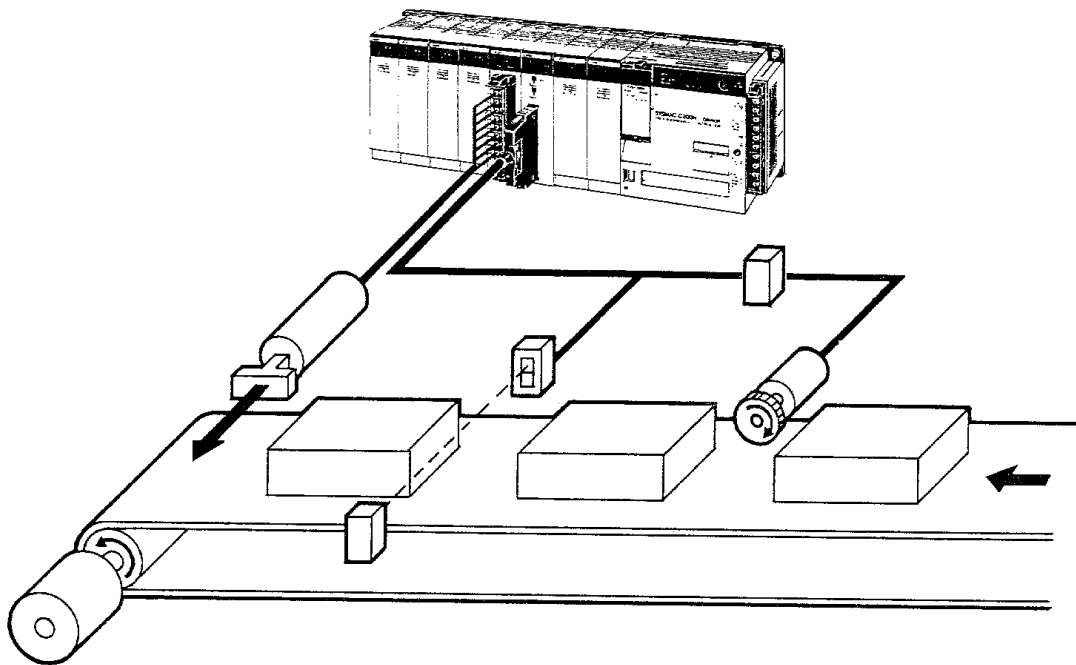# C200H-CT001-V1/CT002
High-speed Counter Units

Operation Manual

Revised September 2000

Read and Understand this Manual

Please read and understand this manual before using the product. Please consult your OMRON representative if you have any questions or comments.

Warranty and Limitations of Liability

WARRANTY

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, REGARDING NON-INFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. OMRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

LIMITATIONS OF LIABILITY

OMRON SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY.

In no event shall the responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.

IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR, OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED, AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE, OR INAPPROPRIATE MODIFICATION OR REPAIR.

Application Considerations

SUITABILITY FOR USE

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the products.

At the customer's request, OMRON will provide applicable third party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use.

The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

- Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this manual.
- Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
- Systems, machines, and equipment that could present a risk to life or property.

Please know and observe all prohibitions of use applicable to the products.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCTS ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

PROGRAMMABLE PRODUCTS

OMRON shall not be responsible for the user's programming of a programmable product, or any consequence thereof.

Disclaimers

CHANGE IN SPECIFICATIONS

Product specifications and accessories may be changed at any time based on improvements and other reasons.

It is our practice to change model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the products may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

DIMENSIONS AND WEIGHTS

Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

PERFORMANCE DATA

Performance data given in this manual is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of OMRON's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the OMRON Warranty and Limitations of Liability.

ERRORS AND OMISSIONS

The information in this manual has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors, or omissions.

Notice:

OMRON products are manufactured for use according to proper procedures by a qualified operator and only for the purposes described in this manual.

The following conventions are used to indicate and classify precautions in this manual. Always heed the information provided with them. Failure to heed precautions can result in injury to people or damage to property.

⚠ **DANGER**   Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ **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, or property damage.

OMRON Product References

All OMRON products are capitalized in this manual. The word "Unit" is also capitalized when it refers to an OMRON product, regardless of whether or not it appears in the proper name of the product.

The abbreviation "Ch," which appears in some displays and on some OMRON products, often means "word" and is abbreviated "Wd" in documentation in this sense.

The abbreviation "PC" means Programmable Controller and is not used as an abbreviation for anything else.

Visual Aids

The following headings appear in the left column of the manual to help you locate different types of information.

Note   Indicates information of particular interest for efficient and convenient operation of the product.

1, 2, 3...   1.   Indicates lists of one sort or another, such as procedures, checklists, etc.

TABLE OF CONTENTS

About this Manual:

This manual covers specifications and procedures necessary for the installation and operation of the C200H-CT001-V1 and C200H-CT002 High-speed Counter Units. It includes example system configurations to ease the implementation cycle. The C200H-CT001-V1 and C200H-CT002 are Special I/O Units for C200H PCs. The C200H-CT001-V1 is a high-speed, reversible counter capable of counting at a maximum of 50 kcps. The C200H-CT002 is a high-speed, reversible counter capable of counting at a maximum of 75 kcps.

Please read this manual carefully and be sure you understand the information provided before attempting to install and operate the C200H-CT001-V1 and C200H-CT002 High-speed Counter Units.

Section 1 contains a brief description of the Units and how they can be used. The Units are displayed and their indicators are explained. An example system configuration is included to demonstrate Unit application. The operating modes and their associated ranges of operation are also described.

Section 2 shows the Unit settings and connector cable pin specifications. Instructions for the construction of input and output connectors are provided. Electrical schematics and examples are presented to further explain Unit operation.

Section 3 describes the operational flow of the counting system. The input types are identified along with instructions for their use. Data transfer timing is described in relation to the PC cycle time.

Section 4 describes the various operating modes in detail. Each mode is described by data allocation, timing charts, commands, flags, and examples. Data formats are explained.

Section 5 presents possible errors and solutions and describes how to handle errors from the PC. The AR area Error and Restart Flags are described.

The following **Appendices** are also provided: Error Codes, Specifications, IR Area Allocations, and DM Area Coding Sheets.

⚠️ **WARNING** Failure to read and understand the information provided in this manual may result in personal injury or death, damage to the product, or product failure. Please read each section in its entirety and be sure you understand the information provided in the section and related sections before attempting any of the procedures or operations given.

PRECAUTIONS

This section provides general precautions for using C200H-CT001-V1/CT002 High-speed Counter Units and related devices.

The information contained in this section is important for the safe and reliable application of the C200H-CT001-V1/CT002 High-speed Counter Units. You must read this section and understand the information contained before attempting to set up or operate a C200H-CT001-V1/CT002 High-speed Counter Unit.

1   Intended Audience

This manual is intended for the following personnel, who must also have knowledge of electrical systems (an electrical engineer or the equivalent).

• Personnel in charge of installing FA systems.

• Personnel in charge of designing FA systems.

• Personnel in charge of managing FA systems and facilities.

2   General Precautions

The user must operate the product according to the performance specifications described in the relevant manuals.

Before using the product under conditions which are not described in the manual or applying the product to nuclear control systems, railroad systems, aviation systems, vehicles, combustion systems, medical equipment, amusement machines, safety equipment, and other systems, machines, and equipment that may have a serious influence on lives and property if used improperly, consult your OMRON representative.

Make sure that the ratings and performance characteristics of the product are sufficient for the systems, machines, and equipment, and be sure to provide the systems, machines, and equipment with double safety mechanisms.

This manual provides information for programming and operating the Unit. Be sure to read this manual before attempting to use the Unit and keep this manual close at hand for reference during operation.

⚠ **WARNING** It is extremely important that a PC and all PC Units be used for the specified purpose and under the specified conditions, especially in applications that can directly or indirectly affect human life. You must consult with your OMRON representative before applying a PC system to the above-mentioned applications.

3   Safety Precautions

⚠ **WARNING** Do not attempt to take any Unit apart while the power is being supplied. Doing so may result in electric shock.

⚠ **WARNING** Do not touch any of the terminals or terminal blocks while the power is being supplied. Doing so may result in electric shock.

⚠ **WARNING** Do not attempt to disassemble, repair, or modify any Units. Any attempt to do so may result in malfunction, fire, or electric shock.

4　Operating Environment Precautions

⚠ **Caution** Do not operate the control system in the following locations:

- Locations subject to direct sunlight.
- Locations subject to temperatures or humidity outside the range specified in the specifications.
- Locations subject to condensation as the result of severe changes in temperature.
- Locations subject to corrosive or flammable gases.
- Locations subject to dust (especially iron dust) or salts.
- Locations subject to exposure to water, oil, or chemicals.
- Locations subject to shock or vibration.

⚠ **Caution** Take appropriate and sufficient countermeasures when installing systems in the following locations:

- Locations subject to static electricity or other forms of noise.
- Locations subject to strong electromagnetic fields.
- Locations subject to possible exposure to radioactivity.
- Locations close to power supplies.

⚠ **Caution** The operating environment of the PC system can have a large effect on the longevity and reliability of the system. Improper operating environments can lead to malfunction, failure, and other unforeseeable problems with the PC system. Be sure that the operating environment is within the specified conditions at installation and remains within the specified conditions during the life of the system.

5　Application Precautions

Observe the following precautions when using the PC system.

⚠ **WARNING** Always heed these precautions. Failure to abide by the following precautions could lead to serious or possibly fatal injury.

- Always ground the system to 100 Ω or less when installing the Units. Not connecting to a ground of 100 Ω or less may result in electric shock.
- Always turn OFF the power supply to the PC before attempting any of the following. Not turning OFF the power supply may result in malfunction or electric shock.
  - Mounting or dismounting Power Supply Units, I/O Units, CPU Units, Memory Units, or any other Units.
  - Assembling the Units.
  - Setting DIP switches or rotary switches.
  - Connecting cables or wiring the system.
  - Connecting or disconnecting the connectors.

⚠ **Caution** Failure to abide by the following precautions could lead to faulty operation of the PC or the system, or could damage the PC or PC Units. Always heed these precautions.

- Fail-safe measures must be taken by the customer to ensure safety in the event of incorrect, missing, or abnormal signals caused by broken signal lines, momentary power interruptions, or other causes.

- Interlock circuits, limit circuits, and similar safety measures in external circuits (i.e., not in the Programmable Controller) must be provided by the customer.

- Always use the power supply voltages specified in this manual. An incorrect voltage may result in malfunction or burning.

- Take appropriate measures to ensure that the specified power with the rated voltage and frequency is supplied. Be particularly careful in places where the power supply is unstable. An incorrect power supply may result in malfunction.

- Install external breakers and take other safety measures against short-circuiting in external wiring. Insufficient safety measures against short-circuiting may result in burning.

- Do not apply voltages to the Input Units in excess of the rated input voltage. Excess voltages may result in burning.

- Do not apply voltages or connect loads to the Output Units in excess of the maximum switching capacity. Excess voltage or loads may result in burning.

- Disconnect the functional ground terminal when performing withstand voltage tests. Not disconnecting the functional ground terminal may result in burning.

- Be sure that all the mounting screws, terminal screws, and cable connector screws are tightened to the torque specified in this manual. Incorrect tightening torque may result in malfunction.

- Leave the label attached to the Unit when wiring. Removing the label may result in malfunction if foreign matter enters the Unit.

- Remove the label after the completion of wiring to ensure proper heat dissipation. Leaving the label attached may result in malfunction.

- Double-check all wiring and switch settings before turning ON the power supply. Incorrect wiring may result in burning.

- Wire correctly. Incorrect wiring may result in burning.

- Mount Units only after checking terminal blocks and connectors completely.

- Be sure that the terminal blocks, Memory Units, expansion cables, and other items with locking devices are properly locked into place. Improper locking may result in malfunction.

- Check the user program for proper execution before actually running it on the Unit. Not checking the program may result in an unexpected operation.

- Confirm that no adverse effect will occur in the system before attempting any of the following. Not doing so may result in an unexpected operation.

    - Changing the operating mode of the PC.

    - Force-setting/force-resetting any bit in memory.

    - Changing the present value of any word or any set value in memory.

- Resume operation only after transferring to the new CPU Unit the contents of the DM Area, HR Area, and other data required for resuming operation. Not doing so may result in an unexpected operation.

- Do not pull on the cables or bend the cables beyond their natural limit. Doing either of these may break the cables.

- Do not place objects on top of the cables or other wiring lines. Doing so may break the cables.

- Use crimp terminals for wiring. Do not connect bare stranded wires directly to terminals. Connection of bare stranded wires may result in burning.

- When replacing parts, be sure to confirm that the rating of a new part is correct. Not doing so may result in malfunction or burning.

- Before touching a Unit, be sure to first touch a grounded metallic object in order to discharge any static built-up. Not doing so may result in malfunction or damage.

SECTION 1
Introduction

This section introduces the High-speed Counter Unit. It starts by describing Unit nomenclature and then describes the type of system the Units are generally incorporated it. This section ends with an introduction to the six operating modes, which are described in more detail in *Section 4*.

1-1   Introduction

The C200H-CT001-V1 and C200H-CT002 are Special I/O Units for C200H PCs. The C200H-CT001-V1 can be connected directly to an incremental encoder with an open-collector output or source output to function as a high-speed, reversible counter capable of counting at a maximum of 50 kcps.

The C200H-CT002 can be connected directly to an incremental encoder with an RS-422 line driver output or through an Encoder Adapter to an incremental encoder with a open-collector output to function as a high-speed, reversible counter capable of counting at a maximum of 75 kcps.

The C200H-CT002 is more resistive to noise than the C200H-CT001-V1 and should be used wherever excessive cable length or a noise-prone environment is anticipated. Unless otherwise specified, all information presented applies to both High-Speed Counter Units. Both the High-Speed Counter Units are referred to generically as the Counter Unit.

1-2   Nomenclature

The nomenclature is the same for both the C200H-CT001-V1 and the C200H-CT002. The C200H-CT001-V1 is shown below.

Indicators

Unit number switch ("Machine No.")

Operating mode switch

I/O Connector
Connect to the input device(s) and to any outputs used.
Attach the enclosed connector to the proper cable(s).
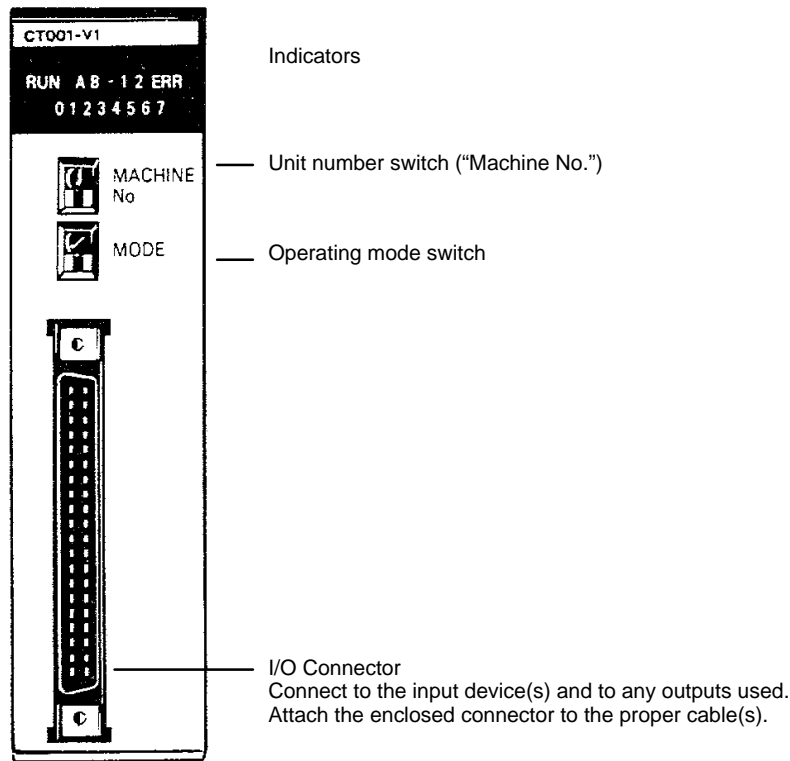
Indicator	Function
RUN	Lit during normal operation or when waiting for input. Goes out for errors.
A	Lit when input A is ON.
B	Lit when input B is ON.
1	Lit when control input IN1 is ON.
2	Lit when control input IN2 is ON.
ERR	Lit when an error has occurred.
0 to 7	Lit when corresponding output is ON.

2

1-3 System Configuration

Example Configuration

The following example system configuration uses the Counter Unit to determine whether or not product length is acceptable. The length of the products passing by on the conveyor is measured by using the output from a photoelectric switch to initiate and end counting of pulses output from an encoder. Product length is checked against standards and the product is ejected if it is out of the acceptable range.
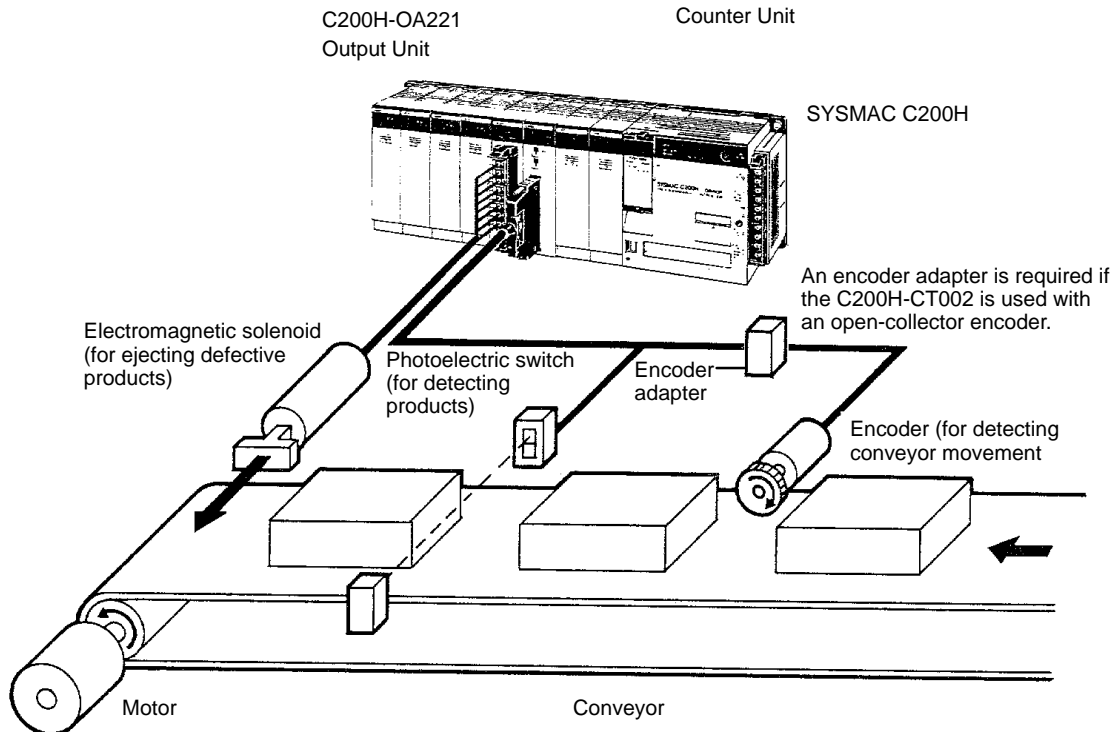
Many other applications are possible by combining other types of inputs and outputs. Refer to *Section 4 Data Allocation and Operating Modes* for other application examples.

Maximum number of Special I/O Units per PC

A maximum of 10 Special I/O Units, including Position Control Units, Counter Units, etc., can be mounted under the same PC, regardless of whether they are on the CPU Rack, the Expansion I/O Rack, or the rack containing a Remote I/O Slave Unit controlled by the PC. No more than four of these can be mounted onto any one rack containing a Remote I/O Slave Unit.

Mounting Location

The Counter Unit can be mounted to any but the 2 rightmost CPU Rack slots. Mounting the Counter Unit to either of these slots will prevent you from mounting devices directly to the PC's CPU.
The back panel DIP switch must be set before the Counter Unit is mounted. (Refer to *2-1 Switch Settings*.)

1-4   Operating Modes

The Counter Unit can be operated in any one of the six operating modes described below. External outputs are available in only 3 modes: linear, circular, and preset. The function of these outputs depends on the mode. (The mode is selected using the mode selector on the front panel of the Counter Unit, as described in *2-1 Switch Settings*.) The following is merely an introduction to the operating modes, all of which are covered in detail in *Section 4 Data Allocation and Operating Modes*.

Linear Mode

In linear mode, the counter value is incremented and decremented between –8,388,608 and 8,388,607 and is continually compared with preset ranges.

When the counter value is within a range (or ranges), specified outputs are turned ON. The same output may be specified for one or more overlapping ranges, in which case the output will be turned ON whenever the counter value is within one or more of the ranges.

A maximum of 16 ranges may be specified, each with upper and lower limits.

These limits must be within the counter range, i.e., between –8,388,608 and 8,388,607. Data can be transferred from the PC to change range limits or to set the present counter value as desired.

Circular Mode

In circular mode, the counter value restarts from zero after reaching a preset maximum value or returns to the preset maximum value when the counter value is decremented past zero. In all other respects, including data transfer, circular mode functions exactly as the linear mode. The preset maximum value must be between 0 and 65,535.

Preset Mode

In preset mode, the counter value is normally decremented from a preset value (between 1 and 8,388,607) to zero, although it can also be incremented. During this decrement phase, a total of 3 outputs may be switched ON and OFF according to ON/OFF counter values. When the counter value reaches zero, a total of 4 outputs may be turned ON, either indefinitely or for a preset time, T. Data can be transferred from the PC to change ON/OFF counter values as desired.

Gate Mode

Two types of gate mode operation are available on the C200H-CT002: normal and cumulative. Only the normal type is available on the C200H-CT001-V1. In normal gate mode, pulses are counted while control input IN1 (the count signal) is ON. The counter value is retained when input IN1 goes OFF until input IN1 goes ON again, at which point counting restarts from zero. In the cumulative type, control input IN1 serves as the reset signal and counting continues while control input IN2 (the count signal) is ON. Each time input IN2 is turned ON, counting continues from the current counter value until it is reset to zero by input IN1. In either type of gate mode, the counting range is between –8,388,608 and 8,388,607 and counting may be in either direction. This mode does not support data transfer or external outputs from the Counter Unit.

Latch Mode

In latch mode, counting begins from zero when control input IN1 (count signal) is turned ON and ranges between –8,388,608 and 8,388,607. Pulses are counted continuously (regardless of whether input IN1 is ON or OFF) , but the current counter value is always the counter value latched the last time control input IN2 (the latch signal) was turned ON, i.e., the current counter value remains unchanged while the latch signal (control input IN2) is ON and is updated to the actual count while the latch signal is OFF. Counting may be restarted from zero at any time be activating control input IN1. Control inputs

IN1 and IN2 may originate either externally or internally. This mode does not support external outputs from the Counter Unit or data transfer.

Sampling Mode

In sampling mode, pulses are counted for a preset interval after control input IN1 (the count signal) is turned ON. Counting may be in either direction.

Counting always begins at zero and ranges between −8,388,608 and 8,388,607. The time interval must be between 10 and 9,999 ms.

Control input IN1 may originate either externally or internally. This mode does not support external outputs from the Counter Unit or data transfer.

SECTION 2
Switch Settings and Wiring

This section provides the Unit settings and connector cable pin specifications. Instructions for the construction of input and output connectors are provided. Electrical schematics and examples are presented to further explain Unit operation.

2-1 Switch Settings

Always turn off the Counter Unit before setting the unit number and mode selectors. Use a regular screwdriver, being careful not to damage the slot in the screw. Be sure not to leave a selector midway between settings.

Front Panel DIP Switch

Switch name	Function
Unit no.	Used to set the unit number. Unit numbers run from 0 through 9 and are the same for all Special I/O Units, i.e. unit number 0 may be assigned to a Position Control Unit; unit number 1, to a High-speed Counter Unit; etc. Do not set the same number for more than one Special I/O Unit.
Mode	Used to set the operating mode. Modes run from 1 through 6, as follows: 1: Linear 2: Circular 3: Preset 4: Gate 5: Latch 6: Sampling

Back Panel DIP Switch   This switch must be set before the Counter Unit is mounted. It is not necessary to set all the pins for all operating modes. Refer to *3-2 Input Selection* and *Section 4 Data Allocation and Operating Modes* for operational details.
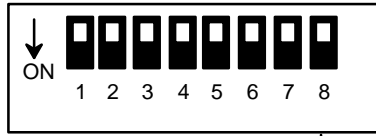
Input Selection

Pins 1 through 3 are used to select the type of inputs for inputs A and B.

1	2	3	Input type	
OFF	OFF	OFF		Normal
OFF	OFF	ON	Offset phases	x2
OFF	ON	*		x4
ON	OFF	*	Up and down pulses	
ON	ON	*	Pulse and direction	

Internal Reset Bit

8	Function
OFF	Reset bit inoperative
ON	Reset bit effective on rising edge.

This setting is effective only for operating modes 1,2, and 3.

For Operating Mode 1 or 2: Input Z

4	5	Function
OFF	*	Input Z inoperative
ON	OFF	Input Z effective on falling edge.
ON	ON	Input Z effective on rising edge.

For Operating Mode 3: Start Input

4	5	Function
OFF	*	Start on START command (IR n, bit 00).
ON	*	Start on control input IN2.

Control Input IN1

6	7	Function
OFF	*	Control input IN1 inoperative
ON	OFF	Control input IN1 effective on falling edge.
ON	ON	Control input IN1 effective on rising edge.

This setting is effective only for operating modes 1,2, and 3.
In modes 4, 5, and 6, control inputs IN1 and IN2 are always effective on their rising edges

*Pins marked with asterisks are not used.

2-2 Wiring

Connector Pin Arrangement Names of inputs and outputs and the pin arrangement of the connector are shown below (as viewed from the front). The connector is a Fujitsu FCN-361J040 (solder type), and is included with the Counter Unit.

C200H-CT001-V1

Row B	Pin no.	Row A
Input A: 24 VDC	20	Input A: 12 VDC
Input A: 0 V	19	Input A: 5 VDC
Input B: 24 VDC	18	Input B: 12 VDC
Input B: 0 V	17	Input B: 5 VDC
Input Z: 24 VDC	16	Input Z: 12 VDC
Input Z: 0 V	15	Input Z: 5 VDC
	14	
	13	Control input IN1: 12/24 VDC
Control input IN1: 0 V	12	Control input IN1: 5 VDC
	11	Control input IN2: 12/24 VDC
Control input IN2: 0 V	10	Control input IN2: 5 VDC
	9	
Outputs 0 through 3 Power supply: 5 to 24 VDC	8	Output 0
	7	Output 1
Outputs 0 through 3, COM: 0 V	6	Output 2
	5	Output 3
Outputs 4 through 7 Power supply: 5 to 24 VDC	4	Output 4
	3	Output 5
Outputs 4 through 7, COM: 0 V	2	Output 6
	1	Output 7

C200H-CT002

Row B	Pin no.	Row A
	20	
Input A: neg.	19	Input A: pos.
	18	
Input B: neg.	17	Input B: pos.
	16	
Input Z: neg.	15	Input Z: pos.
	14	
	13	Control input IN1: 12/24 VDC
Control input IN1: 0 V	12	Control input IN1: 5 VDC
	11	Control input IN2: 12/24 VDC
Control input IN2: 0 V	10	Control input IN2: 5 VDC
	9	
Outputs 0 through 3 Power supply: 5 to 24 VDC	8	Output 0
	7	Output 1
Outputs 0 through 3, COM: 0 V	6	Output 2
	5	Output 3
Outputs 4 through 7 Power supply: 5 to 24 VDC	4	Output 4
	3	Output 5
Outputs 4 through 7, COM: 0 V	2	Output 6
	1	Output 7

Wiring Connectors

Solder-type connectors are included with the Counter Unit.

Use wire with a cross-sectional area of 0.3 mm^2 or less. When soldering, do not short-circuit an adjacent terminal; cover the soldered section with an insulation tube. When using multicore cable, wire output and input cables separately.

Wire   Insulation tube

Connector

11
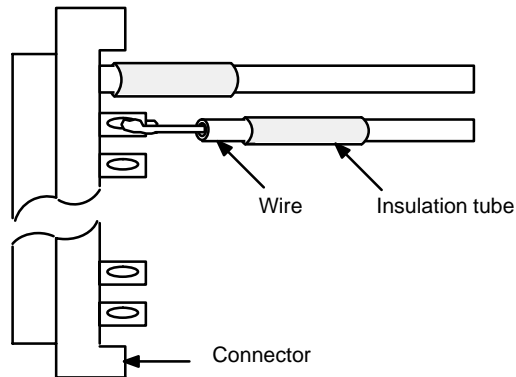
Differentiating Cables and Connector Pin Numbers

Input and output cables can be differentiated by position, as shown on the right below. Alignment with the connector pin numbers is also as shown on the left below. Please make sure you are wiring to the correct pins.

Shape of connector on the reverse side.

B20 — A20
B19 — A19

B6 — A6
B5 — A5
B4 — A4
B3 — A3
B2 — A2
B1 — A1

Pin number marks

Connector pins as viewed from the solder side.

Input cables

Output cables
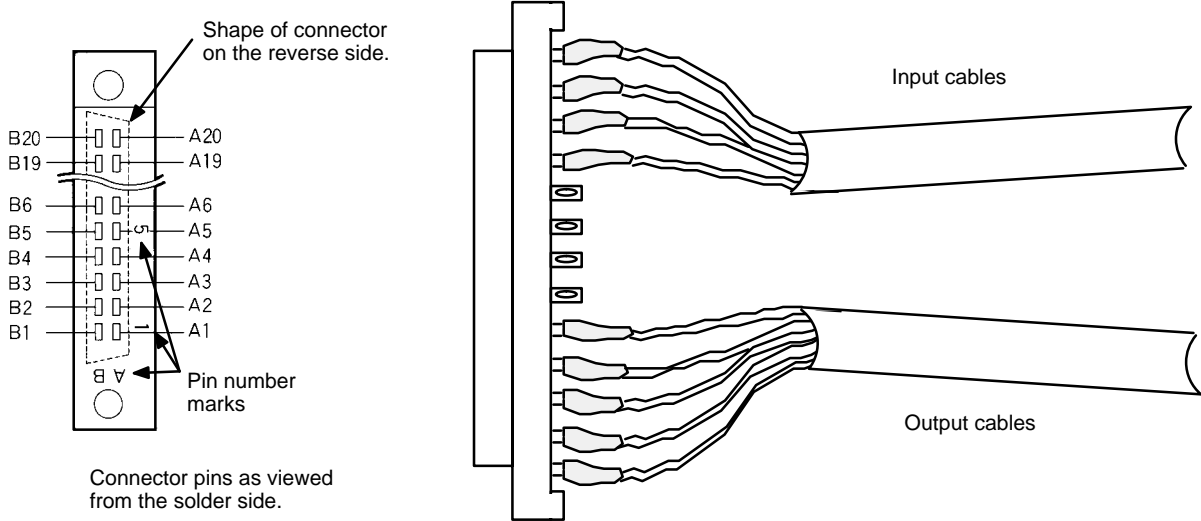
Assembling Connectors

Assemble connectors as shown below.

