click on [OK].

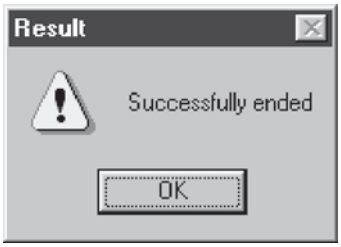


3. Click on [Send setting (Save in N-400 EEP-ROM)].
   When you click on [Read N-400 settings], the settings of the N-400 can be read on the host computer.

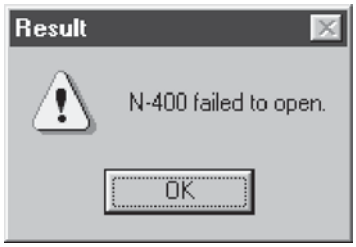


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4. If the settings of the N-400 were successfully read, the following message appears.



If the host computer failed to read the data, the following message appears.



If this message is displayed, check the following points:

- Check that [COM PORT] is set to the values listed in step 1. when the N-400 displays “S0 (50).”
- Check that the power to the N-400 is ON.
- Check that the RS-232C cable pin assignment of the N-400 is the same as that of the host computer.

5. After the settings are read, press the N-400 test switch once to reset the “S0 (50)” condition. (If the N-400 does not display “S0 (50)”, you do not need to press the test switch.)
When the N-400 displays “00”, the reading procedure is completed.

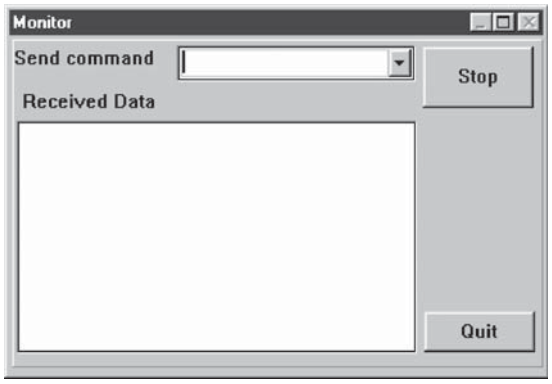
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3.5 Using Monitor

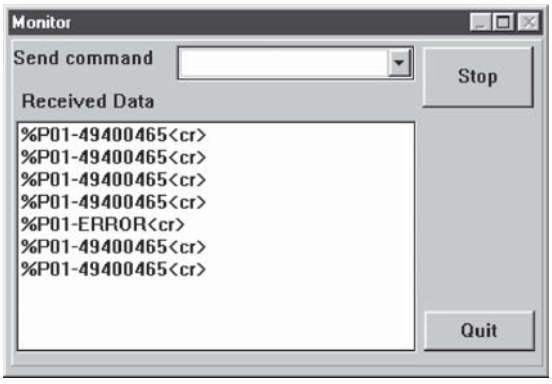
This setup software provides the “Monitor” program to check if the N-400 can send data properly. The “Monitor” program allows you to display the data read by the BL series on the host computer’s monitor screen, and also to send a command from the host computer to the N-400 or BL series.

1. Click on [COM PORT] to set the communication parameters of the host computer according to the current settings of the N-400.

2. Click on [Monitor]. The MONITOR screen will appear.



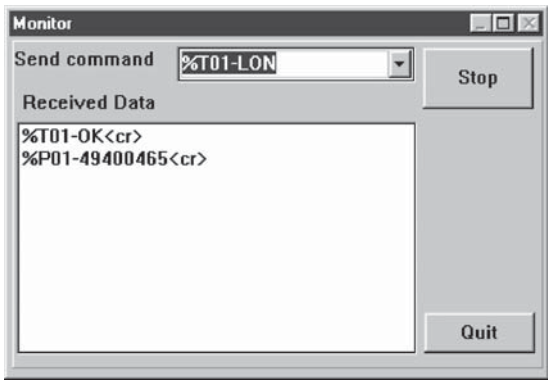
3. When the BL series reads bar codes, the data read by the BL series is listed on the screen (in the [Received Data] field). A record of up to 1000 lines of data can be obtained. Using the scroll bar at the right of the [Received Data] field, you can see the previous data.



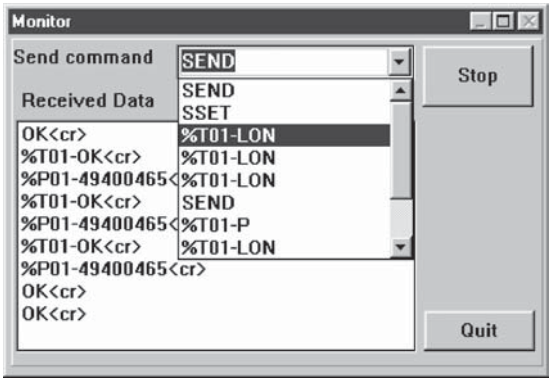
4. If you click [Stop], received data is not listed. (The button name is changed to [Start].) If you try to display received data again, click on [Start].

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5. When you enter a command in the “Send command” field, you can send the command to the N-400 (or BL series). The format of the command to be sent is “[Command] + [CR]”. Typing command and pressing [ENTER] key sends the command.



6. When you click on the [ARROW] button in the “Send command” field, the commands previously sent are listed. (Up to 100 commands can be listed.)



7. Click on [Quit] to quit this mode.

Procedure for starting BL test mode using the “Monitor” screen

To start the BL series “Reading rate check” mode by sending a command from the host computer to the N-400 in multidrop link mode, send the command using the “Monitor” screen according to the procedure below.

■ Using the N-400 in multi-drop link mode

1. Send the “Specific ID polling” command (see p. 72) so that polling is performed only for the BL series to be tested. To send the command using the Monitor screen, be sure to enter the command using uppercase characters. [CR] of the following command corresponds to the [Enter] key of the personal computer.

   POLEmm[CR] * mm = 01 to 31 (ID number of BL series)

Note: When only a few BL series units are connected, you need not send this command. However, when many BL series units are connected, the cycle of the N-400’s polling for each BL series becomes longer than the reading cycle of the test mode, causing the data to be stored in the N-400 buffer. To prevent this, be sure to send the above command.

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2. Send the test mode command to the BL series to be tested. When the test mode is started, data read by the BL series is listed in the [Received Data] field of the Monitor screen.

   %Tmm-TEST1[CR] * mm = 01 to 31: ID number of BL series

3. To quit the test mode, send the test mode end command.

   %Tmm-QUIT[CR] * mm = 01 to 31: ID number of BL series

4. To continue the test mode with a BL series of a different ID number, repeat steps 1. to 3.

5. When you finish using the test mode, reset the “Specific ID polling” command. If the auto polling mode is selected, send the “Auto polling ON” command. If the manual polling mode is selected, send the “Auto polling OFF” command.

   - Auto polling: POLE00[CR]
   - Manual polling: POFF[CR]

■ Using the N-400 in multi-head scan mode

1. Send the “Specific ID polling” command (see p. 72) so that polling is performed only for the BL series to be tested. To send the command using the Monitor screen, be sure to enter the command using uppercase characters. [CR] of the following command corresponds to the [Enter] key of the personal computer.

   POLEm[CR] * mm = 01 to 31 (ID number of BL series)

Note: In multi-head scan mode, the N-400 performs polling only when the BL series read bar codes. Therefore, to use the test mode, you need to send the “Polling ON” command or “Specific ID polling” command before starting the test mode so that polling is always enabled.

2. Send the test mode command to the BL series to be tested.

   %Tmm-TEST1[CR] * mm = 01 to 31: ID number of BL series

3. To quit the test mode, send the test mode end command.

   %Tmm-QUIT[CR] * mm = 01 to 31: ID number of BL series

4. To continue the test mode with a BL series of a different ID number, repeat steps 1. to 3.

5. When you finish using the test mode, send the “Polling OFF” command.

   POFF[CR]

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3.6 List of Error Messages

Error message		Contents
Errors during setup	“Timer value incorrect. [OK]”	The setting of the trigger ON time exceeds the range of 1 to 255 (x10 ms) in the interference suppression mode.
	“Station number incorrect.” [OK]	The setting of the station number exceeds the range of 000 to 255.
	“Block number incorrect. [OK]”	The setting of the block number exceeds the range of 0 to 255 when the file register is used in PLC link.
Errors communication	“N400 settings failed. [OK]”	Communication with N-400 (for sending settings) is abnormal.
	“N-400 failed to open. [OK]”	Communication with N-400 (for reading settings) is abnormal.
Errors file editing	“Accessing file during rejected. [OK]”	No floppy disk is inserted. The floppy disk is write-protected. The floppy disk is full.
	“File not found. [OK]”	The file name is incorrect. Enter a correct file name.
	“File name incorrect. [OK]”	

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Chapter 4

Multi-Drop Link Mode Control Procedure

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4.1 Multi-Drop Link Mode

4.1.1. Controlling multi-drop link mode

Multi-drop link mode can control up to thirty-one BL series units through a host computer.

Since the complex communication (RS-485 communication) between each BL series unit and the N-400 is controlled by the N-400, the host computer controls the communication with the N-400 only, and consequently can be operated with a simple program. (The ID number assigned to the header of the transmitted data allows you to identify the BL series unit that sent the data.) Therefore, multi-drop link mode provides a system configuration that allows use of a simpler program on the host computer.

The procedures for controlling the N-400 through a host computer are classified into the following three methods:

- Data communication: Used to send bar code data read by the BL series to the host computer.
- Command communication to the BL series: Used to send commands to the BL series.
- Command communication to the N-400: Used to control the N-400 directly or change the settings of the N-400.

* All of the above communication is performed using ASCII codes.

Details on these control methods are described on the following pages.

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Setting the Baud Rate of the BL Series

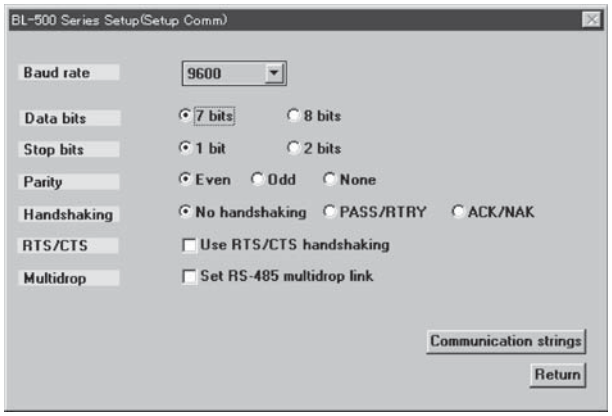
In order to increase the response speed of the BL-500/180 series when it is connected in the multi-drop link mode through the N400, we recommend that the baud rate for RS-485 communication between the BL-500/180 series and the N-400 be set to 38400 bps.

The baud rate cannot be set through normal operations to between 19200 and 38400 bps with the BL series setup software included with the BL-500/180 series. (The baud rate can be set to be in the above range using serial commands.)

However, the BL-500/180 series' baud rate can be set between 19200 and 38400 bps by performing the following procedure. (The following procedure is not described in the "BL-500/180 Series User's Manual".)

The following procedure refers to the BL-180 series setup software. The procedure is exactly the same for the BL-500 series.

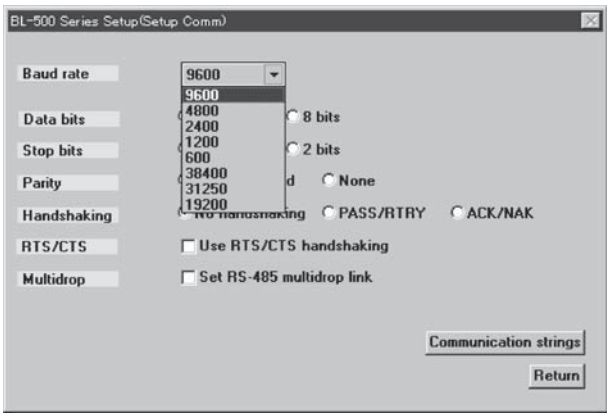
1. Display the "Communication Setup" screen with the BL series setup software.



2. Select either "7 bits" or "8 bits" for the "data length" parameter on the communication setup screen by clicking on the appropriate value. (The selected item is enclosed in a dotted line box.)

3. Press the [@] key once.

4. After the above operation, select "baud rate". Baud rates of 19200 to 38400 bps are added to this parameter. Select the desired baud rate.



* Perform the above operation every time you start the setup software.

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4.1.2 Setup procedure

For setup and connection procedures, see p. 10. This section describes the procedures for setting the N-400, BL series and host computer only.

Setting the BL series

Using the BL setup software or serial communication, set the BL as follows:

1. Set “Multi-drop Link” to “Enable”.

2. Assign ID numbers (1 to 31) to the connected BL series. Be sure not to assign the same ID number to different units.

3. Set the RS-485 communication parameters (baud rate, data length, parity and stop bit length) for the BL series according to the N-400’s settings. The default settings for the BL series and the N-400 are as follows:

   Baud rate: 9600 bps
   Data length: 7 bits
   Parity: Even
   Stop bit length: 1 bit

Note: To increase the response speed, set the BL series’ baud rate to 38400 bps.

4. Setting “Handshaking protocol” or “RTC/CTS” is not effective.

5. Set “Header” to “None”. Setting “Delimiter” is not effective.

* Set other parameters as required.

Setting the N-400

Using the N-400 setup software, set the N-400 as follows:

1. Set the host mode to multi-drop link mode. (☞ *See p. 38.*)

2. Set the handshaking protocol on the “PROTOCOL” screen. (☞ *See p. 40.*)

3. Enter the ID numbers of the connected BL series on the “ID SETUP” screen. (☞ *See p. 41.*)

   To perform manual polling, do not register ID numbers.

4. Set the baud rate, data length, parity and stop bit length according to the host computer’s settings on the “RS-232C” screen. (☞ *See p. 42.*)

5. Set the baud rate, data length, parity and stop bit length according to the BL series’ settings on the “RS-485” screen. (☞ *See p. 43.*)

Note: To increase the response speed, set the RS-485 communication baud rate to 38400 bps. (Set the BL series’ baud rate to this value as well.)

Setting the host computer

Set the RS-232C communication parameters (baud rate, data length, parity and stop bit length) for the host computer according to the N-400’s settings.

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4.2 Data Communication in Multi-Drop Link Mode

In multi-drop link mode, the bar code data read by the BL series is sent to the host computer through either “Auto polling” or “Manual polling”.
The following sections describe these polling methods individually.
You should normally use auto polling mode.

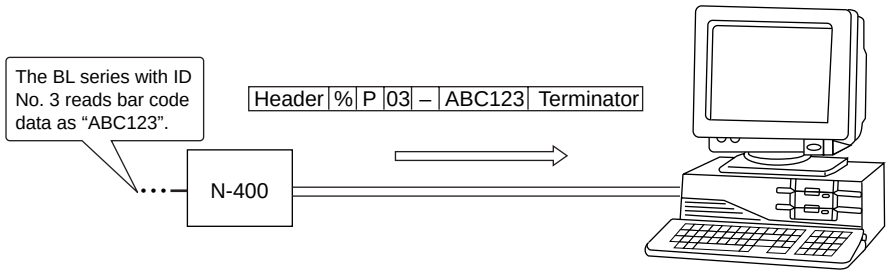
4.2.1 Auto polling

■ Auto polling mode

When the ID numbers of the BL series connected to the N-400 have been registered in auto polling mode, the N-400 automatically executes polling (queries the BL series of the specified ID number about its data). The obtained data is constantly sent to the host computer from the N-400.

Since the N-400 automatically queries the BL series about its data, the host computer can be operated using a simple program.

■ Communication format



In auto polling mode, the N-400 sends the read data to the host computer in the following format:

Header	%	P	mm	–	(Data)	Terminator

- mm = 01 to 31: ID number of BL series
- (Data) = Read data
  OVER: “BUFFER OVERFLOW” error has occurred. (☞ *See p. 63.*)
- Select the header and delimiter from the following formats. The header and delimiter can be changed to any string of five characters or less.

  Header: **[ESC]**, **[STX]**, None
  Delimiter: [**CR]**, **[CR][LF]**, **[ETX]**

■ Setting auto polling mode

To set auto polling mode, use the N-400 setup software (☞ *see p. 42*) or serial commands (☞ *see p. 71*).
Using the serial commands, you can easily control auto polling (stop or start auto polling).

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4.2.2 Manual polling

■ Manual polling

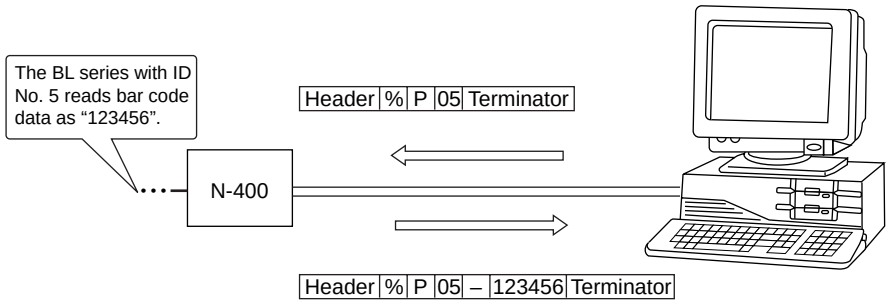
When you send a polling command from the host computer to a desired BL series while in manual polling mode, the BL series sends back its data to the host computer.

In manual polling mode, the host computer is operated with a more complex program than in auto polling mode, because the host computer executes the polling. However, manual polling mode allows data to be sent back to the host computer only when the host computer can receive the data. For this purpose, manual polling mode is useful. (In auto polling mode, data is constantly sent to the host computer regardless of the conditions of the host computer.)

