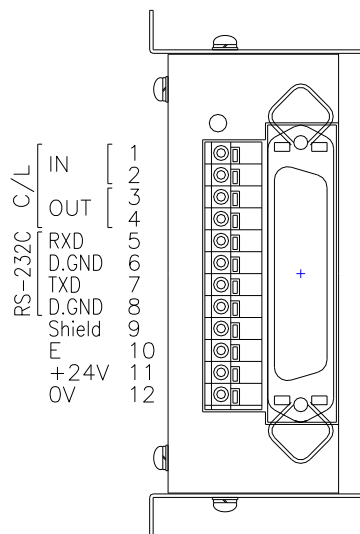




# SERIAL to BCD CONVERTOR

MODEL CV-3010

## OPERATION MANUAL



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※This operation manual is applied to the product shipped after Sep/2015

Revision history:

Rev.1 (2/Oct/2015)

Addition of explanation of Connectable indicator,  
Details of I/F and Pulse width of STROBE signal

Rev.2 (26/May/2023)

Revision of explanation of Connectable indicator

This document is translated from MA4-00148-R2 (Japanese)

## § 1. Summary

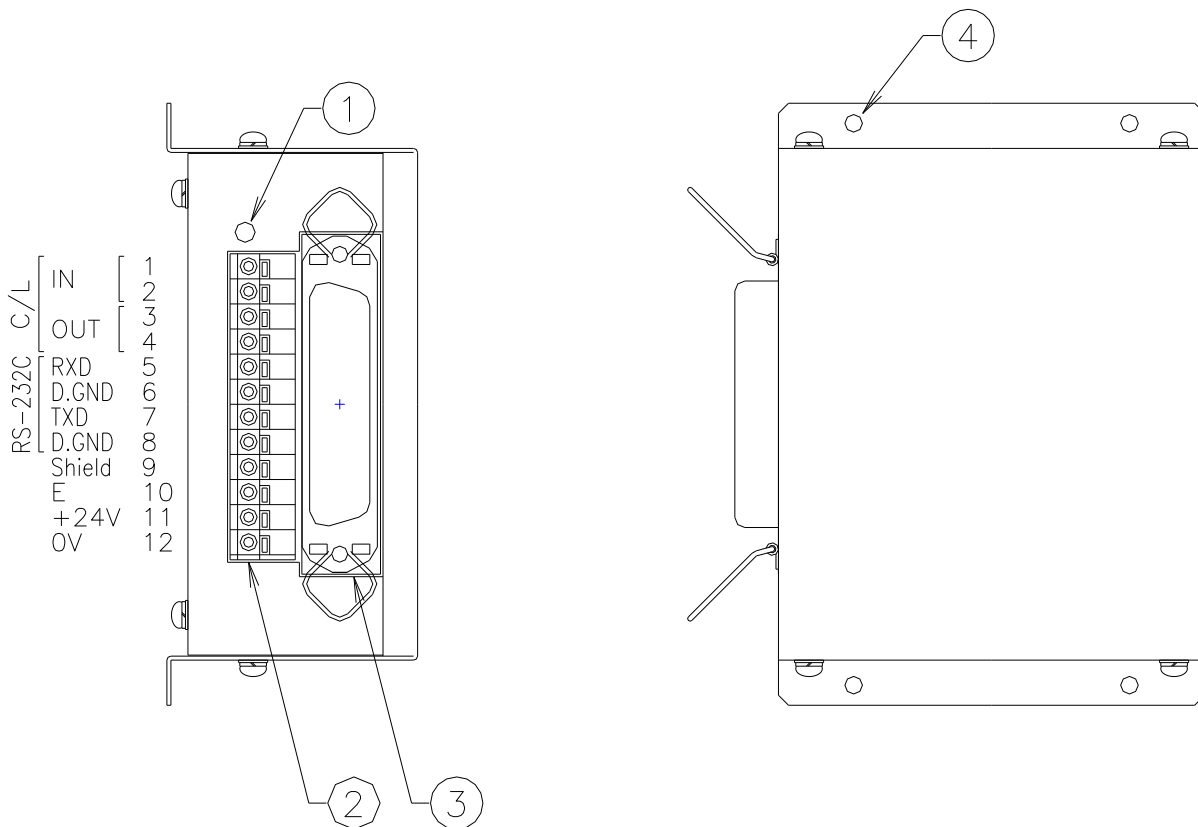
This unit is a convertor to transform serial data which are transmitted from TOYO digital indicator to BCD data. BCD data is output through Open Collector signal which is isolated from an inner circuit by a photo coupler.

