HITACHI PROGRAMMABLE CONTROLLER

HIDIC EH-150

Counter Module EH-CU/CUE

APPLICATION MANUAL

NJI-321B(X)

Revision History

No.	Description of Revision	Data of	Manual Number
1	First edition		NJI-321(X)
2	Count value record mode addition (P1-2, P3-3, P7-5, P7-12, P7-13, Appendix A2) Error correction (P1-2, P5-1, P702, P7-3, P7-14) EH-CUE addition	2001/10/1	NJI-321A(X)
3	Differential voltage added.	2004/8	NJI-321B(X)

Safety Precautions

Read this manual and related documents thoroughly before installing, operating, performing preventive maintenance or performing inspection, and be sure to use the unit correctly. Use this product after acquiring adequate knowledge of the unit, all safety information, and all cautionary information. Also, make sure this manual enters the possession of the chief person in charge of safety maintenance.

Safety caution items are classified as "Danger" and "Caution" in this document.

DANGER : Cases where if handled incorrectly a dangerous circumstance may be created, resulting in possible death or severe injury.

CAUTION : Cases where if handled incorrectly a dangerous circumstance may be created, resulting in possible minor to medium injury to the body, or only mechanical damage.

However, depending on the circumstances, items marked with CAUTION may result in major accidents.

In any case, they both contain important information, so please follow them closely.

Icons for prohibited items and required items are shown below:

: Indicates prohibited items (items that may not be performed). For example, when open flames are prohibited, is shown.

: Indicates required items (items that must be performed). For example, when grounding must be performed, is shown.

1. About installation

CAUTION

- Use this product in an environment as described in the catalogue and this document.
  If this product is used in an environment subject to high temperature, high humidity, excessive dust, corrosive gases, vibration or shock, it may result in electric shock, fire or malfunction.
- Perform installation according to this manual.
  If installation is not performed adequately, it may result in dropping, malfunction or an operational error in the unit.
- Do not allow foreign objects such as wire chips to enter the unit.
  They may become the cause of fire, malfunction or failure.

2. About wiring

REQUIRED

- Always perform grounding (FE terminal).
  If grounding is not performed, there is a risk of electric shocks and malfunctions.

CAUTION

- Connect power supply that meets rating.
  If a power supply that does not meet rating is connected, fire may be caused.
- The wiring operation should be performed by a qualified personnel.
  If wiring is performed incorrectly, it may result in fire, damage, or electric shock.

3. Precautions when using the unit

DANGER

- Do not touch the terminals while the power is on.
  There is risk of electric shock.
- Structure the emergency stop circuit, interlock circuit, etc. outside the programmable controller (hereinafter referred to as PC).
  Damage to the equipment or accidents may occur due to failure of the PC.
  However, do not interlock the unit to external load via relay drive power supply of the relay output module.

CAUTION

- When performing program change, forced output, RUN, STOP, etc., while the unit is running, be sure to verify safety.
  Damage to the equipment or accidents may occur due to operation error.
- Supply power according to the power-up order.
  Damage to the equipment or accidents may occur due to malfunctions.

4. About preventive maintenance

DANGER
• Do not connect the ⊕, ⊖ of the battery in reverse. Also, do not charge, disassemble, heat, place in fire, or short circuit the battery. There is a risk of explosion or fire.

PROHIBITED
• Do not disassemble or modify the unit. These actions may result in fire, malfunction, or malfunction.

CAUTION
• Turn off the power supply before removing or attaching module/unit. Electric shock, malfunction or failure may result.

WARNING

To ensure that the equipment described by this manual. As well as all equipment connected to and used with it, operate satisfactorily and safety, all applicable local and national codes that apply to installing and operating the equipment must be followed. Since codes can vary geographically and can change with time, it is the user's responsibility to determine which standard and codes apply, and to comply with them.

FAILURE TO COMPLY WITH APPLICABLE CODES AND STANDARDS CAN RESULT IN DAMAGE TO EQUIPMENT AND/OR SERIOUS INJURY TO PERSONNEL.

INSTALL EMARGENCY POWER STOP SWITCH, WHICH OPERATES INDEPENDENTLY OF THE PROGRAMMABLE CONTROLLER TO PROTECT THE EQUIPMENT AND/OR PERSONNEL IN CASE OF THE CONTROLLER MALFUNCTION.

Personnel who are to install and operate the equipment should carefully study this manual and any other referred to by it prior to installation and/or operation of the equipment. Hitachi Industrial Equipment Systems Co., Ltd. constantly strives to improve its products, and the equipment and the manual(s) that describe it may be different from those already in your possession.

If you have any questions regarding the installation and operation of the equipment, or if more information is desired, contact your local Authorized Distributor or Hitachi Industrial Equipment Systems Co., Ltd.

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OPERATION OF THIS EQUIPMENT IN A RESIDENTIAL AREA IS LIKELY TO CAUSE INTERFERENCE IN WHICH CASE THE USER, AT HIS OWN EXPENSE, WILL BE REQUIRED TO TAKE WHATEVER MEASURES MAY BE REQUIRED TO CORRECT THE INTERFERENCE.

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Quality Assurance Dept.
Hitachi Industrial Equipment Systems Co., Ltd.
46-1 Ooaza-Tomioka Nakajo-machi
Kitakanbara-gun, Niigata-ken
959-2608 JAPAN

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As the product works with user program, and Hitachi Industrial Equipment Systems Co., Ltd. cannot test all combination of user program components, it is assumed that a bug or bugs may happen unintentionally. If it is happened: please inform the fact to Hitachi Industrial Equipment Systems Co., Ltd. or its representative. Hitachi will try to find the reason as much as possible and inform the countermeasure when obtained.

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Table of contents

Chapter 1 Introduction

We appreciate that you have selected the EH-150 Counter Module of the Hitachi programmable logic controller. This application manual describes how to properly operate the EH-150 Counter Module(hereinafter called as the EH-CU/CUE). Read carefully this manual to familiarize yourself with the procedures respectively of installation , operation, and maintenance and check. The following documentation related to the EH-150 PLC is also available and should be used together.

Table 1.1 List of manual

Item	Name of documentation	Manual No.
EH-150 APLLICATION MANUAL	EH-150 Application Manual	NJI-280*X
Programming Software	LADDER EDITOR (MS-DOS version) LADDER EDITOR for Windows®(Windows®95/98/NT4)	NB-325*X NJI-206*X/299*X
Counter module	Counter module (EH-CU/CUE) Application Manual	NJI-321*X

*The last character of the manual number may be modified when the product is revised.
Notes. The contents of this manual may be modified without previous notice.

1.1 Before Use

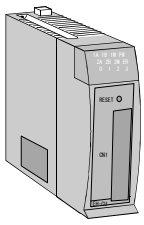
When you purchased the EH-series Counter Module , please check the following matters:

(1) If model name and specifications are correct.

(2) If there is no shipping damage on product (If any, consult the dealer of the counter module.)

(3) If following parts are in a carton box.

Table 1.2 List of Counter Module Parts

No.	Products name	Model number	Outlook	Pcs	Remarks
1	EH-series Counter Module	EH-CU or EH-CUE		1	
2	Notes to use	NJI-322*: Japanese	-	1	
		NJI-322*(X): English	-	1	

1.2 Outline

1.2.1 Outline

1. EH-150 Counter Module (EH-CU/CUE) is a special function module that is installed on the basic base or expansion base of EH-150 series.
2. EH-CU/CUE can count high speed pulse train that digital input module cannot follow.
3. EH-CU/CUE can output according to the data set by user program.

1.2.2 Characteristics

1. EH-CU/CUE is 1 slot module size, with 2 / 1 channels 32 bit counter.
2. EH-CU/CUE can count 4 mode pulse types which are 2 phase input mode, single phase (CW/ CCW signal) mode, 2 phase input mode (4 time multiplied) and single phase (Clock and direction signal) mode. These modes are selectable by dip setting switches.
3. High speed. (Maximum frequency is 100kHz (25kHz at 4 time multiplied mode).)
4. EH-CU/CUE has 2 types of interfaces. The one is differential input (line driver) and the other is open collector input (12-24 V DC).
5. EH-CU/CUE has ring counter mode too.
6. High speed response (less than 1ms) output. The comparison output is open collector type, so EH-CU/CUE can be connected to the external device directly.
7. In normal counting mode EH-CU/CUE can be set to the preset value from the current value by marker input.
8. EH-CU/CUE can memorize the current values at marker input (each channel 63 points). (Available from ROM version 0010 or later)

1.3 Notes to use

(1) EH-CPU5/448/3**/***A should be used with EH-CU/CUE. In case CPU is CPU104/208, CPU with ROM Rev.02 or later should be used. (But the external output of double words (DYrus5 to 6) can't be used.)**

(2) There are some limitations of comparison output and marker input. In details, refer to 5.2 “Normal counnter and Ring counter”.

(3) When installing or uninstalling, turn off the power supply.

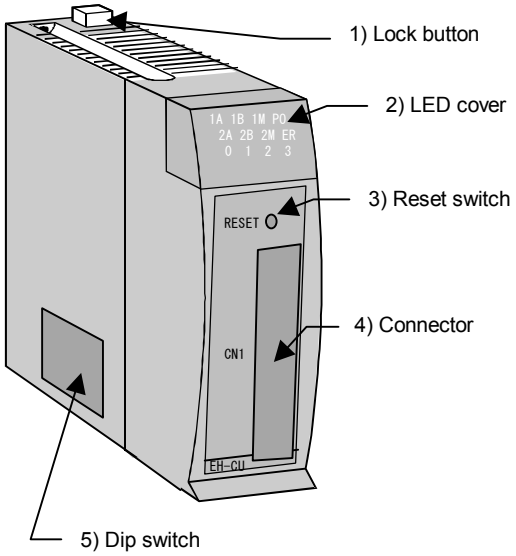
(4) EH-CU/CUE is high-speed input module which can count max. 100 kHz. If there is a noise on input signal, EH-CU/CUE may count wrong. External cables of EH-CU/CUE should be laid out fully apart from the other power and signal cables. In detail refer 6.3 “Wiring”.

(5) When input frequency is higher, the input signal may be changed by wiring method, length of wiring, kind of cable, and driver spec. of pulse output. Use a differential output line driver as possible.

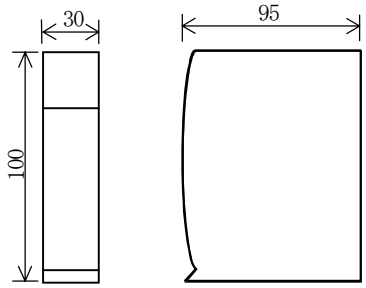
Chapter 2 Structure

2.1 Structure and Parts name

Name and Function

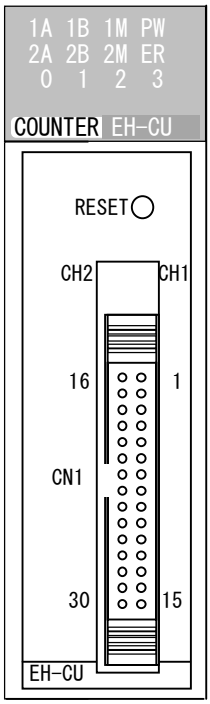


Model	EH-CU/CUE
Weight	Approx. 160g
Dimensions(mm)	100H × 30W × 95D (mm)



NO.	Name	Function	Remark
1)	Lock button	When dismounting the module from a base unit, press this button and lift up the module, if necessary, the module can be fixed by a screw (M4, 10 mm).	
2)	LED cover	This is the cover for LED that displays the module status.	Refer to 2.3
3)	Reset switch	In case of hardware error, push this button.	Refer to 2.2
4)	Connector	Interface to encoder and output devices.	Refer to 2.2 and 4.3
5)	Dip switch	Setting for EH-CU/CUE mode. Set these switches before power ON.	Refer to 5.1

2.2 Module nameplate and Signals



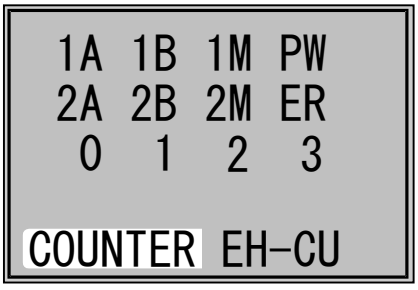
No.	Ch. 2	No.	Ch. 1		Voltage input (Open collector)	Differential input (Line driver)
16	Vin A	1	Vin A	A	12-24V power	NC
17	A (+)	2	A (+)		NC	(+) signal
18	A (–)	3	A (–)		Open collector	(–) signal
19	Vin B	4	Vin B	B	12-24V power	NC
20	B (+)	5	B (+)		NC	(+) signal
21	B (–)	6	B (–)		Open collector	(–) signal
22	Vin M	7	Vin M	M	12-24V power	NC
23	M (+)	8	M (+)		NC	(+) signal
24	M (–)	9	M (–)		Open collector	(–) signal
25		10			NC	
26		11				
27		12				
28	Y2	13	Y0	output	Comparison output (Open collector)	
29	Y3	14	Y1		Comparison output (Open collector)	
30	Com 2	15	Com 1		Com1 and 2 are separated.	

Note: The pin number defined of EH-CU/CUE is different from the number of the connector itself. CH2 is available in EH-CU only.

2.3 LED display

LED	Meaning	ON	OFF	Blinking
PW	Power LED	Normal operation	Hardware error	Parameters setting is not completed.
ER	Error LED	Hardware error	Normal operation	-
1A	Ch-1, A-phase	Corresponding input signal is ON	Corresponding input signal is OFF	-
1B	Ch-1, B-phase			
1M	Ch-1, Marker			
2A	Ch-2, A-phase			
2B	Ch-2, B-phase			
2M	Ch-2, Marker			
0, 1, 2, 3	Output Y0-Y3	Corresponding output signal is ON	Corresponding input signal is OFF	-

Note 1 : Marker LED's 1M and 2M are independent from the marker polarity setting. These LED's light up when the input is "ON" . The meaning of "ON" is mentioned in the chapter 4.
Note 2 : Error LED lights up when the reset switch is pushed, but it is normal.
Note 3 : LED 2A,2B,2M, 2 and 3 are available in EH-CU only.