When auto polling is not performed (when the BL series' ID numbers have not been registered with the N-400 setup software), manual polling mode can be used.

■ Sequence and format for communication

In manual polling mode, data is sent in the following sequence and format:



1. Send a polling command from the host computer.

Header	%	P	mm	Terminator

2. The BL series sends back its bar code data.

Header	%	P	mm	–	(Data)	Terminator

- mm = 01 to 31: ID number of BL series
- (Data) = Read data

  e: This code is sent back when the BL series has read no data.

  OVER: "BUFFER OVERFLOW" error has occurred. (☞ *See p. 63*)

  NC: The BL series with the specified ID number does not exist, or is not connected for communication.

  SERR: Communication error has occurred.

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- The polling command can be received in either of the following formats:

%	P	mm	CR	,	STX	%	P	mm	ETX

[LF] can be added to the end of the command. When **[ESC]** is added to the head of the command, data stored in the N-400's receiving buffer can be cleared.

- Specify the read data format by selecting the "Header" and "Delimiter" from the following formats. (⇨ *See p. 40.*) The read data format can be changed.

  Header: **[ESC]**, **[STX]** None
  Delimiter: **[CR]**, **[CR][LF]**, **[ETX]**

■ Setting manual polling mode

If ID numbers have not been registered with the N-400 setup software, manual polling mode can be used. (When ID numbers have been registered, the N-400 automatically selects auto polling mode.)

Reference: Auto polling mode simplifies the host computer's program since the polling command is constantly sent to each BL series from the N-400, instead of from the host computer.

4

4.2.3 Capacity of Transmission Buffer

■ Transmission buffer of N-400

The N-400's transmission buffer can store up to 24 Kbytes (24576 characters).

The number of characters stored in the transmission buffer per piece of data is the number of characters of the data (including the additional data such as number of decodings) plus two characters indicating the data attributes.

Example 1

When the number of bar code digits is 10 (with no additional data)
24576 / (10 + 2) = 2048
The transmission buffer can store 2048 pieces of data.

Example 2

When the number of bar code digits is 20 (with no additional data)
24576 / (20 + 2) = 1117
The transmission buffer can store 1117 pieces of data.

If the number of read data exceeds the buffer capacity, the N-400 sends back the following "BUFFER OVERFLOW" error code to the host computer, and clears all data stored in the transmission buffer. (The N-400 displays error code "97".)

Header	%	P	00	–	OVER	Terminator

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■ Transmission buffer of BL series

The BL-500/BL-180 series provides a transmission buffer that can store 400 bytes (400 characters). This buffer temporarily stores the BL series' data and the N-400 executes polling for the data stored in this buffer. The data is stored until polling is executed.

Five characters per piece of data indicating the data attributes are added to the number of characters of the data (including the additional data such as number of decodings) when stored in the transmission buffer .

Example 1

When the number of bar code digits is 10 (with no additional data)
400 / (10 + 5) = 26
The transmission buffer can store 26 pieces of data.

Example 2

When the number of bar code digits is 20 (with no additional data)
400 / (20 + 5) = 16
The transmission buffer can store 16 pieces of data.

If the number of read data exceeds the buffer capacity, the BL series until causing the BUFFER OVERFLOW error sends the following error code to the host computer, and clears all data stored in the BL series.
The other BL series units which did not cause the error can continue to operate normally.

%	P	mm	CR	,	STX	%	P	mm	ETX

* mm = 01 to 31: ID number of BL series

The BUFFER OVERFLOW error occurs when the BL series' reading interval is shorter than the polling interval. To prevent this error, take the following actions:

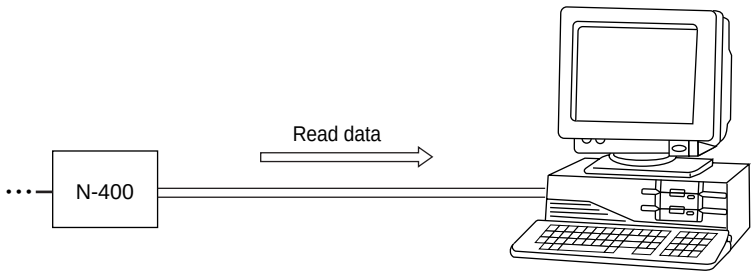
- Reduce the polling interval by setting the baud rate to 38400 bps (the highest rate) for the RS-485 communication between the N-400 and each BL series unit.
- Reduce the polling interval by reducing the number of connected BL series units.
- Reduce the amount of data to be processed by the N-400 by increasing the BL series' reading interval.
- In manual polling mode, modify the program so that the polling command is sent to the BL series before the BUFFER OVERFLOW error occurs with the BL series.
- Erase all ID numbers of disconnected BL series on the "ID SETUP" screen of the N-400 setup software.

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4.2.4 Handshaking protocol

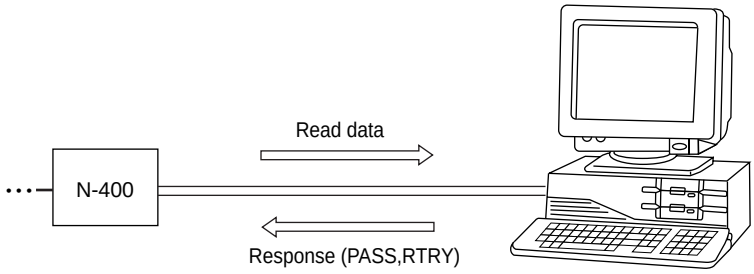
The N-400 supports the following four types of data communication modes (handshaking protocols).
The handshaking protocols described in the following sections are common to both auto polling mode and manual polling mode.

No handshaking



- The N-400 automatically sends read data to the host computer without using any handshaking protocol.

PASS/RTRY protocol



- After sending read data to the host computer, the N-400 waits for the response (PASS or RTRY) from the host computer.
  When the host computer sends the “PASS (quit)” command to the N-400, communication of one piece of data is completed, and the N-400 is ready to send the next data.
  The N-400 sends back no data in response to the “PASS” command.

- If the “RTRY” (request to re-send) command is sent to the N-400 while the N-400 is waiting for the “PASS” command, the N-400 sends the same data again, and waits for the “PASS” command.
  After the N-400 receives the “PASS” command, the N-400 sends back no data even if the “RTRY” command is sent to the N-400.

- The BL series can read bar code data even when the N-400 is waiting for the “PASS” command. In this case, the read data is stored in the transmission buffer of the N-400. (➪ *For the capacity of the transmission buffer, see p. 63.*)
  If the amount of read data exceeds the buffer capacity, the N-400 sends back the “BUFFER OVERFLOW” error code to the host computer (➪ *see p. 63*), and clears all data stored in the transmission buffer.
  In this case, the N-400 stops its operation. The N-400’s operation restarts when the “PASS” command is sent to the N-400 in response to the “OVER” code.

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- The “PASS” and “RTRY” commands can be received in either of the following formats:

  PASS **[CR]**, or **[STX]** PASS **[ETX]**

  [ESC] can be added to the head of the command, or **[LF]** can be added to the end of the command.

Note 1: Even when the N-400 is waiting for the “PASS” command, it can still receive any type of command. In this case, the N-400 immediately sends back a response (e.g. “OK”) to the host computer.

Note 2: If the “SSET” command (➪ *see p. 73*) is sent to the N-400 while it is waiting for the “PASS” command, the N-400 clears the data stored in the transmission buffer and goes into SETUP mode.

ACK/NAK protocol

- The ACK/NAK protocol uses **[ACK]** (06H) instead of “PASS”, and **[NAK]** (15H) instead of “RTRY” described in the above protocol. The operation is the same as the above protocol; only the response codes are different.

4

RTS/CTS control

- When the RTS signal is turned OFF during RS-232C communication, the N-400 becomes ready for data transmission. When the RTS signal is turned ON, the N-400 starts sending data. This cannot stop/start the data transmission once data is being sent. It is effective for controling the transmission of a set of data.

- Even when the RTS signal is OFF, the BL series can read bar code data. In this case, the read data is stored in the transmission buffer of the N-400. (➪ *For the buffer capacity, see p. 63.*) If the amount of read data exceeds the buffer capacity, the N-400 clears all data stored in the transmission buffer. In this case, the N-400 stops its operation. The N-400’s operation restarts when the RTS signal is turned ON, or when the N-400 sends back the “OVER” code to the host computer. (➪ *See p. 63.*)

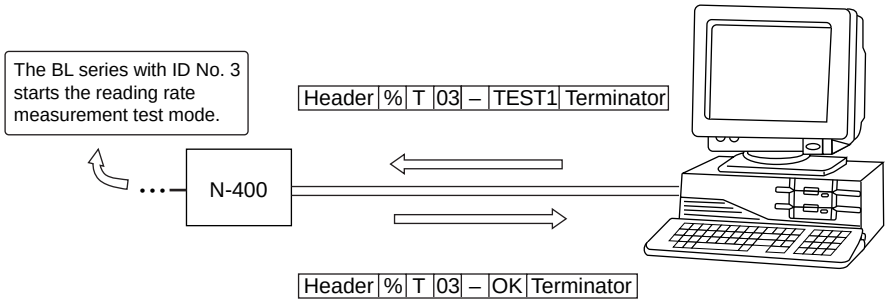
Note 1: The RTS/CTS control can be used together with other handshaking protocols.

Note 2: When the RTS signal is OFF, the N-400 does not send back a response (e.g. “OK) to the host computer.

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4.3 Command Transmission To BL Series

All the serial commands that can be used for the BL series can be sent from the host computer through the N-400 to the BL series. Send these commands in the following sequence and format:



1. Send a command in the following format from the host computer.

Header	%	T	mm	–	Serial command	Terminator

2. When the command is received by the BL series, the BL series sends back a response in the following format:

Header	%	T	mm	–	Response	Terminator

- mm = 01 to 31: ID number of BL series
- (Response) = Response to the command (“OK”, “ERROR”, etc.)

  NC: “Disconnection” error. This error occurs when the BL series with the specified ID number does not exist.

  SERR: Communication error

* For the serial commands, the response to the serial commands, and the error codes, see the BL series User’s Manual. The BL series does not send any response to some of the direct control commands (TEST1, LON, etc.). However, the BL series always send back a response when they are used in multi-drop link mode.

  • OK: Normal processing
  • ERR00: Incorrect command

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- 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 to the end of the command. However, **[LF]** is not added to the response.

* When **[ESC]** is added to the head of the command, the N-400's receiving buffer is cleared. However, **[ESC]** is not added to the response.

Example: Sending "LON" to start reading the BL series with ID No. 5

Command being sent: | % | T | 05 | – | LON | CR |

Response: | % | T | 05 | – | OK | CR |

Command being sent: | ESC | STX | % | T | 05 | – | LON | ETX |

Response: | STX | % | T | 05 | – | OK | ETX |

Note: When the reading rate check mode (TEST1) start command is sent to the BL series, the data is stored in the BL series' buffer, causing the buffer overflow error, unless auto polling is performed.

Even if auto polling is performed, the buffer overflow error may occur because the polling interval is longer than the BL series' reading interval when many BL series are connected. In this case, send the "Specific ID polling ON" command to the N-400 (*see p. 72*) to control the N-400 directly so that auto polling is performed only for the BL series to be tested.

After using the specific ID polling mode, be sure to reset this command.

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4.4 N-400 Direct Control Commands

You can perform the following controls by sending a command to the N-400.
1) Assigning an ID number to the BL series for which auto polling is performed.

2) Setting auto polling mode to ON/OFF

3) Checking if the BL series is properly connected

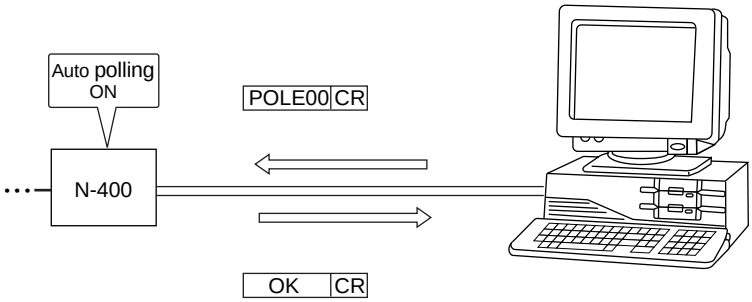
4) Reading control command in multi-head scan mode

5) Resetting the N-400

The above control 1) can be set with the N-400 setup software. (☞ *See p. 42.*) The above control 3) can be performed using the connection test switch provided on the N-400. (☞ *See p. 51.*)

4.4.1 Communication procedure

■ **Sequence and format for communication**



(For a description of the commands, see the following pages.)

1. Send a direct control command to the N-400 from the host computer.

2. After the N-400 receives the command, the N-400 sends back a response (e.g. “OK” or “NG”) to the host computer.

Note: If an incorrect command is sent, the N-400 sends back no response.

The ID number is not specified in the command/response format.

The N-400 returns the response with the same header and delimieter as it receives.

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 to the end of the command. However, **[LF]** is not added to the response.

* When **[ESC]** is added to the head of the command, the N-400’s receiving buffer is cleared. However, **[ESC]** is not added to the response.

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Example: When the "Polling ON" command is sent to the N-400

When "POLE00 **[CR]**" is sent to the N-400, the response is "OK **[CR]**".

When "**[STX]** POLE00 **[ETX]**" is sent to the N-400, the response is "**[STX]** OK **[ETX]**".

When "**[ESC]** POLE00 **[CR]**" is sent to the N-400, the response is "OK **[CR]**."

4.4.2 Description of commands

The following is a description of each command.

Registering and checking the ID numbers of the BL series for which auto polling is performed.

Registers ID numbers for auto polling and checks which ID numbers are registered.

* The following commands are intended for the N-400. These commands do not check whether the BL series of the registered ID number is connected.

- **Registering all ID numbers**

  Command: ID00nnnnn...
  n = 0: Do not register
  n = 1: Register

  Response: OK
  ERR07... :"n" is any value other than "0" or "1".

  Description:
  "n" corresponds to the ID number (1 to 31) in ascending order. (Thirty-one "n"s are required.) If you need to register ID numbers 2, 3 and 4, the command is ID000111000.....

- **Checking all ID numbers**

  Command: IDCHK

  Response: nnnnn...
  n = 0: Not registered
  n = 1: Registered

  Description:
  "n" corresponds to the ID number (1 to 31) in ascending order. (Thirty-one "n"s are required.)

- **Registering individual ID number**

  Command: IDmmn...
  mm = 01 to 31 (ID number)
  n = 0: Do not register
  n = 1: Register

  Response: OK
  ERR01...: "mm" exceeds the range of "01" to "31".
  ERR07: "n" is any value other than "0" or "1".

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- **Checking individual ID number**

  Command: IDCHKmm
  [mm = 01 to 31 (ID number)]

  Response:
  ON: Registered
  OFF: Not registered
  ERR01: “mm” exceeds the range of “01” to “31”.

- **Registering serial ID numbers**

  Command: IDMAXmm
  [mm = 01 to 31 (ID number)]

  Response: OK
  ERR01: “mm” exceeds the range of “01” to “31”.

  Description: Registers all ID numbers not more than “mm”.
  When “mm” is “00”, registering serial numbers is disabled.

- **Checking serial ID numbers**

  Command: IDMAX

  Response: MAXmm
  mm = 01 to 31 (ID number)
  mm = 00 : Not registered
  mm = 99: The registered ID numbers are not serial numbers.

  Description:
  Registers all ID numbers not more than “mm”.
  When the registered ID numbers are not serial numbers, the response is “99”.

Saving registered ID numbers

The registered ID numbers for auto polling are saved in the N-400.

Command: IDSAVE
Response: OK

Controlling auto polling

Setting auto polling mode to ON or OFF.

- **Auto polling ON**

  Command: POLE00
  Response: OK

Example: Sending the command to start auto polling (When ten BL series units are connected)

1. Send “ID00111111111100000000000000000000 **[CR]**” (or “IDMAX10 **[CR]**”).
2. The N-400 sends back “OK **[CR]**”.
3. Send “POLE00 **[CR]**.”
4. The N-400 sends back “OK **[CR]**”.

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- **Specific ID polling ON**

  Command: POLEmm
  [mm = 01 to 31 (ID number)]

  Response: OK
  ERR01: “mm” exceeds the range of “01” to “31”.

  The “Specific ID polling ON” command is used to execute polling for the BL series with the specified ID number only.
  When the N-400 executes polling for several BL series in reading rate check mode, a large amount of data is continuously sent from the BL series, which causes the buffer overflow error because the polling interval is longer than the reading interval.
  To perform the reading rate check, use the “Specific ID polling ON” command.

- **Checking auto polling**

  Command: POLE

  Response: mm OFF
  mm = 01 to 31 (ID number)
  Auto polling is performed for the BL series specified by “IDmm” only.
  mm = 00: Auto polling ON
  OFF: Auto polling OFF

- **Auto polling OFF**

  Command: POFF
  Response: OK

Checking connections in multi-drop link mode

Checks if the RS-485 communication between the N-400 and each BL series is normal.

Command: SRCmm
[mm = 01 to 31 (ID number)]

Response:
OK: Connection is correct.
NC: “Disconnection” error
SERR: Communication error
ERR01: “mm” exceeds the range of “01” to “31”.

Controlling reading operation

Used to activate the reading trigger signal using a command in multi-head scan mode.
* This command can be used in multi-head scan mode only.