This unit has functions of Data hold and Logic inversion, etc. which are controlled by external command input.

The power supplied voltage is DC24V which is isolated from an inner circuit by insulated DC/DC convertor.

## § 2. Appearance and Each part name

Appearance of the unit



- |                        |   |
|------------------------|---|
| ① SERIAL MONITOR (LED) | LED for indicating that serial data is transmitting/receiving |
| ② TERMINAL             | 5mm pitch screw-less terminal for serial I/O and power line   |
| ③ CONNECTOR            | 36pin-Amphenol for BCD output and external command input      |
| ④ MOUNTING HOLE        | Use 4-M3 screw to fix this unit                               |

Attached accessories

- |  |        |
|--|--------|
| ① Operation Manual                           | 1 copy |
| ② Connector (DDK 57-30360 or the equivalent) | 1 pc   |

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### § 3. Function & Operation

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#### 3 – 1) General

This unit is a convertor to transform 0~20mA current loop(as 'C/L' thereafter) or RS-232C serial data which are transmitted from TOYO digital indicator to BCD data which is output through Open Collector signal.

##### 1). Connectable digital indicators

TOYO's digital indicator equipped with C/L or RS-232C output can connect to CV-3010.

•TOYO's digital indicator equipped with C/L output as standard are:  
DLS-5028A,DLS-5025B,DLS-5037,DLS-5026B,DLS-5031A

•TOYO's digital indicator equipped with C/L output as option are:  
DLS-5033A(OP-4),TI-703(OP-4)

•TOYO's digital indicator equipped with RS-232C as standard is:  
DLS-5031A

•TOYO's digital indicator equipped with RS-232C interface as option. It should connect to CV-3010 through C/L signal if equipped with C/L as standard:  
DLS-5028A(OP-3),DLS-5025B(OP-3),DLS-5037(OP-3),DLS-5026B(OP-3),TI-703(OP-3)

Cable length of RS-232C should be less than 15m. But cable length of C/L signal is up to 100m because C/L signal is transmitted by current.

Input signal to this unit is either C/L signal or RS-232C signal. Cannot accept both signal at the same time.

To enable addition of external connected device, either C/L or RS-232C input serial signal is delivered to output port of RS-232C and C/L terminal.

##### 2). BCD signal and accompanied signal

BCD output is 24bit Open Collector signal which is isolated by photo coupler.

BCD data : 5digit (4bitx5), Polarity(+), Overflow

STROBE : Timing signal of acquisition data

RUN : Alert signal for power failure, detecting abnormal of input signal

Above data will be updated each time receiving data through C/L or RS-232C signal.

This unit accepts 4 input signals to control conversion.

Data Hold : Update of BCD data is hold

Logic inversion of data : Invert of BCD data, Polarity(+), Overflow

Logic inversion of STROBE : Invert of STROBE signal

Pulse width of STROBE : Pulse width of STROBE is 100msec or 20msec.

#### 3 – 2) Input / Output interface

##### 1). Serial data input (RS-232C or C/L)

Digital indicator equipped with C/L output is connected to C/L input of this unit.

Digital indicator not equipped with C/L output but RS-232C interface as option is connected to RS-232C input of this unit

Receivable data protocol of RS-232C is fixed as the followings.

