Magnescale®

BCD Unit

LZ71-B

Read all the instructions in the manual carefully before use and strictly follow them.
Keep the manual for future references.

Instruction Manual

[For U.S.A. and Canada]

THIS CLASS A DIGITAL DEVICE COMPLIES WITH PART15 OF THE FCC RULES AND THE CANADIAN ICES-003. OPERATION IS SUBJECT TO THE FOLLOWING TWO CONDITIONS.
(1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND
(2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDERSIGNED OPERATION.

CET APPAREIL NUMÉRIQUE DE LA CLASSE A EST CONFORME À LA NORME NMB-003 DU CANADA.

[For the customers in Australia]

Australian EMC Notice

This product complies with the following Australian EMC standards.
AS/NZS 4252.1 /94 EMC Generic Immunity Part1
AS/NZS 2064 /92 Emission Standard for ISM Equipment

Contents

INSTALLATION

OPERATION

INSTALLATION

Be sure to read this section before use.

1. Before Operation

Thank you for purchasing this Magnescale Co., Ltd. product.

Read this instruction manual through carefully before use, and keep it properly for future references. In particular, the contents of "3. Installation and Connection" are especially important for ensuring proper operation. Be sure to read this section and make sure the expansion unit is installed correctly before use. This instruction manual mainly explains the differences when the expansion unit is added to the LY71 counter unit. For other contents, see the LY71 instruction manual.

1-1. Precautions

This expansion unit is designed for use connected with the LY71, and requires the same handling cautions as when the LY71 is used alone.

See the LY71 instruction manual for the various cautions.

1-2. Item List
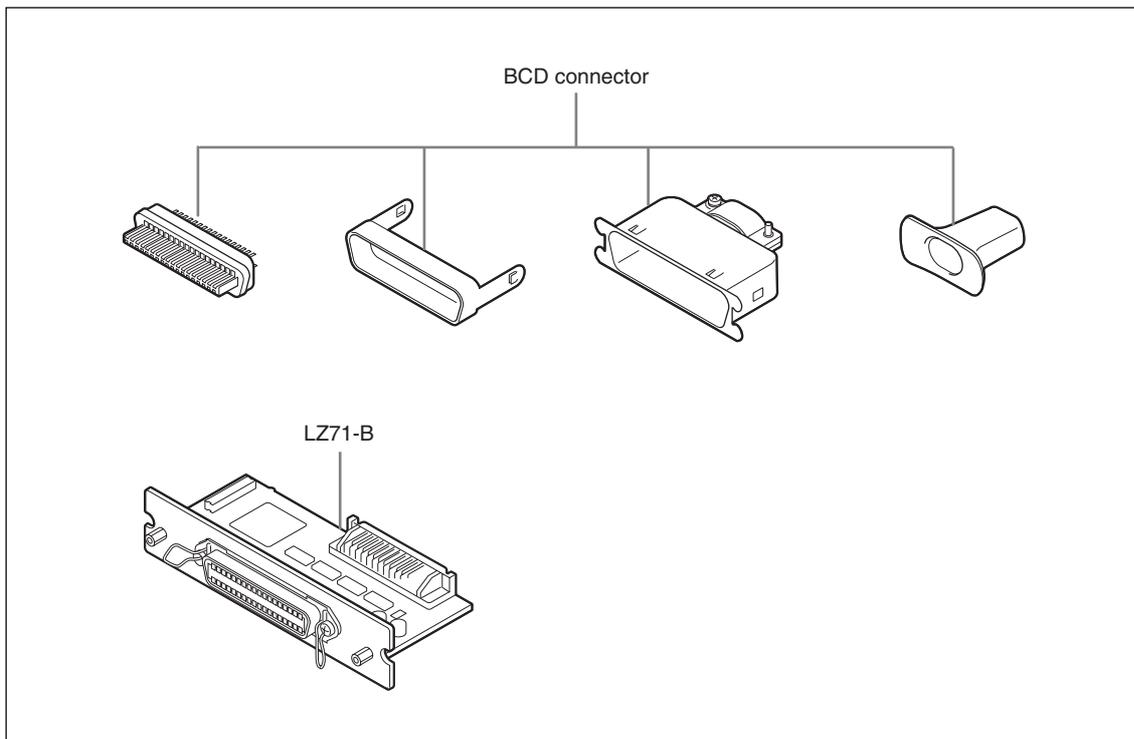
1-3. Features

Easy function expansion

The functions of your current LY71 counter unit can be expanded simply by inserting the expansion unit into the LY71.

BCD output of various data

In addition to the current value, the maximum, minimum and peak-to-peak values can be output as BCD data for use as control data by PLC (Programmable Logic Controller) and other devices.

Various output modes

In addition to positive logic, BCD data can also be output in negative logic. The expansion unit also supports a wide range of systems with output formats including constant output (*), latch (**) and request output.
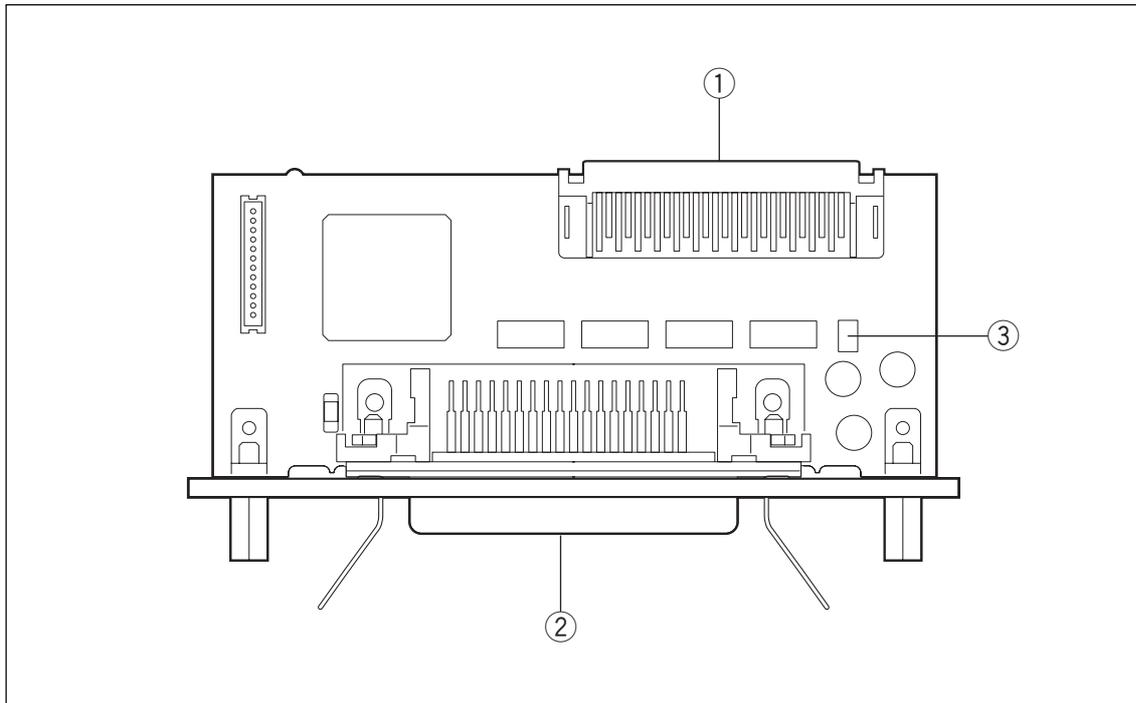
(*)　Prohibited when updating data.