Chapter 3 Specifications

3.1 General specifications

Table 3.1 General Specifications

Item	Specification
Operating temperature and humidity	0 to 55 °C, 20 to 90 %RH (no condensation)
Storage temperature and humidity	-10 to 75 °C, 10 to 90 %RH (no condensation)
Vibration resistance	In accordance with JIS C 0911
Noise resistance	○Noise voltage 1500 Vpp Noise pulse width 100 ns, 1 μs by using noise simulator. (According to Hitachi internal test procedure.) ○Based on NEMA ICS 3-304 (with the exception of input module) ○Static noise : 3000 V at metal exposed area
Dielectric withstand voltage	250 V DC between External signal terminal and case ground (FG) terminal
Current consumption	5 V DC 310 mA
Usage environment	No corrosive gasses, no excessive dirt
Structure	Attaches to an open wall
Cooling	Natural air cooling

3.2 General specifications

Table 3.2 Performance Specifications

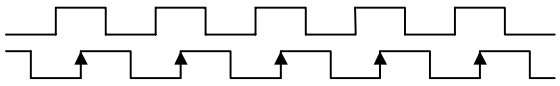
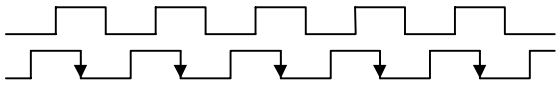
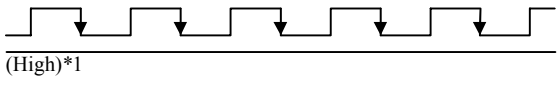
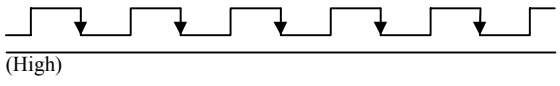
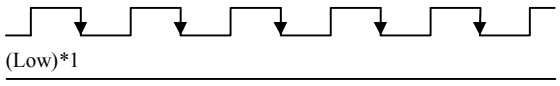
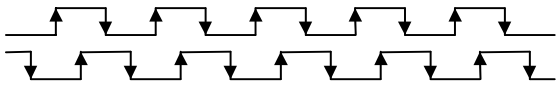
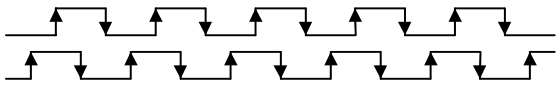
Item		Specifications	
		EH-CU	EH-CUE
Count range		32 bit (0 to 4 294 967 295)	
Countable pulse frequency		100 kHz (25 kHz at 4 time multiple)	
Count mode		2 phases, single phase (CW/CCW,CK/U/D) and 2 phases 4 time multiple (Common for both channels.)	
Number of channel		2 channels	1 channel
Differential input voltage		5V DC (Min. 4mA)	
	ON voltage	Min. 2.0 V	
	OFF voltage	Max. 0.8 V	
Open collector input voltage		12 to 24 V DC	
	ON voltage	Min. 10 V	
	OFF voltage	Max. 4 V	
Isolation system		Photo-coupler isolation	
Phase difference (A-B)	A: A, CW, CK	+ 45° to +125° at forward rotation - 45° to - 125° at reverse rotation	
	B: B, CCW, U/D		
	M: Marker (Z)		
Count pulse width		ON : 4 μs, OFF : 4 μs or more	
Marker pulse width		10 μs or more (ON edge)	
External connector		30-pin connector for 2 channels	
External wiring		Paired common shielded wire	

Table 3.3 Output Specifications

Item			Specification	
			EH-CU	EH-CUE
Output voltage			12/24 V DC (maximum 30 V DC)	
Load current			Maximum 20 mA/ point	
Output mode			Transistor (open collector)	
Minimum load current			1 mA	
Output delay time		ON to OFF	1 ms or less	
		OFF to ON	1 ms or less	
Voltage drop			Maximum 1.5 V	
External output points			4 points (selectable each channel)	2 points (selectable each channel)
	Up and down counter		Current value = (latch) comparison value 1 or Current value > (level) comparison value 1	
	Ring counter		Current value = (latch) comparison value 2	
Leak current			Maximum 0.5 mA	
Polarity			Minus (-) side in module (common) . Common is (-).	
External power supply voltage			12/24 V DC (Maximum 30 V DC)	
Isolation system			Photo-coupler isolation	

Table 3.4 Count method

↑ or ↓ is the counting timing.

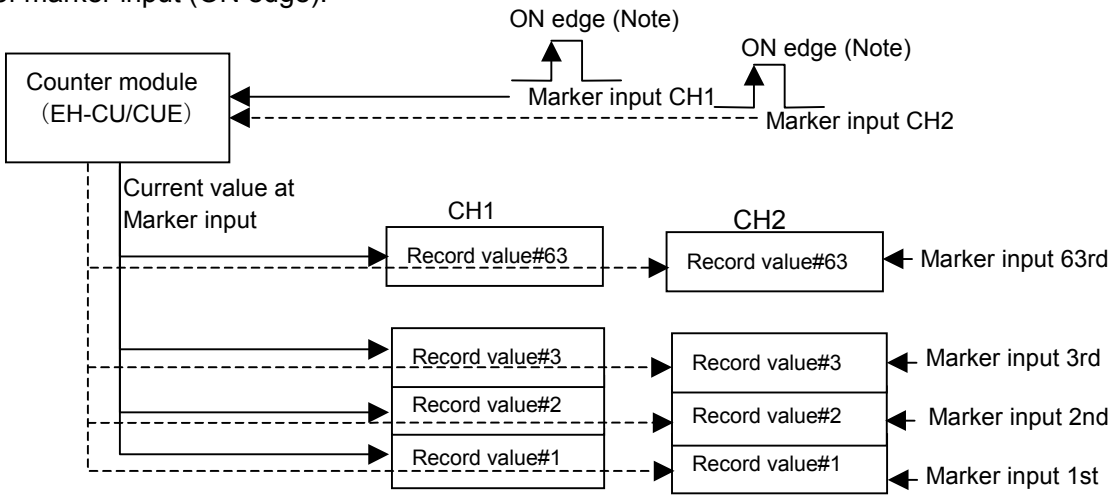
Count method			Selectable by Dip switches	Dip switches
Mode 1 2 phase	Up = A & B↑	Phase A Phase B		SW1:OFF SW2:OFF
	Down = A & B↓	Phase A Phase B		
Mode 2 (CW/CCW) single phase	Up = A↓ & B A = CW, B = CCW	Phase A Phase B	 (High)*1	SW1:ON SW2:OFF
	Down = A & B↓ A = CW, B = CCW	Phase A Phase B	(High) 	
Mode 3 (CK/U/D) single phase	Up = B & A↓ A = CK, B = Up/Down	Phase A Phase B	 (High)	SW1:OFF SW2:ON
	Down = $\overline{B}$ & A↓ A = CK, B = Up/ Down	Phase A Phase B	 (Low)*1	
Mode 4 2 phase (4 time multiple)	Up = A & B↑+ $\overline{A}$ & B↓ + $\overline{B}$ & A↑ + B & A↓	Phase A Phase B		SW1:ON SW2:ON
	Down = A & B↓ + $\overline{A}$ & B↑ + B & A↑ + $\overline{B}$ & A↓	Phase A Phase B		

*1 High is input “OFF”, Low is input “ON”.

3.3 Counter value record mode (ROM ver. 0010 or later)

(1) Counter value record mode

EH-CU/CUE memorizes the current value to the internal memory of EH-CU/CUE at the rising edge of marker input (ON edge).



(Note) When DIP SW3/4 is "ON", timing is ON edge, when DIP SW is "OFF", timing is "OFF edge". CH2 is available in EH-CU only.

Table 3.4 Count value record mode specification

Item	Specification	Remark
Maximum record number	Each channel 63 points	Data after the 64th time is not recorded.
Record 2 channel Simultaneous	Possible	
Maximum record frequency	50 kHz or less	Error ±3 pulses

(2) Record mode setting

Use a count value record mode setting command (see 7.5.4)

(3) Read the recorded data

Use a count record data read command (see 7.5.4).

(4) Clear the recorded data

Use a count record data clear command (see 7.5.4).

(5) Read the record mode setting

Use a count record value read command (see 7.5.4).

(6) Execute record

Data is recorded only when marker is enable (ME1 and ME2 is "1").

(Note) When marker is disable, the following is possible to use.
Record mode setting, Read the record data, Clear the record data, Read record mode setting.

(7) Power failure memory

EH-CU/CUE does not support power failure memory. When you need power failure memory, store the data to CPU memory which is set power failure memory by read the record data command.

(8) Operation of CPU RUN to STOP and STOP to RUN

Even when CPU operation is from RUN to STOP or from STOP to RUN, recorded data is not cleared.

Chapter 4 Interface

4.1 Input Interface

< Input interface circuit >
The input interface of EH-CU/CUE has both interfaces for differential output and for open collector output. Figure 4.1 shows the structure of the interface circuit. (Only one signal is shown)

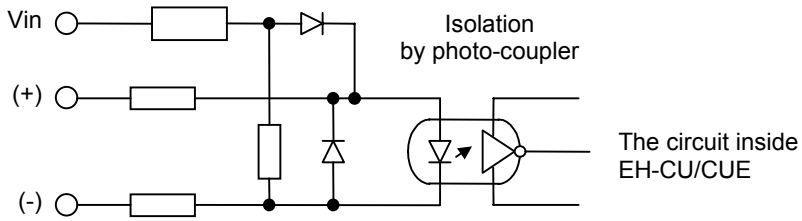


Figure 4.1 The structure of input interface

4.1.1 Example : Differential input (Line receiver)

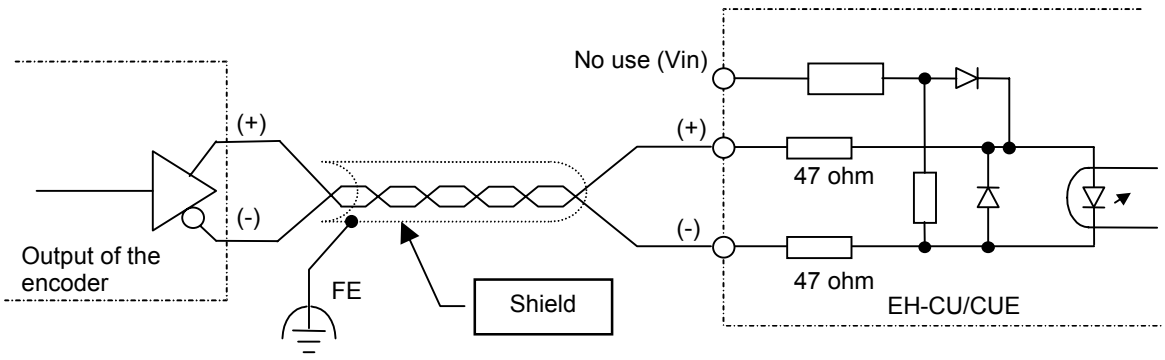
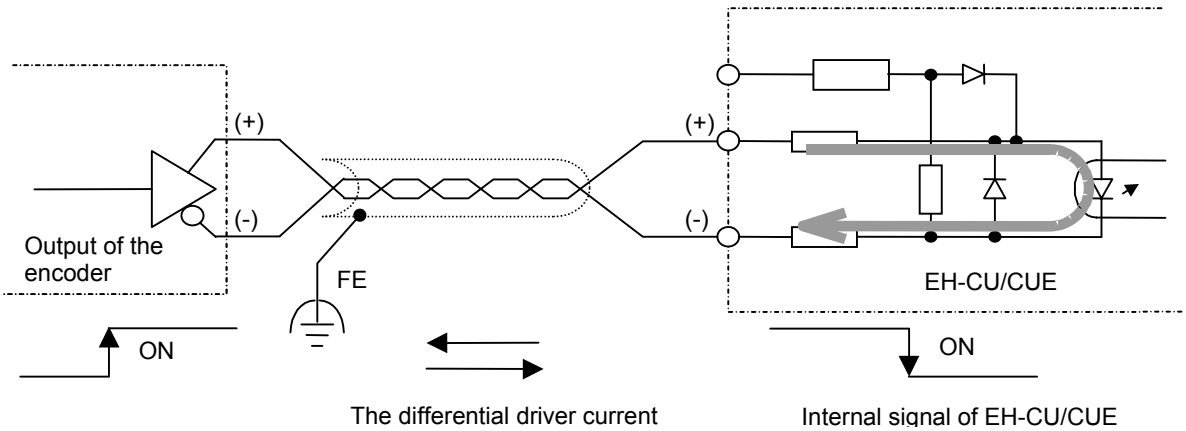


Figure 4.2 The interface with differential input

<Definition of input "ON">
When the differential driver current of the encoder passes the photo-coupler, input signal turns "ON" as below figure.



4.1.2 Example : Open collector output

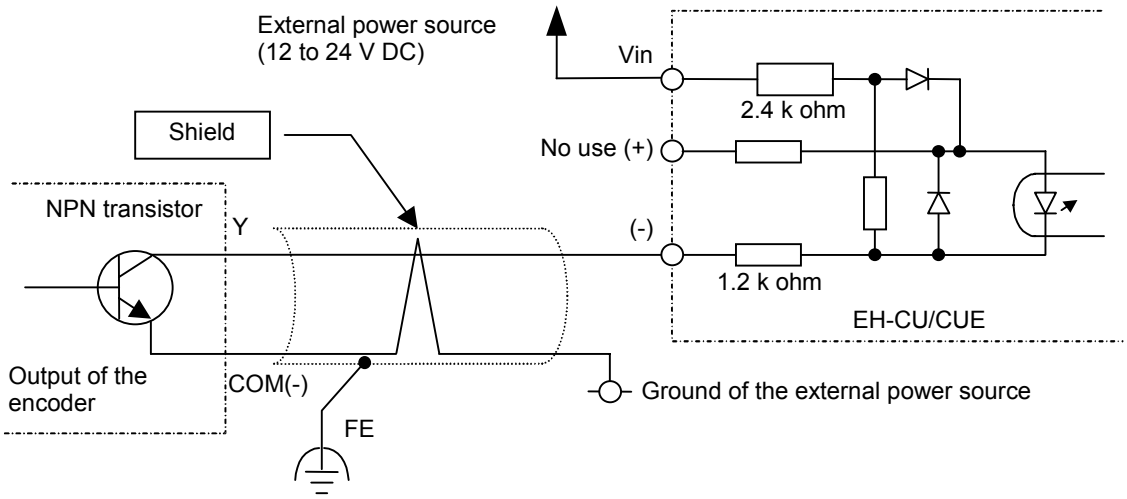
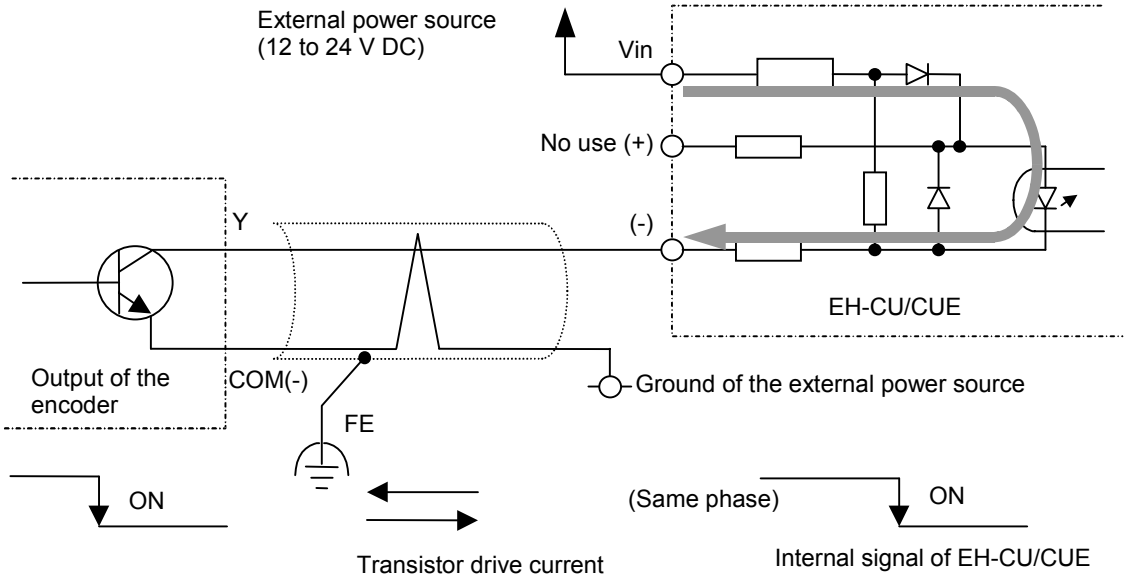


Figure 4.3 The interface with open collector output

<Definition of input "ON">
When the transistor current of the encoder run the photo-coupler, input signal is "ON" like under figure.



4.2 Output Interface

< Output interface circuit >
EH-CU/CUE has output interfaces of open collector type. Figure 4.4 shows a structure of the circuit.
When the output transistor is “ON”, the output current flows into the output transistor.
Please connect an additional fuse rated about 0.5A to each COM terminal outside, for protection of internal wiring.