- **Starting reading**

  Command: LON
  Response: None

- **Ending reading**

  Command: LOFF
  Response: None

  You can start/end reading operation by sending the above command in the same way as when using trigger input.
  These commands can be used in multi-head mode only.

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- The “LON” command corresponds to “Trigger input: ON”, and the “LOFF” command corresponds to “Trigger input: OFF”.
- When the bar code data read by the BL series has already been sent to the host computer, you do not need to send the “LOFF” command (in “Single Label” reading mode only).
- These commands can be changed to any string of up to eight characters.

Reset

Resets the data stored in the N-400.

Command: RESET
Response: OK

Clearing transmission buffer

Clears the transmission buffer of the N-400 and all BL series.

Command: BCLR
Response: OK

Checking trigger input status

Used to monitor the ON/OFF status of the trigger input connected to the N-400.

* This command can be used in multi-head scan mode only.

Command: TIMCHK
Response: ON OFF

Shift to SETUP mode

Used to go to the SETUP mode. (See p. 4-19.)

Command: SSET
Response: OK

Specifying the ID number of command transmission destination (Hotline command)

Normally, when a command is sent to the BL series, the ID number of the BL series is added to the command.

If you send the following command, you can send a command to the specified BL series without adding its ID number to the command.
After using this command, be sure to reset it.

- **Specifying the Destination ID number for command transmission**

  Command: TRCIMmm
  [mm = 01 to 31 (ID number)]

  Response: OK
  ERR01: “mm” exceeds the range of “01” to “31”.

- **Resetting the destination ID number for command transmission**

  Command: TROFF
  Response: OK

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● **Checking the destination ID number for command transmission**

Command: TRCOM

Response: mm
[mm = 01 to 31 (ID number)
mm = 00: ID number is not specified.]

■ **Description of the procedure**

1. Send the “TRCOMmm” command. (The N-400 sends back “OK”.)
   The N-400 displays the specified ID number.

2. You can then send a command to the specified BL series without adding its ID number.
   (For the commands sent to the BL series, see the BL series User’s Manual.)

   Example
   • To start reading: Send “LON [CR]”.
   • To end reading: Send “LOFF [CR]”.
   • To go to the SETUP mode: Send “SSET [CR]”.

3. When the N-400 fails to send a command to the BL series, the BL series sends back the following response:

   NC: The BL series with the specified ID number is disconnected.
   SERR: Communication error

4. After the command transmission is completed, be sure to send “TROFF”. Otherwise, the N-400 cannot receive any commands.

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4.5 N-400 Setup Command

This section describes the procedure for changing the N-400's settings by sending a command to the N-400.

To change the settings of the N-400, you should normally use the N-400 setup software instead of these commands.

■ Details of the communication

1. Send the "SSET" direct control command to the N-400.
   The N-400 then goes into SETUP mode. (In SETUP mode, the N-400 displays "S1(Set)".)
   When this command is processed normally, the N-400 sends back "OK".

2. After the N-400 goes into SETUP mode, send the command of the item to be changed (setting change command) to the N-400.
   When this command is processed normally, the N-400 sends back "OK".
   If an error occurs, the N-400 sends back "ERR**". (** is the error code.)

3. To confirm the N-400's current settings, send the setting check command to the N-400.
   When this command is processed normally, the N-400 sends back the data on the current settings.
   If an error occurs, the N-400 sends back "ERR**".(** is the error code.)

4. To save the settings in the EEPROM of the N-400, send the "SAVE" command to the N-400.
   If updated settings are saved in the EEPROM, these settings take effect the next time the N-400 is turned ON.
   When this command is processed normally, the N-400 sends back "OK".
   If an error occurs, the N-400 sends back "ERR**". (** is the error code.)

5. To exit SETUP mode and perform normal reading operation, send the "SEND" command to the N-400.
   When this command is processed normally, the N-400 sends back "OK".
   If an error occurs, the N-400 sends back "ERR**". (** is the error code.)

■ Communication format

The ID number is not specified in the command/response format.

The N-400 returns the response with the same header and delimieter as it receives.

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 to the end of the command. However, **[LF]** is not added to the response.

* When **[ESC]** is added to the head of the command, the N-400's receiving buffer is cleared. However, **[ESC]** is not added to the response.

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■ Response error codes

If an incorrect setup command is sent to the N-400, the N-400 sends back the cause of the error (error code).

Error response: ERR** (** is the error code.)

Error code	Cause of error
00	Undefined command
01	The ID number exceeds the setting range.
02	The number included in the command does not correspond to anything.
05	The number included in the command is too long.
06	“hhh...” is too short.
07	“N” is any value other than “0” or “1”.
08	“n” exceeds the setting range.
09	“nnn” or “nn” exceeds the setting range.
10	“hhh...” is not specified as HEX codes (hexadecimal numbers).
11	Setting “hhh... = FF” is impossible.
12	“hhh...” exceeds the specified number of characters.
14	The data stored in the EEPROM may be corrupted. Initialize the settings.
15	The area storing the initial settings is incorrect.

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Description of setup commands

■ Saving settings/Initializing settings/Quitting SETUP mode

Function	Command	Response	Description	Error code
Saving settings in the EEPROM	SAVE	OK	See p. 74.	00, 02, 05, 14
Initializing settings	DFLT	OK	Resets the current settings to the default values and saves them in the EEPROM.	00, 02, 05, 14, 15
Quitting SETUP mode	SEND	OK	See p. 74.	00, 02, 05, 14

■ HOST MODE

Function	Command		Response	Description	Error code
Mode	Change	WP00n	OK	n = 0: Multi-drop link n = 1: Multi-head scan mode	00, 02, 05, 07, 14
	Confirm	RP00	00n		
Interference suppression Trigger	Change	WP06n	OK	n = 0: Disable n = 1: Enable	
	Confirm	RP06	06n		
ON time in interference suppression mode	Change	WP47nnn	OK	nnn = 001 to 255 (Units: 10 ms)	00, 02, 05, 07, 09, 14
	Confirm	RP47	47nnn		
Read mode	Change	WP12n	OK	n = 0: Single n = 1: Multi-label 1 n = 2: Multi-label 2	00, 02, 05, 08, 14
	Confirm	RP12	12n		
Data trans-mission timing (Effective in signal label mode only)	Change	WP13n	OK	n = 0: After read n = 1: At trigger	00, 02, 05, 07, 14
	Confirm	RP13	13n		
Read error code	Change	WP55hhh..	OK	hhh... = Read error code (up to eight characters) * To set a read error code, use HEX (hexadecimal) codes. * hhh... = FF: Read error code is not set.	00, 02, 05, 10, 12, 14
	Confirm	RP55	55hhh..		

Tips To set a read error code, use the following command format.

Example: To set the read error code to "BR"

B R
WP554252 * B = 42h, R = 52h

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■ TRIGGER INPUT SETUP (Effective in multi-head scan mode only)

Function	Command		Response	Description	Error code
Trigger input signal type	Change	WP05n	OK	n = 0: Level n = 1: One-shot	00, 02, 05, 07, 14
	Confirm	RP05	05n		
One-shot input time	Change	WP42nnn	OK	nnn = 001 to 255 (Units: 100 ms)	00, 02, 05, 07, 09, 14
	Confirm	RP42	42nnn		
Trigger input time	Change	WP04n	OK	n = 0: 2 ms n = 1: 10 ms	00, 02, 05, 07, 14
	Confirm	RP04	04n		
State of trigger input	Change	WP03n	OK	n = 0: Normally open n = 1: Normally closed	———
	Confirm	RP03	03n		
Characters of trigger ON command Change	WP56hhh...		OK	hhh... = Trigger ON command (up to eight characters) * To set this command, use HEX (hexadecimal) codes.	00, 02, 05, 06, 11, 14
	Confirm	RP56	56hhh...		
Characters of trigger OFF command	Change	WP57hhh..	OK	hhh... = Trigger OFF command (up to eight characters) * To set this command, use HEX (hexadecimal) codes.	00, 02, 05, 06, 11, 14
	Confirm	57hhh..	———		

Tips

To set the characters of the trigger ON/OFF commands, use the following command format:

*Example: To change the trigger ON command to "**[CR]**" or "**[STX]S[ETX]**".*

S
WP5653 * S = 53h

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■ PROTOCOL SETUP

Function	Command		Response	Description	Error code
Handshaking protocol 1	Change	WP07n	OK	n = 0: No handshaking n = 1: Use protocol *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 n = 1: ACK/NAK protocol	
	Confirm	RP08	08n		
Header	Change	WP51hhh...	OK	hhh... = Header (up to five characters) * To set a header, use HEX (hexadecimal) codes. * hhh... = FF: Header is not set.	00, 02, 05, 10, 12, 14
	Confirm	RP51	51hhh...		
Delimiter	Change	WP52hhh...	OK	hhh... = Delimiter (up to five characters) * To set a delimiter, use HEX (hexadecimal) codes. * hhh... = FF: Delimiter is not set.	00, 02, 05, 07, 14
	Confirm	R39	39n		
Adding checksum	Change	WP39n	OK	n = 0: Do not add n = 1: Add	
	Confirm	RP39	39n		

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■ PROTOCOL SETUP (only when PLC link is used)

Function	Command		Response	Description	Error code
PLC link model	Change	WP36n	OK	n = 0: PLC link disabled n = 1: SYSNAC-C n = 2: MELSEC-A n = 3: KV n = 4: MELSEC-A (File register is used.)	00, 02, 05, 08, 14
	Confirm	RP36	36n		
Trigger input through PLC link	Change	WP37n	OK	n = 0: Disable n = 1: Enable	00, 02, 05, 07, 14
	Confirm	RP37	37n		
DM head address	Change	WP40nn	OK	nn = 00 to 99 (0000 to 9900)	00, 02, 05, 07, 09, 14
	Confirm	RP40	40nn		
PLC / station number	Change	WP43nn	OK	nn = 00 to 31	
	Confirm	RP43	43nn		
File register block number	Change	WP41nnn	OK	nnn = 000 to 255	
	Confirm	RP41	41nnn		

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■ ID SETUP

Function	Command		Response	Description	Error code
Registering ID number (for each unit)	Change	WIDmmn	OK	mm = 01 to 31 (ID 3 number) n = 0: Do not register n = 1: Register	00, 01, 02, 05, 07, 14
	Confirm	RIDmm	mmn		
Registering serial numbers (Register all ID numbers more than the specified number.)	Change	WIDMAXmm	OK	mm = 01 to 31 (ID 4 number) * If “mm” is “99” in the response, serial ID numbers are not registered.	00, 01, 02, 05, 14
	Confirm	RWIDMAXmm	MAXmm		
Registering all serial numbers	Change	WIDAnnn...n	OK	n = 0: Do not register n = 1: Register * “n” corresponds to ID numbers (1 to 31) in ascending order.	00, 02, 05, 07, 14
	Confirm	RIDA	Annn...n		

■ RS-232C SETUP

Function	Command		Response	Description	Error code
Baud rate	Change	WP35n	OK	n = 5: 38400 bps n = 6: 31250 bps n = 7: 19200 bps n = 0: 9600 bps n = 1: 4800 bps n = 2: 2400 bps n = 3: 1200 bps n = 4: 600 bps	00, 02, 05, 08, 14
	Confirm	RP35	35n		
Data length	Change	WP30n	OK	n = 0: 7 bits n = 1: 8 bits	00, 02, 05, 07, 14
	Confirm	RP30	30n		
Parity	Change	WP31n	OK	n = 0: None n = 1: Set parity * To set the parity type, use the "Parity type" command.	
	Confirm	RP31	31n		
Parity type	Change	WP32n	OK	n = 0: Even n = 1: Odd	
	Confirm	RP32	32n		
Stop bit length	Change	WP33n	OK	n = 0: 1 bit n = 1: 2 bits	
	Confirm	RP33	33n		
RTS/CTS control	Change	WP22n	OK	n = 0: Disable n = 1: Enable	
	Confirm	RP322	22n		

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■ RS-485 SETUP

Function	Command		Response	Description	Error code
Baud rate	Change	WP75n	OK	n = 5: 38400 bps n = 6: 31250 bps n = 7: 19200 bps n = 0: 9600 bps n = 1: 4800 bps n = 2: 2400 bps n = 3: 1200 bps n = 4: 600 bps	00, 02, 05, 08, 14
	Confirm	RP75	75n		
Data length	Change	WP70n	OK	n = 0: 7 bits n = 1: 8 bits	00, 02, 05, 07, 14
	Confirm	RP70	70n		
Parity	Change	WP71n	OK	n = 0: None n = 1: Set parity * To set the parity type, use the "Parity type" command.	
	Confirm	RP71	71n		
Parity type	Change	WP72n	OK	n = 0: Even n = 1: Odd	
	Confirm	RP72	72n		
Stop bit length	Change	WP73n	OK	n = 0: 1 bit n = 1: 2 bits	
	Confirm	RP73	73n		

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4.6 Communication Time Consideration

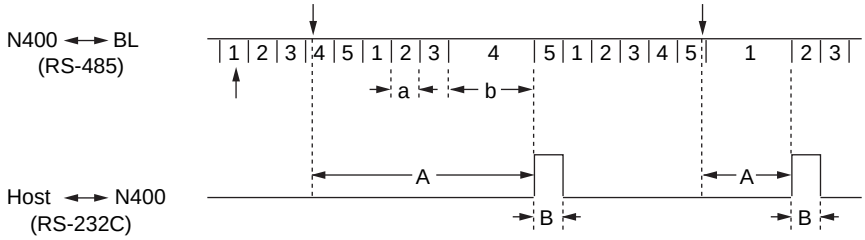
This section describes how to calculate the time required for data transmission and for command transmission in multi-drop link mode.

■ How to calculate data transmission time

The following is the timing chart for multi-drop link mode communication .

Through the RS-485 communication between the N-400 and each BL series unit, data transmission is constantly performed from the BL series to the N-400.

When the N-400 sends the polling command to a BL series with a specified ID number, the data read by the BL series is sent to the host computer through the RS-232C interface of the N-400.



* The above timing chart shows the case in which five BL series units are connected.

Therefore, data transmission is delayed by a certain time duration until the polling command is sent to the BL series after the BL series reads bar code data.

First, obtain the time duration required for the RS-485 data transmission.

In the RS-485 data transmission from the BL series to the N-400, the required time varies depending on whether the BL series has stored bar code data (the BL series has already read bar code data) or not.
In the above timing chart, “a” (the RS-485 data transmission time is short) shows the case in which the BL series has stored no data, and “b” (the RS-485 data transmission time is long) shows the case in which the BL series has stored some data.

- a: RS-485 data transmission time required when the BL series has stored no data

Baud rate (for RS-485)	Communication time (a)
9600 bps	27.9 ms
38400 bps	12.8 ms

- b: RS-485 data transmission time required when the BL series has stored some data

Baud rate (for RS-485)	Communication time (b)		
	Number of data digits: 10	Number of data digits: 20	Number of data digits: 32
9600 bps	64 ms	74 ms	86 ms
38400 bps	28 ms	32 ms	37 ms

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From the above data, the RS-485 data transmission time (“A” shown in the timing chart on the previous page) is obtained as follows:

- Maximum time: A = a x n + b (n = Number of connected BL series)
- Minimum time: A = b

* The above table shows the case in which one BL series sends data to the N-400. When several BL series simultaneously send data, the required time may be longer than the above.
The time duration “b” (corresponding to the case in which the BL series has stored some data) is prolonged.

Next, obtain the time duration required for the RS-232C data transmission.

The RS-232C data transmission time (“B” shown in the timing chart on the previous page) can be obtained from the following formula:

$$B = \frac{\text{Amount of data + (1: Set Parity) + Start/Stop bit}}{\text{Baud rate}} \times (\text{Number of data digits + Header/Delimiter + 5})$$

Baud rate (for RS-232C)	Communication time (b)		
	Number of data digits: 10	Number of data digits: 20	Number of data digits: 32
9600 bps	21.3 ms	33.8 ms	48.8 ms
38400 bps	5.4 ms	8.5 ms	12.2 ms

From the above data, the total communication time is obtained as follows:

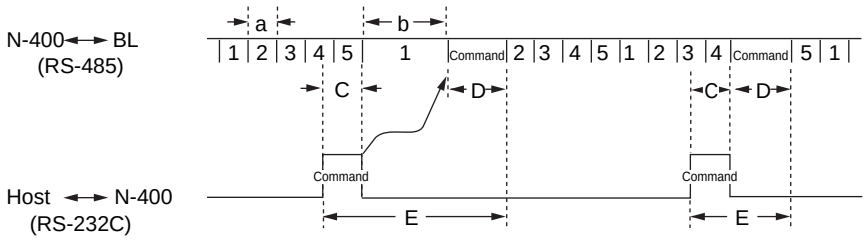
Communication time = A + B

■ Command communication time

When you send a command (e.g. Laser ON command) to the BL series, obtain the time duration for how long it takes for the BL series to receive the command after you send it to the N-400.

The communication time required to send a command to the BL series consists of the time required for the RS-232C command transmission from the host computer to the N-400, and the time required for the RS-485 command transmission from the N-400 to each BL series.

However, since each BL series constantly sends its data to the N400, the command transmission from the N-400 to the BL series must be performed in the interval of the data transmission from the BL series to the N-400.



First, obtain the time (C) required for the RS-232C command transmission from the host computer to the N-400. Calculate this time duration by substituting the number of command characters (e.g. LON: three characters, LOFF: four characters) for the number of data digits in formula B given above.