Communication speed 2400bps

Communication protocol Start-stop synchronous (Asynchronous)

Communication format Data bit:7bit, Stop bit:2bit, Parity:Even, Data:ASCII code

## 2). Serial data output (RS-232C or C/L)

When C/L signal or RS-232C signal is input to this unit, same signal is transmitted from both C/L and RS-232C port of this unit, which help to add external connected devices. But when receiving error has been detected, the detected data is not transmitted. (including: flaming error, parity error, over-run error)

Transmitting data protocol of RS-232C is same as the receiving data protocol.

A serial signal monitor LED which places close to the input terminal is flashing when transmitting/receiving a serial signal.

## 3). BCD data output

BCD data is output through 24bit Open Collector output, which consists of NPN transistor and photo coupler, TOSHIBA TLP627, and is isolated from an inner circuit. BCD data are output from 36pin-Amphenol connector, Emitter is common to pin#13,#14,#31 and #32 of the connector.

Rated output is DC30V, 30mA (resistive load). Saturation voltage between Collector and Emitter is 1.2V or less at the rated load.

Output logic is selectable. Status between Collector and Emitter against negative/positive logic are shown in a Table below.

Output data	Negative logic		Positive logic	
	Status Collector - Emitter	Output level at pull up end	Status Collector - Emitter	Output level at pull up end
0	Open	High	Short	Low
1	Short	Low	Open	High

## 4). External command input

There are 4 external commands, as Data Hold, Logic inversion of data, Logic inversion of STROBE and Pulse width of STROBE, which are set by external Relay contact MAKE input. Each contact current consumption should be approximately 5mA (at applied voltage 5V).

Ground of external input is common to the ground of inner circuit. The external Relay contacts and this unit are supposed to build in the same control box, so that the cable length between contacts and this unit should be less than 10m.

When the ground of external input is connected to Emitter of BCD output, external command is not accepted because it is isolated from BCD output.

## 3 – 3) Each function

### 1). BCD data output

This unit outputs 5digit BCD signal which are converted from serial data of the measured value comprised of ASCII code transmitted from TOYO's digital indicator.

Decimal point is ignored if it is attached.

When a digital indicator indicates overflow, 4bit data of each digit output '1'. (5digit BCD output 'FFFFFF' in result). Using this function, it is possible to detect overflow without addition of a bit as a discriminator.

### 2). Overflow output

When a connected digital indicator indicates overflow (All digits are flashing), output '1'.

### 3). Polarity output

Output '1' when BCD data is plus.

Output '0' when BCD data is minus.

### 4). STROBE output

BCD data is updated whenever the measured value data comprised of ASCII code is received. STROBE signal is set '1' after 10msec from when BCD data is updated and is set '0' after 100msec after setting '1'.

Timing of acquisition of BCD data is to detect a rise edge of the STROBE signal first and capture BCD data within 100msec.

5). RUN signal

RUN signal output '1' after receiving the first serial data from powered ON.

All the most of TOYO's digital indicator transmit data 4times/second or 16times/second. If receiving data is stopped for 1 second, treat as abnormal of indicator or disconnection of cable, RUN signal output '0' until the next data is received.

Logic of RUN signal is fixed to the negative logic. Status between Collector - Emitter is OFF when powered OFF. RUN signal can be used as detecting abnormal of indicator or power failure.

6). Data Hold signal

When making electrical short between #16 and #18(D.COM) of 36pin-Amphenol connector, update of BCD data is stopped within 50msec. BCD data and STROBE signal is not updated while electrical short between them.

In case of being impossible to utilize STROBE signal, capture BCD data after 50msec from when Data Hold signal is input to this unit.