4.2.1 Example: Connection with external device

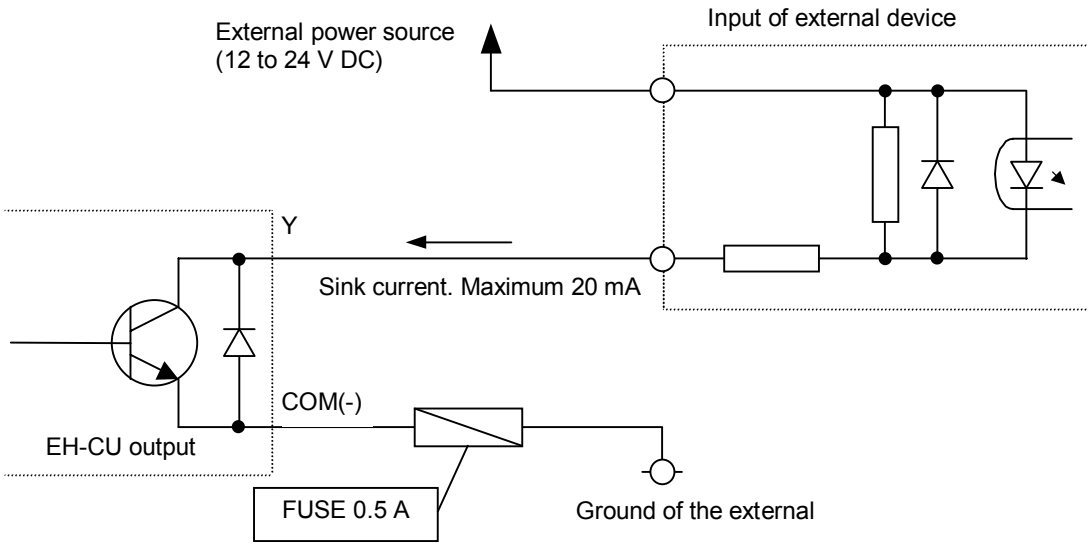


Figure 4.4 The interface of transistor

4.3 How to connect

Use the connector specified as below or compatible one.

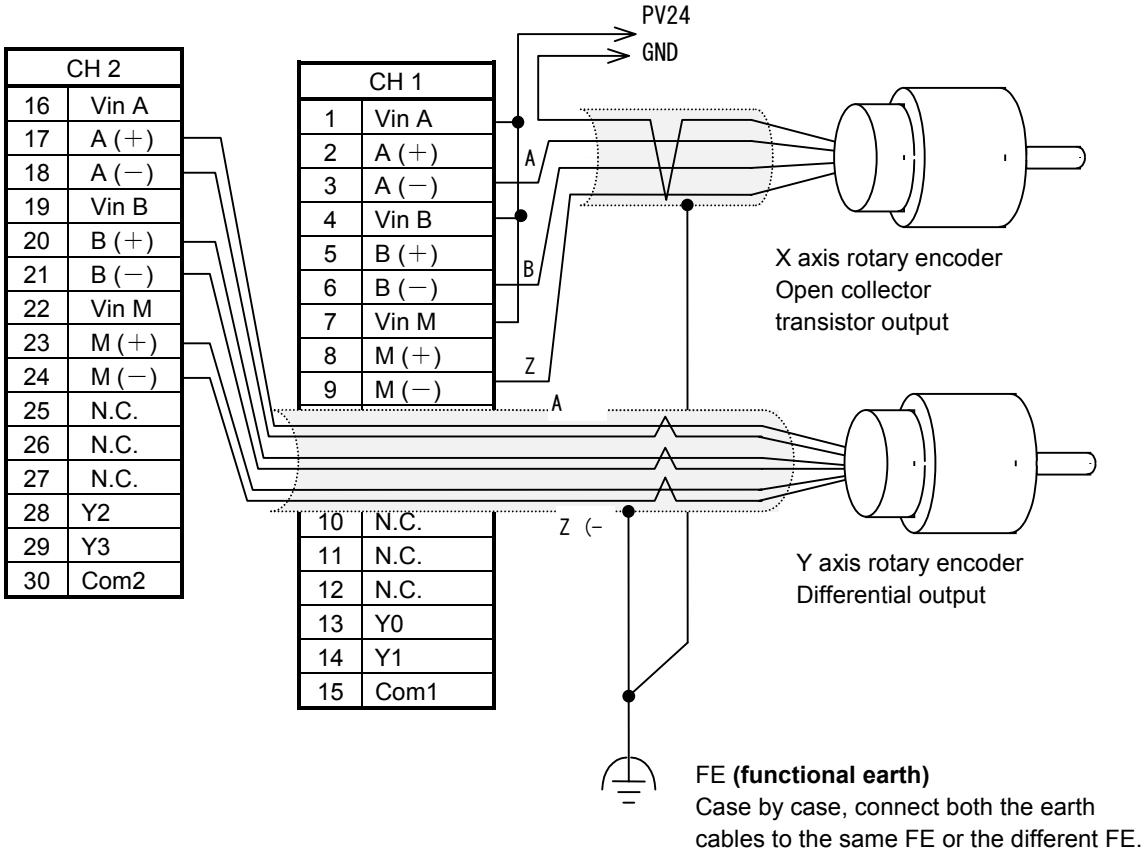
1. Connector model for EH-CU/CUE side
HIF3BA-30PA-2.54DS 30pin (male connector) made by HIROSE or equal one.

2. Connector model for the device side. Free wires and pin-socket of solderless type.

Connector case	HIF3BA-30D-2.54C	Connector case for 30 pins	Supplied by HIROSE
Connector pin (applicable tool)	HIF3-2226SCC (HIF3-TB2226HC)	Partial plated terminal For AWG#22-26 wire *1	Supplied by HIROSE
Connector case cover	HIF3-30CV		Supplied by HIROSE

*1 AWG22-26 wire is ϕ0.64-0.40mm
Refer Chapter 6.3 “Wiring” about the notes of wiring.

Example: connection to a rotary encoder

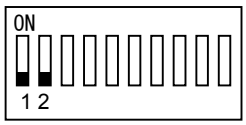
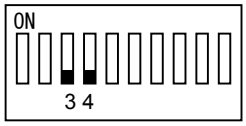
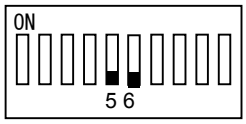
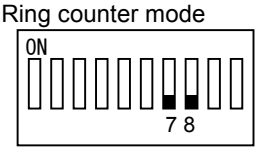
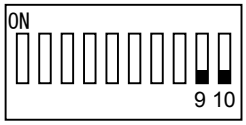


Refer to Chapter 6.3 “Wiring” about the notes of wiring.

Chapter 5 Setting

5.1 Setting dip switches

Set the dip switches by a certain sharp tool carefully, and do not touch other electric parts.

1	Counter mode  SW1,2	SW 1and 2 : Counter mode This setting mode is common in both channels. SW1:SW2 OFF:OFF 2 phase counter (Maximum 100kHz) O N:OFF Single phase counter (CW, CCW) OFF:O N Single phase counter (CK, U/D) O N:O N 2 phase 4 time multiple counter (Maximum 25kHz)
2	Marker polarity  SW3,4	SW 3 and 4 : Polarity of the marker input Refer to the Chapter 4 “Interface” about the definition of input “ON". SW 3 is for CH1, and SW 4 is for CH2. OFF: Input “OFF” is the marker input ON. O N: Input “ON” is the marker input ON.
3	CPU stop count  SW5,6	SW 5 and 6 : Counting in CPU STOP mode. SW5 is for CH1 and SW6 is for CH2. OFF: counter disabled in CPU STOP. O N : counter enabled in CPU STOP.
4	Ring counter mode  SW7,8	SW7 and 8 : Ring counter. Ring counter : Upper limit value is Setting value1, lower limit value is Preset value, do not use Marker input. Normal counter: Upper limit value is “HFFFFFFFF”, lower limit value is “0”, when marker inputs, the current value change to Preset value. SW7 is for CH1 and SW8 is for CH2. OFF: Normal counter O N: Ring counter
5	Reserve  SW9,10	SW9 and SW10 are reserved. Keep “OFF”.

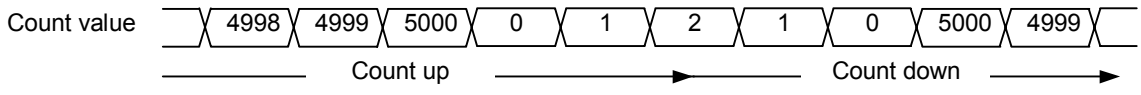
The other functions can be set by software commands. Refer to Chapter 7 about the detail of software commands.

5.2 Normal counter and Ring counter

	Item	Normal counter	Ring counter
Specification	Minimum value	0	Specified in Preset value *1
	Maximum value	HFFFFFFFF	Specified in Setting value *1
	Over flow flag	When the current value changes HFFFFFFFF to 0, this flag will be “1”.	Not available
	Under flow flag	When the current value changes 0 to HFFFFFFFF, this flag will be “1”.	Not available
	Over flow flag clear	When this flag is “1”, the over flow flag will be cleared (level).	Not available
	Under flow flag clear	When this flag is “1”, the under flow flag will be cleared (level).	Not available
	Count enable	EH-CU starts counting when the enable bit is set “1”.	EH-CU/CUE starts counting when the enable bit is set “1”.
	Count disable	EH-CU stops counting when the enable bit is set “0”.	EH-CU/CUE stops counting when the enable bit is set “0”.
Comparison detection	Comparison (=, latch output)	In case of counting up, Comparison “=” means, (Counter) = (Setting value 1) + 1 *2 In case of counting down, Comparison “=” means, (Counter) = (Setting value 1) - 1 *2	In case of counting up, Comparison “=” means, (Counter) = (Setting value 1) + 1 *2 In case of counting down, Comparison “=” means, (Counter) = (Setting value 1) - 1 *2
	Comparison (>, level output)	In case of counting up, Comparison “>” means, (Counter) > (Setting value 1) + 1 *2 In case of counting down, Comparison “>” means, (Counter) > (Setting value 1) - 1 *2	Not available
	Comparison (=, latch output) clear	To clear Comparison ”=” bit	To clear Comparison ”=” bit
	Output enable or disable	For external output enabled or disabled	For external output enabled or disabled
Marker	Marker input	When marker input is detected, the Current value is replaced by the Preset value *3	Not available
	Marker enable or disable	For marker input enabled or disabled.	Not available
	Marker logic	For marker logic positive or negative.	Not available
Setting value	Current value	The current value *4	The current value of EH-CU/CUE *5
	Preset value	When marker input is detected, the Current value is replaced by the Preset value *4	Used for the Minimum value *5
	Setting value 1	Comparison value (Set point) *4	Used for the Maximum value *5
	Setting value 2	Not available	Comparison value (Set point) *5

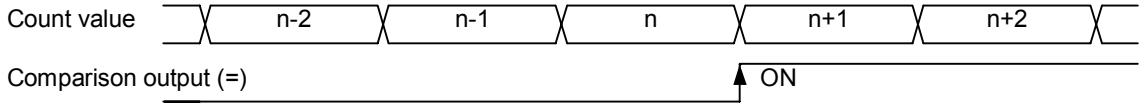
*1 In case of Ring counter, the maximum value is included in the counted value.

Example) In case of the max. value is “5000”, and min. value is “0”.



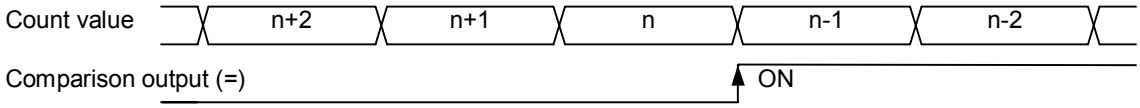
*2 Definition of the counter output
In case of the comparison (=, latch output)
In counting up, the comparison output is “ON” when the current value changes “n” to “n+1”.

(n = Setting value1)



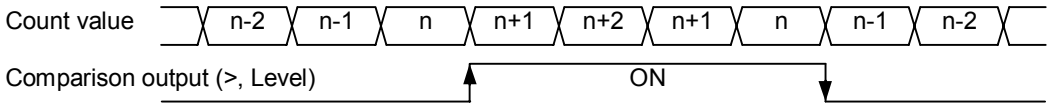
In counting down, the comparison output is “ON” when the current value changes “n” to “n-1”.

(n = Setting value1 or Setting value2)

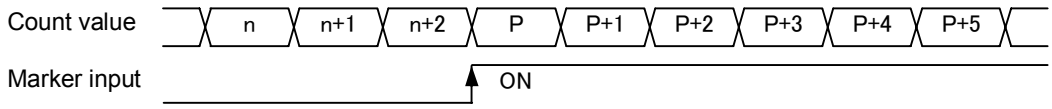


In case of the comparison (>, Level detection)
The comparison output is “ON” when the current value changes “n” to “n+1” or “n-1”.

(n = Setting value1)



*3 Specification of the marker input.(P= Preset value)



The marker input is detected at “ON” edge. So the counter keeps operation even if the marker is still “ON”.

***4 In case of Normal counter mode, Current value, Preset value and Setting value 1 can be written during counting.**

***5 In case of Ring counter mode, Current value can be written during counting, but the Current value should be between the min. and the max. value.**
The Preset value and Setting value1, 2 can be written only when CPU is in STOP mode. If these parameters are out of range or wrong combinations, PW LED will be blinking.

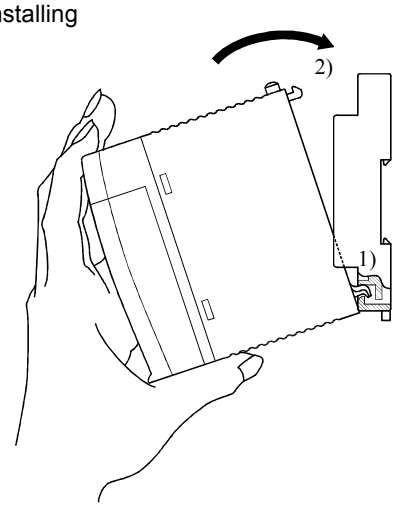
Chapter 6 Installation and Wiring

6.1 Installation of Module

EH-150 can be installed in both the basic and expansion base unit.
Install and uninstall the module after turn off the base unit power source.
Set dip switch before installing the module according to Chapter 5.1 “Setting dip-switches”.

6.2 Loading the Module

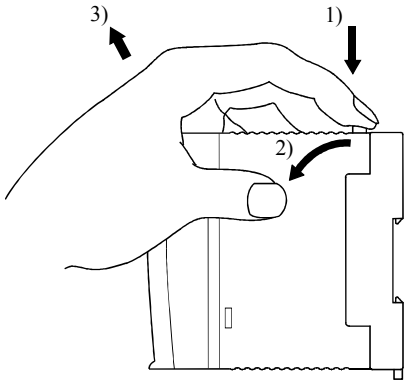
(1) Installing



1) Hook the claw at the lower section of the module to the hole in the base.
2) Press in the upper side of the module until it clicks.

Note 1: After loading the module, check to make sure it does not come out.
Note 2: Load the power module at the leftmost side of the base unit.
Note 3: Load the CPU module and I/O controller to the right neighbor of the power module.

(2) Removing



1) Push in the lock button.
2) With the lock button pushed in, pull the top of the module toward the front.
3) Raise it toward the top and pull it out.

Note: For the power module, pull it out while pushing down the two lock buttons.

6.3 Wiring

Take much care of separation from the other wires. Because EH-CU/CUE that can count high frequency pulse that is maximum 100kHz is very sensitive to short width pulses, so in the case that the noise from the other wires come across to EH-CU/CUE, EH-CU/CUE may not count correctly.
In case of high frequency, EH-CU/CUE may not count correctly by the wiring method, the length of wire, the cable impedance or short of pulse drive power.
So we recommend the differential input.

<Notes of wiring>

1) Length of wire

Wire within 10m from EH-CU/CUE to the pulse output device like encoder.

2) Separation to the power lines.

Use the cable with shields for wiring to the pulse output device like encoder. In this case connect a drain wire to the shield net both sides, because it can be connected to the functional earth not only on the device side but also PLC side.

Separate the duct within the signal wires of EH-CU/CUE from other wires. (Another input/ output wires and power source wires)

3) Add a ferrite core

Insert a ferrite core with the input/output shielded wires, and wind the shielded wires by one turn around the ferrite core.

4) Regarding failsafe

Construct an interlock circuit outside the PLC.