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Baud rate (for RS-232C)	Communication time (B)	
	Command = LON	Command = LOFF
9600 bp	12.5 ms	13.8 ms
38400 bps	3.2 ms	3.5 ms

Then, obtain the time duration (D) required for the RS-485 command transmission from the N-400 to the BL series. When the reading start command (LON) or reading end command (LOFF) is sent to the BL series, for example, the communication time is as follows:

Baud rate (for RS-485)	Communication time (D)	
	Command = LON	Command = LOFF
9600 bp	29 ms	30 ms
38400 bps	11.5 ms	11.8 ms

From the above data, the total communication time (E) can be obtained as follows:

Maximum time: E = C + b + D

* b: Time required for the data transmission from the BL series to the N-400 when the BL series has stored some data

Minimum time: E = C + D

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Chapter 5

Multi-Head Mode Control Procedure

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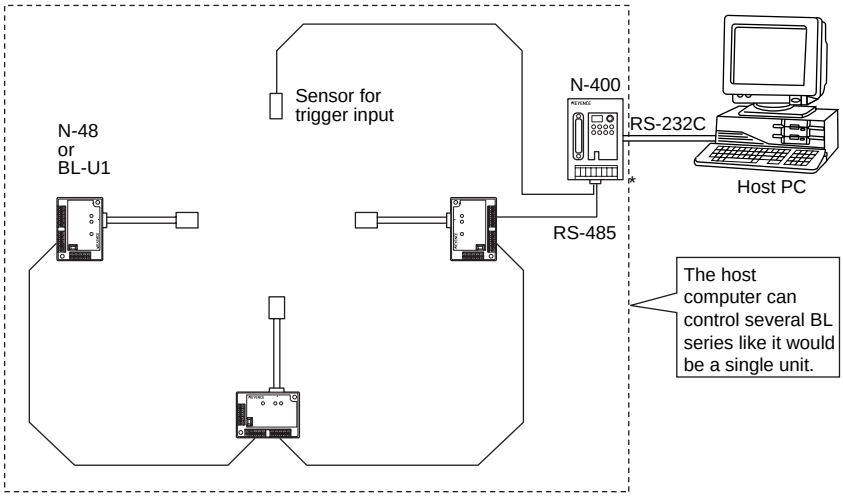
5.6 Communication Time 98

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5.1 Multi-head Mode

5.1.1 Controlling multi-head mode

If the bar code position on a product is unknown, or if bar codes are printed in several positions, the bar code data cannot be read with a single bar code reader. In such cases, several bar code readers need to be mounted in various positions or at various angles.
When the N-400 is used in multi-head mode, the host computer can control several BL series like it would be a single unit.



The procedures for controlling the N-400 using the host computer are classified into the following three methods:

- Data communication: Used to send bar code data read by the BL series to the host computer.
- Command communication to the BL series: Used to send a command to the BL series.
- Command communication to the N-400: Used to control the N-400 directly or change the settings of the N-400.

* All of the above communication methods use ASCII codes.

The procedures for sending a command to the BL series or the N-400 are the same as for multi-drop link mode. For details, see the descriptions on multi-drop link mode.

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5.1.2 Setup procedure

For setup and connection procedures, see p. 10. This section describes the procedures for setting the N-400, BL series and host computer only.

Setting the BL series

1. Set “Multi-drop Link” to “Enable”. (Click the button.)

2. Assign ID numbers (1 to 31) to the connected BL series. Be sure not to assign the same ID number to different units.

3. Set the RS-485 communication parameters (baud rate, data length, parity and stop bit length) for the BL series according to the N-400’s settings. The default settings for the BL series and the N-400 are as follows:

   Baud rate: 9600 bps
   Data length: 7 bits
   Parity: Even
   Stop bit length: 1 bit

Note: To increase the response speed, set the BL series’ baud rate to 38400 bps.

4. Setting “Handshaking protocol” or “RTS/CTS” is not effective.

5. Set “Header” to “None”. Setting the terminator is not effective.

6. Set the BL series’ reading mode to “Single label”.

7. Set the trigger input signal type to “Level”.

8. Set the read error code of the BL series according to the N400’s setting. Normally, the read error code is set to “ERROR” (default setting).

9. Set the reading start command and read end commands according to the N-400’s settings. Normally, these commands are set to “LON” and ”LOFF” respectively (default settings).

* Set other parameters as required.

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Setting the N-400

Using the N-400 setup software, set the N-400 as follows:

1. Set the host mode to multi-head mode (Click the button). (⇨ *See p. 38.*)

2. In multi-head mode, connect the trigger input to the N-400 so that all BL series connected to the N-400 are controlled as if they are a single bar code reader. You must set the “Read mode” and “Trigger input signal type” of the N-400.

3. Enter the ID numbers of the connected BL series on the “ID SETUP” screen. (⇨ *See p. 42.*)

4. Set the baud rate, data length, parity and stop bit length according to the host computer’s settings on the “RS-232C SETUP” screen. (⇨ *See p. 42.*)

5. Set the baud rate, data length, parity and stop bit length according to the BL series’ settings on the “RS-485 SETUP” screen. (⇨ *See p. 43.*)

Note: To increase the response speed, set the RS-485 communication baud rate to 38400 bps. (Set the BL series’ baud rate to this value as well.)

6. Set the read error code of the N-400 according to the BL series’ setting. Normally, the read error code is set to “ERROR” (default setting).

7. Set the reading start command and read end commands according to the BL series’ settings. Normally, these commands are set to “LON” and ”LOFF” respectively (default settings).

Setting the host computer

Set the RS-232C communication parameters (baud rate, data length, parity and stop bit length) for the host computer according to the N-400’s settings.

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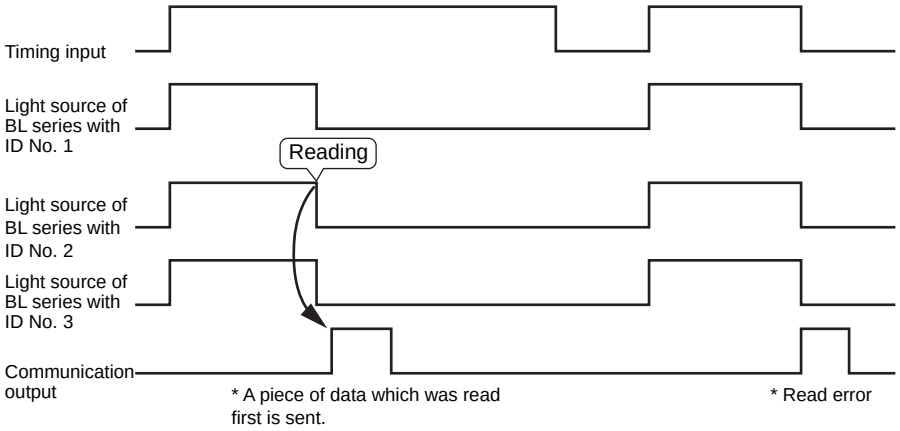
5.2 Reading Operation in Multi-Head Mode

5.2.1 Difference in operation depending on reading mode

Multi-head mode can control several BL series like they are a single bar code reader. The N-400 provides the “Level” and “Oneshot” trigger signal types, and the “Single” label and “Multi” label reading modes.

“Single” label reading mode

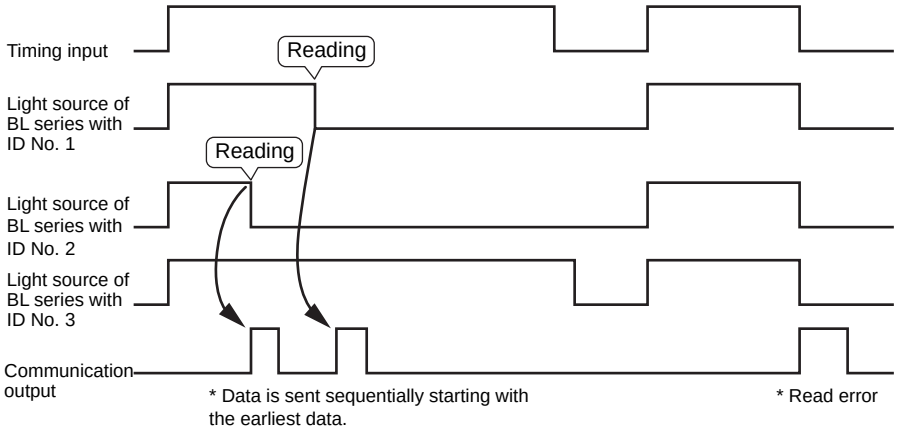
The following timing chart shows the case in which three BL series are connected.



- In the “Single” label reading mode, a piece of data which was first read by any of several BL series is sent to the host computer. (When any of the connected BL series reads bar code data, all light sources of the other BL series are turned OFF.) Therefore, several BL series can be operated like a single bar code reader.
- If all of the connected BL series units cannot read bar code data while the trigger input is ON, a read error code is output.
- Normally, the BL series sends data immediately after reading it. However, you can set the data transmission timing so that data is sent after the trigger input is turned OFF. (☞ *See p. 94.*)

“Multi 1” label reading mode

The following timing chart shows the case in which three BL series are connected.

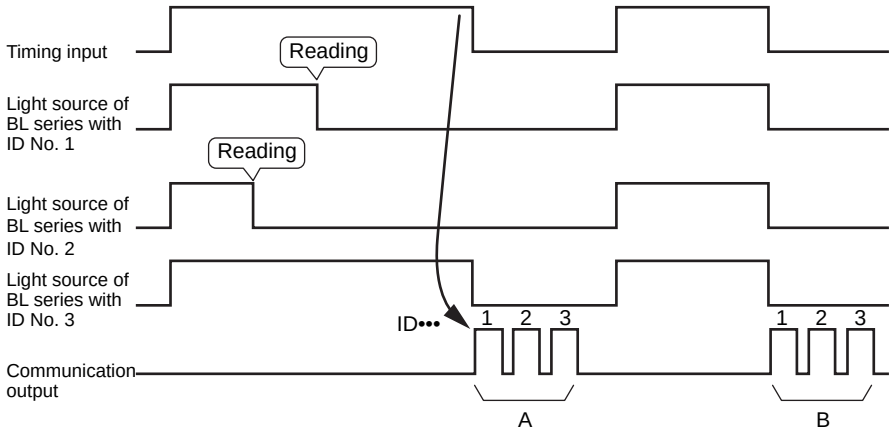


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- In “Multi 1” reading mode, all connected BL series units read bar code data while the trigger input is ON, and send the individual data immediately after reading it.
- A BL series that causes a read error sends no data.
- If all of the connected BL series cannot read bar codes while the trigger input is ON, a read error code is output.

“Multi 2” reading mode

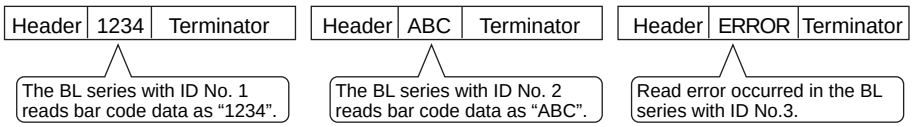
The following timing chart shows the case in which three BL series are connected.



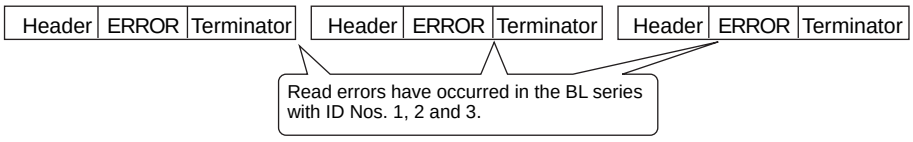
- In “Multi 2” reading mode, all connected BL series read bar code data while the trigger input is ON, and send the individual data after the trigger input is turned OFF, starting with the smallest ID number.
- In “Multi 2” reading mode, every connected BL series sends a piece of data. A BL series which causes a read error sends an error code.

  Example: In the above timing chart, the communication output is as follows:

  Communication output (A):



  Communication output (B):



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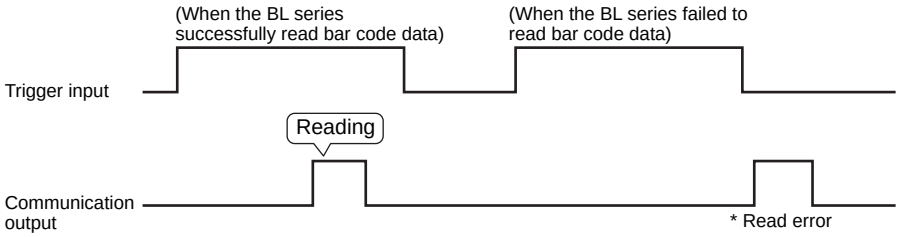
5.2.2 Trigger input signal type

When the trigger input is connected to the N-400 in multi-head mode, the trigger signal is sent to all connected BL series to start the reading operation.

The trigger input signal type can be set for the N-400 as well as for the BL series.

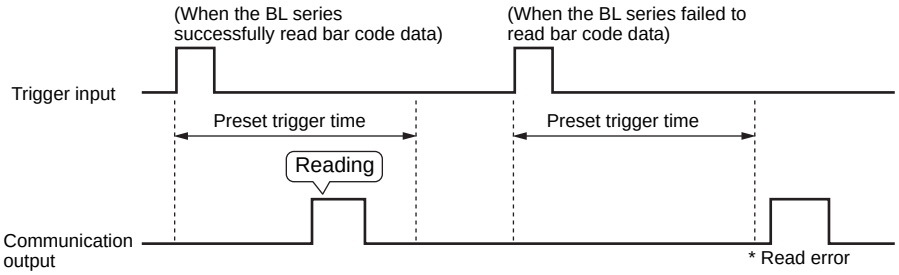
“Level” trigger signal

While the trigger input is ON, the BL series reads bar code data.



“One-shot” trigger signal

After the rising edge of the trigger input is detected, the BL series reads bar code data for the preset trigger time.



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5.2.3 Data transmission timing

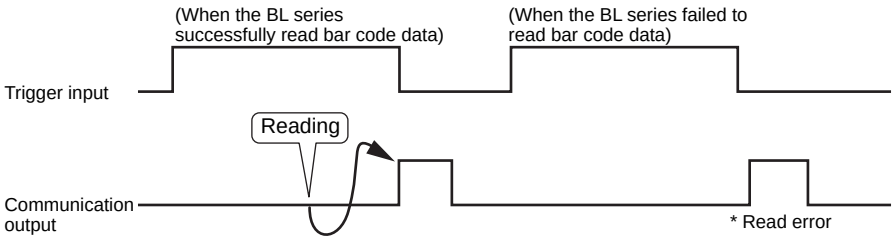
Data transmission timing can be selected from the following modes only in single-label reading mode:
(The data transmission timing cannot be selected in the multil 1/2/3 reading modes.)

- After reading

  This mode allows the BL series to send data immediately after reading them. This operation is the same as that described in the timing chart in “5.2.2 Trigger input signal type”. Normally, the data transmission timing should be set to this mode.

- After trigger input is turned OFF

  This mode allows the BL series to send data when the trigger input is turned OFF. (If the one-shot trigger mode is selected, data is sent after the preset measurement time has passed.)



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5.3 Data Communication in Multi-Head Mode

5.3.1 Communication format

The communication format for multi-head mode is as follows:

Header	Reading Data	Delimiter

The communication format does not include an ID number. However, to assign ID numbers to the connected BL series, make sure that the same ID number is not assigned to different units.

The header and delimiter can be selected from the following formats: (The header and delimiter can be changed to any string of up to five characters.) To change the header and delimiter format, change the settings of the N-400.

Header: [ESC]/[STX]/None
Delimiter: [CR]/[CR][LF]/[ETX]

Tips You can change the communication format so that an ID number is included. The communication format including an ID number is the same as that for multi-drop link mode.

Header	P	mm	–	Reading Data	Terminator

[mm = 01 to 31 (ID number)]

5.3.2 Handshaking protocol

The handshaking protocol and the capacity of the transmission buffer for multi-head mode is the same as that for multi-drop link mode. For details, see the descriptions for multi-drop link mode.

5.3.3 Read error code

If the BL series fails to read bar code data, a read error code is sent. However, since the read error code can be easily changed on the BL series, the code indicating a read error must be specified on the N-400.

Therefore, the read error code setting of the N-400 must be the same as that of all connected BL series.
The default setting of the read error code is as follows:

Header	ERROR	Delimiter

The read error code can be easily changed. However, you must ensure that the same error code is specified for all connected BL series.

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5.4 Command Communication in Multi-Head Mode

The command communication in multi-head mode is the same as that in multi-drop link mode. For details, see the descriptions for multi-drop link mode. The following sections describe the main points only.

5.4.1 Sending a command to BL series

The data communication format does not include an ID number. However, the command sent to the BL series must include an ID number.

• Command sent to BL series

Header	%	P	mm	–	Serial command	Delimiter

• Response

Header	%	P	mm	–	Response	Delimiter

For details about the communication format, see pp. 4-10 and 4-11.

Note: To use the BL series' reading rate check mode, send the "Specific ID polling ON" command first. (➪ *See p. 72.*) After using this command, be sure to reset it.

5.4.2 N-400 direct control/setup commands

The commands sent to the N-400 are the same as those used in multi-drop link mode.

