

PROGRAMMABLE CONTROLLER

PROSEC T3

CHANGE DETECT DC INPUT MODULE

CD332

USER'S MANUAL

TOSHIBA CORPORATION

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Safety Precautions

This module (CD332) is a change detect DC input module for Toshiba's Programmable Controller PROSEC-T3 or T3H (hereafter called T3 generically). Read this manual thoroughly before using this module. Also, keep this manual and related manuals so that you can read them anytime while this module is in operation.

Safety Symbols

The following safety symbols are used on the product and/or in the related manuals. Pay attention to information preceded by the following symbols for safety.

 **WARNING** Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

 **CAUTION** Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

Safety Precautions

CAUTION

- Turn off power to the T3 and to the CD332 before removing or mounting the CD332. Failure to do so can cause electrical shock or damage to this product.
- Read the Safety Precautions described in the T3 User's Manual before using the T3 and the CD332.
- Follow the instructions described in this manual and in the T3 User's Manual when installing and wiring the T3 and the CD332.
- The CD332 has been designed for the T3. Use your CD332 only on the rack of the T3.
- Remove the CD332 from the rack before setting the jumper plugs on the CD332. Do not touch other components on the CD332's printed circuit board. It may cause damage to the CD332.
- The CD332 consumes maximum 0.3 A of internal 5 Vdc power. Confirm that the total 5 Vdc consumed current per one power supply module is within the limit (7A). If it exceeds the limit, the T3 cannot operate properly and this may cause unsafe situation.

About This Manual

About This Manual

This manual explains the specifications and operations of the Change Detect DC Input Module (CD332) for Programmable Controller T3. Read this manual carefully before using the CD332.

Inside This Manual

Section 1 Overview

This section introduces the CD332. The CD332 has an interrupt generation function for the T3. This section outlines the CD332's function. The external features of the CD332 are also provided in this section.

Section 2 Specifications

This section provides the hardware and functional specifications of the CD332. The information for external wire connections is also provided in this section.

Section 3 Mode Setting

The input delay time and the interrupt generation timings are user selectable. This section explains the switch settings for this purpose.

Section 4 I/O Allocation

This section provides the information to design T3 program for the CD332. This section explains the I/O allocation and functions of the I/O register assigned to the CD332.

Section 5 Programming

The CD332 generates an interrupt signal for the T3. This section provides T3's sample program for the CD332. Precautions for using the interrupt function are also explained in this section.

Related Manuals

The following related manuals are available for T3. Besides this manual, read the following manuals for your better understanding.

T3 User's Manual - Hardware

This manual covers the T3's main body and basic I/O - their specifications, handling, maintenance and services.

T3 User's Manual - Functions

This manual explains the functions of the T3 and how to use them. The necessary information to create user program is covered in this manual.

T3H User's Manual

This manual explains the specifications of the T3H and the functional differences between the T3H and the T3.

T-series Instruction Set

This manual provides the detailed specifications of instructions for Toshiba's T-series Programmable Controllers.

T-series Computer Link Function

This manual provides the information for a computer to communicate with T3 through the T-series Programmable Controller's Computer Link function.

T-PDS (Ver. 1.4) Basic Operation manual

This manual explains how to install the T-series program development system (T-PDS) into your computer and provides basic programming operations.

T-PDS (Ver. 1.4) Command Reference Manual

This manual explains the T-series program development system (T-PDS) in detail.

T-PDS (Ver. 1.6) Expanded Functions

This manual explains the expanded functions on the T-PDS version 1.6. This manual supplements the T-PDS (Ver.1.4) Command Reference Manual.

T-series Handy Programmer (HP911) Operation Manual

This manual explains the functions and key operations of the T-series Handy Programmer (HP911).



Other than the listed above, some T3 related manuals for special I/O modules and data transmission modules are available. Contact Toshiba for more information.

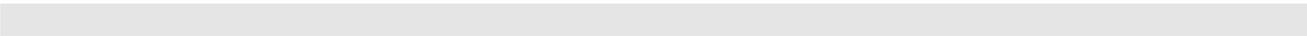
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Section 1

CD332 Overview

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1. CD332 Overview

1.1 Introduction

The change detect DC input module CD332 (hereafter called CD332) is an 8 points 12 - 24 Vdc input module with interrupt generation function for Toshiba's Programmable Controller PROSEC-T3 or T3H (hereafter called T3 generically).

When the input signal status of the CD332 is changed, the CD332 generates an interrupt for the T3. Then the T3 immediately stops ordinary operation and starts to execute the pre-assigned I/O interrupt program.

The task switching time in the T3 is less than 500 μ s. (under interrupt enable state)

The interrupt generation timing of the CD332 can be selected as follows for each input point. This selection is made by the DIP switches provided on the front of the CD332.