When PLC supply is turned on or off, the lag tome and difference in startup time between the PLC unit power and the external power (particularly DC power supply) for the PLC I/O module signals, may temporarily cause the I/O not to operate normally.

5) Install a lightning arrestor

To prevent damage to equipment from being struck by lightning, it is recommended that a lightning arrestor is to be set up for each PLC power supply.

Chapter 7 Programming

7.1 I/O Assignment

EH-CU/CUE occupies 8 words (5 words input (WX) and 3 words output (WY))
I/O assignment is " **FUN 0**".

7.2 Input and Output register

The input and output registers of EH-CU/CUE are defined as the following table.

Table 7.1 Function of the input and output registers

Register NO.	Direction	Function
WX r u s 0	EH-CPU←EH-CU/CUE (Reading from EH-CU/CUE)	Status Register The information of EH-CU/CUE status can be monitored here. The meaning of each bit depends on the command in the Control Register.
WX r u s 1 WX r u s 2	EH-CPU←EH-CU/CUE (Reading from EH-CU/CUE)	CH1 Status word (low word)*1 CH1 Status word (high word)*1 In normal operation (XHS=0), **the current value is set in this register.** If XHS is "1", preset value or Setting value1 or 2 of CH1, etc are set according to command in Control Register.
WX r u s 3 WX r u s 4	EH-CPU←EH-CU/CUE (Reading from EH-CU/CUE)	CH2 Status word (low word)*1 CH2 Status word (high word)*1 In normal operation (XHS=0), **the current value is set in this register.** If XHS is "1", preset value or Setting value1 or 2 of CH2, etc are set according to command in Control Register.
WY r u s 5	EH-CPU→EH-CU/CUE (Writing to EH-CU/CUE)	Control Register Set command and handshake bit in this register in order to control EH-CU/CUE. Before the setting , Data words must be set in WYrus6, 7 in advance.
WY r u s 6 WY r u s 7	EH-CPU→EH-CU/CUE (Writing to EH-CU/CUE)	Data word (low word) Data word (high word)

Note: r : Remote master number. (In the case of the module installed CPU unit, r= 0)
u : unit or Remote slave station number.
s : slot number on the base unit.
0 to 7: word number of the module.

*1 When CPU reads Status words (WX r u s 1 to 4), CPU can read the unit per word (16 bits) data correctly, but CPU can not read two words (32 bits) at the same time. In order to read the current value (32 bits) correctly, CPU should be set "Current value latch command" to Control Register and latch the count data before read the count data.
During handshake operation, the count value is fixed but the pulse counting is continued.

7.3 Detail of Registers

7.3.1 WX r u s 0 Status Register

The status of EH-CU/CUE is set in Status Register.

	WX r u s 0															
Bit	X15	X14	X13	X12	X11	X10	X09	X08	X07	X06	X05	X04	X03	X02	X01	X00
Definition	XHS	-	CH2	CH1	OF2	UF2	OF1	UF1	EQ2	OE2	ME2	CE2	EQ1	OE1	ME1	CE1

Bit	Definition	Contents
X15	XHS	X-Handshake flag: The response flag from EH-CU/CUE for the commands from CPU. When it change from “0” to “1”, the value of Status words is valid. In detail refer chapter 7. 3. 3. **(Notes) When XHS is “1”, the value of X0 – X11 are all “0”.**
X14	-	No definition. Always “0”
X13	CH2	CH2 valid flag: When it is “1”, the value (flags, data, commands) for CH2, is valid.
X12	CH1	CH1 valid flag: When it is “1”, the value (flags, data, commands) for CH1, is valid.
X11	OF2	CH2 Overflow flag : This flag goes “1” when CH2 counter is over the max. value. The status “1” is kept until receiving the clear command even if CPU status changes “RUN” to “STOP” or “STOP” to “RUN”.
X10	UF2	CH2 Underflow flag : This flag goes “1” when CH2 counter is under the min. value. The status “1” is kept until receiving the clear command even if CPU status changes “RUN” to “STOP” or “STOP” to “RUN”.
X09	OF1	CH1 Overflow flag : This flag goes “1” when CH1 counter is over the max. value. The status “1” is kept until receiving the clear command even if CPU status changes “RUN” to “STOP” or “STOP” to “RUN”.
X08	UF1	CH1 Underflow flag : This flag goes “1” when CH1 counter is under the min. value. The status “1” is kept until receiving the clear command even if CPU status changes “RUN” to “STOP” or “STOP” to “RUN”.
X07	EQ2	CH2 equal flag : This flag goes “1” when CH2 counter value reaches to the Comparison value (set point). The status “1” is kept until receiving the clear command even if CPU status changes “RUN” to “STOP” or “STOP” to “RUN”.
X06	OE2	CH2 output enabled flag : This flag goes “1” when the output is enabled. Default is “0”. The status “1” is cleared when CPU status changes “RUN” to “STOP” or “STOP” to “RUN” if the counter is disabled in CPU STOP by dip switch.
X05	ME2	CH2 Maker enabled flag : This flag goes “1” when the marker input is enabled. Default is “0”. The status “1” is kept even if CPU status changes “RUN” to “STOP” or “STOP” to “RUN”.
X04	CE2	CH2 counter enable flag : This flag goes “1” when the counter is enabled. Default is “0”. The status “1” is cleared when CPU status changes “RUN” to “STOP” or “STOP” to “RUN” if the counter is disabled in CPU STOP by dip switch.
X03	EQ1	CH1 equal flag : This flag goes “1” when CH1 counter value reaches to the Comparison value (set point). The status “1” is kept until receiving the clear command even if CPU status changes “RUN” to “STOP” or “STOP” to “RUN”.
X02	OE1	CH1 output enabled flag : This flag goes “1” when the output is enabled. Default is “0”. The status “1” is cleared when CPU status changes “RUN” to “STOP” or “STOP” to “RUN” if the counter is disabled in CPU STOP by dip switch.
X01	ME1	CH1 Maker enabled flag : This flag goes “1” when the marker input is enabled. Default is “0”. The status “1” is kept even if CPU status changes “RUN” to “STOP” or “STOP” to “RUN”.
X00	CE1	CH1 counter enable flag : This flag goes “1” when the counter is enabled. Default is “0”. The status “1” is cleared when CPU status changes “RUN” to “STOP” or “STOP” to “RUN” if the counter is disabled in CPU STOP by dip switch.

7.3.2 WY r u s 5 Control Register

Set EH-CU/CUE's functions to Control Register.

	WY r u s 5															
Bit	Y95	Y94	Y93	Y92	Y91	Y90	Y89	Y88	Y87	Y86	Y85	Y84	Y83	Y82	Y81	Y80
Definition	YHS	CMD	CH2	CH1	CM3	CM2	CM1	CM0	EC2	OE2	ME2	CE2	EC1	OE1	ME1	CE1

Bit	Definition	Contents
Y95	YHS	Y-Handshake bit : When it is set from"0" to "1", it is set the commands from CPU to EH-CU/CUE. In detail refer chapter 7. 3. 3.
Y94	CMD	Command Mode bit : This flag must be "0" in case of "Setting Command mode". In case of "Flag mode", this must be "1".
Y93	CH2	Selecting CH1 for commands : Set "1" when the command is for CH2.
Y92	CH1	Selecting CH2 for commands : Set "1" when the command is for CH1.
Y91	CM3	Command bit 3-0 : According to the status of these 4 bits, EH-CU/CUE can be operated. In case CM3-0 are all "0", below mentioned 8 flags can be set directly. In case CM3-0 is "H1" to "HF", other flags and data can be set depending on the status of CMD bit.
Y90	CM2	
Y89	CM1	
Y88	CM0	
Y87	EC2	Equal flag clear bit for CH2 : This flag is to clear "Equal flag" for CH2. The default value is "0".
Y86	OE2	Output enable bit for CH2 : This flag is to enable the output for CH2. The default value is "0".
Y85	ME2	Marker enable bit for CH2 : This flag is to enable the marker input for CH2. The default value is "0".
Y84	CE2	Counter enable bit for CH2 : This flag is to enable the counter for CH2. The default value is "0".
Y83	EC1	Equal flag clear bit for CH1 : This flag is to clear "Equal flag" for CH1. The default value is "0".
Y82	OE1	Output enable bit for CH1 : This flag is to enable the output for CH1. The default value is "0".
Y81	ME1	Marker enable bit for CH1 : This flag is to enable the marker input for CH1. The default value is "0".
Y80	CE1	Counter enable bit for CH1 : This flag is to enable the counter for CH1. The default value is "0".

*1 About Marker Logic refers chapter 5.1 Setting dip switches.

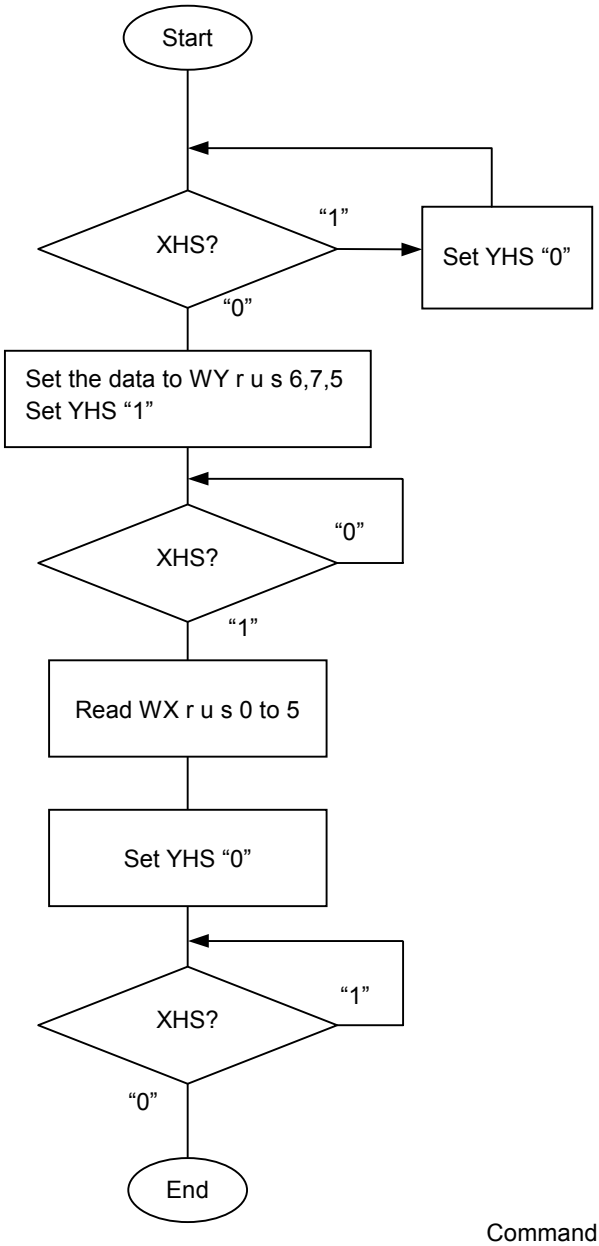
Note : Since I/O area of EH-CU/CUE is limited (8 words), in order to control EH-CU/CUE, hand shake communication is necessary with using the status register and control register, which requires user program (ladder program). Please refer to the following sample program.

The command for EH-CU/CUE is specified by the combination of above mentioned flags and command bits.

But only the current value is automatically read out to WX1 to 4 without any program like other analog modules.

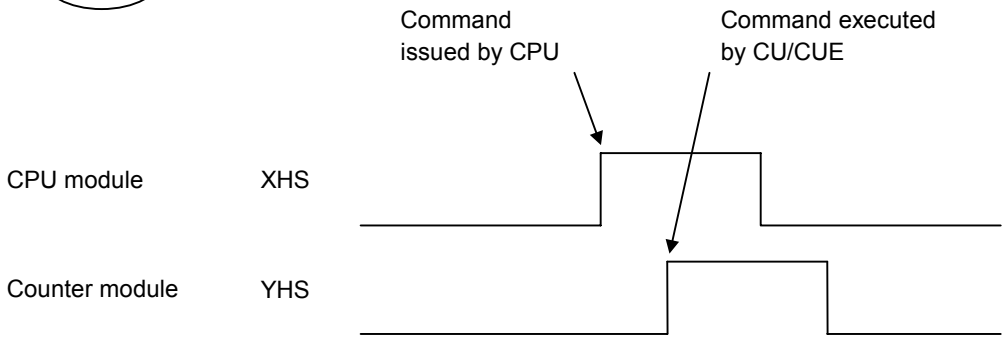
7.3.3 Communication Specification Between EH-CPU and EH-CU/CUE

Set data from EH-CPU to EH-CU/CUE according to the procedure under.



Procedure of User program

1. See XHS status "1" or "0". If XHS is "1", set YHS "0" and wait XHS become "0".
2. If XHS is "0", set the necessary data to WYrus6 and WYrus7, and set the command to WYrus5 before setting "1" to YHS.
3. After EH-CU/CUE receives the command, EH-CU/CUE responses to set "1" to XHS.
4. After EH-CPU reads the necessary data, set "0" to YHS.



7.4 Control Command

7.4.1 Command List

CMD is bit14 of Control Register, CM3-0 are bit11-08 of Control Register.

Table 7.4 Commands list

	CMD bit	Both channels	CM3-0 bits	Contents
	Bit14	Bit13-12	Bit11-08	
Global	-	-	H0	Global command. It controls the flags of EH-CU/CUE.
Setting command	0	Disable(0)	H1	Read the latched current value.
		Enable *1	H2	Write Setting value 1 *3
			H3	Write Setting value 2 *3
			H6	Read Setting value 1
			H7	Read Setting value 2
		Enable	H8 *4	Count value record mode setting
			H9 *4	Read recorded data *5
			HA *4	Clear recorded data
			HB *4	Read record mode setting
			HD	Read Preset value
		Enable *1	HE	Write Preset value *3
			HF	Write Current value
Flag command	1	Enable	H1	Specify comparison output (Cannot set in counting) *2
			H2	Clear Overflow flag
			H3	Clear Underflow flag
			H4	Read each flag

*1 When both channels (bit12,13 are ”1”,”1”) are enable, the same data is set to CH1 and CH2.

*2 Comparison output cannot be specified when count enable is valid (CE1 or CE2 is “1”)

*3 In case of Ring counter, the current value 1 or 2 or Preset value cannot be set when count enable is valid (CE1 or CE2 is “1”)

*4 These commands has been added since ROM ver.0010.

*5 When the both channels are specified, the number of read data is the same.

7.5 Command Specification

7.5.1 Global Command

Table 7.5 Global command (CM3-0 = H0)

Global command						CM3-0 = H0				Function		Control flag of EH-CU/CUE					
Setting command/Data	WYrus5	Y95	Y94	Y93	Y92	Y91	Y90	Y89	Y88	Y87	Y86	Y85	Y84	Y83	Y82	Y81	Y80
		YHS	0	0	0	0	0	0	0	EC2	OE2	ME2	CE2	EC1	OE1	ME1	CE1
	WYrus6 WYrus7	No data to be set (ignored)															
	Set the flags to Y80 to Y86 accordingly. Refer to 7.3.2 “Control Register” for the definition of each flag																
Response Data	WXrus0	X15	X14	X13	X12	X11	X10	X09	X08	X07	X06	X05	X04	X03	X02	X01	X00
		XHS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	WXrus1-4	There is no response data. Previous data is kept.															
	XHS bit is set “1”. Please refer to the chapter 7.3.1 for details of X00 to X11.																