• Command sent to N-400

Header	Command	Delimiter

• Response

Header	Response	Delimiter

➪ *For details about the communication format, see pp. 69, 70 and 75.*

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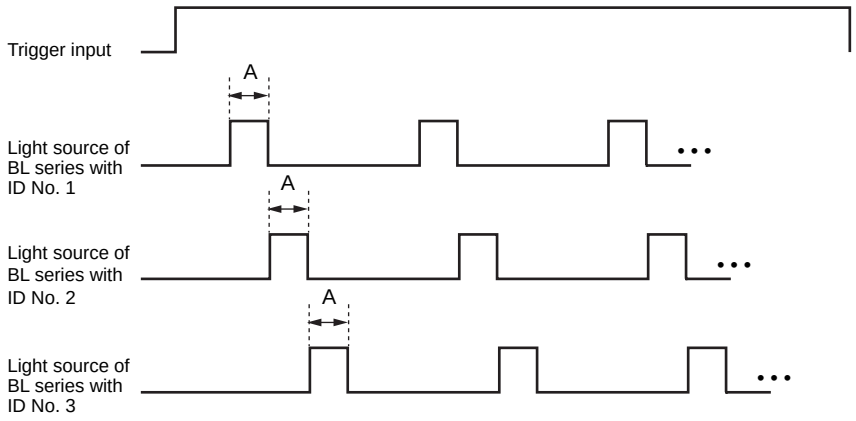
5.5 Interference Suppression Function

In multi-head mode, the BL series' light sources (laser beams) are usually turned ON simultaneously.

If the BL series are mounted close to each other, the laser beam emitted from one unit enters the receiver of another unit, causing mutual interference. This may result in a reading error or unstable reading. (Laser beams in close proximity often cause interference.)

The interference suppression function allows each BL series' laser beam to be turned ON sequentially starting at the unit with the smallest ID number. Therefore, the connected BL series do not simultaneously emit a laser beam. This function prevents the laser beams from interfering with each other, ensuring stable readings.

The differences in operation depending on the reading mode and the trigger input signal type are the same as those in normal multihead mode.



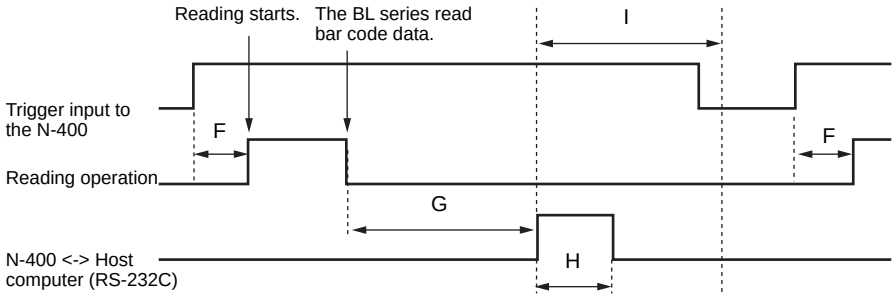
- You can change the laser ON time (A) of each BL series by changing the BL series' setting. When (A) is prolonged, the reading operation is stabilized, but it is not applicable for a high-speed line. Conversely, when (A) is reduced, the reading operation is applicable for a high-speed line, but the reading stability may decrease.

Note: The interference suppression function prolongs the time duration that each BL series' light source is OFF. Therefore, reading may be impossible, when the scan time is extremely short (for example, when the BL series cans bar codes on a high -speed line).

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5.6 Communication Time

The following is the operation timing chart for “Single label” reading in multi-head mode. This operation timing chart shows the case in which only one BL series succeeded in reading bar code data. When several BL series simultaneously read bar code data, the communication time may be longer than the following data.



Reading start delay time (F)

When the trigger input connected to the N-400 is turned ON in multi-head mode, the N-400 sends the “Reading start (LON)” command to all connected units. Therefore, the start of the BL series’ reading operations is delayed by the time duration until the command transmission to all the BL series is completed.

The communication time required to send the reading start command to one BL series is as follows:

Baud rate (RS-485)	Reading start delay time (D)
9600 bps	31 ms
38400 bps	13.5 ms

When the number of connected BL series is “n”, the communication time is calculated as follows:

F = D x n * n = Number of connected BL series

Serial output maximum delay time (G)

The serial output maximum delay time is the maximum delay time until the N-400 sends bar code data to the host computer after the BL series reads the data.

When the RS-485 communication baud rate is 38400 bps:

Number of connected BL series	Serial output maximum delay time (G)		
	Number of data digits: 10	Number of data digits: 20	Number of data digits: 32
2	96 ms	106 ms	116 ms
5	258 ms	268 ms	278 ms
10	528 ms	538 ms	548 ms
20	1,068 ms	1,078 ms	1,088 ms
31	1,662 ms	1,672 ms	1,682 ms

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• Serial communication time (H)

The serial communication time can be obtained from the following formula:
(This formula applies to the case in which an ID number is not added to the data.)

$$H = \frac{\text{Number of data + (1: Set Parity) + Start/Stop bit}}{\text{Baud rate}} \times$$

(Number of data digits + Header/Delimiter)

Baud rate (for RS-232C)	Serial communication time (H)		
	Number of data digits: 10	Number of data digits: 20	Number of data digits: 32
9600 bps	15 ms	27.5 ms	42.5 ms
38400 bps	3.8 ms	6.9 ms	10.7 ms

• Next trigger input receiving OFF time (I)

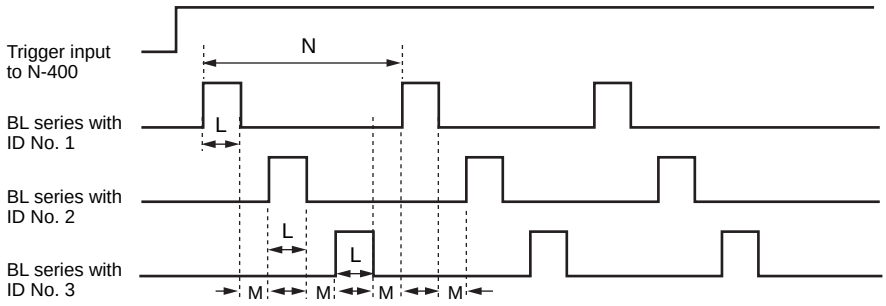
During this time, the BL series does not start operation even when the next trigger input is turned ON.

When the RS-485 communication baud rate is 38400 bps:

Number of connected BL series	Next trigger input receiving OFF time (I)
2	50 ms
5	140 ms
10	290 ms
20	590 ms
31	920 ms

■ When the interference suppression function is used

The timing chart in interference suppression mode is as follows:



• Scan time per unit (L)

The setting of the trigger ON time in interference suppression mode can be changed to a value in the range of 10 ms to 2550 ms. However, the trigger ON time in interference suppression mode depends on the setting of the RS-485 communication baud rate, because the laser ON/OFF command transmission time is required. Even if the trigger ON time is set to 10 ms, for example, the actual ON time is approximately 50 ms when the baud rate is set to 38400 bps. (The trigger ON time for each unit cannot be set to less than 50 ms.)

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The following table shows the actual minimum scan time for each baud rate setting.

Baud rate (RS-485)	Actual minimum scan time (L)
9600 bps	141 ms
38400 bps	58 ms

• Scan OFF time (M)

When the interference suppression function is used, a time lag occurs between the scan of one BL series and the next. During this period, the BL series cannot read bar code data.

Baud rate (for RS-485)	Scan OFF time (M)
9600 bps	36.5 ms
38400 bps	14.8 ms

• Scan cycle time (N)

The cycle time between the scan of one BL series and the next BL series is increased when the number of connected BL series is increased or when the trigger ON time is prolonged.

To reduce the scan cycle time (to scan bar codes on a high-speed line), reduce the number of connected BL series or shorten the trigger ON time.

The scan cycle time can be calculated from the following formula:

N = (L + M) n* n = Number of connected BL series

Note: When the interference suppression function is used, the reading operation is not applicable for a high-speed line because the scan OFF time of each BL series is prolonged.

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Chapter 6

PLC Link

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6.1 PLC Link

The PLC link enables read data to be directly stored in the internal memory of a PLC (programmable logic controller).

Since the N-400 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 settings of the N-400 and BL series cannot be changed on the PLC.
- The PLC link cannot send a command to the BL series. However, the PLC link provides a reading control address to start/end reading.
- The PLC link cannot send a command to the N-400. The start of auto polling or registration of ID numbers cannot be set on the PLC.
  To register ID numbers, use the N-400 setup software.

6.1.1 List of PLCs used for PLC link

KEYENCE **KV series**	(Built-in CPU port) KV-10/16/24/40/80 KV-300 (Serial link unit) KV-L2
Mitsubishi **MELSEC-A series**	(Built-in CPU port) A2CCPU24 A2CCPU24-PRF (Calculator link unit) AJ71C24 AJ71C24-Sx AJ71UC24 A0J2-C214S1 A1SJ71C24-R2/PRF A1SJ71UC24-R2/PRF
OMRON **SYSMAC-C series**	(Built-in CPU port) C20H/28H/40H/60H/80H C200HS(CPU21/23/31/33) C200HE(CPU42) C200HG(CPU43/63) C200HX(CPU44/64) (High-order link unit) C200H-LK201(-V1) C500-LK203 C500-LK201-V1 C120-LK201-V1 (Communication board) C200HW-COM02 C200HW-COM04 C200HW-COM05 C200HW-COM06
OMRON **SYSMAC-CQM1 series**	(Built-in CPU port) CQM1(CPU21/41/42/43/44)
OMRON **SYSMAC-CV series**	(Built-in CPU port) CV500 CV1000 CV-M1 (High-order link unit) CV500-LK201

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6.1.2 Devices used for PLC link

The N-400 supports the following PLC devices.
To use MELSEC-A series, select the data register or file register.

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.

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

The MELSEC-A series provides an extension file register.

When a block number is specified during the N-400 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 N-400 setup and PLC programming), the file register incorporated in the CPU is used.

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6.2 Setup Procedure

For setup and connection procedures, see p. 10. This section describes the procedures for setting the N-400, BL series and PLC only.

6.2.1 Setting the BL series

1. Set “Multi-drop Link” to “Enable”. (Click the button.)

2. Enter the ID numbers (1 to 31) for the connected BL series. Be sure not to assign the same ID number to different units.

3. Set the RS-485 communication parameters (baud rate, data length, parity and stop bit length) for the BL series according to the N-400’s settings. The default settings of the BL series and the N-400 are as follows:

   Baud rate: 9600 bps
   Data length: 7 bits
   Parity: Even
   Stop bit length: 1 bit

Note: To increase the response speed, set the BL series’ baud rate to 38400 bps.

4. Setting “Handshaking protocol” or “RTS/CTS” is not effective.

5. Set “Header” to “None”. Setting “Delimiter” is not effective.

   * To use multi-head scan mode, set the following parameters.

Additional setups for multi-head scan mode use

1) To use the N-400 in multi-head scan mode, set the BL series’ reading mode to “Single label”.

2) Set the trigger input signal type to “Level”.

3) Set the read error code according to the N-400’s setting.
   Normally, the read error code is set to “ERROR” (default setting).

4) Set the reading start command and read end commands according to the N-400’s settings. Normally, these commands are set to “LON” and ”LOFF” respectively (default settings).

   * Change other parameters as required.

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6.2.2 Setting the N-400

Using the N-400 setup software, set the N-400 as follows:
For the difference in settings depending on the type of the link unit or PLC, see "Setting the PLC" on the next page.

1. Set the host mode to multi-drop link mode or multi-head scan mode. (⇨ *See p. 38.*)

2. Set the PLC link on the "PROTOCOL SETUP" screen. (See p. 40)

   - PLC model name
     To use the KV-L2 in "Link" mode, select "SYSMAC-C" for the N-400's setting.
   - DM head address
   - Trigger input through PLC
   - Setting PLC unit number/station number
   - Setting file register to "Enable" or "Disable"

3. Enter the ID numbers for the connected BL series on the "ID SETUP" screen. (⇨ *See p. 42.*)

4. Set the baud rate, data length, parity and stop bit length according to the PLC's settings on the "RS-232C SETUP" screen. (⇨ *See p. 42.*)

   Setting "RTS/CTS" protocol is not effective when PLC link is enabled.

5. Set the baud rate, data length, parity and stop bit length according to the BL Series' settings on the "RS-485 SETUP" screen. (⇨ *See p. 43.*)

Note: To increase the response speed, set the RS-485 communication baud rate to 38400 bps. (Set the BL series' baud rate to this value as well.)

* To use multi-head scan mode, set the following parameters.

Additional setups for multi-head scan mode use

1) In multi-head scan mode, connect the trigger input to the N-400 so that all of the BL series connected to the N-400 are controlled like a single bar code reader. You must also set the "Read mode" and "Trigger input signal type" on the N-400.

2) Set the read error code according to the BL series' setting. Normally, the read error code is set to "ERROR" (default setting).

3) Set the reading start command and read end commands according to the BL series' settings. Normally, these commands are set to "LON" and "LOFF" respectively (default settings).

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6.2.3 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 N-400's settings.
2. Set the station number according to the N-400's setting.
3. Set the mode to "Protocol Type 4 ".
4. Set the main channel to "RS-232C".
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).

■ **Setting SYSMAC-C series**

1. Set the RS-232C communication parameters (baud rate, data length, parity and stop bit length) according to the N-400's settings.
2. Set the unit number according to the N-400'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 "RS-232C".
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.

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

1. The KV series' handheld programmer port must always be 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 N-400 according to the above settings. Set the N-400's communication mode to "KV".

2. No other parameters need to be set.

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■ Settings for KV-L2/KV mode

1. Set the KV-L2's communication mode to "KV mode".
   Set the N-400'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 N-400 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".

5. No other parameters need to be set.

■ Settings for KV-L2/Display Interface mode

1. Set the KV-L2's communication mode to "Display Interface" mode. To use Display Interface mode, select "SYSMAC-C" for the N-400's setting.

2. Set the baud rate, data length, parity and stop bit length according to the RS-232C communication parameters of the N-400.

3. Set the unit number according to the N-400's setting.

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

5. No other parameters need to be set.

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6.3 Device Assignment

The device assignment varies depending on whether the PLC link is used in multi-drop link mode or in multi-head scan mode. The following sections describe the device assignment in each mode.

6.3.1 Device assignment in multi-drop link mode

The data areas used to control the N-400 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 of the N-400 setup software, the device numbers are automatically assigned based on the specified head address.

■ Data memory head address for each ID number and reading trigger areas

The addresses of "+00" to "+30" (based on the specified head address) indicate the areas where the bar code data for each ID number is stored.

The addresses of "+31" to "+61" indicate the areas used to send a reading trigger signal to the BL series. These areas are not assigned if you set "Reading trigger input area" to "Disable" in the N-400 setup software. (In this case, these areas can be used for other purposes.)

Address	Description	Reference page
+00	Data memory head address for ID No. 1	p. 108
+01	Data memory head address for ID No. 2	
+02	Data memory head address for ID No. 3	
: :	: :	
+30	Data memory head address for ID No. 31	
+31	Reading trigger area for ID No. 1	p. 108
+32	Reading trigger area for ID No. 2	
+33	Reading trigger area for ID No. 3	
: :	: :	
+61	Reading trigger area for ID No. 31	

- The "+00" to "+30" data memory head addresses can be set to the same number. If the same head address is specified, data from all the BL series is stored in the same area.

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■ Data memory areas for each ID number

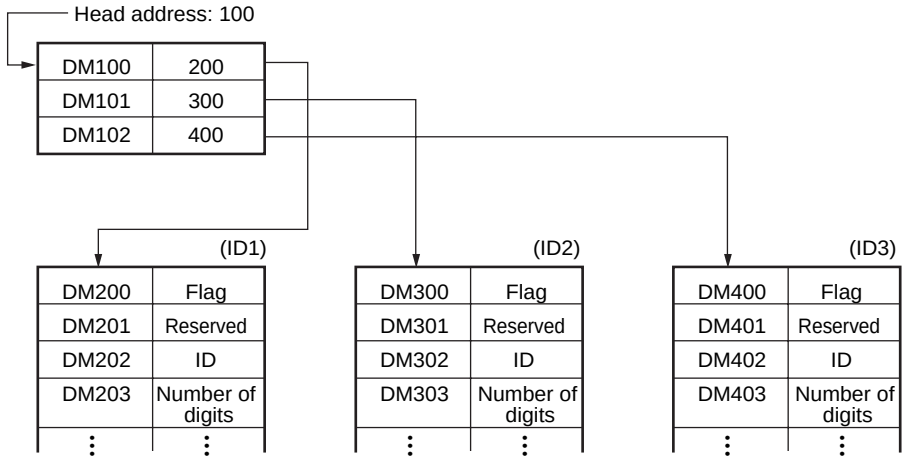
Bar code data read by the BL series for each ID number is stored in the areas of "+00" to "+30" (based on the specified data memory head address). In the following table, "A" indicates the data memory head address.

When ten BL series are connected, ten data memory areas exist (if the different data memory head addresses are specified for each ID number).

Address	Description	Reference page
A + 00	Data memory flag area	pp. 110 and 111
A + 01	Reserved area	—
A + 02	ID number	p. 112
A + 03	Number of digits of bar code data	
A + 04	1st digit of bar code data	
A + 05	2nd digit of bar code data	
A + 06	3rd digit of bar code data	
: :	: :	
A + 258	255th digit of bar code data	

Note: These data areas accept up to 255 digits. However, the BL series can read only 32 digits. Therefore, all the areas for 255 digits are not used for the N-400. Only the areas corresponding to the number of the data digits are used.

Example: When the head address is "100" and three BL series (ID nos. 1 to 3) are connected:



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■ Detailed description on device assignment

+00 to +30
Data memory head address for each ID number

Specify the head address of the areas where the read data are stored. (Specify the head address as binary data.)
Specify different head addresses for each ID number. (If the same address is specified, all data is replaced with the last data when BL series units with different ID numbers continuously read data.)