(**)　There are two types of latch: BCD data only and BCD data and display.

Open collector output

Output data is output in open collector format, allowing direct connection with PLC (Programmable Logic Controller) and other devices.

2. Name and Function of Each Part

① **60-pin connector**

   Used to insert the expansion unit into the LY unit body.

② **BCD output connector**

   Used for BCD data output and data request signal input.

③ **SW300 switch**

   1: ON (at shipment) .... See "3-2-4. Input circuit delay time" for details.
   2: OFF (fixed)

3. Installation and Connection

3-1. Installing the Expansion Unit

1 Remove the screening cover of the expansion unit slot and insert the expansion unit.
The expansion unit may be installed in any of the two slots. If two BCD units are used, insert both units.
When using two BCD units, BCD1 is fixed at the 1st axis, and BCD2 is fixed at the 2nd axis.

2 Secure the expansion unit firmly in place using the screws which held the screening cover in place.

Use when removing
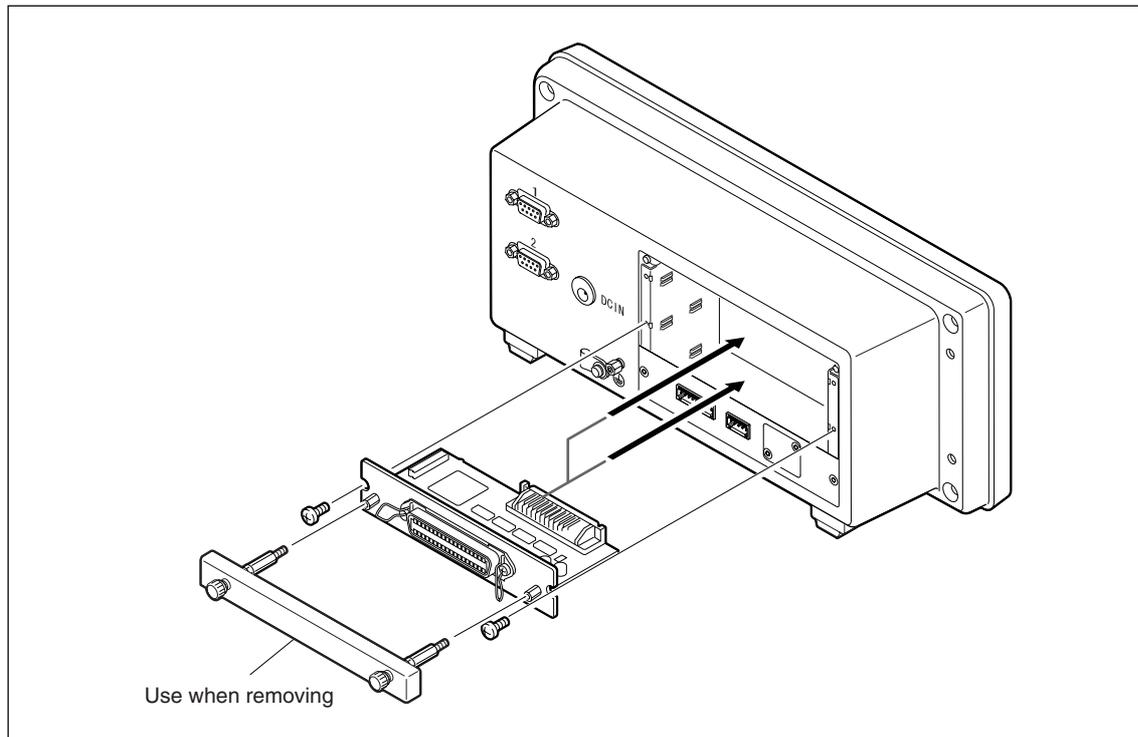
3-2. Connecting the Output Connector

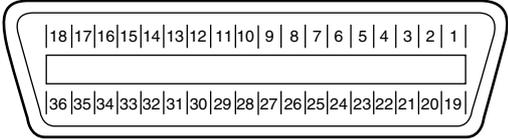### 3-2-1. BCD output connector pins

| Pin No.	Signal		Pin No.	Signal	
1	DRQ2 input		19	DRQ3 input	
2	POL (Sign)		20	READY output	
3	7th digit	Q2 (B)	21	7th digit	Q1 (A)
4	7th digit	Q4 (D)	22	7th digit	Q3 (C)
5	6th digit	Q2 (B)	23	6th digit	Q1 (A)
6	6th digit	Q4 (D)	24	6th digit	Q3 (C)
7	5th digit	Q2 (B)	25	5th digit	Q1 (A)
8	5th digit	Q4 (D)	26	5th digit	Q3 (C)
9	4th digit	Q2 (B)	27	4th digit	Q1 (A)
10	4th digit	Q4 (D)	28	4th digit	Q3 (C)
11	3rd digit	Q2 (B)	29	3rd digit	Q1 (A)
12	3rd digit	Q4 (D)	30	3rd digit	Q3 (C)
13	2nd digit	Q2 (B)	31	2nd digit	Q1 (A)
14	2nd digit	Q4 (D)	32	2nd digit	Q3 (C)
15	1st digit	Q2 (B)	33	1st digit	Q1 (A)
16	1st digit	Q4 (D)	34	1st digit	Q3 (C)
17	DRQ1 input		35	+Vcc	
18	COM		36	COM	

The letters in parentheses have the following values: A = 1, B = 2, C = 4, D = 8.

Connector pin assign
(as seen on the rear panel of the counter unit)

| 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |

| 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 |

• Connector to be procured
  Use the equivalent of 57-30360 micro ribbon connector manufactured by Daiichi Denshi Kogyo Co., Ltd. (DDK)

Digits displayed on the counter unit

123.4565

7th digit   1st digit

Digital display
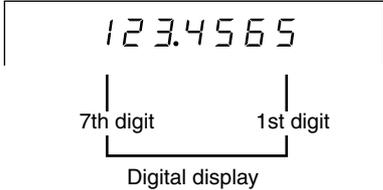
Note The least significant digit (rightmost digit) displayed on the counter unit is the 1st digit.