7). Logic inversion of data signal

When making electrical short between #34 and #36(D.COM) of 36pin-Amphenol connector, invert the logic of BCD data, Polarity, Overflow

Open : Negative logic (at the time of shipment)

Short : Positive logic

8). Logic inversion of STROBE signal

When making electrical short between #17 and #18(D.COM) of 36pin-Amphenol connector, invert the logic of STROBE signal

Open : Negative logic (at the time of shipment)

Short : Positive logic

9). Pulse width changing of STROBE signal

When making electrical short between #35 and #36(D.COM) of 36pin-Amphenol connector, pulse width of STROBE signal is changed.

Set 100msec when transmitting data of the connected digital indicator is 4 times/second.

Set 20msec when transmitting data of the connected digital indicator is 16 times/second.

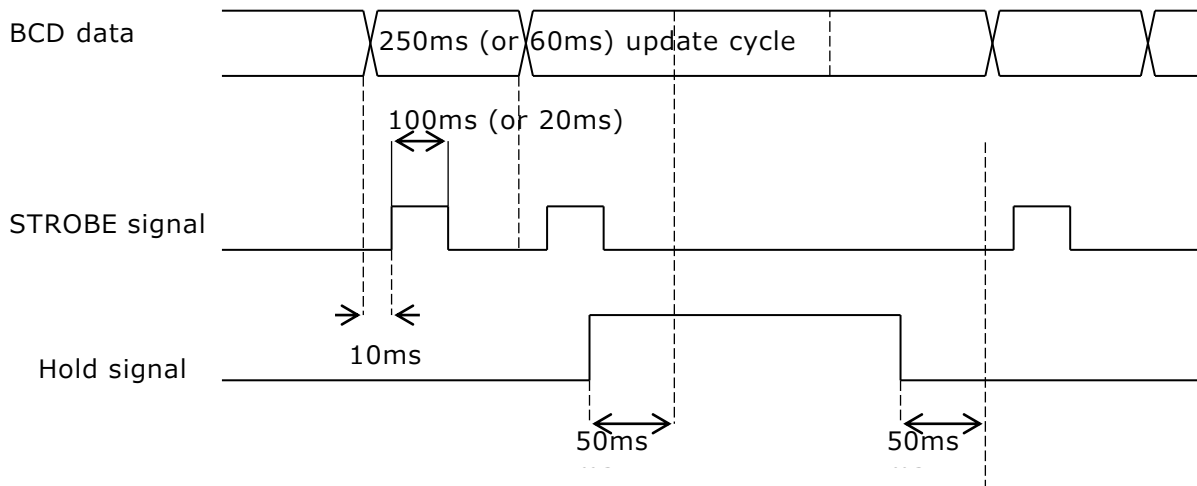
Open : Pulse width 100msec. (at the time of shipment)

Short : Pulse width 20msec.

### 3 – 4) Timing of acquisition of BCD data

#### 1). Timing chart of BCD data output sequence

This unit is operated according to the following timing at most cases.



After a serial data has been received, BCD data is updated.

After 10msec from an update of BCD data, STROBE signal is transmitted for 100msec or 20msec time length.

After 50msec from input of Hold signal, BCD data is hold and not updated. After 50msec from release of Hold signal, BCD data is updated again.

#### 2). Methods of acquisition of BCD data

BCD data is unstable during updating period. Transition time to turn ON of output transistor (including photo coupler) is approximately tens of  $\mu$ sec. But transition time to turn OFF of it is approximately up to hundreds of  $\mu$ sec depending on a load.

Transition time can vary depending on the individual of transistor or load differences or surrounding temperature.

Thus, if connected equipment try to capture all the 24bit data at same time while data is updating, it will result in capture data error.

For example, when capturing data while it is transiting from 19999 to 20000, BCD data might be 29999 or 10000, which is capture data error.

To prevent such capture data error, please capture data by one of the following method.

##### ① Method to utilize STROBE signal

STROBE signal is high level '1' and BCD data is stable after 10msec from updating BCD data. STROBE signal is '1' for 100msec (or 20msec). Because an update data cycle of a connected digital indicator is 250msec (or 60msec), after STROBE signal turns to low level '0' there is no possibility to update the next data at least for 100msec (or 20msec).