- (1) Rising edge (from OFF to ON)
- (2) Falling edge (from ON to OFF)
- (3) Both edges (both OFF to ON and ON to OFF)

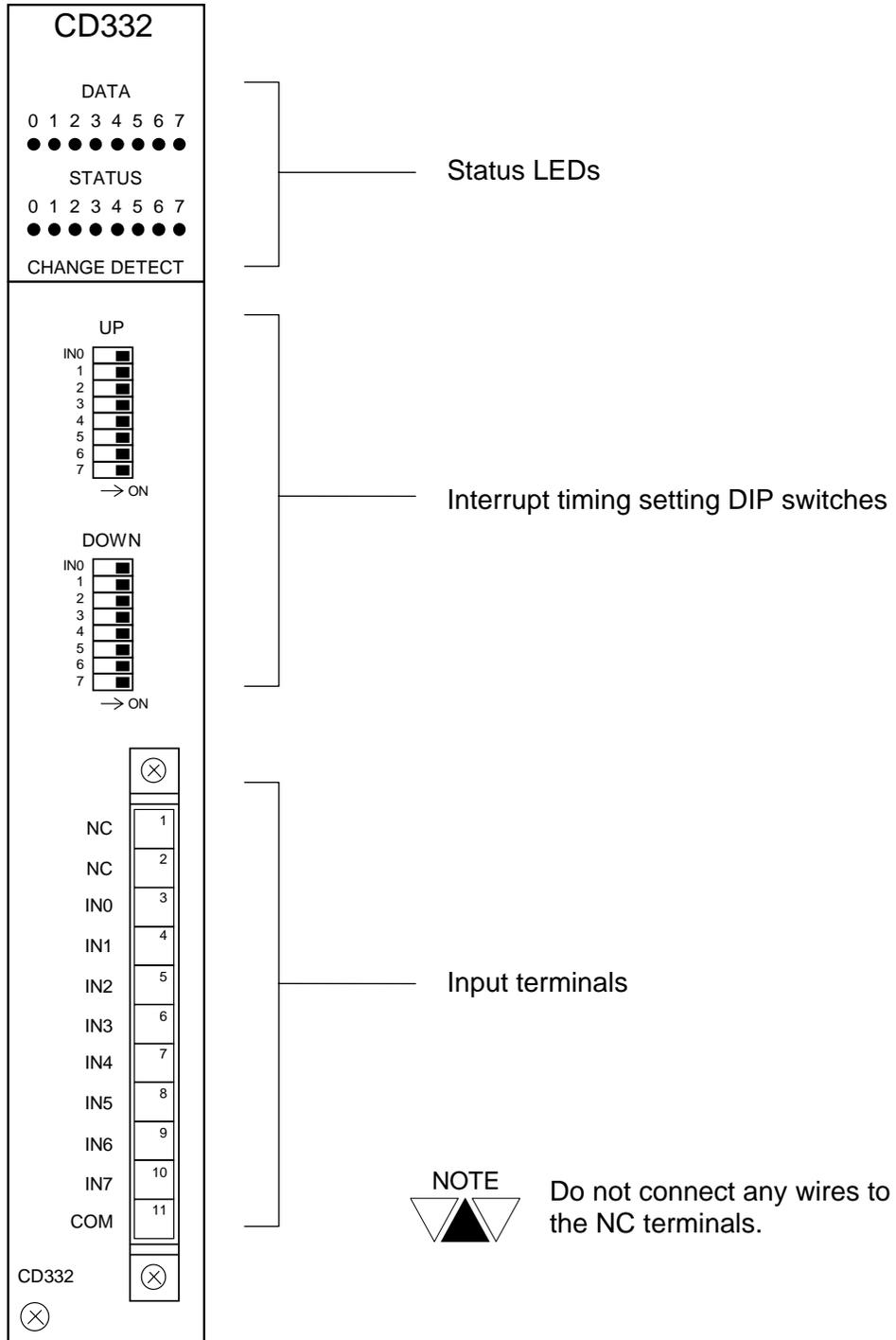
This CD332 has 8 input points. By using one CD332, up to 8 interrupt factors can be processed. On the other hand, up to 8 I/O interrupt programs are available in the T3. Therefore, total up to 64 (= 8 \times 8) interrupt factors can be processed by the T3 by using 8 CD332s.

The input voltage of the CD332 is 12 to 24 Vdc. The input delay time can be selected either normal or high speed as 8 points block by setting the internal jumper plugs.



NOTE The T3 supports 8 I/O interrupt programs. Therefore, maximum 8 CD332s can be used with the T3.

1.2 External features



1. CD332 Overview

Status LEDs

Indicates the input signal ON/OFF status (DATA 0 - 7) and the interrupt generation point (STATUS 0 - 7). Normally STATUS 0 - 7 are all OFF. (momentary ON)

| | |
|--------------|--|
| DATA 0 - 7 | Indicates the input signal status of IN0 to IN7. Lit when ON. |
| STATUS 0 - 7 | Indicates the input point which is the interrupt factor. (returned to OFF by resetting the interrupt flag) |

Interrupt timing setting DIP switches

Total 16 switches are provided. These switches are used to set the interrupt generation timing for each input point. (Rising, falling or both edges)
Refer to section 3.2.