7.5.2 Setting Command

Table 7.6 Read current value (CM3-0 = H1)

Setting command CMD = 0						CM3-0 = H1				Function		Read the latched current value					
Setting command/Data	WYrus5	Y95	Y94	Y93	Y92	Y91	Y90	Y89	Y88	Y87	Y86	Y85	Y84	Y83	Y82	Y81	Y80
		YHS	0	0	0	0	0	0	1	*	*	*	*	*	*	*	*
	WYrus6 WYrus7	No data to be set (ignored)															
	Both channels data will be read out at the same time.																
Response Data	WXrus0	X15	X14	X13	X12	X11	X10	X09	X08	X07	X06	X05	X04	X03	X02	X01	X00
		XHS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	WXrus1	Low word (16 bits) of CH1’s latched current value															
	WXrus2	High word (16 bits) of CH1’s latched current value															
	WXrus3	Low word (16 bits) of CH2’s latched current value															
	WXrus4	High word (16 bits) of CH2’s latched current value															

Table 7.7 Write Setting value 1 command (CM3-0 = H2)

Setting command CMD = 0						CM3-0 = H2				Function		Write Setting value1					
Setting command/Data	WYrus5	Y95	Y94	Y93	Y92	Y91	Y90	Y89	Y88	Y87	Y86	Y85	Y84	Y83	Y82	Y81	Y80
		YHS	0	CH2	CH1	0	0	1	0	*	*	*	*	*	*	*	*
	WYrus6	Low word (16bits) of Setting value1															
	WYrus7	High word (16bits) of Setting value1															
	Write the Setting value 1 to WYrus6 and 7. Set “1” to CH1 or/and CH2 accordingly. If both channels are valid (CH1 and CH2), the same data will be set to both channels.																
Response Data	WXrus0	X15	X14	X13	X12	X11	X10	X09	X08	X07	X06	X05	X04	X03	X02	X01	X00
		XHS	0	CH2	CH1	0	0	0	0	0	0	0	0	0	0	0	0
	WXrus1-4	No response data. The previous value is kept.															
	If the data is set properly, the data in Y92 and Y93 will be stored in X12 and X13.																

Table 7.8 Write Setting value2 command (CM3-0 = H3)

Setting command CMD = 0						CM3-0 = H3				Function		Write Setting value2					
Setting command/Data	WYrus5	Y95	Y94	Y93	Y92	Y91	Y90	Y89	Y88	Y87	Y86	Y85	Y84	Y83	Y82	Y81	Y80
		YHS	0	CH2	CH1	0	0	1	1	*	*	*	*	*	*	*	*
	WYrus6	Low word (16bits) of Setting value2															
	WYrus7	High word (16bits) of Setting value2															
	Write the Set Setting value 2 to WYrus6 and 7. Set “1” to CH1 or/and CH2 accordingly. If both channels are valid (CH1 and CH2), the same data will be set to both channels. In case of Ring counter, Setting value2 cannot be written.																
Response Data	WXrus0	X15	X14	X13	X12	X11	X10	X09	X08	X07	X06	X05	X04	X03	X02	X01	X00
		XHS	0	CH2	CH1	0	0	0	0	0	0	0	0	0	0	0	0
	WXrus1-4	No response data. The previous value is kept.															

Note Bit value “*” means “Don’t care”.

Table 7.9 Read Setting value1 command (CM3-0 = H6)

Setting command CMD = 0						CM3-0 = H6				Function		Read Setting value1					
Setting command/Data	WYrus5	Y95	Y94	Y93	Y92	Y91	Y90	Y89	Y88	Y87	Y86	Y85	Y84	Y83	Y82	Y81	Y80
		YHS	0	CH2	CH1	0	1	1	0	*	*	*	*	*	*	*	*
	WYrus6 WYrus7	No data to be set (ignored)															
	Set “1” to CH1 or/and CH2 accordingly.																
Response Data	WXrus0	X15	X14	X13	X12	X11	X10	X09	X08	X07	X06	X05	X04	X03	X02	X01	X00
		XHS	0	CH2	CH1	0	0	0	0	0	0	0	0	0	0	0	0
	WXrus1	Low word (16 bits) of CH1’s Setting value1															
	WXrus2	High word (16 bits) of CH1’s Setting value1															
	WXrus3	Low word (16 bits) of CH2’s Setting value1															
	WXrus4	High word (16 bits) of CH2’s Setting value1															
	The previous data will be kept for not requested channel.																

Table 7.10 Read Setting value2 command (CM3-0 = H7)

Setting command CMD = 0						CM3-0 = H7				Function		Read Setting value2					
Setting command/Data	WYrus5	Y95	Y94	Y93	Y92	Y91	Y90	Y89	Y88	Y87	Y86	Y85	Y84	Y83	Y82	Y81	Y80
		YHS	0	CH2	CH1	0	1	1	1	*	*	*	*	*	*	*	*
	WYrus6	No data to be set (ignored)															
	WYrus7																
	Set “1” to CH1 or/and CH2 accordingly.																
Response Data	WXrus0	X15	X14	X13	X12	X11	X10	X09	X08	X07	X06	X05	X04	X03	X02	X01	X00
		XHS	0	CH2	CH1	0	0	0	0	0	0	0	0	0	0	0	0
	WXrus1	Low word (16 bits) of CH1’s Setting value2															
	WXrus2	High word (16 bits) of CH1’s Setting value2															
	WXrus3	Low word (16 bits) of CH2’s Setting value2															
	WXrus4	High word (16 bits) of CH2’s Setting value2															
	The previous data will be kept for not requested channel.																

Table 7.11 Read Preset value command (CM3-0 = HD)

Setting command CMD = 0						CM3-0 = HD				Function		Read Preset value					
Setting command/Data	WYrus5	Y95	Y94	Y93	Y92	Y91	Y90	Y89	Y88	Y87	Y86	Y85	Y84	Y83	Y82	Y81	Y80
		YHS	0	CH2	CH1	1	1	0	1	*	*	*	*	*	*	*	*
	WYrus6	No data to be set (ignored)															
	WYrus7																
	Set “1” to CH1 or/and CH2 accordingly.																
Response Data	WXrus0	X15	X14	X13	X12	X11	X10	X09	X08	X07	X06	X05	X04	X03	X02	X01	X00
		XHS	0	CH2	CH1	0	0	0	0	0	0	0	0	0	0	0	0
	WXrus1	Low word (16 bits) of CH1’s Preset value															
	WXrus2	High word (16 bits) of CH1’s Preset value															
	WXrus3	Low word (16 bits) of CH2’s Preset value															
	WXrus4	High word (16 bits) of CH2’s Preset value															
	The previous data will be kept for not requested channel.																

Table 7.12 Write Preset value command (CM3-0 = HE)

Setting command CMD = 0						CM3-0 = HE				Function		Write Preset value					
Setting command/Data	Wyrus5	Y95	Y94	Y93	Y92	Y91	Y90	Y89	Y88	Y87	Y86	Y85	Y84	Y83	Y82	Y81	Y80
		YHS	0	CH2	CH1	1	1	1	0	*	*	*	*	*	*	*	*
	Wyrus6	Low word (16bits) of Preset value															
	Wyrus7	High word (16bits) of Preset value															
	Set Preset value to WYrus6 and 7. Set “1” to CH1 or/and CH2. If both channels are valid (CH1 and CH2), the same data will be set to both channels.																
Response Data	WXrus0	X15	X14	X13	X12	X11	X10	X09	X08	X07	X06	X05	X04	X03	X02	X01	X00
		XHS	0	CH2	CH1	0	0	0	0	0	0	0	0	0	0	0	0
	WXrus1-4	No response data. The previous value is kept.															

Table 7.13 Write Current value command (CM3-0 = HF)

Setting command CMD = 0						CM3-0 = HF				Function		Write Current value					
Setting command/Data	WYrus5	Y95	Y94	Y93	Y92	Y91	Y90	Y89	Y88	Y87	Y86	Y85	Y84	Y83	Y82	Y81	Y80
		YHS	0	CH2	CH1	1	1	1	1	*	*	*	*	*	*	*	*
	WYrus6	Low word (16bits) of Current value															
	WYrus7	High word (16bits) of Current value															
	Set Current value to WYrus6 and 7. Set “1” to CH1 or/and CH2. If both channels are valid (CH1 and CH2), the same data will be set to both channels.																
Response Data	WXrus0	X15	X14	X13	X12	X11	X10	X09	X08	X07	X06	X05	X04	X03	X02	X01	X00
		XHS	0	CH2	CH1	0	0	0	0	0	0	0	0	0	0	0	0
	WXrus1-4	No response data. The previous value is kept.															

7.5.3 Flag Command

Table 7.14 Specify comparison output command (CM3-0 = H1)

Flag command CMD = 1						CM3-0 = H1				Function		Specify comparison output					
Setting command/Data	WYrus5	Y95	Y94	Y93	Y92	Y91	Y90	Y89	Y88	Y87	Y86	Y85	Y84	Y83	Y82	Y81	Y80
		YHS	1	CH2	CH1	0	0	0	1	*	*	*	*	*	*	*	*
	WYrus6	Disable bit access															
		>	=	>	=	>	=	>	=	>	=	>	=	>	=	>	=
		CH2		CH1		CH2		CH1		CH2		CH1		CH2		CH1	
		Specify “Y3” output				Specify “Y2” output				Specify “Y1” output				Specify “Y0” output			
	WYrus7	No data to be set (ignored)															
	Write WYrus6 according to the table above. It is not allowed to configure several information to one terminal (like both channels to Y0), but several terminals can be configured with same information (like channel 1 to both Y0 and Y1). (Example) All Y0 to Y3 for CH1 “=” : WYrus6 = H1111 (Example) Y3 for CH2 “>”, Y2 for CH2 “=”, Y1 for CH1 “>”, Y0 for CH1 “=” : WYrus6 = H8421 Note : Please enable the output (OE1/2) in advance by global command, otherwise the output terminals are invalid. This command must be executed when counting disabled. When output configuration is changed, the counter output will be cleared.																
Response Data	WXrus0	X15	X14	X13	X12	X11	X10	X09	X08	X07	X06	X05	X04	X03	X02	X01	X00
		XHS	0	CH2	CH1	0	0	0	0	0	0	0	0	0	0	0	0
	WXrus1-4	No response data. The previous value is kept.															

Table 7.15 Clear Overflow flag command (CM3-0 = H2)

Flag command CMD = 1						CM3-0 = H2				Function		Clear Overflow flag					
Setting command/Data	WYrus5	Y95	Y94	Y93	Y92	Y91	Y90	Y89	Y88	Y87	Y86	Y85	Y84	Y83	Y82	Y81	Y80
		YHS	1	CH2	CH1	0	0	1	0	*	*	*	*	*	*	*	*
	WYrus6	No data to be set (ignored)															
	WYrus7																
	Set “1” to CH1 or/and CH2. If both channel valid flags (CH1 and CH2) are set, both channel flag are cleared.																
Response Data	WXrus0	X15	X14	X13	X12	X11	X10	X09	X08	X07	X06	X05	X04	X03	X02	X01	X00
		XHS	0	CH2	CH1	0	0	0	0	0	0	0	0	0	0	0	0
	WXrus1-4	There are no response data. The previous value is kept.															
	When XHS bit of WXrus0 is “1”, the setting is completed.																

Table 7.16 Clear Overflow flag command (CM3-0 = H3)

Flag command CMD = 1						CM3-0 = H3				Function		Clear Under flow flag					
Setting command/Data	WYrus5	Y95	Y94	Y93	Y92	Y91	Y90	Y89	Y88	Y87	Y86	Y85	Y84	Y83	Y82	Y81	Y80
		YHS	1	CH2	CH1	0	0	1	1	*	*	*	*	*	*	*	*
	WYrus6 WYrus7	No data to be set (ignored)															
	Set “1” to CH1 or/and CH2. If both channels are valid (CH1 and CH2), both channel flags are cleared.																
Response Data	WXrus0	X15	X14	X13	X12	X11	X10	X09	X08	X07	X06	X05	X04	X03	X02	X01	X00
		XHS	0	CH2	CH1	0	0	0	0	0	0	0	0	0	0	0	0
	WXrus1-4	There is no response data. The previous value is kept.															
	When XHS bit of WXrus0 is “1”, the setting is completed.																

Table 7.17 Read each flag command (CM3-0 = H4)

Flag command CMD = 1						CM3-0 = H4				Function		Read each flag					
Setting command/Data	WYrus5	Y95	Y94	Y93	Y92	Y91	Y90	Y89	Y88	Y87	Y86	Y85	Y84	Y83	Y82	Y81	Y80
		YHS	1	CH2	CH1	0	1	0	0	*	*	*	*	*	*	*	*
	WYrus6 WYrus7	No data to be set (ignored)															
	Set “1” to CH1 or/and CH2.																
Response Data	WXrus0	X15	X14	X13	X12	X11	X10	X09	X08	X07	X06	X05	X04	X03	X02	X01	X00
		XHS	0	CH2	CH1	0	0	0	0	0	0	0	0	Y3	Y2	Y1	Y
	WXrus1	X31	X30	X29	X28	X27	X26	X25	X24	X23	X22	X21	X20	X19	X18	X17	X16
		0	0	0	0	0	U/D	OF1	UF1	0	0	0	EQ1	EC1	OE1	ME1	CE1
	WXrus2	X47	X46	X45	X44	X43	X42	X41	X40	X39	X38	X37	X36	X35	X34	X33	X32
		0	0	>	=	0	0	>	=	0	0	>	=	0	0	>	=
		Specify “Y3” output				Specify “Y2” output				Specify “Y1” output				Specify “Y0” output			
	WXrus3	X63	X62	X61	X60	X59	X58	X57	X56	X55	X54	X53	X52	X51	X50	X49	X48
		0	0	0	0	0	U/D	OF2	UF2	0	0	0	EQ2	EC2	OE2	ME2	CE2
	WXrus4	X79	X78	X77	X76	X75	X74	X73	X72	X71	X70	X69	X68	X67	X66	X65	X64
		>	=	0	0	>	=	0	0	>	=	0	0	>	=	0	0
		Specify “Y3” output				Specify “Y2” output				Specify “Y1” output				Specify “Y0” output			
	When XHS bit of WXrus0 is “1”, the result is set to CH1 and CH2 and Y3-0 in WXrus0. The status of the each channel flags are set in WXrus1 and WXrus3. When U/D is “1”, it is counting up. When U/D is “0”, it is counting down. WXrus1 is CH1’s status and Wxrus3 is CH2’s status. The specified information of the output “Y3-0” are set in WXrus2 and WXrus4. Wxrus2 is CH1’s status and WXrus4 is CH2’s status.																

7.5.4 Data setting Command (new commands)

The below four data setting commands are added after ROM Ver.0010 or later

Table 7.18 Count value record mode setting command (CM3-0 = H8)

Setting command CMD = 0						CM3-0 = H8				Function		Count value record mode setting					
Setting command/Data	WYrus5	Y95	Y94	Y93	Y92	Y91	Y90	Y89	Y88	Y87	Y86	Y85	Y84	Y83	Y82	Y81	Y80
		YHS	0	CH2	CH1	1	0	0	0	*	*	*	*	*	*	*	*
	WYrus6	No data to be set (ignored)															
	WYrus7																
	Set “1” to CH1 or/and CH2. If both channels are valid (CH1 and CH2), both channel data will be stored. If both channels are invalid (CH1 and CH2), this command is not executed, and return to normal mode.																
Response Data	WXrus0	X15	X14	X13	X12	X11	X10	X09	X08	X07	X06	X05	X04	X03	X02	X01	X00
		XHS	0	CH2	CH1	0	0	0	0	0	0	0	0	0	0	0	0
	WXrus1-4	No response data. The previous value is kept.															
	When XHS bit of WXrus0 is set “1”, count value record mode is completed.																

Table 7.19 Read recorded data command (CM3-0 = H9)

Setting command CMD = 0						CM3-0 = H9				Function		Read recorded data					
Setting command/Data	WYrus5	Y95	Y94	Y93	Y92	Y91	Y90	Y89	Y88	Y87	Y86	Y85	Y84	Y83	Y82	Y81	Y80
		YHS	0	CH2	CH1	1	0	0	1	0	0	Record number					
	WYrus6	No data to be set (ignored)															
	WYrus7																
	Set the requested recording number to Y80 to Y85(H01 to H3F (1 to 63)). When the record number is 0, the number of recorded data is read out. When both Y92 and Y93 are "1", the data number of CH1/2 is the same number.																
Response Data	WXrus0	X15	X14	X13	X12	X11	X10	X09	X08	X07	X06	X05	X04	X03	X02	X01	X00
		XHS	0	CH2	CH1	0	0	0	0	0	0	Record number					
	WXrus1	Channel 1 low 16 bit recorded data (Number of recorded data)															
	WXrus2	Channel 1 High 16 bit recorded data															
	WXrus3	Channel 2 low 16 bit recorded data (Number of recorded data)															
	WXrus4	Channel 2 High 16 bit recorded data															
	When XHS bit of WXrus0 is set “1”, the read data is valid. When the record number is 0, the number of recorded value is set to the low byte (High byte is 0").																