3-2-2. Interface cables

Use a shielded interface cable as shown in the figure right for connection to the BCD connector.

Connect the COM terminal (terminal numbers 18 and 36) separately from the shield. (Please procure the shielded connection cable.)
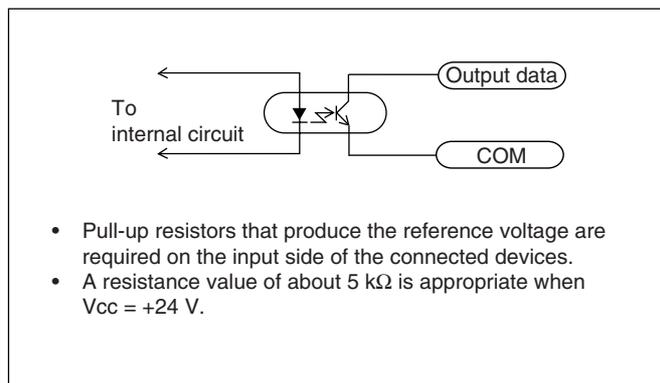
Failure to use a shielded cable may result in misoperation due to external noise, etc.

Cable section
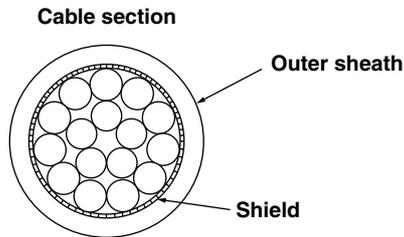
3-2-3. Connection circuits

• **Output circuit**

All BCD data and READY signals are output using a photocoupler.

• Pull-up resistors that produce the reference voltage are required on the input side of the connected devices.
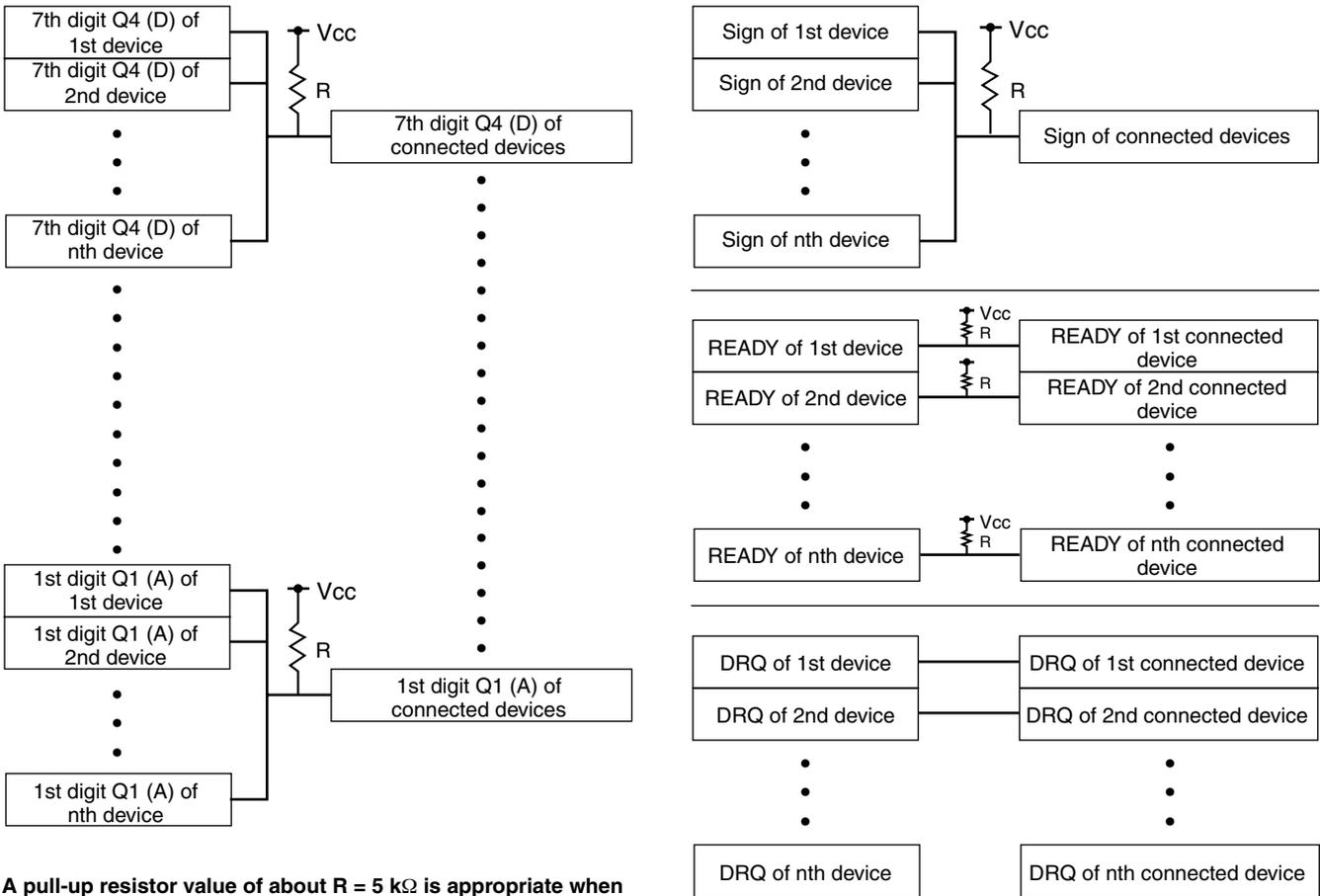• A resistance value of about 5 kΩ is appropriate when Vcc = +24 V.

When connecting several devices in parallel on a single PLC, etc., using BCD output (wired OR connection), use the 3-state output mode.

  * In 3-state output mode, there will be no output of BCD data if there is no DRQ input.

Precautions when using 3-state
• Connect each bit of the data and the sign in parallel.
• Connect the READY signal for each device separately.
• Also connect each of the DRQ inputs separately.
• Do not allow DRQ input to multiple LY71 devices simultaneously while in 3-state output mode. Doing so will result in simultaneous output of BCD data from all the LY71 devices with DRQ input and may cause damage.
• Pull-up resistors that produce the reference voltage are required on the input side of the connected devices.