Input terminals

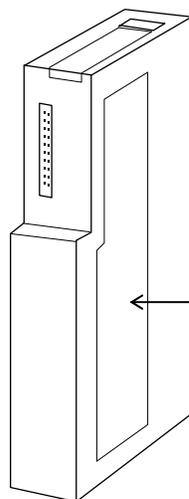
Used to connect the external input signals. Refer to section 2.4.



Do not connect any wires to the NC terminals.

Jumper plugs

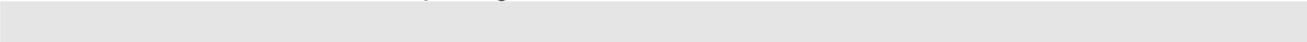
CD332 rear view



Jumper plugs for selecting the input delay are provided. Refer to section 3.1.

Section 2

Specifications

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- 

2. Specifications

2.1 General specifications

| Item | Specifications | Remarks |
|--------------------------|--------------------------------------|----------|
| Power voltage | 5 Vdc (supplied from back plane bus) | |
| Current consumption | 0.3 A (5 Vdc) maximum | Note (1) |
| Environmental conditions | Conforms to T3 specifications | |
| Withstand voltage | 1500 Vac - 1 minute | Note (2) |
| Size | T3 I/O module size (1 slot) | |
| Weight | Approx. 450 g | |

Note (1) The T3's power supply module can supply maximum 7 A of internal 5 Vdc. Check that the internal 5 Vdc current consumption per one power supply module does not exceed the limit.

Note (2) Between external terminals and internal circuit.

2.2 Functional specifications

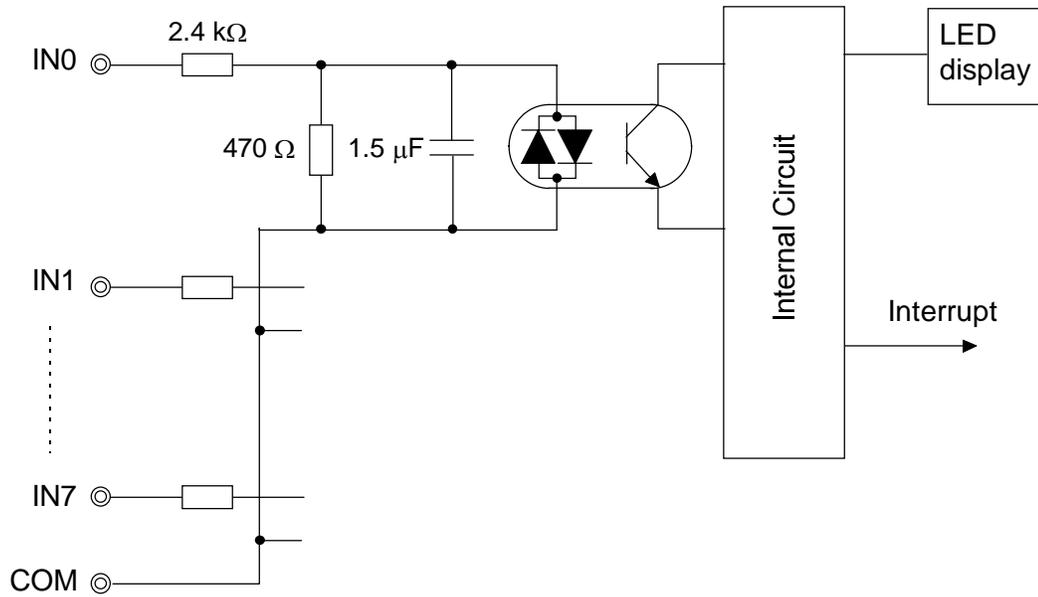
| Item | Specifications | Remarks |
|-------------------------|---|--|
| Module type | Change detect DC input | |
| I/O allocation type | iX 1W | |
| Input type | DC input, current source/sink | |
| Number of input points | 8 points (8 points/common) | |
| Rated input voltage | 12 - 24 Vdc | |
| Input voltage range | 10 - 30 Vdc | |
| Rated input current | 10 mA (at 24 Vdc) | |
| Minimum ON voltage | 9.6 Vdc | |
| Maximum OFF voltage | 3.5 Vdc | |
| ON delay time | 30 ms or less (normal mode) 3.0 ms or less (high speed mode) | Note (1) |
| OFF delay time | 35 ms or less (normal mode) 3.5 ms or less (high speed mode) | Note (1) |
| LED display | DATA 0 - 7 | Input status display for all points, lit at ON, internal logic side |
| | STATUS 0 - 7 | Interrupt point display, returned to OFF by resetting the interrupt flag |
| Interrupt function | Generates interrupt signal for T3 when input status of each point is changed. Interrupt timing can be selected for each point either rising, falling or both edges. | Note (2) |
| Number of modules on T3 | Max. 8 modules | |

Note (1) The normal or high speed mode can be selected by internal jumper plug settings. Refer to section 3.1.