+31 to +61
Reading trigger area for each ID number

These areas are used to send the trigger input signal to the BL series to start reading bar code data.
You can set these areas to “Used” or “Unused”, depending on the N400’s internal setting. (☞ *See p. 40.*) If you set these areas to “Unused”, users can freely use the areas.

When a photoelectric sensor for trigger input is connected to the BL series, do not use these areas.

Specify these areas as follows:

- Start reading (Trigger ON): 0001
- End reading (Trigger OFF): 0000

Note: Specify these areas as “0000” while the BL series is not reading bar code data.

A +00 (A: Data memory head address specified as +00 to +30)
Data memory flag area

These areas are used as a flag that indicates if bar code data has been stored in each area.
The flag areas can be used for the following two purposes:

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Real-time control

- To specify the flag areas, use “0000” or “0001”.
- While the N-400 is writing the bar code data read by the BL series in the PLC’s memory, the flag area is specified as “0001”.
- When data writing is completed, the flag area becomes “0000”. This indicates that new data has been stored in the A+02 to A+258 addresses.
  When the A+00 address is “0000”, the stored data is effective.

  Example 1
  Normally, the A+00 address is set to “0000”.
  While the N-400 is writing data, the flag area is “0001”. When the flag area becomes “0000”, the data stored in the A+02 to A+258 addresses can be processed.

  Example 2
  Normally, the A+00 address is set to “0001”.
  When data writing is completed, the flag area becomes “0000”. The data stored in the A+02 to A+258 addresses can then be processed.
  Set the A+00 address to “0001” immediately after data processing is completed.
  When the A+00 address becomes “0000”, this indicates that writing new data is completed.

Note: When the BL series 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 below.

Sequential processing

- To specify the flag areas, use “0002” or “0003”.
- When the A+00 address is “0002”, new data can be stored.
- When data writing is completed, the flag area becomes “0003”, and new data has been stored in the A+02 to A+258 addresses.
- After data processing is completed, set the flag area to “0002”. Writing new data is impossible until the flag area is “0002.
- Data which cannot be stored in the specified areas is retained in the BL series’ transmission buffer. (In sequential processing mode, data is retained in the BL series’ transmission buffer instead of the N-400’s transmission buffer. For the capacity of the BL series’ transmission buffer, see p. 63.) If the amount of retained data exceeds the buffer capacity, the “BUFFER OVERFLOW” error occurs and the “OVER” code is stored in the corresponding area.

Tips

Even when the BL series with ID No. 1 retains data (the flag area is “0003”), data from the BL series with other ID numbers can be stored (if the flag area is “0002”). Thus, the sequential processing for each ID number is performed independently.

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A +02 to +258
Data (ID number, number of digits, data) memory area

- The ID number of the BL series that read the data is stored in the A +02 address. The number of data digits is stored in the A +03 address as binary data.
- The read bar code data is stored in the A+04 to +258 addresses using the ASCII codes (Hexadecimal numbers in two digits) by the digit. (*See the ASCII code table on p134.*)
- If a read error occurs, the “ERROR” code is stored in the corresponding area. (The read error code can be easily changed according to the BL series’ setting.)
- If the buffer overflow error occurs with the BL series, the “OVER” code is stored in the corresponding area.

A+02	ID number (1 to 31)
A+03	Number of digits of bar code data (1 to 255)
A+04	1st digit of read data
A+05	2nd digit of read data
:	:
A+258	255th digit of read data

Note: These data areas accept up to 255 digits. However, the BL series can read only 32 digits. Therefore, all of the areas for 255 digits are not used for the N-400. Only the areas corresponding to the number of the data digits are used.

Example: When the BL series with ID No. 12 reads bar code data as “KE12”:

A + 02	12		← ID number
A + 03	4		← Number of digits
A + 04	$004B	"K"	← Specified by ASCII codes (hexadecimal numbers)
A + 05	$0045	"E"	
A + 06	$0031	"E"	
A + 07	$0032	"2"	

Example: When a read error (ERROR) occurs in the BL series with ID No. 4:

A + 02	4		← ID number
A + 03	5		← Number of digits
A + 04	$0045	"E"	← Specified by ASCII codes (hexadecimal numbers)
A + 05	$0052	"R"	
A + 06	$0052	"R"	
A + 07	$004F	"O"	
A + 08	$0052	"R"	

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Operation when a connection error occurs

The power supply of the connected BL series is turned off:
- The BL series is disconnected from the BL-U1 or N-48:
- The cable is disconnected:
- A communication error occurs:

If a communication failure occurs between the BL series and N-400 when the N-400 is in the multi-drop link mode, the N-400 operates as follows:

Address	Contents	Operation during a connection error
A + 00	"Write Data" flag	The flag is turned on as data are area written.
A + 01	Reserved area	
A + 02	ID number	"FFFF" is written.
A + 03	Number of bar code	"1" is written. (This indicates that the number of digits of the error code written in "A + 04" is "1".)
A + 04	First digit of bar code data	During connection error: "N (ASCII codes: 4E)" is written. During communication error: "S (ASCII codes: 53)" is written.

* The above specifications apply to the multi-drop link mode only. The same specifications do not apply to the multi-head scan mode.
* The addresses subsequent to "A + 04" retain the previous data.

Note: If the N-400's power supply is turned on before the BL series is turned on, the N-400 starts communication before the BL series starts. This results in the above connection error. Create programs that ignore the connection error when the power supply is turned on in this case.

6.3.2 Device assignment in multi-head scan mode

These areas are used to store the bar code data read in multi-head scan mode. Unlike multi-drop link mode, multi-head scan mode can control several BL series like a single unit. Therefore, this mode provides only one data memory area.

Address	Description	Reference page
A + 00	Data memory flag area	pp. 113 and 114
A + 01	Reading trigger area	p. 114
A + 02	BL series ID number memory area	p. 115
A + 03	Number of digits of bar code data	
A + 04	1st digit of bar code data	
A + 05	2nd digit of bar code data	
:	:	
:	:	
A + 06	3rd digit of bar code data	
A + 258	255th digit of bar code data	

■ Detailed description on device assignment

+00
Data memory flag area

This area is used as a flag that indicates if bar code data has been stored in the area.
The flag area can be used for the following two purposes:

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Real-time control

- To specify the flag area, use “0000” or “0001”.
- While the N-400 is writing the bar code data read by the BL series in the PLC’s memory, the flag area is specified as “0001”.
- When data writing is completed, the flag area becomes “0000”. This indicates that new data has been stored in the A+02 to A+258 addresses.
  When the A+00 address is “0000”, the stored data is available.

  Example 1
  Normally, the A+00 address is set to “0000”.
  While the N-400 is writing data, the flag area is “0001”. When the flag area becomes “0000”, the data stored in the A+02 to A+258 addresses can be processed.

  Example 2
  Normally, the A+00 address is set to “0001”.
  When data writing is completed, the flag area becomes “0000”. The data stored in the A+02 to A+258 addresses can then be processed.
  Set the A+00 address to “0001” immediately after data processing is completed.
  When the A+00 address becomes “0000”, this indicates that writing new data is completed.

Note: When the BL series 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. This prevent this, use the sequential processing mode.

6

Sequential processing

- To specify the flag area, use “0002” or “0003”.
- When the A+00 address is “0002”, new data can be stored.
- When data writing is completed, the flag area becomes “0003”, and new data has been stored in the A+02 to A+258 addresses.
- After data processing is completed, set the flag area to “0002”. Writing new data is impossible until the flag area is “0002.
- Data which cannot be stored in the specified areas is retained in the BL series’ transmission buffer. (⇨ *For the capacity of the BL series’ transmission buffer, see p. 63.*) If the amount of retained data exceeds the buffer capacity, the buffer overflow error occurs and the “OVER” code is stored in the corresponding area.

+01
Reading trigger area

This area is used to send the trigger input signal to the BL series to start reading bar code data.
You can set this area to “Used” or “Unused”, depending on the N400’s internal setting. (⇨ *See p. 41.*) If you set this area to “Unused”, users can freely use it.

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When a photoelectric sensor for trigger input is connected to the BL series, do not use this area.
Specify this area as follows:

- Start reading (Trigger ON): 0001
- End reading (Trigger OFF): 0000

Note: Specify this area as “0000” while the BL series is not reading bar code data.

+02 to +258
Data (ID number, number of digits, data) memory area

- The ID number of the BL series that read the data is stored in the +02 address. The number of data digits is stored in the +03 address as binary data.
- The read bar code data is stored in the +04 to +258 addresses using the ASCII codes (Hexadecimal numbers in two digits) by the digit. (See the ASCII code table on p.134.)
- If a read error occurs, the “ERROR” code is stored in the corresponding area. (The read error code can be easily changed according to the BL series’ setting.)
- If the buffer overflow error occurs with the BL series, the “OVER” code is stored in the corresponding area.

A+02	ID number (1 to 31)
A+03	Number of digits of bar code data (1 to 255)
A+04	1st digit of read data
A+05	2nd digit of read data
:	:
A+258	255th digit of read data

Note: These data areas accept up to 255 digits. However, the BL series can read only 32 digits. Therefore, all of the areas for 255 digits are not used for the N-400. Only the areas corresponding to the number of the data digits are used.

Example: When the BL series reads bar code data as “KE12”:

+ 02	12		← ID number
+ 03	4		← Number of digits
+ 04	$004B	"K"	← Specified by ASCII codes (hexadecimal numbers)
+ 05	$0045	"E"	
+ 06	$0031	"1"	
+ 07	$0032	"2"	

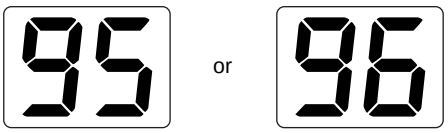
Example: When a read error (ERROR) occurs:

+ 02	1		← ID number
+ 03	5		← Number of digits
+ 04	$0045	"E"	← Specified by ASCII codes (hexadecimal numbers)
+ 05	$0052	"R"	
+ 06	$0052	"R"	
+ 07	$004F	"O"	
+ 08	$0052	"R"	

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6.4 PLC Link Error

When a communication error occurs during PLC link, communication stops and the N-400 displays the following code:



When this error occurs with the PLC link, check the following points:

1. Check if the RS-232C communication parameters (baud rate, data length, parity and stop bit) for the PLC are matched with the N400's settings.

2. Check if the N-400's communication mode is set to "KV", "MELSEC" or "SYSMAC".

3. Check if the PLC's settings are correct. (See pp. 106 and 107.)

4. Check if the cable connections are correct, or if any cable is disconnected. Referring to pp. 14 to 16 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 N-400 do not exist in the PLC, communication is impossible.

6. Check if the link unit operates normally.

To re-start the PLC link, press the test switch.

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

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6.5 Communication Time

Even in PLC link mode, the RS-485 communication between the N-400 and each BL series is regarded as the same as standard mode serial communication. (⇨ *See pp. 83 to 85.*)

The time required for the RS-232C communication between the N-400 and the PLC is described below:
This communication time may change depending on the PLC's scan time and the model of the PLC.

■ Time required for RS-232C data transmission in PLC link mode

The time required for data transmission from the N-400 to the PLC is as follows:
This time duration corresponds to the "RS-232C data transmission time in multi-drop link mode" (B) described on p. 84. To obtain the total communication time, add the "RS-485 data transmission time" (A) described on p. 82.

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

Number of data digits	MELSEC-A	SYSMAC-C	KV(KV mode)
10	Approx. 300 ms	Approx. 350 ms	Approx. 500 ms
20	Approx. 350 ms	Approx. 400 ms	Approx. 750 ms
32	Approx. 400 ms	Approx. 500 ms	Approx. 1050 ms

■ Communication time to start reading using reading trigger area

To control the BL 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 N-400.

This time duration corresponds to the "RS-232C command transmission time"(C) described on p. 84.

To obtain the total communication time, add the "RS-485 command transmission time" (D + b) described on p. 84.

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

Number of connected BL series	MELSEC-A	SYSMAC-C	KV(KV mode)
1	Approx. 150 ms	Approx. 150 ms	Approx. 100 ms
31	Approx. 400 ms	Approx. 600 ms	Approx. 1.5 s

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Appendix A Specifications

N-400

Model		N-400
Connectable bar code reader		BL-700 series, BL-500 series, BL-180 series
Trigger input	Rated input	15 to 26 VDC, 10 mA max.
	Max. OFF current	1.0 mA
RS-232C	Applied standards	EIA, RS-232C standards
	Synchronization	Start-stop (full-duplex)
	Transmission code	ASCII code
	Baud rate	600/1200/2400/4800/9600/19200/31250/38400bps
	Data length	7 or 8 bits
	Parity check	Even/Odd/None
	Stop bit length	1 or 2 bits
RS-485	Applied standards	EIA, RS-485 standards
	Synchronization	Start-stop (full-duplex)
	Transmission code	ASCII code
	Baud rate	600/1200/2400/4800/9600/19200/31250/38400 bps
	Data length	7 or 8 bits
	Parity check	Even/Odd/None
	Stop bit length	1 or 2 bits
	Max. number of connectable units	31
	Max. total 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 or corrosive gas
Vibration resistance		10 to 55 Hz, 1.5 mm double amplitude in X, Y and Z directions, respectively
Power supply voltage		24 VDC +10%/-20%
Current consumption		140 mA max.
Weight		Approx. 180 g

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N-48

Model		N-48
Conversion interface		RS-232C & RS-485 (Level conversion)
Connectable bar code reader		BL-500 series
		BL-180 series
Power supply for bar code reader		5 VDC ±5% (600 mA)
Trigger input	Rated input	15 to 26 VDC, 10 mA max.
	Max. OFF current	1.0 mA
OK/NG output	Output form	NPN open-collector
	Rated load	30 VDC, 100 mA
	Leakage current (at OFF)	0.1 mA max.
	Residual voltage (at ON)	1 V max.
Interface		RS-485 multi-drop (Max. number of connectable units: 31) (Max. total 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 or corrosive gas
Vibration resistance		10 to 55 Hz, 1.5 mm double amplitude in X, Y and Z directions, respectively
Power supply voltage		24 VDC +10%/-20%
Current consumption		260 mA max.
Weight		Approx. 100 g

BL-U1

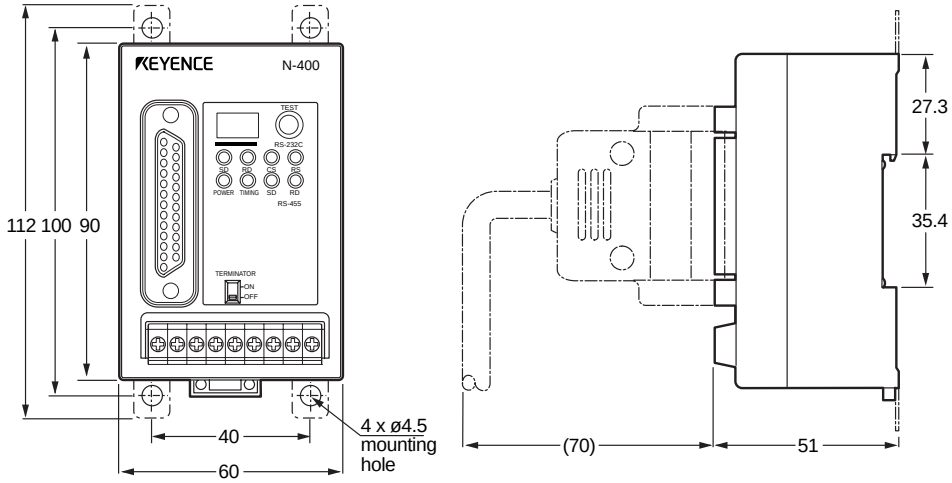
Model		BL-U1
Power supply for bar code reader		5 VDC ±5% (1.5 A)
Power supply for sensor		12 V ±10% (300 mA)
Trigger input	Rated input	8.5 to 30 VDC, 10 mA max.
	Max. OFF current	0.5 mA
OK/NG output	Output form	NPN open-collector
	Rated load	30 VDC, 100 mA
	Leakage current (at OFF)	0.1 mA max.
	Residual voltage (at ON)	1 V max.
Interface		RS-232C, RS-422A, RS-485 multi-drop (Max. number of connectable units: 31) (Max. total 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 or corrosive gas
Vibration resistance		10 to 55 Hz, 1.5 mm double amplitude in X, Y and Z directions, respectively
Power supply voltage		100 to 240 VAC (50/60 Hz)
Power consumption		40 VA (100 VAC), 50 VA (240 VAC)
Weight		Approx. 615 g (including cable)