Round head screw (8mm M2, two total)

Nut (M2, four total)

Round head screw (10mm M2, two total)

Case

Connector

Lock screw
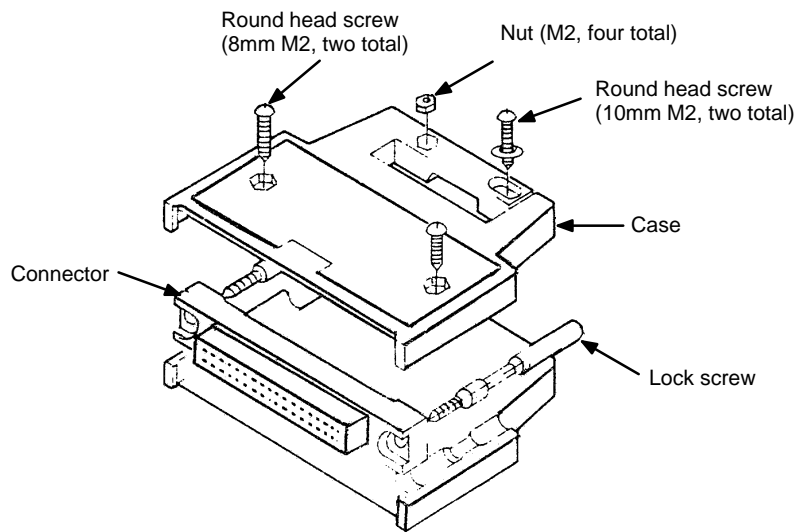
Note Any of the following connectors can be used as required by operating conditions. The jack is a Fujitsu model 360.

1, 2, 3... 1. FCN-361J040 (solder-type, included with Counter Unit)
FCN-360C040-B (connector cover)
2. FCN-363J040 (crimp type, housing)
FCN-363J-AU (connector)
FCN-360C040 (connector cover)
3. FCN-367J040-AV/F (crimp type)

Wiring Precautions

For the C200H-CT001-V1, the terminals that are used depend upon the power supply of inputs A, B, and Z.

For the C200H-CT002, inputs A, B, and Z must be line driver inputs (Am26LS31-compatible). Positive and negative terminals must be wired correctly. The terminals that are used depend upon the power supply of the control inputs. Be careful to connect to the correct terminals. Supply only one voltage for

each input. The terminals for output power supply, 5 to 24 VDC and COM (0 V), are separated into two: those for outputs 0 through 7. These are not interconnected internally. If the 5 to 24 VDC and COM (0 V) terminals for the output power supply are connected incorrectly, an internal fuse will burn out, preventing operation. This fuse is not user serviceable. This fuse will also burn out if the output current exceeds 0.5 A/common, again preventing operation. When wiring inputs A, B, and Z, the following measures must be taken to prevent interference from noise:

1, 2, 3...   1.   Use shielded twisted pair cable and ground the shield.

2.   Keep wiring as short as possible and do not place lines parallel to possible sources of noise, such as power lines.

3.   Use a stabilized power supply that is independent from other input and output power supplies.

The external power supply must be greater than or equal to the load power supply. (An error may occur if the external power supply is less than the load power supply.) In the example on the following page, E1 must be greater than or equal to E2.
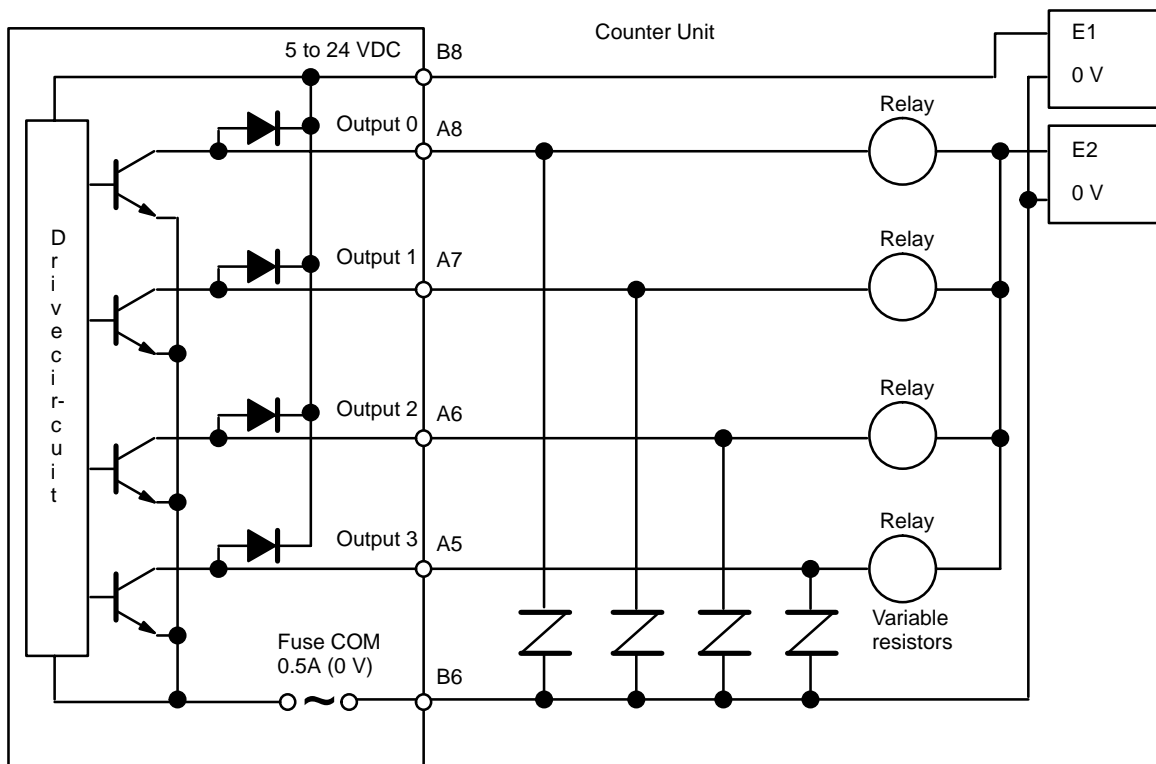
Input and Output Circuits   Actual pin numbers are arranged in order from the top of the connector starting with A20 and B20. For each input, connect the 0-V terminal and only one of the other terminals, i.e., do not supply more than one voltage for any input. The circuits are shown on the following pages.

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C200H-CT001-V1 Input Circuits

	1.6 kΩ	**B20......** Input A: 24 VDC
	560 Ω	**A20......** Input A: 12 VDC
Rectifier		**A19......** Input A: 5 VDC
		B19...... Input A: 0 V

	1.6 kΩ	**B18......** Input B: 24 VDC
	560 Ω	**A18......** Input B: 12 VDC
Rectifier		**A17......** Input B: 5 VDC
		B17...... Input B: 0 V

	1.6 kΩ	**B16......** Input Z: 24 VDC
	560 Ω	**A16......** Input Z: 12 VDC
Rectifier		**A15......** Input Z: 5 VDC
		B15...... Input Z: 0 V

	1.3 kΩ	**A13......** Control input IN1: 12/24 VDC
Filter		**A12......** Control input IN1: 5 VDC
		B12...... Control input IN1: 0 V

	1.3 kΩ	**A11......** Control input IN1: 12/24 VDC
Filter		**A10......** Control input IN1: 5 VDC
		B10...... Control input IN1: 0 V

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C200H-CT001-V1 Output Circuits

B8...... Output power
supply: 5 to 24 VDC

A8...... Output 0

A7...... Output 1

A6...... Output 2

A5...... Output 3

Fuse
0.5 A

B6...... Output COM: 0 V

B4...... Output power
supply: 5 to 24 VDC

A4...... Output 4

A3...... Output 5

A2...... Output 6

A1...... Output 7

Fuse
0.5 A

B2...... Output COM: 0 V
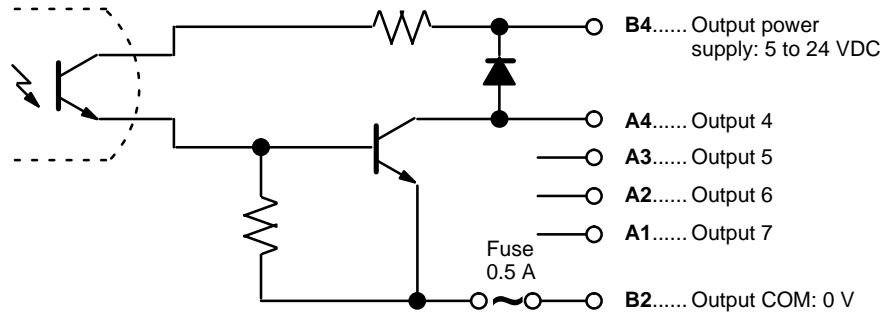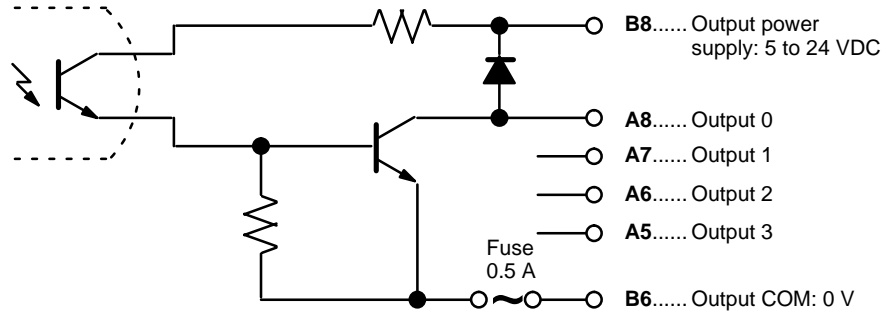
C200H-CT002 Input Circuits

A19......	Input A: pos.	
B19......	Input A: neg.	
A17......	Input B: pos.	
B17......	Input B: neg.	
A15......	Input Z: pos.	
B15......	Input Z: neg.	

1.3 kΩ **A13......** Control input
IN1: 12/24 VDC

Filter **A12......** Control input
IN1: 5 VDC

B15...... Control input
IN1: 0 V

1.3 kΩ **A11......** Control input
IN1: 12/24 VDC

Filter **A10......** Control input
IN1: 5 VDC

B10...... Control input
IN1: 0 V
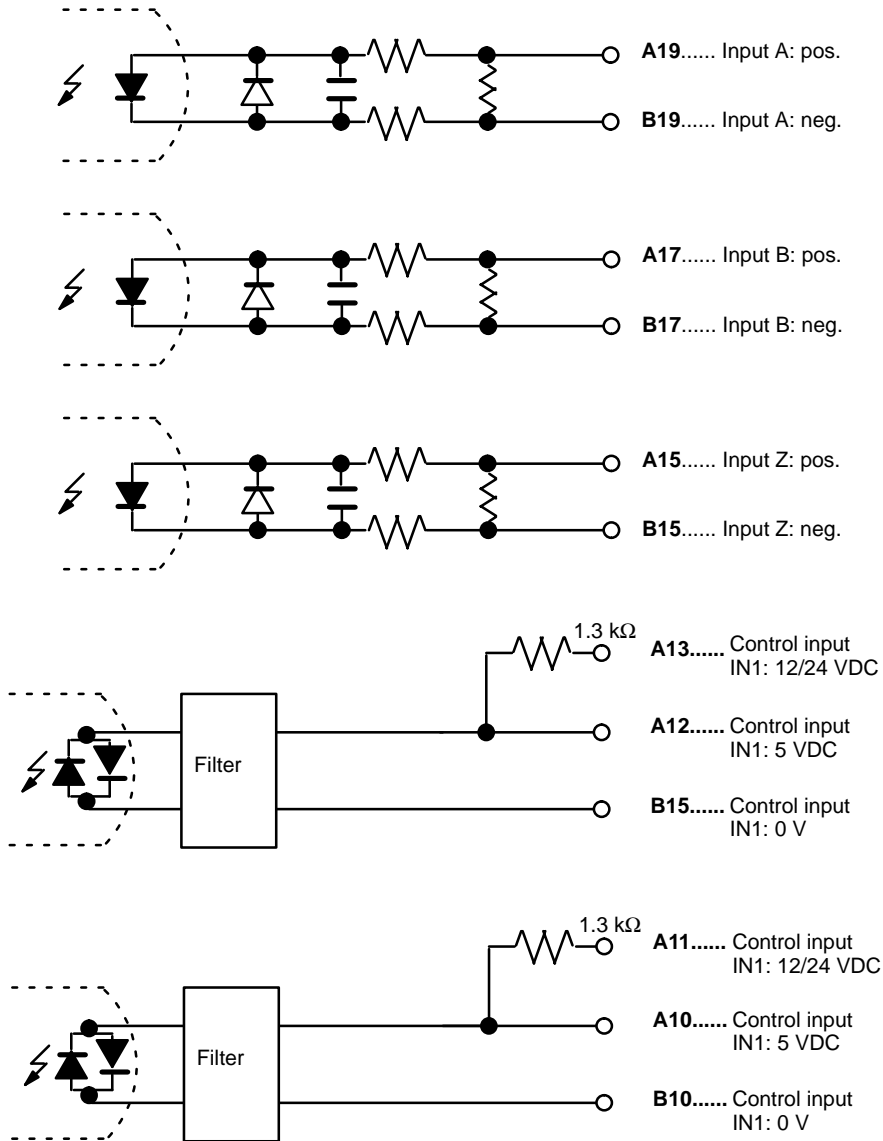
C200H-CT002 Output Circuits
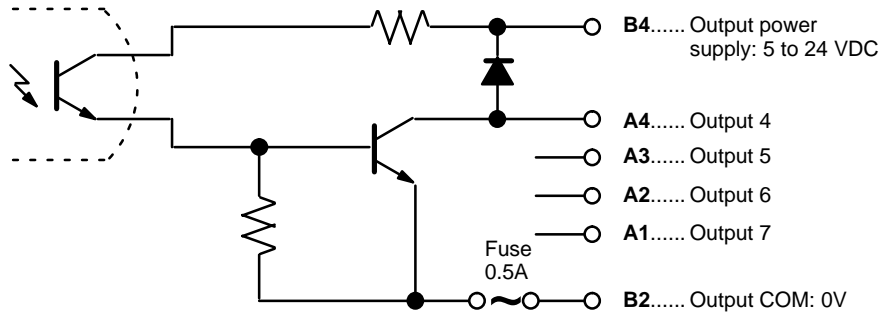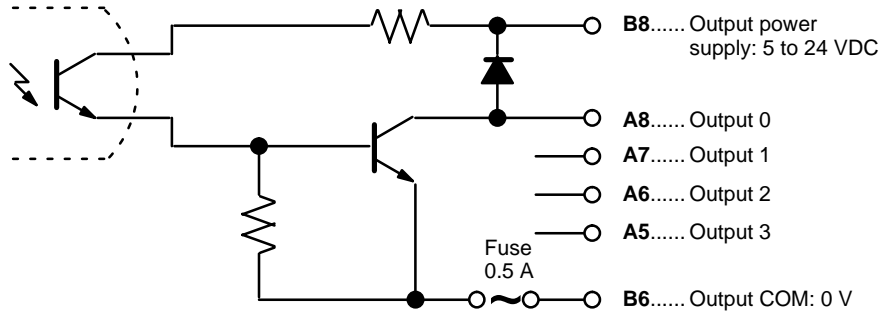
2-3 Input Circuit Wiring Examples

2-3-1 C200H-CT001-V1

Examples

The following wiring examples show connections between encoders and inputs A, B, and Z.

**Example 1
12-VDC, Open-collector
Encoder**

This example shows the connections that would be used for a 12-VDC power supply and an incremental encoder with a open-collector output.

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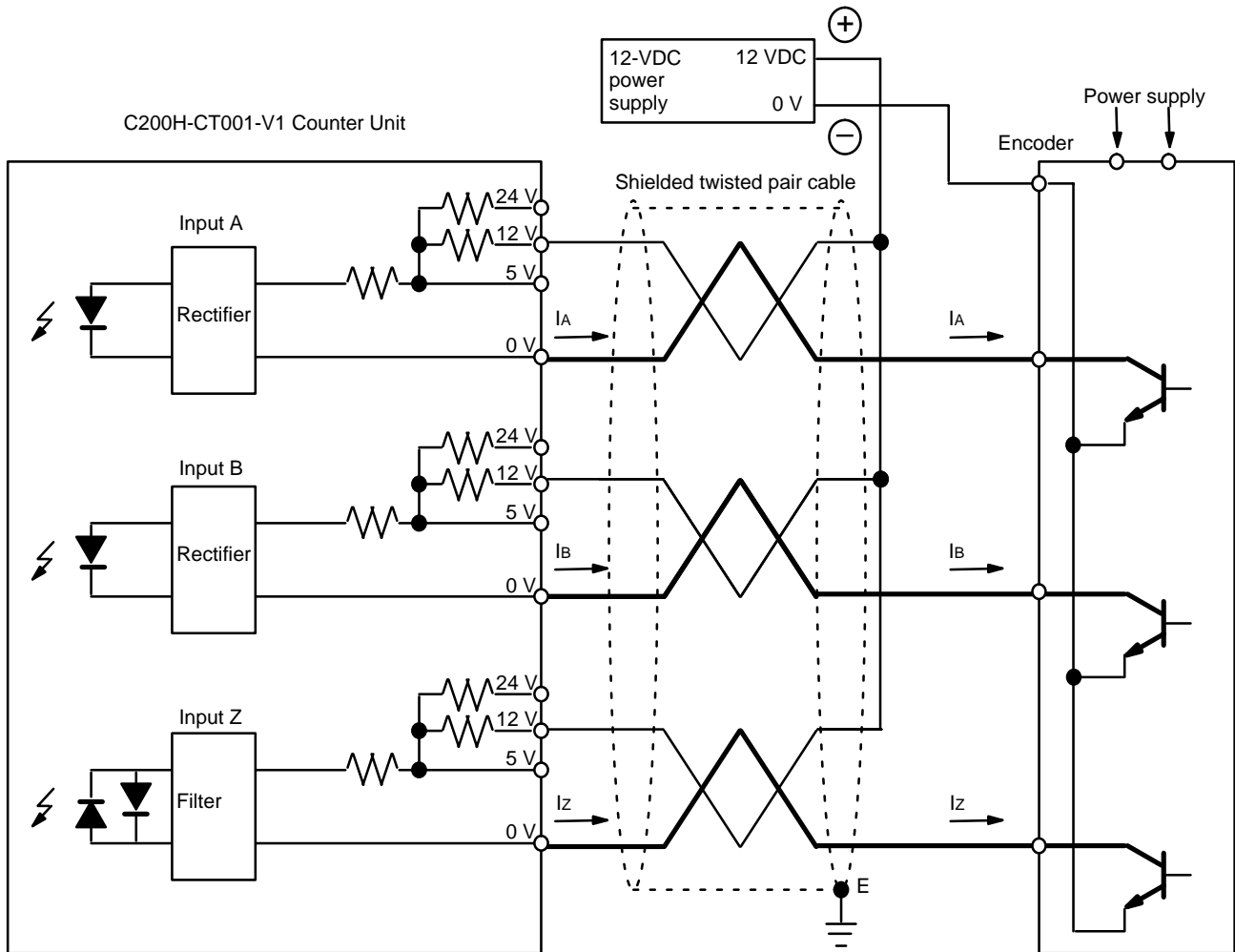
**Example 2
12-VDC, Voltage-output,
Sync-load Encoder**

This example shows the connections that would be used for a 12-VDC power supply and a sync-load encoder with a voltage output. When the encoder output is high, the input to the Counter Unit turns OFF. When the encoder output is low, the input to the Counter Unit turns ON.
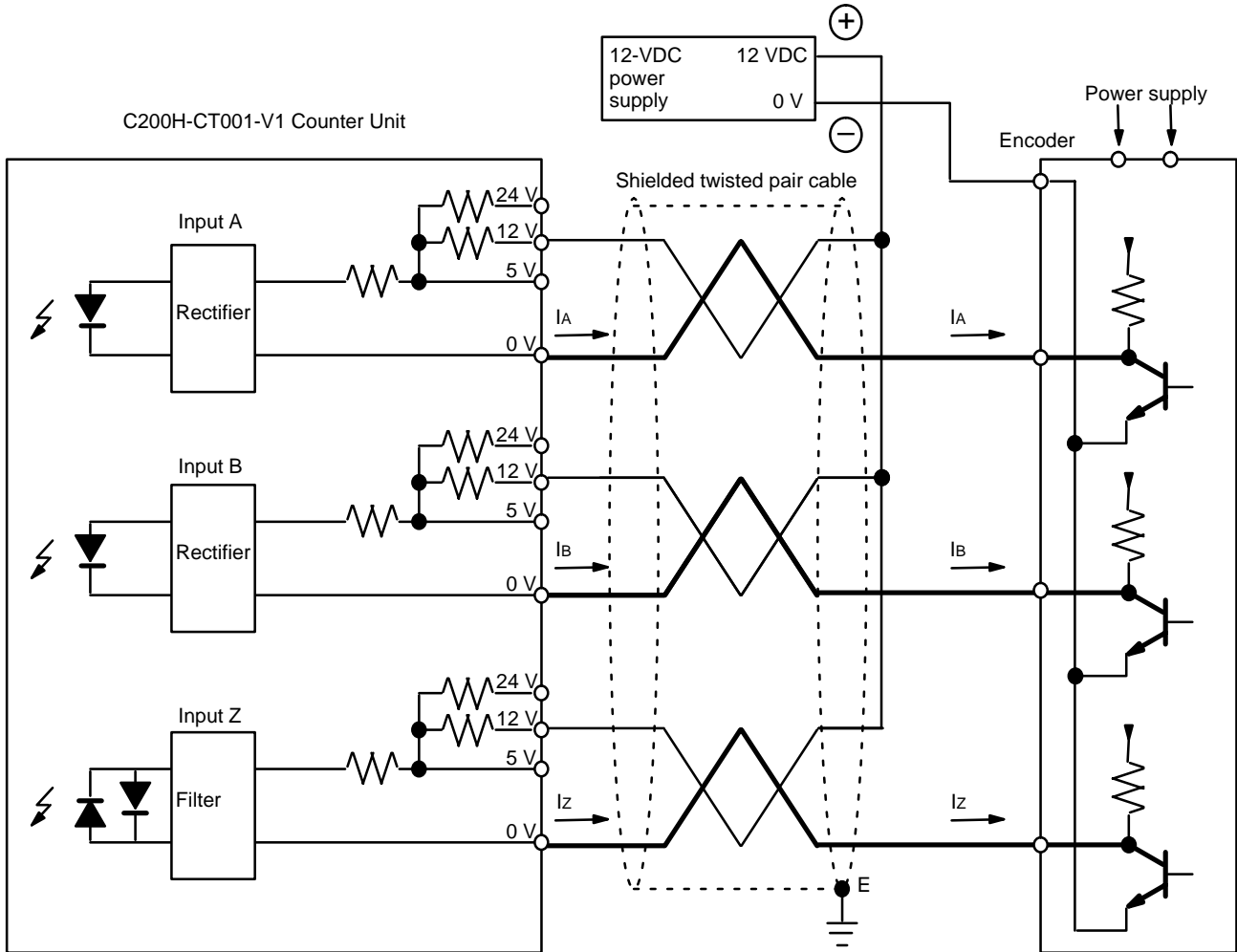
**Example 3
5 VDC, Voltage-output,
Source-load Encoder**

This example shows the connections that would be used for a 5-VDC power supply and a source-load encoder with a voltage output. Here, attention must be paid to the ON voltage.
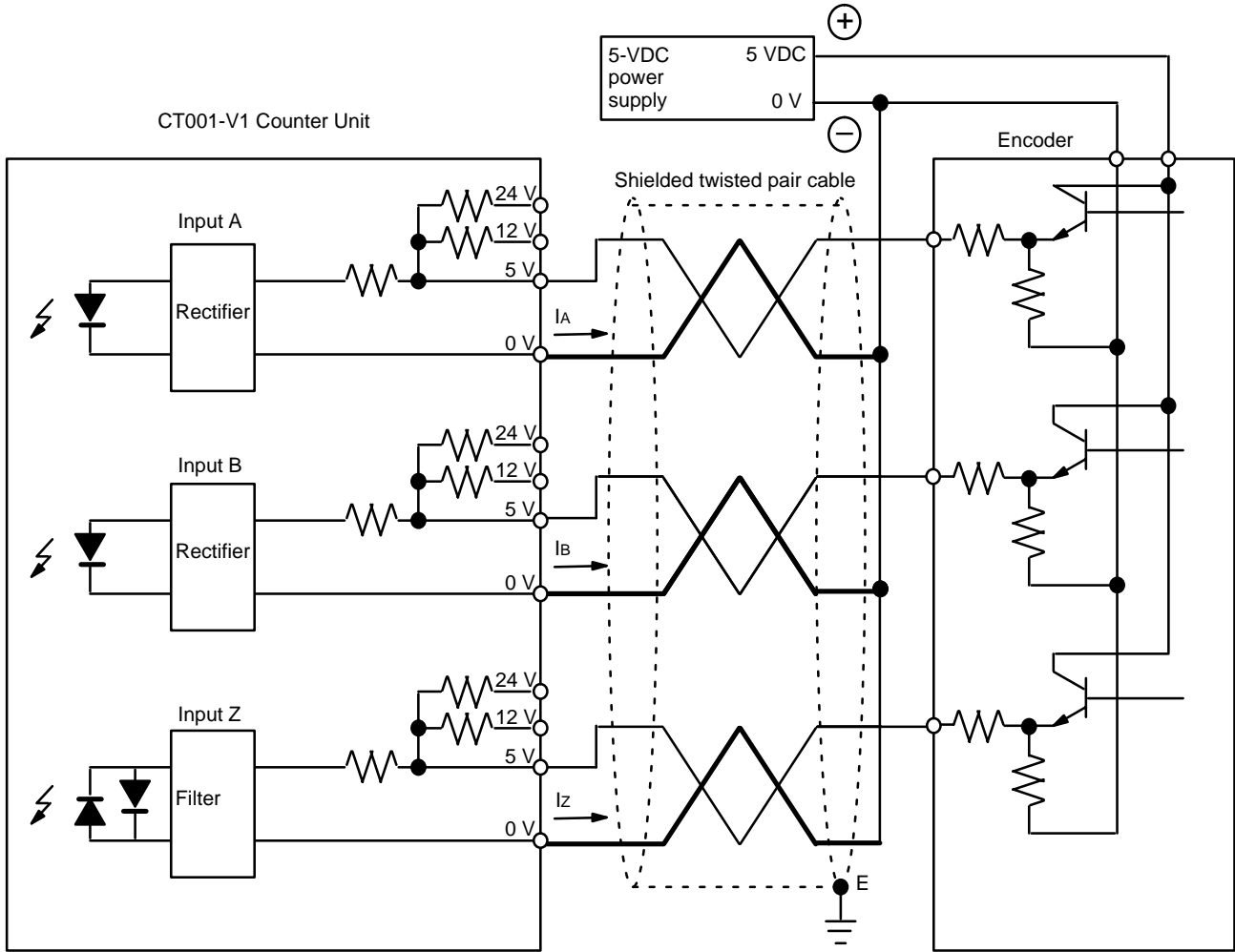
2-3-2 C200H-CT002

Example 1
Line-driver Encoder

The following wiring examples shows connections between a line-driver encoder (Am26LS31-compatible) with outputs A, B, Z and inputs A, B, and Z.
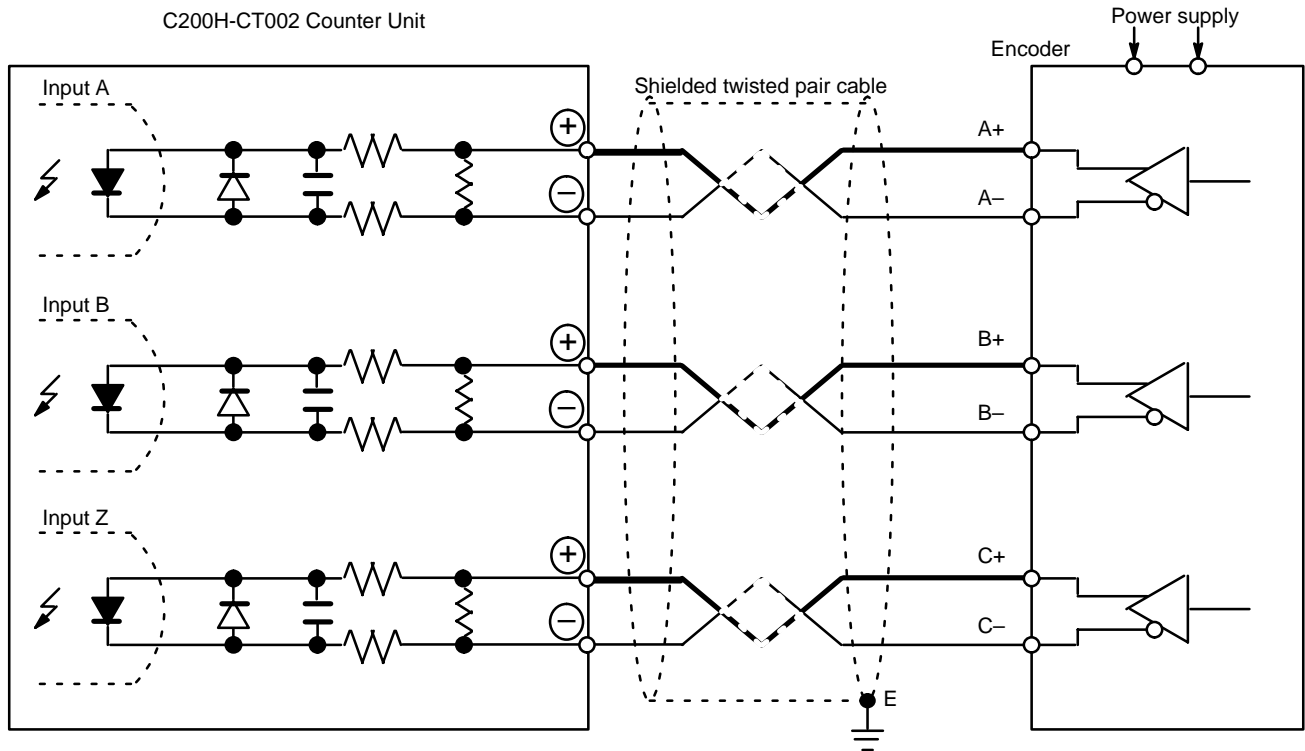
Example 2
Open-collector Encoder and Encoder Adapter