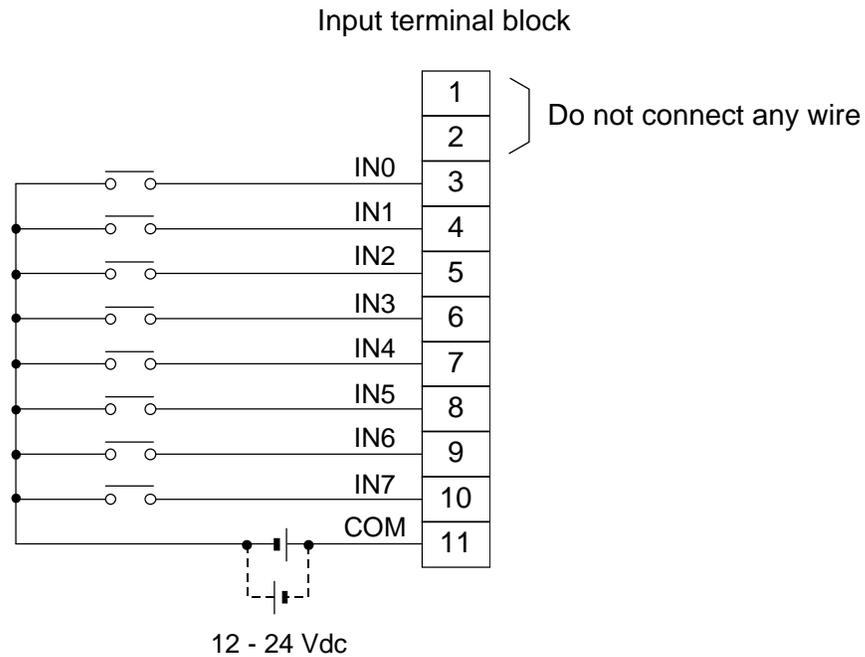
The delay time includes the input filter and internal sampling.

Note (2) The interrupt timing is selected by DIP switches. Refer to section 3.2.

2.3 Input circuit

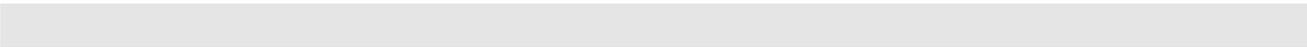


2.4 Input signal connections



Section 3

Mode Setting

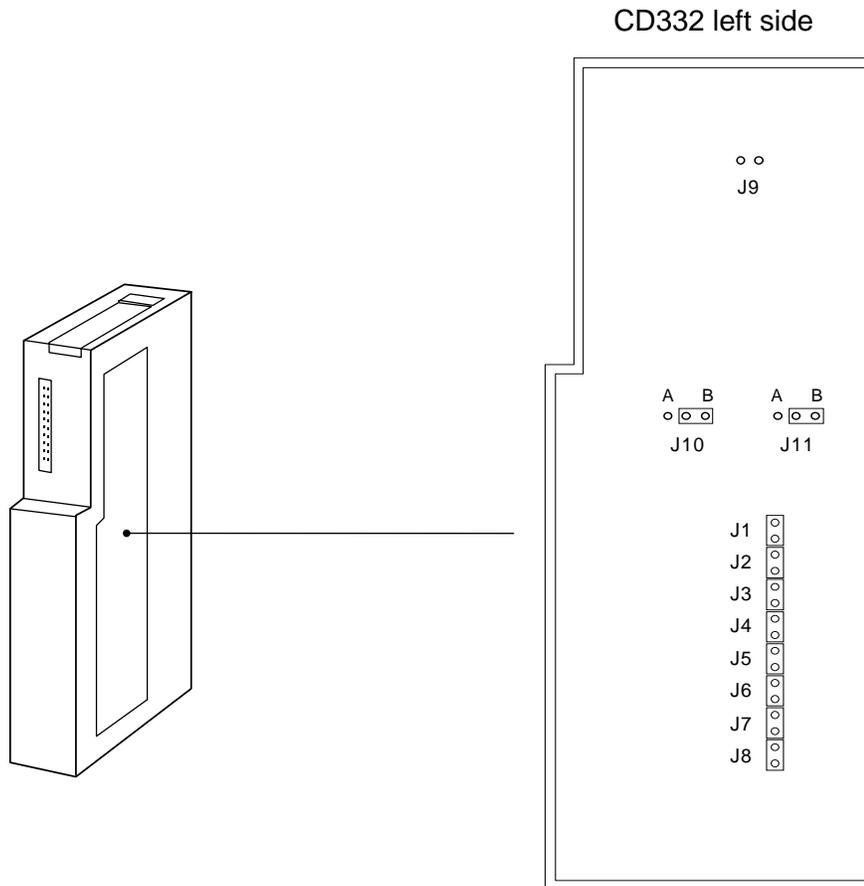
- 3.1 Input delay setting, 14*
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- 

3. Mode Setting

3.1 Input delay setting

The input delay time of the CD332 can be selected either normal or high speed mode. Refer to section 2.2 for the delay time of each mode.