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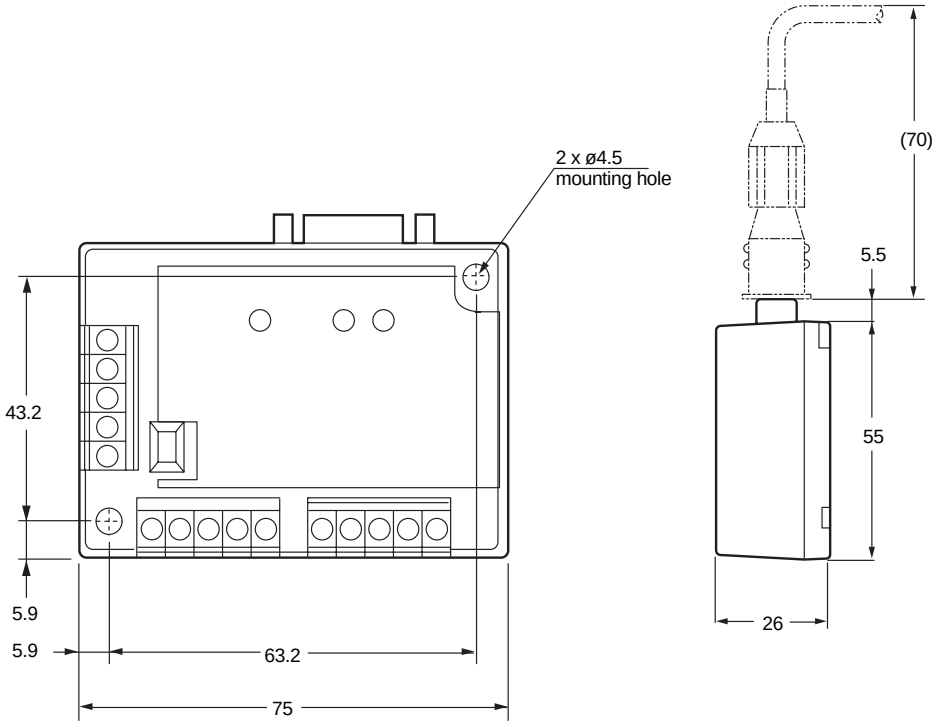
Appendix B Dimensions

Unit: mm

N-400

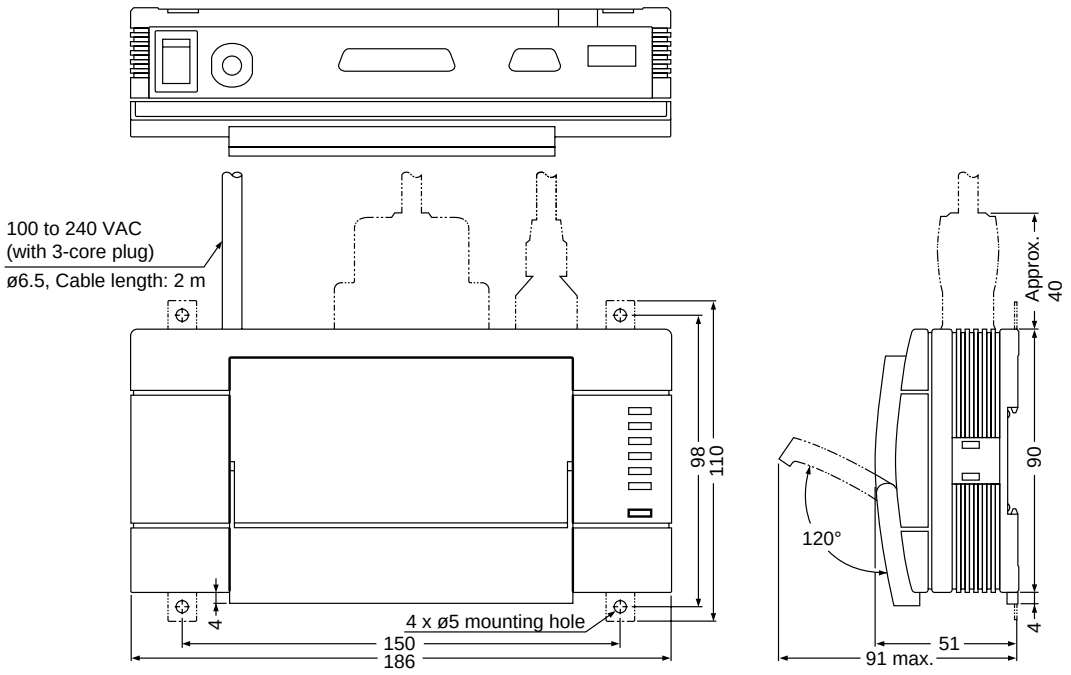


N-48



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BL-U1



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Appendix C Sample Programs

Sample programs for multi-drop link

The following program (QBASIC) is an example of a serial communication program for multi-drop link mode and multi-head mode.

The bar code data read by the BL series, along with the transmitted command and response to the command can be displayed.

Enter the commands using the keyboard and press the [Return] key to send the command.

Set the N-400 as follows:

- Header: None
- Delimiter: **[CR]**
- Handshaking protocol: No handshaking or PASS/RTRY protocol

```
100  '***N-400 SAMPLE PROGRAM*******************************
110    'CLS 3
120    DAT$ = "": RD$ = "": CM$ = ""
130    OPEN "COM1:9600,E,7,1,RS,CS,DS,CD" FOR RANDOM AS #1
140  '*BUFFCLR '***CLEARING BUFFER**************************
150    A = LOC(1)
160    IF A <> 0 THEN R$ = INPUT$(1, #1): GOTO 140
165   '
170  '*MAIN '***MAIN ROUTINE********************************
180    A = LOC(1)
190      K$ = INKEY$
195   WHILE K$ <> "E"
200      IF K$ <> "" THEN GOSUB 410
210    IF A = 0 THEN 170
220      RD$ = INPUT$(1, #1)
320        IF RD$ = CHR$(&HD) THEN GOSUB 1000: GOTO 170
330      DAT$ = DAT$ + RD$
340   GOTO 170
400  '
410  '*COMMAND :'***TRANSMITTING COMMAND********************
420   IF K$ = CHR$(&HD) THEN 470
440     CM$ = CM$ + K$
450     PRINT K$;
460     RETURN
470  '*SEND
480    PRINT #1, CM$; CHR$(&HD); :             'TRANSMITTING COMMAND
490    PRINT : PRINT CM$; " WAS SENT"
500    CM$ = ""
510  RETURN
520    '
1000 '*RECEIVE :'***RECEIVING*******************************
1010   LDAT$ = LEFT$(DAT$, 2)
1020    IF LDAT$ = "%P" THEN GOSUB 2000: RETURN
1030    IF LDAT$ = "%T" THEN GOSUB 3000: RETURN
1040    GOSUB 3000: RETURN
1050   '
2000 '*DATA RECEIVE :'***RECEIVING DATA*********************
2010   MDAT$ = MID$(DAT$, 6, 4)
2020     IF MDAT$ = "OVER" THEN GOSUB 4000: RETURN
2030   MDAT$ = MID$(DAT$, 6, 2)
2040     IF MDAT$ = "NC" THEN GOSUB 5000: RETURN
2050   MDAT$ = MID$(DAT$, 6, 4)
2060     IF MDAT$ = "SERR" THEN GOSUB 6000: RETURN
2070   MDAT$ = MID$(DAT$, 6, 1)
2080     IF MDAT$ = "e" THEN GOSUB 7000: RETURN
2090   GOSUB 8000: RETURN
```