Table 7.20 Clear recorded data command (CM3-0 = HA)

Setting command CMD = 0						CM3-0 = HA				Function		Clear recorded data					
Setting command/Data	WYrus5	Y95	Y94	Y93	Y92	Y91	Y90	Y89	Y88	Y87	Y86	Y85	Y84	Y83	Y82	Y81	Y80
		YHS	0	CH2	CH1	1	0	1	0	*	*	*	*	*	*	*	*
	WYrus6 WYrus7	No data to be set (ignored)															
	Set “1” to CH1 or/and CH2. When both Y92 and Y93 are "0", the clear is completed.																
Response Data	WXrus0	X15	X14	X13	X12	X11	X10	X09	X08	X07	X06	X05	X04	X03	X02	X01	X00
		XHS	0	CH2	CH1	0	0	0	0	0	0	0	0	0	0	0	0
	WXrus1-4	There are no response data. The previous value is kept.															
	When XHS bit of WXrus0 is set “1”, it is complete to count value record mode.																

Table 7.21 Read record mode setting command (CM3-0 = HB)

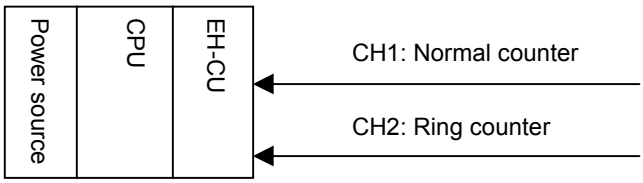
Setting command CMD = 0						CM3-0 = HB				Function		Read record mode setting					
Setting command/Data	WYrus5	Y95	Y94	Y93	Y92	Y91	Y90	Y89	Y88	Y87	Y86	Y85	Y84	Y83	Y82	Y81	Y80
		YHS	0	CH2	CH1	1	0	1	1	*	*	*	*	*	*	*	*
	WYrus6 WYrus7	No data to be set (ignored)															
	Set “1” to CH1 or/and CH2.																
Response Data	WXrus0	X15	X14	X13	X12	X11	X10	X09	X08	X07	X06	X05	X04	X03	X02	X01	X00
		XHS	0	CH2	CH1	0	0	0	0	0	0	0	0	0	0	0	0
	WXrus1-4	There are no response data. The previous value is kept.															
	CH1 or CH2 flag is set applicable to the count value record mode. When XHS bit of WXrus0 is set “1”, the response data is valid.																

7.6 User Program

This program doesn't include safety system like interlock circuit as it is just example for using EH-CU/CUE. When using EH-CU/CUE in your system, be sure to consider about safety carefully.

7.6.1 Module construction about the next example of setting the counter

Below figure is the module construction about the next example of setting counter.



EH-CU is installed on slot "0".

7.6.2 Example of setting the counter

Table 7.2 Setting specifications

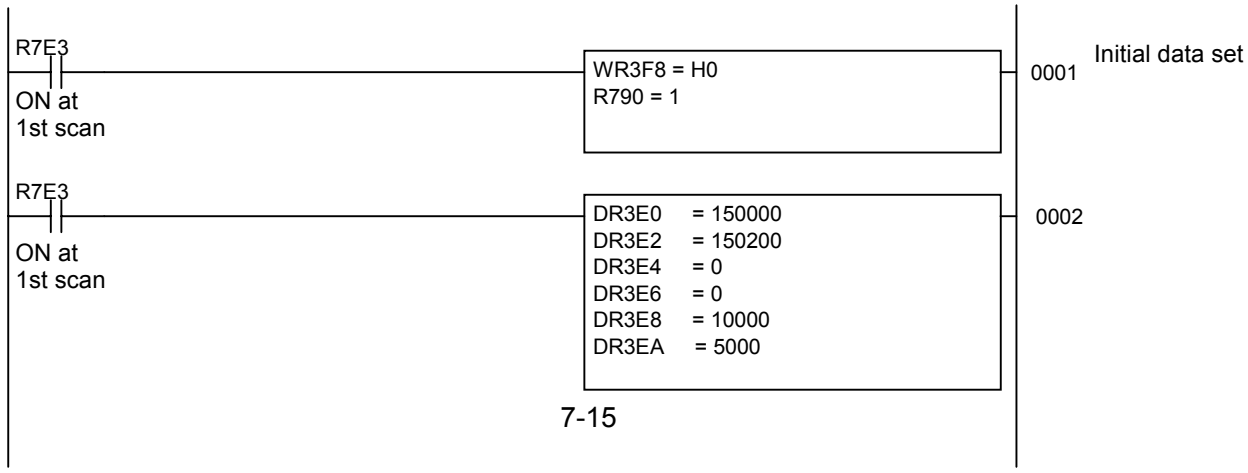
Item	CH1	CH2	Remark
Count enable during stopping	Enable	Disable	Dip-switch "5" is "ON"
Counter mode	Normal counter	Ring counter	Dip-switch "8" is "ON"
Marker enable or disable	Enable	-----	
Marker logic	Negative "ON" edged detection.	-----	Dip-switch "3" is "OFF"
Lower limit	0	Preset value	
Upper limit	HFFFFFFFF	Setting value1	
Preset value	150000	0 (Lower limit)	
Setting value1	150200 (Comparison value)	10000 (Upper limit)	
Setting value2	-----	5000(Comparison value)	
Comparison output	Y0 is set as "=".	Y2 is set as "=".	
	Y1 is set as ">".		

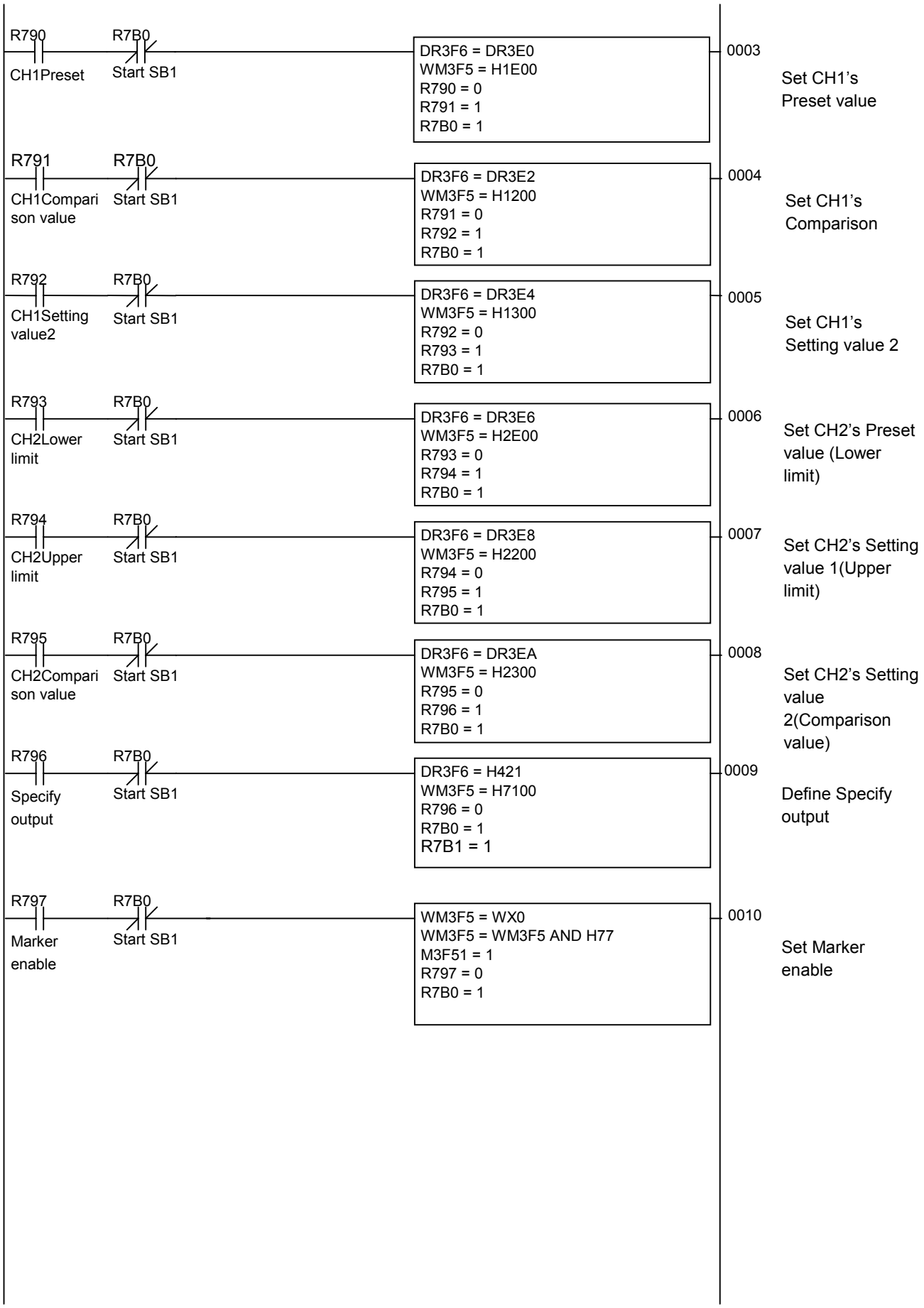
Table 7.3 Used internal outputs

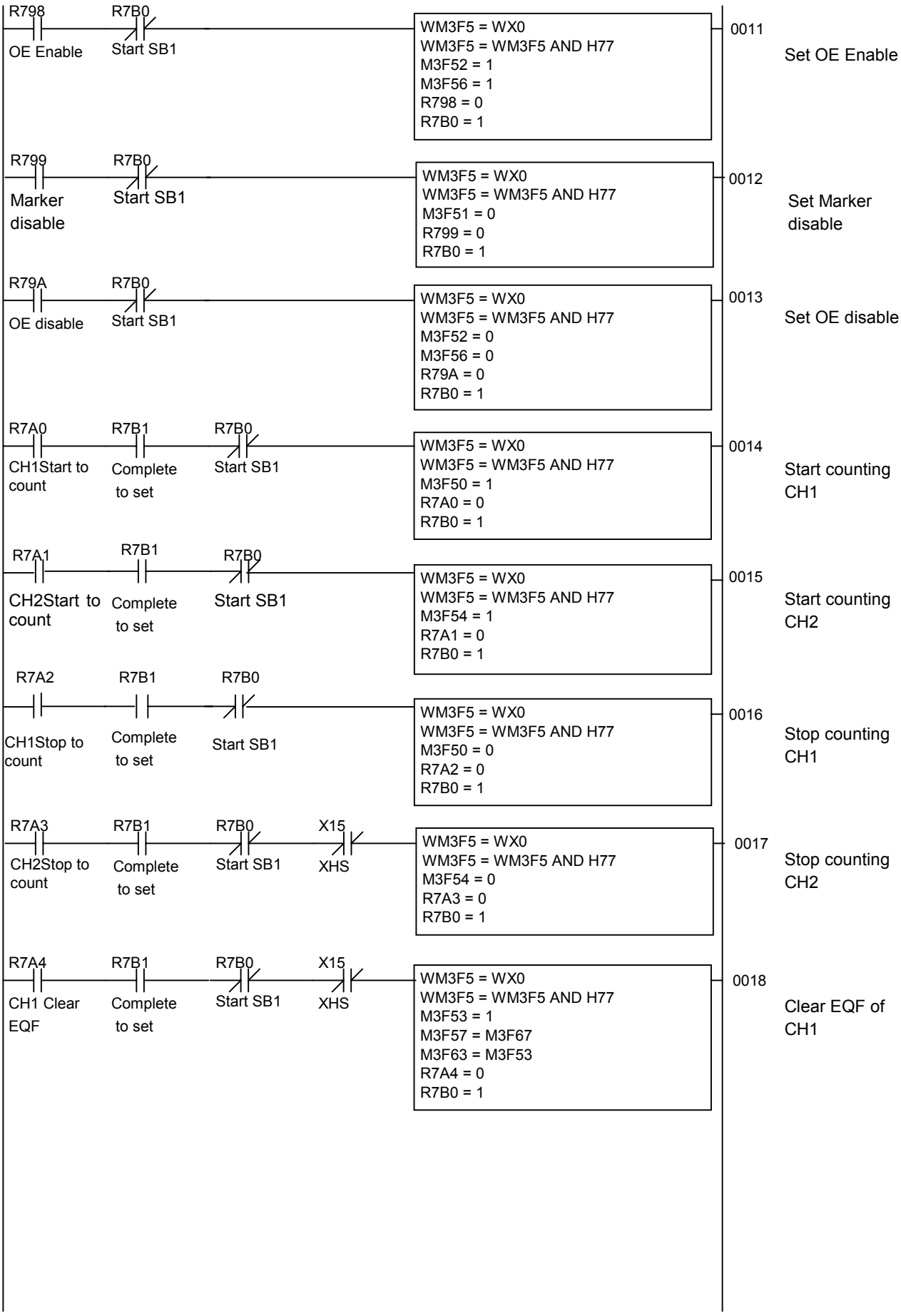
Area	Contents	Remark	Area	Contents	Remark
WR03F0	Working area for WXrus0		R799	Marker disable setting flag	CH1 only
WR03F1	Working area for WXrus1		R79A	OE disable setting flag	Same time for CH1
WR03F2	Working area for WXrus2		R79F	Flag of reading setting flags	and CH2
WR03F3	Working area for WXrus3		R7A0	CH1's flag starting to count	
WR03F4	Working area for WXrus4		R7A1	CH2's flag starting to count	
WR03F5	Working area for WYrus5		R7A2	CH1's flag stopping to count	
WR03F6	Working area for WYrus6		R7A3	CH2's flag stopping to count	
WR03F7	Working area for WYrus7		R7A4	Clear CH1's comparison flag as "="	
WR03F8	Transference of SB1's state		R7A5	Clear CH2's comparison flag as "="	
DR3E0	Preset value of CH1		R7A6	Reset the CH1's Clear flag	
DR3E2	Setting value1 of CH1		R7A7	Reset the CH2's Clear flag	
DR3E4	Setting value2 of CH1		R7A8	Clear the over flow	CH1 only
DR3E6	Preset value of CH2		R7A9	Clear the under flow	
DR3E8	Setting value1 of CH2		R7AA	Read Preset value	
DR3EA	Setting value2 of CH2		R7AB	Read Setting value1`	
DR3EC	CH1's writing value		R7AC	Read Setting value2	
DR3EE	CH2's writing value		R7AD	Read the latched current value	Same time for CH1 and ch2
R790	CH1Preset	Setting flag	R7AE	Writing Current value	
R791	CH1Comparison value	Setting flag	R7AF	Reading Setting flag`	
R792	CH1Setting value2	Setting flag	R7B0	The flag of starting SB1	
R793	CH2Lower limit	Setting flag	R7B1	Complete flag to Setting the counter	
R794	CH2Upper limit	Setting flag	WM3F0	Working area of WX0	
R795	CH2Comparison value	Setting flag	DM3F1	Working area of writing CH1's Current value.	
R796	Specify output	Setting flag	DM3F3	Working area of writing CH2's Current value.	
R797	Marker enable setting flag	CH1 only	WM3F5	Working area of WY5	
R798	OE enable setting flag	Same time for CH1 and CH2	WM3F6	Before status data of WM3F5	