Thus, to capture BCD data, first detect a rise edge of the STROBE pulse to '1', and next capture all the 24bit data within 100msec (or 20msec).

The value inside ( ) is the one at pulse width of STROBE signal=20msec when transmitting data of connected digital indicator is 16times/second.

This method makes the delay time of data acquisition be shortest compared to the other two methods.

##### ② Method to utilize Data Hold command

When making electrical short between #16 and #18(D.COM), update of BCD data is stopped within 50msec and BCD data is stable.

After 50msec from input of Data Hold command, capture all the 24bit data.

③ Method to capture data more than 2 times

Capture all the 24bit data 2 times with interval more than 10msec. Compare both data and if they coincide, regard as correct data. If not coincide, consider that the first data is captured before update and the second data is captured after update, or data are captured while in transition state of unstable. In that case, capture data again after 10msec or more. Use this method, capturing data at least 3 times, judge the correct data to prevent a capture data error.

3). Recommended logic and RUN signal

This unit can invert output of BCD data (5digit data, polarity (+), over) and STROBE signal independently.

Because BCD data is output by Open Collector, status between Collector-Emitter is OFF when powered OFF. Thus, it is recommended to use negative logic of both BCD data and STROBE signal.

When using positive logic, it is impossible to distinguish the state of plus side overflow (5digit data and polarity are all '1') and state of powered OFF. Also STROBE signal becomes '1' when powered OFF.

If using positive logic, it is recommended to utilize RUN signal. Status between Collector-Emitter of this signal is OFF only when powered OFF or receiving data from digital indicator is stopped for more than one second. Treat RUN signal as an alert to help to prevent such trouble.

When using negative logic, to monitor RUN signal, it is easy to detect an alert.

3 – 5) Operation at abnormal

All the 24bit output between Collector-Emitter are OFF when powered OFF, also they are OFF until the first serial signal coming in from powered ON.

When receiving data is stopped for more than 1 second caused by disconnection of cable or receiving error, BCD data output '-00000' regardless specified logic. Because zero output from digital indicator is only '+0', it is easy to distinguish that '-0' is abnormal. STROBE signal is not output in this case. RUN bit between Collector-Emitter is OFF



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## § 4. Troubleshooting

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If this unit does not work properly, please take the following measures. If the trouble still cannot be solved, then please contact our company.

At query, please inform us the model name, product serial number, and conditions of this unit as detailed as possible.

### 4 – 1 ) Basic check point

#### 1). Please check if using a correct power supply.

This unit is supplied voltage with DC24V±10% (100mA typ.).

#### 2). Please check that wires are connected to the terminal and connector properly and firmly.

### 4 – 2 ) Troubleshooting when the desired operation cannot be achieved.

#### 1). Check input of serial signal

Check whether the serial signal monitor LED is flashing regularly. That LED is blinking ON/OFF 4 times per second when the serial data is received normally.

When the LED is not flashing, please check the wiring of input signal of the terminal. Check whether there is no disconnection of wires or each signal line of RS-232C or C/L is wired to appropriate terminal.

C/L signal has no polarity.

Check whether RXD and D.COM of RS-232C signal is wired correctly.

Either RS-232C or C/L should be connected to the input terminal. If both are connected, it is unable to receive serial data.

#### 2). BCD data is not output even the serial monitor LED is flashing.

Check the subsequent wiring of BCD output. It is unable to detect ON/OFF of Emitter – Collector by a tester because it is Open Collector output.

Each output of Collector side should be connected to the plus side of external DC supply through a load. Each output of Emitter side should be connected to the minus side of external DC supply.

Also check whether the external DC supply is satisfied with the rated output of photo coupler in this unit. (Max. DC30V, 30mA, resistive load).

#### 3). BCD data does not coincide with data of connected digital indicator all the time, or several times in a day.

① Check the logic inversion of BCD data (Negative logic at the time of shipment).

② Check the logic inversion of STROBE signal (Negative logic at the time of shipment).