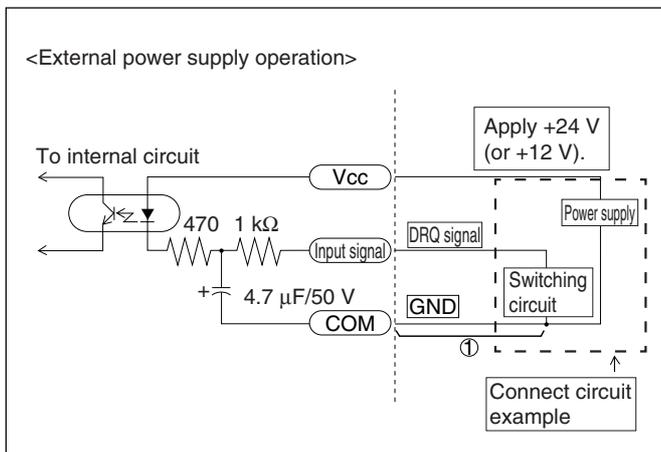| 7th digit Q4 (D) of 1st device |
| --- |
| 7th digit Q4 (D) of 2nd device |
| • • • |
| 7th digit Q4 (D) of nth device |

Vcc
R

7th digit Q4 (D) of connected devices

1st digit Q1 (A) of 1st device
1st digit Q1 (A) of 2nd device
• •
1st digit Q1 (A) of nth device

Vcc
R

1st digit Q1 (A) of connected devices

Sign of 1st device
Sign of 2nd device
• • •
Sign of nth device

Vcc
R

Sign of connected devices

READY of 1st device	Vcc R	READY of 1st connected device
READY of 2nd device	Vcc R	READY of 2nd connected device
• • •		• • •
READY of nth device	Vcc R	READY of nth connected device

DRQ of 1st device	DRQ of 1st connected device
DRQ of 2nd device	DRQ of 2nd connected device
• • •	• • •
DRQ of nth device	DRQ of nth connected device

A pull-up resistor value of about R = 5 kΩ is appropriate when Vcc = +24 V.

• Separate the DRQ signals from other signals as much as possible in order to eliminate the effects of crosstalk between input signals and output signals.

Output signals

Input signals

If these lines are close together, crosstalk may be generated.

• **Input circuit**

<External power supply operation>

To internal circuit

Vcc

Apply +24 V (or +12 V).

470   1 kΩ

Input signal

DRQ signal

Power supply

4.7 μF/50 V

GND

Switching circuit

COM

①

Connect circuit example
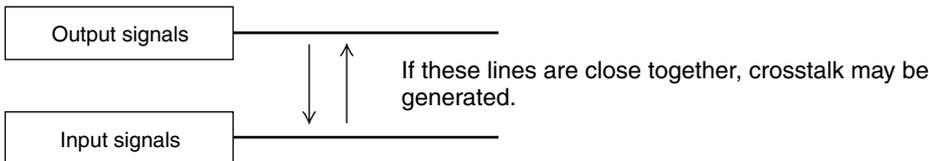
3-2-4. Input circuit delay time

When a signal is input to BCD request signal DRQ1 to 3, the input circuit produces a delay time until the signal is transmitted to the internal processing block. Care should be taken as this delay time varies widely according to the operating voltage of the input circuit.

(Example)   During +24 V operation, there is a delay time of approximately 350 μs until the signal is transmitted internally.

The processing time from when the signal is transmitted internally until the actual data is output varies according to the operating conditions. For details, see "6. BCD Output Mode Operation and Usage."

The delay time can be greatly shortened by not connecting portion ① of the input circuit shown on the previous page. When using with portion ① not connected, turn 1 on the SW300 switch to OFF. In this case, however, as misoperation occurs easily due to noise, etc., be sure to implement sufficient noise countermeasures.

| Reference |

When ① is not connected during +24 V operation:

Delay time = approximately 3 μs

4. Settings

4-1. Advanced Settings

The BCD unit does not have any basic settings. Set the items needed in the LY71 advanced settings (see the LY71 Installation Manual) for use. The basic key operation procedures are identical to the LY71 unit.

Setting details

Display	Setting item	Setting value	Setting details

$bcd \rightarrow \bar{n}d.\square\bigcirc\bigcirc\diamondsuit$ (A-axis display)
After 1 second
	Output mode	$\square$
		C
		$C.$
		
		d
		$d.$
		
		L
		$L.$
		
		$\daleth$
		$\bigcirc\bigcirc$
		01 to 20, $--$
		$\diamondsuit$
		
		o
		$-$
			Output mode
			  Constant output
			  Constant output
			  (data overwrite update)
			  Latch (BCD only)
			  Latch (BCD only)
			  (data overwrite update)
			  Latch (Display and BCD)
			  Latch (Display and BCD)
			  (data overwrite update)
			  3-state
			Output delay time
			  1 to 20 ms, -- None
			Output data status during alarm and power on
			  Output
			  OFF

$LGC.\boxed{1}\boxed{2}$
(B-axis display)
	Output logic	$\boxed{1}$
		P
		$\sqcap$
		$\boxed{2}$
		P
		$\sqcap$
			BCD data
			  Positive logic
			  Negative logic
			Sign
			  Positive logic
			  Negative logic
			Note: Fixed at negative logic with READY signal

① ② ③
$d.\boxed{A}\boxed{B}\boxed{A}\boxed{B}\boxed{A}\boxed{B}$
	Output data	①
		②
		③
		
		$\boxed{A}$
		1
		2
		A
		
		$\boxed{B}$
		C
		A
		1
		P
			Output data at DRQ1 input
			Output data at DRQ2 input
			Output data at DRQ3 input
			
			  1st axis
			  2nd axis
			  Addition axis
			Note: When using two BCD units, BCD1 is fixed at the 1st axis, and BCD2 is fixed at the 2nd axis.
			
			  Current value
			  Maximum value
			  Minimum value
			  Peak-to-peak value

4-1-1. Output mode

Constant output mode	Continuous data output while updating positional information of the measuring unit. (See "6-1. Constant Output Mode" for details)
Latch output mode	When the DRQ signal is input, continuous data is output with the positional information of the measuring unit at that time being loaded, re-calculated, and retained. (See "6-2. Latch Output Mode" for details)
3-state output mode	When the DRQ signal is OFF, all signals are output H (OFF). Measuring unit positional information is loaded, calculated, and output only when there is DRQ signal input. (See "6-3. 3-state Output Mode" for details)

Data overwrite update   – For customers using previous models (such as the LY51) –

Set to data overwrite update (constant output mode / latch output mode) when the device in use monitors data even when the READY signal is invalid, in order to avoid device errors. If the data overwrite update function is not used, all data will be turned OFF temporarily while the READY signal is invalid.

Note

Do not use data obtained while the READY signal is invalid, as this data is indeterminate.

Setting Procedure

1 Press the ◯ key on counter display A to select the mode.
The selected item flashes. Switching between using or not using the data overwrite update function is possible by pressing the ◯ key while CdL is flashing.