The following wiring example shows connections between an open-collector encoder and an Encoder Adapter (C500-AE001), and between the Encoder Adapter and inputs A, B, and Z. Connections should be wired so that Counter Unit inputs go ON when encoder outputs go ON. Because the C500-AE001 Encoder Adapter uses an Am26LS31-compatible line driver, high voltage is impressed on the positive terminal and low voltage is impressed on the negative terminal when the output is high.
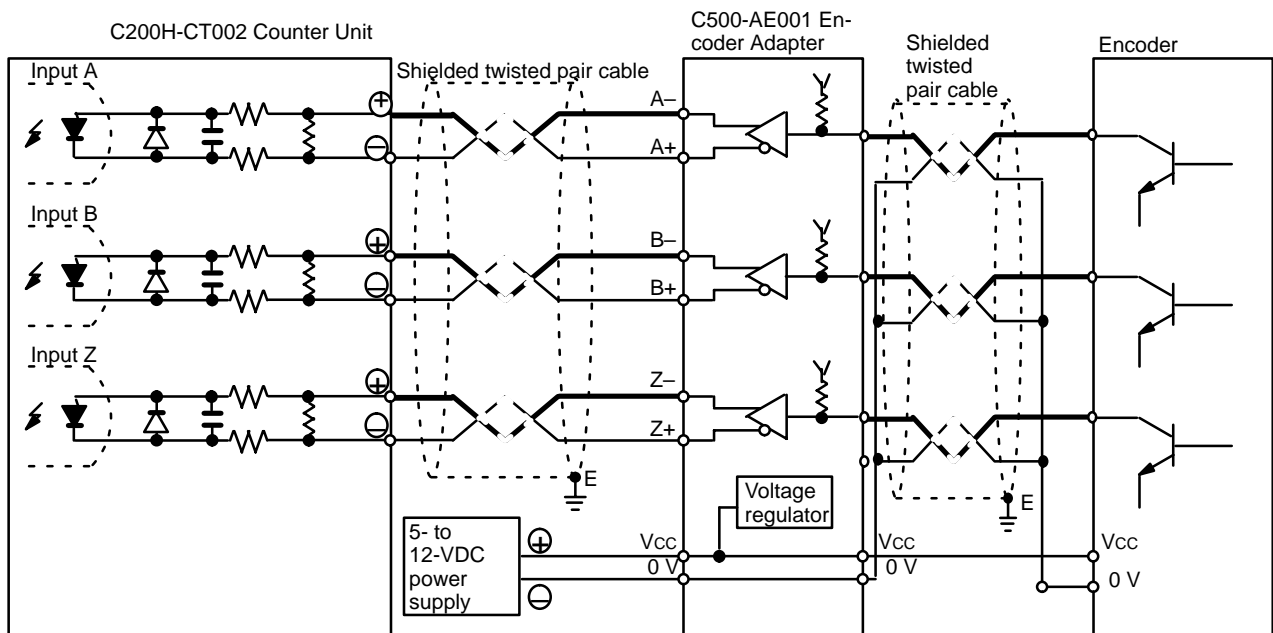
Control Input Wiring Examples

In order to prevent chattering, install the input wiring with as few contacts as possible.
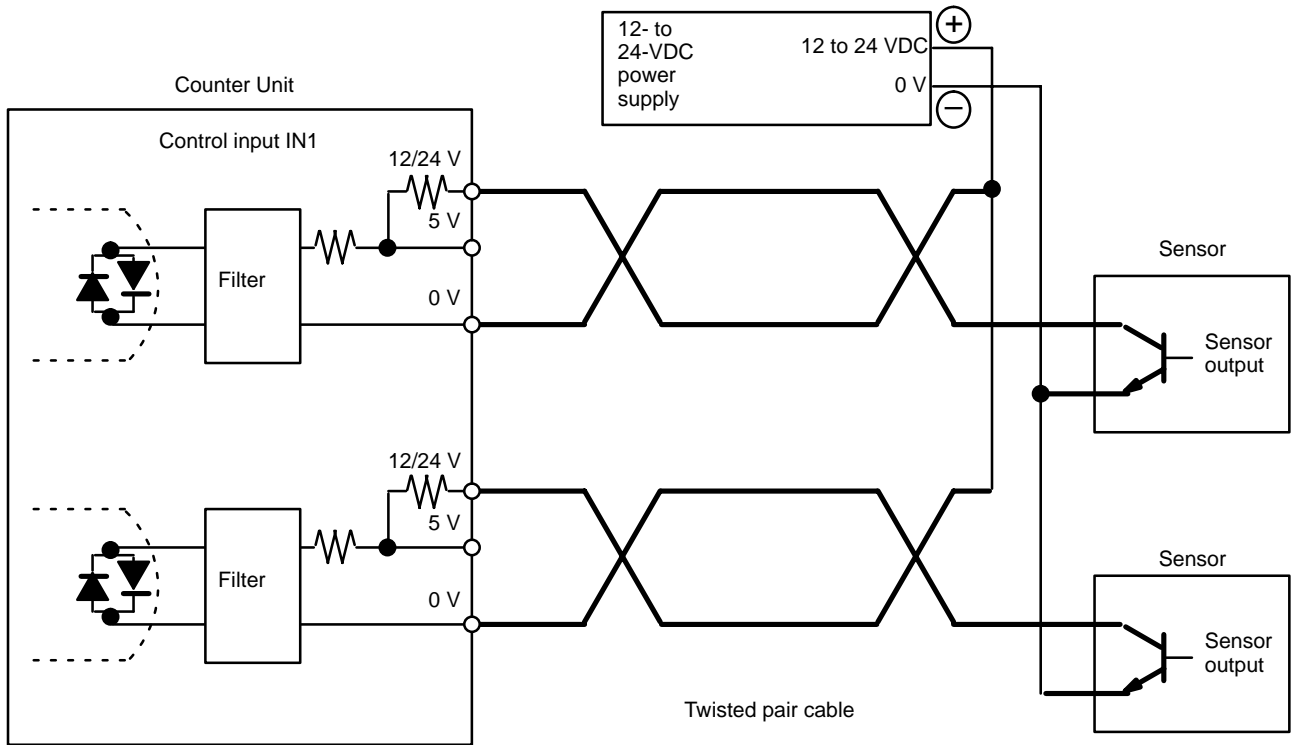
External Output Wiring Example

The following example shows output wiring with outputs 0 through 3 connected to relays and outputs 4 through 7 connected to TTL devices.
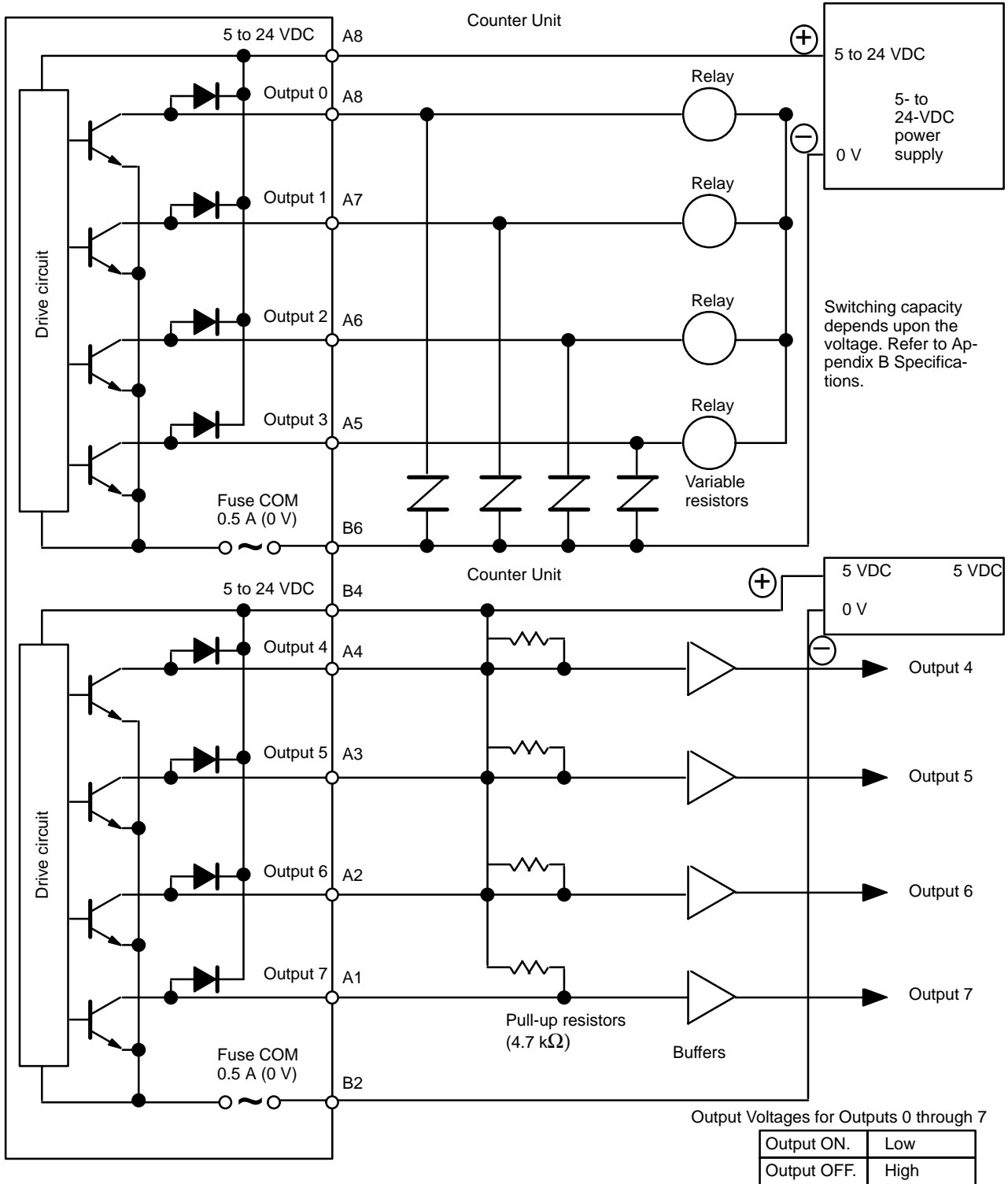
2-4   Dimensions

Unit Dimensions (Unit: mm)
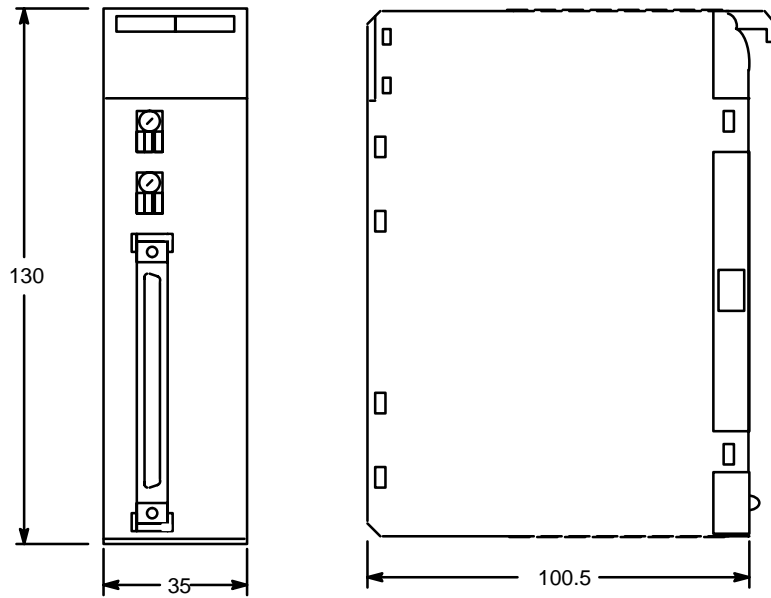
Mounted Dimensions (Unit: mm)
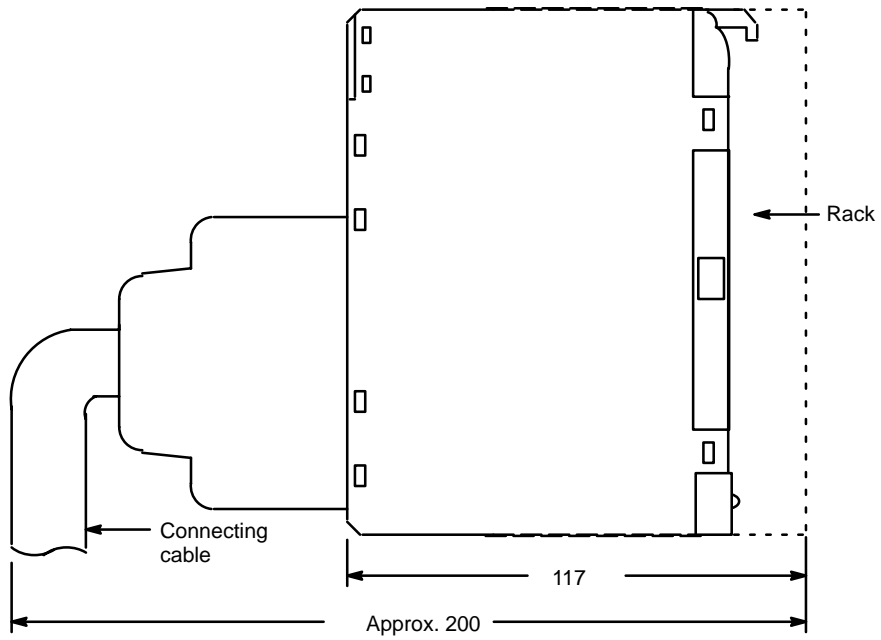
SECTION 3
Operation

This section describes the operational flow of the counting system. The input types are identified along with instructions for their use. Data transfer timing is described in relation to the PC cycle time.

3-1   Operational Flow

Each Special I/O Unit mounted under a C200H PC is assigned a unit number between 0 and 9. The unit number assigned to the Counter Unit determines the 100 DM words and 10 IR words that will be allocated to it. DM words are used for Counter Unit parameters; IR words, for command bits and flags. (Refer to *4-1 Data Configuration and Allocation* for details.) The following procedure outlines the steps necessary to operate the Counter Unit.

1, 2, 3... 1. Set the mode selector on the front panel to the desired operating mode, and then set the DIP switch on the rear panel accordingly. (Refer to *2-1 Switch Settings.*)

2. Set the unit number with the selector on the front panel. (Refer to *2-1 Switch Settings.*)

3. Using the Programming Console, set data required in the DM area under the unit number.

4. Prepare the user program to operate the Counter Unit using the allocated IR area words and bits.

It is also possible to set parameters and counter values in any data area using the user program or the Programming Console. This data can then be transferred to the Counter Unit by using the TRANSFER DATA command bit. (Refer to page 40 *TRANSFER DATA Command.*)

3-2   Input Selection

Any one of three types of inputs can be selected: offset phase inputs (i.e., two inputs with offset phases), individual up and down inputs, and pulse and direction inputs. All three types of inputs include a reset input. Any type of any input can be used with any of the operating modes, although not all operating modes support resetting. (Refer to *Section 4 Data allocation and Operating Modes* for details.) The type of inputs is selected with the back panel DIP switch.

3-2-1   Offset Phases

Offset phase inputs use the difference in phase between two inputs to determine whether the counter value will be incremented or decremented. An input multiplier, either x 2 or x 4, is available with offset phase inputs to increase accuracy. If the x 2 multiplier is selected, the counter value will be incremented or decremented twice for each input A pulse; if the x 4 multiplier is selected, the counter value will be incremented or decremented four times for each input A pulse. The multiplier is set with the back panel DIP switch. (Refer to *2-1 Switch Settings.*)

The counter can be reset in the linear or circular operating modes by using the Z-phase output of the encoder. Refer to *3-3 Reset Conditions* for details.
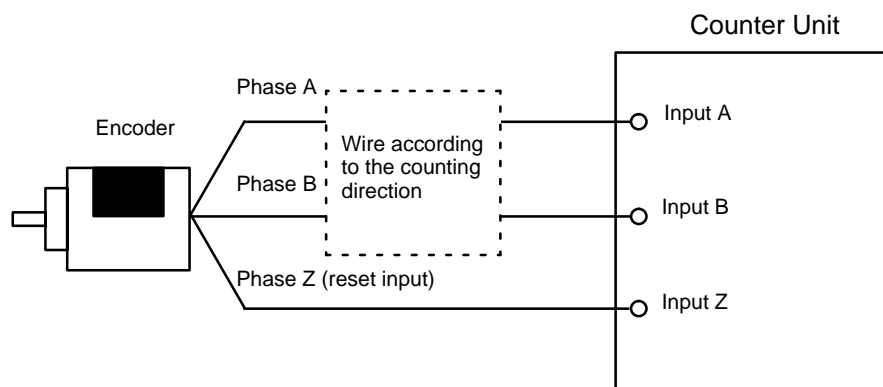
Counting Speed   The maximum pulse frequency possible for offset phase inputs is determined by the specifications of the incremental encoder connected to the Counter

Units. The following example shows calculations E6B-CWZ3C Incremental Encoder when used with the C200H-CT001-V1. Rotational directions are given as viewed from the end of the encoder shaft.

Encoder Specifications

Power supply	4.75 to 13.2 VDC, ripple (p-p): 5% max.
Current consumption	50 mA max.
Resolution	500 pulses/revolution
Outputs	Phase A, phase B, phase Z
Output type	Open collector
Output capacity	Applied voltage: 30 VDC max. Sync. current: 80 mA max. Residual voltage: 1 V max
Max. frequency	30 kHz
Output phase difference (between phase A and B)	90°±45° (1/4T±1/8T)
Output fall/rise time	1.0 μs max.

CW Rotation   Here, input A is advanced by 1/4T±1/8T over input B.
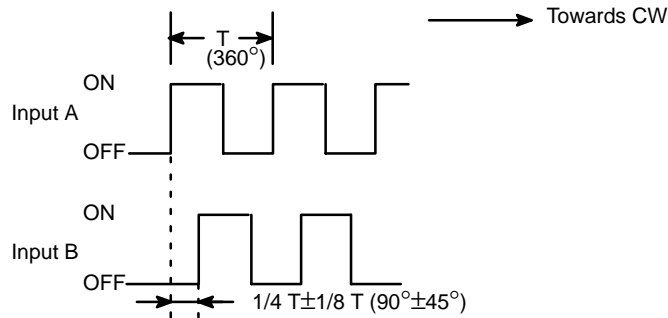
CCW Rotation   Here, input A is delayed by 1/4T±1/8T over input B.
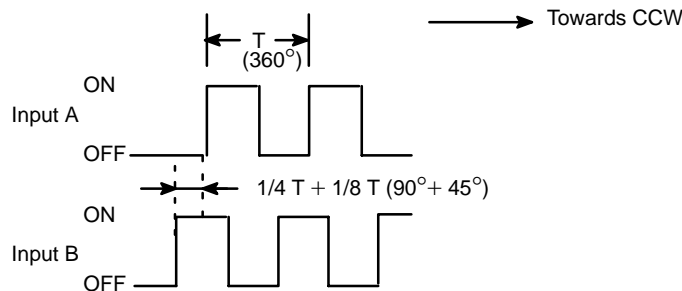
Since the output phase difference is 90°±45°, the minimum phase difference produced by this encoder is as follows:

90° − 45° = 45°

Because the C200H-CT001-V1 requires a minimum phase difference of 4.5 4.5 must be less than 45°/360°. T must therefore be less than 36 meaning the maximum frequency, 1/T, would be 27.7 kcps (54 rps for 500 pulses per revolution). This would be the maximum frequency at which this encoder could be used with the C200H-CT001-V1. With the C200H-CT002, a minimum phase difference of 3 is required. Computing as above shows a maximum frequency of 41.7 kcps when using the C200H-CT002 with this encoder.

Note The minimum pulse width must be considered when using input Z to reset the counter. With the C200H-CT001-V1, the pulse width of input Z must be 0.1 ms or greater, and the return frequency must be 5 kcps or less. With the

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C200H-CT002, the pulse width of input Z must be 10 or greater, and the return frequency, allowing for software processing time, must be 10 kcps or less.

3-2-2   Up and Down Pulses

With separate up and down pulse inputs, the counter value is incremented or decremented on the rising edge of the appropriate input. Here, sensors could replace the encoders to provide inputs A and B.

In the linear or circular operating modes, the counter can be reset by connecting input Z to a sensor or switch.
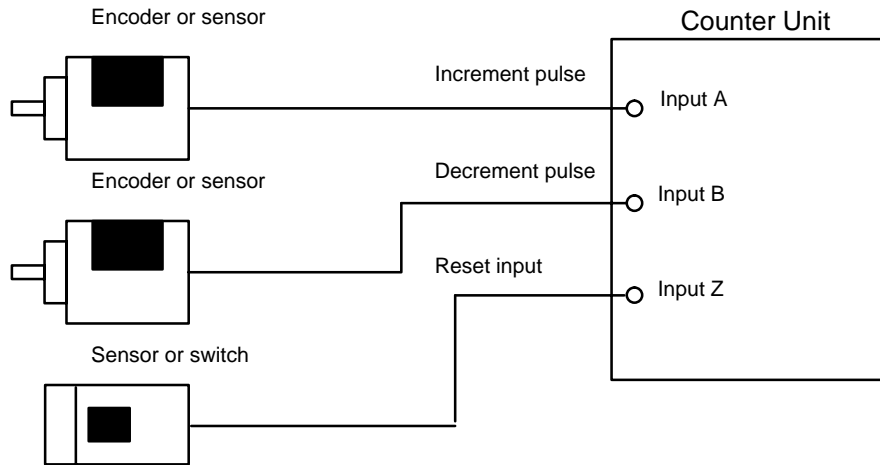
3-2-3   Pulse and Direction

With pulse and direction inputs, the counter value is incremented or decremented on the rising edge of the pulse input. If the direction input is OFF, the counter value is incremented; if the direction input is ON, the counter value is decremented. The direction input should be switched between ON and OFF only when the pulse input is OFF.

In the linear or circular operating modes, the counter can be reset by connecting input Z to a sensor or switch.
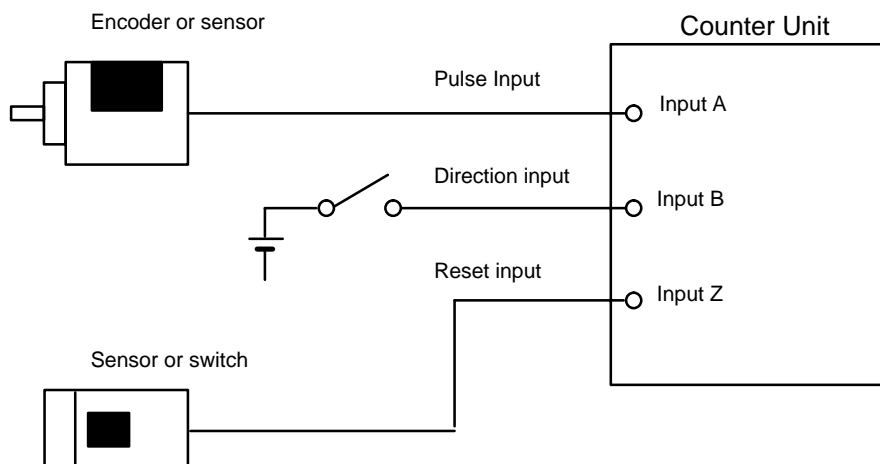
3-3   Counter Reset Conditions

Counter reset conditions vary according to the combination of inputs used and pin settings on the back panel DIP switch. The DIP switch settings required for the input combinations shown in the following table and the operating modes that can be used with each are shown on the next page. (The numbers 1 through 17 above the input patterns correspond to the settings.) Resetting is not possible in the gate, latch, and sampling operating modes. All inputs for each pattern must be in the status shown for setting to be effective. The minimum input pulse width for the input Z is 0.1 ms;that for the control input IN1, 1 ms.

In the following table, input Z is indicated by Z; control input IN1, by IN1, and the internal reset bit, by IRB. The point at which the reset actually takes place is indicated by the arrow at the bottom of each pattern. The DIP switch settings for each pattern are described on the following page.

Inputs used	Reset conditions and timings			
	1	2	3	4
Input Z Control input IN1 Internal reset bit	Z IN1 IRB	Z IN1 IRB	Z IN1 IRB	Z IN1 IRB
	5	6	7	8
Input Z Control input IN1	Z IN1	Z IN1	Z IN1	Z IN1
	9	10		
Input Z Internal reset bit	Z IRB	Z IRB		
	11	12		
Control input IN1 Internal reset bit	IN1 IRB	IN1 IRB		
	13	14		
Input Z	Z	Z		
	15	16		
Control input IN1	IN1	IN1		
	17			
Internal reset bit	IRB			

DIP Switch Settings   Pins 1 through 3 do not affect resetting

Pattern number on previous page	Pin Settings					Possible operating modes		
	4	**5**	**6**	**7**	**8**	**Linear**	**Circular**	**Preset**
1	ON	ON	ON	ON	ON	OK	OK	OK
2	ON	ON	ON	OFF	ON	OK	OK	OK
3	ON	OFF	ON	ON	ON	OK	OK	OK
4	ON	OFF	ON	OFF	ON	OK	OK	OK
5	ON	ON	ON	ON	OFF	OK	OK	OK
6	ON	ON	ON	OFF	OFF	OK	OK	OK
7	ON	OFF	ON	ON	OFF	OK	OK	OK
8	ON	OFF	ON	OFF	OFF	OK	OK	OK
9	ON	ON	OFF	*	ON	OK	OK	OK
10	ON	OFF	OFF	*	ON	OK	OK	OK
11	OFF	*	ON	ON	ON	OK	OK	OK
12	OFF	*	ON	OFF	ON	OK	OK	OK
13	ON	ON	OFF	*	OFF	OK	OK	OK
14	ON	OFF	OFF	*	OFF	OK	OK	OK
15	OFF	*	ON	ON	OFF	OK	OK	OK
16	OFF	*	ON	OFF	OFF	OK	OK	OK
17	OFF	*	OFF	*	ON	OK	OK	OK

*These pins may be either ON or OFF.

3-4   Data Transfer Timing

Data transfer is available in linear and circular modes to change ranges limit settings or the current counter value and in preset mode to change range limit settings. The data to be transferred must be prepared in the appropriate form in a PC data area. Data transfer specifications and procedures are described under the relevant operating modes. This section describes only data transfer timing in relation to the PC cycle time.

C200H Cycle Time   The C200H PC cycle consists of the following operations.

Common process-ing	Host link servic-ing	Periph-eral de-vice servic-ing	Processing	I/O re-fresh cycle	Com-mon process-ing	Host link servic-ing	Periph-eral de-vice servic-ing	Processing	I/O re-fresh cycle
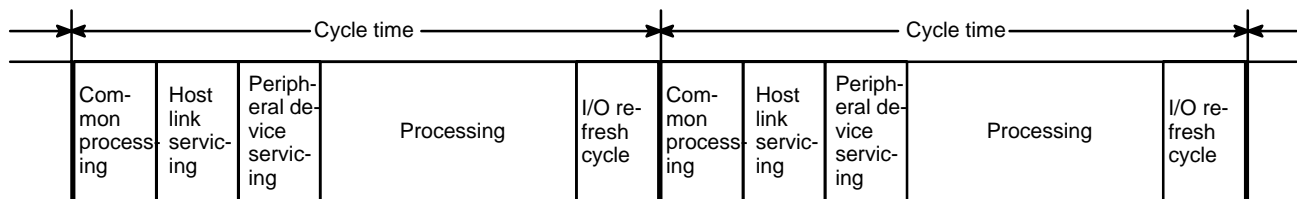
Data Transfer

Input and output data is transferred during the I/O refresh cycle. This means that PC acknowledgement of inputs from the Counter Unit (e.g., status) and Counter Unit acknowledgement of outputs from the PC (e.g., commands) are delayed until the next I/O refresh cycle, as shown below.
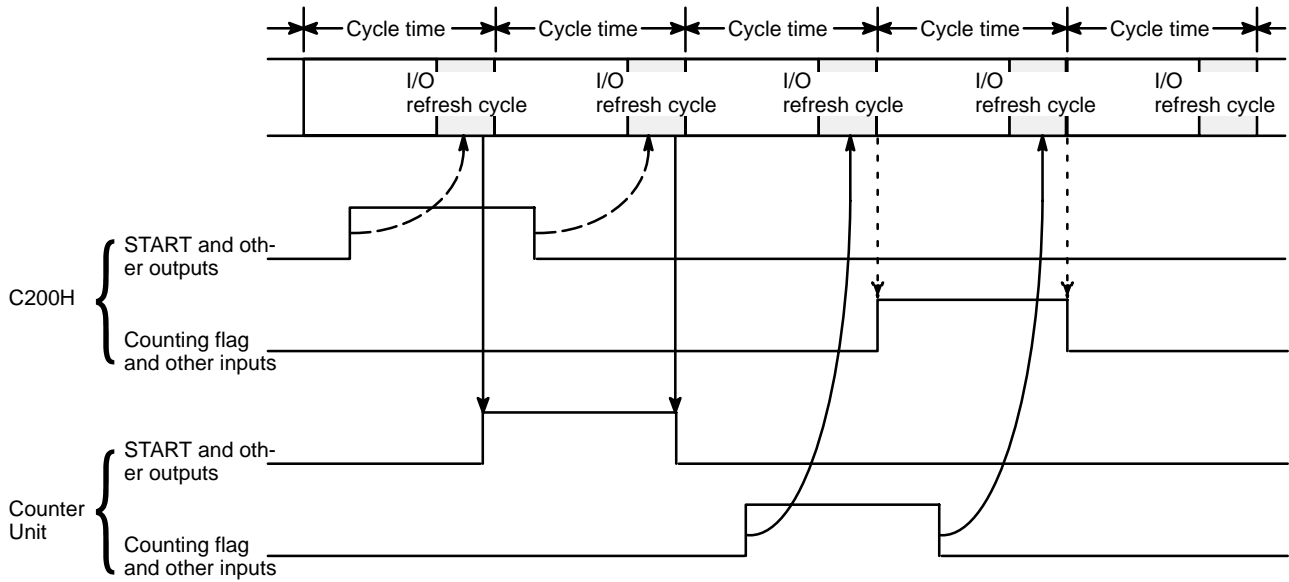
Data transfer would enter into the cycle time as shown below:
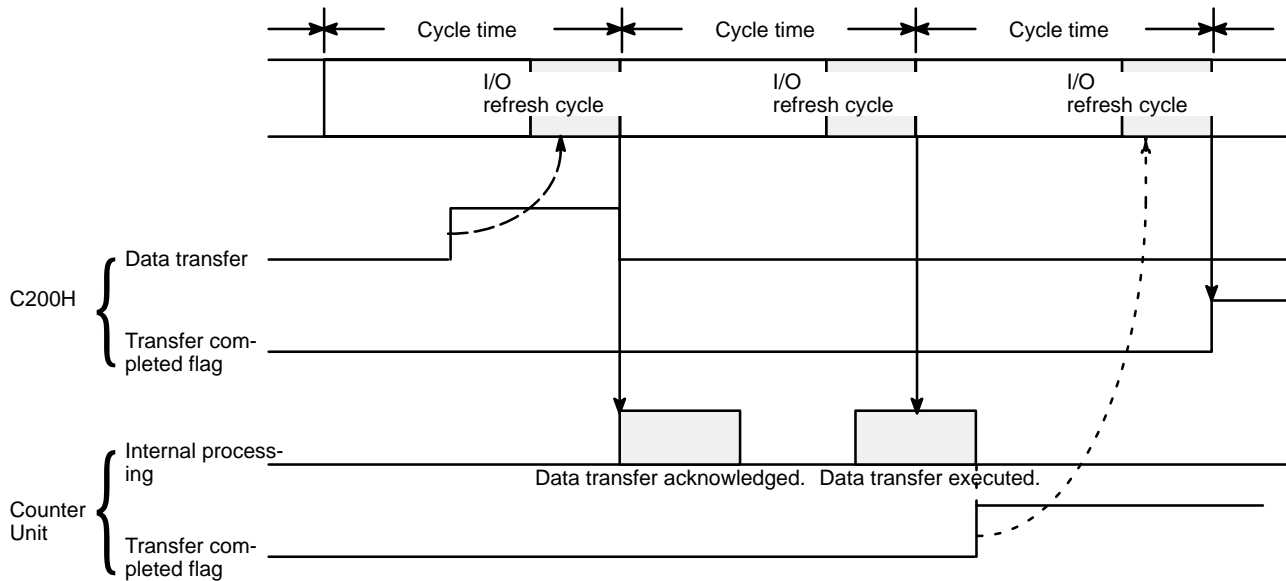
Note: The transfer completed flag reverses status (ON to OFF or OFF to ON) each time a transfer is completed.