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```
2100  '
3000 '*COMMAND RECEIVE:'***RECEIVING COMMAND***************
3010   MDAT$ = MID$(DAT$, 6, 2)
3020     IF MDAT$ = "NC" THEN GOSUB 5000: RETURN
3030   MDAT$ = MID$(DAT$, 6, 4)
3040     IF MDAT$ = "SERR" THEN GOSUB 6000: RETURN
3050   GOSUB 9000: RETURN
3060  '
4000 '*BUFFOVER :'***BUFFER OVER***************************
4010    PRINT DAT$
4020    PRINT "THE UNIT #"; MID$(DAT$, 3, 2); " OCCURS BUFFER OVER."
4030  DAT$ = ""
4040  RETURN
4050  '
5000 '*NOCONNECT :'***CONNECTION ERROR*********************
5010    PRINT DAT$
5020    PRINT "THE UNIT #"; MID$(DAT$, 3, 2); " IS NOT CONNECTED."
5030  DAT$ = ""
5040  RETURN
5050   '
6000 '*SRLERR :'***COMMUNICATION ERROR*********************
6010    PRINT DAT$
6020    PRINT "COMMUNICATION ERROR - PLEASE RETRY"
6030  DAT$ = ""
6040  RETURN
6050  '
7000 '*EMPTY :'***NO DATA**********************************
7010    PRINT DAT$
7020    PRINT "THE UNIT #"; MID$(DAT$, 3, 2); " HAS NO DATA."
7030  DAT$ = ""
7040  RETURN
7050  '
8000 '*BARCODE :'***DISPLAYING READ DATA*******************
8010    PRINT DAT$
8020    PRINT "THE UNIT #"; MID$(DAT$, 3, 2); " READS THE DATA AS";
MID$(DAT$, 6)
8030  DAT$ = ""
8040  RETURN
8050  '
9000 '*RESPONSE :'***DISPLAYING RESPONSE*******************
9010    PRINT DAT$; " WAS RETURNED."
9020  DAT$ = ""
9030  RETURN
9040  WEND
9050  CLOSE #1
9060  END
```

Note: This sample program is shown for your reference only. Please note that this may not work correctly depending on the version of BASIC you use.

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Sample program for PLC link

The following is an example of a PLC link program for multi-drop link mode.

Data is stored in the following areas. Process the data using the program as desired.

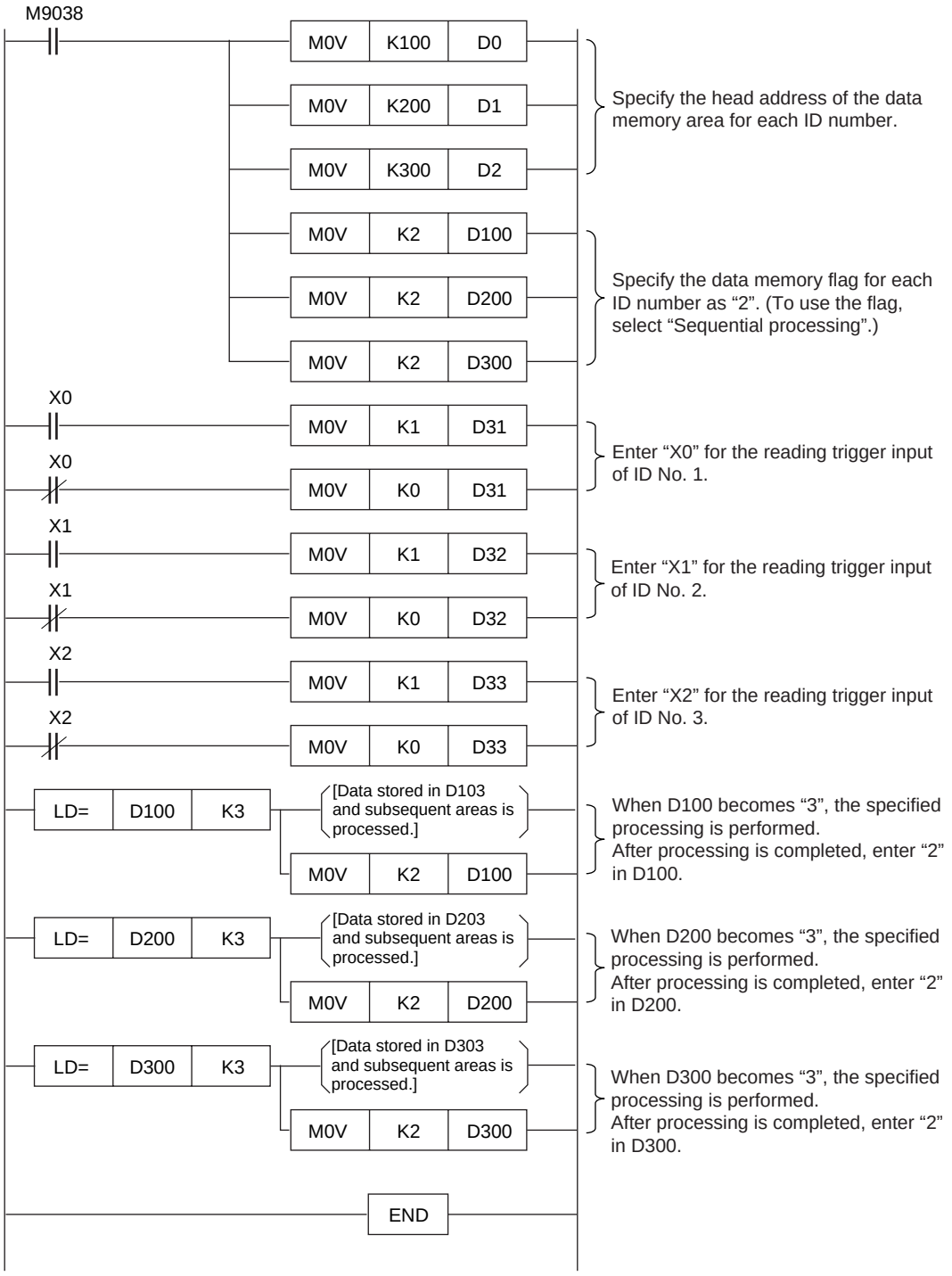
- ID 1: D103 (DM103) and subsequent areas
- ID 2: D203 (DM203) and subsequent areas
- ID 3: D303 (DM303) and subsequent areas

You can use this program based on the following conditions:

- Number of connected BL series: 3
- N-400's settings
  - Mode: Multi-drop link
  - Using PLC trigger area: Enable
- Data memory flag: Sequential processing

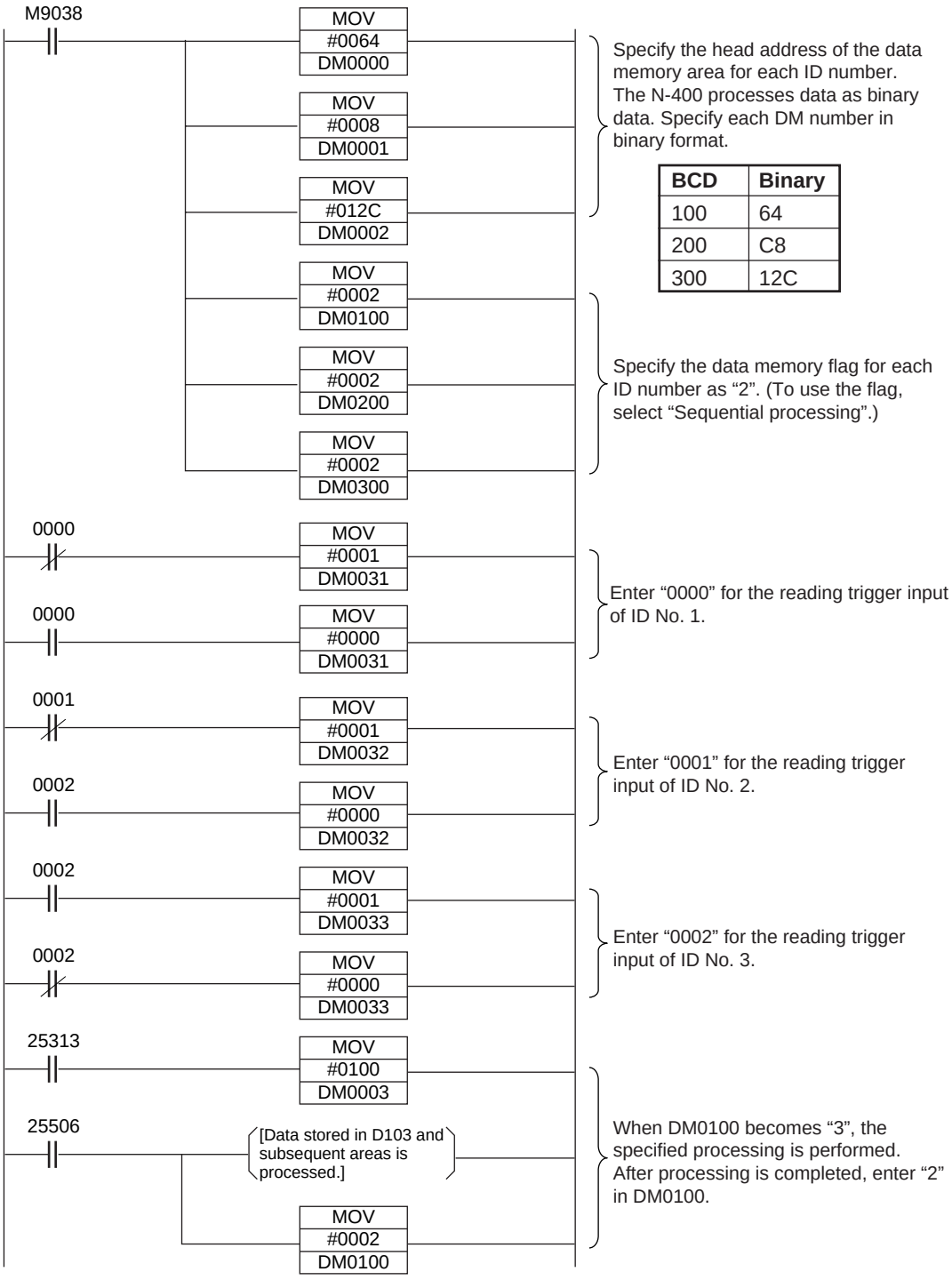
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Program for the MELSEC-A Series



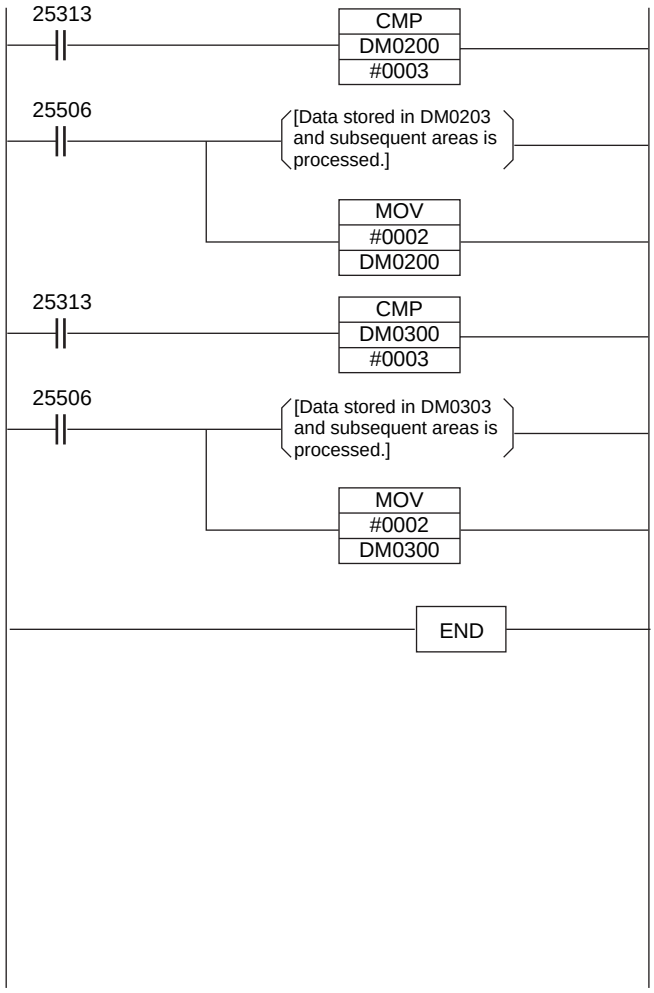
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Program for the SYSMAC-C series



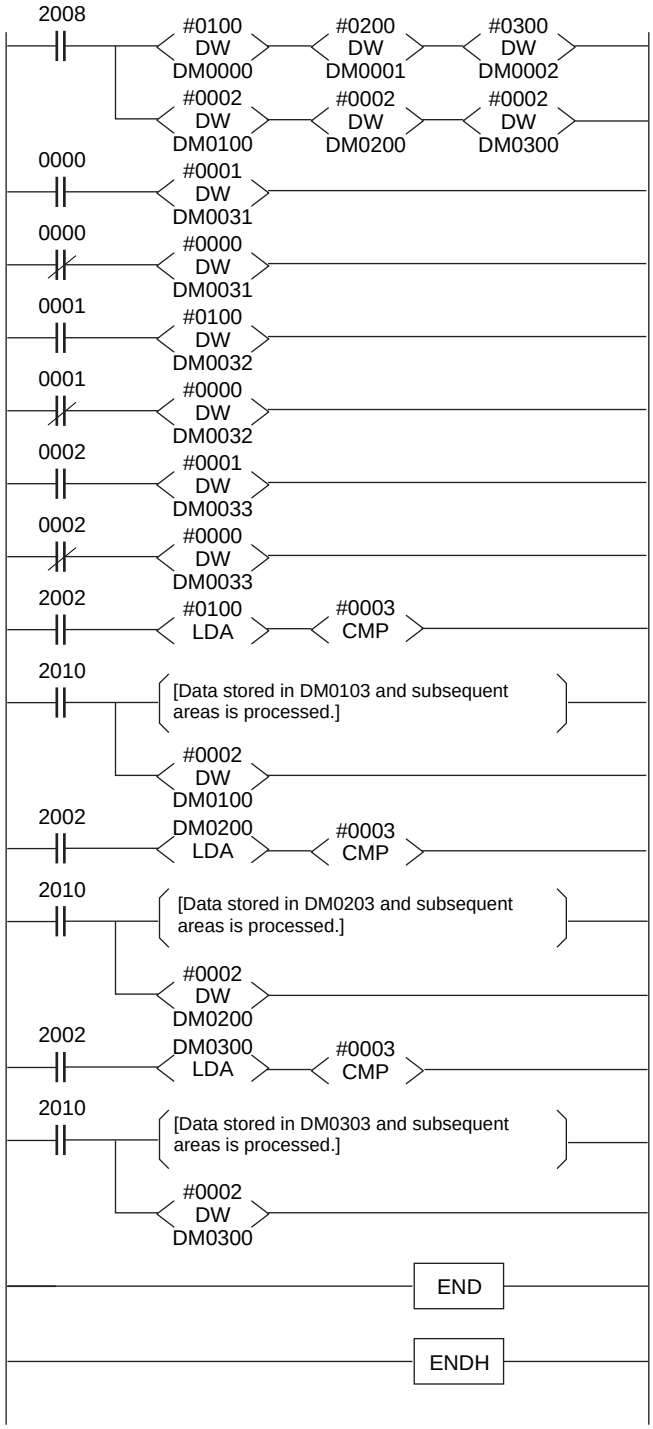
BCD	Binary
100	64
200	C8
300	12C

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Program for the KV series



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Appendix D Troubleshooting

If an abnormal condition occurs while operating this unit, check the following points. If you cannot solve the problem, contact KEYENCE.

Communication is unsuccessful.

1) Check communication between the N-400 and each BL series using the N-400's connection test mode.
   If communication is unsuccessful, check the following points:

① Check if the power switches of the N-400 and all BL series are ON.

② Check if the RS-485 communication parameters (baud rate, data length, parity and stop bit length) for the BL series are the same as the N-400's settings.

③ Check if the BL series is set to multi-drop link mode.

④ Check if the same ID number is assigned to different BL series.

⑤ Check if the specified cable is used for the multi-drop link connection, the cable extension is within the specified distance (1.2 km), and the number of connected BL series is within the specified range (thirty one).

⑥ Check if the multi-drop link connection is not passed through the terminal block or not branched. (➪ *See pp. 20 and 25.*)

⑦ Check if the terminators are correctly set in the multi-drop link connection. (➪ *See pp. 20 and 25.*)

2) Check the communication between the N-400 and the host computer for the following points:

① Check if the communication parameters (baud rate, data length, parity and stop bit length) for the host computer are the same as the N-400's settings.

② Check if the N-400's handshaking protocol is set as desired. Normally, the handshaking protocol is set to "No handshaking".

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3) Check the N-400's settings for the following points:

① Check if the ID numbers of all connected BL series have been registered on the "ID SETUP" screen of the N-400 setup software.

② To use multi-head mode, check the following points in addition to the above.

i) Check if the BL series is set to "Single label" reading mode.

ii) Check if the BL series' trigger input signal type is set to "Level".

iii) Check if the BL series' read error code setting is the same as the N-400.

iv) Check if the BL series' reading start/end commands are the same as the N-400's settings.

"PLC link error" occurs. (The N-400 displays "95" or "96".)

➪ *For details, see p. 116.*

"BUFFER OVERFLOW" error occurs with the BL series. (The BL series sends back the "OVER" code.)

➪ *For details, see p. 64.*

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Appendix E Indications on the N-400

The N-400 displays the following codes:

■ Status indication

These codes indicate that the N-400 is in a special condition.

S0 (S0):
When you press and hold the test switch for five seconds, this code is displayed. When the N-400 displays this code, the communication parameters are set as follows: (☞ *See p. 48.*)
This code is used to send settings to the N-400 on the N-400 setup software.

Baud rate: 9600 bps
Data length: 7 bits
Parity: Even
Stop bit length: 1 bit
Using PLC link: Disable

S1(S1):
The code indicates that the N-400 is in SETUP mode. This code is displayed after the SSET command is sent, or while settings are sent to the N-400 or received from the N-400 on the setup software.

■ Error indication

The following codes indicate that the N-400 is in an abnormal condition.

“99”: 99
That the N-400 is defective. If this error cannot be removed even when the test switch is pressed, contact KEYENCE.

“98”: 98
Indicates an EEPROM memory error. All the settings will be initialized. Press the test switch to reset this error.

“97”: 97
Indicates a data overflow in the N-400’s buffer. Press the test switch to reset this error.

“96”, ”95”: 96 95
Displayed when communication is abnormal in PLC link mode. (Indicates a PLC link error.) Press the test switch to reset this error.

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Appendix F ASCII Code Table

		High-order 4 bits							
	Hexadecimal	0	1	2	3	4	5	6	7
	Binary	0000	0001	0010	0011	0100	0101	0110	0111
Low-order 4 bits	0	0000		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	NAK	$	4	D	T	d	t
	5	0101	ENQ	DC4	%	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	→	,	<	L	\	l	|
	D	1101	CR	←	–	=	M	]	M	}
	E	1110	SO	↑	.	>	N	^	n	~
	F	1111	SI	↓	/	?	O	_	o	del

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Appendix G 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.)

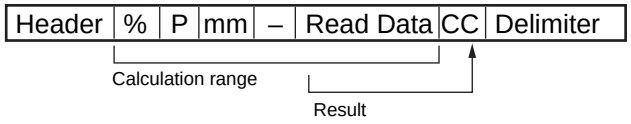
Adding a checksum enables incorrect data translation to be detected in the RS-232C communication. If the checksum does not match when the PASS/RTRY or ACK/NAK protocol is used, modify the program so that the “Request to resend” (RTRY or NAK) command is sent to the N-400. To set the checksum, use the “PROTOCOL SETUP” screen of the N-400 setup software. (The checksum cannot be added when the PLC link is used.)

■ Checksum calculation range and the position to add checksum

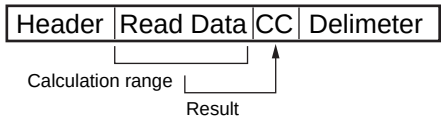
The checksum calculation is performed with all characters except for the header and delimiter. The checksum is added immediately before the delimiter.

CC = Checksum (Two ASCII code characters)

- Data communication in multi-drop link mode

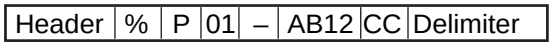


- Data communication in multi-head mode



■ Checksum calculation method

Example:



Calculate the checksum (CC) in the above 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.

Data	ASCII code (Hexadecimal)	Binary	
%	25h	0010	0101
P	50h	0101	0000
0	30h	0011	0000
1	31h	0011	0001
–	2Dh	0010	1101
A	41h	0100	0001
B	42h	0100	0010
1	31h	0011	0001
2	32h	0011	0010 ⊕
		0101	1001 → 59h

* 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”.

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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 = 59 (35h 39h).

Example:

Header	%	P	15	–	ERROR	CC	Delimiter

Result:
CC=04

Header	1234	CC	Delimiter

CC=04

Tips

- Exclusive OR calculation formula
  Calculate the numbers of each bit, referring to the following formula:

  0 ⊕ 0 = 0
  0 ⊕ 1 = 1
  1 ⊕ 0 = 1
  1 ⊕ 1 = 0

* ⊕ : Operator of Exclusive OR

- 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

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Appendix H Setup Parameter List

HOST MODE

Mode	❑ Multi-drop link mode		
	❑ Multi-head mode	Interference suppression	❑ Disable ❑ Enable
		Trigger ON time for interference suppression	( ) * 10 ms to 2550 ms
		Reading mode	❑ Single label ❑ Multi label 1 ❑ Multi label 2
		Data-send timing	❑ After reading ❑ At trigger OFF
		Read error code	( ) * Up to eight characters

TRIGGER SETUP (Effective in multi-head mode only)

Trigger input signal type	❑ Level	❑ One-shot
One-shot input time	( )	* 100 ms to 25.5 s
Input time	❑ 2 ms	❑ 10 ms
State	❑ Normally-open	❑ Normally-closed
Trigger ON command	( )	* Up to eight characters
Trigger OFF command	( )	* Up to eight characters

PROTOCOL SETUP

PLC link	❑ Disable	Handshaking	❑ No handshaking ❑ PASS/RTRY ❑ ACK/NAK
		Header	❑ None ❑ STX ❑ ESC ❑ Custom ( ) * Up to five characters
		Delimiter	❑ CR ❑ CR + LF ❑ ETX ❑ Custom ( ) * Up to five characters
		Add ID	❑ Do not add ❑ Add
		Checksum	❑ Do not add ❑ Add
	❑ Enable	PLC model name	❑ SYSMAC-C ❑ MELSEC-A ❑ KV
		PLC trigger area	❑ Disable ❑ Enable
		DM head address	( ) 00 * 0000 to 9900
		PLC station/ unit number	( ) * 000 to 255
		File register	❑ Disable ❑ Enable
		File register block number	( ) * 000 to 255

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ID SETUP

❑ 01	❑ 08	❑ 14	❑ 20	❑ 26
❑ 02	❑ 09	❑ 15	❑ 21	❑ 27
❑ 03	❑ 10	❑ 16	❑ 22	❑ 28
❑ 04	❑ 11	❑ 17	❑ 23	❑ 29
❑ 05	❑ 12	❑ 18	❑ 24	❑ 30
❑ 06	❑ 13	❑ 19	❑ 25	❑ 31
❑ 07				

RS-232C SETUP

Baud rate	( )	* 600 to 38400 bps
Data length	❑ 7 bits ❑ 8 bits	
Parity	❑ Even ❑ Odd ❑ None	
Stop bit length	❑ 1 bit ❑ 2 bits	
RTS/CTS handshaking	❑ Disable ❑ Enable	

RS-485 SETUP

Baud rate	( )	* 600 to 38400 bps
Data length	❑ 7 bits ❑ 8 bits	
Parity	❑ Even ❑ Odd ❑ None	
Stop bit length	❑ 1 bit ❑ 2 bits	

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Appendix I Default Setting List

HOST MODE

Mode	Multi-drop link

PROTOCOL SETUP

PLC link	Disable
Handshaking	No handshaking
Header	None
Delimiter	CR
Add ID	Add
Checksum	Do not add

ID SETUP

Only ID 1 is registered.

RS-232C SETUP

Baud rate	9600
Data length	7 bits
Parity	Even
Stop bit length	1 bit
RTS/CTS handshaking	Disable

RS-485 SETUP

Baud rate	9600
Data length	7 bits
Parity	Even
Stop bit length	1 bit

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Appendix J Sample Printout of Setting List

/ / / New setting data [Untitled] / / /

[X] selected
[ ] - - - - - -
=> Changed

1) HOST MODE

[MODE]	[X] MULTI-DROP LINK [ ] MULTI-HEAD SCAN
[Interference Suppression]	[X] Disable [ ] ENABLE Timer [10] x 10 msec
[Read mode]	[X] Single [ ] Multi 1 [ ] Multi 2
[Data-send]	[X] After read [ ] At trigger input
[Read error code]	ERROR [4552524F52]

2) Trigger setup (only with MULTI-HEAD SCAN)

[Signal type]	[X] Level [ ] One-shot
[One-shot input time]	[10] x 100 ms
[Input time]	[X] 2 ms [ ] 10 ms
[State]	[X] Normally-open [ ] Normally-close
[Command for Trigger ON]	LON [4C4F4E]
[Command for Trigger OFF]	LOFF [4C4F4646]

3) PROTOCOL SETUP

[Use PLC]	[X] Don't use [ ] Use
[Handshaking]	[X] No handshaking [ ] PASS/RTRY [ ] ACK/NAK
[Header]	[X] None [ ] STX [ ] ESC [ ] Custom
[Delimiter]	[X] CR [ ] CR + LF [ ] ETX [ ] Custom
[Add ID]	[ ] Don't Add [X] Add
[Checksum]	[X] Don't Add [ ] Add
[PLC Model Name]	[ ] SYSMAC-C [ ] MELSEC-A [ ] KV
[PLC Trigger Area]	[X] Disable [ ] ENABLE
[DM Head Address]	000
[PLC Station/Unit No.]	0
[File Register]	[X] Disable [ ] ENABLE
[File Register Block Number]	0

4) ID setup

[X]01 [ ]02 [ ]03 [ ]04 [ ]05 [ ]06 [ ]07 [ ]08 [ ]09
[ ]10
[ ]11 [ ]12 [ ]13 [ ]14 [ ]15 [ ]16 [ ]17 [ ]18 [ ]19
[ ]20
[ ]21 [ ]22 [ ]23 [ ]24 [ ]25 [ ]26 [ ]27 [ ]28 [ ]29
[ ]30
[ ]31

5) RS-232C

[Baud rate]	9600 bit/s
[Data bits]	[X] 7 bits [ ] 8 bits
[Parity]	[X] Even [ ]Odd [ ]None
[Stop bits]	[X] 1 bit [ ]2 bits
[RTS / CTS]	[X] Invalid [ ]Use RTS / CTS handshaking

6) RS485

[Baud rate]	9600 bit/s
[Data bits]	[X] 7 bits [ ] 8 bits
[Parity]	[X] Even [ ]Odd [ ]None
[Stop bits]	[X] 1 bit [ ]2 bits

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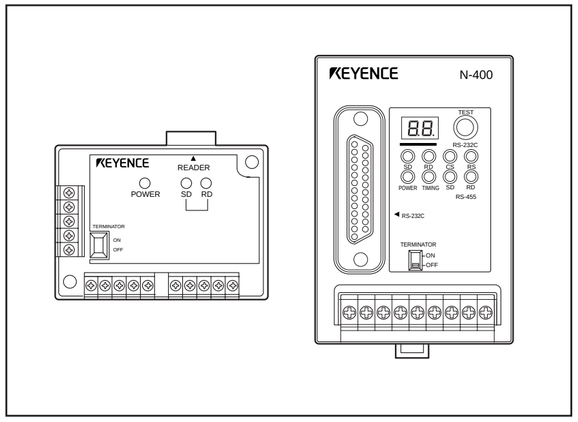
KEYENCE

96M0353

User's Manual

Multi-Drop Controller for BL Series

N-400



Specifications are subject to change without notice.

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