"C"   : Constant output
"$C.$"   : Constant output (data overwrite update)
"d"   : Latch (BCD only)
"$d.$"   : Latch (BCD only) (data overwrite update)
"L"   : Latch (BCD and display)
"$L.$"   : Latch (BCD and display) (data overwrite update)
"7"   : 3-state output

2 Press the ◯ᴱᴺᵀ key.
" $--$ " : Refresh delay time input

3 Press the ◯ key to select the delay time.

4 Press the ◯ᴱᴺᵀ key.

5 Press the ◯ key to select the output status during alarm and power on.

6 Press the ◯ᴱᴺᵀ key.

4-1-2. Output logic

This sets the logic for the BCD data and sign signal that are output. Each can be set independently.

- BCD data logic (identical for each bit)

    If positive logic is used: $\begin{cases} \text{"1"} \Rightarrow H \text{ (OFF)} \\ \text{"0"} \Rightarrow L \text{ (ON)} \end{cases}$ If negative logic is used: $\begin{cases} \text{"1"} \Rightarrow L \text{ (ON)} \\ \text{"0"} \Rightarrow H \text{ (OFF)} \end{cases}$

- Sign bit logic

    If positive logic is used: $\begin{cases} \text{"−"} \Rightarrow H \text{ (OFF)} \\ \text{"+"} \Rightarrow L \text{ (ON)} \end{cases}$ If negative logic is used: $\begin{cases} \text{"−"} \Rightarrow L \text{ (ON)} \\ \text{"+"} \Rightarrow H \text{ (OFF)} \end{cases}$

- READY signal logic (Fixed at negative logic)

    $\begin{cases} \text{"Valid"} \Rightarrow L \text{ (ON)} \\ \text{"Invalid"} \Rightarrow H \text{ (OFF)} \end{cases}$

Note

Output signals are all photocoupler output. Therefore, when nothing is connected to the outputs, output signal ON/OFF can be confirmed but the logic level H/L cannot. If a pull-up resistor is connected to each output pin, L level output can be detected when the output signal is ON, and H level output when OFF.

1 Press the ◯ key on counter display B.

2 Press the ◯ key to select the BCD data logic.

Setting the data logic

3 Press the ◯ᴱᴺᵀ key.

4 Press the ◯ key to select the logic of the sign.

5 Press the ◯ᴱᴺᵀ key.

4-1-3. Output data

This sets the BCD data that is output when DRQ1 to 3 is input.
Because the BCD connector only has wiring for one type of output data, each type of data selected by this item is output by switching the DRQ signal inputs. Because the DRQ signal inputs are switched in one at a time, the unit will not operate normally if multiple DRQ signals are input simultaneously.
In addition, when there is only one type of output data, use DRQ1 for the input, and also set just DRQ1.

1 Press the ◯ key on counter display C.

2 Press the ◯ key to select the DRQ1 output data.

3 Press the ◯ENT key.

4 Press the ◯ key to select the DRQ2 output data.

5 Press the ◯ENT key.

6 Press the ◯ key to select the DRQ3 output data.

7 Press the ◯ENT key.

OPERATION

Refer to this section during normal use.

5. Functions

The BCD output of the expansion unit has a number of items which can be set including the type of data output and the output format.

5-1. Output Data

In addition to the current value, the maximum, minimum and peak-to-peak values can be output using BCD output. For the current value, the 1st axis, 2nd axis, and the value obtained by adding and subtracting these axes can be output. The output data is determined by the output selection (refer to "5-4. Output selection") and is not affected by the display data.

INC data is output for the current value. ABS data cannot be output.

5-2. Output Mode

The BCD data output format can be selected.
- Constant output:
  Data is output constantly other than when updating the BCD data.
- Latch:
  Data is output constantly other than when updating the BCD data.
  However, when the DRQ request signal is input, the latest measuring unit values at that point are loaded, the operations are performed again, and the BCD output data is updated.
  Either the BCD data only or the BCD data and BCD display are held while DRQ is input.
- 3-state output:
  Data is not normally output and all outputs are set to the OFF status. Only when the DRQ request signal is input, the latest measuring unit values at that point are calculated and output as BCD data.

5-3. Output Logic

The BCD data and data sign output logic can be set individually.
When shipped from the factory, the BCD data is positive logic, the sign is "Low" when positive and "High" when negative.

5-4. Output Selection

Three types of output data can be selected.
The output data is switched by inputting the request signal (DRQ) into the DRQ1, DRQ2 and DRQ3 pins.
When shipped from the factory, DRQ1 is set to the current value, DRQ2 to the minimum value, and DRQ3 to the maximum value.
In constant output mode (in which data is output at any time) when the DRQ signal is not input, the DRQ1 data is selected.

6. BCD Output Mode Operation and Usage

There are a number of BCD output modes, and the operation and usage method for each is described below.
(See "4-1-1. Output Mode" (P. 4-2) for the setting method for each mode.)
When the reference point signal is received (load- and hold-related), data cannot be requested by means of the BCD DRQ signals.
Therefore, the BCD request signal is invalid even in reference point reference mode.
If the LY71 flicker control function is used, updating of the BCD output data may be delayed and the same data may be repeatedly output. If this occurs, use with the flicker control function set to OFF.
For the flicker control function setting method, see "4-3. Advanced Settings" in the LY71 Installation Manual.
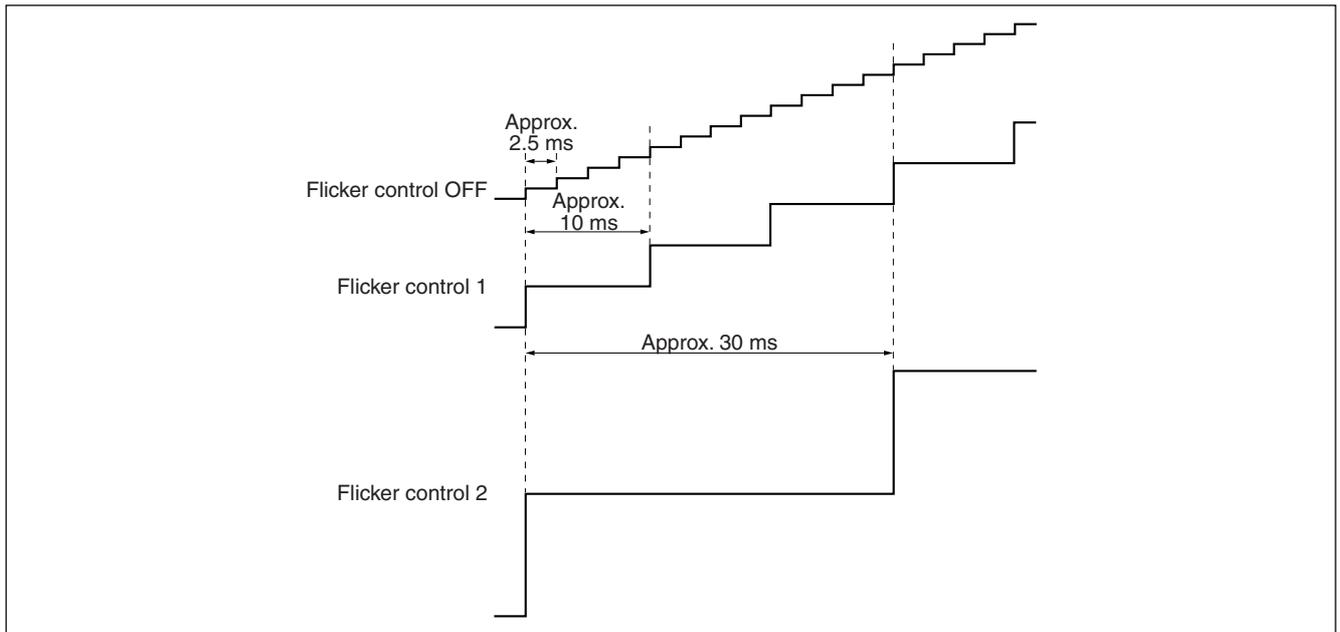
6-1. Constant Output Mode