Data Transfer in Remote I/O Systems

When the Counter Unit is mounted on a Rack containing a Remote I/O Slave Unit, a delay will occur due to data transfer between the Remote I/O Master Unit and the Remote I/O Slave Unit. See the C200H Programming Manual for details.

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SECTION 4
Data Allocation and Operating Modes

This section describes the various operating modes in detail. Each mode is described by data allocation, timing charts, commands, flags, and examples. Data formats are explained.

4-1 Data Configuration and Allocation

IR words 100 through 199 are allocated as I/O refresh areas. Each Counter Unit is allocated 10 consecutive words (although not all modes use all 10 words). The first IR word for each Counter Unit, designated in this manual as n, can be computed from the unit numbers as follows:

n = 100 + 10 x unit number.

IR words are refreshed during the PC's I/O refresh cycle. Note that input and output designations are in reference to the PC, e.g., command bits are outputs, status bits are inputs.

Each Counter Unit is also allocated 100 consecutive words as a parameter area (although not all modes use all 100 words). These words are in the DM area and run from DM 1000 through DM 1999. The first DM word for each Counter Unit, m, can also be computed from the unit number:

m = 1000 + 100 x unit number.

All DM area data for the Counter Unit is transferred to it whenever power is turned ON or the Counter Unit is reset.

These allocations are shown below for all unit numbers. Details of allocations within these words are given under the operating modes to which they apply. A quick overview of word and bit allocations is available in *Appendix C IR Area Allocations* and *Appendix D DM Area Coding Sheets*.

C200H PC   **Counter Unit**

DM area

Unit #0	DM 1000 through 1099
Unit #1	DM 1100 through 1199
Unit #2	DM 1200 through 1299
Unit #3	DM 1300 through 1399
Unit #4	DM 1400 through 1499
Unit #5	DM 1500 through 1599
Unit #6	DM 1600 through 1699
Unit #7	DM 1700 through 1799
Unit #8	DM 1800 through 1899
Unit #9	DM 1900 through 1999

Data is automatically transferred to the Counter Unit when power is turned or when its restart flag in the AR area is turned ON.

Parameter area

Word m

$\int$

Word m+99

Data is transferred to the Counter Unit when the TRANSFER DATA command bit of the IR area si turned ON after setting the TRANSFER DATA command to the specified data area.

Specified Data Area
(DM, fixed DM, I/O, LR, HR, or AR)

Data transfer

Data is transferred when TRANSFER DATA is set.

IR area

Unit #0	100 through 109
Unit #1	110 through 119
Unit #2	120 through 129
Unit #3	130 through 139
Unit #4	140 through 149
Unit #5	150 through 159
Unit #6	160 through 169
Unit #7	170 through 179
Unit #8	180 through 189
Unit #9	190 through 199

Data is transferred to the Counter Unit each I/O refresh.

I/O Area

Word n to n+4   Output data area

Word n+4 to n+9   Input data area

Data Format

Data is allocated by either bit or by word, though it is often input and output by decimal digit, i.e., four bits (BCD), or by hexadecimal digit. Counter values, upper and lower limits of ranges, and some other data are held in two adjacent words, sometimes with a sign digit, in the following format.

	Highest word				Lowest word		
sign	$\times 10^6$	$\times 10^5$	$\times 10^4$	$\times 10^3$	$\times 10^2$	$\times 10^1$	$\times 10^0$

0	+
1	−
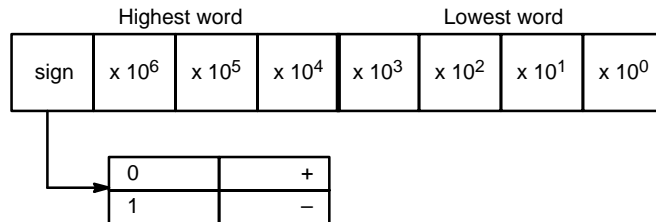
Note that the rightmost word is always the lowest word, i.e., if the two words were m+10 and m+11, the rightmost word would be m+10; the leftmost, m+11. Furthermore, the rightmost digit in each word begins in the lowest bits, i.e., the digits $\times 10^4$ and $\times 10^0$ above would be held in, bits 00 through 03 of their respective words. Even when only one word or part of a word is required to hold data, e.g., the error code or error location, the rightmost digit is also always held in the lower bits. Although decimal notation is generally used for data in this manual, data is handled in the system as binary-coded decimal (BCD) unless otherwise noted. Note that this data is generally input as decimal, whereas hexadecimal data is input as hexadecimal. The number of digits given for certain data refers to the decimal digits, e.g., "7 digits with sign" indicates that the lowest word and rightmost 12 bits of the highest word are allocated to the 7-digit decimal value; the leftmost four bits are allocated to the sign digit.

4-2 Linear and Circular Modes

In both linear and circular modes counter values are incremented and decremented according to any of the three types of input pulses. All functional aspect and data allocations for these two modes are the same, except that in linear mode, counter values range linearly between −8,388,608 and 8,388,607, while in circular mode, counter values range from 0 to a preset maximum value (used only in circular mode), with the maximum value and 0 being adjacent to each other in sequence. That is, decrementing below 0 results in the current counter value going to the maximum value; incrementing past the maximum value results in the current counter value going to zero.

Both modes provide 16 outputs, all of which can be output internally (i.e., to the PC) and eight of which can be output externally (i.e., without passing through the PC) as well as internally. These outputs are sometimes referred to by number and sometimes as either internal inputs and external inputs. The term internal outputs refers to all outputs sent to the PC; external outputs, to all outputs set to the external connector.

Both modes provide 16 ranges for counter values during which the outputs can be set to turn ON. These ranges can be enabled or disabled during operations. Data transfer from the PC data area is also available in both modes to change either range settings or the current counter value.

Although control input IN1 is supposed by both modes, control input IN2 is not used.

Note Stop counter operation before changing the present value to 0 or resetting the Counter Unit in the ring mode. If either of these is performed without stopping counter operation, the maximum value preset operation will not be performed correctly.

4-2-1 Data Allocation

The commands, parameters, flags, and other information in the following tables are described in detail in *4-2-2 DM Area Settings* and *4-2-3 IR Area Settings*.

DM Area

The DM area contains user parameters that are to be set into the Counter Unit, including the operating mode and output range limits. The first DM word for each Counter Unit is indicated by m and equals 1,000 plus 100 times the unit number.

Word	Bit	Function
m	07 through 00	Set to 0.
	11 through 08	Operating mode (Here, either 1: linear or 2: circular)
	15 through 12	Set to 0.
m + 1	15 through 00	Effective range bits (bit numbers correspond to range numbers)
m + 2	15 through 00	Maximum counter value (for circular mode only)
m + 3	15 through 00	6 digits (Bits 15 to 04 not used.)
m + 4 m + 9		Not used.
m + 10	15 through 00	Lower limit for range #0, 7 digits with sign digit
m + 11	15 through 00	
m + 12	15 through 00	Upper limit for range #0, 7 digits with sign digit
m + 13	15 through 00	
m + 14	15 through 00	Output pattern for range #0 (bit numbers correspond to output numbers)
m + 15 m + 19		Lower limit, upper limit, and output pattern for range #1 (Format same as that for range #0.)
m + 20 m + 24		Lower limit, upper limit, and output pattern for range #2 (Format same as that for range #0.)
m + 25 m + 29		Lower limit, upper limit, and output pattern for range #3 (Format same as that for range #0.)
m + 30 m + 34		Lower limit, upper limit, and output pattern for range #4 (Format same as that for range #0.)
m + 35 m + 39		Lower limit, upper limit, and output pattern for range #5 (Format same as that for range #0.)
m + 40 m + 44		Lower limit, upper limit, and output pattern for range #6 (Format same as that for range #0.)
m + 45 m + 49		Lower limit, upper limit, and output pattern for range #7 (Format same as that for range #0.)
m + 50 m + 54		Lower limit, upper limit, and output pattern for range #8 (Format same as that for range #0.)
m + 55 m + 59		Lower limit, upper limit, and output pattern for range #9 (Format same as that for range #0.)
m + 60 m + 64		Lower limit, upper limit, and output pattern for range #10 (Format same as that for range #0.)
m + 65 m + 69		Lower limit, upper limit, and output pattern for range #11 (Format same as that for range #0.)
m + 70 m + 74		Lower limit, upper limit, and output pattern for range #12 (Format same as that for range #0.)
m + 75 m + 79		Lower limit, upper limit, and output pattern for range #13 (Format same as that for range #0.)
m + 80 m + 84		Lower limit, upper limit, and output pattern for range #14 (Format same as that for range #0.)
m + 85 m + 89		Lower limit, upper limit, and output pattern for range #15 (Format same as that for range #0.)
m + 89 m + 99		Not used.

IR Area   The IR area contains commands and status information. Inputs and outputs are given in reference to the PC, i.e., output data is sent from the PC to the Counter Unit; input data, from the Counter Unit to the PC. The first IR word for each Counter Unit is indicated by n and equals 100 plus 10 times the unit number.

Outputs

Word	Bit	Function
n	00	START command
	01	TRANSFER DATA command
	02	ENABLE OUTPUT command
	03	Not used.
	04	CHANGE RANGES command
	05	READ ERROR command
	06	RESET COUNTER command
	07	ENABLE FORCED OUTPUT command
	08	Output #0 force bit
	09	Output #1 force bit
	10	Output #2 force bit
	11	Output #3 force bit
	12	Output #4 force bit
	13	Output #5 force bit
	14	Output #6 force bit
	15	Output #7 force bit
n+1	00	Range #0 enable bit
	01	Range #1 enable bit
	02	Range #2 enable bit
	03	Range #3 enable bit
	04	Range #4 enable bit
	05	Range #5 enable bit
	06	Range #6 enable bit
	07	Range #7 enable bit
	08	Range #8 enable bit
	09	Range #9 enable bit
	10	Range #10 enable bit
	11	Range #11 enable bit
	12	Range #12 enable bit
	13	Range #13 enable bit
	14	Range #14 enable bit
	15	Range #15 enable bit
n+2	15–00	TRANSFER DATA beginning word number, 4 digits
n+3	03–00	TRANSFER DATA data area, 0 to 4
	07–04	Not used. (Set to 0.)
	15–08	Number of transfers, 1 to 3

Inputs

Word	Bit	Function
n+4	00	Counting flag
	01	Z flag
	02	IN1 flag
	03	IN2 flag
	04	Transfer completed flag
	05	Error flag
	06	Count overflow flag
	07	Reset flag
	08	Not used
n+5	07–00	Error location
	15–08	Error code
n+6	15–00	Current counter value, 7 digits with sign
n+7	15–00	(−8,388,608 to +8,388,607)
n+8	00	Range #0 flag
	01	Range #1 flag
	02	Range #2 flag
	03	Range #3 flag
	04	Range #4 flag
	05	Range #5 flag
	06	Range #6 flag
	07	Range #7 flag
	08	Range #8 flag
	09	Range #9 flag
	10	Range #10 flag
	11	Range #11 flag
	12	Range #12 flag
	13	Range #13 flag
	14	Range #14 flag
	15	Range #15 flag
n+9	00	Output #0 flag (external output possible)
	01	Output #1 flag (external output possible)
	02	Output #2 flag (external output possible)
	03	Output #3 flag (external output possible)
	04	Output #4 flag (external output possible)
	05	Output #5 flag (external output possible)
	06	Output #6 flag (external output possible)
	07	Output #7 flag (external output possible)
	08	Output #8 flag (internal output only)
	09	Output #9 flag (internal output only)
	10	Output #10 flag (internal output only)
	11	Output #11 flag (internal output only)
	12	Output #12 flag (internal output only)
	13	Output #13 flag (internal output only)
	14	Output #14 flag (internal output only)
	15	Output #15 flag (internal output only)

4-2-2   DM Area Settings

Operating Mode

DM word m, bits 11 through 08

The operating mode is set with the mode selector on the front panel. Refer to *1-4 Operating Modes* for an overview of available modes.

Effective Range Bits

DM word m+1

Bit numbers correspond to range numbers, i.e., but 0 corresponds to range #0; bit 1, to range #1, etc. Range data is allocated to words m+10 through m+89. Turn ON (set to 1) the bits for all ranges that are to be effective. These bits are effective immediately after the power supply is turned ON or the Counter Unit is restarted. The effective ranges can also be changed using CHANGE RANGES. Refer to *4-3-3 IR Area Settings* for details.

Maximum Counter Value (Circular Mode Only)

DM word m+2 and m+3

Set to between 0 and 65,535.

The counter value will return to zero when incremented past this value and return to this value when decremented below zero.

Range Settings

Words m+10 through m+89

Each of the 16 ranges is allocated 5 consecutive words for its lower limit, upper limit, and output pattern. Refer to *4-3-1 Data Allocation* for the specific words for each range; the following allocations are for range #0. In circular mode, a range will span zero if the lower limit is greater than the upper limit. Ranges may overlap, in which case all outputs specified for each are set. Set all data for unused ranges to zeros.

Lower Limit

Words m+10 and m+11 (Range #0)

The lower limit must be within the limits of the counter value, i.e., between 0 and the maximum counter value in circular mode and between –8,388,608 and 8,388,607 in linear mode. Bits 15 through 12 of DM word m+11 (leftmost digit in higher word) is the sign digit (not used in circular mode).

Upper Limit

Words m+12 and m+13 (Range #0)

The upper limit must also be within the limits of the counter value, i.e., between 0 and the maximum counter value in circular mode and between –8,388,608 and 8,388,607 in linear mode. Bits 15 through 12 of DM word m+13 (leftmost digit in higher word) is the sign digit (not used in circular mode).

Output Pattern

DM word m+14 (Range #0)

Each bit corresponds to the output of the same number. Each output whose bit is ON will be turned ON (set to 1) when the counter value is within range. An output may not be activated, however, if the range is too narrow in comparison to the frequency of the pulse input. All outputs are sent to the IR area word n+9. Outputs #0 through #7 are also sent to outputs 0 through 7 of the external connector when bit 02 of word n is ON.

4-2-3 IR Area Settings

The IR area contains commands used to operate the Counter Unit and flags used to monitor its operation. Both of these are used in programming the desired counter operations.

START Command

Word n, bit 00

Counting starts on rising edge of the START command bit and stops on the falling edge. The current counter value and output pattern immediately before stopping are retained. An exception to this, however, is when the output force bits are used (see below).

ENABLE OUTPUT Command

Word n, bit 02

Set this bit to enable external output of outputs #0 through #7. The status of the outputs are indicated by LEDs 0 though 7 when the outputs are enabled. Word n+9 status is output regardless of the status of ENABLE OUTPUT.

ENABLE FORCED OUTPUT Command

Word n, bit 07

Setting this command bit enables usage of the output force bits in word n, bits 08 through 15.

Output Force Bits

Word n, bits 15 through 08

Output force bits can be set to turn ON outputs #0 through #7, thereby permitting wiring checks. Both ENABLE OUTPUT and ENABLE FORCED OUTPUT must be ON to use the output force bits. The following procedure is used.

1, 2, 3...
1. Make sure START is OFF.
2. Set ENABLE OUTPUT.
3. Make sure all output force bits are OFF.
4. Set ENABLE FORCED OUTPUT.
5. Set the required output force bits.

Refer to *4-2-1 Data Allocation* for the specific bit allocations.

Range Enable Bits

Word n+1

Range enable bits are turned ON to enable and turned OFF to disable outputs within the specified range. The number of the bit in word n+1 is the same as the number of the range it enables. The ranges that are currently effective are indicated in DM word m+1. The settings of the currently effective bits will be changed to those specified by the range enable bits when CHANGE RANGES is set.

CHANGE RANGES Command

Word n, bit 04

Set this command bit to change the effective ranges designated in DM word m+1 to correspond to the settings of the range enable bits.
CHANGE RANGES is effective during counter operation.

RESET COUNTER Command

Word n, bit 06

RESET COUNTER is effective when the internal reset bit is designated with back panel DIP switch settings (refer to *2-1 Switch Settings*). RESET COUNT-ER can be combined with input Z and control input IN1 or resetting is possible using only input Z and/or control input IN1. Refer to *3-3 Counter Reset Conditions* for details. Resetting returns the counter value to 0 and turns OFF all outputs.

TRANSFER DATA Command

Word n, bit 01

TRANSFER DATA can be set to change output ranges or, if the first word being transferred contains FF, it can be set to preset or change the current counter value. Data in the proper format must be prepared in consecutive words in the PC through the PC program or the Programming Console. The parameters described below are required to transfer data. These are followed by explanations of the data format used to prepare data in the PC data area and application examples of TRANSFER DATA for transferring range parameters and counter value. Data transfer is initiated on the rising edge of TRANSFER DATA and is completed at the next I/O refresh. Completion can be confirmed with the transfer completed flag, bit 04 of word n+4. Transfer should be executed only when the Counter Unit is not counting. Execution during counting may cause incorrect outputs.

TRANSFER DATA Beginning Word Number

Word n+2

Indicates the first PC word from which data is to be transferred.

TRANSFER DATA Area

Word n+3, bits 03 through 00

Set to between 0 and 4.

Specifies the PC data area from which data is to be transferred.

Specifications are as follows:

Setting	Data area
0	DM
1	IR
2	LR
3	HR
4	AR

Note Use only the following words in the DM and IR areas: DM 0000 to DM 1999 and IR 000 to IR 235. Although the C200HS provides larger areas, if any words not within the specified ranges are used, an error will occur and an error code of 34 will be output.

Number of Transfers

Word n+3, bits 15 through 08

Set to between 1 and 3.

When changing range parameters, data for up to three ranges can be transferred at the same time. When transferring the counter value, only one value can be transferred at a time.

PC Data Format

Six consecutive words are used as the source of a data transfer. These words must all be in the same data area. If data is transferred for more than one range, the six words for each following transfer must continue consecutively on from the last word for the first transfer. Bits 07 through 00 of the first PC word actually designate either the range number for which data is to be transferred or, if the bits contain FF, they specify that a counter value is to be transferred.

If range parameters are being transferred, the remaining five words contain the lower limit, upper limit, and output pattern for the specified range in the same format that this data is contained in the DM area. If, for example, range #0 parameters were being transferred, the second and third PC words would replace parameters in DM words m+10 and m+11, i.e., the lower limit for range #0.

If a counter value is being transferred, the second and third PC words contain the counter value in the same format that it is held in words n+6 and n+7, and the last three words are ignored. More efficient use of PC words is possible, however, when preparing more than one counter value for transfer. To do this, input FF into

the first and then every third word and input the counter values into the two words after each word containing FF. The last counter value must be followed by three unused words to satisfy the requirement for six words for the last counter value. This setup is shown on the next page for three counter values, with the first PC word indicated by k. Words k, k+3, and k+6 can then be designated individually to set the counter value as required.

PC Word	Contents
k	FF
k+1 and k+2	Counter value 1
k+3	FF
k+4 and k+5	Counter value 2
k+6	FF
k+7 and k+8	Counter value 3
k+9 through k+11	Ignored

Application Example 1: Transferring Range Parameters

The following example shows use of TRANSFER DATA to transfer the upper limit, lower limit, and output pattern for three ranges. The system configuration consists of a Counter Unit (unit #0) on a C200H PC and an Input Unit allocated word 00. The Input Unit is connected to two switches: SW1, which is programmed to START (00000), and SW2, which is programmed to TRANSFER DATA (00001).

Procedure

1, 2, 3...   1.   The range parameters are input into the DM area in a section not normally used by Special I/O Units, starting at DM word 1900 and running through DM word 1905. Parameters for a second range are input starting at DM word 1906 and run through DM word 1911. A third range is input into DM words 1912 through 1917.

2.   The beginning word for transfer, the data area, and the number of transfers is set through the program, which is written to move the beginning word, 1900, into IR word 102 and the number of words and data area, 03 for bits 15 through 08 and 00 for bits 07 through 00, into IR word 103.

Program
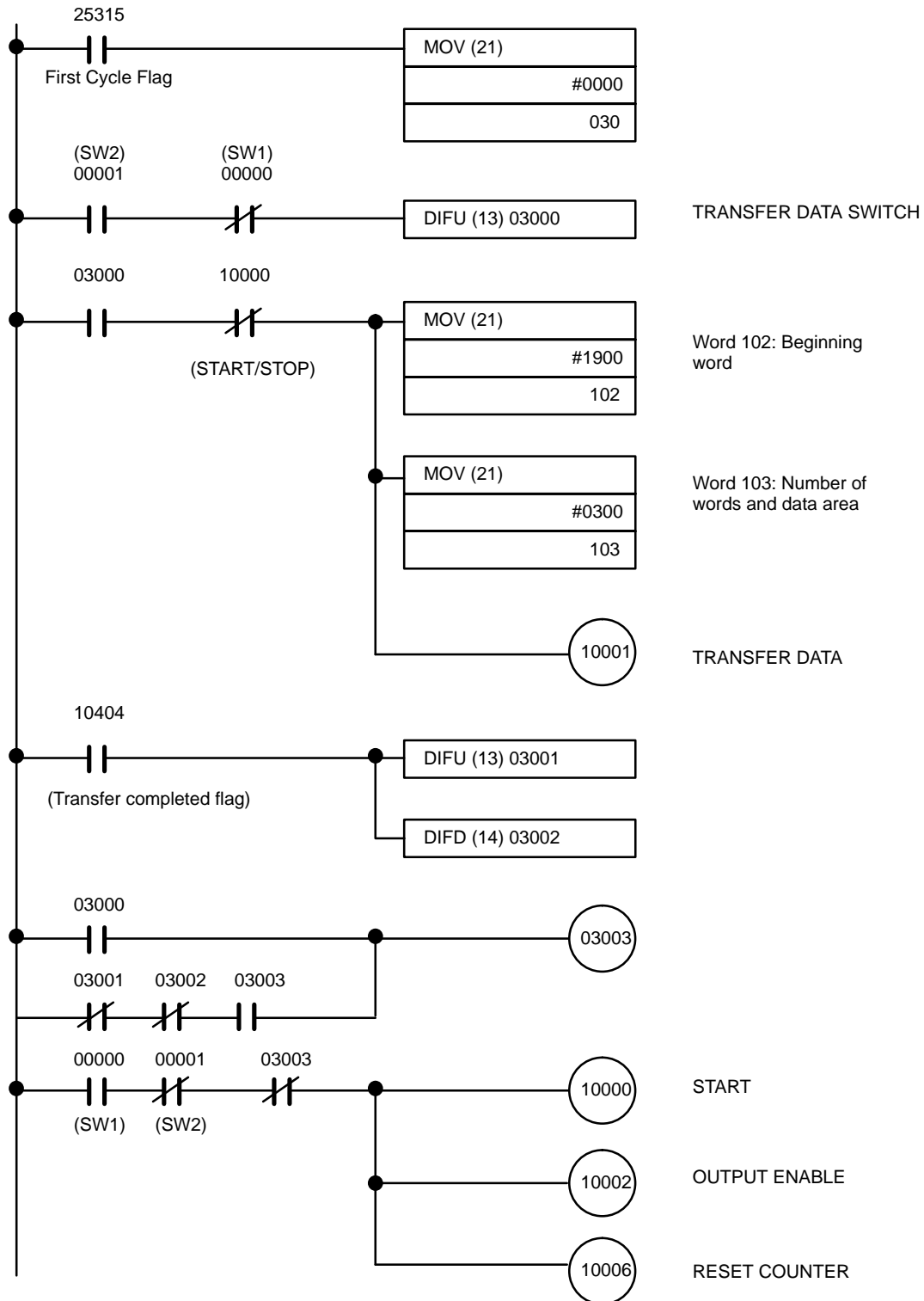
Application Example 2:
Transferring the Counter
Value

The following example shows use of TRANSFER DATA to transfer the counter value. The system configuration consists of a Counter Unit (unit #1) on a C200H PC and three Input Units allocated words 00, 03, and 04. One Input Unit is connected to two switches: SW1, which is programmed to START (00000), and SW2, which is programmed to TRANSFER DATA (00001). Each of the other Input Units is connected to a rotary switch: the switch connected to the Input Unit allocated word 03 is used to input the rightmost four

digits of the counter value, the switch connected to the Input Unit allocated word 04 is used to input the sign digit and the leftmost four digits of the counter value.

Procedure

1, 2, 3... 1. The desired counter value is input with the rotary switches as I/O words 3 and 4.
2. The beginning word for transfer, the data area, and the number of transfers is set through the program, which is written to move the beginning word, 0002, into IR word 112 and the number of transfers and data area, 01 for bits 15 through 08 and 01 for bits 07 through 00, into IR word 113. The program is also used to input "FF" into the first word to indicate transfer of a counter value.

Program

```
        25315
        ┤├──────────────────────────┌─────────────────┐
    First Cycle Flag                 │   MOV (21)       │
                                     ├─────────────────┤
                                     │          #0000   │
                                     ├─────────────────┤
                                     │          030     │
                                     └─────────────────┘

      (SW2)      (SW1)
      00001      00000
      ┤├────────┤/├──────────────────┌─────────────────────────┐   TRANSFER DATA SWITCH
                                     │  DIFU (13) 03000          │

      03000      10000
      ┤├────────┤/├──────────┬───────┌─────────────────┐
               (START/STOP)  │       │   MOV (21)       │      Word 002: Data for beginning
                             │       ├─────────────────┤      transfer word to indicate
                             │       │          #00FF   │      counter value.
                             │       ├─────────────────┤
                             │       │          002     │
                             │       └─────────────────┘
                             │       ┌─────────────────┐
                             ├───────│   MOV (21)       │      Word 112: Beginning
                             │       ├─────────────────┤      word
                             │       │          #0002   │
                             │       ├─────────────────┤
                             │       │          112     │
                             │       └─────────────────┘
                             │       ┌─────────────────┐
                             ├───────│   MOV (21)       │      Word 113: Number of
                             │       ├─────────────────┤      transfers and data area
                             │       │          #0101   │
                             │       ├─────────────────┤
                             │       │          113     │
                             │       └─────────────────┘
                             └──────────────(11001)           TRANSFER DATA

      11404
      ┤├──────────────────────┬──────┌─────────────────────────┐
    (Transfer completed flag) │      │  DIFU (13) 03001          │
                              │       └─────────────────────────┘
                              └──────┌─────────────────────────┐
                                     │  DIFD (14) 03002          │

      03000
      ┤├───────────────────────┬───────────────(03003)
      03001  03002  03003       │
      ┤/├────┤/├────┤├──────────┘

      00000  00001  03003
      ┤├────┤/├────┤/├─────────┬───────────────(11000)         START
      (SW1)        (SW2)        │
                               └───────────────(11002)         OUTPUT ENABLE
```

Counting Flag

Word n+4, bit 00

The counting flag is ON whenever the Counter Unit is counting. The RUN indicator will also be lit.

Z Flag	Word n+4, bit 01

The Z flag indicates the status of input Z. When the flag is ON, the input is high; when the flag is OFF, the input is low. This flag can be accessed during counting.

Note The Z flag may not turn ON if the Z phase pulse width is less than or equal to the C200H/C200HS cycle time +3 ms.

IN1 Flag   Word n+4, bit 02

The IN1 flag indicates the status of control input IN1. When the flag is ON, the input is high; when the flag is OFF, the input is low. This flag can be accessed during counting.

IN2 Flag   Word n+4, bit 03

The IN2 flag indicates the status of control input IN2. When the flag is ON, the input is high; when the flag is OFF, the input is low. This flag can be accessed during counting.

Transfer Completed Flag   Word n+4, bit 04

The transfer completed flag is inverted following completion of TRANSFER DATA.

Error Flag   Word n+4, bit 05

The error flag is turned ON whenever an error has occurred. Information on the type and location of the error is available in IR word n+5 upon execution of READ ERROR.

READ ERROR Command   Word n, bit 05

READ ERROR can be set to access information on the error whenever the error flag is ON. Error information is output to IR word n+5. If more then one error has occurred, information on other errors can be output to IR word n+5 by again setting READ ERROR. The next error will be output each time this bit is turned ON.

Error Location   Word n+5, bit 07 through 00

The error location gives the rightmost two digits of the DM address, i.e., the word number, where the data causing the error is stored.