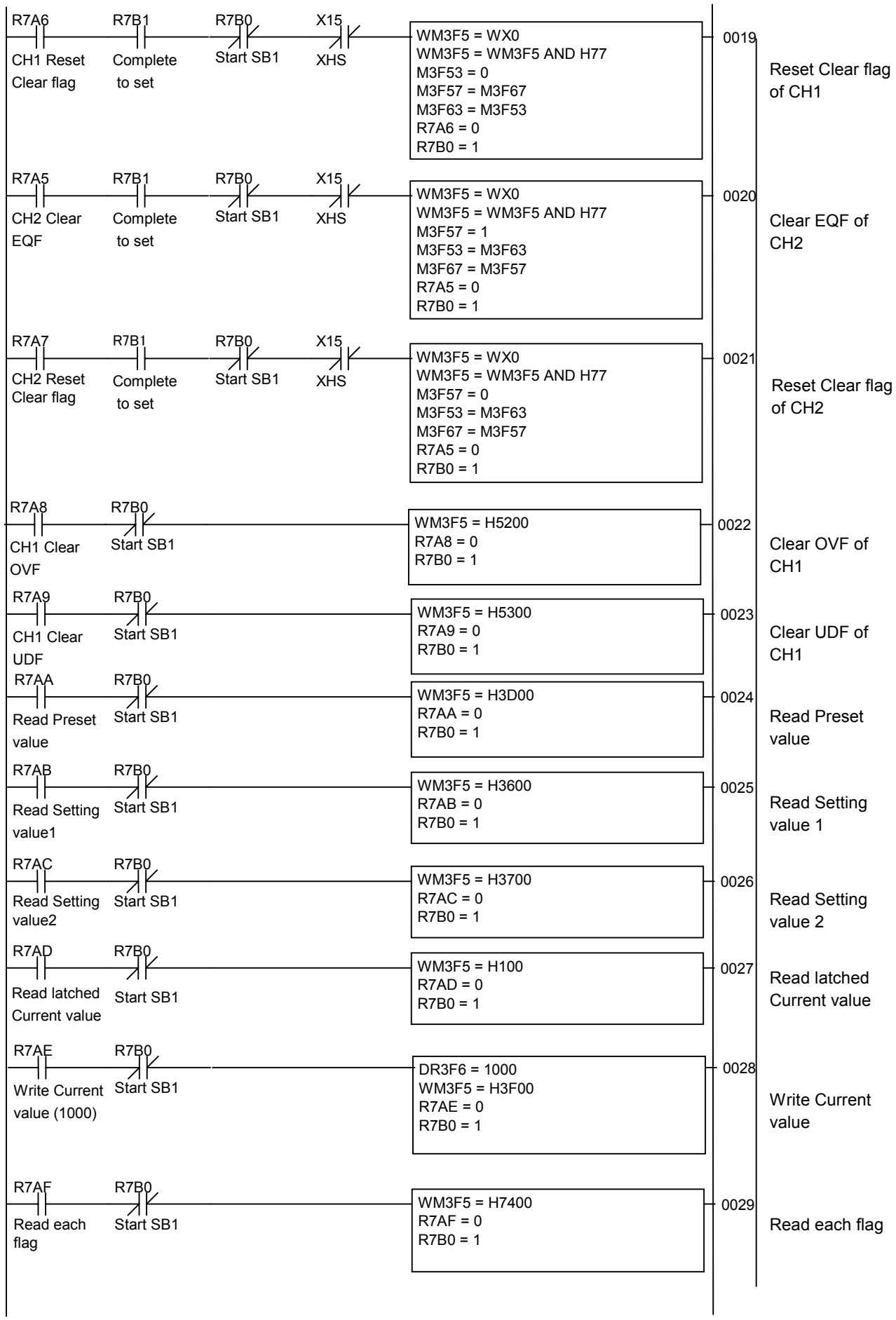
<Program example>

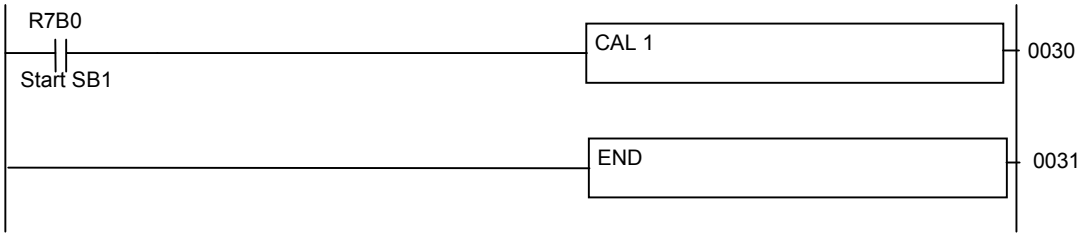
This program set the Preset value, Setting value 1, Setting value 2 and Specify comparison output automatically after the CPU runs. By setting each flag, it does setting enable or disable of Marker or Comparison output, to start or stop to count, to clear comparison flag, to read Preset value, Setting value 1 or Setting value 2.



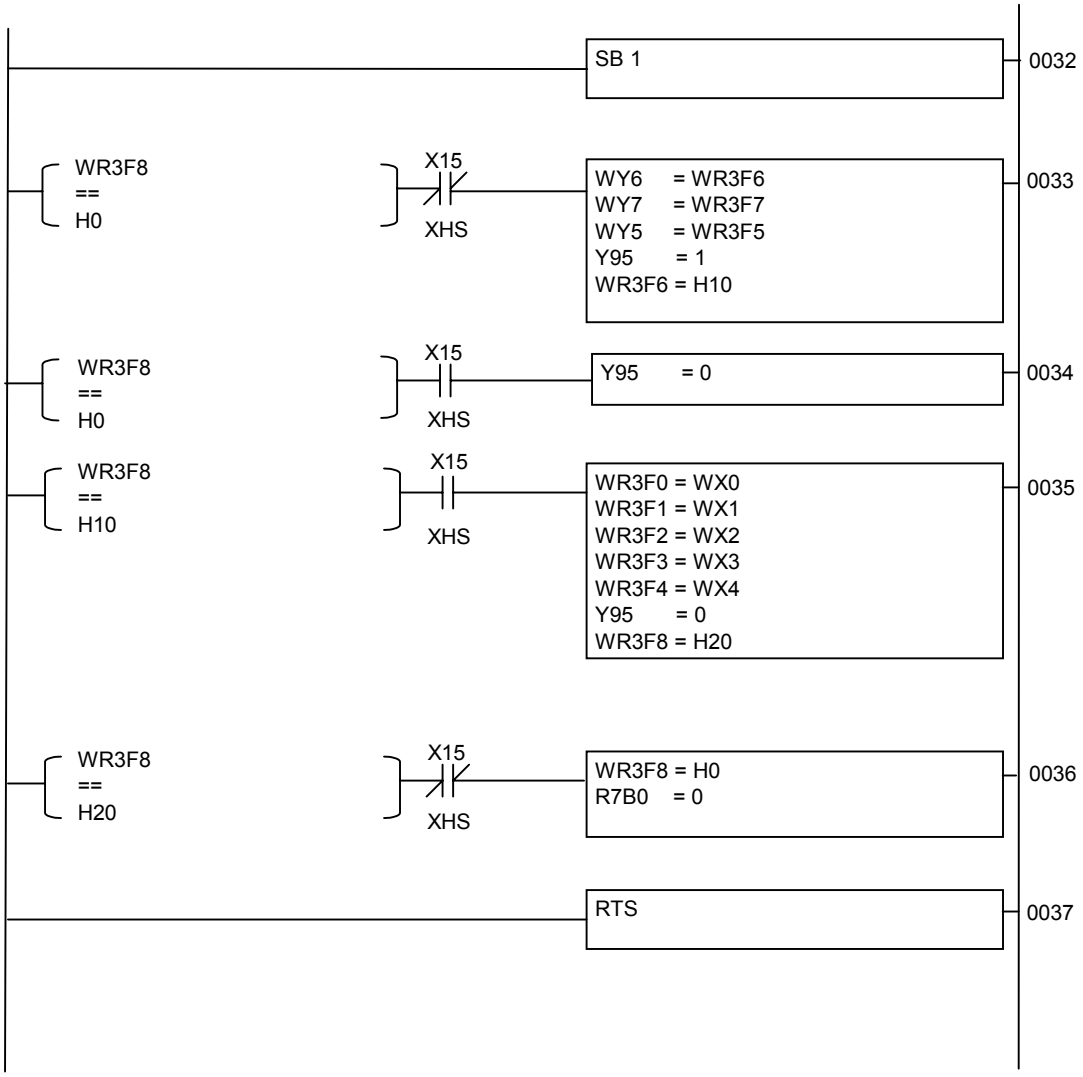

R790
CH1Preset
R7B0
Start SB1
DR3F6 = DR3E0
WM3F5 = H1E00
R790 = 0
R791 = 1
R7B0 = 1
0003
Set CH1's Preset value
R791
CH1Comparison value
R7B0
Start SB1
DR3F6 = DR3E2
WM3F5 = H1200
R791 = 0
R792 = 1
R7B0 = 1
0004
Set CH1's Comparison
R792
CH1Setting value2
R7B0
Start SB1
DR3F6 = DR3E4
WM3F5 = H1300
R792 = 0
R793 = 1
R7B0 = 1
0005
Set CH1's Setting value 2
R793
CH2Lower limit
R7B0
Start SB1
DR3F6 = DR3E6
WM3F5 = H2E00
R793 = 0
R794 = 1
R7B0 = 1
0006
Set CH2's Preset value (Lower limit)
R794
CH2Upper limit
R7B0
Start SB1
DR3F6 = DR3E8
WM3F5 = H2200
R794 = 0
R795 = 1
R7B0 = 1
0007
Set CH2's Setting value 1(Upper limit)
R795
CH2Comparison value
R7B0
Start SB1
DR3F6 = DR3EA
WM3F5 = H2300
R795 = 0
R796 = 1
R7B0 = 1
0008
Set CH2's Setting value 2(Comparison value)
R796
Specify output
R7B0
Start SB1
DR3F6 = H421
WM3F5 = H7100
R796 = 0
R7B0 = 1
R7B1 = 1
0009
Define Specify output
R797
Marker enable
R7B0
Start SB1
WM3F5 = WX0
WM3F5 = WM3F5 AND H77
M3F51 = 1
R797 = 0
R7B0 = 1
0010
Set Marker enable


R798
R7B0
OE Enable
Start SB1
WM3F5 = WX0
WM3F5 = WM3F5 AND H77
M3F52 = 1
M3F56 = 1
R798 = 0
R7B0 = 1
0011
Set OE Enable
R799
R7B0
Marker disable
Start SB1
WM3F5 = WX0
WM3F5 = WM3F5 AND H77
M3F51 = 0
R799 = 0
R7B0 = 1
0012
Set Marker disable
R79A
R7B0
OE disable
Start SB1
WM3F5 = WX0
WM3F5 = WM3F5 AND H77
M3F52 = 0
M3F56 = 0
R79A = 0
R7B0 = 1
0013
Set OE disable
R7A0
R7B1
R7B0
CH1Start to count
Complete to set
Start SB1
WM3F5 = WX0
WM3F5 = WM3F5 AND H77
M3F50 = 1
R7A0 = 0
R7B0 = 1
0014
Start counting CH1
R7A1
R7B1
R7B0
CH2Start to count
Complete to set
Start SB1
WM3F5 = WX0
WM3F5 = WM3F5 AND H77
M3F54 = 1
R7A1 = 0
R7B0 = 1
0015
Start counting CH2
R7A2
R7B1
R7B0
CH1Stop to count
Complete to set
Start SB1
WM3F5 = WX0
WM3F5 = WM3F5 AND H77
M3F50 = 0
R7A2 = 0
R7B0 = 1
0016
Stop counting CH1
R7A3
R7B1
R7B0
X15
CH2Stop to count
Complete to set
Start SB1
XHS
WM3F5 = WX0
WM3F5 = WM3F5 AND H77
M3F54 = 0
R7A3 = 0
R7B0 = 1
0017
Stop counting CH2
R7A4
R7B1
R7B0
X15
CH1 Clear EQF
Complete to set
Start SB1
XHS
WM3F5 = WX0
WM3F5 = WM3F5 AND H77
M3F53 = 1
M3F57 = M3F67
M3F63 = M3F53
R7A4 = 0
R7B0 = 1
0018
Clear EQF of CH1


R7A6
CH1 Reset Clear flag
R7B1
Complete to set
R7B0
Start SB1
X15
XHS
WM3F5 = WX0
WM3F5 = WM3F5 AND H77
M3F53 = 0
M3F57 = M3F67
M3F63 = M3F53
R7A6 = 0
R7B0 = 1
0019
Reset Clear flag of CH1
R7A5
CH2 Clear EQF
R7B1
Complete to set
R7B0
Start SB1
X15
XHS
WM3F5 = WX0
WM3F5 = WM3F5 AND H77
M3F57 = 1
M3F53 = M3F63
M3F67 = M3F57
R7A5 = 0
R7B0 = 1
0020
Clear EQF of CH2
R7A7
CH2 Reset Clear flag
R7B1
Complete to set
R7B0
Start SB1
X15
XHS
WM3F5 = WX0
WM3F5 = WM3F5 AND H77
M3F57 = 0
M3F53 = M3F63
M3F67 = M3F57
R7A5 = 0
R7B0 = 1
0021
Reset Clear flag of CH2
R7A8
CH1 Clear OVF
R7B0
Start SB1
WM3F5 = H5200
R7A8 = 0
R7B0 = 1
0022
Clear OVF of CH1
R7A9
CH1 Clear UDF
R7B0
Start SB1
WM3F5 = H5300
R7A9 = 0
R7B0 = 1
0023
Clear UDF of CH1
R7AA
Read Preset value
R7B0
Start SB1
WM3F5 = H3D00
R7AA = 0
R7B0 = 1
0024
Read Preset value
R7AB
Read Setting value1
R7B0
Start SB1
WM3F5 = H3600
R7AB = 0
R7B0 = 1
0025
Read Setting value 1
R7AC
Read Setting value2
R7B0
Start SB1
WM3F5 = H3700
R7AC = 0
R7B0 = 1
0026
Read Setting value 2
R7AD
Read latched Current value
R7B0
Start SB1
WM3F5 = H100
R7AD = 0
R7B0 = 1
0027
Read latched Current value
R7AE
Write Current value (1000)
R7B0
Start SB1
DR3F6 = 1000
WM3F5 = H3F00
R7AE = 0
R7B0 = 1
0028
Write Current value
R7AF
Read each flag
R7B0
Start SB1
WM3F5 = H7400
R7AF = 0
R7B0 = 1
0029
Read each flag



The below diagram is the sequence of handshake communication between EH-CPU and EH-CU.



Chapter 8 Daily and Periodic Inspection

In order to use the EH-CU/CUE functions in the most desirable condition and maintain the system to operate normally, it is essential to conduct daily and periodic inspections.

8.1 Daily inspection

Verify the following items while the system is running.

Table 8.1 Items for daily inspection

Item	LED display	Inspection method	Normal status	Main cause of error
LED indication	PW	Visual check	Lit	When unlit: Power supply error Hardware error of EH-CU/CUE, etc. When flashing: Wrong setting value.
	ER	Visual check	Unlit	When lit: Hardware error of EH-CU/CUE, etc.
	Other LED	Visual check	Lit or unlit	When lit: Input or output is “ON”. *1 When unlit: Input or output is “OFF”.*1

*1 Refer to the Chapter 4 “Interface”.

8.2 Periodic inspection

Turn off the power for the external I/O ladder and check the following items once every six months.