(1) The output data cannot be latched during constant output mode.
    The requested data specified by the initial settings can be obtained by inputting the data request signals DRQ1, DRQ2 and DRQ3.
    When there is no DRQ input, the data specified by DRQ1 is output.

(2) Data is output constantly, but the data is undetermined when the data is refreshed. The READY signal is invalid when updating the data, so the data during this time should not be used.
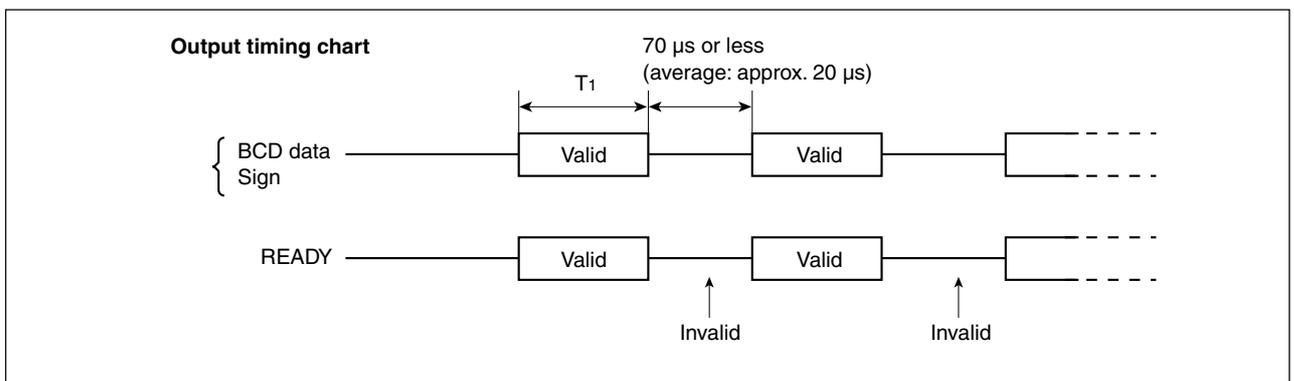
Note

The time T_1 changes according to conditions. If using 2nd axis input or if a separate unit is connected, T_1 is longer. If linear compensation is input, the processing time required also results in T_1 being longer.

- When only one expansion unit LZ71-B is used : T_1 = 2 ms or more (average: approx. 2.5 ms)
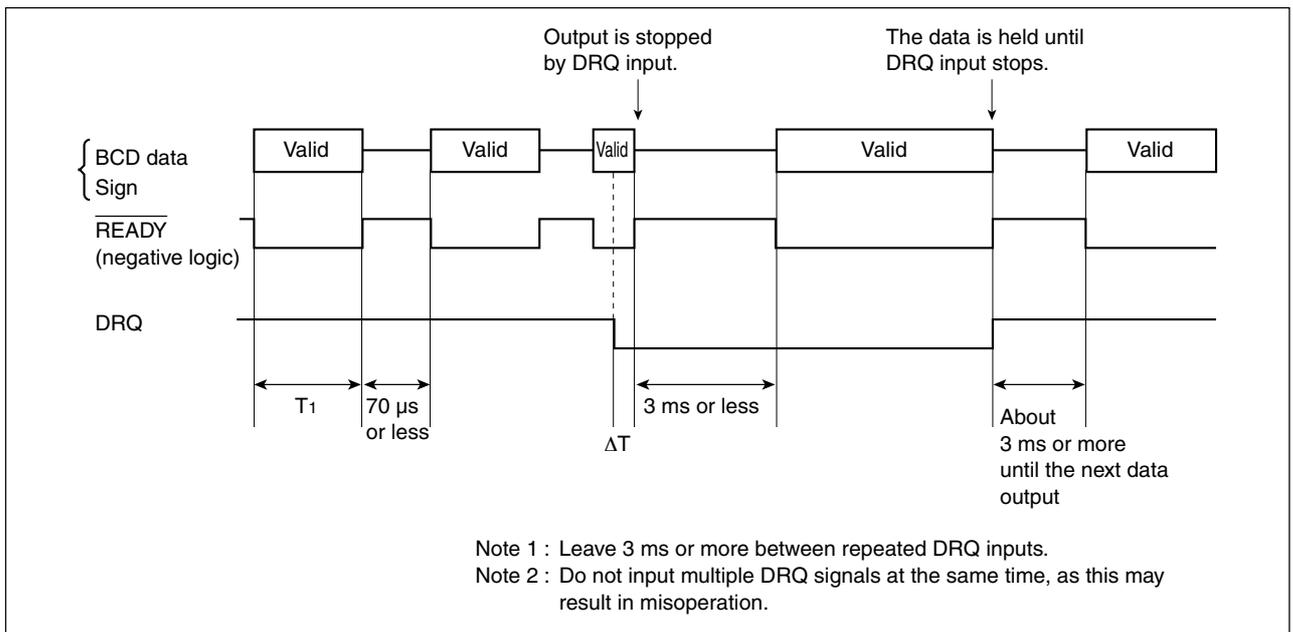- When two expansion units LZ71-B are used : T_1 = 2.5 ms or more (average: approx. 3 ms)
- When expansion units LZ71-B and LZ71-KR are used : T_1 = 3 ms or more (average: approx. 3 ms)