③ When capturing BCD data without condition, capture it when it is stable by using the method of 3-4) 2). 'Methods of acquisition of BCD data'

## § 5. Method of Installation and Connection

### 5 – 1) Installation environment of this unit

- 1) Operation temperature range of this unit is 0 to +40°C.  
Please install this unit in a place not exposed to direct sunlight and condensation.  
Consider ventilation when installing inside a control box which has possibility of filled up heat. (This unit does not generate large amount of heat by itself)
- 2) The power supplied voltage is DC24V±10%.  
Using an improper power supply may cause overheating, damage, malfunction, etc.
- 3) This unit is designed to fix by wall-mount. Please make use of holes 4-Φ4.0 of a cover and fix with M3 screw.  
There is no restriction of installation of direction.

### 5 – 2) Terminal/Connector connection

Serial signal is wired to 5mm pitch, 12pin screw-less terminal.  
The shield line of each cable shall be grounded by either this unit or each connected instrument, so that there is no ground loop.  
Terminal #9(Shield) and #10(E) are connected inside of this unit.

Power supplied voltage is DC24V, which is isolated from an inner circuit by DC/DC converter.

Serial signal from a digital indicator should be wired to the terminal as follows

- C/L signal                      C/L signal from a digital indicator is wired to the terminal #1,#2 (C/L input), with no polarity.
- RS-232C signal              TXD signal from a digital indicator is wired to the terminal #5 (RXD).  
COM signal from a digital indicator is wired to the terminal #6 (D.COM).

Open Collector output is isolated from an inner circuit by photo coupler.  
External command input, RS-232C input and C/L input are not isolated from inner circuit.  
Ground of external input is common to the ground of RS-232C input. Thus it is recommended to prepare external Rely contact to drive external input of this unit.  
Meanwhile, C/L output of this unit is isolated from an inner circuit by photo coupler.

Wiring to BCD data connector should be done through a shielded cable.

#### 1). Terminal

5mm pitch, 12pin screw-less terminal

No.	Connection signal		
1	C/L IN	C/L signal input (No polarity)	Current Loop
2	C/L IN		
3	C/L OUT	C/L signal output (No polarity)	
4	C/L OUT		
5	RXD	Receive data	RS-232C
6	D.COM	Digital ground	
7	TXD	Transmit data	
8	D.COM	Digital ground	
9	Shield	Shield of serial signal	
10	E	Earth / Ground	
11	+24V	Power line (DC+24V)	
12	0	Power line (DC+0V)	

Applicable wire spec.: Single wire = Φ0.4~1.2mm (AWG26~16),  
Strand wire = 0.3~1.25mm<sup>2</sup> (AWG22~16)