Error Code   Word n+5, bit 15 through 08

Error codes indicate the nature of the error and are given in *Appendix A Error Code List*.

Count Overflow Flag   Word n+4, bit 06

The count overflow flag is turned ON when the counter value is greater than 8,388,607 or less than –8,388,608. This flag turns OFF when the next operation is started.

Reset Flag   Word n+4, bit 07

The reset flag turns ON for one PC cycle time after the Counter Unit is reset.

Current Counter Value   Word n+6 and n+7

The current counter value is accessible in words n+6 and n+7 as 6 BCD digits with a sign digit.

Range Flags   Word n+8

The number of each bit in IR word n+8 corresponds to a range number. A range flag is ON whenever the current counter value is within the specified range.

Output Flags Word n+9

The number of each bit in IR word n+9 corresponds to an output number. An output flag is ON whenever the specified output is ON. Output flags are turned ON regardless of the status of ENABLE OUTPUT.

4-2-4 Timing Chart

The following chart shows timing relationships between the command bits (input bits) and output bits in linear and circular mode.

a: Normal outputs
b: Forced outputs
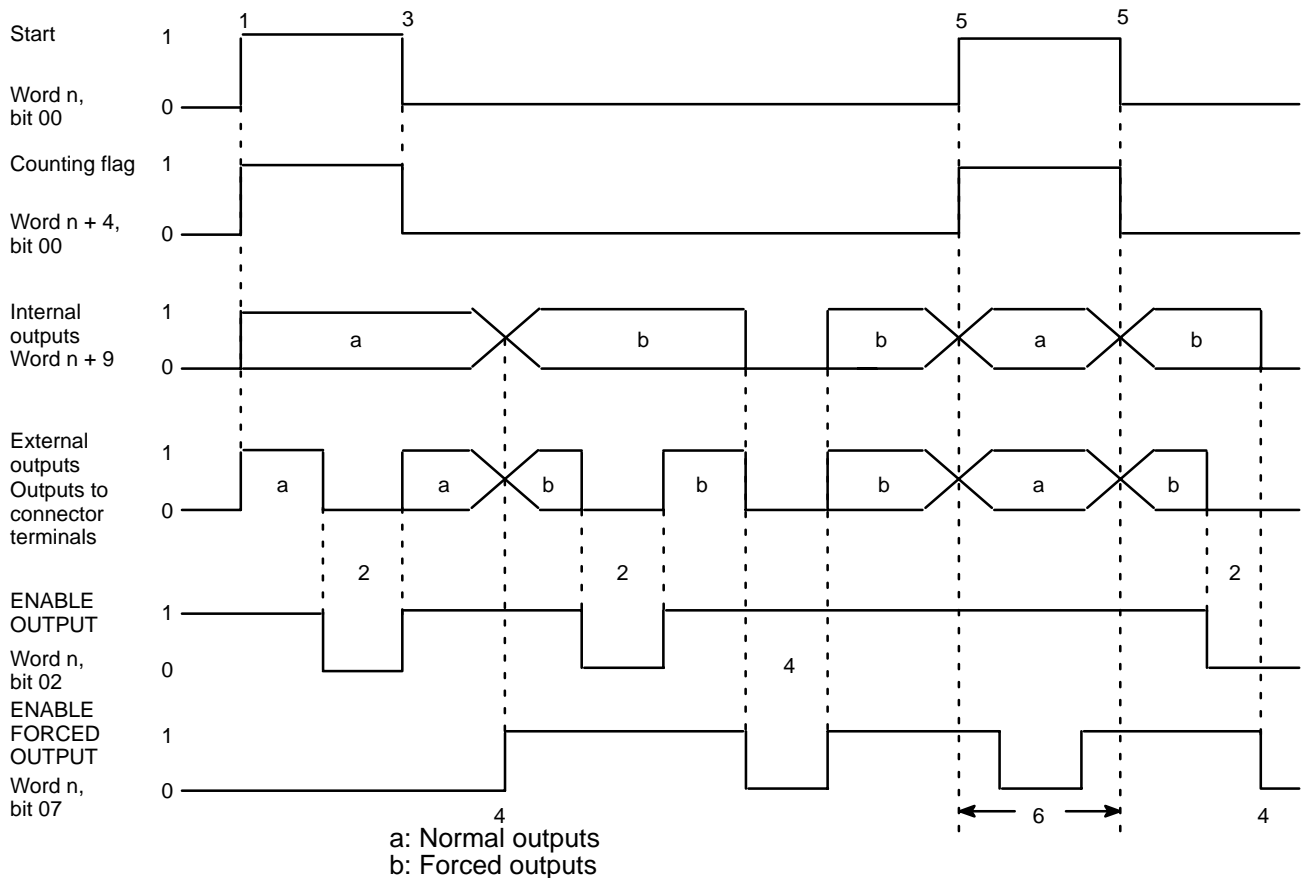
1, 2, 3... 1. START is effective on the rising edge.

2. External outputs are prohibited when ENABLE OUTPUT is OFF.

3. The Counter Units stops counting on the falling edge of START. Status of internal and external outputs are retained.

4. The status of the output force bits is output when ENABLE FORCED OUTPUT is ON. All outputs are reset when ENABLE FORCED OUTPUT goes OFF.

5. Setting START during counting returns all outputs to normal status, i.e., makes ENABLE FORCED OUTPUT ineffective. The status of output force bits is then restored when STOP goes OFF.

6. ENABLE FORCED OUTPUT is ineffective while START is ON.

4-2-5 Application Examples

Linear Operating Mode: Controlling Conveyor Processing System Configuration
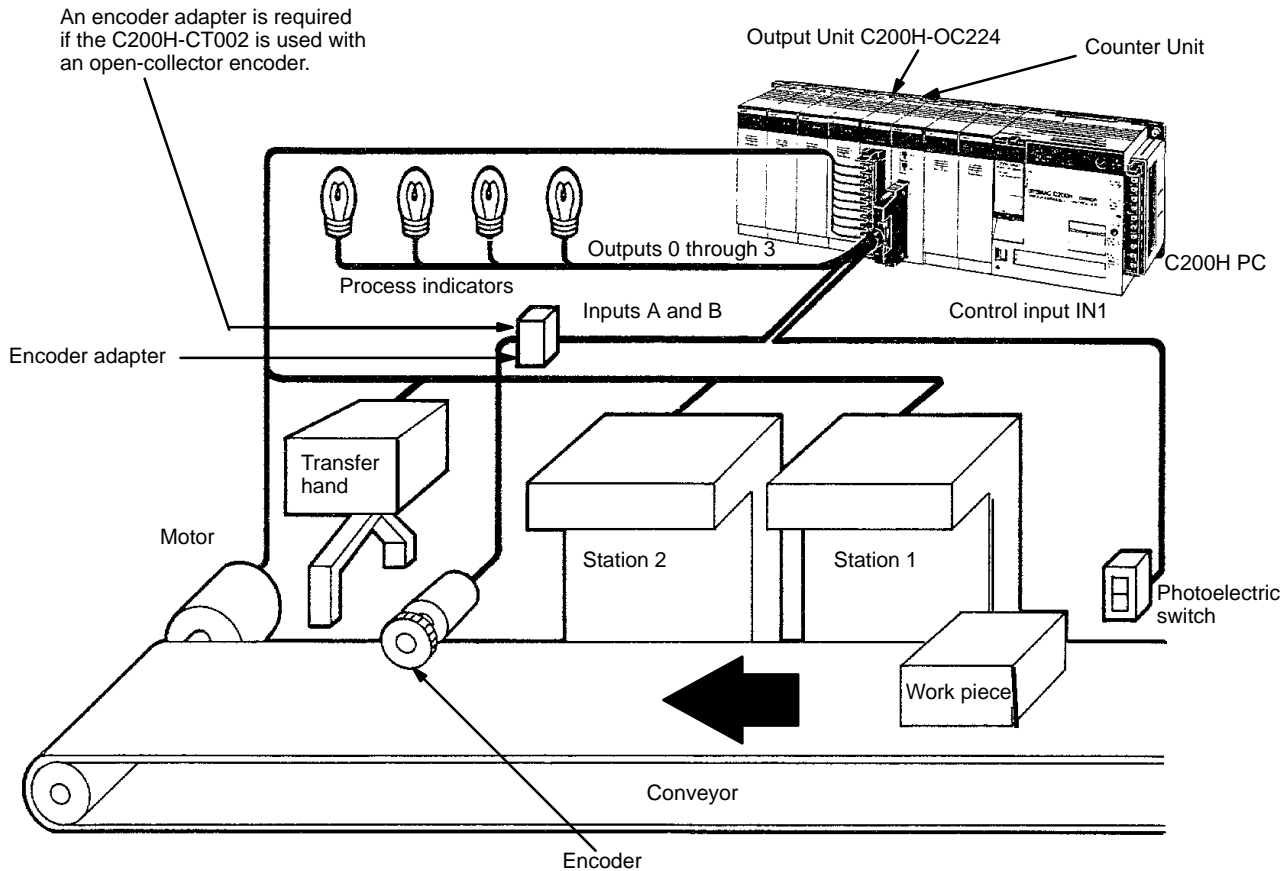
Operation

This example system detects the position of the work piece on the conveyor by means of the pulse input from the encoder and processes the work piece at the required positions.

1, 2, 3...
1. The photoelectric switch detects that the work piece is loaded on the conveyor belt from a transfer conveyor, and the counter value is reset.
2. The counter value is used to control processing at each station.
3. The PC controls the motor operation and drives the transfer hand.

Switch Settings

In this example, the unit number selector and the mode selector are both set to 1. Pins 6 and 7 are turned ON on the back panel DIP switch to designate offset phase inputs with no input multiplier and to make control input IN1 effective on its rising edge. All other pins on the DIP switch are turned OFF.

Wiring

1, 2, 3...
1. Connect the output from the photoelectric switch to control input IN1.
2. Connect encoder outputs to the inputs A and B.
3. Connect outputs 0 through 3 to the process indicators.
4. Connect the Output Unit to the motor and the transfer hand.

DM Area Settings

DM 1100	0	1	0	0	Sets the mode to 1 (linear). Enables ranges #0, #1, #2, and #3.
DM 1101	0	0	0	F	

DM 1110	1	0	0	0	Range #0 (work piece at station 1)
DM 1111	0	0	0	0	Lower limit: 1000; upper limit: 1200
DM 1112	1	2	0	0	Output pattern specifies that output #0 be turned
DM 1113	0	0	0	0	ON when the counter value is within range #0
DM 1114	0	0	0	1	
DM 1115	2	5	0	0	Range #1 (work piece at station 2)
DM 1116	0	0	0	0	Lower limit: 2500; upper limit: 2900
DM 1117	2	9	0	0	Output pattern specifies that outputs #1 and #8
DM 1118	0	0	0	0	be turned ON when the counter value is within
DM 1119	0	1	0	2	range #1
DM 1120	5	0	0	0	Range #2 (work piece at transfer point)
DM 1121	0	0	0	0	Lower limit: 5000; upper limit: 9500
DM 1122	9	5	0	0	Output pattern specifies that outputs #2 and #9
DM 1123	0	0	0	0	be turned ON when the counter value is within
DM 1124	0	2	0	4	range #2.
DM 1125	9	5	0	1	Range #3 (work piece passed through transfer
DM 1126	0	0	0	0	point)
DM 1127	8	6	0	7	Lower limit: 9501; upper limit: 8,388,607
DM 1128	0	8	3	8	Output pattern specifies that outputs #3 and #10 be turned ON when the counter
DM 1129	0	3	0	8	value is within range #3.

Program

START and ENABLE OUTPUT are ON while the start switch is ON.

Processing is performed at station 1 when the current counter value is within range #0.

Processing is performed at station 2 when the current counter value is within range #1.

Transfer hand is operated when the current counter value is within range #2.

Completion process for one cycle is carried out when the current counter value is within range #3

Internal outputs 11908 and 11909 are used to control position-dependent processing. Process indicators are turned ON and OFF directly through outputs #0 through #3. Internal outputs are turned ON/OFF through ranges #0 through #3. These outputs indicate the position of the work piece, and required processing is carried out accordingly.

Range flags can also be used for programming, as shown below.
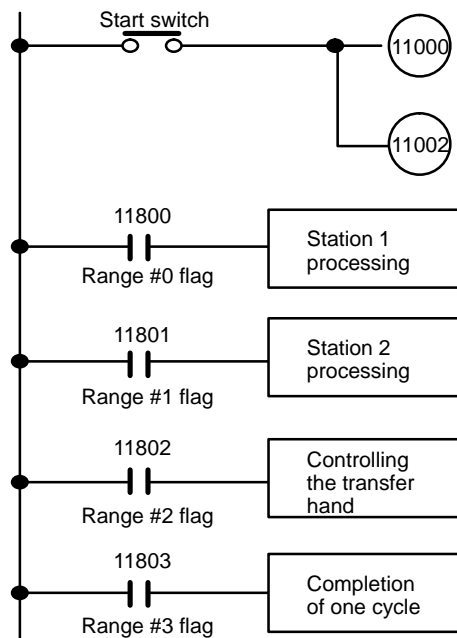
Circular Operating Mode: Functioning as Mechanical Cam Switches System Configuration
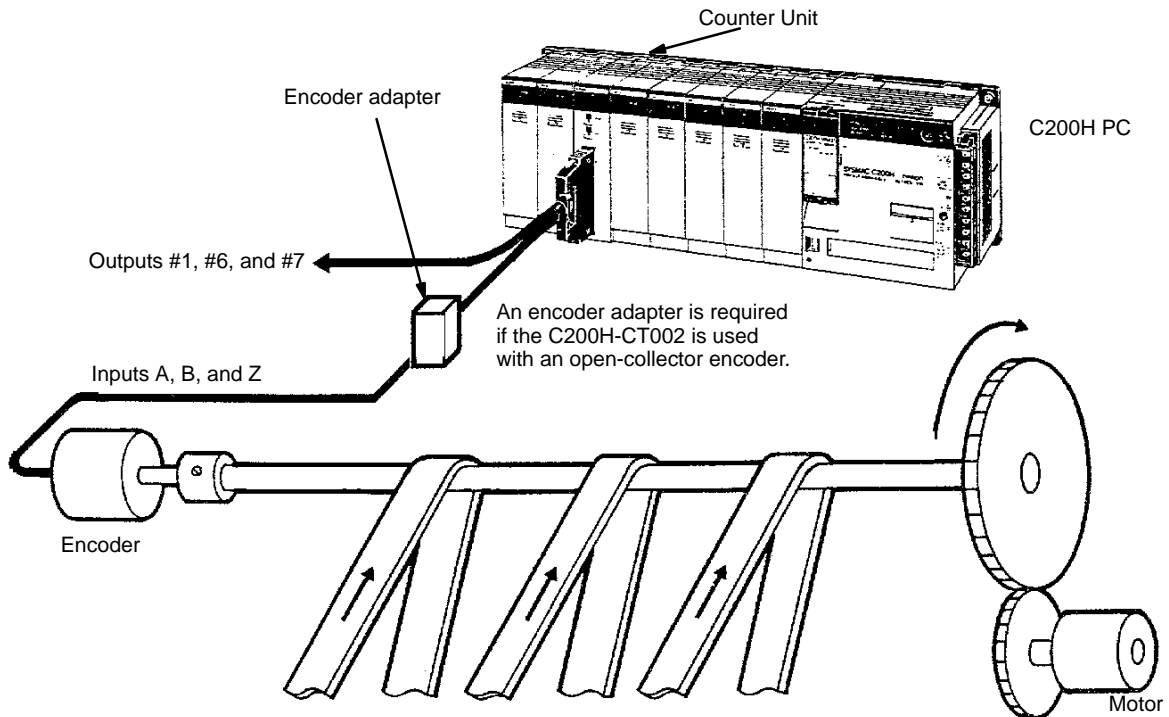
Operation

This example system uses the encoder to detect control timing for devices linked to a shaft driven by a motor. The system controls outputs according to shaft rotation.

Switch Settings

In this example, the unit number selector is set to 1 and the mode selector is set to 2. Pins 2, 4, 6, and 8 are turned ON on the back panel DIP switch to designate offset phase inputs with a x 4 input multiplier and to enable resetting on the rising edge of input Z or RESET COUNTER, whichever is set last (both must be ON to reset the Counter Unit). All other pins are turned OFF.

Wiring

1, 2, 3... 1. Connect encoder outputs to inputs A, B, and Z.
2. Connect outputs #1, #6, and #7 to controllers for devices linked to the shaft.

DM Area Settings

DM 1100	0	2	0	0
DM 1101	0	0	0	7
DM 1102	4	9	9	9
DM 1103	0	0	0	0

Sets the mode to 1 (linear).
Enables ranges #0, #1, #2, and #3.

Sets the maximum counter value to 4,999.
(The counter values change as follows : 0, 1,...4998, 4999, 0, 1,...)

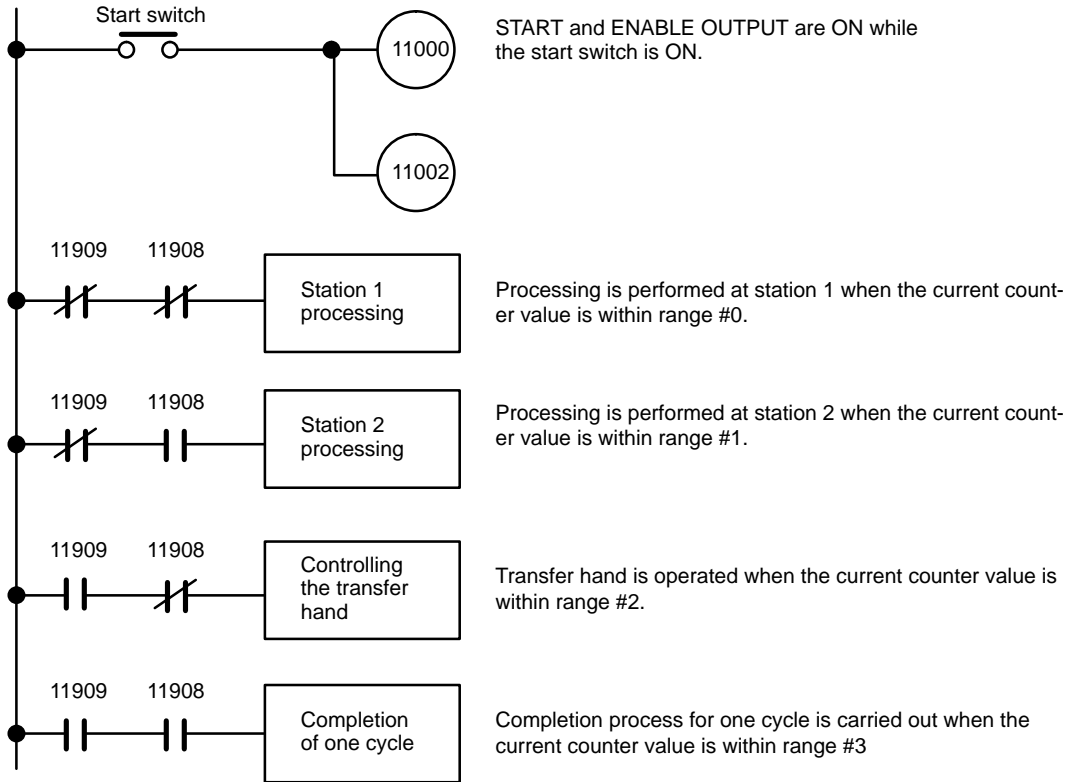|				
DM 1110	1	0	0	0
DM 1111	0	0	0	0
DM 1112	1	0	1	0
DM 1113	0	0	0	0
DM 1114	0	0	8	0
DM 1115	4	3	0	0
DM 1116	0	0	0	0
DM 1117	0	2	0	0
DM 1118	0	0	0	0
DM 1119	0	0	4	2
DM 1120	0	6	0	0
DM 1121	0	0	0	0
DM 1122	3	1	0	0
DM 1123	0	0	0	0
DM 1124	0	0	C	0

Range #0 (work piece at station 1)
  Lower limit: 1000; upper limit: 1010
  Output pattern specifies that output #7 be turned ON when the counter value is within range #0

Range #1 (work piece at station 2)
  Lower limit: 4300; upper limit: 200 (0 is spanned)
  Output pattern specifies that outputs #1 and #6 be turned ON when the counter value is within range #1

Range #2 (work piece at transfer point)
  Lower limit: 600; upper limit: 3100
 Output pattern specifies that outputs #6 and #7 be turned ON when the counter value is within range #2.

Program

START and ENABLE OUTPUT are ON while the start switch is ON.   (11000)

(11002)
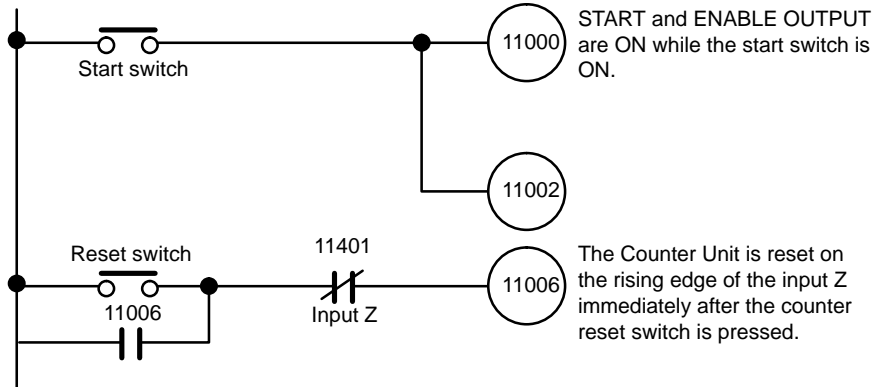
The Counter Unit is reset on the rising edge of the input Z immediately after the counter reset switch is pressed.   (11006)

Start switch

Reset switch   11401
11006   Input Z

Outputs #1, #6, and #7 are directly output from the Counter Unit.

4-3 Preset Mode

In preset mode counter values are decremented (or incremented) according to any of the three types of input pulses. When the start signal is set, the counter value begins from a specified, preset value (maximum: 8,388,607). Up to 20 counter values can be preset. These presets can be updated from the PC six at a time by using TRANSFER DATA.

Eight outputs are available that can be output to the PC and/or externally, i.e., directly to an external device. The first output (#0) turns ON when counting is started and turns OFF at a specified counter value. The next two outputs (#1 and #2) turn ON and OFF at specified counter values. The last four outputs (#4 through #7, output #3 is not used in preset mode) turn ON for either a specified length of time or indefinitely following the countdown. The counter values at which outputs turn ON and/or OFF cannot be changed during operation.

Although control input IN1 is supported as a reset input, control input IN2 and input Z are not used.

Note that, because the counter is designed to count down in preset mode, the encoder input should be set accordingly.

The START command (word n, bit 00) is used to start and stop (i.e., as the start signal) the Counter Unit when pin 4 on the back-panel DIP switch is turned OFF. Control input IN2 is used to start and stop the Counter Unit when pin 4 is ON.

4-3-1 Data Allocation

DM Area

The DM area contains the user-input parameters that are to be set into the Counter Unit, including the operating mode and ON/OFF counter value. The first DM word for each Counter Unit is indicated by m and equals 1,000 plus 100 times the unit number.

Word	Bit	Function
m	07 through 00	Set to 0.
	11 through 08	Operating mode (Here, 3: preset)
	15 through 12	Set to 0.
m+1	15 through 00	OFF counter value for output #0, 7 digits
m+2	11 through 00	
	15 through 12	Set to 0.
m+3	15 through 00	ON counter value for output #1, 7 digits
m+4	11 through 00	
	15 through 12	Set to 0.
m+5	15 through 00	OFF counter value for output #1, 7 digits
m+6	11 through 00	
	15 through 12	Set to 0.
m+7	15 through 00	ON counter value for output #2, 7 digits
m+8	11 through 00	
	15 through 12	Set to 0.
m+9	15 through 00	OFF counter value for output #2, 7 digits
m+10	11 through 00	
	15 through 12	Set to 0.
m+11	15 through 00	ON time for outputs #4 through #7, 4 digits (unit: 0.01 s) Output will remain on until next the start signal if FFFF is input.
m+12 m+13		Not used.
m+14	15 through 00	Preset #0, 6 digits

Word	Bit	Function
m+15	11 through 00	
	15 through 12	Output pattern #0 (for preset #0); Bit 12: output #4 Bit 13: output #5 Bit 14: output #6 Bit 15: output #7

Word	Function
m+16 m+17	Preset #1 and output pattern #1
m+18 m+19	Preset #2 and output pattern #2
m+20 m+21	Preset #3 and output pattern #3
m+22 m+23	Preset #4 and output pattern #4
m+24 m+25	Preset #5 and output pattern #5
m+26 m+27	Preset #6 and output pattern #6
m+28 m+29	Preset #7 and output pattern #7
m+30 m+31	Preset #8 and output pattern #8
m+32 m+33	Preset #9 and output pattern #9
m+34 m+35	Preset #10 and output pattern #10

Word	Function
m+36 m+37	Preset #11 and output pattern #11
m+38 m+39	Preset #12 and output pattern #12
m+40 m+41	Preset #13 and output pattern #13
m+42 m+43	Preset #14 and output pattern #14
m+44 m+45	Preset #15 and output pattern #15
m+46 m+47	Preset #16 and output pattern #16
m+48 m+49	Preset #17 and output pattern #17
m+50 m+51	Preset #18 and output pattern #18
m+52 m+53	Preset #19 and output pattern #19
m+54 to m+99	Not used.

IR Area

The IR area contains commands and status information. Inputs and outputs are given in reference to the PC, i.e., output data is sent from the PC to the Counter Unit; input data, from the Counter Unit to the PC. The first IR word for each Counter Unit is indicated by n and equals 100 plus 10 times the unit number.

Outputs

Word	Bit	Function
n	00	START command (The START command is effective only when pin 4 on the back-panel DIP switch is turned OFF. If pin 4 is ON, control input IN2 is used to start and stop the Counter Unit.)
	01	TRANSFER DATA command
	02	ENABLE OUTPUT command
	03	Not used.
	04	CHANGE PRESET command
	05	READ ERROR command
	06	RESET COUNTER command
	07	ENABLE FORCED OUTPUT command
	08	Output #0 force bit
	09	Output #1 force bit
	10	Output #2 force bit
	11	Output #3 force bit
	12	Output #4 force bit
	13	Output #5 force bit
	14	Output #6 force bit
	15	Output #7 force bit
n+1	07—04	Not used.
	15—08	Preset number, 2 digits, between 00 and 19
n+2	15—00	TRANSFER DATA beginning word number, 4 digits
n+3	03—00	TRANSFER DATA data area, 0 through 4
	07—04	Not used. (Set to 0.)
	15—08	Number of transfers, 1 through 3

Inputs

Word	Bit	Function
n+4	00	Counting flag
	01	Not used.
	02	IN1 flag
	03	Not used.
	04	Transfer completed flag.
	05	Error flag
	06	Count overflow flag
	07	Reset flag
	08	Output #0 flag (external output possible)
	09	Output #1 flag (external output possible)
	10	Output #2 flag (external output possible)
	11	Output #3 flag (external output possible)
	12	Output #4 flag (external output possible)
	13	Output #5 flag (external output possible)
	14	Output #6 flag (external output possible)
	15	Output #7 flag (external output possible)
n+5	07—00	Error location
	15—08	Error code
n+6	15—00	Current counter value, 6 digits with sign (sign digit always 0, i.e., "+")(0 to 8,388,6077)
n+7	15—00	
n+8	07—00	Not used.
	15—08	Current present counter number.
n+9		Not used.

4-3-2 DM Area Settings

Operating Mode

DM word m, bits 11 through 08

The operating mode is set with the mode selector on the front panel. Refer to *1-4 Operating Modes* for an overview of available modes.

Presets

DM words m+14 through m+53

Two words are used to hold each preset counter value from #0 though #19. A counter value between 1 and 8,388,607 must be input for each preset used. The number of the currently effective preset is set in the IR area. Clear all unused presets to 0 to avoid error messages. Words m+54 through m+99 do not need to be cleared.

Output Patterns

Each preset contains an output pattern that designates which outputs are to be turned ON after countdown. All outputs whose bits are ON are output upon completion of the countdown when the relevant preset counter value is used. The output pattern is held in bits 12 through 15 of the higher of the two words used for each preset. Bits correspond to outputs as follows:

Bit 12: output 4   Bit 13: output 5

Bit 14: output 6   Bit 15: output 7

55

ON/OFF Counter Values ON Time

DM words m+1 through m+11

Outputs #0 though #2 turn ON and OFF according to the counter values set in DM words m+1 through m+10. The only exception is that output #0 turns ON at the beginning of the countdown. The diagram below illustrates this situation. Each of the counter values must be set between 0 and 8,388,607.

The ON time sets the length of time that outputs #4 through #7 remain ON after completion of the countdown when they are designated in the relevant output pattern. The setting value must either be between 0 and 99.99 (decimal not input) or it must be "FFFF", in which case the designated outputs will remain ON until the start signal is turned ON again.
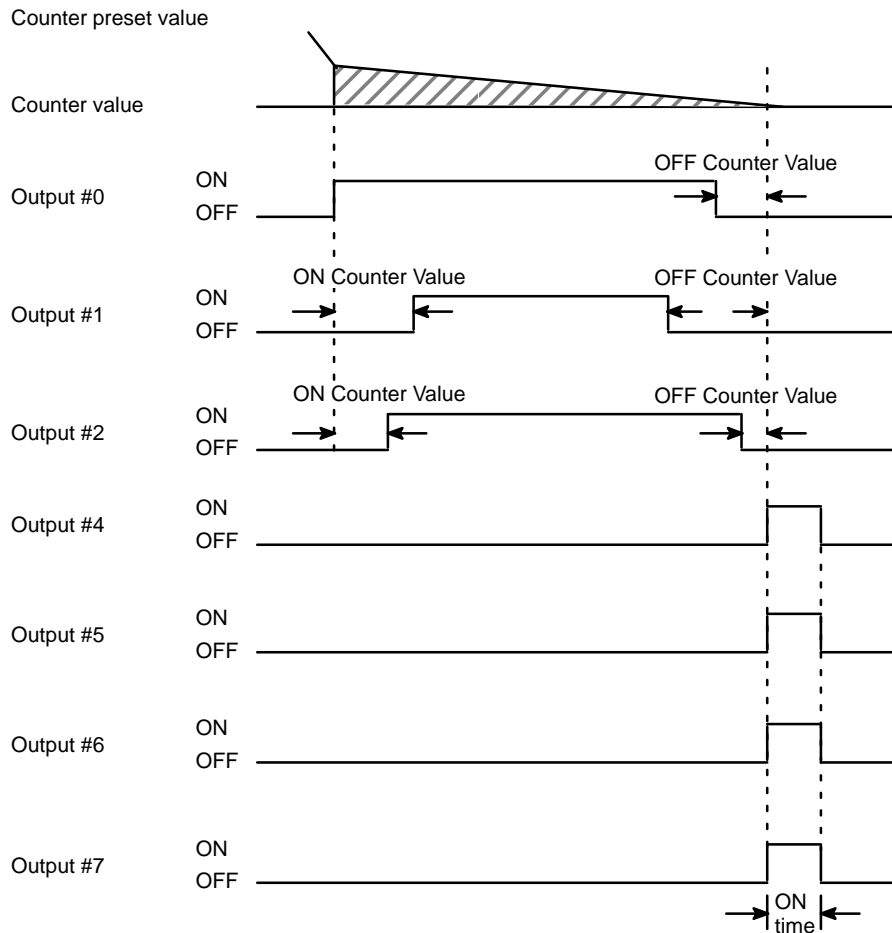
4-3-3   IR Area Settings

The IR area contains commands used to operate the Counter Unit and flags used to monitor its operation. Both of those are used in programming the desired counter operations.