The input delay setting is made by the jumper plugs provided on the CD332's printed circuit board. This setting is applied for all 8 input points as a block.



Set these jumper plugs as follows.

| Mode | J1 | J2 | J3 | J4 | J5 | J6 | J7 | J8 | J9 | J10 | J11 |
|-----------------|------------|----|----|----|----|----|----|----|-----|--------|-----|
| Normal mode | ON (short) | | | | | | | | OFF | B side | |
| High speed mode | OFF (open) | | | | | | | | OFF | A side | |

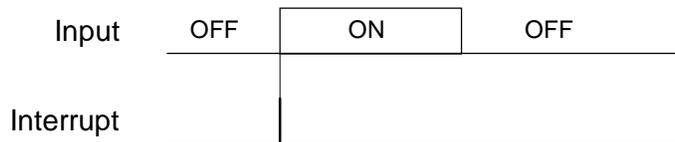


- NOTE**
- (1) The factory setting is the normal mode.
 - (2) Use a pair of tweezers to set the jumper plugs.
 - (3) J9 must be always OFF (open).

3.2 Interrupt generation timing setting

The interrupt generation timing of each input point can be selected either rising, falling or both edges.

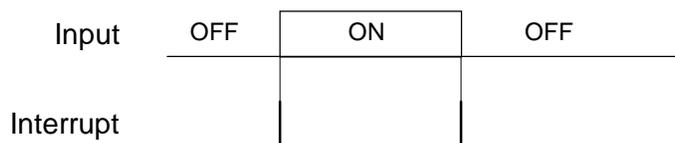
- Rising edge (OFF to ON)



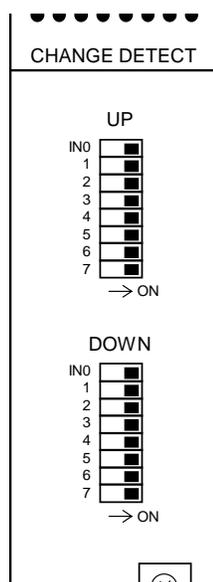
- Falling edge (ON to OFF)



- Both edges (OFF to ON and ON to OFF)



This setting is made by the DIP switches provided on the front of the CD332.



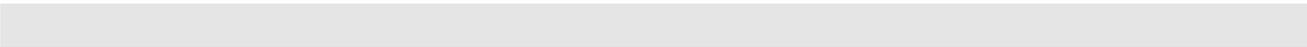
| Mode | UP | DOWN |
|--------------|-----|------|
| Rising edge | ON | OFF |
| Falling edge | OFF | ON |
| Both edges | ON | ON |



- (1) This setting is available for each input point individually.
- (2) The factory setting is all ON. (Both edges)
- (3) Changes of the DIP switches are effective while power on.

Section 4

I/O Allocation

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- 

4. I/O Allocation

4.1 I/O allocation and I/O register

The CD332 has the I/O type 'i X 1W' for I/O allocation. When the automatic I/O allocation is performed with mounting the CD332, the following I/O allocation table will be created in the T3.

(T-PDS screen example - in the case that CD332 is mounted on Slot 0 of Unit 0)

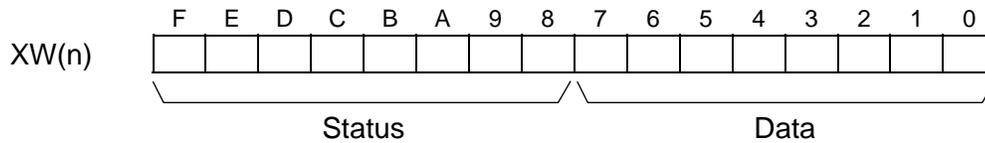
| <I/O Allocation> | | | | | | | | | | | | | | | |
|------------------|---|--------|---|-----------------|---|-----|---|-----------------|---|-----|---|-----------------|---|-----|---|
| ----Unit #0---- | | | | ----Unit #1---- | | | | ----Unit #2---- | | | | ----Unit #3---- | | | |
| Slot | | I/O | | Slot | | I/O | | Slot | | I/O | | Slot | | I/O | |
| PU | [| |] | 0 | [| |] | 0 | [| |] | 0 | [| |] |
| 0 | [| iX 1W] | | 1 | [| |] | 1 | [| |] | 1 | [| |] |
| 1 | [| |] | 2 | [| |] | 2 | [| |] | 2 | [| |] |
| 2 | [| |] | 3 | [| |] | 3 | [| |] | 3 | [| |] |
| 3 | [| |] | 4 | [| |] | 4 | [| |] | 4 | [| |] |
| 4 | [| |] | 5 | [| |] | 5 | [| |] | 5 | [| |] |
| 5 | [| |] | 6 | [| |] | 6 | [| |] | 6 | [| |] |
| 6 | [| |] | 7 | [| |] | 7 | [| |] | 7 | [| |] |
| 7 | [| |] | 8 | [| |] | 8 | [| |] | 8 | [| |] |
| 8 | [| |] | 9 | [| |] | 9 | [| |] | 9 | [| |] |
| 9 | [| |] | 10 | [| |] | 10 | [| |] | 10 | [| |] |

Then, one input register, XW(n) is assigned to the CD332.
In the above example, XW000 is assigned.