(3) READY invalid time

The READY invalid time is normally about 70 µs. However, if this time cannot be picked up because it is too short, the time can be lengthened.
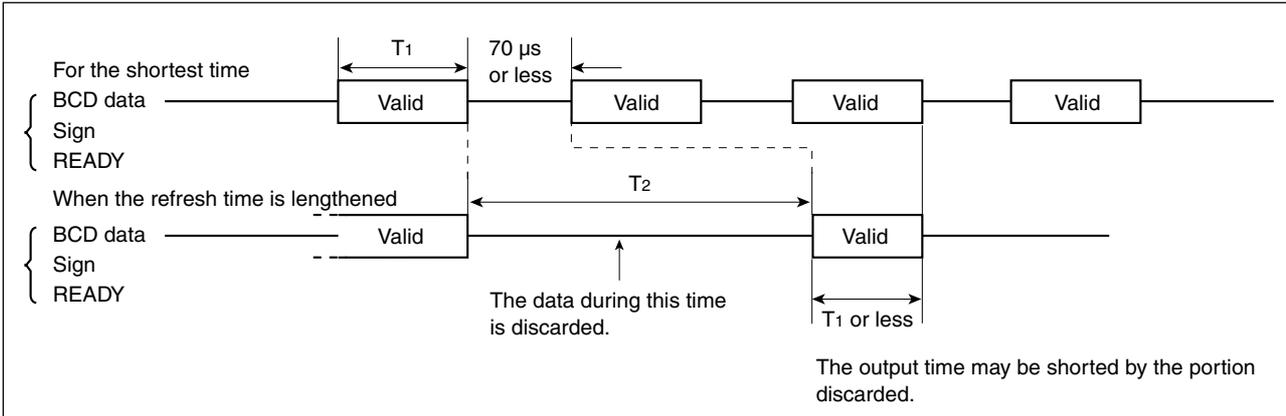
(4) DRQ input switching

When the DRQ signal is switched, the output data also switches.

Be sure to leave 100 µs or more for DRQ switching. Also, do not input multiple DRQ signals at the same time, as this may result in misoperation.
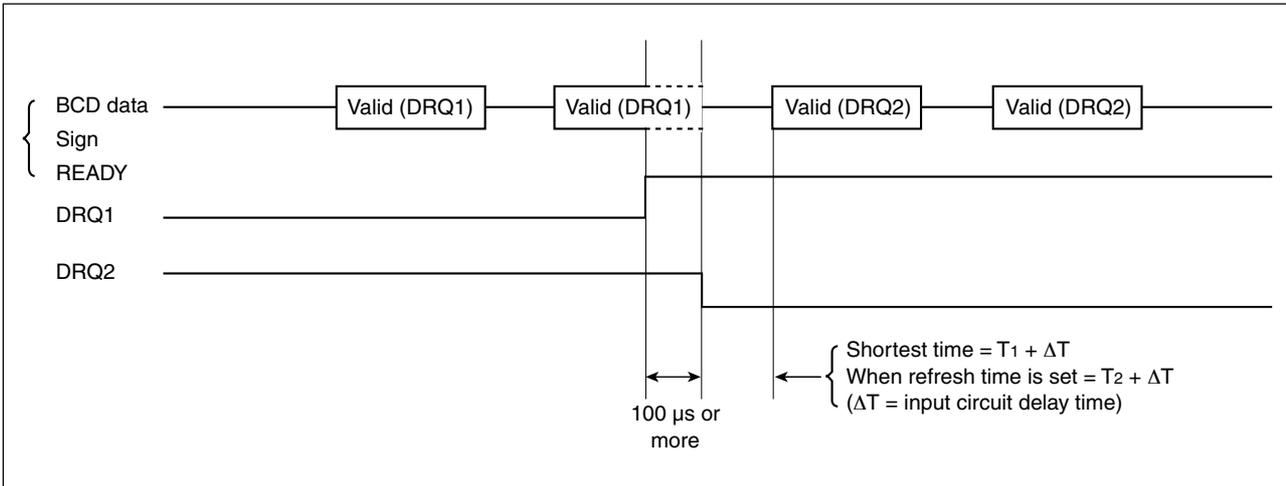
Notes

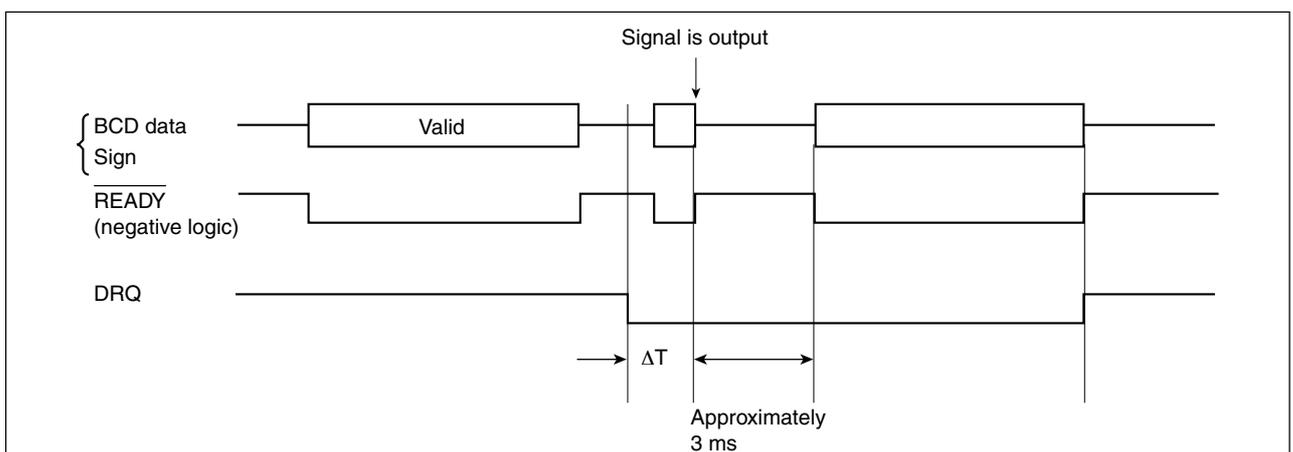ΔT = Input circuit delay time (DRQ input delay time)

When using +24 V input: about 350 µs (3 µs: When there is no COM connection)

(See "3-2-5. Input circuit delay time" for the input circuit delay time)

6-2. Latch Output Mode

(1) The output data can be held during latch output mode.

Output of the requested data specified by the initial settings can be held by inputting the data request signals DRQ1, DRQ2 and DRQ3.

The output does not change while the data is held even if the counter of the input measuring unit operates.

If the unit is set to the mode where the display is also latched at the same time, the display is also held.

• Latch mode (BCD only)   DRQ1 : BCD is latched. Display continues to be updated.

• Latch mode (BCD and display) DRQ1 : BCD and display are both latched.

(2) The timing from when the data request signal DRQ is input until the data is latched is as follows.

The operation timing when DRQ is not input is the same as for constant output.

Note 1 : Leave 3 ms or more between repeated DRQ inputs.
Note 2 : Do not input multiple DRQ signals at the same time, as this may result in misoperation.

Notes

ΔT = Input circuit delay time (DRQ input delay time)

When using +24 V input: about 350 μs (3 μs: When there is no COM connection)

(See "3-2-5. Input circuit delay time" for the input circuit delay time)

Note that because there is an input circuit delay, operation is the same as before the DRQ signal input until the DRQ signal is relayed internally.