START Command

Word n, bit 00

The countdown begins on the rising edge of the START command bit according to parameters from DM area. Note that the countdown will begin with preset #0 unless CHANGE PRESET is ON to designate the number of another preset.

The START command is effective only when pin 4 on the back-panel DIP switch is turned OFF. If pin 4 is ON, control input IN2 is used to start and stop the Counter Unit.

ENABLE OUTPUT Command

Word n, bit 02

Set this bit to enable external output of outputs #0 though #7. The status of the outputs is shown on indicators 0 though 7 when outputs are enabled. Word n+9 status is output regardless of the condition of ENABLE OUTPUT.

ENABLE FORCED OUTPUT Command

Word n, bit 07

Setting this command bit enables usage of the output force bits in word n (bits 08 through 15).

Output Force Bits

Word n, bits 15 through 08

Output force bits can be set to turn ON outputs #0 through #7, thereby permitting wiring checks. Both the ENABLE OUTPUT command bit and the ENABLE FORCED OUTPUT command bit must be ON to use the output force bits. The following procedure is used.

1, 2, 3... 1. Make sure the start signal is OFF.
2. Set ENABLE OUTPUT.
3. Make sure all output force bits are OFF.
4. Set ENABLE FORCED OUTPUT.
5. Set the required output force bits.

Refer to *4-3-1 Data Allocation* for the specific bit allocations.

CHANGE PRESET

Word n, bit 04

CHANGE PRESET is set to designate any preset other than #0. If CHANGE PRESET is OFF when the start signal is set, the countdown will begin from the value designated by preset #0, regardless of the contents of the preset designated by the preset number.

Preset Number

Word n+1, bits 15 through 08

The preset number is set to designate a preset counter value other then preset #0. The number set in bits 15 through 08 is effective only when CHANGE PRESET is turned ON before the start signal is turned ON.

PRESET COUNTER Command

Word n, bit 06

RESET COUNTER is effective when the internal reset bit is designated with back panel DIP switch settings (Refer to *2-1 Switch Settings*). RESET COUNTER can be combined with control input IN1 or resetting is possible using only control input IN1. Refer to *3-3 Counter Reset Conditions* for details. Resetting returns the counter value to 0 and turns OFF all outputs.

TRANSFER DATA Command

Word n, bit 01

TRANSFER DATA can be set to transfer up to 6 preset counter values to replace any of presets #0 through #19. The new presets can then be used for countdown. Data in the proper format must be prepared in consecutive words in the PC through the PC program or the Programming Console. The parameters described below are required to transfer data. These are followed by explanations of the data format used to prepare data in the PC data area. Data transfer is initiated on the rising edge of TRANSFER DATA and is completed at the next I/O refresh. Completion can be confirmed with the transfer completed flag, bit 04 of word n+4. Transfer should be executed only when the Counter Unit is not counting. Execution during counting may cause incorrect outputs.

TRANSFER DATA Beginning Word Number

Word n+2

Indicates the first PC word from which data is to be transferred.

TRANSFER DATA Area

Word n+3, bits 03 through 00

Set to between 0 and 4.

Indicates the PC data area from which data is to be transferred. Indications are as follows:

Setting	Data area
0	DM
1	I/O
2	LR
3	HR
4	AR

Note Use only the following words in the DM and IR areas: DM 0000 to DM 1999 and IR 000 to IR 235. Although the C200HS provides larger areas, if any words not within the specified ranges are used, an error will occur and an error code of 34 will be output.

Number of Transfers

Word n+3, bits 15–08

Set to between 1 and 6.

Counter values can be transferred for up to 6 presets at the same time. To transfer more the 6, TRANSFER DATA must be executed a second time with different parameters.

PC Data Format

Three consecutive words are used as the source of data transfer for each preset that is being transferred. These words must all be in the same data area. If data is transferred for more than one preset, the three words for each following transfer must continue consecutively on from the last word for the first transfer. The first word designates the number of the preset whose value is contained in the following two words. The last two words contain the preset counter value and output pattern in the same format as that used in DM for the normal presets. The numbers of the presets being transferred need not be consecutive.

Counting Flag

Word n+4, bit 00

The counting flag is ON whenever the Counter Unit is counting. This flag will remain ON from when the start signal resets the counter to the preset value until the current counter value reaches 0. Even if external outputs #4 to #7 remain ON after the current counter value reaches 0, the counting flag will be OFF. The RUN indicator will be lit when the counting flag is ON.

IN1 Flag

Word n+4, bit 02

The IN1 flag indicates the status of control input IN1. When the flag is ON, the input is high; when the flag is OFF, the input is low. This flag can be accessed during counting.

Transfer Completed Flag

Word n+4, bit 04

The transfer completed flag is inverted following completion of TRANSFER DATA.

Error Flag

Word n+4, bit 05

The error flag is turned ON whenever an error has occurred. Information on the type and location of the error is available in IR word n+5 upon execution of READ ERROR.

READ ERROR Command

Word n, bit 05

READ ERROR can be set to access information on the error whenever the error flag is ON. Error information is output to IR word n+5. If more than one error has

occurred, information on other errors can be output to IR word n+5 by again set-ting READ ERROR.

Error Location

Word n+5, bit 07 through 00

The error location gives the rightmost two digits of the DM address, i.e., the bit number, where the data causing the error is stored.

Error Code

Word n+5, bit 15 through 08

Error codes indicate the nature of the error and are given in *Appendix A Error Code List*.

Count Overflow Flag

Word n+4, bit 06

The count overflow flag is turned ON when the counter value is incremented passed 8,388,607. This flag turns OFF when the next counting operation is started.

Reset Flag

Word n+4, bit 07

The reset flag turns ON for one PC cycle time after the Counter Unit is reset.

Current Counter Value

Word n+6 and n+7

The current counter value is accessible in words n+6 and n+7 as 6 BCD digits with a sign digit. In preset mode, the sign digit is always 0 (+).

Output Flags

Word n+4 bits, 15 through 08

Output flag bits are ON whenever the corresponding output is ON. Output flags turn ON regardless of the status of ENABLE OUTPUT (word n, bit 02). Refer to *4-3-1 Data Allocation* for specific flag bits.

4-3-4 Timing Chart

The following chart shows timing relationships between the command bits (input bits) and output bits in preset mode when the counter is reset during the count-down.
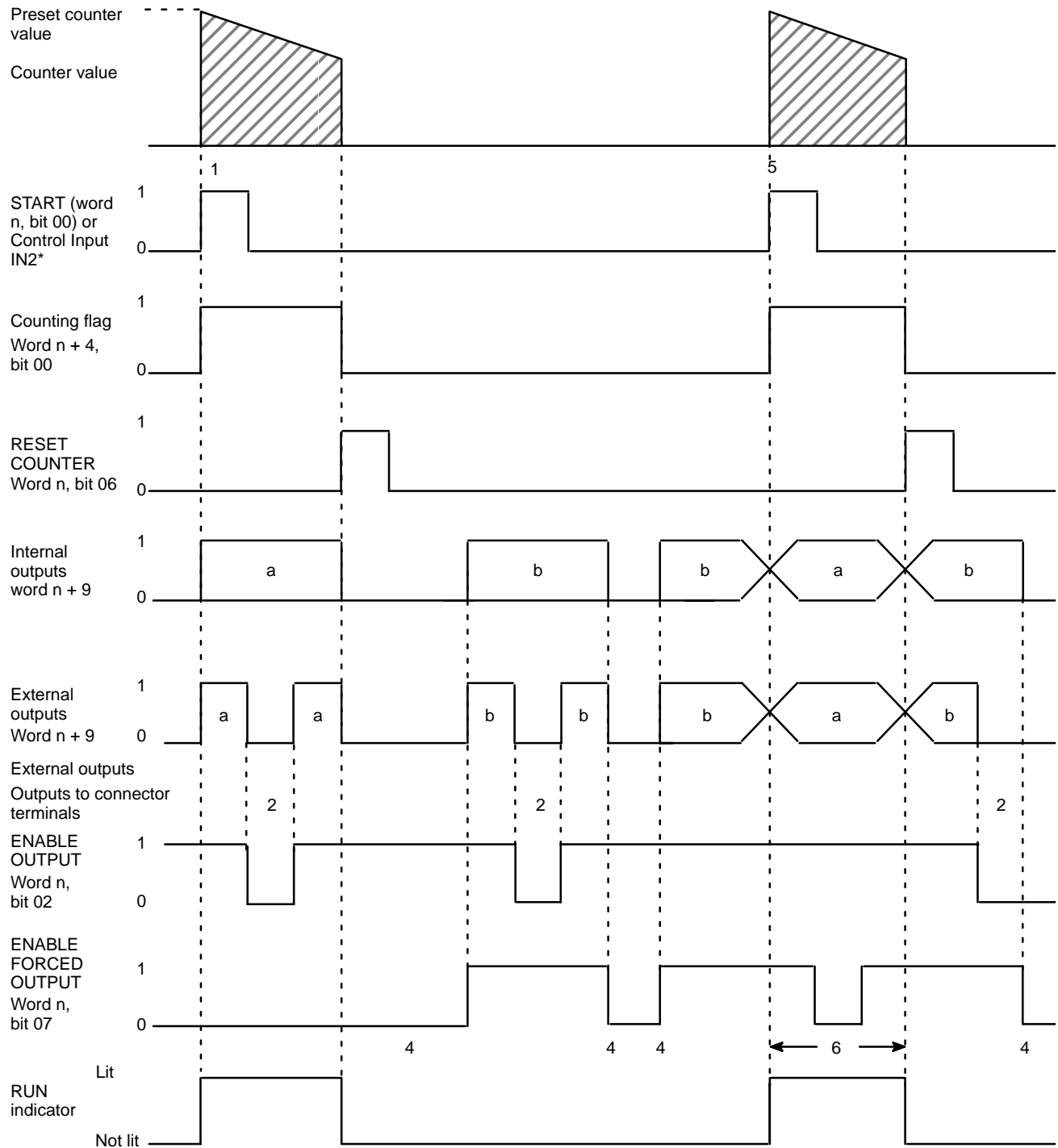
a: Normal outputs
b: Forced outputs

*Pin 4 on the back-panel DIP switch determines which start signal is used. ON: IN2; OFF: START,

1, 2, 3... 1. The start signal is effective on its rising edge.
2. External outputs are not possible while ENABLE OUTPUT is OFF. The bit does not affect internal outputs.
3. The counter value and outputs are reset when RESET COUNTER is set.

60

4. Forced outputs are possible only when the counting flag is OFF.

5. Normal operation is returned to when the start signal is set during forced output.

6. Forced outputs becomes inoperative during normal operation.

7. When RESET COUNTER is set during a forced output, the external out put is momentarily turned OFF, then restored to the status designated by the relevant force bit.

4-3-5 Application Example

Measuring and Cutting Rod System Configuration
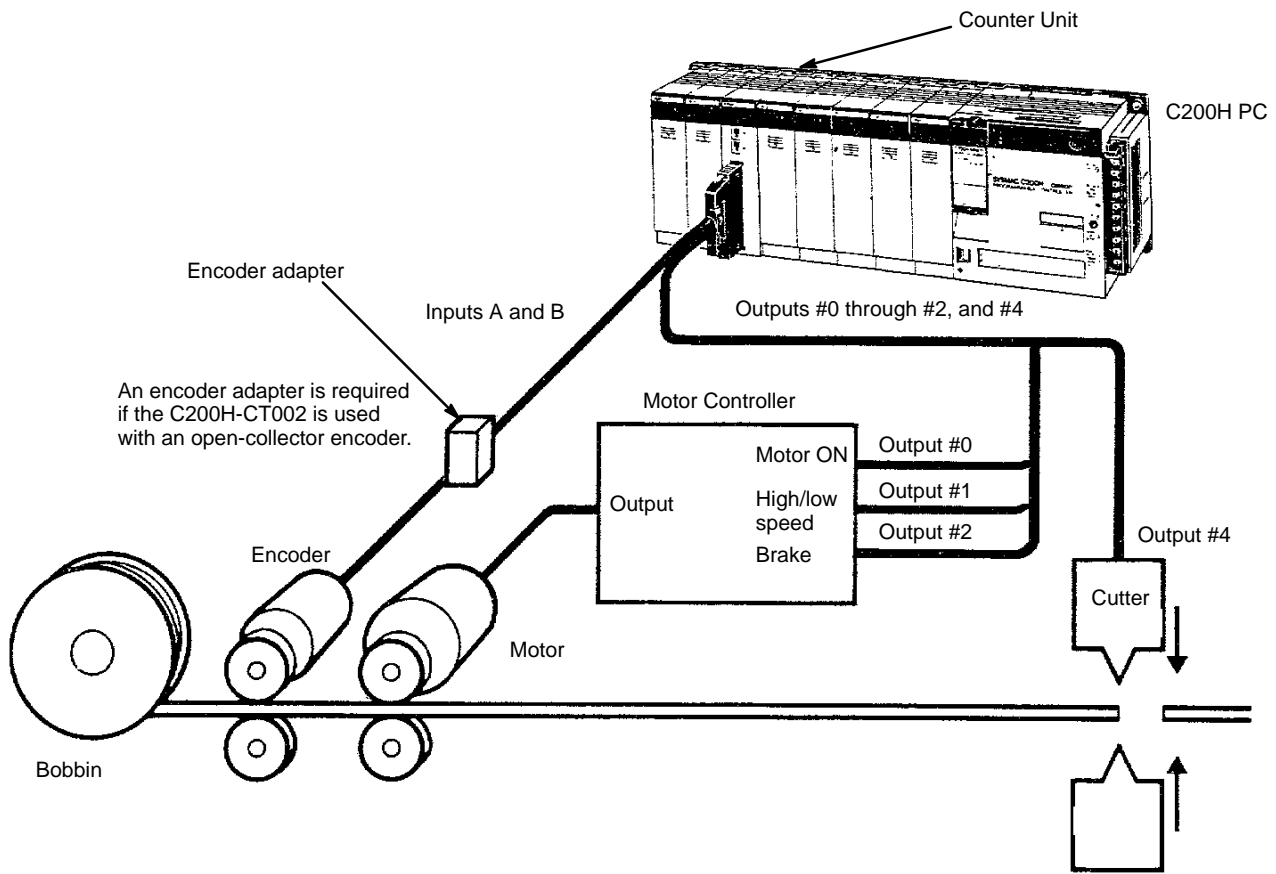
Operation

A specific length wire rod is fed in and cut using the following controlling procedure.

1, 2, 3... 1. The motor is started at a low speed and the brake is turned OFF.

2. The motor speed is increased.

3. The motor speed is decreased just before the designated position.

4. The motor is stopped, taking the distance the motor moves by inertia into consideration.

5. The brake is turned ON immediately before the designated position.

6. The cutter is activated at the designated position.

Counter preset value

Current counter value

Motor drive (Output #0)	ON OFF		A
High/Low speed (Output #1)	High speed Low speed	B	C
Brake (Output #2)	OFF ON		E
Cutter (Output #4)	ON OFF		T
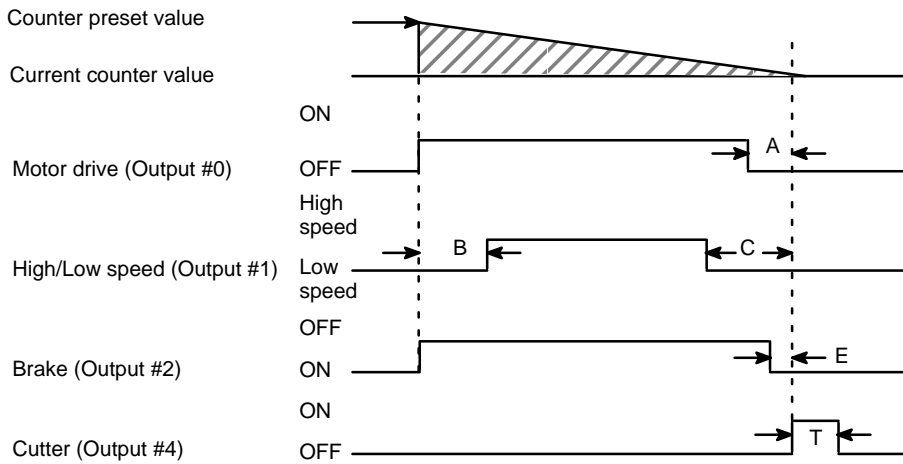
Setting example

Parameter	Setting (ms)
Present counter value	10,000
A	100
B	150
C	200
D	0
E	50
T	500

Switch Settings

In this example, the unit number switch is set to 1 and the mode switch is set to 3. Pins 3 and 8 are turned ON on the back-panel DIP switch to designate offset phase inputs with a x2 input multiplier and to enable RESET COUNTER. All other pins on the DIP switch are turned OFF.

Wiring

1, 2, 3...   1.   Connect encoder outputs to inputs A and B.

2.   Connect outputs #0, #1, and #2 to the motor controller inputs as follows:
        #0: motor start switch; #1: high/low speed switch; #2: brake signal.

3.   Connect output #4 to the input terminal of the cutter driver.

DM Area Settings

DM 1100	0	3	0	0	Sets mode no. 3.
DM 1101	0	1	0	0	A = 100
DM 1102	0	0	0	0	
DM 1103	0	1	5	0	B = 150
DM 1104	0	0	0	0	
DM 1105	0	2	0	0	C = 200
DM 1106	0	0	0	0	
DM 1107	0	0	0	0	D = 0
DM 1108	0	0	0	0	
DM 1109	0	0	5	0	E = 50
DM 1110	0	0	0	0	
DM 1111	0	0	5	0	T = 500 ms
DM 1112	–	–	–	–	
DM 1113	–	–	–	–	
DM 1114	0	0	0	0	Preset = 10000
DM 1115	1	0	0	1	Output #4 only

Program

RESET COUNTER

(11006)   Counter and outputs reset.

25315

(ON for one cycle)

MOV (21)
#0000
111

(11004)

Preset number set (here, to
00). Programming within the
dotted line can be omitted if the
preset number is 00.

25313 (usually ON)

(11002)   ENABLE OUTPUT turned ON.

START

(11000)   START

Output #4

DIFD (14) 03000   Completion of cutter opera-
tion detected (OFF).

03000   11000

(03001)   Outputs indicates completion
of cutting.

03001

4-4   Gate, Latch, and Sampling Modes

In gate, latch, and sampling modes counter values are incremented and decre-
mented while the count signal is ON and according to any of the three types of
input pulses. All three modes permit counting between –8,388,608 and
8,388,607. All modes but cumulative gate mode use control input IN1 as the
count (start) signal. The cumulative gate mode uses control input IN1 as the re-
set signal and control input IN2 as the count (start) signal; latch mode uses con-
trol input IN2 as the latch signal. None of these modes support external outputs.
Control inputs can be designated to originate in IR bits.

4-4-1   Data Allocation

DM Area

The DM area contains the user-input parameters that are to be set into the Counter Unit. The first DM word for each Counter Unit is indicated by m and equals 1,000 plus 100 times the unit number.

Word	Bit	Function
m	07–00	Set to 0.
	11–08	Operating mode (Here, 4: gate; 5: latch; or 6: sampling)
	15–12	Set to 0.
m+1	03–00	Control origin 0000: External (connector input) 0001: Internal (IR area)
	07–04	Set to 0.
	11–08	Gate mode type (gate mode only) 0000: Normal 0001: Cumulative
	15–12	Set to 0.
m+2 through m+99		Not used.

IR Area

The IR area contains commands and status information. Inputs and outputs are given in reference to the PC, i.e., output data is sent from the PC to the Counter Unit; input data, from the Counter Unit to the PC. The first IR word for each Counter Unit is indicated by n and equals 100 plus 10 times the unit number.

Outputs

Word	Bit	Function
n	00	Not used.
	01	SET TIME command (sampling mode only)
	02	Not used.
	03	Internal IN1
	04	Internal IN2.
	05	READ ERROR command
	15–06	Not used.
n+1	15–00	Sampling time, 4 digits in ms (sampling mode only)
n+2 n+9		Not used.

Inputs

Word	Bit	Function
n+4	00	Counting flag.
	01	Not used.
	02	IN1 flag
	03	IN2 flag
	04	Not used.
	05	Error flag
	06	Count overflow flag.
	15–07	Not used.
n+5	07–00	Error location
	15–08	Error code

Word	Bit	Function
n+6	15—00	Current counter value, 6 digits with sign (−8,388,608 to 8,388,607)
n+7	15—00	
n+8 n+9		Not used

Note 1. The RUN indicator will be lit whenever the counting flag (word n+4, bit 00) is ON.

2. The external control inputs IN1 and IN2 must be ON for at least as long as the PC's cycle time to ensure that they can be accurately read from the PC.

4-4-2   DM Area Settings

Operating Mode

DM word m, bits 11 through 08

The operating mode is set with the mode switch on the front panel. Refer to *1-4 Operating Modes* for an overview of available modes.

Control Origin

DM word m+1, bits 03 through 10

Control inputs (start, reset, and latch) can be designated as originating from the connector (control inputs IN1 and IN2) or from the IR area (internal IN1 and IN2). Designations are as follows:

0: External (connector input)

1: Internal (IR area)

Gate Mode Type (Gate Mode Only)

DM word m+1, bits 11 through 08

The gate mode type determines the use of control inputs IN1 and IN2. Refer to *1-4 Operating Modes* for details. Designations are as follows:

0000: Normal

0001: Cumulative

4-4-3   IR Area Settings

SET TIME Command (Sampling Mode Only)

Word n, bit 01

SET TIME is turned ON to use the sampling time held in word n+1. The new sampling time is effective on the rising edge of SET TIME, unless the counting flag in ON, in which case the new sampling time is effective after completion of the current counting operation.

Sampling Time (Sampling Mode Only)

Word n+1

Set to between 0010 and 9999 in ms.

The sampling time designates the time that pulses will be counted following control input IN1.

Control Inputs Internal IN1 or Control Input IN1

Word n, bit 03 or external connector

Internal IN2 or Control Input IN2

Word n, bit 04 or external connector

The setting of the control origin, DM word m+1 bits 03 through 00, determines whether external signals or IR bits are used as the start, latch, and gate signals.

In cumulative gate mode (CT002 only), IN1 is the reset signal and IN2 the count signal. Pulses are counted while IN2 is ON. In normal gate mode, IN1 is the count signal and pulses are counted while it is ON.

In sampling mode, IN1 is the count signal.

In latch mode, IN1 is the count signal and IN2 the latch signal.

Error Flag   Word n+4, bit 05

The error flag is turned ON whenever an error has occurred. Information on the type and location of the error is available in IR word n+5 upon execution of READ ERROR.

READ ERROR Command   Word n, bit 05

READ ERROR can be set to access information on the error whenever the error flag is ON. Error information is output to IR word n+5. If more than one error has occurred, information on other errors can be output to IR word n+5 by again setting READ ERROR.

Error Location   Word n+5, bit 07 through 00

The error location gives the rightmost two digits of the DM address, i.e., the bit number, where the data causing the error is stored.

Error Code   Word n+5, bit 15 through 08

Error codes indicate the nature of the error and are given in *Appendix A Error Code List*.

Counting Flag   Word n+4, bit 00

The counting flag is ON whenever the Counter Unit is counting.

IN1 Flag   Word n+4, bit 02

The IN1 flag indicates the status of control input IN1. When the flag is ON, the input is high; when the flag is OFF, the input is low. This flag can be accessed during counting.

IN2 Flag   Word n+4, bit 03

The IN2 flag indicates the status of control input IN2. When the flag is ON, the input is high; when the flag is OFF, the input is low. This flag can be accessed during counting.

Count Overflow Flag   Word n+4, bit 06

The count overflow flag is turned ON when the counter value is incremented passed 8,388,607. This flag turns OFF when the next operation is started.

Current Counter Value   Word n+6 and n+7

Between −8,388,608 and 8,388,607

The current counter value is accessible in words n+6 and n+7 as 6 BCD digits with a sign digit.

4-4-4   Timing Charts

The following four charts show the relationship between the input and output bits in the two types of gate mode, the latch mode, and the sampling mode.
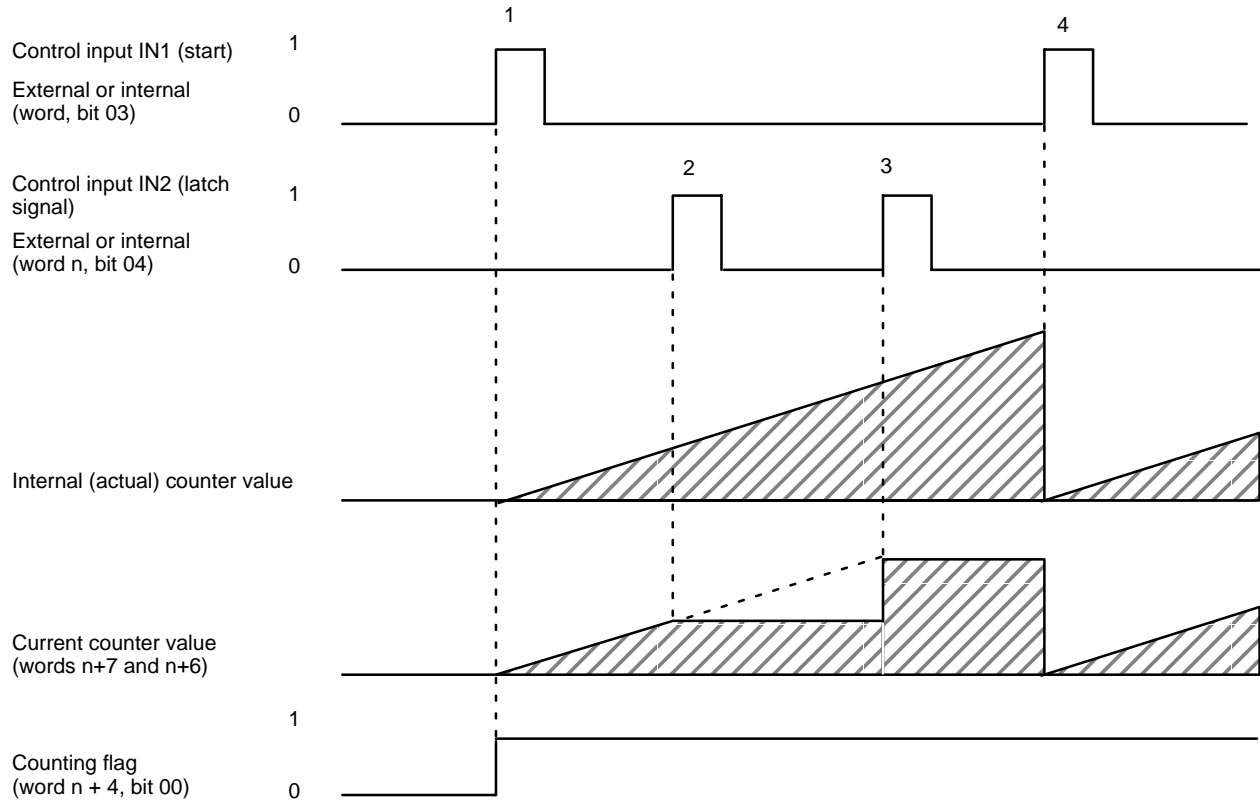
Normal Gate Mode
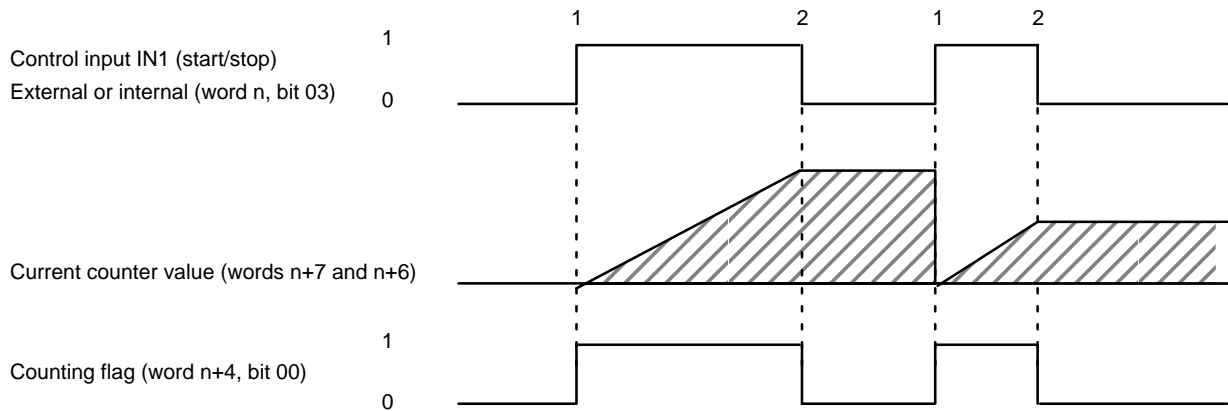
1, 2, 3... 1. Counting starts from 0 on rising edge of IN1.

2. Counting stops on falling edge of IN1. The counter value at that time is retained until the next IN1 signal. No external outputs are supported by the gate mode.