Table 8.2 Items for periodic inspection

Part	Item	Check criteria	Remarks
Programming device to CPU	Check operation of programming device	All switches and display lamps work normally.	
Power supply	Check for voltage fluctuations	85 to 264 V AC (when EH-PSA) 21.6 to 26.4VDC(when EH-PSD)	Tester
Installation and connecting areas	(1) All modules are securely fixed (2) All connectors fit snugly (3) All screws are tight (4) All cables are normal	No defects	Tighten Check insertion Tighten Visual check
Ambient environment	(1) Temperature (2) Humidity (3) Other	0 to 55 °C 20 to 90 % RH (no condensation) No dust, foreign matter, vibration	Visual check
Spare parts	Check number of parts, storage condition	No defects	Visual check
Program	Check program contents	Compare the contents of the latest program saved and CPU contents, and make sure they are the same	Check both master and backup.

Chapter 9 Troubleshooting

If some troubles happen on EH-CU/CUE, please investigate below items.

< Notes of investigation >

(1) Before exchanging modules, turn off the power source certainly.
(2) In case of re-sending the troubled module, please inform us the error phenomenon in detail as possible
(3) The necessary tools in troubleshooting
  1) Plus screwdriver and minus screwdriver.
  2) Digital multifunction tester.

9.1 When EH-CU/CUE does not count pulses.

1. In case of Differential inputs (For details, refer Chapter 4)
  (1) Check the connection between EH-CU/CUE and the pulse output devices.
    Is the polarity of signals or the power source right?
  (2) Check the voltage between the input terminals (Vin) of EH-CU/CUE.
    Is the input voltage normal voltage (approximately from 1 V to 3 V)?
    Is the pulse input to EH-CU/CUE?
2. In case of Open collector inputs (For detail, refer Chapter 4)
  (1) Check the connection between EH-CU/CUE and the pulse output device.
    Is the polarity of signals or the power source right?
  (2) Check the voltage between the input terminals (Vin) of EH-CU/CUE.
    Is Vin terminal connected to the external voltage (from 12 to 24 VDC)?
    Is Vin terminal voltage normal?
    Is the common terminal of the pulse output device connected to the ground of the external power source?
  (3) Check the setting of counter mode. (For details, refer Chapter 3)
  (4) Check the count enable bit.
  (5) Check LED (1A/1B/1M or 2A/2B/2M) is flashing. (Is the pulse input?)

9.2 When the comparison output does not become “ON”.

When the comparison output does not “ON” in spite of completing the right condition.
Check the below items.

(1) Check the voltage of the external power source.
(2) Check the connection between EH-CU/CUE and the external load.
(3) Check the setting data. (For details, refer to Chapter 7)
(4) Check the setting of “OE”. (For details, refer to Chapter 7)
(5) Check the load current, which must be less than 20 mA.

Appendix 1

A.1 For using the EH-CU/CUE

The partial operation is different on the case of using on the side of EH-CPU and the case of using on the side of EH-IOCP.
When using EH-CU/CUE, always take care of the following attention item.

REQUIRED

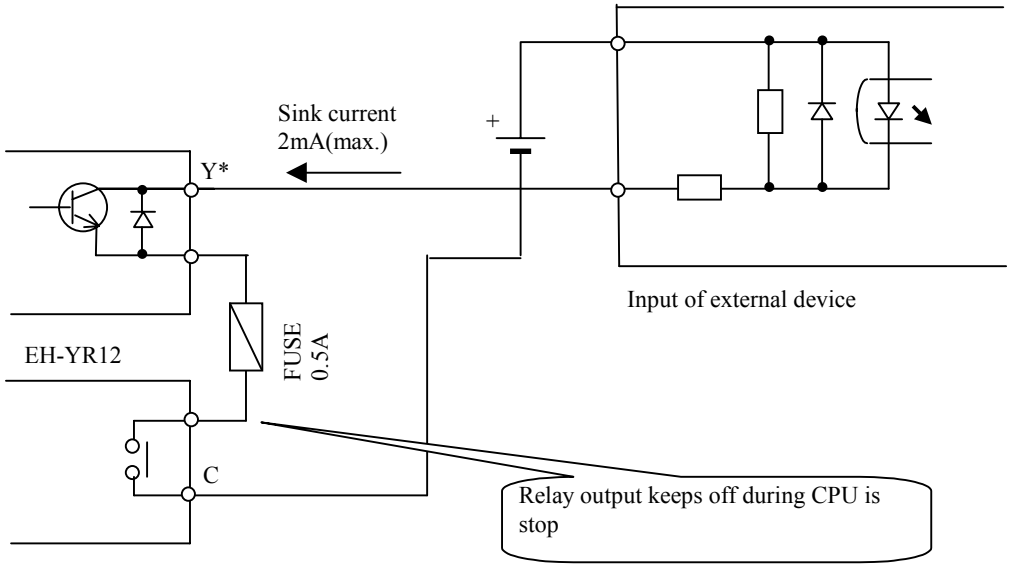
When using EH-CU/CUE on the side of EH-IOCP, the CPU stop count becomes invalid.(fixed in "countable during CPU stopping" mode)

In using the "uncountable during CPU stopping" mode, Insert a relay between comparison output of EH-CU/CUE and the external input device. And control to OFF the relay in PLC(the Profibus-DP master) stopping.

When not use, the comparison output becomes ON follows the OE flag of the control register of EH-CU/CUE even if PLC(the Profibus-DP master) is stopping.

And initialize the current value in case of the CPU become RUN.

The example wiring when controlling the relay which was inserted among the external input device and the comparison output of EH-CU/CUE is shown.



Allocates optional one point of EH-YR12 for the external input device.
Make a circuit at the head of the ladder program to become OFF in STOP or become ON in RUN for PLC(the Profibus-DP master).
The ladder program for EH-150 CPU is shown in the following.

A.2 Commands list (Quick reference)

Each command is valid when the below data(hex) is written to the control register(WYrus5).

Table A.1 Global commands list

Control register (WYrus5) write value	Low 2 figures (a or b)	Setting of CH1(b) or 2(a) EC1,2 Equal flag clear	OE1,2 Output enable	ME1,2 Marker enable	CE1,2 Counter enable	Content
H80ab (to HF0ab)	1	0	0	0	1	Only counter is enable.
	3	0	0	1	1	Marker and counter are enable.
	5	0	1	0	1	Equal output and counter are enable.
	7	0	1	1	1	Equal output, marker and counter are enable.
	9	1	0	0	1	Only counter is enable, clear equal flag(EQ1 or EQ2)
	B	1	0	1	1	Marker and counter are enable, clear equal flag(EQ1 or EQ2)
	D	1	1	0	1	Equal output and counter are enable, clear equal flag(EQ or EQ2).
	F	1	1	1	1	Equal output, marker and counter are enable, clear equal flag(EQ1 or EQ2).
	0	0	0	0	0	Equal output, marker and counter are all disable.
	2	0	0	1	0	Marker is enable, equal output and counter are disable.
	4	0	1	0	0	Only equal output is enable, marker and counter is disable.
	8	1	0	0	0	All equal output and counter are disable, clear equal flag(EQ1 or EQ2)
	A	1	0	1	0	Only marker is enable, equal output and counter are disable, clear equal flag(EQ or EQ2).
	C	1	1	0	0	Equal output is enable, marker and counter are disable, equal flag(EQ1 or EQ2).
	E	1	1	1	0	Equal output, marker are enable. Only counter is disable, clear equal flag(EQ1 or EQ2).

(Note) The above setting is valid when the handshake flag(X15:XHS) of status register(Wxrus0) is "1".

Table A.2-1 Data setting commands list

Command Name	Control register (WYrus5) Write value	Cha-nnel	Response data WXrus0	WXrus1	WXrus2	WXrus3	WXrus4	Content
Read the latched current value (*1)	H81**	CH1,2	H8000	CH1(low)	CH1(high)	CH2(low)	CH2(high)	
Write setting value1 (*2)	H92**	CH1	H9000	-	-	-	-	WYrus6,7 are stored to EH-CU/CUE Normal counter mode: Equal value Ring counter mode: Upper limit
	HA2**	CH2	HA000	-	-	-	-	
	HB2**	CH1,2	HB000	-	-	-	-	
Write setting value2 (*2)	H93**	CH1	H9000	-	-	-	-	At ring counter mode, WYrur6,7 are stored to EH-CU/CUE as the setting value2.
	HA3**	CH2	HA000	-	-	-	-	
	HB3**	CH1,2	HB000	-	-	-	-	
Read setting value1 (*3)	H96**	CH1	H9000	CH1(low)	CH1(high)	-	-	WXrus1 to 4 are Normal counter mode: Equal data Ring counter value: Upper limit
	HA6**	CH2	HA000	-	-	CH2(low)	CH2(high)	
	HB6**	CH1,2	HB000	CH1(low)	CH1(high)	CH2(low)	CH2(high)	
Read setting value2 (*3)	H97**	CH1	H9000	CH1(low)	CH1(high)	-	-	At ring counter mode, WXrus1 to 4 are equal data.
	HA7**	CH2	HA000	-	-	CH2(low)	CH2(high)	
	HB7**	CH1,2	HB000	CH1(low)	CH1(high)	CH2(low)	CH2(high)	
Read preset value (*3)	H9D**	CH1	H9000	CH1(low)	CH1(high)	-	-	WXrus1 to 4 are Normal counter mode: Preset data at marker input. Ring counter mode: Lower limit
	HAD**	CH2	HA000	-	-	CH2(low)	CH2(high)	
	HBD**	CH1,2	HB000	CH1(low)	CH1(high)	CH2(low)	CH2(high)	
Write preset value (*2)	H9E**	CH1	H9000	-	-	-	-	WYrus6,7 are stored to EH-CU/CUE Normal counter mode: Preset data at marker input. Ring counter mode: Upper limit
	HAE**	CH2	HA000	-	-	-	-	
	HBE**	CH1,2	HB000	-	-	-	-	
Write current value (*2)	H9F**	CH1	H9000	-	-	-	-	Current value is changed to WYrus6,7.
	HAF**	CH2	HA000	-	-	-	-	
	HBF**	CH1,2	HB000	-	-	-	-	

(*1) When XHS becomes 1, the current values of both channels are latched at the same time.

(*2) When XHS becomes 1, data is stored to EH-CU/CUE. At the part of "-", the data is kept from the operation before.

(*3) When XHS becomes 1, data is displayed. At the part of "-", the data is kept from the operation before.

(*4) ** means "do not care".

Table A.2 -2Data setting commands list (New commands)

Command Name	Control register (WYrus5) Write value	Cha-nnel	Response data WXrus0	WXrus1	WXrus2	WXrus3	WXrus4	Content
Count value record mode setting (*5)	H98**	CH1	H9000	-	-	-	-	Current value is recorded at the marker input. The data is recorded when ME1 and ME2 are "1".
	HA8**	CH2	HA000	-	-	-	-	
	HB8**	CH1,2	HB000	-	-	-	-	
Read record data (*6)	H99##	CH1	H90##	CH1(low)	CH1(high)	-	-	## is set to the record number. When ## is "0", the recorded data is displayed at "low".
	HA9##	CH2	HA0##	-	-	CH2(low)	CH2(high)	
	HB9##	CH1,2	HB0##	CH1(low)	CH1(high)	CH2(low)	CH2(high)	
Clear recorded data (*7)	H9A**	CH1	H9000	-	-	-	-	
	HAA**	CH2	HA000	-	-	-	-	
	HBA**	CH1,2	HB000	-	-	-	-	
Read record mode setting (*8)	H8B**	CH1	H9000	-	-	-	-	CH1 is the record mode.
	H8B**	CH2	HA000	-	-	-	-	CH2 is the record mode.
	H8B**	CH1,2	HB000	-	-	-	-	CH1 and CH2 are the record mode

(*5) When XHS becomes 1, the count record mode is set.

(*6) When XHS becomes 1, data is stored to EH-CU/CUE. At the part of "-", the data is kept from the operation before. ## is the record number to read. When ## is "0", the number of recorded data is set to the low word.

(*7) When XHS becomes 1, the recorded data is cleared.

(*8) When XHS becomes 1, the data of the channel set to recorded mode is read.

(*9) ** means "do not care".

Table A.3 Specify comparison output command list

Control register (WYrus5) Write value	Control register (WYrus6) Write value	Setting of Output terminal								Response data
		Y3		Y2		Y1		Y0		WXrus0
		(a)	Setting	(b)	Setting	(c)	Setting	(d)	Setting	
HF1**	Habcd	1	CH1:=	1	CH1:=	1	CH1:=	1	CH1:=	H8000
		2	CH1:>	2	CH1:>	2	CH1:>	2	CH1:>	
		4	CH2:=	4	CH2:=	4	CH2:=	4	CH2:=	
		8	CH2:>	8	CH2:>	8	CH2:>	8	CH2:>	

(*1) Do not set the other setting above.

(*2) ** means "do not care".

Table A.4 Overflow/underflow flag command list

Command name	Control register (WYrus5) Write value	Channel	Response data WXrus0	Content
Overflow flag clear	HD2**	CH1	H9000	Clear overflow flag of CH1
	HE2**	CH2	HA000	Clear overflow flag of CH2
	HF2**	CH1,2	HB000	Clear overflow flag of CH1 and CH2
Underflow flag clear	HD3**	CH1	H9000	Clear underflow flag of CH1
	HE3**	CH2	HA000	Clear underflow flag of CH2
	HF3**	CH1,2	HB000	Clear underflow flag of CH1 and CH2

(*) ** means "do not care".

Table A.5 Read each flag command list

Control register (WYrus5) Write value	Chan nel	Response data					Content
		WXrus0	WXrus1	WXrus2	WXrus3	WXrus4	
HD4**	CH1	H9000	CH1 flag	CH1 terminal output	-	-	Read CH1 flag
HE4**	CH2	HA000	-	-	CH2 flag	CH2 terminal output	Read CH2 flag
HF4**	CH1,2	HA000	CH1 flag	CH1 terminal output	CH2 flag	CH2 terminal output	Read both CH1,CH2 flag

(*) ** means "do not care".

Table A.6 Read each flag command response list

Flag data (Hex)	Direction of count	Overflow	Underflow	Equal	Equal flag clear	Output Enable	Marker Enable	Count Enable
WXrus1, WXrus3	U/D	OF1,OF2	UF1,UF2	EQ1,EQ2	EC1,EC2	OE1,OE2	ME1,ME2	CE1,CE2
H00**	Down	0	0	-	-	-	-	-
H01**	Down	0	1(Occurrence)	-	-	-	-	-
H02**	Down	1(Occurrence)	0	-	-	-	-	-
H03**	Down	1(Occurrence)	1(Occurrence)	-	-	-	-	-
H04**	Up	0	0	-	-	-	-	-
H05**	Up	0	1(Occurrence)	-	-	-	-	-
H06**	Up	1(Occurrence)	0	-	-	-	-	-
H07**	Up	1(Occurrence)	1(Occurrence)	-	-	-	-	-
H0*0*	-	-	-	0 (No)	-	-	-	-
H0*1*	-	-	-	1 (Yes)	-	-	-	-
H0**0	-	-	-	-	0	0	0	0
H0**1	-	-	-	-	0	0	0	1(Valid)
H0**2	-	-	-	-	0	0	1(Valid)	
H0**3	-	-	-	-	0	0	1(Valid)	1(Valid)
H0**4	-	-	-	-	0	1(Valid)	0	0
H0**5	-	-	-	-	0	1(Valid)		1(Valid)
H0**6	-	-	-	-	0	1(Valid)	1(Valid)	
H0**7	-	-	-	-	0	1(Valid)	1(Valid)	1(Valid)
H0**8	-	-	-	-	1 (Yes)	0	0	0
H0**9	-	-	-	-	1 (Yes)	0	0	1(Valid)
H0**A	-	-	-	-	1 (Yes)	0	1(Valid)	0
H0**B	-	-	-	-	1 (Yes)	0	1(Valid)	1(Valid)
H0**C	-	-	-	-	1 (Yes)	1(Valid)	0	0
H0**D	-	-	-	-	1 (Yes)	1(Valid)	0	1(Valid)
H0**E	-	-	-	-	1 (Yes)	1(Valid)	1(Valid)	0
H0**F	-	-	-	-	1 (Yes)	1(Valid)	1(Valid)	1(Valid)

(*) ** means "do not care".