Note that the READY signal may be output during that interval.

6-3. 3-state Output Mode

(1) Data is not output if there is no DRQ input during 3-state output mode.

When the DRQ signal is OFF, all signals are output H (OFF). Measuring unit positional information is loaded, calculated, and output only when there is DRQ signal input.

Output of the requested data specified by the initial settings can be held by inputting the data request signals DRQ1, DRQ2 and DRQ3.

(2) The timing from when the data request signal DRQ is input until the data is output is as follows.
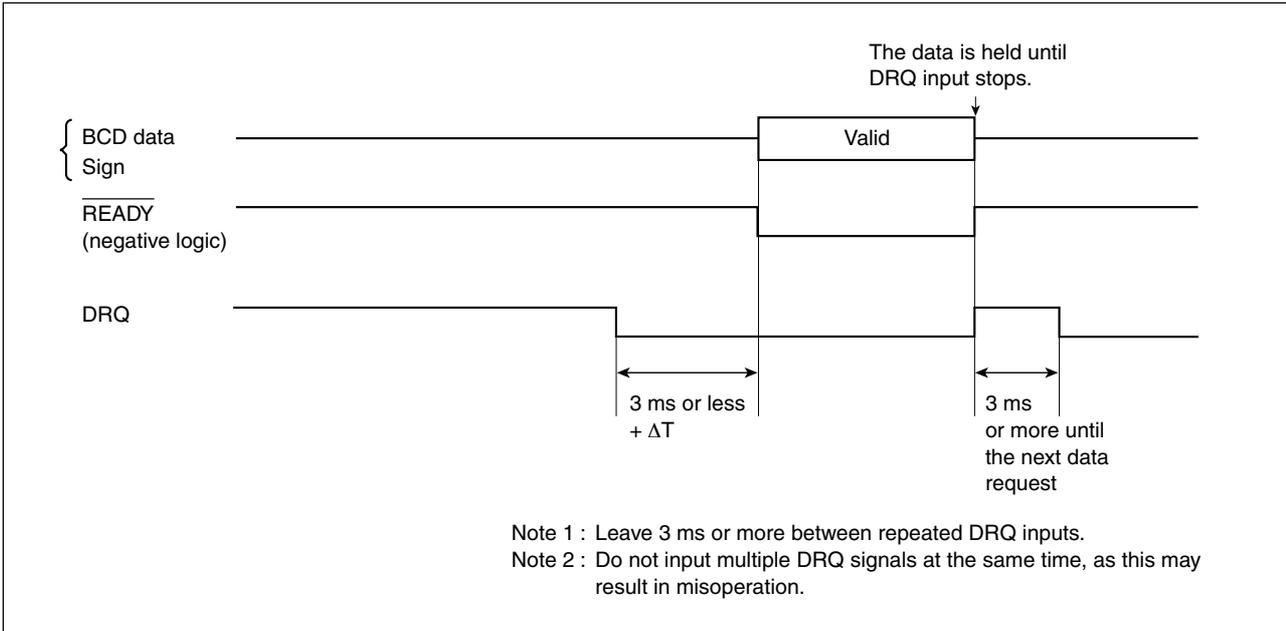
Note 1 : Leave 3 ms or more between repeated DRQ inputs.
Note 2 : Do not input multiple DRQ signals at the same time, as this may result in misoperation.

Notes

ΔT = Input circuit delay time (DRQ input delay time)

When using +24 V input: about 350 μs (3 μs: When there is no COM connection)

(See "3-2-5. Input circuit delay time" for the input circuit delay time)

(3) Data output time

The time after DRQ is input until data is output is the same as in latch mode.

7. Troubleshooting

See the LY71 instruction manual for trouble related to the LY71.

This section describes the troubleshooting procedures related to BCD output.

There is no BCD output.	☞	• BCD output is open collector output. Therefore, if nothing is connected to the output, no data will be output. A pull-up resistor is necessary to produce the reference voltage on the receiving circuit side. • Is the unit set to 3-state mode? When set to 3-state mode, the DRQ signal must be input in order to output data. • Is the BCD cable connected correctly? or is the cable broken? • Are multiple DRQs being input simultaneously? • Is data for an axis that does not exist being output? (For example, the LY71 unit is set to 1st axis only input, but the BCD data output is set to the addition axis or the 2nd axis.)

The READY signal is not output or does not turn off.	☞	• The READY signal time can be changed. Is a recognizable time set? (Input the time with the initial settings.) • Is the READY signal cable connected correctly? or is the cable broken?

The BCD data is incorrect.	☞	• Is the output data setting correct? Set the correct output data with the initial settings. • Is the BCD cable connected correctly? or is the cable broken? • Are multiple DRQs being input simultaneously? • Is data for an axis that does not exist being output? (For example, the LY71 unit is set to 1st axis only input, but the BCD data output is set to the addition/subtraction axis or the 2nd axis.)

The count remains stopped.	☞	• Is the DRQ signal being input? Other than during constant output or latch (BCD only), the display will remain held while the DRQ signal is input. Input the DRQ signal only when data is required.

8. Specifications

Item		Contents
BCD output		7 digit parallel data (4 bits × 7 digits), sign (1 bit), READY signal (1 bit)
	Output logic	Positive and negative logic can be selected individually for the data and sign by the settings. The READY signal is fixed at negative logic.
	Electrical specifications	Photocoupler output V_{CE} : Recommended DC +12 to 24 V I_C : Max. 15 mA/terminal, TOTAL: 300 mA
		Output connector: 36-pin micro ribbon connector
	Output data during alarm and power on	Selectable from data output or alarm status (all "OFF") by the initial settings.
	Output data	Current (1st axis, 2nd axis, addition axis), maximum, minimum and peak-to-peak values
Latch		Selectable from "BCD only latch" and "BCD & display latch" by the initial settings.
	Input signal	DRQ1 to 3 (Photocoupler: 12 to 24 V)
	Output selection	Three DRQ input signals: DRQ1 to 3 Output data is assigned by the settings. Ex.) DRQ1: Current value, DRQ2: Maximum value, DRQ3: Minimum value
	Output modes	Selectable from the following by the settings. Constant output (Output regardless of DRQ. However, prohibited when refreshing data.) Latch (BCD only latch) Latch (BCD & display latch) Request output (Output only when DRQ input. Otherwise, all outputs "OFF".)
Operating temperature range		0 °C to 40 °C (32 °F to 104 °F) (No condensation)
Storage temperature range		–20 °C to 60 °C (–4 °F to 140 °F) (20 to 90 % RH, no condensation)

9. Dimensions

Specifications and appearances of the products are subject to change for improvement without prior notice.

(Unit: mm)

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