Cumulative Gate Mode (C200H-CT002 Only)
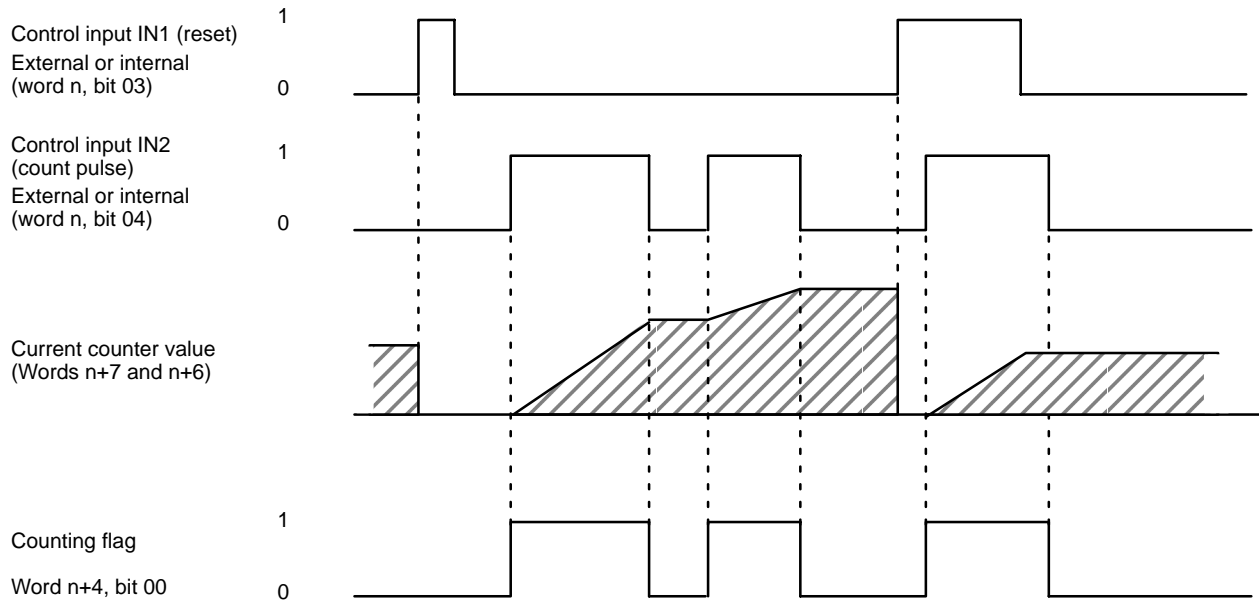
1, 2, 3... 1. The current counter value is reset to zero on the leading edge of IN1.

2. Counting continues from the last current counter value on rising edge of IN2.

3. Counting stops on falling edge of IN2. The counter value at that time is retained until the next IN1 signal. No outputs are supported by the gate mode.

Latch Mode

Control input IN1 (start)
External or internal
(word, bit 03)

Control input IN2 (latch signal)
External or internal
(word n, bit 04)

Internal (actual) counter value

Current counter value
(words n+7 and n+6)

Counting flag
(word n + 4, bit 00)

1, 2, 3...   1.   Counting starts from 0 on the rising edge of IN1.
2.   The current counter value is latched (frozen) on the rising edge of IN2 (latch signal) and latched value is maintained until the next IN2 or IN1 signal.
3.   The internal counter value continues to be incremented and decremented without being affected by the latch signal.
4.   Both the internal current counter values are reset to 0 on the next IN1 signal. No outputs are supported by the latch mode.

Sampling Mode
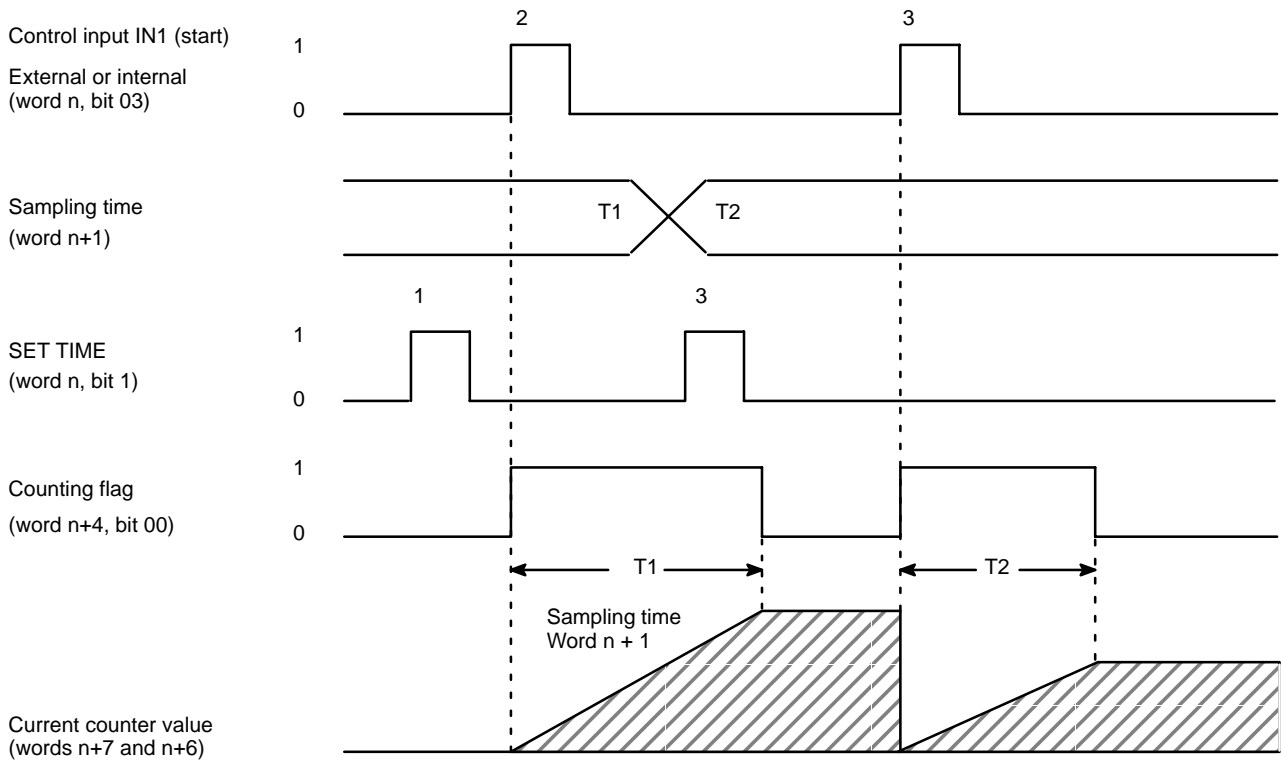
1, 2, 3... 1. The sampling time is set from word n+1 before starting.

2. Counting starts from 0 on the rising edge of IN1. After expiration of the sampling time, the count stops and the counter value is retained until the next IN1 signal.

3. When SET DATA is turned ON while the counting flag is ON, the new sampling time is set after completion of the counting operation and used for the next counting operation. No external outputs are supported by the sampling mode.

Note Set up the system so that control input IN1 turns ON after setting the sampling time has been completed. The following is an example for internal control input 1.
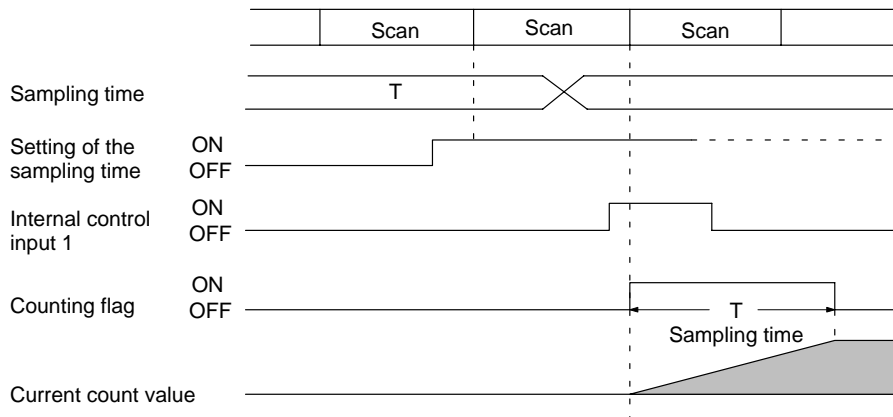
4-4-5 Application Examples

Gate Mode: Measuring Product Length System Configuration
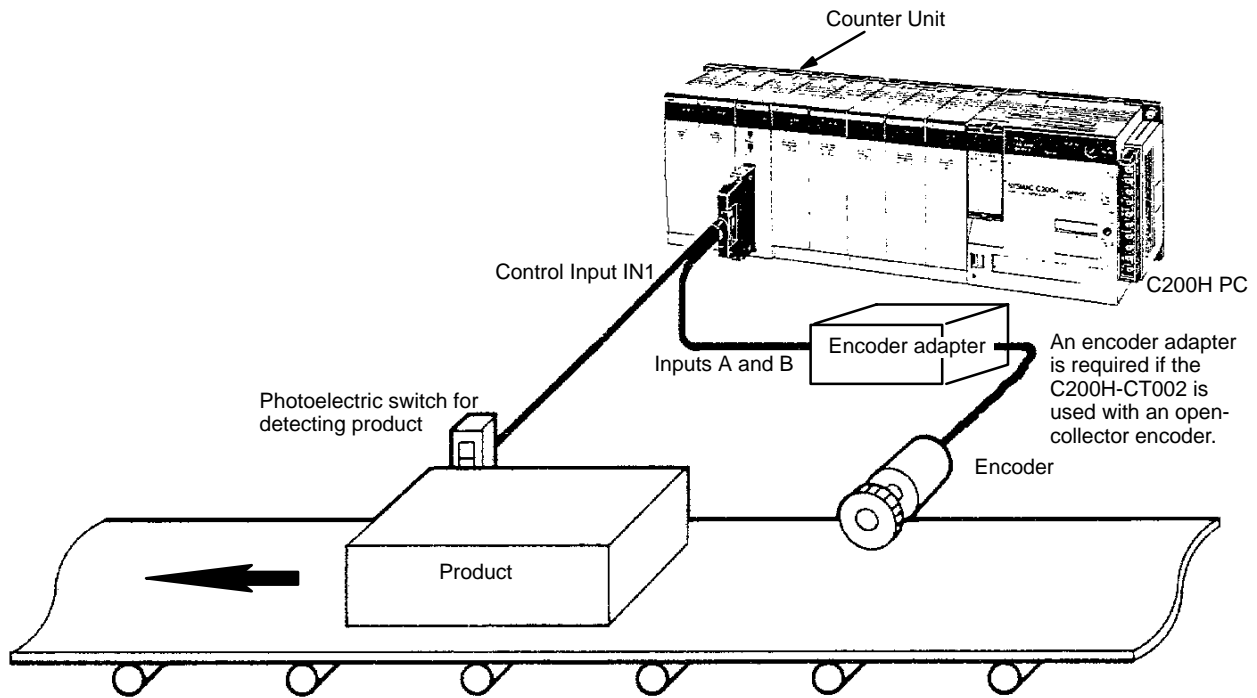
Operation　　　　This example system counts encoder inputs while the photoelectric switch is ON to measure the lengths of products on a conveyor. The PC uses the resulting length measurements to determine if product lengths are within standards.

Switch Settings　　　　In this example, the unit number selector is set to and 1 and the mode selector is set to 4.

All pins are turned OFF on the back panel DIP switch to designate offset phase inputs with no input multiplier.

Wiring

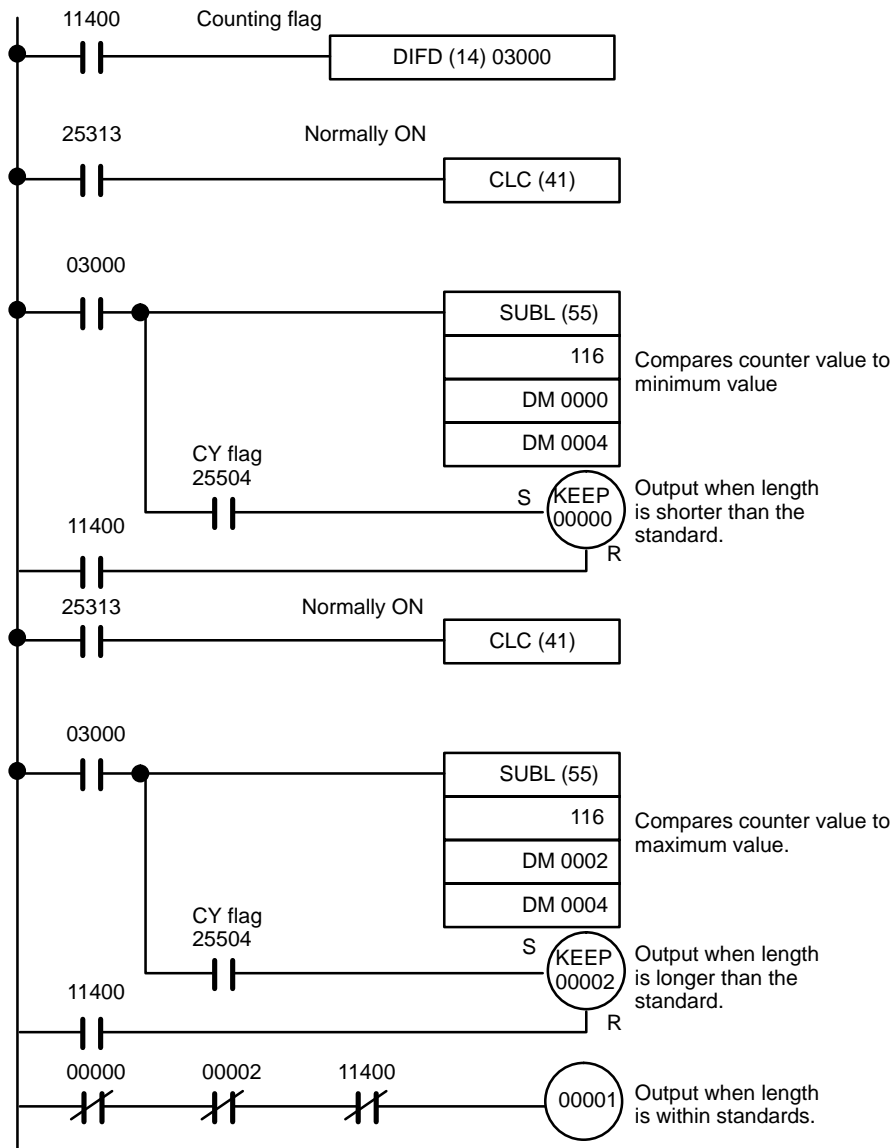*1, 2, 3...*　1.　Connect encoder outputs to inputs A and B.

2.　Connect the photoelectric switch output to control input IN1.

DM Area Settings

DM 1100	0	4	0	0
DM 1101	0	0	0	0

Sets the mode to 4 (gate). Designates use of control IN1 from the connector (not the internal IN1) and normal gate mode (not cumulative).
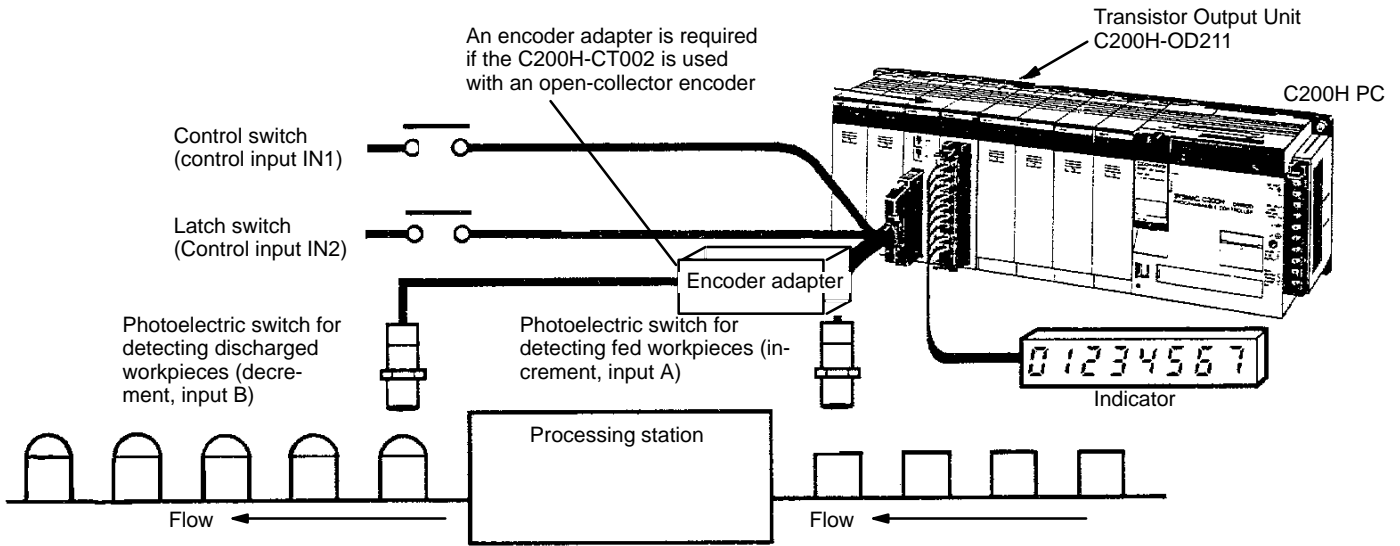
Program

```
  11400       Counting flag
───┤├──────────────────────────┌──────────────────────┐
                               │  DIFD (14) 03000     │
                               └──────────────────────┘

  25313       Normally ON
───┤├──────────────────────────┌──────────────────────┐
                               │  CLC (41)            │
                               └──────────────────────┘

  03000
───┤├──────●───────────────────┌──────────────────────┐
           │                   │  SUBL (55)           │
           │                   ├──────────────────────┤
           │                   │              116     │    Compares counter value to
           │                   ├──────────────────────┤    minimum value
           │                   │  DM 0000             │
           │                   ├──────────────────────┤
           │                   │  DM 0004             │
           │                   └──────────────────────┘
           │  CY flag                        S  ╭──────╮   Output when length
           │  25504                            │ KEEP │   is shorter than the
           └───┤├─────────────────────────────┤00000 │   standard.
  11400                                         ╰──────╯
───┤├───────────────────────────────────────────── R

  25313       Normally ON
───┤├──────────────────────────┌──────────────────────┐
                               │  CLC (41)            │
                               └──────────────────────┘

  03000
───┤├──────●───────────────────┌──────────────────────┐
           │                   │  SUBL (55)           │
           │                   ├──────────────────────┤
           │                   │              116     │    Compares counter value to
           │                   ├──────────────────────┤    maximum value.
           │                   │  DM 0002             │
           │                   ├──────────────────────┤
           │                   │  DM 0004             │
           │                   └──────────────────────┘
           │  CY flag                        S  ╭──────╮   Output when length
           │  25504                            │ KEEP │   is longer than the
           └───┤├─────────────────────────────┤00002 │   standard.
  11400                                         ╰──────╯
───┤├───────────────────────────────────────────── R

  00000     00002      11400                    ╭──────╮
───┤/├──────┤/├────────┤/├──────────────────────│00001 │   Output when length
                                                 ╰──────╯   is within standards.
```

Comparison Data			Resulting Outputs	
DM 0000	Min.		00000 ON	Too short
DM 0001				
DM 0002	Max.		00001 ON	Length acceptable
DM 0003				
DM 0004	Results		00002 ON	Too long
DM 0005				

Latch Mode: Monitoring Quantity at a Processing Station System Configuration

An encoder adapter is required
if the C200H-CT002 is used
with an open-collector encoder

Transistor Output Unit
C200H-OD211

C200H PC

Control switch
(control input IN1)

Latch switch
(Control input IN2)

Encoder adapter

Photoelectric switch for
detecting discharged
workpieces (decre-
ment, input B)

Photoelectric switch for
detecting fed workpieces (in-
crement, input A)

`01234567`

Indicator

Processing station

Flow ←   Flow ←

Operation

This example system monitors the number of work pieces in the processing station and displays the currently latched number on a seven-segment indicator.
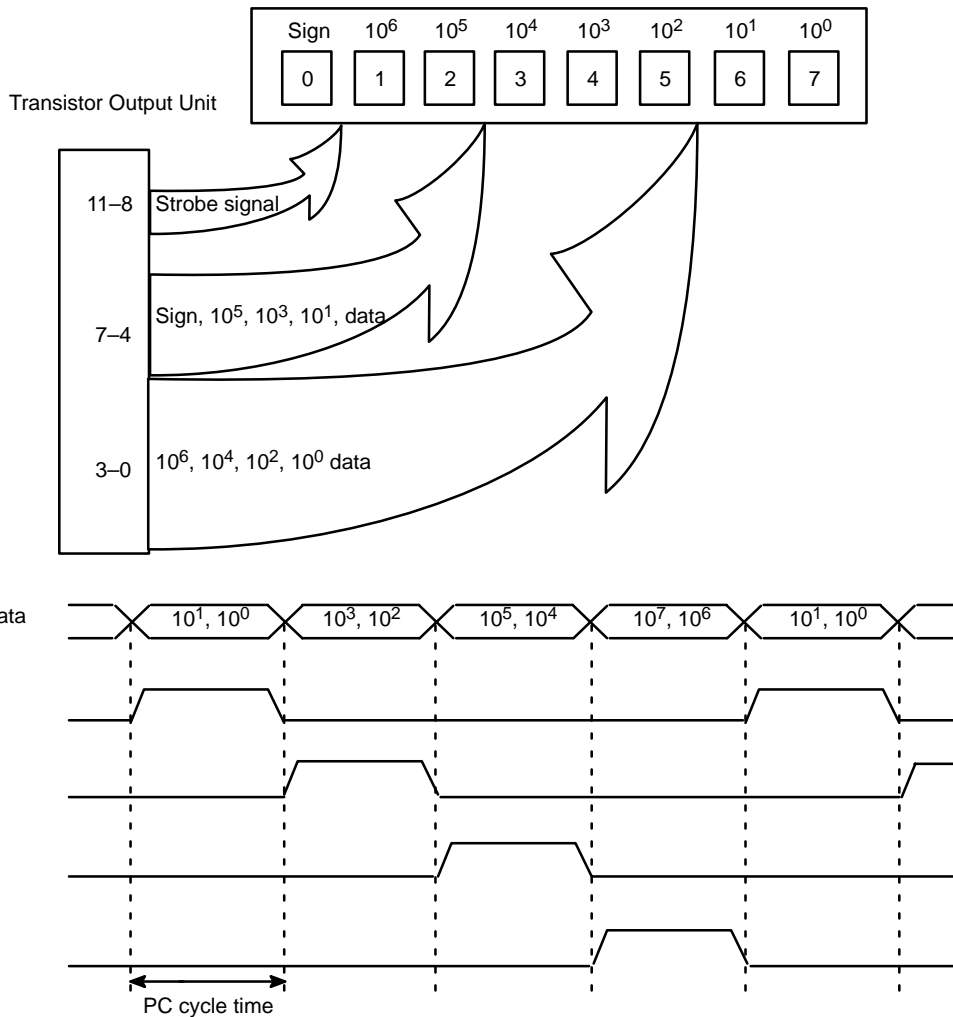
Sign	10^6	10^5	10^4	10^3	10^2	10^1	10^0
0	1	2	3	4	5	6	7

Transistor Output Unit

11–8 Strobe signal

7–4 Sign, 10^5, 10^3, 10^1, data

3–0 10^6, 10^4, 10^2, 10^0 data

Output data 10^1, 10^0 | 10^3, 10^2 | 10^5, 10^4 | 10^7, 10^6 | 10^1, 10^0

Strobe 0

Strobe 1

Strobe 2

Strobe 3

PC cycle time

Switch Settings   In this example, the unit number selector is set to 1 and the mode selector is set to 5. All pins except number 1 are turned OFF on the back panel DIP switch to designate increment/decrement inputs.
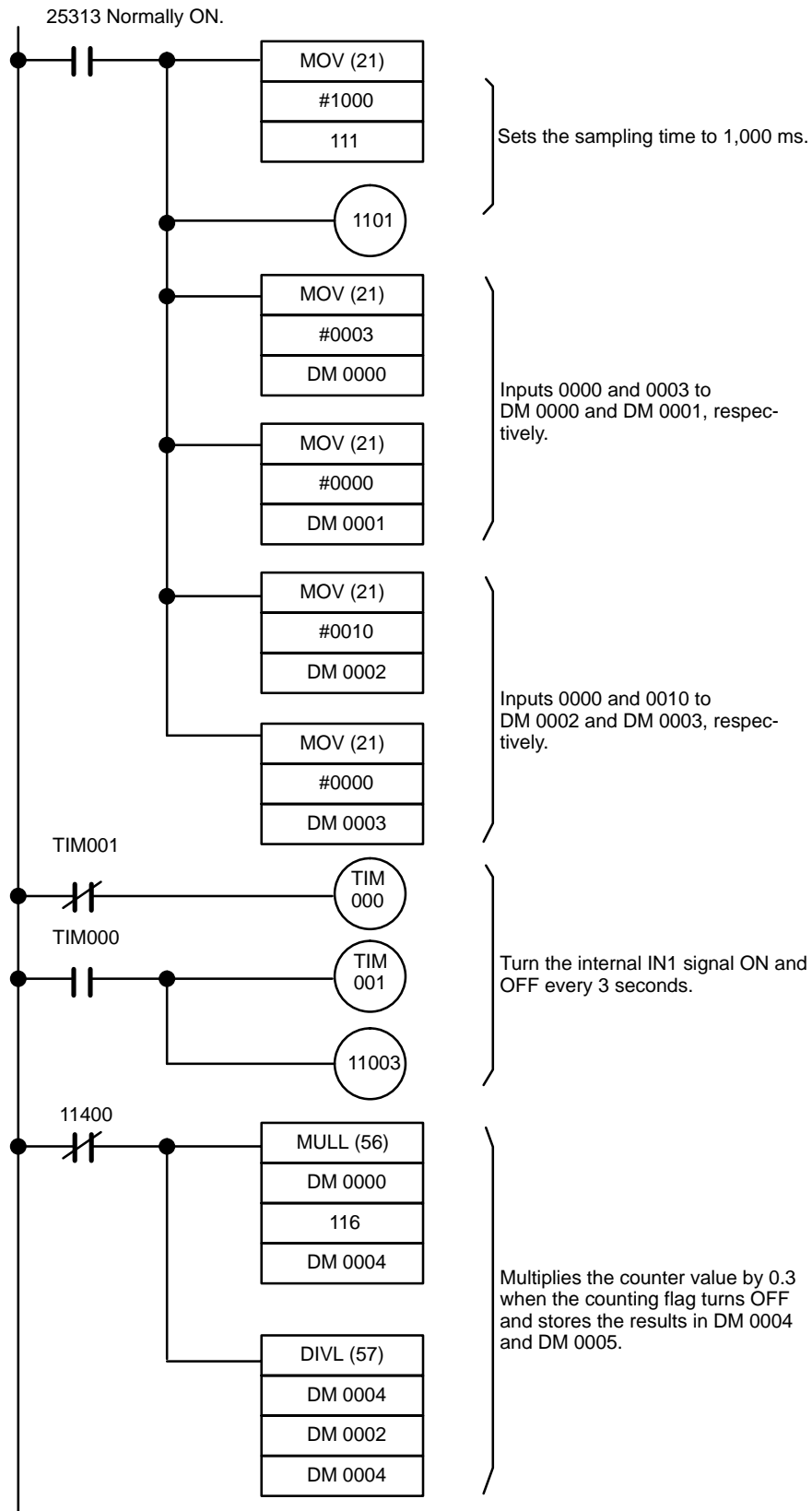
Wiring

1, 2, 3...   1.   Connect the photoelectric switch outputs to input A (increment) and the input B (decrement).
2.   Connect the count switch to control input IN1.
3.   Connect the latch switch to control input IN2.

DM Area Settings

DM 1100	0	5	0	0	Sets the mode to 5 (latch).
DM 1101	0	0	0	0	Designates use of control input IN1 from the connector (not the internal IN1).

Program

		(ON for one cycle.)	MOV (21)	Initializes strobe data.
25315	⊣⊢		#1111	
			030	

The ladder diagram contains the following rungs:

25315 (ON for one cycle.) — MOV (21), #1111, 030 — Initializes strobe data.

03000 — ANDW (34), 116, #00FF, 001 — Outputs 10^1 and 10^0 when strobe 0 = "1"

03001 — MOVD (83), 116, #0012, 001 — Outputs 10^3 and 10^2 when strobe 1 = "1"

03002 — ANDW (34), 117, #00FF, 001 — Outputs 10^5 and 10^4 when strobe 2 = "1"

03003 — MOVD (83), 117, #0012, 001 — Outputs 10^7 and 10^6 when strobe 3 = "1"

25313 Normally On — MOVD (83), 030, #0200, 001 — Strobe signal output

03015 — STC (40)

03015 — CLC (41)

25313 Normally On — ROL (27), 030 — Rotating the strobe data counterclockwise

Sampling Mode Example 1: Weighing Objects System Configuration
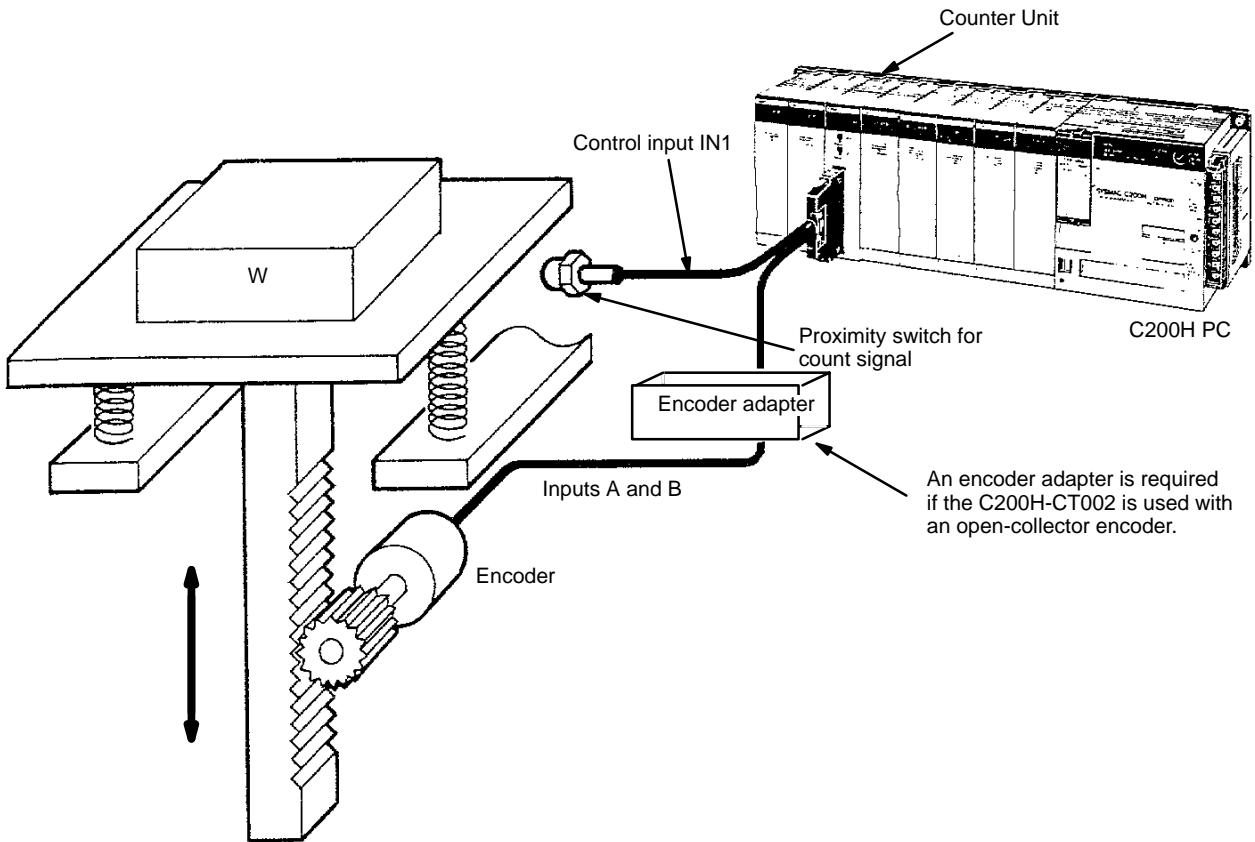
Operation
In this example system, encoder pulses are counted for a fixed period after placing an object onto a scale. The weight of the object is measured only after all vibration has stopped.