2). Connector

36pin connector, DDK : 57-40360-7700(D12) or the equivalent

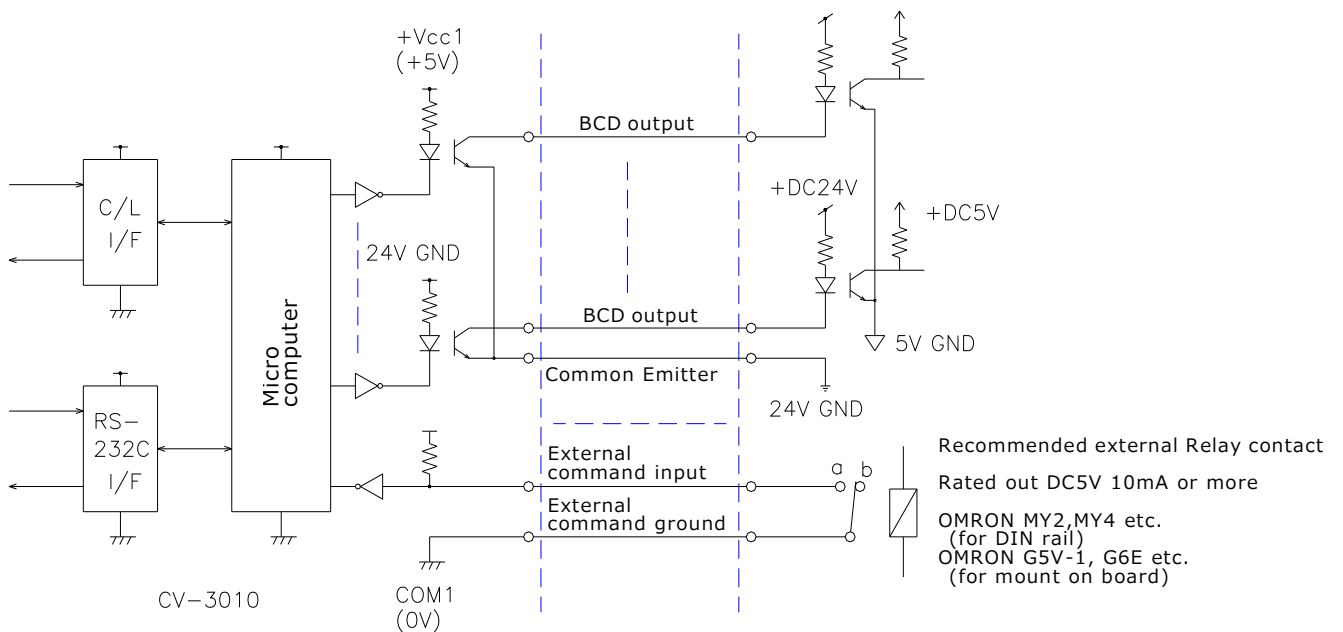
Direction	Connection signal	No.	No.	Connection signal	Direction
OUT	BCD data 10 <sup>0</sup> -1	1	19	BCD data 10 <sup>0</sup> -2	OUT
	BCD data 10 <sup>0</sup> -4	2	20	BCD data 10 <sup>0</sup> -8	
	BCD data 10 <sup>1</sup> -1	3	21	BCD data 10 <sup>1</sup> -2	
	BCD data 10 <sup>1</sup> -4	4	22	BCD data 10 <sup>1</sup> -8	
	BCD data 10 <sup>2</sup> -1	5	23	BCD data 10 <sup>2</sup> -2	
	BCD data 10 <sup>2</sup> -4	6	24	BCD data 10 <sup>2</sup> -8	
	BCD data 10 <sup>3</sup> -1	7	25	BCD data 10 <sup>3</sup> -2	
	BCD data 10 <sup>3</sup> -4	8	26	BCD data 10 <sup>3</sup> -8	
	BCD data 10 <sup>4</sup> -1	9	27	BCD data 10 <sup>4</sup> -2	
	BCD data 10 <sup>4</sup> -4	10	28	BCD data 10 <sup>4</sup> -8	
	OVER	11	29	POL(+)	
	STROBE	12	30	RUN	
	Common Emitter	13	31	Common Emitter	
14		32			
	N.C.	15	33	N.C.	
IN	Data Hold	16	34	Logic inversion of Data	IN
	Logic inversion of STROBE signal	17	35	Pulse width changing of STROBE signal	
	D.COM	18	36	D.COM	

Applicable wire connector: DDK 57-30360 or the equivalent

Connector pin#18,36(D.COM) are common to the terminal#6,8(D.COM) of RS-232C serial I/O, but are independent from pin#13,14,31,32(Common Emitter) of BCD data output.

5 – 3 ) Precautions of wiring

BCD data output of this unit is Open Collector output. External command input of this unit should be driven by external Relay contact due to not isolated from an inner circuit. The external Relay contacts and this unit are supposed to build in the same control box, so that the cable length between Relay contacts and this unit should be less than 10m. BCD data signal can be extended as long as 100m because they are isolated from an inner circuit. But it will depend on the surrounding circumstances.



## § 6. Dimensional drawing