Note that the I/O type has 'i' designation. It means that the CD332 has interrupt generation function for the T3, also the T3 will not update the assigned input register in the batch I/O processing. To read data through the input register, the Direct I/O instruction (FUN235) is necessary.

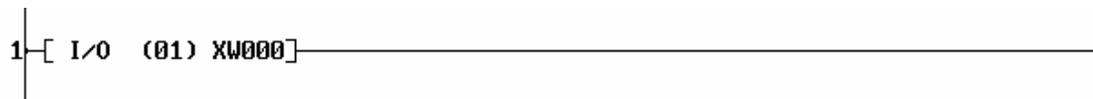
4. I/O Allocation

The following table shows the function of each bit of the input register assigned to the CD332.



| Register | Bit | Name | Description | |
|----------|-----|--------|--------------------|--|
| XW(n) | 0 | Data | IN0 | Indicates ON/OFF status of input IN0 |
| | 1 | | IN1 | Ditto IN1 |
| | 2 | | IN2 | Ditto IN2 |
| | 3 | | IN3 | Ditto IN3 |
| | 4 | | IN4 | Ditto IN4 |
| | 5 | | IN5 | Ditto IN5 |
| | 6 | | IN6 | Ditto IN6 |
| | 7 | | IN7 | Ditto IN7 |
| | 8 | Status | IN0 | Comes ON when interrupt is generated by IN0 changing |
| | 9 | | IN1 | Ditto IN1 changing |
| | A | | IN2 | Ditto IN2 changing |
| | B | | IN3 | Ditto IN3 changing |
| | C | | IN4 | Ditto IN4 changing |
| | D | | IN5 | Ditto IN5 changing |
| | E | | IN6 | Ditto IN6 changing |
| F | IN7 | | Ditto IN7 changing | |

The data of the CD332 can be read into the XW(n) register by using the Direct I/O instruction (FUN235).



By executing the Direct I/O instruction, the interrupt flag (interrupt request) is reset to OFF internally, and at the same time, the status bits are reset to OFF inside the CD332.

4. I/O Allocation

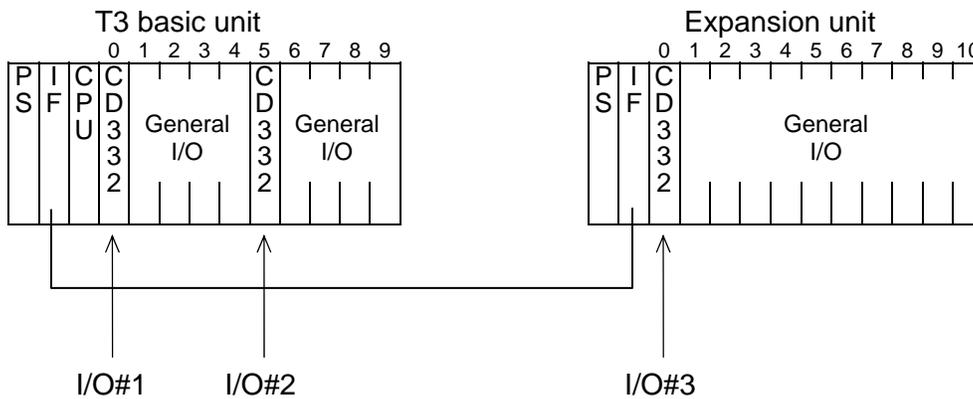
4.2 Interrupt assignment

The T3 has 8 I/O interrupt programs, I/O#1 to I/O#8.

If one interrupt generation module (CD332) is used, the I/O#1 program is assigned to the CD332. And the I/O#1 is activated when the CD332 generates an interrupt.

If two or more (up to 8) interrupt generation modules (CD332, etc.) are used, the interrupt programs are assigned sequentially from the module allocated closest to the T3 CPU.

For example, if 3 CD332s are used, the I/O#1, I/O#2 and I/O#3 are assigned sequentially as follows.



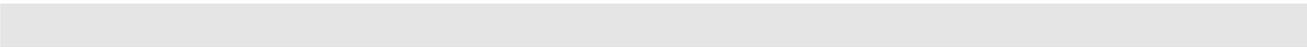
As for the interrupt priority, the interrupt generation module which is allocated closest to the T3 CPU has highest priority and followed by this order.