Switch Settings
In this example, the unit number selector is set to 1 and the mode selector is set to 6. All pins except pins number 2 and 3 are turned OFF on the back panel DIP switch to designate offset phase inputs with a x4 input multiplier.

Wiring

1, 2, 3... 1. 1Connect the incremental encoder outputs to the inputs A and B.

2. Connect the proximity switch output to control input IN1.

DM Area Settings

DM 1100	0	6	0	0	Sets the mode to 6 (sampling).
DM 1101	0	0	0	0	Designates use of control input IN1 from the connector (not the internal IN1).

Program

25315 (ON for one cycle.)

| MOV (21) |
| #3000 |
| 111 |

Sets the sampling time to 3 s.

(11001) SET TIME

11400   Counting flag

DIFD (14) 03000   Detects the completion of weighing (OFF during counting).

03000

| MOV (21) |
| 116 |
| DM 0000 |

The current counter value is stored in DM 0000 and DM 0001 when the weighing is completed.

| MOV (21) |
| 117 |
| DM 0001 |
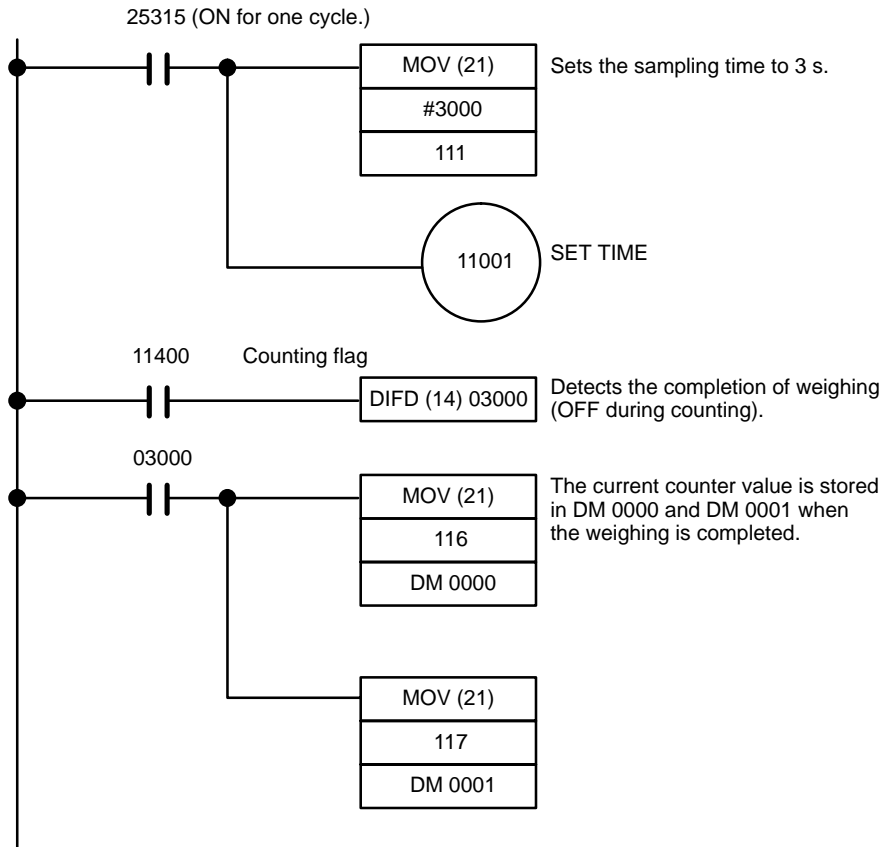
Sampling Mode Example 2: Measuring Speed System Configuration

Counter Unit

Input A

An encoder adapter is required if the CT002 is used with an open-collector encoder.

Encoder adapter

C200H PC

Encoder (single)
Resolution: 200 pulses/revolution

Motor
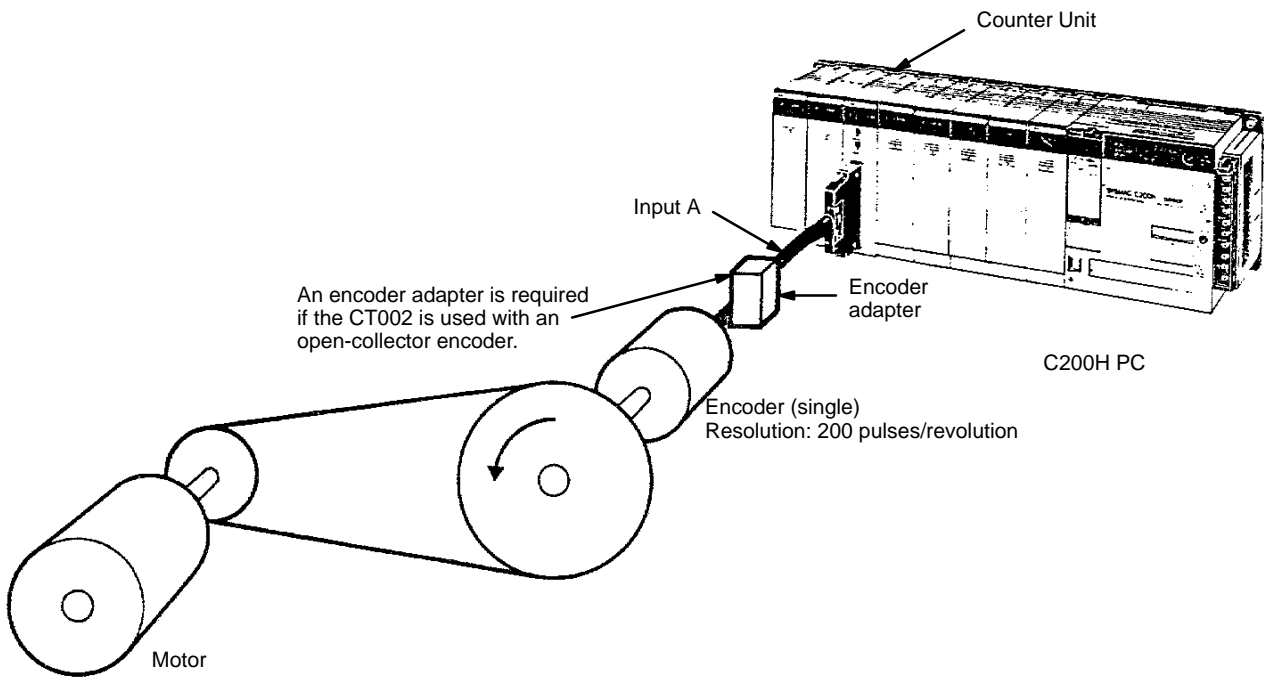
Operation   This example system counts, for a specific interval, pulses from an incremental encoder that is directly connected to a rotating shaft. The PC then converts the pulse count into a shaft speed (rpm). Here, the speed in rpm would

be the number of pulses per second times 60 divided by the number of pulses per shaft rotation (i.e., 200), or 0.3 times the pulse count per second.

Switch Settings

In this examples, the unit number selector is set to 1 and the mode selector is set to 6. All pins except pins 1 and 2 are turned OFF on the back panel DIP switch to designate pulse and direction inputs.

Wiring

1, 2, 3...   1.   Connect the incremental encoder output to the inputs A.
2.   Do not connect any output to input B, and set the counter to increment.

DM Area Settings

DM 1100	0	6	0	0	Sets the mode to 6 (sampling).
DM 1101	0	0	0	1	Designates use of internal IN1 from the PC (not control input IN1).

Program

25313 Normally ON.

MOV (21)
#1000
111

Sets the sampling time to 1,000 ms.

1101

MOV (21)
#0003
DM 0000

MOV (21)
#0000
DM 0001

Inputs 0000 and 0003 to DM 0000 and DM 0001, respectively.

MOV (21)
#0010
DM 0002

MOV (21)
#0000
DM 0003

Inputs 0000 and 0010 to DM 0002 and DM 0003, respectively.

TIM001

TIM 000

TIM000

TIM 001

Turn the internal IN1 signal ON and OFF every 3 seconds.

11003

11400

MULL (56)
DM 0000
116
DM 0004

DIVL (57)
DM 0004
DM 0002
DM 0004

Multiplies the counter value by 0.3 when the counting flag turns OFF and stores the results in DM 0004 and DM 0005.

SECTION 5
Error Processing

This section presents possible errors and solutions and describes how to handle errors from the PC. The AR area Error and Restart Flags are described.

5-1　Error Indications

When an error occurs, the ERROR indicator will light and the error flag will turn ON. Error information is then output to IR word n+5 when READ ERROR is set. READ ERROR can be set as many times as necessary to access further error information. (Information for up to 30 errors will be saved in the system.)

Error information in IR word n+5 consists of the error location, which indicates the last two digits of the DM address where the error originates, and the error code, which classifies the error (Refer to *Appendix A Error Code List*). The error location is held in bits 07 through 00; the error, in bits 15 through 08.

If the counter value overflows, the ERROR indicator will light and the counter overflow flag will turn ON. The error flag will not turn ON for counter overflows, and error information will not be output to IR word n+5.

If an error occurs, correct the cause of the error and clear all PC error flags. Error information and the Counter Unit error flag will be cleared after all errors are read out with READ ERROR.

5-2　Troubleshooting from the PC

Errors in the Counter Unit can be monitored from the PC. The Counter Unit is monitored as a Special I/O Unit, and as such is treated the same as a Position Control Unit or any other Special I/O Unit.

Error List for Special I/O Units

Error	Possible cause and status	Correction
Waiting for Special I/O Unit startup.	●Special I/O Unit has a hardware malfunction. ●PC will not begin operation.	●Replace the Special I/O Unit with a new Unit. (The malfunctioning Unit displays only $s when I/O table is read.)
Too many Special I/O Units.	●Same unit number has been assigned to more than one Special I/O Unit. ●PC will not begin operation. ●SR bit 25415 is ON.	●Set unit numbers so that each is used only once (Unit numbers can be accessed by reading I/O table.)
Error in Special I/O Unit.	●Refreshing was not normally executed between CPU and the Special I/O Unit. ●Only the malfunctioning Unit will stop operation. ●SR bit 25415 is ON.	●Obtain the malfunctioning Unit number by reading AR bits 0000 to 0009, remove the cause of the error, and then restart by turning OFF, ON, then back off the appropriate restart flag (AR bits 0100 to 0109). If the Counter Unit does not recover normal operation after restarting, replace it with a new one.

AR Area Error and Restart Flags for Special I/O Units

Error Flags   The following error flags will turn ON when the same unit number is assigned to more than one Special I/O Unit, or when the refreshing operation between the PC and the Special I/O Unit is not normally executed.

Bit	Unit number
AR 000	0
AR 001	1
AR 002	2
AR 003	3
AR 004	4
AR 005	5
AR 006	6
AR 007	7
AR 008	8
AR 009	9

Restart Flags   The following restart flags are turned ON and OFF to restart Special I/O Units. It is not necessary to turn OFF Counter Unit power when its restart flag is used.

Bit	Unit number
AR 0100	0
AR 0101	1
AR 0102	2
AR 0103	3
AR 0104	4
AR 0105	5
AR 0106	6
AR 0107	7
AR 0108	8
AR 0109	9

Appendix A
Error Codes

Code	Error type	Meaning
11	Numeric	Data is not BCD or data is 0.
12	Counting range	Data is less than –8,388,608 or greater than 8,388,607. (Circular mode: data is less than 0 or greater than 65,535.)
14	Inconsistent data	The mode setting on the front panel and the operating mode set in DM area are inconsistent, or upper and lower settings for ranges are reversed.
15	Parameter error	Error in parameters other than those covered under codes 11, 12, and 14, above.
32	Counter preset	The counter preset number is not between 00 and 19.
33	Transfer range no./transfer preset no.	The range number for TRANSFER DATA is not between 00 and 15 transfer preset no. or the preset number for TRANSFER DATA is not between 00 and 19.
34	Beginning word no.	The beginning word number for TRANSFER DATA is not acceptable.
35	Data area	The data area number for TRANSFER DATA is not acceptable.
36	Number of transfers	The number of transfers exceeds the specified maximum or is set to 0.

Item	Specification
Number of axes	One per Counter Unit
Operating modes	Any of the following six: Linear mode Circular mode Preset mode Gate mode Latch mode Sampling mode
Count input signals	Input A Input B
Counting signal level	CT001-V1: 5, 12, or 24 VDC (Selected when wiring). CT002: Same as RS-422 line driver (Am26LS31-compatible).
Input modes	Offset phases Separate up and down inputs Pulse and direction inputs
Counting speed	CT001-V1: 50 kcps max. CT002: 75 kcps max. (Depends on encoder when using offset phase inputs. Refer to *3-2-1 Offset phases*).
Other	Input multiplier (x2 or x4) available for offset phase inputs.
Input signals	Input Z Control input IN1 Control input IN2
External signal level	CT001-V1: 5, 12, or 24 VDC (Selected when wiring). CT002: Same as RS-422 line driver (Am26LS31-compatible).
External outputs	8 total
Output level	External output power supply: 5 to 24 VDC Switching capacity: 16 to 80 mA
Internal consumption	300 mA max. at 5 VDC (supplied from rack).
Weight	400 g max. (excluding connectors).
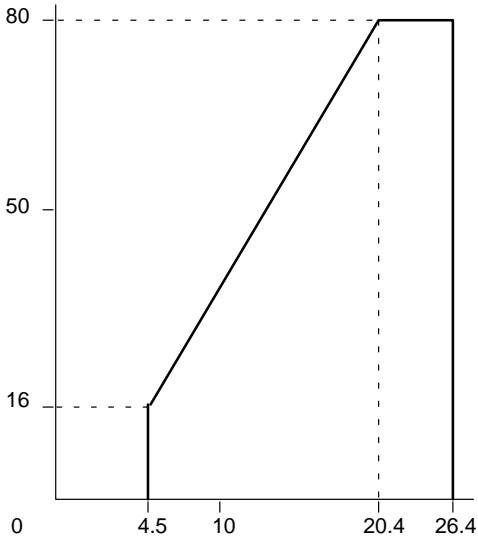
Maximum Required Response Speed (Pulse Input to Output)

No. of ranges	Linear mode	Circular mode
1	0.74 ms	0.66 ms
8	1.17 ms	1.02 ms
16	1.40 ms	1.10 ms
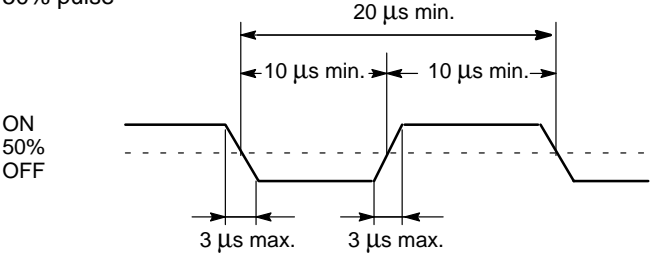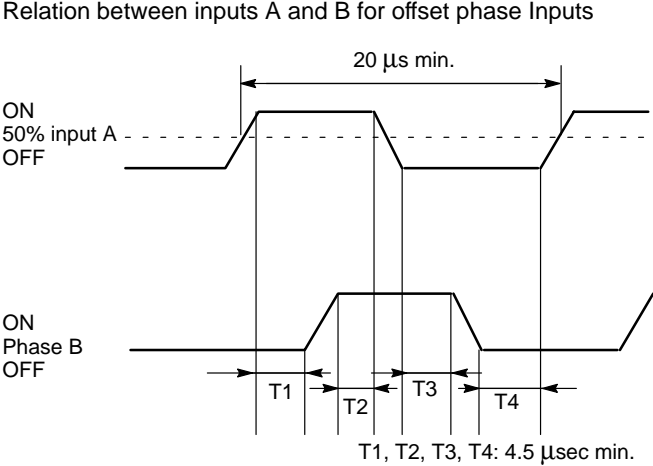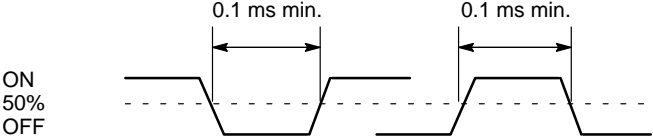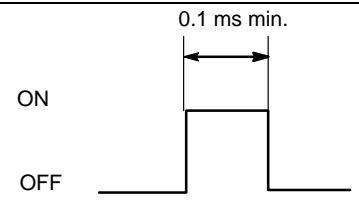
Note Add the I/O refresh time (approximately 3 ms) to the values in the above table to compute the response speed when the I/O refresh timing differs from the output timing.

I/O Specifications
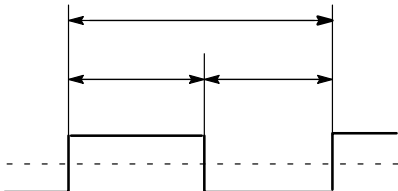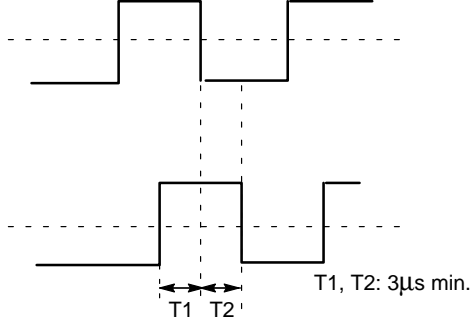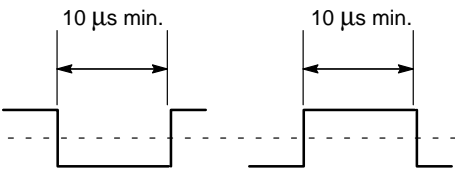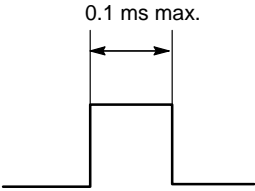
Output Specifications (Outputs 0 through 7)

Item	Specification
Switching capacity	6 mA at 4.5 VDC to 80 mA at 26.4 VDC (Refer to table below.) Maximum: 320 mA/common
Leak current	0.1 mA max.
Residual voltage	0.4 V max.
ON/OFF response time	High-speed counting process time 0.3 ms
External power supply	5 to 24 VDC + 10% (50 mA max. at 26.4 VDC)
Switching capacity	Maximum Switching Capacity: Power Supply Characteristic. The maximum switching capacity is determined by the power supply as shown in the following diagram: Switching capacity External power supply

C200H-CT001-V1 Input Specifications

Item	Inputs A, B, and Z			Control inputs IN1 and IN2	
Input voltage	5 VDC±10%	12 VDC±10%	24 VDC±10%	5 VDC±10%	12 or 24 VDC±10%
Input current	12 mA typical (7.5 to 18 mA)			4 to 7 mA	4 to 13 mA
ON voltage (min.)	4.5 VDC	10.2 VDC	21.6 VDC	4.5 VDC	10.2 VDC
OFF voltage (max.)	2.0 VDC	3.0 VDC	4.0 VDC	2.0 VDC	3.0 VDC
ON/OFF response time	---			1 ms max.	
Minimum response time	*Inputs A and B Waveform of inputs A and B Rise/fall time: 3μs max. 50 kHz, 50% pulse 20 μs min. 10 μs min. — 10 μs min. ON 50% OFF 3 μs max. 3 μs max. Relation between inputs A and B for offset phase Inputs 20 μs min. ON 50% input A OFF ON Phase B OFF T1 T2 T3 T4 T1, T2, T3, T4: 4.5 μsec min. There must be at least a 4.5-μs interval between the change point of input A and that of input B. *Input Z A pulse width of at least 0.1 ms is required. 0.1 ms min. 0.1 ms min. ON 50% OFF			0.1 ms min. ON OFF **Note:** These signals must remain ON for at least the length of the PC's cycle time to be accurately read from the PC.	

C200H-CT002 Input Specifications

Item	Inputs A, B, and Z	Control inputs IN1 and IN2	
Input voltage		5 VDC±10%	12 or 24 VDC±10%
Input current		4 to 7 mA	4 to 13 mA
ON voltage (min.)	Same as the RS-422 line driver (Am26LS31-compatible).	4.5 VDC	10.2 VDC
OFF voltage (max.)		2.0 VDC	3.0 VDC
ON/OFF response time		1 ms max.	
Minimum response time	*Input A and B Waveform at positive terminals 75 kHz, 50% pulse ON 0V OFF Relation between inputs A and B for offset phase Inputs ON Input A 0V OFF ON Phase B 0V OFF T1 T2 T1, T2: 3μs min. There must be at least a 3 μs interval between the change point of input A and that of input B. *Input Z A pulse width of at least 10 μs is required. 10 μs min. 10 μs min. ON 0V OFF	0.1 ms max. ON OFF **Note:** These signals must remain ON for at least the length of the PC's cycle time to be accurately read from the PC.	

(n = 100 + 10 x unit no.)

Linear and Circular Operating Modes

Word		Bit															
		15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Output	n	#7	#6	#5	#4	#3	#2	#1	#0	ENABLE FORCED OUTPUT	RESET COUNTER	READ ERROR	CHANGE PRESET	---	ENABLE FORCED OUTPUT	TRANSFER DATA	START
		Output force bits															
	n+1	Range enable bits															
	n+2	TRANSFER DATA beginning channel number															
	n+3	Number of transfers								TRANSFER DATA data area							
Input	n+4	---								Reset Completed	Count overflow flag	Error flag	Transfer completed flag	IN2 flag	IN1 flag	Z flag	Counting flag
	n+5	Error code								Error location							
	n+6	Current counter value (rightmost 4 digits)															
	n+7	Current counter value (sign and leftmost 3 digits)															
	n+8	Range flags															
	n+9	Output flags															

Preset Operating Mode

Word		Bit															
		15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Output	n	#7	#6	#5	#4	#3	#2	#1	#0	ENABLE FORCED OUTPUT	RESET COUNTER	READ ERROR	CHANGE PRESET	---	ENABLE FORCED OUTPUT	TRANSFER DATA	START
		Output force bits															
	n+1	Range enable bits															
	n+2	TRANSFER DATA beginning channel number															
	n+3	Number of transfers								TRANSFER DATA data area							
Input	n+4	#7	#6	#5	#4	#3	#2	#1	#0	Reset flag	Count overflow flag	Error flag	Transfer completed flag	---	IN1 flag	---	Counting flag
		Output flags															
	n+5	Error code								Error location							
	n+6	Current counter value, 7 digits															
	n+7																
	n+8	Range flags								---							

Gate, Latch, and Sampling Operating Modes

Word		Bit							
		15	06	05	04	03	02	01	00
Output	n	---	READ ERROR	Internal IN2	Internal IN1	---	Internal IN1	---	---
	n+1	Sampling time							
Input	n+4	---	Count overflow flag	Error flag	---	IN2 flag	IN1 flag	---	Counting flag
	n+5	Error code		Error location					
	n+6	Current counter value (rightmost 4 digits)							
	n+7	Current counter value (sign and leftmost 3 digits)							

Appendix D
DM Area Coding Sheets

m = 1000 + (100 x unit no.)

Linear and Circular Operating Modes DM 00 through 99

Word	15–00				Function	Word	15–00				Function	Word	15–00				Function
00	0		0	0	Operating mode	35					Lower limit, range #5	70					Lower limit, range #12
01					Effective range bits	36						71					
02					Maximum counter value (circular mode only)	37					Upper limit, range #5	72					Upper limit, range #12
03	0	0	0			38						73					
04					Not used.	39					Output pattern, range #5	74					Output pattern, range #12
05																	
06						40					Lower limit, range #6	75					Lower limit, range #13
07						41						76					
08						42					Upper limit, range #6	77					Upper limit, range #13
09						43						78					
10					Lower limit, range #0	44					Output pattern, range #6	79					Output pattern, range #13
11																	
12					Upper limit, range #0	45					Lower limit, range #7	80					Lower limit, range #14
13						46						81					
14					Output pattern, range #0	47					Upper limit, range #7	82					Upper limit, range #14
						48						83					
15					Lower limit, range #1	49					Output pattern, range #7	84					Output pattern, range #14
16																	
17					Upper limit, range #1	50					Lower limit, range #8	85					Lower limit, range #15
18						51						86					
19					Output pattern, range #1	52					Upper limit, range #8	87					Upper limit, range #15
						53						88					
20					Lower limit, range #2	54					Output pattern, range #8	89					Output pattern, range #15
21																	
22					Upper limit, range #2	55					Lower limit, range #9	90					Not used.
23						56						91					
24					Output pattern, range #2	57					Upper limit, range #9	92					
						58						93					
25					Lower limit, range #3	59					Output pattern, range #9	94					
26												95					
27					Upper limit, range #3	60					Lower limit, range #10	96					
28						61						97					
29					Output pattern, range #3	62					Upper limit, range #10	98					
						63						99					
30					Lower limit, range #4	64					Output pattern, range #10						
31																	
32					Upper limit, range #4	65					Lower limit, range #11						
33						66											
34					Output pattern, range #4	67					Upper limit, range #11						
						68											
						69						Output pattern, range #11						

Preset Operating Mode

Word	15			00	Function
00	0	3	0	0	Operating mode
01					OFF counter value for output #0
02	0				
03					ON counter value for output #1
04	0				
05					OFF counter value for output #1
06	0				
07					ON counter value for output #2
08	0				
09					OFF counter value for output #2
10	0				
11					ON time for outputs #4 through #7
12					Not used.
13					
14					Preset #0
15					
16					Preset #1
17					
18					Preset #2
19					
20					Preset #3
21					
22					Preset #4
23					
24					Preset #5
25					
26					Preset #6
27					
28					Preset #7
29					
30					Preset #8
31					
32					Preset #9
33					

Word	15–00	Function
34		Preset #10
35		
36		Preset #11
37		
38		Preset #12
39		
40		Preset #13
41		
42		Preset #14
43		
44		Preset #15
45		
46		Preset #16
47		
48		Preset #17
49		
50		Preset #18
51		
52		Preset #19
53		
54		Not used.
55		
56		
57		
58		
59		
60		
61		
62		
63		
64		
65		
66		
67		

Word	15–00	Function
68		
69		
70		
71		
72		
73		
74		
75		
76		
77		
78		
79		
80		
81		
82		
83		
84		
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89		
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92		
93		
94		
95		
96		
97		
98		
99		

Gate, Latch and Sampling Operating Modes

Word	15		00		Function
00	0		0	0	Operating mode (4: gate; 5: latch; or 6: sampling)
01	0		0		Control origin and gate mode type

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G–I

L–O

P

R–S

Revision History

A manual revision code appears as a suffix to the catalog number on the front cover of the manual.

Cat. No. W141-E1-4
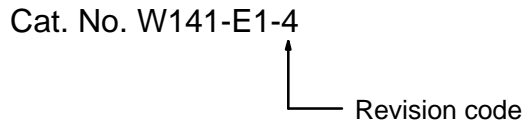
└── Revision code

The following table outlines the changes made to the manual during each revision. Page numbers refer to the previous version.

Revision code	Date	Revised content
1	September 1989	Original production
2	December 1990	Converted to current format.
2A	October 1994	Complete layout change. Scan time changed to cycle time throughout the manual. Corrections made and product functionality added as follows: **Page 9:** Setting of pin 4 added for preset counter operating mode. **Pages 10, 11:** Row B information corrected for pin number 8. **Page 16, 17:** Power supply voltage changed to 12 VDC. **Page 35:** Note added on operation of transfer complete flag. **Page 45:** Paragraph added to START explanation. Explanation of ENABLE OUTPUT corrected. **Page 46:** "I/O" area changed to "IR" area. **Page 48:** Second instruction line and function code of DIFD corrected. **Page 50:** Second instruction line and function code of DIFD corrected. **Page 58:** Explanation changed to say that either START or external control input IN2 can be used as start signal for counter. **Page 62:** Output numbers corrected for bits 10 through 15. **Page 64:** Explanation of ENABLE OUTPUT corrected. **Page 66:** Information added on operation of counting flag. **Page 67:** Information corrected concerning CT001-V1 support of bit 07. **Page 73:** Notes added after table. **Page 85:** Switch setting corrected. **Page 99:** Specifications for the external signal level and output level changed. Note added concerning response speed. **Page 100:** Leak current corrected to 0.1 mA. **Pages 101, 102:** Note added on signal length of IN1 and IN2.
2B	July 1995	The following corrections/additions were made. **Page 12:** Diagram of connector pin numbers added. **Page 40:** The following mistake was deleted: When counting is started, the current counter value is reset to 0 and external outputs #0 through #7 are turned OFF. **Pages 41, 58:** Note added on useable DM and IR words. **Page 45:** Precaution added on Z flag operation.
2C	August 1996	**Page 14:** The pin number B15 for the fourth circuit corrected to B12. **Page 37:** "Lower limit" corrected to "upper limit for words m+12 and m+13. **Page 38:** Output numbers for bits 01 to 15 of input word n+9 corrected to 1 to 15 respectively.
3	April 2000	A precautions section was added to the beginning of the manual and the following changes were made. **Pages 36 and 69:** Notes added.
4	September 2000	**Page xiii:** Minor change made to wording of information on mounting. **Pages 14 and 16:** Changes made to graphics in several places.