NOTE In default, the T3's I/O interrupt program and the interrupt generation module are related as mentioned above. However user can change this relation (assignment) by using the interrupt assignment function of the T3. For this function, refer to the T3 User's Manual - Function.

Section 5

Programming

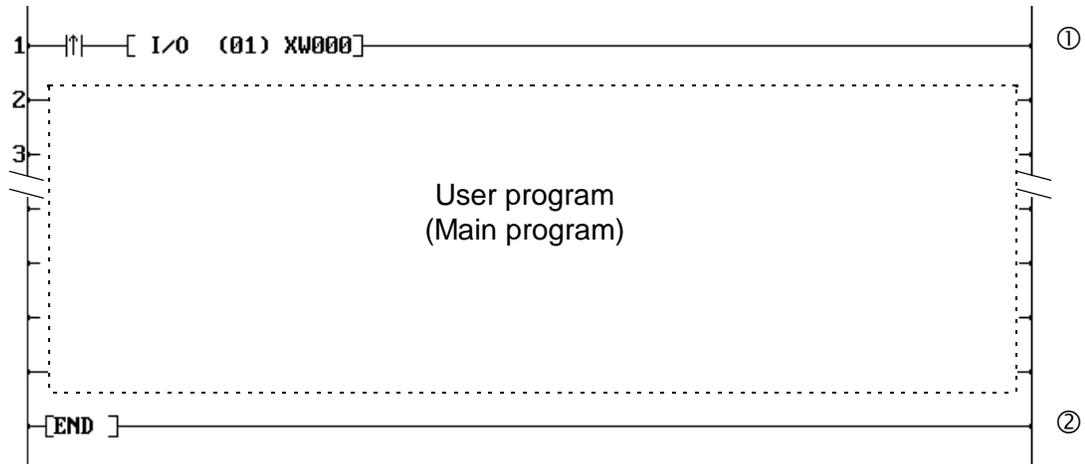
- 5.1 T3 sample program, 22*
 - 5.2 Interrupt operation, 24*
- 

5. Programming

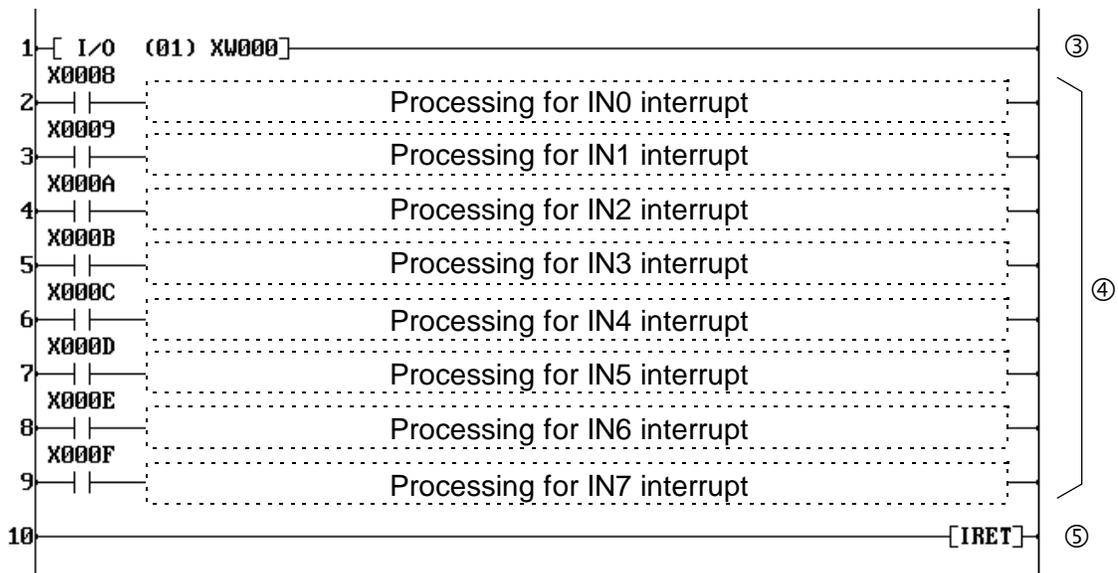
5.1 T3 sample program

The following sample program configuration shows the case of one CD332 is used. In this example, it is assumed that XW000 is assigned to the CD332.

Main Program



I/O Interrupt Program #1 (I/O#1)



5. Programming

- ① At the first scan, initializes the status of the CD332. – Important
- ② End of the main program
- ③ Resets the interrupt flag and confirms the interrupt factor. – Important
- ④ Processing program for each interrupt factor
(Subroutine call can also be used)
- ⑤ End of the interrupt program



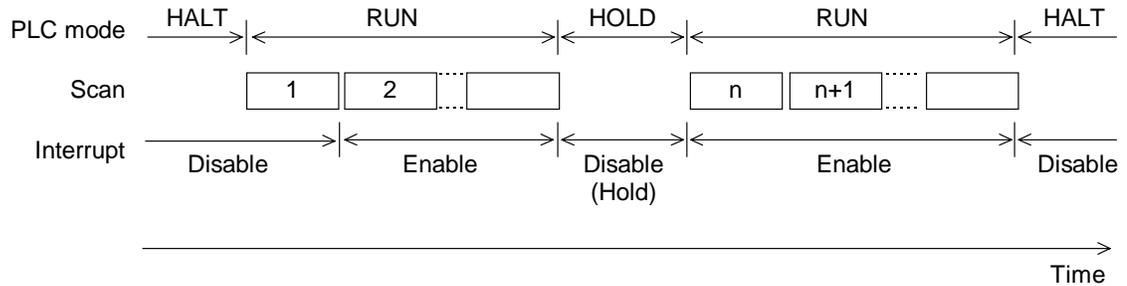
NOTE

When the Direct I/O instruction for the CD332 is executed, the internal interrupt flag of the CD332 is reset. Therefore, do not use the Direct I/O instruction for the CD332 on the main program, except ① above.

5. Programming

5.2 Interrupt operation

The enable/disable of the interrupt program is changed as follows.

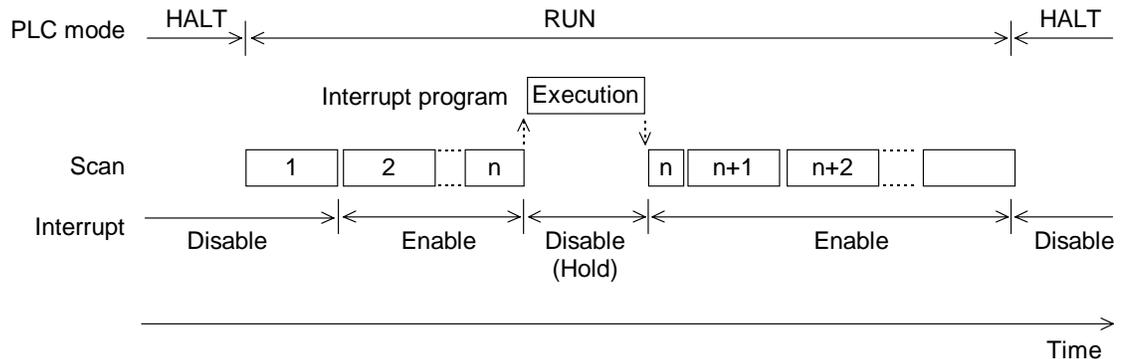


In the RUN mode, interrupt operation is disabled at the first scan, and enabled from the second scan.

In the HALT mode, interrupt operation is disabled.

In the HOLD mode, interrupt operation is disabled but the interrupt requests occurred during HOLD mode is held.

During interrupt program execution, other interrupts are disabled, and the interrupt request is held as follows.



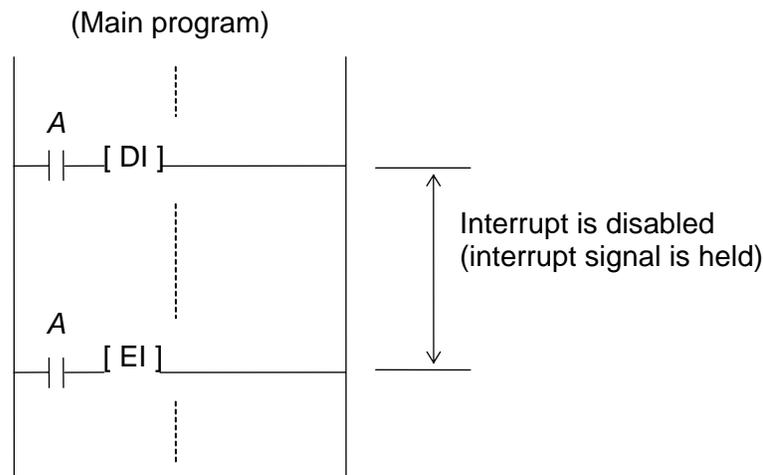
Note) The held interrupt requests are accepted when interrupt status is changed to enable, according to the priority as follows.

(Timer interrupt → I/O#1 → I/O#2 → ... → I/O#8, in default)

The interrupt operation can be controlled by the user program instructions, DI (disable interrupt) and EI (enable interrupt). If a part of program is required to be executed under interrupt disable state, these instructions can be used.

When using these instructions, note the following precautions.

- On the T3 program, interrupt enable/disable can be controlled by using EI instruction (FUN140) and DI instruction (FUN141). These instructions should be used in a pair in the sequence of DI first and followed by EI.



- EI and DI instructions should not be used in interrupt program. Also, these instructions should not be executed in the first scan.

When using the interrupt function, the following general precautions should be considered.

- The high frequency of the interrupt generation will cause T3 inoperative. Because, in such case, the T3 becomes busy to execute the interrupt program, and cannot execute the main program.
- When the CD332 is used, pay attention to the external noise environment. Especially, when using the high speed response mode, check this point carefully.

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